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NAAC Accredited Autonomous Institution
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ISO 9001:2015 & ISO 14001:2015 Certified Institution
Thalavapalayam, Karur - 639 113.

A Minor Project Report

On

Water pump Automatic Transformation System

Submitted in partial fulfillment of requirements for the award of the

Degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

Under the guidance of

Mr. K. KARTHIK (Assistant Professor)/CSE

Submitted by

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.KUMARASAMY COLLEGE OF ENGINEERING

(Autonomous)

KARUR–639113

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(Autonomous Institution affiliated to Anna University, Chennai)

KARUR–639113

BONAFIDE CERTIFICATE

Certified that his minor project report **"Water pump Automatic Transformation System"** is the bonafide work of **"ELAMARAN A (21BCS029), JEYARAM R (21BCS047), KAPIL M (21BCS052) and KAVIN B (21BCS054)"** Who carried out the project work during the academic year 2022-2023 under my supervision.

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VISION OF THE INSTITUTION

- To emerge as a leader among the top institutions in the field of technical education

MISSION OF THE INSTITUTION

- Produces mart technocrats with empirical knowledge who can surmount global challenges.
- Create a fully engaged, learner-centric campus environment to provide quality education to the students.
- Maintain mutually beneficial partnerships with our alumni, industry,and
- Professional associations.

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- To achieve education and research excellence in Computer Science and Engineering.

MISSION OF THE DEPARTMENT

- To excel in academics through effective teaching and learning techniques.
- To promote search in the area of computer science and engineering with a focus on innovation.
- To transform students into technically competent professionals with societal and ethical responsibilities.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

PEO1: Graduates will have a successful career in software industries and R&D divisions through continuous learning.

PEO2: Graduates will provide effective solutions for real-world problems in the key domain of computer science and engineering and engage in lifelong learning.

PEO3: Graduates will excel in their profession by being ethically and socially responsible.

PROGRAM OUTCOMES(POs)

Engineering students will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identity, formulate, review research literature, and analyzecomplexengineeringproblemsreachingsubstantiatedconclusionsusingfirstprinciplesof mathematics, the natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate public health, safety, and environmental considerations.
4. **Conduct investigations of complex problem sets:** Use research-based knowledge and research methods including design of experiments, analysis, and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineeringandITtoolsincludingpredictionandmodelingtocomplexengineeringactivities with an understanding of the limitations.
6. **The engineer and society:** App reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts ,and demonstrate the knowledge of ,and need for sustainable development.
8. **Ethics:** Apply ethical principles, and commit to professional ethics, responsibilities, and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member in a diverse team season multidisciplinary settings.
10. **Communication: Communicate effectively on complex engineering activities with the engineering** community and with society at large such as, being able to command write reports and designs and design do make effective presentations, and give and receive clear instructions.

11. **Project management and finance Demonstrate knowledge and understanding of the engineering management** principles in applying and apply to one's work, as a remember and leading team to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for preparation and the ability to engage in independent and life-learn learning in the context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

PSO1: Professional Skills: Ability to apply the knowledge of computing techniques to design and develop computerized solutions for problems.

PSO2: Successful career: Ability to utilize computing skills and ethical values in creating a successful career.

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ABSTRACT WITH PO AND PSO MAPPING

ABSTRACT	POs MAPPED	PSOs MAPPED
The Water Pump Automatic Transformation System (WPATS) is an innovative solution that enhances water pumping efficiency through smart technology. The sensor which detects the level of water in the water tank. When the water reaches the maximum capacity level it will automate the valves. The system offers remote monitoring, adaptive pumping strategies, and predictive maintenance, revolutionizing water management in various industries and applications. WPATS simplifies pump operation and contributes to sustainable future. The Water Pump Automatic Transformation System represents a significant advancement in water pumping technology, offering a comprehensive solution .	**PO1(3)** **PO2(3)** **PO3(3)** **PO4(3)** **PO5(3)** **PO6(2)** **PO7(3)** **PO8(2)** **PO9(3)** **PO10(3)** **PO11(3)** **PO12(3)**	**PSO1(3)** **PSO2(3)**

Note: 1-Low, 2-Medium, 3-High

SUPERVISOR **HEAD OF THE DEPARTMENT**

ABSTRACT

The Water Pump Automatic Transformation System (WPATS) is an innovative solution that enhances water pumping efficiency through smart technology. The sensor which detects the level of water in the water tank. When the water reaches the maximum capacity level it will automate the valves. The system offers remote monitoring, adaptive pumping strategies, and predictive maintenance, revolutionizing water management in various industries and applications. WPATS simplifies pump operation and contributes to sustainable future. The Water Pump Automatic Transformation System represents a significant advancement in water pumping technology, offering a comprehensive solution .

