AQUAPONICS SYSTEM MONITORING AND CONTROLLING USING IOT

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ABSTRACT

Food security has been a recurring issue for many countries in the world including Singapore. This project further exploits the design and development of an aquaponics system for home environment, with the notion that if every household within a country can generate its own fish and plants, the overall food demand of the country will be reduced. The proposed smart and sustainable home aquaponics system consists of various sensors, actuators, and microcontroller with internet connectivity to continuously monitor, control, and record fish tank water and ambient air quality. Healthy growth of fish and plants are ensured by sending an early warning to the user in the event of any abnormal system condition via a push notification in a feature-rich internet of things (IoT) mobile application. Furthermore, appropriate actuators are automatically operated to rectify abnormalities in a timely manner. Plant grow lights and fish feeder are also automatically controlled to optimize fish and plant growth. Measurement results successfully demonstrate the efficacy of the proposed home aquaponics system to grow healthy fish and plants, with minimal operational costs and human intervention

Keywords: *Aquaponic system, home environment, fish, plant, monitor and control, IoT, fish feeder, minimal cost.*

1. INTRODUCTION

This project exploits the design and development of an aquaponics system for home environment, with the notion that if every household within a country can generate its own fish and plants, the overall food demand of the country will be reduced. The proposed home aquaponics system consists of various sensors, actuators, and microcontroller with internet connectivity to continuously monitor, control, and record fish tank water and ambient air quality. Healthy growth of fish and plants are ensured by sending an early warning to the user in the event of any abnormal system condition via a push notification in a feature-rich internet of things (IoT) mobile application. and also appropriate actuators are automatically operated to rectify abnormalities in a timely manner. Plant grow lights and fish feeder are also automatically controlled to optimize fish and plant growth.

2. EXISTING SYSTEM

The Existing system also observes the air and water temperature, humidity, pH, and water level. Data gathered from the parameters only monitored by the Arduino microcontroller, it's not securely stored and doesn't used for the further real time analysis.

3. PROPOSED SYSTEM

In proposed system, the sensor readings are monitored and displayed to the user in real time through the IoT and securely sent to an online spreadsheet for storage and further analysis. We are proposing the controlling the devices from anywhere by using the cloud.

4. HARDWARE DESCRIPTION

4.1 ARDUINO UNO:

The Arduino Uno is microcontroller board grounded on the ATmega328 (datasheet). It comprises of 14 digital input/output pins (out of which 6 can be utilized as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a facilitation for USB connectivity, a power jack, an ICSP header, and a reset button.

4.2 ESP8266 MODULE:

The ESP8266 can be controlled from your local Wi-Fi network or from the internet. The ESP-01 module has GPIO pins that be programmed to turn a LED or a relay ON/OFF through the internet.

4.3 LDR:

A Light Dependent Resistor (LDR) is also called a photoresistor or a cadmium sulfide (CdS) cell. It is also called a photoconductor. It is basically a photocell that works on the principle of photoconductivity.

4.4 PH SENSOR:

A pH sensor helps to measure the acidity or alkalinity of the water with a value between 0-14. When the pH value dips below seven, the water starts to become more acidic. Any number above seven equates to more alkaline.

4.5 TEMPERTURE SENSOR:

A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. There are many different types of temperature sensors. Some temperature sensors require direct contact with the physical object that is being monitored (contact temperature sensors), while others indirectly measure the temperature of an object (non-contact temperature sensors).

4.6 HUMIDITY SENSOR:

A humidity sensor(hygrometer) senses, measures and reports both moisture and air temperature. Humidity sensors work by detecting changes that alter electrical currents or temperature in air**.**

4.7 WATER LEVEL SENSOR:

Level sensors are used to monitor and regulate levels of a particular free-flowing substance within a contained space. These substances are usually liquid, however level sensors can also be used to monitor some solids such as powdered substances.

4.8 WATER FLOW MOTOR:

Submersible pumps are limited in power and are only suitable for systems with a total gph need of 1200 or less. As a general rule your water pump should circulate the entire volume of the water in your aquaponic system at least every two hours.

4.9 FISH FEEDING SYSTEM:

A Servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and accleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

