WATER LEVEL MONITORING SYSTEM USING IOT

Project report submitted in partial fulfillment of the requirement for the award of the Degree of B.Tech

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CERTIFICATE

This is to certify that this thesis entitled **"WATER LEVEL MONITORING SYSTEM USING IOT**" submitted by **B. Umesh Chandra(20241A04I6), B. Neha (20241A04I7),** in partial fulfilment of the requirements for the degree of Bachelor of Technology in Electronics and Communication Engineering of JNTUH, during the academic year 2022-23, is a bonafide record of research work carried out by his/her under our guidance and supervision. The contents of this thesis, in full or in parts, have not been submitted to any other university or Institution for the award of any degree or diploma.

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DECLARATION

I hereby declare that the mini project entitled **"WATER LEVEL MONITORING SYSTEM USING IOT"** is the work done during the period from **December 2022 to May 2023** and is submitted in the partial fulfilment of the requirements for the award of Bachelor of Technology in Electronics and Communication Engineering from Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous under Jawaharlal Nehru Technology University, Hyderabad). The results embodied in this project have not been submitted to any other university or Institution for the award of any Degree or Diploma.

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ABSTRACT

Water level monitoring plays a crucial role in various industries, agricultural systems, and residential applications. We propose a water level monitoring system that utilizes a combination of sensors, including LED, OLED, ultrasonic, and a buzzer, integrated through an Internet of Things (IoT) platform. The system aims to provide real-time monitoring and alert mechanisms to ensure efficient water management and prevent potential damages caused by water overflow or depletion. The water level monitoring system consists of multiple sensors strategically placed at different water storage or supply points. Here we use LED and OLED sensors to provide visual indications of the water level, allowing users to easily gauge the status. The ultrasonic sensor is utilized to measure the distance between the sensor and the water surface, enabling precise water level detection. To facilitate seamless communication and data processing, an IoT-based approach is adopted. Furthermore, the system is designed to trigger an alert mechanism through the integration of a buzzer. Additionally, the system can be connected to mobile applications or web interfaces, enabling remote monitoring and control from any location. The proposed water level monitoring system provides several advantages, including accurate and real-time monitoring, early warning alerts, and remote accessibility. It offers a cost-effective and efficient solution for water management, ensuring optimal usage and preventing potential water-related hazards.

TABLE OF CONTENTS

CHAPTER – 1

1.1 INTRODUCTION

The process requirement in many industries hotels, farms, hostels, and domestic purposes etc. includes an overhead tank for water, which is usually fed through an electric pump by controlling the switch.it leads to difficulty while controlling with switch Using IoT (Internet of Things)

The proposed water level monitoring system utilizes a combination of sensors, including LED, OLED, ultrasonic, and a buzzer, integrated through an IoT-based architecture. These sensors work collaboratively to measure and indicate the water level accurately, ensuring reliable and efficient monitoring.
LED and OLED sensors are employed to provide visual indications of the water level.

Ultrasonic sensors play a crucial role in accurately measuring the distance between the sensor and the water surface. They emit ultrasonic waves and measure the time taken for the waves to reflect. By calculating the travel time, the system can determine the precise water level in realtime. This method offers high accuracy and is unaffected by factors such as water turbidity or temperature.

To enable seamless communication and data processing, an IoT-based approach is adopted. The sensor data is collected and transmitted to a central control unit or a cloud-based server through wireless communication protocols like Wi-Fi or Bluetooth. The collected data is then processed and analyzed to determine the water level status. Through an intuitive user interface, users can access real-time data, historical trends, and configure threshold settings for customized alerts.

In case of critical water level conditions, an integrated buzzer is activated to provide an audible alert. This alert mechanism ensures that users are promptly notified of any potential risks, allowing them to take immediate actions to mitigate the situation.

Additionally, the system can be integrated with mobile applications or web interfaces, enabling remote monitoring and control from any location with an internet connection.

The proposed water level monitoring system offers several advantages over traditional methods, including accurate and real-time monitoring, early warning alerts, remote accessibility, and data analytics capabilities.

By implementing this system, industries, agriculture, and residential users can optimize their water management practices, conserve resources, and minimize the risks associated with improper water levels.

1.2 PROBLEM STATEMENT

The main problem with the current water level monitoring system is that it is not efficient and effective, particularly during natural disasters and emergencies. Often, there is a high risk of flooding and other water–related disasters, which can result in significant financial losses and endanger the lives of people living in affected areas. Therefore, there is a need for an innovative and reliable water level monitoring system that can provide accurate and timely data to help make informed decisions and take proactive measures to prevent disasters.

With the implementation of this water level monitoring system, it will possibly accurately and efficiently monitor water levels across different locations. Furthermore, it will provide a basis for effective decision-making in water management, ensuring the optimal use of water resources.

1.3 AIM AND OBJECTIVES

Aim:

The aim of our project water level monitoring system is to accurately measure and track the water levels in various bodies of water, such as rivers, lakes, reservoirs, and dams, to provide real-time data for effective water resource management, flood prediction, and environmental monitoring.

Objectives:

The objective of the project includes:

1. designing and developing a reliable and accurate water level sensor that can measure the water level in real time.

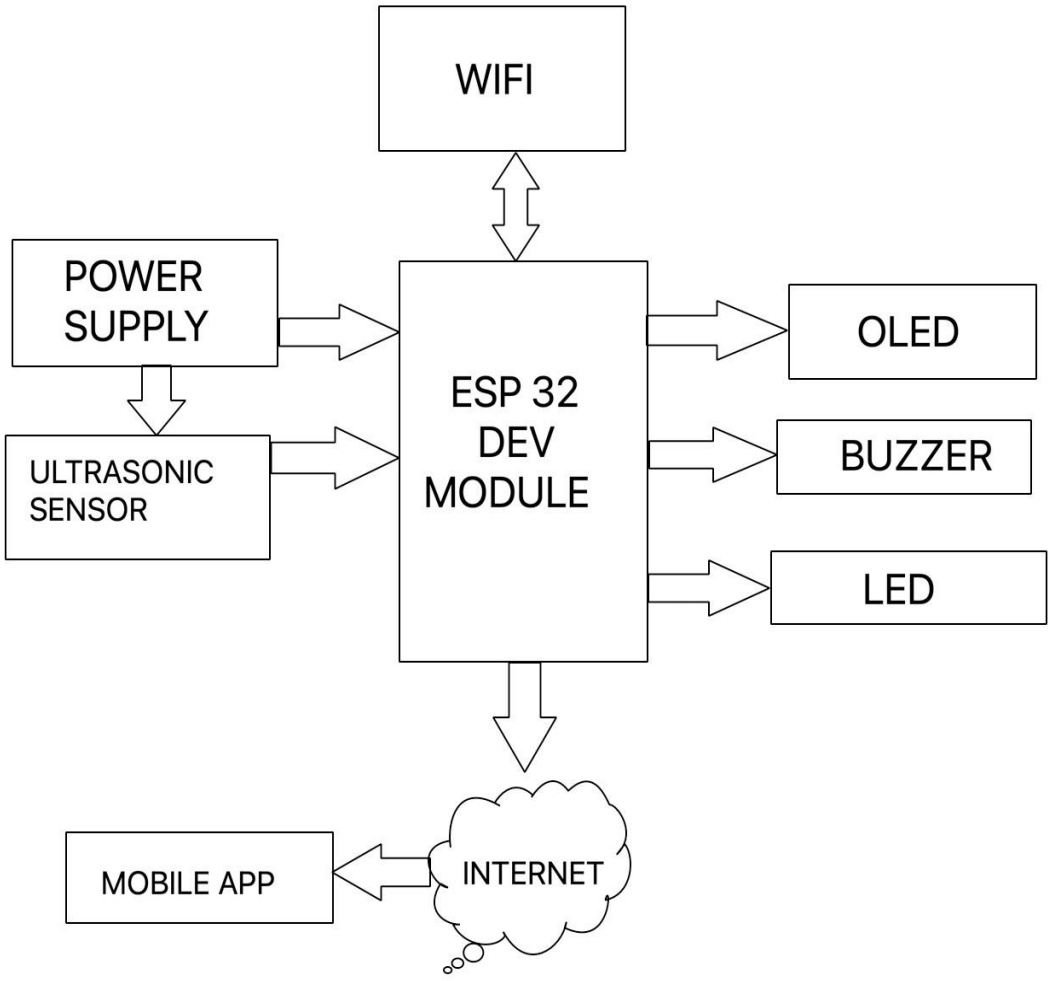
2. integrating the system with the Internet of Things (IoT) to allow for remote monitoring and control.

3. enhancing water management by providing accurate data that can be used to optimize water usage, prevent flooding, and detect leaks.

Overall, the aim of the water level monitoring system project is to enhance water management practices, prevent water-related disasters, and support sustainable water management practices.

CHAPTER – 2

2.1 BLOCK DIAGRAM:



2.2 COMPONENTS:

2.2.1 ESP32 Devkit V1:

The ESP32 is a microcontroller board based on the ESP32 chip, which is a powerful and lowcost Wi-Fi and Bluetooth-enabled system on a chip (SoC). The ESP32 chip has two cores that can operate independently and support multiple communication protocols, making it a versatile choice for a variety of lot (Internet of Things) projects.

The Arduino ESP32 board is designed to facilitate easy development of lot applications with the ESP32 chip. It has built-in support for OTA (over-the-air) programming and includes a microUSB port and a DC power jack for easy powering and programming.

Additionally, the board has various pins for digital and analog input/output, as well as communication ports for UART, SPI, and 12C. This makes the board compatible with a wide range of sensors, displays, and other peripherals.

The Arduino IDE (Integrated Development Environment) can be used to program the ESP-32 board, and there is a wealth of community support and resources available for getting started with Arduino ESP-32 development.

The ESP32 board has a Micro-USB for programming, powering up, and for transfer of data on a serial line to and from the laptop. It has an on-board LED connected to GPIO2 which can be used for debugging purposes. It has a RESET and a BOOT button. The BOOT button needs to be kept pressed while downloading the program to the board. The Dev Kit also has 4 MB of external flash memory.

