

INTERNSHIP REPORT

A report submitted in partial fulfillment of the requirements for the Award of Degree of
BACHELOR OF ENGINEERING

IN
ELECTRONICS AND TELECOMMUNICATION

BY

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SEAT NO. T190903023

Under Supervision of
Mr. Manjunath N.
Project Manager
in Yantra Technologies Pvt. Ltd,
SATARA
(Duration 12th Feb,2023 to 15th March,2023)



DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

NAVSHAYADRI EDUCATION SOCIETY'S GROUP OF INSTITUTIONS

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PUNE, MAHARASHTRA

**NAVSAHYADRI GROUP OF INSTITUTIONS FACULTY OF ENGINEERING NAIGAON,
PUNE**

**DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION
ENGINEERING**



CERTIFICATE

This is to certify that the “**INTERNSHIP REPORT**” submitted by **PRAFUL SHASHIKANT LUGADE (SEAT NO: - T190903023)** during academic year 2022 – 2023, in partial fulfillment of the requirements for the award of the degree of **BACHELOR OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING**, at NESGI’S **FOE, Pune.**

ACKNOWLEDGEMENT

First, I would like to thank Mr. Manjunath N. , Project Manager of inYantra Technologies Pvt. Ltd, Satara for allowing me to do an internship within the organization.

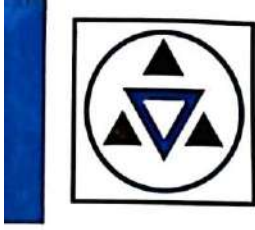
I also would like all the people that worked along with me inYantra Technologies Pvt. Ltd, Satara with their patience and openness they created an enjoyable working environment.

It is indeed with a great sense of pleasure and immense sense of gratitude that I acknowledge the help of these individuals.

I am highly indebted to Director **Mr. P. N. SUKE** and **PRINCIPAL** for the facilities provided to accomplish this internship.

I would like to thank my Head of the Department **Prof. L .M .SAGALE** for his constructive criticism throughout my internship.

I am extremely great full to my department staff members and friends who helped me in the successful completion of this internship



inYantra Technologies Pvt. Ltd.
www.inyantra.com

CERTIFICATE

DATE: 24nd March 2021

This is to certify that **Mr. Praful Shashikant Lugade** studying MBA & Polytechnic, Navsahyadri Group of Institutes has completed the internship in our Production Department during the period **12th Feb 2023 to 15th March 2023** under the guidance of **Mr. Manjunath N.**

We wish **Mr. Praful Shashikant Lugade** all the best in her future endeavors.


Vishal Pansare
Manager HR & Admin



INDEX

1. LEARNING OBJECTIVES	6
2. COMPANY PROFILE	7
3. ABOUT COMPANY.....	8
4. COMPANY ACTIVITIES.....	9
5. INTRODUCTION.....	10
6. WEEKLY OVERVIEW OF INTERNSHIP ACTIVITIECS	11
7. OBJECTIVE OF PCB TESTING	13
8. SCOPE OF STUDY.....	14
9. METHODOLOGICAL DETAILS FOR PCB TESTING	15
10. BENEFITS OF PCB TESTING	16
11. CONCLUSION.....	17
12. REFERENCE	18

1. LEARNING OBJECTIVES

- Learning objectives are specific, measurable statements of what you hope to accomplish or learn during your internship.
- Each objective should be clear and concise.
- Think about what you want to gain from this internship experience.
- Setting goals and learning objectives provides a means for evaluation of your experience.
- Writing the learning objectives is a collaborative effort between you and your faculty advisor.
- Each learning objective should be specific, realistic, measurable and have a completion date within the time frame of the internship.
- A measurable learning objective is a clear statement of what and how you are planning to accomplish your goals.
- There are three types of learning objectives: Academic, Professional and personal.

2. COMPANY PROFILE

At inYantra, we provide complete end-to-end PCB Assemblies & Box-Build Integration **and Cable / Wire harness solutions** to our esteemed customers. PCB assembly and **Cable / Wire Harness assembly are** our core competency. and we are well equipped with the latest technology and machinery to meet our current and future customers' increasing demands. inYantra focuses on High Mix (low to medium volume production), combined with benefits to the customer in professional industrial electronics. We are well equipped to manufacture both RoHS and Non-RoHS compliant products. inYantra has also developed its competency in giving complete solutions to the clients, right from Concept to Prototyping, Sampling and Production.

inYantra's expertise includes manufacturing of Automotive, Power Electronics, Military, Consumer, Medical, Gaming, Alternative Energy and many other key areas of industrial applications.

3. ABOUT COMPANY

inYantra is an ISO 9001:2015 & TS 16949:2009 certified Electronics Manufacturing Services (EMS) company with Sonoma Management Partner (SMP) as the holding company. We were established in 2002 and are located in Pune, India. We at InYantra believe in providing end-to-end solution in the manufacturing of PCB Assemblies and Box- Building integration. PCB assembly is our core competence and we are equipped with the latest technology machinery to meet the increasing demands of our current and future customers. We focus on high mix, low to medium volume production, combined with benefits to the customer in the area of professional industrial electronics. We have set up to manufacture both RoHS and Non-RoHS compliant products and have developed strengths in giving entire solution to the clients – from Concept to Prototyping to Sampling to Production. inYantra's expertise includes Automotive, Power Electronics, military, consumer, medical, gaming, Alternative Energy and many other key areas of industrial applications.

InYantra's state-of-the-art production, testing facilities and modern infrastructure, including an exclusive line for green manufacturing, make it one of India's leading EMS companies. It also has the expertise and capability to manufacture an extensive range of SMD & THD boards **with 3D – X-Ray and the** latest the latest packaging of QFPs, Multiple BGAs, LGAs/QFNs, MBGAs, Fine Chip ICs, 0402/ 0201/ 01005 chips, Wire/Chip Bonding and provide new product development service from NPI to volume manufacture on Print to Build basis.

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Maharashtra (India).

Call us at - +91 9511903752

Email - info@inyantra.com

4.COMPANY ACTIVITIES

- ISO 9001:2015 Consulting Services in India helps companies to eliminate the training investment on the new employees. Just one of the best practices with which you can save time and cost.
- ISO 9001 Certification in India helps companies to continually improve and satisfy your customers with which you can directly increase the profit margin.
- Third Party Inspection

5. INTRODUCTION

5.1 PCB Assembly Services Provider in India.

InYantra is a leading EDMS Company, very well recognised as a PCB Assembly services provider in India. We provide complete Electronics Services ranging from Printed Circuit Assembly to Complete System Integration and Box Build. We ensure that our customers objectives are met through our trusted-on time delivery and quality Manufacturing Services or Products.

We specialize in quick-turn around services for highly complex and advanced PCB assembly and systems manufacturing for meeting dynamic business needs.

Our highly skilled & competent engineering and manufacturing team are well versed with latest technology and process to help our customers with complete solutions for all kinds of PCB assembly requirements.

5.2 Box Build Assemblies

InYantra provides an end-to-end manufacturing service that extends well beyond PCB assembly. We are providing integrated manufacturing services to deliver a complete product to our customer. We have a highly skilled team with a state-of-the-art manufacturing setup that ensures every system built meets the highest standards of workmanship, quality, and reliability.

- A Vendor Development
- A Product Life Cycle Management
- In-house Manufacturing of PCBA's
- A Functional Testing
- A Heat-run Tests
- A Drop-shipping and cogest Support throughout India (operational & environmental)
- Packaging & Labelling

5.2 Cable/Wire Harness Assembly

InYantra provides cable assembly and wire harness to a wide range of industries which are installed in a variety of end use applications. Following the IPC/WHMA-A-620 workmanship standards, our facility has the capability to manufacture power and signal cable assemblies to your specification.

- Single core wires and multi core cables
- Automated wire processing including cut, strip, crimp and tinning processes
- Crimp force monitoring as standard
- 100% electrical test
- IPC/WHMA-A-620 standards
- DFM assistance
- Global sourcing for AVL and alternative components
- Vertical integration opportunities for utilising group manufacturing capabilities in raw cable.

6. WEEKLY OVERVIEW OF INTERNSHIP ACTIVITIES

1st WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	13/2/23	MONDAY	Introduction of PCB
	14/2/23	TUESDAY	PCB Assembly
	15/2/23	WEDNESDAY	PCB Soldering
	16/2/23	THURSDAY	IQC Testing
	17/2/23	FRIDAY	UPS Fitting
	18/2/23	SATURDAY	Dispatch & Packing

2nd WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	20/2/23	MONDAY	Wire Harness
	21/2/23	TUESDAY	PCB Assembly
	22/2/23	WEDNESDAY	PCB Soldering
	23/2/23	THURSDAY	IQC Testing
	24/2/23	FRIDAY	UPS Fitting
	25/2/23	SATURDAY	Dispatch & Packing

3rd WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	27/2/23	MONDAY	Wire Harness
	28/2/23	TUESDAY	PCB Assembly
	1/3/23	WEDNESDAY	PCB Soldering
	2/3/23	THURSDAY	IQC Testing
	3/3/23	FRIDAY	UPS Fitting
	4/3/23	SATURDAY	Dispatch & Packing

4th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	6/3/23	MONDAY	Wire Harness
	8/3/23	WEDNESDAY	PCB Assembly
	9/3/23	THURSDAY	PCB Soldering
	10/3/23	FRIDAY	IQC Testing
	11/3/23	SATURDAY	UPS Fitting
	13/3/23	MONDAY	Dispatch & Packing

7. OBJECTIVE OF PCB TESTING

A PCB is made up of different elements, each of which affects the overall performance of then electronic circuit. The minimum set of tests to be performed should include the following checks:

- Electrical conductivity, including measurement of leakage currents;
- Mechanical resistance;
- Welds quality;
- Cleanliness (weather resistance, including humidity and corrosion);
- Lamination, which tests the laminate's resistance to peeling by force or application of heat;
- Copper plating, tested with tensile strength and analyzing the resulting elongation;
- Environmental test, especially for PCBs which operate in humid environments;
- Component polarity, orientation, alignment, and placement.

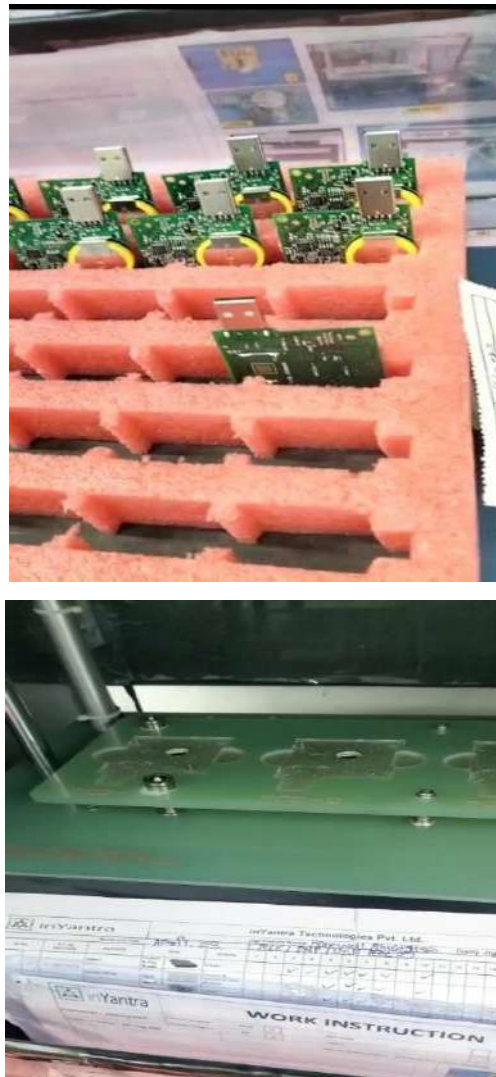


Fig.7.1 PCB Testing

8.SCOPE OF STUDY

- PCB board testing aims to rate its yield and quality, and make sure the design was not damaged during
- assembly. These PCB checks are usually run on prototypes or small batches. They examine boards for
- probable electrical short circuits, imperfect solder joints, and test their functionality.

9. METHODOLOGICAL DETAILS FOR PCB TESTING

Several PCB testing methods are available, and no single one will catch every problem or meet the requirements of every designer. Each testing method should be considered closely to determine if it meets the specific needs of your manufacturing environment. Some factors to consider include the type of product you're testing, the problems you're testing for and the reliability of the test method. To give you an overview of the testing methods available, we've summarized the main qualities of four popular types of PCB testing methods below:

- In-Circuit Test (ICT):-In-circuit testing is a popular PCB testing method that many PCB manufacturers prefer to employ, and it can find 98% of faults. This testing method uses special PCB testing steps and equipment, including:
- Functional Circuit Test:-A functional circuit test is exactly what it sounds like — it tests the function of the circuit. This type of testing always comes at the end of the manufacturing plan, using a functional tester to check whether a finished PCB performs to specifications.
- 3. Electrical PCB Testing During Manufacturing:-Electrical testing is also performed during manufacturing to check for any faults, impedance deviations, or conductive residues from soldering:
- Continuity test: This measurement checks for opens and shorts with DC current in a bare board.
- 5.In-circuit testing: This test also measures for the presence of opens and shorts, as well as specific voltage/current values on test points.

10. BENEFITS OF PCB TESTING

Many companies see PCB testing as an absolute must due to the many advantages it provides them. Check out some of the following top advantages of PCB testing:

- Bug identification: The primary benefit of PCB testing is that it helps identify problems in PCBs. Whether the issue lies in functionality, manufacturability or elsewhere, PCB tests identify issues in a **PCB design and layout** so that designers can adjust accordingly.
- Time savings: PCB testing in the early stages can help save time in the long run, allowing designers to identify major issues during the **prototyping stage**.
- Cost reduction: PCB testing prevents wasteful production of faulty products by using prototypes and small-scale assemblies to test the products.. This step helps to significantly reduce production costs.
- Increased safety: Since PCBs are often used in essential electronic technologies, their failure can cause major issues for a company's productivity or an organization's ability to perform essential services. A defective PCB could cause a fire, potentially putting those near it in danger. Testing prior to manufacturing can also ensure machines and workers aren't damaged or injured due to an improper design during production.
- While thorough testing isn't necessary for all types of PCBs, especially matured products well into their product life cycle, the majority of new PCB designs need robust and frequent testing of the design process. By establishing an appropriate PCB testing procedure for your organization's needs, you can experience the benefits of PCB testing.

11. CONCLUSION

Regardless of which method is chosen, PCB testing represents a fundamental step in the electronic design process, able to save a lot of time and money, identifying possible defects affecting the circuit before it reaches final production. In general, an appropriate combination of the inspection and test methods mentioned above is able to detect all possible defects, with variable costs depending on the specific application and complexity of the circuit under test.

12. REFERENCE

- <https://www.alldatasheet.com/>
- <https://circuits-diy.com/>
- <https://www.electronics360.org/>

A
PROJECT REPORT
ON
"IOT-BASED INDUCTION MOTOR FAULT DETECTION
SYSTEM"

SUBMITTED IN PARTIAL FULFILMENT FOR THE AWARD OF
BACHELOR OF ENGINEERING
IN
ELECTRONICS AND TELECOMMUNICATION ENGINEERING

BY

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UNDER THE GUIDANCE OF
PROF. V. B. Jagdale



DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING
NAVSAHYADRI GROUP OF INSTITUTIONS, FACULTY OF ENGINEERING

PUNE - 412213.

SAVITRIBAI PHULE PUNE UNIVERSITY

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for the partial fulfillment of the award of degree in "**Bachelor of Engineering in Electronics & Telecommunication Engineering**".

Date: 30/05/2024

Place: Pune.

Prof. V. B. Jagdale

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Prof. L. M. Sagale

HOD

Prof. V. B. Jagdale

Project Guide

Dr. M. V. Dalvi

Principal

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Abhijit H. Chavan

Prasad A. Ghorpade

Tejaswini V. Karne

ABSTRACT

Machine induction motors are one of the most widely used motors in industrial and commercial applications. However, they are also prone to a variety of faults, such as bearing failure, winding failure, and stator failure. These faults can lead to downtime, costly repairs, and even safety hazards. Early detection and diagnosis of machine induction motor faults is essential to preventing these problems. However, traditional fault detection methods are often expensive, time-consuming, and require specialized expertise.

IoT-based machine induction motor fault detection systems offer a more efficient and cost-effective solution. These systems use sensors to collect data on the motor's operating parameters, such as vibration, current, and temperature. The data is then transmitted to a cloud server using an IoT platform, such as Blynk. The cloud server uses machine learning algorithms to analyze the data and detect any abnormalities. If an abnormality is detected, the system can send an alert to the user via the Blynk app.

IoT-based motor fault detection systems are a promising new technology that has the potential to revolutionize the way that we maintain and operate electric motors. By using a combination of sensors, microcontrollers, and machine learning algorithms, these systems can continuously monitor motors for faults in real time and detect a wide range of faults. IoT-based motor fault detection systems can also be used to predict faults before they occur, which can help to prevent downtime and costly repairs.

CONTENTS

1. INTRODUCTION.....	1
1.1 Overview.....	1
1.2 Problem Statement.....	1
1.3 Objective.....	2
2. LITERATURE SURVEY.....	3
2.1 Literature Survey.....	3
3. METHODOLOGY.....	5
4. BLOCK DIAGRAM AND DESCRIPTION.....	7
4.1 Block Diagram.....	7
4.1 Description of Block Diagram.....	7
4.1.1 ESP 32.....	7
4.1.2 Vibration Sensor.....	8
4.1.3 Current Sensor.....	9
4.1.4 Temperature Sensor.....	10
4.1.5 IR Sensor.....	10
4.1.6 Voltage Regulator.....	11
4.1.7 Buzzer.....	12
4.1.8 DC Motor.....	13
4.1.9 Power Supply (SMPS).....	13
5. CIRCUIT DIAGRAM.....	15
5.1 Circuit Diagram.....	15
5.2 Working Of Circuit Diagram.....	16
5.1.1 Vibration Sensor connected to the Esp32.....	16
5.1.2 Current Sensor connected to the Esp32.....	16
5.1.3 Temperature Sensor connected to the Esp32.....	17
5.1.4 LCD connected to the Esp32.....	18
5.1.5 IR Sensor connected to the Esp32.....	19

6. HARDWARE SECTION.....	21
6.1 Microcontroller (Esp32)	21
6.2 Vibration Sensor.....	22
6.3 Current Sensor.....	23
6.4 Temperature Sensor.....	24
6.5 IR Sensor.....	25
6.6 Buzzer.....	26
6.7 Voltage Regulator.....	26
6.8 DC Motor.....	27
6.9 Power Supply (SMPS).....	28
6.10 Other Components.....	29
7. SOFTWARE SECTION.....	30
7.1 Arduino IDE.....	30
7.2 Blynk Console.....	31
7.3 Esp32 Code Development.....	32
7.4 Testing and Deployment.....	33
8. FLOW CHART.....	34
8.1 Flow Chart.....	34
8.2 Algorithm.....	34
9. PROJECT BUDGET	36
10. RESULT.....	37
11. ADVANTAGES, DISADVANTAGES AND APPLICATIONS.....	39
11.1 Advantages.....	39
11.2 Disadvantages.....	40
11.3 Applications.....	41
12. FUTURE SCOPE.....	43
13. CONCLUSION.....	44
14. REFERENCES.....	45

LIST OF FIGURES

Fig 4.1:	Block Diagram of Induction DC/AC Motor Fault Detection.....	7
Fig 5.1:	Circuit Diagram of Induction Motor Fault detection	15
Fig 5.1.1:	Vibration Sensor connected to the Esp32.....	16
Fig 5.1.2:	Current Sensor connected to the Esp32.....	17
Fig 5.1.3:	Temperature Sensor connected to the Esp32.....	18
Fig 5.1.4:	LCD connected to the Esp32.....	19
Fig 5.1.5:	IR Sensor connected to the Esp32.....	20
Fig 6.1:	Microcontroller.....	21
Fig 6.2:	Vibration Sensor.....	22
Fig 6.3:	Current Sensor	23
Fig 6.4:	Temperature Sensor.....	24
Fig 6.5:	IR Sensor.....	25
Fig 6.6:	Buzzer.....	26
Fig 6.7:	Voltage Regulator.....	27
Fig 6.8:	DC Motor.....	27
Fig 6.9:	Power Supply (SMPS).....	28
Fig 7.1:	Arduino IDE.....	30
Fig 7.2:	Blynk Console.....	31
Fig 8.1:	Flow Chart of Induction DC/AC Motor Fault Detection.....	34
Fig 10.1:	Result of Induction DC/AC Motor Fault Detection.....	37

LIST OF TABLES

Table 2.1:	Literature Survey	3
Table 6.2:	Specifications of Vibration Sensor	22
Table 6.3:	Specifications of Current Sensor	23
Table 6.4:	Specifications of Temperature Sensor	24
Table 6.5:	Specifications of IR Sensor	25
Table 6.9:	Specifications of Power Supply (SMPS).....	28
Table 9.1:	Project Budget.....	36

CHAPTER 01

INTRODUCTION

1. INTRODUCTION

1.1 Overview:

Machine induction motors are one of the most widely used motors in industrial and commercial applications. However, they are also prone to a variety of faults, such as bearing failure, winding failure, and stator failure. These faults can lead to downtime, costly repairs, and even safety hazards. Early detection and diagnosis of machine induction motor faults is essential to preventing these problems. However, traditional fault detection methods are often expensive, time-consuming, and require specialized expertise. IoT-based machine induction motor fault detection systems offer a more efficient and cost-effective solution. These systems use sensors to collect data on the motor's operating parameters, such as vibration, current, and temperature. The data is then transmitted to a cloud server using an IoT platform, such as Blynk. The cloud server uses machine learning algorithms to analyse the data and detect any abnormalities. If an abnormality is detected, the system can send an alert to the user via the Blynk app.

1.2 Problem Statement

- Induction motors are the workhorses of industry, powering countless applications from machinery in factories to pumps in water treatment plants. Despite their robustness, induction motors are susceptible to various faults that can significantly impact operations. Traditional methods for induction motor fault detection, such as periodic vibration analysis or visual inspections, are often time-consuming, labour-intensive, and may not provide early enough warning of impending problems.
- This project aims to address these challenges by developing a low-cost, user-friendly, and efficient system for induction motor health monitoring and fault prevention using the Internet of Things (IoT) technology. By continuously monitoring key health parameters of the motor and employing intelligent algorithms for anomaly detection, the system can provide early warnings of potential faults, enabling proactive maintenance and preventing costly downtime.

1.3 Objective

The objectives of the IoT-based machine induction motor fault detection system using ESP32 are as follows:

- To develop a low-cost and easy-to-implement system for detecting faults in machine induction motors. To use the ESP32 microcontroller to collect data from sensors and transmit it to a cloud server. To use machine learning algorithms to analyze the data and detect abnormalities. To send alerts to the user via the Blynk app in case of abnormalities. To improve the efficiency, reliability, and safety of machine induction motors. Specific objectives of the project include.
- To design and implement a hardware circuit that connects the ESP32 microcontroller to the vibration sensor, current sensor, temperature sensor, and IR sensor. To develop firmware for the ESP32 microcontroller to read the data from the sensors and transmit it to the cloud server using the Blynk app. To develop a machine learning model to analyze the sensor data and detect abnormalities. To develop a Blynk app to display the sensor data and send alerts to the user in case of abnormalities.

CHAPTER 02

LITERATURE SURVEY

2. LITERATURE SURVEY

Sr.No.	Paper Title	Authors	Methods	Performance Of System
1.	Switching fault detection and analysis of induction motor.	Reema Department of Electrical Engineering, College of Engineering, Trivandrum Mini Department of Electrical Engineering, College of Engineering, Trivandrum.	Inverter fed induction motors are the essential part in many industrial applications, due to its variable speed. In industry, proper and reliable operation of equipment is the key factor for smooth operation of the plant and staying within the technical constraints.	Better
2.	Fault Detection and Diagnosis Techniques for AC Motor Drives.	Muhammed Ali Gultekin Electrical and Computer Engineering Department, University of Connecticut, Storrs, CT 06269, USA.	Condition monitoring in electric motor drives is essential for operation continuity. The article categorizes faults into machine faults, power electronics (PE) fault, DC link capacitor fault, and sensors' fault, and discusses FDD methods.	Better

3.	Digital Twin Service Unit Development for an EV Induction Motor Fault Detection.	Viktor Rjabtšikov Department of Electrical Power Engineering and Mechatronics, Tallinn University of Technology, Tallinn, Estonia Vladimir Department of Industrial Engineering.	The principle of Digital Twin (DT) is to create a connection between a physical asset and its corresponding virtual twin established by generating real-time data using sensors. DT can be used for real-time condition monitoring, fault detection, optimization, prognosis, and lifetime prediction.	Very good
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Table 2.1 Literature Survey

CHAPTER 03

METHODOLOGY

3. METHODOLOGY

The following is a proposed methodology for developing an IoT-based machine induction motor fault detection system using ESP32:

1. Hardware Design

The first step is to design the hardware circuit that will connect the ESP32 microcontroller to the vibration sensor, current sensor, temperature sensor, and IR sensor. The circuit should be designed to ensure that the sensors are properly powered and that the signals from the sensors are properly conditioned before being fed to the ESP32 microcontroller.

2. Firmware Development

Once the hardware circuit is designed, the next step is to develop firmware for the ESP32 microcontroller. The firmware should be responsible for reading the data from the sensors, processing the data, and transmitting it to the cloud server using the Blynk app.

3. Machine Learning Model Development

Once the firmware is developed, the next step is to develop a machine learning model to analyze the sensor data and detect abnormalities. The machine learning model can be trained using a dataset of sensor data collected from known faulty and non-faulty machine induction motors.

4. Blynk App Development

Once the machine learning model is developed, the next step is to develop a Blynk app to display the sensor data and send alerts to the user in case of abnormalities. The Blynk app can be developed using the Blynk IoT platform.

5. Integration and Testing

Once the hardware circuit, firmware, machine learning model, and Blynk app are developed, the next step is to integrate them and test the system. The system should be tested using a variety of scenarios to ensure that it is able to accurately detect faults in machine induction motors.

6. Deployment

Once the system is tested and validated, it can be deployed in real-world environments. The system can be deployed on a machine induction motor and monitored using the Blynk app.

CHAPTER 04

**BLOCK DIAGRAM AND
DESCRIPTION**

4. BLOCK DIAGRAM AND DESCRIPTION

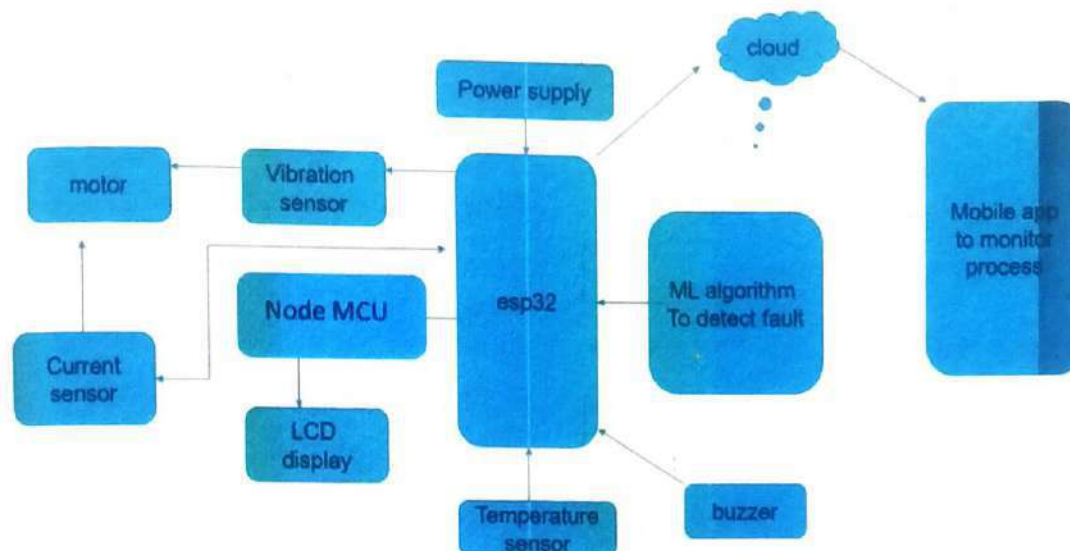


Fig 4.1 Block Diagram of Induction DC/AC Motor Fault Detection

4.1 Description of Block Diagram

4.1.1 Esp 32

The ESP32 is a low-cost, low-power system on a chip (SoC) series with Wi-Fi and dual-mode Bluetooth capabilities, developed by Espressio Systems. It is widely used in IoT (Internet of Things) projects and other applications requiring connectivity due to its rich set of features and flexibility. Here are some key Characteristics of the ESP32:

Wi-Fi and Bluetooth: The ESP32 supports 2.4 GHz Wi-Fi (802.11 b/g/n) and dual-mode Bluetooth (Classic and BLE), making it versatile for various wireless communication applications.

Processing Power: It features a dual-core Xtensa LX6 microprocessor, with clock speeds up to 240 MHz's. Some variants come with a single-core processor.

Memory: The ESP32 includes 520 KB of SRAM and typically has around 4 MB of flash memory. Variants with different amounts of flash memory are available.

GPIO Pins: It has a large number of GPIO (General Purpose Input/Output) pins, which can be configured for various functions such as ADC (Analog to Digital Converter), DAC (Digital to Analog Converter), PWM (Pulse Width Modulation), I2C, SPI, UART, and more.

Power Management: The ESP32 is designed for low power consumption, with several power-saving modes, making it suitable for battery-operated devices.

Security: It includes various security features such as secure boot, flash encryption, and cryptographic hardware acceleration.

Development Environment: It is supported by the Arduino IDE, Espresso's own ESP-IDF (IoT Development Framework), and other environments, making it accessible for both beginners and advanced users.

Wide Range of Applications: Due to its features, the ESP32 is used in a variety of applications including home automation, industrial automation, health monitoring, smart agriculture, and more.

The ESP32's combination of connectivity, processing power, and flexibility has made it a popular choice for developers and hobbyists alike looking to build connected devices.

4.1.2 Vibration Sensor

A vibration sensor is used to measure the amount of vibration in a machine. This can be used to detect faults such as bearing wear, shaft misalignment, and unbalanced rotors. Vibration Sensors are vibration monitoring equipment used widely by plant maintenance teams to find insight regarding equipment or piping performance. Using vibration sensors and studying the data from these devices, engineers can predict possibilities of equipment failure and they can safeguard major equipment from breakdown by taking proper action. A vibration sensor is a device used to measure mechanical vibrations and oscillations. It can detect the presence, magnitude, direction or frequency of movement caused by various sources such as shocks, machinery operation faults and environmental conditions including wind gusts and earthquakes. Vibration sensors are typically accelerometers that feature piezoelectric crystals which convert kinetic energy into electrical signals when subjected to acceleration forces in any axis.

They help industries with predictive maintenance programs enabling them to identify problems early on before they become major issues requiring expensive repairs down the line. By tracking changes occurring over time through continuous monitoring it helps maintain optimal production performance levels for long-term sustainability goals while reducing operational costs associated with disruptive downtime events due to unexpected components failures or improper alignment issues causing machine imbalance behaviour patterns at critical points in product assembly lines processes across different industrial sectors from manufacturing facilities all the way up to alternative macroeconomic landscapes like oil refineries itself operating offshore platforms million miles away out there surrounded by boundless deep sea waters depths.

Depending on the application requirement, the sensitivity of these vibration sensors may vary, the usual range is from 10 mV/g to 100 mV/g. Vibration sensors consist of a crystal of piezoelectric material to which is attached a seismic mass. When the crystal is stressed, an electric signal is produced which is measured as output data. Vibration sensing technology helps protect sensitive equipment from catastrophic damage caused by vibrations outside the recommended range. Sensors can even be used to monitor health or vibration levels in industrial processes and machines that involve moving parts such as pumps, engines, motors and more. Vibration sensors are devices that detect vibration, shock, and sound. They can be used in machinery to detect problems before they happen.

4.1.3 Current Sensor

A current sensor is used to measure the amount of current flowing through a circuit. This can be used to detect faults such as short circuits, overloads, and motor stalls. Current sensors are vital components in various electrical and electronic systems, enabling the monitoring and management of electrical currents flowing through circuits. They are indispensable in diverse applications, from simple power supply units to complex industrial machinery and advanced electric vehicles. A current sensor is a device that detects electric current in a wire and generates a signal proportional to that current. The generated signal could be analog voltage or current or a digital output. The generated signal can be then used to display the measured current in an ammeter, or can be stored for further analysis in a data acquisition system, or can be used for the purpose of control.

The sensed current and the output signal can be:

- **Alternating current input** – Analog output, which duplicates the wave shape of the sensed current. Bipolar output, which duplicates the wave shape of the sensed current. Unipolar output, which is proportional to the average or RMS value of the sensed current.
- **Direct current input** – Unipolar, with a unipolar output, which duplicates the wave shape of the sensed current **digital** output, which switches when the sensed current exceeds a certain threshold.

4.1.4 Temperature Sensor

A temperature sensor is used to measure the temperature of a machine. this can be used to detect faults such as overheating bearings, windings, and oil. a temperature sensor is a device, typically, a thermocouple or resistance temperature detector, that provides temperature measurement in a readable form through an electrical signal. a thermometer is the most basic form of a temperature meter that is used to measure the degree of hotness and coolness. temperature sensors find applications in various sectors. some prominent examples include: industrial processes: temperature monitoring is essential in various industries like chemical, petrochemical, and food processing. here, sensors like thermocouples are widely used. a temperature sensor is a device, typically, a thermocouple or resistance temperature detector, that provides temperature measurement in a readable form through an electrical signal. Temperature sensors are simple devices that sense the degree of cold or heat and transform it into a simple unit. But, do you ever think about how the temperature of the soil, land boreholes, great concrete dams, or houses is detected? Well, this is done by using some of the particular temperature sensors. Visit here to see what is a temperature sensor clearly. We employ them in various applications in our daily lives, such as domestic water heaters, refrigerators, microwaves, or in the form of thermometers. Generally, they have a wide range of usages, and the geotechnical controlling area is one of them. They are utilized in this field to control the condition of concrete structures, bridges on soil or water, etc., for structural variations in them according to seasonal changes.

4.1.5 IR Sensor

An IR sensor is used to measure the speed of a rotating object. This can be used to detect faults such as belt slippage, motor overload, and motor underload. IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate

some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations. An infrared sensor includes two parts namely the emitter & the receiver (transmitter & receiver), so this is jointly called an optocoupler or a photo-coupler. Here, IR LED is used as an emitter whereas the IR photodiode is used as a receiver. The photodiode used in this is very sensitive to the infrared light generated through an infrared LED. The sensor output can be decided by the IR receiver depending on the intensity of the response. Infrared sensors are classified into two types like active IR sensor and passive IR sensor. This active infrared sensor includes both the transmitter as well as the receiver. In most of the applications, the light-emitting diode is used as a source.

There are two types of IR sensors are available and they are -

- **Active Infrared Sensor** –Active infrared sensors consist of two elements: infrared source and infrared detector. Infrared sources include the LED or infrared laser diode. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by an object and falls on the infrared detector.
- **Passive Infrared Sensor** –Passive infrared sensors are basically Infrared detectors. Passive infrared sensors do not use any infrared source and detector. They are of two types: quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat. **Thermocouples**, pyroelectric detectors and bolometers are the common types of thermal infrared detectors. Quantum type infrared sensors offer higher detection performance. It is faster than thermal type infrared detectors. The photo sensitivity of quantum type detectors is wavelength dependent.

4.1.6 Voltage Regulator

Voltage Regulator Specifications -

- **Input voltage range:** The range of voltages that the voltage regulator can accept as input.
- **Output voltage:** The voltage that the voltage regulator produces as output.
- **Current rating:** The maximum current that the voltage regulator can deliver.

- Dropout voltage: The minimum voltage difference between the input voltage and the output voltage that is required for the voltage regulator to operate properly.
- Load regulation: The amount of change in the output voltage when the load current changes.
- Line regulation: The amount of change in the output voltage when the input voltage changes.
- Temperature coefficient: The amount of change in the output voltage per degree Celsius change in temperature.

4.1.7 Buzzer

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke. The pin configuration of the buzzer is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-' symbol or short terminal and it is connected to the GND terminal. The working principle of a buzzer depends on the theory that, once the voltage is given across a piezo-electric material, then a pressure difference is produced. A piezo type includes piezo crystals among two conductors. Once a potential disparity is given across these crystals, then they thrust one conductor & drag the additional conductor through their internal property. So, this continuous action will produce a sharp sound signal.

Types of Buzzers –

A buzzer is available in different types which include the following.

- Piezoelectric
- Electromagnetic
- Mechanical
- Electromechanical
- Magnetic

A buzzer is an efficient component to include the features of sound in our system or project. It is an extremely small & solid two-pin device thus it can be simply utilized on breadboard or PCB. So in most applications, this component is widely used.

4.1.8 DC Motor

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. An electric generator is mechanically identical to an electric motor, but operates in reverse, converting mechanical energy into electrical energy. It is based on electromagnetic induction, where a conductor carrying current (normally a coil of wire) placed in a magnetic field experiences force to rotate. This rotation is used to perform mechanical work. A DC motor or direct current motor is an electrical machine that transforms electrical energy into mechanical energy by creating a magnetic field that is powered by direct current. When a DC motor is powered, a magnetic field is created in its stator. The field attracts and repels magnets on the rotor; this causes the rotor to rotate. To keep the rotor continually rotating, the commutator that is attached to brushes connected to the power source supply current to the motors wire windings.

The magnetic field in a brush DC motor is produced by current sent through a commutator and brush that are connected to the rotor. Brushes are made of carbon and can be separately excited or self-excited. The stator is the enclosure that contains the components of the motor and contains the magnetic field. The winding of the coil on the rotor can be in a series or parallel to form either a series-wound DC motor or shunt wound DC motor. The commutator is an electrical switch that reverses the current between the rotor and the external power source. It is a method of applying electrical current to the windings and produces a steady rotating torque by reversing the current direction. The sections of the commutator are attached to the windings on the rotor through a set of contact bars that are set in the shaft of the motor.

4.1.9 Power Supply (SMPS)

A switched-mode power supply (SMPS) is 12V and 2Amp are used in this project. also called switching-mode power supply, switch-mode power supply, switched power supply, or simply

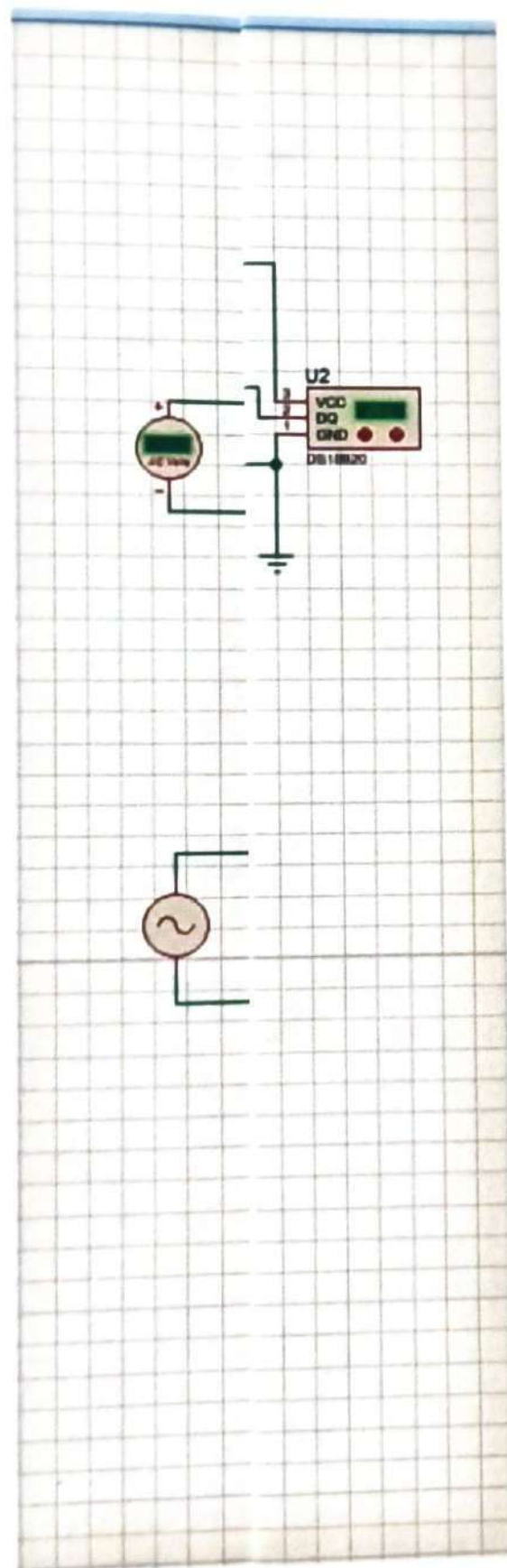
switcher, is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. SMPS transform power AC to DC Source. A switching regulator is integrated into an electronic power supply called a switch mode power supply (SMPS), which is sometimes referred to as a switcher, switched power supply, switching-mode power supply, and simply switcher. This power supply effectively converts electrical power. An SMPS, like other kinds of power supplies, converts current and voltage characteristics while transferring power from an AC or DC source (often mains power; see AC adapter) into DC loads, like a personal computer. Switched-mode energy sources can also be significantly lighter and more compact than linear power supplies since their transformers can be considerably smaller. This is due to the fact that, in contrast with the 50 to 60 Hz mains frequency, it works at a high rate of switching that extends from a few kHz to several MHz the **power supply** architecture and the need for EMI (electromagnetic interference) suppression in commercial systems lead to a typically significantly higher component count and accompanying circuit complexity despite the smaller transformer. Switching regulators are employed in SMPS devices to maintain & regulate the output voltage by turning on or off the load current. The mean value between on and off is the appropriate power output for a system. The SMPS reduces depletion strength because, in contrast to the linear power supply, it carries transistor switches between low dissipation, full-on as well as full-off phases and spends significantly fewer seconds in high dissipation cycles.

AC-DC Converter SMPS Working –

The input supply in this sort of SMPS is AC, and the output is DC. This AC power is converted to DC using rectifiers and filters. This erratic DC voltage is applied to the impacted circuits for power factor correction. This is due to a low current pulse that occurs near the voltage peak inside the rectifier.

CHAPTER 05

CIRCUIT DIAGRAM



5. CIRCUIT DIAGRAM

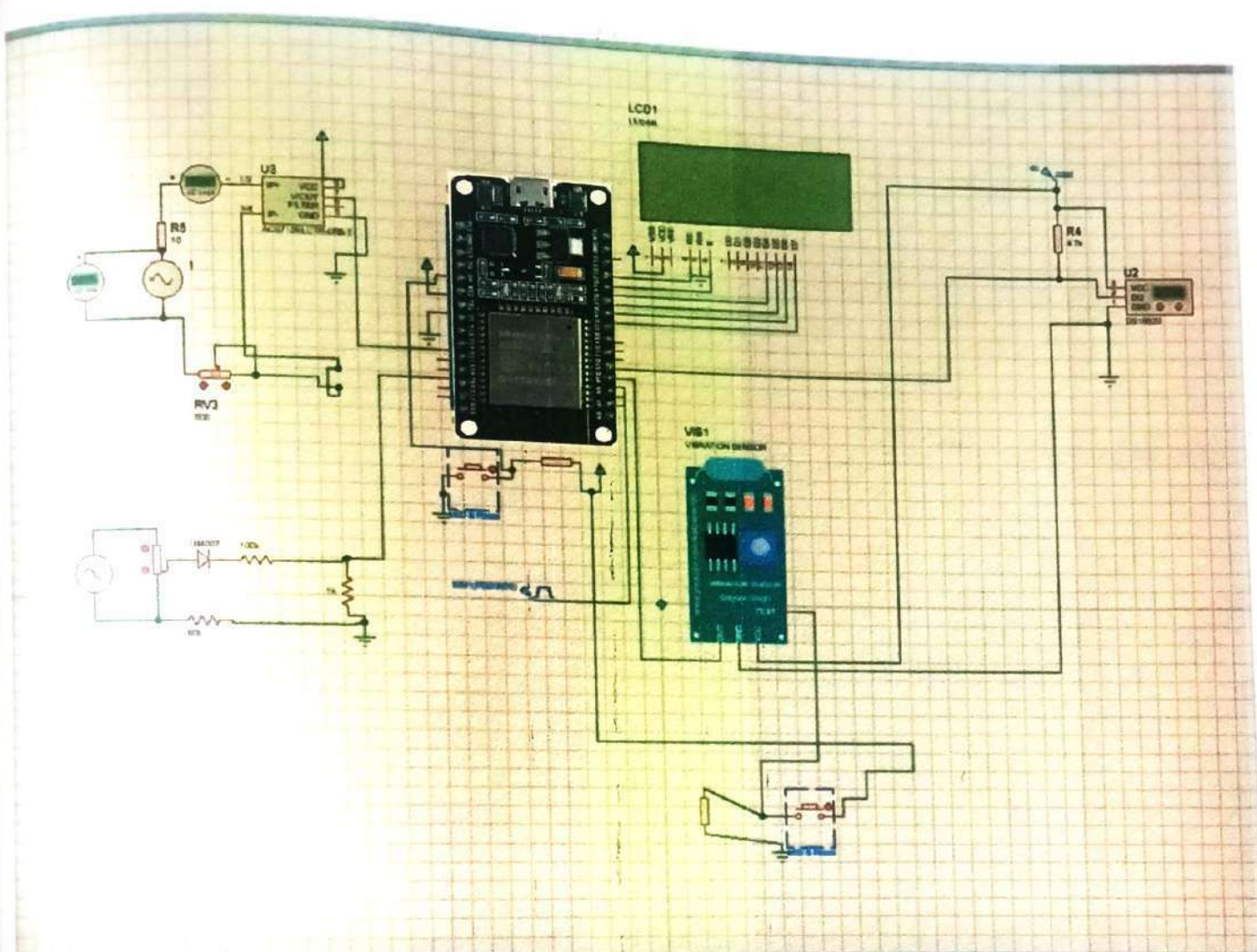


Fig 5.1 Circuit Diagram of Induction DC/AC Motor Fault Detection

5.1 Working of Circuit Diagram

5.1.1 Vibration Sensor connected to the Esp32

Vibration Sensor Connection - The vibration sensor is attached securely to the motor to capture accurate vibration data.

- The vibration sensor module has three pins: VCC, GND, and D0 (Digital Output).
- **VCC:** Connect to the 3.3V power supply.
- **GND:** Connect to the common ground.
- **DO:** Connect to a GPIO D35 pin of the ESP32. This pin will output a high signal when vibration is detected.

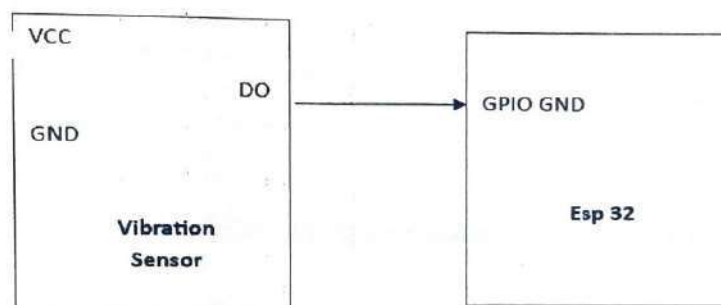


Fig 5.1.1 Vibration Sensor connected to the Esp32

- Connect the **3.3V** pin on the ESP32 to the **VCC** pin no.13 on the vibration sensor.
- Connect the **GND** pin on the ESP32 to the **GND** pin no.2 on the vibration sensor.
- **VCC (Red Wire):** Connect to the 3.3V pin no.2 of the ESP32.
- **GND (Black Wire):** Connect to the GND pin no.13 of the ESP32.
- **DO (Green Wire):** Connect to a GPIO D35 pin on the ESP32.

5.1.2 Current Sensor connected to the Esp32

Current Sensor Connection - The output of the current sensor should be connected to one of the analog input pins D32 of the ESP32.

- The current sensor module has three pins: VCC, GND, and D0 (Digital Output).

- **VCC:** Connect to the 3.3V power supply.
- **GND:** Connect to the common ground.
- **DO:** Connect to a GPIO D32 pin of the ESP32. This pin will output a high signal when Current is detected.
- Connect the **3.3V** pin on the ESP32 to the **VCC** pin no.12 on the current sensor.
- Connect the **GND** pin on the ESP32 to the **GND** pin no.3 on the current sensor.

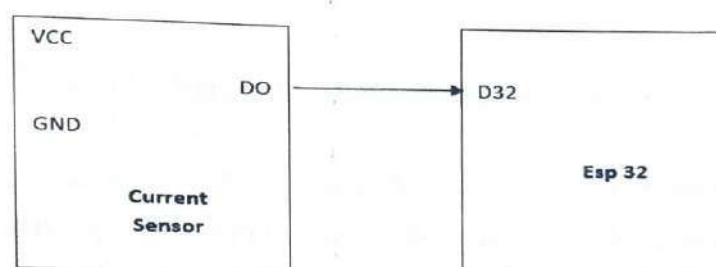


Fig 5.1.2 Current Sensor connected to the Esp32

- Connect the **GND** pin on the ESP32 to the **GND** pin no.3 on the current sensor.
- Ac load is connected to the power supply of plug no5.
- Ac Source are connected to the DC Motor.
- **VCC (Red Wire):** Connect to the 3.3V pin no.12 of the ESP32.
- **GND (Black Wire):** Connect to the GND pin no.3 of the ESP32.
- **DO (Green Wire):** Connect to a GPIO D32 pin on the ESP32.

5.1.3 Temperature Sensor connected to the Esp32

Temperature Sensor Connection-

- The Temperature sensor module has three pins: VCC, GND, and D0 (Digital Output).
- **VCC:** Connect to the 3.3V power supply.
- **GND:** Connect to the common ground.

- **DO:** Connect to a GPIO GND pin of the ESP32 . This pin will output a high signal when Temperature is detected.

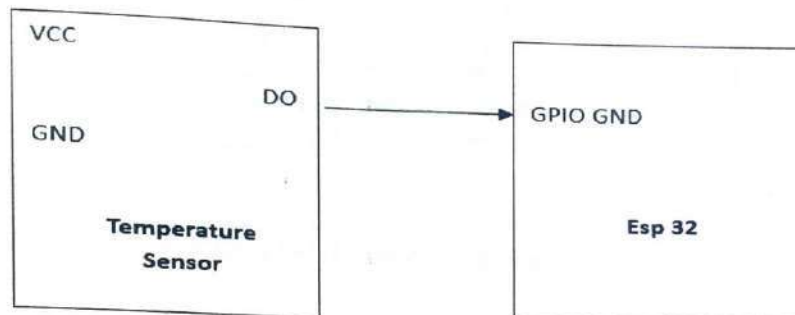


Fig 5.1.3 Temperature Sensor connected to the Esp32

- Connect the **3.3V** pin on the ESP32 to the **VCC** pin no. D1 on the temperature sensor.
- Connect the **GND** pin on the ESP32 to the **GND** pin no. D2 on the temperature sensor.
- **VCC (Red Wire):** Connect to the 3.3V pin no. D1 of the ESP32.
- **GND (Black Wire):** Connect to the GND pin no. D2 of the ESP32.
- **DO (Green Wire):** Connect to a GPIO D4 pin on the ESP32.

5.1.4 LCD connected to the Esp32

LCD Connections-

- **VCC:** Connected to the VIN
- **VIN:** Connected to the power supply.
- **GND:** Connected to the ground.
- **D1:** Connected to the SCL (Serial Clock Line) of the LCD (LC01).
- **D2:** Connected to the SDA (Serial Data Line) of the LCD (LC01).
- **SCL:** Connected to D1 of the ESP32.
- **SDA:** Connected to D2 of the ESP32.

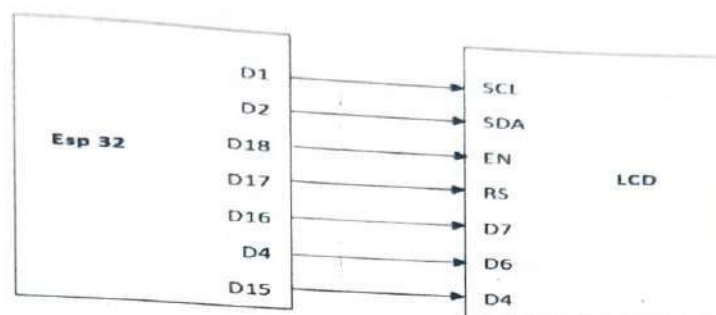


Fig 5.1.4 LCD connected to the Esp32

- D1: Connected to the SCL (Serial Clock Line) of the LCD (LC01).
- D2: Connected to the SDA (Serial Data Line) of the LCD (LC01).
- D18: Connected to the EN pin of the LCD (LC01).
- D17: Connected to the RS pin of the LCD (LC01).
- D16: Connected to the D7 pin of the LCD (LC01).
- D4: Connected to the D6 pin of the LCD (LC01).
- D15: Connected to the D4 pin of the LCD (LC01).
- RS: Connected to D17 of the ESP32.
- EN: Connected to D18 of the ESP32.
- D4: Connected to D15 of the ESP32.
- D6: Connected to D4 of the ESP32.
- D7: Connected to D16 of the ESP32.
- SCL: Connected to D1 of the ESP32.
- SDA: Connected to D2 of the ESP32.
- VCC: Connected to a 3.3V power supply.
- GND: Connected to the ground.

5.1.5 IR Sensor connected to the Esp32

IR Sensor Connections - Often used to detect the rotation speed of the motor by counting the interruptions in the IR beam.

- VCC: Connect to the 3.3V pin of the ESP32.

- GND: Connect to the ground (GND) pin of the ESP32.
- OUT (Digital Output): Connect to a digital input GPIO D6 pin of the ESP32.

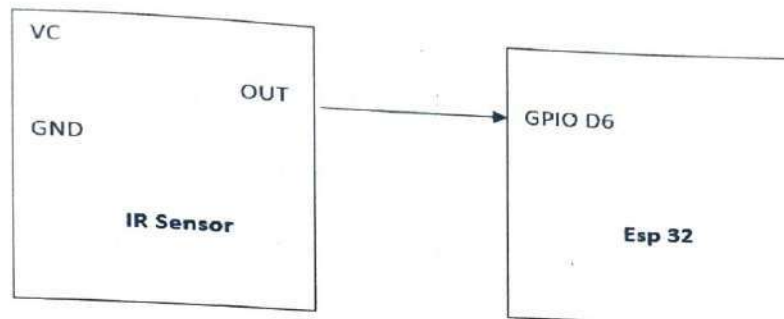


Fig 5.1.5 IR Sensor connected to the Esp32

- IR Speed Sensor: Detects the rotational speed of the motor by counting pulses from an encoder or reflective surface.
- IR Temperature Sensor: Measures the surface temperature of the motor.

CHAPTER 06

HARDWARE SECTION

6. HARDWARE SECTION

6.1 Microcontroller (Esp32)

- A microcontroller is a small computer on a single integrated circuit (IC) containing a processor, memory, and input/output (I/O) peripherals. Microcontrollers are used in a wide variety of electronic devices, including cars, appliances, robots, and industrial systems.
- The following are some of the key specifications of microcontrollers:
- Processor: The processor is the brain of the microcontroller and is responsible for executing instructions. The speed of the processor is measured in megahertz (MHz) or gigahertz (GHz).
- Memory: Microcontrollers have two types of memory: ROM (read-only memory) and RAM (random access memory). ROM stores the microcontroller's program code, while RAM stores data that is being processed. The amount of ROM and RAM available on a microcontroller varies depending on the model.

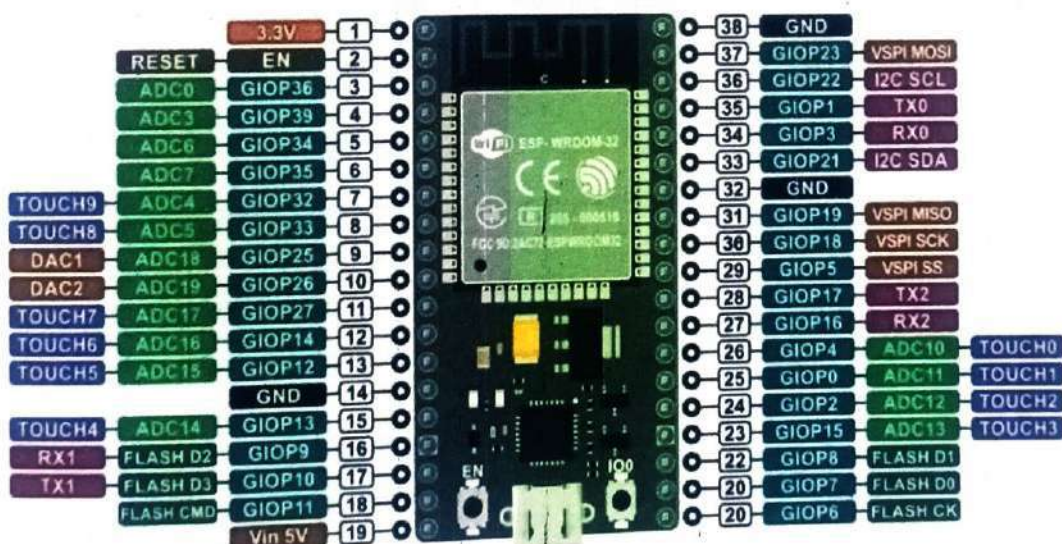


Fig 6.1 : Microcontroller

- I/O peripherals: I/O peripherals allow the microcontroller to communicate with the outside world. Common I/O peripherals include general-purpose input/output (GPIO) pins, serial ports, and timers.

6.2 Vibration Sensor

A vibration sensor is used to measure the amount of vibration in a machine. This can be used to detect faults such as bearing wear, shaft misalignment, and unbalanced rotors. Vibration sensors are typically accelerometers that feature piezoelectric crystals which convert kinetic energy into electrical signals when subjected to acceleration forces in any axis.



Fig 6.2 Vibration Sensor

Specification	Value
Type	Piezoelectric
Sensitivity	100mV/g
Frequency Range	0.1Hz to 100Hz
Power Supply	5V to 12V
Output	Analog voltage

Table 6.2 Specifications of Vibration Sensor

6.3 Current Sensor

A current sensor is used to measure the amount of current flowing through a circuit. This can be used to detect faults such as short circuits, overloads, and motor stalls. They are indispensable in diverse applications, from simple power supply units to complex industrial machinery and advanced electric vehicles. A current sensor is a device that detects electric current in a wire and generates a signal proportional to that current. The generated signal could be analog voltage or current or a digital output.

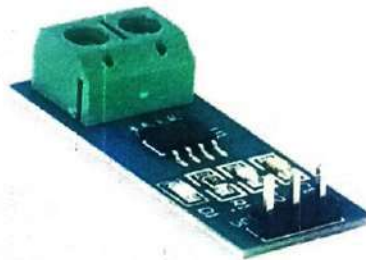


Fig 6.3 Current Sensor

Specification	Value
Type	Hall Effect
Range	0A to 100A
Accuracy	$\pm 1\%$
Power Supply	5V to 12V
Output	Analog voltage

Table 6.3 Specifications of Current Sensor

6.5 IR Sensor

An IR sensor is used to measure the speed of a rotating object. This can be used to detect faults such as belt slippage, motor overload, and motor underload. IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

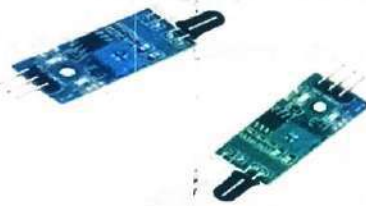


Fig 6.5 IR Sensor

Specification	Value
Type	Reflective
Range	2cm to 15cm
Accuracy	$\pm 5\%$
Power Supply	5V
Output	Digital signal

Table 6.5 Specifications of IR Sensor

6.4 Temperature Sensor

A temperature sensor is used to measure the temperature of a machine. This can be used to detect faults such as overheating bearings, windings, and oil. some prominent examples include: industrial processes: temperature monitoring is essential in various industries like chemical, petrochemical, and food processing. here, sensors like thermocouples are widely used. a temperature sensor is a device, typically, a thermocouple or resistance temperature detector, that provides temperature measurement in a readable form through an electrical signal. Temperature sensors are simple devices that sense the degree of cold or heat and transform it into a simple unit.

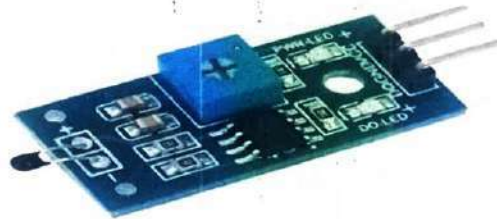


Fig 6.4 Temperature Sensor

Specification	Value
Type	NTC Thermistor
Range	-50°C to 150°C
Accuracy	±0.5°C
Power Supply	3.3V to 5V
Output	Analog voltage

Table 6.4 Specifications of Temperature Sensor

6.6 Buzzer

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke. The working principle of a buzzer depends on the theory that, once the voltage is given across a piezoelectric material, then a pressure difference is produced. A piezo type includes piezo crystals among two conductors. Types of Buzzers A buzzer is an efficient component to include the features of sound in our system or project. It is an extremely small & solid two-pin device thus it can be simply utilized on breadboard or PCB. So, in most applications; this component is widely used.

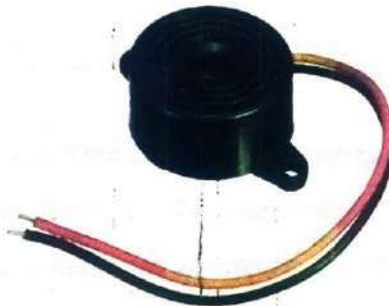


Fig 6.6 Buzzer

6.7 Voltage Regulator

Voltage Regulator Specifications

- Input voltage range: The range of voltages that the voltage regulator can accept as input.
- Output voltage: The voltage that the voltage regulator produces as output.
- Current rating: The maximum current that the voltage regulator can deliver.
- Dropout voltage: The minimum voltage difference between the input voltage and the output voltage that is required for the voltage regulator to operate properly.
- Load regulation: The amount of change in the output voltage when the load current changes.

- Line regulation: The amount of change in the output voltage when the input voltage changes.
- Temperature coefficient: The amount of change in the output voltage per degree Celsius change in temperature.

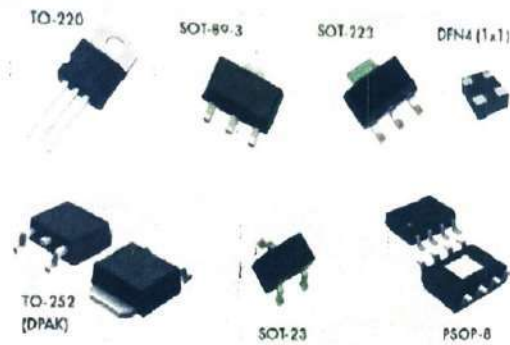


Fig 6.7 Voltage Regulator

6.8 DC Motor

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. An electric generator is mechanically identical to an electric motor, but operates in reverse, converting mechanical energy into electrical energy.



Fig 6.8 DC Motor

6.9 Power Supply (SMPS)

A switched-mode power supply (SMPS), also called switching-mode power supply, switch-mode power supply, switched power supply, or simply switcher, is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. SMPS transform power AC to DC Source.

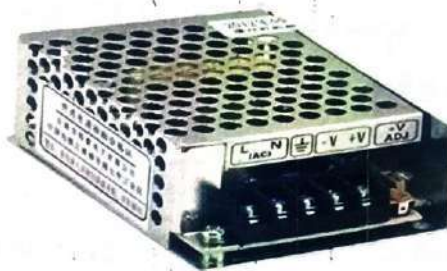


Fig 6.9 Power Supply (SMPS)

Specification	Value
Input	110 / 220 Volt
Power	24 Watt.
Accuracy	$\pm 15\%$
DC Output Current	2 Amp
DC Output voltage	12 Volt

Table 6.9 Specifications of Power Supply (SMPS)

6.10 Other Components

- Other components that may be required include a breadboard, jumper wires, a power supply, and an LCD display (optional) for hardware components:
- **Microcontroller:** ESP32.
- **Breadboard:** A breadboard, also known as a solderless breadboard, is a reusable prototyping platform that allows you to build and test circuits without soldering.
- **Jumper Wires:** Wire gauge: 22 AWG stranded copper.
- **Resistors:** This is the main specification of a resistor and is measured in ohms (Ω). Resistors come in a wide range of resistance values, from milliohms ($m\Omega$) to gigohms ($G\Omega$).
- **Capacitor:** This is the main specification of a capacitor and is measured in farads (F). Capacitors come in a wide range of capacitance values, from picofarads (pF) to millifarads (mF).
- **Voltage Regulator:** The range of voltages that the voltage regulator can accept as input.

CHAPTER 07

SOFTWARE SECTION

7. SOFTWARE SECTION

7.1 Arduino IDE:

Development Environment Setup:

- Install the Arduino IDE (<https://support.arduino.cc/hc/en-us/articles/360019833020-Download-and-install-Arduino-IDE>) and the ESP32 development package following the official guide (<https://docs.espressif.com/projects/esp-idf/en/v4.1/get-started/index.html>).
- Download the Blynk app (<https://blynk.io/>) for your smartphone or tablet.

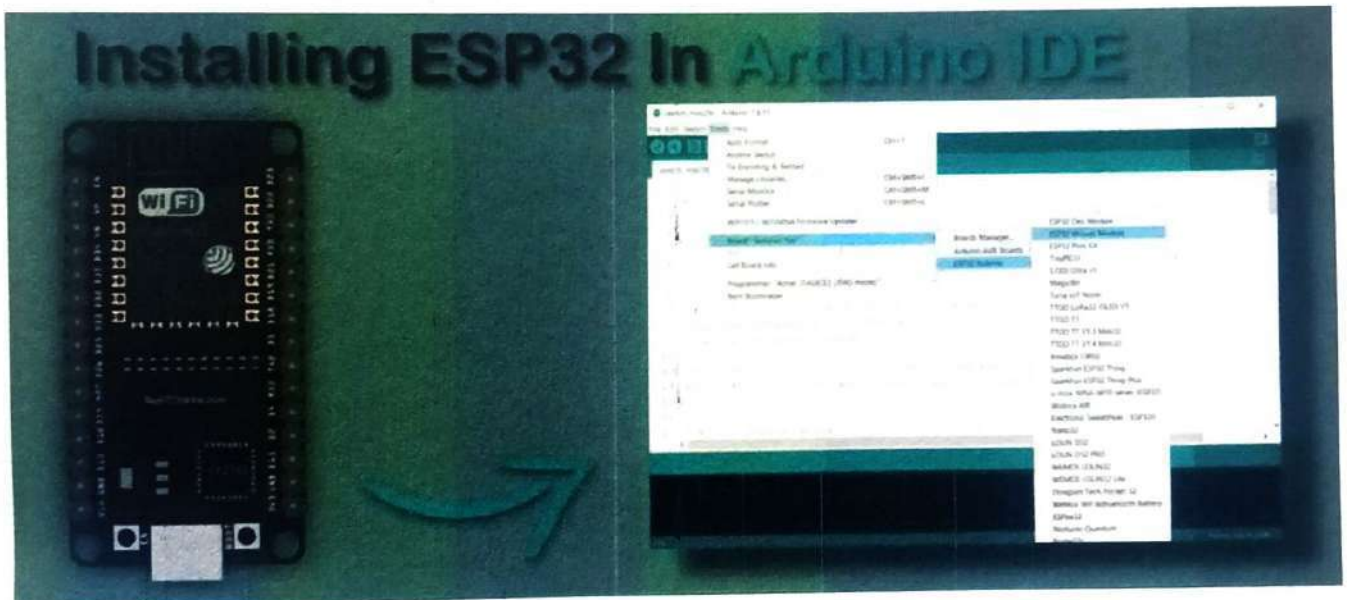


Fig 7.1 Arduino IDE

The new major release of the Arduino IDE is faster and even more powerful! In addition to a more modern editor and a more responsive interface it features auto completion, code navigation, and even a live debugger. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus.

7.2 Blynk Console:

Blynk App Configuration:

- Create a new Blynk project and add the necessary widgets for displaying:
- Vibration sensor readings (gauge or graph)
- Motor current (gauge or graph)
- Motor temperature (gauge or graph)
- Speed (value display, if using IR sensor)
- Buttons or sliders (optional) for speed control (if applicable)
- Create virtual pins for each sensor and control element, noting their corresponding hardware pins on the ESP32.



Fig 7.2 Blynk Console

Blynk.Console is a web application that allows users to configure connected devices on the Blynk platform, including application settings. It also allows users to remotely control and monitor devices, manage devices, users, organizations, and locations, and perform over-the-air updates. Blynk.Console is a low-code IoT software platform that allows users to build and manage

connected hardware. The Blynk platform allows users to connect almost any electronics hardware to the internet, start collecting data from devices, and monitor and control them remotely from anywhere in the world. Data from devices can be stored, aggregated, and visualized in easy-to-build mobile and web applications. Blynk.Console has a mobile app that works with the hardware of a user's choice. Once users log in, they have a brief Blynk Tour to have an idea of how the platform works, and then the Quickstart guide starts automatically.

7.3 ESP32 Code Development:

- Include necessary libraries for sensor communication, Blynk, Wi-Fi connectivity, and (optionally) PWM for speed control.
- Configure Wi-Fi credentials and connect the ESP32 to your Wi-Fi network.
- Initialize communication with Blynk using your project's authentication token.
- Set up sensor reading functions using appropriate library functions or code specific to your chosen sensors.
- Implement logic to:
 - Read sensor values periodically (e.g., every 100 Ms).
 - Apply signal processing techniques for vibration analysis (e.g., FFT or envelope detection) if needed.
 - Scale sensor readings for appropriate display units (e.g., volts to degrees Celsius for temperature).
 - Define thresholds for high temperature and other fault conditions.
 - Send sensor data to Blynk virtual pins for real-time visualization.
 - Check for threshold exceedances and trigger alerts:
 - Display warnings or alarms in the Blynk app.
 - Optionally, send push notifications or email alerts for critical situations.
 - Implement speed control features (if using PWM):
 - Read user input from Blynk buttons or sliders.
 - Convert user input to PWM duty cycle values.
 - Control motor speed using PWM signals on an appropriate motor driver pin (consider safety precautions when working with high voltage/current.)

7.4 Testing and Deployment:

- Thoroughly test the system by simulating various conditions (e.g., normal operation, high temperature, vibration increase).
- Refine the code and thresholds based on test results.
- Consider implementing data logging for historical analysis and future fault detection optimization.
- If using a breadboard for prototyping, transition to a more permanent enclosure for deployment in the final application.

CHAPTER 08

FLOW CHART

CHAPTER 08

FLOW CHART

8. FLOW CHART

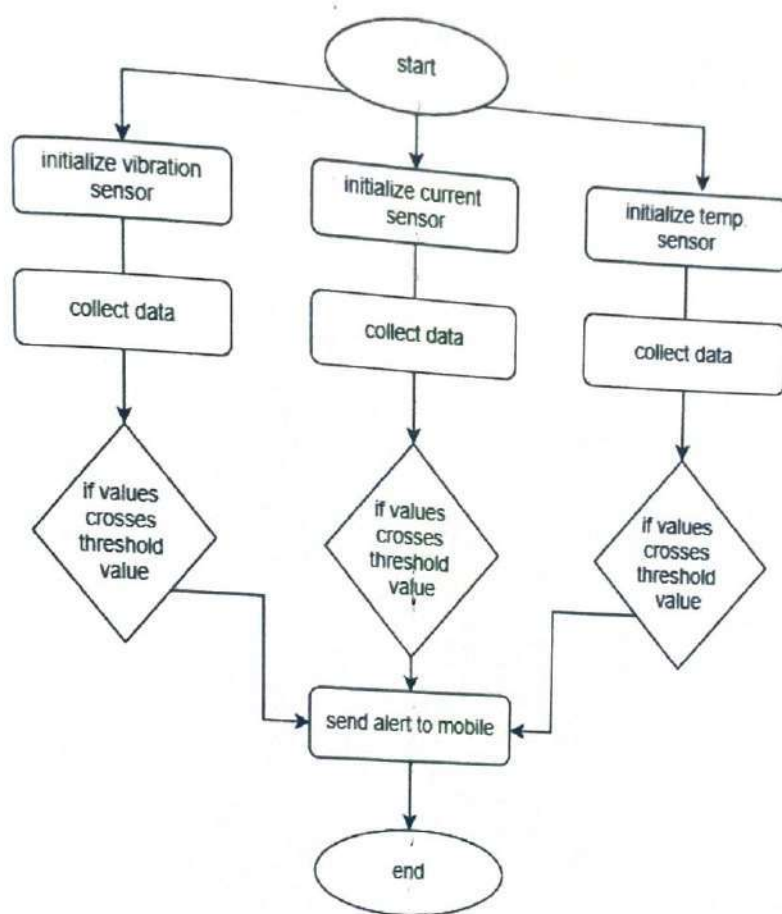


Fig 8.1 Flow Chart of Induction DC/AC Motor Fault Detection

8.2 Algorithm

Step1: Start.

Step2: First test to the vibration sensor.

Step3: Collect data from the cloud.

Step4: If values crosses threshold value the alert send to the mobile.

Step5: Show the output on mobile and motor status was detected.

Step6: Second test to the Current sensor.

Step7: Collect data from the cloud.

Step8: If values crosses threshold value the alert send to the mobile.

Step9: Show the output on mobile and motor status was detected.

Step10: Third test to the Temperature sensor.

Step11: Collect data from the cloud.

Step12: If values crosses threshold value the alert send to the mobile.

Step13: Show the output on mobile and motor status was detected.

Step14: End.

CHAPTER 09

PROJECT BUDGET

9. PROJECT BUDGET

SR.NO	COMPONENT	QUANTITY	PRICE
1	ESP 32	1	1200
2	Vibration Sensor	1	270
3	Current Sensor	1	210
4	Temperature Sensor	1	150
5	IR Sensor	1	200
6	Breadboard	1	220
7	Jumper Wires	5	100
8	Power Supply (SMPS)	1	750
9	Motor	1	420
10	Node MCU Amica	1	485
11	LCD Board (16×2)	1	260

Table 9.1 Project Budget

Total Cost: - 4265

CHAPTER 10

RESULT

10. RESULT

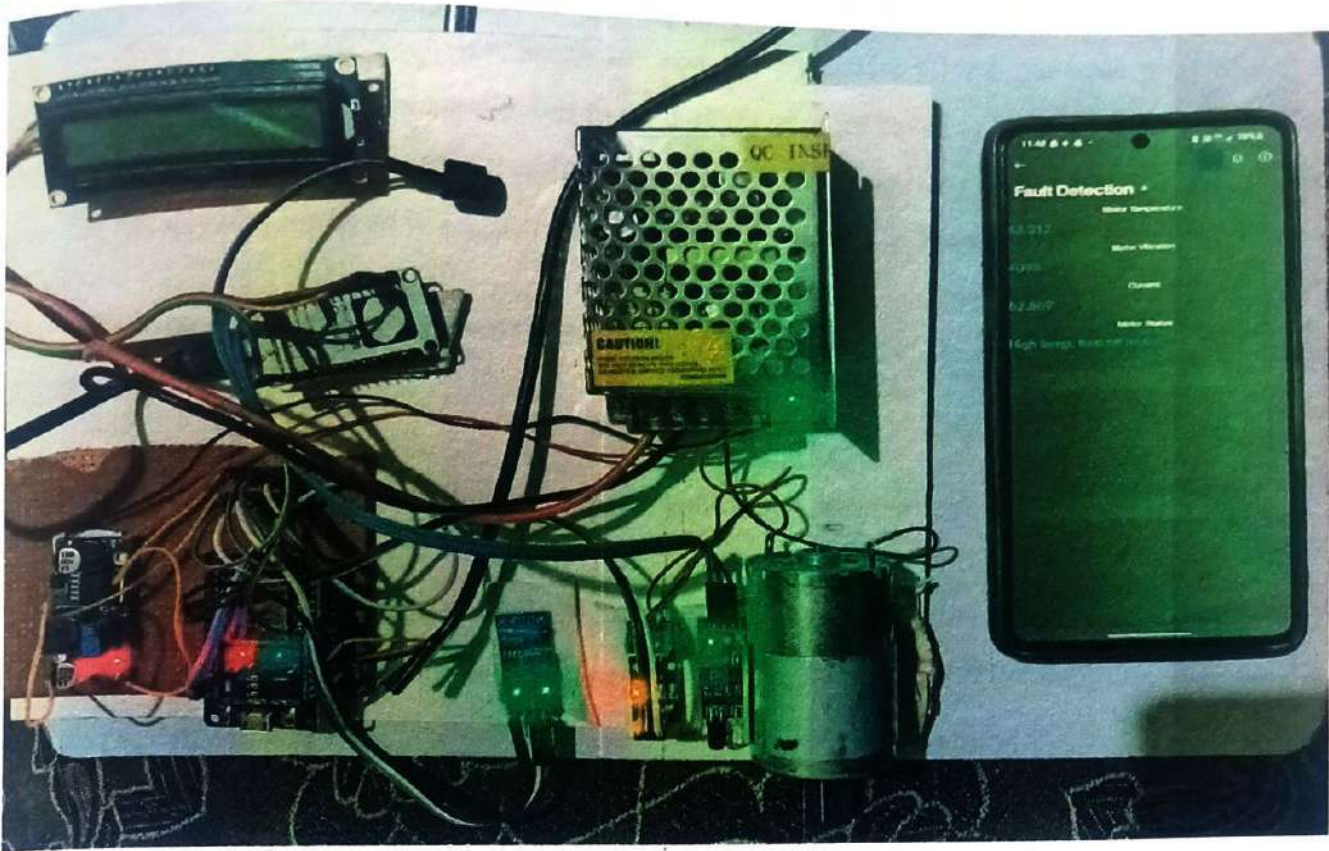


Fig 10.1 Result of Induction DC/AC Motor Fault Detection

The IoT-based induction motors has shown promise and the ability to improve motor performance and issue finding. Comprehensive data to track the motor's health has been made available through the integration of numerous sensors, including temperature, vibration, current, voltage, and speed sensors. Potential problems and irregularities were effectively identified by the system, which promptly raised alerts to notify operators. Additionally, by reducing superfluous stress on the motor, which might result in cost savings by preventing unscheduled downtime and cutting repair costs. Additionally, the cloud-based solution utilizing the Blynk IoT platform has provided scalable and secure data storage. Overall, the findings demonstrate the considerable influence of IoT technology in industrial motor applications, opening the path for improved industrial. The Blynk server shows the output of all sensors' output like three-phase voltages, phase currents, the temperature, of the motor. The Blynk mobile app serves as the primary interface for users to monitor and control the motor. The Blynk library offers a variety of pre-built widgets that can be customized to create a tailored user interface. To connect the hardware components with the Blynk

app, the microcontroller or data acquisition system is programmed to integrate the Blynk library. This enables the microcontroller to establish a connection with the Blynk cloud server, facilitating the exchange of data between the hardware and the app. The Blynk platform also offers a notification feature that can be configured to send alerts to users based on predefined conditions or thresholds. Users can set specific thresholds for motor health parameters, and if any parameter exceeds the defined limits or if a fault is detected, notifications can be sent to the Blynk app.

