Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 7, No. 3, July : 2023

DEVELOPMENT OF WATER MONITORING SYSTEM USING IOT FOR AQUACULTURE

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Abstract
The IoT (Internet of things) is rapidly developing technology that is now spreading its wings across many industries. Whereas Aquaculture mainly refers to cultivating aquatic organisms providing suitable environments for various purposes, including commercial, recreational, public purposes. This project demonstrates how to use Internet of Things (IoT) based gadgets to monitor aquaculture's fundamental requirements and supply items required for the fisheries. In this project, we'll try to implement monitoring of aquaculture water quality using an Arduino, a number of sensors, a smartphone, and an android application. This tool will be used to monitor various water properties to improve the living conditions for fish. These gadgets have sensors that can monitor the water's temperature, the potential of hydrogen (pH), dissolved oxygen and ammonia levels, which are necessary for effective fish farming int the right conditions. An android based mobile application will be developed and farmers, fishermen and people related to aquaculture will be users of this application.

Keywords:
Internet of Thing (IoT), Aquaculture, Water Quality Monitoring.

I. Introduction

Aquaculture also called aqua-farming, breeding, raising, harvesting of fish, seaweed, algae and many other organisms. Aquaculture is the set of practises, knowledge, and methods used to raise some aquatic plant species and animal species. This activity is extremely important for both food production and financial growth. Due to abrupt climate fluctuations that create changes in water quality characteristics, commercial aquaculture is facing a number of challenges. Aqua farmers use manual testing to determine the state of various parameters. However, manual testing takes a long time and produces inaccurate findings since the factors use to gauge water quality are constantly changing. If automatic monitoring in some way, the better. To solve the issues, aquaculture should adopt modern technology. Technology must support a number of important application areas, such as living quality, welfare, environmental changes, etc. for rural development. Therefore we need to be more careful while selecting the right technology for this kind of advancement.

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II. Literature

This section describes literature review related to proposed system. We have done review on different technologies that are involved in the water monitoring system.

Yi-Bing Lin et al [1] developed an IoT based Mini aquarium system called Fishtalk which used several sensors and actuators. The sensors used were to find the temperature, pH, Electrical Conductivity, Dissolved Oxygen, and total dissolved solvents. However, the Fishtalk system did not have an ammonium sensing sensor and a turbidity sensor which is a measure of the extent to which water loses transparency due to the presence of suspended particles. A Cost-Efficient Automated Pisciculture Assistance System Using the Internet of Things (IoT) is developed in [2] which used sensors such as temperature, pH, turbidity and to measure the water damage. Here the author designed this system as a cost-efficient one, he did not have any sensor to measure Ammonia which is also dangerous for fishes if it crosses the lower limit. This system also does not have a system to automate the feeding process.

Guandong Gao et al[3] developed an intelligent IoT-based control and traceability system to forecast and maintain water quality in freshwater fish farms. The sensors the author used were to measure water temperature, water electrical conductivity, water level, pH value, water body turbidity, and dissolved oxygen. However, this system did not have any sensor to measure Ammonia.

A water monitoring IoT system for fish farming ponds by using basic sensors such as temperature and water level sensors is analyzed in [4]. The author did not include other basic measuring parameters such as pH and dissolved oxygen. GSM-based fish monitoring system [5] using IOT explains about the fish monitoring and uses various sensors for monitoring the fish aquarium tank. The sensors like pH, Water level sensors are used to sense the pH level and level of the water. It will indicate the signal through buzzer and LED. The control of this system is done by the Arduino board.

An Intelligent Fish Tank Control System Based on Internet of Things Cloud Computing Platform is designed in[6]. The author used only water level sensors (Water Sensor), light sensor, temperature sensor (DS18B20) and focused much on the Internet of Things Cloud Computing Platform and hence he did not use other sensors such as turbidity, dissolved oxygen, etc.Smart monitoring and controlled aquaponic system- based on IoT is developed in [7]. Core Sensors used in this system are the Humidity sensor and Temperature sensor. Humidity is a measure of the amount of water vapor contained in the air and the value of the sensor can be accessed through smart phone applications and websites from anywhere with the Internet connection.

A. Zaini et al [8] developed the IOT based Monitoring and managing Nutrient Film Technique (NFT) Aquaponic and it records water pH, , ammonia gas level, water temperature and water depth through the pH sensor, temperature sensors, ammonia gas sensors, and ultrasonic sensors. Depth sensors can be implemented to retrieve the water depth level on the Aquaponic pond and the ammonia gas sensor implemented to extract the ammonia gas content in the aquaponic pond by adding and compensating value base on the differs of the error value. T. Abinaya et al [9] proposed a multiple sensors used to continuously monitor the parameters such as pH level, temperature, foul smell detector, Ammonia content, dissolved oxygen, and water level. In the system, MQ4 ELECTRONIC NOSE is used as a foul smell detector sensor. In [10], the authors developed a system to monitor water quality, through Potential of Hydrogen (pH), sending the information with GSM in an Arduino-based architecture.