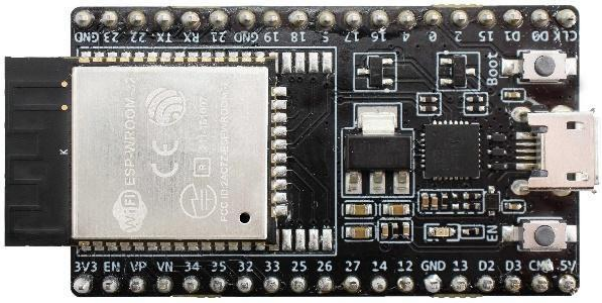


Figure 2.2.1.a. ESP32 DEVKIT V1

ESP32 PINOUT:

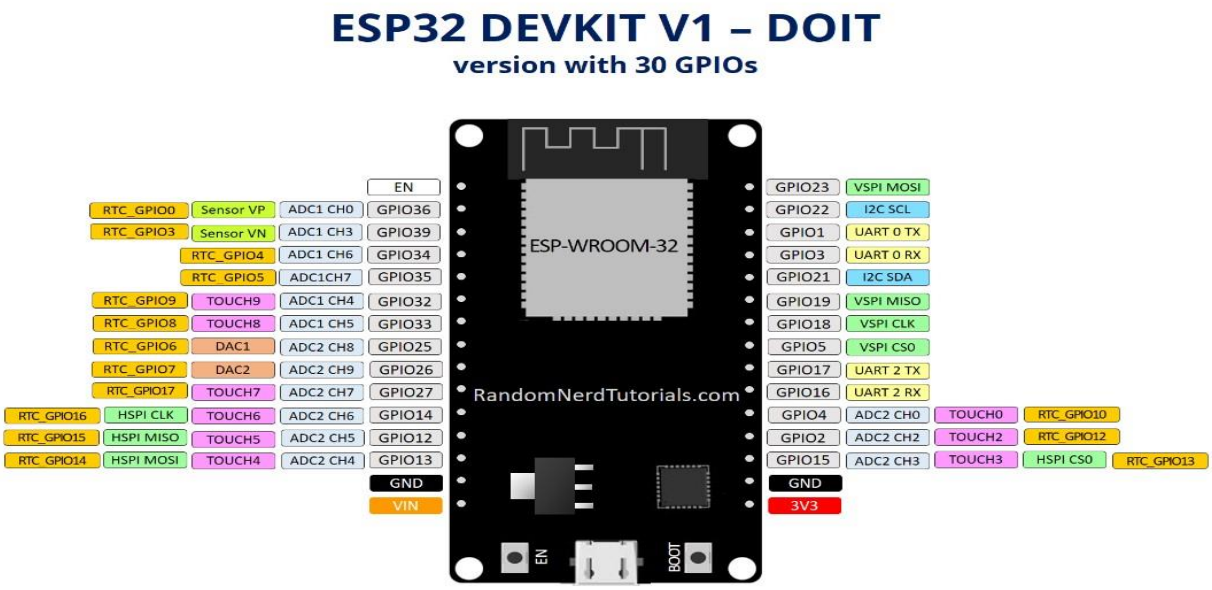


Figure 2.2.1.b. ESP32 Devkit V1

pinout

ESP32 PIN DESCRIPTION:

- The ESP32 is a versatile microcontroller with a wide range of pins that can be used for various functions. Here is a brief description of the ESP-32 pinout:
- GPIO Pins: The ESP32 has a total of 38 general-purpose input/output (GPIO) pins that can be used to interface with various external devices.
- Analog Input Pins: The ESP32 has 18analog input pins which can be used to measure analog voltages.
- UART Pins: The ESP32 has 3 UART interfaces which can be used for serial communication with other devices.
- 12C Pins: The ESP32 has 2 12C interfaces which can be used for connecting with 12C devices.
- SPI Pins: The ESP32 has 4 SPI interfaces which can be used for interfacing with SPI devices.
- PWM Pins: The ESP32 has 16 PWM output pins which can be used to control the brightness of LEDs or the speed of motors.
- SD Card Interface: The ESP32 also has an SD card interface which can be used to read/write data to an SD card.

- Ethernet Interface: The ESP32 also has an Ethernet interface which can be used for connecting to the internet or a local network.
- ADC Pins: The ESP32 has 2 ADC pins which can be used to measure analog voltage input.
- DAC Pins: The ESP32 has 2 DAC pins which can be used to output analog voltage.
- Overall, the ESP32 pinout provides a wide range of options for interfacing with external devices and sensors, making it a popular choice for IOT projects and other applications.

ESP32-FEATURES:

- I/O Pins: Input/Output pins are used to connect and communicate with external devices such as sensors, actuators, and other electronic components.
- Micro USB Jack: A micro-USB jack is a connector that allows the ESP32 to be connected to a computer or power source for programming, power supply, and data transfer.
- EN Button: The EN (Enable) button is used to reset the ESP32 or put it into bootloader mode for programming.
- Boot Button: The Boot button is used to force the ESP32 into bootloader mode during firmware uploading or updating.
- Red LED: The red LED is an onboard light-emitting diode that can be controlled by the ESP32 to indicate the status of the device or for any custom signaling purposes.
- Blue LED: Like the red LED, the blue LED is an onboard light-emitting diode that can be controlled by the ESP32 for status indication or custom signaling.
- Internal Memory: The ESP32 has internal memory, typically around 520 KB of SRAM, which is used for storing variables, program code, and other runtime data.
- External Flash: The ESP32 module often comes with a built-in external flash memory chip, typically 4 MB in size, which is used for storing program code, firmware, and other data.
- Wi-Fi: The ESP32 supports Wi-Fi connectivity, allowing it to connect to wireless networks and access the internet for data transfer, communication, and remote control.
- Bluetooth: The ESP32 supports Bluetooth technology, including Bluetooth Classic and Bluetooth Low Energy (BLE), enabling wireless communication and interaction with other Bluetooth-enabled devices.

ADVANTAGES AND DISADVANTAGES OF ARDUINO ESP32:

Advantages:

1. Dual-core processor.
2. Wi-Fi and Bluetooth connectivity.
3. Low power consumption.
4. Large memory.
5. Rich set of peripherals.
6. Low cost.
7. Open-source software.

Disadvantages:

1. support only Wi-Fi networks with a frequency range of 2.4 GHz.
2. Power Consumption is more.
3. Programming of ESP-32 is more complex.
4. ESP-32 doesn't have built-in hardware security.
5. It has limited support.
6. Heat dissipation is more.

APPLICATIONS OF ESP32:

1. Used for home automation systems, smart appliances, and sensor networks.
2. ESP-32 board can be used for building robotics projects, such as remotely controlled, drones or automated machines.
3. ESP-32 has integrated audio and video processing capabilities.
4. ESP-32 is widely used in educational settings for teaching programming, electronics and IOT development.
5. ESP-32 can be used for developing data logging systems.

2.2.2 ULTRASONIC SENSOR

An ultrasonic sensor is a type of sensor that uses sound waves to detect the presence of objects or measure distances. It works by sending out high-frequency sound waves and then measuring the time it takes for the sound waves to bounce back from an object and return to the sensor.

An ultrasonic sensor is a device that uses sound waves to detect the presence or proximity of objects. It works by emitting high-frequency sound waves (typically above 20 kHz) and then measuring the time it takes for the sound waves to bounce back off an object and return to the sensor. Ultrasonic sensors can be used to measure distance, detect the presence of objects, and perform other functions in a variety of applications.

The sensor consists of a transmitter and a receiver. The transmitter sends out a sound wave, which travels through the air and reflects off an object. The receiver then detects the reflected sound wave and measures the time it took for the wave to return.

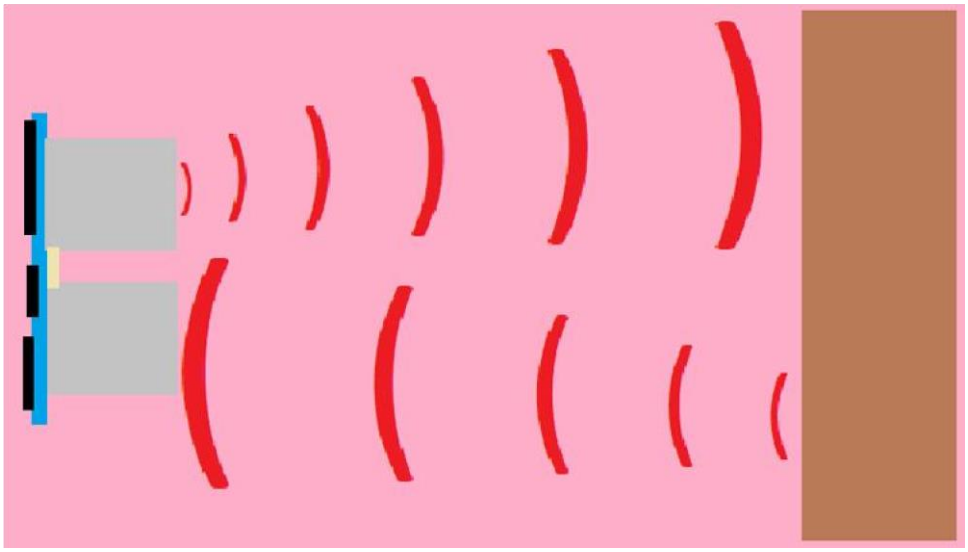


Fig 2.2.2 .a

To calculate the distance between the sensor and the object, The formula for this calculation is

D = ½ T x C (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters (about 1125.33 ft)/second)

Figure 2.2.2.b ultrasonic

PINS:

- VCC (Voltage Supply Pin) - This pin is used to provide power to the ultrasonic sensor. It is usually connected to a 5V or 3.3V power supply.
- GND (Ground Pin) - This pin is connected to the ground of the system to complete the circuit.
- Trig (Trigger Pin) - This pin is used to trigger the ultrasonic sensor to send out a sound wave. A high voltage pulse of at least 10 microseconds is sent to this pin to initiate a measurement.
- Echo Pin - This pin is used to receive the reflected sound wave from the object being measured. When the sound wave is detected, this pin sends a high voltage signal back to the microcontroller, and the duration of this signal is proportional to the distance between the sensor and the object.

APPLICATIONS OF ULTRASONIC SENSOR:

1.Irrigation,

2.Towing tank,

3.Flood monitoring,

4.Sea, pond, lake, and river level data.

ADVANTAGES AND DISADVANTAGES OF ULTRASONIC SENSOR:

Advantages:

1. Detection without physical contact.
2. Compact size and low cost.
3. High sensitivity.
4. Large measuring range.
5. Dust and dirt resistance.