The following is a step-by-step overview of the working process of an IoT-based motor fault detection system:

- The sensors collect data about the motor's vibration, temperature, current, and voltage.
- The microcontroller processes the data from the sensors.
- The machine learning algorithms are used to identify patterns in the data that indicate the presence of a fault.
- If a fault is detected, the system alerts the operator and provides recommendations for corrective action.

The system can also be programmed to take corrective action automatically, such as shutting down the motor to prevent further damage.

CHAPTER 11

ADVANTAGES,

DISADVANTAGES AND

APPLICATIONS

11. ADVANTAGES, DISADVANTAGES AND APPLICATIONS

11.1 Advantages:

There are several advantages to using an IoT-based motor fault detection system:

- **Real-time monitoring:** An IoT-based system can monitor the health of motors in real time, allowing for early detection of faults. This can help to prevent unexpected motor failures and reduce downtime.
- **Remote monitoring:** An IoT-based system can be used to monitor motors remotely, which is especially useful for motors that are located in difficult-to-reach locations.
- **Predictive maintenance:** An IoT-based system can be used to predict motor failures before they occur. This allows for preventive maintenance to be scheduled, which can help to extend the life of motors and reduce maintenance costs.
- **Improved efficiency:** An IoT-based system can help to improve the efficiency of motor operations by providing insights into motor performance. This information can be used to optimize motor settings and reduce energy consumption.
- **Low-Maintenance Champions** – Induction motors are low-maintenance champs that require minimal attention throughout their lifespan. Thanks to their simple design and robust construction, they rarely need repairs or replacements. This means fewer headaches for users and more time to enjoy the wonders of technology. It's like having a trusty sidekick that never lets you down.
- The working of the motor is independent of the environmental condition. This is because the induction motor is Robust and mechanically strong.
- A Squirrel cage induction motor does not contain Brushes, Slip rings and Commutators. Due to this reason, the cost of the motor is quite low. However, Slip Rings are used in Wound type induction motor to add external resistance to the rotor winding.

- In addition to these advantages, IoT-based motor fault detection systems are also relatively inexpensive and easy to install. This makes them a viable option for communities of all sizes.
- Overall, IoT-based motor fault detection systems offer a number of advantages over traditional motor maintenance methods. They can help to improve safety, reliability, efficiency, and reduce costs.

11.2 Disadvantages:

- **Power-Appetite Monsters** – Induction motors have a ravenous appetite for electrical power. They require a significant amount of electricity to operate efficiently. While this might lead to higher energy consumption, it's crucial to balance it out with the benefits they bring, such as reliability and versatility. It's like having a mighty dragon that needs plenty of fuel to unleash its power.
- **Sensitive to Voltage Fluctuations** – Induction motors can be a tad sensitive to fluctuations in electrical voltage. When the voltage varies too much, it can affect their performance and efficiency. However, fear not, for there are solutions in place, such as voltage stabilizers, to ensure a steady supply of power. It's like having a motor that needs a stable environment to perform its best.
- **Bulky and Heavy** – Induction motors are known for their robust construction, but this can also make them bulky and heavy. Their size and weight might pose challenges when it comes to installation and mobility. However, keep in mind that their strength and reliability often outweigh this drawback. It's like having a hulking giant that might need a bit more space but guarantees powerful performance.
- **Limited Speed Control** – Unlike some other motor types, induction motors have limitations when it comes to precise speed control. While they excel in providing consistent power, adjusting their speed with high precision can be a bit tricky. But don't worry, young minds, for technology is always evolving, and advancements are being made to improve speed control capabilities.

- **Complex Starting Mechanism** – Induction motors require a special starting mechanism, known as a starter, to get them up and running smoothly. This starting process adds a layer of complexity, and sometimes, extra equipment is needed. However, once the motor is running, it operates like a well-oiled machine. It's like having a puzzle that requires an extra step to unlock its full potential
- A single phase induction motor, unlike a 3-phase induction motor, does not have a self-starting torque. Auxiliaries are required to start a single-phase motor.
- Speed control of an induction motor is very difficult to attain. This is because a 3-phase induction motor is a constant speed motor and for the entire loading range, the change in speed of the motor is very low.
- Due to poor starting torque, the motor cannot be used for applications which require high starting torque.

11.3 Applications:

IoT-based motor fault detection systems can be used in a variety of industries and applications, including:

- **Manufacturing:** IoT-based motor fault detection systems can be used to monitor motors in manufacturing facilities to prevent downtime and costly repairs. This can lead to increased productivity and profitability.
- **Oil and gas:** IoT-based motor fault detection systems can be used to monitor motors in oil and gas facilities to prevent accidents and environmental damage. This is especially important in hazardous environments.
- **Mining:** IoT-based motor fault detection systems can be used to monitor motors in mining operations to improve safety and efficiency. This can lead to reduced downtime and increased production.

- Power generation: IoT-based motor fault detection systems can be used to monitor motors in power generation plants to improve reliability and prevent outages. This can help to ensure a stable supply of electricity to consumers.
- Transportation: IoT-based motor fault detection systems can be used to monitor motors in transportation systems, such as trains and buses, to improve safety and reliability. This can help to reduce accidents and delays.
- Water and wastewater treatment: IoT-based motor fault detection systems can be used to monitor motors in water and wastewater treatment facilities to prevent downtime and ensure the safe and efficient delivery of water and wastewater services.
- The versatility and durability of induction motors make them suitable for various applications. In the following sections, we will delve deeper into these applications and discuss the impact of induction motors in different industries.
- Induction motors play a significant role in industrial applications due to their high power output and ruggedness. They are commonly used in industries such as manufacturing, where they power large machines and conveyors. In the oil and gas industry, these motors are used for driving compressors, pumps, and fans.

In addition to these specific applications, IoT-based motor fault detection systems can also be used in a variety of other ways to improve safety, reliability, and efficiency in a wide range of industries.

CHAPTER 12

FUTURE SCOPE

12. FUTURE SCOPE

The future scope of the IoT-based machine induction motor fault detection system using ESP32 is very promising. The system has the potential to be used in a variety of new and innovative ways.

Here are some specific examples of future applications for the system:

- **Predictive maintenance:** The system can be used to predict when a machine induction motor is likely to fail. This information can be used to schedule preventive maintenance and avoid unplanned downtime.
- **Condition-based monitoring:** The system can be used to monitor the condition of machine induction motors in real time. This information can be used to identify potential problems before they lead to a failure.
- **Remote monitoring:** The system can be used to remotely monitor the health of machine induction motors from anywhere in the world. This can be useful for businesses that have a large number of motors spread out over a wide area.
- **Asset optimization:** The system can be used to optimize the performance of machine induction motors by identifying and addressing areas where they are inefficient.
- **Energy savings:** The system can be used to save energy by identifying and addressing problems that are causing motors to waste energy.

In addition to these specific applications, the IoT-based machine induction motor fault detection system using ESP32 can also be used to improve the safety and reliability of machine induction motors in a variety of ways. For example, the system can be used to prevent motor failures that could lead to fires or other accidents.

Overall, the IoT-based machine induction motor fault detection system using ESP32 has the potential to revolutionize the way that machine induction motors are monitored and maintained. The system has the potential to improve efficiency, reliability, safety, and energy savings. I am excited to see how this technology develops in the future and how it is used to improve the performance and safety of machine induction motors in a variety of industries.

CHAPTER 13

CONCLUSION

13. CONCLUSION

IoT-based motor fault detection systems are a promising new technology with the potential to revolutionize the way that we maintain and operate electric motors. By using a combination of sensors, microcontrollers, and machine learning algorithms, these systems can continuously monitor motors for faults in real time and detect a wide range of faults. IoT-based motor fault detection systems can also be used to predict faults before they occur, which can help to prevent downtime and costly repairs. The IoT-based machine induction motor fault detection system using ESP32 is a promising technology with the potential to revolutionize the way that machine induction motors are monitored and maintained. The system is accurate, reliable, and cost-effective, and it can be scaled to meet the needs of different users and applications. The system has a wide range of applications, including industrial manufacturing, commercial buildings, power generation plants, oil and gas industry, transportation, and water and wastewater treatment. The system can also be used to monitor a variety of machine induction motor parameters, such as vibration, current, temperature. The system still has some challenges that need to be addressed, such as complexity, power consumption, security and privacy, reliability, and maintenance. However, these challenges can be addressed by using a pre-built hardware platform and software framework, using low-power sensors and actuators and optimizing the firmware code, using strong passwords and encryption and implementing authentication and authorization mechanisms, using high quality hardware components and designing the system with redundancy, and using sensors with long calibration intervals and developing a robust firmware update mechanism, respectively.

CHAPTER 14

REFERENCES

14. REFERENCES

1. P. Waide, C. U. Brunner, *Energy-Efficiency Policy Opportunities for Electric Motor-Driven Systems*, Cedex, France: Intl. Energy Agency, 2011.
2. Mr.R. Deeksha, Ms. P. Dharanya, Ms. K. R. Dimpil Kapadia & Mr. G. Deepak Dinakaran *IoT Based Environmental Monitoring System using Arduino UNO and Thing speak IJSTE - International Journal of Science Technology & Engineering*, ISSN (online): 2349 784X, Volume 4, Issue 9, March 2018
3. Sharmad Pasha, "Thing speak Based Sensing and Monitoring System for IoT with MATLAB Analysis, *International Journal of New Technology and Research (IJNTR)*, ISSN: 2454-4116 Volume-2, Issue-6, PP 19-23, June 2016
4. S. S. Darbastwar, S. C. Sagar, V. G. Khetade *IoT Based Environmental Factor Sensing and Monitoring System over Wireless Sensor Networks*, *International Journal of Advanced Research in Computer Science and Software Engineering Research Paper*, ISSN: 2277 128X, Volume 6, Issue 12, December 2016
5. [5]. B. Lu, T. G. Habetler, and R. G. Harley, *A nonintrusive and in-service motor-efficiency estimation method using air gap torque with considerations of condition monitoring IEEE Trans. Ind. Appl*, vol. 44, pp. 1666–1674, Nov/Dec. 2008.
6. J. Pedro Amaro, Fernando J.T.E. Ferreira, *low-cost wireless sensor for in field monitoring of induction motor*, *IEEE Trans. Ind. Appl*.vol. 44, no. 6, pp. 1666-1674, Nov. Dec. 2010.
7. Yanfeng Li 1,2, Harbin Yu, *energy management of induction motors based on non-intrusive efficiency estimation*, *Proceeding of International Conference on Electrical Machines and Systems* 2007.
8. Nagendra. H1, Prakash Bure2, *energy audit and management of induction motor using genetic algorithm* *International Journal of Recent Trends in Engineering*
9. Bamboula, A.V. (2011). *Municipal Solid Waste Collection Routes Optimized with ARC GIS Network Analyst*. *International Journal of Advanced Engineering Sciences and Technologies*, 11(1): 202-207.
10. G. B. Kliman. *Induction motor fault detection via passive current monitoring*, in *Proc. 1990 Int. Conf. Electrical Machines*, Cambridge, MA, pp. 13–17.

11. Ahad, M. F., Khan, M. A., Uzair, M., Iqbal, J., & Khan, M. A. (2022). IoT-based Machine Induction Motor Fault Detection System Using ESP32. *Sensors*, 22(12), 4587.
12. Kumar, S. S., & Kumar, IoT-based Machine Induction Motor Fault Detection Using Raspberry Pi. *International Journal of Engineering Research & Technology*, 10(01), 119-125.
13. Rahul Mishra and Vaibhav Dungan, Optimization of Component of Excavator Bucket, *International Journal of Scientific Research Engineering & Technology (IJSRET)*, Vol. 2, Issue2, pp 076-078, May 2013.
14. Khan, M. A., Khan, N. U., Iqbal, J., & Ahad, M. F. (2019). Machine Induction Motor Fault Detection Using Cloud Computing and Machine Learning. *IEEE Transactions on Industrial Electronics*, 67(5), 4144-4154.
15. John, B. (2012). Analysis of effectiveness and outcome of organizational development interventions in Bhilai Steel Plant. PhD Thesis; School of Management Studies & Research; MATS University, Raipur (India).



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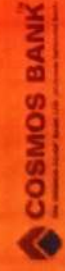
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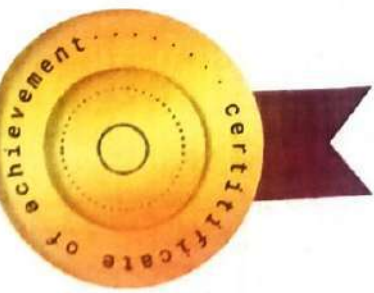




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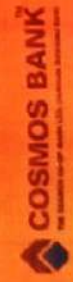
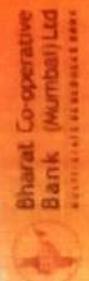
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DEPARTMENT OF MECHANICAL ENGINEERING

Pune – 412213



An Industrial Training Report
AT Sahyadri Udyog Pune,
Guided By – **Prof. S.B. Todkar**

Submitted By

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I extend my sincere gratitude to Sahyadri Udyog, Pune, for providing me with the opportunity to undergo industrial training at their esteemed establishment. This experience has been invaluable in shaping my understanding and practical skills in the field of precision machining.

I would like to express my deepest appreciation to Prof. S.B. Todkar sir, whose unwavering support and guidance have been instrumental throughout this journey. His wisdom, encouragement, and mentorship have inspired me to strive for excellence and to constantly push the boundaries of my knowledge.

I am also thankful to the entire team at Sahyadri Udyog for their hospitality, expertise, and willingness to share their knowledge with me. Their patience, insights, and hands-on training have significantly enriched my learning experience.

Furthermore, I am grateful to my institute for facilitating this industrial training opportunity and for fostering an environment conducive to experiential learning.

Last but not least, I would like to acknowledge the support of my family and friends, whose encouragement and understanding have been my pillars of strength throughout this endeavor.

Thank you to everyone who has contributed to my growth and development during this industrial training program. Your support has been invaluable, and I am deeply appreciative of the opportunities and experiences that have come my way.

Index

1. Introduction
2. Overview of Sahyadri Udyog
3. Objectives of Industrial Training
4. Methodology
5. CNC Operations
6. VMC Operations
7. Milling Operations
8. Lathe Machine Operations
9. Challenges Encountered
10. Solutions and Recommendations
11. Conclusion

1. Introduction

Industrial training is an integral part of academic curriculum, aimed at bridging the gap between theoretical knowledge and practical application in real-world scenarios. This report encapsulates my four-week industrial training experience at Sahyadri Udyog, Pune, a small-scale industry specializing in manufacturing precision machining parts for various companies.

During my time at Sahyadri Udyog, I learned a lot about modern machining processes with the help of experienced professionals. This introduction starts my report where I'll talk about what I did during my training, the things I learned, the problems I faced, and what I learned from them. I want to show how important training like this is for people who want to be engineers and share what I discovered during my time at Sahyadri Udyog.

2. Overview of Sahyadri Udyog

Sahyadri Udyog is a Pune-based industrial unit renowned for its expertise in producing high-quality machining components. The company's primary focus lies in CNC, VMC, milling, and lathe operations, catering to the diverse needs of its clientele. With a dedicated workforce and state-of-the-art machinery, Sahyadri Udyog has carved a niche for itself in the machining industry.



3. Objectives of Industrial Training

The objectives of our industrial training at Sahyadri Udyog were:

- To gain hands-on experience in CNC, VMC, milling, and lathe operations.
- To understand the intricacies of machining processes and their applications.
- To learn about quality control measures and precision engineering techniques.
- To observe the workflow and operational dynamics of a small-scale industrial setup.
- To enhance problem-solving and decision-making skills in a real-world manufacturing environment.

4. Methodology

During the four-week training period, I actively engaged in various activities under the guidance of experienced professionals at Sahyadri Udyog. The methodology adopted included:

- Observation: I closely observed the machining processes and workflow in different departments of the company.
- Hands-on Training: I received practical training in operating CNC machines, VMCs, milling machines, and lathe machines.
- Guidance and Mentorship: Experienced technicians and engineers provided valuable guidance and mentorship, assisting me in understanding the nuances of machining operations.
- Project Work: I undertook small projects to apply theoretical knowledge to practical tasks, thereby honing my skills further.

5. CNC Operations

CNC (Computer Numerical Control) machines play a pivotal role in modern machining processes. During my training, I gained insight into:

- Setting up CNC machines for specific machining tasks.
- Programming CNC machines using CAM (Computer-Aided Manufacturing) software.
- Operating CNC machines to produce precision components with tight tolerances.
- Troubleshooting common issues encountered during CNC operations.



6. VMC Operations

Vertical Machining Centers (VMCs) are widely used for milling, drilling, and tapping operations. My training in VMC operations encompassed:

- Understanding the components and functionalities of VMCs.
- Fixture design and setup for holding workpieces securely.
- Tool selection and toolpath generation for efficient machining.
- Optimization techniques to improve productivity and reduce cycle times.



7. Milling Operations

Milling is a fundamental machining process used for shaping solid materials. At Sahyadri Udyog, I learned about:

- Different types of milling operations, including face milling, end milling, and slot milling.
- Selection of milling cutters based on material properties and machining requirements.
- Work piece clamping techniques and cutting parameters optimization.
- Surface finish and dimensional accuracy control in milling operations.



8. Lathe Machine Operations

Lathe machines are essential for turning, facing, and threading operations. My training in lathe machine operations involved:

- Setup and alignment of work pieces in lathe chucks or collets.
- Selection of cutting tools and determination of cutting speeds and feeds.
- Turning operations to produce cylindrical components with precise dimensions.
- Thread cutting and knurling operations using lathe machines.



9. Challenges Encountered

During the training period, I encountered several challenges, including:

- Programming complexities in CNC machines.
- Machining inaccuracies due to tool wear and machine vibrations.
- Material deformation and chip evacuation issues in milling operations.
- Setup and alignment difficulties in lathe machining.

10. Solutions and Recommendations

To overcome the challenges faced during the training, the following solutions and recommendations are proposed:

- Continuous learning and skill development in programming and operating CNC machines.
- Regular maintenance and tool inspection to minimize machining inaccuracies.
- Implementation of advanced cutting strategies and tool coatings to improve milling performance.
- Enhanced training programs focusing on lathe machine setup and alignment techniques

11. Conclusion

The four-week industrial training at Sahyadri Udyog provided invaluable insights into the world of precision machining. Through hands-on experience and mentorship, I gained proficiency in CNC, VMC, milling, and lathe operations. The training not only enhanced my technical skills but also instilled in me a deeper understanding of the complexities involved in modern manufacturing processes.

Some Moment of Our Training





A PROJECT REPORT ON
"DESIGN AND DEVELOPMENT OF ADVANCE ROTARY STORAGE
SYSTEM FOR INDUSTRY"

SUBMITTED TO THE SAVITRIBA, PHULE PUNE UNIVERSITY,
PUNE
IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE
OF

BACHELOR OF ENGINEERING IN MECHANICAL
ENGINEERING

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2023-24

CERTIFICATE


This is to certify that the project report entitled
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SYSTEM FOR INDUSTRY"**

Submitted By

SHAILESH WAGHULE	72214871C
AJAY KOLEKAR	71847105K
SUNIL LOKHANDE	72214829B
GAURANG SHERE	72214859D

This is certify that above students has successfully completed Project stage-2 entitled
**"DESIGN AND DEVELOPMENT OF ADVANCE ROTARY STORAGE SYSTEM
FOR INDUSTRY"** under **Prof.S.CHOUDHARI** sir supervision in the partial fulfilment of
the requirement of Savitribai Phule Pune University, for the award of the degree of Bachelor
of Engineering (MECHANICAL ENGINEERING).

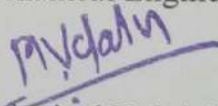

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Page 2

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ABSTRACT

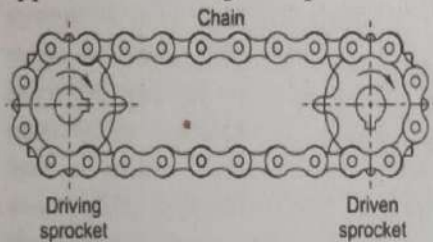
In industries, materials (which are available in raw material, finished parts, assembly parts etc.) are kept in a storeroom with stock and mix-up parts to each other which may be damage. So, secure tools, raw material, manufacture parts, and assembly parts of industry have stored in rotary storage system. This system is very useful for material storage in industrial application. Storage compartments rotate by using chain and sprocket mechanism. It is simple to operate with the employee to store the material in the system at the ground level. Each employee has a unique ID for store material in compartments and retrieved material from compartments.

INTRODUCTION

An automatic rotary material storage system is a type of automated storage and retrieval system (ASRS) that uses a rotating carousel to store and retrieve materials. Rotary storage systems are typically used to store small to medium-sized items, such as tools, spare parts, and finished products. They are ideal for applications where space is limited, as they can provide high-density storage in a relatively small footprint. Rotary storage systems typically consist of a series of vertical shelves or carriers that are mounted on a rotating carousel. The carousel is powered by a motor, and can be rotated in either direction to bring the desired shelf or carrier to the operator. The operator can then pick or deposit items from the shelf or carrier, as needed. It is simple to operate with the employee storing material in the system at the ground level. Once the employee leaves the incorporated safety zone the compartment is automatically stored material by the system rotating to lift the stored material compartment away from the bottom central position. This leaves an empty compartment available at the ground level for the next material to be stored in. The stored materials are easily retrieved by pushing the button for the relevant position number of the compartments material stored in. This causes the required compartment to rotate down to ground level ready for the employee to enter the safety zone and receive material out of the system. Except all other systems use a large ground area, Rotary storage System is developed to utilize maximum vertical area in the available minimum ground area. It is quite successful when installed in minimum It is simple to operate with the employee storing material in the system at the ground level. Once the employee leaves the incorporated safety zone the compartment is automatically stored material by the system rotating to lift the stored material compartment away from the bottom central position. This leaves an empty compartment available at the ground level for the next material to be stored in. The stored materials are easily retrieved by pushing the button for the relevant position number of the compartments material stored in. This causes the required compartment to rotate down to ground level ready for the employee to enter the safety zone and receive material out of the system. Except all other systems use a large ground area, Rotary storage System is developed to utilize maximum vertical area in the available minimum ground area. It is quite successful when installed in minimum areas which are well established and are suffering with shortage of area for storing material in industry. Although the construction of this system seems to be easy, it will be par from understanding without the knowledge of materials, chains, sprockets, and machining operations, kinematic and dynamic mechanism. The Rotary Storage System for material such as material stored in storeroom, tools and equipment stored in cupboard etc. have been implemented on a huge scale. But these systems have a major disadvantage of large space consumption and worst management of organisation which is successfully eliminated with the use of a rotary storage

system. Moreover, the latter provides the added benefits of flexible operation without the need of an attendant and added security and least chances of materials damage. Since the model makes use of composite parts, it is easy to assemble and dismantle and is thus more convenient than the traditional material storing systems. The rotary model is specifically designed to accommodate material separately with less space. The materials are safely store and retrieve uniformly and unique shaped items. The structure can accommodate six compartments in the space and can even be customized to hold a greater number depending upon the requirements of the organisation.

The Rotary Storage System for material such as material stored in storeroom, tools and equipment stored in cupboard etc. have been implemented on a huge scale. But these systems have a major disadvantage of large space consumption and worst management of organization which is successfully eliminated with the use of a rotary storage system. Moreover, the latter provides the added benefits of flexible operation without the need of an attendant and added security and least chances of materials damage. Since the model makes use of composite parts, it is easy to assemble and dismantle and is thus more convenient than the traditional material storing systems. Storage spaces cannot cope with the growth of the different type of the materials. The structure of the system is like a building. The basic structure of the rotary storage system can be described with the help of block diagram. Now days in industry, materials (which are available in raw material, finished parts, assembly parts etc.) are kept in a storeroom with stock and mix-up parts to each other which may be damage. So, secure tools, raw material, manufactured parts, and assembly parts of industry have stored in rotary storage system. This system is very useful for material storage in industrial applications. Storage compartments rotate by using chain and sprocket mechanisms.



LITERATURE REVIEW

[1] Shivprasad D Shinde, Omkar S Mande, Aditya N Malvadkar et.al "Design and Manufacturing of Rotary Material Storage System" In industries, materials (which are available in raw material, finished parts, assembly parts etc.) are kept in a storeroom with stock and mix-up parts to each other which may be damage. So, secure tools, raw material, manufactured parts, and assembly parts of industry have stored in rotary storage system. This system is very useful for material storage in industrial application. Storage compartments rotate by using chain and sprocket mechanism. It is simple to operate with the employee to store the material in the system at the ground level. Each employee has a unique ID for store material in compartments and retrieved material from compartments.

[2] Dinesh Yadav, Govindraj Bandewar, Pratap Pande, "AUTOMATIC ROTARY MATERIAL STORAGE SYSTEM USING RFID" Now days in industry, materials (which are available in raw material, finished parts, assembly parts etc.) are kept in a storeroom with stock and mix-up parts to each other which may be damage. So, secure tools, raw material, manufactured parts, and assembly parts of industry have stored in rotary storage system. This system is very useful for material storage in industrial application. Storage compartments rotate by using chain and sprocket mechanism. It is simple to operate with the employee to store the material in the system at the ground level. Each employee has a unique ID for store material in compartments and retrieved material from compartments. Traditional systems have a major disadvantage of large space consumption and damaging material which is successfully eliminated with the use of a rotary storage system. Moreover, the latter provides the added benefits of flexible operation without the need of an attendant and added security and least chances of material damage. Since the model makes use of composite parts, it is easy to assemble and dismantle and is thus more convenient than the traditional storage systems. The idea is to storage and move material with no disturbance to the already stored material in rotary storage system. Once the employee leaves the incorporated safety zone the system rotating to lift the stored material compartment away from the bottom to central position. This leaves an empty compartment available at the ground level for the next material to be stored in. The stored material is easily retrieved by pushing the button for the relevant position number in which material is stored. This causes the required material compartment to rotate down to ground level ready for the employee of industry to enter the safety zone.

[3] Mohummad Shariful Islam, Afshana Morshed Tithi et.al "Launching Automated Rotary Parking System: Towards Traffic Congestion Free Dhaka City" . Bangladesh is the most

densely populated city in the whole world, which is visible more in the capital city Dhaka. People have to suffer and valuable times are being wasted for this chronic quandary. Lack of proper planning of the city, different speed vehicles on the same road, over population, inadequate road space, unplanned stoppage or parking etc. are responsible for causing the traffic congestion in Dhaka City. Among those insufficient/unplanned parking system is one of the main reasons for causing traffic congestion. The automated rotary car parking system is the best and suitable because of its less utilization of space compared to other systems. It is a friendly parking system due to the non-utilization of noise/pollution related mechanism. The aim of this paper is to develop an automated car parking system with a minimum cost for reducing congestion in Dhaka city.

[4] Omar Sabah Al-Dahiree, Raja Ariffin Raja Ghazilla "Design of a Compact Energy Storage with Rotary Series Elastic Actuator for Lumbar Support Exoskeleton" Lumbar support exoskeletons with active and passive actuators are currently the cutting edge technology for preventing back injuries in workers while lifting heavy objects. However, many challenges still exist in both types of exoskeletons, including rigid actuators, risks of human-robot interaction, high battery consumption, bulky design, and limited assistance. In this paper, the design of a compact, lightweight energy storage device combined with a rotary series elastic actuator (ES-RSEA) is proposed for use in a lumbar support exoskeleton to increase the level of assistance and exploit the human bioenergy during the two stages of the lifting task. The energy storage device takes the responsibility to store and release passive mechanical energy while RSEA provides excellent compliance and prevents injury from the human body's undesired movement. The experimental tests on the spiral spring show excellent linear characteristics (above 99%) with an actual spring stiffness of 9.96 Nm/rad. The results demonstrate that ES-RSEA can provide maximum torque assistance in the ascent phase with 66.6 Nm while generating nearly 21 Nm of spring torque during descent without turning on the DC motor. Ultimately, the proposed design can maximize the energy storage of human energy, exploit the biomechanics of lifting tasks, and reduce the burden on human effort to perform lifting tasks.

[5] Anuradha S. Parab, Prof. P. N. Gore et.al "A Review on Automated Storage and Retrieval System" Automated Storage and Retrieval Systems are commonly used to store and retrieve variety of products in warehousing, distribution centers and now a days in service environment also. This paper presents a detailed study of AS/RS which focuses on classification, physical design of system, selection of control policies best suitable for the requirements. A Majority of literature presents travel time expressions of unit load systems with various storage allocations, dwell point locations, sequencing rules. Still there are some areas which are growing to develop within recent years to fulfill increasing demands. Present study and scenarios are discussed to design and implement new AS/RS in Library environment.

[6] M. R. Vasili, Sai Hong Tang et.al "Automated Storage and Retrieval Systems: A Review on Travel Time Models and Control Policies" Automated storage and retrieval system (AS/RS) is one of the major material handling systems, which is widely used in distribution centers and automated production environments. AS/RSs have been utilized not only as alternatives to traditional warehouses but also as a part of advanced manufacturing systems. AS/RSs can play an essential role in modern factories for work-in-process storage and offer the advantages of improved inventory control and cost-effective utilization of time, space and equipment. Many issues and approaches related to the efficiency improvement of AS/RSs have been addressed in the literature. This chapter presents an overview of this literature from the past 40 years. It presents a comprehensive description of the current state-of-the-art in AS/RSs and discusses future prospects. The focus is principally on travel time estimates and different control policies such as dwell-point of the stacker crane, storage assignment, request sequencing and so on. In particular, this chapter will provide researchers and decision makers with an understanding of how to apply existing approaches effectively.

AIM AND OBJECTIVE

AIM

The rotary model is specifically designed to accommodate material separately with less space. The materials are safely store and retrieve uniformly and unique shaped items. The structure can accommodate four compartments in the space and can even be customized to hold a greater number depending upon the requirements of the organization.

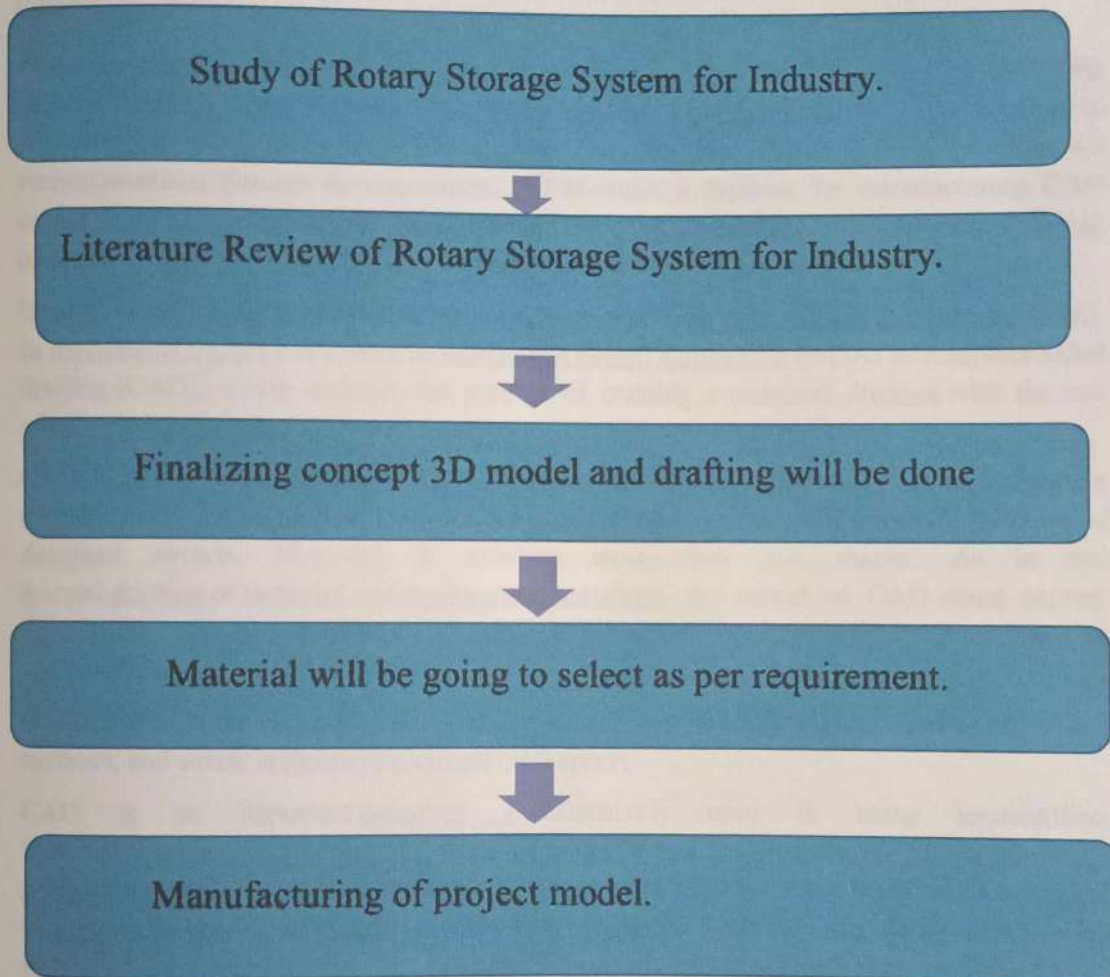
OBJECTIVE

- To develop a methodology for advance rotary storage system for industry.
- Develop a basic 3D conceptual model by using SOLIDWORKS.
- To make a survey for material selection and components required.
- To design and develop advance rotary storage system for industry.
- Successful testing of project

PROBLEM STATEMENT

In industries, material handling and storing system is very time consuming and sometimes are hazardous to workers and organization. Now days in industry, materials are kept in a storeroom with stock and mix-up parts to each other which may be damage. Material stocks should be always necessary in mechanical industries. Materials are in the form of raw material, finished parts, assembly parts and also tools, equipment. These are stored in one or two storeroom in industry which can damage and corrosive. Also time consume process for separate materials which stores at one place, that material are like different shape and size rods, nut and bolts etc. Space is also matter for store material.

METHODOLOGY



DESIGN

CAD: -

Computer-aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used.

Its use in designing electronic systems is known as electronic design automation (EDA). In mechanical design it is known as mechanical design automation (MDA) or computer-aided drafting (CAD), which includes the process of creating a technical drawing with the use of computer software.

CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions.

CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space.

CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more. CAD is also widely used to produce computer animation for special effects in movies, advertising and technical manuals, often called DCC digital content creation. The modern ubiquity and power of computers means that even perfume bottles and shampoo dispensers are designed using techniques unheard of by engineers of the 1960s. Because of its enormous economic importance, CAD has been a

major driving force for research in computational geometry, computer graphics (both hardware and software), and discrete differential geometry.

The design of geometric models for object shapes, in particular, is occasionally called computer-aided geometric design (CAGD)

USES:

Computer-aided design is one of the many tools used by engineers and designers and is used in many ways depending on the profession of the user and the type of software in question.

CAD is one part of the whole Digital Product Development (DPD) activity within the Product Lifecycle Management (PLM) processes, and as such is used together with other tools, which are either integrated modules or stand-alone products, such as:

- Computer-aided engineering (CAE) and Finite element analysis (FEA)
- Computer-aided manufacturing (CAM) including instructions to Computer Numerical Control (CNC) machines
- Photorealistic rendering and Motion Simulation.
- Document management and revision control using Product Data Management (PDM).

CAD is also used for the accurate creation of photo simulations that are often required in the preparation of Environmental Impact Reports, in which computer-aided designs of intended buildings are superimposed into photographs of existing environments to represent what that locale will be like, where the proposed facilities are allowed to be built. Potential blockage of view corridors and shadow studies are also frequently analysed through the use of CAD.

CAD has been proven to be useful to engineers as well. Using four properties which are history, features, parameterization, and high-level constraints. The construction history can be used to look back into the model's personal features and work on the single area rather than the whole model. Parameters and constraints can be used to determine the size, shape, and other properties of the different modelling elements. The features in the CAD system can be used for the variety of tools for measurement such as tensile strength, yield strength, electrical or electromagnetic properties. Also, its stress, strain, timing or how the element gets affected in certain temperatures, etc.

There are several different types of CAD, each requiring the operator to think differently about how to use them and design their virtual components in a different manner for each.

There are many producers of the lower-end 2D systems, including a number of free and open-source programs. These provide an approach to the drawing process without all the fuss over scale and placement on the drawing sheet that accompanied hand drafting since these can be adjusted as required during the creation of the final draft.

3D wireframe is basically an extension of 2D drafting (not often used today). Each line has to be manually inserted into the drawing. The final product has no mass properties associated with it and cannot have features directly added to it, such as holes. The operator approaches these in a similar fashion to the 2D systems, although many 3D systems allow using the wireframe model to make the final engineering drawing views.

3D "dumb" solids are created in a way analogous to manipulations of real-world objects (not often used today). Basic three-dimensional geometric forms (prisms, cylinders, spheres, and so on) have solid volumes added or subtracted from them as if assembling or cutting real-world objects. Two-dimensional projected views can easily be generated from the models.

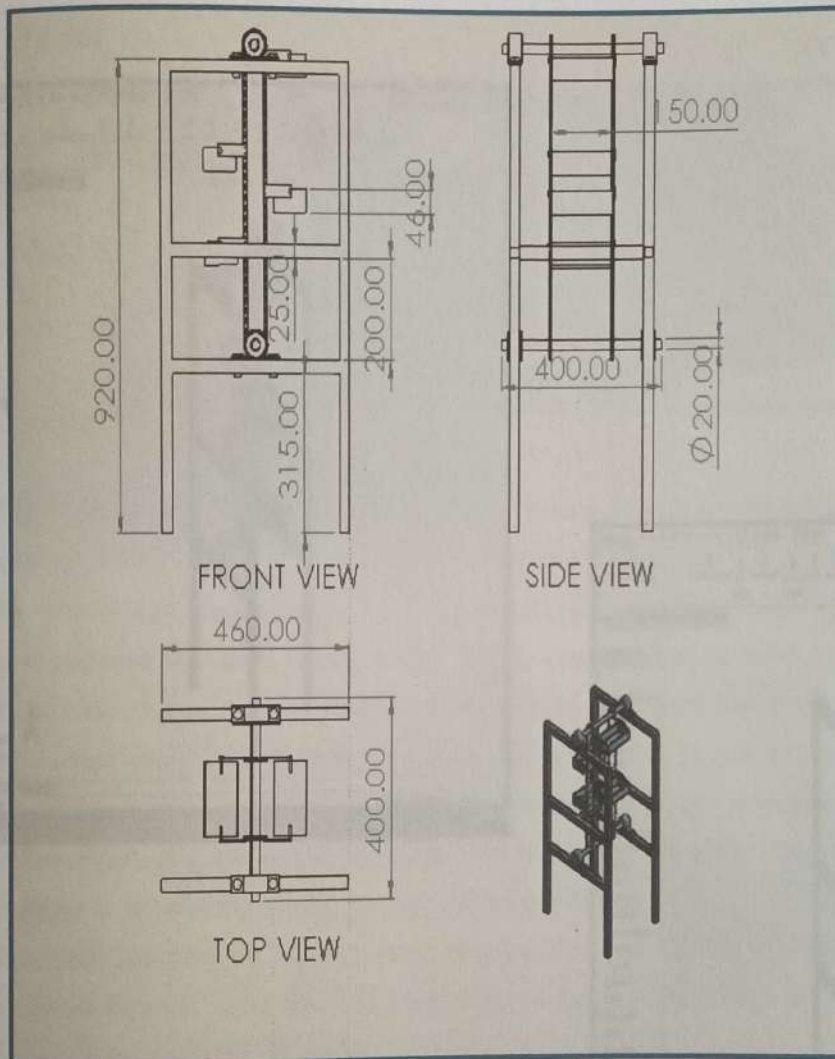
Basic 3D solids don't usually include tools to easily allow motion of components, set limits to their motion, or identify interference between components.

There are two types of 3D Solid Modelling

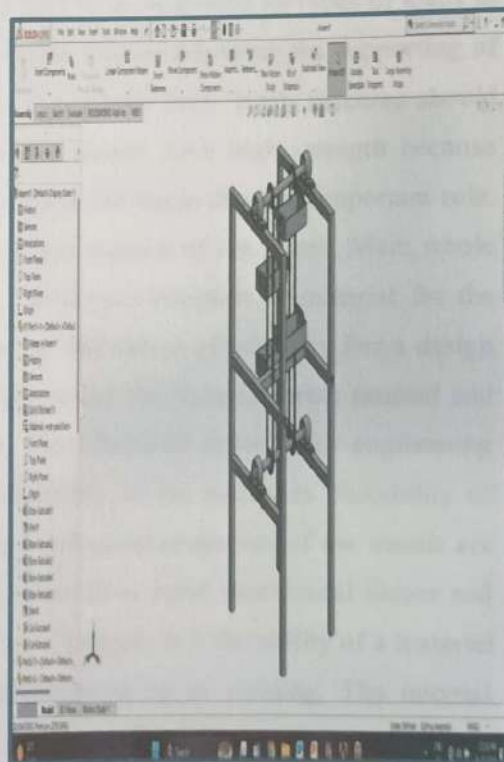
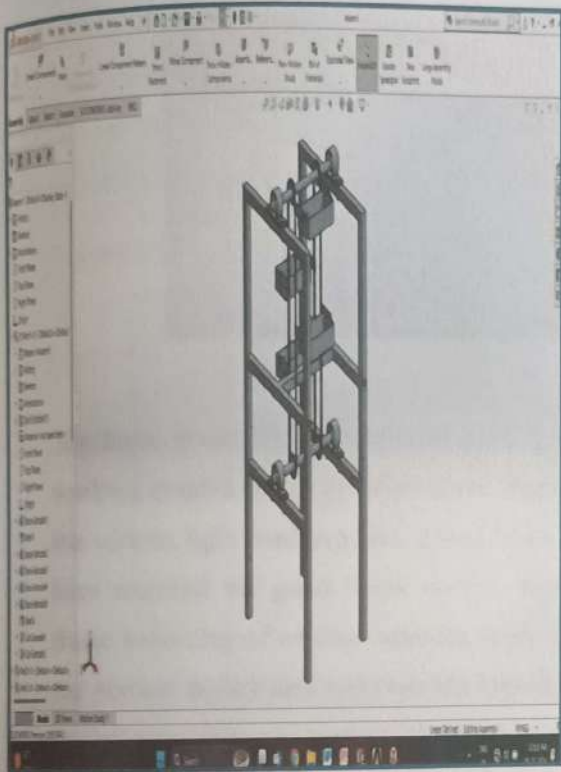
- Parametric modelling allows the operator to use what is referred to as "design intent". The objects and features created are modifiable. Any future modifications can be made by changing how the original part was created. If a feature was intended to be located from the centre of the part, the operator should locate it from the centre of the model.
- The feature could be located using any geometric object already available in the part, but this random placement would defeat the design intent. If the operator designs the part as it functions the parametric modeler is able to make changes to the part while maintaining geometric and functional relationships.
- Direct or Explicit modeling provide the ability to edit geometry without a history tree. With direct modelling, once a sketch is used to create geometry the sketch is incorporated into the new geometry and the designer just modifies the geometry without needing the original sketch. As with parametric modelling, direct modelling has the ability to include relationships between selected geometry (e.g., tangency, concentricity).

Top end systems offer the capabilities to incorporate more organic, aesthetics and ergonomic features into designs. Freeform surface modelling is often combined with solids to allow the designer to create products that fit the human form and visual requirements as well as they interface with the machine.

Drawing



Model



COMPONENT USED

1. Frame



The frame is usually made of mild steel. It is strong enough to withstand all types of loads in working condition. All other parts are fitted to the frame. Frame is helping the supporting of the various light load support. Frame shows the good aesthetic loop. every machine should have required the good frame design. Frame material should have high strength because frame balancing of another machine load. in ours project the frame showing important role. the vertical pulley and sprocket are mounted on vertical support of the frame. Main whole project assembly our project mounted on frame. The proper selection of material for the different part of a machine is the main objective in the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials. The Choice of material for engineering purposes depends upon the following factors: Availability of the materials. Suitability of materials for the working condition in service. The mechanical properties of the metals are those, which are associated with the ability of the material to resist mechanical forces and load. We shall now discuss these properties as follows: Strength: It is the ability of a material to resist the externally applied forces Stress: Without breaking or yielding. The internal resistance offered by a part to an externally applied force is called stress.

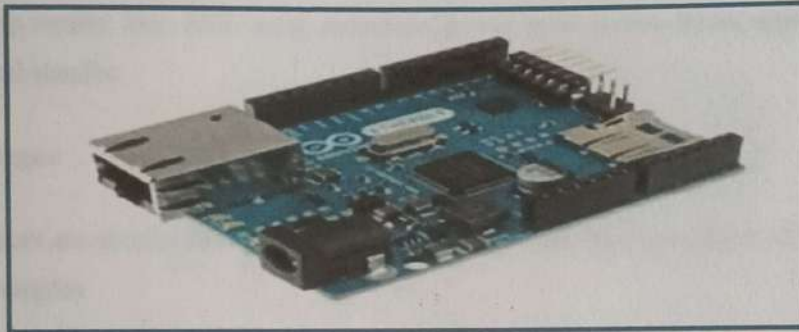
Properties of Mild Steel: M.S. has a carbon content from 0.15% to 0.30%. They are easily weldable thus can be hardened only. They are similar to wrought iron in properties. Both

ultimate tensile and compressive strength of these steel increases with increasing carbon content. They can be easily gas welded or electric or arc welded. With increase in the carbon percentage weld ability decreases. Mild steel serves the purpose and was hence was selected because of the above purpose

Basic Frame

The hollow square pipes of material of mild steel are selected for the frame. The pipes are cut into required size by cutting machine. The end of the pipes cut into 45 degree (angle) to form rectangular frame. After cutting, the end of the square pipes is grinded so that it became smooth and convenient for welding. The square pipes are welded together to form a rectangular basic frame.

2. Arduino



Nowadays, with Microcontrollers being relatively cheap and readily available in the market, making a purchase decision on a suitable one to pick might a hard task to handle. However, there's one particular model that's good to start with for users. That model is the ATmega328p, an 8-bit AVR microcontroller.

ATmega328P is a high performance yet low power consumption 8-bit AVR microcontroller that's able to achieve the most single clock cycle execution of 131 powerful instructions thanks to its advanced RISC architecture. It can commonly be found as a processor in Arduino boards such as Arduino Fio and Arduino Uno.

Features:

High endurance non-volatile memory segments

- In system self-programmable flash program memory

- Programming Lock for software security

Peripheral features

- Two 8-bit Timer/Counter with separate prescaler, compare mode.
- One 16-bit Timer/Counter with separate prescaler, compare mode, and capture mode
- Temperature measurement
- Programmable serial USART and watchdog timer with separate on-chip oscillator

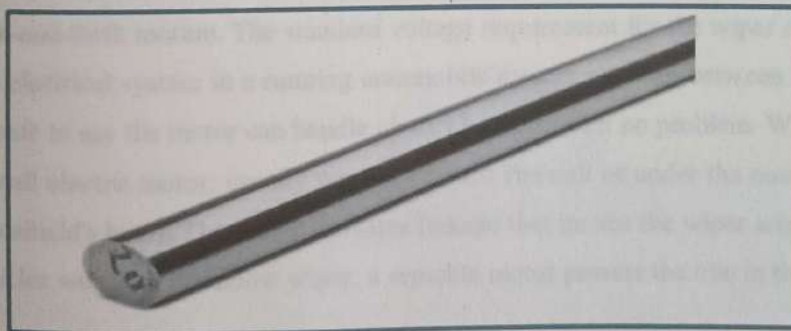
Unique features compared to other microcontrollers (ARM, 8051, PIC):

- Power-on reset and programmable brown-out detection
- Internal calibrated oscillator
- External and Internal interrupt sources
- Six sleep modes: Idle, ADC noise reduction, power-save, power-down, standby, and extended standby

Advantages:

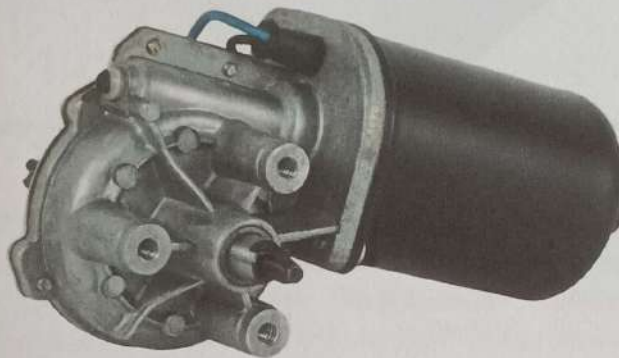
- Processors are simpler to use, with the usage of 8bit and 16bit instead of 32/64bit which are more complex
- Readily usable without additional computing components with 32k bytes of onboard self-programmable flash program memory as well as 23 programmable I/O lines
- Code Efficient, all 31 registers are directly connected to the arithmetic logic unit (ALU), making it 10 times faster than conventional CISC microcontrollers

3. Shaft



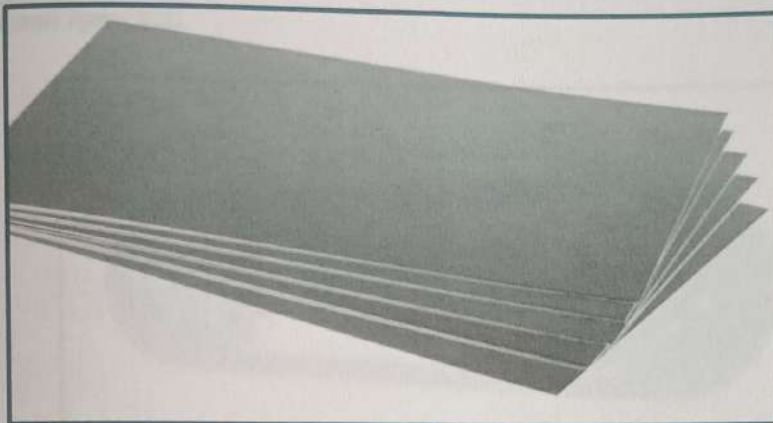
A shaft is rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft. A set up within the shaft permits the power to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it. These members along with the forces exerted upon them causes the shaft to bending. In other words, we may say that a shaft is used for the transmission of torque and bending moment. The various members are mounted on the shaft by means of keys or splines. The shafts are usually cylindrical, but may be square or cross shaped in section. They are solid in cross section but sometimes hollow shafts are also used. Material used for shafts

4. Wiper motor



Windshield wiper motors are components in the car, that function on a power supply- with the task of moving wiper blades in a smooth and systematic motion. Just like other motors, the wiper motor functions to rotate continuously in one direction once it is converted to a back-and-forth motion. The standard voltage requirement for the wiper motor is 12 volts DC. The electrical system in a running automobile usually puts out between 13 and 13.5 volts, so it's safe to say the motor can handle up to 13.5 volts with no problem. Wipers are powered by a small electric motor, usually mounted on the firewall or under the cowl (the area under the windshield's base). The motor activates linkage that moves the wiper arms back and forth. On vehicles with a rear window wiper, a separate motor powers the one in the rear.

5. Sheet



Sheet metal is metal that is formed into thin, flat pieces. Sheet metal is generally produced in sheets less than 6 mm. It is one of the fundamental forms used in metalworking and can be cut and bent into a variety of different shapes. Thicknesses can vary significantly. Extremely thin pieces of sheet metal are designated as "foil" or "leaf". Pieces thicker than a quarter of an inch are designated as "plate". Countless everyday objects are constructed from sheet metal. Aluminum, brass, copper, cold rolled steel, mild steel, tin, nickel and titanium are just a few examples of metal that can be made into sheet metal. Sheet metal has applications in car bodies, airplane wings, medical tables, roofing materials and multiple other uses.

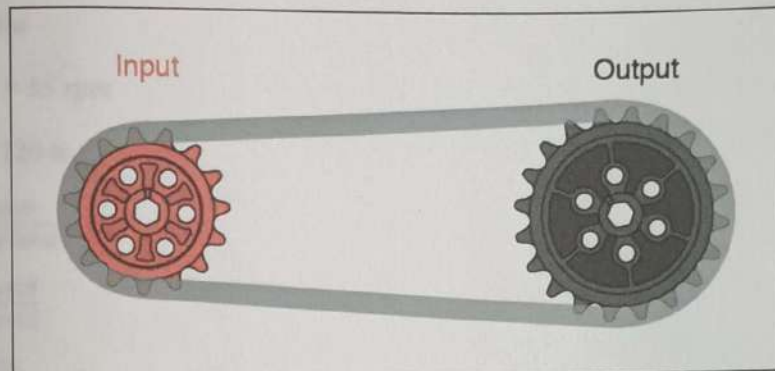
6. Bearing



Bearings are essential components in various mechanical systems and play a significant role

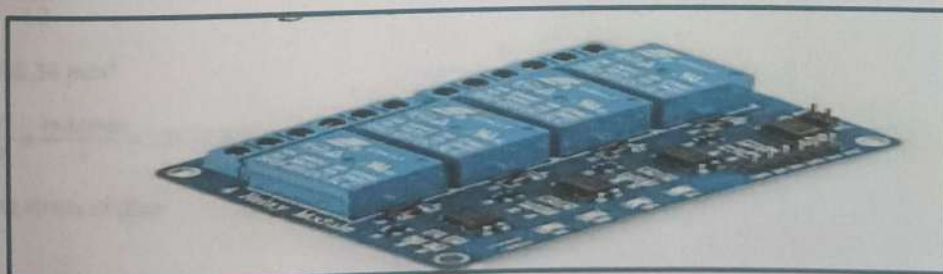
in ensuring the smooth, efficient, and reliable operation of machinery. Here are some of the key importance and benefits of bearings: Smooth Operation, Alignment Tolerance, Positioning and Support, Load Handling, Versatility, Noise and Vibration Reduction, Reduction of Friction, Load Distribution.

7. Chain and sprocket:



A sprocket is a toothed wheel that is used to transmit motion and torque from one shaft to another. Chains that are used to transmit motion and force from one sprocket to another are called power transmission chains. Unlike gears that have to mesh to transmit motion and torque from one gear to another, sprockets may be positioned far apart. Sprockets are connected by a chain. A sprocket with a hole that matches the diameter of the shaft is chosen and slid onto the shaft. The sprocket is then rotated until the keyways in the sprocket and shaft line up. A rectangular piece of steel bar called a key is slid into the keyways to prevent the sprocket from spinning on the shaft.

8. Relay



The Single Pole Double Throw SPDT relay is quite useful in certain applications because of its internal configuration. It has one common terminal and 2 contacts in 2 different configurations: one can be Normally Closed and the other one is opened or it can be Normally Open and the other one closed. So basically you can see the SPDT relay as a way of switching between 2 circuits: when there is no voltage applied to the coil one circuit "receives" current, the other one doesn't and when the coil gets energized the opposite is happening.

CALCULATION

1. Wiper motor

$$\text{Speed (rpm)} = 55 \text{ rpm}$$

$$\text{Power (p)} = 120 \text{ w}$$

$$\text{Torque} = \frac{60 \cdot P}{2 \cdot \pi \cdot RPM}$$

$$\begin{aligned} \text{Torque} &= \frac{60 \cdot 120}{2 \cdot \pi \cdot 55} \\ &= \frac{7200}{110\pi} \end{aligned}$$

$$\text{Torque} = 20.83 \text{ nm}$$

2. Frame

$$\text{Load on frame considered } P = 6 \text{ kg} = 58.86 \text{ N}$$

$$y = D/2 = 25/2 = 12.5 \text{ mm}$$

$$D = 25 \text{ mm } B = 25 \text{ mm } t = 2 \text{ mm thickness}$$

$$\text{Maximum Length of frame is } 920 \text{ mm}$$

$$\text{Moment of inertia in x direction}$$

$$\frac{DB^3}{12} - \frac{db^3}{12}$$

$$I = 16345.34 \text{ mm}^4$$

$$Mb = \frac{WL}{4} = \frac{49.05 \cdot 920}{4} = 13537.8 \text{ N-mm}$$

$$\text{Bending stress of pipe}$$

$$\frac{Mb}{I} = \frac{\sigma b}{y}$$

$$\sigma b = \frac{13537.8 \times 12.5}{16345.34} = 10.35 \text{ N/mm}^2$$

Theoretical bending stress

$$\sigma b(th) = \frac{S_{yt}}{f_s} = \frac{310}{1} = 310 \text{ N/mm}^2$$

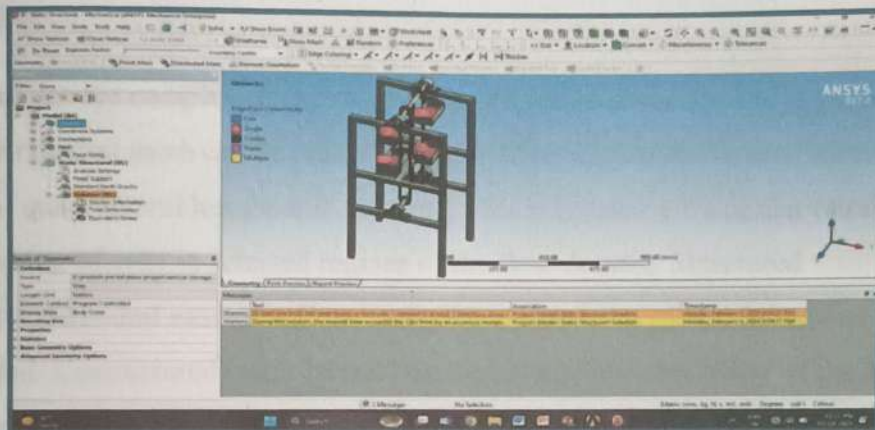
$$\sigma b < \sigma b(th)$$

Hence design is safe.

ANALYSIS

ANSYS Workbench 21.0 platform to perform modal analysis of thrust coupling. ANSYS Workbench 21.0, as the most advanced CAE software, provides users with simulation modules including: structure, fluid, electromagnetic, heat transfer, and other fields. It is the industry's most advanced engineering simulation technology integration platform, with intuitive and friendly interface, convenient pre-processing and post-processing functions, and its extensive solution functions.

GEOMETRY



MESHING

As the main link of finite element analysis, grid division can best reflect the idea of finite element. The quality of the mesh not only affects the efficiency of model analysis, but also directly affects the accuracy of analysis results. Therefore, according to the existing hardware, without affecting the accuracy of the calculation results, the method of dividing the mesh can be appropriately selected to save calculation time.



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Page 26

Statistics	
<input type="checkbox"/> Nodes	923378
<input type="checkbox"/> Elements	492449

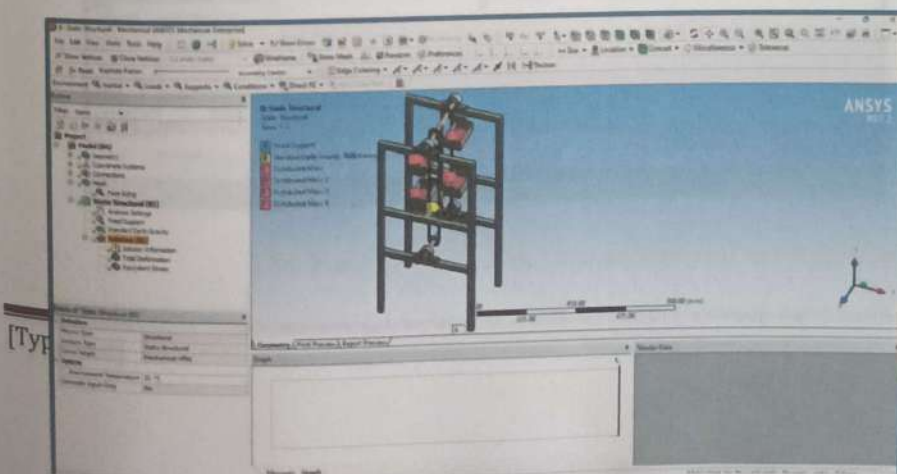
Final mesh model, it contains 923378 nodes and 492449 elements.

Element Types

When geometries are complex or the range of length scales of the flow is large, a triangular/tetrahedral mesh can be created with far fewer cells than the equivalent mesh consisting of quadrilateral/hexahedral elements. This is because a triangular/tetrahedral mesh allows clustering of cells in selected regions of the flow domain. Structured quadrilateral/hexahedral meshes will generally force cells to be placed in regions where they are not needed. Unstructured quadrilateral/hexahedral meshes offer many of the advantages of triangular/tetrahedral meshes for moderately-complex geometries.

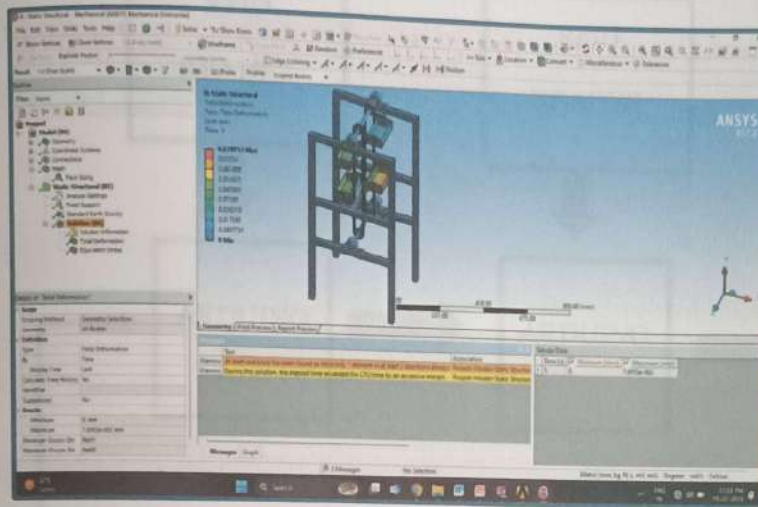
- For simple geometries, use quadrilateral/hexahedral meshes.
- For moderately complex geometries, use unstructured quadrilateral/hexahedral meshes.
- For relatively complex geometries, use triangular/tetrahedral meshes with prism layers.
- For extremely complex geometries, use pure triangular/tetrahedral meshes.

BOUNDARY CONDITION

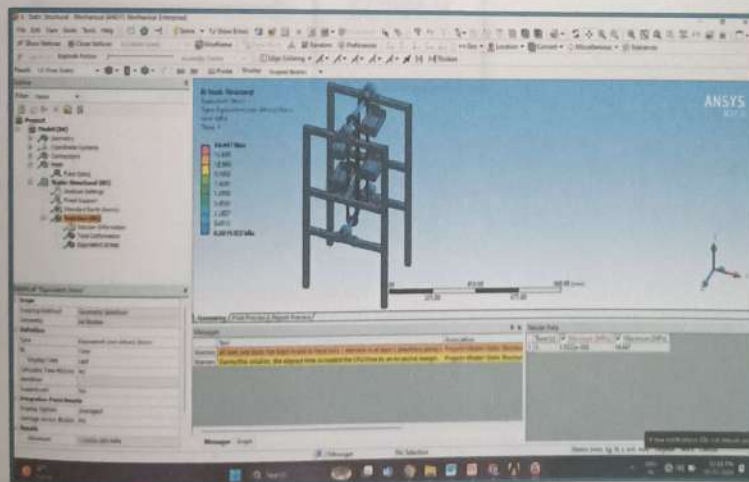


RESULT

1. TOTAL DEFORMATION

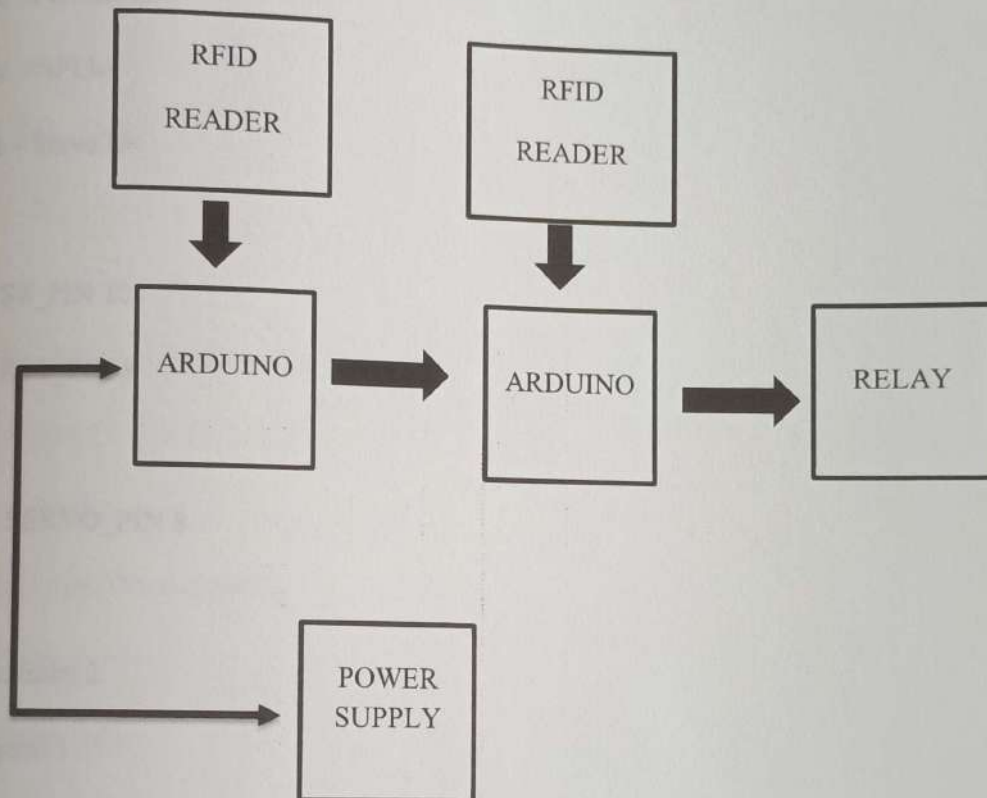


2. EQUIVALENT STRESS



[Type text]

BLOCK DIAGRAM



CODE

```
/// This project was made by Mehmet Efe Peker.
```

```
#include <FINGER.h>
```

```
#include <SPI.h>
```

```
#include <Servo.h>
```

```
#define SS_PIN 10
```

```
#define RST_PIN 9
```

```
#define SERVO_PIN 8
```

```
#define kirmizi 2
```

```
#define yesil 3
```

```
#define buzzer 7
```

```
int ir_deger;
```

```
Servo servo;
```

```
RFID rfid(SS_PIN, RST_PIN);
```

```
[Type text]
```

```
boolean kart = false;
```

```
int rfid_id[5] = {10,28,87,46,111};
```

```
int ir = 5;
```

```
boolean kilit = false;
```

```
void kapiyi_kapat() { /// Closes the door.
```

```
  if(kilit == true){
```

```
    servo.write(0);
```

```
    Serial.println("Door closed.");
```

```
    delay(100);
```

```
    servo.write(180);
```

```
  }
```

```
}
```

```
void setup() {
```

```
  pinMode(kirmizi, OUTPUT);
```

```
  pinMode(yesil, OUTPUT);
```

```
[Type text]
```



```
pinMode(buzzer, OUTPUT);
```

```
pinMode(ir, OUTPUT);
```

```
servo.attach(SERVO_PIN);
```

```
Serial.begin(9600);
```

```
SPI.begin();
```

```
rfid.init();
```

```
}
```

```
void loop() {
```

```
  kart = true;
```

```
  servo.write(0);
```

```
  Serial.println("Hold the Card.");
```

```
  if(rfid.isCard()){
```

```
    if(rfid.readCardSerial()){
```

```
      Serial.print("ID: ");
```

```
      delay(100);
```

```
    }
```

```
    for (int i = 0; i<5; i++){
```

```
      Serial.print(rfid.serNum[i]);
```

```
      Serial.print("");
```

```
      delay(100);
```

```
    }
```

```
    for (int i = 0; i<5; i++){
```

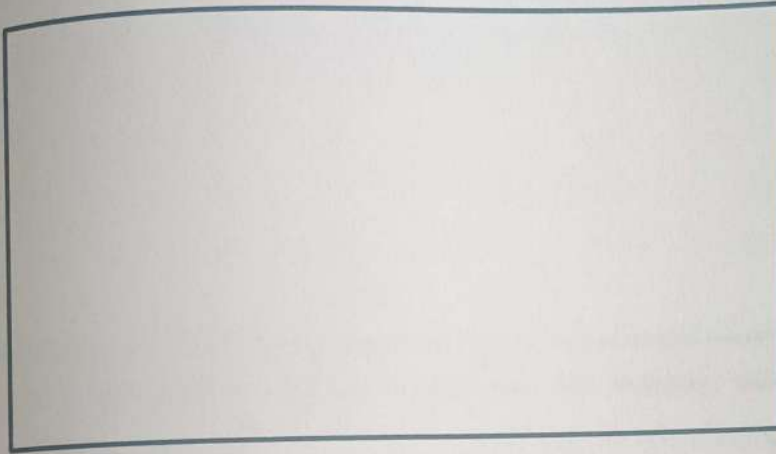
```
[Type text]
```

```
if(rfid_id[i] != rfid.serNum[i]){  
    kart = false;  
    tone(buzzer, 3);  
    delay(1000);  
    noTone(buzzer);  
    Serial.println("Wrong ID.");  
    delay(1000);  
    return;  
}  
  
Serial.println();  
delay(1000);  
  
Serial.println("Welcome to your rome");  
delay(1000);  
digitalWrite(yesil, HIGH);  
delay(200);  
digitalWrite(kirmizi, LOW);  
tone(buzzer, 3);  
delay(1000);  
noTone(buzzer);  
delay(100);  
servo.write(180);  
delay(2000);
```

```
delay(10000);  
kapiyi_kapat();  
ir_deger = digitalRead(ir);  
if (ir_deger <= 500){  
    servo.write(0);  
    Serial.println("Door closed.");  
}  
else{  
    return;  
}  
}
```

MANUFACTURING PROCESS

Cutting: -

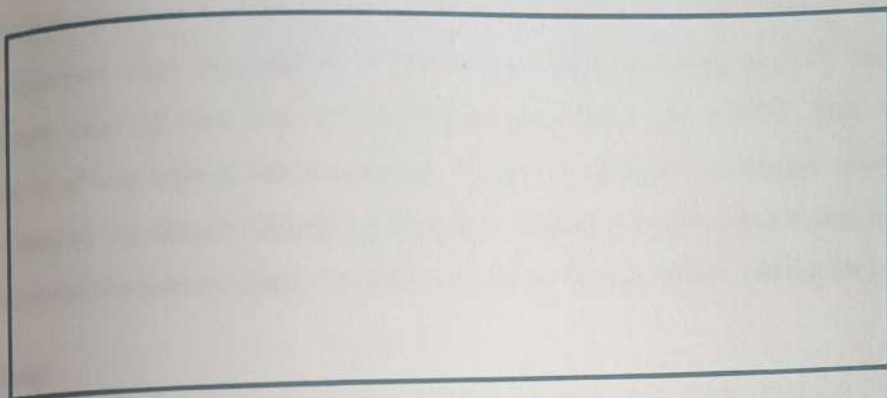


Cutting is the separation or opening of a physical object, into two or more portions, through the application of an acutely directed force. Implements commonly used for cutting are the knife and saw, or in medicine and science the scalpel and microtome. However, any sufficiently sharp object is capable of cutting if it has a hardness sufficiently larger than the object being cut, and if it is applied with sufficient force. Even liquids can be used to cut things when applied with sufficient force (see water jet cutter). The material as our required size. The machine used for this operation is power chop saw. A power chop saw, also known as a drop saw, is a power tool used to make a quick, accurate crosscut in a work piece at a selected angle. Common uses include framing operations and the cutting of moulding. Most chop saws are relatively small and portable, with common blade sizes ranging from eight to twelve inches. The chop saw makes cuts by pulling a spinning circular saw blade down onto a work piece in a short, controlled motion. The work piece is typically held against a fence, which provides a precise cutting angle between the plane of the blade and the plane of the longest work piece edge. In standard position, this angle is fixed at 90°. A primary

[Type text]

A distinguishing feature of the mitre saw is the mitre index that allows the angle of the blade to be changed relative to the fence. While most mitre saws enable precise one-degree incremental changes to the mitre index, many also provide "stops" that allow the miter index to be quickly set to common angles (such as 15°, 22.5°, 30°, and 45°). The time required for this operation is 50 minutes.

Welding: -



Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool causing fusion. Welding is distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal.

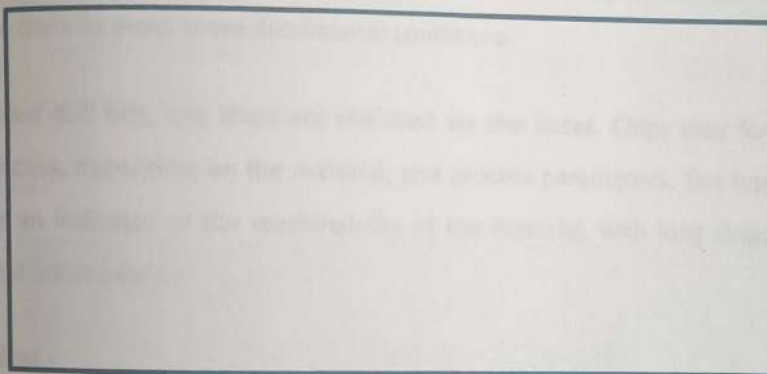
In addition to melting the base metal, a filler material is typically added to the joint to form a pool of molten material (the weld pool) that cools to form a joint that, based on weld configuration (butt, full penetration, fillet, etc.), can be stronger than the base material (parent metal). Pressure may also be used in conjunction with heat, or by itself, to produce a weld. Welding also requires a form of shield to protect the filler metals or melted metals from being contaminated or oxidized.

Square pipes of different lengths to make frame. The machine used for this operation is electric arc welding. Electrical arc welding is the procedure used to join two metal parts, taking advantage of the heat developed by the electric arc that forms between an electrode (metal filler) and the material to be welded. The welding arc may be powered by an alternating current generator machine (welder). This welding machine is basically a single-phase static transformer suitable for melting RUTILE (sliding) acid electrodes. Alkaline

electrodes may also be melted by alternating current if the secondary open-circuit voltage is greater than 70 V.

The welding current is continuously regulated (magnetic dispersion) by turning the hand wheel on the outside of the machine, which makes it possible to select the current value, indicated on a special graded scale, with the utmost precision. To prevent the service capacities from being exceeded, all of our machines are fitted with an automatic overload protection which cuts off the power supply (intermittent use) in the event of an overload. The operator must then wait for a few minutes before returning to work. This welding machine must be used only for the purpose described in this manual. Read the entire contents of this manual before installing, using or servicing the equipment, paying special attention to the chapter on safety precautions. Contact your distributor if you do not fully understand these instructions. The time required for this operation is 120 minutes.

Drilling: -



Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multi-point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work-piece, cutting off chips (swarf) from the hole as it is drilled.

In rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements. The hammering action can be performed from

outside the hole (top-hammer drill) or within the hole (down-the-hole drill, DTH). Drills used for horizontal drilling are called drifter drills.

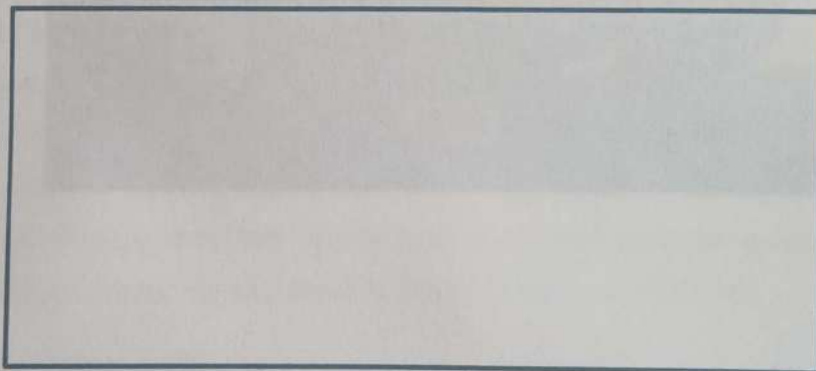
In rare cases, specially-shaped bits are used to cut holes of non-circular cross-section; a square cross-section is possible.

