

# IoT Based Smart Water Tank Control and Monitoring System

**Divyashree L. K<sup>1</sup>, Vivek K<sup>2</sup>**

Lecturer, Electronics Engineering, Government Polytechnic College Kasaragod<sup>1</sup>

Student, Electronics Engineering, Government Polytechnic College Kasaragod<sup>2</sup>

**Abstract:** Water management has become a critical concern due to rapid urbanization and increasing water demand. Conventional water tank systems rely on manual motor operation, which often results in water overflow, wastage of electricity, and increased human effort. This paper presents the design and implementation of an **IoT based Smart Water Tank Control and Monitoring System** that automatically controls the water pump and inlet valve based on real-time water level data. The system employs an Arduino ATmega328 microcontroller for local control and a NodeMCU ESP8266 module for cloud connectivity. Water level sensing is achieved using level sensors, and the system status is transmitted to a Firebase cloud platform, enabling remote monitoring and control through a mobile application. Manual override functionality is also incorporated to ensure reliability during network or system failures. The proposed system improves water conservation, reduces power consumption, and offers a cost-effective solution suitable for domestic, institutional, and agricultural applications.

**Keywords:** IoT, Smart Water Tank, Water Level Monitoring, NodeMCU, Arduino, Firebase

## I. INTRODUCTION

Water is an essential resource for domestic, agricultural, and industrial applications. In many residential and institutional buildings, water is pumped manually into overhead tanks without proper monitoring, leading to overflow and wastage of water and electricity. Continuous human supervision is inefficient and impractical.

With the advancement of the **Internet of Things (IoT)**, physical devices can be interconnected and monitored remotely through the internet. IoT-based automation systems have found extensive applications in smart homes, smart agriculture, and smart villages. Water level monitoring plays a significant role in efficient water management.

This work proposes an IoT-enabled smart water tank system that monitors water levels in real time and automatically controls the pump motor and valve. The system provides both **automatic and manual modes**, ensuring reliability and flexibility.

## II. SYSTEM OVERVIEW

The Smart Water Tank Control and Monitoring System consist of the following major components:

- Power supply unit
- Arduino ATmega328 microcontroller
- NodeMCU ESP8266 Wi-Fi module
- Water level sensors (Low and High level)
- Relay modules for pump and valve control
- Firebase cloud database
- Mobile application interface

The system continuously monitors the water level and transmits data to the cloud. Based on predefined thresholds, the pump and valve are controlled automatically. Users can also monitor and operate the system remotely using a smart phone.

**III. BLOCK DIAGRAM**

Figure 1 illustrates the block diagram of the proposed system.

**Water tank automation**

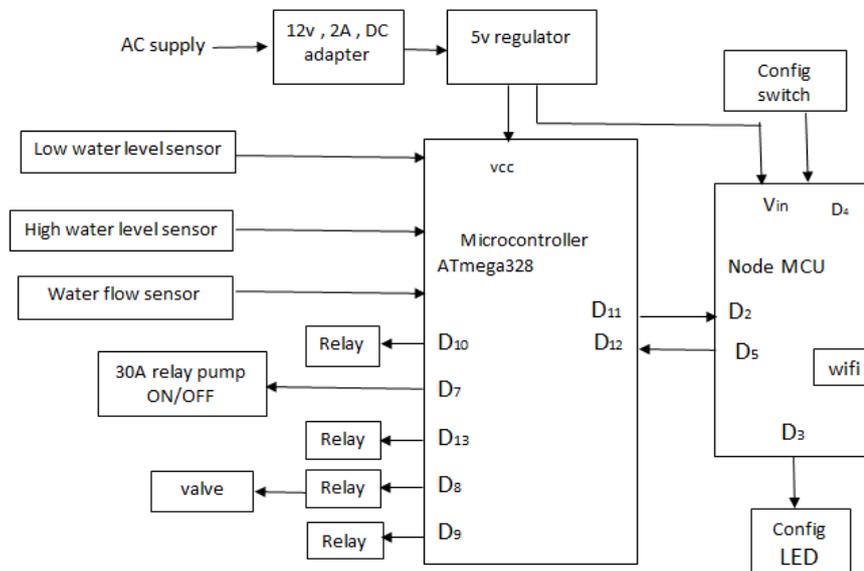


Figure 1: Block Diagram of IoT Based Smart Water Tank Control and Monitoring System

**IV. BLOCK DIAGRAM DESCRIPTION**

A 12 V, 2 A DC adapter supplies power to the system. A voltage regulator converts 12 V to 5 V to power the Arduino ATmega328 and NodeMCU module. Water level sensors detect low and high water levels inside the tank.

The Arduino processes sensor data and controls two relay modules—one for the water pump and another for the inlet valve. The NodeMCU communicates with the Firebase cloud database over Wi-Fi and exchanges data with the Arduino using serial communication.

