AN AUTOMATIC WATER TANK LEVEL CONTROLLER

A PROJECT WORK I REPORT

Submitted by

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in partial fulfillment of the requirements for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

KONGU ENGINEERING COLLEGE

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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MAY 2023

BONAFIDE CERTIFICATE

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This is to certify that the project report entitled **AN AUTOMATIC WATER TANK LEVEL CONTROLLER** is the bonafide record of is the project work done by **JANAKRISHNAN K P (20ECR057), KARTEESWAR K P (20ECR071), LATHIKA M V (20ECR088)** in partial fulfilment of the requirements for the award of the Degree of Bachelor of Engineering in Electronics and Communication Engineering of Anna university, Chennai during the year 2023.

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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MAY 2023 DECLARATION

We affirm that the consultancy project work I report titled **AN AUTOMATIC WATER TANK LEVEL CONTROLLER** being submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering is the original work carried out by us. It has not formed the part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

Date: (Signature of the Candidates)

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I certify that the declaration made by the above candidate is true to the best of my knowledge.

Date: Name & Signature of the supervisor with seal

ABSTRACT

This project presents a prototype of an automatic water tank system designed to enhance water tank level control in an industrial setting. The system aims to regulate the water level, prevent wastage, and ensure optimal tank conditions without requiring human intervention. The tank used in this system has a capacity of 5000 liters and is elevated at a height of 15 feet. The prototype utilizes a float sensor switch and relay module to accurately detect the water level and automatically control a water pump. By automating the filling process, the system eliminates the need for manual pump control by employees and reduces the risk of water wastage due to forgetting to turn off the pump. The prototype's performance metrics, such as accuracy, response time, and energy efficiency, are dependent on the specific design and implementation choices made during its development. Overall, the system provides increased comfort and convenience to users, ensuring optimal water levels in the tanks while minimizing water wastage.

ACKNOWLEDGEMENT

First and foremost, we acknowledge the abundant grace and presence of the almighty throughout different phases of the project and its successful completion.

We wish to express our hearty gratitude to our honorable Correspondent **Thiru.A.K.ILANGO B.Com., M.B.A., LLB.,** and other trust members for having provided us with all the necessary infrastructures to undertake this project.

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We would like to express our profound interest and sincere gratitude to our respected Head of the department **Dr.T.MEERADEVI ME., Ph.D.,** for her valuable guidance.

A special debt is owed to the project coordinator **Dr.S.SASIKALA B.E., M.E., Ph.D.,** Associate Professor and **Mr.K.KAVINKUMAR B.E., M.E.,** Assistant Professor (Sr.G), Department of Electronics and Communication Engineering for their encouragement and valuable advice that made us to carry out the project work successfully.

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We hereby thank **Mr.S.VIJAYAKUMAR** of SS WEAVES, Erode for giving us an opportunity to associate with them to execute the project.

We are grateful to all the faculty and staff members of the Electronics and Communication Engineering Department and persons who directly and indirectly supported this project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

GND	Ground
HVAC	Heating Ventilation and Air conditioning
IoT	Internet of things
LED	Light Emitting Diode
OUT	Output
VCC	Power Supply

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This project focuses on developing an automatic water tank system that regulates water levels in tanks and reservoirs. It would be widely used in home, industries, and agriculture to maintain a consistent water supply, prevent overflow, and protect the pump. The system utilizes sensors to detect the water level and activates or deactivates the pump accordingly. By automating pump operation, the system offers convenience, efficiency, and cost savings. It ensures a consistent water level, prevents overflow or dry running of the pump, and reduces water and electricity bills. Additionally, the system can be programmed for specific pump operation times, providing automated water management capabilities. Overall, this project aims to create an automatic water tank system that optimizes water usage, enhances pump performance, and offers automated control for various applications.

1.2 PROBLEM STATEMENT

The company has tanks with a capacity of 5000 liters. However, the employees, who are responsible for filling the tanks using a motor, often forget to turn off the motor, leading to significant water wastage. The tanks are located on the company roof, making it challenging to manually check the water level. If the tanks run dry, it hampers the water supply to the company. Furthermore, the company aims to calculate the average daily water usage.