Disadvantages:

1. Training is more extensive than other methods.
2. More expensive.
3. Difficult to use on thin materials.
4. complications.
5. Needs relatively smooth surface.
6. Must know velocity of part and have a reference to calibrate against for equipment set-up.

FEATURES OF ULTRASONIC SENSOR:

1. Distance Measurement.
2. Non-Contact Sensing.
3. Wide Range.
4. High Accuracy.
5. Fast Response Time.
6. Integration Capability.
7. Adjustable Sensing Range.
8. Multiple Output Options.

2.2.3 OLED:

An OLED (Organic Light Emitting Diode) display is a type of display technology that uses organic compounds to emit light when an electric current is applied. An OLED display is made up of millions of tiny organic pixels that emit light when activated, allowing for high contrast, vibrant colors, and deep blacks.

It is a self-emitting display that does not require a backlight and offers high contrast and low power consumption. OLED displays are thin, lightweight, and flexible, making them ideal for use in wearable devices and other portable electronics.

An OLED sensor is a sensor that uses an OLED display to display sensor data or provide a visual interface for interacting with a sensor system.

One example of an OLED sensor is a heart rate monitor that uses an OLED display to show the user their heart rate in real-time. The OLED display can also be used to display other relevant information, such as workout data or notifications from a connected smartphone.

Another example of an OLED sensor is a gas sensor that uses an OLED display to show the concentration of a particular gas in the surrounding environment. The OLED display can also provide information about the status of the sensor, such as battery life or calibration status.

Figure 2.2.3 OLED

FEATURES OF OLED:

1. High Contrast.
2. Wide Viewing Angle.
3. Fast Response Time.
4. Thin and Lightweight.
5. Flexible and Bendable.
6. Wide Color Gamut.
7. High Pixel Density.
8. Design Flexibility.

ADVANTAGES AND DISADVANTAGES OF OLED:

Advantages:

1. energy efficiency.
2. High contrast display.
3. Flexible and light weight.
4. It doesn't require backlighting.
5. It is much brighter than LED's.
6. Thickness is less than 1mm.
7. The manufacturing process is simple, and the cost is lower.
8. Higher luminous efficiency and lower energy consumption.
9. The low temperature characteristic is good, and it can still display normally at minus 40 degrees.

Disadvantages:

1. 1.Life span is usually only 5000 hours (about 7 months).
2. Large-size screens cannot be replaced.
3. There is a problem of insufficient color purity,
4. It is not easy to display bright and rich colors.
5. More expensive.

APPLICAIONS OF OLED:

1. Televisions and Monitors OLED devices
2. Smartphones and Tablets.
3. Wearables.
4. Light Panels.
5. Used in mobile devices.
6. digital cameras.
7. Laptops.
8. VR headsets.

2.2.4 BUZZER:

A buzzer sensor, also known as a buzzer module or buzzer alarm, is an electronic component that is used to generate a sound or alarm signal. It typically consists of a piezoelectric element and a driver circuit that converts an electrical signal into an audible sound.

Buzzer sensors come in a variety of types and sizes, including active and passive buzzers. Active buzzers have an integrated driver circuit and can be directly connected to a microcontroller or other electronic device, while passive buzzers require an external driver circuit to generate sound. Buzzer sensors can also have different sound frequencies and volume levels, depending on the application.

A buzzer sensor typically has two terminals, which are used to connect the buzzer to a power source and a control signal. The positive terminal (marked +) is connected to the power supply or the positive output of a control signal. The negative terminal (marked -) is connected to the ground or the negative output of a control signal.

When an alternating current (AC) or pulse-width modulated (PWM) signal is applied to the buzzer sensor, the piezoelectric element inside the buzzer vibrates, producing an audible sound. The frequency and duration of the sound can be controlled by adjusting the input signal.

The pitch of the sound produced by the buzzer is determined by the frequency of the input signal. Higher frequencies produce a higher pitch sound, while lower frequencies produce a lower pitch sound. Buzzer sensors can produce sounds ranging from a few hertz to several kilohertz.

Overall, buzzer sensors are versatile and useful components that are used in a variety of electronic projects and systems. They are easy to use and can provide audible feedback or warning signals to users, making them ideal for applications where visual feedback may not be effective or practical.

The buzzer works by using a piezoelectric crystal to convert electrical energy into mechanical vibrations, which in turn produce sound waves. It is easy to use and can be powered by a 5V power

source. The buzzer does not require a complex circuit to operate and can be driven directly by a microcontroller or other electronic device.

Figure 2.2.4 Buzzer.

FEATURES OF BUZZER:

1. Sound Generation.
2. Compact and Lightweight.
3. Simple Operation.
4. Low Power Consumption.
5. Wide Operating Voltage Range.
6. Different Sound Output Options.
7. Cost-Effective.

ADVANTAGES AND DISADVANTAGES OF BUZZER:

Advantages:

1. 1.Simply compatible.
2. 2.Frequency Response is Good.
3. 3.Size is small.
4. 4.Energy consumption is less.
5. 5.The range of voltage usage is Large.
6. 6.Sound pressure is high.

Disadvantages:

1. 1.controlling is a little hard.
2. 2.Generates Annoying sound.
3. 3.Training is necessary to know how to repair the condition without just turning it off.

APPLICATIONS OF BUZZER:

1. Communication Devices.
2. Electronics used in Automobiles.
3. Alarm circuits.
4. Portable Devices.
5. Security Systems.
6. Timers.
7. Household Appliances.
8. Electronic Metronomes.
9. Sporting Events.
10. 10.Annunciator panels.
11. 11.Game shows.

2.2.5 LED:

LED sensors are electronic devices that use a light-emitting diode (LED) to detect changes in light intensity. They work by emitting light and then detecting the amount of light that is reflected in the sensor. This reflected light is then used to determine the presence or absence of an object or to measure changes in distance or position.

LED sensors can detect changes in the amount of reflected light as a person or object moves through the sensor's field of view.

LED sensors are also commonly used in distance measurement systems, where they can be used to measure the distance between the sensor and an object. As the distance between the sensor and object changes, the amount of reflected light also changes, which can be used to calculate the distance between the two.

Overall, LED sensors are versatile and reliable devices that are used in a wide range of applications where accurate detection or measurement of light is required.

Figure 2.2.5 LED.

FEATURES OF LED:

1. Energy Efficiency.
2. Long Lifespan.
3. Instantaneous Lighting.
4. Compact and Small Size.
5. Wide Range of Colors.
6. Low Heat Emission.
7. Solid-State Technology.

ADVANTAGES AND DISADVANTAGES OF LED:

Advantages:

1. Low Voltage Operation.
2. Long Lifespan.
3. No Heat.
4. Energy Efficiency.
5. Flexibility.
6. Durability
7. Instant on/off.
8. Color Options.
9. Improved Environmental Performance.

Disadvantages:

1. Higher Initial Cost.
2. Directional Light.
3. Heat Sensitivity.
4. Quality Variation.
5. Blue Light Hazard.
6. transformer similarity.
7. Overheating can cause decreased light life.

APPLICATIONS OF LED:

1. Lighting.
2. Display Screens.
3. Automotive Lighting.
4. Traffic Signals.
5. Medical Devices.
6. Horticulture Lighting.
7. Microprocessors.
8. Multiplexers.
9. advanced watches.

2.2.6 GROVE COMAPTIBLE:

Grove-compatible wires are specialized cables designed to work with the Grove system of sensors, actuators, and other electronic modules. The Grove system is a popular plug-and-play platform that simplifies the process of prototyping and building electronic projects, especially for beginners.

Grove compatible wires typically have a 4-pin connector on each end, which fits into the standard connectors found on Grove modules. The wires come in different lengths and colors, making it easy to connect various Grove components together without the need for soldering or breadboarding.

Grove compatible wires are widely available from many electronics suppliers. They are also inexpensive, which makes them a cost-effective solution for building Grove-based projects.

Figure 2.2.6 Grove connectors.

ADVANATAGES OF GROVE COMPATIBLE CONNECTORS:

1. Standardized Connectors.
2. Simple Interface.
3. Color-Coded Cables. 4. No Polarity Reversal.
5. Wide Availability.
6. Reusability.
7. 4-pin female connector fits into Grove ports on electronic modules.

FEATURES OF GROVE COMPATIBLE CONNECTORS:

1. Universal Interface.
2. Plug-and-Play.
3. Color-Coded Wires.
4. Extensible Cabling.

Overall, Grove compatible connectors offer a user-friendly and standardized approach to connecting electronic modules, making it easier for both beginners and experienced users to prototype and build projects without the need for intricate wiring or soldering skills.

