Technical Review of an Automated Shrimp Farming Industry Based On Internet of Things.

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Abstract

Developing and growing countries are assisted on the social and economic fronts by the InIoT, a fast expanding technology. The third-largest fish producer in the world is India. Aquatic products are generated annually at a rate of 11 million tonnes. IoT usage is expanding in a variety of sectors, including manufacturing, mining, education, transportation, and healthcare. Aquatic creatures are raised in freshwater and marine environments under controlled, natural conditions. However, for fish farming to be profitable and sustainable, major adjustments must be made to the current resource- and labor-intensive practices. The major goal of this task is to develop an IoT-based observing method that uses an embedded device and a smartphone to control shrimp farming and resolve issues. This project will use an ESP32 microcontroller and Google Fire Base to achieve this purpose. With the aid of actuators and sensors, this system can be employed as an embedded system to regulate and keep an eye on significant environmental factors. The pH or the volume of dissolved oxygen are just two examples of parameters. It is feasible to build a system for alert notification that notifies farmers through Wi-Fi and enables them to use an Android app to examine the status of actuators and sensors

***Keywords*：** *ESP32 microcontroller, Google Fire Base, actuators, sensors, embedded*

1. INTRODUCTION

Due to the rising international request for seafood, aquaculture is one of the most rapidly developing fields. Fish is the most sought-after sea food among all of them due to its health advantages. Due to the growing demand for fish, fish farming has a significant impact on the economy of any nation. However, due to insufficient output to fulfil global demand, several nations must import fish. For instance, despite an annual fish supply from both aquaculture and catch, only half of Ghana's need is satisfied. Due to the current supply shortage and the restricted prospects for supply growth, aquaculture has taken on critical relevance for the growth of the fisheries sector in several nations across the world. Since fish illnesses are widespread and directly affect harvesting yield, fisheries management depends on monitoring water quality. A protected farming area might be useful for minimizing production and environmental effects. Such regions may have more consistent water flow, which promotes steady cultivation conditions and waste dispersion. Water quality needs to be regularly monitored and managed because it is a requirement system, pH, dissolved oxygen, wifi, Android app.

For fish. Overfeeding is one of the blunders made by aqua farmers since the leftover food might contaminate the water. Monitoring of the tank's critical components, such as temperature, water level, dissolved oxygen concentration, ammonia concentration, is necessary to avoid unfavorable farming conditions. The ideal temperature should be maintained and managed within the right range because fish are cold-blooded creatures. The fish must have access to enough oxygen for appropriate metabolism; otherwise, they will stay at the surface to collect oxygen, which would slow their metabolism and cause them to eventually perish from a shortage of oxygen. For optimal biological productivity, the dissolved oxygen level should always be greater than 5 ppm, and the pH level should be between 7 and 8.5. Aquaculture is one of the areas that is expanding the fastest in India. Aquaculture is one of the areas that is expanding the fastest in India. It makes up roughly 1.07% of the GDP. An estimate puts the amount of fish needed by 2025 at around 16 million tonnes. Commercial aquaculture was created as a result of overfishing that has depleted natural fisheries. Water quality metrics fluctuate as a result of abrupt climatic changes, which presents challenges for commercial aquaculture.

1. Literature Survey

The PH, temperature, and electrical conductivity of the water were employed as the parameters for water quality in this study. The ESP32, which serves as a server and data processing device, acquires the sensors. paper 2,To help with ongoing monitoring of water conditions based on four physical factors, a smart IoT-based water quality monitoring system is put in place: Turbidity, temperature, pH, and electric conductivity levels are all factors to consider In paper 3, To monitor and manage the water parameters, the author suggests employing an Internet of Things (IoT) system. Ammonia, water level, pH, unpleasant odour, temperature, and the amount of dissolved oxygen in the water are all monitored and controlled by the systemIn paper 4, a scalable, low-cost, low-power, and low-range method for monitoring the quality of water is provided by this system using a LoRa module and the LoRaWAN protocol (LPWAN).The system uses a wireless LoRa module to add sensors to the microcontroller and broadcast and receive sensor data, as well as the IoT platform Thing Speak for testing and displaying sensor readings for water quality.In paper 5, This research suggests an IoT-based approach for monitoring water quality. Solar energy is used to supply the sensors' energy needs.

