Smart Water Level Monitoring and Control System Using ESP8266 and Blynk

A PROJECT REPORT

*Submitted by*

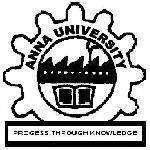
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***in partial fulfillment for the award of the degree of***

**BACHELOR OF ENGINEERING**

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# COMPUTER SCIENCE AND ENGINEERING



**RAJALAKSHMI ENGINEERING COLLEGE,**

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**RAJALAKSHMI ENGINEERING COLLEGE, CHENNAI**

**BONAFIDE CERTIFICATE**

Certified that this project report titled “**Smart Water Level Monitoring and Control System Using ESP8266 and Blynk**” is the bonafide work of “**SWETHA ADLURU (210701276), SUDHARSAN S (210701266)”** 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.

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# ABSTRACT

This project seeks to improve water level monitoring and management in residential, industrial, and agricultural settings by developing a smart system utilizing the ESP8266 microcontroller, ultrasonic sensors, and the Blynk platform. Traditional methods, which often involve manual checks and mechanical float-based systems, suffer from inaccuracies, human error, and lack of real-time data, leading to inefficient water use, overflow, and shortages. The proposed system addresses these issues by using ultrasonic sensors to measure water levels accurately and transmitting this data in real-time to the Blynk mobile application. Users can monitor water levels remotely, receive up-to-date information, and make timely interventions to prevent wastage and ensure optimal water usage.

A key feature of this system is its control functionality, allowing users to activate or deactivate water level sensing via the Blynk app. This feature is particularly useful for maintenance or temporary suspension of monitoring. The system is designed to be user-friendly, cost-effective, and easy to install, making it accessible to a wide range of users. By providing accurate, real-time data, the system reduces the need for manual inspections, saves time and labor, and minimizes the risk of human error. Additionally, it promotes sustainable water management by enabling informed decisions about water use.

# ACKNOWLEDGEMENT

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**CHAPTER 1**

**INTRODUCTION**

Water management is a critical challenge that affects various sectors, including residential, industrial, and agricultural domains. Effective water level monitoring in storage tanks is essential to prevent overflow, shortages, and inefficient water usage. Traditional methods of water level monitoring often rely on manual inspections or mechanical float-based systems. These approaches are not only time-consuming but also prone to inaccuracies and human error. Manual checks require significant labor and do not provide real-time data, making it difficult to respond promptly to changing water levels. Mechanical systems, on the other hand, can malfunction, leading to incorrect readings and potential water wastage or shortages.

To address these issues, there is a growing need for automated and reliable water level monitoring systems that can provide real-time data. Such systems should be capable of remote monitoring and control, enhancing user convenience and allowing for timely interventions. Advances in microcontroller technology and wireless communication have opened up new possibilities for developing smart water level monitoring solutions. By leveraging these technologies, it is possible to create systems that are not only precise and efficient but also user-friendly and cost-effective. This project aims to develop a smart water level monitoring and control system using the ESP8266 microcontroller, ultrasonic sensors, and the Blynk platform.

# 1.1 MOTIVATION

* Traditional water level monitoring methods are often inaccurate and unreliable. This project aims to provide a precise and dependable solution using ultrasonic sensors and microcontroller technology, reducing water wastage and shortages.
* Manual inspections and mechanical systems lack real-time data capabilities. This project offers real-time water level information to users' smartphones, enabling prompt and informed decisions.
* Remote monitoring and control of water levels offer significant convenience. Users can manage water resources from anywhere, reducing the need for physical presence and labor.
* A smart water level monitoring system reduces operational costs by minimizing water wastage, lowering maintenance expenses, and preventing overflow or shortage-related damage.
* Efficient water management is essential for sustainability, especially in water-scarce regions. This project promotes better water usage practices, contributing to resource conservation and environmental sustainability.