1.3 OBJECTIVE

The project involves developing an automated system to control a motor responsible for filling tanks based on water level detection. The system will turn off the motor when the water level reaches a certain point to prevent wastage and turn it on when the water level drops below a certain point to refill the tank.

Additionally, the system will measure and record the water usage in both tanks to calculate the average water usage per day. The objective of the project is to provide the company with an efficient and cost-effective solution to reduce water wastage, monitor water levels, and optimize their water usage. This system can help the company save money on water bills, reduce their environmental impact, and ensure a reliable water supply.

1.4 SCOPE OF THE PROJECT

The primary function of our project is to automate the water level management process and ensure that the water level in the tank is maintained at a consistent level.It is used in a wide range of applications, including households, commercial buildings, industries, and agriculture.Its scope extends to any application where water level management is required, making it a versatile and indispensable tool.

1.5 FLOAT SENSOR SWITCH

The float sensor switch is given as a pictorial representation in figure 1.1. It is a type of sensor commonly used in automatic water tank level controllers to detect the water level in a tank. It consists of a float that rises and falls with the water level and a switch that is triggered when the float reaches a certain level. The following are some of the specifications of a float switch sensor:

Material: The float switch sensor is typically made of a non-corrosive material such as stainless steel or plastic to prevent damage from water or other liquids.

Maximum voltage: The maximum voltage rating of a float switch sensor varies depending on the model and manufacturer, but it is typically between 100 and 250 volts.

Maximum current: The maximum current rating of a float switch sensor also varies depending on the model and manufacturer, but it is typically between 0.5 and 1 ampere.

Maximum temperature: The maximum temperature rating of a float switch sensor is typically around 80-90 degrees Celsius, but some models can withstand higher temperatures.

Switching mechanism: The switching mechanism of a float switch sensor can be either a reed switch or a mechanical switch. Reed switches are more reliable and have a longer lifespan, but they are also more expensive.

Figure 1.1 FLOAT SWITCH SENSOR

Overall, the specifications of a float switch sensor can vary depending on the specific model and manufacturer. It is important to choose a float switch sensor that is compatible with the water tank level controller and meets the requirements of the application.

1.6 RELAY MODULE

The relay module is given as a pictorial representation in figure 1.2. It is an electromagnetic switch that is used to control the flow of electricity in a circuit. It consists of a coil and a set of contacts that are mechanically linked to the coil. When a current flows through the coil, it generates a magnetic field that pulls the contacts together, closing the circuit and allowing the flow of electricity. When the current is removed from the coil, the contacts return to their original position, opening the circuit and stopping the flow of electricity. Relays are commonly used in a variety of applications, including industrial automation, automotive systems, and home appliances. They are useful for controlling high-current or high-voltage circuits with low-voltage signals, such as those generated by microcontrollers or sensors. By using a relay, a low-voltage signal can control a high-voltage circuit without the risk of damaging the low-voltage device. Relays come in various sizes and configurations, depending on the application and requirements. They can be classified based on their number of poles (the number of separate circuits the relay can control) and their number of throws (the number of possible positions of the contacts). Some relays also include additional features such as a built-in diode to protect against voltage spikes or a time delay to control the duration of the relay's operation. Overall, relays are an important component in many electrical and electronic systems, providing a safe and reliable way to control the flow of electricity.

