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IOT Based Organic Farming by Aquaponics Method using Raspberry PI

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ABSTRACT: Aquaponics is a food production method that combines the traditional hydroponics with aquaculture in a symbiotic relationship that facilitates a sustainable system with necessary input as all the water and nutrients within are re-circulated in order to grow terrestrial plants and aquatic life. This technique of agriculture can possibly replace other traditional methods if brought in use effectually. And when traditional Aquaponics meets the technology, remarkable outcomes could become visible. The IoT based Aquaponics Monitoring system features to monitor temperature and humidity level, using the specific sensors has been done and then after perceiving those values from the sensors, the values were displayed through a 16*2 Liquid Crystal Display as well as on the web by the application of Internet of Things. A new technology, Internet of Things has been introduced that bridges the gap between the physical world and the digital world and that starts with things. To connect the sensors with the internet, the database server and application server can be managed so as to display the information regarding the sensors. In order to introduce technology to the traditional aquaponics system, use of Raspberry Pi microcomputer and Internet of Things in the system has been done.

KEYWORDS: Aquaponics, Aquaculture, Raspberry Pi, Internet of Things.

I. INTRODUCTION

Aquaponics refers to the system that supports the dual combination of the aquaculture (fish rearing) and the hydroponics (production of the plants without soil). The excretions of the fish containing ammonia are converted by the nitrifying bacteria into nitrites and then to nitrates which can be used as nutrients for the plants. As compared to the traditional methods of farming, aquaponics is favorable for the place where there is no fertile soil, or lack of water or even lack of free land/soil.

The main objective of this system is to develop an Internet of Things based aquaponics monitoring system which measures and displays parameters like pH level, water level, humidity, temperature, etc. on continuously to the user. Sensors are the hardware components that are used for acquiring information to and from Internet of Things technology. With the application of Internet of Things in Aquaponics system, remarkable changes can be brought in the field of agriculture by simply monitoring and maintaining the system parameters for effective growth of the plants. The use of Wi-Fi of Raspberry helped to connect the system to the web where in the data server stored the values of system parameters like pH value, temperature and humidity in the database and provided the information to the web server where the user can access the data in JavaScript Object Notation format and in graphical format as well. With the application of Internet of Things in the Aquaponics Monitoring system, the values of the system parameters and information can be displayed on the web server continuously. As with any electronic system, an embedded system requires a hardware platform on which it performs the operation. Embedded system hardware is built with a microprocessor or microcontroller. The embedded system hardware has elements like input output (I/O) interfaces, user interface, memory and the display.

II. LITERATURE REVIEW

[1].J. E. Racoky, "Aquaculture- Aquaponics system," Agricultural Statement Experiment, 2003.

Aquaponics is a food production method that combines the traditional hydroponics with aquaculture in a symbiotic relationship that facilitates a sustainable system with necessary input as all the water and nutrients within are re-

circulated in order to grow terrestrial plants and aquatic life. This technique of agriculture can possibly replace other traditional methods if brought in use effectually. And when traditional Aquaponics meets the technology, remarkable outcomes could become visible. The IoT based Aquaponics Monitoring system features to monitor pH value, temperature and humidity level, water level using the specific sensors has been done and then after perceiving those values from the sensors,. A new technology, Internet of Things has been introduced that bridges the gap between the physical world and the digital world and that starts with things. To connect the sensors with the internet, the database server and application server can be managed so as to display the information regarding the sensors. In order to introduce technology to the traditional aquaponics system, use of Raspberry Pi microcomputer and Internet of Things in the system has been done.

[2]. "Development of Aquaponic System using Solar Powered Control Pump," IOSR Journal of Electronics and Electrical Engineering (IOSR-JEEE), vol. 8, no. 6, p. 6, 2013

This paper describes the development of an aquaponic system using solar panel to control the water pump and air pump based on Peripheral Interface Controller (PIC) technology. Solar power is ideally can be used in Malaysia due to location factor and also give the benefit to the environment as renewable energy. It involves a combination of electrical, electronics and agriculture into one sustainable system which consists of a solar panel, inverter, water pump and air pump. The solar panel is the most cleanest ways to produce electricity. With the average output voltage is 12V while the maximum output voltage produce by the solar panel is 18 V. The voltage depends on light capture by solar panel. Weather can minimize the light capture by solar panel thus affect the overall performance. This project requires a substitution power grid with green energy from solar panel which an inverter is used to convert Direct Current (DC) to Alternate Current (AC) and to step up 12V to 110V or 240V. A microcontroller is used to control the operation of an aquaponic system for switching water pump, air pump, battery charge and discharge state.

