

Automated Pond Monitoring System

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Abstract—The Technology and Innovations are improving day by day in every aspect. IoT plays a key role in our daily life. One of the aspects that needs improvement is Aqua-culture that plays a key-role in improving Aqua farmers yield. It is very important to support Aqua culture to improve farmers standard of living. Water is the most essential component in aqua culture and it is important to maintain the quality of water. The proposed system consists of sensors that measures the quality of water and sends data to the user mobile phone for quick access and response. It is a time saving technique whereas traditional methods consume much time as well as they are probabilistic and costly. A traditional scheme needs to collect the samples and sends to laboratory for testing and monitoring. The results may be inaccurate sometimes. Our system is equipped with pH Sensor and temperature sensor for measurement of pond's water quality. The values were read by sensors and these values were sent to the user mobile phone via Blynk Application through NodeMCU. The NodeMCU converts analog readings into accurate digital equivalents which can be acquired using internet from remote locations. NodeMCU was coded to acquire, analyze and report to user's mobile phone using standard GUI. This GUI was designed using Blynk Application for an android mobile.

Index Terms— IoT, Aqua Culture, pH Sensor, Blynk, NodeMCU, GUI.

I. INTRODUCTION

We all know that food is basic need for human being to sustain. The population growth is increasing rapidly, scarcity of food is also increasing. It means the production of food is not matching population demand. To reduce the food crisis there are different types of food production streams. The main form of food production is Agriculture. There are mainly two types i.e., land and aqua farming. The land farming is far better than the aqua farming and the production is more whereas in aqua culture the production is low as well it involves more cost and it is a time taking process. If we could technologically contribute for the aqua farming using IoT the food crisis would decrease, and the production gaps can be filled making farming a reliable profession.

Aqua culture is also known as aqua farming. Aqua farming is a practice involving growth for well-being of aquatic organisms. It can be done in different waters they are fresh water, brackish water and salt water. The main objective of aqua culture is to produce protein rich, nutritive, palatable and easily digestible food supplies at low or reasonable cost. The proposed work has scope to contribute in this direction. By developing aqua culture and improving the quality and features of water like pH. and temperature by properly supplying food and oxygen levels to the aquatic organisms the growth would be proper.

This would in turn fetch huge profits for the stakeholders.

In traditional method the temperature is identified using laboratory tests and pH is measured using Titration method. The proposed model consists of a single wired temperature sensor and a pH electrode that detects the potential difference between the actual to the reference pH settings. The traditional methods are time consuming and for pH detection the titration method takes more than a day to get results. Sometimes pH. value can be calculated using pH indicator strips, but these strips are not reusable.

IoT means internet of things. It is a 21st century technology. It consists of interconnected devices with embedded electronics. These devices collect, process and transfer data via internet. It mainly consists of sensors, internet connectivity, data processing and user interface. These sensors sense the changes in the surroundings and transfer data via internet. It is popularly called as machine to machine communication.

II. PROBLEM STATEMENT

In these modern days everyone is depending on technology and everyone is thinking about smart work rather than hard work, so we got up with an idea to reduce farmers labour i.e., rather than collecting samples of water and submitting to the laboratory and waiting for results he could expect accurate quality parameters instantly in no time using his mobile phone. This would reduce the number of times he need to visit the aqua farm to monitor the activities. The automated system would guarantee accuracy and as well saves valuable farmers time.

III. PROPOSED METHOD

The model comprises hardware with developed software and the overall system is aimed at tracking the water quality deploying IoT. The system consists of sensors and NodeMCU as a wifi module. The sensors collect the data and send for further processing via internet. The NodeMCU connects both hardware and software components. It is a wifi module that operates at 3 V DC power supply. The sensors were used to read pond's pH and temperature. In this the pH is an analog sensor and temperature sensor is a digital sensor. The temperature and pH sensor operates at 3.3 V to 5 V DC power supply. The temperature sensor input pin, ground pin and data pin are connected to the NodeMCU. After establishment of connection the sensors start collecting the physical parameters. NodeMCU has been coded to acquire datum which gets processed and then sent to the user mobile phone via Blynk application. The block representation is reported in Figure 1.

