Lab Report

Course Code: CSE 412

Course Title: Big Data and IoT

Submitted To

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Project Title: Water Level Monitoring System

Project Description: For our course CSE 412, we've taken an engaging and practical project: the Water Level Monitoring System. This project was more than just a classroom exercise; it was about applying our learning to a real-world application. We aimed to develop a system that accurately monitors water levels using an ESP8266 microcontroller and an ultrasonic sensor. This setup allowed us to measure water levels without direct contact, which was helpful for numerous applications like maintaining water tanks, managing irrigation systems, or even monitoring environmental water sources. The project was an exciting blend of hardware interfacing and software programming, giving us hands-on experience on the Internet of Things (IoT) domain. It was an excellent opportunity to see how operating systems interact with and control hardware and how these skills can be applied to solve practical problems. Through this project, we were not just learning about coding or circuitry; we were understanding how to combine these elements to create a functional and valuable tool. It was a step towards bridging the gap between theoretical knowledge and practical application in computer science and engineering.

Equipment’s List:

The list of required components is given below –

• Nodemcu ESP8266 x 1

• Ultrasonic Sensor x 1

• Relay Module x 1

• LCD Screen x 1

• I2C Module x 1

• LEDbulbx5

• 220-ohm resistor x 5

• Jumper Wires

• Breadboard x 1

Environment setup:

For our Water Level Monitoring System, data collection is straightforward and automated. Here's how it works:

Measurement: The ultrasonic sensor, mounted at a fixed point, measures the distance to the water surface. This happens whenever the ultrasonic() function is called in the loop.

Data Processing: The ESP8266 microcontroller calculates the water level by subtracting this distance from the maximum level of the tank. We store each reading in an array for averaging.

Averaging: After every 20 measurements, the system calculates the average water level. This is done by summing all the readings in the array and dividing by 20.

Data Transmission: The current water level is sent to the Blynk app after each measurement (via Blynk.virtualWrite(V0, blynkDistance)). The average level is sent every 20th measurement (via Blynk.virtualWrite(V2, MaxLevel - average)).

Display: Simultaneously, the current water level and the average (every 20th run) are displayed on the LCD screen for immediate viewing.

This process allows us to continuously monitor and record the water level in real-time, providing both instant readings and averaged data for a comprehensive understanding of water level trends.

Circuit diagram:

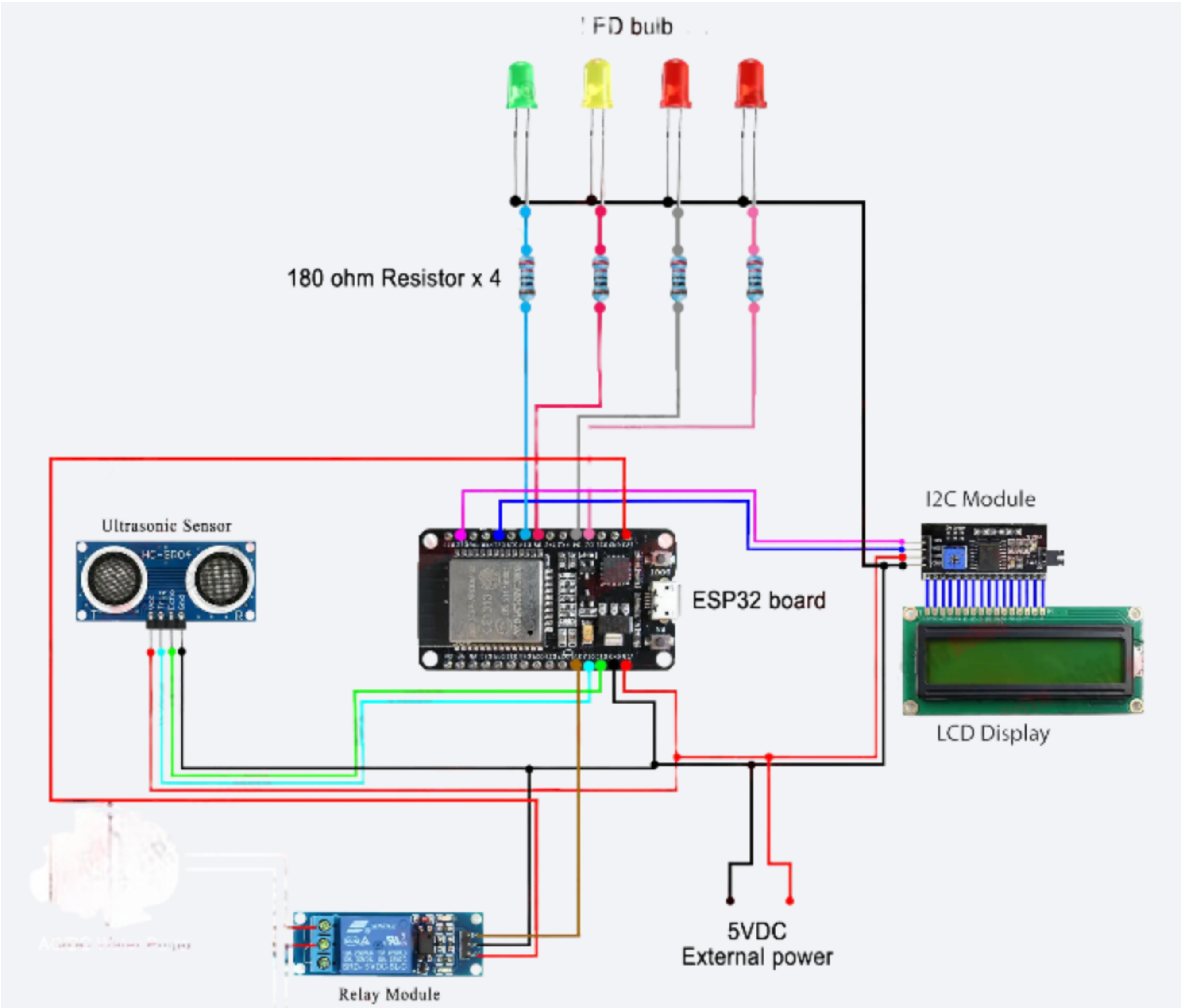