The Objectives of the proposed system is as follows -

1) Selection of sensors for measuring temperature, oxygen, ammonia.
2) To develop a program for arduino used for fish monitoring system.
3) To develop mobile application for displaying the parameter of aquaculture.

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2.1 Working Steps

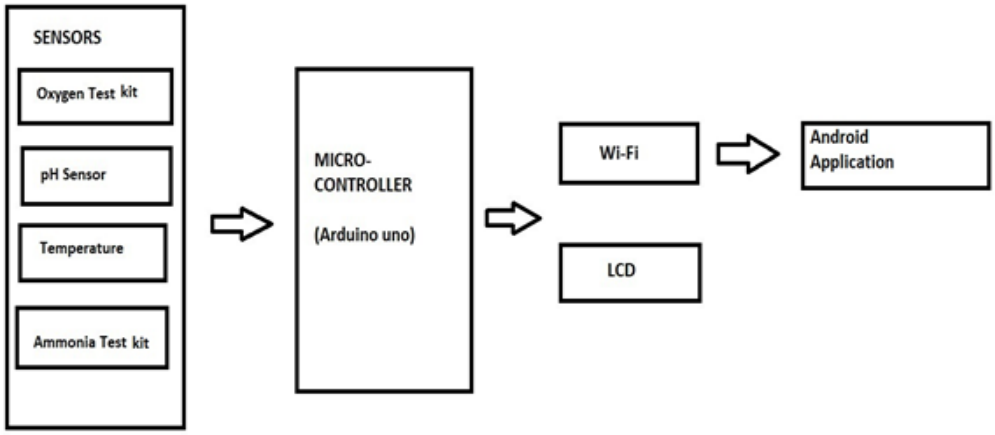

Fig.1 Proposed System

Working Steps:

Step1: Selection of sensor's according to the parameters necessary for the aquaculture -1) Water proof temperature sensor 2) Dissolved Oxygen testing kits 3) Dissolved Ammonia testing kits 4) pH sensor.

Step 2: Designing of circuit: Connecting all the sensors and testing kit as input to Arduino UNO and sending all the output values to the server using Wi-fi module (Node MCU).

Step 3: Developing Android Application: The desired application will be created using the MIT application inventor, which is very user-friendly system. We will get storage from Google firebase and will provide this storage to the application. The firebase will provide API Key. This API key will be included in application backend to show data on application.

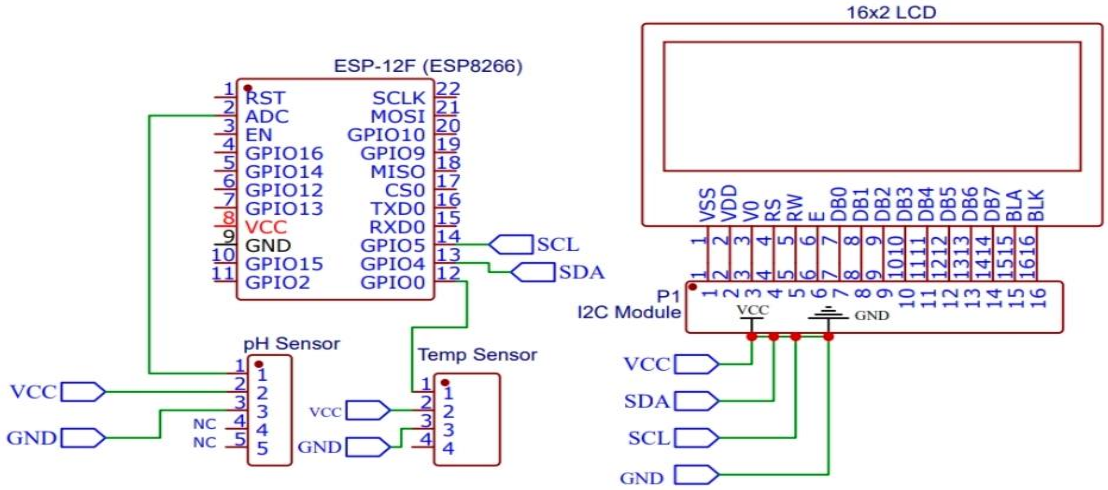

Fig.2 Layout of Proposed System

Step 4: Results:

pH sensors Result: The pH value collected from sensor will be transfer to application through wi-fi module. This value will be shown in pH section of application. Normally the pH scale ranging from 6.5 to 8.5 is suitable for fish production. It the values after the pH will be greater than this scale, necessary action has to be taken.