In paper 6, Mechanical, electrical, and communication components are all incorporated into the system (IoT).A pi camera makes up the electrical component that is connected to a Raspberry Pi B+ module and allows the gathering of real-time video data pertaining to fish. In paper 7, recounts how the prototype that iswas made and preserved in Kumah Farms near Kumasi, Ghana. Making assessments of the water quality was the main objective available to fish farmers at a reasonable cost because they might not have the money to purchase commercial water measurement sensors because they only know what has to be done on their ponds using conventional methods. In paper 8, IoT technology is being used to create a smart fish farm with remote management and observation capabilities. In paper 9, the old method of monitoring water quality has been replaced by the author with low-cost monitoring approaches based on machine learning, the Internet of Things, and cloud computing. The surrounding air and water's temperature can be regulated by the model, which has the ability to change itself.In paper 10, An IoT-based system for a water quality monitoring system for crab farming brings attention to the necessity to maintain threshold values of pond water quality. In paper 11, the fish dialogue system use sensors to instantly control aquarium actuators. In paper 12, Here, an open IoT platform and big data platform are provided to quicken development in rural Africa. Technology is not just restricted to rural areas. In paper 13, the suggested paper's major objective is the routine monitoring of water quality measurements for the purpose of taking preemptive action. In paper 14, Using sensors and actuators, the implement new approaches an embedded system for monitoring and controlling environmental conditions. In paper 15, The Raspberry Pi 3 was used in the design and construction of the mechanism for measuring water quality. In paper 16, Due to the extreme wave, unpredictable wind, extreme remoteness, and current conditions, farming Atlantic salmon in an open environment presents special challenges to structures, equipment, and operation. In paper 17, A model of aquaculture's increasing status is made using an artificial neural network. The rising state model, created in this study using artificial neural network technology, influences a number of water quality indices and could be helpful in tackling expert system congestion difficulties. The outcomes of the experiments show that this strategy works.

2. System Requirements

HARDWARE USED:

DS18b20(temperature sensor), DHT11(Humiditysensor), Water level, Turbidity, PH sensor, Relay*2, Water pump inlet and outlet, Servo motor for fish feeder, ESP32 Microcontroller, MQ135, Ultrasonic sensor and Glass heater

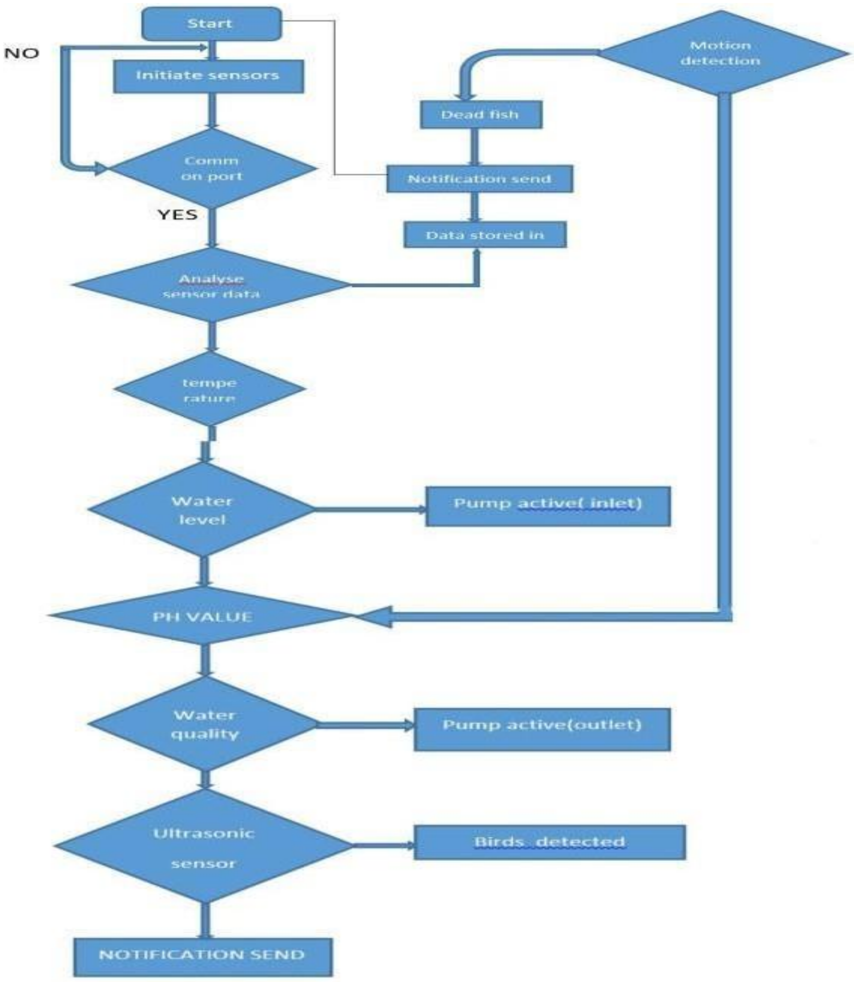
SOFTWARE USED:

Google fire base, MIT app, Arduino IDE and Embedded C

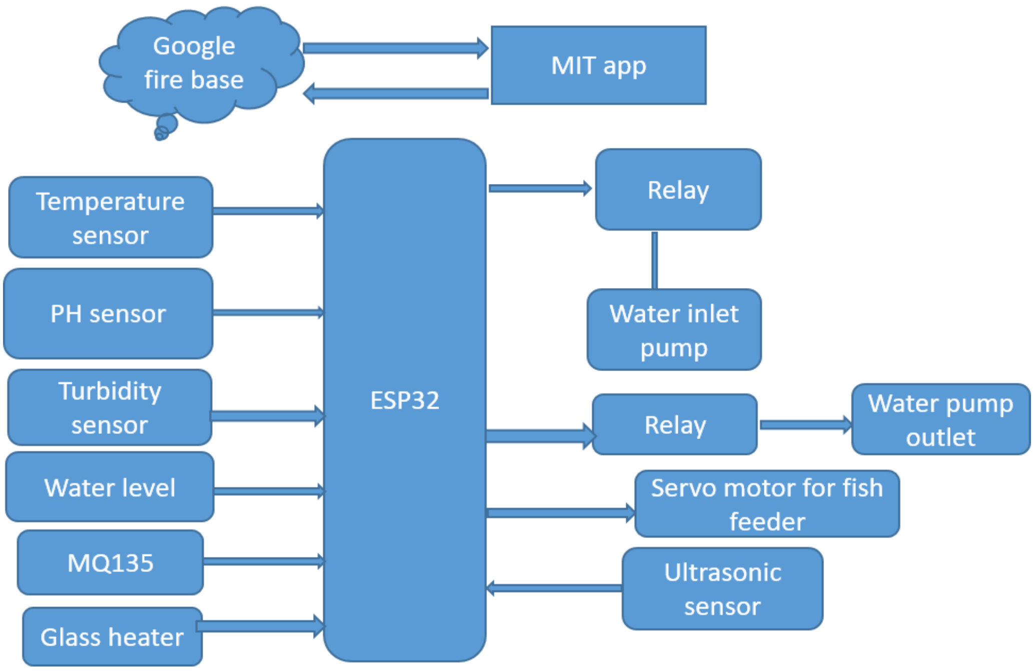
3. Proposed Methodology

In the proposed model we are adding a sensor that checks the temperature and humidity of the water in the aquarium. In case if the temperature increases we will get the notification through an app. In our project the storing module inform the user that an well-organized quantity of food is current in the bowl. The Wi-Fi component comprise the connectivity of the scheme with the internet and stop associated with the customer knowledge. The knowledge is recognized by the ESP32 microcontroller so that the Wi-Fi module is the nature of our scheme which communicates with the customer and the scheme. The notification and alert module provides the user with announcement when there is a absence of food in storing and announcement arises a day before the food storage develops empty to save proprietors time and proprietor doesn’t need to hurry to works to marketplace as he always has ordinary. Also the user gets notification when there is any bird interaction and when temperature is high. All necessary values are stored in a google firebase. A SERVO motor is added to feed food for fish. Relay is used to operate the water pump and stepper motor automatically. Temperature (DS18b20), water level, turbidity and humidity (DHT11) sensors used to sense the data and send to google firebase and it sends data to the app. Temperature sensor is recycled to detect the sea temperature and send it to the microcontroller. A Ph instrument is recycled to detect the water sharpness of the water. Water level is detected by the sensor. Turbidity sensor is used to detect the water purity and sends notification to the mobile application. Relay is used to water inlet by water pump and outlet automatically. Servo motor is used to feed fish automatically. MQ135 is used to detect air quality and Ultrasonic sensor is used to detect the birds' interaction. Glass heater is used to heat when water gets cooled. Wi-Fi is connected to the microcontroller and all sensors detect and send data to the microcontroller and it sends data to the google firebase where data is stored and sent to the app and through mobile app we can monitor these things.

