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Aquaculture Monitoring and Control System Based On IOT

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Abstract - *This project offers a comprehensive solution for monitoring and regulating aquaculture conditions using cutting-edge Internet of Things (IoT) technology. By leveraging ESP8266 NodeMCU and Arduino UNO, alongside a range of sensors including the DS18B20 waterproof temperature sensor, water level sensor, and turbidity sensor, it ensures real-time monitoring of vital parameters in aquatic environments. Precise control of water circulation and management is made possible through the integration of motor drivers with submersible pumps. The Blynk App serves as the user-friendly control interface, granting remote access and management of water pumps. Meanwhile, sensor data is continuously collected and displayed on ThingSpeak, offering consumers valuable insights into the current state of their aquaculture setup. This project harnesses IoT technology to enhance aquaculture management efficiency and productivity, while also ensuring optimal environmental conditions for aquatic life. Its modular design enables scalability and customization, catering to various aquaculture configurations and settings.*

Key Words*: *Arduino UNO, Sensors, Motor Driver, Wifi Module, ThingSpeak, IOT, Aquaculture, Blynk App.

1.INTRODUCTION

In the ever-evolving world of aquaculture, where precision and efficiency are crucial, we've embraced Internet of Things (IoT) technology to revolutionize monitoring and control systems. Our project introduces a comprehensive aquaculture monitoring and control system, engineered to enhance the aquatic environment, boost productivity, and ensure sustainability, all thanks to top-notch components and ingenious technologies. We've employed ESP8266 NodeMCU and Arduino UNO microcontrollers, along with a range of sensors specifically designed for aquatic settings. The DS18B20 waterproof temperature sensor delivers precise temperature readings essential for maintaining ideal conditions for aquatic life. Water level sensors keep us informed about water levels in real-time, crucial for efficient resource management. Monitoring turbidity, a key water quality indicator, is made possible with advanced turbidity sensors. By measuring suspended particles in water, our system ensures accurate water quality control, vital for the health and growth of aquatic organisms. Our control system seamlessly integrates with the user-friendly Blynk App interface, offering remote access and control of water pumps. Users can easily adjust water flow rates, ensuring precise regulation of the aquatic environment based on specific needs. Additionally, we utilize ThingSpeak as a data visualization platform, providing stakeholders with a comprehensive overview of key parameters. Turbidity and water level data are presented in clear percentages, enabling informed decision-making to optimize operations.

2. METHODOLOGY

2.1 Components Used

2.1.1 Arduino UNO:

The Arduino Uno, powered by the ATmega328P microcontroller, features 14 digital I/O pins (6 PWM), 6 analog inputs, USB connectivity, a power jack, and reset button. It is the foundational USB Arduino board, setting the standard for the platform's development.

2.1 Arduino Uno

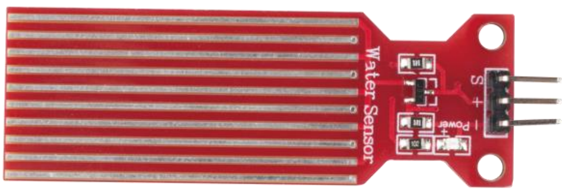
2.1.2 DS18B20 Waterproof Temperature Sensor:

The DS18B20 digital temperature sensor accurately measures water temperature within a range of-127°C to +125°C with ±0.5°C precision. Utilizing a One-Wire interface, it offers configurable resolution and is ideal for diverse applications requiring reliable temperature monitoring.

2.2 DS18B20 Temperature Sensor

2.1.3 Water Level Sensor:

The Water Sensor detects water presence, ideal for leak detection and water level monitoring. It provides analog output proportional to water level and operates effectively in various environments.



2.3 Water Level Sensor

2.1.4 Turbidity Liquid Particle Detection Sensor:

The turbidity sensor measures water quality by assessing turbidity, using light transmission and dissipation to detect suspended particles. This sensor monitors total suspended solids crucial for maintaining water clarity in aquaculture and environmental settings, impacting submerged vegetation and surface temperatures.

2.4 Turbidity Sensor

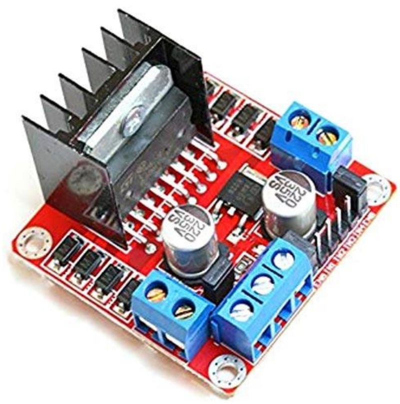
2.1.5 ESP8266 NodeMCU:

The ESP8266 NodeMCU is a compact Wi-Fi enabled microcontroller board, featuring GPIOs, ADC, PWM, SPI, I2C, and UART interfaces. Its versatility and low power consumption make it perfect for IoT projects, facilitating sensor data acquisition and wireless communication.

