IoT-Based Water Level Monitoring and Pump Control Using ESP8266 NodeMCU

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Introduction to the Microproject

Water management is a critical challenge in both domestic and agricultural settings. Overflowing tanks, dry reservoirs, and inefficient pump usage lead to water wastage and energy loss. This microproject proposes an IoT-based water level monitoring and pump control system using the ESP8266 NodeMCU development board.

The system uses an ultrasonic sensor to measure the water level in a tank or reservoir. Based on predefined thresholds, the NodeMCU controls a water pump via a relay module. Real-time data is transmitted to an IoT dashboard, allowing users to monitor water levels remotely and receive alerts when action is needed.

This project demonstrates how microcontrollers and IoT technologies can be integrated to create a smart, automated, and scalable solution for water conservation and management.
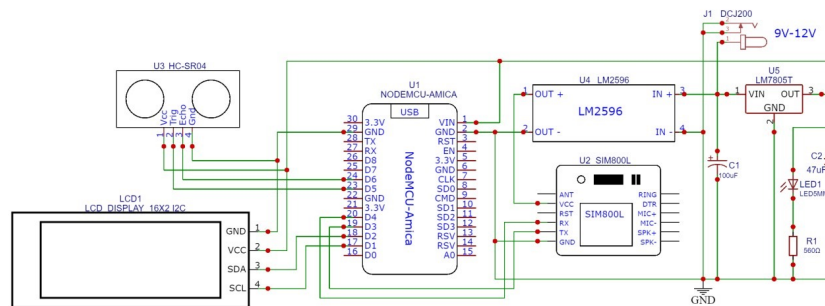
Block Diagram with Explanation

Figure 1: Functional Block Diagram of Water Level Monitoring System

Explanation:

- **Ultrasonic Sensor (HC-SR04):** Measures the distance between the sensor and the water surface. This data is used to calculate the water level.

- **NodeMCU (ESP8266):** Processes sensor data and controls the relay module. It also sends water level data to an IoT dashboard.

- **Relay Module:** Acts as a switch to control the water pump based on water level thresholds.

- **Water Pump:** Automatically turns ON/OFF depending on the water level.

- **IoT Dashboard:** Displays real-time water level data and system status remotely.
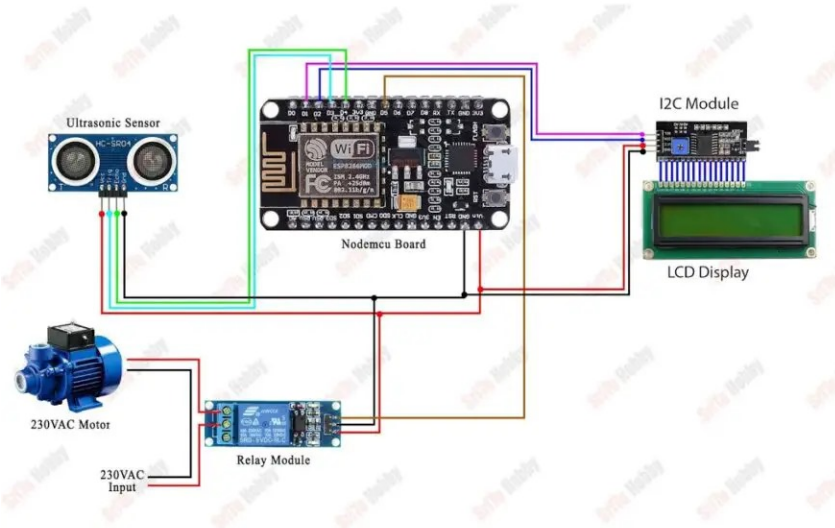
Circuit Diagram and Components

Figure 2: Circuit Diagram of Water Level Monitoring System

Components Used:

- ESP8266 NodeMCU Wi-Fi Board

- HC-SR04 Ultrasonic Sensor

- Relay Module (5V)

- Water Pump (DC/Submersible)

- Power Supply (9V–12V DC with LM2596 or LM7805 regulator)

- Jumper wires, breadboard

Circuit Explanation:

- The HC-SR04 sensor is connected to digital pins D5 and D6 of the NodeMCU for trigger and echo.

- The relay module is connected to digital pin D1 to control the pump.

- The NodeMCU calculates the water level based on the time taken for the ultrasonic pulse to return.

- If the water level falls below a set threshold, the NodeMCU activates the relay to turn on the pump.

- Power is supplied through a regulated 5V source, ensuring safe operation of all components.

NodeMCU Pin	Component Connection
D5	HC-SR04 Trigger
D6	HC-SR04 Echo
D1	Relay Module IN
GND	Sensor & Relay Ground
5V	Sensor VCC & Relay VCC

Table 1: NodeMCU Pin Connections for Water Level Monitoring System

Expected Outputs/Outcomes

- Real-time water level data displayed on an IoT dashboard.

- Automatic pump control based on water level thresholds.

- Alerts and notifications for low or high water levels.

- Reduced water wastage and optimized pump usage.

- Scalable solution for smart homes, agriculture, and municipal water systems.

- Demonstration of IoT-enabled water management technology.