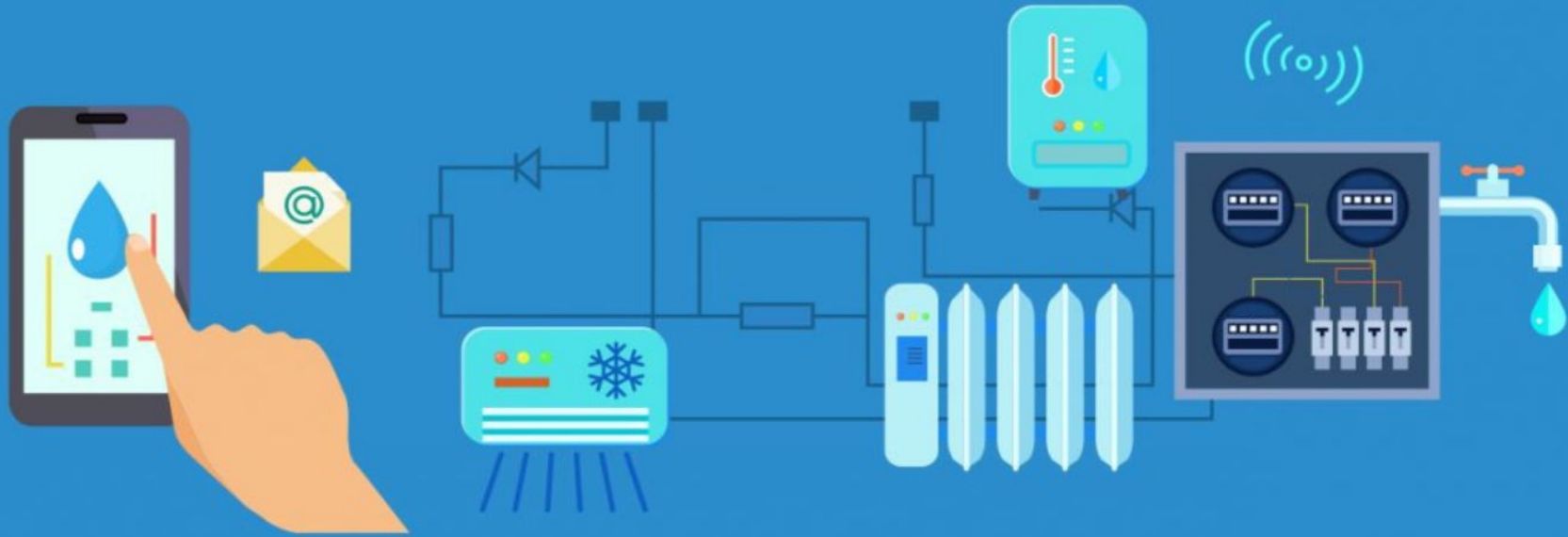# IoT-Based Smart Water Management System

Using ESP32, Blynk IoT Cloud, Ultrasonic Sensor & Mobile App

Introduction

❑ **Objective**
● To design an IoT-based water level monitoring and control system that:
● Measures real-time water level in a tank using an ultrasonic sensor.
● Displays water level data on the Blynk IoT dashboard.
● Automatically controls a water pump based on tank level.
● Provides manual override and emergency stop via app.

❑ **Why This Project?**
● Prevents water overflow and dry-run damage to pumps.
● Saves water & electricity by optimizing pump usage.
● Remote monitoring & control via smartphone.
● Affordable & scalable for homes, farms, and industries.

