Annexure – I(Outer and Inner Cover)

ARDUINO BASED LIQUID LEVEL SENSOR

Project Report Submitted To

Chhattisgarh Swami Vivekanand Technical University Bhilai(India)

In Partial Fulfillment For Award of The Degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE and ENGINEERING

By

NIKITA KUMAR

RAHUL BEHRA

KUSHAL SAHU

NIKHIL CHANDEL

Under The Guidance of

Mr. Nitesh Nema

Department of Computer Science and Engineering

LAKHMI CHAND INSTITUTE OF TECHNOLOGY BILASPUR

Session – 2023-24

Annexure – II

DECLARATION BY THE STUDENTS

We the undersigned solemnly declare that the project report titled **Arduino Based Liquid Level Sensor** is based on our own work carried out during the course of our study under the supervision of **Mr. Neetesh Nema.**

We assert that the statements made and conclusions drawn are an outcome of our work. We further certify that

I. The work contained in the report is original and has been done by us under the general supervision of our supervisor(s).

II. The work has not been submitted to any other Institute for any other degree/diploma/certificate in this university or any other University of India or abroad.

III. We have followed the guidelines provided by the University in writing the report.

IV. Whenever we have used materials (data, theoretical analysis, and text) from other sources,

we have given due credit to them citing in the text of the report and giving their details in the references.

_____ Nikita Kumar Enrollment No. : BJ3792

_____ Rahul Behra Enrollment No. : BJ3701

_____ Kushal Sahu Enrollment No. : BJ3687

_____ Nikhil Chandel Enrollment No. :BJ3691

Annexure - III

CERTIFICATE FROM THE SUPERVISOWS

This is to certify that the work incorporated in the project report entitled **Arduino Based Liquid Level Sensor** is a record of work carried out by Nikita Kumar bearing Enrollment No.:BJ3692 . , Rahul Behra bealing Enrollment No.:BJ3701 , Kushal Sahu bearing Enrollment No.:BJ3687, Nikhil Chandel bearing Enrollment No.:BJ3691 under my/our guidance and supervision for the award of Degree of Bachelor of Technology in the faculty of Depaltment of Computer Science Engineering of Chhattisgarh Swami Vivekanand Technical University, Bhilai, Chhattisgarh, India.

To the best of my/our knowledge and belief the project report

i) Embodies the work of the candidates themselves,
ii) Has duly been completed,
iii) Fulfils the requirement BE degree of the University and
iv) Is up to the desired standard both in respect of contents and language for being refened to the exammers

_____

(Signature of the Supervisor)

Mr. Nitesh Nema

Fonvarded to Chhattisgarh Swami Vivekanand Technical University, Bhilai

_____

(Signature of the Head of the Department)

(Seal of the Department Computer Science Engineering)

Annexure – IV

CERTIFICATE BY THE EXAMINERS

This is to certify that the project report entitled **Arduino Based Liquid Level Sensor** which is submitted by

1. <Nikita Kumar>, Roll No.: <303102220021>, Enrollment No. :< BJ3692.>
2. <Rahul Behra>, Roll No. : <303102220030>, Enrollment No. :< BJ3701.>
3. <Kushal Sahu>, Roll No.: <303102220016>, Enrollment No. :< BJ3687.>
4. <Nikhil Chandel>, Roll No.: <303102220006>, Enrollment No. :< BJ3691.>

has been examined by the undersigned as a part of the examination for the award of the degree of Bachelor of Engmeermg in Electrical Engineering from Chhattisgarh Swami Vivekanand Technical University, Bhilai.

_____	_____
(Signature of the Extemal Examiner)	(Signature of The Internal Examiner)
……..	Mr. Nitesh Nema
Date:	Date:
Designation:	Designation:
Institute:	Institute:

:

Acknowledgement

We feel profound pleasure in bringing out this project report for which we have to go from pillar to post to make it a reality. This project work reflects contributions of many people with whom we had long discussions and without which it would not have been possible. We must first of all, express our heartiest gratitude to respected Mr. Neetesh Nema (Dept. of CSE) for providing us all guidance to complete the project.

