Real-Time Monitoring of Fishery

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***Abstract* —The present work aims at providing a solution for continuous real-time monitoring the water quality of inland fisheries. The parameters being monitored are pH, temperature, turbidity, water level, dissolved oxygen & nitrogen, area-wise fish density. There are provisions for (i) restoring water level if it decreases below threshold, (ii) automatic feed mechanism for fishes. All data are remotely accessible in Android application developed specifically for the project. For control of the sensors, actuators and internet connectivity a Raspberry Pi module has been used.**

***Keywords* —Sensors, Devices, Machine Learning, Internet of Things, Camera, Android Applications, Graphs, Fishery**

I. INTRODUCTION

Pisciculture is a major part of Indian economy and caters to the diet of a large part of population. Presently, the water bodies are severely affected due to pollution from several sources. This article proposes a method to monitor and ensure the quality of water available for healthy pisciculture with smart monitoring and automation. The fishermen regularly face the problem of providing their respective water bodies with good quality water that will be suitable for the specific kind of fish being farmed. The general practice is to send the water samples to laboratories for testing. This process is time consuming and such laboratories are only available in major locations. Fish population is very sensitive to changes in water conditions within a short period of time. These factors often adversely affect health of the cultured fish population causing death of crop and poor yield. The surviving crop does not grow enough to meet the market criteria, causing losses. This work is on an automation system that uses specific sensors, devices and Internet of Things (IOT) Technology to monitor the water quality of aquarium/pond round-the-clock. The proposed system uses sensors for (i) turbidity to check water quality, (ii) pH to check the acidity and alkalinity, (iii) temperature, (iv) water level, (v) dissolved oxygen and nitrogen. When the water level goes below certain threshold, water pump is started to restore the level to the desired value. The system may be programmed to provide food at periodic intervals. In this system, waterproof submersible AI cameras will be fitted, that will record data of population density and size of fishes. The system will also have an anti-theft alarm to prevent fish from being stolen notifying the fishermen on his mobile phone. The fishermen will get all the parametric data in his phone through Android applications with proper graphs as well as notifications.

II. LITERATURE SURVEY

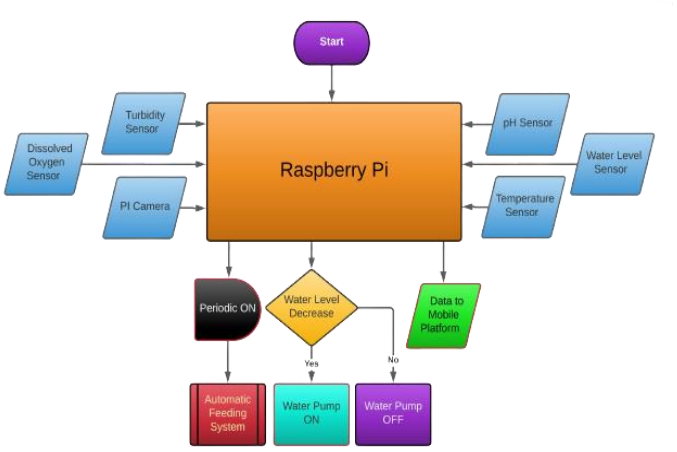
The work described in [1] to detect the quality of aquaculture water, and with the help of the micro climate. The solution is designed to weed and salt water for agriculture, as well as for fish farming. In the second article [2] is the monitoring and control of systems, aquaculture is the farming of seaweed and fish. Seaweed farming is playing an important role in the business and is constantly growing. The main feature of the system is a PC Duino micro-controller, which performs the function in the control of the data transmission, and the operation of an automatic sampling unit, which is based on the comparison of the values of the measured parameters, with a particular threshold. The importance of technology, such as the Recirculation Aquaculture System will be integrated with the sensors and the CNS and development of filter system of measurement, control, and destroy all of the parameters, variables, and waste and has been developed by the academic institution and it has already been shown, was to be considered. In the third paper[3], a continuous water quality monitoring system is presented, consisting of a sensor to measure dissolved oxygen, pH, and the collection of data on the basis of the Duino PC, micro-controller, a sampling device and a PC-based graphical display. The automatic sampling unit has been designed with a 12-V PSC-stepper motor holder, 12 V pump, and 8, and a glass tube, the sample racks. The experimental results show that when the measured value is below 5 mg/L and a pH of less than 4 or greater than 9), the sample collection device to be controlled by the

