WATER LEVEL INDICATOR SYSTEM USING ARDUINO UNO

A PROJECT REPORT

submitted by

VASIKARAN G S (210701305)
VISHAL B (210701315)

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in

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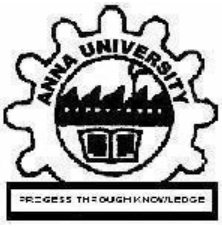

RAJALAKSHMI ENGINEERING COLLEGE,

ANNA UNIVERSITY : CHENNAI 600 025

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RAJALAKSHMI ENGINEERING COLLEGE, CHENNAI

BONAFIDE CERTIFICATE

Certified that this project report titled "**WATER LEVEL INDICATOR SYSTEM USING ARDUINO UNO"** is the bonafide work of **"VASIKARAN G (210701305), VISHAL B (210701312)"** who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE

Ms. S. Ponmani M.E.,MBA,

SUPERVISOR

Assistant Professor

Department of Computer Science and Engineering

Rajalakshmi Engineering College

Chennai - 602 105

Submitted to Project Viva-Voce Examination held on _____

Internal Examiner **External Examiner**

ABSTRACT

In this project, we present a Water level Indicator System implemented using Arduino micro controller. The "Water Level Indicator System" is a project designed to provide a reliable and accurate method for monitoring water levels in various applications such as water tanks, reservoirs, and environmental monitoring. Utilizing an Arduino micro-controller, this system integrates ultrasonic sensors to measure the water level by calculating the distance from the sensor to the water surface. The real-time data is processed by the Arduino and displayed on an LCD screen, providing a clear visual representation of the water level. Additionally, the system includes LED indicators and a buzzer to alert users when water levels reach critical thresholds, ensuring timely intervention to prevent overflow or shortage. This project aims to enhance water management efficiency and prevent wastage by offering a cost-effective, easy-to-implement solution suitable for both residential and industrial settings.The system's design prioritizes simplicity and scalability, making it an ideal choice for a wide range of applications.The use of Arduino not only ensures affordability but also offers flexibility for future enhancements, such as integrating wireless communication modules like Wi-Fi or Bluetooth for remote monitoring and control.This project also emphasizes sustainability by helping to manage water resources more effectively, reducing waste and promoting conservation.Overall, the Water Level Indicator System represents a significant step towards smarter water management solutions in an era where resource efficiency is paramount.

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CHAPTER 1

INTRODUCTION

The Water Level Indicator System, implemented using Arduino, is an innovative solution designed to monitor and display water levels in real-time, providing a reliable and efficient way to manage water resources. This project utilizes the Arduino micro-controller to interface with various sensors that detect water levels in a tank or reservoir. The system includes a series of LEDs and an LCD display to indicate different water levels, from empty to full, offering a clear visual representation. The Arduino processes the sensor data and triggers alerts when the water reaches critical levels, ensuring timely actions to prevent overflow or dry conditions. This project not only simplifies water level monitoring but also promotes water conservation by enabling better control and management of water usage in households, agriculture, and industrial applications.In addition to its basic monitoring capabilities, the Water Level Indicator System offers several advanced features to enhance its functionality. The system can be integrated with wireless communication modules such as Wi-Fi or Bluetooth, allowing users to remotely monitor water levels through a mobile app or web interface. This remote accessibility ensures that users can keep track of water levels even when they are not physically present at the site.

1.1Motivation

- **Customer Satisfaction**: Our project prioritizes reliability, customization, and effective notification systems to ensure optimal water level indicator technology for user needs.

- **Conservation of Water Resources**: By providing accurate and real-time monitor of water levels, the system helps in preventing water overflow and ensuring efficient use of available water resources. This contributes significantly to water conservation efforts.

- **Educational Value**: For students and hobbyists, implementing a water level indicator system using Arduino serves as a practical and educational project. It helps in understanding fundamental concepts of electronics, programming, and sensor technology.

1.2 Objectives

- **Accurate Water Level Measurement:** Develop a system capable of accurately measuring water levels in tanks or reservoirs using sensors integrated with an Arduino micro controller.