2.5 Esp8266 Node MCU

2.1.6 L298n Motor Driver:

The L298N motor driver is a dual H-bridge driver capable of controlling two DC motors or one stepper motor. It accepts input voltages up to 46V and provides high-current outputs.



2.6 L298N Motor Driver

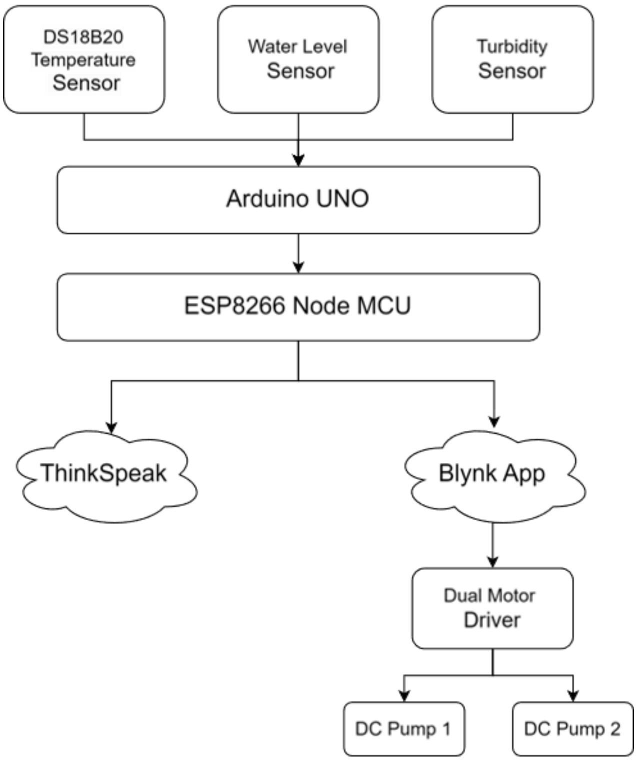
2.1. 7 12V Submerged pumps:

The 3V - 12V DC submersible pump operates within this voltage range. It is suitable for various applications, including hydroponics, aquariums, and water fountains, providing efficient water circulation and transfer.

2.7 Submerged Pump

2.1 Project Workflow

In our aquaculture monitoring and control system, the DS18B20 temperature sensor, water level sensor, and turbidity sensor play pivotal roles by sending signals to the Arduino Uno, serving as the primary receiver and processor of sensor data. Once the Arduino Uno receives and processes this information, it transfers the processed data to the ESP8266 Node MCU. This component acts as the gateway to the internet, facilitating data transmission to the cloud-based platform, ThingSpeak, and the Blynk app. Through internet connectivity, the ESP8266 Node MCU ensures seamless communication between the system and external platforms. The Blynk app, accessible via smartphones, receives the transmitted data and presents it to the user in a user-friendly interface. Additionally, users can utilize the Blynk app to remotely control the operation of the DC pumps, enabling adjustments to water circulation as needed. It's important to note that while both ThingSpeak and the Blynk app receive data from the ESP8266 Node MCU independently, they collectively contribute to the system's comprehensive monitoring and control capabilities.



2.8 Project Block Diagram

3. RESULTS AND DISCUSSION

3.1 Temperature Sensor

We calibrate the temperature sensor by immersing its probe in water at different temperatures and comparing its readings with a digital meter. With an average success rate of 19.12°C, our meticulous calibration ensures precise temperature measurements for our aquaculture system.

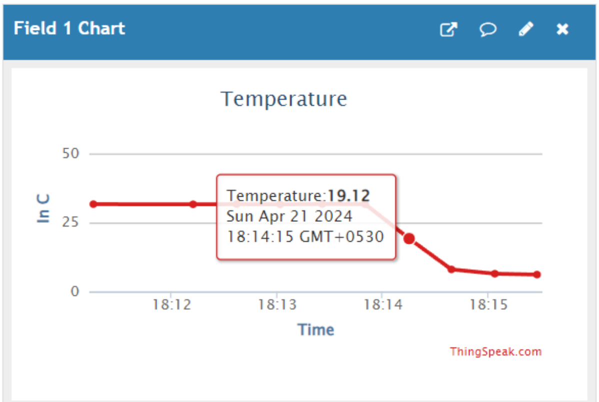


Fig 3.1 Temperature graph on ThingSpeak

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3.2 Water Level Sensor

The water level sensor calibration test entails submerging the sensor probe in water at different levels. This process ensures accurate readings by comparing them with a digital meter, achieving a 56% success rate.