CHAPTER – 3

3.1 CIRCUIT DIAGRAM:

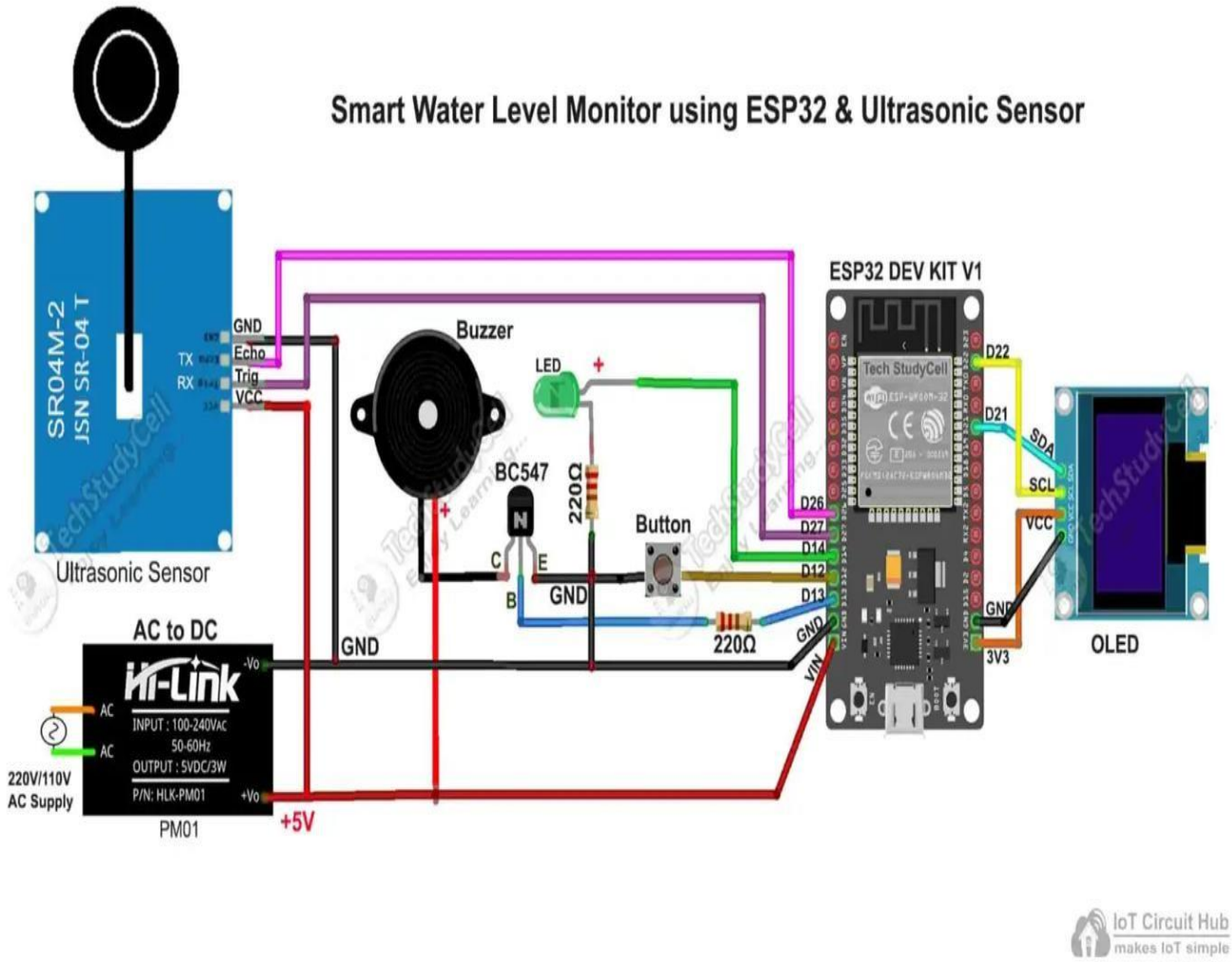


Figure 3.1 circuit diagram.

3.2 CONNECTIONS :

From the circuit diagram we can observe the interfacing of OLED, ultrasonic sensor, buzzer, led with Arduino ESP-32. Ultrasonic sensor is interfaced with Arduino in-order to detect the distance of water. A 0.96″ I2C OLED screen displays these water levels for easy monitoring. The buzzer and led are interfaced to Arduino to know if the water level is too low or high.

3.2.1 ESP32 INTERFACING WITH ULTRASONIC SENSOR:

Ultrasonic sensor which contains 2 terminals which emit an ultrasonic signal and receive the emitted ultrasonic signal.

An ultrasonic sensor is a device that uses sound waves with frequencies above the range of human hearing to measure distance. Ultrasonic sensors work by sending out a high-frequency sound wave and then measuring the time it takes for the sound wave to bounce back. The sensor then calculates the distance based on the time it took for the sound wave to return. It has 4 pins VCC, GND, TRIG, ECHOPIN.

The ESP-32 is a development board that has all the features you need to create your projects. It is designed for mobile, wearable electronics, and Internet-of-Things (IoT) applications. The ESP32 development board consists of 32-bit LX6 microprocessors.

TO connect an ultrasonic sensor with ESP-32:

- Connect the VCC and GND pins of the waterproof ultrasonic sensor to the ESP32 5V and GND pins.
- Connect the GPIO D26 **&** D27 to the Echo & TREG pins of the waterproof ultrasonic sensor.

3.2.2 OLED AND LED INTERFACING:

In the simplest terms, a light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it. Light is produced when the particles that carry the current (known as electrons and holes) combine within the semiconductor material. Led has two terminals: positive and negative.

Led connections: Positive pin should be connected to digital pin 5 of Arduino. Negative pin should be connected to anyone of led. Another led of the resistor should be connected to the ground of Arduino.

Led is connected to GPIO **D14** of ESP32.

An OLED (Organic Light Emitting Diode) is a type of display technology that uses organic compounds to produce light when an electric current is applied. OLED displays are thinner and lighter than LCD displays and offer better color contrast and viewing angles. An OLED display is made up of millions of tiny organic pixels that emit light when activated, allowing for high contrast, vibrant colors, and deep blacks.

An OLED sensor is a sensor that uses an OLED display to display sensor data or provide a visual interface for interacting with a sensor system.

OLED connections: The OLED SDA & SCL pins relate to the **D21** & **D22** GPIO of ESP32.And VCC is connected to 5v supply GND is connected GND.

3.2.3 BUZZER AND PUSH BUTTON INTERFACING:

A buzzer is an electronic device that makes a buzzing or beeping sound when an electric current is passed through it. Buzzer is used in IoT projects to alert the user of an event or to signal that something has happened.

Buzzer connections: Buzzer connected with GPIO **D13** of ESP32.

A push button is a simple switch that is activated by pressing it. Push buttons are used in projects to trigger events or to control devices.

Button connections: GPIO **D12** connected with the push button to stop the buzzer.

3.2.4 TRANSISTORS AND RESISTORS INTERFACING:

A transistor is a semiconductor device that can amplify or switch electronic signals. Transistors are used in IoT projects to control the flow of electricity and to amplify signals.

It has 3 terminals, namely 1. collector,2. Base,3. Emitter.

A resistor is an electronic component that resists the flow of electricity. Resistors are used in IoT projects to limit the amount of current flowing through a circuit and to protect other components from damage. It is a passive component, which means it does not require a power source to function. Resistors are available in a wide range of values, sizes, and power ratings to suit various applications.

Transistor and Resistor connections: it has 3 terminals.

- Collector it is connected to buzzer negative end.
- The base is connected to a 220-ohm resistor and given to GPIO D13.
- The emitter is connected to a 220-ohm resistor and the negative end of led.

3.2.5 PROJECT WORKFLOW:

Stage 1: HARDWARE SETUP:

- Set up the physical components of the water level monitoring system, including an ultrasonic sensor, OLED display, led, buzzer, and ESP32 microcontroller.
- Connect the ultrasonic sensor, OLED, LED, buzzer to the ESP32 board.
- Use Grove connectors to connect if required.

Stage 2: PROGRAM DEVELOPMENT:

- Write the program in Arduino IDE and connect it to hardware setup through USB port.
- And set up to Google Firebase.
- Develop a mobile app using Blynk to show the level of water.

Stage 3: OPERATION:

In this task our primary point is to recognize the water level and keep monitoring it. A water level monitoring system using IoT with an ultrasonic sensor, OLED, LED, buzzer, and ESP32 is a project that allows you to monitor the water level in a tank remotely using your smartphone or computer. The ESP32 is a low-cost Wi-Fi-enabled microcontroller that can connect to the internet and send data to a cloud server or directly to your device.

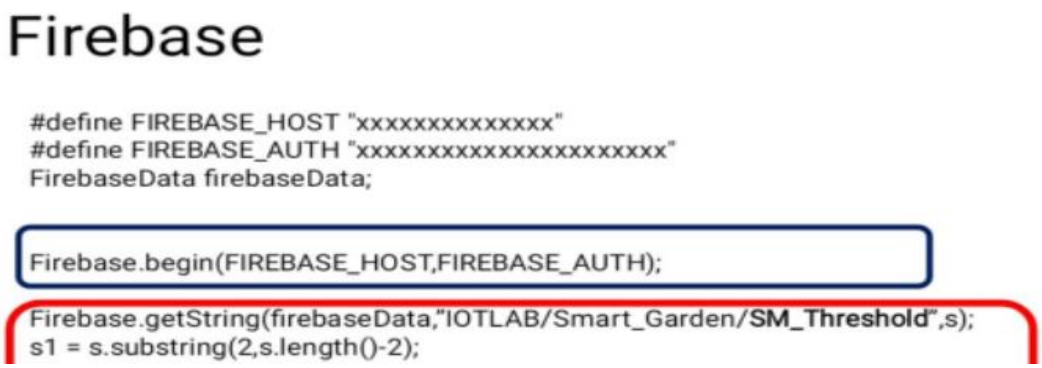
Using ultrasonic Sensor, we measure the water level in the tank. While fitting the ultrasonic sensor in the water tank, we make sure the minimum distance between the sensor and the full tank water level must be greater than 25cm (about 9.84 in). It works by sending out ultrasonic waves and measuring the time it takes for them to bounce back from the water surface.

The distance is then calculated using the speed of sound in air. And this distance is displayed on OLED. And we also use led to indicate the status of the system. For example, it can be used to indicate when the system is powered on, or when the water level is too high or too low. And we also use buzzer to alert you when the water level in the tank is too high or too low. For example, it can be used to sound an alarm when the water level is too high and there is a risk of flooding. The ESP32 is the main controller that connects all the components together. It communicates with the ultrasonic sensor, OLED display, LED, and buzzer, and sends data to the internet. And set up with cloud to receive and process the water level data from the ESP32.

And by mobile app development we can interface for monitoring the water level remotely.

CHAPTER-4

4.1 CLOUD DATABASE ACCESS



Firebase is a mobile and web application development platform that provides developers with a variety of tools and services to help them build high-quality apps. Firebase is a cloud-based platform that provides developers with a variety of tools and services to help them build high-quality apps. Firebase provides a real-time database, authentication, cloud storage, hosting, and more.

Firebase is a powerful backend platform developed by Google that provides a wide range of services and tools for building web and mobile applications.

Remote Config enables you to remotely manage the behavior and appearance of your application without requiring app updates. You can customize features, A/B test different configurations, and dynamically change the app's behaviour based on user segments.

Firebase is a platform developed by Google that offers a range of tools and services for building mobile and web applications. One of the key services offered by Firebase is a cloud-hosted database, which allows developers to store and retrieve data in real-time.

Here are the steps to open cloud database access with Firebase:

- Sign up for a Firebase account and create a new project.
- In your project dashboard, go to the "Database" section and select "Create Database".
- Choose a starting mode for your database. You can either start in "test mode" or "locked mode".
- If you choose "test mode," you will be able to read and write data to your database without any authentication. If you choose "locked mode," you will need to set up authentication for your database before you can read or write data.
- Once your database is created, you can start accessing it through the Firebase SDKs. Firebase offers SDKs for a variety of platforms, including web, Android, iOS, and Unity.

- To use the SDK, you will need to add it to your project and configure it with your Firebase project credentials. You can find detailed instructions for setting up the Firebase SDK in the Firebase documentation.

