

Smart Fish Farming using Sensors

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Abstract

According to current market trends, Pisciculture is the most profitable and fastest growing business. Prominent research has been observed in the field of smart farming, and use of biosensors in farming can possibly reform all parts of the business. Farm management system can be improved by introducing an efficient monitoring system that can continuously record and track the variation in environment and its effect on the animal's organic behavior. Such systems will direct us towards sustainable productivity and motivate the society to work for animal welfare. In this paper, I am proposing a biosensor to observe the behavior of fishes and its responses towards the biological changes.

1. Introduction

In Pisciculture, growth of fishes relies on the characteristics of water in the pond. Temperature, pH level, oxygen, nutrient level and salinity of water are the various parameters that should be taken care to increase the fish yield [1]. An appropriate level of these parameters should be maintained otherwise it can have adverse effect on the life of fishes. It is quite difficult to maintain an optimal level because they get rapidly affected by the changing in the environmental conditions. As a result, it is mandatory to closely monitor the characteristics of water for accurate analysis so that accurate measures could be taken to preserve and extend the business. The major focus of this paper is to study the internal facts of pisciculture [2]. It is very important to maintain healthy aquatic life. The continuous monitoring system can help to track the alteration in water characteristics and synthetically altering water contents to avoid problems that are threat to fishes. Biosensor can monitor multiple factors like PH level, temperature and oxygen proportion and collected data can be stored in the form of digital signals [3]. The real time system can collect the data and perform comparative analysis over it. If the current value exceeds the optimal set point then system generated warning will be sent to the farmer so that preventive measures could be taken timely [4,5]. In fish farming, the most challenging issue is continuous monitoring and human cannot keep track of every activity inside the pond to detect the passed away fishes. Humans with years of experience cannot record the activity with precision, so to relax the procedure this type of automation is required. Such type of automated systems are more useful when size of pond is large and we want to reduce human effort. And technology can give better results.

2. Problem Definition

With the increase in demand of fishes, Pisciculture has become the fastest growing business. The major challenge by farmer in fish farming is to have a continuous track of water quality of ponds and synchronize variant management operations independently and concurrently. The advancement in the field of mobile computing, sensor technology and wireless communication has relaxed the process of acquiring and processing and collecting the data. Conventional ways of observing has been overpowered by the automated remote monitoring systems by systematically streamlining the information gathering procedure and has reduced the time delays. Wireless sensor network are used to track the ponds for significant parameters like humidity, temperature PH level, humidity and nutrient content [6,7]. The system will help economically and reduce human effort. The system generated results will be more organized and can be used to minimize the loss in farming and maximize the profit. The sensor network can be deployed in aquaculture field by using minimum sensor node. The purpose is to analyze the off-field and on-field issues responsible for deployment of biosensor and to implement cost- benefit analysis. The procedure can be carried out in following steps:

1. At the first stage, data should be collected and stored in a structured form in database. Due to continuous monitoring, immense data will be collected and it has be stored in a systematic way so that further various time series data mining algorithms could be applied to extract the observant patterns.
2. In the later stage, user friendly interface should be designed to generate alarming message to farmer in their native language so that they can take preventive measures to avoid miserable situations.

To ease out the implementation part, system can be divided into two modules. First module will comprise of sensor that will track the events and store the set points and the other module will receive the data and store it in the database. Data can be displayed in graphical interface so that scientists and farmers can observe and scrutinize the data. Farmers will get system generated messages in their mobile phones in their native language regarding alarming environmental conditions. The interface will circulate the analyzed and precise data. The production of pond gets adversely affected by the amount of dissolved oxygen. Water with low dissolved oxygen is a threat to lives of fishes and make them prone to deadly diseases. The appropriate amount of dissolved oxygen helps in the survival of fishes as it let them breathe, algal respiration and waste decomposition. Another important factor is optimal level of temperature. Temperature affects growth of fishes and immunity. With the increase in temperature values, requirement of dissolved oxygen also increases. Appropriate temperature oversight ammonia toxification, and controls solubility of gases. Major areas that should be monitored are following:

1. Water Temperature :

- a. Calculating the temperature of water.
- b. Equipment's used: Arduino, DS18B20 Water Proof temperature Sensor Probe.

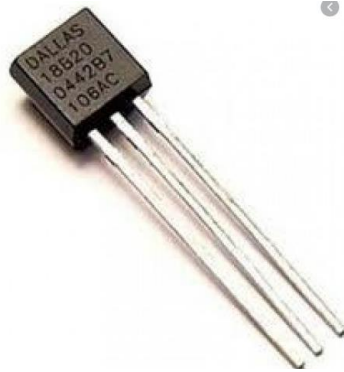


Fig.2.1 Arduino DS18B20

2. Volume of water:

- a. By calculating the water level, we can find the volume of water.
- b. Equipment's used: Arduino, HC-SR04 ultrasonic ranging module.



Fig.2.2 Pin Diagram of Arduino Ultrasonic Range Detection Sensor

3. Varying the agitator speed depends upon the content of oxygen

- a. Finding the dissolved oxygen in water.
- b. Equipment's used: Analog Dissolved Oxygen Sensor/Meter K for Arduino, Analog pH Sensor, Analog Signal Isolator.

4. Exchange of exact statistical data to client using SMS and application

- a. Using computer vision and efficient algorithm.
- b. Capturing the upper layer of water to find is there any floating fishes on it.

5. Assumptions and Dependencies

The workability of the Smart Fish Farming using sensors is completely dependent on the many sensors like Ultra Sonic Range Detection Sensor, DHT11 Sensor and Node MCU. The Ultra Sonic Range Detection Sensor should respond whenever it found an obstacle on the surface of water. It sends the message to microprocessor that it encounter with an obstacle. Then the microprocessor will send the data to the server. Whenever the microprocessor receives another message from the server then it sends a warning message to the owner.

Sensors are required for sensing the changing and Arduino for collecting the information from sensors and for sending the information to the server. We need a website where user can register his/her self for our services. Using this account, he/she can access their account and they can see and analyze the information about their pisciculture yield and growth and health. Server uses the mobile number of the user which is mandatory while creating for sending alert messages to the user if there is any emergency at the pond. Adopt IO trigger through supplying at least 10us sequence of high level signal, The module automatically sends eight 40khz square wave and automatically detect whether receive the returning pulse signal. If there are signals returning, through outputting high level and the time of high level continuing is the time of that from the ultrasonic transmitting to receiving.

3. Conclusion

This paper propose a sensor that can be used to analyze the water characteristics by collecting variant values corresponding to temperature, humidity, PH level and nutrient levels. Sensor will continuously monitor the variation in quality of water depending on environmental conditions and generate warning to farmer by sending text messages in their native language so that they can preventive measures.

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