- **Cost-Effective Solution:** Develop a budget-friendly system using readily available components to make it accessible for households, small businesses, and community water management projects.

CHAPTER 2

LITERATURE REVIEW

1. **Diksha Sharma ET AL. (2019)** discuss the design and implementation of a simple water level indicator using Arduino. Their system employs a series of float switches connected to the Arduino to detect different water levels.
2. **S. Patel et al. (2020)** delve into the integration of the Internet of Things (IoT) with water level monitoring systems. Their Arduino-based model includes Wi-Fi modules to transmit water level data to a cloud server, allowing users to monitor levels through a mobile application.
3. **A. Ghosh and R. Saha. (2020)** present an ultrasonic sensor-based water level monitoring system using Arduino. The system measures the distance between the sensor and the water surface, providing accurate real-time data on water levels.
4. **R. Mehta and A. Singh. (2021)** further enhance this concept by incorporating machine learning algorithms to predict water usage patterns and optimize water distribution. Their system uses historical data to forecast demand, thereby improving water management efficiency .

2.1 Existing System

Existing water level indicator systems leveraging Arduino technology exhibit a range of functionalities from basic water level detection to sophisticated remote monitoring capabilities. The most fundamental systems use simple conductive or float-based

sensors connected to an Arduino board to indicate different water levels through LEDs or buzzer alarms. These setups, while cost-effective and straightforward, provide limited data and require physical proximity for monitoring.

2.1.1 Advantages of the existing system

- **Simplicity:** The design is straightforward and easy to understand, making it accessible even for beginners in electronics and Arduino programming.
- **Cost-Efficiency** :These systems are generally cost-effective to implement and maintain, making them accessible for a wide range of applications and budgets.

2.1.2 Drawbacks of the existing system

- **Dependence on Internet Connectivity**: Requires a stable internet connection for real-time monitoring and alerts, which can be a limitation in remote areas.
- **Complexity and Cost**: Higher initial setup cost and complexity compared to non-Iot systems, including the need for network setup and maintenance.

2.1 Proposed System

The proposed system for a water level indicator using Arduino aims to provide a reliable, accurate, and cost-effective solution for monitoring and managing water levels in various applications such as domestic water tanks, agricultural reservoirs, and industrial tanks. This system combines the advantages of different sensor technologies and integrates modern communication capabilities to enhance functionality and user experience.

2.2.1 Advantages of the proposed system

- **Accurate and Continuous Monitoring**: The ultrasonic sensor provides precise and continuous water level measurements, improving reliability.
- **Real-Time Alerts**: Immediate on-site alerts (buzzer and LEDs) and remote notifications ensure timely intervention for critical water levels.
- **Remote Accessibility**: The integration of a Wi-Fi module and cloud server enables remote monitoring and management via a mobile app or web interface.

CHAPTER 3

SYSTEM DESIGN

3.1 Development Environment

3.1.1 Hardware Requirements

Arduino UNO

Bread Board

Buzzer

IR Sensor

Water Sensor

Jumper wires

Red,Green and Yellow LED's

Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

Arduino UNO

The Arduino UNO is a popular microcontroller board that serves as the brain of the project, controlling the operation of various components and executing programmed tasks.

Breadboard

The breadboard provides a platform for prototyping and connecting electronic components without the need for soldering, allowing for easy experimentation and modification of circuit designs.

Buzzer

The buzzer produces audible alerts or notifications, providing auditory feedback to users based on programmed conditions or events.

IR SENSOR

An infrared proximity sensor that detects the presence of water based on the reflection of infrared light.

WATER SENSOR

Typically a conductive or capacitive sensor that detects the presence and level of water in the tank.

Jumper wires

Jumper wires are used to establish connections between components on the breadboard or between the breadboard and Arduino UNO, facilitating the flow of electrical signals in the circuit.

Resistors

Resistors are crucial components in electronic circuits, including a water level indicator system using Arduino. They are used to control the current flow and protect other components from damage due to excessive current.