- Once the SDK is set up, you can start reading and writing data to your database using the Firebase Realtime Database API. The API allows you to access your data in real time and provides powerful features like data synchronization and offline support.

We can Monitor the performance in Firebase. Performance Monitoring helps you gain insights into your app's performance, including network latency, rendering times, and resource utilization. It allows you to identify and optimize areas that may impact the user experience.

In summary, Google Firebase is used as the cloud database in this project, which requires a host URL and database authentication key credentials to access. The "FirebaseESP32.h" Arduino library is installed to gain access to the database. The database can be securely accessed using Gmail ID credentials. This database is used to store and retrieve information such as the cardholder's name, date, time, and status (in/out), and the present status of the person can be displayed on the mobile app developed.

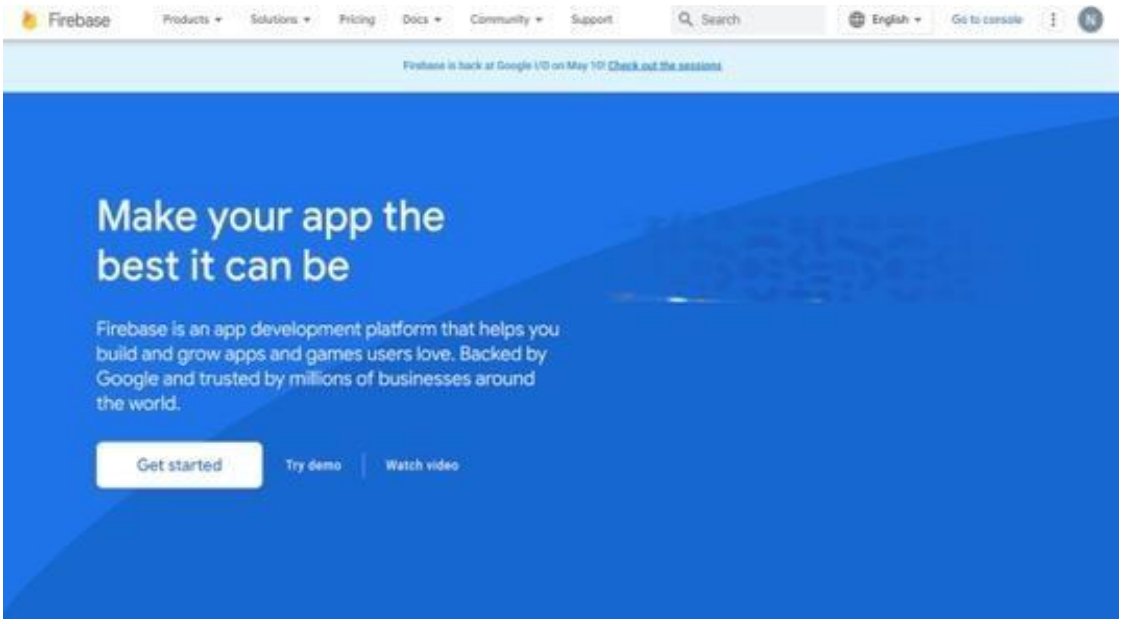


Figure 4.1.a

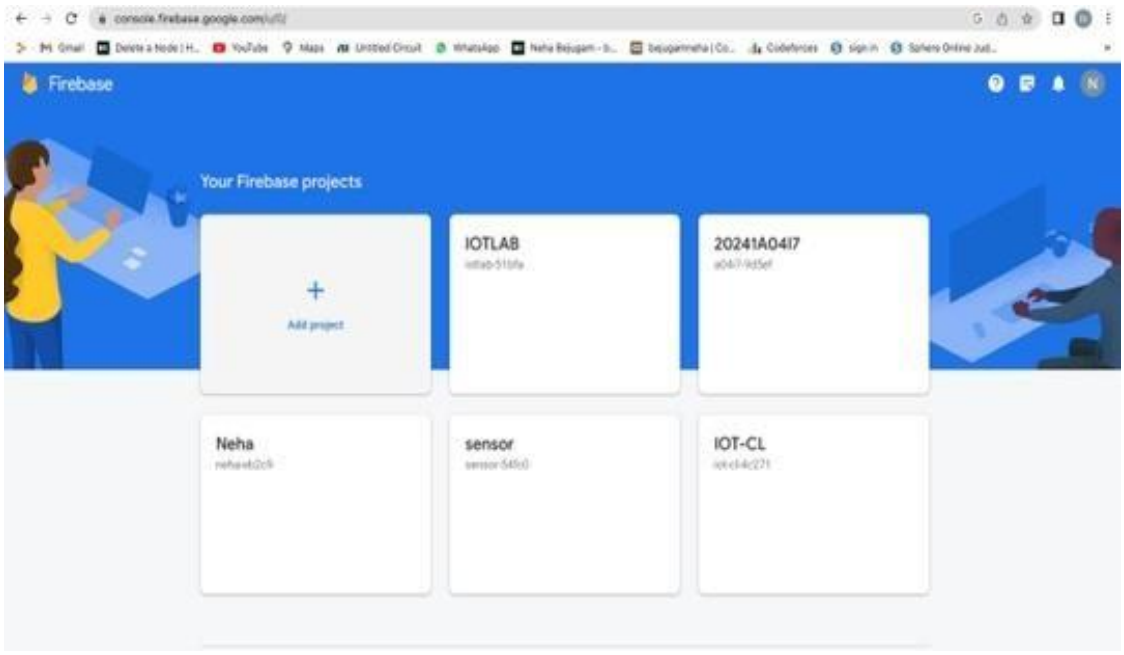


Figure 4.1.b

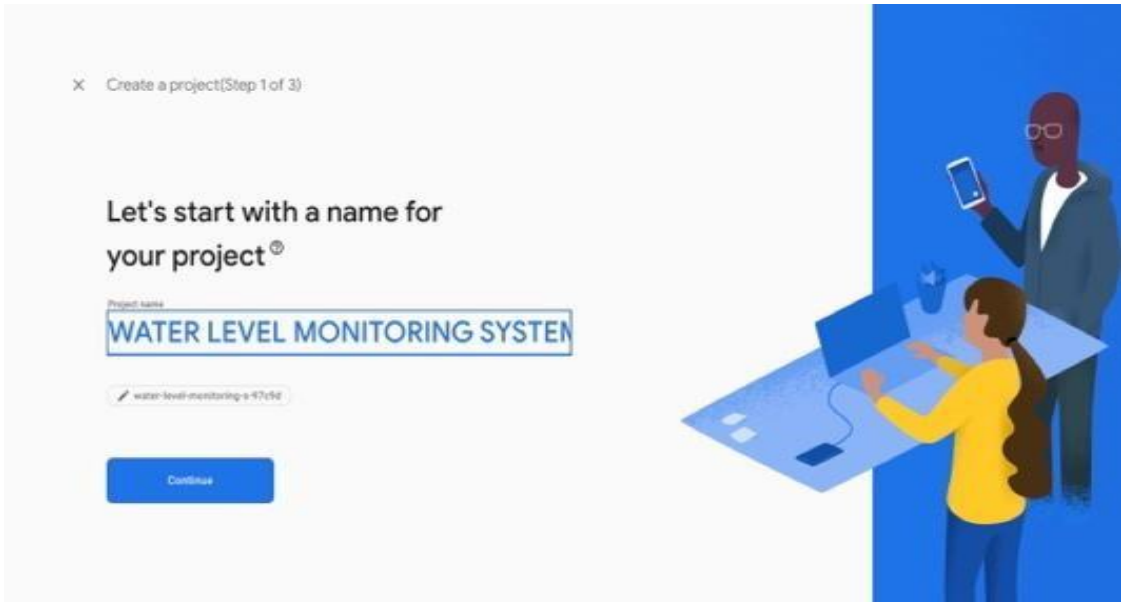


Figure 4.1.c

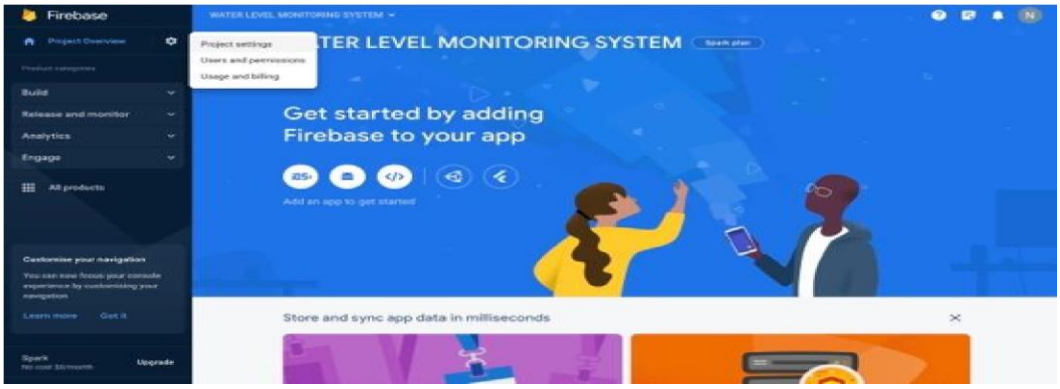


Figure 4.1.d

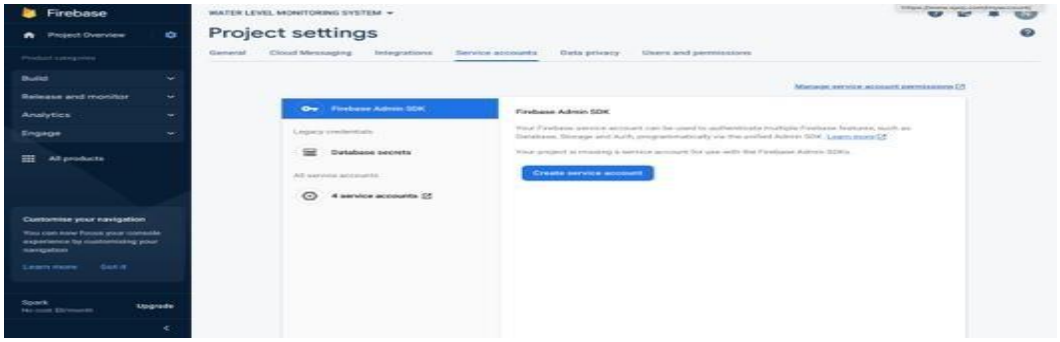


Figure 4.1.e

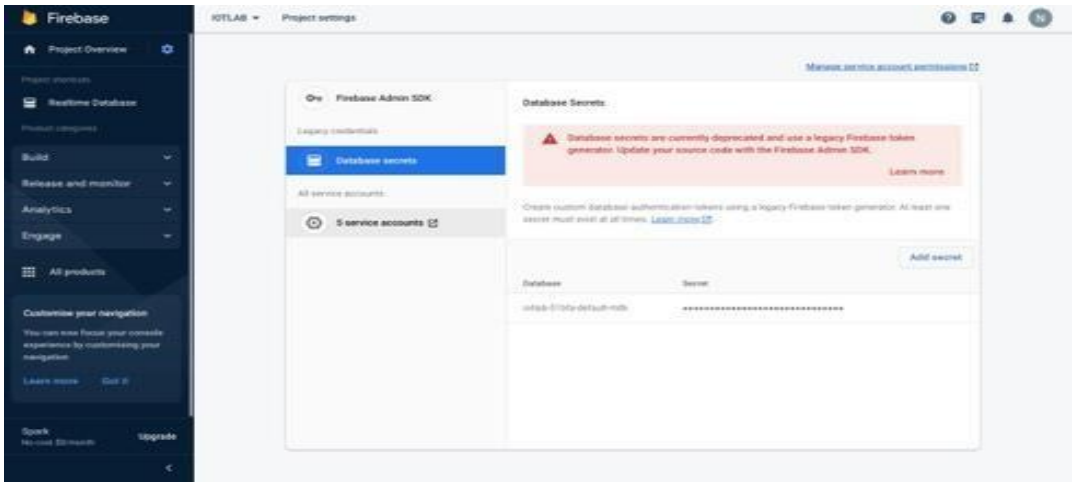


Figure 4.1.f

4.2 MOBILE APP DEVELOPMENT

To develop the mobile app for our project, we will be using Kodular, Kodular is a free and open-source online platform for creating Android mobile applications. It allows users, especially those without extensive programming knowledge, to build fully functional apps using a drag-and-drop interface. Kodular is based on the concept of "block programming," where users can visually assemble blocks of code to create their app's functionality.

Kodular provides a visual interface that allows users to design their app's user interface by dragging and dropping components such as buttons, labels, text boxes, and more.
The platform offers a blocks-based coding system similar to Scratch, where users can create the app's functionality by assembling blocks of code. This eliminates the need to write traditional code manually.
Kodular provides a rich set of built-in components and extensions, enabling users to incorporate features such as camera access, GPS location, database connectivity, and more into their apps.
Kodular offers a live companion app called "Kodular Companion" that can be installed on Android devices. This allows developers to test their app instantly on a connected device while building it on the Kodular platform.
Kodular supports various monetization options, including banner ads, interstitial ads, and rewarded ads. This enables developers to generate revenue from their apps through advertisements. Once the app development is complete, Kodular provides an easy way to export the app as an APK file, which can be installed on Android devices or published to the Google Play Store.
Kodular has an active community forum where users can seek help, share ideas, and collaborate with other developers. Additionally, it supports extensions that allow users to add extra functionality to their apps.

Kodular is built on the MIT App Inventor project, which is also a visual programming platform for creating Android apps. However, Kodular offers additional features and enhancements over App Inventor, making it a popular choice among app developers, especially those who are new to programming.