filling-in of a 20-ml sample is 650 ms. In the celebrated paper [4], the measured data can be displayed on a computer for further analysis. This is the prototype of the system is expected to find wide application in the field of the monitoring of the environment for the aquaculture industry. The article presents a method for monitoring and controlling the movement of the fluid in the direction of the firms in the industry, and a web server. The Arduino micro-controller development board to read the heart rate from the flow meter and sends it to the Raspberry pi, a micro-computer for controlling the solenoid valve, which is connected to the pipeline.In the sixth article [6] gives an overview of the more popular methods for the measurement of dissolved oxygen (DO). The principal methods of measuring dissolved oxygen are optical and electrochemical. Electrochemical sensors can be divided into polar graphic, pulsed, and electroplating. The sensors can be designed to test for biochemical oxygen demand, spot, sampling, and / or long-term monitoring. A dissolved oxygen meter, water quality meter, or the recording of data in the system can be used to capture the data produced by the sensor. The temperature is typically measured by a thermistor in the sensor, and which is recorded by a counter, or a data logger without having to ask. Many of the meters include an internal barometer, and the recording of data in the system may be configured to, with the help of an external barometric pressure or in water level sensor for measurement of pressure. In the seventh paper [7] shows an analog pH meter, specially designed for the Arduino controller, and it has a built-in simple, convenient and practical connection and function. In order to use it, simply connect the pH sensor to the RF-out connector, and plug the PH2.0 interface into the analog connection of an Arduino controller.

III.PROPOSED PLAN & METHODOLOGY

This work is adding value to fishery quality monitoring system by including features like dissolved oxygen & nitrogen, pH, turbidity, temperature sensor, submersible camera. The device is also measuring water level using a sensor. Depending on the water temperature the device has set up the automatic water pump system. The device hasalso installed automatic feeding system to provide fishes with food at regular intervals. The device will be checking water volume at regular intervals so that the fishes don't die and can grow as per market criteria with the help of AI camera algorithms. So this is the comparison between this paper & other paper. This device is also cheap in availability and convenient in use.The system is constructed out of off-the-shelf items and hence readily implementable.

Flowchart for IOT &Mobile Application Development:



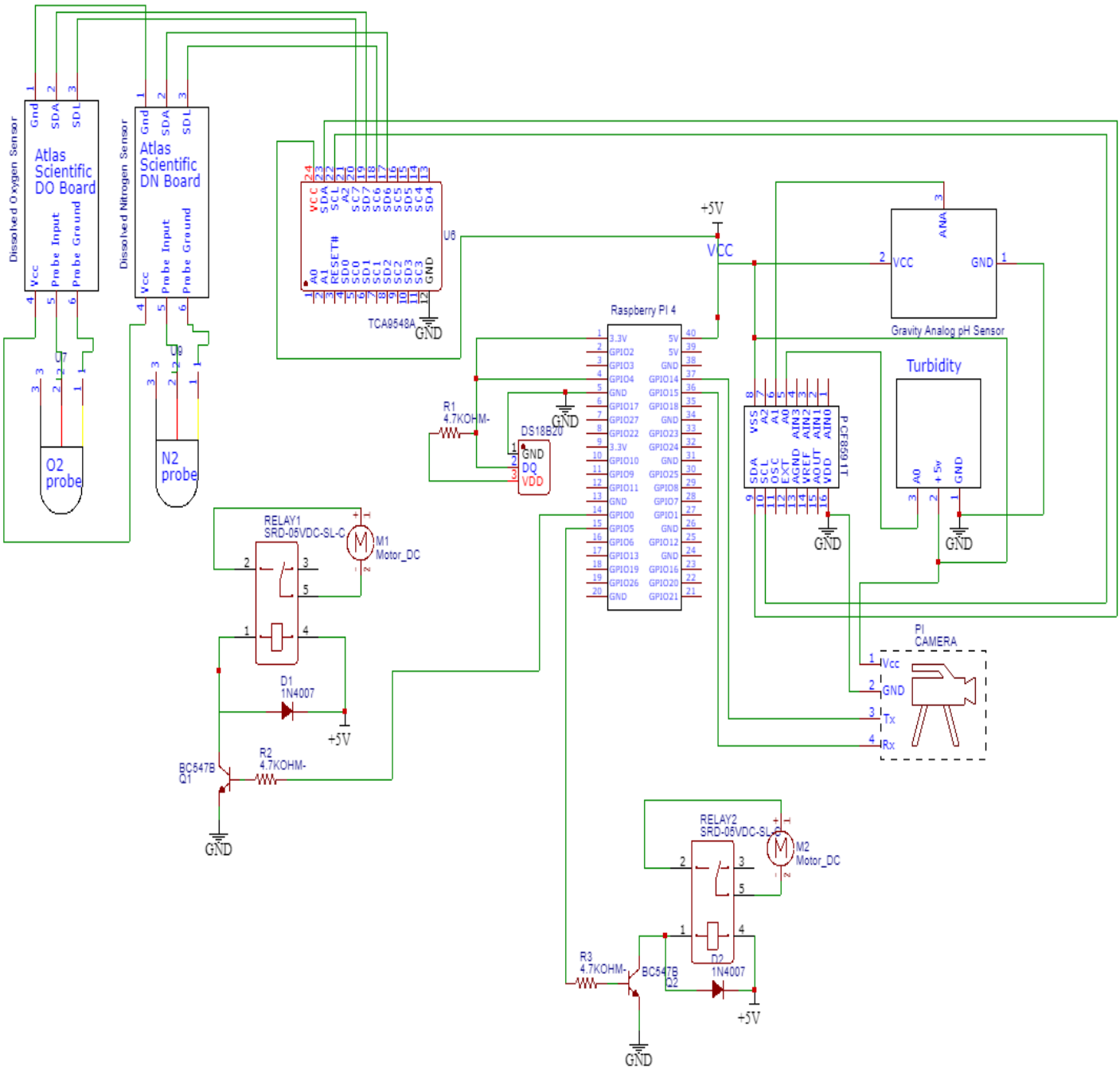
Features & Techniques:

1. Turbidity sensor is used for water quality checking, that is, TDS of water. If the turbidity value is 329 then water is pure. But if turbidity value decreases then the water is not pure enough for pisciculture. In this project turbidity sensor continuously checks the water purity.
2. PH Sensor is used for checking the acidity and basicity of water. If pH value ranges within 6.2 and 7.6 then the water is pure. If the value decreases below 6.2 then the water is acidic and if the value increases beyond 7.6 then the water is basic.
3. Temperature sensor is used for checking the temperature of water and the nearby atmosphere. The sensor continuously checks the temperature of water. The normal temperature is 25°C. If the temperature increases or decreases then the water will not be suitable for pisciculture.
4. Water level sensor is used for checking the volume of water in the aquarium. The sensor continuously measures the water level. If the water level decreases below the threshold then the consumer will get an alert notification is his/her mobile phone.
5. In this project water pump has used. This water pump can be handled both manually and automatically. The water pump will operate itself automatically based on the temperature and water level. If water temperature increases then the water level will starts falling below the threshold value which will make the water pump start automatically. The consumer will get an alert notification is his/her mobile phone. If the water level crosses the threshold level then the pump will go off automatically and the consumer will get an alert & notification is his/her mobile phone.

6. This device has an automatic feeding system for fishes. This device uses a relay servo motor that will provide food in the tank at regular automatically. The consumers don't have to monitor the fishes to feed them from time to time.
7. In this device we have used a Pi Camera, which is an AI camera, that checks the volume of fish in the aquarium and also act as an anti-theft device. We have used an OpenCv platform that has a classifier model that can recognize fish and its density.