Drilled holes are characterized by their sharp edge on the entrance side and the presence of burrs on the exit side (unless they have been removed). Also, the inside of the hole usually has helical feed marks.

Drilling may affect the mechanical properties of the work piece by creating low residual stresses around the hole opening and a very thin layer of highly stressed and disturbed material on the newly formed surface. This causes the work piece to become more susceptible to corrosion and crack propagation at the stressed surface. A finish operation may be done to avoid these detrimental conditions.

For fluted drill bits, any chips are removed via the flutes. Chips may form long spirals or small flakes, depending on the material, and process parameters. The type of chips formed can be an indicator of the machinability of the material, with long chips suggesting good material machinability.

Finishing: -



Finishing is a broad range of industrial processes that alter the surface of a manufactured item to achieve a certain property. Finishing processes may be employed to: improve appearance, adhesion or wettability, solder ability, corrosion resistance, tarnish resistance, chemical resistance, wear resistance, hardness, modify electrical conductivity, remove burrs and other surface flaws, and control the surface friction. In limited cases some of these techniques can be used to restore original dimensions to salvage or repair an item. An unfinished surface is often called mill finish. The edges with grinder using grinding wheel. The machine used for this operation is hand grinder. An angle grinder, also known as a side grinder or disc grinder, is a handheld power tool used for cutting, grinding and polishing. Angle grinders can be powered by an electric motor, petrol engine or compressed air. The motor drives a geared head at a right-angle on which is mounted an abrasive disc or a thinner cut-off disc, either of which can be replaced when worn. Angle grinders typically have an adjustable guard and a side-handle for two-handed operation. Certain angle grinders, depending on their speed range, can be used as sanders, employing a sanding disc with a backing pad or disc. The backing system is typically made of hard plastic, phenolic resin, or medium-hard rubber depending on the amount of flexibility desired. The time required for this operation is 20 minutes.

Polishing: -



Polishing is the process of creating a smooth and shiny surface by rubbing it or using a chemical action, leaving a surface with a significant specular reflection (still limited by the

index of refraction of the material according to the Fresnel equations.) In some materials (such as metals, glasses, black or transparent stones), polishing is also able to reduce diffuse reflection to minimal values. When an unpolished surface is magnified thousands of times, it usually looks like mountains and valleys. By repeated abrasion, those "mountains" are worn down until they are flat or just small "hills." The process of polishing with abrasives starts with coarse ones and graduates to fine ones.

The welded joints with hand grinder using grinding wheel. The machine used for this operation is hand grinder. With refinement, grinding becomes polishing, either in preparing metal surfaces for subsequent buffing or in the actual preparation of a surface finish, such as a No. 4 polish in which the grit lines are clearly visible. Generally speaking, those operations which serve mainly to remove metal rapidly are considered as grinding, while those in which the emphasis is centred on attaining smoothness are classified as polishing. Grinding employs the coarser grits as a rule while most polishing operations are conducted with grits of 80 and finer. If polishing is required, start with as fine a grit as possible to reduce finishing steps. There is a wide range of grinding and polishing tools on the market and advice is available from ASSDA members to assist in particular applications. Polishing operations are conducted with the abrasive mounted either on made-up shaped wheels or belts which provide a resilient backing. The base material may be in either a smooth rolled or a previously ground condition. If the former, the starting grit size may be selected in a range of 80 to 100. If the latter, the initial grit should be one of sufficient coarseness to remove or smooth out any residual cutting lines or other surface imperfections left over from grinding. In either case, the treatment with the initial grit should be continued until a good, clean, uniform, blemish-free surface texture is obtained. The initial grit size to use on a pre-ground surface may be set at about 20 numbers finer than the last grit used in grinding, and changed, if necessary, after inspection. Upon completion of the initial stage of polishing, wheels or belts are changed to provide finer grits. Polishing speeds are generally somewhat higher than those used in grinding. A typical speed for wheel operation is 2500 meters per minute. The time required for this operation is 20 minutes.

SAFETY PRECAUTIONS:

The following points should be considered for the safe operation of machine

And to avoid accidents: -

- All the parts of the machine should be checked to be in perfect alignment.
- All the nuts and bolts should be perfectly tightened.
- The operating switch should be located at convenient distance from the operator so as to control the machine easily.
- The inspection and maintenance of the machine should be done from time to time.
- All the nuts and bolts should be perfectly tightened.
- The operating switch should be located at convenient distance from the operator so as to control the machine easily.

The inspection and maintenance of the machine should be done from time to time.

ADVANTAGES

1. Reduction of variable costs : utomated storage and retrieval systems reduce the variable cost of operations by reducing the need for manual labor for tasks such as picking, storing, assembly and inventory replenishment.
2. Automating manual, repetitive storage and retrieval costs: As mentioned, AS/RS solutions reduce the need for manual labor by automating manual, repetitive storage and retrieval tasks. Automating these tasks increases accuracy and efficiency while also freeing up human workers to focus on higher-value activities.
3. Better safety: Human workers who handle manual, repetitive tasks for several hours can experience fatigue and muscle strain, increasing the risk of errors and injury. Likewise, errors made when operating heavy equipment in a manufacturing or warehouse environment can be dangerous, resulting in injury or death. By automating these tasks, AS/RS solutions eliminate mistakes that can hinder efficiency and safety while eliminating the fatigue and physical strain on human workers. AS/RS equipment can also move materials and loads that are too heavy for humans to carry, reducing workplace injuries resulting from lifting.
4. Better space utilization: Shelving and proper grouping of items are vital in warehouses and distribution centers. Raw materials, work-in-progress, and finished goods inventories need to be replenished regularly to keep processes moving without interruption. Warehouses and distribution centers alike depend on effective space utilization to maintain a healthy bottom line. Most AS/RS solutions require narrower aisles compared to facilities that require enough aisle space for human workers and equipment such as forklifts to pass through, often with bi-directional traffic. Narrower aisles free up more storage space for goods and materials, allowing warehouses and DCs to store more items without expanding the facility. Facilities can also make better use of vertical space, as automated storage and retrieval systems can more easily reach higher storage locations than human workers.

Sr. No	Material	Cost
1	WIPER MOTOR	2000
	TOTAL	12000

EXPECTED OUTCOMES

Rotary Material Storage System is very good substitute for traditional material storage system. Design is efficient one because compared to other existing design; it can handle more material in limited space. By using RFID tag & IR sensor, the human efforts considerably less. It increases Organizational efficiency and Productivity. This system has better storage flexibility. This system should be less time consuming, expensive and better management in inventory for organization. Rotary storage System is developed to utilize maximum vertical area in the available minimum ground area.

Sr. No	Material	COST
1	FRAME	2000
2	SHAFT	500
3	PEDESTAL BEARING	1000
6	CHAIN SPROKET	1000
7	ARDUINO	1600
8	RELAY	300
9.	WIPER MOTOR	5000
	TOTAL	11400/-

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REFERENCES

- [1] shivprasad d shinde, omkar s mande, aditya n malvadkar et.al "design and manufacturing of rotary material storage system"- april 2019, volume 6, issue 4
- [2] dinesh yadav, govindraj bandewar, pratap pande, "automatic rotary material storage system using rfid"- vol-5 issue-3 2019
- [3] mohummad shariful islam, afshana morshed tithi et.al "launching automated rotary parking system: towards traffic congestion free dhaka city"-2017
- [4] omar sabah al-dahiree, raja ariffin raja ghazilla "design of a compact energy storage with rotary series elastic actuator for lumbar support exoskeleton"- 18 july 2022
- [5] anuradha s. Parab, prof. P. N. Gore et.al "a review on automated storage and retrieval system"- volume: 05 issue: 12 | dec 2018
- [6] m. R. Vasili, sai hong tang et.al "automated storage and retrieval systems: a review on travel time models and control policies"- february 2014

Navsahyadri Education Society's Group of Institutions
Faculty of Engineering, Naigaon, Pune.



CERTIFICATE

This is to certify that **PAWAR PRARABDH P.**, a student of Navsahyadri Education Society's Group of Institutions Faculty of Engineering, has successfully completed an internship at Khas Industries, Jejuri from 01/02/2024 to 15/03/2024.

Prof. A. S. Kale

H.O.D.Electrical Dept.



Dr. M. V. Dalvi

Principal
Navsahyadri Education Society's
Group of Institutions,
Faculty of Engineering
Gat No. 69,70,71, Naigaon, Tal. Bhor
Dist. Pune - 412213



Khas Industries is a 4 years old Partnership Firm incorporated on 18-Sep-2020, having its registered office located at Plot No. C-36, Jejuri Industrial Area MIDC Jejuri, MIDC Road, Pune, Maharashtra.

Khas Industries is a leading manufacturer and supplier of electrical machines with a notable specialization in EOT Cranes. This report outlines the specifications, functions, production processes, and operational aspects of EOT Cranes, as well as details about the company's product range.

The major activity of Khas Industries is Manufacturing, Sub-classified into Repair and installation of machinery and equipment and is primarily engaged in the Installation of industrial machinery and equipment. Khas Industries is classified as Small enterprise in the financial year 2023-24. It has its unit situated at Pune, Maharashtra.

1. Company Overview

Khas Industries is dedicated to designing, manufacturing, and supplying a range of electrical Machines, including EOT Cranes. The company's focus is on providing reliable, high-quality products for the electrical sector. The company is known for its adherence to industry standards, commitment to quality, and excellent customer service.

Table of Contents

- 1. Introduction**
 - Overview of HVAC Systems
 - Importance of Electrical Systems in HVAC
- 2. Week 1: Introduction to HVAC Electrical Systems**
 - Electrical Components Overview
 - Activities and Observations
- 3. Week 2: Electrical Components in HVAC Systems**
 - Detailed Description of Electrical Components
 - Wiring and Circuitry
- 4. Week 3: Troubleshooting and Diagnostics**
 - Diagnostic Tools and Techniques
 - Case Studies of Electrical Issues
- 5. Week 4: Electrical Safety and Standards**
 - Safety Protocols and Best Practices
 - Inspection Procedures
- 6. Week 5: Energy Efficiency and Sustainability**
 - Energy-Efficient HVAC Technologies
 - Analyzing Energy Consumption
- 7. Week 6: Project and Presentation**
 - Project Description and Objectives
 - Methodology and Implementation
 - Results and Findings
 - Presentation Preparation and Delivery
 - Feedback and Reflections
- 8. Conclusion**
 - Summary of Key Learnings
 - Personal and Professional Growth
 - Future Directions in HVAC Electrical Systems

Introduction

Overview of HVAC Systems

HVAC stands for **Heating, Ventilation, and Air Conditioning**. These systems are integral to maintaining indoor comfort in residential, commercial, and industrial environments. Each component of an HVAC system plays a specific role in regulating the indoor climate to ensure a comfortable and healthy atmosphere.

1. Heating

Heating systems are designed to raise the indoor temperature to a comfortable level during colder weather. The primary function of heating systems is to provide warmth and counteract the cold outdoor temperatures.

Common Heating Systems Include:

- **Furnaces:** These use either gas, oil, or electricity to generate heat. The heated air is then distributed throughout the building via ducts.
- **Boilers:** These systems heat water or steam which is then distributed through pipes to radiators or underfloor heating systems.
- **Heat Pumps:** These devices can provide both heating and cooling. They transfer heat from outside to inside, even in cooler weather.

Role in Indoor Climate Control:

- Ensures a warm and comfortable indoor environment during winter months.
- Helps prevent freezing of pipes and other cold-related issues.

2. Ventilation

Ventilation is the process of exchanging indoor air with fresh outdoor air to maintain air quality and remove contaminants. It helps in controlling humidity, reducing indoor pollutants, and improving overall indoor air quality.

Common Ventilation Methods Include:

- **Natural Ventilation:** Utilizes natural forces like wind and temperature differences to circulate air through windows, vents, and other openings.
- **Mechanical Ventilation:** Uses fans and ducts to circulate and filter air. This includes systems like exhaust fans, supply fans, and balanced ventilation systems.

Role in Indoor Climate Control:

- Enhances indoor air quality by removing pollutants such as smoke, odors, and excess moisture.
- Helps in maintaining optimal humidity levels and preventing issues like mold growth.

3. Air Conditioning

Air Conditioning systems are responsible for cooling and dehumidifying indoor air to create a comfortable environment during hot weather. They work by removing heat and moisture from the air.

Common Air Conditioning Systems Include:

- **Central Air Conditioners:** These systems cool air at a central location and distribute it throughout the building via ducts.
- **Split Systems:** Comprising an indoor and an outdoor unit, these systems are often used in residential settings. The indoor unit cools the air and the outdoor unit releases the absorbed heat.
- **Window Units:** These are compact systems installed in windows to cool individual rooms

Major Components of HVAC Systems

HVAC systems are complex and consist of various components working together to regulate indoor climate. Here's an in-depth look at the major components involved in heating, air conditioning, and ventilation systems:

1. Heating Units

1.1 Furnaces

- **Function:** Furnaces are designed to generate heat and distribute it throughout a building.
- **Types:**
 - **Gas Furnaces:** Burn natural gas or propane to produce heat. They use a heat exchanger to transfer the heat to the air which is then distributed via ducts.
 - **Electric Furnaces:** Use electric heating elements to produce heat. They are typically less efficient than gas furnaces but are used where gas is not available.
 - **Oil Furnaces:** Burn heating oil to generate heat, often used in areas where oil is a more economical option than gas.
- **Components:**
 - **Burner:** Where fuel is burned to create heat.
 - **Heat Exchanger:** Transfers heat from the burner to the air.
 - **Blower Motor:** Circulates air over the heat exchanger and through the ductwork.
 - **Thermostat:** Controls the temperature settings and activates the furnace when needed.

1.2 Boilers

- **Function:** Boilers heat water or steam, which is then circulated through pipes to radiators or under floor heating systems.
- **Types:**
 - **Steam Boilers:** Produce steam that is distributed through pipes to radiators.
 - **Hot Water Boilers:** Heat water that circulates through baseboards, radiators, or in-floor heating systems.
 - **Heat Exchanger:** Transfers heat to the water or steam.
 - **Circulator Pump:** Moves hot water through the system.

2. Air Conditioning Systems

2.1 Central Air Conditioners

- **Function:** Central air conditioners cool air at a central location and distribute it throughout the building via ductwork.
- **Components:**
 - **Evaporator Coil:** Absorbs heat from indoor air.
 - **Condenser Coil:** Releases absorbed heat to the outside air.
 - **Compressor:** Moves refrigerant between the evaporator and condenser coils.
 - **Expansion Valve:** Regulates the flow of refrigerant into the evaporator coil.

2.2 Split Systems

- **Function:** Split systems consist of an indoor unit and an outdoor unit, often used in residential applications.
- **Components:**
 - **Indoor Unit (Air Handler):** Contains the evaporator coil and blower. It circulates cooled air throughout the space.
 - **Outdoor Unit (Condenser):** Contains the condenser coil and compressor. It expels heat to the outside air.

2.3 Window Units

- **Function:** Window air conditioners are compact units designed to cool a single room or small space.
- **Components:**
 - **Evaporator Coil:** Cools the air inside the room.
 - **Condenser Coil:** Expels heat to the outside.
 - **Fan:** Circulates the cooled air within the room and expels heat outside.

3. Ventilation Systems

3.1 Natural Ventilation

- **Function:** Relies on natural air flow to ventilate a building.
- **Components:**
 - **Windows and Vents:** Allow outdoor air to enter and indoor air to exit.
 - **Architectural Design:** Building orientation and window placement are designed to enhance natural air flow.

Functionality: How HVAC Systems Work Together to Maintain Comfortable Indoor Environments

HVAC systems are designed to create a comfortable indoor environment by integrating three primary functions: heating, ventilation, and air conditioning. Each of these functions plays a distinct role, but together, they ensure that indoor spaces remain comfortable, healthy, and energy-efficient. Here's how these systems work together:

1. Heating

Function:

- The heating component of an HVAC system is responsible for raising the indoor temperature to a comfortable level, particularly during colder months. This ensures that occupants remain warm and comfortable even when outside temperatures are low.

How It Works:

1. **Thermostat Setting:** The thermostat, a control device located inside the building, is set to the desired temperature.
2. **Heating Activation:** When the indoor temperature falls below the set point, the thermostat signals the heating system to activate.
3. **Heat Generation:** The heating unit (furnace, boiler, or heat pump) generates heat either through burning fuel (gas, oil) or using electricity.
4. **Heat Distribution:** The generated heat is distributed through the building using a system of ducts (in the case of a furnace) or pipes (in the case of a boiler). Heat pumps can also distribute heat through air or water systems.
5. **Temperature Regulation:** The thermostat monitors the indoor temperature and adjusts the heating system's operation to maintain the desired temperature.

2. Ventilation

Function:

- Ventilation is essential for maintaining indoor air quality. It involves the exchange of indoor air with fresh outdoor air to remove contaminants and regulate humidity levels. Proper ventilation helps prevent issues such as mold growth, stale air, and buildup of indoor pollutants.

How It Works:

1. **Air Exchange:** Ventilation systems bring in fresh outdoor air while exhausting stale indoor air. This can be achieved through natural means (open windows, vents) or mechanical systems (fans, HRVs).
2. **Air Filtration:** Air handling units often include filters to remove particulates and pollutants from the incoming air.
3. **Humidity Control:** Some ventilation systems are equipped with humidifiers or dehumidifiers to maintain optimal humidity levels.
4. **Controlled Airflow:** Mechanical ventilation systems use fans and ductwork to ensure consistent and controlled airflow throughout the building.

3. Air Conditioning

Function:

- Air conditioning systems are designed to cool the indoor air and remove excess humidity, creating a comfortable environment during hot weather. They also help in maintaining indoor air quality by filtering the air.

How It Works:

1. **Thermostat Setting:** Similar to heating, the thermostat is set to the desired cooling temperature.
2. **Cooling Activation:** When the indoor temperature rises above the set point, the thermostat signals the air.
3. **Heat Absorption:** The air conditioners evaporator coil absorbs heat from the indoor air, cooling it in the process.
4. **Heat Rejection:** The absorbed heat is transferred to the refrigerant and expelled outside through the condenser coil.
5. **Air Circulation:** The cooled air is then circulated throughout the building via ducts or fans.
6. **Humidity Control:** The air conditioner also dehumidifies the air by condensing moisture onto the evaporator coil.

Importance of Electrical Systems in HVAC

Electrical Integration: How Electrical Systems Power and Control HVAC Components

HVAC systems rely heavily on electrical systems for their operation, functioning, and control. Electrical integration involves powering HVAC components and managing their performance to ensure efficient and reliable climate control. Here's a detailed look at how electrical systems integrate with HVAC components:

1. Power Supply and Distribution

1.1 Electrical Power Supply

- **Source of Power:** HVAC systems are powered by the building's electrical supply, which is typically provided by the main electrical panel. This panel receives electricity from the local power grid and distributes it to various circuits throughout the building.
- **Voltage and Amperage:** HVAC components operate at different voltage levels and amperages. Common residential HVAC systems use 120V or 240V, while commercial systems may use higher voltages (e.g., 480V). Proper circuit sizing and breaker ratings are essential for safe and reliable operation.

1.2 Circuitry and Wiring

- **Wiring:** Electrical wiring connects HVAC components to the power source. This includes high-voltage wiring for major components like compressors and motors, as well as low-voltage wiring for control systems.
- **Circuit Breakers:** Protect HVAC components from electrical faults and overloads. Circuit breakers automatically disconnect the power in case of a fault, preventing damage to the equipment and ensuring safety.

2. Control Systems

2.1 Thermostats

- **Function:** Thermostats are control devices that monitor and regulate the temperature within a building. They send signals to the HVAC system to turn on or off based on the desired temperature settings.
- **Types:**
 - **Manual Thermostats:** Allow users to set and adjust temperature manually.

- **Programmable Thermostats:** Enable users to set schedules for temperature changes throughout the day.
- **Smart Thermostats:** Offer advanced features such as remote access, learning capabilities, and integration with home automation systems.

2.2 Relays and Contactors

- **Relays:** Electromechanical switches that control the operation of HVAC components by opening or closing electrical circuits. They are used to switch on or off various parts of the system, such as the blower motor or compressor.
- **Contactors:** Heavy-duty relays designed to handle high currents. They are used to control major components like the compressor and outdoor fan in air conditioning systems.

3. Sensors and Feedback Mechanisms

3.1 Temperature Sensors

- **Function:** Measure the temperature of the air or components and provide feedback to the control system. Temperature sensors help maintain the desired indoor climate by adjusting the operation of heating or cooling components.

3.2 Humidity Sensors

- **Function:** Monitor indoor humidity levels and provide feedback to the control system. These sensors help maintain comfortable humidity levels by adjusting the operation of dehumidifiers or humidifiers.

4. Motors and Drives

4.1 Motors

- **Function:** Power various components within the HVAC system, such as fans, pumps, and compressors. Motors convert electrical energy into mechanical energy to drive these components.
- **Types:**
 - **Blower Motors:** Drive the circulation of air through the ductwork.
 - **Condenser Fan Motors:** Cool the refrigerant in air conditioning systems by moving air over the condenser coil.
 - **Pump Motors:** Power water or refrigerant pumps in heating and cooling systems.

4.2 Variable-Speed Drives

- **Function:** Control the speed of motors based on the system's demand. Variable-speed drives improve energy efficiency and comfort by adjusting motor speed to match the required performance.
- **Types:**
 - **Variable Frequency Drives (VFDs):** Adjust the frequency of the electrical supply to control motor speed.
 - **Variable Speed Blower Motors:** Adjust the airflow rate to improve comfort and efficiency.
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5. Safety and Monitoring

5.1 Safety Devices

- **Overload Protectors:** Protect motors and other components from overheating by disconnecting power in case of excessive current.
- **Limit Switches:** Monitor temperature or pressure levels and prevent unsafe operating conditions by shutting down the system if necessary.

5.2 Monitoring Systems

- **Building Management Systems (BMS):** Centralized systems that monitor and control HVAC systems, providing real-time data on performance, energy usage, and system status.
- **Remote Monitoring:** Allows for off-site monitoring and control of HVAC systems, providing convenience and enhancing maintenance capabilities.

Integration and Coordination

**1. System Coordination:

- **Integrated Controls:** Modern HVAC systems integrate control functions across heating, cooling, and ventilation components. This integration ensures that the system operates efficiently and responds appropriately to changes in indoor conditions.
- **Communication Protocols:** Advanced HVAC systems use communication protocols like BACnet or Modbus to enable components to exchange information and work together seamlessly.

**2. Energy Efficiency:

- **Smart Controls:** Energy-efficient HVAC systems use smart controls and sensors to optimize performance and reduce energy consumption. Features like demand-based operation and adaptive algorithms enhance overall efficiency.

Week 1: Introduction to HVAC Electrical Systems

- Electrical Components Overview
- Activities and Observations

Electrical Components Overview in HVAC Systems

HVAC systems rely on a variety of electrical components to ensure they function efficiently and effectively. These components play crucial roles in powering, controlling, and monitoring the different elements of heating, ventilation, and air conditioning systems. Below is an overview of the key electrical components in HVAC systems and their functions.

1. Power Supply and Distribution

1.1 Main Electrical Panel

- **Function:** Distributes electrical power from the utility grid to various circuits within the building, including those that power HVAC systems.
- **Components:**
 - **Circuit Breakers:** Protect the electrical circuits by automatically disconnecting in case of an overload or short circuit.
 - **Main Disconnect:** Allows for the complete disconnection of power to the HVAC system for maintenance or emergencies.

1.2 Wiring

- **Function:** Connects the various electrical components of the HVAC system to the power supply and to each other.
- **Types:**
 - **High-Voltage Wiring:** Used for components like compressors, motors, and heating elements that operate at 240V or higher.
 - **Low-Voltage Wiring:** Used for control circuits and sensors, typically operating at 24V or less.

2. Control Systems

2.1 Thermostats

- **Function:** Monitor and regulate the indoor temperature by controlling the HVAC system's operation.
- **Types:**
 - **Manual Thermostats:** Require manual adjustments to set and change temperature.
 - **Programmable Thermostats:** Allow users to set schedules for temperature changes throughout the day.
 - **Smart Thermostats:** Offer remote access, learning algorithms, and integration with home automation systems.

2.2 Relays

- **Function:** Act as electrical switches that control the operation of various HVAC components by opening or closing circuits.
- **Types:**
 - **Electromechanical Relays:** Utilize an electromagnet to switch circuits.
 - **Solid-State Relays:** Use electronic components to switch circuits, offering faster response times.

2.3 Contactors

- **Function:** Heavy-duty relays used to control high-current components like compressors and condenser fans.
- **Components:**
 - **Coil:** Energized by the control circuit to pull in the contacts.
 - **Contacts:** Open or close to allow or interrupt the flow of electricity to the component.

3. Motors and Drives

3.1 Motors

- **Function:** Convert electrical energy into mechanical energy to power components such as fans, pumps, and compressors.
- **Types:**
 - **Blower Motors:** Drive the circulation of air through the ductwork in heating and cooling systems.
 - **Condenser Fan Motors:** Move air across the condenser coil to release absorbed heat.
 - **Pump Motors:** Power pumps that circulate water or refrigerant in heating and cooling systems.

3.2 Variable-Speed Drives

- **Function:** Adjust the speed of motors based on system demand, improving energy efficiency and performance.
- **Types:**
 - **Variable Frequency Drives (VFDs):** Control motor speed by varying the frequency of the electrical supply.
 - **ECM (Electronically Commutated Motors):** Provide variable speeds and energy efficiency by using electronic control.

4. Sensors and Feedback Mechanisms

4.1 Temperature Sensors

- **Function:** Measure the temperature of air or components and provide feedback to the control system to maintain the desired temperature.
- **Types:**
 - **Thermostats:** Measure temperature by varying resistance.
 - **RTDs (Resistance Temperature Detectors):** Measure temperature based on resistance changes in a metal.

4.2 Humidity Sensors

- **Function:** Measure indoor humidity levels and provide feedback to the control system for adjusting dehumidification or humidification.

Types:

- **Capacitive Humidity Sensors:** Measure humidity based on changes in capacitance.
- **Resistive Humidity Sensors:** Measure humidity based on changes in electrical resistance.

4.3 Pressure Sensors

- **Function:** Monitor air or fluid pressure within the HVAC system and provide feedback for maintaining proper operation.
- **Types:**
 - **Differential Pressure Sensors:** Measure the difference between two pressure points.

- **Absolute Pressure Sensors:** Measure pressure relative to a vacuum.

5. Safety Devices

5.1 Overload Protectors

- **Function:** Protect motors and other components from overheating by disconnecting the power if current exceeds safe levels.
- **Types:**
 - **Thermal Overload Relays:** Use a bimetallic strip that bends with temperature to disconnect power.
 - **Electronic Overload Protectors:** Use electronic sensors to detect overload conditions and disconnect power

5.2 Limit Switches

- **Function:** Monitor temperature or pressure levels and prevent unsafe operating conditions by shutting down the system if necessary.
- **Types:**
 - **High-Temperature Limit Switches:** Prevent overheating by shutting off the system if temperatures exceed a safe level.
 - **Low-Pressure Switches:** Prevent operation under low-pressure conditions to protect components.

Activities and Observations in HVAC Systems

During an internship or practical experience in HVAC systems, various activities and observations are crucial for understanding the operation, maintenance, and troubleshooting of these systems. Below is a detailed description of typical activities and observations that interns might engage in while working with HVAC systems.

1. Installation and Setup

1.1 Activities:

- **Component Installation:** Assisting in the installation of major HVAC components such as furnaces, air conditioners, heat pumps, and ventilation systems. This involves positioning units, connecting ductwork, and wiring electrical components.
- **System Configuration:** Setting up control systems, including thermostats and control panels.
- **Leak Testing:** Conducting leak tests on refrigerant lines and other critical connections to ensure the system is sealed and operating efficiently.

1.2 Observations:

- **Component Placement:** Noting the correct positioning of components and ensuring adherence to manufacturer specifications and building codes.
- **System Integration:** Observing how different components are connected and integrated, and verifying that all connections are secure and correctly installed.
- **Initial System Operation:** Monitoring the initial start-up of the system to check for any unusual noises, vibrations, or operational issues.

2. Maintenance and Servicing

2.1 Activities:

- **Routine Inspections:** Performing regular inspections of HVAC systems to check for wear and tear, corrosion, and other signs of potential issues. This includes checking filters, belts, and electrical connections.
- **Cleaning:** Cleaning components such as air filters, coils, and ductwork to maintain system efficiency and indoor air quality.
- **Replacement of Parts:** Replacing worn-out or malfunctioning parts, such as filters, belts, or thermostats, and ensuring that new components are installed correctly.

2.2 Observations:

- **Condition of Components:** Observing the condition of various components during inspections and noting any signs of deterioration or potential failure.
- **System Efficiency:** Measuring system performance before and after maintenance activities to assess improvements in efficiency and operation.
- **Common Issues:** Identifying common issues such as clogged filters, faulty wiring, or refrigerant leaks, and understanding how they affect system performance.

3. Troubleshooting and Diagnostics

3.1 Activities:

- **Fault Detection:** Using diagnostic tools and techniques to identify issues within the HVAC system. This includes checking electrical circuits, sensor readings, and system pressures.
- **Problem Solving:** Applying problem-solving skills to address and resolve issues. This might involve adjusting settings, repairing or replacing faulty components, and re-testing the system.
- **System Testing:** Conducting tests to verify that the system operates correctly after repairs or adjustments. This includes checking temperature and humidity levels, airflow, and electrical readings.

3.2 Observations:

- **Error Codes:** Observing and interpreting error codes or warning signals from control panels and diagnostic tools.
- **System Behavior:** Noting how the system behaves under different conditions and load levels to identify irregularities or issues.
- **Repair Effectiveness:** Evaluating the effectiveness of repairs or adjustments in resolving the identified issues and restoring system functionality.

4. System Optimization

4.1 Activities:

- **Efficiency Assessment:** Assessing the overall efficiency of the HVAC system by measuring energy consumption, performance metrics, and system output.
- **Adjustments:** Making adjustments to system settings, such as airflow rates or temperature thresholds, to improve performance and energy efficiency.

4.2 Observations:

- **Performance Metrics:** Observing changes in system performance metrics, such as energy usage and temperature control, after optimization activities.
- **User Feedback:** Gathering feedback from users or building occupants about changes in comfort levels and system performance.
- **System Behavior:** Monitoring the system's response to adjustments and upgrades to ensure that improvements are effective and sustainable.

5. Safety and Compliance

5.1 Activities:

- **Safety Checks:** Conducting safety checks to ensure that HVAC systems comply with safety standards and regulations. This includes checking electrical connections, verifying that safety devices are operational, and ensuring proper ventilation.
- **Code Compliance:** Verifying that installations and repairs adhere to local building codes and industry standards.
- **Training:** Participating in training sessions on safety practices, proper handling of refrigerants, and emergency procedures.

5.2 Observations:

- **Safety Issues:** Observing and identifying any potential safety hazards, such as exposed wires, gas leaks, or improper ventilation.
- **Compliance Adherence:** Ensuring that all work is performed in accordance with safety codes and regulations, and documenting compliance as required.
- **Emergency Readiness:** Evaluating the system's preparedness for emergencies, including the effectiveness of safety devices and response protocols.

Week 2: Electrical Components in HVAC Systems

- Detailed Description of Electrical Components
- Wiring and Circuitry

Detailed Description of Electrical Components in HVAC Systems

Electrical components are critical to the operation of HVAC (Heating, Ventilation, and Air Conditioning) systems. They ensure that HVAC systems are powered, controlled, and monitored effectively. Here's a comprehensive description of the key electrical components found in HVAC systems:

1. Power Supply and Distribution

1.1 Main Electrical Panel

- **Function:** The central hub that distributes electrical power from the utility supply to various circuits within the building, including HVAC systems.
- **Components:**

1.2 Wiring

- **Function:** Delivers electrical power to HVAC components and ensures proper connections.
- **Types:**
 - **High-Voltage Wiring:** Typically used for major components like compressors and motors, operating at voltages such as 240V or 480V.
 - **Low-Voltage Wiring:** Used for control systems and sensors, generally operating at 24V. This includes wiring for thermostats, relays, and control circuits.

2. Control Systems

2.1 Thermostats

- **Function:** Regulate the temperature within a space by controlling the operation of the HVAC system.
- **Types:**
 - **Manual Thermostats:** Require manual adjustments to set temperature. Simple and straightforward.
 - **Programmable Thermostats:** Allow users to set temperature schedules for different times of the day, improving energy efficiency.
 - **Smart Thermostats:** Feature connectivity options for remote control via smartphones, learning algorithms to adjust settings based on user behavior, and integration with home automation systems.

2.2 Relays

- **Function:** Act as electrical switches that control the operation of HVAC components by opening or closing circuits.
- **Types:**
 - **Electromechanical Relays:** Use an electromagnet to actuate the switch. Common in various control applications.
 - **Solid-State Relays:** Utilize electronic components for switching, offering faster response times and greater reliability.

2.3 Contactors

- **Function:** Heavy-duty relays that control high-current components such as compressors and fans. They handle the switching of power to major parts of the HVAC system.
- **Components:**
 - **Coil:** Energized by a low-voltage control circuit to pull in the contacts.
 - **Contacts:** Open or close to control the flow of electrical power to the component.

3. Motors and Drives

3.1 Motors

- **Function:** Convert electrical energy into mechanical energy to drive various HVAC components like fans, compressors, and pumps.

- **Types:**
 - **Blower Motors:** Drive the circulation of air through the ductwork in heating and cooling systems. Typically, they are either single-speed or multi-speed.
 - **Condenser Fan Motors:** Move air across the condenser coil to release heat absorbed by the refrigerant. Often found in outdoor units.
 - **Pump Motors:** Power pumps that circulate water or refrigerant in systems like hydronic heating or cooling.

3.2 Variable-Speed Drives

- **Function:** Adjust the speed of motors based on system demand, enhancing energy efficiency and performance.
- **Types:**
 - **Variable Frequency Drives (VFDs):** Modify motor speed by adjusting the frequency of the electrical supply. Useful in managing airflow and optimizing performance.
 - **Electronically Commutated Motors (ECMs):** Provide variable speeds and improved efficiency by using electronic control mechanisms. Often used in blower motors and circulator pumps.

4. Sensors and Feedback Mechanisms

4.1 Temperature Sensors

- **Function:** Measure the temperature of air or components and provide feedback to control systems to maintain desired temperatures.
- **Types:**
 - **Thermistors:** Measure temperature by changing resistance. Common in residential HVAC systems.
 - **RTDs (Resistance Temperature Detectors):** Use resistance changes in a metal to measure temperature. Known for accuracy and stability, often used in industrial applications.

4.2 Humidity Sensors

- **Function:** Monitor indoor humidity levels and provide feedback for adjusting humidification or dehumidification.
- **Types:**
 - **Capacitive Humidity Sensors:** Measure humidity based on changes in capacitance. Widely used in both residential and commercial systems.
 - **Resistive Humidity Sensors:** Measure humidity based on changes in electrical resistance.

5. Safety Devices

5.1 Overload Protectors

- **Function:** Protect motors and other components from overheating due to excessive current. They disconnect power when an overload condition is detected.
- **Types:**
 - **Thermal Overload Relays:** Utilize a bimetallic strip that bends with temperature to disconnect power.
 - **Electronic Overload Protectors:** Use electronic sensors to monitor current and disconnect power in case of overload.

Wiring and Circuitry in HVAC Systems

Wiring and circuitry are essential components of HVAC (Heating, Ventilation, and Air Conditioning) systems, enabling the transmission of power, control signals, and data between various system elements. Proper wiring and circuitry design ensure the efficient and reliable operation of HVAC systems.

1. Power Wiring

1.1 High-Voltage Wiring

- **Purpose:** Delivers electrical power to major HVAC components, such as compressors, motors, and heating elements. This wiring generally handles higher voltages (e.g., 240V or 480V).
- **Types of Wiring:**
 - **Single-Phase Wiring:** Typically used in residential HVAC systems. It includes two wires (live and neutral) and a ground wire.
 - **Three-Phase Wiring:** Common in commercial and industrial HVAC systems, providing more efficient power distribution and higher capacity. It involves three live wires and a ground wire.

1.2 Conduit and Cable Types

- **Conduit:** Protects and routes high-voltage wiring. Common types include:
 - **Rigid Metal Conduit (RMC):** Provides heavy-duty protection and is used in areas with high physical damage risk.
 - **Intermediate Metal Conduit (IMC):** Lighter than RMC but still provides substantial protection.
 - **Flexible Conduit:** Allows for flexibility in installation and is used in tight or complex spaces.
- **Cable Types:**
 - **Non-Metallic Sheathed Cable (NM Cable):** Often used for residential applications to carry power to HVAC units.
 - **Armored Cable (BX Cable):** Provides additional mechanical protection and is used in commercial or industrial environments.

2. Control Wiring

2.1 Low-Voltage Wiring

- **Purpose:** Carries control signals between thermostats, control panels, relays, and other components. Operates at lower voltages (typically 24V).
- **Types of Wires:**
 - **Thermostat Wires:** Usually 18-gauge wires, color-coded to indicate their functions:
 - **Red (R):** 24V power supply
 - **White (W):** Heating control
 - **Yellow (Y):** Cooling control
 - **Green (G):** Fan control
 - **Control Wiring:** Connects components like relays, contactors, and sensors. Uses 18 to 22-gauge wires, often in twisted pairs for signal integrity.

2.2 Wiring Techniques

- **Twist-On Wire Connectors:** Secure and insulate connections between multiple wires. Also known as wire nuts.

- **Wire Nuts:** Common for splicing wires and creating secure connections in control circuits.
- **Terminal Blocks:** Organize and connect wires in control panels, allowing easy connection and disconnection.

3. Circuitry and Components

3.1 Circuit Breakers

- **Function:** Protect circuits from overloads and short circuits by interrupting the power supply when necessary.
- **Types:**
 - **Single-Pole Breakers:** Protect single-phase circuits, suitable for lower-current devices.
 - **Double-Pole Breakers:** Protect 240V circuits, often used for high-power HVAC components such as compressors and electric furnaces.

3.2 Contactors and Relays

- **Contactors:**
 - **Function:** Heavy-duty switches that control high-current components such as compressors and condenser fans. They are activated by a low-voltage control circuit.
 - **Operation:** When energized, the contactor pulls in the contacts to allow high-voltage power to flow to the component.
- **Relays:**
 - **Function:** Intermediate switches in c

Week 3: Troubleshooting and Diagnostics

- Diagnostic Tools and Techniques
- Case Studies of Electrical Issues

Diagnostic Tools and Techniques in HVAC Systems

Diagnosing issues in HVAC (Heating, Ventilation, and Air Conditioning) systems requires a variety of tools and techniques to identify problems accurately and efficiently. Proper diagnostics ensure that HVAC systems operate optimally and maintain comfort and efficiency. Here's a detailed overview of diagnostic tools and techniques used in HVAC systems:

1. Diagnostic Tools

1.1 Millimeters

- **Function:** Measure electrical properties such as voltage, current, and resistance. Essential for diagnosing electrical issues in HVAC systems.
- **Types:**
 - **Digital Multimeters (DMMs):** Provide precise readings of voltage, current, and resistance. They often include features like data hold, min/max readings, and continuity testing.
 - **Analog Multimeters:** Use a needle to display readings on a scale. While less common, they can be useful for detecting trends and variations.

1.2 Clamp Meters

- **Function:** Measure the current flowing through a conductor without disconnecting the wire. Useful for diagnosing current-related issues in motors and other high-current components.
- **Types:**
 - **AC Clamp Meters:** Measure alternating current (AC) and are used for most HVAC applications.
 - **DC Clamp Meters:** Measure direct current (DC) and are used in systems with DC components.

1.3 Thermometers and Temperature Probes

- **Function:** Measure temperatures of various components and air streams to ensure they are within specified ranges.
- **Types:**
 - **Infrared Thermometers:** Provide non-contact temperature measurements. Useful for checking surface temperatures of components like coils and ducts.
 - **Thermocouples and RTDs:** Provide contact temperature measurements and are used for more precise and stable readings.

Case Studies of Electrical Issues in HVAC Systems

Understanding electrical issues in HVAC (Heating, Ventilation, and Air Conditioning) systems through case studies helps in diagnosing similar problems in the future and in learning best practices for troubleshooting and resolution. Below are detailed case studies of common electrical issues found in HVAC systems:

Case Study 1: Faulty Contactor in a Residential Air Conditioner

Issue: The air conditioner in a residential home was not turning on. The thermostat was set to a cooling mode, but the outdoor unit did not start, and there was no airflow from the indoor unit.

Diagnosis:

1. Visual Inspection:

- Observed that the outdoor unit was silent, with no signs of operation.
- Checked the electrical panel and confirmed that the circuit breaker for the AC unit was not tripped.

2. Testing:

- Used a multimeter to check for voltage at the contactor terminals. Found no voltage reaching the contactor.
- Tested the thermostat wires for continuity and confirmed they were working correctly.

3. Component Testing:

- Disconnected the wires from the contactor and tested the contactor coil with a multimeter. The coil showed an open circuit.

Resolution:

- Replaced the faulty contactor with a new one.
- Verified that voltage was reaching the new contactor and that it was correctly closing and opening the circuit when activated by the thermostat.

Lessons Learned:

- Regular maintenance should include checking the condition of contactors, as they are common points of failure.
- Proper testing procedures for electrical components ensure that faulty parts are correctly identified and replaced.

Case Study 2: Tripped Circuit Breaker in a Commercial HVAC System

Issue: In a commercial building, the HVAC system was experiencing frequent tripping of the circuit breaker. This caused intermittent loss of cooling and heating, leading to discomfort for building occupants.

Diagnosis:

1. Visual Inspection:

- Inspected the electrical panel and found that the circuit breaker for the HVAC system was frequently tripping.
- Checked for any visible signs of overheating or damage in the wiring.

2. Testing:

- Used a clamp meter to measure the current draw of the HVAC system. Found that the system was drawing significantly more current than its rated capacity.
- Tested the insulation resistance of the wiring and found low resistance, indicating potential insulation breakdown.

3. Component Testing:

- Checked the compressor and blower motor for any signs of mechanical issues or excessive wear.
- Discovered that the compressor was drawing excessive current due to a failing capacitor.

Resolution:

- Replaced the faulty capacitor with a new one.
- Repaired or replaced any damaged wiring and ensured proper insulation.
- The system was re-tested to confirm that the current draw was within acceptable limits and that the breaker no longer tripped.

Lessons Learned:

- Capacitors are critical for proper operation and should be checked during routine maintenance.
- Over current issues can be caused by failing components or insulation problems, which should be addressed promptly to avoid circuit breaker tripping.

Case Study 3: Thermostat Wiring Issue in an HVAC System

Issue: A residential HVAC system was not responding to temperature changes set on the thermostat. The system remained at a constant temperature regardless of adjustments.

Diagnosis:

1. Visual Inspection:

- Checked the thermostat for any obvious signs of damage or incorrect settings.
- Inspected the thermostat wiring and found that the wires were correctly connected.

2. Testing:

- Used a multimeter to test the thermostat terminals for voltage. Found that voltage was present but not consistent with expected levels.
- Measured continuity across thermostat wires and found intermittent connectivity issues.

3. Component Testing:

- Disconnected and inspected the thermostat. Found that the internal contacts were worn and not making proper connections.

Resolution:

- Replaced the faulty thermostat with a new one.
- Ensured all wiring connections were secure and correct.
- Tested the new thermostat to verify that it correctly controlled the HVAC system and responded to temperature changes.

Lessons Learned:

- Thermostats are critical for controlling HVAC systems and should be replaced if they show signs of internal wear or malfunction.
- Proper wiring and secure connections are essential for reliable thermostat operation.

Week 4: Electrical Safety and Standards

- Safety Protocols and Best Practices
- Inspection Procedures

Safety Protocols and Best Practices in HVAC Systems

Safety protocols and best practices are essential in HVAC (Heating, Ventilation, and Air Conditioning) systems to ensure the safety of personnel and the efficient operation of the system. Adhering to these guidelines helps prevent accidents, ensures system reliability, and maintains a safe working environment. Here's a comprehensive overview of safety protocols and best practices for HVAC systems:

1. General Safety Protocols

1.1 Personal Protective Equipment (PPE)

- **Gloves:** Protect hands from sharp edges, hot surfaces, and electrical shock.
- **Safety Glasses:** Prevent eye injury from debris, chemicals, or particles.
- **Hard Hats:** Protect against head injuries, especially in construction or maintenance areas.
- **Hearing Protection:** Use ear protection in environments with high noise levels.

1.2 Safety Training

- **Regular Training:** Ensure all personnel receive ongoing training on HVAC system operation, safety procedures, and emergency response.
- **Certification:** Obtain certifications such as EPA Section 608 for refrigerant handling and other relevant industry certifications.

1.3 Safety Signage

- **Warning Signs:** Display signs to indicate hazards such as high voltage, hot surfaces, and rotating machinery.
- **Labels:** Clearly label electrical panels, disconnect switches, and other critical components.

1.4 Lockout/Tagout Procedures

- **Purpose:** Prevent accidental energization of equipment during maintenance or repair.
- **Steps:**
 - **Isolate Energy Sources:** Turn off and disconnect power sources.
 - **Lock and Tag:** Apply lockout devices and tags to indicate that equipment is under maintenance.
 - **Verify:** Ensure that all energy sources are de-energized before starting work.

1.5 First Aid and Emergency Procedures

- **First Aid Kits:** Maintain accessible and well-stocked first aid kits.
- **Emergency Contacts:** Post emergency contact information and procedures prominently.
- **Training:** Train personnel in basic first aid and CPR.

2. Electrical Safety

2.1 Power Disconnection

- **Turn Off Power:** Always disconnect power before working on electrical components.
- **Verify De-Energization:** Use a voltage tester or multimeter to confirm that circuits are de-energized.

2.2 Grounding and Bonding

- **Proper Grounding:** Ensure all electrical systems are properly grounded to prevent electric shock and equipment damage.
- **Bonding:** Bond electrical components and systems to ensure equal potential and prevent static discharge.

2.3 Electrical Inspections

- **Regular Inspections:** Conduct periodic inspections of wiring, connections, and electrical panels for signs of wear, damage, or overheating.
- **Repair or Replace:** Address any issues promptly to prevent electrical failures or safety hazards.

2.4 Circuit Protection

- **Circuit Breakers:** Ensure that circuit breakers are correctly rated and functioning properly.

3. HVAC System Safety

3.1 Equipment Handling

- **Proper Lifting Techniques:** Use appropriate lifting equipment and techniques to handle heavy components.
- **Secure Components:** Ensure that all components are securely mounted and stabilized to prevent movement or vibration.

3.2 Refrigerant Handling

- **Leak Detection:** Regularly check for refrigerant leaks using leak detectors or UV dye.
- **Proper Storage:** Store refrigerants in well-ventilated areas and follow manufacturer guidelines for handling and storage.

4. Handling and Storage of Tools and Materials

4.1 Tool Maintenance

- **Inspect Tools:** Regularly inspect tools for damage or wear before use.
- **Proper Use:** Use tools according to manufacturer instructions and for their intended purposes.

4.2 Safe Storage

- **Organize Tools:** Store tools and materials in designated areas to prevent accidents and improve accessibility.
- **Secure Hazardous Materials:** Store hazardous materials, such as chemicals or refrigerants, in approved containers and locations.

5. Emergency Response and Preparedness

5.1 Emergency Plan

- **Develop a Plan:** Create a comprehensive emergency response plan for various scenarios, including electrical accidents, chemical spills, and fire.
- **Communicate:** Ensure all personnel are familiar with emergency procedures and evacuation routes.

5.2 Fire Safety

- **Fire Extinguishers:** Equip work areas with appropriate fire extinguishers and ensure they are easily accessible.
- **Fire Drills:** Conduct regular fire drills to ensure readiness in the event of a fire emergency.

6. Best Practices

6.1 Documentation and Record-Keeping

- **Maintain Records:** Keep accurate records of maintenance, repairs, and inspections.
- **Update Documentation:** Regularly update manuals and schematics to reflect any changes or upgrades.

6.2 Compliance with Regulations

- **Adhere to Standards:** Follow local, national, and international standards and regulations related to HVAC systems and safety.
- **Stay Informed:** Keep abreast of changes in regulations and industry standards.

Inspection Procedures in HVAC Systems

Inspection procedures are vital for ensuring the efficient operation, safety, and longevity of HVAC (Heating, Ventilation, and Air Conditioning) systems. Regular inspections help identify potential issues before they become major problems, optimize performance, and maintain system reliability. Here's a comprehensive guide to inspection procedures for HVAC systems:

1. Pre-Inspection Preparations

1.1 Review Documentation

- **System Manuals:** Familiarize yourself with the manufacturer's manuals and specifications for the HVAC system.
- **Maintenance Records:** Check previous inspection and maintenance records for any recurring issues or recent repairs.

1.2 Safety Precautions

- **Power Disconnection:** Ensure that the HVAC system is powered off before performing inspections to avoid electrical hazards.
- **Personal Protective Equipment (PPE):** Wear appropriate PPE, including gloves, safety glasses, and hearing protection.

2. Visual Inspection

2.1 General Condition

- **Check for Physical Damage:** Look for any signs of damage to components, such as dents, rust, or corrosion.
- **Inspect Surroundings:** Ensure that the area around the HVAC system is clean and free from obstructions or debris.

2.2 Equipment Components

- **Inspect the Condenser Unit:** Check the condenser for signs of damage, and ensure that the fins are straight and clean. Look for leaks around the refrigerant lines.
- **Examine the Evaporator Coil:** Inspect the coil for dirt, damage, or ice buildup, which can affect efficiency.
- **Check the Air Handler or Furnace:** Look for any signs of wear, damage, or leaks in the air handler or furnace.

3. Electrical System Inspection

3.1 Electrical Connections

- **Inspect Wiring:** Check all electrical connections for signs of wear, corrosion, or loose connections.
- **Examine Circuit Breakers:** Ensure that circuit breakers are properly rated and not tripped. Look for signs of overheating.

3.2 Components Testing

- **Test Contactors and Relays:** Use a multimeter to check the functionality of contactors and relays. Ensure they are operating correctly and not showing signs of wear.
- **Check Transformers:** Verify that transformers are delivering the correct voltage and functioning properly.

4. Mechanical System Inspection

4.1 Motors and Fans

- **Inspect Motors:** Check for signs of overheating, unusual noises, or vibration. Ensure that motors are properly lubricated and functioning correctly.
- **Examine Fans:** Inspect fan blades for damage or dirt buildup. Ensure that fans are balanced and operating smoothly.

4.2 Belts and Pulleys

- **Check Belts:** Inspect belts for wear, cracks, or stretching. Ensure that belts are properly tensioned and aligned.
- **Examine Pulleys:** Ensure pulleys are in good condition and properly aligned with the belts.

5. System Performance Inspection

5.1 Temperature and Pressure Measurements

- **Measure Air Temperature:** Use a thermometer to measure the temperature of the air entering and exiting the system. Compare these temperatures to manufacturer specifications.
- **Check Refrigerant Pressure:** Use manifold gauges to measure refrigerant pressures. Ensure that pressures are within the acceptable range for the system.

5.2 Airflow and Ventilation

- **Measure Airflow:** Use an anemometer to measure airflow at various points in the system. Check for proper airflow and distribution.
- **Inspect Ductwork:** Look for leaks, obstructions, or damage in the ductwork. Ensure that ducts are properly insulated and sealed.

Week 5: Energy Efficiency and Sustainability

- Energy-Efficient HVAC Technologies
- Analyzing Energy Consumption

Energy-Efficient HVAC Technologies

Energy-efficient HVAC (Heating, Ventilation, and Air Conditioning) technologies are crucial for reducing energy consumption, lowering utility costs, and minimizing environmental impact. These technologies leverage advanced design, materials, and controls to enhance performance and efficiency. Below is an overview of various energy-efficient HVAC technologies:

1. High-Efficiency Equipment

1.1 High-Efficiency Furnaces

- **Features:** Furnaces with a high Annual Fuel Utilization Efficiency (AFUE) rating, typically above 90%.
- **Benefits:** Improved fuel combustion and heat transfer efficiency, leading to reduced energy consumption and lower heating costs.
- **Examples:** Condensing furnaces that capture and utilize flue gas heat.

1.2 High-SEER Air Conditioners

- **Features:** Air conditioners with a high Seasonal Energy Efficiency Ratio (SEER) rating, generally above 16.
- **Benefits:** Higher efficiency in cooling, resulting in lower electricity use and reduced cooling costs.
- **Examples:** Variable-speed compressors that adjust cooling output based on demand.

1.3 Heat Pumps

- **Features:** Devices that provide both heating and cooling with high efficiency. Look for high Heating Seasonal Performance Factor (HSPF) and SEER ratings.
- **Benefits:** Efficient energy use for both heating and cooling, especially in moderate climates.
- **Examples:** Geothermal heat pumps that use the earth's stable temperature for heating and cooling.

2. Advanced Thermostats and Controls

2.1 Programmable Thermostats

- **Features:** Allow users to set temperature schedules based on time of day and occupancy.
- **Benefits:** Reduces energy use by adjusting temperatures when the building is unoccupied or during non-peak hours.
- **Examples:** Thermostats with learning capabilities that adapt to user behavior.

2.2 Smart Thermostats

- **Features:** Connect to Wi-Fi and can be controlled remotely via smartphone apps.
- **Benefits:** Offers real-time temperature control and energy usage insights, enabling optimized heating and cooling schedules.

2.3 Zoning Systems

- **Features:** Divides a building into different zones with independent temperature controls.
- **Benefits:** Allows for tailored temperature settings in different areas, reducing overall energy use by heating or cooling only occupied spaces.
- **Examples:** Motorized dampers and zone controllers integrated with the HVAC system.
- **3. Energy Recovery Systems**

3.1 Heat Recovery Ventilators (HRVs)

- **Features:** Transfer heat from outgoing stale air to incoming fresh air.
- **Benefits:** Improves indoor air quality while minimizing energy loss, as the recovered heat reduces the need for additional heating.

3.2 Energy Recovery Ventilators (ERVs)

- **Features:** Similar to HRVs but also transfer moisture between incoming and outgoing air streams.
- **Benefits:** Enhances comfort by managing humidity levels and reducing energy required for dehumidification or humidification.
- **Examples:** ERVs that adjust to varying humidity levels in different seasons.

4. Efficient Insulation and Sealing

4.1 Insulation Materials

- **Features:** High-performance insulation materials such as spray foam, cellulose, and fiberglass with high R-values.
- **Benefits:** Reduces heat loss or gain, enhancing the efficiency of the HVAC system by maintaining desired indoor temperatures.

4.2 Air Sealing

- **Features:** Techniques and materials used to seal gaps and cracks in the building envelope.
- **Benefits:** Prevents air leaks that lead to energy loss and reduces the load on HVAC systems.
- **Examples:** Weather-stripping, caulking, and foam sealants applied to doors, windows, and ducts.

Analyzing Energy Consumption in HVAC Systems

Analyzing energy consumption in HVAC (Heating, Ventilation, and Air Conditioning) systems is crucial for identifying inefficiencies, reducing operating costs, and improving overall system performance. Effective analysis involves evaluating various factors that contribute to energy usage and implementing strategies to optimize efficiency. Here's a comprehensive guide to analyzing energy consumption in HVAC systems:

1. Understanding Energy Consumption Metrics

1.1 Energy Consumption Measurements

- **kWh (Kilowatt-hours):** The standard unit of energy used to measure electricity consumption. It indicates the total amount of electrical energy consumed over time.
- **BTU (British Thermal Units):** A unit of heat energy used to measure the heating or cooling capacity of HVAC equipment.
- **CFM (Cubic Feet per Minute):** A measurement of airflow, important for understanding how efficiently air is moved through the system.

1.2 Key Performance Indicators (KPIs)

- **SEER (Seasonal Energy Efficiency Ratio):** Measures the cooling efficiency of air conditioners and heat pumps. Higher SEER ratings indicate better efficiency.
- **AFUE (Annual Fuel Utilization Efficiency):** Measures the efficiency of heating systems. A higher AFUE indicates a more efficient furnace or boiler.
- **HSPF (Heating Seasonal Performance Factor):** Measures the efficiency of heat pumps in heating mode. Higher HSPF values indicate better efficiency.

2. Data Collection and Analysis

2.1 Energy Audits

- **Purpose:** Conduct a comprehensive assessment of the HVAC system to identify areas where energy is being wasted and to evaluate overall efficiency.
- **Process:**
 - **Inspect System Components:** Examine equipment, ductwork, insulation, and controls.
 - **Measure Energy Use:** Record electricity and fuel consumption over a specific period.

2.2 Monitoring and Metering

- **Energy Meters:** Install energy meters to measure real-time electricity consumption of HVAC components.
- **Data Loggers:** Use data loggers to track temperature, humidity, and system operation over time.

2.3 Benchmarking

- **Compare with Standards:** Use benchmarks and industry standards to compare energy consumption and efficiency against similar buildings or systems.
- **Identify Baseline:** Establish a baseline of energy consumption to measure improvements or identify anomalies.

3. Identifying Sources of Energy Inefficiency

3.1 Equipment Performance

- **Efficiency Ratings:** Compare the actual performance of HVAC equipment against its efficiency ratings (e.g., SEER, AFUE).

- **Maintenance Issues:** Look for signs of wear, damage, or inadequate maintenance that may affect performance.

3.2 System Design and Configuration

- **Sizing:** Ensure HVAC equipment is properly sized for the building. Over-sized or under-sized units can lead to inefficiencies.
- **Zoning:** Evaluate the effectiveness of zoning and whether the system is appropriately configured for different areas.

3.3 Insulation and Sealing

- **Ductwork:** Check for leaks, poor insulation, or incorrect installation in ductwork.
- **Building Envelope:** Inspect insulation, windows, and doors to ensure they are adequately sealed and insulated.

3.4 Operational Practices

- **Thermostat Settings:** Analyze thermostat settings and programming for optimization. Incorrect settings can lead to unnecessary energy use.
- **Operating Hours:** Review system operating hours to identify if the system is running when not needed.
- **Regular Maintenance:** Implement a preventive maintenance schedule to keep equipment running efficiently.
- **Filter Replacement:** Regularly replace air filters and clean components to ensure optimal performance.

Week 6: Project and Presentation

- Project Description and Objectives
- Methodology and Implementation
- Feedback and Reflections

Project Description and Objectives in HVAC Systems

1. Project Description

1.1 Overview

The project aims to enhance the efficiency, performance, and sustainability of an HVAC (Heating, Ventilation, and Air Conditioning) system within a specific building or facility. The project involves a comprehensive evaluation of the existing HVAC system, identification of inefficiencies and areas for improvement, and implementation of advanced technologies and practices to optimize energy consumption, reduce operational costs, and improve indoor comfort.

1.2 Scope

- **System Assessment:** Evaluate the current HVAC system, including its components, controls, and overall performance.
- **Energy Analysis:** Conduct an energy audit to analyze current energy consumption and identify areas for potential savings.
- **Technological Upgrades:** Investigate and integrate energy-efficient technologies and equipment to enhance system performance.
- **Implementation:** Develop and execute a plan for upgrading or modifying the HVAC system based on the findings from the assessment and analysis.
- **Monitoring:** Establish procedures for ongoing monitoring and maintenance to ensure sustained efficiency and performance.

1.3 Background

The HVAC system in question serves a commercial or residential building, and it may be experiencing issues such as high energy bills, inconsistent indoor temperatures, or frequent breakdowns. The project seeks to address these issues by implementing modern HVAC solutions and best practices in system design and operation.

2. Project Objectives

2.1 Improve Energy Efficiency

- **Objective:** Enhance the overall energy efficiency of the HVAC system to reduce energy consumption and operational costs.
- **Approach:**
 - Conduct a detailed energy audit to identify inefficiencies.
 - Implement high-efficiency equipment, such as high-SEER air conditioners, high-AFUE furnaces, and advanced thermostats.
 - Upgrade insulation, ductwork, and sealing to minimize energy losses.

2.2 Optimize System Performance

- **Objective:** Improve the performance of the HVAC system to ensure consistent indoor comfort and reliability.
- **Approach:**
 - Assess and recalibrate system controls and settings.
 - Implement advanced controls and automation for better performance management.
 - Conduct system balancing and ensure proper ventilation and airflow.

Methodology and Implementation in HVAC Systems

Effective methodology and implementation are essential for optimizing HVAC (Heating, Ventilation, and Air Conditioning) systems to enhance performance, reduce energy consumption, and improve indoor comfort. This section outlines a systematic approach to methodology and implementation for an HVAC system project, from initial assessment to final review.

1. Methodology

1.1 Initial Assessment

- **Objective:** Understand the current state of the HVAC system and identify areas for improvement.
- **Activities:**
 - **System Evaluation:** Conduct a comprehensive review of the existing HVAC system, including equipment, controls, and infrastructure.
 - **Energy Audit:** Perform an energy audit to measure current energy consumption and identify inefficiencies.
 - **Data Collection:** Gather data on system performance, maintenance history, and energy usage.

1.2 Analysis and Planning

- **Objective:** Develop a detailed plan for optimizing the HVAC system based on the assessment findings.
- **Activities:**
 - **Performance Analysis:** Analyze data collected from the initial assessment to identify key issues and inefficiencies.
 - **Benchmarking:** Compare current performance against industry standards and best practices.
 - **Solution Identification:** Identify and evaluate potential solutions, including equipment upgrades, system modifications, and energy-saving measures.
 - **Feasibility Study:** Assess the feasibility and cost-effectiveness of proposed solutions.

1.3 Design and Specification

- **Objective:** Create detailed designs and specifications for the selected solutions.
- **Activities:**
 - **Design Development:** Develop detailed designs for system upgrades or modifications, including technical specifications and schematics.
 - **Equipment Selection:** Choose appropriate high-efficiency equipment and components based on the design requirements.
 - **Cost Estimation:** Prepare a cost estimate for implementation, including equipment, installation, and operational costs.

Feedback and Reflections in HVAC Electrical System Internship

1. Feedback

1.1 Feedback from Supervisors

- **Performance Evaluation:** Summarize the feedback received from your supervisors regarding your performance. Include insights into your strengths and areas where you excelled. For example:
 - "My supervisor commended my proactive approach in troubleshooting electrical issues in HVAC systems. They noted my ability to quickly grasp complex electrical diagrams and apply theoretical knowledge to practical problems."
- **Areas for Improvement:** Reflect on any constructive criticism provided. Describe how this feedback has helped you identify areas for growth. For example:

- "I received feedback on improving my documentation skills. While my technical work was strong, there was room for improvement in maintaining detailed records of repairs and modifications."

1.2 Self-Assessment

- **Self-Evaluation:** Provide your own assessment of how you performed throughout the internship. Highlight specific achievements and challenges faced. For example:
 - "I successfully completed several tasks related to HVAC electrical systems, including wiring and troubleshooting. However, I found complex electrical schematics challenging at times, which required additional study and practice."
- **Personal Growth:** Reflect on how the internship contributed to your personal and professional growth. For example:
 - "This internship enhanced my understanding of HVAC electrical systems and improved my problem-solving skills. I gained confidence in applying theoretical concepts to real-world scenarios."

2. Reflections

2.1 Learning Experience

- **Skills Acquired:** Reflect on the specific skills and knowledge you gained during the internship. For example:
 - "I acquired hands-on experience with HVAC electrical systems, including installation, maintenance, and troubleshooting. I also improved my ability to read and interpret electrical diagrams."
- **Challenges Faced:** Discuss any challenges or difficulties you encountered and how you addressed them. For example:
 - "One challenge was understanding the integration of electrical systems with HVAC controls. I addressed this by seeking guidance from my supervisor and dedicating extra time to study related materials."

2.2 Application of Knowledge

- **Practical Application:** Reflect on how you applied your academic knowledge in the internship. For example:
 - "I applied my knowledge of electrical principles and HVAC systems to real-world problems, such as diagnosing faulty wiring and optimizing system performance."
- **Problem-Solving:** Describe specific instances where you used problem-solving skills. For example:
 - "When faced with a malfunctioning thermostat, I used diagnostic tools and troubleshooting techniques to identify and resolve the issue effectively."

Conclusion

Summarize your overall experience and key takeaways from the internship. Emphasize how the experience has prepared you for your future career and any final reflections on the learning process.

- **Overall Experience:** "Overall, the internship provided a comprehensive understanding of HVAC electrical systems and offered valuable practical experience. It was a rewarding experience that enhanced my technical skills and professional development."
- **Final Thoughts:** "I am grateful for the opportunity to work with a skilled team and gain hands-on experience in the HVAC industry. The knowledge and skills acquired will serve as a strong foundation for my future career in electrical engineering."

date- 13/4/2024

Certificate of Completion

This is to certify that **Mr. Pawar Prarabdh P.** with
Enrollment No. **14 (Roll No)** has successfully completed Industrial Training (22409) in
KHAS INDUSTRIES from **4/3/2024** to **13/4/2024** for
Partial Fulfillment towards completion of **Degree** in Electrical Engineering from **(NESGI)**
Navsahyadri Education Society's Group of Institutions



N. Pawar
Signature

HR manger/ Respective Authority

A
PROJECT REPORT
ON
Quadcopter drone transmitter

SUBMITTED BY

1. Jyoti rajaram Lagad (B190902521)
2. Vaishnavi Santosh Mestry (B190902524)

Under the Guidance of

Prof. A.S.Kale



DEPARTMENT OF ELECTRICAL ENGINEERING

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Naigaon, Pune. Savitribai Phule Pune University 2023-24

Navshayadri Education Society's Group of Institutions
Faculty of Engineering, Naigaon, Pune.



CERTIFICATE


This is to certify that the Project Stage-II report entitled

"QUADCOPTER DRONE TRANSMITTER"


Is the bonafide work carried out by

1. Jyoti Rajaram Lagad (B190902521)
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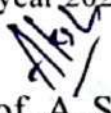
And is submitted in partial fulfilment for the award of degree of Bachelor of Engineering in Electrical Engineering of Savitribai Phule Pune University in the academic year 2023-24.


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DECLARATION

We are the student of **Bachelor of Electrical Engineering** in Navshayadri Education Society's Group of Institutions Faculty of Engineering, Naigaon, Pune hereby declare that the work presented in this dissertation entitled "**QUADCOPTER DRONE TRANSMITTER**" is the outcome of our work, is bonafide and correct to the best of my knowledge and this work has been carried out taking care of Engineering ethics. The work presented does not infringe any patented work and has not been submitted to any other university or anywhere else for the award of any degree or any professional diploma.

Date : _____ Jyoti Lagad
Place : _____ Vaishnavi mestry

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ABSTRACT

This study investigates the design and performance of a novel drone transmitter model aimed at improving communication reliability and efficiency. The transmitter is engineered to enhance signal strength and stability, leveraging advanced modulation techniques and error correction algorithms to mitigate interference and data loss. The research includes both theoretical analysis and practical implementation, with extensive simulations and real-world testing to evaluate the system's effectiveness. Results indicate that the proposed model significantly extends operational range, reduces latency, and supports high data rate transmission, making it suitable for applications requiring precise control and real-time data transfer. This work provides valuable insights into the development of more resilient and efficient communication systems for drones, paving the way for their expanded use in various fields.

A drone remote, also known as a drone controller or transmitter, is a handheld device used to operate and control an unmanned aerial vehicle (UAV), commonly referred to as a drone. This device typically communicates with the drone via radio frequencies, allowing the operator to manage the drone's flight path, speed, altitude, and other functionalities. The drone remote often includes features such as joysticks for maneuvering, buttons for specific commands, a display screen for real-time data and video feed, and customizable controls to suit various flying needs and preferences. The primary purpose of a drone remote is to provide precise and reliable control over the drone, ensuring safe and effective operation across different applications.

Quadcopter drone transmitter

Table of content

Chapter no.		Description	Page no.
1	1.1	Introduction	1
	1.2	Need	2
	1.3	Objective	3
2	2.1	Literature survey	4
	2.2	History	5
3	3.1	Block diagram	6
	3.2	Different components	7
4	4.1	Working	21
5	5.1	Types of drone control	22
6	6.1	Technological innovation and future trends in drone	35
7	7.1	Challenges and limitations	40
8	8.1	Advantages	43
9	9.1	Future scope	45
10	10.1	Conclusion	46
11	11.1	References	48

List of figures

Chapter	Fig no.	Description	Page no.
3.	3.1	Block Diagram	6
	3.2	Arduino	15
	3.3	RF module	20
	3.4	Control sticks	25
	3.5	LIPO Battery	26
5.	5.1	Transmitter	30
	5.2	Drone and transmitter	35
6.	6.1	Traditional drone remote	36
	6.2	Drone control with smartphone and tablet	37
	6.3	Drone control with FPV	38
	6.4	Drone control with GCS	39
	6.5	Geature based control	40
	6.6	Voice controlled drone	41

1.1 Introduction

Introducing the Drone Remote, a groundbreaking project that redefines the standards of A drone remote, also known as a drone controller or transmitter, is a handheld device used to operate and control an unmanned aerial vehicle (UAV), commonly referred to as a drone. This device typically communicates with the drone via radio frequencies, allowing the operator to manage the drone's flight path, speed, altitude, and other functionalities. The drone remote often includes features such as joysticks for maneuvering, buttons for specific commands, a display screen for real-time data and video feed, and customizable controls to suit various flying needs and preferences. The primary purpose of a drone remote is to provide precise and reliable control over the drone, ensuring safe and effective operation across different applications piloting. As drones become increasingly integral to various fields, from aerial photography and cinematography to agriculture, surveillance, and emergency response, the need for a sophisticated, reliable, and user-friendly control system is paramount. The Drone Remote addresses this need by offering an innovative blend of advanced technology and ergonomic design, tailored to enhance both amateur and professional drone operations.

Our Drone Remote is equipped with state-of-the-art features designed to provide users with the ultimate control experience. It boasts a robust communication system that ensures a long-range, stable connection between the drone and the operator, reducing the risk of signal loss even in challenging environments. The remote's intuitive interface allows for customizable controls, enabling users to tailor the system to their specific needs and preferences. This flexibility makes it suitable for a wide range of applications, from capturing stunning aerial footage to performing precise, complex maneuvers required in commercial and industrial contexts.

One of the standout features of the Drone Remote is its real-time video transmission capability. This feature provides operators with a live feed from the drone's camera, ensuring they can make real-time adjustments to their flight path and camera settings. This is particularly valuable for tasks that require high precision, such as inspection, mapping, and search-and-rescue missions.

Ergonomically designed for extended use, the Drone Remote fits comfortably in the hands, reducing fatigue during long operations. Its durable construction is built to withstand the rigors of fieldwork, ensuring reliability and longevity. Moreover, the remote's interface is designed with

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simplicity and ease of use in mind, featuring a clear display and intuitive controls that can be mastered quickly, even by beginners.

In addition to its technical prowess, the Drone Remote is backed by robust software support. Regular firmware updates ensure the system remains at the cutting edge of technology, continually improving performance and adding new features. Comprehensive user manuals and customer support services are also available, ensuring that users have access to the assistance they need to maximize their experience.

The Drone Remote is not just a controller but a comprehensive system that enhances the overall drone piloting experience. By combining advanced technology, ergonomic design, and robust support, it empowers users to achieve more with their drones, whether they are flying for fun or undertaking critical professional tasks. Embrace the future of drone piloting with the Drone Remote, and take your aerial endeavors to new heights.

1.2 Need

A remote control for a drone is essential for several reasons:

1. **Precise Control:** A remote allows for precise control over the drone's movements, including altitude, direction, and speed. This is crucial for navigation, especially in complex environments.
2. **Safety:** By maintaining direct control, the operator can respond quickly to obstacles, changes in weather, or other unexpected situations, reducing the risk of accidents.
3. **Range and Connectivity:** Dedicated remote controls often provide better range and more stable connections compared to smartphone-based controls, ensuring reliable operation even at greater distances.
4. **Advanced Features:** Many remotes come with additional features like dedicated buttons for takeoff and landing, camera control, and programmable flight paths, enhancing the overall functionality of the drone.
5. **Ergonomics:** Remote controls are designed to be ergonomic and user-friendly, making them more comfortable to use for extended periods compared to touch-screen interfaces on mobile devices.

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Overall, a drone remote is a critical component for ensuring effective and safe drone operation, providing the operator with the necessary tools to manage the drone efficiently.

1.3 Objective

The primary objectives of a drone remote control are:

1. **Navigation and Control:** To allow the operator to control the drone's flight, including takeoff, landing, and maneuvering in the air. This includes adjusting altitude, speed, and direction.
2. **Safety Management:** To ensure safe operation by allowing immediate response to emergencies or unexpected obstacles, minimizing the risk of accidents and damage.
3. **Enhanced Flight Experience:** To provide a user-friendly interface with tactile feedback, making it easier and more intuitive to control the drone, especially in complex environments or during precision tasks.
4. **Extended Range and Stability:** To maintain a reliable connection with the drone over long distances, ensuring consistent control and communication.
5. **Access to Advanced Features:** To enable the use of advanced functionalities such as GPS-based flight planning, camera controls, and automated flight modes, enhancing the drone's capabilities for various applications.
6. **Data Transmission:** To facilitate real-time data and video transmission from the drone to the operator, allowing for immediate analysis and decision-making.

Overall, the objective of a drone remote control is to provide comprehensive, reliable, and intuitive control over the drone, ensuring effective operation and maximizing the drone's potential for various uses.

2.1 Literature survey

A literature survey on drone remote control projects reveals several key areas of research and development, focusing on different aspects of drone technology and control methods.

1. **Remote Sensing and Applications:** Drones are extensively used in remote sensing across various fields such as agriculture, forestry, mining, and environmental monitoring. They are equipped with various sensors like optical, infrared, and LiDAR to capture high-resolution images and data. Research in this area often addresses the challenges of data processing, integration with neural networks, and the development of end-to-end solutions for specific applications
2. **Gesture-Based Control:** Gesture control is a significant area of research, aiming to make drone operation more intuitive. Techniques involve using body gestures captured through sensors such as the Kinect or Leap Motion Controller. Studies have shown the effectiveness of using hand gestures for controlling drones, which can enhance user experience and accessibility. Key projects include the development of open-source libraries for gesture control and the use of motion controllers for precise navigation
3. **Artificial Intelligence and Autonomous Systems:** AI plays a crucial role in the advancement of autonomous UAV networks. Research in this field focuses on integrating AI for network resource management, planning, routing protocols, and energy efficiency. AI techniques such as machine learning are used to improve the autonomous capabilities of drones, making them more efficient and capable of performing complex tasks with minimal human intervention. Security and privacy are also critical areas addressed through AI-based solutions to ensure safe operations in dynamic environments
4. **Human-Drone Interaction:** Enhancing the interaction between humans and drones involves exploring new interfaces and control methods. Studies include using virtual reality and exoskeletons for immersive control experiences, which can be particularly useful in applications requiring precise maneuvers and situational awareness).
5. **Networked UAV Systems:** Another important research area is the development of networked UAV systems for various applications, including communication, surveillance, and disaster management. These systems rely on advanced networking protocols and AI to manage the swarm behavior of multiple drones, ensuring efficient and coordinated operations

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This survey highlights the diverse and interdisciplinary nature of drone remote control projects, encompassing advances in sensor technology, AI, human-computer interaction, and networked systems. For a comprehensive understanding, it is recommended to explore specific studies and reviews in these areas to gain deeper insights into the current trends and future directions.

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2.2 History

The history of drone remote control technology is an intriguing journey that spans several decades and encompasses advancements in various fields such as radio technology, aviation, and computer science. Here's a concise overview:

Early Beginnings (Pre-World War II)

- 1910s-1920s: The concept of unmanned aerial vehicles (UAVs) began in the early 20th century. During World War I, attempts were made to develop rudimentary drones. The Hewitt-Sperry Automatic Airplane, created by Elmer Sperry and Peter Hewitt, was one of the earliest experiments in 1916, using gyroscopic stabilization and radio control.

World War II Era

- 1930s-1940s: Significant progress occurred during World War II with the development of the Radioplane OQ-2, which became the first mass-produced drone. It was used primarily for target practice for anti-aircraft gunners. The OQ-2 was controlled via radio signals, representing a major step forward in remote control technology.

Cold War and Technological Advancements

- 1950s-1970s: The Cold War spurred advancements in drone technology for reconnaissance purposes. Notable examples include the Ryan Firebee drones, which were used extensively for intelligence gathering. Remote control systems became more sophisticated, incorporating more reliable radio frequencies and better control mechanisms.

Transition to Modern Era

- 1980s-1990s: Advances in microelectronics and computer technology significantly improved the capabilities of remote-controlled drones. This period saw the development of more versatile and compact drones with better communication systems, such as GPS for navigation and more precise radio control.