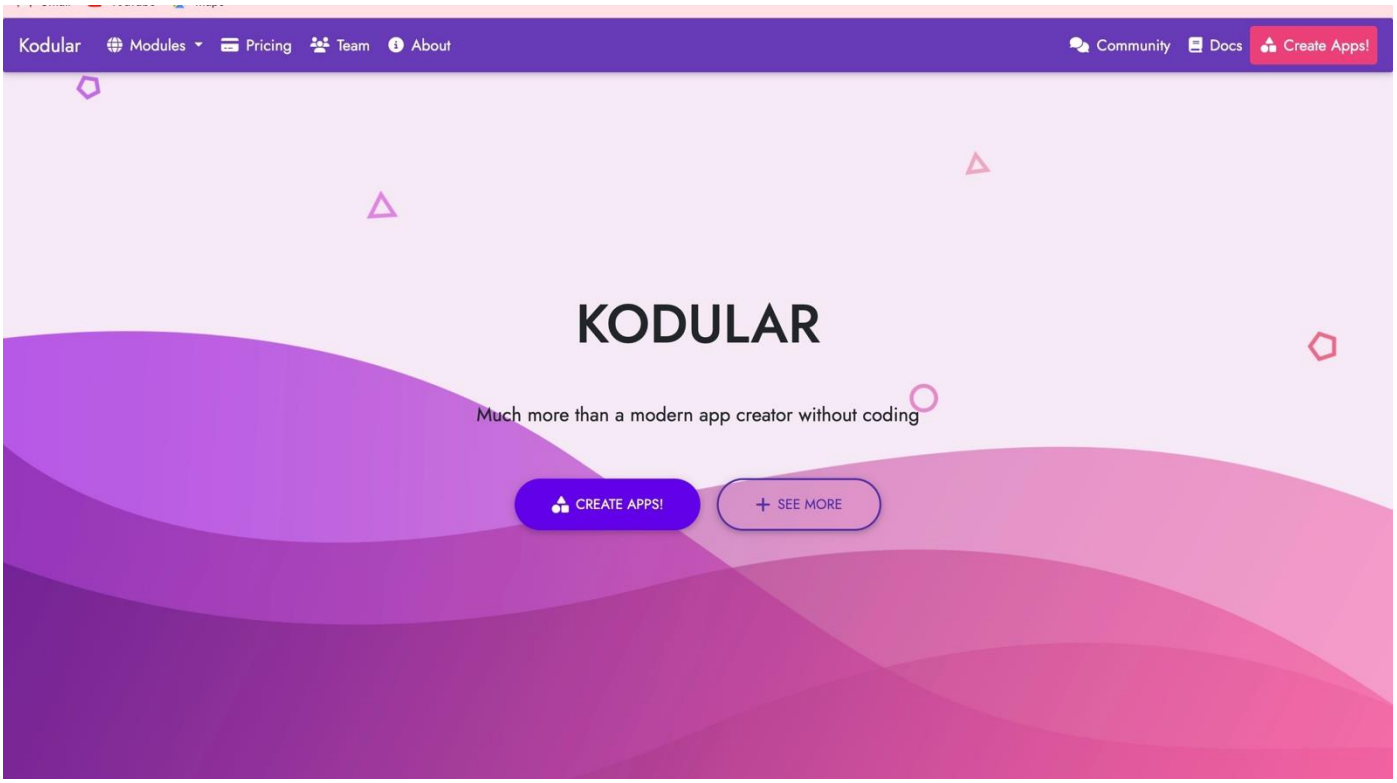


Figure-4.2.a

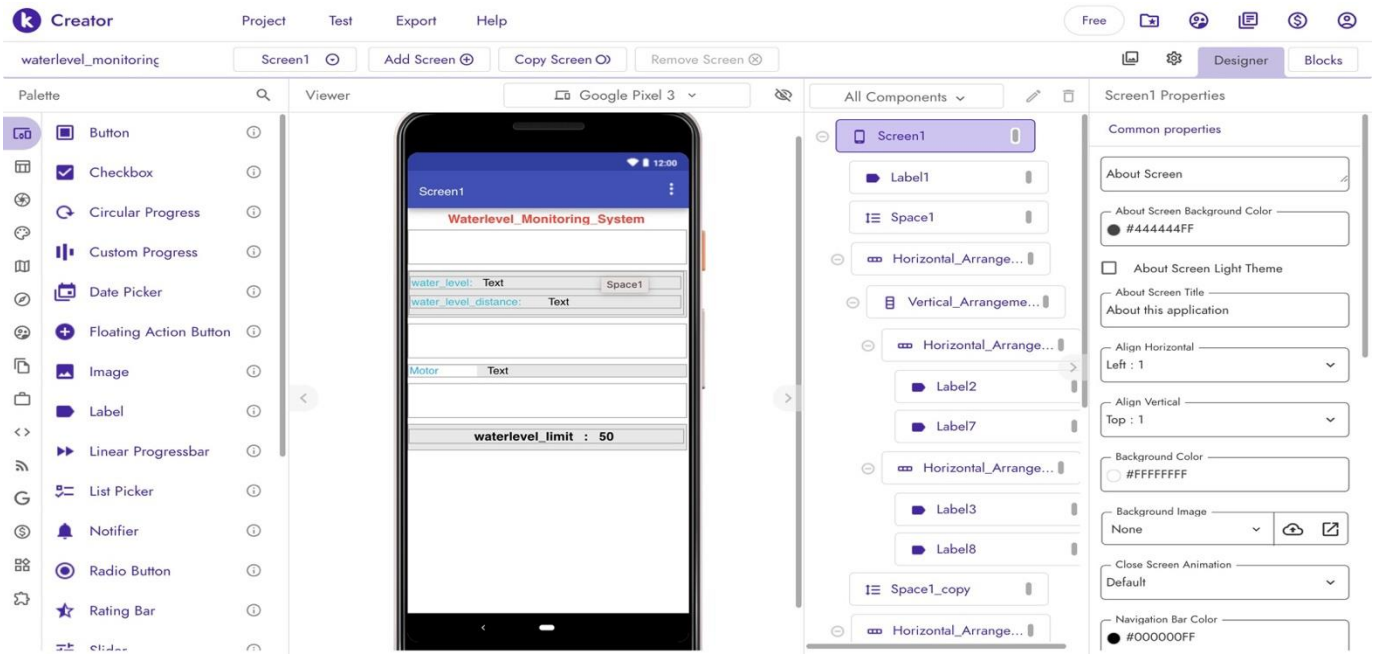


Figure-4.2.b

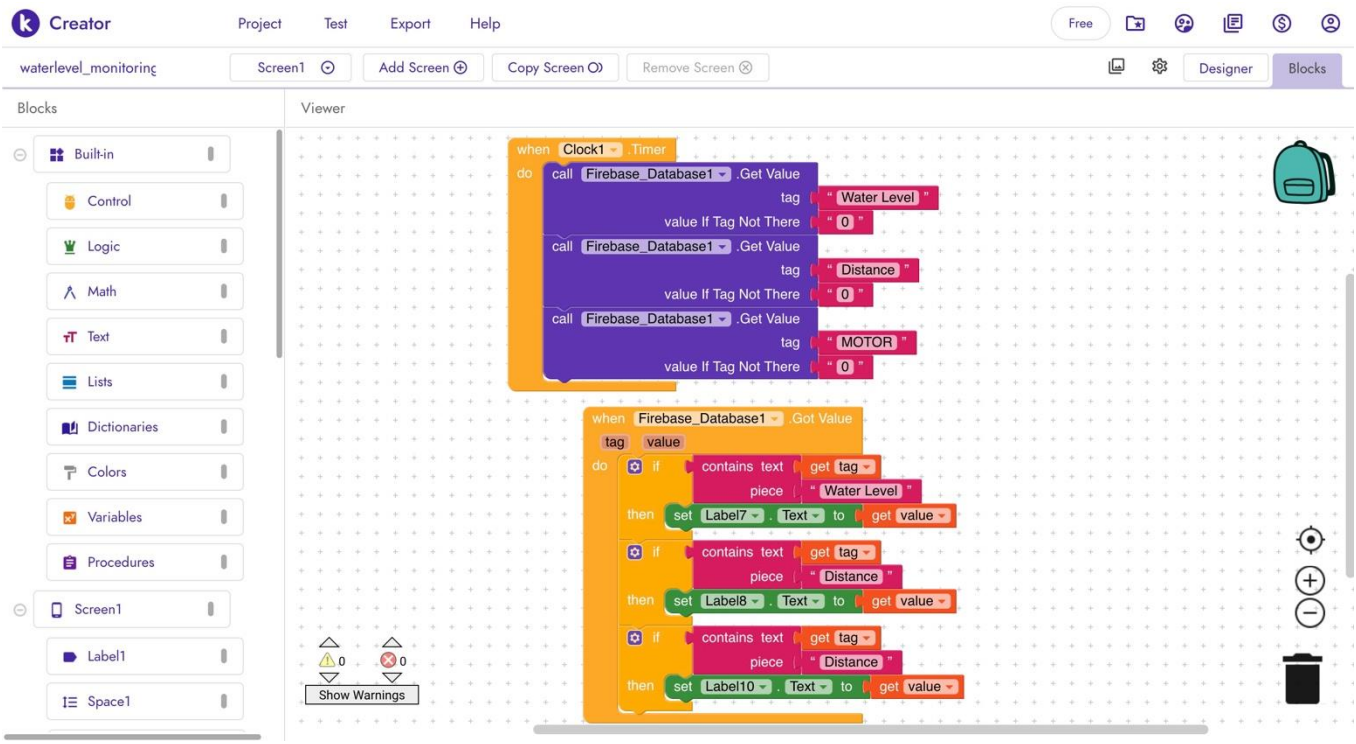

Creator
Project
Test
Export
Help
Free
waterlevel_monitoring
Screen1
Add Screen
Copy Screen
Remove Screen
Designer
Blocks
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen1
Label1
Space1
when Clock1 .Timer
do call Firebase_Database1 .Get Value
tag "Water Level"
value If Tag Not There "0"
call Firebase_Database1 .Get Value
tag "Distance"
value If Tag Not There "0"
call Firebase_Database1 .Get Value
tag "MOTOR"
value If Tag Not There "0"
when Firebase_Database1 .Got Value
tag value
do if contains text get tag
piece "Water Level"
then set Label7 . Text to get value
if contains text get tag
piece "Distance"
then set Label8 . Text to get value
if contains text get tag
piece "Distance"
then set Label10 . Text to get value
0
0
Show Warnings

Figure 4.2 c

CHAPTER-5

```
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>
#include "FirebaseESP32.h"
#define OLED_ADDRESS 0x3C
Adafruit_SSD1306 display(128, 64, &Wire, OLED_ADDRESS);
#define trig 12
#define echo 13
#define THRESHOLD_DISTANCE 50
#define FIREBASE_HOST "iot-lab-569ed-default-rtdb.firebaseio.com"
#define FIREBASE_AUTH "sVp4muWqQHuCU5HGxuaG5WmEWCXf4Aq9AlFsJRzN"
#define WIFI_SSID "IDEAlab01"
#define WIFI_PASSWORD "griet@idealab"
FirebaseData firebaseData;
void setup() {
  Serial.begin(9600);
  display.begin(SSD1306_SWITCHCAPVCC, OLED_ADDRESS);
  display.clearDisplay();
  display.setTextColor(SSD1306_WHITE);
  display.setTextSize(1);
  display.setCursor(0, 0);
  display.println("waterlevel_monitoring");
  display.setCursor(4, 16);
```

```
 display.println("System");
 display.display();
 delay(4000);
 display.clearDisplay();
 pinMode(trig, OUTPUT);
 pinMode(echo, INPUT);

//Connecting to Wi-Fi network
 WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
 Serial.print("Connecting to Wi-Fi");
 while (WiFi.status() != WL_CONNECTED)
 {
   Serial.print(".");
   digitalWrite(25,HIGH);
   delay(1000);
   digitalWrite(25,LOW);
 }
 Serial.println();
 Serial.print("Connected with IP: ");
 digitalWrite(33,HIGH);
 digitalWrite(12,HIGH);
 delay(500);
 digitalWrite(33,LOW);
 digitalWrite(12,LOW);


 Serial.println(WiFi.localIP());
```

```
  Serial.println();
  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
  Firebase.reconnectWiFi(true);

}
void loop() {

  ultrasonic();
}
void ultrasonic() {
  digitalWrite(trig, LOW);
  delayMicroseconds(4);
  digitalWrite(trig, HIGH);
  delayMicroseconds(10);
  digitalWrite(trig, LOW);
  long t = pulseIn(echo, HIGH);
  long cm = t / 29 / 2;

  display.clearDisplay();
  display.setCursor(0, 0);
  if (cm>= THRESHOLD_DISTANCE) {
    display.println("WARNING: Low water level!");
    Firebase.setString(firebaseData,"Water Level","WARNING_Low_+water_level!");
     Firebase.setInt(firebaseData,"Distance",cm);
  }
  else{
  Serial.print("Water Level: ");
```

```
Firebase.setString(firebaseData,"Water Level","Water_Level_Normal");
Firebase.setInt(firebaseData,"Distance",cm);
Serial.print(cm);
Serial.println(" cm");
}
display.display();
  display.setCursor(0, 16);
display.print("Distance: ");
display.print(cm);
display.print(" cm");
display.display();

delay(1000); // Optional delay between readings
}
```

CHAPTER-6

6.1 RESULT:

The water level monitoring system project successfully utilizes ultrasonic sensors, LEDs, and a buzzer to track water levels. The data is displayed and controlled through the kodular app, providing an efficient and user-friendly solution.

Through the app, users can monitor water levels in tanks, reservoirs, or any other water storage systems. The app communicates with sensors or devices placed in the water storage systems, which collect and transmit the water level data to Firebase Cloud.