3.1.1Software Requirements

- Arduino IDE

CHAPTER 4

PROJECT DESCRIPTION

The Water Level Indicator project aims to provide a reliable, cost-effective, and efficient solution for monitoring water levels in various applications, such as household water tanks, agricultural irrigation systems, and industrial reservoirs. This system utilizes an Arduino microcontroller as the core component, interfaced with an ultrasonic sensor to measure the water level accurately. The project incorporates an LCD display for real-time local monitoring, a buzzer for audible alerts, and LEDs for visual indicators to signal critical water levels.The ultrasonic sensor, positioned at the top of the water tank, emits ultrasonic waves and measures the time it takes for the waves to bounce back from the water surface. This time is used to calculate the distance to the water surface, providing an accurate measurement of the water level. The Arduino processes this data and updates the LCD display, showing the current water level in centimeters. If the water level crosses predefined thresholds, the system activates the buzzer and corresponding LEDs to alert users

4.1 SYSTEM ARCHITECTURE

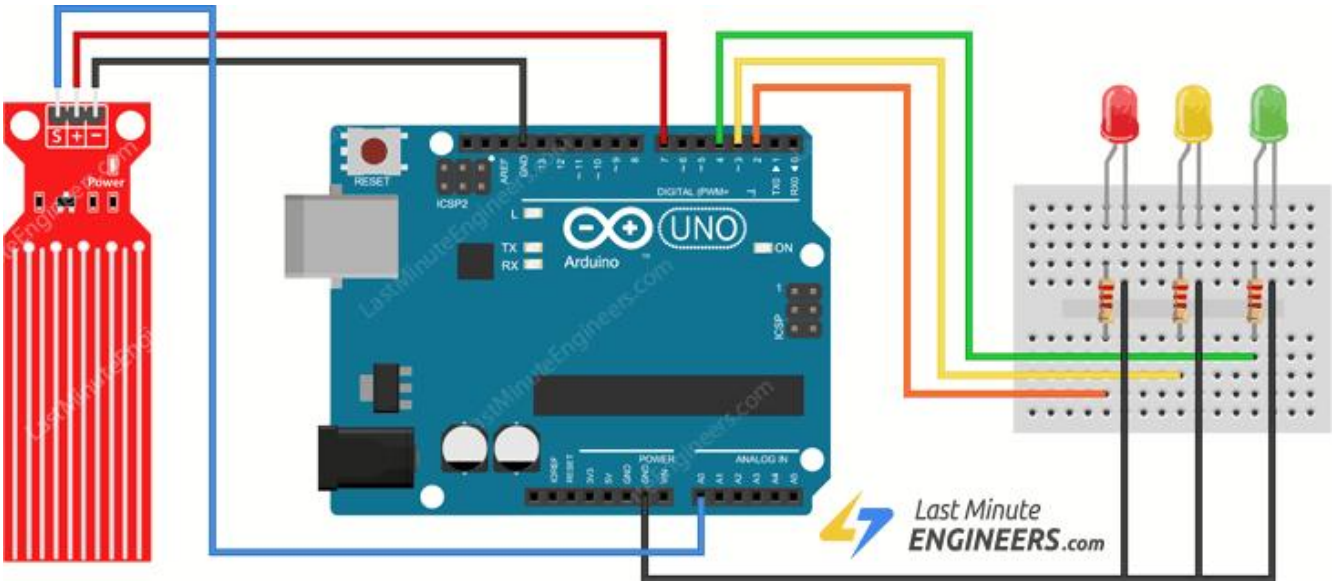

Fig 4.1 System Architecture

4.2 METHODOLOGY

The methodology for developing the water level indicator using Arduino involves a structured approach, starting from system design to implementation and testing. The process begins with defining the requirements and selecting appropriate components. The core components include an Arduino Uno micro controller, an ultrasonic sensor for water level detection, an LCD display for real-time monitoring, a buzzer and LEDs for alerts, and a Wi-Fi module for remote connectivity. The first step is the assembly of the hardware. The ultrasonic sensor is mounted at the top of the water tank to measure the distance to the water surface. The Arduino is programmed to process the sensor data and calculate the water level. The LCD display is connected to the Arduino to provide continuous, real-time feedback on the water level. The buzzer and LEDs are configured to trigger alerts when the water level exceeds or falls below predefined thresholds, ensuring immediate local notification of critical conditions.