4. Flowchart



5. Block Diagram



6. Proposed an Automated Shrimp Farming Industry Based On Internet of Things

The ESP32, which serves as a server and data processing device, acquires the sensors. pH sensors are used with an esp32 microcontroller and a smartphone app to determine the purity of the water. Any user can use an Android application to check the water quality utilizing the internet and Wi-Fi anywhere in the world that is within the Wi-Fi threshold range.These four parameters are used in various analyses to determine the water's state, and any necessary action can then be taken.[1]. The water parameters are determined by connecting each of adding each sensor separately to an Arduino Uno. The gathered information is sent to an application running on the.NET platform, where it is compared against WHO benchmark values. To ascertain whether the sample is appropriate for drinking, On the basis of the measured data, the water parameters can be examined [2]. The sensor nodes gather real-time data, which is then sent to Arduino to be processed. When the parameters go above the threshold, the processor tells the associated controller to do what is needed. Additionally, these values are transmitted through Wi-Fi to the cloud, from which they may be obtained in the control room. The interested party receives these values in succinct messages through GSM modem. Because it is compatible with them, this technology can be utilized with any kind of aquaculture system [3]. The system uses a wireless LoRa module to add sensors to the microcontroller and broadcast and receive sensor data, as well as the IoT platform Thing Speak for testing and displaying sensor readings for water quality [4]. Using sensors, this system measures the turbidity and pH levels using an Arduino Mega 2560. These sensors collect data, which is then transmitted via a Wi-Fi module, to the cloud. The assessed & displayed data is then captured. via Thing

Speak, a cloud server, and rendered visibly on LCD. This technology is present in the overhead and roof-top tanks, and it can be viewed online from any location in the world [5].

The mechanical components utilized for food dispensing include a stepper motor and a B+ via web interface, both of which are controlled by a Raspberry Pi. There are two feeding options: manual feeding through a web interface and prescheduled feeding by the carrier. While the schedule for planned feeding must be defined in the webpage, manual feeding requires the user to feed the fish using a web interface [6]. The system senses and keeps track of a number of sensors, including temperature, water level, pH, and oxygen level. A microcontroller also manages the aquarium's closed-loop water system, and the MQTT protocol is supported via the online application or mobile app [8]. The system utilizes Lightweight Message Queuing Telemetry Transport (MQTT) and LoRa-based wireless sensor networks to communicate with mobile, embedded, and sensor devices. Sensor nodes serve as publishers in the system while mobile client devices serve as subscribers. A LoRa wireless interface, along with pH, temperature, and salinity sensors, are used to build sensor nodes that monitor water quality. Additionally, a node-red dashboard-equipped web-based monitoring tool is created for gathering data on water quality remotely [9].

The fish dialogue system use sensors to instantly control aquarium actuators. The system enables the creator to modify intelligent control to take into account various water circumstances. The fish have a sophisticated fish feeding system since they could be overfed or underfed. The reasons of loss due to IoT message delays and water control conditions are further examined using measuring approaches and a simulated analytical model [11]. . It is intended for all IoT applications. IoT applications can now be combined with big data capabilities thanks to this platform additionally, the platform may adjust to the limitations and particular needs of consumers in Africa. In order to show the practicality of the platform design, this article first gives an introduction of big data platforms and IoT, describes their technological components, and then shows three instances [12]. Four components make up the architecture. (1). A battery, a solar panel, a DC-DC converter, as well as a charge controller make up a power module. (2). There are sensors for pH, carbonates, dissolved oxygen, nitrate, temperature, and ammonia in a sensor module. (3). There is a processor within each microcontroller module. Due to the Raspberry Pi 3's low operating costs, it is utilised as a computer. (4). Aquafarmers are required to have an application installed on their mobile device, which is recognized as an output module. The obtain data and history buttons are the main two buttons in this program[13]. A single microcontroller board based on an Arduino Uno board contains all of the devices in the farming field. The Raspberry Pi-based data logging system acquires the microcontroller-monitored real-time sensor data in real time. The Raspberry Pi records real-time sensor readings on its SD card. The Raspberry Pi will automatically turn on and off actuators such as an aerator and a pump based on the threshold values of numerous parameters. The farmers might utilize IoT to manage pumps and aerators. Based on the current temperature and humidity, information from a weather forecasting website may be collected. Using an app for a web service [14]. Using small bubbles to oxygenate the water, aquaculture uses this technique to test the water's quality. The quality of the water is measured in a number of areas, including pH, temperature, and dissolved oxygen. The program reader and sensor acquisition software were developed by the data processing device using Python and a Raspberry Pi 3.There are two phases to the test: (1). Performance monitoring technology (2). Stability readings from sensors. Microbubble aeration is used to test the device monitoring in aquariums, and the sensor testing is done in a lab. Using micro bubble aeration, eel aquaculture is carried out. The characteristics employed in this device monitoring are capable of operating effectively [15]. Aquaculture operations will be able to be exposed in six key areas with confidence and safety. (1) Operational decision support and monitoring. (2). vessel design for operations in the open. (3) Fish welfare and behavior. (4) Remote operations using autonomous systems and technology. 5. Buildings for exposed places. (6) Management of risk and safety[16].