It would be unfair if we do not mention the invaluable contribution and timely cooperation extended to us by staff members of our department. And we can never forget the most worthy advices given by Prof. Vishnu Kant Soni (H.O.D of CSE), that would help us with our entire lifestyle.

Last but not the least we express our sincere thanks to the institute Lakhmi Chand Institute of Technology, Chhattisgarh for providing such a platform for implementing the ideas in our mind.

Abstract

This project focuses on the design, development, and implementation of an Arduino-based liquid level sensor system for monitoring and controlling the levels of various liquids in industrial and domestic settings. The need for precise liquid level measurement is crucial in numerous applications, ranging from chemical processing plants to household water tanks. This project aims to provide an efficient, cost-effective, and user-friendly solution to address this demand.

The proposed system employs ultrasonic sensors to accurately measure liquid levels, interfacing with an Arduino microcontroller for data processing and transmission. The ultrasonic sensors utilize sound waves to determine the distance between the sensor and the liquid surface, enabling reliable and non-invasive liquid level measurement. The Arduino microcontroller processes the sensor data and communicates with a user interface for real-time monitoring and control.

The hardware architecture consists of ultrasonic sensors, Arduino microcontrollers, and communication modules. The ultrasonic sensors are strategically placed in liquid containers, ensuring comprehensive coverage for accurate level detection. The Arduino microcontroller processes the sensor data using programmed algorithms to convert distance measurements into liquid levels. The communication module facilitates data transfer to a user interface for remote monitoring and control.

The software aspect of the project involves developing a user-friendly interface for seamless interaction with the liquid level sensor system. The interface provides real-time visualization of liquid levels, historical data analysis, and configurable settings for customized applications. Additionally, the system incorporates alert mechanisms to notify users of critical liquid levels, preventing overflows or shortages.

The project's significance lies in its potential applications across various industries and domestic scenarios. In industrial settings, precise liquid level monitoring is crucial for maintaining optimal production processes, preventing equipment damage, and ensuring the safety of personnel. In households, the system can be employed to manage water levels in tanks, providing users with better control over water usage and reducing the risk of water shortages.

Table of Contents

Preliminary Pages :

Chapters:

- **Introduction**
- **Background Research**
- **Methodology**
- **Problem Statement for Real-World Application**
- **Program**
- **Advantages/Disadvantages**
- **Applications**
- **Future Scope**
- **Conclusion**
- **Future Work**
- **References**

CHAPTER – 1

INTROUCTION

❖ Introduction:

Monitoring the liquid level in a container is a common requirement in various industrial and DIY projects. Whether you need to keep track of water levels in a reservoir, fuel levels in a tank, or any other liquid-based application, having an accurate and cost-effective solution is crucial. In this guide, we will explore a unique approach to create a homemade liquid level sensor using simple materials and couple it with an Arduino microcontroller for precise level measurements. Additionally, we'll learn how to visualize the liquid level graphically on a PC monitor, thanks to the versatile "SerialComInstruments" software.

The DIY sensor we are about to construct is not only cost-effective but also quite ingenious. The primary component needed is a ribbon cable salvaged from an old IDE disk or floppy drive. By using this ribbon cable, we can create a sensor that is not only reliable but also adaptable to various container depths. With a bit of creativity and some simple electronics, we can craft a sensor that accurately measures liquid levels based on changes in capacitance.

To start, you'll need to extract four wires from the ribbon cable and cut them to a length that matches the depth of the container you wish to monitor. Next, on one end of these wires, you'll remove the insulation for a length of about 1 centimeter. On the other end, you'll need to waterproof them in some way to ensure their durability and functionality when submerged in the liquid.

The concept behind this sensor is that when it's immersed in a liquid, the capacitance of the sensor changes proportionally with the liquid level. This change in capacitance can be detected and measured using an Arduino microcontroller. To achieve this, we'll utilize the "Capacitor" library, which allows us to measure capacitance without the need for external hardware. With just one digital pin and one analog pin on the Arduino, we can accurately capture the changes in capacitance as the liquid level varies in the container.