Manual override switches and LED indicators are included to ensure safe operation during emergencies or network failures.

**V. FLOWCHART**

The operational flow of the system is shown in Figure 2.

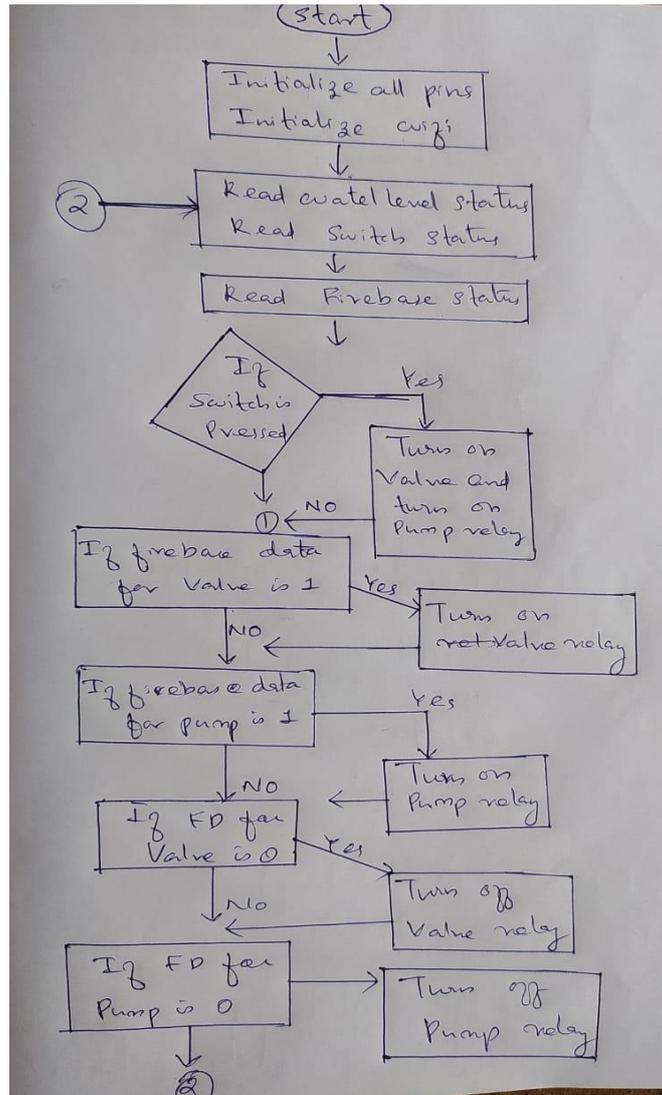


Figure 2: Flowchart of Smart Water Tank Control System

## VI. HARDWARE IMPLEMENTATION

The hardware consists of an Arduino ATmega328 for sensor processing and relay control, while NodeMCU ESP8266 provides IoT connectivity. A PCB is designed to integrate all components securely and reduce wiring complexity.

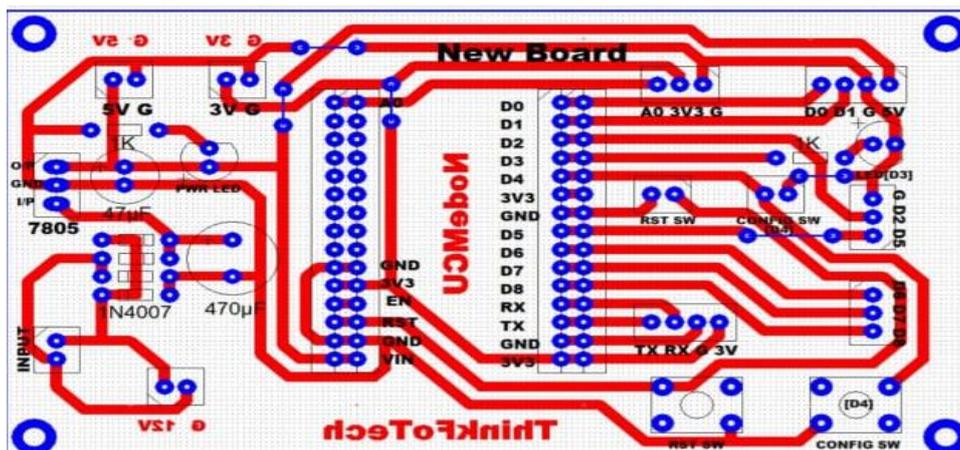


Figure 3: PCB Layout of Smart Water Tank System

## VII. SOFTWARE IMPLEMENTATION

The system software is divided into two parts:

### A. Arduino Program

The Arduino code reads water level sensors, controls relays, handles manual override switches, and communicates system status to the NodeMCU.