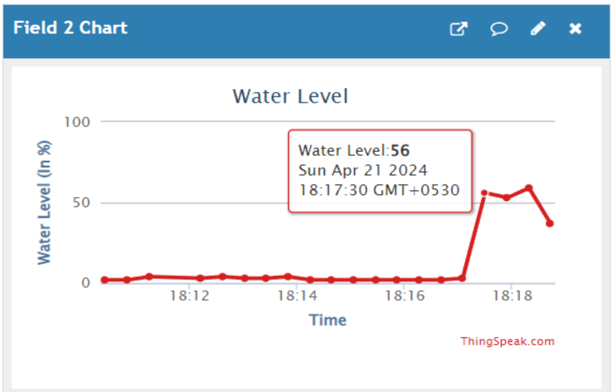

Fig 3.2 Water Level graph on ThingSpeak

3.3 Turbidity Sensor

The turbidity sensor calibration test immerses its probe in water at different levels of clarity. By comparing sensor readings with a digital meter, we achieve a 96% success rate, ensuring accurate measurements for our system.

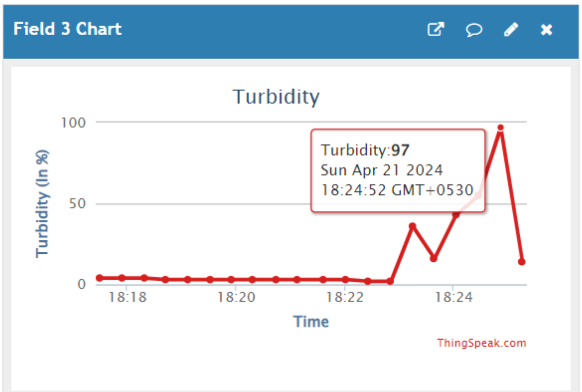

Fig 3.3 Turbidity graph on ThingSpeak

3.4 Blynk App- Channel

The app shows two buttons labeled "OUTPUT PUMP" and "INPUT PUMP" which are currently both switched to “OFF”.

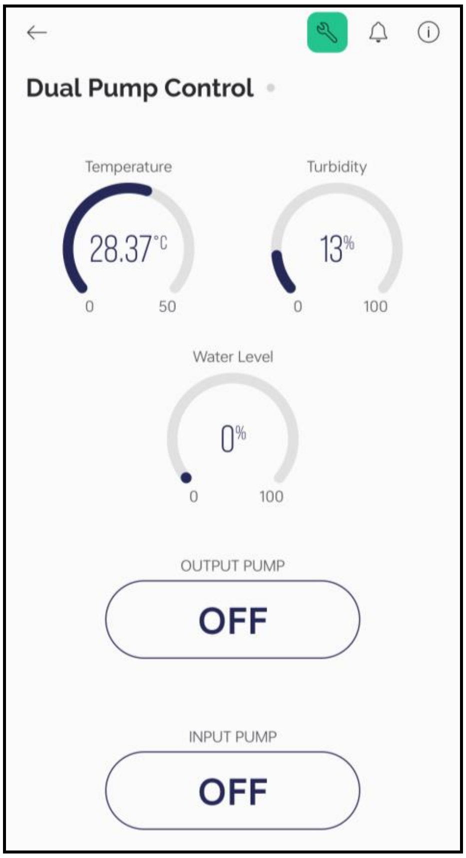

Fig 3.4 ThinkSpeak Motor Control

4. CONCLUSION

In conclusion, the aquaculture monitoring and control system showcased in this project harnesses the power of IoT devices and sensors to efficiently manage critical parameters in aquaculture operations. Utilizing DS18B20 temperature sensors, water level sensors, and turbidity sensors, real-time data on water temperature, level, and clarity is meticulously collected. This information is seamlessly transmitted to an Arduino Uno, serving as the central hub, and then to an ESP8266 NodeMCU for wireless connectivity. Integration with ThingSpeak offers stakeholders comprehensive visualization of environmental conditions within the aquaculture facility. Moreover, the inclusion of a Blynk API enables remote control of water pumps via a dual motor controller, enhancing system functionality and enabling active management of water circulation and quality. Overall, this project underscores the transformative potential of IoT technology in revolutionizing aquaculture management practices, offering real-time monitoring, data-driven decision-making, and remote-control capabilities to optimize operations and ensure the well-being of aquatic organisms.

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