In this device all systems and sensors are connected to Raspberry Pi. This is a mini pc system. Raspberry pi has its own internet system with along Wi-Fi, through which we send all data of peripherals to the cloud. For cloud we have used Google Firebase real-time backend Database. Consumer can access this data of the peripherals which will be sent to them in their mobilephone from cloud. Consumer will get all alert notifications in his/her mobile phones. Since we have used cloud and its login authentication, the data of device and consumers is private, secured and worldwide.

Circuit diagram:



IV.EXPLANATION & RESULT ANALYSIS

In this project we have explained the result analysis of IOT device below.

The Fig.1 is showing the output of turbidity sensor. The sensor is successfully operating in the relevant range from 10 to 500. TDS range of 310 to 340 is acceptable for pisciculture.

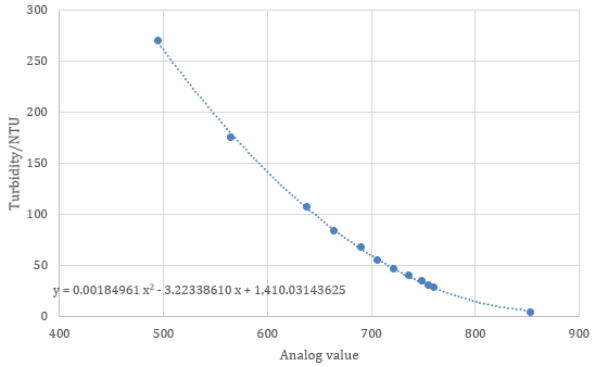


Fig.1 Turbidity sensor reading

The Fig.2 is showing the output of pH sensor. The sensor is successfully operating in the relevant range from 4.5 to 9. PH range of 6.2 to 7.6 is acceptable for pisciculture.

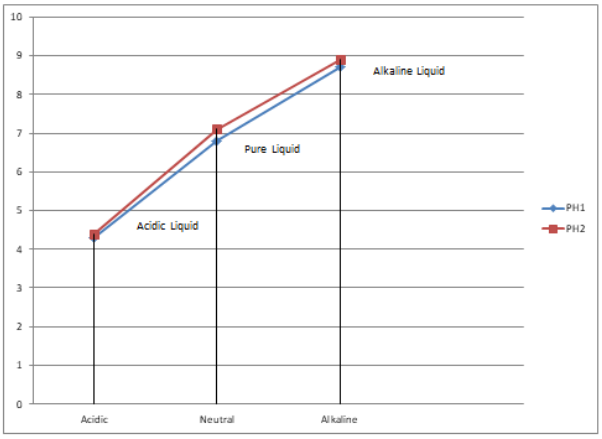
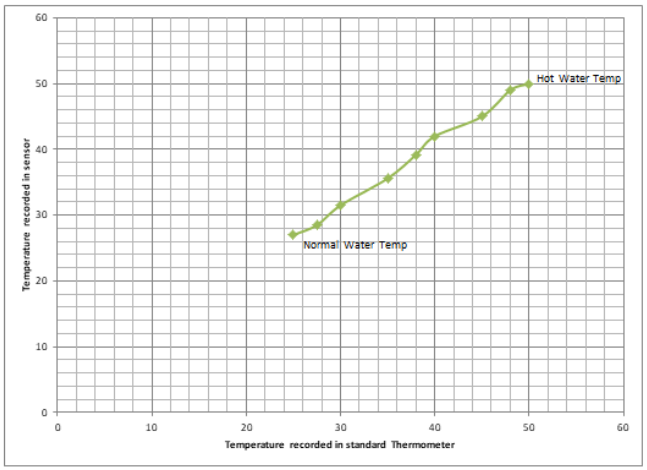


Fig.2 PH Sensor reading

The Fig.3& Fig.4 is showing the output of DS18B20 temperature sensor. The sensor is successfully operating in the relevant range from 5°C to 50°C. Temperature range of 22°C to 26°C is acceptable for pisciculture.