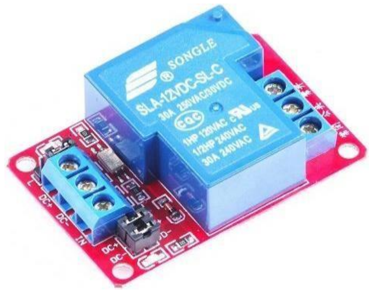

Figure 1.2 RELAY MODULE

The operation of a relay is based on the principle of electromagnetic induction. When a current flows through the coil of wire in a relay, it creates a magnetic field around the coil. This magnetic field attracts an iron or steel core, called the armature, which is connected to one or more contacts. When the armature is attracted to the coil, it pulls the contacts together, closing the circuit. When the current flowing through the coil is interrupted or turned off, the magnetic field collapses, and the armature returns to its original position, opening the contacts and breaking the circuit. Relays are widely used in a variety of applications, including motor control, lighting control, HVAC systems, security systems, and more. They provide a simple and reliable way to control circuits and can be easily integrated into existing systems.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter gives a detailed explanation of the literature review and theoretical background of the project. The literature review basically deals with related project written by other researchers, the difficulties they encountered, limitations and modifications that should be made. Theoretical background explains in detail about some of the most important components used in the project.

2.2 REVIEW OF RELEVANT LITERATURE

Here is a brief literature review for automatic water tank level controllers:

"Design and Implementation of Automatic Water Level Controller Using Microcontroller" by R. S. Bhamra and H. S. Hundal. This study discusses the design and implementation of an automatic water level controller using a microcontroller. The system uses sensors to detect the water level and a microcontroller to control the pump's on and off time. The study concludes that the controller provides an efficient and cost-effective solution to water level management.

"Smart Water Level Monitoring and Controlling System Using IoT" by V. V. Pawar and S. S. Kadam. This study proposes a smart water level monitoring and controlling system using the Internet of Things (IoT) technology. The system uses ultrasonic sensors to measure the water level and sends the data to a cloud server for real-time monitoring and control. The study concludes that the system provides an efficient and convenient solution to water level management.

"Automatic Water Level Control System Using Wireless Sensor Network" by T. K. Jha and P. K. Sahu. This study proposes an automatic water level control system using a wireless sensor network. The system uses ultrasonic sensors to measure the water level and a wireless sensor network to transmit the data to a control unit. The study concludes that the system provides an efficient and cost-effective solution to water level management.

"Design and Implementation of Automatic Water Level Controller Using Arduino" by M. H. Hassan and M. A. Rahman. This study discusses the design and implementation of an automatic water level controller using an Arduino microcontroller. The system uses float switches to detect the water level and an Arduino microcontroller to control the pump's on and off time. The study concludes that the controller provides an efficient and cost-effective solution to water level management.

Overall, these studies suggest that automatic water tank level controllers are effective, efficient, and cost-effective solutions for water level management. They offer convenience, automation, and real-time monitoring, making them an essential component of modern water management systems.

CHAPTER 3

EXISTING METHOD

There are several existing methods for automatic water tank level control, including:

Float switch method: This method uses a float switch sensor that is placed inside the water tank. The sensor detects the water level and sends a signal to a control unit to switch the pump on or off depending on the water level.

Ultrasonic method: This method uses an ultrasonic sensor that sends a sound wave to the water surface and measures the time it takes for the wave to bounce back. The time delay is used to calculate the water level, and the control unit switches the pump on or off accordingly.

Capacitive method: This method uses a capacitive sensor that measures the capacitance between two electrodes placed inside the water tank. The capacitance is proportional to the water level, and the control unit switches the pump on or off depending on the capacitance reading.

Pressure method: This method uses a pressure sensor that measures the pressure at the bottom of the water tank. The pressure is proportional to the water level, and the control unit switches the pump on or off depending on the pressure reading.

Conductivity method: This method uses a conductivity sensor that measures the electrical conductivity of the water. The conductivity is proportional to the water level, and the control unit switches the pump on or off depending on the conductivity reading.

Each method has its advantages and disadvantages, depending on the specific application requirements. For example, the float switch method is simple and cost-effective, but it may not be suitable for large water tanks or tanks with varying water levels. The ultrasonic method is accurate but may be affected by the presence of foam or turbulence in the water. The pressure method is reliable but may require calibration over time. The conductivity method is sensitive to impurities in the water and may not be suitable for all applications.