Now, as exciting as it is to measure the liquid level with precision, we can take this project a step further by visualizing the data on a PC monitor. For this purpose, we will employ the versatile and free software called "SerialComInstruments." This software enables you to create a set of virtual instruments for bidirectional communication with microcontrollers like the Arduino. It offers a variety of instruments that can be placed anywhere on the screen, and its data protocol is user-friendly, making it accessible even to hobbyists. The software's simplicity,

combined with a few lines of microcontroller code, allows you to quickly develop a working project.

In this guide, we'll walk you through the entire process of constructing the DIY liquid level sensor, interfacing it with an Arduino, and setting up the visualization on your PC monitor using "SerialComInstruments." The sensor's precision and linearity make it an ideal choice for a wide range of applications, and you can further enhance its accuracy by using two metal strips placed in parallel and insulated with plastic wrap.

By the end of this project, you'll have a reliable and cost-effective solution for monitoring liquid levels, with the added benefit of graphical visualization for data interpretation and analysis. Let's dive into the details and create a practical, high-precision liquid lev

CHAPTER – 2

BACKGROUND RESEARCH

❖ Background Research:

Knowing the level of water in an overhead tank is a tedious task which usually leads to climbing up the stairs to the tank and checking the level manually or allowing the water overflowing from the top. But electronic water level indicators can fix this issue. Most of the available systems use dipped electrodes or float switches, which may not perform well in the long run. This project provides a different approach to knowing the water level using an Ultrasonic module with Arduino and with LEDs. This method is contactless, so issues like corrosion of the electrodes won't affect this system. The initial electric water controllers in the early 1990's helped professionals to track water levels in chemical industries, and also in agricultural and irrigation projects. They were initially used in tracking liquid levels in irrigation lakes, water tanks, boilers etc. However, the initial designs proved to be imperfect and a long-term solution were attempted with solid state electronics. These new solid-state electronics along with integrated electronics offer greater performance with low cost as well efficient along with easy installation. These sensors take less energy and can be used for continuous operation.

CHAPTER – 3

METHODOLOGY

❖ Methodology:

1. Sensor Construction:

- Gather a ribbon cable from an old IDE disk or floppy drive.

- Separate and cut four wires to the depth of the liquid container.

- Remove insulation from one end, leaving about 1 cm exposed.

- Waterproof the other end of the wires.

- Create two parallel metal strips, laminated with plastic wrap, to increase accuracy.

- Ensure the metal strips are isolated from the liquid.

2. Arduino Setup:

- Program the Arduino microcontroller using the "Capacitor" library.

- Connect the sensor to one digital pin and one analog pin on the Arduino.

3. Software Installation:

- Download and install "SerialComInstruments 4.1" software from the author's page.

4. Configuration and Interface Design:

- Open "SerialComInstruments" software.

- Configure the software for bidirectional communication with the Arduino.

- Design a graphical interface to monitor the liquid level using virtual instruments.

5. Data Protocol:

- Establish a simple data protocol for communication between the Arduino and the software.

6. Calibration:

- Calibrate the system to ensure accurate level measurements. This may involve setting reference points for different liquid levels.el monitoring system with homemade sensors and an Arduino microcontroller.

7. Monitoring and Display:

- Implement code on the Arduino to continuously measure the capacitance of the sensor.

- Send this data to the PC using the established data protocol.

- Display the liquid level information graphically on the PC monitor using the software. 8. Visualization and Analysis:

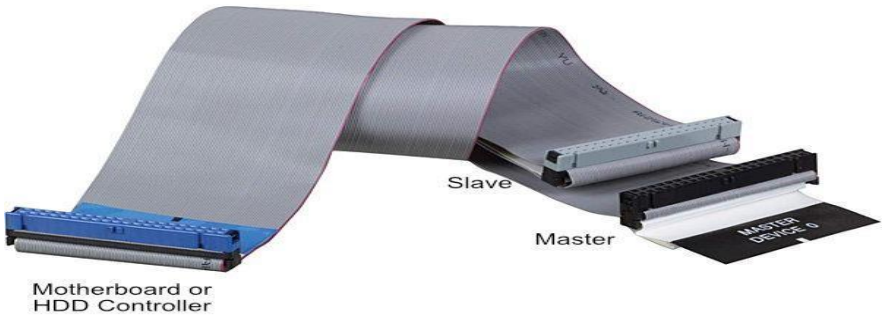
- Monitor the liquid level changes and observe the graphical representation in real-time.