III. PROPOSED METHOD

The existing problems seen in the traditional aquaponics system can be detached by the introduction of electronic approach in the system. And this can encourage people to produce organic and healthy plants for daily use or consumption in their own household. For this project, the setup of an aquaponics system consisting of fish tank and grow bed for plants was done. Then, a monitoring section was established in order to detect the pH value, temperature and humidity of aquaponics system by the use of Ultrasonic sensor, water leakage, soil condition pH sensor module and Temperature and Humidity sensor (DHT11) respectively. Figure 1 shows Block diagram of proposed system

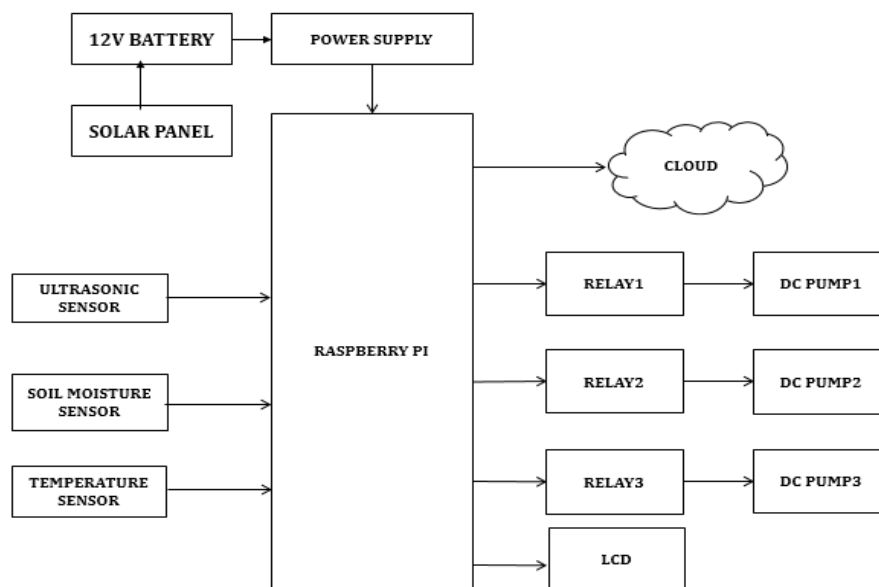


Figure 1 Block diagram of proposed system

All these sensors were interfaced to the Raspberry pi. Relay has been used for pump controlling feature. Raspberry pi has allowed the system to be Internet of Things based by using inbuilt WIFI. By the application of Internet of Things in this system, it has been possible to view the readings from anywhere in the world and also it provided the graphical and analytical view of the system parameters which define the IoT Based Aquaponics Monitoring System.

IV. WORKING OPERATION

Using Ultrasonic sensor it will calculate the water level in aquarium container. If it will beyond the range pump motor will turn on and send the water to the aqua plants container. Plants will absorb the neutrons and purify the water and this purified water is send to another container. After purifying the water send into the aquarium container when needed. We used ds18b20 sensor for calculate the temperature in aquarium. Every data will send to the server using internet protocol.

V. RESULTS

The prototype of IOT based organic forming by using aquaponics system is shown Figure 2. The prototype contains different types of sensors and their connections. The 3 tanks are arranged one below other. First tank is aquatic plants, second is fish farming and last is the water. Figure 3 shows Characteristics of Plant level and temperature and Figure 4 shows Characteristics of Fish level



Figure 2 IOT based organic forming by using aquaponics system



Figure 3 Characteristics of Plant level and temperature

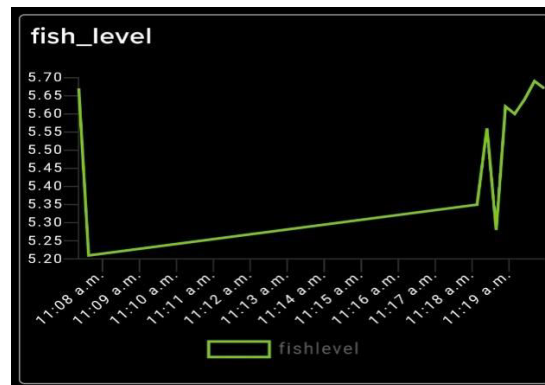


Figure 4 Characteristics of Fish level

V. CONCLUSION AND FUTURE SCOPE

The existing problems seen in the traditional aquaponics system can be detached by the introduction of electronic approach in the system. And this can encourage people to produce organic and healthy plants for daily use or consumption in their own household. For this project, the setup of an aquaponics system consisting of fish tank and grow bed for plants was done. Then, a monitoring section was established in order to detect the pH value, temperature and humidity, of aquaponics system by the use of Ultrasonic sensor, soil condition and Temperature, respectively. All these sensors were interfaced to the Raspberry Pi microcontroller. relay has been used for pump controlling feature. Raspberry Pi has allowed the system to be Internet of Things based. By the application of Internet of Things in this system, it has been possible to view the readings from anywhere in the world and also it provided the graphical and analytical view of the system parameters which define the IoT Based Aquaponics Monitoring System.

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