CHAPTER 4

PROPOSED METHOD

4.1 WORKING OF FLOAT SENSOR:

The float sensor consists of a float attached to a lever arm. The lever arm is connected to a switch mechanism that opens or closes an electrical circuit depending on the position of the float. As the water level rises in the tank, the float attached to the lever arm also rises, causing the lever arm to move. This movement is transferred to the switch mechanism, which then activates the relay to turn off the water pump/valve. When the water level falls, the float also falls, causing the switch mechanism to close the circuit, which activates the relay to turn on the water pump/valve.

Specifications of Float Sensor:

When selecting a float sensor, the following specifications should be considered:

Material: The float sensor should be made of materials that are resistant to corrosion and can withstand the harsh conditions inside the water tank.

Contact Rating: The contact rating should be high enough to handle the voltage and current required for the relay.

Sensitivity: The float sensor should be sensitive enough to detect changes in the water level and activate the switch mechanism accordingly.

Size and shape: The float sensor should be compact enough to fit into the water tank without taking up too much space.

Cost: The cost of the float sensor should be reasonable and affordable, without compromising on quality and performance.

Table 4.1 Specifications Float Sensor

Specification	Description
Material	Stainless Steel
Contact Rating	250VAC/5A
Sensitivity	0.5mm
Size and Shape	60mm x 90mm x 30mm
Cost	$10 - $20

4.1.1 Peripherals of Float Sensor:

The float sensor may require additional peripherals to function effectively, such as:

Cables: The float sensor is connected to the relay via cables, which carry the signal from the sensor to the relay.

Relay: The relay is responsible for turning on/off the water pump/valve based on the signal received from the float sensor.

Water Pump/Valve: The water pump/valve is used to refill the tank when the water level falls below a certain threshold.

LED Indicators: The LED indicators display the current water level in the tank, indicating whether the tank is full, partially full, or empty.

Figure 4.1 FLOAT SENSOR PIN DESCRIPTION

Ground (GND): This pin is connected to the ground.

Power Supply (VCC): This pin is connected to the power supply.

Output (OUT): This pin is connected to the relay input and sends a signal to the relay to turn on/off the water pump/valve based on the water level detected by the float sensor.

4.2 WORKING OF RELAY

A relay is an electromagnetic switch that is used to control the operation of an electrical circuit. The relay consists of a coil, an armature, and one or more sets of contacts. When an electric current is passed through the coil, it generates a magnetic field that attracts the armature towards it. This movement of the armature causes the contacts to either make or break the electrical connection in the circuit.

For example, if the relay is used to control a pump, when the coil is energized, the armature moves and closes the contact, allowing the electrical current to flow to the pump, turning it on. Conversely, when the coil is de-energized, the armature moves back to its original position, opening the contact, and interrupting the electrical current to the pump, turning it off. In the context of a water level control system, a float sensor is used to detect the water level in a tank. When the water level reaches a specific height, the float sensor sends an electrical signal to the relay, which activates the coil, and the contacts open or close, depending on the desired function. This action turns on or off the pump or valve to control the water level in the tank.

Table 4.2 Specifications Relay

Specification	Description
Type of Module	Relay Module
Number of Channels	1, 2, 4, 8, or more
Type of Relay	Electromechanical Relay
Input Voltage	5V DC or 12V DC
Maximum Load Capacity of Relay	10A, 250V AC
Contact Configuration	SPDT
Trigger Current	5mA or less
LED Indicator	Yes
Operating Temperature Range	-20°C to +70°C
Board Size	25mm x 30mm (for a 1-channel module)
Mounting Holes	Yes
Power Consumption	0.36W per channel
Compatibility	Arduino, Raspberry Pi, and other microcontrollers

4.3 WORKING OF LED

In an automatic water level controller, an LED (Light Emitting Diode) is commonly used as an indicator to show the current status of the system. The LED can be used to indicate when the motor is running or when the water level has reached a certain point. When the motor is running, the LED will be lit to indicate that the water is being pumped or refilled. Conversely, when the motor is turned off, the LED will be off to indicate that the water level has reached the desired level, and the system is in standby mode.