Components Used

| Component	Quantity	Purpose
ESP32 Microcontroller	1	IoT Brain (Wi-Fi & Control)
HC-SR04 Ultrasonic Sensor	1	Measures water level
Relay Module	1	Controls water pump
Transistor (NPN 2N2222)	1	Switch to control relay/pump
Resistor (1K)	1	Limits current flow into transistor
Water Pump	1	Moves water in/out of tank
LED	1	For testing
Power Supply (5V)	1	Powers ESP32 & sensors
Blynk Mobile App	1	Remote monitoring & control
Breadboard & Jumper Wires	As needed	Circuit connections
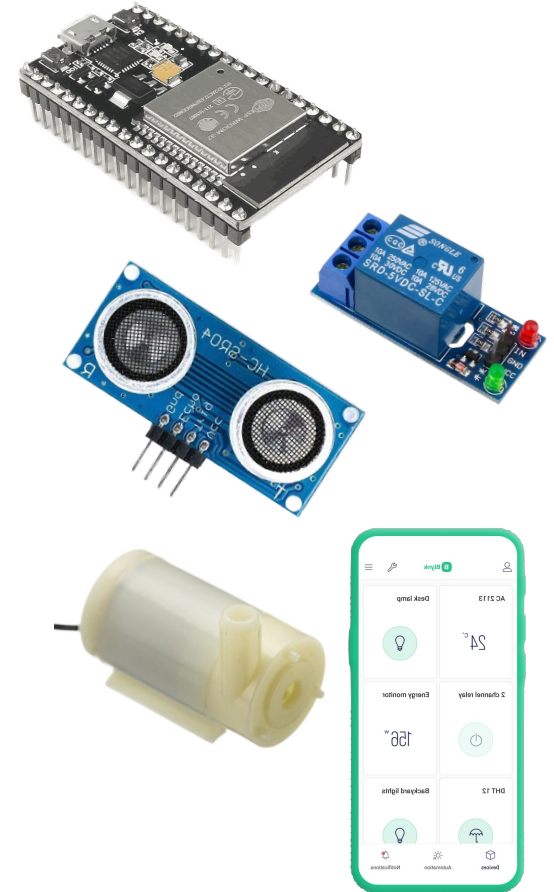
System Architecture