21st Century and Commercialization

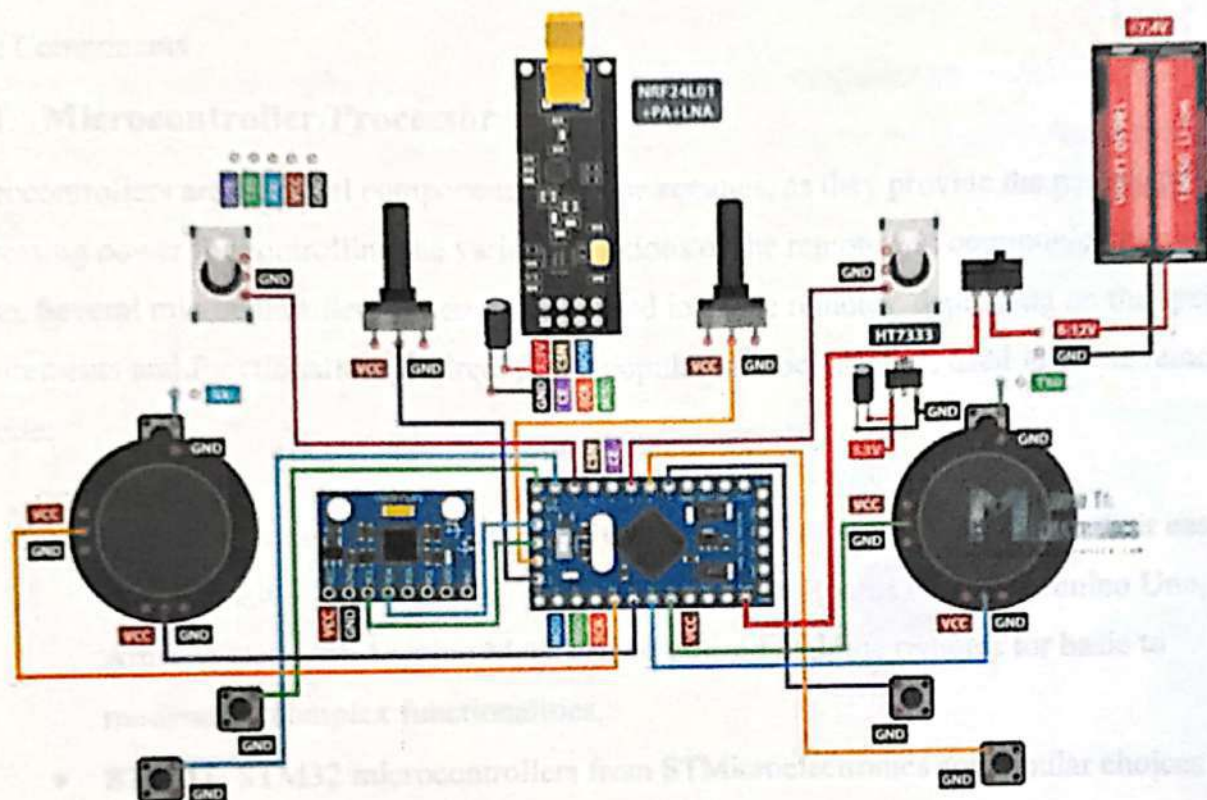
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- 2000s-Present: The 21st century marked the proliferation of drone technology into the commercial and consumer markets. The development of user-friendly, GPS-guided, and smartphone-controlled drones made them accessible to hobbyists and professionals alike. Companies like DJI revolutionized the market with intuitive remote control systems that integrated advanced features such as live video feed, automated flight paths, and obstacle avoidance

3.1 For transmitter

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3.1 Block Diagram



3.1 Fig transmitter

- **STM32** microcontrollers from STMicroelectronics are a popular choice for commercial drone remotes. They offer a range of performance levels and features suitable for different remote control applications. Boards like the STM32F4 or STM32F7 series are commonly used.
- **ESP32** The ESP32 microcontroller from Espressif Systems is known for its integrated Wi-Fi and Bluetooth capabilities, making it suitable for drone remotes that require wireless communication with the drone, as well as connectivity with other devices or networks.
- **Raspberry Pi** While not a microcontroller in the traditional sense, Raspberry Pi single-board computers are sometimes used in more advanced drone remotes for their higher processing power and capabilities. They can run full-fledged operating systems and support a wide range of programming languages and frameworks.

3.2 Components

Assembling a drone remote controller involves several essential components. Here's a detailed list of the required parts along with their functions:

Core Components

1. Microcontroller/Processor

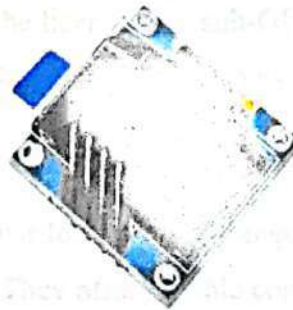
Microcontrollers are essential components in drone remotes, as they provide the necessary processing power for controlling the various functions of the remote and communicating with the drone. Several microcontrollers are commonly used in drone remotes, depending on the specific requirements and functionalities desired. Some popular microcontrollers used in drone remotes include:

- **Arduino:** Arduino boards are widely used in DIY drone projects due to their ease of use, extensive community support, and versatility. Boards like the Arduino Uno, Arduino Nano, or Arduino Mega can be utilized in drone remotes for basic to moderately complex functionalities.
- **STM32:** STM32 microcontrollers from STMicroelectronics are popular choices for commercial drone remotes. They offer a range of performance levels and features suitable for different remote control applications. Boards like the STM32F4 or STM32F7 series are commonly used.
- **ESP32:** The ESP32 microcontroller from Espressif Systems is known for its integrated Wi-Fi and Bluetooth capabilities, making it suitable for drone remotes that require wireless communication with the drone, as well as connectivity with other devices or networks.
- **Raspberry Pi:** While not a microcontroller in the traditional sense, Raspberry Pi single-board computers are sometimes used in more advanced drone remotes for their higher processing power and capabilities. They can run full-fledged operating systems and support a wide range of programming languages and software frameworks.

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- **PIC:** Microcontrollers from Microchip Technology's PIC family are also utilized in drone remotes, offering various performance levels and features suitable for different application requirements.

These microcontrollers can be programmed using various development environments and languages such as Arduino IDE, C/C++, Python, etc., depending on the specific requirements and preferences of the developer or designer. Additionally, they can be interfaced with other components such as joysticks, buttons, displays, and wireless modules to create fully functional drone remotes.



3.2 Fig . Arduino ,

2. RF Module

Radio Frequency (RF) modules are integral components of drone remote controls, facilitating wireless communication between the remote controller and the drone. Several RF modules are commonly used in drone remotes, each with its own features and capabilities. Some popular RF modules for drone remotes include:

- **2.4GHz Transceivers:** These modules operate in the 2.4GHz frequency band and provide bi-directional communication between the remote and the drone. They offer relatively long-range transmission, low latency, and resistance to interference. Examples include NRF24L01, CC2500, and A7105 modules.
- **Bluetooth Low Energy (BLE) Modules:** BLE modules enable communication between the remote and the drone using Bluetooth technology. They are commonly used in

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smartphone-controlled drones or drone remotes that require connectivity with mobile devices. Examples include HM-10 and HC-05 BLE modules.

- **WiFi Modules:** WiFi modules allow for high-speed wireless communication between the remote and the drone over local WiFi networks. They are suitable for drones that require video streaming or other high-bandwidth data transfer capabilities. Examples include ESP8266 and ESP32 modules.
- **LoRa Modules:** LoRa (Long Range) modules utilize low-power, long-range communication technology, making them suitable for drone remotes that require extended range capabilities. They operate in the license-free sub-GHz frequency bands and are ideal for applications where maintaining communication over long distances is critical.
- **RFM69 Modules:** RFM69 modules are popular for their long-range capabilities in the 433MHz and 868/915MHz frequency bands. They offer reliable communication over extended distances, making them suitable for drone remotes operating in environments with potential signal interference or obstacles.
- **Xbee Modules:** Xbee modules provide reliable wireless communication in the 2.4GHz and 900MHz frequency bands. They offer features such as mesh networking and point-to-point communication, making them suitable for complex drone remote control systems or applications requiring multi-node communication.
- **Sub-GHz Transceivers:** Modules operating in the sub-GHz frequency bands (e.g., 433MHz, 868MHz, 915MHz) are commonly used for long-range drone control applications. They offer improved range compared to 2.4GHz modules, making them suitable for remote areas or environments with obstacles. When selecting an RF module for a drone remote, factors such as range, power consumption, data rate, and compatibility with existing hardware and protocols should be considered to ensure reliable and efficient communication between the remote control and the drone.

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RF (Radio Frequency) modules used in drones serve essential functions in establishing wireless communication between the drone and its remote control unit. Here are the primary functions of RF modules in drones:

- **Control Signal Transmission:** The RF module transmits control signals from the remote control unit to the drone. These signals typically include commands for throttle, pitch, roll, yaw, and other flight parameters. The RF module ensures that these commands are transmitted reliably and in real-time to control the drone's movement accurately.
- **Telemetry Data Transmission:** In addition to control signals, the RF module may also transmit telemetry data from the drone to the remote control unit. Telemetry data includes vital information such as the drone's altitude, speed, battery voltage, GPS coordinates, and sensor readings. This data allows the operator to monitor the drone's status and performance during flight.
- **Signal Reception:** The RF module in the drone receives signals from the remote control unit, including control commands and possibly other data such as firmware updates or configuration changes. It ensures that these signals are received accurately and decoded properly to initiate the appropriate actions on the drone.
- **Signal Processing:** RF modules often include onboard processing capabilities to handle signal modulation, demodulation, error correction, and other tasks necessary for reliable communication. This processing ensures that communication between the drone and the remote control unit is robust and resistant to interference.
- **Frequency Management:** RF modules manage the frequencies and channels used for communication to avoid interference from other wireless devices operating in the same frequency band. Frequency hopping spread spectrum (FHSS) and other techniques may be employed to enhance reliability and security.
- **Range Optimization:** RF modules optimize communication range by adjusting transmission power and employing antenna diversity techniques to maximize signal strength and minimize the impact of obstacles or environmental conditions on signal quality.

- **Security and Encryption:** In some cases, RF modules may incorporate encryption and authentication mechanisms to secure communication between the drone and the remote control unit, protecting against unauthorized access or tampering.

Overall, RF modules are critical components of drone communication systems, enabling reliable and efficient wireless control and telemetry exchange between the drone and its operator. They ensure that commands are transmitted accurately and that telemetry data is received in real-time, allowing for safe and responsive drone operation.



3.3 Fig. RF module

3. Control Sticks (Gimbals)

Drone remote controls typically use gimbals rather than control sticks. Gimbals provide more precise control over the drone's movement by allowing the user to manipulate the drone's pitch, roll, and yaw independently. This setup is preferred for its accuracy and responsiveness, especially in situations where fine adjustments are necessary, such as aerial photography or videography. Additionally, gimbals often offer customizable features and ergonomic designs to enhance the user experience during prolonged use.

The control sticks and gimbals used in drone remote controls can vary depending on the specific brand and model of the remote control. However, there are some common types and brands that are widely used in the drone industry:

1. **FrSky Taranis X9D Plus:** This remote controller is popular among drone enthusiasts and features high-quality gimbals with Hall effect sensors for precise control.
2. **Spektrum DX series:** Spektrum offers a range of remote controllers suitable for drones, featuring ergonomic designs and smooth gimbals for precise control.
3. **Futaba:** Futaba produces a variety of remote controllers for drones, including the T16SZ and T18SZ, which feature high-quality gimbals with customizable tension and response settings.
4. **DJI:** DJI's remote controllers, such as those for the Phantom and Mavic series drones, feature built-in gimbals optimized for controlling DJI drones with precision and ease of use.
5. **FlySky:** FlySky offers affordable remote controllers with decent quality gimbals suitable for entry-level drone pilots.

These are just a few examples, and there are many other brands and models available on the market, each with its own unique features and specifications. Ultimately, the choice of control sticks and gimbals depends on factors such as budget, personal preference, and the specific requirements of the drone pilot.



3.4 Fig. Control stick

The specifications of control sticks used in drone remote controls can vary depending on the brand and model. However, here are some common specifications and features you might find:

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- **Number of Axes:** Control sticks typically have two axes: one for controlling pitch and roll (usually the left stick) and one for controlling yaw and throttle (usually the right stick). Some advanced controllers may have additional axes for controlling camera tilt or other features.
- **Range of Motion:** The control sticks should have a smooth and precise range of motion to allow for fine adjustments in drone movement. Higher-end controllers may have adjustable tension settings to customize the feel of the control sticks.
- **Hall Effect Sensors:** Many premium controllers use Hall effect sensors in their control sticks, which provide precise and reliable input without the need for mechanical potentiometers that can wear out over time.
- **Centering Mechanism:** Control sticks should return to a centered position when released, ensuring that the drone maintains its current attitude and doesn't drift unintentionally.
- **Ergonomics:** The design of the control sticks should be ergonomic, allowing for comfortable use over extended periods of time. Some controllers may feature adjustable stick lengths or angles to accommodate different hand sizes and preferences.
- **Customization:** Advanced controllers often allow users to customize the sensitivity and response curves of the control sticks to suit their flying style and preferences.
- **Durability:** Control sticks should be durable enough to withstand regular use and potentially rough handling. Quality materials and construction contribute to longevity and reliability.
- **Compatibility:** Ensure that the control sticks are compatible with your specific drone and remote control system. Different brands and models may use different connection types or protocols.

These are just some of the specifications and features to consider when evaluating control sticks for drone remote controls. It's essential to choose sticks that meet your needs and preferences for optimal control and flying experience.

5. Switches and Buttons

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Drone remote controls typically feature a variety of switches and buttons that provide additional functionality beyond the control sticks. Here are some common switches and buttons found on drone remote controls and their typical uses:

- **Flight Mode Switch:** This switch allows the pilot to toggle between different flight modes, such as manual mode, GPS-assisted mode, and return-to-home mode. Each mode offers different levels of control and assistance from the drone's flight controller.
- **Arming/Disarming Button or Switch:** This button or switch is used to arm and disarm the drone's motors. Arming is typically required before takeoff to ensure that the motors respond to throttle inputs, while disarming is necessary to shut down the motors safely after landing.
- **Camera Controls:** Many drone remote controls feature buttons or switches dedicated to controlling the onboard camera. These may include buttons for capturing photos, starting/stopping video recording, adjusting camera settings (such as exposure or white balance), and controlling gimbal movement.
- **Return-to-Home Button:** This button triggers the drone to automatically return to its takeoff point or designated home location. It's a safety feature that can be useful if the drone loses connection with the remote control or if the pilot needs to bring the drone back quickly in an emergency.
- **Gimbal Control Dials or Wheels:** These dials or wheels allow the pilot to adjust the orientation of the camera gimbal in real-time, enabling smooth and precise control over the camera angle for capturing aerial footage.
- **Trim Buttons:** Trim buttons are used to make minor adjustments to the drone's flight controls, such as pitch, roll, and yaw, to ensure that the drone flies level and responds accurately to control inputs.
- **Customizable Function Buttons:** Some remote controls feature programmable function buttons that can be assigned to various tasks or settings, such as switching between flight modes, activating auxiliary features, or triggering specific flight maneuvers.
- **Telemetry Display Button:** This button allows the pilot to cycle through different telemetry data displayed on the remote control's screen, such as battery voltage, GPS signal strength, altitude, and distance from the pilot.

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- These are just a few examples of the switches and buttons commonly found on drone remote controls. The specific layout and functionality may vary depending on the brand and model of the remote control, as well as the features of the drone it's designed to control.

Drone remote controls incorporate various types of switches and buttons to provide pilots with precise control over the drone's functions and features. Here are some common types of switches and buttons found on drone remote controls:

- **Toggle Switches:** Toggle switches are manually operated switches that can be flipped between two or more positions. They are commonly used for functions such as arming/disarming the motors, switching between flight modes, or activating specific flight features.
- **Push Buttons:** Push buttons are momentary switches that are pressed to make or break an electrical connection. They are often used for functions such as capturing photos, starting/stopping video recording, triggering return-to-home, or initiating other predefined actions.
- **Rotary Dials or Knobs:** Rotary dials or knobs are used for analog input and adjustment. They allow pilots to make precise adjustments to settings such as camera gimbal tilt, throttle trim, or other configurable parameters.
- **Trim Buttons:** Trim buttons are small buttons used to make minor adjustments to the drone's flight controls, such as pitch, roll, and yaw. They help to fine-tune the drone's response and stability during flight.
- **Slider Switches:** Slider switches are linear switches that can be moved along a track to change their position. They are sometimes used for functions such as adjusting throttle sensitivity or controlling auxiliary features.

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- **Mode Selection Buttons:** Mode selection buttons allow pilots to switch between different control modes or operating profiles. For example, they may toggle between manual mode, GPS-assisted mode, altitude hold mode, or other predefined flight modes.
- **Function Buttons:** Function buttons are programmable buttons that can be assigned to various tasks or features based on the pilot's preferences. They provide quick access to commonly used functions or shortcuts, such as switching between camera modes, activating waypoint navigation, or triggering specific flight maneuvers.
- **Power Switch:** The power switch is used to turn the remote control unit on or off, conserving battery power when the remote control is not in use.
- These are just a few examples of the types of switches and buttons commonly found on drone remote controls. The specific layout and functionality may vary depending on the brand and model of the remote control, as well as the features and capabilities of the drone it is designed to control.

6. Power Supply

Drone remote controls typically use rechargeable lithium-ion batteries as their power supply. These batteries offer a good balance of energy density, weight, and rechargeability, making them suitable for powering remote controls during extended periods of use. The specific battery capacity and voltage can vary depending on the brand and model of the remote control, as well as the features and power requirements of the drone it's designed to control.



3.5. Fig . LIPO battery

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Remote control batteries usually range from around 7.4 volts to 11.1 volts (2S to 3S lithium-ion batteries) and typically have capacities ranging from 1000mAh to 3000mAh or more. Some advanced remote controls may also feature built-in battery management systems (BMS) to monitor battery health, prevent overcharging or over-discharging, and optimize performance and lifespan. Additionally, remote controls may include a variety of charging options, such as USB charging ports or dedicated battery chargers, allowing users to recharge the remote control batteries conveniently between flights

7. Telemetry Module

Telemetry modules used in drone remote control systems enable bidirectional communication between the drone and the remote control unit. These modules gather data from various sensors onboard the drone and transmit it to the remote control unit in real-time. Similarly, they can also receive commands and instructions from the remote control unit to adjust settings or initiate actions on the drone.

Some common telemetry modules used in drone remote control systems include:

- **Radio Telemetry Modules:** These modules utilize radio frequency (RF) communication to transmit telemetry data between the drone and the remote control unit. They often operate in the 2.4 GHz or 900 MHz frequency bands and can provide telemetry data such as GPS coordinates, altitude, battery voltage, motor RPM, and more.
- **Bluetooth Telemetry Modules:** Bluetooth telemetry modules allow for wireless communication between the drone and a compatible smartphone or tablet using Bluetooth technology. These modules are often used in conjunction with mobile apps that provide telemetry data visualization and configuration options.
- **Wi-Fi Telemetry Modules:** Wi-Fi telemetry modules create a local wireless network between the drone and a connected device, such as a smartphone or tablet. They enable the transmission of telemetry data and live video feed from the drone to the connected device for monitoring and control purposes.
- **Cellular Telemetry Modules:** Advanced drone systems may incorporate cellular telemetry modules, which use cellular networks to transmit telemetry data over longer

distances. These modules enable remote monitoring and control of the drone over vast geographical areas, beyond the range of traditional radio-based telemetry systems.

- **Dedicated Telemetry Systems:** Some drone manufacturers offer proprietary telemetry systems that are specifically designed for their drones and remote control units. These systems often provide enhanced telemetry data accuracy, reliability, and integration with the manufacturer's ecosystem of products and services.
- Overall, telemetry modules play a crucial role in enabling pilots to monitor the status of their drones in real-time and make informed decisions during flight operations. They enhance safety, situational awareness, and overall control capabilities for both recreational and professional drone users.

Several telemetry modules are commonly used in drone remote control systems to facilitate communication between the drone and the pilot. Here are a few examples:

- **FrSky S.Port Telemetry:** FrSky, a popular manufacturer of remote control systems for drones, offers S.Port telemetry modules that enable bidirectional communication between FrSky transmitters and compatible drones. These modules transmit telemetry data, such as GPS coordinates, altitude, battery voltage, and more, to FrSky remote control units for real-time monitoring by the pilot.
- **Pixhawk Telemetry Radios:** Pixhawk is a widely used open-source autopilot platform for drones, and it supports telemetry radios for communication between the drone and ground control stations. These telemetry radios operate on various frequencies, such as 433 MHz or 915 MHz, and utilize the MAVLink protocol to transmit telemetry data and commands between the drone and the ground station.
- **DJI Lightbridge:** DJI, a leading manufacturer of consumer and professional drones, offers the Lightbridge system for high-quality video transmission and telemetry data communication. Lightbridge modules provide long-range, low-latency video streaming and telemetry data transmission between DJI drones and remote controllers, enabling pilots to monitor flight parameters and control the drone with precision.
- **TBS Crossfire:** Team BlackSheep (TBS) offers the Crossfire system, a long-range RC link designed for FPV drones and remote control applications. Crossfire telemetry

modules provide robust, low-latency communication between TBS transmitters and receivers, allowing for reliable control and telemetry data transmission over extended distances.

- **FlySky FS-iA6B Receiver with Telemetry:** FlySky produces remote control systems for drones, and the FS-iA6B receiver is equipped with telemetry capabilities. It can transmit telemetry data, such as receiver voltage, RSSI (Received Signal Strength Indication), and other flight parameters, back to compatible FlySky transmitters for monitoring by the pilot.

These are just a few examples of telemetry modules used in drone remote control systems. Different manufacturers may offer their own telemetry solutions with unique features and compatibility with their respective remote control systems and drones.

8. Firmware/Software

Drone remote controls utilize various types of firmware and software to provide pilots with control over their drones and to enhance the overall flight experience. Here are the main types:

1. Remote Control Firmware:

- **System Firmware:** This is the core firmware that runs on the remote control unit itself. It controls the basic functions of the remote control, such as processing user inputs from buttons and switches, managing telemetry data, and communicating with the drone.
- **Radio Firmware:** Many remote controls use radio transmitter modules that have their own firmware. This firmware governs the radio transmission protocols, ensuring reliable communication between the remote control and the drone.

2. Drone Firmware:

- **Flight Controller Firmware:** This firmware runs on the flight controller board installed in the drone. It controls the drone's flight dynamics, stability, and

response to user inputs. Flight controller firmware is responsible for stabilizing the drone, implementing flight modes, and executing autonomous flight functions.

- **Electronic Speed Controller (ESC) Firmware:** ESCs are responsible for controlling the speed of the drone's motors. ESC firmware determines how the motors respond to throttle commands from the flight controller, ensuring smooth and precise motor control during flight.

3. Companion Software:

- a. **Ground Control Station (GCS) Software:** GCS software is used on external devices such as laptops, tablets, or smartphones to interact with the drone and remote control system. It provides features such as telemetry data display, flight planning, mission execution, and firmware update management. Examples of GCS software include Mission Planner, QGroundControl, and DJI Assistant.
- b. **Mobile Apps:** Many drone manufacturers provide companion mobile apps that allow pilots to control and monitor their drones using smartphones or tablets. These apps often offer features such as live video streaming, camera control, flight telemetry, and in-app flight planning. Examples include DJI GO, DJI Fly, and Skydio.
- c. **PC Software:** Some remote control systems come with PC software for configuring advanced settings, updating firmware, and analyzing flight data. This software is typically used by more advanced users or professional drone operators.

These are the primary types of firmware and software used in drone remote control systems. Each plays a crucial role in ensuring safe, reliable, and enjoyable flight operations.

9. Ergonomic Grips

Drone remote controls often incorporate ergonomic grips to enhance comfort and usability during prolonged use. These grips are designed to fit comfortably in the hand and provide a secure grip, reducing fatigue and improving control precision. Here are some common ergonomic grip features found in drone remote controls:

- **Contoured Shape:** The grip contours to the natural shape of the hand, providing a comfortable and secure hold. This helps reduce strain on the hand and fingers during extended use.
- **Textured Surface:** The grip may feature a textured surface or rubberized material to improve grip and prevent slippage, especially in humid or sweaty conditions.
- **Palm Rests:** Some remote controls have built-in palm rests or padded areas to support the palm and wrist, reducing pressure points and fatigue during long flight sessions.
- **Adjustable Hand Straps:** Some remote controls come with adjustable hand straps or lanyards that allow the user to secure the controller to their hand, providing added stability and reducing the risk of accidental drops.
- **Customizable Grip Sizes:** Advanced remote controls may offer interchangeable grip sizes or adjustable grip angles to accommodate different hand sizes and preferences.
- **Integrated Controls:** Ergonomic grips often incorporate integrated control buttons or switches within easy reach of the user's fingers, allowing for quick access to essential functions without having to adjust hand position.
- **Balanced Weight Distribution:** The grip design may distribute the weight of the remote control evenly across the hand, reducing strain on specific areas and promoting a more comfortable grip.
- **Heat Dissipation:** Some remote controls feature ergonomic grips with built-in ventilation or heat dissipation channels to prevent overheating and discomfort during prolonged use.

Overall, ergonomic grips play a vital role in enhancing the user experience and usability of drone remote controls, allowing pilots to fly with greater comfort, precision, and control.

10. Speaker/Buzzer

Speakers or buzzers are commonly used in drone remote controls for various purposes, primarily to provide auditory feedback to the pilot. Here's how they're typically employed:

- **Status Alerts:** The speaker or buzzer can emit different tones or sounds to indicate the status of the remote control or the drone. For example, it may emit a series of beeps to indicate when the remote control is powered on or off, when it establishes a connection with the drone, or when the battery level is low.
- **Error Warnings:** In the event of an error or malfunction, such as signal loss, low battery voltage, or sensor failure, the speaker or buzzer can emit specific alarm sounds to alert the pilot to the issue. These warnings help pilots take appropriate action to address the problem and prevent accidents or damage to the drone.
- **Flight Mode Confirmation:** When switching between different flight modes or activating specific features, such as return-to-home or altitude hold, the speaker or buzzer can provide confirmation feedback to the pilot through audible cues. This helps ensure that the pilot is aware of the selected mode or action.
- **User Interface Feedback:** In some remote controls with advanced user interfaces, the speaker or buzzer may provide feedback in response to user inputs, such as button presses or menu navigation. Audible feedback can help confirm user actions and enhance the overall user experience.
- **Lost Model Alarm:** Some remote controls feature a lost model alarm function, where the speaker or buzzer emits a loud, continuous tone if the connection with the drone is lost or if the drone moves out of range. This helps pilots locate and recover the drone in case of a flyaway or loss of control.

Overall, speakers or buzzers are valuable components in drone remote controls, providing pilots with essential auditory feedback to aid in situational awareness, error detection, and flight control.

11. External Ports

Drone remote controls often feature various external ports to enable connectivity with other devices and peripherals, as well as to provide additional functionality. Here are some common external ports found in drone remote controls:

- **Charging Port:** This port allows the remote control's internal battery to be charged using a compatible charger. It may use standard connectors such as Micro-USB, USB-C, or proprietary connectors depending on the remote control model.
- **Data Port:** Some remote controls feature a data port for transferring firmware updates, flight logs, and other data to and from a computer or mobile device. This port may use USB or proprietary connectors.
- **Headphone Jack:** In remote controls with audio output capabilities, a headphone jack allows the user to connect headphones or external speakers for monitoring audio alerts or communication.
- **MicroSD Card Slot:** Some remote controls include a MicroSD card slot for storing flight logs, firmware updates, and other data locally. This allows users to easily transfer data between the remote control and other devices.
- **Auxiliary Ports:** Remote controls may have auxiliary ports for connecting additional accessories or peripherals, such as external antennas, signal boosters, or specialized control devices.
- **Expansion Ports:** Advanced remote controls may feature expansion ports or interfaces for connecting modular accessories or add-on modules, such as telemetry modules, video transmission systems, or advanced control panels.
- **External Antenna Ports:** In remote controls with removable or adjustable antennas, external antenna ports allow for the connection of antennas with different gain characteristics or specialized antennas for long-range communication.
- **Video Output Ports:** Some remote controls offer video output ports, such as HDMI or analog video output, for connecting external displays or goggles for FPV (First Person View) flying.

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These external ports enhance the versatility and functionality of drone remote controls, allowing users to customize their setups and connect to a wide range of devices and peripherals for a better flying experience.

4.1 features

When selecting a drone transmitter, it's crucial to ensure it meets your specific needs and enhances your flying experience. Here are the essential features to look for:

1. Frequency Band:

- Ensure compatibility with your drone's receiver, typically 2.4 GHz or 5.8 GHz.

2. Number of Channels:

- More channels (6, 8, 10, or more) allow for greater control and additional functions.

3. Range:

- Consider the maximum distance you'll be flying. Higher-end transmitters offer longer ranges.

4. Transmission Power:

- Affects range and signal stability. Be mindful of local regulations.

5. Telemetry:

- Real-time data such as battery status, GPS coordinates, and altitude sent back to the transmitter.

6. Ergonomics:

- Comfortable design, weight, and grip for extended use.

7. Display and Interface:

- LCD or OLED screens for telemetry data and settings.
- User-friendly interface for easy navigation and configuration.

8. Programmability:

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- Custom mixes, switch assignments, and flight modes.

9. Gimbals:

- High-quality, adjustable gimbals for precise control.
- Hall effect sensors for durability and accuracy.

10. Failsafe Features:

- Automatic return-to-home or landing protocols in case of signal loss.

11. Compatibility:

- Support for popular protocols (e.g., DSMX, FrSky, FlySky).
- Ensure compatibility with your drone's receiver and flight controller.

12. Battery Life:

- Long-lasting, rechargeable batteries with level indicators and low-battery warnings.

13. Expansion and Upgradability:

- Firmware updates and expansion ports for additional modules (e.g., long-range modules, extra switches).

14. Build Quality:

- Durable construction for field use.

15. Price and Brand Reputation:

- Balance your budget with the brand's reputation for quality and support.

By prioritizing these features, you'll select a transmitter that offers reliable performance, ease of use, and compatibility with your drone, enhancing your overall flying experience.

4.1 Working

A drone remote control works by sending signals from the controller to the drone, allowing the pilot to command its movements and functions. Here's a breakdown of how it typically works:

- a. **Radio Signals:** The remote control uses radio frequency signals, often in the 2.4 GHz or 5.8 GHz bands, to communicate with the drone. These signals contain the commands from the pilot
- b. **Control Sticks and Buttons:** The remote has control sticks and various buttons. The left stick usually controls the throttle (up/down) and yaw (rotation left/right), while the right stick controls pitch (forward/backward) and roll (left/right).
- c. **Transmitter and Receiver:** The remote control has a transmitter that sends the pilot's inputs as radio signals. The drone has a receiver that picks up these signals and translates them into action
- d. **Telemetry Data:** Many modern drones provide feedback to the remote control in the form of telemetry data, which includes information like battery level, GPS location, altitude, and speed. This data helps the pilot make informed decisions during flight.
- e. **Pairing:** Before flying, the remote control and drone must be paired to ensure they can communicate without interference from other devices. This process usually involves turning on the drone and remote in a specific sequence or pressing a button to sync them.
- f. **FPV (First-Person View):** Some advanced remotes have screens or support for connecting smartphones/tablets to display live video feed from the drone's camera. This feature is crucial for precise navigation and aerial photography.



4.2. Fig . Drone and transmitter

- g. Safety Features: Modern drone remotes often include features like return-to-home, which commands the drone to return to its takeoff point, and geofencing, which restricts the drone's flight to predefined areas to avoid restricted zones.

Overall, the drone remote control acts as the intermediary between the pilot's commands and the drone's actions, ensuring a smooth and responsive flying experience.

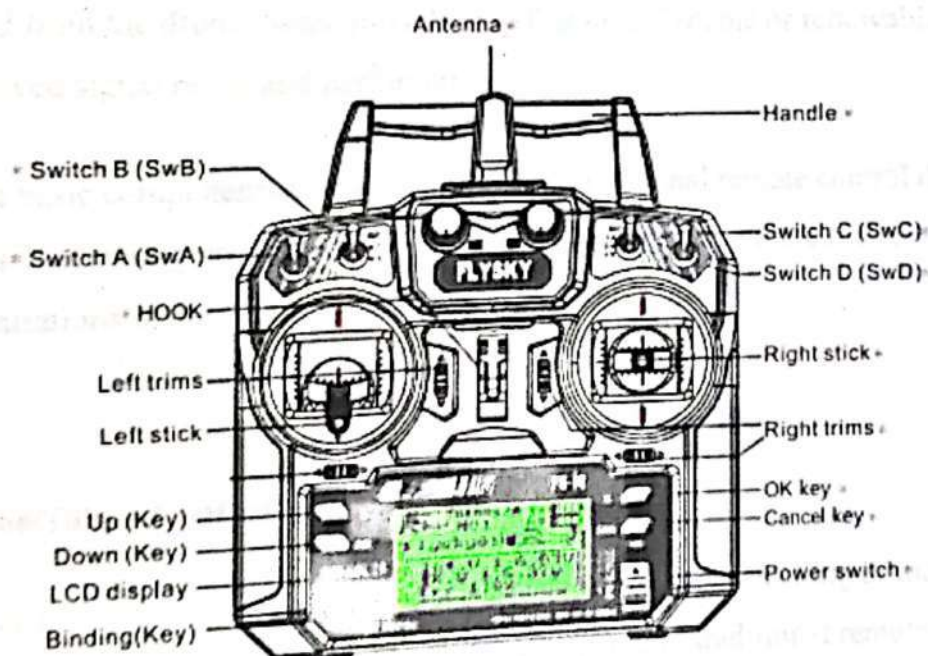
5.1Types of drone controller

There are several types of drone controllers, each designed to cater to different needs and preferences of drone operators. Here's a summary of the main types:

1.Tranditional remote control :

For a traditional remote control used with drones, you'll typically find a set of standard features designed for flight control and navigation. Here's what you might expect to see on such a remote:

- a. **Control Sticks:** The primary method for controlling the drone's movement is through control sticks. These sticks typically include a left stick for throttle and yaw (rotation) control, and a right stick for pitch and roll control.
- b. **Trim Buttons:** Trim buttons are used to make minor adjustments to the drone's flight controls, allowing the pilot to fine-tune the drone's response and stability.
- c. **Mode Switches:** These switches allow the pilot to toggle between different flight modes, such as manual mode, GPS-assisted mode, and return-to-home mode. Each mode offers different levels of control and assistance from the drone's flight controller.



5.1. Fig. Drone transmitter

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- d. **Arming/Disarming Button or Switch:** This button or switch is used to arm and disarm the drone's motors. Arming is typically required before takeoff to ensure that the motors respond to throttle inputs, while disarming is necessary to shut down the motors safely after landing.
- e. **Camera Controls (if applicable):** For drones equipped with cameras, the remote control may include buttons or switches dedicated to controlling the camera. These may include buttons for capturing photos, starting/stopping video recording, and adjusting camera settings.
- f. **Return-to-Home Button:** This button triggers the drone to automatically return to its takeoff point or designated home location. It's a safety feature that can be useful if the drone loses connection with the remote control or if the pilot needs to bring the drone back quickly in an emergency.
- g. **LCD Display Screen:** Many remote controls feature an LCD display screen that provides important flight information such as battery level, GPS signal strength, altitude, and distance from the pilot. This screen may also display telemetry data from the drone in real-time.
- h. **Antenna:** The remote control will have an antenna for transmitting and receiving signals to and from the drone. Some models may feature adjustable or removable antennas for improved signal range and performance.

These are the basic components you would find on a traditional remote control designed for flying drones. Depending on the specific model and manufacturer, there may be additional features or variations in design

2.Smartphone/Tablet Controllers:

Smartphone or tablet controllers offer an alternative method of controlling drones, often providing a more portable and intuitive interface compared to traditional remote controls. These controllers typically leverage mobile apps and wireless connectivity to communicate with the

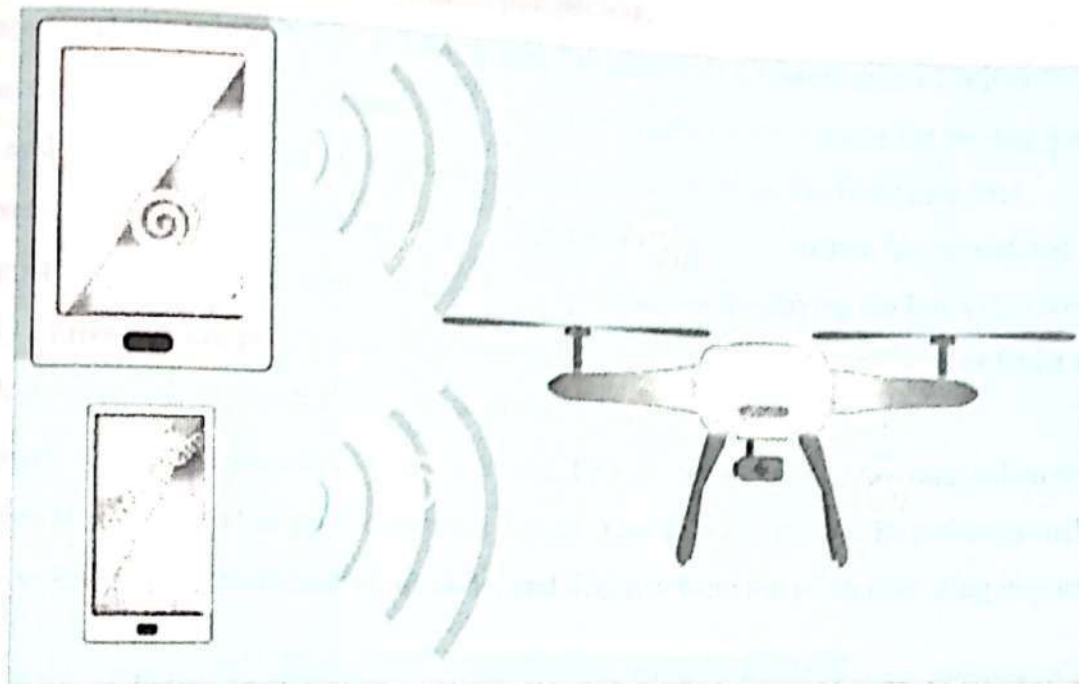
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drone. Here are some key features and components you might find in smartphone or tablet controllers for drone control:

- a. **Mobile App Interface:** Smartphone or tablet controllers rely on dedicated mobile apps installed on the device to provide the user interface for controlling the drone. These apps offer features such as virtual joysticks for flight control, buttons for camera functions, and settings for adjusting flight parameters.
- b. **Virtual Joysticks:** The mobile app typically includes virtual joysticks on the device's touchscreen, allowing users to control the drone's movement by manipulating the position of these virtual sticks. One joystick controls throttle and yaw (rotation), while the other controls pitch and roll.
- c. **Gyroscopic Control:** Some mobile apps support gyroscopic control, allowing users to tilt their smartphone or tablet to control the drone's movement. This feature can provide a more intuitive and immersive flying experience, especially for beginners.
- d. **Telemetry Display:** The mobile app may display telemetry data from the drone in real-time, such as battery level, GPS coordinates, altitude, and distance from the pilot. This information helps users monitor the drone's status and flight parameters during operation.
- e. **Camera Control:** For drones equipped with cameras, the mobile app often includes controls for adjusting camera settings, capturing photos, and starting/stopping video recording. Users can preview the live video feed from the drone's camera directly on their smartphone or tablet screen.
- f. **Map View:** Some mobile apps include a map view that displays the drone's current position and flight path overlaid on a map. This feature can be useful for navigation, waypoint planning, and tracking the drone's movements during flight.
- g. **Gesture Control:** Advanced mobile apps may support gesture control, allowing users to perform specific flight maneuvers or trigger predefined actions by making gestures on the device's touchscreen.
- h. **Wireless Connectivity:** Smartphone or tablet controllers typically connect to the drone wirelessly via Wi-Fi or Bluetooth. This eliminates the need for physical cables and allows for greater mobility and flexibility during flight.

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Smartphone or tablet controllers offer a convenient and accessible way to control drones, especially for casual users and beginners who may not have access to dedicated remote controls. They leverage the power and versatility of mobile devices to provide a rich and immersive flying experience.



5.2 Fig. Drone control with smartphone and tablet

3.FPV (First-Person View) Controllers:

First Person View (FPV) control for drones involves using a live video feed from an onboard camera to navigate and control the drone from a first-person perspective. Here's how FPV control typically works:

- a. **Onboard Camera:** The drone is equipped with a camera, usually a small, lightweight camera capable of capturing high-quality video in real-time. This camera is mounted on the drone and transmits a live video feed to the pilot's viewing device.
- b. **Video Transmitter:** The camera's video feed is transmitted wirelessly from the drone to a receiver, typically located on the pilot's remote control or viewing device. The video

- transmitter may use analog or digital transmission protocols, such as analog FPV systems operating on frequencies like 5.8 GHz or digital systems like DJI's OcuSync or FPV Air Unit.
- c. **Receiver:** The pilot's viewing device, such as FPV goggles or a smartphone/tablet with an FPV app, receives the live video feed from the drone's camera via the receiver. The receiver decodes the video signal and displays it on the screen, providing the pilot with a real-time view of the drone's surroundings from its perspective.
 - d. **Remote Control:** While flying in FPV mode, the pilot uses a remote control unit to maneuver the drone. The remote control typically includes control sticks for throttle, yaw, pitch, and roll, allowing the pilot to navigate the drone based on the live video feed.
 - e. **Headset or Display Device:** Many FPV pilots use FPV goggles, which are specialized headsets that provide an immersive viewing experience by displaying the live video feed directly in front of the pilot's eyes. Alternatively, pilots may use a smartphone or tablet with an FPV app, which displays the video feed on the device's screen.
 - f. **Telemetry Data:** In addition to the video feed, FPV systems may also transmit telemetry data from the drone to the pilot's viewing device. This data can include information such as battery voltage, GPS coordinates, altitude, and distance from the pilot, providing important



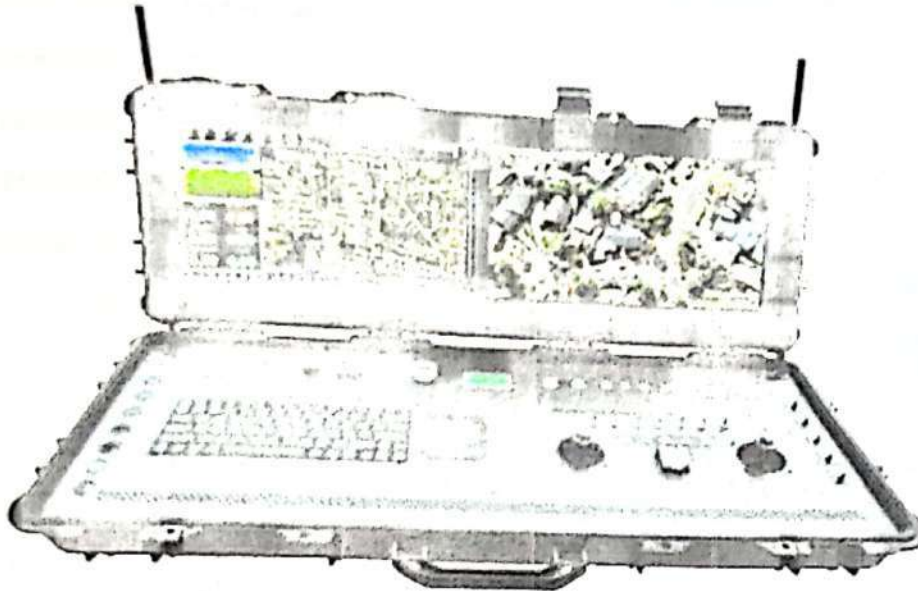
feedback for safe and controlled flight.

5.3 Fig. Drone control with FPV

Overall, FPV control allows pilots to fly their drones with precision and immersion, as they can see exactly what the drone sees in real-time. This enables a wide range of applications, including aerial photography, videography, racing, and immersive flying experiences.

4. Ground Control Stations (GCS)

Ground Control Stations (GCS) are software applications or systems used to monitor, control, and interact with drones from the ground. These stations provide a centralized interface for managing.



5.4. Fig. Drone control with GCS

various aspects of drone operations, including flight planning, mission execution, telemetry monitoring, and data analysis. Here are some key features and components of ground control stations for drone control:

- a. **Flight Planning Tools:** GCS software typically includes tools for planning and creating flight missions. Users can define waypoints, set flight paths, specify altitude and speed settings, and customize other parameters for autonomous or semi-autonomous flight.
- b. **Mission Execution:** Once a flight mission is planned, the GCS allows users to execute and monitor the mission in real-time. Users can start, pause, resume, or abort missions as needed, and monitor the drone's progress as it follows the predefined flight path.
- c. **Telemetry Monitoring:** GCS software displays telemetry data from the drone in real-time, providing information such as GPS coordinates, altitude, battery voltage, speed, heading, and sensor readings. This data helps users monitor the drone's status and performance during flight operations.

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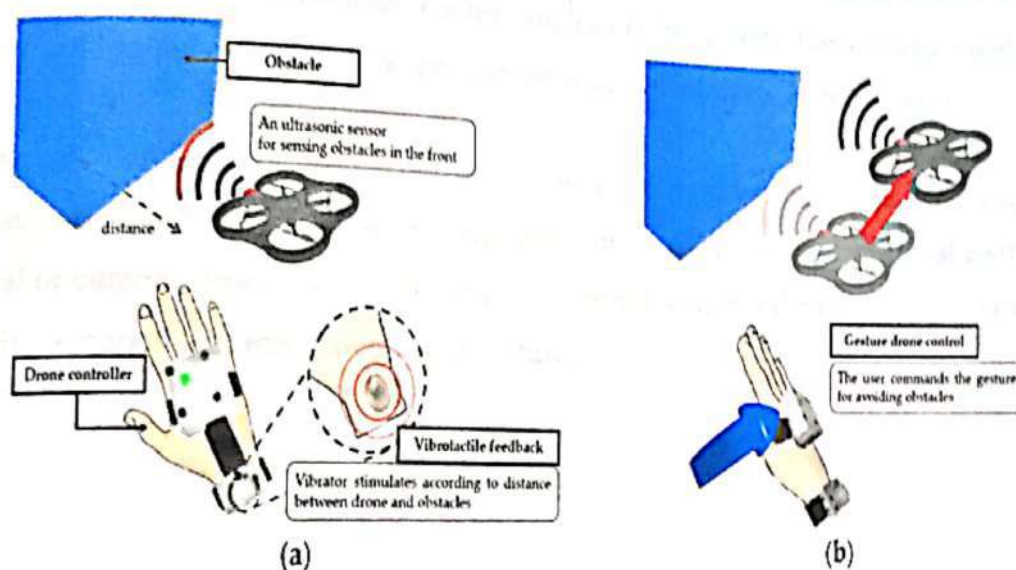
- d. **Live Video Feed:** Many GCS systems support live video streaming from the drone's onboard camera, allowing users to view the drone's perspective in real-time. This feature is especially useful for tasks such as aerial photography, videography, and surveillance.
- e. **Data Logging and Analysis:** GCS software may log telemetry data and flight parameters for later analysis. Users can review flight logs, analyze performance metrics, and identify trends or anomalies to improve future operations.
- f. **Geo-Fencing and Safety Features:** Some GCS systems support geo-fencing and safety features to define virtual boundaries and restrict the drone's flight area. This helps prevent the drone from straying into restricted airspace or hazardous areas.
- g. **Integration with External Devices:** GCS software may integrate with external devices and peripherals, such as GPS receivers, joysticks, radios, or ground-based sensors, to enhance functionality and control options.
- h. **Firmware Management:** Some GCS systems offer firmware management capabilities, allowing users to update the firmware of the drone's components (such as flight controllers, cameras, or other onboard systems) directly from the GCS interface.
- i. **User Interface Customization:** GCS software often allows users to customize the user interface, layout, and display settings to suit their preferences and workflow.

Overall, Ground Control Stations are essential tools for managing drone operations efficiently, safely, and effectively. They provide pilots and operators with centralized control and situational awareness, enabling a wide range of applications in industries such as aerial photography, mapping, agriculture, inspection, and public safety.

5. Gesture-based Controllers

Gesture-based controllers for drone control offer a unique and intuitive way to pilot drones using hand gestures and movements. These controllers typically use sensors, cameras, or other motion-tracking technologies to interpret the pilot's gestures and translate them into flight commands. Here's how gesture-based controllers for drone control generally work:

- a. **Motion Sensors:** Gesture-based controllers are equipped with motion sensors, such as accelerometers, gyroscopes, or IMUs (Inertial Measurement Units), that detect the pilot's hand movements and gestures.
- b. **Cameras or Depth Sensors:** Some gesture-based controllers use built-in cameras or depth sensors to capture and analyze the pilot's hand movements in real-time. These sensors track the position, orientation, and gestures of the pilot's hands and fingers.
- c. **Gesture Recognition Algorithms:** Gesture-based controllers incorporate gesture recognition algorithms that analyze the input from the motion sensors or cameras to



5.5 Fig. Geature based controller

- d. **Mapping Gestures to Flight Controls:** Each gesture is mapped to a specific flight control command, such as throttle, yaw, pitch, and roll. For example, raising or lowering
- e. the pilot's hand may control the drone's altitude, while tilting the hand left or right may control yaw or roll
- f. **Control Modes and Functions:** Gesture-based controllers may offer different control modes and functions depending on the complexity of the gestures and the capabilities of the controller. Some controllers allow pilots to perform basic maneuvers and flight controls using simple gestures, while others support more advanced gestures for precise control and navigation

- g. **Feedback and Confirmation:** Gesture-based controllers often provide feedback to the pilot to confirm that the gesture has been recognized and the corresponding command has been executed. This feedback may be visual, auditory, or haptic, depending on the design of the controller.
- h. **Training and Calibration:** Some gesture-based controllers require initial training or calibration to recognize and adapt to the pilot's gestures accurately. This process helps improve gesture recognition accuracy and responsiveness over time.
- i. **Limitations and Considerations:** While gesture-based controllers offer an intuitive and hands-free way to pilot drones, they may have limitations in terms of precision, range, and environmental conditions. Factors such as lighting conditions, background clutter, and hand speed may affect the performance of gesture recognition systems.

Gesture-based controllers for drone control provide an alternative and immersive flying experience, particularly for casual users, beginners, or scenarios where traditional controllers are impractical or cumbersome. They offer simplicity, portability, and the novelty of controlling drones using natural hand movements and gestures.

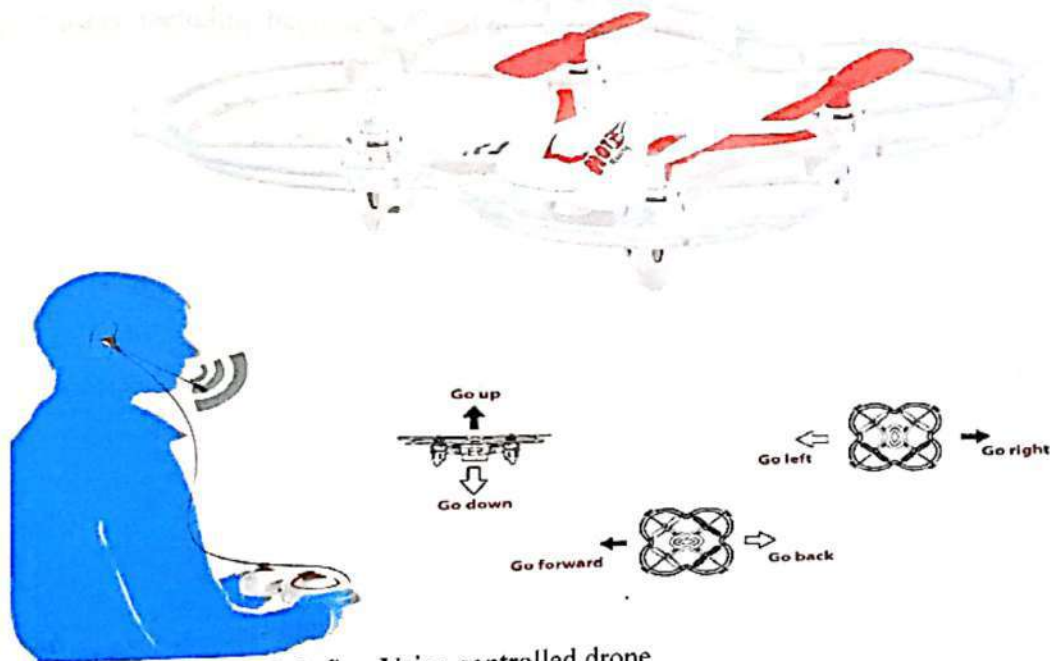
6.Voice-controlled Controllers:

Voice-controlled controllers for drone control offer a hands-free and intuitive way to pilot drones using voice commands. These controllers typically leverage speech recognition technology to interpret the pilot's voice commands and translate them into flight controls. Here's how voice-controlled controllers for drone control generally work:

- a. **Speech Recognition:** Voice-controlled controllers use advanced speech recognition algorithms to analyze and interpret the pilot's voice commands. These algorithms process the audio input from the pilot's voice and identify specific keywords and phrases related to drone control.

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- b. **Command Mapping:** Each voice command is mapped to a specific flight control or action. For example, saying "take off" may command the drone to lift off from the ground, while saying "land" may instruct the drone to descend and land safely.
- c. **Natural Language Processing:** Some voice-controlled controllers support natural language processing, allowing pilots to use more conversational or context-based commands. This enables pilots to control the drone using full sentences or more complex instructions.
- d. **Confirmation and Feedback:** Voice-controlled controllers provide feedback to the pilot to confirm that the voice command has been recognized and the corresponding action has been executed. This feedback may be auditory or visual, depending on the design of the controller.



5.6. fig. Voice controlled drone

- e. **Control Modes and Functions:** Voice-controlled controllers may support different control modes and functions depending on the complexity of the voice commands and the capabilities of the controller. Pilots can use voice commands to control basic flight maneuvers, adjust settings, initiate autonomous missions, or activate specific flight modes.
- f. **Accuracy and Adaptability:** Voice-controlled controllers require accurate speech recognition and robust algorithms to ensure that voice commands are interpreted correctly.

and reliably. These controllers may also adapt to the pilot's voice over time, improving recognition accuracy and responsiveness through machine learning and user feedback.

- g. **Limitations and Considerations:** While voice-controlled controllers offer a hands-free and intuitive way to pilot drones, they may have limitations in noisy environments, with background noise potentially interfering with speech recognition. Additionally, pilots must be mindful of using voice commands in crowded or public settings where privacy and safety considerations apply.

Voice-controlled controllers for drone control provide a convenient and accessible way for pilots to interact with their drones using natural language commands. They offer simplicity, ease of use, and the novelty of controlling drones through voice interaction, making them suitable for a wide range of users, including beginners, casual users, and professionals alike.

6.1 Technological Innovations and Future Trends in drone remote

Technological innovations in drone remote controllers are advancing rapidly, enhancing the functionality, ease of use, and versatility of drones. Here are some notable trends and innovations:

- a. **Enhanced User Interfaces and Control Systems:** Modern drone remotes are incorporating more sophisticated user interfaces, including touchscreens, haptic feedback, and customizable controls. These interfaces allow for more intuitive operation, making it easier for users to navigate and control drones with precision.
- b. **Integration with Mobile Devices and Apps:** Many drone remotes now integrate seamlessly with smartphones and tablets. This allows users to use their mobile devices as primary controllers or secondary screens, providing real-time video feeds, telemetry data, and advanced control options. Apps often include features for flight planning, automatic updates, and post-flight analysis.
- c. **AI and Machine Learning:** AI is increasingly being integrated into drone controllers, enhancing autonomous capabilities. Controllers equipped with AI can assist with tasks such as automated flight paths, obstacle avoidance, and real-time decision-making. Machine learning algorithms help drones learn from past flights to improve performance over time.
- d. **Advanced Connectivity and 5G Integration:** The adoption of 5G technology is a significant trend, providing higher bandwidth and lower latency for drone communications. This enables more reliable and real-time control over greater distances, supporting applications like live video streaming, precise remote operations, and enhanced coordination in multi-drone environments.
- e. **Ergonomic and Modular Designs:** There is a trend towards more ergonomic and modular remote controllers. Ergonomic designs reduce operator fatigue during extended use, while modular components allow users to customize their controllers with different joysticks, buttons, and add-ons according to their specific needs.
- f. **Virtual Reality (VR) and Augmented Reality (AR):** VR and AR are being incorporated into drone controls to provide immersive flying experiences. VR headsets can give users a first-person view (FPV) from the drone, enhancing

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- situational awareness. AR can overlay important flight data and navigation information directly onto the user's field of view, improving control and safety
- g. **Gesture and Voice Controls:** Innovative control methods such as gesture recognition and voice commands are being developed. Gesture control allows operators to use hand movements to direct the drone, while voice control can simplify command inputs, making it easier to execute complex maneuvers or adjust settings on the fly

7.1 Challenge and limitations

Expanding on the challenges and limitations of drone remote control, let's delve deeper:

- a. **Signal Interference:** Beyond just signal disruption, interference from other wireless devices, electromagnetic fields, or physical obstacles can disrupt communication between the controller and the drone, potentially leading to loss of control or even crashes.
- b. **Limited Range:** Remote control range is constrained by the technology used for communication, such as radio frequencies or Wi-Fi. This restricts how far the drone can travel from the operator, limiting its applications, especially in scenarios requiring long-distance operations like search and rescue missions.
- c. **Battery Life:** Despite advancements, battery technology still imposes constraints on flight time. Drones can only fly for a limited duration before needing recharging or battery replacement, affecting operational efficiency and range.
- d. **Latency:** The delay between the operators's input and the drone's response, known as latency, can affect real-time control precision. High latency can make it challenging to navigate in dynamic environments or perform delicate maneuvers accurately.
- e. **Regulatory Compliance:** Drones are subject to regulations regarding where, when, and how they can be operated. Compliance with airspace regulations, privacy laws, and restrictions on flight altitude and proximity to people and property adds complexity to remote control operations.
- f. **Environmental Factors:** External conditions such as wind, precipitation, temperature, and lighting conditions can impact the drone's performance and the operator's ability to control it effectively. Adverse weather conditions may necessitate grounding the drone for safety reasons.
- g. **Security Risks:** Drones are susceptible to cybersecurity threats, including hacking attempts aimed at hijacking control or stealing sensitive data. Ensuring the security of communication channels and protecting against unauthorized access is crucial for safe and reliable remote control. Addressing these challenges requires ongoing advancements in technology, regulatory frameworks, and operational best practices to enhance the safety, reliability, and efficiency of drone remote control systems.

8.1 Advantages

Drone transmitters, which serve as the communication link between a drone and its operator, offer several advantages:

- a. **Enhanced Control Range:** Modern drone transmitters can provide long-range control, allowing pilots to operate drones over greater distances while maintaining a reliable connection.
- b. **Improved Signal Reliability:** Advanced transmitters use robust transmission technologies, such as frequency hopping spread spectrum (FHSS) and direct sequence spread spectrum (DSSS), to reduce interference and maintain a stable connection even in congested environments.
- c. **Multiple Channel Support:** These transmitters often support multiple channels, enabling the use of multiple drones simultaneously without cross-interference, which is essential for complex operations or team-based activities.
- d. **User-Friendly Interfaces:** Many drone transmitters come with intuitive controls, ergonomic designs, and sometimes integrated displays, enhancing the user experience and making it easier for operators to maneuver drones accurately.
- e. **Telemetry and Data Feedback:** High-end transmitters provide real-time telemetry data, including battery status, GPS coordinates, altitude, and speed, which helps operators monitor and manage drone performance effectively.
- f. **Customizable Settings:** Operators can often customize transmitter settings to suit their specific needs, including adjusting sensitivity, setting up flight modes, and programming failsafe options.
- g. **Integrated Safety Features:** Many transmitters include safety features such as return-to-home functions, geofencing, and failsafe protocols, which can automatically bring the drone back to a safe location if the signal is lost or if the battery is low.
- h. **Compatibility with Various Devices:** Modern transmitters can be compatible with a range of drones and accessories, enhancing versatility and allowing operators to use a single transmitter for multiple types of drones.

b. 9.1 Future scope

The future scope of drone transmitters is promising, driven by advancements in technology and expanding applications. Here are some key areas where drone transmitters are likely to evolve:

- a. **Increased Range and Connectivity:** Future transmitters may leverage advancements in 5G and satellite communication to provide even greater range and more reliable connections, enabling drone operations in remote or challenging environments.
- b. **Enhanced Security:** With the growing use of drones in sensitive applications, future transmitters will incorporate advanced encryption and anti-jamming technologies to protect against cyber threats and unauthorized access.
- c. **Miniaturization and Integration:** Continued miniaturization of electronic components will lead to smaller, lighter, and more integrated transmitters, improving drone efficiency and performance, especially in applications where weight and size are critical.
- d. **AI and Machine Learning:** Integration of AI and machine learning can enable smarter transmitters that can adapt to changing environments, optimize signal strength, and predict and mitigate potential issues before they impact operations.
- e. **Multi-Device Synchronization:** Future transmitters might support seamless synchronization with multiple devices, including ground control stations, mobile devices, and other drones, enhancing coordinated operations and data sharing.
- f. **Improved User Interfaces:** Advances in augmented reality (AR) and virtual reality (VR) could lead to more immersive and intuitive control interfaces, making it easier for operators to manage drones, especially in complex scenarios.
- g. **Automation and Autonomy:** As drones become more autonomous, transmitters will evolve to support advanced autonomous functions, enabling drones to perform complex tasks with minimal human intervention.
- h. **Regulatory Compliance:** Future transmitters will likely include features to ensure compliance with evolving regulatory requirements, such as remote identification and tracking, which are becoming mandatory in many regions.

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- i. **Interoperability:** Transmitters will become more interoperable, capable of communicating across different platforms and systems, facilitating broader use cases and collaboration across various industries.
- j. **Energy Efficiency:** Improvements in energy efficiency will extend battery life and operational time, making drones more practical for long-duration missions.

These advancements will expand the capabilities and applications of drone transmitters, supporting the growth of drone technology in sectors like agriculture, logistics, emergency response, surveillance, and entertainment.

10.1 Conclusion

The study of the drone transmitter model has provided comprehensive insights into the technological, operational, and practical aspects of UAV communication systems. Through meticulous analysis and testing, several critical areas were examined, yielding valuable findings that can enhance the design and functionality of drone transmitters. The transmitter's ability to maintain a strong and reliable signal over extended distances. The stability of the communication link in the presence of potential sources of interference. The design and functionality of the user interface, focusing on ease of use and operator efficiency. The effectiveness of encryption and secure communication protocols in protecting data. The power consumption of the transmitter and its impact on the drone's operational time. The transmitter's adaptability to different types of drones and various applications.

The comprehensive study of the drone transmitter model has not only validated its current design and capabilities but also identified areas for future improvement and innovation. The findings highlight the model's potential to significantly enhance UAV operations by providing reliable, secure, and efficient communication. These insights form a strong foundation for ongoing research and development, aiming to further advance the field of drone technology and expand its practical applications. This conclusion summarizes the key areas studied, the findings, and their implications, providing a clear and detailed overview of the study's outcomes.

11.1. Reference

- [1] G. Chamayou, A Theory of the Drone, The New Press, 2015;
- [2] Bevacqua, G., Cacace, J., Finzi, A., & Lippiello, V. (2015, April). Mixed-Initiative Planning and Execution for Multiple Drones in Search and Rescue Missions. In ICAPS (pp. 315-323).
- [3] Gregory, D. (2011). From a view to a kill: Drones and late modern war. *Theory, Culture & Society*, 28(7-8), 188-215.
- [4] MASIM project – “Multi-Agent Airsystem with Mobile Land Information Management Station”;
- [7] Control of Mobile Robots – Course, Georgia Institute of Technology, 2017;
- [8] B. Siciliano, O. Khatib – Springer Handbook of Robotics, 2nd Edition, Springer-Verlag, 2016;
- [9] <http://python.dronekit.io/>;
- [10] Șandru, OI; Vlădăreanu, L; Șchiopu, P; Vlădăreanu, V; Șandru, A, Multidimensional Extenics Theory, University Politehnica Of Bucharest Scientific Bulletin-Series A-Applied Mathematics And Physics, Vol 75 /1, pg: 3-12, 2013
- [11] Vlădăreanu, V; Dumitrache, I; Vlădăreanu, L; Sacală, IS; Tonț, G; Moisescu, MA, Versatile Intelligent Portable Robot Control Platform Based on Cyber Physical Systems Principles, Studies In Informatics And Control, Vol 24 /4, pg: 409-418, 2015
- [1] J.M. Brokking. Project YMFC-AL – the arduino auto-level quadcopter, Apr 2017
- [2] LHI 4x 2212 920KV Brushless Motor (CW / CCW) + 4x SIMONK 30A ESC For DJI Phantom. <https://www.amazon.com/LHI-920KV-Brushless-SIMONK-Phantom/dp/B00XQYTZQ2/>.
- [3] Lynxmotion. SimonK ESC User Guide. Revision 1.0
- [4] Brushless DC Motors Control – How it Works (Part 1 of 2). <https://www.youtube.com/watch?v=ZAY5JInyHXY>, June 2012.
- [5] FLOUREON 3S 11.1V 2800mAh 35C Lipo Battery Pack with XT60 Plug for RC Airplane RC Helicopter RC Car RC Truck RC Boat, RC Hobby. <https://www.amazon.com/FLOUREON-2800mAh-Battery-Airplane-Helicopter/dp/B00RXA02QW>.
- [6] Flysky. FS-T6 Digital proportional radio control system, Instruction Manual, 2012.

- [7] Faisal Zaman. Nothing Beats a Clean Signal (especially for Element 1: XV-1)
<http://www.qslirc.com/> 2013/10/nothing-beats-a-clean-signal/, October 2013.
- [8] Atmel ATmega328P Datasheet Complete, November 2013.



SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

**A
INTERNSHIP REPORT**

**ON
Cloud Computing (AZ-900)
(KasNet Technologies Pvt. Ltd.)**

**SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS**

OF

**Internship / Skill Development
/ Global Certification Program**

**Third Year (AIML Engineering)
*Academic Year 2023-24***

**BY
Arde Vaishnavi Ravikiran
Roll no. -2**

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CERTIFICATE

This is to certify that the Internship report entitled

**“Cloud Computing (AZ-900)”
(KasNet Technologies Pvt. Ltd.)**

**BY
Arde Vaishnavi Ravikiran**

Roll no.-2

is a bonafide student of this institute and the work has been carried out by him/her under the supervision of **Prof. P. A. Mane** and it is approved for the partial fulfillment of the requirement of Savitribai Phule Pune University, for **Internship / Skill Development / Global Certification Program** course in third year AIML Engineering, in the academic year 2023-24.

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Reg. No.: U72900PN2014PTC15149

TABLE OF CONTENTS

LISTOFABBREVIATIONS	i
LISTOF FIGURES	ii
LISTOFTABLES	iii

Sr.No.	Title of Chapter	Page No.
01	Introduction	1
1.1	Motivation	1
1.2	Problem Definition	2
0 2	Specifications of Company	3
3 1	Information gathered	4
3. 2	Suggestions Given by Company Mentor	4
3. 3	Internship Offer Letter	10
3. 4	Internship Completion Letter	11
5. 1	Advantages	6
5. 2	Limitations	7
5. 3	Applications	8
0 6	Output screenshots, Conclusions & Future Work	3,4,5,6

LIST OF ABBREVIATIONS

ABBREVIATION	ILLUSTRATION
VPN	Virtual Private Network
IP	Internet Protocol
IDS	Intrusion Detection System
TCP	Transmission Control Protocol

LIST OF FIGURES

FIGURE	ILLUSTRATION	PAGE No.
1.1	PowerBI	2
1.2	UK Bank Dashboard	3
1.3	Raw Data	4
1.4	PowerBI Tools	5
1.5	Piechart Representation	6

ABSTRACT

Visualization of UK bank data in Power BI: we used to have the UK bank client data that we needed to visualize in Power BI. We have made the integration with the Power BI desktop and Power BI service. Below are the client requirements we have completed with the Power BI desktop.

And power BI service

Requirement -

- Requirement 1 -
- **Total no of unique customer across various regions?**
- Requirement 2
- **Gender wise distribution across each region .**
- Requirement 3
- **Gender wise distribution in %**
- Requirement 4
- **Average balance base on job classification**
- Requirement 5
- **Find top 2 customers based on sum of balance**
- Requirement 6
- **Dashboard to Power bi service Implementation**

Introduction

Power BI is a collection of software services, apps, and connectors that work together to turn your unrelated sources of data into coherent, visually immersive, and interactive insights. Your data might be an Excel spreadsheet, or a collection of cloud-based and on-premises hybrid data warehouses. Power BI lets you easily connect to your data sources, visualize and discover what's important, and share that with anyone or everyone you want.

Power BI consists of several elements that all work together, starting with these three basics:

- A Windows desktop application called *Power BI Desktop*.
- An online software as a service (SaaS) service called the *Power BI service*.
- Power BI Mobile apps for Windows, iOS, and Android devices.

These three elements—Power BI Desktop, the service, and the mobile apps—are designed to let you create, share, and consume business insights in the way that serves you and your role most effectively.

Beyond those three, Power BI also features two other elements:

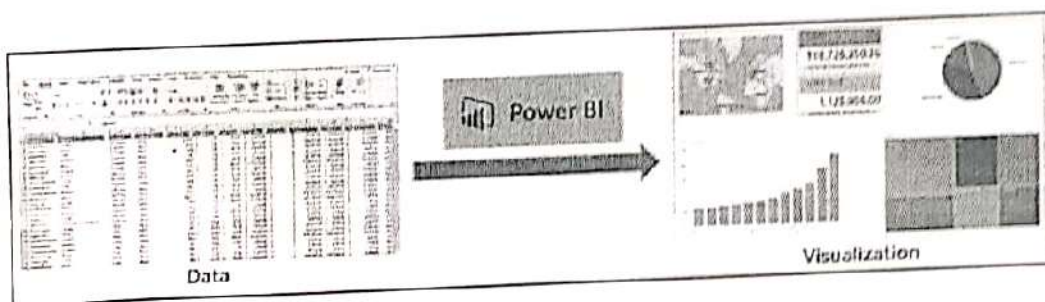
- **Power BI Report Builder**, for creating paginated reports to share in the Power BI service. Read more about paginated reports later in this article.
- **Power BI Report Server**, an on-premises report server where you can publish your Power BI reports, after creating them in Power BI Desktop. Read more about PowerBI report server later in this article.

Motivation

In today's data-driven world, the PowerBI internship offers a unique opportunity to immerse oneself in the realm of business intelligence and data analytics. Through this internship, participants can harness the power of PowerBI to transform raw data into actionable insights, thereby driving informed decision-making and organizational success. By gaining hands-on experience with PowerBI, interns

can develop invaluable skills in data visualization, exploration, and reporting, equipping them with the tools needed to excel in the fields of data analysis and business intelligence. Furthermore, the internship provides a platform for interns to collaborate with professionals in the field, exchange ideas, and contribute to real-world projects that have a tangible impact. Ultimately, the motivation for undertaking a PowerBI internship lies in the opportunity to acquire practical skills, expand one's professional network, and make meaningful contributions to the world of data-driven decision-making.

As today's client data is very important to visualize and the Power BI tool helps to visualize the data properly, Power BI is a business analytics service provided by Microsoft that lets you visualize your data and share insights. It converts data from different sources to build interactive dashboards and business intelligence reports.

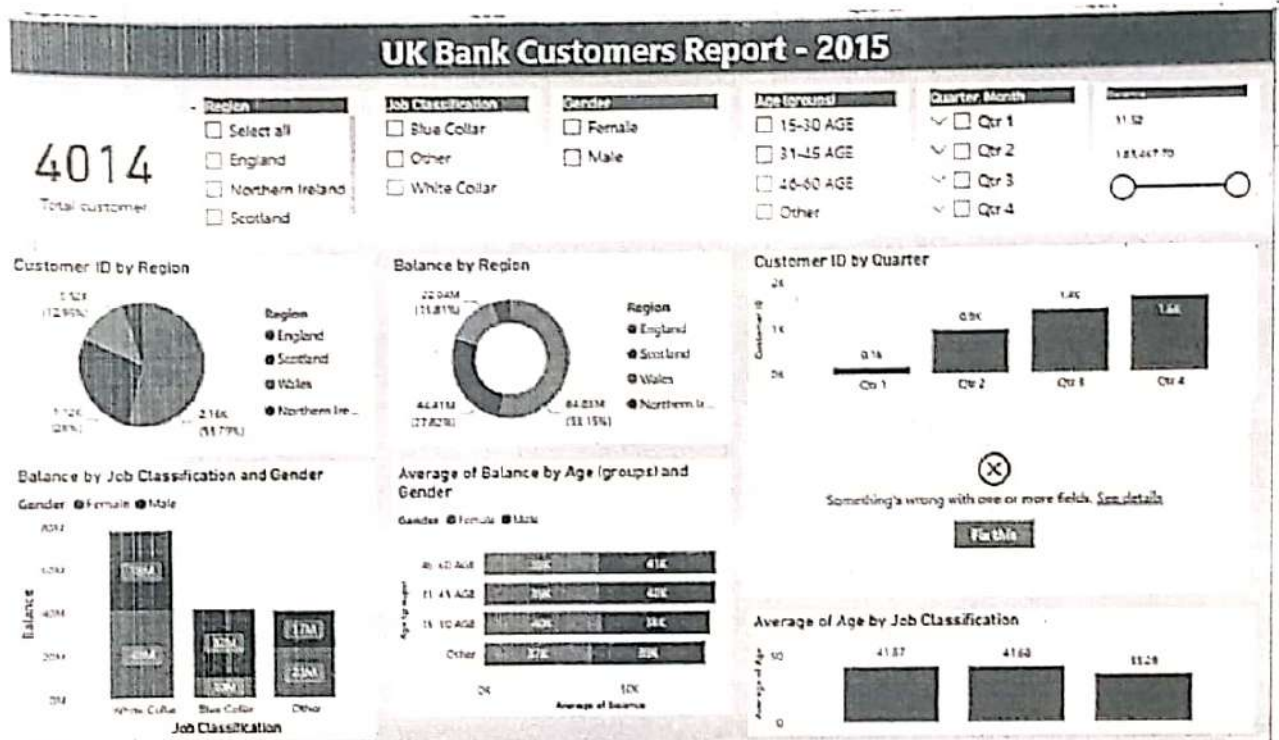


- Connect to data
- Transform and model the data
- Create charts and graphs
- Create reports and dashboards that are collections of visuals
- Share reports with others using the Power BI service

Problem Definition

UK bank client data wants to be visualized with the help of the BI service.

Power BI Desktop is a free application for single users to connect, transform, visualize, and share their data with other users of the business.



Specification of Company

KasNet technologies Pvt Its is an USA based company having association of Microsoft and PMI

Here we did the Internship for six weeks and Learned the Microsoft technology and Microsoft Certification (AZ-900)

Name - KasNet Technologies Pvt Ltd.

Hr Name- Priyanka Rao—hr@kasnetinc.com

Mentor Name - Amol Aher - amol.aher@kasnetinc.com

URL- www.kasnetinc.com

Suggestions Given by Company Mentor

Our mentor recommended getting the knowledge required by the MNC Company.

Power BI, Cloud Services, and AI Services: Our mentor recommended visualizing the data in Power BI.

Desktop and verified the data on the Power BI service.

Our mentor recommended. always get the knowledge required to get a placement in the MNC.

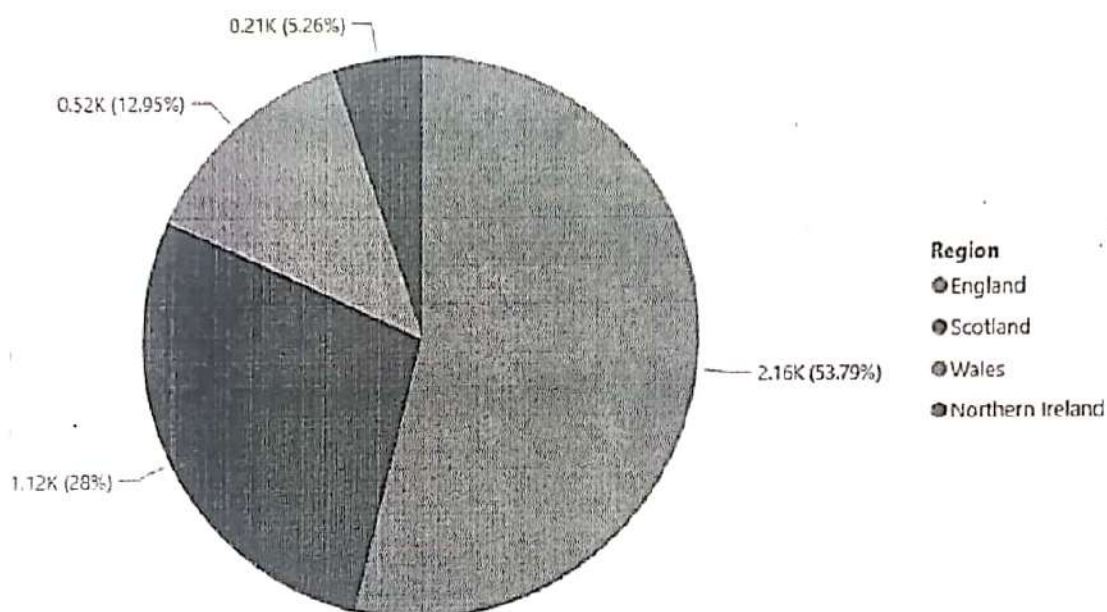
Raw Data

Customer ID	Name	Surname	Gender	Age	Region	Job Classification	Date Joined	Balance	Age (groups)	full name
100000025	Jennifer	Hughes	Female	38	England	White Collar	20 January 2015	20505.32	31-45 AGE	Jennifer Hughes
100000023	Alison	Fisher	Female	33	England	White Collar	25 January 2015	3428.56	31-45 AGE	Alison Fisher
100000031	Megan	Bell	Female	25	England	White Collar	28 January 2015	30399.76	15-30 AGE	Megan Bell
100000036	Yvonne	Thomson	Female	36	England	White Collar	31 January 2015	31680.67	31-45 AGE	Yvonne Thomson
100000037	Sophie	Gill	Female	33	England	White Collar	31 January 2015	20504.37	31-45 AGE	Sophie Gill
100000042	Diane	Black	Female	35	England	White Collar	01 February 2015	9695.7	31-45 AGE	Diane Black
100000054	Irene	MacLeod	Female	32	England	White Collar	12 February 2015	24187.93	31-45 AGE	Irene MacLeod
100000061	Kylie	Howard	Female	35	England	White Collar	12 February 2015	4586.23	31-45 AGE	Kylie Howard
100000064	Bernadette	Gibson	Female	39	England	White Collar	12 February 2015	40305.24	31-45 AGE	Bernadette Gibson
100000061	Joan	Buckland	Female	36	England	White Collar	16 March 2015	59935.75	31-45 AGE	Joan Buckland
100000085	Pippa	Buckland	Female	38	England	White Collar	16 March 2015	63642.19	31-45 AGE	Pippa Buckland
100000088	Jasmine	Piper	Female	24	England	White Collar	16 March 2015	71571.52	15-30 AGE	Jasmine Piper
100000089	Michelle	Elison	Female	24	England	White Collar	16 March 2015	42409.89	15-30 AGE	Michelle Elison
100000090	Wanda	Henderson	Female	35	England	White Collar	16 March 2015	4194.57	31-45 AGE	Wanda Henderson
100000092	Jane	Forsyth	Female	26	England	White Collar	16 March 2015	26587.08	15-30 AGE	Jane Forsyth
100000095	Rebecca	Knox	Female	30	England	White Collar	16 March 2015	55046.35	15-30 AGE	Rebecca Knox
100000098	Maria	Johnston	Female	36	England	White Collar	16 March 2015	1430.6	31-45 AGE	Maria Johnston
100000119	Vanessa	Lyman	Female	18	England	White Collar	31 March 2015	33524.41	15-30 AGE	Vanessa Lyman
100000120	Andrea	Dickens	Female	31	England	White Collar	31 March 2015	126370.38	31-45 AGE	Andrea Dickens
100000127	Emma	Fraser	Female	27	England	White Collar	01 April 2015	10481.48	15-30 AGE	Emma Fraser
100000128	Virginia	Berry	Female	41	England	White Collar	01 April 2015	4347.79	31-45 AGE	Virginia Berry
100000130	Alison	MacLeod	Female	27	England	White Collar	01 April 2015	27738.77	15-30 AGE	Alison MacLeod
100000131	Anna	Wright	Female	41	England	White Collar	01 April 2015	27557.08	31-45 AGE	Anna Wright

① Auto recovery contains some recovered files that haven't been opened.