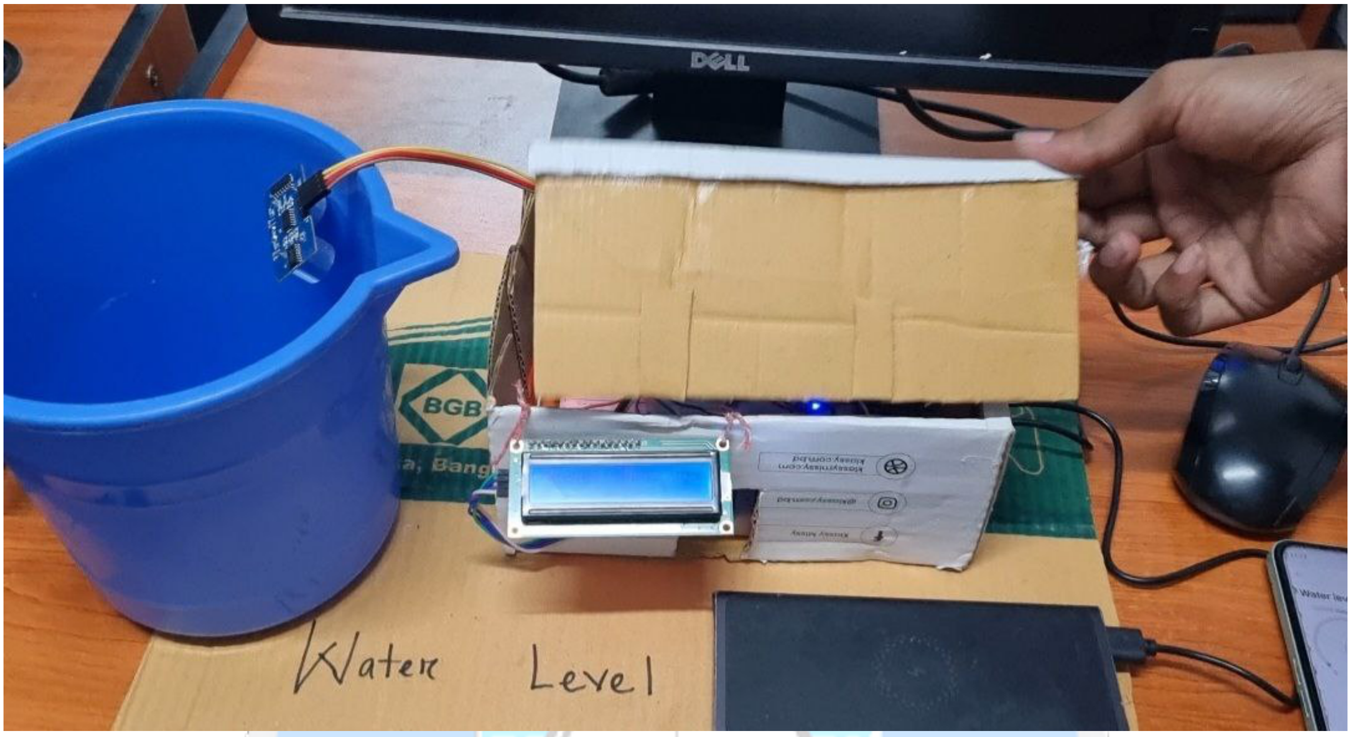
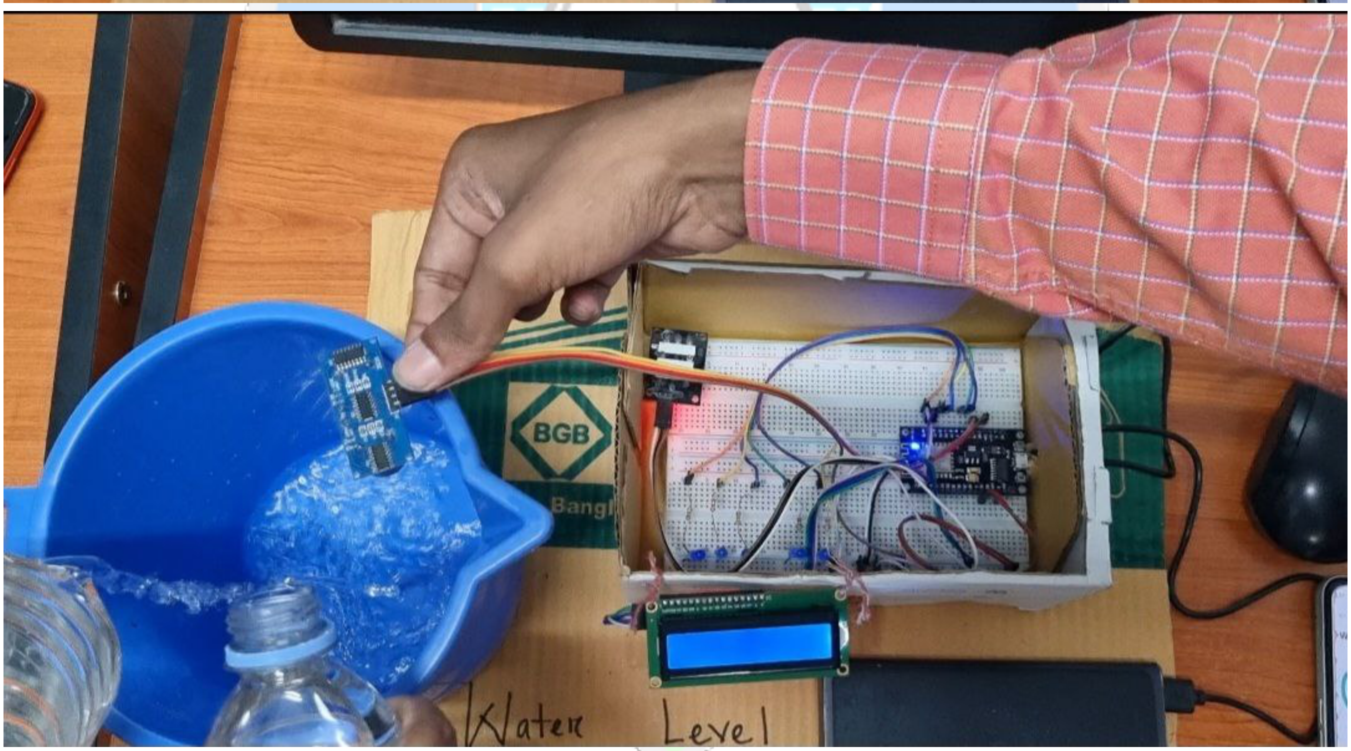