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Fig.3 pH sensor

Dissolved Oxygen test: A necessary amount of drop of test chemical will be poured in water, after pouring the test chemical we will wait for 4-5 min till the colour of water changes. When the colour of water changes, we will compare the colour of water with the colour chart of oxygen which will be provided in water. If the level of oxygen is low then the colour will be light, if it is high then the colour will be dark.

Fig.4 Dissolved Oxygen test kit

Dissolved Ammonia test: For the ammonia test we will add necessary amount of test chemical in water. And we will wait till there is some change in colour of water. After this we will compare the change in colour of water with the colour chart provided in the application. Water is healthy as long as the level is below 1 ppm. When the ammonia level will be above 1 ppm, the water will not be safe for fish.

Fig.5 Dissolved Ammonia test kit

Temperature Measurement: The output water proof temperature senor that will be connected as input, will be transfer to the mobile application through server. If the temperature of water will be high this will be harmful for the fishes.

Fig.6 Temperature Sensor

2.2 Result

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This system will count various parameters like temperature, ammonia, dissolved oxygen and pH level and display this parameter on android application. This system will be basically used to monitor aquaculture water. Thus, the fish will grow healthy.

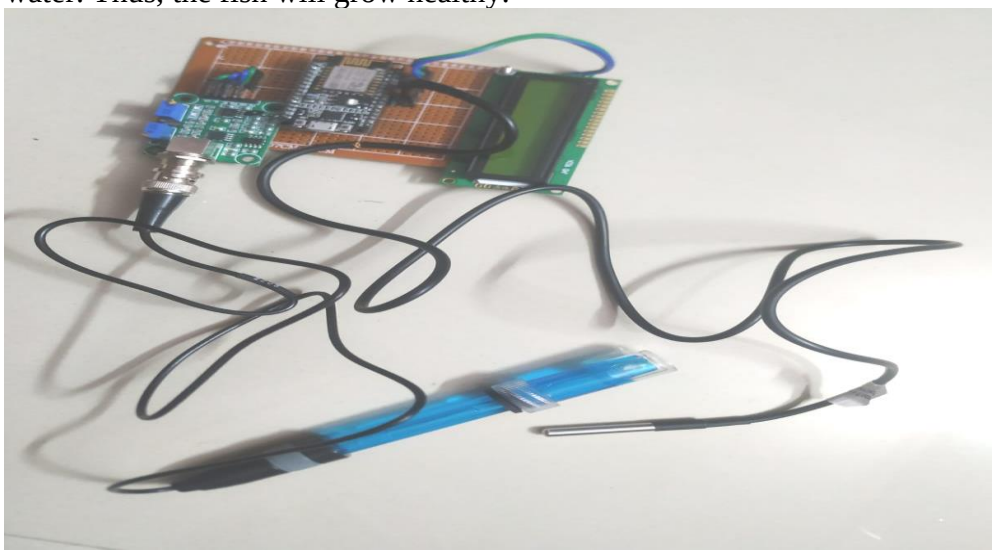


Fig.7 Hardware –Proposed System

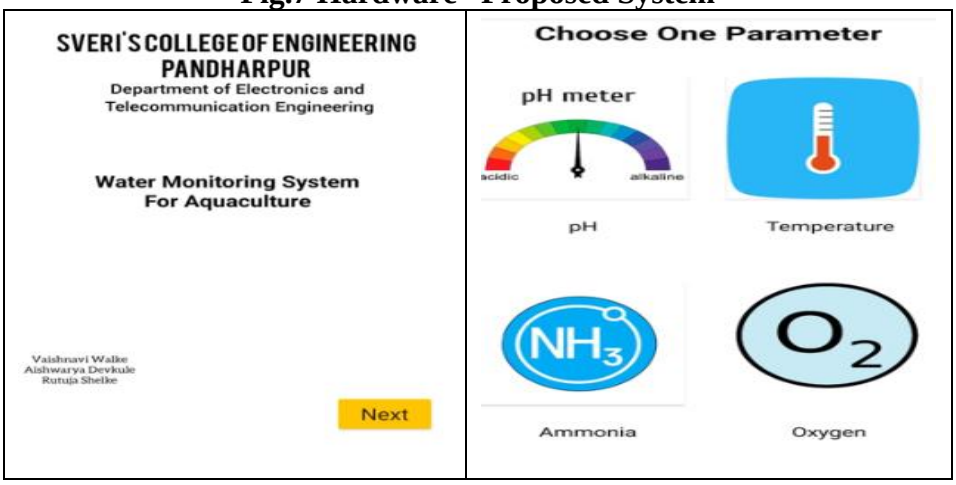
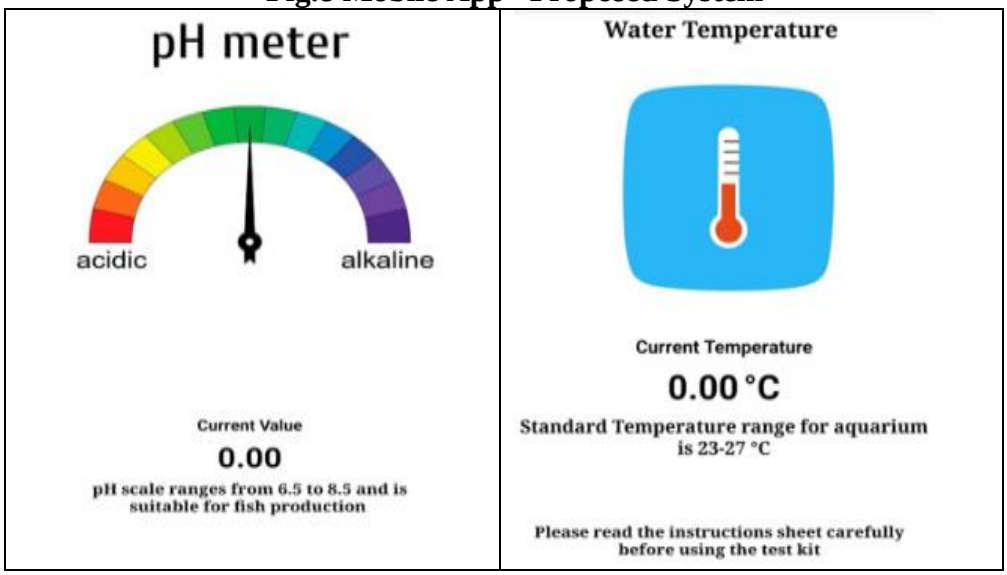


Fig.8 Mobile App –Proposed System



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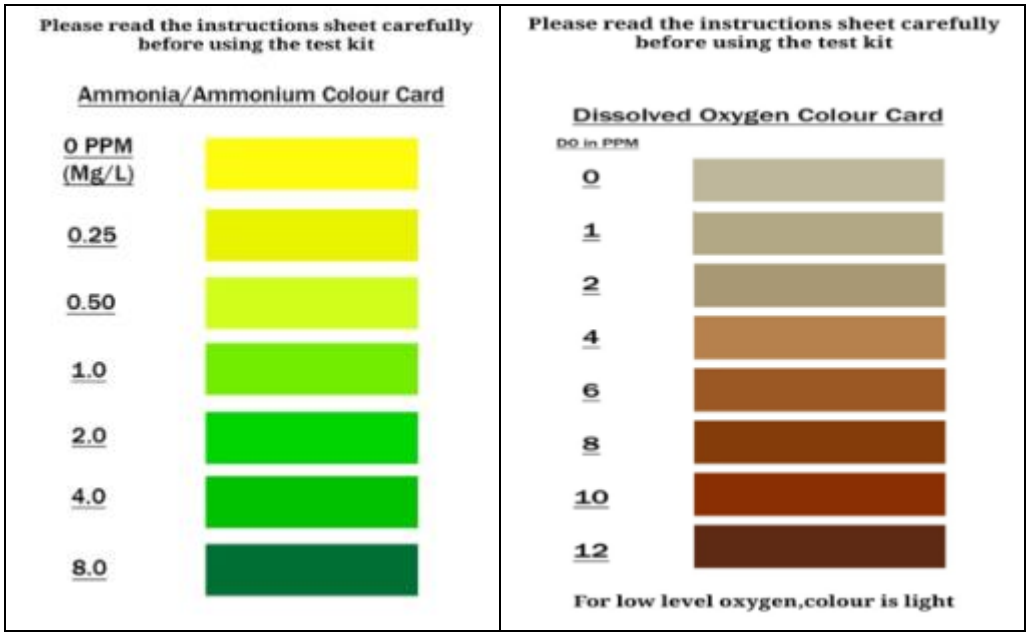

Fig.9 Mobile App – Result-Proposed System

III. Conclusion

Water monitoring of aquaculture is one of the emerging issues in the world and it has become extremely important to increase productivity. This IoT based is used to check water quality using different parameters of the water in aquaculture.

In this project, Oxygen, Ammonia, pH, Temperature of water is checked using sensor with unique advantage and existing technologies. The system can monitor water quality which is low in cost and does not require people on duty. So the water quality testing is economical, convenient and fast. In this project we designed a water monitoring system based on Arduino Node MCU and android app.

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