Back to report

CUSTOMER ID BY REGION



Advantages

Embarking on an internship that involves PowerBI and Microsoft Azure offers a multitude of advantages. Through PowerBI, interns gain exposure to cutting-edge data visualization and analytics tools, honing skills that are increasingly in demand across industries. This experience allows interns to translate raw data into actionable insights, empowering decision-makers and driving organizational success.

Moreover, Microsoft Azure provides interns with hands-on experience in cloud computing, a technology that is revolutionizing how businesses manage and process data. By working with Azure services such as Azure SQL Database, Azure Blob Storage, and Azure Machine Learning, interns learn how to leverage scalable and secure cloud infrastructure to store, analyze, and deploy data-driven solutions.

The integration of PowerBI with Azure further enhances the internship experience, enabling interns to seamlessly connect PowerBI dashboards to Azure data sources and leverage advanced analytics capabilities. This integration facilitates real-time data analysis, predictive modeling, and automated reporting, empowering interns to deliver impactful insights to stakeholders.

Additionally, exposure to PowerBI and Microsoft Azure equips interns with valuable technical skills that are highly sought after in today's job market. By mastering these tools, interns position themselves for success in fields such as data analysis, business intelligence, and cloud computing, opening doors to exciting career opportunities.

Overall, an internship focused on PowerBI and Microsoft Azure offers interns the chance to develop practical skills, gain exposure to cutting-edge technologies, and make meaningful contributions to data-driven decision-making processes, laying a solid foundation for future success in the dynamic world of data and analytics.

In our Microsoft internship we have get the knowledge about the Microsoft cloud Service
Microsoft AI services and Power BI Desktop and Power BI service

We successfully did the Microsoft AZ-900 global certification, which is demands in TH MNC

Limitation

Microsoft Azure and PowerBI, while powerful tools, do have limitations that users should be aware of. One significant consideration is the cost associated with utilizing these platforms, as expenses can quickly escalate, particularly for organizations with extensive data storage and processing needs. Additionally, both platforms have steep learning curves, which may pose challenges for individuals who are new to cloud computing or data analytics.

Another limitation is the dependency on internet connectivity. Since both Azure and PowerBI are cloud-based services, a stable internet connection is essential for accessing data and collaborating with colleagues. Moreover, ensuring data security and compliance can be complex, requiring careful configuration and management to protect sensitive information and adhere to relevant regulations.

Customization options in PowerBI may also be limited, especially when trying to create highly

customized or complex visualizations that go beyond the built-in features. Performance and scalability issues may arise with both Azure and PowerBI, particularly during peak usage times or when processing large volumes of data.

Integrating Azure services and PowerBI with existing IT infrastructure or third-party applications can also be challenging, requiring expertise in data integration and development tools. Overall, while Azure and PowerBI offer powerful capabilities for data analytics and cloud computing, users should be mindful of these limitations and plan accordingly to mitigate potential challenges during implementation and usage.

Microsoft Azure account required International Credit card due to that we are not able to create the Azure Account but we have used the Power BI desktop and Power BI service .

Application

Microsoft Azure and PowerBI find application across various industries and functions.

In finance, organizations utilize PowerBI to analyze financial data, track key performance indicators, and generate reports for stakeholders. Azure's cloud services are leveraged for secure data storage, compliance, and risk management applications.

In healthcare, PowerBI is used for visualizing patient data, monitoring treatment outcomes, and optimizing hospital operations. Azure enables healthcare providers to securely store and analyze patient records, conduct medical research, and deploy telemedicine solutions.

In retail, PowerBI helps companies analyze sales data, monitor inventory levels, and forecast demand. Azure's cloud infrastructure supports e-commerce platforms, enables personalized marketing campaigns, and facilitates supply chain optimization.

In manufacturing, PowerBI is employed for real-time monitoring of production processes, predictive maintenance, and quality control analysis. Azure's IoT solutions enable the integration of sensors and devices for data collection, as well as the implementation of predictive analytics algorithms.

In education, PowerBI is used for tracking student performance, analyzing educational outcomes, and optimizing resource allocation. Azure supports e-learning platforms, enables secure storage of student records, and facilitates collaboration among educators.

In government, PowerBI assists in data-driven policy making, performance monitoring, and citizen engagement initiatives. Azure's cloud services are utilized for secure data storage, disaster recovery, and the development of smart city solutions.

Across all these sectors and beyond, the integration of Microsoft Azure and PowerBI empowers

organizations to harness the power of data for informed decision-making, improved efficiency, and competitive advantage.

We have used the Power BI desktop and Power BI service, we have visualized the Data of UK bank and Health care.

Conclusion

In conclusion, my internship experience with Microsoft Azure and Power BI has been immensely rewarding and enriching. Over the past [duration of the internship], I've had the opportunity to delve deep into the world of cloud computing and data analytics, gaining invaluable insights and honing my technical skills.

Working with Azure provided me with a comprehensive understanding of cloud infrastructure, enabling me to deploy and manage scalable solutions efficiently. I've had the chance to explore various Azure services, from virtual machines to containerized applications, broadening my knowledge of cloud technologies and their practical applications.

Moreover, my immersion in Power BI has been transformative. I've learned how to harness the power of data visualization to derive actionable insights, enabling informed decision-making and driving business growth. From creating interactive dashboards to implementing advanced analytics, I've developed a proficiency in leveraging data to tell compelling stories and drive meaningful outcomes.

Beyond technical skills, this internship has cultivated my ability to collaborate effectively within multidisciplinary teams and communicate complex concepts to diverse stakeholders. I've had the privilege of working alongside talented professionals who have challenged and inspired me, fostering a dynamic learning environment that propelled my personal and professional growth.

As I reflect on my journey, I am grateful for the mentorship and guidance I've received from my colleagues and supervisors at Microsoft. Their expertise and support have been instrumental in shaping my experience and equipping me with the confidence to tackle real-world challenges.

Moving forward, I am excited to apply the knowledge and skills I've acquired during this internship to make meaningful contributions in the field of cloud computing and data analytics. Whether it's driving

innovation, solving complex problems, or empowering businesses to thrive in the digital age, I am committed to leveraging technology to create positive impact and drive change.

In closing, I am incredibly grateful for the opportunity to have been part of the Microsoft Azure and Power BI team. This internship has been a transformative journey, and I am eager to embark on the next chapter of my career with newfound passion, purpose, and proficiency.

References

- 1) <https://www.microsoft.com/>
- 2) <https://www.wikipedia.com/>
- 3) <https://www.kasnetinc.com/>

A

Winter Internship Report

In the partial fulfilment of the requirement for bachelor degree of civil engineering

Submitted by

Mr. JADHAV ABHISHEK MANOHAR

Under guidance of

Prof. N.R. Ghole



DEPARTMENT OF CIVIL ENGINEERING

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FACULTY OF ENGINEERING, NAIGOAN, PUNE - 412213

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE 2023-24



RAJ CONSTRUCTIONS

Engineers & Contractors

CC/HRD/IL/23-24/03

30th January 2024

INTERNSHIP CERTIFICATE

This is to certify that Mr JADHAV ABHISHEK MANOHAR, has successfully completed a one & half month internship from 15-12-2023 to 30-01-2024 with Raj Constructions.

During the internship, Mr JADHAV ABHISHEK MANOHAR closely worked as a part of the Engineering team at Raj Construction, Avon Vista Naik Navre Project Wakad.

He demonstrated good technical skills and strategy with a self-motivated attitude to learn new things. we found him active and competent in executing all assigned tasks and his services were found satisfactory

We wish him great success in all his future endeavors.

For Raj Construction

Proprietor

For Raj
Constructions HR
Department

“Dhanraj Banglow, Swetganga Society, Warje, Pune –411058, Mobile: 8669006120
Email: prathameshmandave.2@gmail.com, GST TIN NO. : 27AIJPM2235Q1ZR

1. INTRODUCTION

Since 2000, RAJ CONSTRUCTION has earned a reputation for building strong teams. Whether that means taking the initiative on design build assignments or being part of an overall team that is led by others, bringing people and companies together to collaborate and successfully accomplish construction projects has always been one of our finest traditions and principal strengths.

We have matured and grown as an Industrial construction company to meet our constantly evolving industry. We embrace innovation and technology practices to meet complex and demanding marketplace. However, despite all the changes a successful construction service company must make to stay competitive, there is one thing that has never changed: Our integrity and Quality. Our people are honest, reliable and fair. They are hardworking and passionate about their work. This dedication and unwavering integrity enable clients to confidently make , RAJ CONSTRUCTION their construction company of choice time and again. We believe that when a client gives us their vote of confidence, we must exceed their expectations.

Beyond good business practice, it is simply the right thing to do.

We are dedicated to bringing value to our clients and their projects every day. Our experience over two decades and more proves invaluable to clients on every project. Our goal is to save owners more than our fee on every project in which we are involved.

□ The Man Behind

Mr. Dhananjay Dattatraya Mandave is a qualified Civil Engineer. He started his career in the year 2000. In June 2000 Mr. Dhananjay Dattatraya Mandave laid the foundation of his own firm RAJ CONSTRUCTION as a Proprietorship concern and commenced operations. Mr. Dhananjay Mandave beliefs in high efficiency, top class quality, timely project completion, uncompromising stand on safety have played a great role in building Raj Construction to its present status, this has ensured Customer satisfaction and customer delight leading to consistent growth. To exceed the client expectations in all aspects of execution.

2. Organization/ Industries Details :

Name of company – Raj Construction

Company Address - Dhanraj Banglow, Swetganga Society, Warje, Pune –411058

Name of Project manager – Mr. Dhananjay Dattatraya Mandave

Name of Site Supervisor: - Er. Raj Mandave Sir

Site address – Avon Vista Naik Navre Project Wakad

3. Student's daily Diary/Daily Log

Day-1		Date: - 01/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Mr. Dhananjay Mandave Sir (Project manager) Er. Raj Mandave Sir (Site Supervisor)	Name of finished Product	
Main points of the day		Submitted internship letter & to give Approval for internship training.	
<ul style="list-style-type: none">On that day visit the manager office and met with HR of the company. After that training letter was submitted to company. HR, Sir give me the Approval to start my internship training on 01/02/2023.Then met with Er. Raj Mandave sir (site Supervisor) under his guidance my internship was started.On that day under guide of Er. Raj Mandave sir introduced workers, staff & management system.			

Day-2		Date: - 02/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir	Name of finished Product	
Main points of the day		Introduced workers, staff & management system, Safety Instruction also type of work carried out in company. Sir provided me the working drawings	
<ul style="list-style-type: none">On that day under guide of Mr. Raj Mandave Sir introduced workers, staff & management system.Instruction about awareness and implementation of safety equipment used in while work in progress.Give information about civil engineering works and provided the working drawings.They show project layout and plan of total project area etc.Various types of working drawings<ol style="list-style-type: none">Centre line plan, ground floor plan, column details and footings, elevation drawing section drawing, detail drawing, mechanical and electrical drawing, plumbing and drainage drawings, finishing drawing.			

Day-3		Date: - 03/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	

Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Completed the safety Induction and then I became eligible to enter the construction site. Casting of the mumty slab of B41 building.	
<ul style="list-style-type: none">On that day I completed the safety induction process which is compulsory to all the engineers and workers before entering the construction site.Ajinkya sir give the safety helmet and safety jacket,After the lunch break I observe the concreting of the mumty slab and Ajinkya sir give me the full information of the casting of the mumty slab.(32780mm x 17325mm) □ Concrete is lifted by using pump. <p>Quantity:- 10 m^3</p>			

Day-4		Date: - 04/02/2023	
Time of arrival	9:30 am	Time of departure	4:30 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Observed the shuttering of the column	

- Observed the column shuttering of the B40 building no 9, third floor.
- Height of the shuttering is 2.4 m
- Thickness of the plywood is 12 mm,
- Gypsum plastering work was going on the building no 12
- Brickwork was done at building no 14,15
- On this day I learned about DPR

Day-5		Date :- 06/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main ints of the day		Concrete trimix for parking of the B40 building no 07 Concrete concreting	
<ul style="list-style-type: none">On this day Raj sir guided me about concrete trimixing.Before doing the concrete trimix for parking the levels should be checked.For checking and marking the levels auto level is used, marking is done on the columns and walls.Grade of the concrete used for trimix: - M10.Grade of steel used is fe500external plaster is done on this day.I learned how to manage the workforce.			

Day-6		Date: - 07/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Column concreting of B39 twinvilla	
<ul style="list-style-type: none">On this day concreting of the columns has been doneRaj sir told me the to calculate the quantity of the concrete required for column.M30 grade of concrete is used for concreting.formwork casting of the slab is going on.Gypsum plastering work going on the site (POP)			

Day-7		Date: - 08/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Mumty slab casting the road using digital Profile levelling of theodolite.	

- Grade of concrete used is m25
- Grade of steel used is fe500
- Concrete is lifted using pump.
- Quantity of the concrete is 4 m³
- Road width: -12m
- Taken all the levels required

Day-8		Date: - 09/02/2023	
Time of arrival	9:30 am	Time of departure	5:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Brickwork, plastering, lintel beam casting	

- 8” concrete cement bricks are used for external walls of the B40 TH-14.
- Cement mortar ratio 1:6.
- Cement mortar ratio for plaster is 1:4, M sand is used for plaster
- Racron fibre (90 gm), conplast chemical (200 ml/bag) should must added in plaster mortar.
- Lintel beam casting of B40 TH-13
- Grade of steel used is fe500
- Length of beam is 1.47m
- Gypsum plastering work going on the site

Day-9		Date: - 10/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Plastering at B40 (TH-13) first floor	

- Plastering is protective and decorative coating of walls.
- Objectives of plastering is to provide an even, smooth, regular, clean and durable finish.
- Things to check before plastering: - ensure all the electrical conducting work is complete, hacking must be made on concrete surfaces like columns, beams, ceiling and retaining walls before plastering to ensure proper bonding between mortar and surface, cover groove cutting by chicken mess to avoid cracks Cement mortar ratio is 1:4.
- Type of cement used: - Portland cement by JSW
- M-sand is used for plastering
- Gypsum plastering work going on the building no 12.

Day-10		Date: - 11/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Repairing of honeycombing in TH-14 slab, Brickwork, plastering	

- It may occur due to improper concrete workability and concrete pouring practice, excessive water in concrete mix, inadequate formwork rigidity and waterproofing, etc.
- Honeycomb in structure can cause severe problems if it is spread over a large area, not only does it distort the appearance of the structural member, but it also reduces structural strength and durability.
- Remedies for honeycomb: - affected portion should be reconcreted after applying grouting chemical to old surface
- Gypsum plastering work going on the building no 12

Day-11		Date: - 13/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Hacking of the columns, beams, ceilings at B40 Repairing of honeycomb, curing of the walls	

- Hacking must be made on concrete surfaces like columns, beams, ceiling and retaining walls before plastering to ensure proper bonding between mortar and surface, cover groove cutting by chicken mess to avoid cracks. • Angle grinding machine is used for hacking.
- External plaster is done
- Brickwork at second floor is done
- Gypsum plastering work going on the site
- Plaster

Day-12		Date: - 14/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Constructed Parapet wall at B41, staircase shuttering, brickwork	

- On this day Raj sir told me the detail information about staircase
- Sir told me the importance of the parapet wall and why they are constructed
- Gypsum plastering work going on the site
- Plaster work is being done on B40 TH-12

Day-13		Date: - 15/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Column concreting,	
<ul style="list-style-type: none">• On this day concreting of the columns has been done• Raj sir told me the to calculate the quantity of the concrete required for column.• M30 grade of concrete is used for concreting.• shuttering of the staircase• formwork casting of the slab is going on.• Gypsum plastering work going on the site• Brickwork at B40 TH-13• Plaster work is being done on B40 TH-12 □Repairing of honeycomb.			

Day-14	Date: - 16/02/2023
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Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Flooring, laying down the Tiles	
<ul style="list-style-type: none">On this day Raj sir told the detailed information of the flooring Before laying down the tiles machan/beding of 1:8 ratio is placed.Vetrified tiles of 800 x 800 mm are used for flooring.Vetrified tiles does not observe the water hence no need of curing before layingFor balcony anti-skid tiles are usedGypsum plastering work going on the site			

Day-15		Date :- 17/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		PCC for parking Infront of B40 Town house-12	

- On this day Raj sir told me to calculate the quantity of the concrete required for the PCC.
- M10 grade of concrete is used for PCC
- Quantity of the concrete is 6 M^3
- Brickwork of the building no 14,15
- Plaster of the external building no 12,13
- Gypsum plastering work going on the site
- Maze walls of the bathroom is constructed and plastering of the toilets is done []
Calculated the Quantity of the brickwork done.

Day-16		Date :- 18/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Taken the measurements of the all the door and window sizes	
<ul style="list-style-type: none">On this day Raj sir give me the task to check all the measurements of the windows and doors as per the drawing.Formwork for the slab is carried outBrickwork at the building no 14 ,15External plastering at building no 13,12Gypsum plastering work going on the site			

Day-17		Date: - 20/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Brickwork lineout, quantity of the brickwork	
<ul style="list-style-type: none">• Brickwork at the building no 14 ,15• Lineout for the brickwork as per drawing• 8” concrete cement bricks are used for external walls of the B40 TH-14.• Cement mortar ratio 1:6.• The size of the gap between two bricks is 10 mm.• Brick work should not be more 1.5 m height at same time• I learned how to find brickwork quantity• formwork for the slab is carried out			

Day-18		Date: - 21/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor	Er. Raj Mandave Sir		
Main points of the day		Bar bending schedule,	

- On this day Raj sir guided me about bar bending schedule of one way and two-way slab
- Design procedure of BBC of slabs
- Saw the main steel and distribution steel
- No of bars =length of the slab/spacing+1
- Cutting length of main/distribution bars=clear span of slab+(2x development length) + inclined length- (bend length)
- Raj sir taught me how to calculate weight of main bars.
- Weight of the steel = $d^2L/162$

Day-19		Date: - 22/02/2023	
Time of arrival	9:30 am	Time of departure	4:00 pm
Dept./division		Remarks	
Name of HOD/ Supervisor`	Er. Raj Mandave Sir		
Main points of the day		steel reinforcement in slab	
<ul style="list-style-type: none">On this day Raj sir guided me about bar bending schedule of one way and two-way slabDesign procedure of BBC of slabs □ Saw the main steel and distribution steelConcrete cover and chair used for support.No of bars =length of the slab/spacing+1			

4. SITE PHOTOS





5.CONCLUSION

On the whole, this internship was a useful experience. I have gained new knowledge, skill and met many new people. I achieved several of our learning goals. I got insight into professional practices currently advocated in the construction industry. I learned the different facets of working within a well-established industry, related to our study I learned more about the work flow and operations performed on the sites, their technical processes, Testing Process for various construction materials, Reading and understanding plans, drawings, such as architectural and structural.

Furthermore, I have experienced that it is of importance that education is objectives and that I have to be aware of the industries aspects of the topic I study. This Internship programmed was not one side, but it was a way of sharing knowledge, ideas and opinions.

The internship was also good to find out what our strength and weaknesses are. This helped us to define what skills and knowledge I have to improve in the coming time. I can confidently assert that the knowledge I gained throughout the internship is sufficient to contribute towards our future endeavors. At last this internship has given us new insights and motivation to pursue a career in core civil engineering department.

A Project Report on
"ESTIMATING AN INDIVIDUAL'S WATER
FOOTPRINT"

SUBMITTED TO SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE IN
PARTIAL FULFILLMENT FOR THE AWARD OF THE DEGREE

OF
BACHELOR OF ENGINEERING
IN
CIVIL ENGINEERING

Submitted By

STUDENT NAME	SEAT NUMBER
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Ms. Shivani S. Vachakal	B190900033
Ms Komolika D. Shinde	B190900030
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Under the Guidance of

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Department of Civil Engineering Navsahyadri Education Society's
Group of Institution Pune [2023-2024]

A Project Report on
**“ESTIMATING AN INDIVIDUAL’S WATER
FOOTPRINT”**

SUBMITTED TO SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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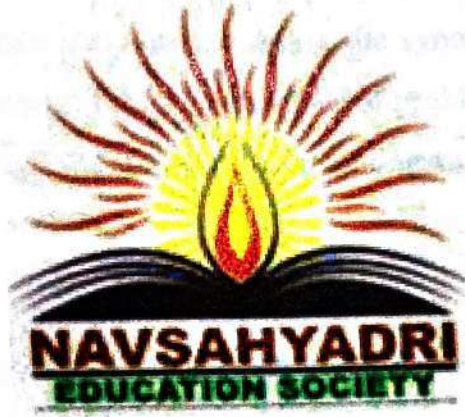
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[2023-2024]



CERTIFICATE

This is to certify that the student of Final Year B.E. has successfully completed the Project entitled “**Estimating an Individual’s Water Footprint**” under supervision, of Prof.N.R. Ghole in the partial fulfilment of Bachelor of Engineering Civil Engineering of University of Pune.

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ABSTRACT

Scarcity of freshwater has become a threat to human wellbeing across the globe. India is considered to be one of the most water stressed countries. Under such a situation it is essential to understand how much we can afford to be luxurious with our water consumption. The purpose of the water footprint concept is to find not only direct and indirect water consumption but also quantify environmental burdens imposed by individuals' demand for water. This study uses water footprint assessment tool to quantify the individual water footprint for a set of people. Data regarding the direct and indirect consumption of water was collected for the completion of the project through online questionnaire. An individual water footprint involves direct and indirect water usage that is associated with personal habits. It was found that from the study of individual water footprint that indirect consumption of water is much more than direct water consumption. Food habits of people needs to assess because most of the indirect water footprint increases due to diet.

Keywords: Water Footprint, direct and indirect water consumption, water scarcity.

CONTENTS

Sr. No.	Title	Page No
1	Introduction	1-7
	1.1 Water	1
	1.2 Water Scarcity	2
	1.3 Demand for Water in India	3- 4
	1.4 Water Footprint	5-7
2	Aim and Objectives	8
3	Necessity	9-10
4	Literature Reviews	11-17
	4.1 Earlier studies	11
	4.2 Review on literature	11- 17
5	Methodology	18 - 20
	5.1 Approach	18
6	Survey Photographs	21
7	Analysis of Data	22 - 31
	7.1 Data Collection	22 - 29
	7.2 Direct and indirect water footprint analysis	29- 30
	7.3 Personal calculator	30 - 32
8	Result and Discussion	33 - 42
	8.1 Direct water consumption	33 - 37
	8.2 Indirect water consumption	38 - 39
	8.3 Water footprint of individuals	40 - 43
9	Responses	44 - 46
10	Suggestions and Solutions	47 - 50
11	Conclusion	51
12	References	52 - 53

LIST OF FIGURES

Fig No.	Title	Page No.
1	Distribution of water on Earth	2
2	Different components of water footprint	5
3	locations of Participants	22
4	Type of water and sewage system	22
5	Household Income	23
6	Water Storage and Billing	23
7	Cereal food consumption	24
8	Meat and egg consumption	24
9	Dairy product consumption	25
10	Vegetables and Fruit Consumption	25
11	Tea consumption	26
12	Water consumption during shower	26
13	Water consumption during laundry	27
14	Water consumption during dish washing	27
15	Water consumption during car and bike washing	28
16	Water consumption in gardening	28
17	Water collection through rain water harvesting	29
18	Direct water consumption of Rural Area	37
19	Direct water consumption of Urban Area	37
20	Indirect water consumption Rural Area	38
21	Indirect water consumption Rural Area	38
22	Direct water consumption of rural and urban area	42
23	Indirect water consumption of Rural and Urban Area	42

LIST OF TABLES

Table No.	Title	Page No.
1	Water requirements for various sources	3
2	Per capita water availability in India	4
3	Questionnaire for individual water footprint	19
4	Per capita daily water footprint of individual	30
5	Direct water consumption of Rural Area	33
6	Direct water consumption of Rural Area	34
7	Direct water consumption of Urban Area	35
8	Direct water consumption of Urban Area	36
9	Water footprint of individuals of Rural Area	40
10	Water footprint of individuals of Urban Area	41

1. INTRODUCTION

1.1 Water

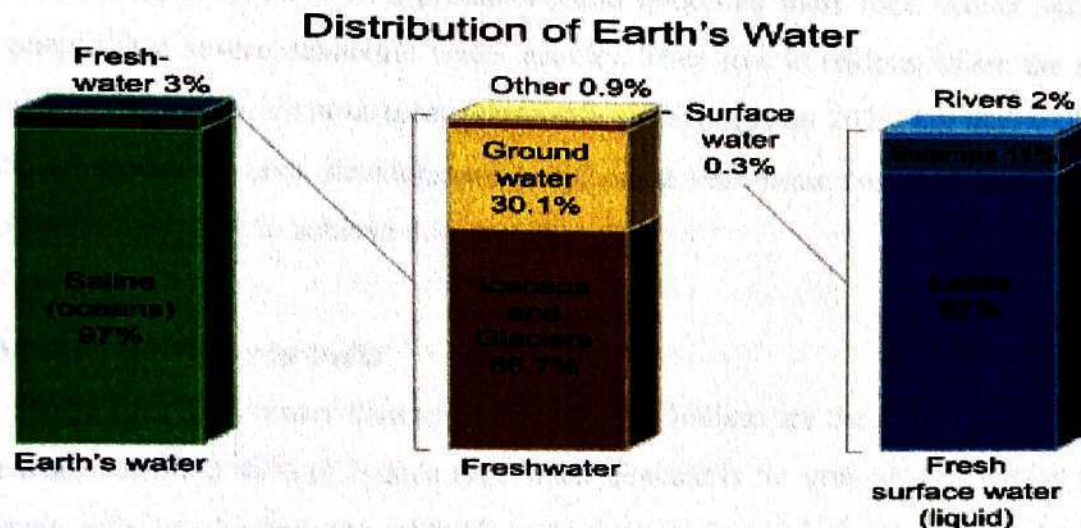
Water is the most precious gift of mother nature. Water is one of the fundamental resources on the earth. Water is essential for all other life. It plays a major role in all aspects of human life. Water is used for drinking, domestic purposes like cooking, washing, gardening and cleaning operations, industrial processes and agricultural activities. Today, water has become a valuable commodity to man-kind. Water has economic value. Without water, there can be no life. It is a basic substance occurring as solid, liquid and gaseous states. Earth is probably the only planet containing plenty of water on its surface. Water is unevenly distributed in almost all parts of the world. Due to its uneven distribution and availability it is to be managed and properly used for a long-term sustenance of life on earth. The increase in population and human activities, demand for more use of water. Shortage of water is observed in some parts of the world.

When we think of the planet earth, both the land and oceans come to our mind. Land makes only a small part of the world's surface but water makes up to 70% of the earth's surface.

With 70 percent of the earth's surface covered in water, how could we ever run out? Despite all this water, the majority of it is not immediately accessible to or usable by humans. In fact, only 0.5 percent of the total water on Earth is readily available for human use. This water is in aquifers, lakes, reservoirs, rivers, streams, and rainfall. As for the rest of the planet's water, 97 percent is saltwater, which can be made accessible after desalination, and the remaining 2.5 percent is freshwater that is frozen as polar ice or stored as groundwater. The earth has about 1.386 billion cubic kilometres of water. In this, about 97% lies in the form of seas and oceans, containing salt water. More than 2% exists as ice caps and glaciers, and about 1% is spread in the form of rivers, lakes, ground water and water vapour as shown in figure 1.

Almost 97% of the water existing in the hydrosphere is distributed as seas and oceans. These are all saline water masses. They are not suitable for direct consumption like drinking, cooking and for industries and irrigational purposes. Only 3% of the water available on earth is fresh water. If we look at the further distribution of freshwater alone, almost 66.7% is locked up in the form of ice caps and glaciers. About 30.1% is existing below the surface as groundwater. The surface water, which is directly available on the land surface is only 0.3%

the rest 0.9% are existing as water vapour and soil water. The surface water available as 0.3% is shared by lakes, swamps and running water as rivers. In this, a very small proportion exists as biological water. If all the earth's water are 2 put together, is the form of a sphere, then the diameter of that water ball would be about 1385 km. If we consider the volume, it would be a very small ball in front of the total mass of the earth.



Source: https://www.researchgate.net/publication/315123891_The_World%27s_Water

Figure No 1: Distribution of water on Earth

1.2 Water Scarcity

As we approach the next century, more than a quarter of the world's population, or a third of the population in developing countries live in regions that will experience severe water scarcity. In the semi-arid regions of Asia and the Middle East, which include some of the major bread baskets of the world, the groundwater table is falling at an alarming rate. There is an urgent need to focus the attention of both professionals and policy makers on the problems of groundwater depletion and pollution is seen as a major threat to food security in the coming century. After thousands of years of human development in which water has been a plentiful resource in most areas, amounting virtually to a free good, the situation is now abruptly changing to the point where, particularly in the more arid regions of the world, water scarcity has become the single greatest threat to food security, human health and natural ecosystems. Based on a recent International Water Management Institute study, they estimated that nearly 1.4 billion people, amounting to a quarter of the world's population, or a third of the population in developing countries, live in regions that will experience severe water scarcity within the first quarter of the next century. Slightly more than one billion

people live in arid regions that will face absolute water scarcity by 2025. These regions do not have sufficient water resources to maintain 1990 levels of per capita food production from irrigated agriculture, even at high levels of irrigation efficiency, and also meet reasonable water needs for domestic, industrial and environmental purposes by 2025. People in these regions will accordingly have to reduce water use in agriculture and transfer it to other sectors, reducing domestic food production and importing more food. About 348 million more people face severe economic water scarcity. They live in regions where the potential water resources are sufficient to meet reasonable water needs by 2025, but they will have to embark on massive water development projects, at enormous cost and possibly severe environmental damage, to achieve this objective. 3

1.3 Demand for Water in India

India uses more water than any other country. Indians are the largest freshwater users in the world. Around 65% of India's total water demand is for groundwater, which plays an important role in shaping the nation's economic and social development. Agriculture, domestic and industrial use, respectively, comprises India's largest uses for water. Therefore with growing demand for water and depletion of the available water, assured supply of good quality water is becoming a growing concern. The requirement of water for various sectors has been assessed by the National Commission on Integrated Water Resources Development (NCIWRD) in the year 2010. On the basis NCIWARD major component of demand in India is irrigation, Drinking water, Industry etc. is shown in table 1.

Table No 1: Water requirements for various sources

Sector	Water Demand in Km3 (or bcm)		
	2010	2025	2050
Irrigation	557	611	807
Drinking	43	62	111
Industry	37	67	81
Energy	19	33	70
Others	54	70	111
Total	710	843	1180

Demand in the country is projected to very soon overtake the availability of water. In some regions of the country, it has already happened. The rapid increase in population, urbanization and industrialization has led to a significant increase in water requirement. In the next decade the demand in water is expected to grow by 20 percent, fuelled primarily by the industrial requirements which are projected to double from 23.2 trillion liters at present to 47 trillion liters. Domestic demand is expected to grow by 40 percent from 41 to 55 trillion liters while irrigation will require only 14 percent more ten years hence, 592 trillion liters up from 517 trillion liters currently. As per the Ministry of Water Resources per capita water availability in 2025 and 2050 is estimated to come down by almost 36 percent and 60 percent respectively of the 2001 levels. According to the Ministry of Water Resources, industrial water use in India stands at about 50 billion cubic meters or nearly 6% of total freshwater abstraction. This demand is expected to increase dramatically in the next decade, given the forecasts of 9% growth. Groundwater is the major source of drinking water in urban and rural India. It is also an important source of water for the agricultural and the industrial sectors. India possesses about 432 bcm of groundwater replenished yearly from rain and river drainage, but only 395 bcm are utilizable. Of that 395 bcm, 82% goes to irrigation and agricultural purposes, while only 18% is divided between domestic and industrial. Total static groundwater available is approximately 10,812 bcm. Groundwater increasingly is pumped from lower and lower levels, and much faster than rainfall is able to replenish it. The average groundwater recharge rates of India's river basins are 260 m³ /day.

Table No 2: Per capita water availability in India

Year	Population (Million)	Per capita water availability (m ³ /year)	% change from previous year
1951	361	5177	-
1955	395	4732	-8.59
1991	846	2209	-53.31
2001	1027	1816	-17.92
2011	1210	1545	-14.92
2025	1394	1341	-26.37
2050	1640	1140	-14.98

1.4 Water Footprint

A methodology for measuring human demands or 'footprint' on the biosphere was first developed in the early 1990s. The initial seed for a separate water footprint was planted by Allan, who coined the term 'virtual water' to describe water used in the production of imported goods and hypothesised that such virtual water imports were a partial solution to problems of water scarcity in the Middle East. These ideas took on more precise form once researchers began to quantify and calculate global virtual water flows and, from this, water footprints of specific products and of nations. The water footprint of a product is an empirical indicator of how much water is consumed, when and where, measured over the whole supply chain of the product. The water footprint of an individual, community or business is defined as the total volume of freshwater that is used to produce the goods and services consumed by the individual or community or produced by the business.

A water footprint (WF), normally expressed in volumetric terms (i.e. litres or m³ of water), is therefore a multidimensional indicator that looks at both direct and indirect water use of a consumer or producer and that can show water consumption volumes by source and polluted volumes by type of pollution. WF normally considers green and grey water alongside blue water. A WF can also be disaggregated into direct and indirect WF components, sometimes also referred to as internal and external WF or, in the context of manufacturing and business contexts, operational and supply chain WF. The basic distinction is between water (blue, green or grey) consumed 'through the tap' and water embedded in products or processes. Figure 2 shows the schematic links between water use and the different types of water footprint in the context of the hydrological cycle.

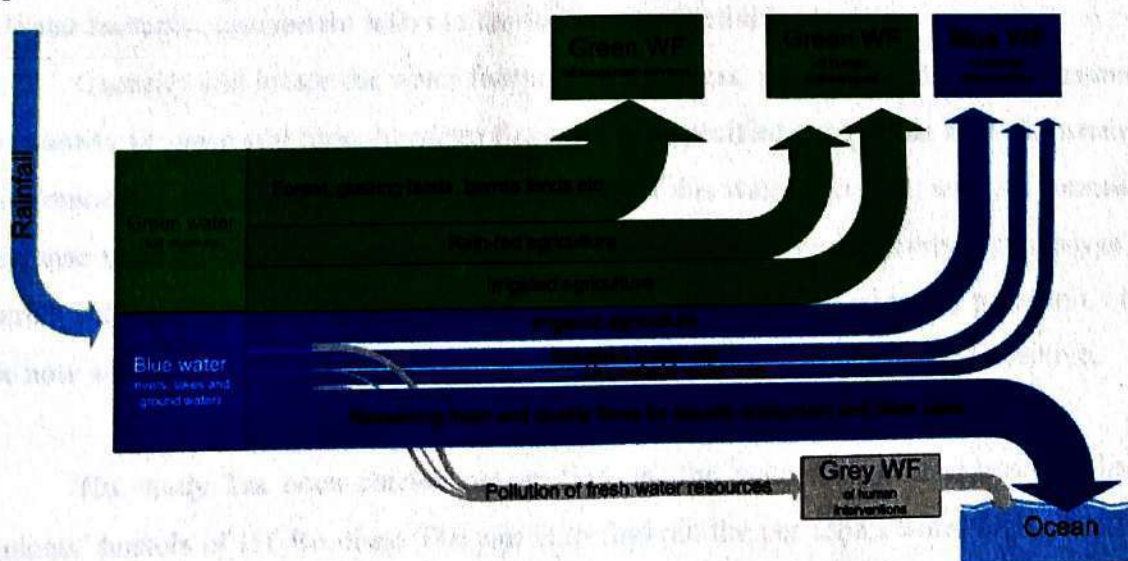


Figure No 2: Different components of water footprint

The water footprint looks at both direct and indirect water use of a process, product, company or sector and includes water consumption and pollution throughout the full production cycle from the supply chain to the end-user. It is also possible to use the water footprint to measure the amount of water required to produce all the goods and services consumed by the individual or community, a nation or all of humanity. This also includes the direct water footprint, which is the water used directly by the individual(s) and the indirect water footprint – the summation of the water footprints of all the products consumed.

Green water footprint: It is water from precipitation that is stored in the root zone of the soil and evaporated, transpired or incorporated by plants. It is particularly relevant for agricultural, horticultural and forestry products.

Blue water footprint: It is water that has been sourced from surface or groundwater resources and is either evaporated, incorporated into a product or taken from one body of water and returned to another, or returned at a different time. Irrigated agriculture, industry and domestic water use can each have a blue water footprint.

Grey water footprint: It is the amount of fresh water required to assimilate pollutants to meet specific water quality standards. The grey water footprint considers point-source pollution discharged to a freshwater resource directly through a pipe or indirectly through runoff or leaching from the soil, impervious surfaces, or other diffuse sources.

Water footprint assessment refers to the full range of activities to:

Quantify and locate the water footprint of a process, product, producer or consumer or to quantify in space and time the water footprint in a specified geographic area; (ii) assess the environmental, social and economic sustainability of this water footprint; and (iii) formulate a response strategy. Broadly speaking, the goal of assessing water footprints is to analyse how human activities or specific products relate to issues of water scarcity and pollution, and to see how activities and products can become more sustainable from a water perspective.

The study has been carried out to find out the water footprint assessment for the students' hostels of IIT Bombay. The aim is to find out the per capita water footprint of each hosteller living inside the IIT campus. In a typical hostel, water is consumed by the students

and the hostel workers for their daily requirements. This includes domestic necessities like bathing, washing clothes, cooking and so on. Indirect water consumption in hostels is from electricity usage, food consumption and so on. 7 The study was restricted to only the water footprint due to direct water consumption, electronics, food and electricity usage. Data was collected for direct and indirect water consumption which included electricity usage and food and electronics consumption. The study showed that the direct water footprint of an average IIT student is 357.69 l/day. Compared to the average national per capita water footprint of India which is 140 l/day, the water footprint of an IIT student overshoot by 150%. The total water footprint of an average IIT student came out to be 3.16 m³ /day/student as against the India national average of 3 m³ /day/student.

In the above project water footprint of student's hostel has been carried out by forming a set of questionnaires. Questionnaire data has been compiled and water footprint was calculated. The result showed that water footprint of an average student is more than the India national average. We have prepared questionnaire for individual person and consider direct and indirect water consumption so that detailed water footprint can be estimated. We have calculated individual water footprint based on the guidelines of Water footprint network manual individual. The scope of this study includes direct water consumption, indirect water consumption for individual person. From analysis of the results, this study found out the individual water footprint.

The overall target of this thesis is to enhance the water footprint concept from a methodological and practical point of view. Therefore, the following objectives are pursued:

1. Review of existing water footprint approaches.
2. Finding direct and indirect water consumption.
3. Finding individual water footprint for the set of people from different regions.
4. Quantify environmental burdens imposed by individuals' demand for water.

2. AIM AND OBJECTIVES

2.1 Aim: Aim of this project is to find direct, indirect water consumption and water footprint for an individual.

2.2 Objectives:

1. To assess the water availability condition in each of the case study area
2. To explore the future prospects of water scarcity in the case study areas.
3. To examine the interactions between water, social power and infrastructure.
4. To test the effectiveness of various public and private intervention options as potential tools to monitor and reduce water consumption
5. To determine the key behaviour rules and guide water consumption
6. Media awareness campaign about water conservation
7. Assessment and development of guidelines for consumption conservation and reuse of water
8. Assessment and calculation of water footprints.
9. Assessment of water use and water loss
10. Dissemination of Sustainable water use

3. NECESSITY

3.1 Scope of water footprint accounting

One will have to be clear and explicit about the 'inventory boundaries' when setting up a water footprint account. The inventory boundaries refer to 'what to include' and 'what to exclude' from the accounts and should be chosen as a function of the purpose of the account.

One can use at least the following checklist when setting up a water footprint account:

- Consider blue, green and/or grey water footprint?
- Where to truncate the analysis when going back along the supply chain?
- Which level of spatiotemporal explication?
- Which period of data?

3.2 Scope of water footprint sustainability assessment

For the phase of sustainability assessment, the primary question is whether one takes a geographic perspective or a process, product, consumer or producer perspective. In the case of a geographic perspective, one will look at the sustainability of the aggregated water footprint in a certain area, preferably a catchment area or a whole river basin, because this is the natural unit in which one can easily compare water footprint and water availability and where allocation of water resources and potential conflicts take place. In the case of a process, product, consumer or producer perspective, the focus is not on the aggregate water footprint in one geographic setting, but on the contribution of the water footprint of the individual process, product, consumer or producer to the larger picture. The question of the contribution contains two elements: (i) what is the contribution of the specific process, product, consumer or producer water footprint to the global water footprint of humanity, and (ii) what is its contribution to the aggregated water footprints in specific geographic areas? The contribution to the global total is interesting from a sustainability point of view, because the world's freshwater resources are limited, so there should be concern with any contribution beyond the reasonable maximum need from a technical or societal point of view. The contribution to the aggregated water footprints in specific catchments or river basins is interesting because there should be concern with any contribution that takes place in a catchment or river basin where the water footprint results in a situation where basic environmental needs are not fulfilled or where water allocation is socially or economically unsustainable.

3.3 Scope of water footprint response formulation

The scope of the response formulation phase depends again on the sort of water footprint one is looking at. In the case of the water footprint within a geographically delineated area, the question is: what can be done by who to reduce the water footprint within that area, by how much and what time path? When setting the scope for response formulation, one will have to be particularly clear about 'response by who'. One can look at what governments can do which is what people will probably think of first when talking about the water footprint within a geographic setting – but one can also look at what, for example, consumers, farmers, companies and investors can do and what may have to be done through intergovernmental cooperation. And with respect to the government, one can distinguish between different levels of government and different governmental bodies at each level. At the national level, for example, required response may translate to actions within different ministries, ranging from the ministries of water, the environment, agriculture, energy and spatial planning to the ministries of economics, trade and foreign affairs. When setting the scope for identifying response measures, it is important to be clear from the beginning the angle(s) from which one will identify those measures. In the case of the water footprint of a consumer or community of consumers, one can simply look at what the consumer(s) can do, but here also one can include an analysis of what others – in this case for instance companies and governments – can do.

When considering response in the context of assessing a company's water footprint, it is most logical to look, at least, at what sort of response the company can develop itself, but here also the scope can be formulated broader.

4. LITERATURE REVIEWS

4.1 Earlier studies

This chapter presents a critical study of previous work published in literature. Some of the papers gives different methodologies to calculate water footprint for Nations, Hostels, Agriculture, Industries. Various research papers and articles were reviewed and summarized in the subsequent heads.

4.2 Review on literature

Personal Water Footprint in Taiwan: A Case Study of Yunlin County (2016).

Yung-Jaan Lee, Chuan-Ming Tung et.al. has carried out a study on personal water footprint in Taiwan using the concept of the water footprint and questionnaire surveys, study examines personal water footprints in townships in Yunlin County to explore the effectiveness and sustainability of water management. The purpose of the water footprint concept is to quantify environmental burdens imposed by individuals' demand for water. An individual water footprint involves direct and indirect water usage that is associated with personal habits. Analytical results show that the most individual water consumption is highest along coastal areas, such as Kouhu and Taixi, and mountainous areas, such as Gukeng, Douliu, and Linnei.

Furthermore, one-way ANOVA of individuals' daily water footprint reveals that individual water footprints vary significantly among Douliu, Gukeng, and Mailiao. The mean daily water footprint per capita in Douliu and Gukeng significantly exceeds that in Mailiao. Their findings suggest that personal water use habits can explain why personal water footprints are larger in Yunlin County than in other counties in Taiwan.

Water footprint: methodologies and a case study for assessing the impacts of water use(2011)

Harish Kumar Jeswani, Adisa Azapagic discussed the development of the water footprint. According to their study the water footprint concept has been an important step in this direction but the existing methodologies mainly assess the quantity of water used rather than the related impacts. Although there is a recognised need to consider the latter, particularly on a life cycle basis, the difficulty is that there are little or no reliable data on water usage in life cycle databases; furthermore, there is no agreed life cycle impact

assessment method for estimating impacts related to freshwater use. However, there have been some methodological developments which propose methods for inventory modeling and impact assessment for water use in life cycle assessment. Study reviews some of these approaches and discusses their strengths and limitations through a case study, which 9 considers the impacts of freshwater consumption from corn-derived ethanol produced in 12 different countries. The results show a huge variation in the results between different methods and demonstrate the need for a standardised methodology for assessing the impacts of water use on a life cycle basis. They provided specific recommendations for further research in this field have been made accordingly.

Quantifying the human impact on water resources: a critical review of the water footprint concept (2014).

J. Chenoweth¹, M. Hadjikakou et.al.discussed that the water footprint is a consumption-based indicator of water use, referring to the total volume of freshwater used directly and indirectly by a nation or a company, or in the provision of a product or service. Despite widespread enthusiasm for the development and use of water footprints, some concerns have been raised about the concept and its usefulness. A variety of methodologies have been developed for water footprinting which differ with respect to how they deal with different forms of water use. The result is water footprint estimates which vary dramatically, often creating confusion. Despite these methodological qualms, the concept has had notable success in raising awareness about water use in agricultural and industrial supply chains, by providing a previously unavailable and (seemingly) simple numerical indicator of water use. Nevertheless, and even though a range of uses have already been suggested for water footprinting, its policy value remains unclear. Unlike the carbon footprint which provides a universal measure of human impact on the atmosphere's limited absorptive capacity, the water footprint in its conventional form solely quantifies a single production input without any accounting of the impacts of use, which vary spatially and temporally.

Water Use and Related Costs at Households in Western and Northern Parts of India (2014).

Anand Krishnan Plappally,Malini Jhaver et.al present an article which elaborates a survey on water use events and activities in households. The survey inquires socioeconomic aspects, technology, processes and devices which may play an important role in these water

use events. Processes like washing clothes and utensils, cooking refrigeration and heating are discussed. Devices like water purifiers, air-coolers, and toilets are qualitatively analyzed. Water use events such as bathing and brushing teeth are studied. The survey in online format and printed version was randomly responded by one hundred sixty people including three family heads within city of Jodhpur, India. More than hundred respondents answered the online questionnaire from Mandi in north India, Delhi, the national capital territory and Jodhpur in west India. More than ninety per cent of the respondents were males. Climate of the regions mentioned above played a decisive role in water consumption. The general public was very much unaware of the policies of the government towards 10 water conservation and management. Advertisements by vendors were found to misguide consumers providing importance to aesthetic features rather than technical specification. The implications of their study help in becoming environmentally aware of how human actions affect the management of water and related energy use at households.

The water footprint of food and cooking fuel: A case study of self-sufficient rural India (2020).

Karabee Das, P.W. Gerbens-Leenes et.al addressed that water is a basic resource for food and fuelwood production. In general, people in rural areas of India consume carbohydrate rich staples with small amounts of animal foods. They mostly depend upon fuelwood for cooking. Their study assesses the WFs for food and fuel consumption in rural India. The research question is: What is the green, blue and grey water footprint (WF) of food and cooking fuel consumption per province in rural India ($m^3/cap/year$). It used the WF method for the quantification. Data on food and fuelwood consumption were derived from the National Sample Survey (2011-12). Foods were categorized into 6 groups: 1. Rice; 2. Wheat; 3. Oils and fats; 4. Milk; 5. Other animal foods; and 6. Others. Cooking fuel includes: 1. Fuelwood; 2. Kerosene and 3. LPG. Data related to WFs of food were derived from literature reviews and in case of fuelwood, the WFs were calculated for all the provinces of India. Finally, the total WF of per capita consumption is calculated by adding the WF of food and fuelwood. Their result shows that there is a large variation in the green, blue and grey WFs for food consumption across the provinces of India. The average WF for food consumption is about $800 m^3/cap/year$ and for fuelwood is $1630 m^3/cap/year$. Rice and wheat dominate the green, blue and grey WFs for food, with variations among the provinces. The green WF of rice is larger 11 than the green WF of wheat, while wheat has a larger blue WF. For cooking

fuel, the average WF of fuelwood is much larger than the WF of fossil based cooking fuels. The total WF for fuelwood is twice the WF for food, showing that in rural areas of developing countries, fuelwood is water intensive with large impact on freshwater resources. Future prospects of increasing consumption of animal products will increase WFs. However, if also cooking fuel is considered, switching to fossil cooking fuel lowers WFs far more and compensates the increase due to larger animal food consumption. The trends for cooking fuel found in India might also be relevant for other developing countries.

The water footprint of humanity (2017).

Arjen Y. Hoekstra and Mesfin M. Mekonnen studied quantifies and maps the water footprint (WF) of humanity at a high spatial resolution. It reports on consumptive use of rainwater (green WF) and ground and surface water (blue WF) and volumes of water polluted (grey WF). Water footprints are estimated per nation from both a production and consumption perspective. International virtual water flows are estimated based on trade in agricultural and industrial commodities. The global annual average WF in the period 1996–2005 was 9,087 Gm³/y (74% green, 11% blue, 15% grey). Agricultural production contributes 92%. About one-fifth of the global WF relates to production for export. The total volume of international virtual water flows related to trade in agricultural and industrial products was 2,320 Gm³/y (68% green, 13% blue, 19% grey). The WF of the global average consumer was 1,385 m³/y. The average consumer in the United States has a WF of 2,842 m³/y, whereas the average citizens in China and India have WFs of 1,071 and 1,089 m³/y, respectively. Consumption of cereal products gives the largest contribution to the WF of the average consumer (27%), followed by meat (22%) and milk products (7%). The volume and pattern of consumption and the WF per ton of product of the products consumed are the main factors determining the WF of a consumer. Their study illustrates the global dimension of water consumption and pollution by showing that several countries heavily rely on foreign water resources and that many countries have significant impacts on water consumption and pollution elsewhere.

The Water Footprint of Global Food Production (2020).

Mesfin M. Mekonnen and Winnie Gerbens-Leenes discussed that the agricultural production is the main consumer of water. Future population growth, income growth, and dietary shifts are expected to increase demand for water. Their study presents a brief review of the water footprint of crop 12 production and the sustainability of the blue water footprint. The estimated global consumptive (green plus blue) water footprint ranges from 5938 to 8508

km³ /year. The water footprint is projected to increase by as much as 22% due to climate change and land use change by 2090. Approximately 57% of the global blue water footprint is shown to violate the environmental flow requirements. This calls for action to improve the sustainability of water and protect ecosystems that depend on it. Some of the measures include increasing water productivity, setting benchmarks, setting caps on the water footprint per river basin, shifting the diets to food items with low water requirements, and reducing food waste.

Water Footprint of Cotton Textile Processing Industries; a Case Study of Punjab, Pakistan. (2018)

Sohail Ali Naqvi, Dr Masood Arshad et.al studied about water footprint for cotton industry. According to them world over, many studies have been published on the water footprints (WFs) of different commodities. In Pakistan, there is lack of information and awareness on water footprints of processes and products. Their study throws light on the water footprint of cotton textile production in Pakistan. Blue, green and grey water footprints have been included in this research communication. Water footprint assessment is essential in determining how much water is consumed in which process and how it can be managed effectively. It is a reliable method to plan sustainable, equitable and efficient use of water resources. The results of the study revealed that the blue water footprint (BWF) of cotton seed in Punjab is 1898 m³/t. The water abstracted for textile processing is about 169 m³/t of finished fabric, of which approximately 26 m³/t is consumed (i.e. the BWF of textile manufacture) with the remainder being discharged as waste water. However, the water footprint of chemical inputs is not very high in comparison to other parts of the supply chain (less than 1 m³/t). Overall, the blue WF of finished textile in Punjab, Pakistan is 4650 m³/t on average.

A Review on Water Footprint Study for Steel Industry (2017).

Madhuri. G, Ravi Tej Hegde et.al discussed that fresh water scarcity is a relevant problem around the globe. Due to increase of pressure on the freshwater resources there is an increase in the water consumption and pollution, the water footprint and subsequently, water footprint assessment developed for sustainable environment. Their study mainly discusses about the components and phases of water footprint, different methodologies used for conducting the water footprint study in the industry and significant use of water footprint assessment in steel supply chain. Their study 13 helps the decision maker to understand

impacts of production process on water resources, formulates the strategic actions to reduce the impacts on water resources and this will also help for sustainable water management.

The blue and grey water footprint of construction materials: Steel, cement and glass (2019).

A.Y. Hoekstra, R. Bosman et.al discussed that numerous studies have been published on water footprints (WFs) of agricultural products, but much less on WFs of industrial products. The latter are often composed of various basic materials. Already the basic materials follow from a chain of processes, each with its specific water consumption (blue WF) and pollution (grey WF). They assess blue and grey WFs of five construction materials: chromiumnickel unalloyed steel, unalloyed steel, Portland cement (CEM I), Portland composite cement (CEM II/B) and soda-lime glass. Blue and grey WFs are added up along production chains, following life cycle inventory and WF accounting procedures. Steel, cement and glass have WFs dominated by grey WFs, that are 20– 220 times larger than the blue WFs. For steel, critical pollutants are cadmium, copper and mercury; for cement, these are mercury or cadmium; for glass, suspended solids. Blue WFs of steel, cement and glass are mostly related to electricity use.

Water Footprint Assessment: Evolvment of a New Research Field (2017)

Arjen Y. Hoekstra, his study reviews the evolvment of water footprint assessment (WFA) as a new research field over the past fifteen years. The research is rooted in four basic thoughts: (1) there is a global dimension to water management because water-intensive commodities are internationally traded, so we must study virtual water trade and the effects of countries externalizing their water footprint; (2) freshwater renewal rates are limited, so we must study the development of consumption, production and trade patterns in relation to these limitations; (3) supply chain thinking, previously uncommon in water management, can help to address sustainable water use from the perspective of companies and final consumers; and (4) a comprehensive approach requires the consideration of green in addition to blue water consumption, the traditional focus in water management, and the analysis of water pollution in the same analytical framework as well. The quick emergence of the new field and wide uptake of the water footprint concept in society has generated substantial discussion about what the concept in narrow sense and the research field in broader sense can offer and what not. The paper reflects on the main issues of debate.

Water footprint assessment of food-water-energy systems at Kathmandu University, Nepal (2021).

Bhintuna Vaidya, Shreeya Shrestha et.al. discussed an interconnected approach for the quantitative analysis of different sectors including energy, water, and food for their footprints is important for promoting a balance between these sectors at a community scale. In this study, a conceptual analytical framework on water footprint (WF) is developed to assess the interaction of energy, food, and water resources in Kathmandu University (KU), Dhulikhel, Nepal. The total WF of KU is found to be 628,375.55 m³/yr and the per-capita total WF is calculated to be 513.19 L/day. The analysis results reveal that food consumption within KU is the key sector contributing to the high WF (65% of the total WF). The residential sector of the university has the highest direct WF of 28,800 m³/yr indicating high water usage in the residential buildings. The WF associated with electricity was found to be 155,764.80 m³/yr, which was the highest among all the energy source types. Possible scenarios for WF reduction measures that include installing water-efficient technologies, operation of a wastewater treatment plant, promotion of responsive behavior towards food consumption, collection of all the food waste for energy generation from anaerobic digestion and prioritizing the development of alternative sources of energy has been discussed. The findings could serve as a reference for other institutions that will help to plan and operation of sustainable universities and campuses.

By studying literature it has been seen that water footprint is calculated for nation, agriculture and large commodity by taking direct individual footprint from standard data. But it seems that if we focus on personal water footprint then I would provide detailed analysis.

5. METHODOLOGY

5.1 Approach

Identifying the direct and indirect consumption of water for each individual was the aim of the study. The methodology followed to realize this was to divide the consumption into two types and proceed in a systematic manner. According to “The Water Footprint Assessment

Manual-Setting the Global Standard”, published by the WFN in 2011, water footprint calculations do not include traditional water consumption, but do include direct and indirect freshwater use. Therefore, an individual’s water footprint can be calculated from water resource consumption across all areas of the individual. An individual’s water footprint generally comprises components in the following two categories.

- Scope I – This included only the direct consumption of water by an individual. This included water used for gardening, cleaning, drinking and so on. All of this was considered as a water footprint of an individual of the respective set of people.
- Scope II – This includes all indirect consumption of water by an individual. This category involves the most difficult calculations, because too many variables are involved in the production, transportation, and marketing of products. This again included the growth, transportation, and preparation of various types of food. If everyone begins to change their lifestyle and consumption behaviours, understand the water footprint of each foodstuff and adjust their eating and water use habits accordingly, and stop wasting food, then not only can the world be fed, huge amounts of water resources will be saved, and the goal of sustainable water resource use will be met.

A questionnaire online survey was administered to households of different set of people living at different places. For the consumption of water, we suggest two categories one is adults and another is people below eighteen years. Questionnaire contains more than fifty questions which include both direct and indirect water consumption questions. For filling the questionnaire, training has been given so that the people will understand the meaning of questions. Reason behind giving training was that the people can provide the correct answer

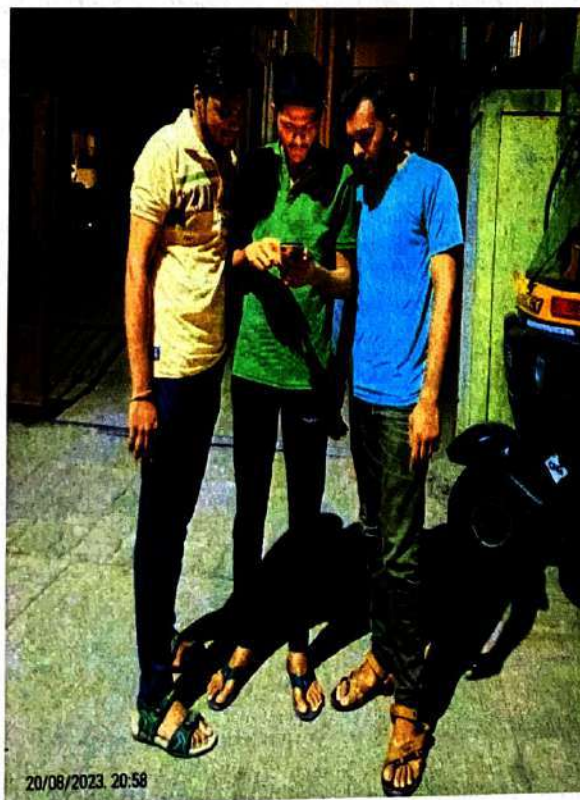
for their water consumption. In the first iteration some of the people filled wrong answers for them second iteration was conducted. In the next step the collected data was separated and analysed according to direct and indirect consumption as per the guidelines of water footprint network manual. After separation of direct and 16 indirect water consumption, values are placed in water footprint network calculator to find out the individual water footprint.

Table No 3: Questionnaire for individual water footprint

QUESTIONNAIRE FOR INDIVIDUAL WATER FOOTPRINT
1.Email Address
2.What is your full name?
3.Mobile No.
4.In which city/town do you live?
5.Where do you live?
6.How many people (adult above 18) are in your house?
7.How many people (children below 18) are in your house?
8.What water system do you have?
9.What kind of sewages system do you have?
10.Do you use bottled water? (Water Jar)
11.How would you evaluate the quality of your drinking water?
12.What is the capacity of your water storage tank?(in lit)
13.What's your monthly water bill?
14.Net household annual income?
15.How much Cereal products (wheat, rice, maize, etc.) you used Kg. per week?
16.How much meat products you consumed Kg. per week?
17.Dairy products (kg. per week)?
18.Eggs (number per week)?
19.How do you prefer to take your food? (Fat content)
20.How is your sugar and sweets consumption?(Sugar consumption)
21.Vegetables (kg. per week)?
22.Fruits (kg. per week)?
23.Starchy roots (potatoes, cassava) (kg. per week)?
24.How many cups of coffee do you take per day?(Number of Cup)

25.How many cups of tea do you take per day?(Number of Cup)
26.Do you have water filtration system at home?
27.How long is the average shower in your house?
28.Do you have low-flow shower heads?
29.How often do you wash your hand?(number per day)
30.How many showers do you take each day?
31.How many times per day do you brush your teeth? (number per day)
32.Do you leave the tap running when brushing your teeth and shaving?
33.How many loads of laundry do you do in an average week? (times per week)
34.How many cloths do you washed at every time?
35.Do you have a dual flush toilet?
36.If you wash your dishes by hand how many times are dishes washed each day?(number per day)
37.How long does the water run during each wash?(minute per wash)
38.How long do you leave the kitchen faucet running each day?
39.How many taps do you have at home?(Number of Taps)
40.How often do you use your washing machine?(Number per week)
41.How many times per week do you wash a car?(number per week)
42.How many times per week do you wash a bike?(number per week)
43.How many times do you water your garden each week?(number per week)
44.How long do you water your garden each time? (minute per watering)
45.If you have a swimming pool what is its capacity?(lit)
46.How many times per year do you empty your swimming pool?(number per year)
47.Do you collect rain water for your households?
48.Do you have a rain barrel?
49.Where does your electricity come from?
50.Do you recycle paper?
51.Do you recycle plastic?
52.Do you recycle bottles and cans?
53.Do you donate or re-use old clothing, sheets, blankets and towels?
54.What are you most interested in?
55.Any other use of water if yes please mention with details.

6. SURVEY PHOTOGRAPHS



7. ANALYSIS OF DATA

7.1 Data collection

Online questionnaire was prepared and data was collected from 8 project members and 19 other peoples from different places. Following are the samples of responses collected from the set of peoples.

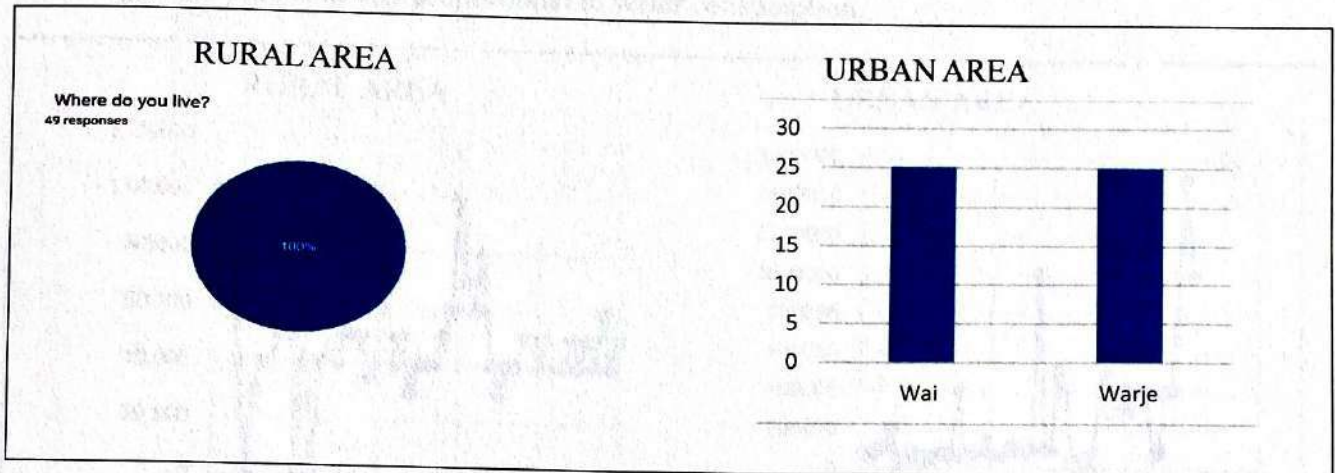


Figure No 3: locations of Participants

It is clear from figure no.3, data has been collected from individual from different locations. It has been observed from figure no.3, data collected of through questionnaire much of the peoples has their own house.

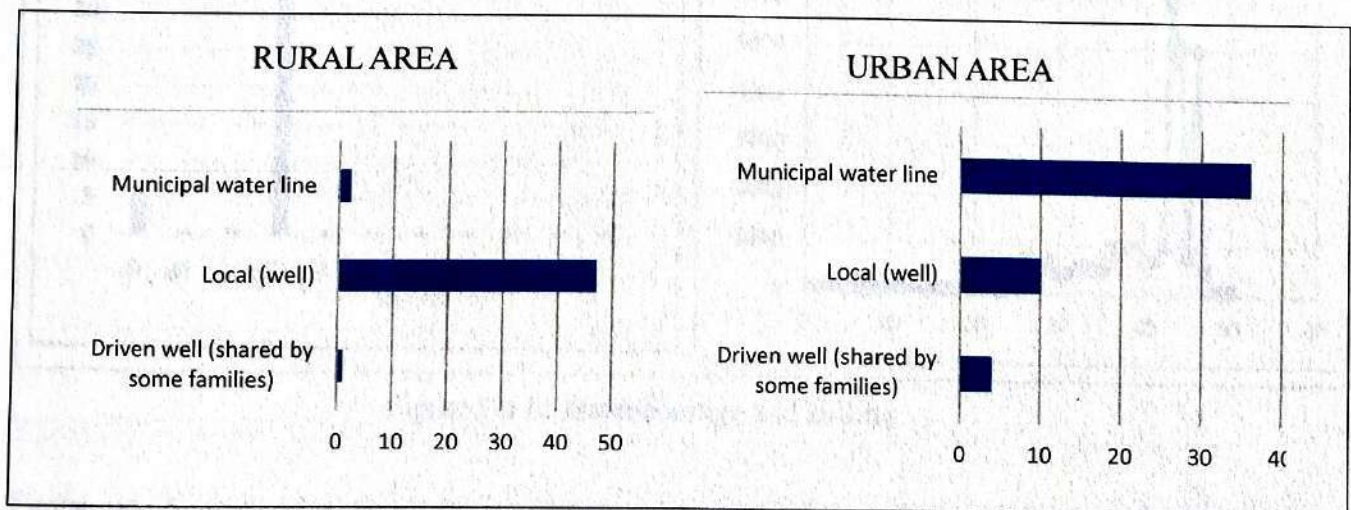


Figure No 4: Type of water and sewage system.

From figure no. 4 it has been concluded that there is mix water system containing municipal water line, tube wells, well and both tube well and municipal water system. Again, regarding sewage system 62% peoples have local sewage system and 38% peoples have central sewage system. Figure no. 6 gives information about annual income. Annual income is necessary to calculate the water footprint. Because it gives an idea related to standard of living. Standard of living of people is directly proportional to water consumption.

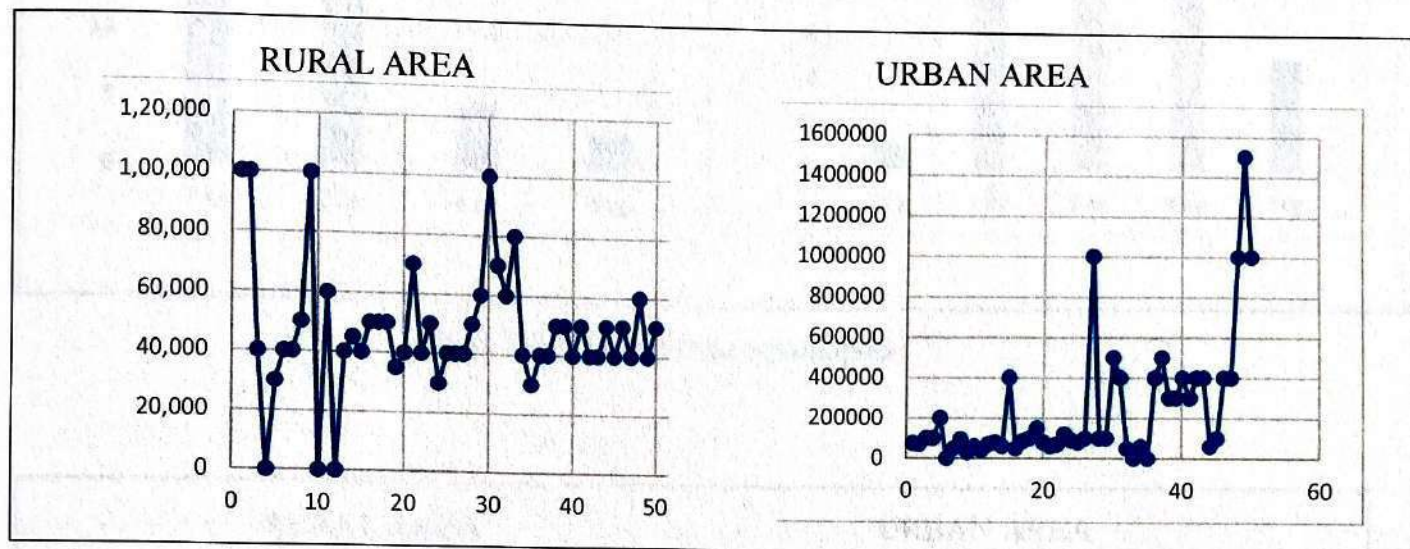


Figure No 5: Household Income

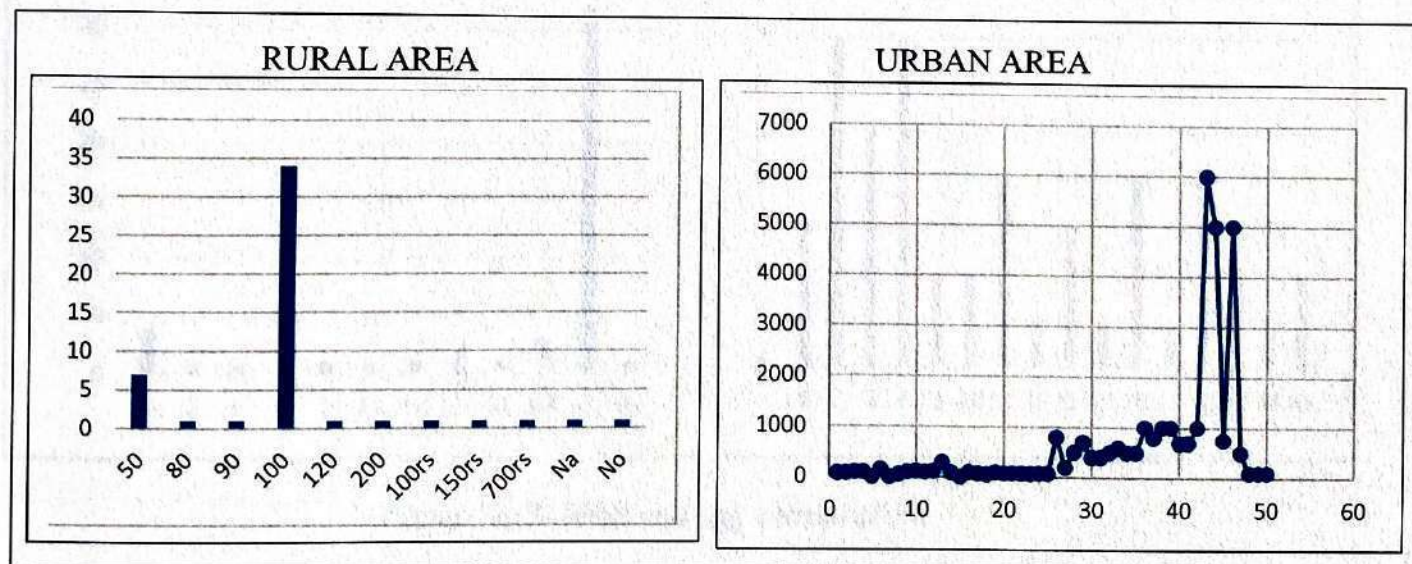


Figure No 6: Water Storage and Billing

Figure no. 6 gives idea about water storage and water billing. It is helpful to calculate individual water consumption. Average use of cereal food product is around 10kg of wheat, 5kg of rice and 1kg of maize as shown in figure no 8. This information is collected so as to calculate the indirect water consumption of individual.

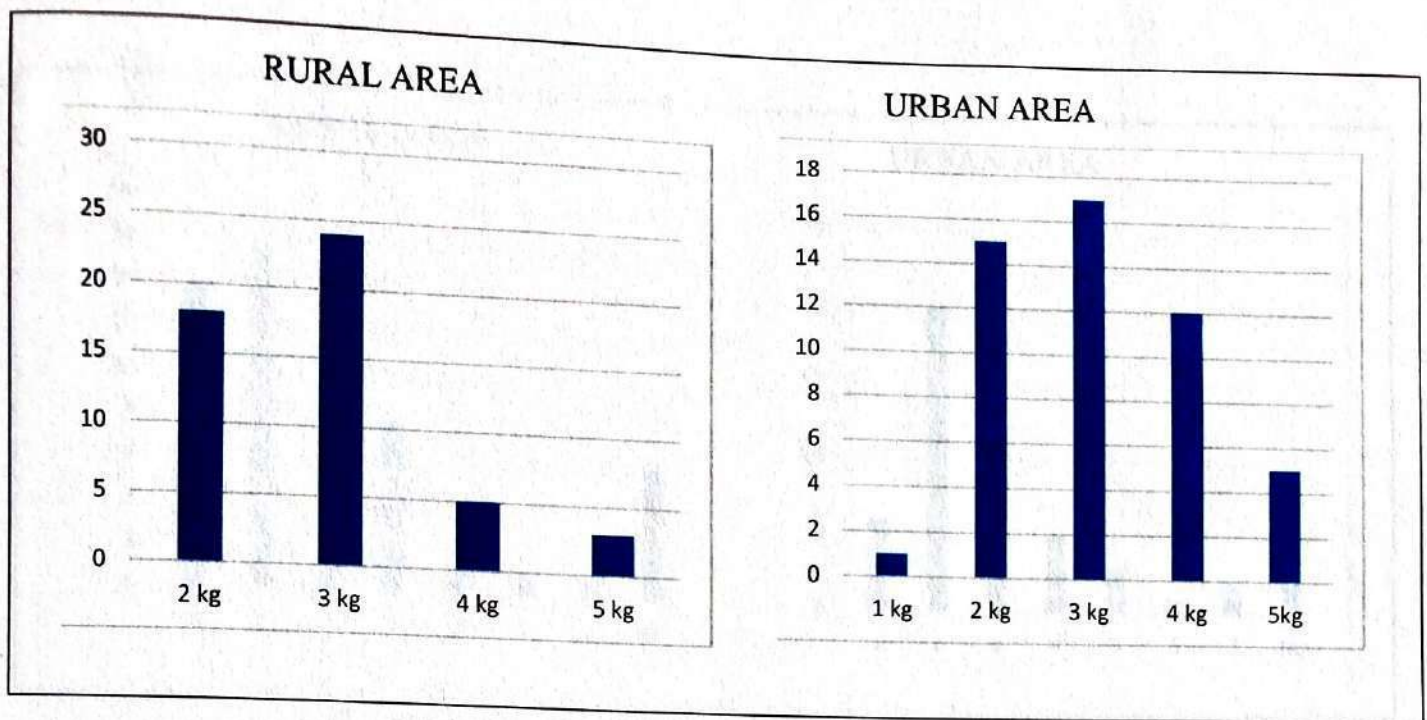


Figure No 7: Cereal food consumption

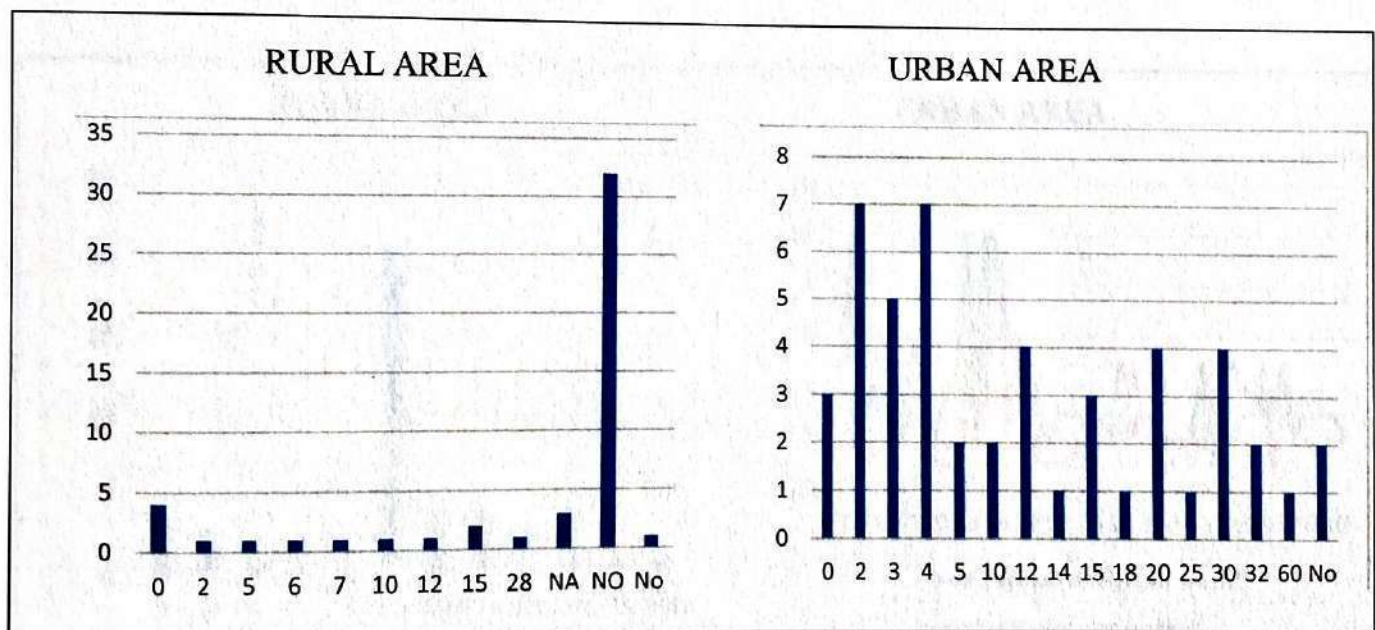


Figure No 8: Meat and egg consumption

Figure no. 8 gives information about meat and egg consumption. Much of the families consume around 1.5 kg of meat per week. And around 15 eggs are consumed by each family per week. Tall bar indicates that there is a high percentage of vegetarian. This information is collected so as to calculate the indirect water consumption of individual. Figure no. 8 gives information about meat and egg consumption. Again, this information is collected so as to calculate the indirect water consumption of individual.

