An Approach for Automation of Aquaculture and Alerting Aqua Farmer

A. Rahul, K. Srideep, V. Sai Gireesh, T. L. Surekha

Abstract: ***Time to time information about the water quality is crucial for the farmer to increase the productivity. In this project we use the arduino and sensors to sense the different values from the aqua pond and upload them to the cloud. Also, if the level of Dissolved Oxygen falls below a certain threshold value an SMS alert to the aqua farmer so that he can take preventive measures. Also, the aerators are turned on automatically to maintain the threshold value.***

Also, an android app is developed and downloaded on the farmers mobile so that he can monitor the parameters in the water and take pre-emptive actions to prevent the spread of any diseases in the pond and increase the productivity and health of the aquatic organisms. The app shows the present levels of parameters in the pond. Through this we can achieve the real time monitoring of the pond.

Index Terms: Automatic Aerators, Real Time monitoring, Water parameters sensing, Cloud.

I. INTRODUCTION

1.1 Origin of the Problem

Aqua Monitoring is essential for all the aqua farmers for improving the quality of their fish and maintaining their business for a long run. The farmers whose land lost its fertility or the farmers who are greedy for more turn over turn their land into ponds for aqua culturing as it yields more income than normal land cultivation. But the problem arises as they are new to this aqua culture and tend to do mistakes which leads to the introduction of diseases in the aquatic organisms. This results in the decrease in the quality of the fish which ultimately leads to the loss in business. The land also can't be used for irrigation. This means the farmer also loses his land.

The focal idea of this project is to help such farmers to increase their productivity by improving the quality of the aqua species by monitoring the pond in the real-time and providing the required supplies so that the species can maintain their health. Also, the farmer can take precative measures to when the conditions deteriorate so that it will prevent the outbreak of the diseases.

1.2 Basic Definitions and Background

1.2.1 Aerator

The actuators in IOT that are used to maintain the level of Dissolved Oxygen in the water which is crucial for the aquatic organisms for their sustenance in the pond. These aerators are like propellers that run on water to push the oxygen present in the air into the water so that the percentage of dissolved oxygen inside the water increases.

1.2.2 Sensors

The sensors are the parts that interact with the environment to measure the required parameters and send them to the processors that process the sensed data and act accordingly using the actuators. The different sensors used in the project are pH sensor, DHT11 sensor etc.,

1.2.2.1 pH Sensor

The pH sensor measures the pH value of the water. The pH value is the concentration of the H+ ions inside the water which is H20 (H+ ions and OH- ions). The value of pH is inversely proportional to the Dissolved Oxygen in the water.

1.2.2.2 DHT11 Sensor

The DHT11 sensor measures the Temperature and Humidity. They are measured using semi-conductors that are sensitive and inversely proportional to the temperature.

1.2.3 Arduino

The arduino is the processor that has microprocessor embedded onto it. It also has the inbuilt digital and analog pins that are used to communicate with the sensors. The arduino board that we used in our project is AT Mega 328. This board uses AT Mega 328 chip as its processor hence the name.

1.2.4 Automation

The process of doing the work automatically that is, little or no intervention of the humans. In our project we automated the aerators so that they will maintain the Dissolved Oxygen percentage in the water.

1.2.5 Cloud

The space that can be accessed from anywhere in this world with an electronic device like smartphones, Laptops, PDS's (Personal Digital Assistants) etc., with an internet connection. The cloud provides storage space on the servers which can be accessed with the above set of resources. In our project it is used to store the values of the parameters that are sensed from the sensors.

1.2.6 SMS

Short Message Service (SMS) is used to alert the farmer that the aerator has been turned on due to the fall in the value of the Dissolved Oxygen and also send the values of the remaining parameters at that moment so that appropriate precautions can be taken to reduce the risk.

1.2.7 Android Application

An Android app is a software application running on the Android platform. Because the Android platform is built for mobile devices, a typical Android app is designed for a smartphone or a tablet PC running on the Android OS.

