PROTOTYPE OF AQUACULTURE USING IoT TECHNOLOGIES

Kumar Sai Sankar Javvaji
Department of ECE
VFSTR
(Deemed to be University)
Guntur, Andhra Pradesh, India
kumarsaisankarjavvaji@gmail.com

Md. Abbas Hussain
Department of ECE
VFSTR
(Deemed to be University)
Guntur, Andhra Pradesh, India
Abbas2hussain34@gmail.com

***Abstract*-- India is the world's third fish producer in the world. It produces an average of 11 million tons of aquatic products every year. Andhra Pradesh and west Bengal stands the top states to produce marine foods in India. Aquaculture plays the decisive and integral role in developing the sunrising growth of GDP of nation. From the survey aquaculture moulds over 41 million tons of production. During 2019, the fish production increased 73% from the past decades. Since it has a lot advantage in the present trend, the production of aquaculture must be taken a keen care. This proposed system which is implemented in Raspberry Pi has covered all the maximum precautions that should be taken a proper care by monitoring the pH level, Dissolved oxygen, temperature and turbidity inside the pond automatically. And the alert notification is sent to farmer through the GSM and farmer can monitor all the sensor and actuator status through the android mobile app.**

Keywords: IoT, Aquaculture, Raspberry pi, Android mobile app, Thingspeak.

I.INTRODUCTION

India is the 7th largest country Geographically and 2nd most populous country in the world. In aquaculture farming India occupies 1st place but in production it occupies third place. Aquaculture is contributing about 1.07% of the nation GDP. It is expected by 2025 India needs 16 million tons of fish requirements. But recent scenario the aquatic production is decreases due to sudden geographical climatic conditions. It is very hard and consumes a lot of time for manual testing of aquatic parameters this can be overcome by using the suitable and reliable technology which can monitor and guide the farmer to take preventive methods automatically and conveniently.

If we see the current trend of technologies Internet of Things (IoT) has a booming growth and it is very reliable for the production of Aquaculture. IoT is the Union of People, process, Network and connectivity. In this each device is assigned with an Internet Protocol (IP) address and connected to the internet so that anyone can identify that device. By using IoT we can monitor all the aquatic parameters and control with respective their actuators. The proposed system uses the Raspberry pi as a CPU and can monitor pH, Dissolved oxygen, Temperature, Turbidity and the water level by using the different sensors and control these parameters by using the actuators like Oxygen booster, cooling tubes, Inlet and Outlet motors.

II. RELATED WORKS

Javvaji. et.al. [1] implemented a prototype of automated Polyhouse system using Arduino mega and ESP8266 module. It can control water level, light and temperature automatically. [3] The paper by Raju sitaramaraju, and Hari Kumar Verma, here the raspberry Pi is used the sensors such as pH ammonia, dissolved oxygen sensors are interfaced directly to the microcontroller module raspberry Pi. Here Wi-Fi module is used where raspberry Pi has its access to it and with the help of it, the data is sent to the mobile app in the computer where we can monitor the data in every aspect. if any problem caused in the water does not have its solution by own it should be taken care by the worker and the data can't be sent to the longer distances in this project. [5] The paper by sajal Saha, Hasan Rajib, Sumaiya Kabir ,the title," iot based automatic fish farm monitoring system", here the paper deals with the quality monitoring of the fish farm .here the temperature sensor sensor ,

conductivity sensors are used which are used to monitor the quality of the water . hear the colour acquisition is also used where smartphone is used to take the camera of the water. with the help of the colour it identifies the water quality and the water temperature is monitored with the help of water heater all the data that is captured is sent to the mobile application with the help of Wi-Fi and Bluetooth. here the data is monitor in the fcm app . any of the changes in the sensors may result in the message alert system to the owner of the water form .limitation is about the acquisition of the image of the water from the phone if suppose the waterfalls on the phone may lead to the shortage of the phone and leads to damage [6] The paper by Mehboob Hasan Rohit majibul Karim Siddique , the title ,"cost efficient automated pisculture assistant system using internet of things here the nodemcu plays the vital role in monitoring the quality of water in every aspect here the pH sensor in the turbidity sensor is used which are interfaces directly to the nodemcu with the help of Wi-Fi module the nodemcu is connected to the application ifttt where it sends all the data to the the application with the help of Wi-Fi and Bluetooth message sending plays the vital role in this project hear the mqtt model in the ifttt model is used, and the 4 channel output isolated relay is used where it helps to pump the oxygen and monitor the water temperature in it. [2,4] [7-11] in these papers are the authors proposed a system which can monitors different aquatic parameters.