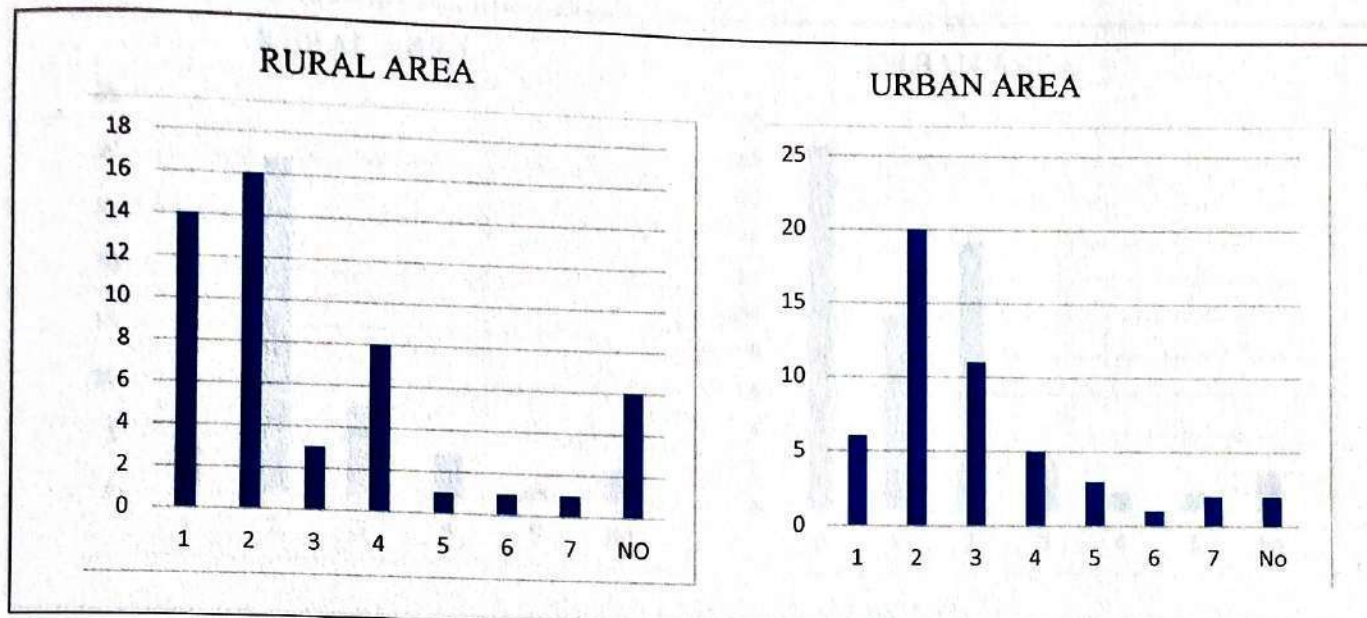


Figure No 9: Dairy product consumption

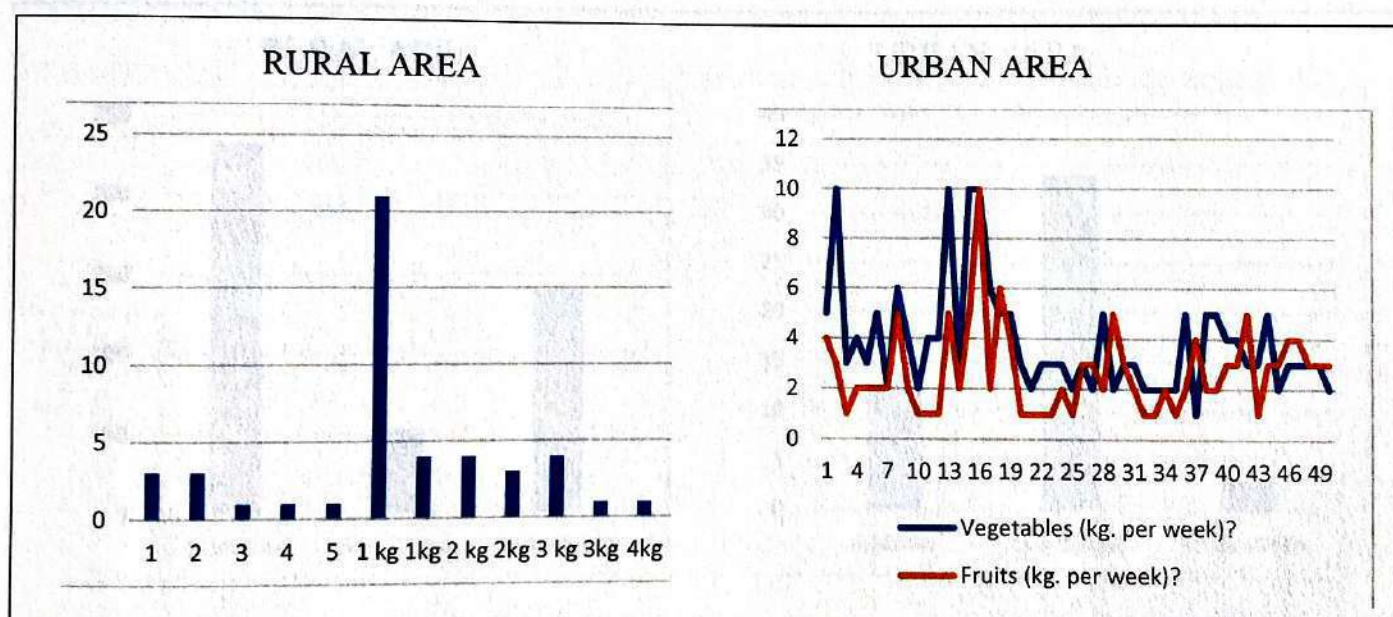


Figure No 10: Vegetables and Fruit Consumption

Figure no. 10 gives information about vegetable and fruit consumption. Many of the families consume around 2 kg of mix vegetable per week. And around 5 kg of fruits are consumed by each family per week. This information is collected so as to calculate the indirect water consumption of individual. Figure no. 11 gives information about tea consumption by families per day. Again, this information is collected so as to calculate the indirect water consumption of individual.

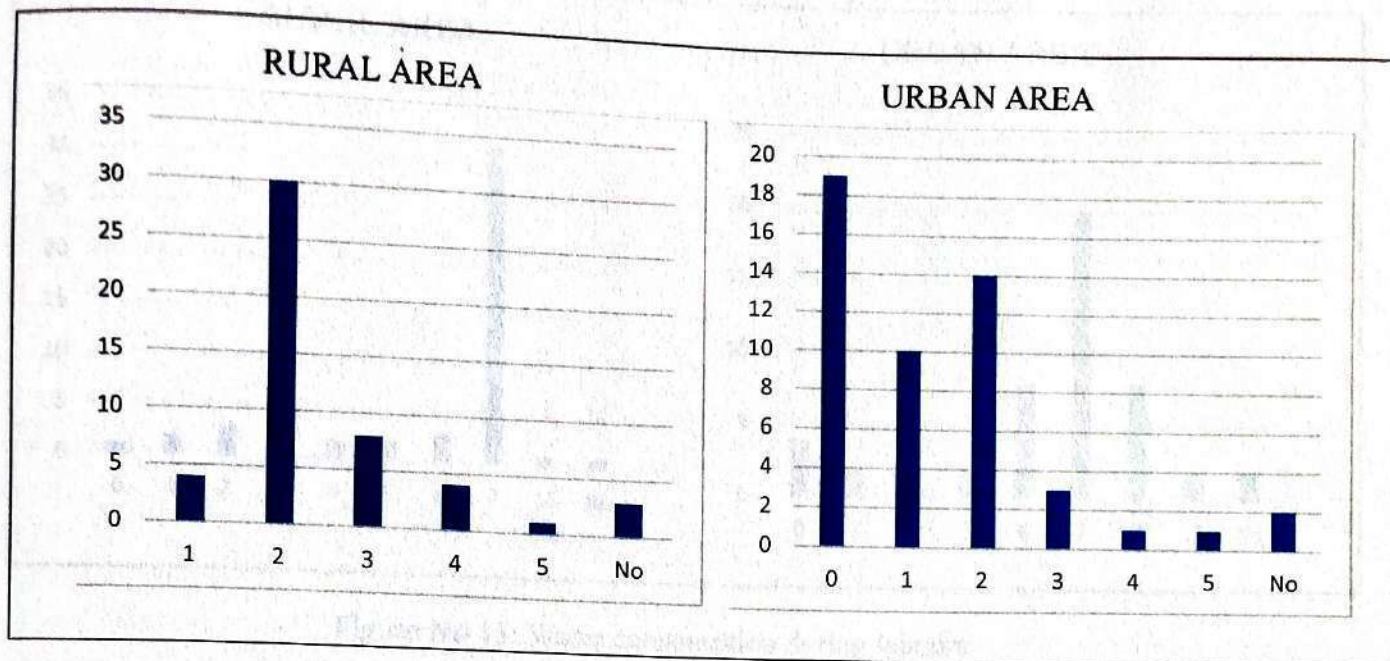


Figure No 11: Tea consumption

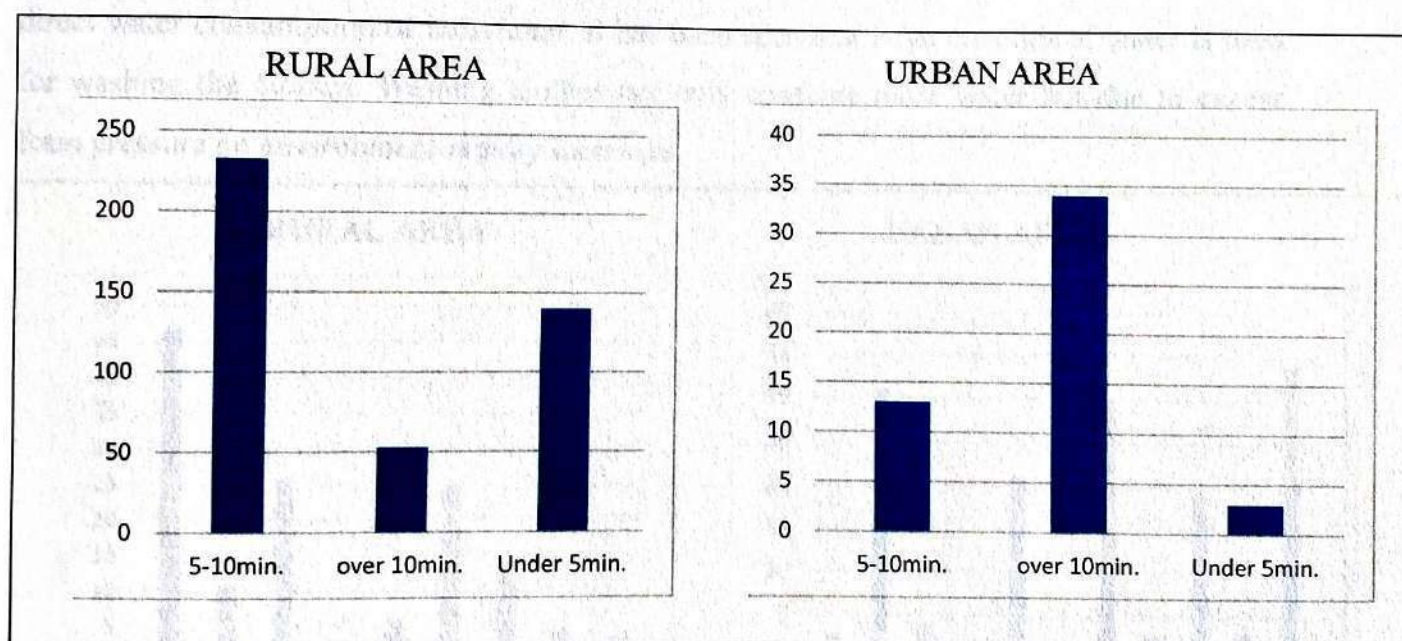


Figure No 12: Water consumption during shower

Figure no. 12 gives information about water consumption during shower. It has been seen that high percentage of people uses shower for 5-10 min. Around 10 times people washed their hand per day This information is collected so as to calculate the direct water consumption of individual.

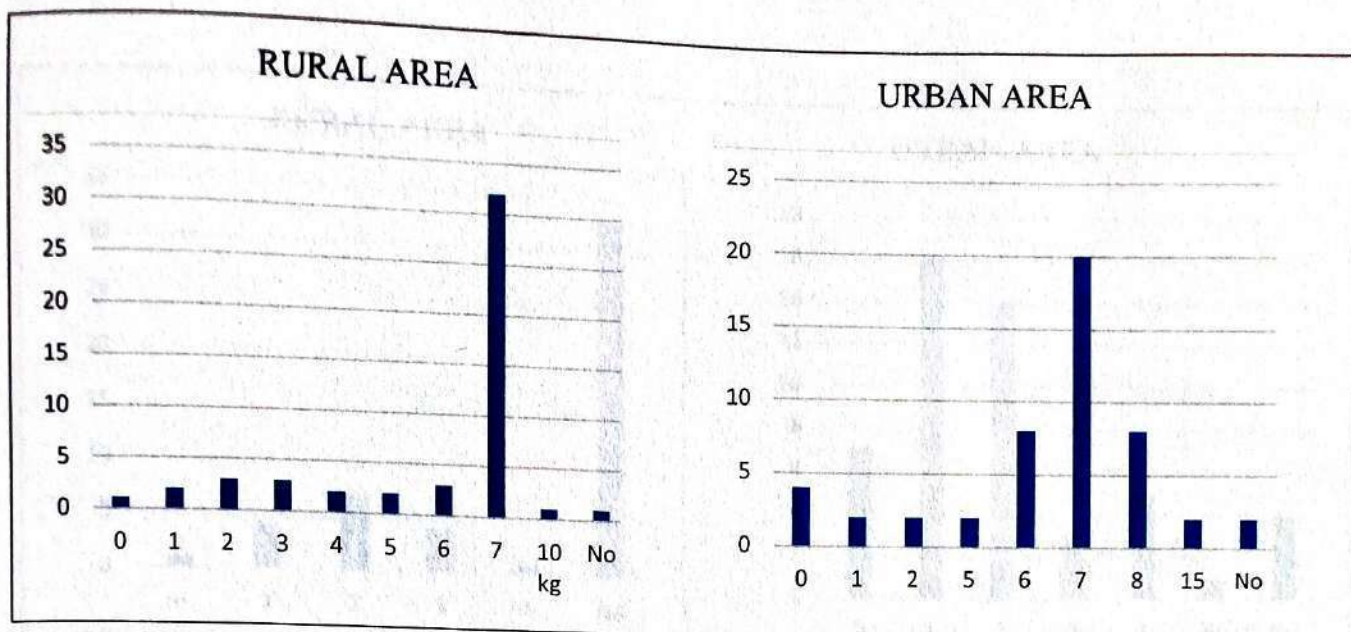


Figure No 13: Water consumption during laundry

Figure no. 13 gives information about water consumption during laundry. It has been seen that high percentage of people washes clothes around 6 times per week. Around 12 cloths are being washed each time during a day. This information is collected so as to calculate the direct water consumption of individual. It has been seen that large quantity of water is used for washing the clothes. Washing clothes not only consume more water but due to excess form pressure on environment rapidly increases.

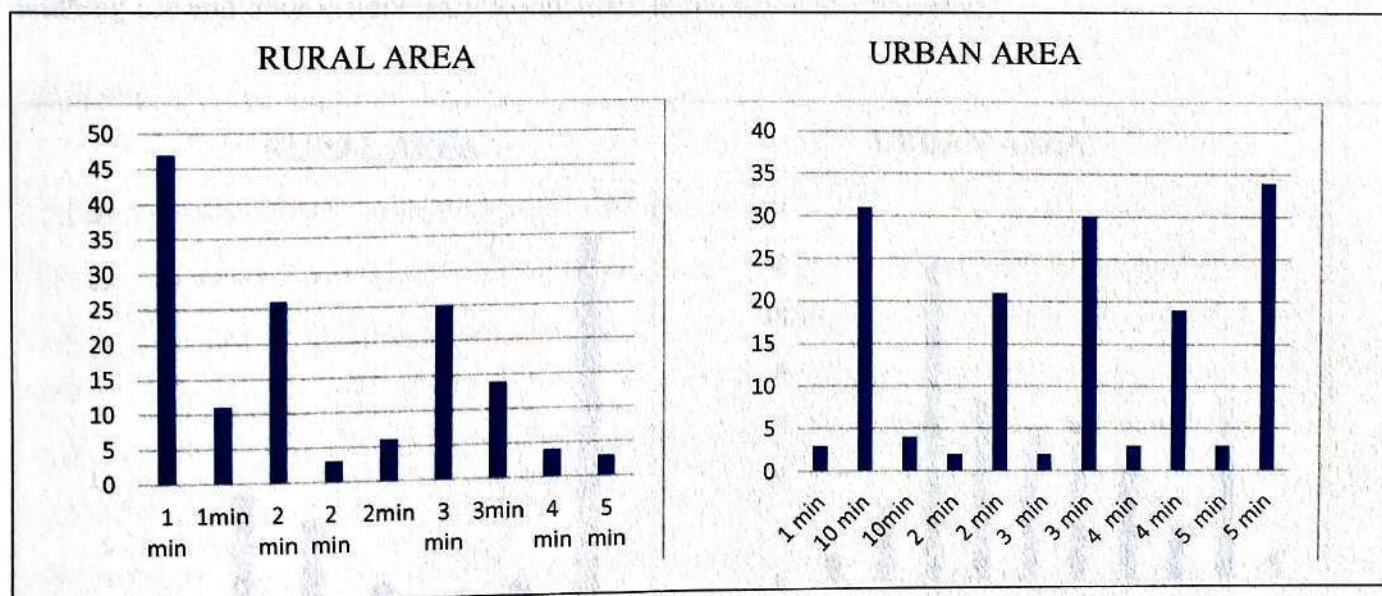


Figure No 14: Water consumption during dish washing

Figure no. 14 gives information about water consumption during dish washing. There are two set of questions one is regarding dish washing and period of dish washing. This information is collected so as to calculate the direct water consumption of individual.

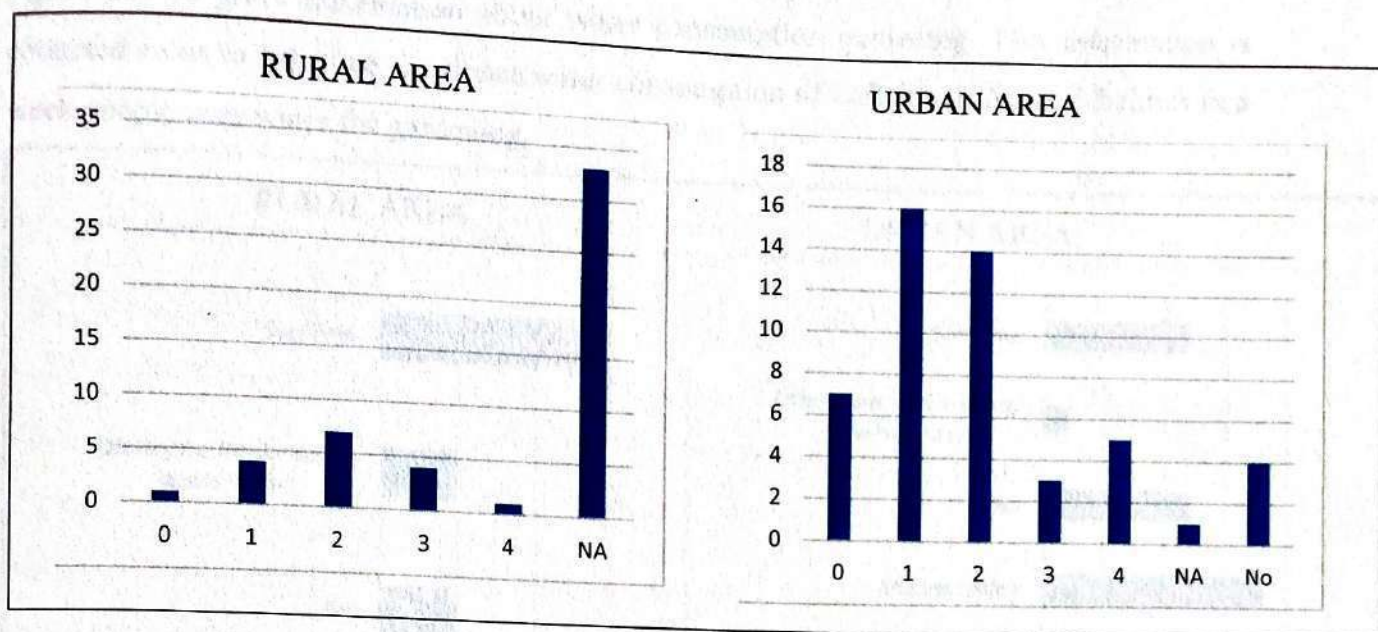


Figure No 15: Water consumption during car and bike washing

Figure no. 15 gives information about water consumption during car and bike washing. This information is collected so as to calculate the direct water consumption of individual. Around once in a week people used to wash a bike. Many of the families does not have cars. We have seen that when we wash car or bike it requires huge amount of water. Therefore washing car and bike is necessary to calculate individual water footprint.

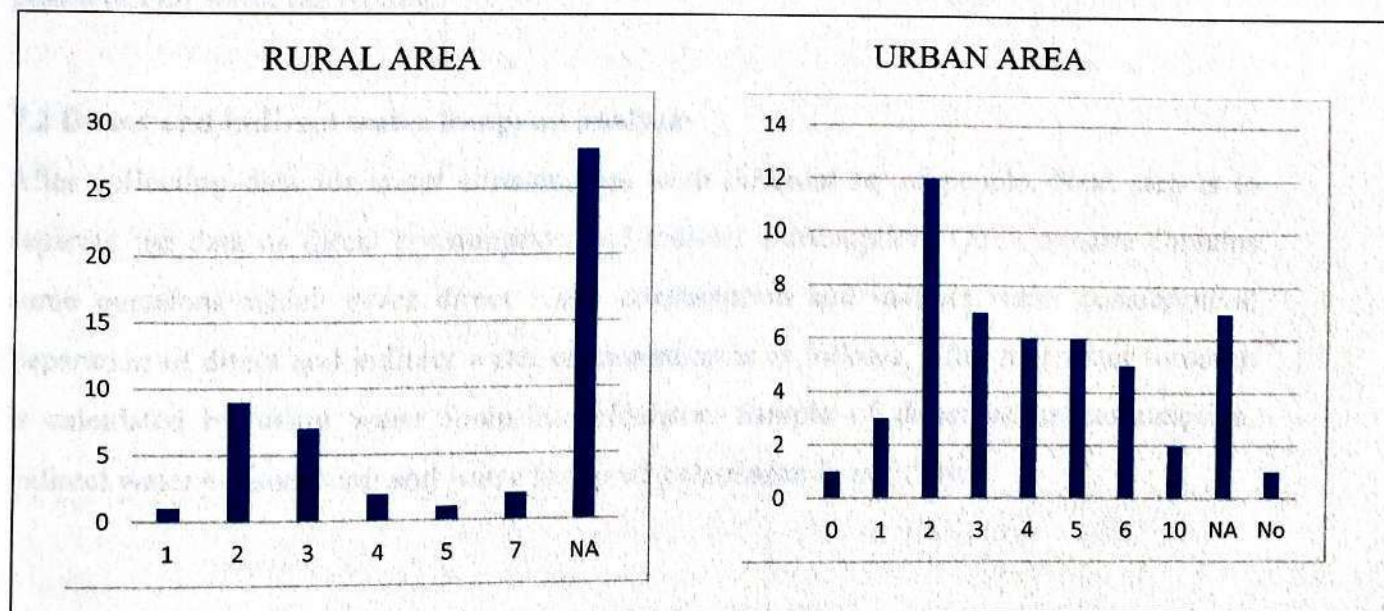


Figure No 16: Water consumption in gardening

Figure no. 16 gives information about water consumption gardening. This information is collected so as to calculate the direct water consumption of individual. Around 5 times in a week people uses water for gardening.

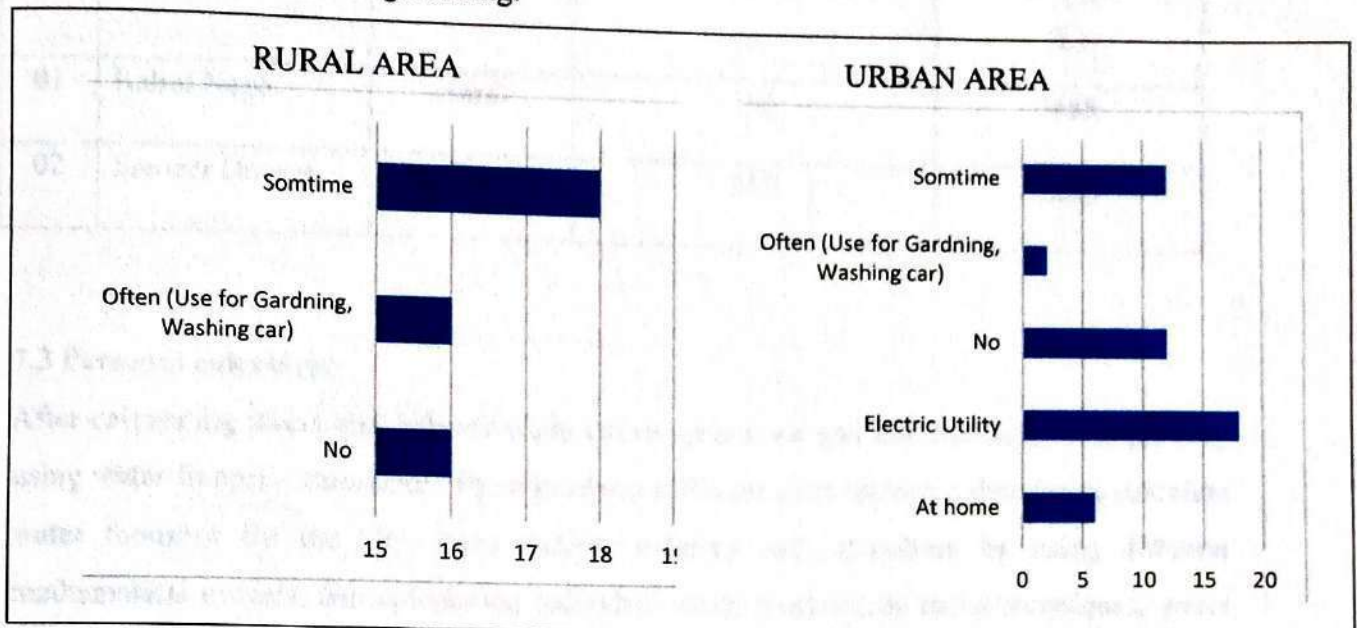


Figure No 17: Water collection through rain water harvesting

Figure no. 17 gives information about water collection through rain water harvesting and rain barrel. Only few family have rain water harvesting system and rain barrel. Though we are in 21st century and reach to the moon we can see from data collected, there are very few family practices rain water harvesting.

7.2 Direct and indirect water footprint analysis

After collecting data for water consumption from different set of people. Next step is to separate the data as direct consumption and indirect consumption. Questionnaire contains some questions which gives direct water consumption and indirect water consumption. Separation of direct and indirect water consumption is as follows. After that water footprint is calculated by using water footprint calculator. Sample of direct water consumption, indirect water consumption and water foot print calculation is as follows.

Table No 4: Per capita daily water footprint of individual.

Sr. No	Name of Person	Location	(Direct) Water Use/Day in Everyday Life (L)	Virtual (Indirect) Water Use/Day (L)
01	Rahul Nage	Sarai	153	3485
02	Sameer Bhagat	Wai	257	6698

7.3 Personal calculator

After calculating direct and indirect water consumption, we can find out water foot print by using water footprint calculator. There has been different methodologies develop to calculate water footprint for the city, town, nation, industry and agriculture by using different mathematical models. But calculating individual water footprint by using techniques, water footprint network has develop a calculator. For calculating water footprint we need to calculate direct and indirect water consumption first. This is generally used to calculate personal water footprint. Sample of water footprint calculator is given below.

Your individual water footprint is equal to the water required to produce the goods and services consumed by you. Please take your time and feel free to use the extended water footprint calculator developed by the researchers at UNESCO-IHE to assess your own unique water footprint. The calculations are based on the water requirements per unit of product as in your country of residence.

Note: put decimals behind a point, not a comma (e.g., write 1.5 and not 1,5).

Sr No.	Question For Individual	Answers		
1	Email			
2	What is your full name?			
3	In which city/town do you live?			
4	Where do you live?	O Own house	O Apartment	O Flat
5	How many people are in your house?			
6	Which type of water system do you have?	O Municipal water line	O Local (well)	O Driven well (shared by some families)
7	What kind of sewage system do you have?	O Local	O Central	O Polluted water is driven into the nature

8	Do you use bottled water?	O Not at home	O Few bottles a week	O Use only bottled water for drinking
9	How would you evaluate the quality of your drinking water?	O Very good	O Satisfactory	O Very bad
10	What is the capacity of your water storage tank? (liters)			
11	what's your monthly water bill? Your answer			
12	Net household annual income? Your answer			
13	Food consumption, how much Cereal products (Wheat, rice, maize, etc.) you used Kg. per week?	O 2 kg	O 4 kg	O 5 kg
14	How much meat products you consumed Kg? per week?			
15	Dairy products (kg. per week)?			
16	Eggs (numbers per week)? Your answer			
17	How do you prefer to take your food? (Fat content)	O Average	O Low	O High
18	Vegetables (kg. per week)? Your answer			
19	Fruits (kg. per week)?			
20	Starchy roots (potatoes, cassava) (kg. per week)? Your answer			
21	How many cups of coffee do you take per day? (Number of Cup)			
22	How many cups of tea do you take per day? (Number of Cup) Your answer			
23	Domestic water use - indoors (liters) Your answer			
24	Do you have water filtration system at home?	O Yes	O No	
25	How long is the average shower in your house?	O Under 5 min	O 5-10 min	O Over 10 min
26	Do you have low-flow shower heads?	O Yes	O no	O Other
27	How often do you wash your hand? (Number per day)			
28	How many showers do you take each day?	O Yes		
29	Do you leave the tap running when brushing your teeth and shaving?	O yes	O No	O Other
30	How many times per day do you brush your teeth? (Number per day)		O No	O Other

31	How many loads of laundry do you do in an average week? (Times per week)	DISCUSSION		
32	Do you have a dual flush toilet?			
33	If you wash your dishes by hand how many times are dishes washed each day? (Number per day)			
34	How long does the water run during each wash? (Minute per wash)			
35	If you have a dish washer, how many times is it used each week? (Number per)			
36	How long do you leave the kitchen faucet running each day?	O Under 5 min		
37	How many taps do you have at home? (Number of Taps)		O 5-10 min	O Over 10 min
38	How often do you use your washing machine? (Number per week)			
39	Domestic water use - outdoors (liters)			
40	How many times per week do you wash a car? (Number per week) Your answer			
41	How many times do you water your garden each week? (Number per week) Your answer			
42	How long do you water your garden each time? (Minute per watering) Your answer			
43	How long per week do you spend rinsing equipment, driveways, or sidewalks each week? (Minute per week) Your answer			
44	If you have a swimming pool what is its capacity? (Cubic meter)			
45	How many times per year do you empty your swimming pool? (Number per year)			
46	Do you collect rain water for your households?			
47	Where does your electricity come from?	O At home		
48	Do you recycle paper?	O None	O Electric Utility	O Other
49	Do you recycle plastic?	O None	O Some	O All
50	Do you recycle bottles and cans?	O None	O Some	O All
51	Do you donate or re-use old clothing	O None	O Some	O All

Figure No 19: Water footprint calculator

8. RESULT AND DISCUSSION

8.1 Direct water consumption

Following tables gives the values regarding direct consumption of water. It includes bathing, laundry, dish washing, car and bike washing, hand washing, drinking, and gardening. Total direct water consumption values are given in water consumption per liter per person.

Table No 5: Direct water consumption of Rural Area

DIRECT WATER CONSUMPTION OF RURAL AREA												
What is your full name?	LOCATION	BATH	Hand Wash	LAUNDARY	FLUSHING	Dish Washing	Car Washing	Bike Washing	Coffee	Tea	Gardening	TOTAL
Rahul sheknath Nage	SARAI	30	5	50	60	3	0	4	0	1	0	153
Yash Sheknath Nage	SARAI	60	10	175	30	3	10	5	0	1	5	299
Varun shyam Nage	SARAI	60	10	150	30	3	0	10	0	1	0	264
Vaibhav Nage	SARAI	30	3	175	60	3	0	5	0	1	15	292
Mahesh Sahebrao Nage	SARAI	30	6	100	60	4	0	4	0	1	0	205
Rushikesh Sandu Nage	SARAI	60	8	50	30	3	0	2	0	1	0	154
Om Gorakh Jadhav	SARAI	30	5	45	30	3	10	0	0	1	2	126
Satish Sandip Nage	SARAI	30	8	80	30	2	0	2	0	1	0	153
Jay Sheknath Nage	SARAI	30	7	175	30	3	10	5	0	1	20	281
Abhishek Devnath Nage	SARAI	60	11	150	60	3	0	4	0	1	2	291
Rohit Ganesh Nage	SARAI	60	12	45	60	3	0	1	0	1	3	185
Sagar Kailas kanjune	SARAI	60	7	50	30	3	0	1	0	1	0	152
Shubham padale	SARAI	30	6	50	60	3	0	0	0	1	0	150
Aaditya Sominath Nage	SARAI	30	10	100	30	3	10	2	0	1	1	187
Manoj Sahebrao Nage	SARAI	30	5	60	60	3	0	0	0	1	0	159
Pravin Nage	SARAI	60	10	60	60	2	0	1	0	1	2	196
Vishnu khandagale	SARAI	60	5	40	30	3	0	2	0	1	0	141
Nitin Kaduba Nage	SARAI	60	4	75	30	3	0	4	0	1	2	179
Sheknath Vitthal Nage	SARAI	60	15	175	30	2	10	10	0	1	15	318
Atish kaduba Nage	SARAI	30	7	50	30	3	0	2	0	1	1	124
Atul Gopinath Nage	SARAI	60	7	50	60	3	0	0	0	1	5	186
Jijabai Kaduba Nage	SARAI	30	12	75	30	3	0	0	0	1	2	153
Sangita Nage	SARAI	30	10	100	30	2	0	0	0	1	1	174
Shivraj Sanjay padale	SARAI	60	10	150	30	2	0	2	0	1	2	257
Aviraj Ramhari Nage	SARAI	30	10	75	60	3	5	2	0	1	2	188

Table No 6: Direct water consumption of Rural Area

DIRECT WATER CONSUMPTION OF RURAL AREA												
What is your full name?	LOCATION	BATH	Hand Wash	LAUNDARY	FLUSHING	Dish Washing	Car Washing	Bike Washing	Coffee	Tea	Gardening	TOTAL
Sushil Nage	SARAI	30	15	75	60	3	0	4	0	2	0	189
Kanchan Nage	SARAI	30	15	150	30	3	0	0	0	2	0	230
Mangal Nage	SARAI	60	3	100	30	2	0	0	0	2	3	200
Mangal Bhikan Nage	SARAI	30	10	100	60	3	5	2	0	2	3	215
Nadkulkumar Suryabhan Nage	SARAI	60	3	100	30	3	0	0	0	2	2	200
Sunita Sanjay Nage	SARAI	60	4	50	30	1	0	0	0	3	2	150
Sarika Nirutti Nage	SARAI	60	12	100	30	3	0	0	0	0	0	205
Yashoda Apparao Nage	SARAI	60	2	50	30	3	0	2	0	4	2	153
Avinash Nage	SARAI	60	7	70	60	3	0	0	0	2	0	202
Sarsabai Sahebrao Nage	SARAI	60	2	10	60	2	0	5	0	2	4	145
Omkar Padale	SARAI	60	7	120	30	3	0	2	0	2	0	224
Nikhil Sanjay Padale	SARAI	60	2	120	30	3	0	0	0	2	0	217
Indubai Ramdas Nage	SARAI	30	10	50	30	3	0	5	0	2	4	134
Sagar Nage	SARAI	30	14	70	30	3	10	5	0	3	0	165
Vijay Bhande	SARAI	30	15	75	60	3	5	2	0	2	2	194
Bhagwan Nage	SARAI	30	10	50	30	2	0	2	0	2	2	128
Krushna Kanjune	SARAI	30	10	120	60	3	10	0	0	2	0	235
Sunita Baban Nage	SARAI	60	6	75	60	3	0	0	0	2	2	208
Kaveri Vishwas Nage	SARAI	30	10	75	60	3	0	2	0	2	4	186
Rohit Nage	SARAI	30	15	50	30	3	0	3	0	2	0	133
Nirupam Nage	SARAI	30	15	75	30	3	0	0	0	1	0	154
Vithabai Kanjune	SARAI	30	15	75	30	3	0	0	0	1	0	154
Nirupam Nage	SARAI	30	15	75	30	3	0	5	0	2	0	156
Vithabai Kanjune	SARAI	30	6	50	60	3	0	5	0	2	0	156
Pratik Nage	SARAI	30	10	100	30	3	10	0	0	3	0	186
Asha Nage	SARAI	30	10	100	30	3	0	0	0	2	2	177
Rushikesh Nage	SARAI	30	10	100	60	3	0	1	0	2	3	209

Table No 7: Direct water consumption of Urban Area

DIRECT WATER CONSUMPTION OF URBAN AREA												
What is your full name?	LOCATION	BATH	Hand Wash	LAUNDARY	FLUSHING	Dish Washing	Car Washing	Bike Washing	Coffee	Tea	Gardening	TOTAL
Pratik Subhash Jamdade.	Wai	75	2	200	90	2	0	5	1	2	17	394
Ganesh Rajput	Wai	90	4	200	90	3	0	10	0	2	17	416
Kiran samir jadhav	Wai	60	15	200	90	3	10	10	0	1	34	423
Samir ankush jadhav	Wai	45	8	200	60	3	20	5	1	0	34	376
Prisha Mahesh jagtap	Wai	60	8	250	60	2	0	10	2	0	17	409
Pratik ajit bhosale	Wai	75	2	175	90	2	0	5	3	1	17	370
Sameer Sudhir Bhagat	Wai	60	8	100	60	2	0	10	0	0	17	257
Dayanand Balasaheb Arva	Wai	45	3	200	60	3	10	10	2	5	34	372
Ritesh subhash jamdade	Wai	30	10	250	90	3	0	5	2	3	17	410
Archna jamdade	Wai	45	8	200	90	2	0	5	1	2	17	370
Sunanda nanaware	Wai	60	6	200	90	2	0	10	0	2	34	404
Swapnli vijay mandhre	Wai	75	8	200	60	2	0	5	2	0	34	386
Sachin Ashok Jamdade	Wai	75	5	250	90	3	10	5	2	2	17	459
Sarika jamdade	Wai	60	6	200	90	3	0	5	2	0	34	400
Navnath Vilas Babar	Wai	45	10	100	90	2	40	10	0	0	17	314
Tejas Jagannath Sankpal.	Wai	60	10	200	60	4	0	10	5	10	34	393
Sourabh bichkar	Wai	75	5	200	90	2	10	10	0	0	17	409
Sumit sampat suryavanshi	Wai	90	10	100	60	3	0	10	0	1	34	308
Pranav Dhumal.	Wai	60	4	125	60	3	10	5	0	0	17	284
Shivanshi pratik dagde	Wai	45	4	200	90	2	10	5	1	1	34	392
Sakshi shubham tapre	Wai	60	4	200	60	2	20	5	1	1	34	387
Sourabh pravin jamdade	Wai	90	2	250	90	3	10	5	2	0	34	486
Vanita rajendra tarte	Wai	60	5	200	90	2	10	10	0	2	34	413
Gayatri Sadashiv bodke	Wai	45	6	250	90	2	10	10	2	0	34	449
Vaibhav appaso gurav	Wai	60	4	200	90	3	10	10	0	3	34	414

Table No 8: Direct water consumption of Urban Area

DIRECT WATER CONSUMPTION OF URBAN AREA												
What is your full name?	LOCATION	BATH	Hand Wash	LAUNDARY	FLUSHING	Dish Washing	Car Washing	Bike Washing	Coffee	Tea	Gardening	TOTAL
Saroja mandave	Warje	90	10	200	30	3	0	10	0	0	34	377
Prathamesh bagal	Warje	90	6	250	60	2	10	5	0	4	34	461
Dhananjay mane	Warje	75	7	175	30	2	0	10	1	1	17	318
Sangeet jadhav	Warje	90	5	200	30	2	20	5	1	2	34	389
Pramilq Waghmare	Warje	75	7	175	60	3	0	10	2	2	17	351
Harshda thakare	Warje	90	10	200	60	3	0	10	1	1	34	409
Radhika basu	Warje	90	12	250	60	3	10	5	3	2	17	452
Jayshree mahajan	Warje	75	15	150	30	3	20	5	3	2	34	337
Sanali pande	Warje	90	12	175	30	2	0	10	1	2	17	339
Sunita jadhav	Warje	90	13	200	60	2	0	5	0	2	34	406
Ganesh pawar	Warje	75	10	250	30	3	10	5	2	0	17	402
Chaitanya wadkar	Warje	90	8	175	60	3	10	5	1	0	34	386
Mayuri santosh gole	Warje	75	6	175	60	2	10	10	0	0	34	372
Riddhi wadkar	Warje	90	5	200	30	3	20	5	2	0	17	372
Rohini sastur	Warje	90	10	250	30	3	0	5	2	2	34	426
Shubham bhosle	Warje	90	12	250	60	2	20	10	1	4	17	466
Swati savant	Warje	75	13	175	60	3	0	5	1	1	34	367
Jyoti asbe	Warje	75	10	250	30	3	10	10	3	3	17	411
Lahu asabe	Warje	75	11	175	30	2	20	5	3	3	34	358
Kavita salunke	Warje	90	6	150	30	3	20	10	3	1	17	330
Archana walunjakar	Warje	90	5	150	60	3	0	10	2	1	34	355
Kanchana niphadkar	Warje	75	7	175	30	3	0	10	2	1	34	337
Santosh desai	Warje	75	10	250	30	2	20	5	1	1	17	411
Kailash Kumar	Warje	75	10	200	60	3	10	10	1	1	34	404

It has been seen from result for the purpose of bathing, laundry and toilet flushing people need more water. Nearly 70% of water is utilized in above activities. Some of people use shower for bathing therefore water consumption for bathing is very high. Due to dual toilet flushing more water is consumed. Hence out of 27 participants 23 are using water more than the 135 L/Capita/Day. It has been seen from result out of twenty seven participant four participant use water within the limit. Standard water consumption value is 135 L/Capita/Day. If we avoid shower and use single flushing toilet the huge quantity of water can be saved. If the use of washing machine is avoided, then also we can save water.

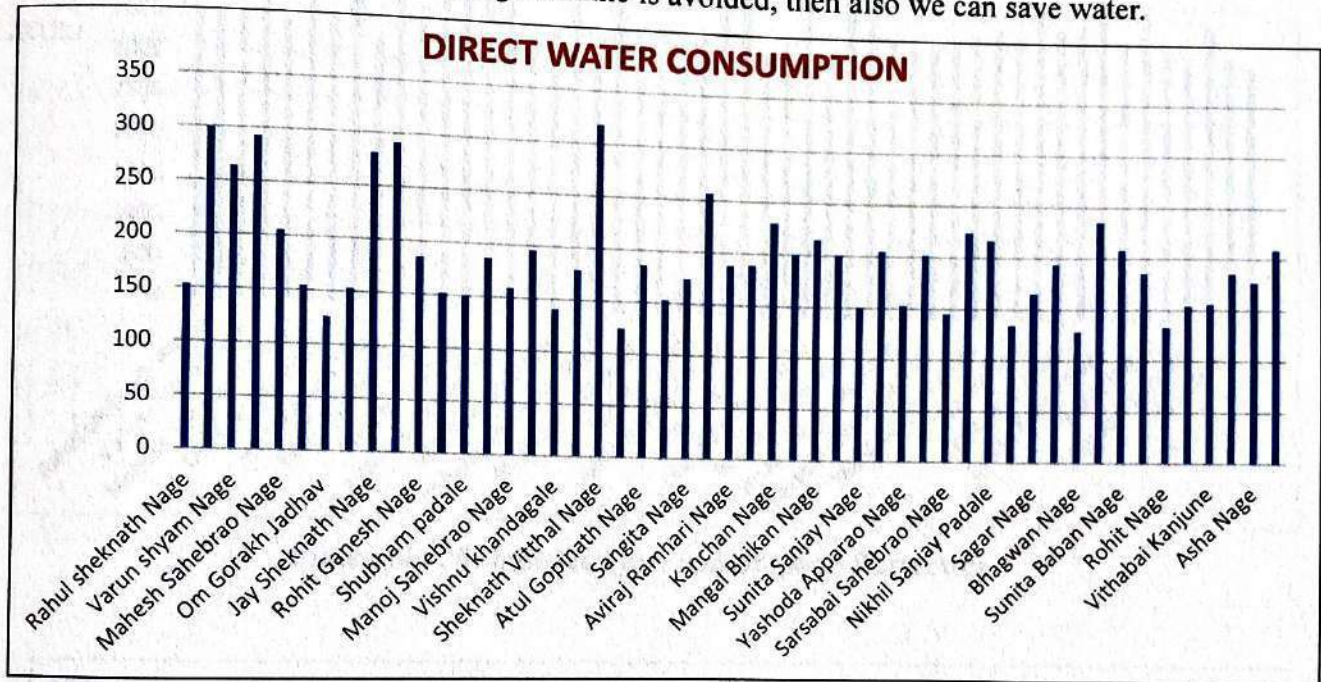


Figure No 18: Direct water consumption of Rural Area

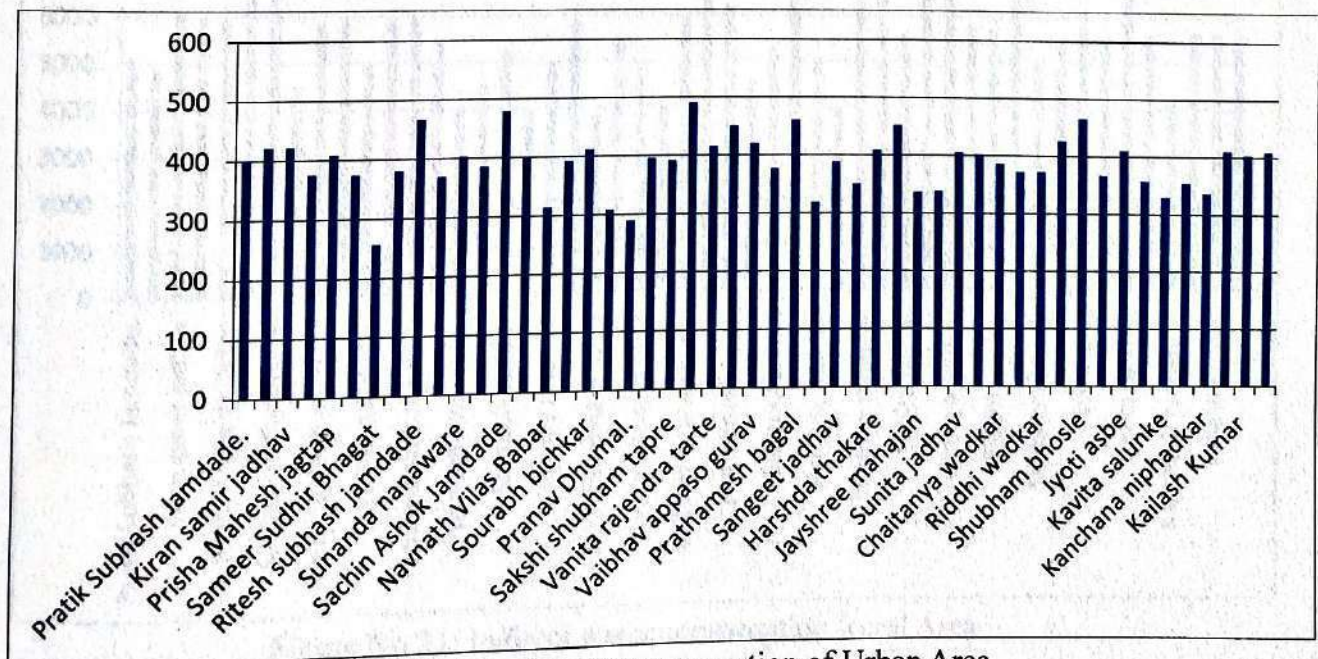


Figure No 19: Direct water consumption of Urban Area

8.2 Indirect water consumption

Following tables gives the values regarding indirect consumption of water. It includes water consumption required to produce different food items Total indirect water consumption values are given in water consumption per liter per person.

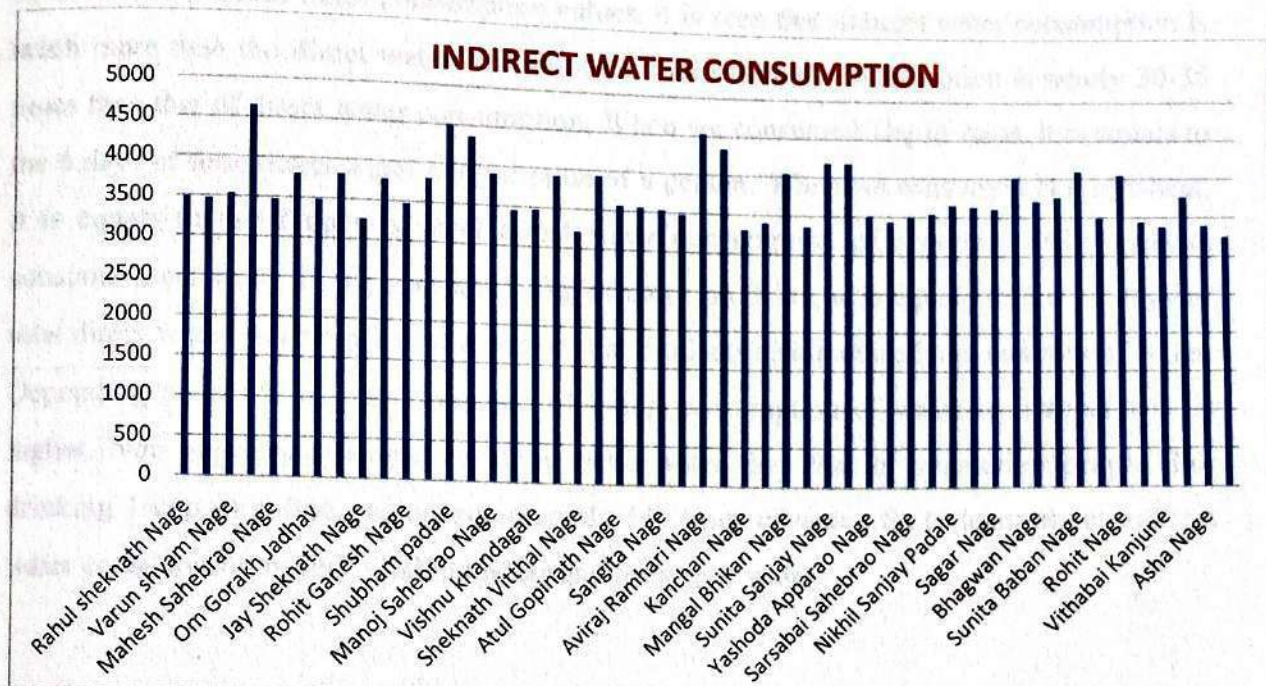


Figure No 20: Indirect water consumption Rural Area

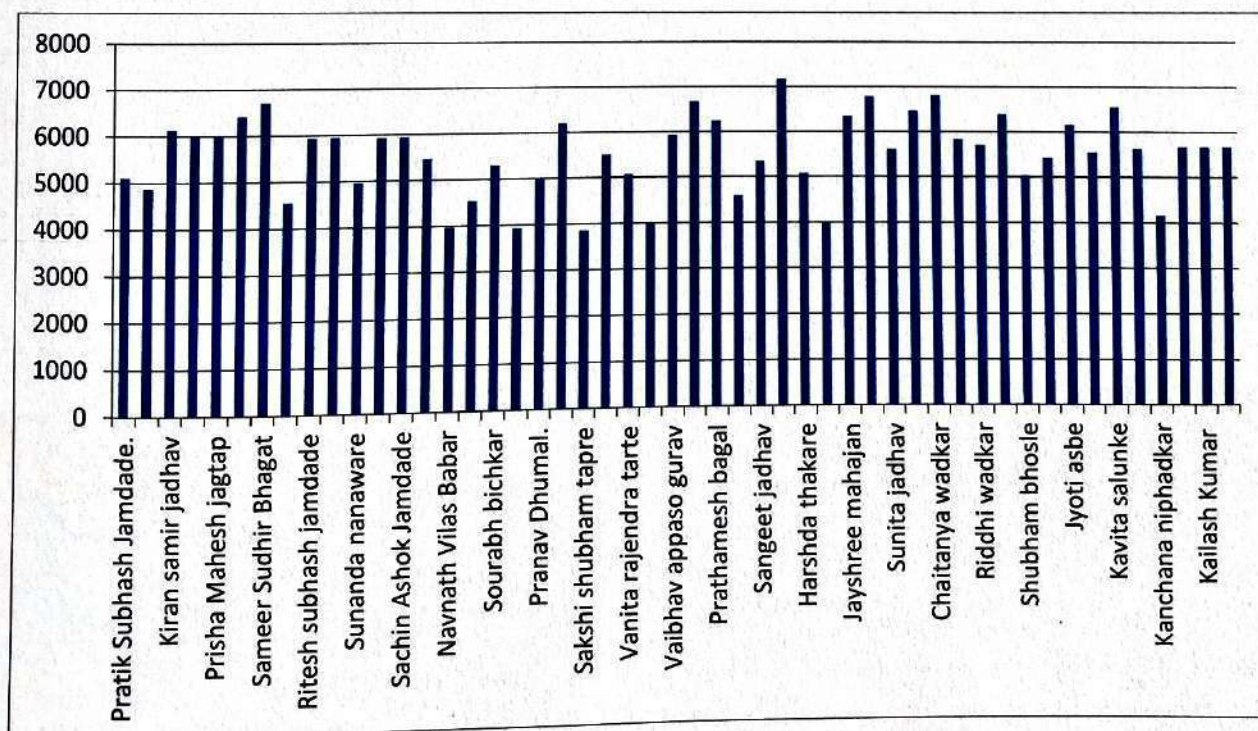


Figure No 21: Indirect water consumption Rural Area

We always care for water that we are consuming directly that means the water that we can see when we are using. Above table shows result of indirect water consumption, which includes all the hidden water that is required to produced products we are using in day to day life such as wheat, rice, meat, eggs, sugar, vegetables, fruit, roots, coffee, tea etc. When we observed the indirect water consumption values, it is seen that indirect water consumption is much more than the direct water consumption. Indirect water consumption is nearly 30-35 times than that of direct water consumption. When we consumed 1kg of meat, it is equals to the 6 days of total direct water consumption of a person. When we consumed 1kg of wheat, it is equals to the 2 days of total direct water consumption of a person. Dairy product consume more water if we consumed 1kg of dairy products, it is equals to the 15 days of total direct water consumption of a person. Fat products also require huge quantity of water. Depending upon the diet and standard of living consumption of water in indirect way is higher. Non vegetarian people consume more water than that of vegetarian people. For drinking 1 cup of coffee, we consume nearly 140 litres of water. So to learn about indirect water consumption is very vital to understand the use of water.

8.3 Water footprint of individuals

Following tables gives the direct, indirect and water footprint of individuals. Water footprint values are given as m³/year of individual.

Table No 9: Water footprint of individuals of Rural Area

RURAL AREA DATA				
Sr. No	Name of Participant	Location	Direct water consumption lit/day/person	InDirect water consumption lit/day/person
1	Rahul sheknath Nage			
2	Yash Sheknath Nage	Sarai	153	3485
3	Varun shyam Nage	Sarai	299	3466
4	Vaibhav Nage	Sarai	264	3534
5	Mahesh Sahebrao Nage	Sarai	292	4649
6	Rushikesh Sandu Nage	Sarai	205	3462
7	Om Gorakh Jadhav	Sarai	154	3802
8	Satish Sandip Nage	Sarai	126	3477
9	Jay Sheknath Nage	Sarai	153	3814
10	Abhishek Devnath Nage	Sarai	281	3250
11	Rohit Ganesh Nage	Sarai	291	3768
12	Sagar Kailas kanjune	Sarai	185	3466
13	Shubham padale	Sarai	152	3802
14	Aaditya Sominath Nage	Sarai	150	4490
15	Manoj Sahebrao Nage	Sarai	187	4358
16	Pravin Nage	Sarai	159	3897
17	Vishnu khandagale	Sarai	196	3447
18	Nitin Kaduba Nage	Sarai	141	3466
19	Sheknath Vitthal Nage	Sarai	179	3908
20	Atish kaduba Nage	Sarai	318	3213
21	Atul Gopinath Nage	Sarai	124	3931
22	Jijabai Kaduba Nage	Sarai	186	3561
23	Sangita Nage	Sarai	153	3553
24	Shivraj Sanjay padale	Sarai	174	3526
25	Aviraj Ramhari Nage	Sarai	257	3470
26	Sushil Nage	Sarai	188	4528
27	Kanchan Nage	Sarai	189	4335
28	Mangal Nage	Sarai	230	3303
29	Mangal Bhikan Nage	Sarai	200	3398
30	Nadkukumar Suryabhan Nage	Sarai	215	4037
31	Sunita Sanjay Nage	Sarai	200	3352
32	Sarika Nirutti Nage	Sarai	150	4180
33	Yashoda Apparao Nage	Sarai	205	4180
34	Avinash Nage	Sarai	153	3496
35	Sarsabai Sahebrao Nage	Sarai	202	3432
36	Omkar Padale	Sarai	145	3488
37	Nikhil Sanjay Padale	Sarai	224	3534
38	Indubai Ramdas Nage	Sarai	217	3647
39	Sagar Nage	Sarai	134	3628
40	Vijay Bhande	Sarai	165	3599
41	Bhagwan Nage	Sarai	194	4006
42	Krushna Kanjune	Sarai	128	3701
43	Sunita Baban Nage	Sarai	235	3754
44	Kaveri Vishwas Nage	Sarai	208	4090
45	Rohit Nage	Sarai	186	3481
46	Nirupam Nage	Sarai	133	4048
47	Vithabai Kanjune	Sarai	154	3440
48	Pratik Nage	Sarai	156	3375
49	Asha Nage	Sarai	186	3764
50	Rushikesh Nage	Sarai	177	3390
			209	3247

Table No 10: Water footprint of individuals of Urban Area

URBAN AREA DATA				
Sr. No	Name of Participant	Location	Direct water consumption lit/day/person	InDirect water consumption lit/day/person
1	Pratik Subhash Jamdade.			
2	Ganesh Rajput	Wai	400	5115
3	Kiran samir jadhav	Wai	422	4872
4	Samir ankush jadhav	Wai	423	6131
5	Prisha Mahesh jagtap	Wai	376	5999
6	Pratik ajit bhosale	Wai	409	5999
7	Sameer Sudhir Bhagat	Wai	374	6419
8	Dayanand Balasaheb Arvatkar	Wai	257	6698
9	Ritesh subhash jamdade	Wai	381	4551
10	Archna jamdade	Wai	467	5927
11	Sunanda nanaware	Wai	370	5946
12	Swapnli vijay mandhre	Wai	404	4970
13	Sachin Ashok Jamdade	Wai	386	5938
14	Sarika jamdade	Wai	480	5950
15	Navnath Vilas Babar	Wai	400	5471
16	Tejas Jagannath Sankpal.	Wai	314	3965
17	Sourabh bichkar	Wai	393	4540
18	Sumit sampat suryavanshi	Wai	412	5300
19	Pranav Dhumal.	Wai	308	3931
20	Shivanshi pratik dagde	Wai	290	4986
21	Sakshi shubham tapre	Wai	396	6207
22	Sourabh pravin jamdade	Wai	392	3856
23	Vanita rajendra tarte	Wai	491	5511
24	Gayatri Sadashiv bodke	Wai	416	5073
25	Vaibhav appaso gurav	Wai	451	3969
26	Saroja mandave	Warje	420	5927
27	Prathamesh bagal	Warje	377	6672
28	Dhananjay mane	Warje	461	6245
29	Sangeet jadhav	Warje	318	4585
30	Pramilq Waghmare	Warje	389	5337
31	Harshda thakare	Warje	351	7167
32	Radhika basu	Warje	409	5076
33	Jayshree mahajan	Warje	452	4000
34	Sanali pande	Warje	337	6343
35	Sunita jadhav	Warje	339	6778
36	Ganesh pawar	Warje	406	5618
37	Chaitanya wadkar	Warje	402	6475
38	Mayuri santosh gole	Warje	386	6812
39	Riddhi wadkar	Warje	372	5828
40	Rohini sastur	Warje	372	5704
41	Shubham bhosle	Warje	426	6396
42	Swati savant	Warje	466	5035
43	Jyoti asbe	Warje	367	5428
44	Lahu asabe	Warje	411	6161
45	Kavita salunke	Warje	358	5549
46	Archana walunjakar	Warje	330	6551
47	Kanchana niphadkar	Warje	355	5640
48	Santosh desai	Warje	337	4166
49	Kailash Kumar	Warje	411	5674
50	Mayuri Sundar	Warje	404	5678
			410	5674

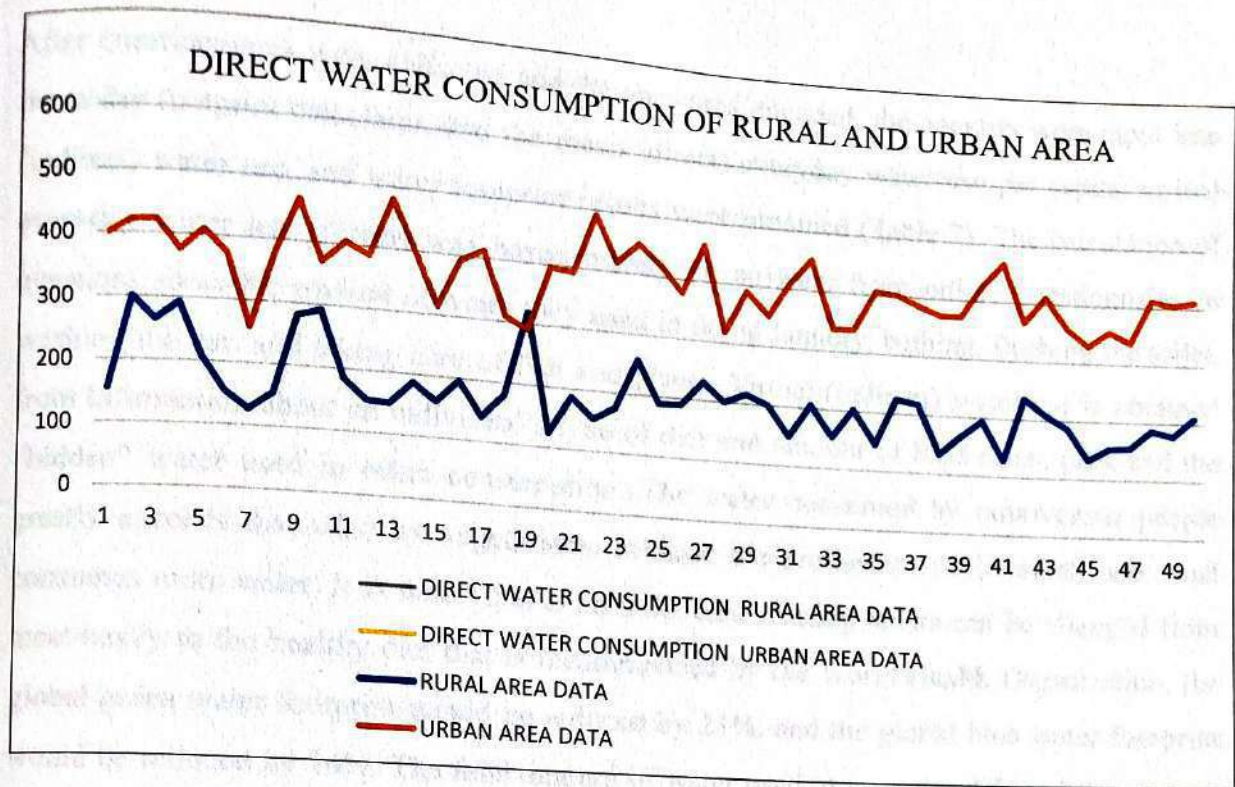


Figure No 22: DIRECT WATER CONSUMPTION OF RURAL AND URBAN AREA

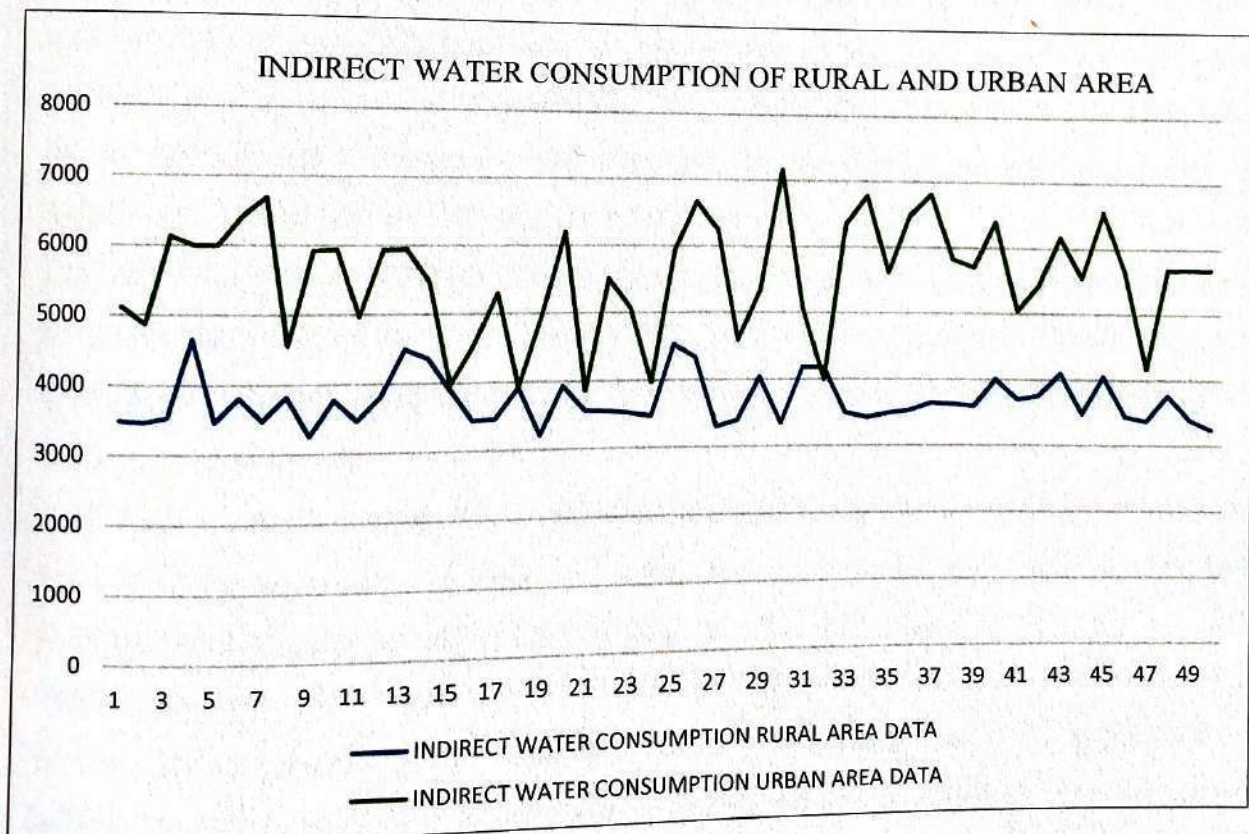


Figure No 23: Indirect water consumption of Rural and Urban Area

After questionnaires were collected and the answers encoded, the answers were input into the water footprint calculator, and the mean (direct) everyday water use per capita, virtual (indirect) water use, and water footprint results were obtained (Table 7). The calculation of everyday water use (direct) was based mainly on answers from online questionnaire to questions about the amount of water they used in doing laundry, bathing, flushing the toilet, washing the car, and taking care of fish and plants. Virtual (indirect) water use is obtained from information about an individual's type of diet and amount of food eaten, pets, and the "hidden" water used in other consumption. The water consumed by omnivorous people greatly exceeds that used by vegetarians, because the production of livestock and meat consumes more water. It is noted that if an individual's eating habits can be changed from meat-heavy to the healthy diet that is recommended by the World Health Organization, the global green water footprint would be reduced by 23%, and the global blue water footprint would be reduced by 16%. The total amount of water used in everyday life and the amount of virtual water used is the individual's daily water footprint.

9. RESPONSES

Vaibhav Nage - From the analysis it is clear that, rural communities in India have less water consumption as compared to urban. It somehow relates to the current Bengaluru water crisis. This is just a demo for other cities. Focusing on cutting water consumption will not solve the problem. Rather we need more attention on soil rejuvenation and watershed management like Cauvery Calling and Save Soil movement.

Abhishek Nage - Until today we were only using water, but you have reminded us once again through your project how and how much water should be used, otherwise we would not have realized that water goes to waste in this way. We benefited a lot Now the topic remains in the city; you have shown your estimate of how the people of the city should use water The village has plenty of water. Therefore, water is used sparingly in the village

Aditya From the review of data we understand that water consumption of rural area is less as compare to urban area and the suggestion you provide in very useful for minimize the water consumption in day-to-day life.

Shivraj padale - Water consumption has a big problem in today's world special in urban and industrial sectors there are large wastage of water in industrial sectors. Due to waste water let into the rivers by the industries, the harmful chemical pollutes the water and causes health issues to humans as well as animals. So, the water from industries should be treated well before they are let into the rivers.

Mahesh Nage - Hi, I would say this is a great initiative to reduce water consumption and let people know about this fact how they can save water on a daily basis directly and indirectly. I definitely apply this trick to save water in my daily routine. Much appreciated. keep up the good work.

Atul Nage - Yaa it's actually more relates our daily life. And the suggestion you provides are very easy to reduce our daily life water consumption. We will definitely try and implement the suggestions told by you. Thank you.

Prisha Jagtap - Water shortage is becoming a greater concern to individuals, the environment and the economy. From the information and suggestions given by you is very helpful to reduce water consumption and indirectly the water footprint. We don't think earlier that we doing wastage of water but by your survey we got that information.

Sarika Jamdade - The information given by you is very important to know how to save water by reducing our water consumption in different ways. I will try to reduce my water consumption by applying your technics in my daily routine.

Sameer Bhagat - Hello, we received your suggestions regarding our daily water consumption, it is very helpful to reduce water use in daily routine. We can use your given suggestions to reduce our water consumption. Due to your project we realize our daily water use and there is huge wastage of water. Now we start reducing water use and we take care no wastage of water will happen by us.

Vanita Tarte - Freshwater is essential to our daily lives, but its supply is limited, therefore reducing water consumption is essential for us to save environment. I will implement your suggestions in my daily routine to reduce my water footprint.

Kiran Jadhav - The information given by you helps in increasing our awareness of water intensive product and minimize its consumption. I will try to improve my diet, living habits essential to save water.

Pratik Jamdade - Water shortage is big upcoming crisis which India will face, To save our country need to start saving water by self-first and your project will help us to save water and your given suggestions are very helpful to save our daily water uses. By using your suggestions we can start saving water in kitchen, garden and our other daily uses. Thank you for your suggestions and all the best for your project.

Mayuri gole - Being a part of this community and not knowing that how dangerous it could be to waste water this way was very shameful for up. But after attending the survey of your team we came to know the whole scenario and now we as a community need to conserve water in order to save it for future, because we don't want our country to be one of those who are majorly facing drought condition and we will definitely keep in mind whatever suggestion you gave us to conserve water because if there is no water then there is no life...

"Jal hi Jeevan Hai "

Ganesh Pawar - Your survey team's visit to my home to raise awareness about water was incredibly impactful. Your dedication to spreading such an important message is truly inspiring. I'm grateful for the knowledge you all shared and the positive change you are fostering. Thank you, team for your valuable contribution to our community! "

Chaitanya wadkar - I want to express my sincere gratitude to your survey team for taking the time to visit my home and educate me about the importance of water conservation. And I think we should not only reduce water consumption but also, we should look after many new ideas for water conservation such as recycle wastewater, rainwater harvesting, protecting wetland, repairing water dripping faucets and these ideas will also help us a lot to conserve water and to save it for future

Jyoti asbe - Your survey was very helpful for us and the suggestions you gave to save water were also very much appreciable ...we will surely remember your suggestions and will work according to it... In order to save water we would like to put small steps forward.... keep it up for your work. Thank you for all your help.

Saroja mandave - This survey gives detailed information on data of water used and analysis of urban water consumption habit in different region and we came to the conclusion that we should efficiently use water and also stop blindly using and wasting water... in order to save water for future generation. Government should also take concerned about the water consumption.

10. Suggestions and Solutions

Some of the little things we can do to reduce our water footprint as consumers are:

1. Grey water recycling involves reusing water from showers and sinks for watering plants. This system captures and treats grey water, making it safe for reuse, thereby reducing fresh water usage by recycling used water. It is ideal for garden irrigation and toilet flushing.
2. Rainwater harvesting systems collect rainwater in barrels or tanks for garden use. These systems include gutters, downspouts, and storage tanks, reducing reliance on municipal water for irrigation. They also help manage storm water and prevent flooding.
3. Fixing dripping faucets and leaking pipes promptly can save significant amounts of water. Even small leaks can waste a lot of water over time. Simple repairs can lead to substantial water savings, reducing water bills and preventing water damage.
4. Installing low-flow faucets and showerheads reduces water consumption without sacrificing performance. These fixtures maintain good pressure with lower flow rates. They are easy to install and effective in saving water.
5. Smart irrigation systems use sensors to measure soil moisture and water plants only when necessary. This minimizes water waste by avoiding over-watering and enhances garden health while conserving water.
6. Using high-efficiency washing machines and dishwashers that consume less water can significantly reduce household water usage. Modern appliances are designed to be water-efficient, performing cleaning tasks with reduced water consumption and leading to long-term savings on water bills.
7. Green roofs involve growing plants on rooftops to absorb rainwater. They reduce storm water runoff, provide insulation, and help keep buildings cooler and more energy-efficient. Additionally, they add green space and promote biodiversity in urban areas.