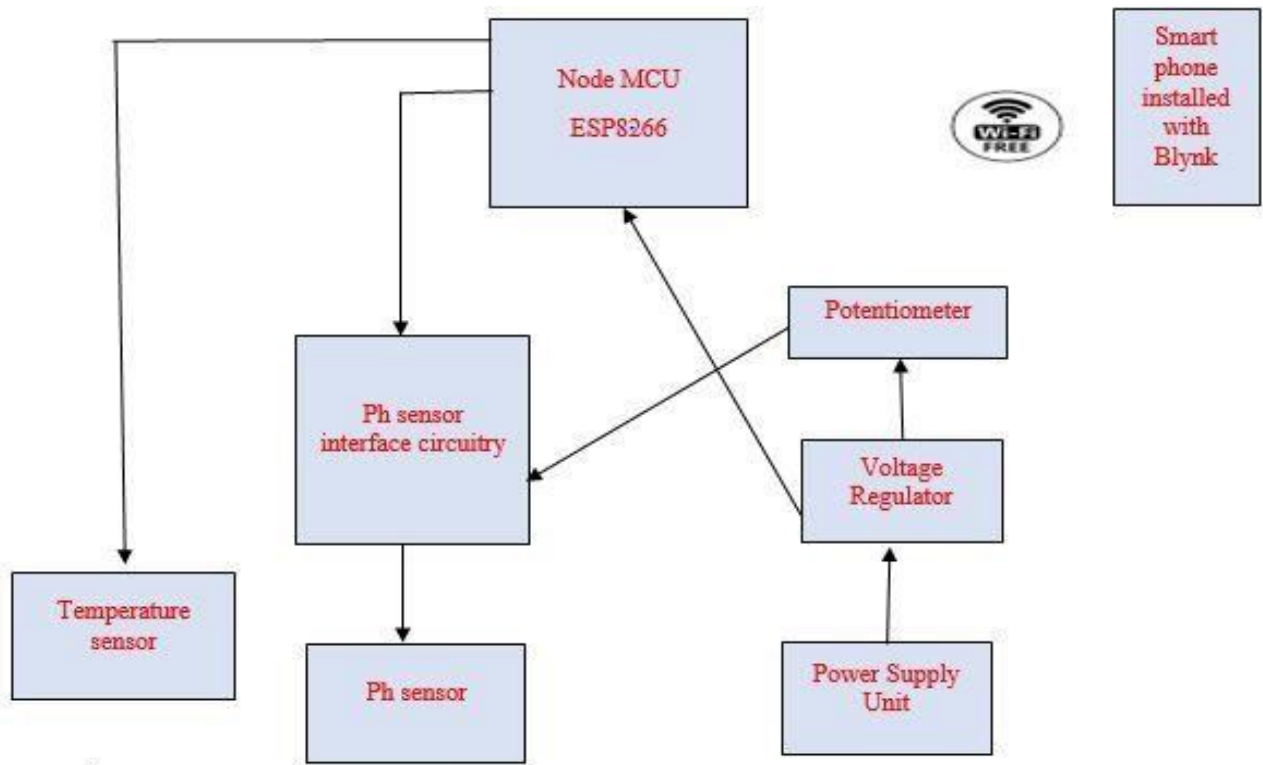


Figure 1. Block representation of proposed Pond Monitoring System

pH explains about potential or power of hydrogen. It determines the quality of liquid by determining its chemical properties. pH sensor works on potentiometric principle. pH sensor was invented by soren sereson in 1909. A normal pH scale consists 0-14. In this project we used an analog pH sensor. It consists of an measuring system and an reference system. The potential difference between these systems gives the pH value.for an acid the pH value is less than 7 and for a base it would be greater than 7. If the th pH value of a solution is equal to 7 then it is called as neutral. We used an analog pH sensor it requires an pH sensor interface. It links between the pH sensor and NodeMCU. The snapshots of the pH Sensor and the interface were reported in Figures 2 & 3 respectively. Table 1 shows the various effects when pH value changes.