❏ **Block Diagram**
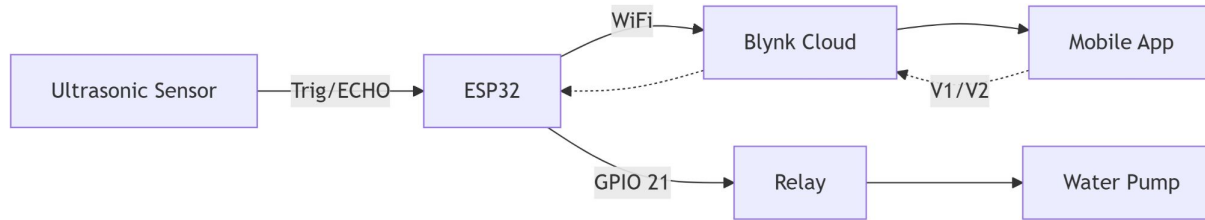
❏ **Working Principle**
1. Ultrasonic sensor measures the distance to the water surface.
2. ESP32 calculates the water level percentage and sends it to Blynk Cloud.
3. Blynk App displays real-time water level and allows manual control.
4. Automated Pump Logic:
   ○ Pump ON if level < 20% (prevent dry run).
   ○ Pump OFF if level > 80% (prevent overflow).
5. Manual override & emergency stop via Blynk app.
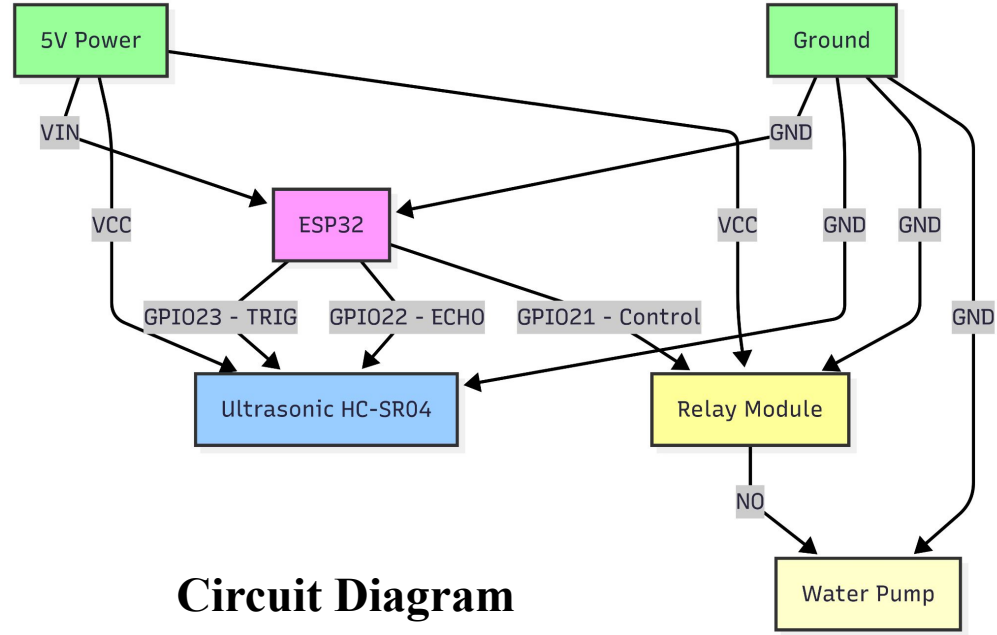
Working Procedure of System Model
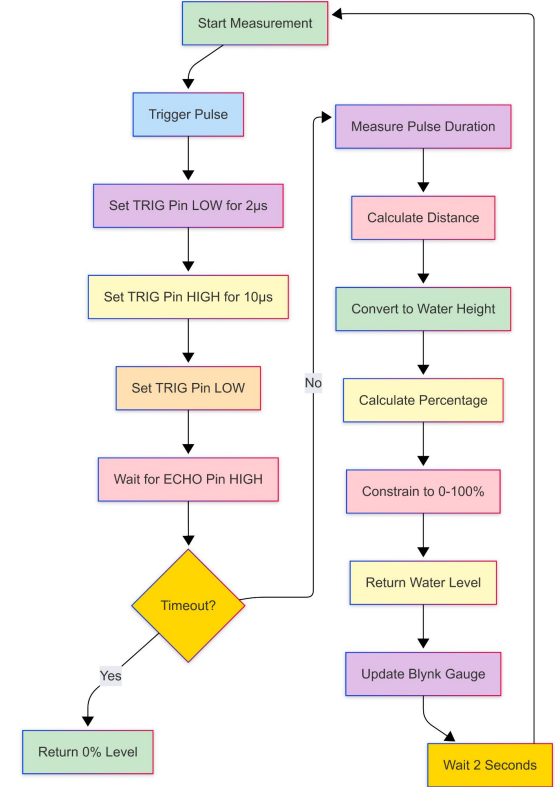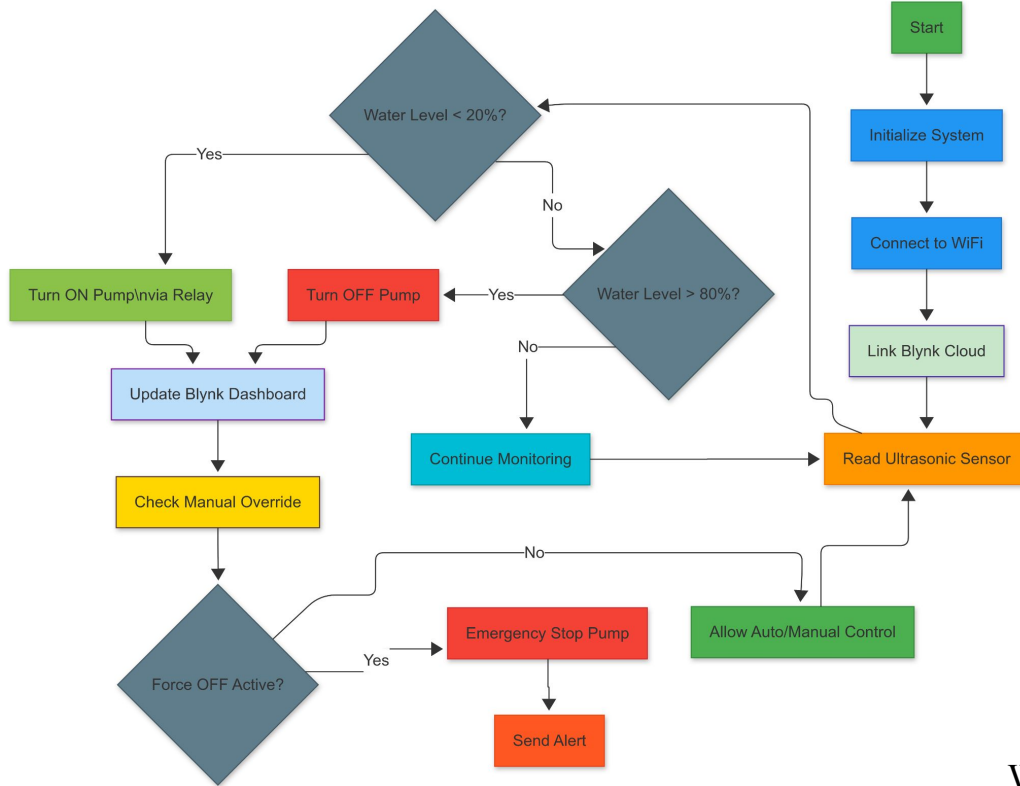
Workflow of the HC-SR04 ultrasonic sensor