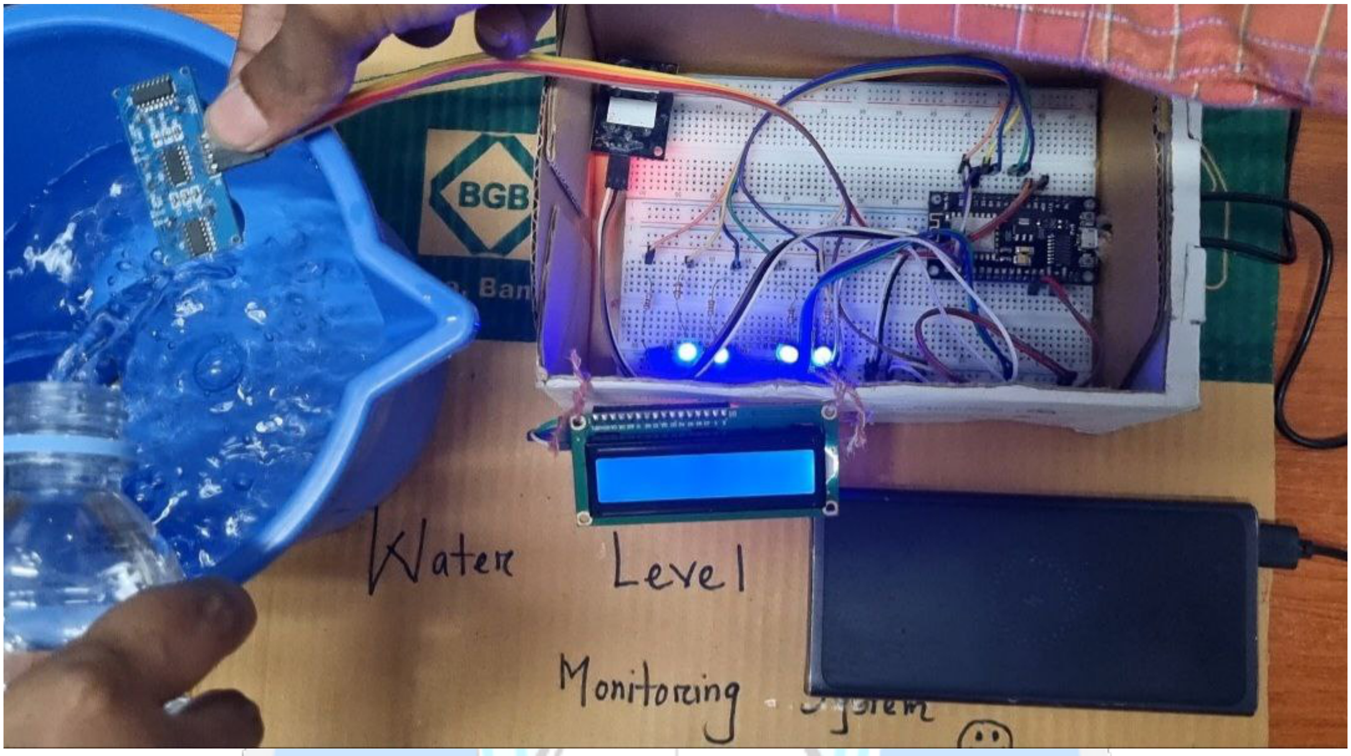