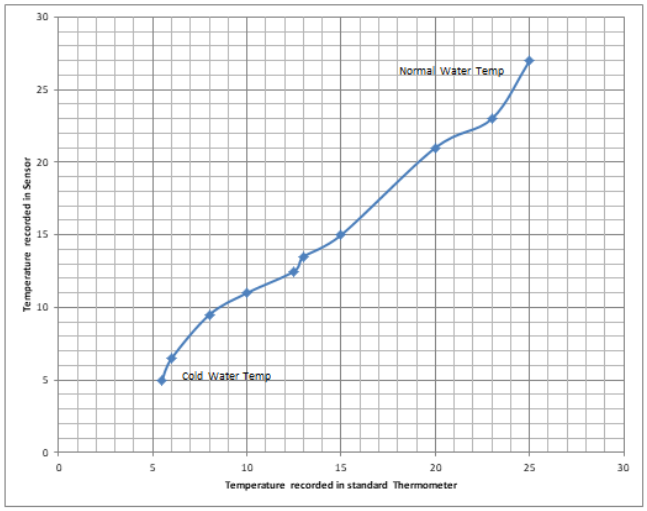


Fig.3Temperature sensor operating depends on temperature increasing

Here AI waterproof Pi Camera has used for detecting the density of fishes in water.In this Fig.5 when density of fishes will increase automatically camera will detect it and send the data to the mobile phone using firebase cloud.

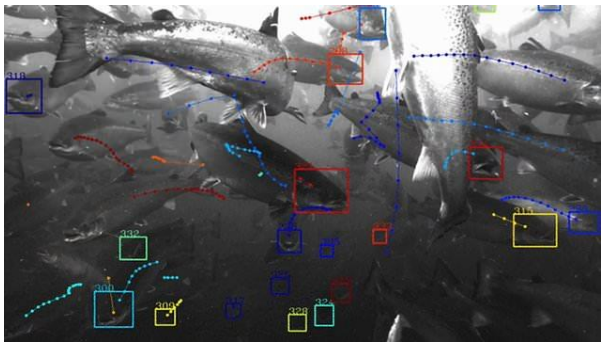


Fig.5Fish density recognizing through AI Waterproof PI Camera

In this project the water pump can be handled both manually and automatically. The water pump will operate itself automatically based on the temperature and water level. If water temperature increases then the water level will starts falling below the threshold value(80%) which will make the water pump start automatically& if the water level crosses the

threshold level(80%) then the pump will go off automatically. The consumer will get an alert & notification is his/her mobile phone.

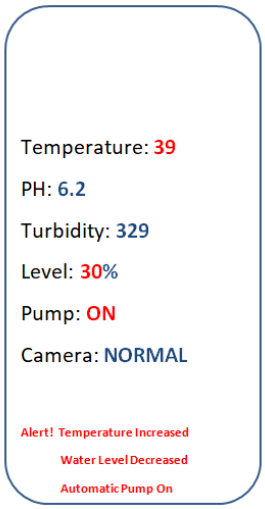


Fig.6Mobile Application showing the real-time values of all sensors & device

Fig.7Demonstration of sensors & devices used in this paper project

Fig.8Showing the real-time sensors values in Firebase Cloud Real-Time Backend Database

Pricing Table:

Water Bodies	Area	Price(Approx.)
Aquarium	Mini	Rs. 12000/-
Pond	1/2 sq.km	Rs. 15000/-

V. CONCLUSION & FUTURE WORK

A prototype system has been demonstrated for inland fishery which can monitor pH, temperature, dissolved oxygen & nitrogen, turbidity, visual fish population together with actuator for feeding system and water-pump. The monitored data is available remotely in user's mobile phone application through Internet of Things technology. Further work would aim at field demonstration of the integrated system. Installation of such system is challenging because the system has to be robust to endure weather and tampering. Also, the system has to have security features to ensure authorized access. Together with these value additions the system can be a valuable tool for small-scale fisheries of rural areas.

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