Circuit Diagram & Connections

Wiring Setup

| ESP32 Pin	Connected To
GPIO 23	Ultrasonic (TRIG)
GPIO 22	Ultrasonic (ECHO)
GPIO 21	Relay/Pump Control
GND	Sensor & Relay GND
5V	Sensor VCC

Circuit Diagram

Software Setup

1. Install Required Libraries
- Blynk Library (for IoT connectivity)
- WiFi.h (for ESP32 Wi-Fi)

2. Blynk App Configuration
- Create a New Project in Blynk App.
- Add Widgets:
  - Gauge (V0) → Water Level (%)
  - Button (V1) → Manual Pump Control
  - Button (V2) → Force Pump OFF
- Set Up Events & Notifications (e.g., "Tank Full! Pump Turned OFF").
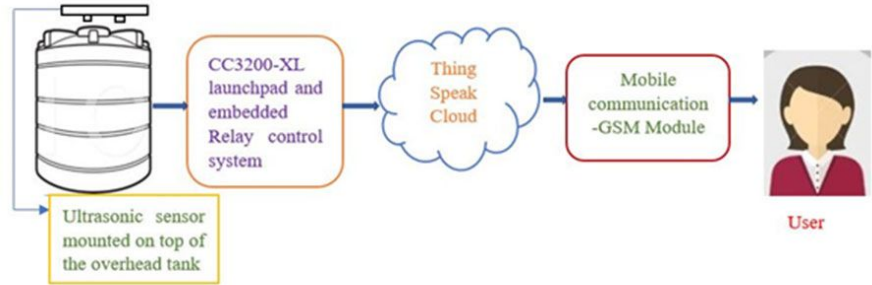
Features & Advantages