- Analyze the data and make any necessary adjustments to improve accuracy and precision.

Materials and Tools:

▪ IDE or floppy drive ribbon cable

A ribbon cable connects a floppy disk drive to a computer's motherboard, transmitting data and power to read/write data on disks.

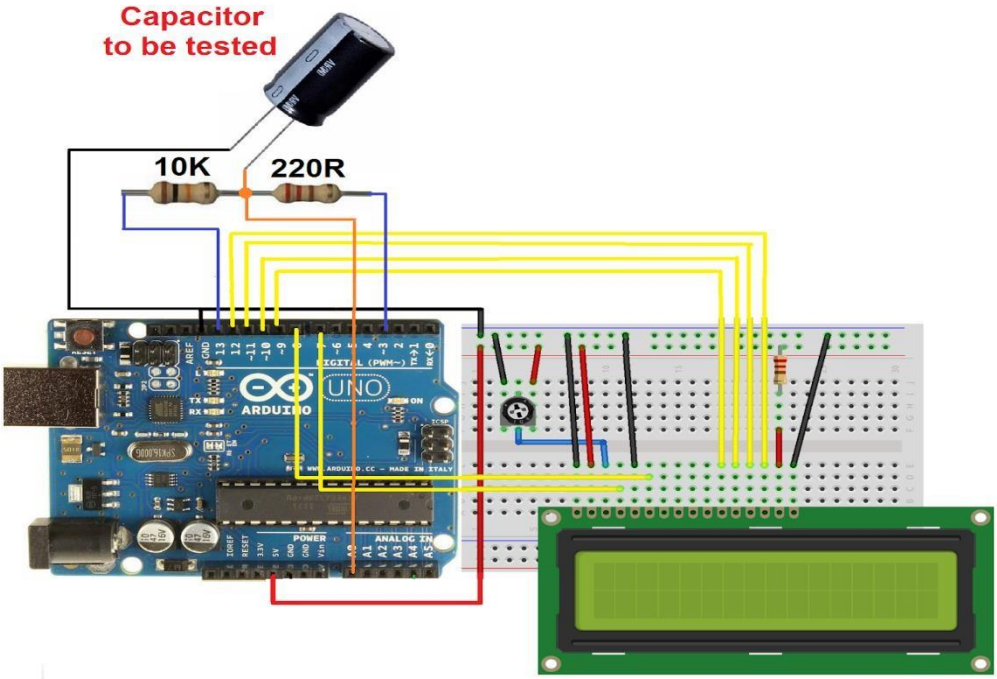


 Arduino microcontroller

Arduino is an open-source microcontroller platform for building electronic projects, offering a versatile hardware and software ecosystem for makers and hobbyists.