5. SOFTWARE DESCRIPTION

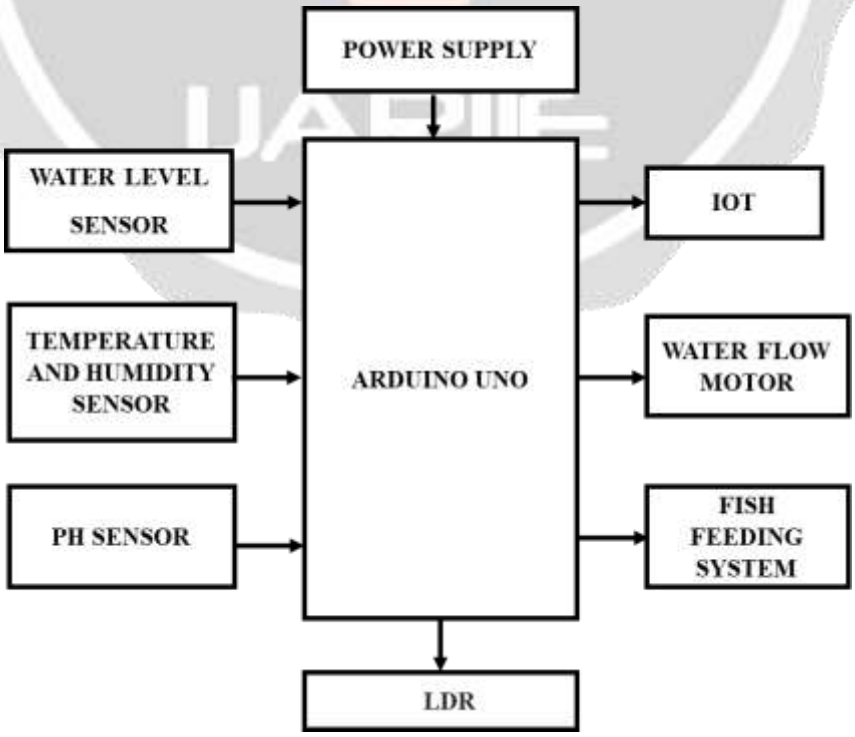
5.1 Arduino IDE:

A program for Arduino may be written in any programming language with compilers that produce binary machine code for the target processor. This will convert the Embedded C language to microcontroller language. Then this is burned into the controller.

5.2 Embedded C :

Embedded systems programming is different from developing applications on a desktop computers. Key characteristics of an embedded system, when compared to PCs, Embedded devices have resource constraints(limited ROM, limited RAM, limited stack space, less processing power) Components used in embedded system and PCs are different; embedded systems typically uses smaller, less power consuming components. Embedded systems are more tied to the hardware.

6. BLOCK DIAGRAM:



7. RESULTS

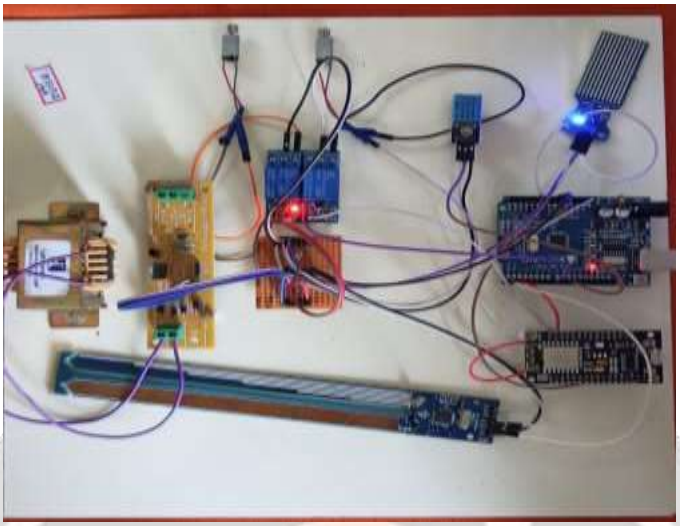


FIG 1: Hardware output

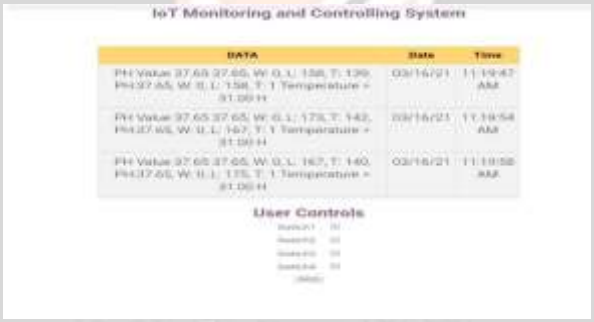


FIG 2: Software output

8. CONCLUSION

Regarding the Taiwan urban conditions and food requirements, this paper studied and implemented one aquaponic system with IoT assisted monitoring. In this project, we concentrated on the ratio of fish and plants and then determined whether the water recirculation can become balance for fish and plants or not. Since this ratio may change with different kinds of fish and plants, we utilize IoT techniques to record all experimental data. In the future, we will try to learn and analyze these data and then build one intelligent IoT automation aquaponic system.

9. FUTURE SCOPE

As the actual implementation of the system for commercial purpose is taken in to the consideration the system can be upgraded with advance components. For improving system Performance, best and advance versions of the components used, can be included in the system Advance version refers to Orange-pi for faster processing, high resolution cameras, higher accuracy digital sensors etc.

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