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1.3 Problem Statement

The crucial of the project is to automate the aerators so that they will maintain the level of Dissolve Oxygen in the water and prevent the introduction of water borne diseases in the aquatic organisms. The values will be updated to the cloud periodically. An SMS alert will be sent to the farmer when the value of the Dissolved Oxygen falls below a Threshold value indicating that the aerators have been turned on and also includes the values of other parameters at that moment in the pond. This will benefit the aqua farmer in the following ways:

A) The farmer need not be present at the pond every time.
B)The energy consumption due to removal of unnecessary running of the aerators.
C) The survival and improvement in the quality of the aquatic species.
D) The aqua farmer can immediately take precautions to stop the birth of any virus or bacteria in the pond.

Hence there is a necessary in the automation and monitoring of the condition of the pond so that the aqua farmers can prevent the loss and actually increase their productivity. This controlled monitoring of the aqua farming increased the quality and the quantity of the species that are being cultivated in the ponds.

II. LITERATURE SURVEY

The papers show different methodologies in developing the IOT systems for the aqua- monitoring system for aqua farmers.

[1] The "Automatic monitoring and control of shrimp aquaculture and paddy field based on embedded system and IOT" paper describes how the sensors are used to monitor the paddy fields [1], this paper only checks the values of the parameters in the paddy fields. There is no automation of the actuators and no SMS alert.

[2] The "A Review of Emerging Trends on the Water Quality Measurement Sensors" paper illustrates how water parameters are sensed an SMS alert is sent to the farmer [2], this paper doesn't send the values to the cloud so there is no storage of values.

[3] The "Monitoring system of aqua culture with automatic control system using arm 7" paper shows only an SMS alert to the farmer [3], this paper doesn't store the values in the cloud and doesn't automate the values and send them to cloud.

[4] The "E-Aquaculture Monitoring Using Internet of Things" paper indicates the automation of the aerators [4].

[5] The "DESIGN OF KNOWLEDGE BASED REAL TIME MONITORING SYSTEM FOR AQUACULTURE USING IOT" paper defines the methods storing the sensed values in the cloud [5], the drawbacks of this paper is that though they store the values in the cloud they don't send an SMS to the farmer and no real time monitoring of the value and alerting the farmer. The farmer has to manually check the values in the cloud.

III. PROPOSED METHOD

3.1 Design Methodology

The below figure 3.1 shows flow of data from one module to another module in this project.

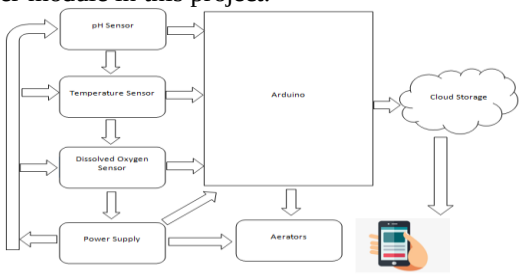

Figure – 3.1 Architecture Diagram

3.3 Description of Algorithm

3.3.1 Algorithm

Step – 1:Use the sensors to sense the value of parameters in the water such as pH, Dissolved Oxygen, Temperature, Humidity etc.,

Step – 2:Send the sensed the values to the arduino connected to the sensors. The Arduino processes the sensed values.

Step – 3: The values are sent to the cloud to store and analyse them.

Step – 4: If the Dissolved Oxygen falls below a threshold value, then an SMS is sent to the farmer. The value of the remaining parameters at that point are also sent to the farmer. The farmer takes the preventive measures based on the value.

Step – 5:The aerators are turned on automatically based on the Dissolved Oxygen value[3].

IV. RESULTS AND OBSERVATIONS

4.1 Stepwise Description of Results

4.1.1 Reading the Sensor Values

The sensors reads the values from the pond and sends them to the arduino which prints the values on the serial monitor. The below figure 4.1 shows the temperature and humidity values on serial monitor that are sensed from DHT11 sensor[5].

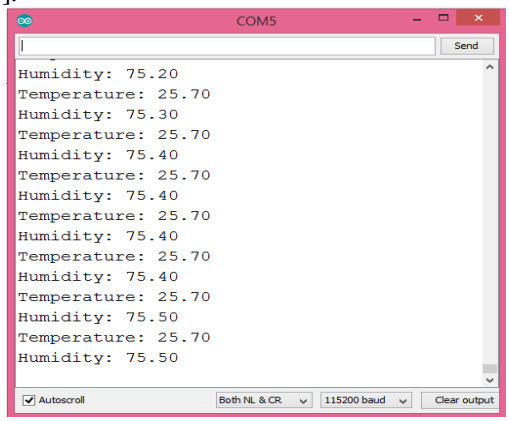

Figure – 4.1 Serial monitor values for DHT11 Sensor

The below figure 4.2 shows the pH values on the serial monitor that are sensed from the pH sensor.