CHAPTER 5

RESULTS AND DISCUSSION

The implementation of the water level indicator using Arduino yielded positive results, demonstrating the system's reliability and effectiveness in real-world applications. The ultrasonic sensor accurately measured water levels in the tank, and the Arduino successfully processed this data to provide real-time updates on the LCD display. Users could easily read the water level in centimeters, allowing for immediate assessment of the tank's status. The alert mechanism, comprising a buzzer and LEDs, proved highly effective in notifying users of critical water levels. When the water level exceeded the predefined high threshold, the system triggered a red LED and the buzzer, providing a clear and audible warning. Similarly, a low water level activated a different LED and the buzzer, ensuring that users were promptly alerted to refill the tank. These features significantly enhance the system's usability by providing immediate and unambiguous feedback.The combination of local and remote monitoring capabilities, along with real-time alerts, makes this system suitable for a wide range of applications, from household water tanks to larger industrial reservoirs. The project highlights the potential of integrating modern sensor technology with IoT for enhanced water management and conservation efforts.

CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 Conclusion

The water level indicator project using Arduino has successfully demonstrated the feasibility and effectiveness of an affordable, reliable, and user-friendly system for water level monitoring. By integrating an ultrasonic sensor, Arduino microcontroller, LCD display, buzzer, LEDs, and a Wi-Fi module, the project provides comprehensive local and remote monitoring capabilities. The system ensures accurate real-time water level readings, immediate alerts for critical levels, and remote access through IoT platforms. These features collectively enhance water management, reduce wastage, and ensure timely interventions. The successful implementation and testing of this project underscore the potential for using Arduino-based solutions in various applications, promoting efficient water usage and conservation. The project serves as a practical example of how modern technology can address everyday challenges in resource management.

6.2 Future Work

Advanced Sensor Integration: Exploring other sensing technologies like capacitive or sensitive sensor for improved accuracy and reliability under different environment condition.

AI and Machine Learning: Implement AI and machine learning algorithms to analyze sensor data patterns, improve detection accuracy, and develop predictive models for early water risk assessment.

Mobile Application Development: Develop user-friendly mobile applications with real-time monitoring features, interactive dashboards, and instant alert notifications for users and emergency responders, enhancing situational awareness and response.

APPENDIX

SOFTWARE INSTALLATION

Arduino IDE

To run and mount code on the Arduino NANO, we need to first install the Arduino IDE. After running the code successfully, mount it.

Sample Code

```
#include <NewPing.h>
#include <LiquidCrystal.h>

// Define pins for the ultrasonic sensor
#define TRIGGER_PIN  12
#define ECHO_PIN     11
#define MAX_DISTANCE 200  // Maximum distance to measure (in centimeters)

// Define pins for the LCD
const int rs = 7, en = 6, d4 = 5, d5 = 4, d6 = 3, d7 = 2;

// Define pin for the buzzer
#define BUZZER_PIN 8

// Initialize the ultrasonic sensor
NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE);

// Initialize the LCD
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

void setup() {
  // Start serial communication for debugging
  Serial.begin(9600);

  // Initialize the LCD and print a message
  lcd.begin(16, 2);
  lcd.print("Water Level:");

  // Initialize the buzzer pin as output
```

```
  pinMode(BUZZER_PIN, OUTPUT);
  digitalWrite(BUZZER_PIN, LOW);
}

void loop() {
  // Get the distance from the ultrasonic sensor
  unsigned int distance = sonar.ping_cm();

  // Print the distance to the serial monitor for debugging
  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");

  // Display the distance on the LCD
  lcd.setCursor(0, 1);
  if (distance == 0) {
    lcd.print("Out of range   ");
  } else {
    lcd.print(distance);
    lcd.print(" cm            ");
  }

  // Check the water level and activate the buzzer if necessary
  if (distance > 150 || distance < 20) {  // Change these values as per your tank's dimensions
    digitalWrite(BUZZER_PIN, HIGH); // Turn buzzer on
  } else {
    digitalWrite(BUZZER_PIN, LOW);  // Turn buzzer off
  }

  // Wait before taking another reading
  delay(1000);
}
```

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