III. PROPOSED METHODOLOGY

The proposed system mainly focused on the safety measures and all the precautions should take care regarding the aquaculture. Here the Raspberry pi module is used as a CPU and all sensors such as Turbidity sensor, dissolved oxygen, temperature, water level sensor and pH sensor, actuators like oxygen booster, Inlet and Outlet water motors are connected to it. The block diagram shown in Fig.1 where all the sensors and actuators are connected to raspberry pi.

The raspberry pi here used in this prototype is the model 3b+ with a BCM2837, 64-bit SoC and a CPU of 1.4 GHz 64 bit quad-core ARM cortex-A53 CPU with a ram of 1Gb. The turbidity sensor monitors the dust particles present in the pond, in this prototype the threshold limit is taken as 250 this sensor works based on the scattering of light on the suspended particles and the resulted reflected light. If the value reaches above 240 then the motor driver drives the inlet and outlet motors and stops after controlling the turbidity level. Here the water level sensor will monitor the water level present in the pond while the inlet and outlet motors are switch on.

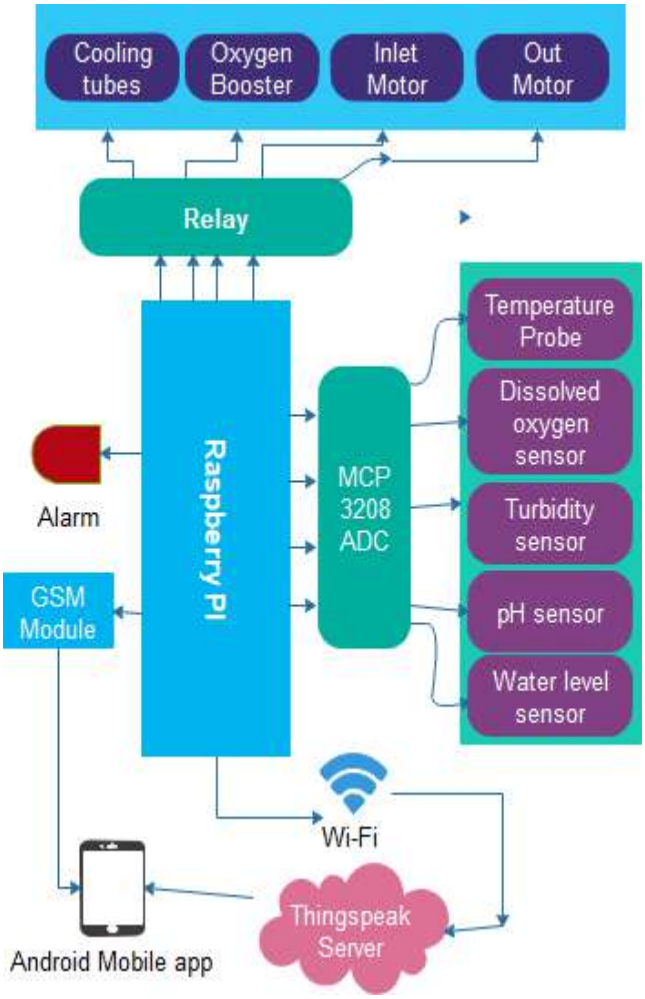

Fig.1. Block diagram of the system

pH is the main aspect regarding the aquaculture monitoring in this system the pH is maintained between the 5-9 range, the sudden change in this leads to automation of outlet water motor takes place in the same way fresh water is driven into the pond. pH sensor here used in this module is v1.1 which gives the maximum accuracy of the water pH levels.

Dissolved oxygen is another main aspect for the healthy growth of aquatic animals. For the best growth the oxygen level should me maintained between 3.5-5 mg/L. the program is written in a way that if the level lesser or beyond this threshold range the oxygen booster will start and increase the oxygen content in the water. The temperature in this prototype is maintained between 28°-40°C if it exceeds the threshold value then the cooling tubes will be activated and make the water cool and suitable for the aquatic organism growth.

Raspberry pi 3b+ has an inbuilt Wi-Fi module. This whole data from sensors and status of actuators is sent to Thingspeak server through Wi-Fi, user can monitor all this data through a android mobile application which is implemented in MIT app inventor in case of any emergency the message will sent to farmer directly through GSM module.

The overall setup having sensors, actuators along with raspberry pi is shown in Fig.2 and Fig.3