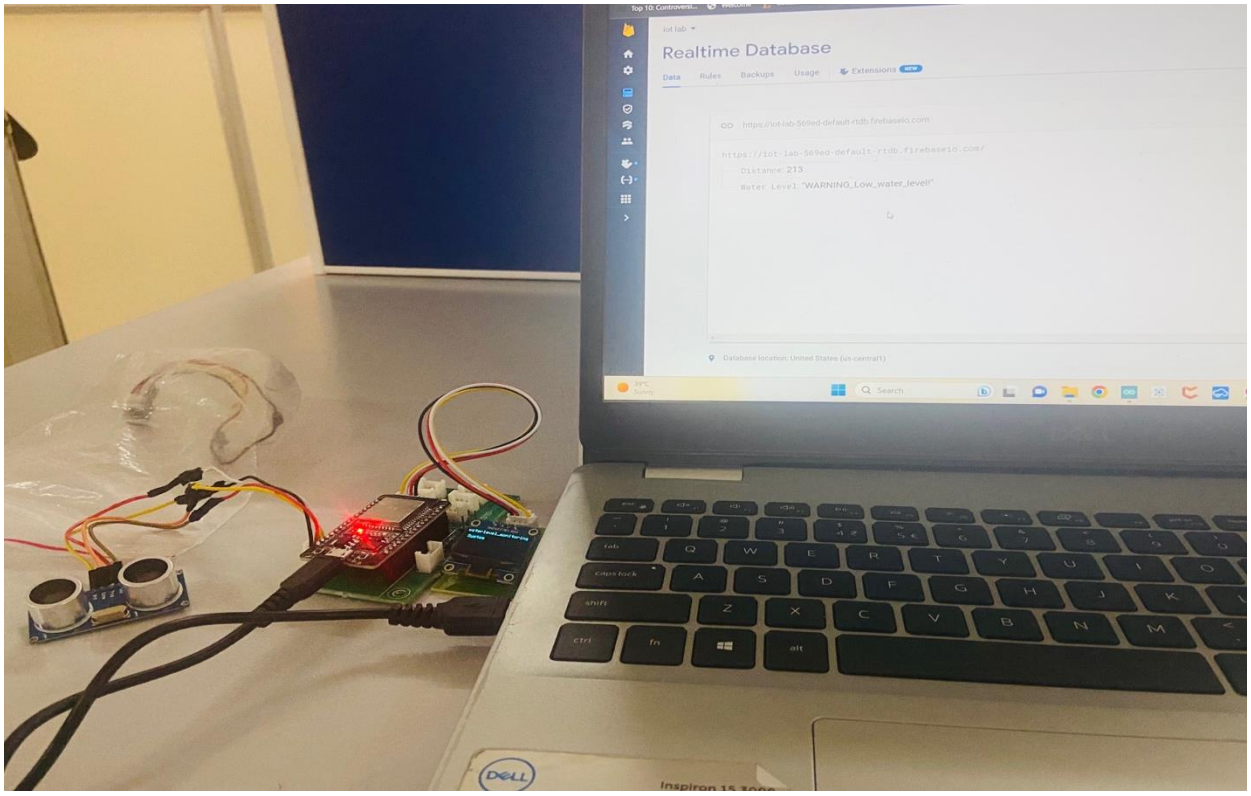


Figure 6.2.a

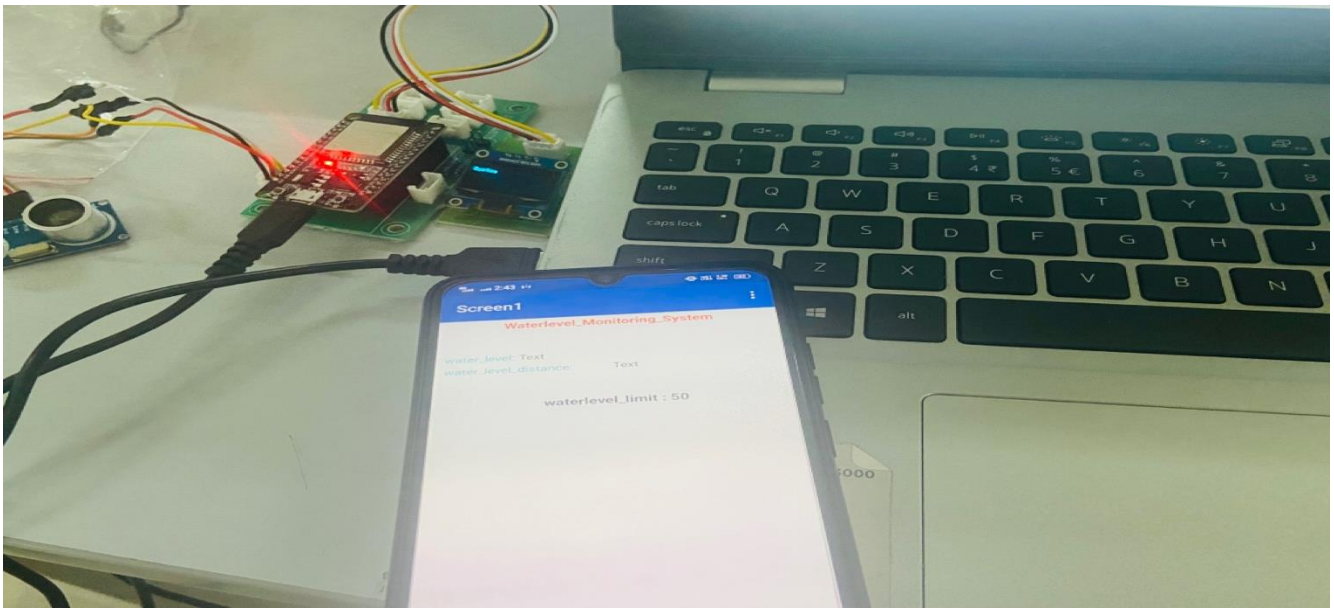


Figure 6.2.b

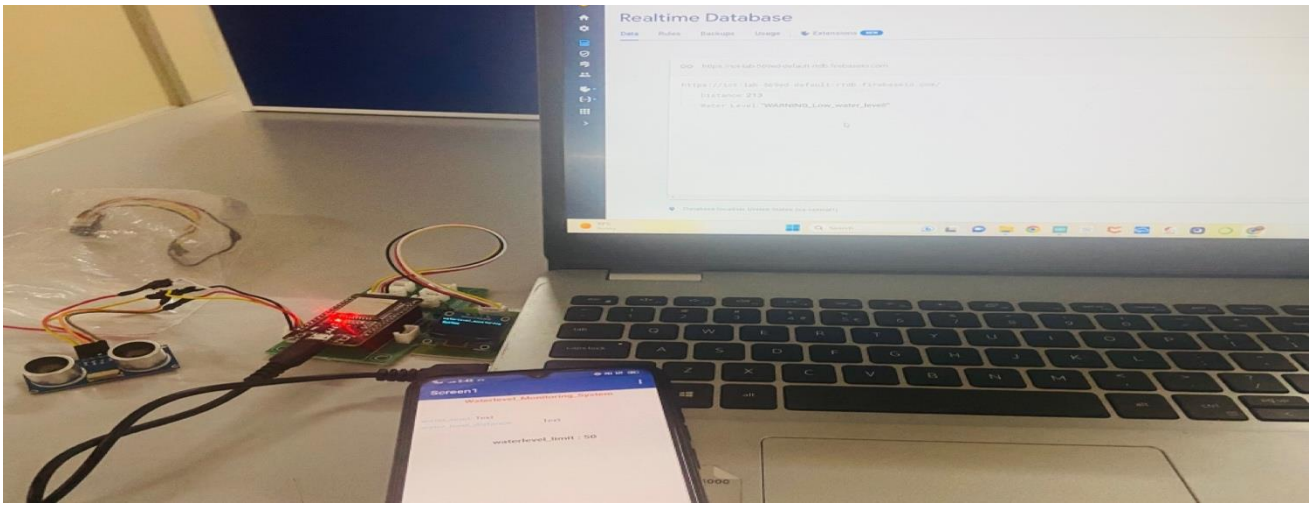


Figure 6.2 c

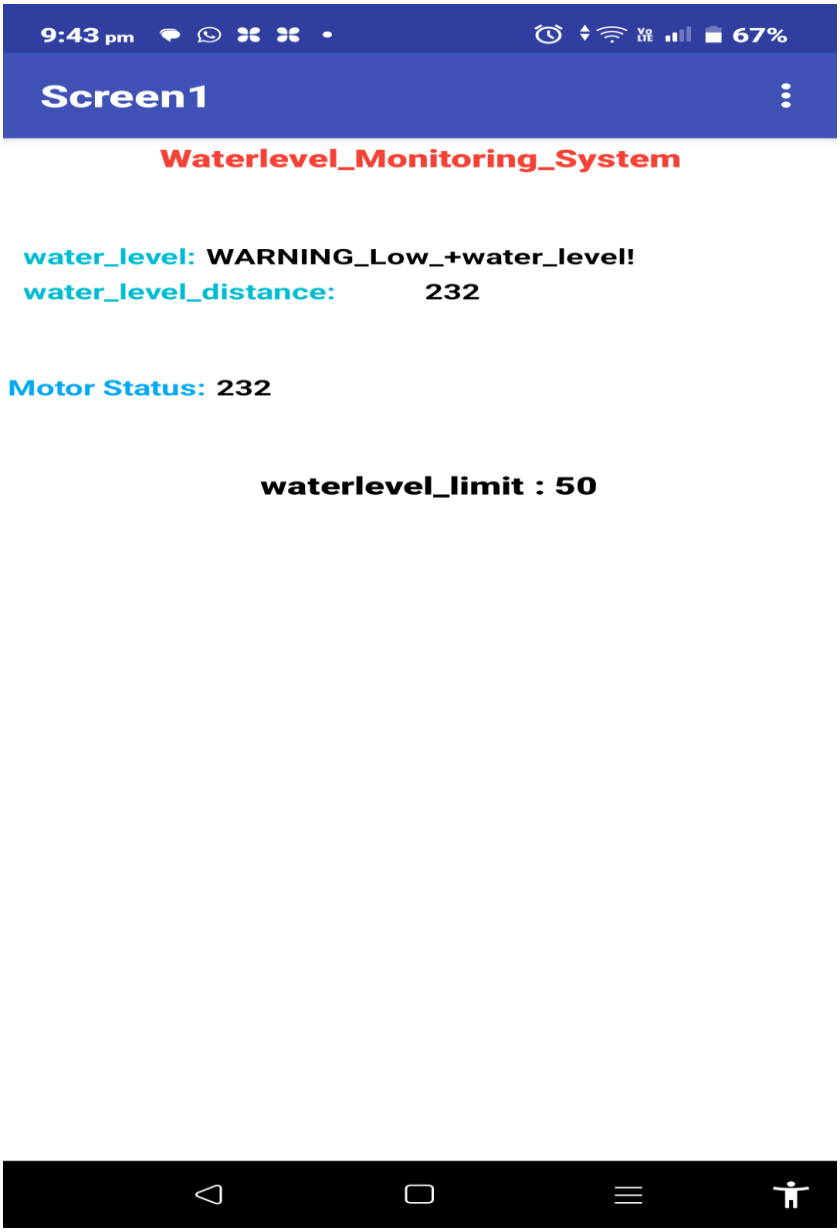

9:43 pm
67%
Screen1
Waterlevel_Monitoring_System
water_level: WARNING_Low_+water_level!
water_level_distance: 232
Motor Status: 232
waterlevel_limit : 50

Figure 6.2 d

6.2 FUTURE SCOPE:

The future scope of a water level monitoring system project is:

- Implementing advanced data analytics algorithms and machine learning techniques to analyze the water level data collected over time.
- Expanding the system to allow remote control and automation of devices based on water levels. This could involve integrating actuators like pumps, valves, or irrigation systems that can be controlled and managed through the mobile app or cloud platform, enabling efficient water resource management.
- Allowing users to share their water level data with relevant stakeholders, such as local authorities, environmental agencies, or research institutions.
- Expanding the system to include water quality monitoring capabilities. Integrating sensors for measuring parameters like pH, temperature, conductivity, or turbidity.
- Enhancing the mobile app to provide real-time notifications and alerts to users based on water level thresholds or critical conditions. Users could receive push notifications, SMS alerts, or email notifications to ensure prompt response and action.
- It's important to note that the future scope of the project can vary depending on factors like budget, time constraints, and specific requirements. These suggestions provide a starting point for further exploration and development of the water level monitoring system project.

6.3 CONCLUSION:

In conclusion, the water level monitoring system project using IoT technology enables real-time monitoring, automation, and remote accessibility for efficient water resource management. With data-driven insights, alerts, and scalability, the project has the potential to contribute to sustainable water management practices.