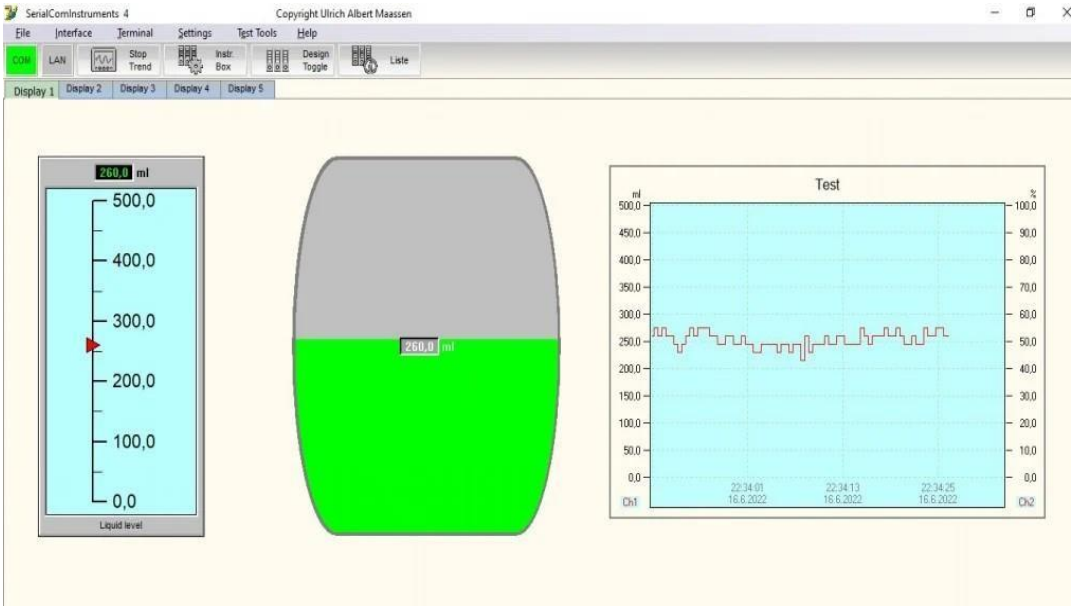
- Capacitor library for Arduino

A capacitor library for Arduino provides code and functions to manage capacitors, enabling precise timing, filtering, and energy storage in electronic projects.



- SerialComInstruments software

Serial communication instrument software facilitates data exchange between a computer and measuring instruments, such as oscilloscopes, allowing data analysis and control.

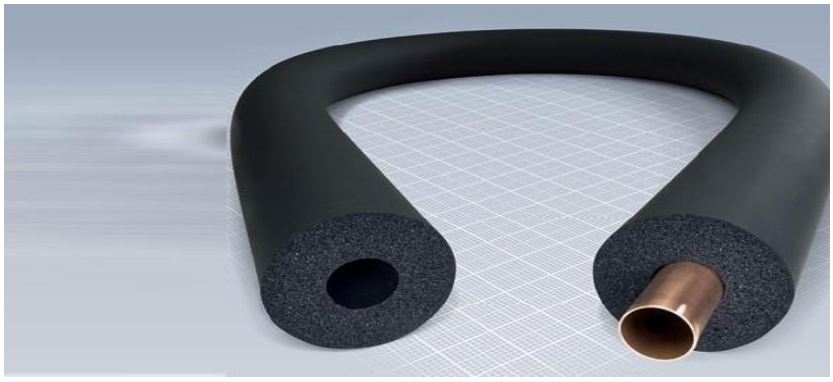


- Water container

A water container is a vessel designed to hold and store water for various purposes, such as drinking, cooking, or irrigation.

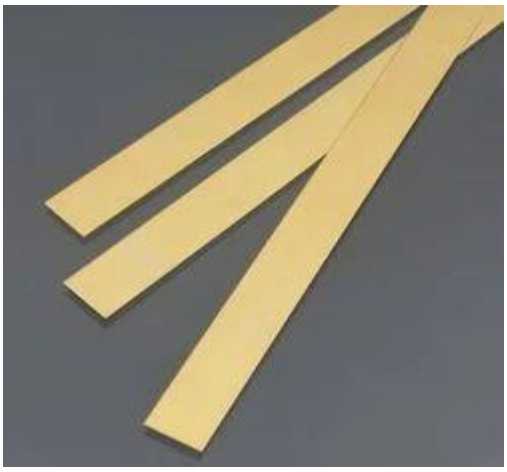
- Insulation and sealing materials

Insulation and sealing materials prevent heat transfer and air leakage, improving energy efficiency and maintaining temperature control in buildings and equipment.



- Two metal strips

"Two metal strips" typically refers to two parallel metal pieces used for various purposes, such as electrical connections, construction, or fastening materials.



- Plastic wrap

Plastic wrap, often made of polyethylene, is a thin, transparent material used for sealing and preserving food or protecting items.

CHAPTER – 4

PROBLEM STATEMENT FOR REAL – WORLD APPLICATION

❖ Problem Statement for Real-World Application:

In various industrial and domestic scenarios, there is a need for accurately monitoring the level of liquids in containers. Existing solutions often come with cost and complexity constraints. To address these challenges, we propose a cost-effective and reliable homemade liquid level sensor using a simple DIY method. The sensor is constructed from readily available materials such as an old IDE disk or floppy drive ribbon cable, and it is interfaced with an Arduino microcontroller. The sensor's capacitance changes proportionally as it is immersed in the liquid, allowing precise level measurement.