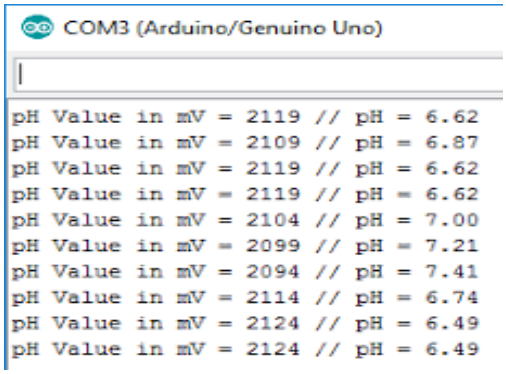

Figure – 4.2 pH value from pH sensor

The OLP cloud is used to send and store the sensor values from the arduino.

These values are used for later analysis. The below figure 4.3 shows the OLP cloud that is used to upload the values to the cloud.

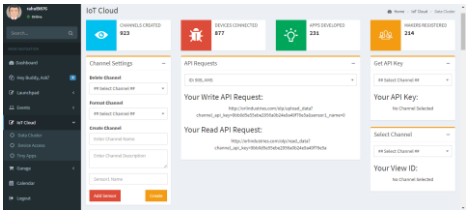

Figure – 4.3 OLP cloud for storing values

The IFTTT is a web service used to send the SMS to the aqua farmer using a

Web Applet. The below figure 4.4 shows the IFTTT applet that is used to send SMS alert to the farmer[7].

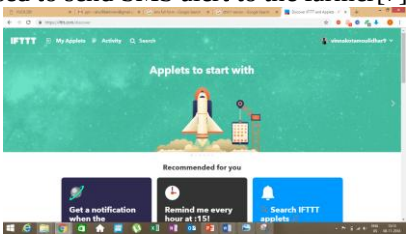

Figure – 4.4 IFTTT Web Service for SMS service

4.2 Test Case Results

4.2.1 Sensing the values from the pond and displaying them

Here the values from the pond are sensed and sent to the arduino. The below figure 4.5 shows the circuit connections of the project[1].

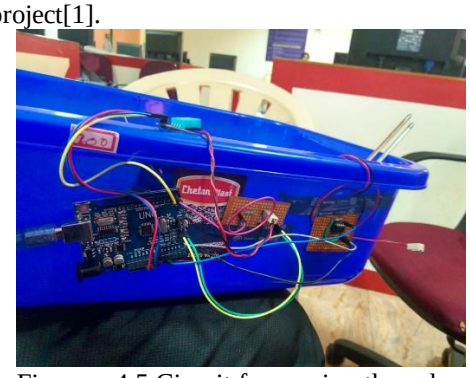

Figure – 4.5 Circuit for sensing the values

The below figure 4.6 shows the sensor values on the serial monitor that are sensed from the sensors[8].

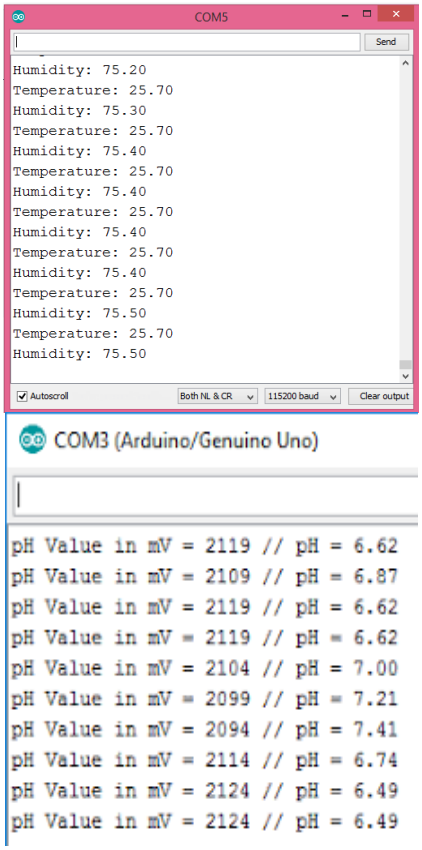

Figure – 4.6 Sensor values on Serial Monitor

4.2.2 Sending the Sensor values to the cloud

The processed values from the arduino are sent to the cloud. The below figure 4.7 shows the values from the sensors that are uploaded to the cloud and their graphs[6].