**1.2 OBJECTIVES**

* Implement water level monitoring using Node MCU and Blynk.
* Enable real-time data acquisition for water level measurements.
* Establish remote accessibility through Wi-Fi connectivity (Node MCU).
* Demonstrate the versatility and effectiveness of microcontroller platforms in IoT applications

**CHAPTER 2**

**LITERATURE REVIEW**

1. The research paper published in 2008 [1] [Autonomous real-time water quality sensing as an alternative to conventional monitoring to improve the detection of food, energy, and water indicators.](https://www.semanticscholar.org/paper/Autonomous-real-time-water-quality-sensing-as-an-to-Dong-Li/ef54f67ccc7e5dfbd47fa5ef1d50b1e4a522dd98)
2. This paper served as the basis for our idea, which we are currently developing.
3. Another paper published in 2011 [2] gave us  [Smart Device to monitor water quality to avoid pollution in IoT environment.](https://www.semanticscholar.org/paper/Smart-Device-to-monitor-water-quality-to-avoid-in-Mala/1c2f9fc992e78d28bebe7b6b7c2dd8c844581127)
4. Furthermore, a paper published in 2021 [3] provided us with details on how to store the data collected from sensors and manage them effectively, especially in large-scale applications.
5. Additionally, a book published in 2010 [4] provided us [Water Quality Monitoring System Using Wireless Sensor Network](https://www.semanticscholar.org/paper/Water-Quality-Monitoring-System-Using-Wireless-Sridharan/6df7e4fec15a37c2a3abe54cb6509680fa25eaa2) with all the information about what can and cannot do. It helped our project seamlessly integrate with third-party services.

2.1 EXISTING SYSTEM

The existing systems for water level monitoring often rely on traditional methods such as manual inspections or wired sensors connected to dedicated monitoring systems. These methods can be labor-intensive, costly to implement, and lack real-time data accessibility. Some advanced systems utilize ultrasonic sensors and microcontrollers like Arduino for automated measurements but may still require physical data retrieval. In contrast, IoT-based systems incorporating Node MCU (ESP8266) enable wireless data transmission, offering remote monitoring capabilities through cloud integration or direct smartphone access. These advancements in IoT technology enhance efficiency and provide timely insights for effective water resource management and flood control applications.

**2.1.1 Advantages of the existing system**

* Real-time Monitoring.
* Cost-effective and Scalable.
* Remote Accessibility.

# 2.1.2 Drawbacks of the existing system

* Limited Range.
* Power Dependency.

**2.2 PROPOSED SYSTEM**

The proposed system aims to overcome the limitations of traditional methods by developing a smart water level monitoring and control system using the ESP8266 microcontroller and the Blynk platform. The system features ultrasonic sensors to accurately measure water levels in storage tanks and calculate the percentage of tank fullness. This data is then transmitted in real-time to a mobile application, allowing users to monitor water levels remotely. The system also includes a control feature enabling users to activate or deactivate water level sensing through the Blynk app. This smart system provides precise, real-time measurements, enhances convenience with remote monitoring, and improves water management by preventing wastage and ensuring optimal water usage. Additionally, it reduces the need for manual inspections, thereby saving time and labor, and allows for immediate response to critical water levels.

**2.2.1 Advantages of the proposed system**

* Remote Monitoring: The proposed system allows for remote monitoring of water levels via Wi-Fi, providing real-time updates and enhancing accessibility.
* Cost-effective and Scalable: Using Node MCU offers a cost-effective and scalable solution for water level monitoring, suitable for various applications and environments.

# CHAPTER 3

**SYSTEM DESIGN**

**3.1 DEVELOPMENT ENVIRONMENT**

* + 1. **Hardware Requirements**
* - Node MCU
* - Ultrasonic Sensor
* - Jumper Wires
* - USB Cable
* - Smartphone

Node MCU

Node MCU is a compact, low-cost development board based on the ESP8266 Wi-Fi module. It's designed for IoT applications and supports easy programming with Lua or Arduino IDE.

Ultrasonic Sensor

An ultrasonic sensor emits high-frequency sound waves and measures the time it takes for the waves to bounce back after hitting an object. This allows for accurate distance measurement without physical contact. Ultrasonic sensors are commonly used in robotics, automation, and distance measurement applications.

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.