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LIST OF ACRONYMS/ABBREVIATIONS

WPATS	Water Pump Automatic Transformation System
IDE	Integrated Development Environment
ICSP	In-Circuit Serial programming
PWM	Pulse Width Modulation

CHAPTER 1

INTRODUCTION

The water pump automatic transformation system marks a significant advancement in the domain of water infrastructure management. This innovative system integrates sophisticated technologies to bring about a fundamental shift in the way water pumping operations are conducted. Automation plays a pivotal role in the system, allowing for the seamless execution of predefined algorithms or adaptive strategies based on the dynamic conditions detected by the sensors. One of the key features of the water pump automatic transformation system is its capacity for remote monitoring and control. In addition to its technical capabilities, the water pump automatic transformation system often interfaces with broader smart grid systems, contributing to a more integrated and intelligent water infrastructure. This integration facilitates improved coordination with energy grids, enabling optimized energy consumption and contributing to the broader goals of sustainability. The user interface of the system is designed to be intuitive and user-friendly, offering operators and administrators a comprehensive overview of the system's status and performance. Visualization tools and dashboards provide valuable insights into pump efficiency, energy usage, and any potential issues that may require attention.

1.1 OVERVIEW

A water pump automatic transformation system integrates advanced technologies such as sensors, automation controls, and remote monitoring to optimize the efficiency and reliability of water pumping processes. By constantly monitoring parameters like water level, pressure, and system health, the system enables automated adjustments in pump operation, ensuring optimal performance. The incorporation of energy-efficient technologies, fault detection, and user-friendly interfaces enhances overall system effectiveness. With features like remote accessibility, predictive maintenance, and scalability, these systems contribute to sustainable water management, reducing operational costs and downtime while meeting regulatory standards for safety and performance.

1.2 DOMAIN INTRODUCTION

ARDUINO IDE :

The Arduino Integrated Development Environment (IDE) is a user-friendly software platform enabling the programming of Arduino microcontrollers. Featuring a straightforward interface, the IDE allows users to write code in C/C++, create sketches with essential functions like setup() and loop(), and easily interact with hardware using pre-built libraries. Selecting the target Arduino board and communication port, users upload and compile their code with a click, leveraging a Serial Monitor for debugging.

ARDUINO UNO :

The Arduino Uno is a widely used microcontroller board renowned for its simplicity and versatility. Built around the ATmega328P microcontroller, it features 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a USB connection for programming and power, a 16 MHz crystal oscillator, a power jack, an ICSP header, and a reset button.

ULTRASONIC SENSOR :

The ultrasonic sensor is a versatile electronic device that utilizes ultrasonic sound waves for distance measurement and object detection. Operating on the principle of echolocation, the sensor emits ultrasonic pulses and calculates the time it takes for the waves to bounce back after hitting an object. This time measurement is then used to determine the distance to the object.

RELAY MODULE :

A relay module is an electronic device designed to control high-voltage, high-current appliances or devices using low-voltage microcontrollers like those found in Arduino and Raspberry Pi. Consisting of one or more electromechanical relays, each with its own switch, the module acts as an intermediary between the microcontroller and the high-power device.

MINI MICRO SUBMARINE :

A mini micro submarine pump is a compact and specialized water pump designed for underwater applications, particularly in miniature or model submarines. These pumps are typically lightweight and compact to fit within the confined spaces of small underwater vehicles. They are often powered by low-voltage direct current (DC) sources, making them suitable for integration with electronic components commonly found in model submarines. The pump's impeller design enables efficient water circulation and propulsion within the confined environment of the submarine.

1.3 OBJECTIVE

The primary objectives of implementing a water pump automatic transformation system are to significantly enhance operational efficiency by integrating advanced automation and control mechanisms, optimize energy consumption through the deployment of adaptive strategies, enable real-time adaptability to fluctuating demand, facilitate remote monitoring and control for improved accessibility and responsiveness, implement robust fault detection mechanisms to enable proactive maintenance and reduce downtime, integrate seamlessly with smart grids for enhanced coordination and sustainability.