Photo of the Project:


DELL
Water Level


Water Level



Data Collection Procedure:

The ultrasonic sensor (e.g., HC-SR04) will be interfaced with the ESP8266 microcontroller; the trigger pin and echo pin interface with the assigned GPIO pins. This sensor generates a high-frequency sound pulse from the trigger pin that will propagate throughout space, reflect from the water surface, and its echo is collected at the receiver pin. The ESP8266 microcontroller will sense time taken by pulse in travelling to the water surface and back. The round-trip time is then used to calculate the distance to water surface using the speed of sound. This distance data detected is further processed by ESP8266 and hence can be displayed on an LCD or sent over to a server or even used to control other devices like water pumps or alarms based on preset thresholds.

Data Visualization:

Our Water Level Monitoring System project used the Blynk platform to create a comprehensive and user-friendly data visualization experience. Our approach involved crafting two dashboards, each tailored to a specific platform:

Web Dashboard: Designed for desktop and larger screen interactions, this dashboard provides a broad view of the water level data. It was particularly useful for in-depth analysis and monitoring over extended periods.

Mobile Dashboard: Focused on accessibility and convenience, the mobile dashboard allowed us to keep track of the water levels on the go. Its design was optimized for clarity and ease of use on smaller screens.

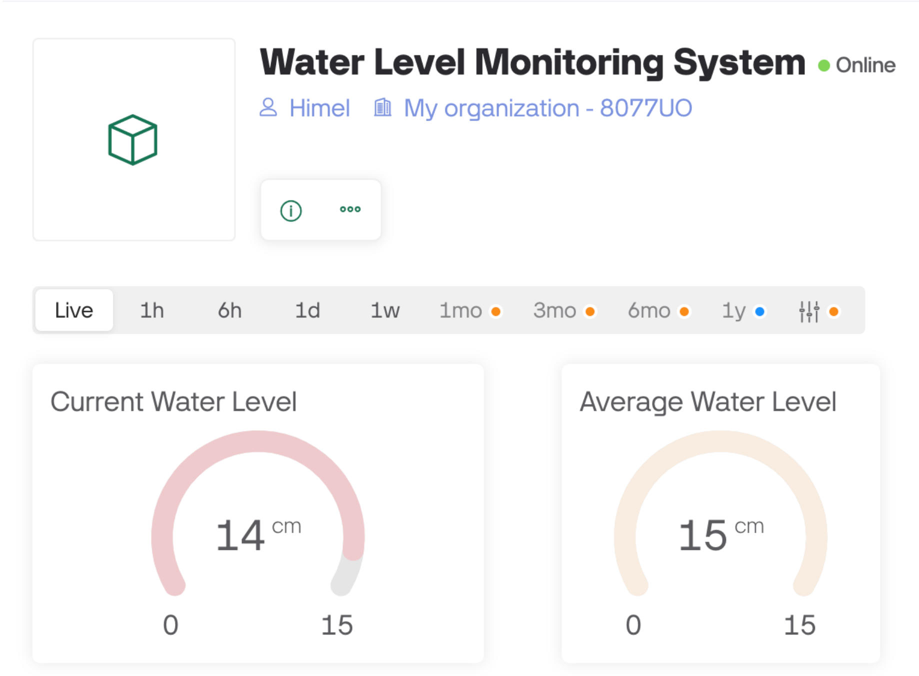
Both dashboards were equipped with two key gauge components:

Current Water Level Gauge: This component displayed the real-time water level in the tank, offering immediate insight into the current status.

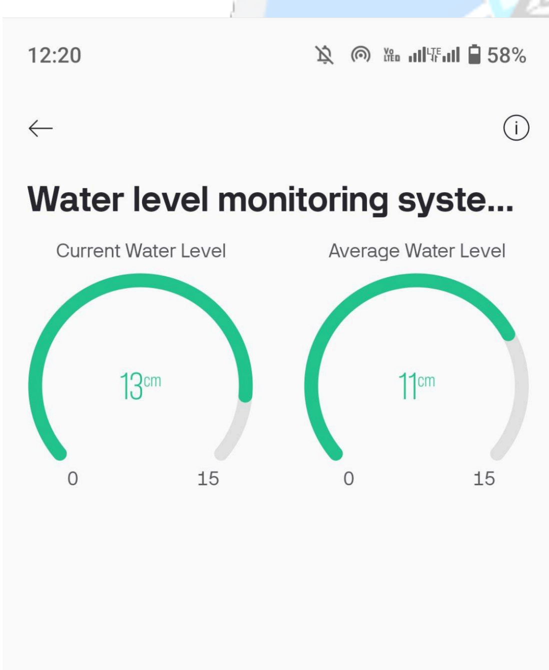
Average Water Level Gauge: This gauge provided a more stable and less fluctuating perspective of the water level trends by calculating and presenting the average water level over a set number of readings.

Through these dashboards, we achieved a dynamic and effective way to visualize and interpret our system's data, enhancing our understanding and ability to respond to water- level changes.

Web Platform:



Mobile Platform:



Timing and Budget:

This project cost us around 2000 Tk. and took a week to complete.

Conclusion:

The water level monitoring system using the ESP8266 microcontroller efficiently measures and monitors water levels using an ultrasonic sensor. It provides real-time visual indicators via LEDs and an LCD display, ensuring precise control and management of water levels. The system's integration with a relay module allows automatic activation of a water pump, enhancing reliability and functionality in various applications.

References:

ESP8266 Documentation:

ESP8266 NodeMCU Documentation provides detailed information about the ESP8266 microcontroller, including its capabilities and how to program it.

Ultrasonic Sensor Datasheet:

HC-SR04 Ultrasonic Sensor Datasheet offers detailed specifications and operational guidelines for the ultrasonic sensor.

Online Tutorials:

How to Interface Ultrasonic Sensor with ESP8266 from Random Tutorials provides a step-by-step guide on connecting and programming the ultrasonic sensor with the ESP8266.

Water Level Monitoring System Using ESP8266 and Ultrasonic Sensor on Circuit Digest gives a comprehensive tutorial on building a water level monitoring system.

Arduino Library:

NewPing Library for Arduino can be used with the ESP8266 to simplify the interfacing of the ultrasonic sensor. It includes functions to measure distances and handle various sensor operations.

YouTube Videos:

ESP8266 NodeMCU and Ultrasonic Sensor Tutorial on YouTube provides a visual and practical demonstration of setting up and programming the sensor with the ESP8266.

Water Level Indicator using Ultrasonic Sensor and ESP8266 shows a complete project with step-by-step instructions.