Figure 2. pH sensor



Figure 3. pH sensor Interface

TABLE I. PH EFFECT ON POND CULTURE

pH	EFFECT
4	Acid death
11	Alkaline death
6-9	Better growth
4-5	No reproduction
5-6	Slow growth
9-14	Denaturing cellular membranes

A. Temperature Sensor

DS18B20 is the temperature sensor we have choosen for the work. It is a single wired sensor that can measure temperature from -55°C to +125°C with an of accuracy of $\pm 0.5^\circ\text{C}$. It was a standard programmable digital sensor that operates with DC 3 V to 5 V. It is a water-proof sensor. It consists of three pins i.e., VCC, DATA and GND. The data pin is connected to the NodeMCU and Vcc to power supply pin and GND pin to chassis ground. The data pin collects data and transmits to the NodeMCU via buses and the data gets processed.



Figure 4. DS18B20 temperature sensor

B. NodeMCU

NodeMCU is a open source IoT platform having both hardware and software. It is a low cost wifi module consists of built-in TCP/IP networking software and a microcontroller operating at 3.3 V DC. NodeMCU is programmed using the Arduino IDE with support for vast open-source libraries. It is compatible with other languages such as micro python and became cheap and popular in the market. It is powerful and easy to use. It consumes very less power.



Figure 5. NodeMCU

C. Arduino IDE

We have utilized Arduino for code development. It enables user to compile and run the code and dumps the code in the hardware system.

D. Potentiometer and Voltage Regulator

To get the constant power supply to NodeMCU and pH sensor interface regulator and potentiometer has been used to protect from supply variations. Figure 6 and Figure 7 displays the typical circuitry used in the work.



Figure 6. Voltage regulator



Figure 7. Potentiometer

E. Blynk

The Blynk application is used to get values to the mobile through notifications. It acts as an interface and provide different widgets. It provides communication between hardware and software. We can create project dashboards and arrange graphs, sliders and other widgets on the screen. It offers a flexible way to send messages and provides security. It is an app editor, and the projects are sharable. The GUI planned for reporting the pond quality was displayed in Figure 8.

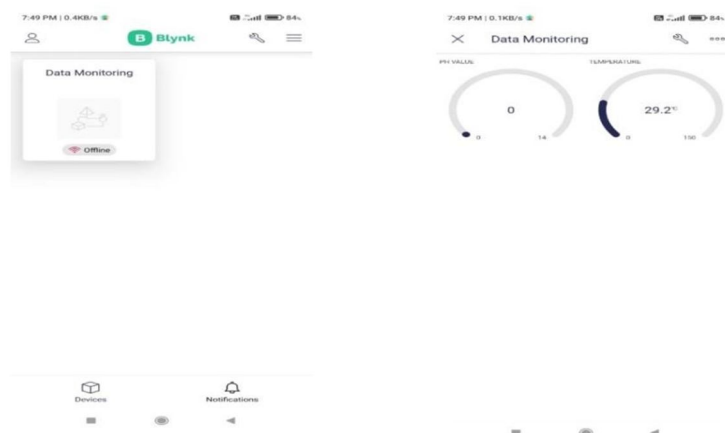


Figure 8. GUI designed using Blynk Application

IV. METHODOLOGY

The Process flow was shown in Figure 9. The first stage is to connect the temperature sensor and pH Sensor with NodeMCU to link up with the internet for acquiring pond quality parameters . The pH sensor is connected to NodeMCU via pH sensor interface. For constant power supply to the NodeMCU we have operated it on a regulator. The sensors determine the changes in the pond parameters.

The Blynk app has to be installed on farmer's mobile from android play store. Assistance is needed to customer to install and create a project with an authentication token. This auth token is used to connect hardware components to software via internet. A couple of Gauge widgets are chosen to reflect the status of temperature and pH values.