The challenge is to develop an effective, low-cost, and easily replicable liquid level monitoring system for a range of applications, including but not limited to:

1. Industrial tanks and reservoirs: Accurate monitoring of liquid levels in storage tanks, ensuring efficient resource management and preventing overflows or shortages.
2. Agricultural irrigation: Efficiently managing water resources for irrigation, preventing water wastage and ensuring crops receive the right amount of moisture.
3. Home automation: Monitoring water levels in home water tanks, sump pumps, or swimming pools to prevent flooding or running out of water.
4. Environmental monitoring: Tracking water levels in natural bodies of water, such as rivers, lakes, and groundwater, for research and environmental conservation purposes.
5. Chemical and pharmaceutical processes: Ensuring precise control of liquid levels in various processes, maintaining product quality and safety.
6. Laboratory applications: Accurate measurement of liquid levels in research and experimentation setups.
7. Water treatment plants: Monitoring the levels of chemicals or liquids used in water treatment processes to maintain water quality.

The proposed DIY sensor and Arduino-based system provide a low-cost, versatile solution for liquid level monitoring. The project aims to address the need for an accessible and accurate system that can be easily replicated by individuals and organizations to enhance liquid level monitoring and management in diverse real-world applications. This project can contribute to resource efficiency, cost savings, and environmental sustainability.

CHAPTER – 5

PROGRAMING

❖ Programing:

```
/* Change these values based on your calibration values */
int lowerThreshold = 420;
int upperThreshold = 520;

// Sensor pins
#define sensorPower 7
#define sensorPin A0

// Value for storing water level
int val = 0;

// Declare pins to which LEDs are connected
int redLED = 2;
int yellowLED = 3;
int greenLED = 4;

void setup() {
Serial.begin(9600);
pinMode(sensorPower, OUTPUT);
digitalWrite(sensorPower, LOW);

// Set LED pins as an OUTPUT
pinMode(redLED, OUTPUT);
```

```
pinMode(yellowLED, OUTPUT);
pinMode(greenLED, OUTPUT);

// Initially turn off all LEDs
digitalWrite(redLED, LOW);
digitalWrite(yellowLED, LOW);
digitalWrite(greenLED, LOW);
}
void loop() {
int level = readSensor();

if (level == 0) {
        Serial.println("Water Level: Empty");
        digitalWrite(redLED, LOW);
        digitalWrite(yellowLED, LOW);
        digitalWrite(greenLED, LOW);
}
else if (level > 0 && level <= lowerThreshold) {
        Serial.println("Water Level: Low");
        digitalWrite(redLED, HIGH);
        digitalWrite(yellowLED, LOW);
        digitalWrite(greenLED, LOW);
}
else if (level > lowerThreshold && level <= upperThreshold) {
```

```
        Serial.println("Water Level: Medium");
        digitalWrite(redLED, LOW);
        digitalWrite(yellowLED, HIGH);
        digitalWrite(greenLED, LOW);
}
else if (level > upperThreshold) {
        Serial.println("Water Level: High");
        digitalWrite(redLED, LOW);
        digitalWrite(yellowLED, LOW);
        digitalWrite(greenLED, HIGH);
}
delay(1000);
}
//This is a function used to get the reading
int readSensor() {
digitalWrite(sensorPower, HIGH);
delay(10);
val = analogRead(sensorPin);
digitalWrite(sensorPower, LOW);
return val;
}
```

Code Explanation:

The sketch begins with the declaration of the Arduino pins to which the sensor's + (VCC) and S (signal) pins are connected.

#define sensorPower 7

#define sensorPin A0

Following that, we define a variable val to store the current water level.

int val = 0;

In the Setup section, we first configure the sensor's power connection to behave as an output, then we set it low to keep the sensor off initially. We establish serial communication as well.

pinMode(sensorPower, OUTPUT);

digitalWrite(sensorPower, LOW);

Serial.begin(9600);

In the loop section, we call the readSensor() custom function once every one second and print the result.

Serial.print("Water level: ");

Serial.println(readSensor());

delay(1000);

The readSensor() custom function simply turns on the sensor, waits 10 milliseconds, reads the analog value from the sensor, turns it off, and returns the analog value.

nt readSensor() {

digitalWrite(sensorPower, HIGH);

```
delay(10);
val = analogRead(sensorPin);
digitalWrite(sensorPower, LOW);
return val;
}
```

CHAPTER – 6

ADVANTAGES/DISADVANTAGES

❖ Advantages/Disadvantages

Advantages

 Automatic water level controllers can maintain an exact preset water level.