USB Cable

A USB cable is a standard cable used for connecting electronic devices to a computer or power source. It facilitates data transfer, device charging, and firmware updates. USB cables come in various types (e.g., USB-A to USB-B, USB-C) and are essential for connecting peripherals like printers, smartphones, and microcontrollers to a computer.

Smartphone

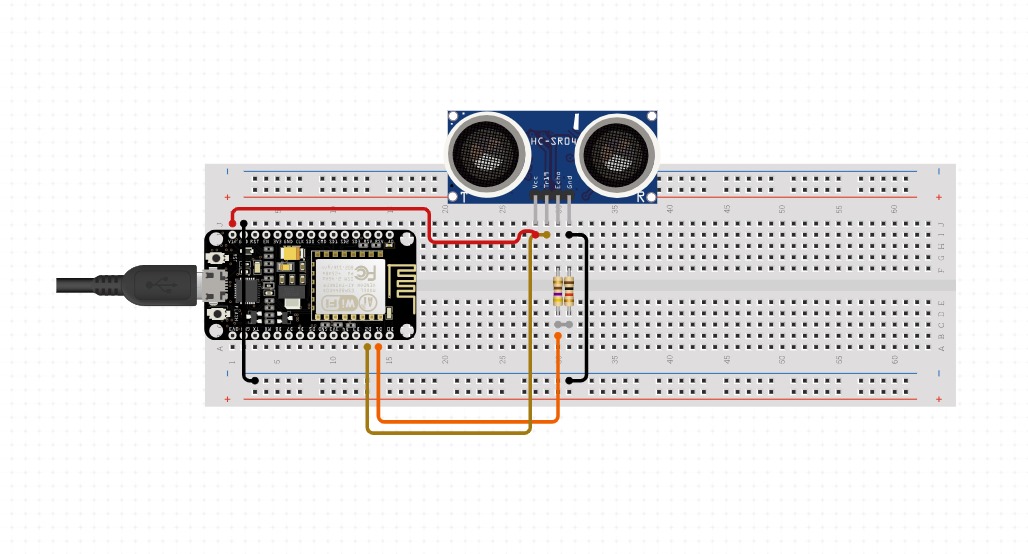
A smartphone is a mobile device that combines phone capabilities with advanced computing features. It typically includes a touchscreen interface, internet connectivity, and access to a wide range of apps. Smartphones can be used for communication, browsing the web, accessing social media, playing games, and running various productivity applications.

**CHAPTER 4**

**PROJECT DESCRIPTION**

This project involves creating a water level monitoring system using Arduino and Node MCU (ESP8266) microcontroller platforms. An ultrasonic sensor measures water levels, with Arduino processing data for local monitoring and USB communication. Node MCU enables wireless data transmission via Wi-Fi, allowing remote monitoring on smartphones. The system enhances water resource management, enabling real-time monitoring and timely responses to water level changes or emergencies. Arduino and Node MCU offer cost-effective, scalable solutions, making IoT-based water monitoring accessible and efficient. This project demonstrates the integration of hardware and software to develop a practical IoT solution for water level monitoring.

**4.1 SYSTEM ARCHITECTURE**



**4.2 METHODOLOGY**

The methodology for developing the water level monitoring system using the ESP8266 involves several essential steps to ensure functionality and reliability. Initially, the hardware setup begins by connecting the ultrasonic sensor to the ESP8266 board following a specified wiring diagram, which includes ensuring an adequate power supply and establishing reliable connections for data transmission. Subsequently, the programming phase entails writing and uploading the necessary code using the Arduino IDE to enable data processing and communication with the ultrasonic sensor. The ESP8266 is also programmed to configure Wi-Fi connectivity and establish protocols for transmitting water level data wirelessly to the Blynk platform. The sensor calibration stage is critical to achieving accurate measurements, involving adjustments and testing to optimize the sensor's performance in water level detection. Following calibration, data transmission protocols are implemented to facilitate the transfer of water level measurements from the ESP8266 to the Blynk app for remote monitoring. This structured approach ensures the successful development and deployment of an IoT-based water level monitoring system capable of real-time remote monitoring and data visualization.