Figure – 4.7 Uploading values to the cloud

4.2.3 Automation of the aerators

If the sensed Dissolved Oxygen value falls below a certain threshold then the aerators are automatically turned on. Through this we can maintain the level of dissolved Oxygen in the water. This will preserve the health and life of aquatic species. The below figure 4.8 shows the automation of the aerator which will turn on automatically when the Dissolved Oxygen falls below a threshold value[9].

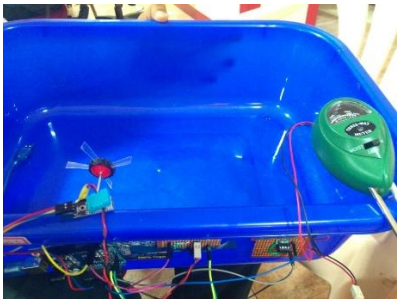

Figure – 4.8 Automation of the aerator

4.2.4 Sending an SMS alert to the farmer

An SMS alert will be sent to the aqua farmer so that he can take preventive measures to prevent the spread of water borne diseases in the aquatic species. The below figure 4.9 shows the SMS alert to the aqua farmer[10].

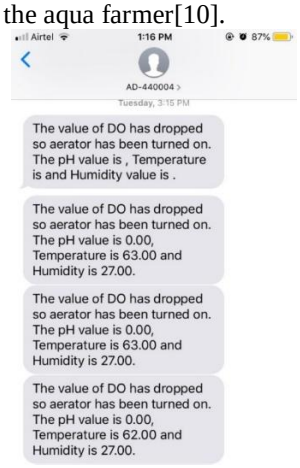

Figure – 4.9 SMS Alert to The Farmer

4.2.5 Android App

The android app helps the farmer to see the present values of the temperature, pH, humidity in the pond. He can analyse the situation and take necessary steps to improve the productivity of the aqua culture.

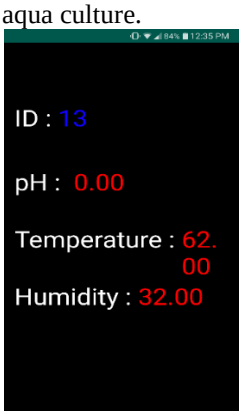

Figure – 4.10 Android app

4.3 Observations from the Work

The automation of the aerators will help the farmer in preventing the spreading and introduction of water borne diseases. Since the farmer will get an SMS alert so that he can take preventive measures to improve the quality of the aquatic species[11].

The data sensed from the sensors is uploaded to the cloud so that the researchers can analyse the data for improving the environment so that to increase the quality of aquatic species.

V. CONCLUSION

5.1 Conclusion

The project involves the usage of sensors like pH, Temperature to measure the temperature, pH, humidity, Dissolved Oxygen values of the pond. The sensed values are processed by the Arduino and sent to the cloud with the help of nodemcu. The Arduino processes these values and if the value of the Dissolved oxygen falls below the threshold value then the aerators are turned on. After the aerators are turned on an SMS is sent to the farmers mobile indicating that the aerators have been turned on and the values of pH, temperature, Humidity at the time of turning on aerator are also sent to the farmer.

The farmer can also see the time to time values in the mobile app which indicates the values of pH, Temperature, Humidity. The quality of the aquatic species can be improved if we improve the environment. Thus, this project provides real time monitoring of the ponds. It also sends an alert message to the farmer so he can take preventive measures to prevent the outbreak of diseases in the pond. The sensed data is sent to the cloud so that data can be used for the analysis by the aqua researchers so that they can use that data for improving the quality of the fish and improve the environment.

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