 It can be installed in homes, hotels, and hospitals. The power used by this controller is low and negligible.

 It can be installed in metro cities where the drinking water is the only water used for all purposes, which keeps the drinking water from being wasted.

 These controllers are compact, easy to install, and easy to move.

 Power saver

 Minimal maintenance

 Can help avoid seepage of roofs and walls due to tanks overflowing

 It can control water levels in any type of storage tank or body of liquid

 Automatic operation saves the manual labor time

Disadvantages

 Water level sensor need to be replaced every 3 years.

 We need to insert the wire in accordance with the level of water

 The rust, foul and deteriorate

 Electronics are usually built separately

CHAPTER – 7

APPLICATIONS

❖ Application

- It can be used in water tanks to control water levels and automatically turn ON/OFF pumps.
- Can be used in factories, commercial complexes, apartments, home, fuel tank level gauging.
- High & low-level alarms.
- Pool water level control.
- Oil tank level controlling
- It will be very much useful to farmers
- It is used for all household purposes

CHAPTER – 8

FUTURE SCOPE

❖ Future Scope

Automatic water level monitoring system has a good scope in future especially for agriculture sector. There are many areas where we need water level controller. It could be agricultural fields, overhead tanks. We can make this project wireless by using NRF transmitter and receiver. We can also add Ethernet shield so that we can get all the information using mobile phones and control it accordingly. The automatic water level controller using Arduino project can also be installed with pH sensors which will help to regulate the acidity. The automatic water level controller has a great future scope. By adding a Wi-Fi module through which it can be controlled through mobile application by doing so it can be used in big building, offices, malls It also has a bright future in Agricultural sector

CHAPTER – 9

CONCLUSION

❖ Conclusion:

this DIY liquid level meter project demonstrates an innovative and cost-effective approach to liquid level monitoring. By leveraging homemade sensors and Arduino microcontrollers, enthusiasts and hobbyists can create highly accurate and customizable solutions for various applications. The project not only emphasizes the technical aspects of sensor construction and data acquisition but also highlights the importance of open-source software tools like SerialComInstruments, enabling users to visualize and analyze the collected data effectively. Overall, this project showcases the power of DIY electronics and software integration, empowering individuals to create practical solutions tailored to their specific needs.

Furthermore, the affordability and simplicity of the proposed system make it accessible for a wide range of users, from small businesses to individual homeowners. The modular design allows scalability, enabling users to expand the system based on specific requirements. The open-source nature of Arduino also encourages community collaboration, fostering continuous improvement and customization.

In conclusion, this project presents a comprehensive solution for liquid level monitoring and control using Arduino and ultrasonic sensors. The combination of hardware and software components results in an efficient, cost-effective, and user-friendly system with broad applications in both industrial and domestic environments. The successful implementation of this liquid level sensor system holds the potential to enhance operational efficiency, reduce resource waste, and contribute to a more sustainable and intelligent approach to liquid management.

CHAPTER – 10

FUTURE WORK

❖ Future Work

Automatic water level monitoring system has a good scope in future especially for agriculture sector. There are any areas where we need water level controller. It could be agricultural fields, overhead tanks. We can make this project wireless by using NRF transmitter and receiver. We can also add Ethernet shield so that we can get all the information using mobile phones and control it accordingly.

CHAPTER – 11

REFERENCES

❖ References:

- https://maker.pro/arduino/projects/arduino-liquid-level-meter-with-simple-homemade-sensor
- https://youtu.be/M4eMRBKIfjE?si=2HqeLlpNQLvC78w2
- https://lastminuteengineers.com/water-level-sensor-arduino-tutorial/#google_vignette
- https://robu.in/water-level-indicator-interfacing-with-arduino-connection-and-code/
- https://www.instructables.com/How-to-use-a-Water-Level-Sensor-Arduino-Tutorial/
- https://www.pantechsolutions.net/iot-based-liquid-level-monitoring-system-using-arduino