**CHAPTER 5**

**RESULTS AND DISCUSSION**

The result of implementing the water level monitoring system using the ESP8266 microcontroller is a functional IoT solution capable of accurately measuring and transmitting water level data in real-time. The system successfully integrates ultrasonic sensors with the ESP8266 platform to enable remote monitoring via Wi-Fi connectivity. Water level measurements are transmitted to a smartphone or computer for visualization and analysis, enhancing water resource management and enabling timely responses to changing water levels. The project demonstrates the effectiveness of ESP8266 in developing cost-effective and scalable IoT applications for environmental monitoring, highlighting the potential for practical use in various industries and applications requiring remote sensing capabilities.

**CHAPTER 6**

**CONCLUSION AND FUTURE WORK**

**6.1 CONCLUSION**

In conclusion, the water level monitoring system developed using Node MCU (ESP8266) demonstrates a versatile approach to IoT applications. The Node MCU-based setup leverages Wi-Fi connectivity for direct smartphone communication, enhancing flexibility and remote monitoring capabilities. This project highlights the adaptability of microcontroller platforms and ultrasonic sensors in sensor-based IoT projects, enabling practical solutions for water level monitoring across different environments and applications. The project contributes to the advancement of accessible and scalable IoT solutions for diverse use cases, particularly in scenarios where remote monitoring and real-time data transmission are crucial for efficient water resource management.

**6.2 FUTURE WORK**

Future work could include integrating additional sensors like temperature or humidity sensors to enhance environmental data collection. This expansion would enable more comprehensive monitoring of water-related parameters. Implementing data logging and cloud integration could facilitate continuous data recording and remote access for historical analysis. Exploring power management enhancements, such as solar panels or optimizing battery life, could ensure sustainable operation, especially in remote locations. These advancements would further improve the functionality and reliability of IoT-based water level monitoring systems.

**APPENDIX**

**SOFTWARE INSTALLATION**

**Arduino IDE**

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

**SAMPLE CODE**

#define BLYNK\_TEMPLATE\_ID "TMPL35Ewp7wTw"

#define BLYNK\_TEMPLATE\_NAME "LDR"

#define BLYNK\_AUTH\_TOKEN "FJPt5b4DLqtgl0EOX6UydWG1zNug3aYn"

#define BLYNK\_PRINT Serial

#include <ESP8266WiFi.h>

#include <BlynkSimpleEsp8266.h>

char auth[] = BLYNK\_AUTH\_TOKEN;

char ssid[] = "Sudharsan"; // WiFi name

char pass[] = "nottu123"; // WiFi password

const int ldrPin = A0; // LDR connected to analog pin A0

const int ledPin = D4; // GPIO pin D4 connected to LED

void setup() {

pinMode(ldrPin, INPUT);

pinMode(ledPin, OUTPUT);

Serial.begin(115200);

Blynk.begin(auth, ssid, pass);

Blynk.virtualWrite(V1,"OFF");

}

void loop() {

Blynk.run();

int buttonState = digitalRead(ledPin);

if (buttonState == HIGH) {

int ldrValue = analogRead(ldrPin);

String ldrStatus = (ldrValue > 320) ? "OFF" : "ON";

Blynk.virtualWrite(V1, ldrStatus);

Blynk.virtualWrite(V2, 0);

if (ldrValue > 320) {

Serial.println("Defect detected: Light is OFF!");

Blynk.virtualWrite(V1,"Defect detected");

Blynk.virtualWrite(V2, 1);

digitalWrite(ledPin, LOW);

//Blynk.virtualWrite(V1, LOW);

delay(1000); // Delay for stability

}

else{

String ldrStatus = (ldrValue > 320) ? "OFF" : "ON";

Serial.print("LDR Value: ");

Serial.print(ldrValue);

Serial.print(" LDR Status: ");

Serial.println(ldrStatus);

Blynk.virtualWrite(V1, ldrStatus);

}

}

else{

Blynk.virtualWrite(V1,"OFF");

}

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