7. Results and Discussions

DATASET:

The dataset contains parameters such as temperature, pH, turbidity, weather etc. The result of this dataset is yield (i.e., 0 or 1). For temperature, pH, turbidity, weather values lesser than threshold value the result i.e., yield will be 1 otherwise 0.

K Nearest Neighbor Algorithm:

● one of the simplest machine learning techniques is K-Nearest Neighbor, which is based on the supervised learning approach.
● using the K-NN method, a new data point is categorized according to how similar and stored the existing data is. This indicates that With the K-NN approach, newly generated data may be swiftly categorized into an appropriate category.
● Both Regression and Classification problems can be solved with the K-NN technique, although Classification issues are where it is most frequently utilized.
● As K-NN is a non-parametric method, it does not assume anything about the data it utilizes as a foundation.
● This algorithm retains the dataset and acts upon it when the time comes for categorization; it is sometimes referred to as a lazy learner because it does not instantly pick up knowledge from the training set.
● By storing the dataset during the training phase, the KNN algorithm simply groups fresh data into a category that is strikingly similar to the training data. ● Example: To help you understand, consider the following scenario: you have a picture of a creature that looks like a dog and a cat. You want to figure out which one it is. Because the KNN method is based on a similarity metric, we can use it for this identification. Our KNN model will categorize the data as belonging to either the dog or cat group by searching for traits in the new data

set that are similar to those in the pictures of cats and dogs..

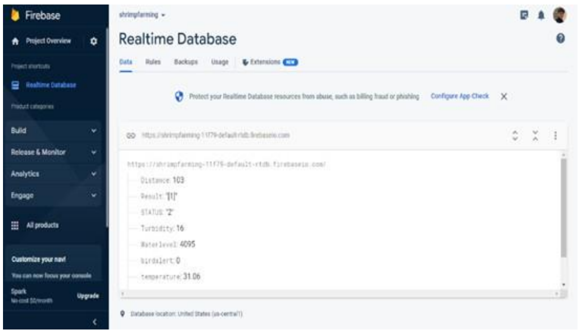
Why KNN procedure?
● KNN is renowned for its scalability, readability, and simplicity. Learning and application

are quite easy and natural.

- It's simple to interpret. The mathematical calculations are clear and simple to understand.
- Less time is spent on calculations.
- It is effective and efficient due to its great predictive capability.
- For large training sets, KNN is particularly successful.
- As there are no underlying assumptions in this approach, it is highly helpful for nonlinear data.
- This approach can be applied to both classification and regression, making it flexible.
- It is reasonably accurate.

GOOGLE FIREBASE CLOUD:

Firebase is an application development platform supported by Google that allows developers to create apps for iOS, Android, and the Web. Firebase offers tools for creating marketing and product trials, tracking analytics, reporting, and fixing app issues.



MIT App Inventor: The following are the top five objectives of the MIT App Inventor team:

Creating Capacity: App Inventor puts out a lot of effort to increase the range of formal and informal mobile computing education that is provided to adults and children globally. We are constantly creating and disseminating training materials and tools through this initiative to help educators create new apps.

With our block-based programming language, we are committed to establishing a substitute onramp for computational thinking education while advancing the study of computer science. We took an active position in national and regional policy discussions regarding standards. We are prepared to participate in and provide our assistance to large-scale campaigns that aim to reach new audiences in order to raise awareness. Updating and preserving the instrument: We pledge to maintain MIT App Inventor as a state-of-the-art free service available to users for the foreseeable future. We continuously update the product, patch bugs, improve performance, and add new features to achieve this.

8. Discussion

We used a number of sensors in this project, including a temperature device, a humidity device, a ph sensor, and a water equal detector. All of the information since the sensors was directed to an esp32 microcontroller, which then accepted and sent the information to Google FireBase, a cloud storage system that would store the information and make it available to an Android app. Relay is also used to automate the control of water filling by a water pump and fish feed by a stepper motor. It will be automatically controlled via an app.

9. Conclusion

Water quality must be sustained since contaminated water cannot be used and negatively impacts ecosystems. There are numerous ways that can be used for the design and implementation parts. For added convenience, Internet and Wi-Fi can be used together to produce greater results than any other system at a lower cost. Aquaculture organisms can be used in neural network-based systems. It is possible to carry out design and implementation using an ESP32 microcontroller, with laboratory-scale monitoring. The pH sensor, which measures acidity, the temperature sensor, which senses temperature and humidity, and the stepper motor, which drives the stepper motor, are all submerged in a shrimp farm. The temperature level during the day is lower than the air temperature, and vice versa. Both automated and manual control mechanisms can be used to feed fish. With our app, we can function.

10. References

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