It enables real-time monitoring, automation, and remote access for efficient water resource management. The integration of data analytics provides valuable insights for informed decision-making. With its scalability and potential for sustainability, the project holds promise for effective water management and conservation.

Overall, the water level monitoring system project utilizing IoT technology offers improved efficiency, data-driven insights, and remote accessibility, leading to better water management practices. With further development, integration, and advancements in IoT technologies, the project has the potential to address critical water challenges and contribute to sustainable water resource management in various domains.

Course Outcomes (Mini and Major Projects) **Project Objectives (Pros)**	Formulate hypothesis for the problem statement(CO1)	Design Engineering Solution to the problem statement with systematic approach. (CO2)	Analyse and develop an efficient solution for implementation of the project. (CO3)	Apply the theoretical concepts while providing solution to the problem statement with teamwork and multidisciplinary approach. (CO4)	Demonstrate professionalism with ethics while preparing and presenting the project work. (CO5)
To understand the concept of h-bridge circuit , its functions and applications	**x**		**X**	**X**	**X**
Working of pelitier module with H-bridge circuit and its properties		**X**	**X**	**X**	

To implement the working of the temperature sensor with H-bridge Circuit and to find the compatibility For the groove module.			X	X	
To implement the Blynk mobile application with the groove board and finding the required output.	X	X	X		
To implement required output of the problem statement.		X	X		
technical report and video demonstration					x