CHAPTER 2

LITERATURE SURVEY

Table Of Content	Merits	Demerits
Haoxiang Lin and Xiangzhan Yu International Journal of Engineering Research & Technology (IJERT) - The Water pump automatic transfer systems come in various types, including float switches, pressure switches, and electronic control systems. Electronic control systems offer advanced control options, allowing for precise management of water supply. The components of an automatic transfer system typically include pumps, switches, piping, and control panels.	It also maintains the water level throughout the day It saves water It is also power	High Initial Cost Pumps can be expensive to purchase and install, especially in large-scale applications
S. A. Sathish Kumar and V. Venkatachalam Engineering Science & Research Support Association (ESRSA) - The design should consider factors like system capacity, redundancy, and safety features to ensure optimal performance. Water pump automatic transfer systems find	Low maintenance Time and money	Pumps can consume a significant amount of energy, which can lead to high operating costs

applications in residential water supply to maintain water pressure, in agricultural irrigation for efficient water distribution, and in wastewater management for pump redundancy. Additionally, they are essential for firefighting systems, where reliability is paramount.		

CHAPTER 3

EXISTING SYSTEM

3.1 BLOCK DIAGRAM

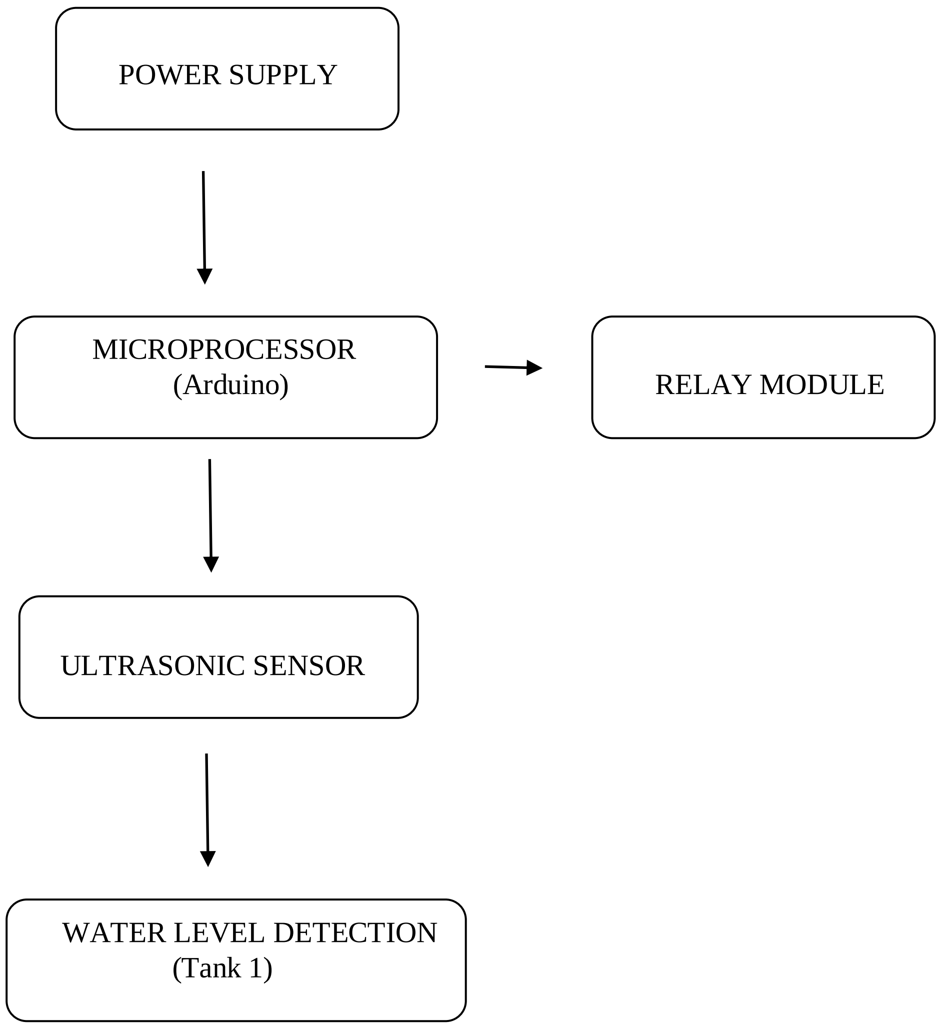

Figure 3.1: Block diagram of Existing system for Water Pump Automatic Transformation System

3.2 MODULE DESCRIPTION

Sensors:

These are used to gather data about the water system. Common sensors include water level sensors, pressure sensors, flow sensors, and temperature sensors. These sensors provide critical input to the control system.

