

IOT BASED AQUAPONICS MONITORING AND CONTROL SYSTEM USING ESP32

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ABSTRACT

Aquaponics is a system that combines the conventional aquarium type aquaculture with hydroponics(plant cultivation in water) creating a symbiotic environment. It creates a ecolocogical system in which the excretions from the fish serves as a nutrient for plants, helping the plants to grow and also, the plants intaking the waste of the fish, thus cleaning the water regularly and recirculating to the aquaculture.

This type of system is becoming a lexicon for many people , but the main limitation being, nonavailability of electronic system for continuous monitoring and control. Thus, this project is the beginning step in order to enable people build their own monitoring systems.

Introduction

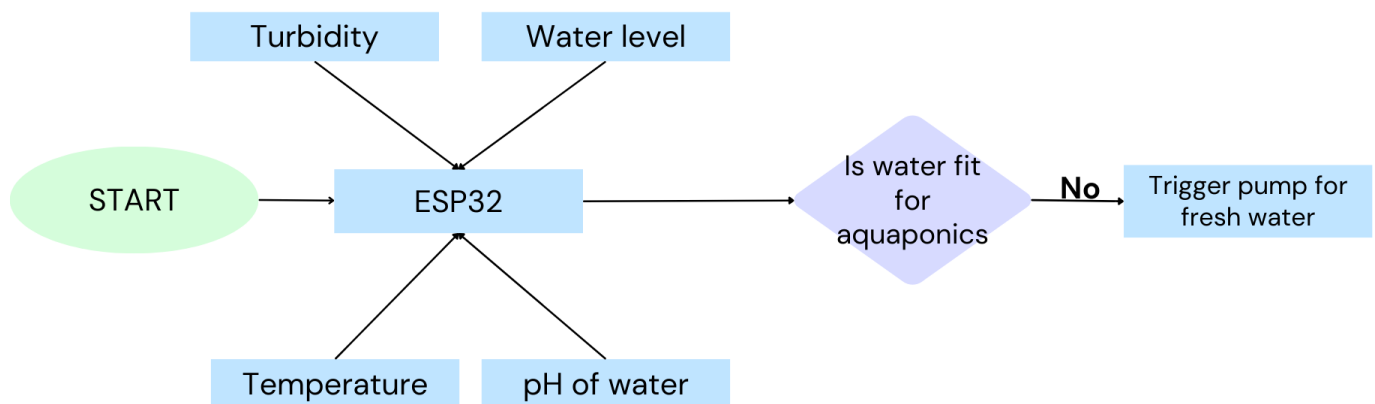
Aquaponics is an innovative, sustainable farming method that combines aquaculture (raising fish) with hydroponics (growing plants in water) in a symbiotic environment. As the system relies on maintaining optimal water quality for both plants and fish, monitoring and controlling water parameters are crucial. Our project focuses on developing an IoTbased aquaponics monitoring and control system using the ESP32 microcontroller. This system is equipped with various sensors, including turbidity, pH, temperature, and water level sensors, to continuously monitor the water's quality. When impurity levels exceed a certain threshold, the system alerts the user and automatically activates pumps to rectify the situation, ensuring a stable environment for both fish and

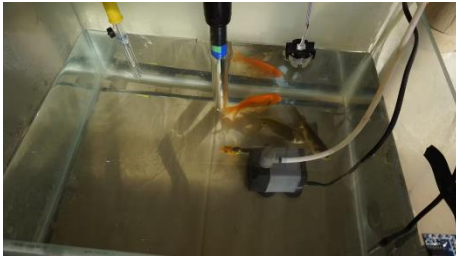
Working

The aquaponics monitoring and control system operates by continuously gathering data from the water using the connected sensors. Each sensor measures a specific parameter:

- Turbidity Sensor: Monitors the clarity of the water, indicating the presence of suspended particles.
- pH Sensor: Measures the acidity or alkalinity of the water, crucial for the health of both fish and plants.
- Temperature Sensor: Tracks the water temperature to ensure it remains within the optimal range for the species being cultivated.
- Water Level Sensor: Monitors the water level to prevent overflows or ensure the tank does not dry out.

These sensors send their readings to the ESP32 microcontroller, which processes the data in realtime. If any parameter crosses its predefined threshold, the system triggers an alert to notify the user. Simultaneously, the system activates the water pumps to either add fresh water, circulate water through a filtration system, or perform other corrective actions necessary to maintain water quality.





Advantages

1. **Automated Monitoring:** The system allows for continuous, realtime monitoring of essential water parameters, reducing the need for manual checks and minimizing human error.
2. **Prompt Response:** By automatically activating corrective measures when thresholds are breached, the system ensures that any potential issues are addressed promptly, maintaining optimal conditions for both fish and plants.
3. **Energy Efficiency:** The use of IoT and ESP32 enables lowpower operation, making the system energyefficient and costeffective.
4. **Remote Accessibility:** The IoT capability allows users to monitor the system remotely, providing flexibility and convenience.
5. **Sustainability:** By maintaining optimal water quality, the system supports the health of the aquaponics ecosystem, leading to more sustainable and productive farming practices.

Conclusion

The IoTbased aquaponics monitoring and control system using ESP32 provides a robust and efficient solution for maintaining the delicate balance required in an aquaponics environment. By leveraging advanced sensor technology and automated control mechanisms, the system ensures that water quality is consistently maintained, supporting the growth and health of both plants and fish. This project demonstrates the potential of IoT in enhancing modern farming practices, making them more sustainable, efficient, and scalable.