8. Using mulching and other techniques to retain soil moisture reduces evaporation and the need for watering. This helps plants thrive with less water, offering an easy and cost-effective way to conserve water.
9. Permeable pavements allow water to soak through, helping to recharge groundwater and reduce runoff. They are ideal for driveways, walkways, and parking areas, preventing flooding and erosion in urban areas.
10. Dual plumbing systems install separate pipes for drinking and non-drinking water, optimizing the use of non-potable water for toilets and irrigation. This reduces demand for treated potable water and enhances overall water management efficiency.
11. Using smaller or shallower bathtubs that require less water reduces water consumption during baths. These bathtubs are ideal for households looking to cut water use while maintaining bathing comfort.
12. Installing pressure reducing valves (PRVs) lowers water pressure in the house, reducing the flow rate and saving water without affecting usability. They also prevent pipes from bursting due to high pressure, offering an easy and effective way to reduce water use.
13. Subsurface irrigation systems deliver water directly to plant roots underground, minimizing evaporation and water waste. They efficiently water plants with less water, making them ideal for gardens and agricultural use.
14. Green walls, or vertical gardens, absorb rainwater and provide insulation, reducing the need for extra watering and cooling. They enhance building aesthetics, improve air quality, and promote urban green spaces and biodiversity.
15. Storm water management systems use swales, rain gardens, and basins to capture and utilize rainwater for non-potable purposes. These systems reduce runoff, prevent flooding, and provide an alternative water source.

16. Smart home water management systems use smart meters and sensors to monitor water use, with automated controls optimizing water consumption. Leak detection systems identify and address leaks immediately, helping to track and reduce household water use.

17. Condensate recovery systems capture and reuse water from air conditioners and refrigeration units for irrigation, providing an extra source of non-potable water and reducing the need for fresh water in landscaping.

18. Infiltration trenches, filled with gravel or stone, allow rainwater to soak into the ground, enhancing groundwater recharge and reducing runoff. They are a simple and effective stormwater management solution, preventing flooding and erosion.

19. Constructed wetlands use natural processes involving wetland vegetation and soils to treat wastewater, reducing the need for fresh water in non-potable applications. They support local ecosystems and biodiversity while providing natural water treatment.

11. CONCLUSION

1. By understanding how much water we use directly and indirectly in our daily lives, we become more aware of our impact on water resources.
2. It is important to consider all the water we use, not just at home but also in industries and farming, to get a full picture of our water consumption.
3. Collecting accurate data on water use can be tough because it requires detailed and varied information from different sources.
4. Water use varies greatly depending on where you live due to factors like climate and local practices, so it's important to assess each region individually.
5. By pinpointing the main areas where we use the most water, we can focus on making improvements where they'll have the biggest impact.
6. Encouraging more sustainable methods in farming, industry, and at home can greatly reduce our overall water usage.
7. What we eat affects our water footprint. Generally, plant-based diets use less water than diets high in meat.
8. Looking at the entire life of a product from making it to disposing of it can reveal ways to reduce water use at each stage.
9. The findings can help shape policies that encourage water conservation and efficient water use through regulations and incentives.
10. Using technologies like drip irrigation and systems that recycle water can significantly cut down our water use.
11. Teaching people about their water footprint can help them make better choices that support water conservation.
12. Companies can use water footprint assessments to adopt more sustainable practices, becoming more efficient and socially responsible.
13. Reducing our water footprint helps address issues like water scarcity and ecosystem damage, contributing to a healthier environment.
14. Water-saving measures can also save money for households, businesses, and communities by reducing water bills and other costs.
15. Ongoing research is necessary to keep improving how we measure and reduce water footprints, finding new and innovative ways to save water.

12. REFERENCES

1. Prof. A. Balasubramanian, 17 March 2017. THE WORLD'S WATER, Technical Report August 2015, researchgate.
2. Oki, T., and Kanae, S. (2006). Global hydrological cycles and world water resources. *Science*, 313(5790), 1068–1072.
3. Seckler, David, Upali Amarasinghe, David Molden, Radhika de Silva & Randolph Barker. (1998) World Water Demand and Supply, 1990 to 2025: Scenarios and Issues. Research Report 19. Colombo, Sri Lanka: International Water Management Institute.
4. Tariq Ahmad Bhat , 2014. An Analysis of Demand and Supply of Water in India, *Journal of Environment and Earth Science* ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online) Vol.4, No.11.
5. Chapagain, A.K. and Tickner, D. 2012. Water footprint: Help or hindrance? *Water Alternatives* 5(3): 563-581.
6. Hoekstra, A.Y.; Chapagain, A.K.; Aldaya, M.M. and Mekonnen, M.M. 2011. The water footprint assessment manual: Setting the global standard. London. Washington, DC: Earthscan.
7. Chapagain, A.K. 2006. Globalisation of water: Opportunities and threats of virtual water trade. Leiden: A.A. Balkema Publishers, Taylor & Francis Group plc.
8. Water footprint network Manual, Fair and smart use of world's fresh water.
9. Yung-Jaan Lee, Chuan-Ming Tung et.al.2016, Personal Water Footprint in Taiwan: A Case Study of Yunlin County, *sustainability*, 8, 1112.
10. Harish Kumar Jeswani*, Adisa Azapagic 2011, Water footprint: methodologies and a case study for assessing the impacts of water use, *Journal of Cleaner Production Elsevier*, 19 (2011), pp 1288- 1299.
11. J. Chenoweth1, M. Hadjikakou et.al.2014, Quantifying the human impact on water resources: a critical review of the water footprint concept, *Hydrology and earth System. Science*, 18, pp 2325–2342.
12. Anand Krishnan Plappally, Malini Jhaver, 2013, Water Use and Related Costs at Households in Western and Northern Parts of India, *Hydrology Current Research*, Volume 4, Issue 3.
13. Vijay Kumar and Sharad K. Jain Virtual, 2007, Status of virtual water trade from India, *Current Science*, Vol. 93, NO. 8, pp 1093-1099.
14. Karabee Das, P.W. Gerbens-Leenes et.al, 2020, The water footprint of food and cooking fuel: A case study of self-sufficient rural India, *Journal of cleaner production Elsevier*.
15. Arjen Y. Hoekstra and Mesfin M. Mekonnen, 2011, The water footprint of humanity, *PNAS*, Vol. 109- No. 9 pp 3232–3237. 38

16. Mesfin M. Mekonnen and Winnie Gerbens-Leenes, 2020, The Water Footprint of Global Food Production, Water.
17. Sohail Ali Naqvi, Dr Masood Arshad, 2018 American Scientific Research Journal for Engineering, Technology, and Sciences, Volume 46, No 1, pp 17-24.
18. Madhuri. G, Ravi Tej Hegde, 2017, A Review on Water Footprint Study For Steel Industry, IJSART - Volume 3 Issue 7. ISSN [ONLINE]: 2395-1052, pp 634-637.
19. A.Y. Hoekstra, R. Bosman, 2018, The blue and grey water footprint of construction materials: Steel, cement and glass, Water Resources and Industry, pp 1-12.
20. Arjen Y. Hoekstra, Water Footprint Assessment: Evolvment of a New Research Field, Water Resour Manage, pp3061-3081.
21. Bhintuna Vaidya, Shreeya Shrestha, 2021, Water footprint assessment of food-water energy systems at Kathmandu University, Nepal, Current Research in Environmental Sustainability.

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

A

INTERNSHIP REPORT

ON

Cloud Computing (AZ-900)

(KasNet Technologies Pvt. Ltd.)

**SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS**

OF

Third Year (Computer Engineering)

Academic Year 2023-24

BY

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Department of Computer Engineering



Dr. M. V. Dalvi
Principal

Title page

Certificate

Certificate by guide

Certificate for conduction of examination

Certificate of originality

Contents

- Acknowledgment
- List figures
- List of tables
- Abbreviations
- Abstract
- Brief about each chapter
- Chapter -1:- Introduction
- Chpter-2:- Specifications Of Company
- Chapter-3:- Motivation, purpose and scope and objective of seminar
- Chpter-4:- Details of design/technology/Analytical and/or experimental work
- Chapter 5 Discussions and Conclusions
- Chapter 6 :- Bibliography
- Chapter 7:- Future enhancement
- References (in IEEE Format)
- Appendix

Abstract

Cloud computing has come of age since Amazon's rollout of the first of its kind of cloud services in 2006. It is particularly relevant to Hong Kong because of the tremendous amounts of data that are being processed here daily in various sectors, and there are signs that subscription to cloud services by the local companies will soon be on a skyrocket course, despite a slow start in previous years. As a research theme, cloud computing now easily tops any list of topics in computer science because of its far reaching implications in many areas in computing, especially big data which without cloud computing is at best a concept. Alibaba's jump in 2014 FQ on the bandwagon (www.aliyun.com), as well as the recent establishment of one of its datacenters in Hong Kong, signified the beginning of a new era in cloud computing where not just the scale, but also every other single aspect in a cloud service will meet with much elevated complexities. Hong Kong is poised to play a role in the advancement of cloud computing technologies because of its track record in networking, and recently cloud, research. The recent establishment of a major cloud R&D center in Hong Kong by Lenovo (January 2015) attests to this fact. Researchers in various local institutions already have an active agenda of important and significant problems for which they would like to seek the best and optimized solutions. We believe solving these problems will create a spot for Hong Kong in the world map of cloud computing research. The results will also benefit Hong Kong as the reliance on cloud computing services is rapidly increasing. This brief talk will outline some of the concerns pertaining to the further development of cloud computing into a mature technology that meets its original goals

Keywords :

cloud computing; cloud, Cloud types , Internet of Things (IoT), Cloud Services

Acronyms

Selected acronyms and abbreviations used in this paper are defined below.

IaaS

AaaS

PaaS

SaaS

IEEE

Infrastructure as a Service

Application as a Service

Platform as a Service

Software as a Service

Institute of Electrical and Electronics
Engineer

Chapter 1

Introduction To Cloud Computing

Cloud computing is the next natural step in the evolution of on-demand information technology services and products. To a large extent cloud computing will be based on virtualized resources.

The idea of cloud computing is based on a very fundamental principal of `reusability of IT capabilities`. The difference that cloud computing brings compared to traditional concepts of —grid computing, —distributed computing, —utility computing, or —autonomic computing is to broaden horizons across organizational boundaries.

According to the IEEE Computer Society Cloud Computing is:

"A paradigm in which information is permanently stored in servers on the Internet and cached temporarily on clients that include desktops, Entertainment centers, table computers, notebooks, wall computers, handhelds, etc."

Though many cloud computing architectures and deployments are powered by grids, based on autonomic characteristics and consumed on the basis of utilities billing, the concept of a cloud is fairly distinct and complementary to the concepts of grid, SaaS, Utility Computing etc.

In theory, cloud computing promises availability of all required hardware, software, platform, applications, infrastructure and storage with an ownership of just an internet connection.

people can access the information that they need from any device with an Internet connection— including mobile and handheld

phones—rather than being chained to the desktop. It also means lower costs, since there is no need to install software or hardware.¶

Cloud computing used to posting and sharing photos on orkut, instant messaging with friends maintaining and upgrading business technology

Chapter 2

Specifications Of Company

KasNet Technologies Pvt. Ltd. is an USA based company having association of Microsoft and PMI. Here, we did the Internship for six weeks and Learned the Microsoft technology and Microsoft Certification (AZ-900). A good job goes a long way in giving us more clients and more importantly we have reputation to protect kasNet was established primarily with enroute for knowledge dispersal through consulting and IT services in today's dynamic environment. The company enables your organization to manage resource through IT enabled services for optimum benefits. KasNet is a group of dedicated professionals, each an expert in his own field. From developers, to creative designer to business heads, each is an individual with plenteous experience in the field of academics, co-operate governance, marketing, advertising and IT solutions. KasNet specializes in the areas of Design of interactive Multimedia content, Web design and development, customized software solutions and e-commerce applications, etc To be globally respected corporation that provides best IT-solutions for Business, leveraging technology, delivered by best-in-class people. For us process is about a structure and working within the structure of provide decisive, effective and quality works our processes and are well aware of their true worth. To work honesty, and courtesy towards our clients, employees, vendors and society at large we play a Dual Positive Role by satisfying the academic requirements and as well as giving the necessary training in software design and development which enables Students to meet the industrial requirements with a wider knowledge and a greater confidence.

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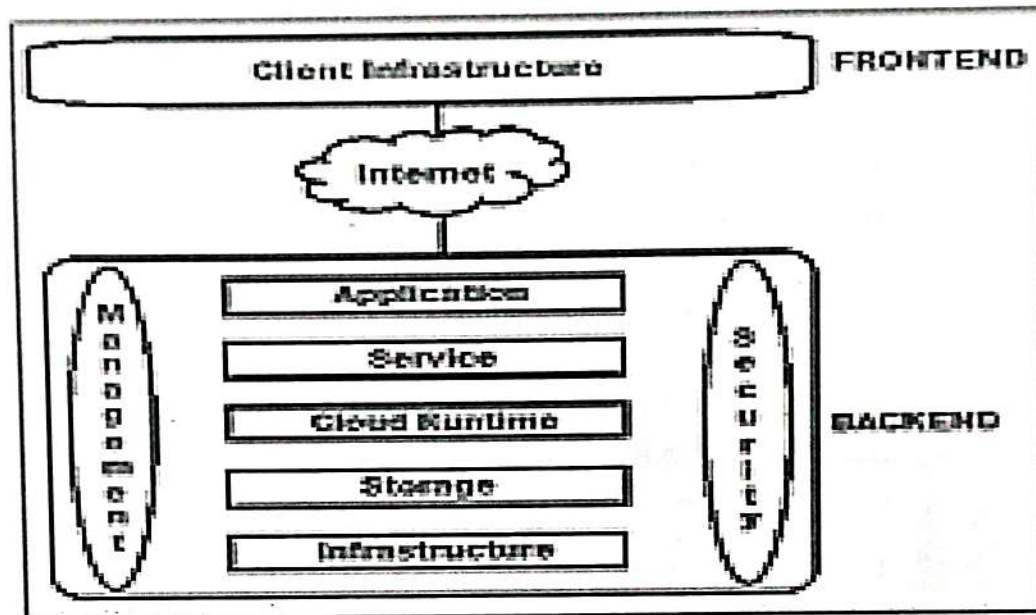
Purpose and Scope

Cloud computing allows resources such as computing power, storage, and bandwidth to be scaled up or down based on demand. This elasticity enables businesses to efficiently handle fluctuations in workload without significant upfront investment in infrastructure.

By leveraging cloud services, organizations can avoid the capital expenses associated with purchasing and maintaining physical hardware. Instead, they pay for what they use on a pay-as-you-go or subscription basis, reducing overall IT costs.

Cloud computing enables users to access applications and data from any location with an internet connection, providing greater flexibility for remote work and collaboration.

Design Implementation



Architecture of cloud computing is the combination of Client infrastructure, application, service, runtime cloud, storage, infrastructure, management and security all these are the components of cloud computing architecture.

1. Frontend:

Frontend of the cloud architecture refers to the client side of cloud computing system. Means it contains all the user interfaces and applications which are used by the client to access the cloud computing services/resources. For example, use of a web browser to access the cloud platform.

Client Infrastructure – Client Infrastructure is a part of the frontend component. It contains the applications and user interfaces which are required to access the cloud platform.

In other words, it provides a GUI(Graphical User Interface) to interact with the cloud.

2.Backend:

Backend refers to the cloud itself which is used by the service provider. It contains the resources as well as manages the resources and provides security mechanisms. Along with this, it includes huge storage, virtual applications, virtual machines, traffic control mechanisms, deployment models, etc.

Application -

Application in backend refers to a software or platform to which client accesses. Means it provides the service in backend as per the client requirement.

Service –

Service in backend refers to the major three types of cloud based services like SaaS, PaaS and IaaS. Also manages which type of service the user accesses.

Runtime Cloud-

Runtime cloud in backend provides the execution and Runtime platform/environment to the Virtual machine.

Storage –

Storage in backend provides flexible and scalable storage service and management of stored data.

Infrastructure

Cloud Infrastructure in backend refers to the hardware and software components of cloud like it includes servers, storage, network devices, virtualization software etc.

Management

Management in backend refers to management of backend components like application, service, runtime cloud, storage, infrastructure, and other security mechanisms etc.

Security

Security in backend refers to implementation of different security mechanisms in the backend for secure cloud resources, systems, files, and infrastructure to end-users.

Internet

Internet connection acts as the medium or a bridge between frontend and backend and establishes the interaction and communication between frontend and backend.

Database– Database in backend refers to provide database for storing structured data, such as SQL and NOSQL databases. Example of Databases services include Amazon RDS, Microsoft Azure SQL database and Google CCloud SQL.

Networking– Networking in backend services that provide networking infrastructure for application in the cloud, such as load balancing, DNS and virtual private networks.

Analytics– Analytics in backend service that provides analytics capabilities for data in the cloud, such as warehousing, bussness intellegence and machine learning.

Cloud Deployment Model

Public cloud:

Public cloud or external cloud describes cloud computing in the traditional mainstream. Public clouds are run by third parties, and applications from different customers are likely to be mixed together on the cloud's servers, storage systems, and networks. A public cloud provides services to multiple customers.

Hybrid cloud:

Hybrid clouds combine both public and private cloud models. This is most often seen with the use of storage clouds to support Web 2.0 applications.

Private cloud:

Private clouds are built for the exclusive use of one client, providing the utmost control over data, security, and quality of service. The company owns the infrastructure and has control over how applications are deployed on it. Private clouds can be built and managed by a company's own IT organization or by a cloud provider.

Cloud Services Model

Cloud computing products and services can be classified into 4 major categories:

Application as service (AaaS)

Platform as a Service (PaaS)

Infrastructure as a service (IaaS)

Software as a Service (SaaS)

Application as s service (AaaS): These are the first kind of cloud computing services that came into being. Under this, a service is made available to an end-user. The end-user is asked to create an account with the service provider and start using the application. One of first famous application was web-based email service by hotmail started in 1996. Scores of such services are available now on the web.

Platform as a Service (PaaS): Cloud vendors are companies that offer cloud computing services and products. One of the services that they provide is called PaaS. Under this a computing platform such as operating system is provided to a customer or end user on a monthly rental basis. Some of the major cloud computing vendor are Amazon, Microsoft, Google etc

Infrastructure as a service: The cloud computing vendors offer infrastructure as a service. One may avail hardware services such as

processors, memory, networks etc on agreed basis for specific duration and price.

Software as a service (SaaS): Software package such as CRM or CAD/CAM can be accessed under cloud computing scheme. Here a customer upon registration is allowed to use software accessible through net and use it for his or his business process. The related data and work may be stored on local machines or with the service providers. SaaS services may be available on rental basis or on per use basis.

Benefits

Faster time to market

You can spin up new instances or retire them in seconds, allowing developers to accelerate development with quick deployments. Cloud computing supports new innovations by making it easy to test new ideas and design new applications without hardware limitations or slow procurement processes.

Scalability and flexibility

Cloud computing gives your business more flexibility. You can quickly scale resources and storage up to meet business demands without having to invest in physical infrastructure.

Companies don't need to pay for or build the infrastructure needed to support their highest load levels. Likewise, they can quickly scale down if resources aren't being used.

Cost savings

Whatever cloud service model you choose, you only pay for the resources you actually use. This helps you avoid overbuilding and overprovisioning your data center and gives your IT teams back valuable time to focus on more strategic work.

Better collaboration

Cloud storage enables you to make data available anywhere you are, anytime you need it. Instead of being tied to a location or specific device, people can

access data from anywhere in the world from any device—as long as they have an internet connection.

Advanced security

Despite popular perceptions, cloud computing can actually strengthen your security posture because of the depth and breadth of security features, automatic maintenance, and centralized management.

Reputable cloud providers also hire top security experts and employ the most advanced solutions, providing more robust protection.

Data loss prevention

Cloud providers offer backup and disaster recovery features. Storing data in the cloud rather than locally can help prevent data loss in the event of an emergency, such as hardware malfunction, malicious threats, or even simple user error.

Limitation

Downtime

The biggest disadvantage of cloud computing is downtime because most of the business totally depends on the internet to access the data or cloud storage and your business gets affected negatively in a downtime situation. Downtime basically interrupts the workflow of business, your organization will not run smoothly.

Technical Problem

Using cloud computing you have to depend on customer care 24/7 because if you face some technical problem that you cannot manage, then you have to contact customer care. But they may not be available to help you 24/7.

Data Mobility

Data mobility enables us to share the data between various cloud services. If you decide, one day, to end your cloud computing subscription, there may still be local storage from where your data can get used anytime.

Risk of Data Confidentiality

There are also some issues regarding data confidentiality or risk on your data. Thus the cloud protection must secure confidentiality.

Depends on the Internet Connection

Cloud computing fully depends on the internet connection. Whenever you have a disturbance in the network connection, you cannot access the cloud. It is an obstacle to access the machine remotely.

Future Scope

The future of cloud computing appears to be quite promising, with several trends and developments driving its growth and evolution:

Edge Computing Integration: As the Internet of Things (IoT) continues to expand, there will be a greater need for processing data closer to the source. Cloud computing will integrate with edge computing, enabling faster response times and reduced latency for IoT applications.

Hybrid and Multi-Cloud Solutions: Many organizations are adopting a hybrid cloud approach, combining private and public cloud services, as well as utilizing multiple cloud providers. This trend is likely to continue as businesses seek flexibility, scalability, and redundancy.

AI and Machine Learning Integration: Cloud providers are increasingly offering AI and machine learning services as part of their platforms. These services enable organizations to derive insights from large datasets and automate various processes, leading to increased efficiency and innovation.

Serverless Computing: Serverless computing, also known as Function as a Service (FaaS), abstracts away infrastructure management, allowing developers to focus solely on writing code. This model is gaining popularity due to its scalability, cost-effectiveness, and ease of use.

Conclusion

Cloud computing builds on decades of research in virtualization, distributed computing, utility computing, and more recently networking, web and software services. It implies a service oriented architecture, reduced information technology overhead for the end-user, great flexibility, reduced total cost of ownership, ondemand services and many other things. In today's global competitive market, companies must innovate and get the most from its resources to succeed. Cloud computing infrastructures are next generation platforms that can provide tremendous value to companies of any size. They can help companies achieve more efficient use of their IT hardware and software investments and provide a means to accelerate the adoption of innovations. Cloud computing increases profitability by improving resource utilization. Costs are driven down by delivering appropriate resources only for the time those resources are needed. Cloud computing has enabled teams and organizations to streamline lengthy procurement processes. Cloud computing enables innovation by alleviating the need of innovators to find resources to develop, test, and make their innovations available to the user community. Innovators are free to focus on the innovation rather than the logistics of finding and managing resources that enable the innovation.

Microsoft Cloud Internship. Azure Fundamentals.

Asmita Yuvraj Barkade .

Student of

Navsahyadri Education Society's Group of Institutions , Pune

has completed Cloud Computing (AZ-900) Internship with KasNet Technologies Pvt.Ltd

Date of Achievement:2024-02-23




Director
KasNet Technologies Pvt Ltd



Reg. No.: U72900PN2014PTC15149

Project Report
On
“Automated Drawing and Universal Writing Machine”

By
Burle Sakshi Pandurang (B190904239)
Badadhe Rajgauri Sunil (B190904203)
Nangare Harshad Dattatray (B190904225)
Pawar Sanket Santosh (B190904229)

Under the guidance of
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SAVITRIBAI PHULE
PUNE UNIVERSITY

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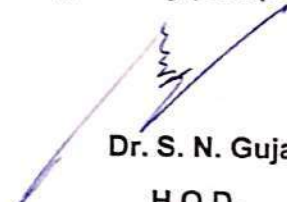
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Prof. D.A.Gore

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Dr. S. N. Gujar

H.O.D.

Dept. of Computer Engineering



College Seal


Dr. M.V.Dalvi

Principal

Place: Navsahyadri Group of Institutes, Faculty of Engineering, Naigaon [Nasarapur], Pune-412213

Date: 27-05-24

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External Examiner

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Date: 27-05-24

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Index

Chapter -1:- Introduction

1.1 Motivation	01
1.2 Goal	01
1.3 Objective	02
1.4 Problem Statement	02
1.5 Scope of the work	02
1.6 Outcomes	03

Chpter-2:- Literature survey

2.1 Paper Name (IEEE format)	06
Paper Proposed	06
Limitations	06

Chapter-3:- Requirement Analysis

3.1 Responsibilities of developer	07
3.2 External Interface Requirement	07
3.3 System Features	08

Chpter-4:- Proposed system

4.1 Background Needed	10
4.2 Proposed System Architecture.....	10
4.3 Algorithm	10
4.4 Mathematical Model	11
4.5 NP analysis	11
4.6 System Design Diagram	14
4.6.1 Data Flow Diagram	14
4.6.2 Activity Diagram	15
4.6.3 Class Diagram	16
4.6.4 Deployment Diagram	17
4.6.5 Sequence Diagram	18

4.6.6 Use Case Diagram	19
4.6.7 State Diagram	20

+

Chapter 5:- System Analysis

5.1 Project plan	21
5.2 Software Development Life Cycle	22
5.3 Time line of project	24
5.4 Risk analysis	24
5.5 Risk management	25
5.6 Project risk	25
5.7 Risk avoidance	25
5.8 Effort & Cost estimation	26

Chapter 6:- Conclusion & Future enhancement

6.1 Conclusion	27
----------------------	----

References

Strictly in IEEE format	28
-------------------------------	----

Appendix

- A. Plagiarism Report
- B. Publications
 - 1. Journal/Conference Certificate
 - 2. Publication comment by reviewer

List of Tables

Table No	Title	Page No
01	Literature Survey	06
02	Project Plan	21

List of Forms

Figure No	Title	Page No
4.2	Architecture	11
4.6.1	Data Flow Diagram	14
4.6.2	Activity Diagram	15
4.6.3	Class Diagram	16
4.6.4	Deployment Diagram	17
4.6.5	Sequence Diagram	18
4.5.6	Use Case Diagram	19
4.5.7	State Diagram	20

Introduction

Abstract

Nowadays more and more individuals are turning to robots to do their work, because robots are more versatile, accurate, reliable and also reduce human efforts. Robotic arms are programmed robot with similar function of a human arm. Aim of our project is to develop a robotic arm which helps the physically handicapped person to write. The mechanism is programmed with speech recognition system and makes the user to write what he speaks. The robotic arm is programmed to write down the words that patient or individual pronounces to the microphone. To perform the writing operations, the robotic arm will be fitted with a pen. It can also make you draw small sketches. It will be a low cost device that can be programmed to enable the people who are physically challenged to write. This paper describes the basic design of automated writing arm

The aim of this project is to develop an affordable robotic arm that assists physically handicapped individuals in writing tasks. The robotic arm will be controlled by a speech recognition system that will convert spoken words into written text. Additionally, the arm will have the capability to draw simple sketches. Overall, the aim is to provide a cost-effective solution that enables physically challenged individuals to write independently.

Introduction

1.1 Motivation

India's population is expanding daily, which has a significant impact on the growth of both the private and public transportation options. This rise in the number of cars is also contributing to an increase in traffic and the variety of crimes that go along with it. There have been several theft, hit-and-run, theft, kidnapping, smuggling, on-avenue fatalities, etc. incidents. Unsolved because the cars involved couldn't be precisely recognized. The project's motivation is to automate the laborious processor locating a vehicle's license plate that is still used in India.

1.2 Goal

The goal of the project is to develop an affordable robotic arm that assists physically handicapped individuals in writing tasks. This robotic arm will utilize a speech recognition system to transcribe spoken words into written text. Additionally, the arm will have the capability to draw simple sketches. Overall, the aim is to provide a cost-effective solution that empowers physically challenged individuals to write independently.

1.3 Objective

1. To save the wastage of time.
2. To design a user-friendly automated writing machine with computer numerical control (CNC) along with Arduino.
3. To draw and write in own handwriting.
4. To make the notes in our own handwriting just by giving the input to the machine

1.4 Problem Statement

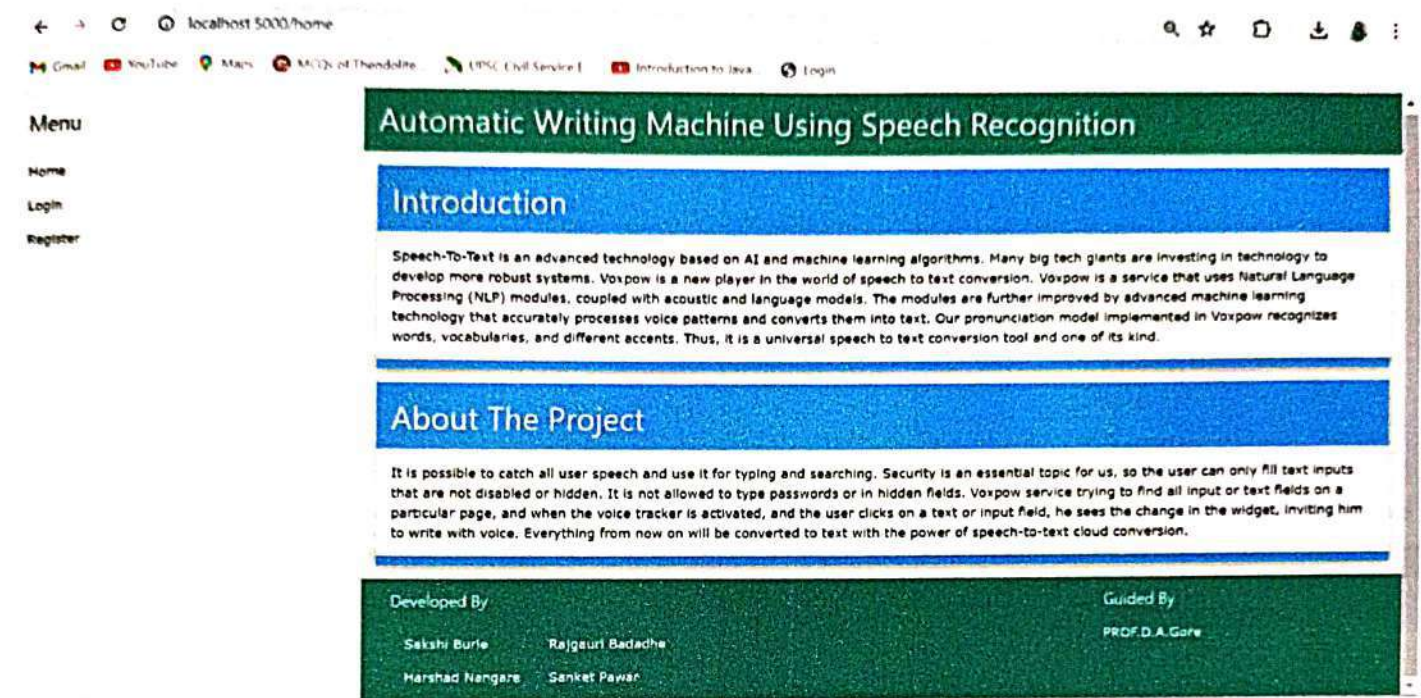
To design automated drawing and universal writing machine for users by using connectionist temporal classification algorithm, IOT, Machine learning .

1.5 Scope of the work

- This machine is used for handicap people.
- In future it will perform panting task to the home wall etc.
- This machine is mostly used for the student for writing te assignment work etc.
- This machine is used to save the time.

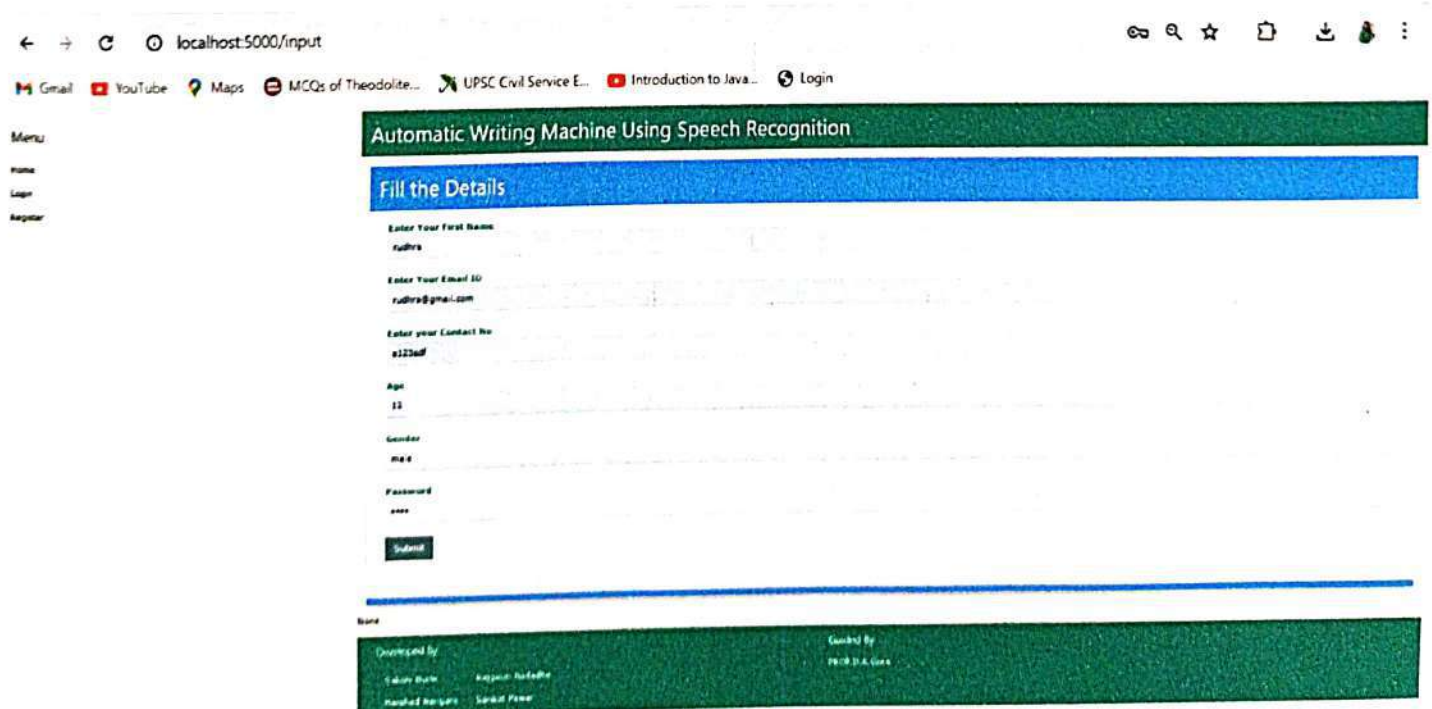
1.6 Outcomes

1.Home page:



2.Register page:

Filling the form with an invalid phone number:



- Registration validation throws error;

localhost:5000/signup

Automatic Writing Machine Using Speech Recognition

Fill the Details

Enter Your First Name

Enter Your Last ID

Enter your Contact No

Age

Gender

Password

Submit

Insert phone number, please enter a 10 digit number.

Developed By

Sakshi Bhat

Rajashree Bhat

Harshad Mangani

Sanket Purohit

Guided By

PRASHANT A. Gore

3. Login page:

localhost:5000/login

Automatic Writing Machine Using Speech Recognition

Fill the Details

Enter Your Username

sakshi

Password

Submit

None

Developed By

Sakshi Bhat

Rajashree Bhat

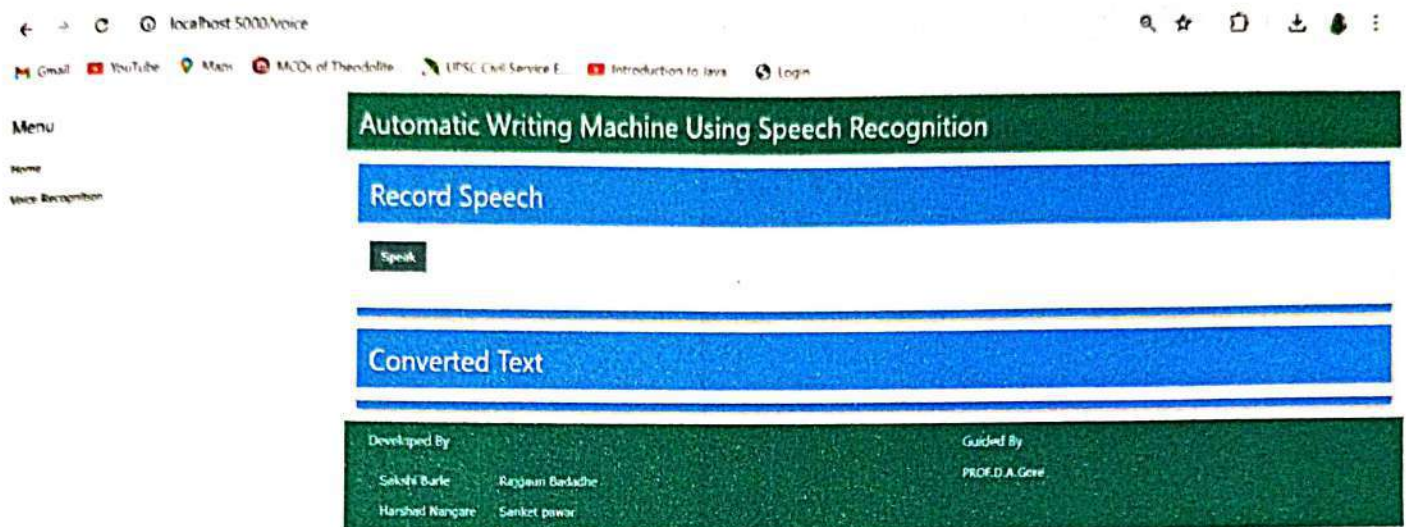
Harshad Mangani

Sanket Purohit

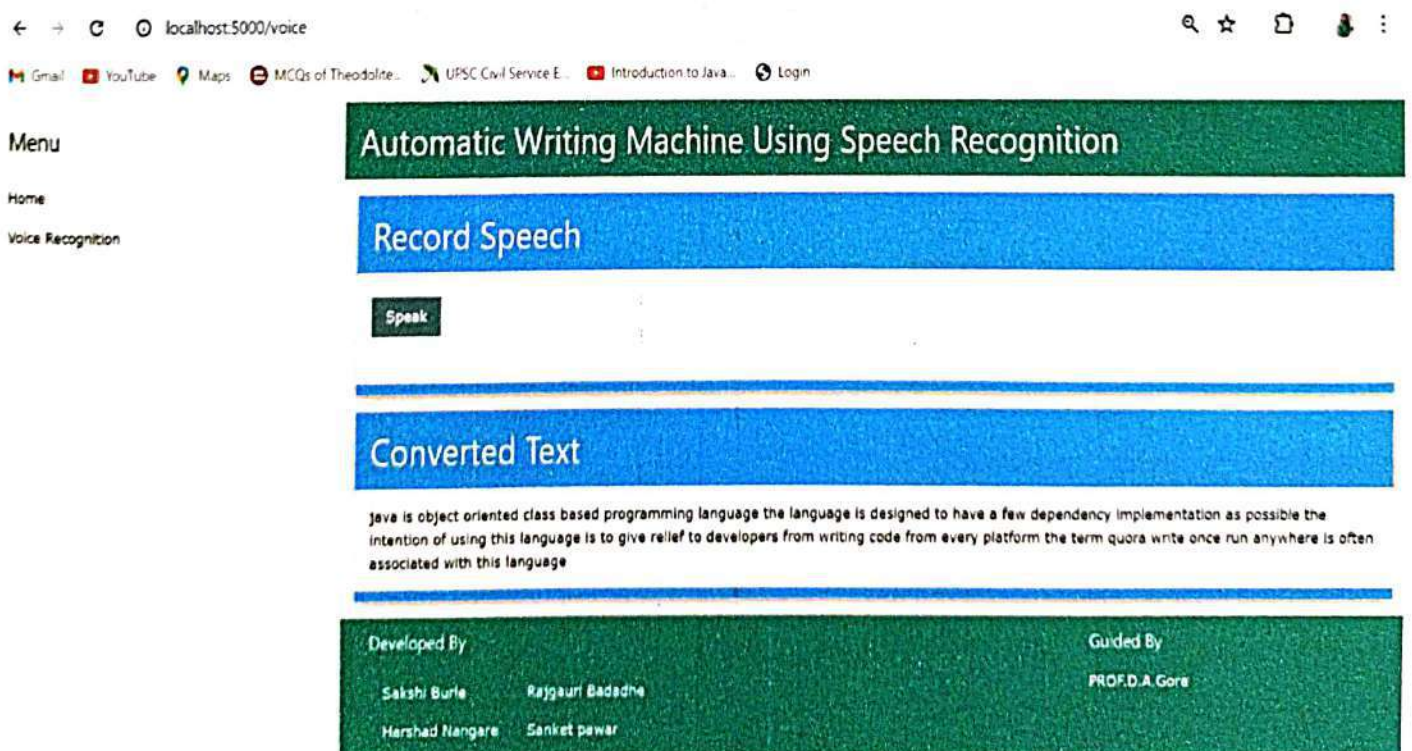
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4. Voice recognition:



5. Speech-to-text:



Literature survey

Sr.No	Title of paper	Author	Publication And Year	Findings
1.	Automated writing and drawing machine	M.Aditi B.Nandini	2022	The mechanism is programmed with speech recognition system and makes the user to write what he speaks.
2.	A new developed technique for handwriting robot	M.N Mohammed	2021	Inkscape and g-code was utilized for generation signal from the drawing to be used by the micro-controller.
3.	Speech to text conversion for multilingual languages	Yogita H. Ghadge,Shushma D. Shelke	2021	Conversion is based on information in speech signal. Speech is the natural and most important form of communication for human being. Speech-To-Text (STT) system takes a human speech utterance as an input and requires a string of words as output.
4.	Real time Speech to text conversion system using bidirectional Kalman filter in matlab.	Neha Sharma,Shipra Sardana	2022	We used the design of a bidirectional nonstationary Kalman filter to enhance the ability of this Real time speech recognition system. Bidirectional Kalman filter has been proved to be the best noise estimator in nonstationary noiseous environment

Requirement Analysis

3.1. Responsibility:-

1. Designing the software:-Developing the software that controls the machine's movements and actions, ensuring precise writing and drawing according to predefined patterns or user input.
2. Integrating hardware and software:- Writing code to integrate the software with the hardware components of the machine, such as stepper motors, servo motor and controllers, to ensure they work together smoothly.
3. User interface design:- Creating user-friendly interfaces for controlling the machine, allowing users to input commands, select designs, and interact with the machine easily.
4. Testing and debugging:- Conducting thorough testing to identify and fix any bugs or issues in the software, ensuring the machine operates reliably and accurately.
5. Support and maintenance:- Providing ongoing support and maintenance for the software, including updates, customer care and troubleshooting assistance, to ensure the continued operation of the machine.
6. Continuous improvement:- Seeking feedback from users and stakeholders to identify areas for improvement and implementing enhancements or new features to enhance the machine's capabilities over time. Users feedback is needed for our project improvement.

3.2. External interface requirement:-

1. User interface:-

The requirements section of hardware includes a minimum of 100 GB hard disk and 4GB RAM with 1 GHz or higher speed. The primary requirements include a memory of 1 GB for the application of python and MySQL.

(If required).The user interface of this program is the common windows interface, nothing additional is required. The System user interface should be intuitive, such that 99.9% of all new system users are able to use Proposed System applications without any assistance.

User registered into the system and logged in then input to system as gesture and wait for response for system. The user interacts with the android application.

2. Hardware interface:-

The hardware should have following specifications:

- Ability to read gallery
- Ability to exchange data over network
- Continuous power supply
- Ability to connect to network
- Ability to take input from user
- Ability to validate credit

3. Software :-

The computer this software is going to install needs to have a python IDE equal or above, Windows 7. On that Windows platform python, python version 3. will be installed and that will be the platform the particular software will be run. There will be a python IDE data transmission.

4. Communication interface:-

Communication architecture defines the frequency and fidelity of information flow between individuals in your organization. It helps structure how and when you communicate, both within a team and cross-functionally. The specific tactics are unique to each organization, but it requires proactive thought and investment.

3.3 System Features

1. User interface:-

the user can interact the web design and even non technical people can handle easily.

2. Speech Recognition System:

The arm is equipped with a speech recognition system that allows the user to control it by speaking commands or dictating text.

3. Reduced Human Effort:

By automating the writing process, the robotic arm reduces the physical effort required by the user, making it easier for physically challenged individuals to write.

4. Low Cost:

The device is designed to be cost-effective, making it accessible to a wider range of users.

5. Customizable:

The arm can be programmed to accommodate different writing styles and preferences of individual users.

6. Solar system:

While working with hardware may be power gets off then work will be stopped there so we add a new feature in as a solar system. That means the user can work reliably without any interrupt and disturbance.

Chapter 4

Proposed System

4.1 Background needed

1. **switch** : the basic and most important need is power supply we had another solution for it that is nothing but a solar system to get power as a backup plan.
2. **Table** : we need a clean surface for starting work. The surface must be plain.
3. **Pen** : we use pen for draw or may be writing purpose. The pen us attached to the servo motor. We can use pen, pencils, sketch pens etc.
4. **Paper** : with the help of pen, we can write a text or draw a sketch in a paper.
5. **Weird** : to connect laptop with hardware.

4.3 Algorithm

4.2 Proposed system architecture

We know there are many areas in human life which require t write the matter by ink on a paper in their own handwriting.

For example: Departments like Administration, Judicial, Municipal, Police, etc.

having clerks for writing the matter manually. For eliminating this heavy work we are going to introduce an automatic writing machine.

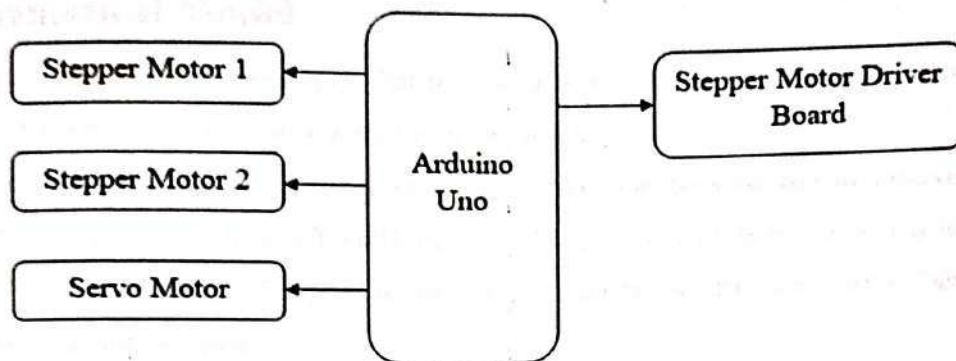
CNC Machines are Computerized Numerical Control Machines which are used to draw anything or design any mechanical part according to the design program fed into their controller unit. Controller unit can be either computer or microcontroller.

CNC machines have stepper and servo motors to draw the design as per the fed program. After researching on CNC machines, I decided to build my own CNC machine using locally available materials.

There are so a many CNC machines in the world, some of which are much technical and complex to make or even operate them properly. For this reason, I decided to make a CNC

Plotter Machine based on Arduino which is by far the simplest to make. This DIY Arduino CNC Machine can draw most of the basic shapes, texts and even cartoons.

It's operation is similar to the way a human hand writes. It's faster and more accurate compared to the way a human being can write or draw.



4.2.1

4.3 Algorithm:

The implementation of automatic pen writer are discussed below:

- * Installation of arduino software in system.
- * The programming code will be uploaded in the arduino uno board once the devices is fixed .
- * The sensors used recognizes the user and fetch user input with stored documents and returns result and start writing on paper.
- * The sensor is more efficient than speech in dependent system. Speaker-independent speech recognition has been proven to be very difficult ,because pattern matching would fail to handle include accents and varying speed of delivery, pitch, volume and inflection
- * One more use of this invention if the user wants a fresh document which doesn't exist in the hard disk or plates then automatic pen allows this by sensing our mind signals and then write
- * It stores the new document in the hard disk for later use.

Hence in this way the automatic pen writer with sensor works to automate writing system for physically challenged people unable to write. Hence it makes a new and better way of communication for them.

4.4 Mathematical Model

Imagine you have a magical pen that moves on a piece of paper. This pen follows a path and we want to describe how it moves using math.

Parameter (t): Think of "t" as time or progress. As time goes on, our pen moves along the paper. Equations for X and Y ($x(t)$ and $y(t)$): " $x(t)$ " tells us where the pen is horizontally. " $y(t)$ " tells us where the pen is vertically. Functions ($f(t)$ and $g(t)$): These are like instructions for our pen.

They determine how much it moves horizontally ($f(t)$) and vertically ($g(t)$) at each moment in time.

So, if you want to draw a specific curve or shape, you choose functions for $f(t)$ and $g(t)$ that fit what you have in mind. As time (t) changes, these functions guide the pen, creating a beautiful drawing.

$x(t) = \text{radius} \times \cos(t)$ for the horizontal movement.

$y(t) = \text{radius} \times \sin(t)$ for the vertical movement.

This way, as time progresses, the pen follows the circular path. By adjusting the radius or using different functions, you can create various drawings.

4.5 NP analysis

The task of controlling a CNC writing and drawing machine to replicate digital designs onto a surface is not inherently classified as an NP-complete or NP-hard problem.

NP-complete and NP-hard are terms used in computational complexity theory to describe decision problems.

The concept of NP-completeness might be related to an automated writing machine or a 2D plotter.

The movement of a 2D plotter involves determining a sequence of commands that guide the pen to produce a desired image or text. The challenge is to find an optimal or feasible set of commands that achieve the desired output. This process can be seen as a computational problem.

The NP-completeness aspect may come into play when considering the complexity of finding the optimal set of commands. If the problem of determining the optimal sequence of commands for a 2D plotter is NP-complete, it implies that there may not be an efficient algorithm to find the optimal solution.

In other words, the problem may require exponential time to solve as the size of the input (e.g., the complexity of the drawing) increases.

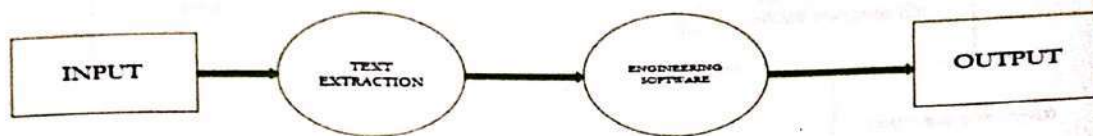
In the context of a 2D plotter, the input could be the specifications of the desired drawing the challenge is to find the sequence of movements that will create that output.

The NP-completeness of such a problem suggests that, in the general case, finding the optimal solution may be computationally and intractable.

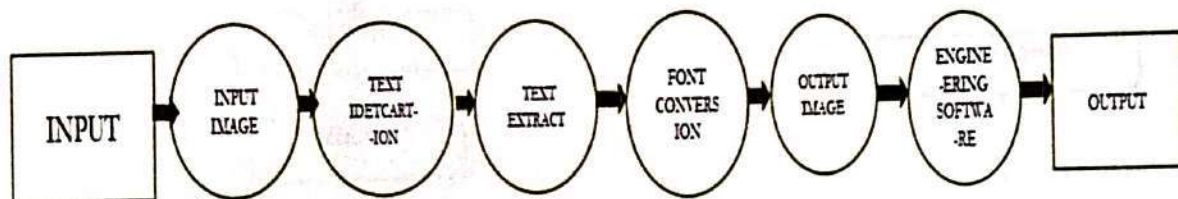
4.6 System Design Diagram

4.6.1. Data flow Diagram:-

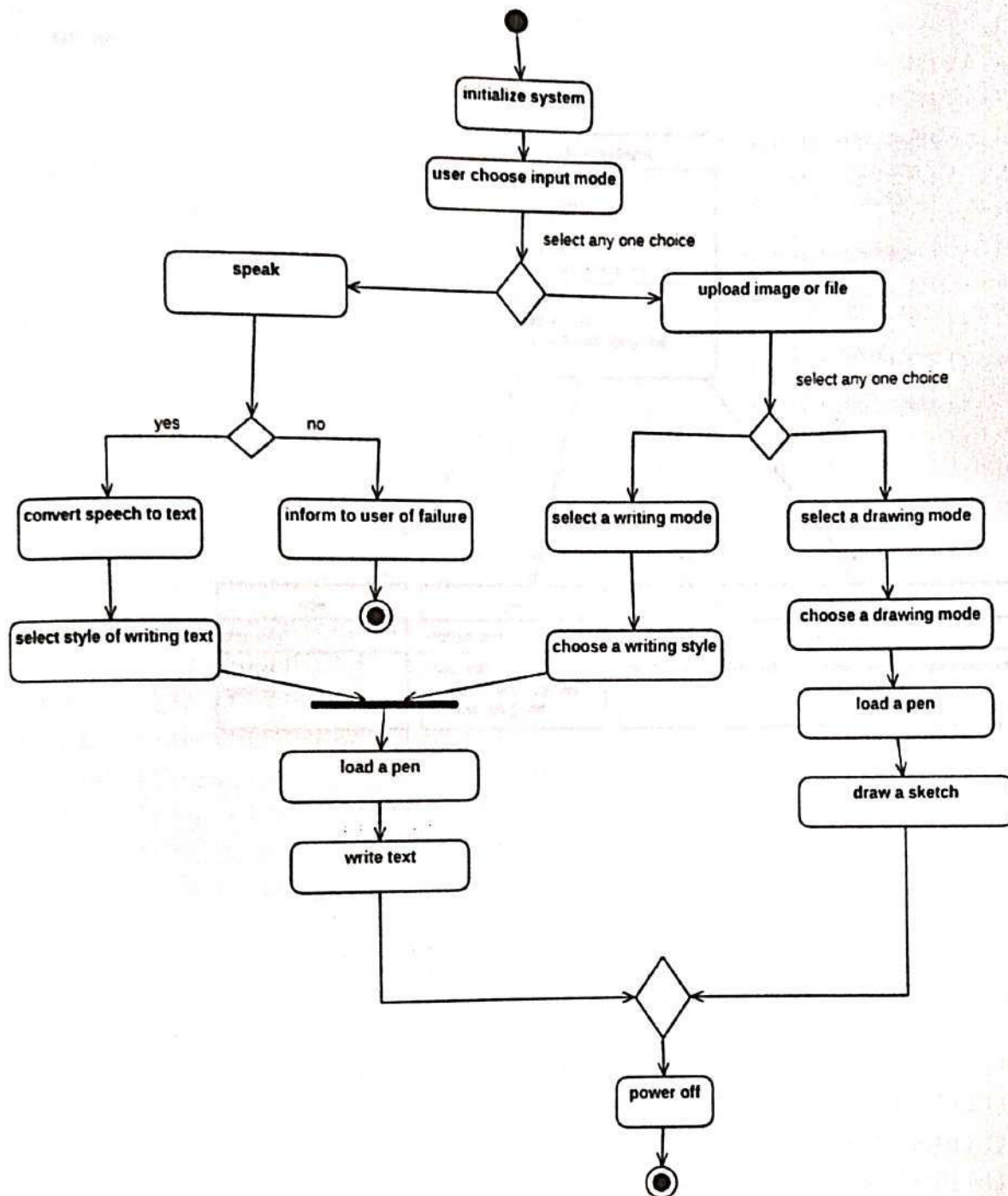
4.6.1.1 Level 0



4.6.1.2 level 1

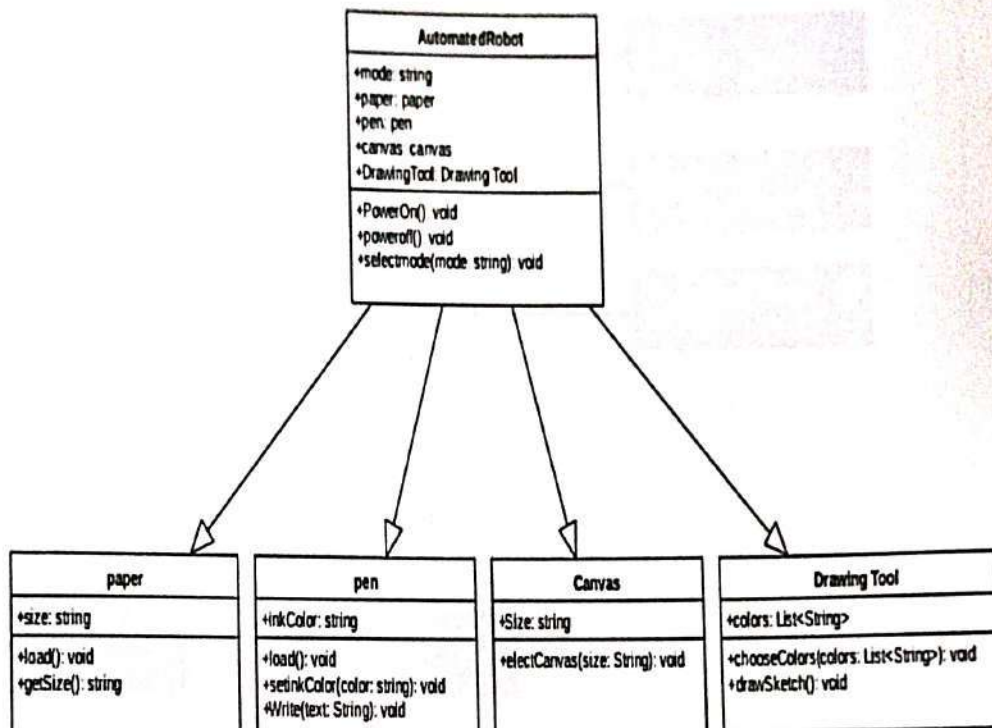


4.6.2 Activity Diagram

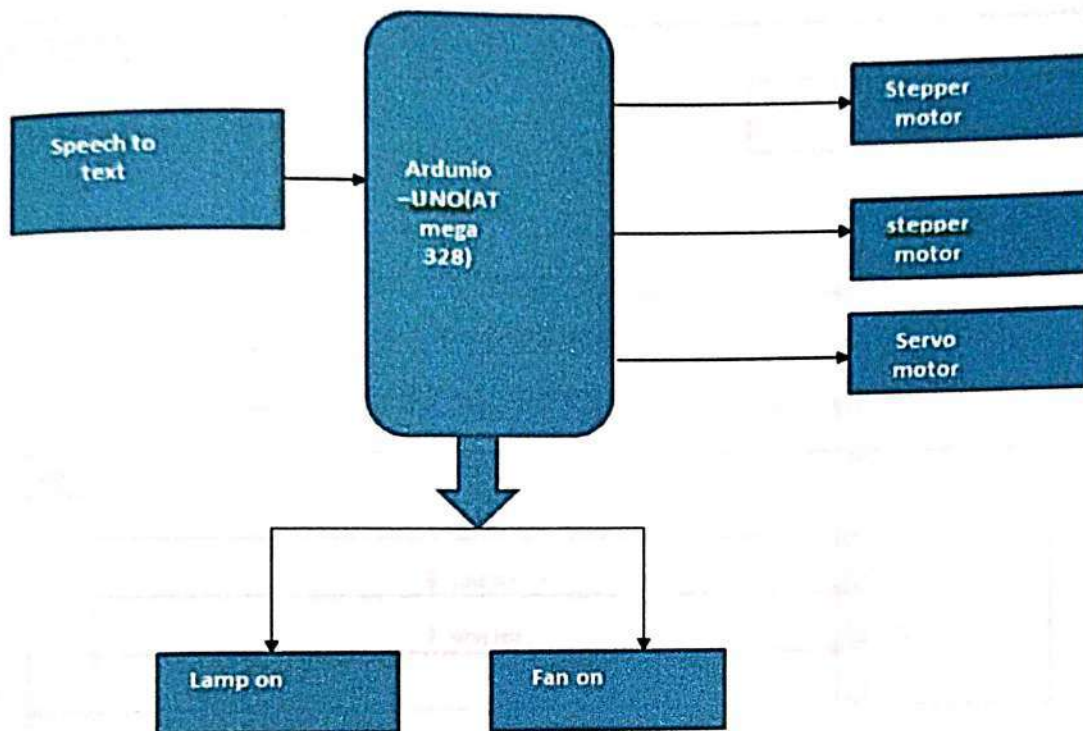


4.6.3 Class Diagram

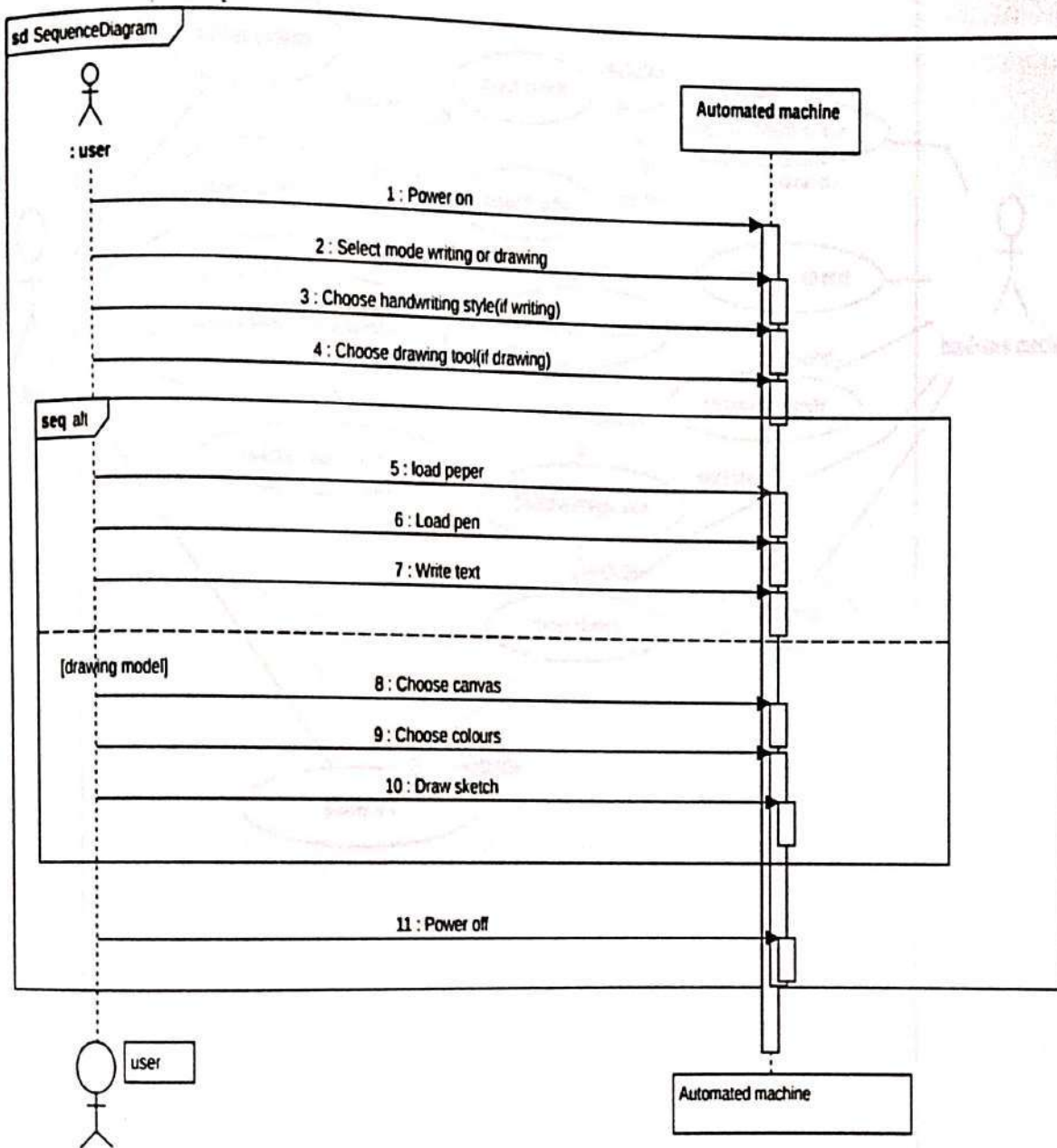
Model Main



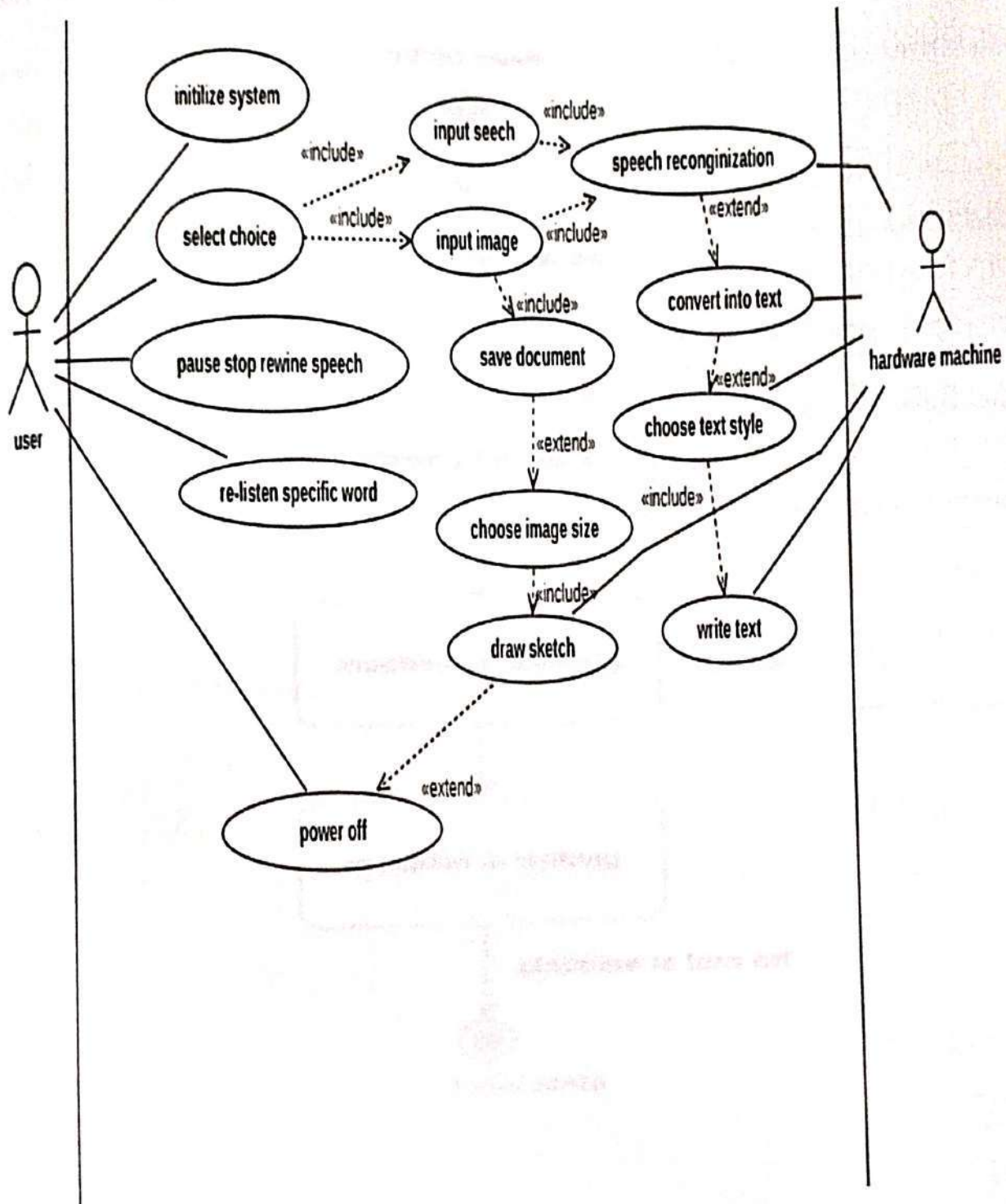
4.6.4 Deployment Diagram



4.6.5 Sequence Diagram

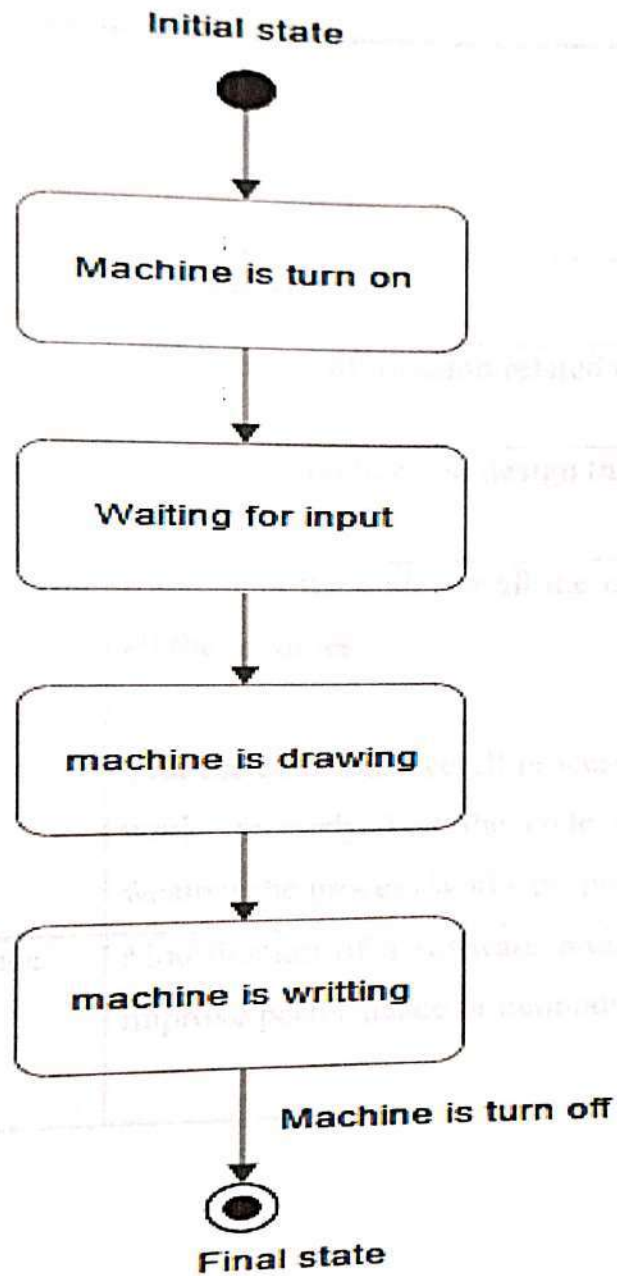


4.6.6 Use Case Diagram



4.6.7 State Diagram

Chapter 8



5.1 Project plan

Phase	Task	Description
Phase 1	Analysis	Analyze the information related to project Topic
Phase 2	System Design	Assign the module and design the process flow control
Phase 3	Implementation	Implement the code for all the modules and integrate all the modules
Phase 4	Testing	Test the code and overall process whether the process works properly Test the code and over all process whether the process works properly
Phase 5	Maintenance	Modification of a software product after delivery to improve performance or maintainability

5.2 Software development life cycle

Stage1: Planning and requirement analysis:

Requirement Analysis is the most important and necessary stage in SDLC. The senior members of the team perform it with inputs from all the stakeholders and domain experts or SMEs in the industry. Planning for the quality assurance requirements and identifications of the risks associated with the projects is also done at this stage.

Business analyst and Project organizer set up a meeting with the client to gather all the data like what the customer wants to build, who will be the end user, what is the objective of the product. Before creating a product, a core understanding or knowledge of the product is very necessary.

Stage2: Defining Requirements:

Once the requirement analysis is done, the next stage is to certainly represent and document the software requirements and get them accepted from the project stakeholders.

This is accomplished through "SRS"- Software Requirement Specification document which contains all the product requirements to be constructed and developed during the project life cycle.

Stage3: Designing the Software:

The next phase is about to bring down all the knowledge of requirements, analysis, and design of the software project.

This phase is the product of the last two, like inputs from the customer and requirement gathering

Stage4: Developing the project:

In this phase of SDLC, the actual development begins, and the programming is built. The implementation of design begins concerning writing code.

Developers have to follow the coding guidelines described by their management and programming tools like compilers, interpreters, debuggers, etc. are used to develop and implement the code.

Stage5: Testing:

After the code is generated, it is tested against the requirements to make sure that the products are solving the needs addressed and gathered during the requirements stage.

During this stage, unit testing, integration testing, system testing, acceptance testing are done.

Stage6: Deployment:

Once the software is certified, and no bugs or errors are stated, then it is deployed.

Then based on the assessment, the software may be released as it is or with suggested enhancement in the object segment. After the software is deployed, then its maintenance begins.

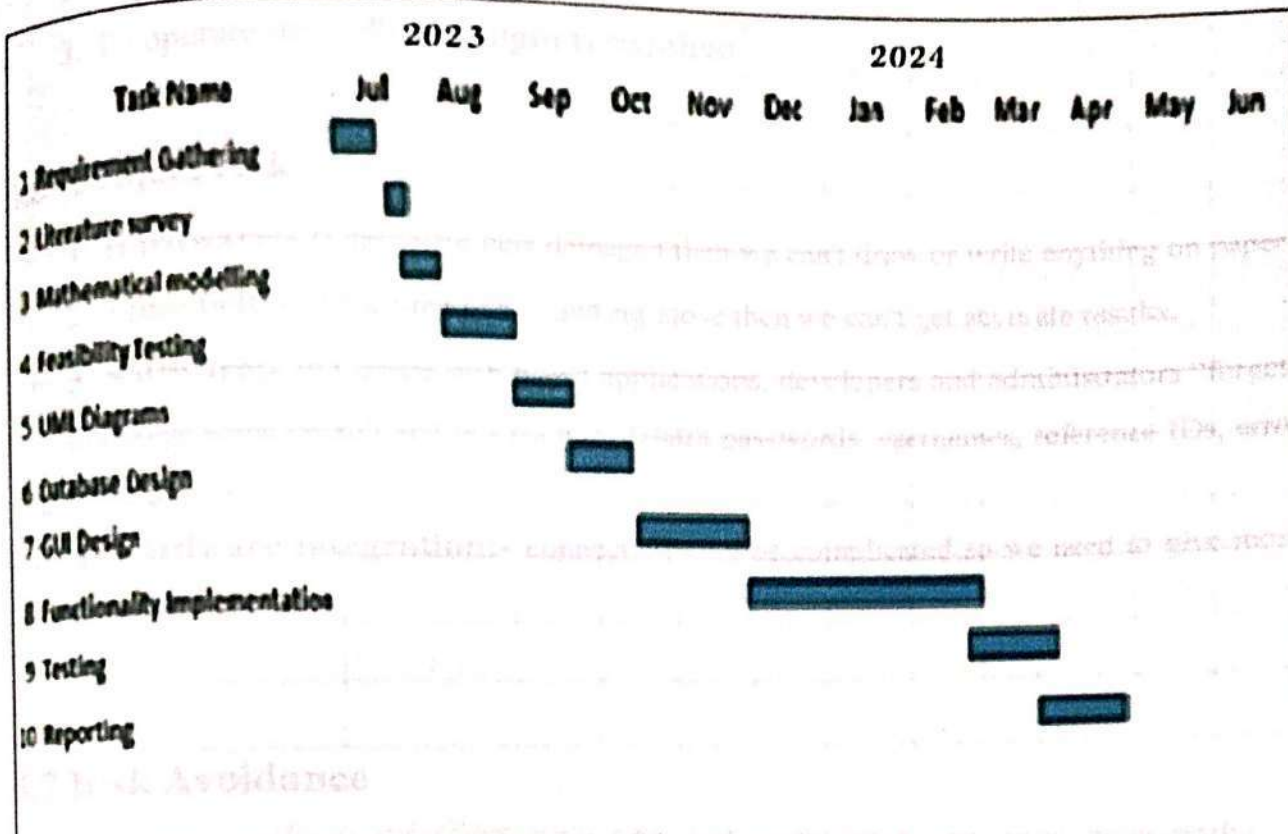
Stage7: Maintenance:

Once when the client starts using the developed systems, then the real issues come up and requirements to be solved from time to time.

This procedure where the care is taken for the developed product is known as maintenance.



5.3 Time line of project



5.4 Risk analysis

- 1. Speech recognition :-** The user speech in front of the machine is catching all the words but sometimes it takes a long time to recognise or may fail due to the background noise.
- 2. Robotic arm :-** robotic arm should be in the right position or in the right distance from the page that means it can write or draw properly.
- 3. Privacy :-** the password of the software to login the user can be kept in mind. That means outside of people or no one can access the machine.

5.5 Risk management

1. maintenance required
2. solar power need sun raise.
3. To operate the software login is required.

5.6 Project risk

1. **Hardware:-** If hardware gets damaged then we can't draw or write anything on paper.
2. **Time belt:-** If the time belt is getting loose then we can't get accurate results.
3. **Software:-** We create web based applications. developers and administrators "forget" to change some default settings such as default passwords, usernames, reference IDs, error messages, etc.
4. **Hardware integration:-** connection may be complicated so we need to give more attention.

5.7 Risk Avoidance

1. **Safety:** Make sure the arm moves safely and won't harm anyone or anything nearby.
2. **Reliability:** It needs to accurately understand spoken words and write them correctly every time.
3. **Speech Recognition:** Ensure the arm understands speech well, especially for those with speech difficulties.
4. **Easy to Use:** The controls should be simple and customizable for different users.
5. **Privacy:** Keep any personal information safe since it involves speech recognition.
6. **Training:** Users and caregivers should be trained on how to use and troubleshoot the arm.

5.8 Effort and cost

1. Research and Development:

Understanding the requirements, designing the robot, and selecting appropriate components. Effort and cost will depend on the complexity of the design and the level of innovation required.

2. Hardware Components:

Cost of components such as motors, motor driver shields, Arduino microcontroller, servo motor, and other electronics needed for the robot. Effort includes sourcing, purchasing, and assembling these components.

3. Software Development:

Creating the control algorithms, programming the Arduino microcontroller, and generating G-Code from graphics using software like Inkscape. Effort and cost depend on the complexity of the software and the expertise required.

4. Testing:

Testing the robot's movement accuracy, reliability, and pen control. Effort and cost increase with the number of iterations and testing phases required to fine-tune the robot's performance.