Microcontroller or PLC (Programmable Logic Controller):

The microcontroller or PLC is the central processing unit of the system. It receives data from the sensors, processes this data, and controls the operation of the water pump based on pre-defined algorithms. Microcontrollers like Arduino or PLCs like Siemens S7 are commonly used for this purpose.

Control Software:

The control software runs on the microcontroller or PLC and includes the logic for the automation system. This software interprets sensor data and decides when to turn the pump on or off, at what speed, and for how long. It may also incorporate safety mechanisms, alarms, and emergency shutdown protocols.

HMI (Human-Machine Interface):

An HMI is often used to allow human operators to interact with the system. This can be a touchscreen display or a web-based interface. The HMI provides real-time data visualization, control settings, and alarms.

CHAPTER 4

PROBLEM STATEMENT

The existing water pump systems face inherent challenges related to inefficiency, lack of real-time adaptability, and increased operational costs. Conventional systems often struggle to respond dynamically to fluctuating water demand, leading to suboptimal performance and unnecessary energy consumption. Additionally, the absence of advanced automation and remote monitoring capabilities hinders timely fault detection and maintenance, resulting in extended downtime and increased operational challenges. In light of these issues, there is a critical need to develop and implement a water pump automatic transformation system that integrates cutting-edge technologies to enhance efficiency, reduce energy consumption, enable real-time adaptability, and improve overall system resilience.