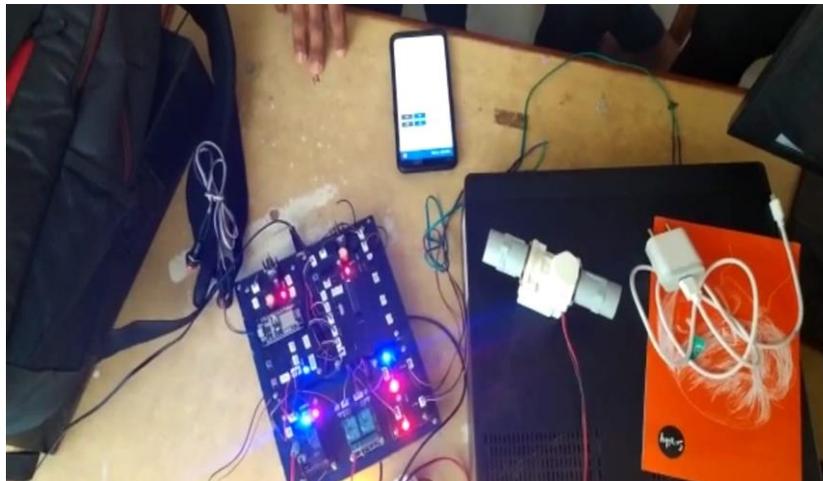
### B. NodeMCU Program

The NodeMCU connects to Wi-Fi, communicates with Firebase cloud, receives control commands from the mobile application, and sends real-time tank status data to the cloud.

Firebase acts as a real-time database that synchronizes data between hardware and the mobile application.

## VIII. WORKING PRINCIPLE

When the water level falls below the minimum threshold, the system automatically switches ON the pump and opens the valve. Once the tank reaches the maximum level, the pump is turned OFF and the valve is closed. The NodeMCU continuously updates the water level and motor status to the Firebase cloud. Users can monitor these values and control the system remotely through a mobile application developed using MIT App Inventor. A manual override switch allows the user to operate the pump directly in case of sensor failure or internet connectivity issues.



## IX. ADVANTAGES

- Automatic operation reduces human intervention
- Prevents water overflow and wastage
- Saves electrical energy
- Remote monitoring and control
- Low maintenance and cost-effective
- Suitable for domestic and institutional use

## X. DISADVANTAGES

- Initial installation cost
- Requires stable internet connectivity
- Sensor degradation over long-term use
- Limited warranty for electronic components

## XI. APPLICATIONS

- Domestic overhead water tanks
- Apartments and commercial complexes
- Agricultural irrigation systems
- Industrial water management

- Sewage and sump pump control
- Cooling tower water level control

## **XII. FUTURE SCOPE**

The system can be enhanced by integrating wireless sensor networks, GSM modules for SMS alerts, and advanced analytics for water consumption monitoring. Integration with smart home ecosystems and AI-based predictive control can further improve efficiency.

## **XIII. CONCLUSION**

The IoT Based Smart Water Tank Control and Monitoring System provides an efficient and reliable solution for water management. By automating pump operation and enabling remote monitoring, the system significantly reduces water wastage and energy consumption. The proposed design is scalable, economical, and well suited for smart home and smart village applications.

## **REFERENCES**

- [1]. Omron Corporation, *Level Control Apparatus*, Technical Guide.
- [2]. "Automatic Water Level Controller – Working Principle," Water Level Controls.
- [3]. Firebase Real time Database Documentation.
- [4]. ESP8266 NodeMCU Datasheet.
- [5]. Arduino ATmega328 Microcontroller Datasheet.

## **BIBLIOGRAPHY**

**1. Divyashree L K, Lecturer** in Electronics Engineering, Govt. Polytechnic College Kasaragod. I have completed M.Tech in VLSI Design and Signal Processing Year June 2018 at LBS College of Engineering Kasaragod and B.Tech in Electronics and Communication Engineering Year July 2015 at LBS College of Engineering Kasaragod. I have received many awards such as Nelson Mandela International Award Excellence Award 2025 for Teacher of the Year and Excellence in classroom management, Women Icon Award 2025 for appreciable work in the field of Education, Merit Certificate of Excellence award for notable contribution & nationwide remarkable performance in Education, Swami Vivekanand Adarsh Ratna Samman for outstanding contribution as Lecturer, Dr. A.P.J. Abdul Kalam Nation Star Award for outstanding contribution as a National Teacher, Green ThinkerZ International Award for Outstanding Teachers 2024-25, Rabindranath Tagore Hall of fame Award for outstanding contribution as Excellent Singer 2025.

**2. Vivek K,** Electronics Engineering Student, Govt. Polytechnic College Kasaragod.