❏ **Key Features**
  ✔ Real-time water level monitoring
  ✔ Automated pump control
  ✔ Manual override & emergency stop
  ✔ Mobile alerts & remote access
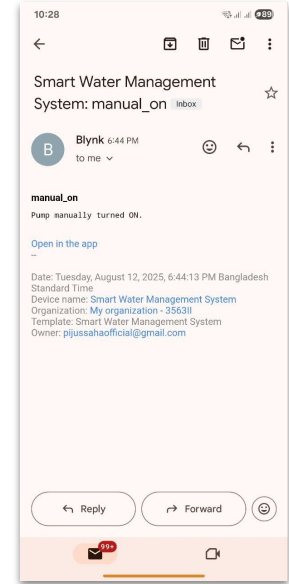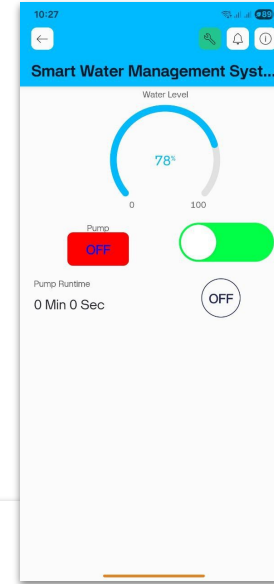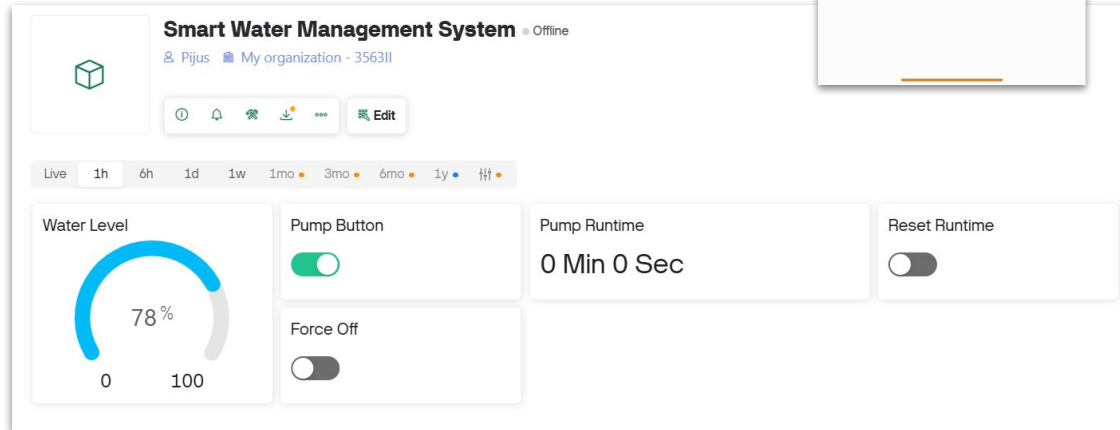 ✔ Low-cost & energy-efficient
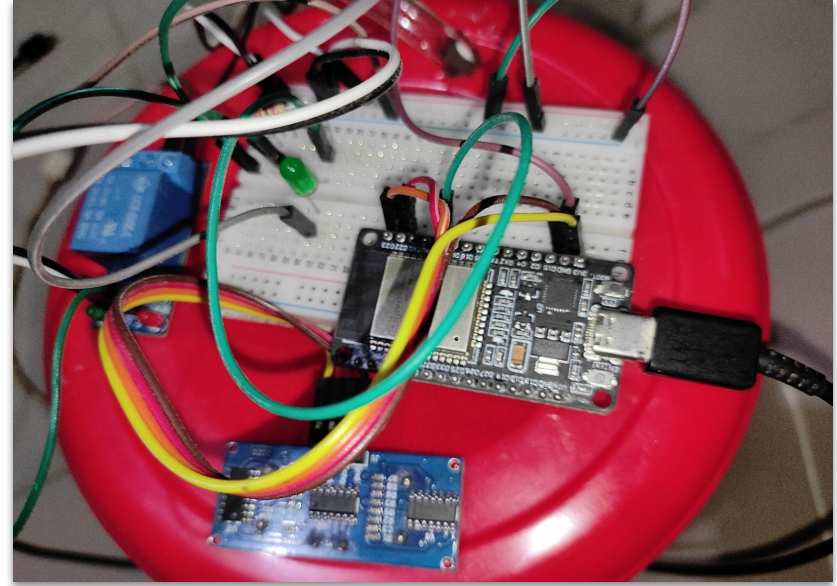
❏ **Advantages Over Traditional Systems**
  ● No need for physical checks (remote monitoring).
  ● Prevents water wastage & pump damage.
  ● Scalable for large tanks & industrial use.