CHAPTER 5

PROPOSED SYSTEM

5.1 BLOCK DIAGRAM

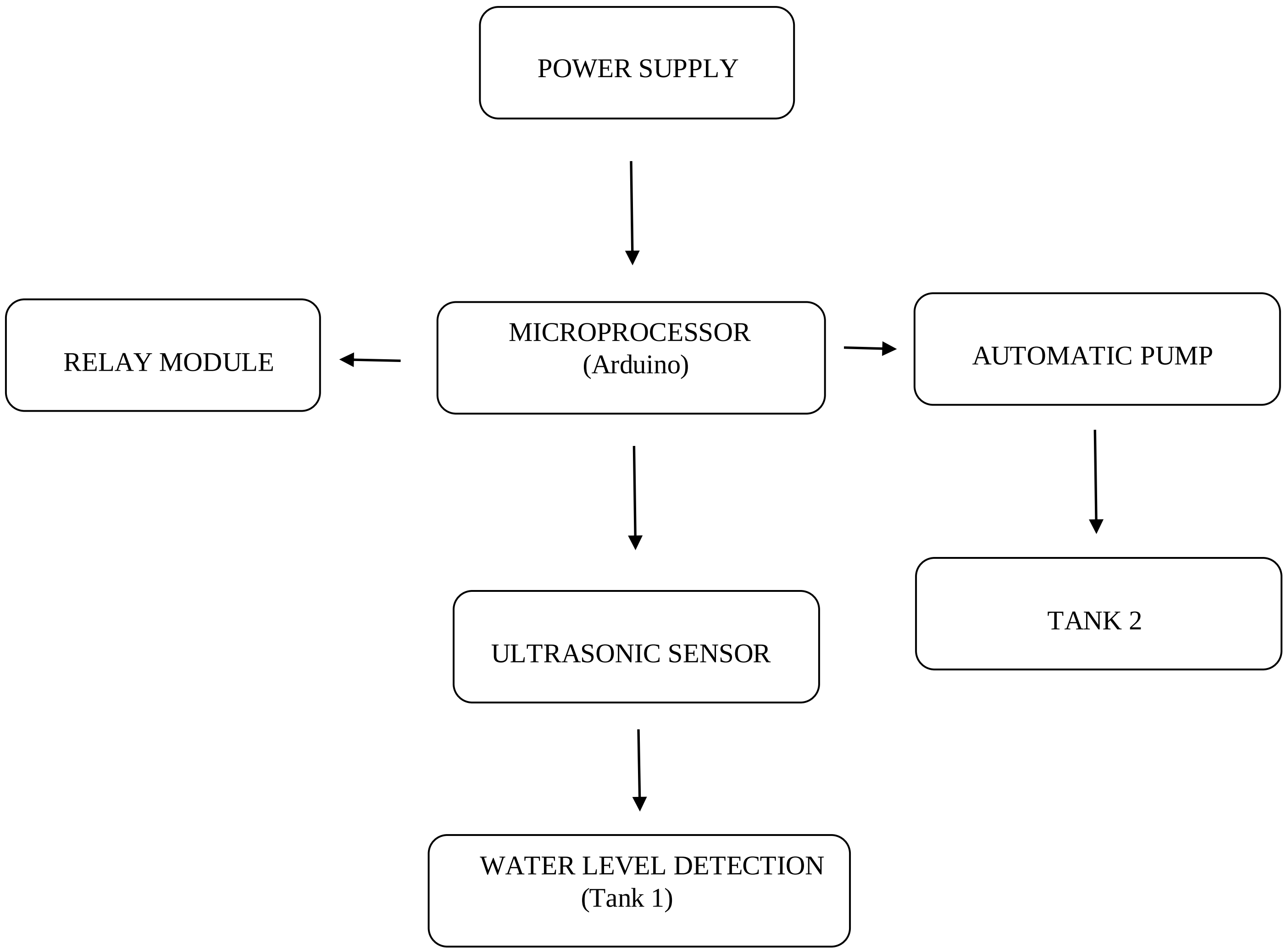

Figure 5.1: Block diagram of Proposed system for Water pump automatic transformation system

5.2 MODULE DESCRIPTION

A water tank level control system, first, connect three HC-SR04 ultrasonic sensors to the Arduino using jumper wires. Power the sensors and Arduino. Then, attach two 5V relay modules to control the water pump and electric ball valve, connecting the relay control pins to digital pins on the Arduino. Connect the water pump and electric ball valve to the relay outputs and ensure a separate 5V power supply for these components. Place the sensors in the tanks, and based on the measured distances, control the water pump to fill the first tank and the electric ball valve to transfer water to the second tank.

Ultrasonic Sensors (HC-SR04):

- Connect the VCC (Voltage) and GND (Ground) pins of each HC-SR04 sensor to the 5V and GND rails on the breadboard, respectively.
- Connect the TRIGGER pins of the three sensors to digital pins on the Arduino (e.g., D2, D3, D4).
- Connect the ECHO pins of the sensors to other digital pins on the Arduino (e.g., D5, D6, D7).

Relay Modules:

- Connect the VCC of both 5V relay modules to the 5V rail on the breadboard.
- Connect the GND of both relay modules to the GND rail on the breadboard.
- Connect the input pins (e.g., IN1 and IN2) of the first relay module to separate digital pins on the Arduino (e.g., D8, D9).
- Connect the common (COM) terminal of the first relay to the positive terminal of the water pump.
- Connect the normally open (NO) terminal of the first relay to the positive

terminal of the ground tank's water supply.

- Connect the input pins (e.g., IN3 and IN4) of the second relay module to separate digital pins on the Arduino (e.g., D10, D11).
- Connect the common (COM) terminal of the second relay to one terminal of the electric ball valve.
- Connect the normally open (NO) terminal of the second relay to the positive terminal of the first tank's inlet.

Tank Level Connections:

- Place the ultrasonic sensors in each tank so they are facing the water surface. Secure them in position.
- Ensure the wires from the sensors are connected according to the previous instructions.

Power Supply:

- Provide a suitable power supply (5V) for the water pump and electric ball valve.
- Connect the ground of the power supply to the GND rail on the breadboard.