The LED is connected in series with a resistor to limit the current flowing through it to a safe value. When the output signal from the relay or sensor reaches a certain threshold level, it activates the LED, and it illuminates. For example, in a typical water level control system, when the water level reaches a certain height, the float sensor sends an electrical signal to the relay, which activates the LED, indicating that the motor is running. When the water level reaches the desired level, the float sensor sends another signal to the relay, which deactivates the LED, indicating that the motor has been turned off. Overall, the LED is a simple and effective way to provide visual feedback on the operation of the automatic water level control system.

CHAPTER 5

METHODOLOGY AND RESULTS

An automatic water tank level controller using a float sensor, relay, and LED indication can also be designed without using any microcontrollers. The methodology and working of such a system can be explained as follows:

Float Sensor:

A float sensor is used to detect the water level in the tank. The sensor consists of a float that moves up and down with the water level, and a switch that is activated when the float reaches a certain position.

Relay:

The float sensor is connected to a relay that is connected to the water pump or valve. When the water level in the tank falls below a certain threshold, the float sensor activates the switch and turns on the relay to start the water pump/valve and refill the tank.

LED Indication:

The system includes LED indicators to show the current water level in the tank. For example, green LED may indicate that the tank is full, yellow LED may indicate that the tank is partially full, and red LED may indicate that the tank is empty.

Power Supply:

The system requires a power supply to operate the relay and the LED indicators. A battery or AC adapter can be used.

The working of the automatic water tank level controller can be summarized as follows:

- When the water level in the tank falls below a certain threshold, the float sensor activates the switch and turns on the relay to start the water pump/valve and refill the tank.
- As the water level in the tank rises, the float sensor detects the change and deactivates the switch, which turns off the relay and stops the water pump/valve.
- The LED indicators show the current water level in the tank, and the system continues to monitor and control the water level as needed.

5.1 BLOCK DIAGRAM

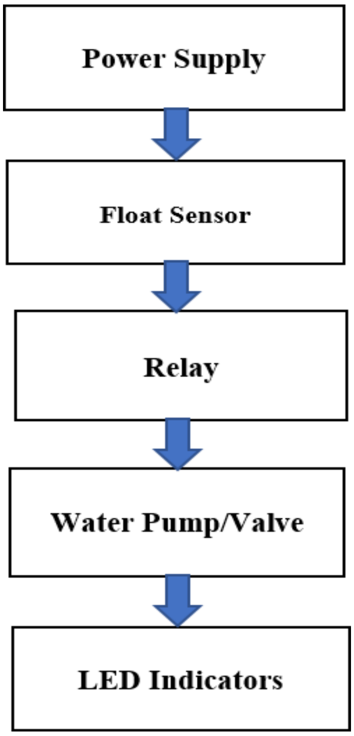

Figure 5.1 BLOCK DIAGRAM

Figure 5.1 explains the complete flow of the system, the power supply provides the necessary power to the float sensor, relay, water pump/valve, and LED indicators. The float sensor is connected to the relay, which is used to control the water pump/valve. When the water level in the tank falls below a certain threshold, the float sensor activates the relay, which turns on the water pump/valve to refill the tank. As the water level rises, the float sensor deactivates the relay, which turns off the water pump/valve.

The LED indicators are also connected to the float sensor, and they show the current water level in the tank. For example, green LED may indicate that the tank is full, yellow LED may indicate that the tank is partially full, and red LED may indicate that the tank is empty.

5.2 HARDWARE OUTPUT

Figure 5.2 FLOAT SENSOR SWITCH IN TANK

In the above Figure 5.2 shows the float sensor switch immersed in the tank in the floating condition which turns on the motor while the tank is empty and turns off the motor while the tank is full.

Figure 5.3 JUNCTION BOX

In the above Figure 5.3 shows the junction box which carries the input wire of the float sensor switch.