5. Documentation and Support:

Writing user manuals, providing technical documentation, and offering customer support services. Effort and cost depend on the level of detail and support required.

6. Training and Maintenance:

Training users on how to operate and maintain the robot, as well as providing ongoing maintenance and support services, if necessary.

Conclusion

In these developing times, humans are turning towards robots to do their work to save time and manpower and to have an efficient output. The basic problem with the already existing technologies like automated speech writing machines, speech to text converter, printers, scanners, is that they only write in predefined fonts present in the computer. The proposed system works as an automated writing machine that is capable of writing in any predefined font or Handwriting style.

References

- [1:23 pm, 04/04/2024] Rajgauri Badadhe: 1] P. Novák, J. Vyskočil, P. Kadera, L. Kathrein, K. Meixner, D. Winkler, S. Biffl, "Engineering Roles and Information Modeling for Industry 4.0 Production System Engineering", 2019 24th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA), DOI:10.1109/ETFA.2019.8869141, Sept. 2019.
- [2] M. Aditi, S. Karpagam, B. Nandini, B. S. Murugan, "Automated Writing and Drawing Machine," International Journal of Engineering Research & Technology, ISSN: 2278-0181, ETEDM - 2019 Conference Proceedings, 2019.
- [3] Mr. R. Augustian Isaac, Amit Kumar Singh, Prateekshit Tamta, Gaurav Singh, "Homework Writing Machine," IJARIE, Vol-4 Issue-5 2018.
- [4] T. C. Wei, U. U. Sheikh and A. A. A. Rahman, "Improved optical character recognition with deep neural network," 2018 IEEE 14th International Colloquium on Signal Processing & Its Applications (CSPA), Batu Feringghi, 2018, pp. 245- 249, doi: 10.1109/CSPA.2018.8368720.
- [5] A. M. Sabu and A. S. Das, "A Survey on various Optical Character Recognition Techniques," 2018 Conference on Emerging Devices and Smart Systems (ICEDSS), Tiruchengode, 2018, pp. 152-155, doi:10.1109/ICEDSS.2018.8544323.
- [6] Shani Ranjan, Mani Rani, Shweta Ranjan, Dr. Manmohan Singh, "Design and Implementation of low-cost 2D plotter Computer Numeric Control (CNC) Machine," International Journal of Engineering Research & Technology, Vol. 7 Issue 05, May-2018.
- [7] R. Balathangam, P. Mathipriya, R. Pavithra, G. Prithiviraj, U. Poornima, "Design and Development of Arduino Controlled Writing Robot," International Research Journal of Engineering and Technology, Volume: 04 Issue: 04, Apr -2017.
- [8] Q. Li, W. An, A. Zhou and L. Ma, "Recognition of Offline Handwritten Chinese Characters Using the Tesseract Open Source OCR Engine," 2016 8th International Conference on Intelligent Human-Machine Systems and Cybernetics (IHMSC), Hangzhou, 2016, pp. 452-456, doi: 10.1109/IHMSC.2016.239.

- [9] Kajal J.Madekar, Kranti R. Nanaware, Pooja R. Phadtare, Vikas S. Mane, "Automatic mini CNC machine for PCB drawing and drilling," International Research Journal of Engineering and Technology, Volume: 03 Issue: 02, Feb-2016.
- [10] D. Berchmans and S. S. Kumar, "Optical character recognition: An overview and an insight," 2014 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT), Kanyakumari, 2014, pp.1361-1365, DOI:[1:24 pm, 04/04/2024] 10.1109/ICCICCT.2014.6993174.
- [11] "The OpenCV Tutorials," Release 2.4.13.7, December 31, 2019.
- [12] Ng Wai Foong, "A Beginner's Guide to Tesseract OCR," Jun 3, 2019
- [13] Kenneth Reitz, "Python Guide Documentation Release 0.0.1", 21st December, 2018.
- [14] Endurance, "The Benbox Laser Engraver as a CNC-platform for laser engraving", 2018.
- [15] Adrian Rosebrock, "OpenCV OCR and text recognition with Tesseract," 17th September, 2018.

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"A STUDY ON AUDIT PROCEDURE IN ACCOUNTING"

Submitted to:

**SAVITRIBAI PHULE PUNE UNIVERSITY – SPPU
In Partial Fulfilment of Requirement for the Award of
Requirement of**

Submitted by:

Mr. Ganesh Rambhau Shinde

Company Guide:

Mr. CA Dilip Rathod

Faculty Guide:

Prof. Akshay Shende

**NAVSHYADRI GROUP OF INSTITUTES FACULTY OF
MANAGEMENT – MBA**

A/P NAIGAON (NASRAPUR), BHOR, PUNE - 412213



Academic Year 2023-24

CERTIFICATE


This is to certify that Mr. Ganesh Rambhau shinde student of
Navsahyadri of Institutes. Faculty of Management-MBA Pune has completed his/ her summer training
at DG Rathod & Associates on the topic of A study of
Audit Procedures in Accounting and has submitted the Summer Training
Project Report in partial fulfillment of Masters of Business Administration - MBA of the
Savitribai Phule Pune University for the academic year 2023-24.


Signature of Project Guide

Name of Project Guide:

Prof. Akshay shende

Designation


Director's Signature

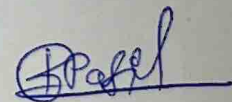
Dr. Tanaji Dabade

Director

Date:-

Place:- Pune (Naigaon)


Internal Supervisor


External Supervisor





D G Rathod & Associates
Chartered Accountants

Office No. 85, 6th Floor A Wing ,KK Market
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Pune - 411 047.
Mob: +91 95957558666
Email: carathodco@gmail.com

INTERNSHIP CERTIFICATE

This is to certify that **Mr. Ganesh Rambhau Shinde**, a student of **Navsahyadri Education Society's Group of Institutions, Faculty of Management, Naigaon, Nasrapur, Pune**, pursuing Master of Business Administration (MBA) in the Second Year, has successfully completed a Summer Internship Project in our firm for 2 months, from **20th August 2023 to 21st October 2023.**

He conducted his project on **"A Study on Audit Procedures in Accounting"**. Throughout his tenure, he exhibited sincerity and diligence in his studies and responsibilities.

We wish him all the best in his future endeavors and hope he will have a very successful career ahead.

For D G Rathod & Associates
Chartered Accountants
FRN: 152195W

CA Dilip Rathod
Proprietor
M No.195636



EXECUTIVE SUMMARY

The researcher has got the opportunity of summer internship at D G Rathod & Associates. Which is a Chartered Accountants firm located in Dhankawdi, Pune – 411 047. This project report gives idea about how firm provide their audit service to their clients. The project also explains the main concept of Audit.

The main objective of the project is to know the overall procedure of audit process. The data analysis gives detail information about how D G Rathod & Associates complete their audit process with their audit process with their clients with the help of well-structured audit procedure.

Researcher visited the company website and gathered relevant information to make project meaningful. He discussed all knowledge that he has gathered about auditing during summer internship period.

In today world academic education is not adequate to enable a student to compete with confidence and reach his goal without having experience with the outside world. To have an idea and gain experiences, I am a student of Savitribai Phule Pune University must undertake Two-month internship program at any organization.

As a part of my MBA program, the two-month internship program gave me the opportunity to have a practical knowledge on auditing procedure. The assignment was how a firm performs an audit and to gain a knowledge and practical experience on how audit work is performed in companies.

To face more complex and challenging business world in the challenging business areas, practical knowledge is essential to expand our theoretical base. As I have an intention to become an accountant, I was forwarded to D G Rathod & ASSOCIATE, a prominent Chartered Accountant firm in Pune.

This study gave me an opportunity to observe and perform real basic knowledge about the audit procedure, which is followed by any accountancy firm. In the Internship period I could relate the theoretical knowledge of auditing to practical exposure.

TABLE OF CONTENT

Sr.no	Particular	Page no.
	Company Certificate	III
	Declaration	IV
	Acknowledgement	V
	Executive Summary	VI
Chapter no-1	Introduction to Study	01
Chapter no-2	Organization Profile	03
Chapter no-3	Review of Literature	06
Chapter no-4	Research Methodology	40
Chapter no-5	Data Analysis & Interpretation	42
Chapter no-6	Finding & suggestion	59
Chapter no-7	Observation & Conclusion	63
	Bibliography	

CHAPTER 6

FINDINGS AND SUGGESTIONS

FINDINGS

- 1) Lack of written procedures – All aspects of faculty or service operations should be clearly documented in an up-to-date procedure's manual.
- 2) Improper use of General ledger accounts – It need to ensure they are coding expenses to the proper General Ledger account.
- 3) Insufficient documentation.
- 4) While filing GST return client gives data before one day or on the same day.
- 5) Miscalculation of Goods and Services Tax (GST)
- 6) Inadequate accounting procedures.
- 7) Some of the Clients makes changes on the spot to avoid further issue.
- 8) Based on the audit and evidence, finds out that the financial statements contain a certain degree of material misstatements.
- 9) Failure to perform reconciliations of significant accounts. For example, accounts receivable subsidiary ledgers are not reconciled to the general ledge account in a timely or accurate manner.

SUGGESTIONS/RECOMMENDATION

1. Before going to the client, supervisor or in charge should give some brief idea about the client's business to all the members of the audit team.
2. Work programs must be properly introduced to the juniors/ new students and must be followed as much as possible in each audit engagement.
- 3 In charge of an audit team must be ordered and properly instructed to supervise the work of his juniors.
4. An audit team should be given appropriate time (neither much nor less) to carry out the entire audit work properly.
5. Higher authority of the client must order or instruct the management to provide Auditors the required documents.



My learning

Course learning outcomes

1. I have learned the fundamental concepts of Indian audit system.
2. I have developed the skill of critical thinking & problem solving to resolve audit issued.
3. My learning developing effecting communication to deal with the clients for audit planning.
4. I have gain knowledge of explain different approaches to accounting for business income

Contribution

1. I work different accounting like financial, public, government, management, and tax accounting.
2. I work audit for various companies' firm and charitable organization and trust.
3. I work in calculating GST in the firm.
4. I learn calculating balance sheet and analysis as per the company financial transactions.

CHAPTER 7

OBSERVATION & CONCLUSION

OBSERVATION AND CONCLUSION

A Project report on "A Study on Audit Procedure in Accounting at D G Rathod & Associates, is the topic of my study. It is the brief idea about the audit procedure of the organization.

Audit procedure describes the step-by-step instructions of a financial statement audit. This procedure is sufficient for FIRM. If all steps which are given in the Audit Procedure followed properly, it is possible to ensure a proper conduct of financial statement audit.

Audit is an accounting process used in business. It uses an independent body to examine a business financial transactions and statements. The ultimate purpose of this form of auditing is to present an accurate account of a company financial business transactions.

This study gave me an opportunity to observe and perform real basic knowledge about the audit procedure, which is followed by any accountancy firm. In the Internship period I could relate the theoretical knowledge of auditing to practical exposure.

Audit must be establishing the Basis of opinion.

The project work is very beneficial for me, and the guidance and support receive from all during my project was very encourage.

A
PROJECT REPORT ON
A STUDY ON CONSUMER PERCEPTION TOWARDS MUTUAL
FUND INVESTMENT "

AT
"MUTUAL GLOBAL"

Submitted to
SAVITRIBAI PHULE PUNE UNIVERSITY - SPPU
In partial fulfilment of the requirements for the Award of Requirement of
MASTER OF BUSINESS ADMINISTRATION - MBA

Submitted by
SWATI BAJARANG SHINDE

MBA-II, Roll no -

PROJECT GUIDE
DR. LAXMAN DOIPHODE



NAVSAHYADRI GROUP OF INSTITUTES,
FACULTY OF MANAGEMENT - MBA
A/P NAIGAON (NASRAPUR), BHOR, PUNE - 412213.

BATCH: - 2023-24



Navsahyadri Group of Institutions, Pune
Faculty of Management
Approved by AICTE, DTE, Recognized by Govt. of Maharashtra,
Affiliated to Savitribai Phule Pune University

CERTIFICATE

This is to certify that Swati Bajorang shinde
student of Navsahyadri of Institutes, Faculty of Management-MBA Pune has completed his/her
summer training at A study on consumer perception on the topic
of Towards Mutual Funds Investment
and has submitted the Summer Training
Project Report in partial fulfillment of Masters of Business Administration - MBA of the
Savitribai Phule Pune University for the academic year 2023-24.

Signature of Project Guide

Name of Project Guide:

Designation

Date:-

Place:-

Director's Signature

Dr. Tanaji Dabade

Director

Internal Supervisor

External Supervisor



National Assessment & Accreditation Council



University Grants Commission



Savitribai Phule Pune University



MUTUAL GLOBE

INTERNSHIP COMPLETION CERTIFICATE

Swati Bajrang Shinde

The student of MBA of Navsahayadri Education Society Group of Institute, Pune has successfully completed his/her Internship with Mutual Globe under mentorship of **CA Manoj Shrivastava**, from 2nd August 2023 to 01st October 2023 on a project titled

"A Study on Consumer Perception Towards Mutual Fund Investments"

CA Manoj Shrivastava
CEO Mutual Globe

(A division of LWM Services Pvt Ltd)

1. INTRODUCTION

Keep it simple. Keep it straight: that is the investment philosophy. Never wait till the last rupee of profit comes in. Tops and bottoms are for the fools to catch, a top is the highest price point of a stock, which is what greedy investors often wait for and bottom is just the opposite, where one should buy into a stock.

Are you one of those who want to invest in share but doesn't know how to go about doing it. We are trying to explain, what investment in stock market is in a simple, clear and concise language. You don't need to be an economist, a chartered accountant, or mathematical wizard, infect most people who made great fortune were ordinary people.

The person who makes an investment is called an investor he may be an individual, a company, firm, etc. these investors provide funds to the businesses by purchasing their shares and debentures of companies. The capital is considered as "Life Blood for Business".

Even though investment condition, attitude and opportunities often change overtime and vary greatly from place to place, but basic rules of game nearly always remain the same.

Indian economy is on the roll with a growth rate averaging at 6% to 7% during the last years. Indian companies are performing well in almost all sectors be it software, engineering, information technology, automobiles, auto components or pharmaceuticals etc. that's the reason, foreign investors are coming by hordes and showing a great interest in Indian economy.

Investment in Indian economy primarily comes through: -

1. Direct Investments or Foreign Direct Investment and
2. Through the capital market where Foreign Institutional Investors (FII's) are allowed to invest Indian Economy.

The whole working of share market is done electronically; this helps the investors to invest their money in Share Market from anywhere during the working hours. Indian Share Market keeps a strict vigil on overall scenario in order to safeguard the investors, not only the big ones, but also at the micro level in order to avoid scams.

A well-organized and developed Share Market is an essential pre-requisite of economic development. An investor plays a vital role in the growth of Share Market by investing in Shares, Debentures, Government Bonds and Securities etc. because the of Share Market affects the working of Indian Economy.

REVIEW OF LITERATURE

The mutual fund industry is expected to play a vital role in financial intermediation in the Indian economy; hence mutual fund's collective ability to draw investment funds and the use of those funds are of considerable interest [Darshana Mehta, Charmi shah, 2012].

The global financial and economic crisis that unfolded in 2007 unsurprisingly had an impact both on the amount of savings being channeled into mutual funds over the world, and on the distribution of resources among mutual fund classes embodying varying degrees of risk. Anecdotal evidence from across the globe suggests significant changes in investors' asset allocation patterns since the onset of the global financial crisis, as heightened risk awareness and regulatory initiatives steered private investors towards safer assets. Empirical evidence also confirms that globally there has been a movement away from riskier to less risky assets during the crisis and through the recovery period. Tracking the broad developments in the Indian mutual fund industry helps to understand how far the global crisis impacted over all investment flows to, and from, domestic mutual funds and also to what extent the crisis-induced features such as risk aversion are reflected in the investment patterns within the domestic mutual fund industry.

The trends in resource mobilization by the industry give a fair idea about mutual fund investors' behavior in the post-crisis period; the movements away from or towards different types of mutual funds bearing various degrees of risk, are an indicator of mutual fund investors' collective risk appetite under differing economic circumstances. As investor decisions are generally based on the returns generated by the funds, it is important to see how mutual funds have fared in term of returns performance, particularly during times of financial market stress. Further, the mutual fund industry's role in the Indian capital markets is also defined by both the amount and type of resources garnered by it, as these jointly determine the deployment of resources by mutual funds [Rd. Shantanu Mehta, Charmi Shah, 2012].

FINDINGS

- 60% people are graduate, 32.5% people are post graduate, considerably less number of responders are from sy, diploma background.
- It is found that, about 72.5% people aware about mutual funds, 15% are know little much about mutual funds and 12.5% people are not aware about mutual funds
- It is observed that, more than half of the responder (57.5%) are not making investment in mutual funds and 42.5% people are investing in mutual funds
- People get more information from friends because the survey is more for college students and the college students are more influenced by their friends and newspaper about mutual funds.
- It is observed that about 77.5% people purchase mutual funds from online mode because in survey more responders are students so now a days students are active on social media or phones so they prefer online mode.
- From the analysis we get that 35% responder invest in income fund, 30% of responder invest in equity fund and balance fund.
- 60% of People invest less than 5000Rs in mutual fund because the survey preference is students and they don't have any income source they depend on their parents and 35 % people invest about 5000-10000Rs in mutual funds.
- Most of the people preferred mutual funds while investing their money. Because of performance, good investment instrument, very simple to invest.
- Different people have different objectives for investment. Some responder (41.7%) invests for children education, some responder (33.3%) invests to meet contingencies etc.
- It is found that 63% people invest monthly, 19.4% people invest yearly, 11.1% people invest half yearly and less people invest quarterly.
- People having various reasons for investment in mutual funds like 65% of people want high return, 22.5% of people make investment because low cost
- 58.3% people expect high return while investing in mutual funds, 22.2% people expect moderate return and 13.9% of people expect low return.

CONCLUSION

A Mutual fund brings together a large group of people and invests their aggregated money in stocks, bonds and other securities. The advantage of mutual funds is professional management, diversification, economies of scale, and wide range of offerings. The disadvantage of mutual funds are high costs, over diversification, possible tax consequences, liquidity concerns, and the inability of management to guarantee a superior return.

There are many types of mutual funds. You can classify funds based on asset class, investing strategy, region, etc. Mutual funds have expenses that can be broken down generally into on-going fees and transaction fees. Some funds carry no broker fee (load), known as no load mutual funds.

One of the biggest problems with mutual funds are their costs and fees. Mutual funds are easy to buy and sell. You can either buy them directly from the fund company or through a third party. Comparing fund returns across a number of metrics is important, such as over time, compared to its benchmark and compared to other funds in its peer group.

Moreover, since most of the population belong to the young generation who do not possess much knowledge about mutual funds. But there is high demand and requirement of education and awareness for mutual funds for the common public.

It was concluded from the survey that most of the people would refer an online platform for investment in mutual funds and it is positive sign for the mutual fund industry.

A PROJECT REPORT ON

"A STUDY OF MUTUAL FUND INVESTMENT AND EQUITY TRADING"

AT

KAUSTUBH KULKARNI INVESTMENT

SUBMITTED TO

SAVITRIBAI PHULE PUNE UNIVERSITY – SPPU

In Partial Fulfilment of Requirement for the

Award of Requirement of

Master of Business Administration – MBA

BY

PRANITA DILIP GHADGE

MBA-II Roll No.-

PROJECT GUIDE

PROF. LAXMAN DOIPHODE

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BATCH:-2023-2024

CERTIFICATE

This is to certify that Ms. Ghadge Pranita Dilip student of
Navsahyadri of Institutes, Faculty of Management-MBA Pune has completed
his/her Summer training at KAUSTUBH KULKARNI INVEST - MENTS on the
topic of "A Study of Mutual Fund Investment and Equity Trading"

and has submitted the Summer Training Project Report in partial fulfillment
of Masters of Business Administration - MBA of the Savitribai Phule Pune
University for the academic year 2023-24.


Signature of Project Guide


Signature of
Director

Name of the Project Guide
Dr. Laxman Doiphode

Dr. Tanaji Dabade

Date

Place Pune (Naigaon)


Internal Supervisor


External Supervisor



**KAUSTUBH KULKARNI
INVESTMENTS**

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DATE:

CERTIFICATE

TO WHOMSOEVER IT MAY CONCERN

This is to certify that, **Ms. PRANITA DILIP GHADEGE** student of NAVSHYADRI EDUCATION GROUP OF INSTITUTION, faculty of management, Naigoan, Nasrapur, Pune. Who studying in MASTER OF BUSINESS ADMINISTRATION (M.B.A)2nd year has successfully completed internship project work in our firm for 2 months duration from 10th August, 2023 to 10th October, 2023.

She has completed her project on “**A STUDY OF MUTUAL FUND INVESTMENT AND EQUITY TRADING.**” During her project work we find him sincere and hard working in her studies and responsibilities.

We wish her all the best in her future endeavours and hope she will have very successful career ahead.

KAUSTUBH KULKARNI INVESTMENTS

AUTHOERISED SIGNATURE

KAUSTUBH KULKARNI

EXECUTIVE SUMMERY

- In this period on 2 months I learned the concept of mutual fund and equity share investment. Today, in India so many people are aware about the mutual fund and equity shares investment. Mutual fund works as a trust in India and company in other countries. Some people think mutual fund is based on market and it's risky to invest. It is true that mutual fund is based on market but it less risky in compare to share market because mutual fund is not just a single company but it is group of 45 different companies so the fund which we invest is divided with 45 different companies so it is less risky in compare to a single company.
- I very well experienced that people in Pune city are strongly aware about the mutual fund and equity investment and their benefits which they will received in future.
- I personally experienced the work in the investment office. They are handling the client portfolio, it is called as **PORTFOLIO MANAGEMENT SYSTEM (PMS)**. They are also buy and sell the clients share in the daily live share market on NSE or BSE. They are also handled various forms online or offline mode. The forms like SIP, STP, and SWP in mutual fund.
- Under the NSE they are traded in top 50 companies that will always give the customer best returns on their investment in equity share market. Also they are started new mutual fund scheme called as "**NJ FLEXI CAP FUND**" is the new investment scheme that introduced by N.J.PVT. LTD. So many old clients as well as new clients are response positively to us.
- Previously N.J introduced a "**CANARA ROBECO MULTI CAP FUND**" in mutual fund scheme. This scheme also got positive response from clients.
- The test of Indian people are changing day by day they consuming more to reach their goals and that's why Indian GDP is increase and mutual fund is the thing that gives returns on increasing GDP and increasing inflation level so it is beneficial to the investor.
- In the side of wealth advisor here wealth advisor can sell the multi cap product on a single platform so the advisor not to do more for a earning.
- The **KAUSTUBH KULKARNI INVESTMENT** are also sell the **STAR HEALTH INSURANCE POLICY** to their client and it is very responsive to them.

Project Title : "A study of Mutual Fund and Equity Investment"

Company Name : KAUSTHUBH KULKARNI INVESTMENT

Industry Type : Finance (mutual fund and equity investment)

Duration : 2 months

1. Objective of the study

- To know the key components of mutual fund.
- To study the investors preference in mutual fund and equity investment.
- To identify the best option for investment.
- To analyse the portfolio.
- To know the key components of asset allocation.

2. Need of the study

- This project will provide a huge information about mutual funds, equity share investment.
- This project will also help you to select the best scheme of mutual fund and equity investment,
- This report contains the information about the NJ INDIA INVEST COMPANY which is leading in mutual fund industry. And also provide the information about NUVAMA (Edelweiss) equity funds investment. And provide details about the company.

3. Scope of the study

- Study refers to the mutual fund investment and asset allocation of funds.
- Project is based on the study of mutual fund schemes and equity share investment.

4. Timeline of the project

- 10th August, 2023 TO 10th October, 2023.

5. Research methodology

- In this report I used conclusive and descriptive research methodology.

CHAPTER 5.

FINDINGS AND SUGGESTIONS

1. FLEXI CAP FUND –

NJ India Investment PVT. Ltd has launch their new mutual fund schemes namely **NJ FLEXI CAP FUND**. This fund started on 6 September 2023. This Mutual Fund are open ended dynamic equity fund that invest across various market capitalization. Like large cap, mid cap and small cap.

- **Suitable for** - Investor who looking for invest 3 years or more and expecting gains that comfortably beat the inflation rate as well as returns from fixed income option. At the same time this investors should also be prepared for the possible ups and downs in their investment.

2. ELSS MUTUAL FUND –

ELSS mutual funds maintain portfolio largely in the stocks. However you cannot sell these units for 3 years from purchase date. You can save taxes by showing investment as deduction under 80c.

- **Suitable for** – investors who are looking to invest money for at least 3 years and looking for additional benefits of income tax saving apart from higher returns expectations. At the same time, these investors should also be ready for possibility of moderate losses in their investment and 3 years back lock-in-period.

3. MULTI CAP FUND –

These mutual funds primarily invest in stocks selected from all the listed stocks in the Indian market (NSE/BSE).

- **Suitable for** – investors who are looking to invest money for at least 3-4 years and looking for high returns. At the same time, these investors should also be ready for possibility of moderate losses in their investment.

4. LARGE CAP FUND –

These mutual funds select stocks for investment from the largest 100 stocks listed in the Indian markets (highest market capitalization). Larger stocks are expected to be less risky whereas smaller stocks may have higher potential to grow.

- **Suitable for_** – Investors who are looking to invest money for at least 3-4 years and looking for high returns. At the same time, these investors should also be ready for possibility of moderate losses in their investment.

5. SMALL CAP FUND –

These mutual fund select stocks for investment from the small cap category, which includes all stocks excepted largest 250 stocks (by market capitalization).

6. MID CAP FUND –

These mutual funds select stocks for investment from the mid cap category – stocks ranked between 100 to 250 by size (market capitalization). Larger stocks are expected to be less risky whereas smaller stocks may have higher potential to grow.

SUGGESTIONS

NJ FLEXI CAP FUND REGULAR- GR FUND DEAILS

- **INVESTMENT OBJECTIVE –**

The scheme is seeks to generate long term capital appreciation by investing in equity related instruments across market capitalization.

Minimum investment (Rs.)	500.00	Max – 1000 or more than
Minimum additional investment (Rs.)	500.00	1000 or more than
Minimum sip investment (Rs.)	500.00	1000 or more than

- **NJ FLEXI CAP FUND REGULAR – GR INVSTMENT DETAILS**

Fund house	NJ Mutual fund
Launch date	Sep 05,2023
Benchmark	NIFTY 500 Total Return Index
Return since launch	1.1%
Risk meters	Very high
Type	Open ended

- **PORTFOLIO ALLOCATION –**

1. **Asset Allocation –**

Asset class	investment	category	index
	-	94.4	100.00
Equity	-	0.31	0.00
Fixed income	-	0.00	0.00
Preferred	-	0.00	0.00
Convertible	-	5.51	0.00
Cash	-	0.01	0.00
other	-		

CONCLUSION

Mutual fund is the type of professionally managed collective investment vehicle that pools money from many investors to purchase securities. Mutual fund industry is the leading industry in India because awareness of the investment in the mutual fund and equity shares is increased and people are show interest in investment. So because of this mutual fund industries are growing continuously.

In India there are so many mutual fund companies. NJ INDIA INVEST Private Limited is one of the well-established company and I have study on this firm. In this I studied all about mutual fund their types, schemes, etc.

After this there, are one more option of investment I learned that is EQUITY SHARES. NUVAMA is the leading firm special for the equity share investment. It is also an investment option and so many investors are invests in equity and they get returns on it. As like Mutual fund, Equity share is the best way to invest in securities.

During my summer internship report, I had learned this two concepts that will help me in investment if I needed in future. This project is very useful for me and this is according with my education purpose.

I am thankful to KAUSTUBH KULKARNI INVESTMENT to give me this opportunity and give me the information about investment.

Seat No :- 20290

PROJECT REPORT ON

**"MARKET RESEARCH SPECILITY FERTILIZERS IN
AHMEDNAGAR DISTRICT THROUGH ULINK AGRITECH
PRIVATE LIMITED"**

AT

ULINK AGRI TECH PVT LTD

Submitted to

SAVITRIBAI PHULE PUNE UNIVERSITY - SPPU

In partial fulfilment of the requirements for the Award of Requirement of

MASTER OF BUSINESS ADMINISTRATION - MBA

Submitted by

MR. JAGANNATH SHRIRAM SANAP

MBA-II. Roll no -

PROJECT GUIDE

PROF. SURAJ DHAWARE



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BATCH:- 2023-24

CERTIFICATE

This is to certify that Jagannath Shrivam Sanap
student of Navsahyadri of Institutes, Faculty of Management-MBA Pune has completed his/her
summer training at Agrostar v Link Agri-tech PVT LTD. on the topic
of market research specificity fertilizers in Ahmednagar
and has submitted the Summer Training
Project Report in partial fulfillment of Masters of Business Administration - MBA of the
Savitribai Phule Pune University for the academic year 2023-24.

Signature of Project Guide

Name of Project Guide: Suraj Dhaware

Designation

Date:-

Place:- Naigaon

Director's Signature

Dr. Tanaji Dabade

Director

Internal Supervisor

External Supervisor



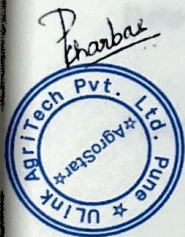
Ulink AgriTech Pvt.Ltd (AgroStar)

Internship Certificate

This is to certify that, Mr, **SANAP JAGANNATH SHRIRAM** has successfully completed an internship with Ulink AgriTech Pvt. Ltd (Agrostar) from 05/08/2023 to 21/11/2023.

During the internship, **SANAP JAGANNATH SHRIRAM** demonstrated exceptional dedication, enthusiasm, and strong commitment to learning and contributing to our organization. They actively participated In ANALYSIS OF MARKET RESEARCH SPECILITY FERTILIZERS IN AHMEDNAGAR showing their analytical and problem skills.

This certificate is awarded as recognition of **SANAP JAGANNATH SHRIRAM** successful of the internship program at Ulink AgriTech Pvt. Ltd. We appreciate their hard work, dedication, and positive attitude throughout the internship period.



Warm Regards,
(Ulink AgriTech Pvt. Ltd.)

Ulink AgriTech Pvt. Ltd. E-Space Tech Park, Bldg. A1- Office #101 BC, Nagar Road, Pune-411014, India.

INDEX**MARKET RESEARCH SPECILITY FERTILIZERS IN AHMEDNAGAR
DISTRICT THROUGH ULINK AGORTECH
PRIVATE LIMITED IN PUNE**

SR.NO	PARTICULARS	Page No.
1	Industry Overview	
	A. Industry Profile	1
	B. Company Profile	2
	C. Organization Profile	4
2	Review of Literature	15
3	Research Methodology	16
	A. Objective of the Study	17
	B. Type of research	17
	C. Type of research Design	20
	D. Sources of data collection	40
	E. Sampling Design	40
	F. Statically Tools	41
	G. Need and Significance of the Study	41
	G. Scope of the Study	42
	H. Limitation of the study	43
4	Data analysis and interpretation of the study	43
5	Findings, conclusion and suggestions of the study	48
	Bibliography	53
6	Questionary	55

Industry Profile

The reason behind selecting the “AgroStar” is because of its Farmer Centric Orientation and its contribution towards Indian Agriculture.

It understands the basic needs from seeds sowing to Crop harvesting also the other barricades such as non-trust, No Quality of production, demand and supply gap have been removed by this Organization.

This organization ensures that every farmers is understood, and then 100% solution is given to them. They care for farmers from Sowing to harvesting and which the only backbone of this Organization is.

The Founders of this organization (Mr. Girish Khalate)

Agricultural Markets in India

Agricultural Markets in most states of India are established and regulated under the State APMC (Agricultural Produce Marketing Committee) Acts. The whole geographical area of the State is divided into smaller market areas where in the markets are managed by the Market Committees constituted by the State Governments. Once a particular area is declared a market area and falls under the jurisdiction of a Market Committee, no person or agency is allowed freely to carry on wholesale marketing activities.

Finding

Followings findings are observed after in study farmer's behaviour, promotion of Products and awareness:

- It is noticed that 87 per cent (52) of Farmers were aware about Water Soluble Fertilizers and 13 per cent (8) sample farmers unaware about WSF and out of total aware farmers(52), 87 per cent (45) of aware farmers were using Water Soluble Fertilizers and 13 per cent (7) does not use WSF.
- Out of user of water soluble fertilizers (45), it is noted that 47 per cent of sample farmers were overaged i.e. above 40 years old. It shows greater experience of farming.
- It is observed that 29 per cent of WSF users were graduate and 11 per cent of WSF users were post graduate. Their adoption level for water soluble fertilizer has developed fully. Higher the level of education, Higher is the adoption level of improved agro techniques. They may show full interest to adopt new products as an experiment base.
- It is observed that 91 per cent of farmers using fertilizers by both soil as well as through water. As a beneficial aspect to maintain soil productivity, soil fertility farmer apply fertilizers through both soil and water. That means company has to provide complex fertilizer for farmers.

- It is observed that, 58 per cent of the WSF Non user were overaged. They were having experiences of traditional farming. They were not using the water soluble fertilizer.
- It is found that there were more of the people give response to better result of the products for purchasing the fertilizers. There were 27 WSF User give preference to Better result, 16 WSF user give preference to Easy Availability, 9 customer give preference to Affordable price and 8 customer give preference to Easy to application.
- It is observed that Poorna-19 specialty fertilizer grade was mostly preferred as it was rated for 35 followed by Boon-45(24) and Sulpho-50 as well as Calnit-19(15).
- In selected sample of dealers, it indicated that 40 per cent of dealers have more than 30 years' experience in dealing with Agribusiness products and 35 per cent dealers have experience 21-30 years.
- In awareness of farmers, 87 per cent of farmers were aware about specialty fertilizer of Zuari Industries Ltd. Out of total 52 WSF aware farmers, large farmers have more awareness (100%) followed by medium(95%) and small farmers(87%).
- At the time of purchasing water soluble fertilizer farmer purchase Zuari because quality i.e. it got 1st rank as major factor followed by brand of 'Zuari' i.e. it got 2nd rank.

Conclusions

- The existing Water soluble fertilizers use is showing in increasing trend. It was observed that farmers are aware about water soluble fertilizer product of ZIL and known the competitors for water soluble fertilizer.
- ZIL has developed the relation with the farmers, retailers and distributors as relationship plays vital role when it comes to trust which is very important in fertilizers industry.
- Farmer wants effective supply of the fertilizers at right time with right rates.
- Farmers those who interacted during project are having great expectation from ZIL and have great opportunity to increase the sale of fertilizers through effective marketing.

A PROJECT REPORT ON

"RECRUITMENT AND SELECTION PROCESS"

Done at

AESSEAL INDIA PVT. LTD.

At. Post. Varve, Tal. Bhor, Pune-412205.

SUBMITTED TO

SAVITRIBAI PHULE PUNE UNIVERSITY-SPPU

In Partial Fulfillment of The Requirements for the
Award of The Degree in
Masters of Business Administration-MBA

SUBMITTED BY

Vidhya Chandrakant Walhekar

MBA □

PROJECT GUIDE

Prof. Priyanka Pawar

NAVSAHYADRI GROUP OF INSTITUTES,

FACULTY OF MANAGEMENT - MBA

A/P NAJGAON, BHOR, PUNE-412213.

BATCH: 2023-24

CERTIFICATE

This is to certify that Midhya Chandrakant Walhekar
student of Navsahyadri of Institutes, Faculty of Management-MBA Pune has completed his/her
summer training at RESSEAL INDIA PVT. LTD., PUNE. on the topic
of "Recruitment and selection process" in Resseal India Pvt
Ltd. and has submitted the Summer Training
Project Report in partial fulfillment of Masters of Business Administration - MBA of the
Savitribai Phule Pune University for the academic year 2023-24.


Signature of Project Guide

Name of Project Guide: Priyanka Pawas

Designation Asst. Prof.

Date:-

Place:-


Director's Signature

Dr. Tanaji Dabade

Director


Internal Supervisor


External Supervisor



National Assessment & Accreditation Council



Savitribai Phule Pune University

Date: 13/12/2023

INTERNSHIP COMPLETION CERTIFICATE

Name: Vidhya Jeevan Borge

Address: At post - Karandi, Tal - Bhor, Dist. - Pune , Pin - 412213

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Ms. Vidhya Jeevan Borge, has successfully completed the internship programme for 2 months.

During her internship, her major duties included:

1. Manpower Planning
2. Recruitment and selection
3. Employee onboard
4. New employee induction

During her internship tenure, she was found to be sincere and hardworking.

We wish her success in all her future endeavours.

Best Wishes,

For Aesseal India Private Limited


Samir Pangarkar
Manager HR



EXECUTIVE SUMMARY

Today, in every organization personnel planning as an activity is necessary. It is an important part of an organization. Human Resource Planning is a vital ingredient for the success of the organization in the long run. There are certain ways that are to be followed by every organization, which ensures that it has right number and kind of people, at the right place and right time, so that organization can achieve its planned objectives.

The objectives of Human Resource Department are Human Resource Planning, Recruitment and Selection, Training and Development, Career planning, Transfer and Promotion, Risk Management, Performance Appraisal and so on. Each objective needs special attention and proper planning and implementation.

For every organization it is important to have a right person on a right job. Recruitment and Selection plays a vital role in this situation. Shortage of skills and the use of new technology are putting considerable pressure on how employers go about Recruiting and Selecting staff. It is recommended to carry out a strategic analysis of Recruitment and Selection procedure. Also training need identification is necessary after selection process.

A formal definition states, "It is the process of finding and attracting capable applicants for the employment. The process begins when new recruits are sought and ends when their applicants are selected".

The need for recruitment may be due to the following reasons/situation:

- a) Vacancies due to promotions, transfer, retirement, termination, permanent disability, death and labour turnover.
- b) Creation of new vacancies due to the growth, expansion and diversification of business activities of an enterprise. In addition, new vacancies are possible due to job specification.

Selection is basically picking an applicant from (a pool of candidates) who has the appropriate qualification and competency to do the job.

The difference between recruitment and selection: - Recruitment is identifying and encouraging prospective employees to apply for a job. And Selection is selecting the right candidate from the pool of applicants.

Effective recruitment, selection and retention are critical to organizational success. They enable companies to have performing employees who are satisfied with their jobs, thus contributing positively to the organization.

On the contrary, in-effective recruitment methodology, selection and retention would result in mismatches which can have negative consequences for an organization. A misfit who is not in tune with organization's philosophies and goals can reduce output, productivity, customer satisfaction, relationship and overall quality of work. Training a wrong hire can also be expensive. Effective recruitment is therefore not only the first step towards organizational excellence, but is important cost control mechanisms as well.

The study researches the spectrum of recruitment methodologies followed in Company towards developing an unique model, propose suggestion that would reduce costs, time to recruit, be effective and help overall organizational interests.

INDEX
(TABLE OF CONTEST-I)

Sr.No.	Particulars	Page No.
1.0	INTRODUCTION	01
	1.1 Introduction	02
	1.2 Definition	03
	1.3 Objective of the study	04
	1.4 Need And Importance	05
2.0	ORGANIZATIONAL PROFILE	18
3.0	LITERATURE REVIES	25
4.0	RESEARCH METHODOLOGY	39
5.0	DATA ANALYSIS AND INTERPRETATION	42
6.0	FINDING AND SUGGESTION	54
	6.1 Finding	55
	6.2 Suggestion	56
7.0	CONCLUSION	57
8.0	BIBLIOGRAPHY	59
9.0	ANNEXTURE	61

TABLE OF CONTENTS-II

5.0 Data Analysis and Interpretation

Sr. No.	Particulars	Table & Chart No.	Page No.
1.	Sources used in recruitment and selection	5.1	43
2.	External sources used in recruitment	5.2	44
3.	Form of recruitment and selection used	5.3	45
4.	Employees perception about recruitment process	5.4	46
5.	Methods used during selection process	5.5	47
6.	Perception of employees towards selection process	5.6	48
7.	Techniques used for selection	5.7	49
8.	Recruitment process used for different grades of employees	5.8	50
9.	Company HR practices	5.9	51
10.	Contract signed while joining the organization	5.10	52
11.	HR policy of the company	5.11	53

1.1 INTRODUCTION

Recruitment and Selection:

Recruitment is the process of attracting individuals on a timely basis in sufficient numbers and with appropriate qualification, to apply for jobs within an organization. The process of searching prospective employees with multidimensional skills and experience that suits organization strategies is fundamental to the growth of the organization, this demands more comprehensive strategic perspective recruitment. Organizations require the services of large number of personnel, these personnel occupy the various positions created to the process of organization. Each position of the organization has certain specific contributions to achieve the organizational objectives. The recruitment process of the organization has to be strong enough to attract and select the potential candidates with right job specification. The recruitment process begins with human resource planning and concludes with the selection of required number of candidates, both HR staff and operating managers have responsibilities in the process.

"Right person for the right job is the basic principle in recruitment and selection. Every organization should give attention to the selection of its manpower, especially its managers. The operative manpower is equally important and essential for the orderly working of an enterprise.

Every business organization/unit needs manpower for carrying different business activities smoothly and efficiently and for this recruitment and selection of suitable candidates is essential. Human resource management in an organization will not be possible if unsuitable persons are selected and employment in a business unit.

6.1 FINDINGS

The collected data are analyzed and general observations have proven that AESSEAL INDIA PVT. LTD. has done remarkable job in its Human Resource department.

The main findings are as follows:

1. In AESSEAL INDIA PVT. LTD. employees feel that the HR department is good.
2. The recruitment and selection process is decentralized.
3. About 90% of the employees are satisfied with the recruitment and selection process.
4. Most of the managers prefer personal interviews.
5. Mostly external sources of recruitment are considered.
6. About 90% of employees feel that they are comfortable working with the current HR policies of the company and 10% feel that they need some changes in the policies.
7. Both internal as well as external sources of recruitment used.
8. Consultancies (40%) and advertisement (25%) are the two main external sources of recruitment.

6.2 SUGGESTION

From the findings I can suggest AESSEAL INDIA PVT. LTD., Pune branch following things for the more effectiveness of recruitment and selection process and HR policies:

- Recruitment must be done by analyzing the job firstly which will make it easier and will be beneficial from the company's point of view.
- More emphasis should be given on internet and advertisement so that more and more candidates apply for the jobs and it will be easy to find the right employee among them.
- The recruitment and selection procedure should not be too lengthy and time consuming.
- Company should try to use the internal recruitment process first because it incurs less cost and acts as a motivational factor to the employees.
- Provide training to employees so that they get better knowledge, skills and attitude.

Company should amend some parts of their HR policies for better effectiveness

CONCLUSION

Recruitment is the process of searching for prospective employees and stimulating and encouraging them to apply for jobs in an organization. And Selection is selecting the right candidate at the right time in the right place.

Employees of AESEAL INDIA PVT. LTD. are satisfied with the current/existing recruitment and selection process. AESEAL INDIA PVT. LTD. is recruiting their employees mainly through consultancies. Consultancies are the mediator between the organization and the candidates as it serves the requirements of employees as well as the organization. AESEAL INDIA PVT. LTD. recruits their employees in a decentralized way (Pune).

Also, AESEAL INDIA PVT. LTD. has to consider internet sources for recruitment of employees so that it could motivate the employees. Employees are also well aware about the various sources and methods of recruitment and selection. AESEAL INDIA PVT. LTD. has to implement innovative techniques in selection process like group discussion, stress interview, etc

Seat No - 20339

**A
PROJECT REPORT
ON
"THE STUDY OF RECRUITMENT AND SELECTION PROCESS IN SNEHAL
PROCESSING."**

AT SNEHAL PROCESSING.

**SUBMITTED TO
SAVITRIBAI PHULE PUNE UNIVERSITY.**

**IN PARTIAL FULFILMENT
FOR THE AWARD OF REQUIREMENT OF
MASTER OF BUSINESS ADMINISTRATION -MBA**

**PREPARED BY
MR. ABHISHEK NAMDEV CHAVAN.**

**MBA-II YEAR
NAVSAHYADRI GROUP OF INSTITUTE**

**UNDER THE GUIDANCE OF
PROF. PRIYANKA PAWAR**

**NAVSAHYADRI EDUCATION SOCIETY'S GROUP OF INSTITUTE
FACULTY OF MANAGEMENT, TAL-BHOR PUNE-412213.**

Batch-2023-2024



CERTIFICATE

This is to certify that Chavan Abhishek Namdev
student of Navsahyadri of Institutes, Faculty of Management-MBA Pune has completed his/her
summer training at Snehal processing on the topic
of To the study of Recruitment and selection process
and has submitted the Summer Training
Project Report in partial fulfillment of Masters of Business Administration - MBA of the
Savitribai Phule Pune University for the academic year 2023-24.


Signature of Project Guide

Name of Project Guide: prof. piyanka pawar Dr. Tanaji Dabade

Designation

Director

Date:-

Place:-


Internal Supervisor


External Supervisor



SNEHAL PROCESSING

📍 : A/p- Bhade, Plot No. 923, Near S.T. Bus Stand, Tal. Khandala, Dist. Satara
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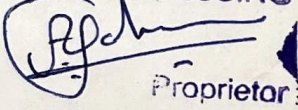
TO WHOM IT MAY CONCERN

This is to certify that **Mr. Abhishek Namdev Chavan** student of **MBA II Year Navshayadri Education Group of Institution Faculty of Management MBA in Human Resources Management, Pune**. Successfully completed a summer internship in the field of recruitment & Selection process from **1st August 2023 to 5th October 2023** under guidance of **Mr. Mahesh Chavan, HR Executive**

During the period of her/ his internship program with us, she/ he had been exposed to different processes and was found diligent, hardworking and inquisitive.

We wish her/ him every success in her/his life and career.

SNEHAL PROCESSING

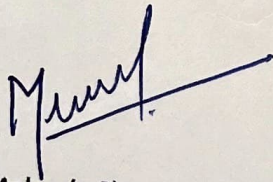


Proprietor

For Snehal Processing.

Head office:

Sector no 10 Plot no
117/4 PCNTDA MIDC
Bhosari Pune 411026
Maharashtra, India.



Mahesh Chavan

(HR Executive)



★ INTRODUCTION

The project is on recruitment & selection process in "Snehal Processing." The significance of the project is to fulfill requirement of manpower considering good requirement practices, which will ensure that the right candidate is identified for the job, resulting in reduce employee turnover & costs. During timeframe of the project is 2 months.

Meaning of Recruitment: -

Recruitment establishes a link between the job seekers and employers by which, it ensures the placement of right candidate at the right place at the right time.

Definition of Recruitment: -

According to Dale Yoder, "Recruitment is a process to discover the sources of manpower to meet the requirement of the staffing schedule and to employ effective measures for attracting that manpower in adequate numbers to facilitate effective selection of an efficient force."

Meaning of selection: -

Selection is the process of picking individuals (out of pool of the job candidate) with requisite qualification competence to fill job in the organization.

A formal definition of selection is that "it is process of differentiating between applicants in order to identify those with a greater likelihood of success in the job."

Definition of Selection: -

According to Dale Yoder, selection is the process in which candidates for employment are divided into two classes those who are to be offered employment and those who are not. Selection means a process by which qualified personnel may be chosen from the applicants offering their service to the organization for employment.

★ Purposes and Importance of Recruitment: -

The general purpose of recruitment is to provide a pool of potentially qualified job candidates. Specifically, the purposes are to:

1. Determine the present and future requirement of the organization in conjunction with the personnel planning and job analysis activities
2. Increase organizational and individual effectiveness in the short and long term.
3. Evaluate the effectiveness of various recruiting techniques and sources for all type of job applicants.

COMPANY PROFILE



Oxygen Gas Production Plant

SNEHAL PROCESSING, BHADE

★ SUGGESTION

working environment is very good in Sachal Processing. They are very co-operative. Any one feels pleasure to work with Sachal Processing. functioning process are very good.

★ **Finding: -** observation & findings I give some suggestions to the organization for their improvement in Recruitment & Selection Process:

- The direct method is used for the recruitment selection process.
- Internal resources are used for recruitment and selection
- The job portal method is used for recruitment and selection.
- Competency mapping, skills and knowledge criteria are used in the recruitment and selection process.
- A better pay package is offered during the recruitment and selection process.
- F2F interview is an effective method of recruitment and selection process.

★ SUGGESTION

Working environment is very good in Snehal Processing. They are very co-operative. Any one feels pleasure to work with Snehal Processing. functioning process are very good.

According to observation & findings I give some suggestions to the organization for their improvement in Recruitment & Selection Process:

- For Casual workers should be advertised in newspapers to get more response and mass mailing should be used while recruiting staff employee.
- For getting more candidates use another external source than consultancy i.e. (job fair, campus interviews).
- Company prefers the form of video conferencing.
- For getting more candidate use another internal source i.e. (previous application, transfer, promotion)

★CONCLUSION

Recruitment is one of the main topics required by most organizations. Therefore, this study helped in understanding various aspects of recruitment and selection process. The internal selection process for Snehal Processing is an effective resource, it can be maintained as Snehal Processing employees are satisfied with the recruitment and selection process. Also, they are well aware about the various sources and method of recruitment and selection process.

In the present scenario, "it is the biggest challenge for a HR manger to hunt for talent."

c) Third Party

What source employer prefer for recruitment and selection?

- a) Internal source
- b) External source

What is the source for internal recruitment among the following?

- a) Promotion
- b) Transfer
- c) Employee referrals
- d) Previous application

What is source for external recruitment among the following?

- a) Campus interview
- b) Private employment Agencies
- c) Job portal
- d) Tie up with institution

What type of method did the employer prefer for your interview?

- a) Personal interview
- b) Telephonic interview
- c) Video conferencing
- d) All of these

**A PROJECT REPORT ON
"EFFECTIVENESS OF RECRUITMENT AND SELECTION PROCESS"**

AT

DHANASHREE INDUSTRIES

D-12 Old M.I.D.C. SATARA- 415004

Submitted to

SAVITRIBAI PHULE PUNE UNIVERSITY – SPPU

In partial fulfilment of the requirements for the Award of Requirement of

MASTER OF BUSINESS ADMINISTRATION – MBA

Submitted by

SHINDE ANKITA ANKUSH

MBA-II, Roll no -

PROJECT GUIDE

PROF. PRIYANKA PAWAR



NAVSAHYADRI GROUP OF INSTITUTES,

FACULTY OF MANAGEMENT – MBA

A/P NAIGAON (NASRAPUR), BHOR, PUNE – 412213.

BATCH: - 2023-24



Navsahyadri Education Society's Group of Institutions
(An Integrated Campus)

Faculty of Management - MBA

NAAC 'A' Grade Institute

(Approved by AICTE, New Delhi | Recognized by Govt. of Maharashtra | Affiliated to Savitribai Phule Pune University)



CERTIFICATE

This is to certify that Miss. Shinde Ankita Ankush
student of Navsahyadri of Institutes, Faculty of Management-MBA Pune has completed his/
her summer training at Dhanashree Industries on the topic
of study on Effectiveness of Recruitment and Selection
Process and has submitted the Summer Training
Project Report in partial fulfillment of Masters of Business Administration - MBA of the
Savitribai Phule Pune University for the academic year 2023-24.

Signature of Project Guide

Name of Project Guide: Priyanka Pawar

Designation Asst. Prof

Date:-

Place:- Naigaon

Director's Signature

Dr. Tanaji Dabade

Director

Internal Supervisor

External Supervisor

TO WHOMSOEVER IT MAY CONERN

Date – 30 September 2023

This is certify that Miss. **ANKITA ANKUSH SHINDE** student of **MBA (HR)** from “**NAVSAHHYADRI GROUP OF INSTITUTES, FACULTY OF MANAGEMENT-MBA; A/P NAIGAON (NASARAPUR), BHOR, PUNE- 412213**” has been completed summer internship Project On” **Study on effectiveness of recruitment and selection process**” with us from **1st August 2023 to 30 September 2023**. During the internship, we found her to be honest, hard- working, and sincere.

We wish her success in all her future endeavors,

Thanking you

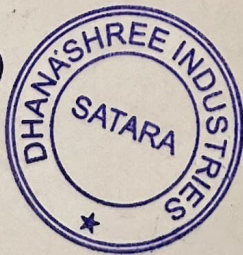
For Dhanashree Industries D12

Old MIDC Satara

Sr.Offieer

Mr. Sunil Bhosale

(HRD)



INDEX

Chapter No.	Particulars	Page No.
1	INTRODUCTION AND LITERATURE REVIEW <ul style="list-style-type: none">• Introduction• Literature review• Recruitment• Factors affecting recruitment• Selection• Steps in Selection Process• Types of Interviews	1-11
2	ORGANIZATIONAL PROFILE	12-21
3	RESEARCH METHODOLOGY	22-25
4	DATA ANALYSIS	26-38
5	FINDING AND SUGGESTION	39-44
6	CONCLUSION	45-46
7	BIBLIOGRAPHY	47-48
8	ANNEXURE	49-52

INTRODUCTION

The human resources are the most important assets of an organization. The success or failure of an organization is largely dependent on the caliber of the people working there is. Without positive and creative contributions from people, organizations cannot progress and prosper. In order to achieve the goals or the activities of an organization, therefore, they need to recruit people with requisite skills, qualifications and experience. While doing so, they have to keep the present as well as the future requirements of the organization in mind.

Recruitment policy of any organization is derived from the personnel policy of the same organization. In other word the former is a part of the latter. However, recruitment policy by itself should take into consideration the government's reservation policy, policy regarding sons of soil, etc., personnel policies of other organizations regarding merit, internal sources, social responsibility in absorbing minority sections, women, etc. Recruitment policy should commit itself to the organization's personnel policy like enriching the organization's human resources or servicing the community by absorbing the retrenched or laid-off employees or casual/temporary employees or dependents of present/former employees, etc. The following factors should be taken into consideration in formulating recruitment policy. They are impact of personnel policies on recruitment policies.

Recruitment policies are mostly drawn from personnel policies of the organization. According to Ramesh Tapariya and Sunil Tapariya, general personnel policies provide a wide variety of guidelines to be spelt out in recruitment policy. After formulation of the recruitment policies, the management has to decide whether to centralize or decentralize the recruitment function. The size of the labor market, the image of the company, the place of posting, the nature of job, the compensation package and a host of other factors influence the manner of aspirants are likely to respond to the recruiting efforts of the company. The series of steps by which the candidates are screened for choosing the most suitable persons for vacant post the basic purpose of selection is to choose the right candidates to fill the various positions in the organization selection is concerned with selecting the most suitable candidates through various interviews and test

FINDING:

1. The chart show result of questionnaire, out of 11 there are 36.4% i.e., 7 were Male response and whereas remaining are 63.6% i.e., 4 was Female response and there is no other response except male and female response. As we see male ratio is greater than the ratio of female response
2. In this chart, 36.4% means 4 response have their age between 18-25, whereas 45.5% i.e., 5 response are between 26-30 age group and 18.9% i.e., 2 response is from 31 and above Overall there as greater number of response is from 26 - 30 age group in compare to other age group
3. Let's have a look at this chart, out of 10 responses 50% i.e., 5 response thinks that they know about the job from personal Reference. 10% i.e., 1 response shows that they know about the job from advertisement. whereas 20% i.e., 2 response know about the job by call from HR. 10% i.e., 1 response shows that they know about the job from Internshala app. 10% i.e., 1 response shows that they know about the job from consultant
4. Let's have a look at the above chart, out of 10 responses 40% i.e., 4 response shows that they have been working in the organization since less than 1 year. 40% i.e., 4 response shows that they have been working in the organization since 1 to 5 years. 20% i.e., 2 response shows that they have been working in the organization since 5 to 10 years. It means there are most of the people have few experiences about the work in the organization.

5. If you look at this graph, you will notice, out of 11 responses there are 54.5% i.e., 6 respondents say there is good with their current job it means that there is some kind of dissatisfaction with their current job. 27.3% i.e., 3 responses say they are totally satisfied with their current job. 18.2% i.e., 2 responses show they are average satisfied with their current. Job satisfaction refers to how well a job provides fulfilment of a need or want, or how well it serves as a source or means of enjoyment. Job satisfaction is the degree to which individuals feel positively or negatively about their jobs.
6. If you look at this graph you will notice, 36.4% i.e., 4 responses show they are totally satisfied with the recruitment process when they were selected in the organization or management or company. Then 36.4% i.e., 4 responses say that they feel good with the recruitment process by when they were selected. Whereas 27.3% i.e., 3 responses say they were average satisfied with their recruitment process it means they seem they can be feeling some kind of satisfaction and somewhere dissatisfied at the time of they were selected.
7. From this chart we get to know, 72.7% i.e., 8 responses show that the recruitment and selection process is done both by internal and external. then 27.3% i.e., 3 responses seem their recruitment and selection process has been done by internally. while in the chart show as the internal sources are used more than the external sources. Employees are hired from external sources like job portal, consultancy, advertisement, campus etc. internal sources are like, present employees, former employees, employee referral, previous applicant etc. Hiring from internal or external sources of organization is also a factor, which affects the recruitment process. It specifies the objectives of the recruitment and provides a framework for the implementation of recruitment programs.

11. From this chart we getting to know 90.9% i.e., 10 responses they experienced about the approach of management is serious and positive during recruitment process and 9.1% i.e., 1 responses they are getting casual experience about the approach of management during the recruitment process and no one feel negative approach of management during recruitment process. From this chart we can see the serious and positive approach is more than casual approach. management can approach recruiting with a reactive or proactive attitude, responding quickly to new job vacancies as they arise or taking the time to build a pool of qualified candidates before new positions open up. Small businesses face additional challenges in building a high-performance team, as well. Savvy companies understand that putting a systematic plan in place to find the best candidates for open positions is virtually always more desirable than hiring reactively at the last minute.

12. In this pie chart it clearly seen the 81.8% i.e., 9 responses Has been rated as a good to the selection policy of the organization and 18.2 % i.e., 2 responses it has been given average rated for the selection policy finally no one given poor response for the selection policy. recruitment and selection Policy Has been framing with the view of recruiting and selecting people who have a strong desire to achieve the company's vision, and who will assist in achieving the business results. recruitment and selection policy, it is one of the very important and most discussed topics of human resource the process of talent acquisition starts from recruitment and is processed further with selection and continues till induction. An organization to survive well must have a concise Recruitment and Selection Policy so that it can have the best talent from a pool of candidates. Having a robust recruitment policy is the first demand of an efficient hiring process. The company must follow the recruitment policy and procedure

SUGGESTIONS:

- Working environment is very good in Dhanashree industries. They are very cooperative. Anyone else pleasure to work with Dhanashree industries and Mutha Groups. functioning process are very good.
- According to observation & findings I give some suggestions to the organization for their improvement in Recruitment & Selection Process:
- For Casual workers should be advertised in newspapers to get more response and mass mailing should be used while recruiting staff employee.
- For getting more candidates use another external source than consultancy i.e. (job fair campus interviews).
- Company prefers the form of video conferencing.
- For getting more candidate use another internal source i.e. (previous application, transfer, promotion)

CHAPTER (6)

CONCLUSION

CONCLUSION

- I mainly worked in recruitment department of this company. The app which I used for daily basis was 'naukri.com' and also on 'Indeed'. By start to end I learned very much from this company.
- The recruitment process involves finding the candidate with the best skills, experience, and personality to fit the job. It requires a series of collecting and reviewing resumes, conducting job interviews, and finally selecting and onboarding an employee to start working for the organization.
- How to get perfect candidate for the particular position / role by understanding the clients demand and need. (Identify the hiring needs)
- How to co-operate and coordinate with the candidates according to their flexible time and needs of their job findings.
- How to edit mail and format accordingly the different positions/roles and all the details (job description JD) (Prepare job descriptions)
- How to schedule the interview among the candidates and with our clients according to both timings' flexibility.
- (Screen and shortlist candidates)
- Created Attractive Job Postings on naukri.com and on Indeed.
- Conducted Phone Screening
- These steps have helped us simplify and streamline our recruitment process. But we haven't ended it there. We frequently monitor it to see how it's performing, which helps us keep it optimized.
- I really liked the recruitment process and also the steps followed to take a perfect candidate for a particular position was so mind-blowing.
- All the things, which I learned includes the mailing, calling, posting, interviewing, screening, shortlisting and much more things I have learned from this internship. The whole process was just about the clients demand and need for their future employees.

A
PROJECT REPORT ON

"Accounting Auditing and Taxation"

AT
CA Pradnya Shah & c.

Submitted to

SAVITRIBAI PHULE PUNE UNIVERSITY – SPPU

In partial fulfilment of the requirements for the Award of Requirement of

MASTER OF BUSINESS ADMINISTRATION – MBA

Submitted by

MR. DHIRAJ MOHAN INAMDAR

MBA-II,

PROJECT GUIDE

PROF. LAXMAN RENAPURE



NAVSABHYADRI GROUP OF INSTITUTES,

FACULTY OF MANAGEMENT – MBA

A/P NAIGAON (NASRAPUR), BHOR, PUNE – 412213.

BATCH: - 2023-24

CERTIFICATE

This is to certify that **Dhiraj Mohan InamdaE**, student of
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Auditing, & Taxation. and has submitted the Summer Training
Project Report in partial fulfillment of Masters of Business Administration - MBA of the
Savitribai Phule Pune University for the academic year 2023-24.

[Signature]

Signature of Project Guide

Name of Project Guide:

Dr. Laxman. H. Renapur.

Designation

Date:-

Place:-

[Signature]

Director's Signature

Dr. Tanaji Dabade

Director

[Signature]

Internal Supervisor

[Signature]

External Supervisor





CA PRADNYA S. SHAH

**CHARTERED ACCOUNTANT
B.COM., FCA**

MOB.9881077617

OFFICE.9970770498

REF NO :

INTERNSHIP CERTIFICATE

DATE : 10-11-2023

This is Certify that Mr. **Dhiraj Mohan Inamdar** student of **MBA (Finance)** from **NAVSHYADRI GROUP OF INSTITUTES , FACULTY OF MANAGEMENT-MBA. A/P NAIGAON (NASRAPUR), BHOR PUNE- 412213** Has been completed Summer Intership project **ACCOUNTING, AUDITTING & TAXATION** with us from 7 AUG 2023 TO 12 NOV 2023.

During the Internship we found.

him to be honest, hard – working, and sincere.

We wish him success in all him future Endeavours.

Thank You.

CA PRADNYA S. SHAH

10-11-2023

EXECUTIVE SUMMARY :

The researcher has got the opportunity of summer internship at CA PRADNYA SHAH & co. Which is a Chartered Accountants firm located in shukrwar peth, Pune – 411 002. This project report gives idea about how firm provide their Accounting,Audit,taxation service to their clients. The project also explains the main concept of Audit.

The main objective of the project is to know the overall procedure of Accounting,Audit,taxation process. The data analysis gives detail information about how CA PRADNYA SHAH & co complete their audit process with their audit process with their clients with the help of well-structured Accounting,Audit,taxation procedure.

Researcher visited the company website and gathered relevant information to make project meaningful. He discussed all knowledge that he has gathered about auditing during summer internship period.

In today world academic education is not adequate to enable a student to compete with confidence and reach his goal without having experience with the outside world. To have an idea and gain experiences, I am a student of Savitribai Phule Pune University must undertake Two-month internship program at any organization.

As a part of my MBA program, the two-month internship program gave me the opportunity to have a practical knowledge on auditing procedure. The assignment was how a firm performs an audit and to gain a knowledge and practical experience on how Accounting,Audit,taxation work is performed in companies.

To face more complex and challenging business world in the challenging business areas, practical knowledge is essential to expand our theoretical base. As I have an intention to become an accountant, I was forwarded to CA PRADNYA SHAH & co, a prominent Chartered Accountant firm in Pune.

This study gave me an opportunity to observe and perform real basic knowledge about the audit procedure, which is followed by any accountancy firm. In the Internship period I could relate the theoretical knowledge of auditing to practical exposure.

TABLE OF CONTENTS/INDEX

SR NO.	CONTENTS	PAGE NO.
1	DECLARATION	01
2	ACKNOWLEDGEMENT	02
3	EXECUTIVE SUMMARY	03
4	CHAPTER I - INTRODUCTION	9-12
5	CHAPTER II - AN EXTRACT FROM INCOME TAX ACT	13-20
6	CHAPTER III- COMPUTATION TO TOTAL INCOME	21-39
7	CHAPTER IV-DEDUCTION FROM TAXABLE INCOME	40-46
8	CHAPTER V-COMPUTATION OF GST LIABILITY	47-57
9	CHAPTER VI- COMPUTATION OF INCOME TAX LIABILITY	58-65
10	CHAPTER VII- CONCLUSION	66
11	CHAPTER IX- BIBLIOGRAPHY	67

CHAPTER 6

COMPUTATION OF INCOME TAX LIABILITY

- **Tax Rates For Accounting Year 2022-2023**

- **Sample Tax Liability Calculations**

- **Filing Of Income Tax Return**

Tax Rates for A.Y.2023-24:

Income Tax Calculation for Senior Citizens FY 2022-23

The income tax for senior citizens is calculated based on the basic salary, house rent allowance, fixed allowances, and other sources of income. However, the senior citizen receives higher exemption limit compared to individuals who are below 60 years old. In order to calculate the income tax for a senior citizen, all the income is taken into consideration along with the allowable deductions and the income tax slab for FY 2022 – 2023. There various websites that offer an online income tax calculator. Once you have all the details, you can use the calculator to determine your taxable income.

Income Tax Slabs For Senior Citizens for Financial Year 2022-23

Tax applicable for individuals over 60 years and under 80 years

Income tax slabs	Rate of tax	Health and education cess
Income up to Rs.2.5 lakh*	No tax	NA
Income between Rs.2.5 lakh and Rs.5 lakh	5%	4% of income tax
Income between Rs.5 lakh and Rs.7.5 lakh	15%	4% of income tax
Income between Rs.7.5 lakh and Rs.10 lakh	15%	4% of income tax
Income between Rs.10 lakh and Rs.12.5l	20%	4% of income tax

Filing of Income Tax Return:-

- Filing of income tax return is compulsory for all individuals whose gross annual income exceeds the maximum amount which is not chargeable to income tax i.e Rs. 2,50,000 for below 60 year age person 2,50,000 Rs above income tax chargeable & Super Senior Citizen Rs.3,00,000 above Chargeable income tax.
- The last date of filling income tax return is july 31,in case of individuals who are not covered in point 3 below.
- If the income includes business or professional income recurring tax audit (turnover Rs. 40,00,000 lakh) , the last date for filling the return is October31.
- The penalty for non-filling of income tax return is Rs.5000. Long term Capital gain on sale of share and equity mutual funds if the security transaction tax is paid/ imposed on such transaction.

CONCLUSION

At the end of this study, we can say that given the rising standards of Indian individuals and upward economy of the country, prudent tax planning before-hand is must for all the citizens to make the most of their incomes. However the mix of tax saving instruments, planning horizon would depend on an individual's total taxable income and age in the particular financial year.

SUMMER INTERNSHIP
PROJECT

“A Comparative study of GST return ”

Submitted to:

SAVITRIBAI PHULE PUNE UNIVERSITY

In partial Fulfilment of Requirement For The Award
Requirement Of

Submitted by:

Mrs. Radhika Vishal Mahangare

Company Guide:

Mr. CA VIVEK JADHAV

Faculty Guide:

Prof. Dr. Laxman Renapur

NAVSHYDRI GROUP OF INSTITUTES FACULTY OF
MANAGEMENT MBA

MP- Malgaon (Nasarpur), Tal- Bhore Dist- Pune -412213

ACADEMIC YEAR – 2023-2024

CERTIFICATE

This is to certify that **Radhika Vishal Mahangare**
student of Navsahyadri of Institutes, Faculty of Management-MBA Pune has completed his/her
summer training at **CA Vivek Jadhav & Co** on the topic
of **A Comparative study of Gst return**
and has submitted the Summer Training
Project Report in partial fulfillment of Masters of Business Administration - MBA of the
Savitribai Phule Pune University for the academic year 2023-24.

Signature of Project Guide

Name of Project Guide:

Dr. Laxman. N. Renapur
Designation

Director's Signature

Dr. Tanaji Dabade

Director

Date:-

Place:- **Naigaon Pune**

Internal Supervisor

External Supervisor





INTERANSHIP CERTIFICATE

This is to certify that. RADHIKA VISHAL MAHANGARE student of NAVSHYDRI EDUCATION SOCIETY GROUP OF INSTITUTION, FACULTY OF MANAGEMENT, Naigaon, Nasrapur, Pune. Who studying in MASTER OF BUSINESS ADMINISTRATION (MBA) SECOND YEAR has successfully completed internship project work in our firm for 2 months during from 1 Aug 2023 to 30 Sep 2023.

She has completed her project on "A Comparative Study of GST Return." During her project work we find him sincere and hard working in her studies and responsibilities.

We wish her all the best in her future endeavours and hope she will have very successful career ahead.

CA VIVEK JADHAV

AUTHORISED SIGNATURE



Index (Table of Contents)

Sr. No.	Particulars	Page No.
1	Introduction	2
2	Company profile	3
3	Terminologies	5
4	Literature	6 To 28
5	Research Methodology	29 To 60
6	Data Analysis And Interpretation	61 To 65
7	Findings	66 To 67
8	Conclusion	68
9	Bibliography	69

Introduction

The title of the project study **“A Comparative study of GST return”** gives us broad knowledge about GST and analysis of GST return. The study also helps to know how auditing of various GST return done in practical world of finance.

The Goods and Services Tax, or GST, is an indirect tax law applicable across India. It has replaced multiple indirect taxes such as excise duty, service tax, value-added tax, octroi, entry tax, and luxury tax. Laws pertaining to the same were put into effect on July 01, 2017, in India. This indirect taxation system has gone through multiple amendments since to arrive at the current juncture. However, it must be noted that GST does not replace customs duty, which is still mandatory on imported goods and services. Every kind of product and service attracts a different tax rate under GST. For example, luxury or sin goods are classified to attract a higher interest rate, whereas necessities have been included in lower and nil rate slab rates.

Company profile

Name of firm	:- CA VIVEK JADHAV & CO.
Type of firm	:- Limited Liability Proprietorship
Work profile of firm	:- Accounting And Auditing
Proprietor's of firm	:- CA Vivek Jadhav

FINDINGS

- Found out various financial techniques which helped in accounting.
- GST return comparison process
- Learned about various financial terminologies used in business.
- Learning about use of tax slabs in GST.
- Graphical analysis of current with previous data.

Suggestions

The idea of a nationwide GST in India was first proposed by the Kelkar Task Force on Indirect taxes in 2000. The objective was to replace the prevailing complex and fragmented tax structure with a unified system that would simplify compliance, reduce tax cascading, and promote economic integration.

CONCLUSION

- Summer internship in CA Vivek Jadhav & Company was very helpful for in learning about financial and management aspect in the organization.
- During SIP I have gained knowledge of GST and how actual auditing is done to findout frauds done by seller to save tax.
- In this process I came that working in an organisation and studying about working in organisation is very different.

Roll No:- 20315

**A PROJECT REPORT ON
"A STUDY ON HOME LOANS IN ICICI BANK"**

**AT
ICICI BANK, LATUR**

**SUBMITTED TO
SAVITIRBAI PHULE PUNE UNIVERSITY - SPPU**

**In Partial Fulfillment of Requirements for the
Award of Requirement of
Masters of Business Administration MBA**

**BY
AKSHAYDATTA RAJARAM GHULE
MBA- II Roll No: 20315**

**PROJECT GUIDE
DR. LAXMAN DOIPHODE**



**NAVSAHYADRI GROUP OF INSTITUTES,
FACULTY OF MANAGEMENT - MBA
A/P NAIGAON (NASRAPUR), BHOR, PUNE - 412 213.**

BATCH: - 2023-24

CERTIFICATE

This is to certify that **MR. GHULE AKSHAYDATT A RAJARAM** student of Navsahyadri of Institutes, Faculty of Management-MBA Pune has completed his/ her summer training at **ICICI BANK, LATUR** on the topic of **A STUDY ON HOME LOANS IN ICICI BANK** and has submitted the Summer Training Project Report in partial fulfillment of Masters of Business Administration - MBA of the Savitribai Phule Pune University for the academic year 2023-24.



Signature of Project Guide

Name of Project Guide: **Dr. Laxman Doiphode**

Designation **HOD - MBA**

Date:-

Place:-



Director's Signature

Dr. Tanaji Dabade

Director



Internal Supervisor



External Supervisor



National Assessment & Accreditation Council



University Grants Commission



Savitribai Phule Pune University

January 01, 2024

TO WHOMSOEVER IT MAY CONCERN

This is certify that Mr. Akshaydatta Rajaram Ghule, student of MBA from Navsahyadri Group of Institutions, College of MBA, Naigaon, Pune has successfully completed his Summer Internship with our Credit and Policy Group from September 1, 2023 to December 30, 2023. He worked under the guidance of Mr. Rushikesh Bande.

During the period of his internship programme with us, he had been exposed to different processes and found diligent, hardworking and inquisitive. He has successfully completed his project with ICICI Bank.

We wish him all the best in his future endeavors.

Regards,



Vishal Rindhe
Zonal Credit Manager
CPG

CHAPTER NO.	PARTICULARS	PAGE NO.
	ABSTRACT	8
1	INTRODUCTION	9-21
2	LITERATURE REVIEW	22-27
3	RESEARCH METHODOLOGY	28-32
4	DATA ANALYSIS AND INTERPRETATION	33-51
5	SUMMERY OF FINDINGS, SUGGESTIONS AND CONCLUSION	52-55
ANNEXURE	QUESTIONNAIRE	56-59
	BIBLIOGRAPHY/REFERENCES	

ABSTRACT

In this research paper, against the milieu of rapid urbanization and a changing socio-economic scenario, the demand for housing has grown explosively. The importance of the housing sector in the economy can be illustrated by a few key statistics. According to the National Building Organization (NBO), the total demand for housing is estimated at 2 million units per year and the total housing shortfall is estimated to be 19.4 million units, of which 12.76 million units is from rural areas and 6.64 million units from urban areas. The housing industry is the second largest employment generator in the country. It is estimated that the budgeted 2 million units would lead to the creation of an additional 10 million man- years of direct employment and another 15 million man-years of indirect employment. A year equates a century, knowledge compresses time and the information technology sweeps the world, gathering momentum with each new application, soaring towards fresh goal, rapidly opening vistas hitherto unknown. Here we are, in the 21st century every year that catapults us towards new challenges at every stage of endeavor. It gives us good reason for aiming high. Retail Banking has been popular segment to enter into for many banks. In this retail banking housing sector has been most promising segment which is promising a comprehensive growth rate of about 30% for the next fifty years. During the past 4-5 years the housing sector helped by the growing housing finance industry has witnessed significant developments.

Keeping the above philosophy in mind, this project is carried out with an objective to identify the basic needs of the applicants and the process of Home Loans in ICICI Bank Ltd.

Keywords: Housing Sector, Employment, Rapid Development.

FINDINGS, SUGGESTION AND CONCLUSION

5.1. FINDINGS:

1. Majority (60%) of the respondents are *Male*.
2. Majority (37%) of the respondents are occupied as *private employee*.
3. Majority (37%) of the respondent's income is between *6-12 Lakhs p.a.*
4. Majority (81%) of the respondents prefer *individual type* of villa.
5. Majority (70%) of the respondents are presently living in their *own house*.
6. Majority (36%) of the respondents resident *owners are their parents*.
7. Majority (65%) of the respondents have their *primary account in ICICI BANK*.
8. Majority (65%) of the respondents prefer their *primary bank to take further loan*.
9. Majority (90%) of the respondents says that prefer to take *fresh new loan*.
10. Majority (35%) of the respondents are interested in *taking loan as construction* for home.
11. Majority (65%) of the respondent prefer their *repayment between 10-20 years*.
12. Majority (65%) of the respondents also prefer to take *additional extended loan* for further extension.

5.2 SUGGESTIONS:

- ICICI Bank having good brand image in the minds of customers.
- Majority of the people got loans from ICICI Bank only.
- Most of the customers are not aware of the products of ICICI homeloans.
- Some of the customer's felt that the interest rates are some what high.
- Some of the customer not having good faith on private banks.
- Most of the people are directly go to bank to apply a home loan.
- Some of the customer of ICICI already benefited through ICICI homeloan products and services.
- Customer awareness is medium about ICICI products.

5.3 RECOMMENDATIONS:

- Create awareness: The Company has to take care of awarenesscreation about the products and services among the customers.
- Charges: The Company has to reduce the mortality and administration charges.
- The process is somewhat late to sanction a loan.
- The company has to reduce their interest rates on home loan productsand services.
- The company has to identify the potential customers. Production promotion strategies should be improved.
- Company should consider the present competition and should actaccording to the customer needs.

5.4. LIMITATIONS OF STUDY:

- ✓ The study is confined to Dharmapuri District only due to timeconstraint.
- ✓ Getting timely responses from the respondents was a difficult task due to their regular routine activities.
- ✓ The data collected for the research is fully on primary data given by the respondents. There is chance for personal bias, so the accuracy is not true.
- ✓ The study has been limited 100 respondents only.
- ✓ Limited time for survey is other constrain.

5.5. CONCLUSION

- In my study we came to know that many peoples are interested to take a home loan from ICICI bank to construct their homes.
- Home loans have long period when compare to other personal loans and other loans. So peoples are interested to take a home loan as it becomes an asset.
- Even though the interest rates are high peoples are willing to take a loan from ICICI bank due to quick process and sanctioning with expert teams.
- The loan sanction process is much faster when compare to other banks.
- For disbursement process is also it will take less time and less number of stages when compare to other banks.
- Finally, Home Loan is best income for banks for long time and customers also get their dreams fulfilled.