CHAPTER 6

SYSTEM SPECIFICATION

6.1 Hardware Specification

• Arduino UNO	: 9 volt (1)
• Relay Module	:5 volt (2)
• Ultrasonic Sensor	:(HC-SR04) 5 volt (3)
• Mini Micro Submerged Water pump	: 5 volt (2)
• Jumper wire	: Required for purpose
• Bread board	: single

6.2 Software Specification

- Arduino IDE
- Intel 5 Processor

CHAPTER 7

RESULTS AND DISCUSSION

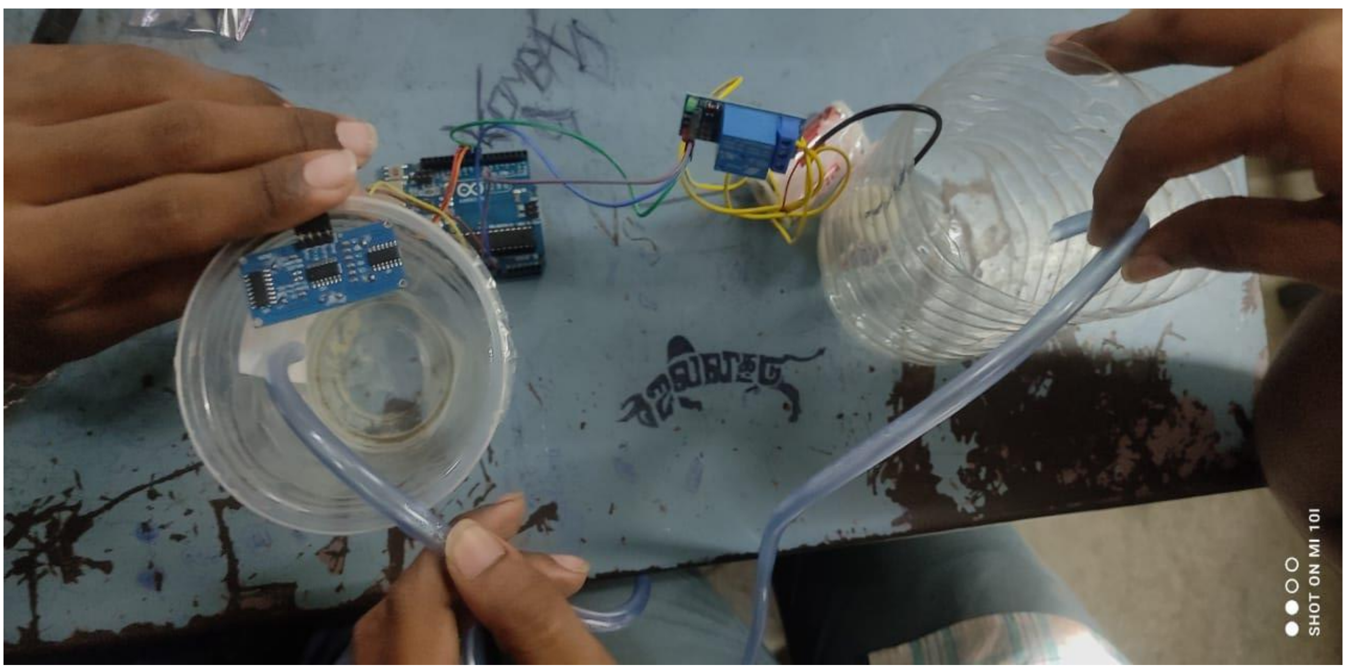

Figure 7.1 Picture of entire project

Figure 7.2 Picture of water level detection and water flow

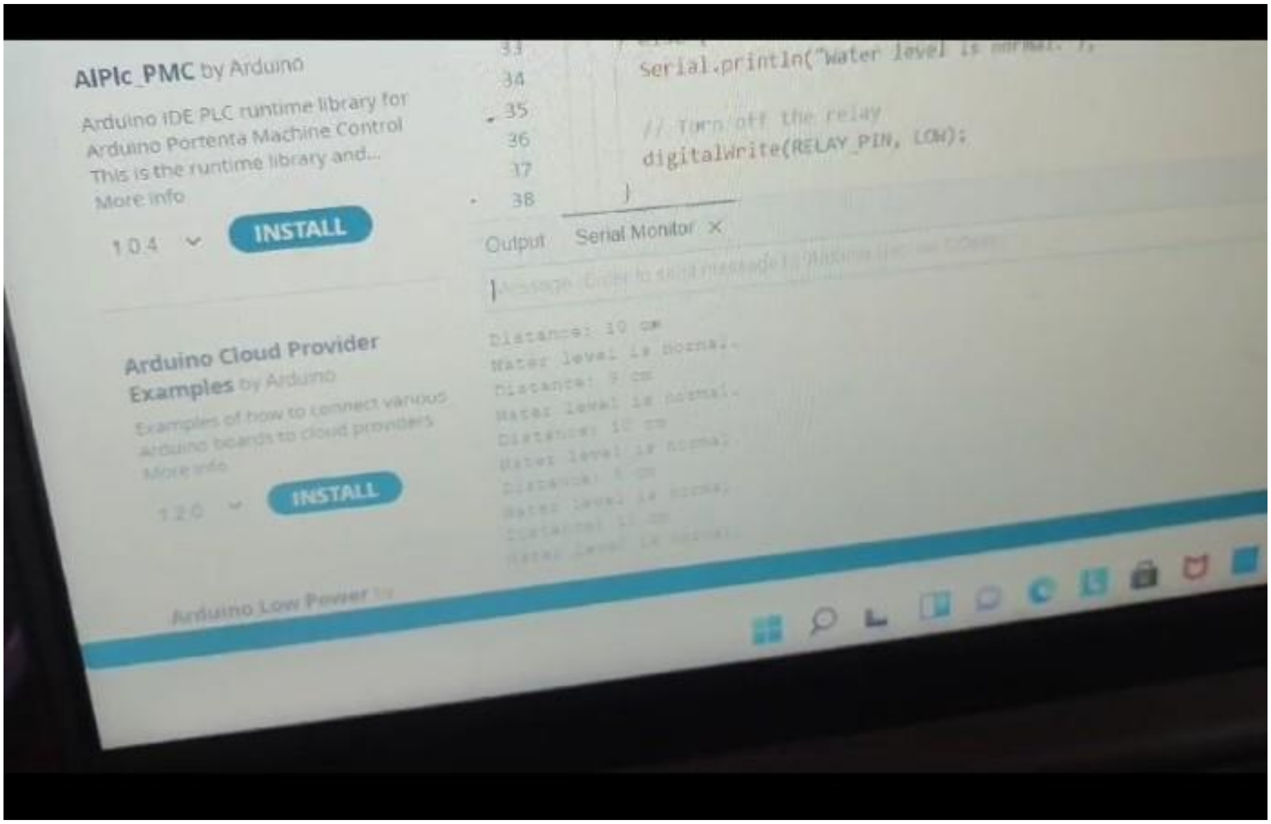

Figure 7.3 Picture of distance measured by sensor

Figure 7.4 Picture of water level detection and water cutoff

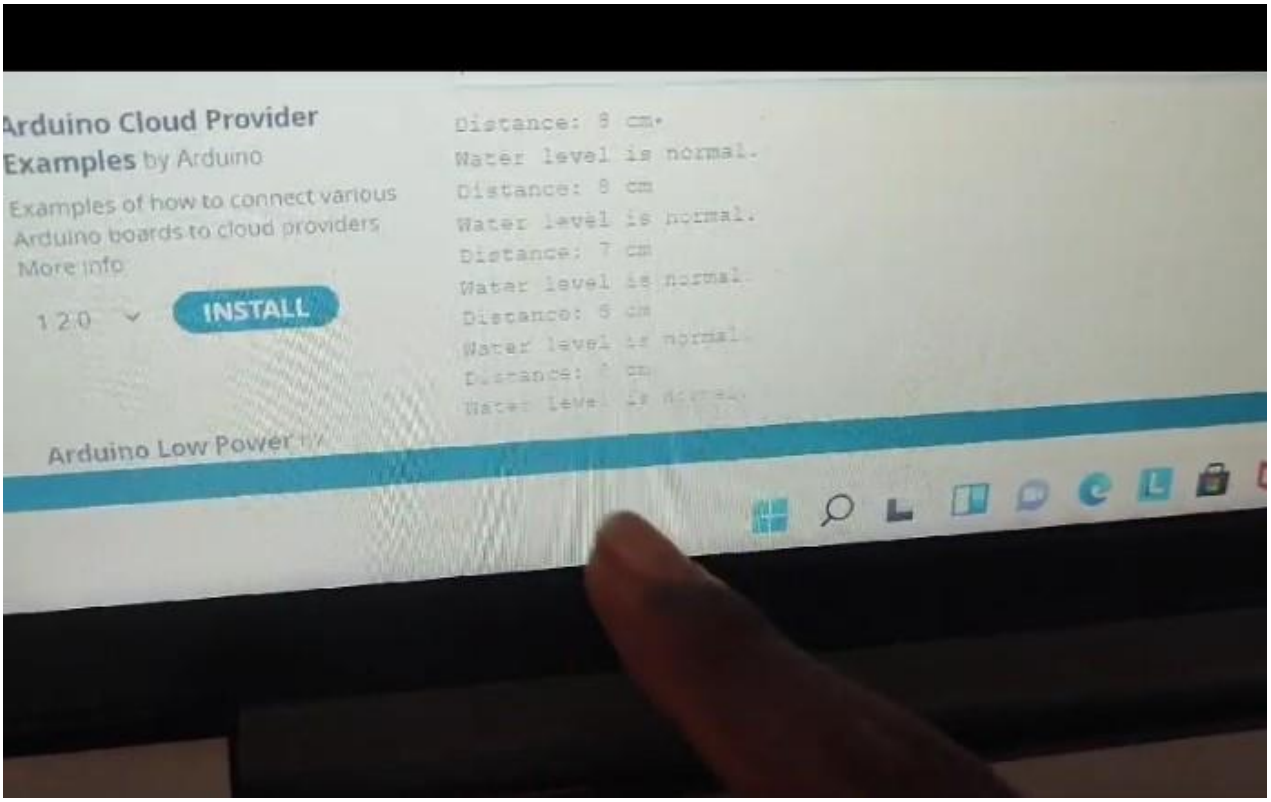

Figure 7.5 Picture of final detection

CHAPTER 8

CONCLUSION AND SCOPE FOR FUTURE WORKS

The Water Pump Automatic Transformation System has successfully improved water pumping efficiency, reduced energy consumption, enhanced reliability, and enabled remote monitoring. It has proven its worth in optimizing water management across various sectors.