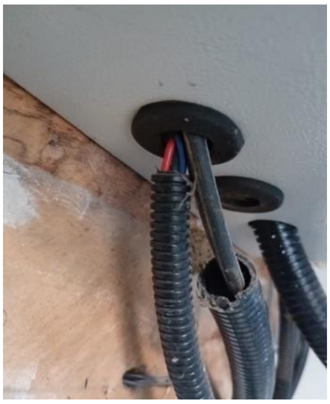

Figure 5.4 INPUT WIRE TO THE METER BOX

In the above Figure 5.4 shows the input wire of the float sensor switch which is connected to the starter box of the pump.

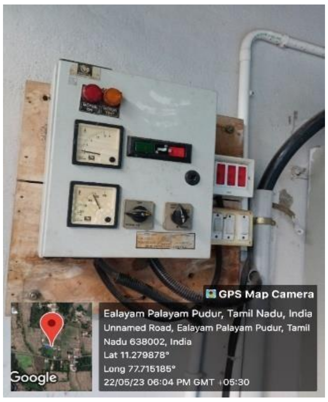

Figure 5.5 STARTER BOX

In the above Figure 5.5 shows our prototype model where the starter box act as an automatic water tank level controller.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

An automatic water tank level controller is an essential device that offers several benefits, including increased efficiency, reduced water wastage, and improved safety. The controller eliminates the need for manual monitoring of water levels, which can be time-consuming and often inaccurate. It uses sensors and a controller to regulate the flow of water in and out of the tank based on the readings from the sensors.

There are several existing methods for automatic water tank level control, including float switch, ultrasonic, capacitive, pressure, and conductivity methods. Each method has its advantages and disadvantages, depending on the specific application requirements. In terms of future scope, there is a growing demand for smart and connected devices, and the automatic water tank level controller is no exception. The integration of wireless communication technologies such as Wi-Fi, Bluetooth, or LoRa can enable remote monitoring and control of the water tank level, making it more convenient and efficient for users. Additionally, artificial intelligence and machine learning algorithms can be used to optimize the performance of the controller, making it more accurate and reliable over time.

Moreover, there is also scope for the development of more sustainable and eco-friendly water tank level controllers that use renewable energy sources such as solar or wind power. These solutions can help reduce energy consumption and carbon emissions, making them more environmentally friendly. With the increasing use of IoT (Internet of Things) technology, there is potential for water tank level controllers to be integrated into larger systems that can offer real-time monitoring and control, remote access, and predictive maintenance. Overall, the future of the automatic water tank level controller looks promising, with continued advancements in technology and increasing demand for efficient and sustainable solutions.

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ACCEPTANCE LETTER

KONGU ENGINEERING COLLEGE

KARTEESWAR K P 20ECR071 <karteeswarkp.20ece@kongu.edu>

(no subject)

SS Weaves <ssweaveserode@gmail.com> Tue, Mar 14, 2023 at 1:00 PM
To: karteeswarkp.20ece@kongu.edu

Sir,

This is to inform you that we are accepting your request and allowing you to do a project in our concern.

The Members allowed to do Project are as follows
1. K. P. Karteeswar
2. M.V. Lathika
3. K.P. Janakrishnan

You are asked to visit our concern and report us soon.

Thanks & Regards,

Mr. S.Vijay kumar
M/s. SS Weaves ,
RSF No.147/b , Elayampalayam pudhur ,
Nathagavundampalayam (po)
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APPRECIATION LETTER

SS WEAVES

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Date: 15-05-2023

To

The Principal,
Kongu Engineering College,
Perundurai,
Erode- 638060.

Sir,

Sub : Confirmation message for receiving the consultancy project of Hardware application – Reg.

As per the discussion made with Mr.G.Thirunavukkarasu, Assistant Professor of ECE,KEC on 15.05.2023 , we said that we were in need of the Hardware application for our company. We had offered this project work to his students

1. Janakrishnan K P(20ECR057)
2. Karteeswar K P(20ECR071)
3. Lathika M V(20ECR088)

We are pleased to inform you that we have received a Hardware application for our agency by these students. The Hardware application has fulfilled our expectation and it is representing our company in an accurate manner.

Thanking you,

15/5/23

(T.SUGANYA),

Managing Director ,