To establish connection between the user and components one should write the code for NodeMCU and another component's using Arduino IDE. During the coding we need to code for auth token provided by the Blynk app and username of the internet and password to establish internet connection for NodeMCU. After the code completion, compile the code in Arduino IDE software if no errors are present then select the appropriate port.

Then run the code, during the running operation the pH and temperature sensors acquire the data from the pond and the NodeMCU processes the data. An average of ten samples collected from pH sensor was represented as a single parameter on Gauge meter. The NodeMCU converts the analog data into its digital equivalent. Processed result is sent to Blynk through Wi-Fi using the same auth token.

V. RESULT

We have implemented a pond monitoring system which saves time for testing the quality of pond by using IOT devices such as sensors and NodeMCU. At the instance of time the results are sent to user mobile Phone through Blynk application. The snapshot of the interconnected system that has to be installed in the pond premises is shown in Figure 10. Figure 11. Shows the system being tested with different samples -potable hot water, lemon water, alkaline sample and soapy liquid (from left to right). We can watch the pH value of these samples at room temperature reported on GUI of mobile. The temperature can also be seen on right gauge of GUI.

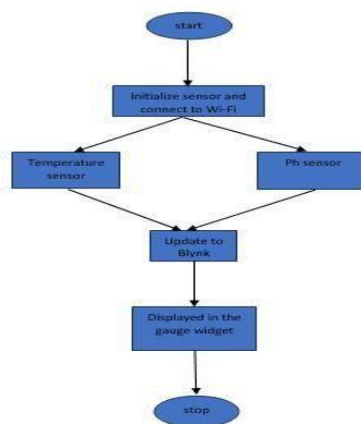


Figure 9. Process Flow for implementing proposed pond monitoring system

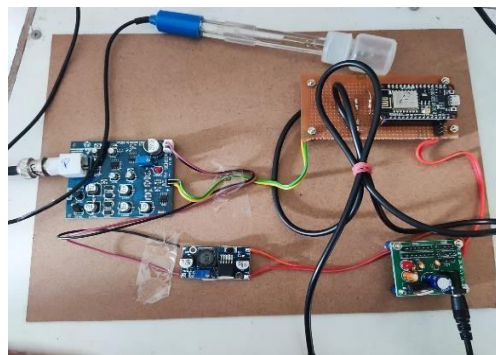


Figure 10. Proposed System at the Pond Premises

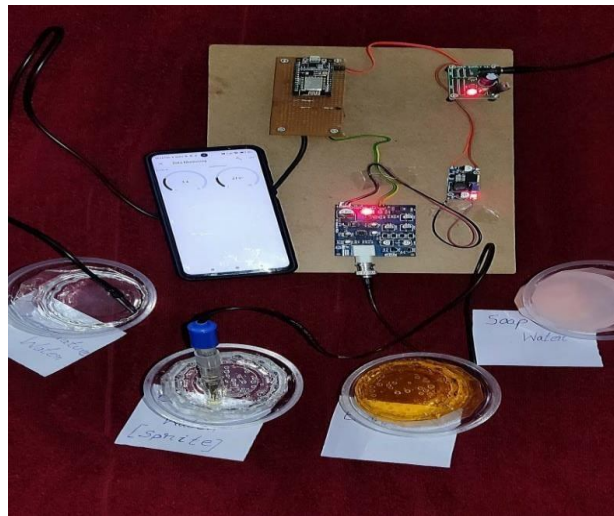


Figure 11. Proposed System with various samples displaying the pond quality on customer android phone

VI. CONCLUSIONS

Aqua farmers need to be more careful because many factors affect the quality of water and in turn the yield. It is important to observe those changes. With the help of traditional method it requires more than a day during that time many changes may happen in the pond and it may affect the production. For instant results we have designed a pond monitoring system. It is very flexible and helpful system which can increase the production. By using IOT technology it is an economical solution for tracking accurate pond parameters. The system can further be modified to read parameters like turbidity, salinity and dissolved oxygen content using suitable sensors.

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