Future endeavors can focus on AI integration for predictive maintenance, incorporating renewable energy sources, water quality monitoring, IoT connectivity, scalability, user-friendly interfaces, data analytics, and cost-effective solutions to further advance and adapt the system for a wider range of applications and sustainability goals.

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APPENDIX

SELECT LANGUAGE PAGE :

```
#include <NewPing.h>

#define TRIGGER_PIN_1 2
#define ECHO_PIN_1 5
#define TRIGGER_PIN_2 3
#define ECHO_PIN_2 6
#define TRIGGER_PIN_3 4
#define ECHO_PIN_3 7
#define RELAY_PUMP_PIN 8
#define RELAY_VALVE_PIN 9

NewPing sensorGround(TRIGGER_PIN_1, ECHO_PIN_1);
NewPing sensorFirstTank(TRIGGER_PIN_2, ECHO_PIN_2);
NewPing sensorSecondTank(TRIGGER_PIN_3, ECHO_PIN_3);

// Adjust these distance thresholds based on your tank levels
int groundTankThreshold = 30;    // Below this level, pump is on
int firstTankThreshold = 50;     // Above this level, pump is off
int secondTankFullThreshold = 70; // Above this level, valve is closed

void setup() {
  pinMode(RELAY_PUMP_PIN, OUTPUT);
  pinMode(RELAY_VALVE_PIN, OUTPUT);
```

```
  // Ensure the pump is initially off
  digitalWrite(RELAY_PUMP_PIN, LOW);
}

void loop() {
  int distanceGround = sensorGround.ping_cm();
  int distanceFirstTank = sensorFirstTank.ping_cm();
  int distanceSecondTank = sensorSecondTank.ping_cm();

  // Control the pump based on ground tank level
  if (distanceGround < groundTankThreshold) {
    digitalWrite(RELAY_PUMP_PIN, HIGH); // Turn on the pump
  } else if (distanceFirstTank > firstTankThreshold) {
    digitalWrite(RELAY_PUMP_PIN, LOW);  // Turn off the pump for the first tank
  }

  // Control the valve based on second tank level
  if (distanceSecondTank > secondTankFullThreshold) {
    digitalWrite(RELAY_VALVE_PIN, HIGH); // Close the valve for the second tank
  } else {
    digitalWrite(RELAY_VALVE_PIN, LOW);  // Open the valve for the second tank
  }
}
```