Fig.2 Hardware setup of Raspberry pi

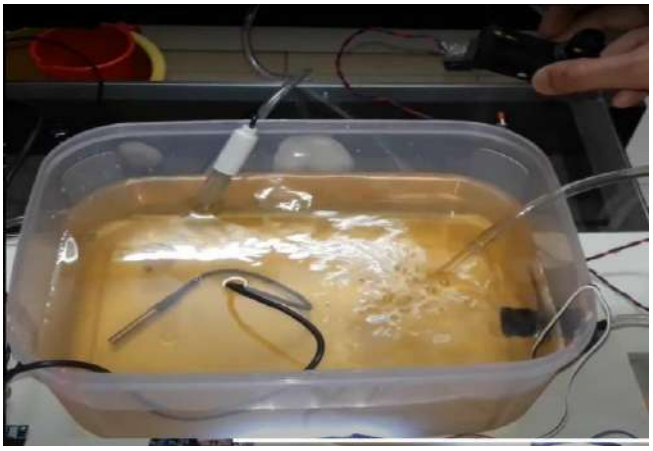

Fig.3 Hardware setup of sensors

IV. ALGORITHM

Step1: Initialize all five sensors and the actuators.
Step2: From time to time, collect sensor data and that will transmit to the controller.
Step3: The processor will process the data and activate / deactivate the corresponding actuators based on the conditions created by the controller using the sensor data.
Step4: Update the status of your actuators / sensors to Thingspeak server and also to Android APP using Wi-Fi.
Step5: In case of any emergency, an SMS will be sent to the farmer via GSM for the necessary actions.
Step6: Repeat the Step2 through step5.

V. RESULTS

This system is implemented by using the raspberry pi 3b+ and the programming is done in python script. Fig.4 shows the results of sensors and the actuators data taken from cloud and Fig.5 shows the resuts which are observed in android app which is implemented in MIT app Inventor.

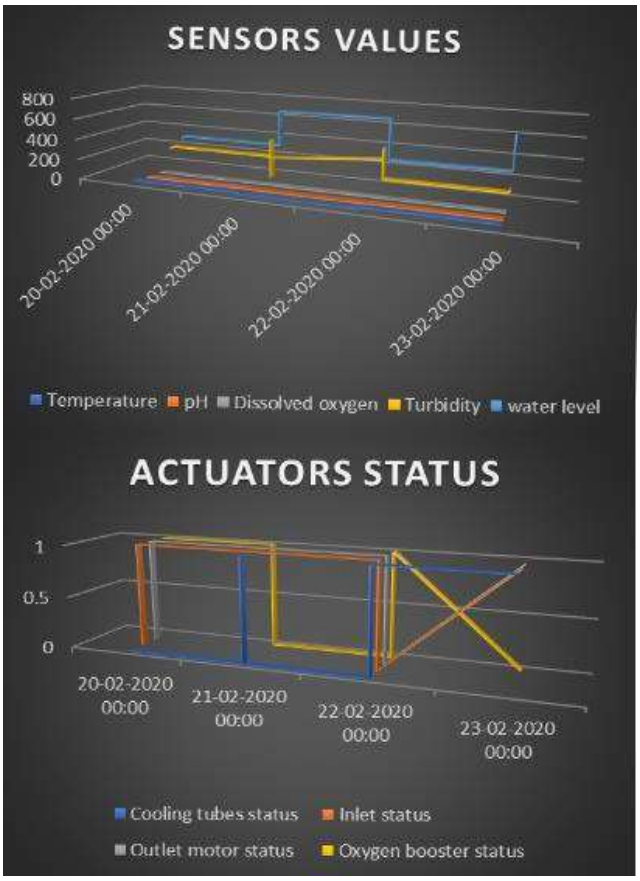

Fig.4 working status of sensors and actuators

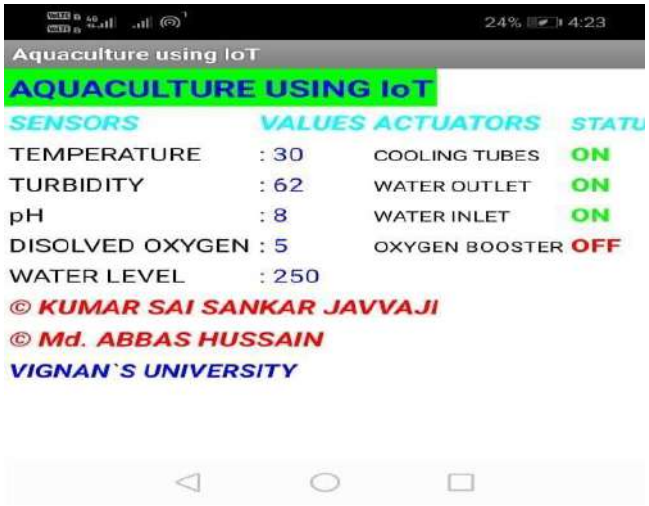

Fig.4 Screenshot of Android mobile app

VI. CONCLUSION

As a developing country India needs to evolve into to the technology and should increase the GDP. Aquaculture plays a Vitol role in the growth of economy by this proposed system we can increase the quantity and quality of aquaculture production and can save the labour cost by moving into automatic technology.This system further can be developed by adding automatic feeding system and cameras. By taking the pictures of aquatic animals we can do analytics by using the image processing and Bigdata so that system can give the predictions of using the proper medicines in proper quantity.

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