Results & Demo

❑ **Expected Output**
- ● Blynk Dashboard:
  - ○ Gauge showing 0-100% water level.
  - ○ Buttons for manual pump control.
- ● Serial Monitor:
  - ○ Displays water level & pump status.
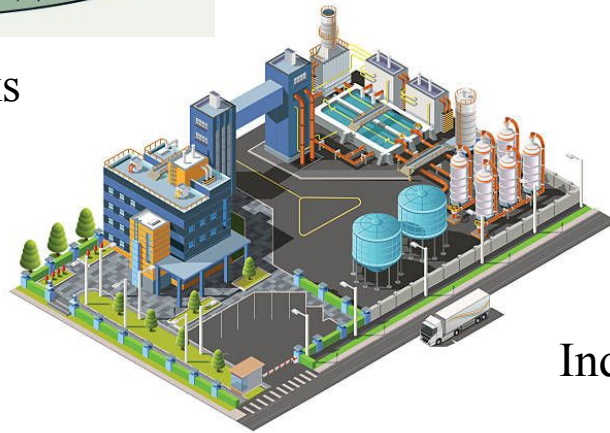
Applications

Home water tanks

Agriculture (irrigation)

Aquariums & hydroponics

Industrial liquid storage

Related Works

System	Tech Used	Connectivity	Cost	Key Feature	Reference
Our System	ESP32 + HC-SR04 + Blynk	WiFi + Cloud	$25	Real-time mobile control	-
SmartTank	Arduino + Ultrasonic + GSM	SMS Alerts	$35	Low-power SMS notifications	IEEE 2020
AquaMonitor	RPi + Pressure Sensor	LoRaWAN	$120	Industrial-grade precision	ScienceDirect 2021
WaterWatcher	NodeMCU + Ultrasonic	WiFi + Firebase	$30	Cloud data logging	Springer 2022
HydroGuard	PIC MCU + Capacitive	Zigbee	$90	High-accuracy (0.3cm error)	ResearchGate 2021

Future Enhancements

- Integrate multiple tanks in a single dashboard.
- Add water quality sensors (pH, turbidity).
- Solar-powered setup for remote areas.
- Voice control (Alexa/Google Assistant).
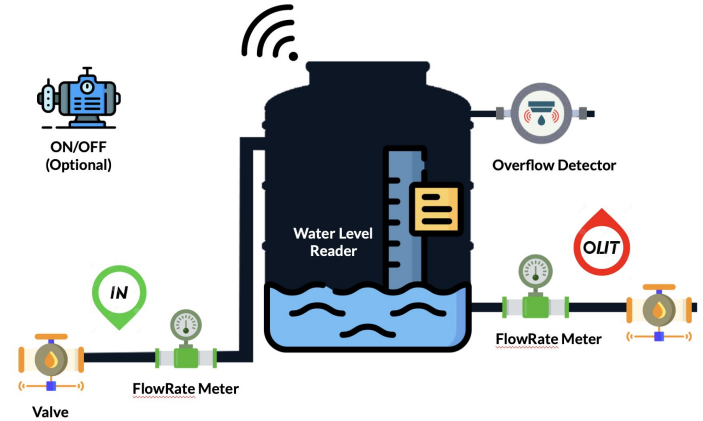
Voice assistant

Conclusion

This project successfully demonstrates an IoT-based smart water management system that:

✅ Automates water pump control for efficiency.
✅ Provides real-time monitoring via smartphone.
✅ Reduces manual intervention and prevents water wastage.

This system is cost-effective, scalable, and easy to deploy, making it ideal for smart homes, farms, and industries.

THANK YOU

**For watching this project.
Share your feedback.**

Gmail : pijussahaofficial@gmail.com