Modernizing Aquaculture by Improving Water Factors using IoT

Prof. Savitha T, Archana M, Bhuvana A, Dharithri
ISE Department, Sri Krishna Institute of Technology, B'lore-560090, India
Faculty ISE Department, Sri Krishna Institute of Technology, B'lore-560090, India

***Abstract*:- Internet of Things (IoT) is a very fast-growing technology and the field of IoT is extending its wings in most of the areas today. This system is outlined to monitoring of water quality of aquaculture utilizing Node MCU, various Sensors and Android application. Water quality parameters used in this work are temperature, pH, turbidity, dissolved oxygen and a chemical detector. A user can monitor the water condition using an android application through the wifi and internet from any location and can provide an easy-to-use low-cost system.**

Keywords: IoT, Aquaculture, ESP 32, Android mobile application.

I. INTRODUCTION

Aquaculture also known as aquafarming, is the controlled cultivation of aquatic organisms such as fish, crustaceans, mollusks, algae and other organisms of value such as aquatic plants (e.g. lotus). Aquaculture involves cultivating freshwater, brackish water and saltwater populations under controlled or semi-natural conditions, and can be contrasted with commercial fishing, which is the harvesting of wild fish. Mariculture, commonly known as marine farming, refers specifically to aquaculture practiced in seawater habitats and lagoons, opposed to in freshwater aquaculture. Pisciculture is a type of aquaculture that consists of the culturing of fish (fish farming) to obtain fish and fish products as food. A recent study from the United Nations shows that aquaculture can improve food security and nutrition by increasing the amount of seafood available for people to eat. If done correctly, aquaculture increases food production, boosts economic growth in coastal and rural areas, and can help keep waterways clean. The food and income benefits provided by inland capture fisheries and aquaculture can afford opportunities for empowering individuals where opportunities in other sectors are limited. Inland fishes are important food and nutritional resources, especially rural economies in developing countries. Sustainable, productive fisheries and aquaculture improve food and nutrition security, increase income and improve livelihoods, promote economic growth and protect our environment and natural resources. Small-scale aquaculture is especially important for meeting the world's growing demand for fish.

II. BACKGROUND STUDY (LITERATURE)

The main goal of this review study was to discover solutions given by other writers and evaluate the limits of their methodologies. After examining all options, the best solution will be implemented.

In [1] the author uses the concept of marking the attendance of the student using face recognition. They proposed a methodology where they use the concept of Principal Component Analysis, local binary pattern. However, the system's effectiveness and accuracy in recognising human faces remain concerns. To tackle this difficulty in the future, researchers will adopt rapid PCA with back-propagation.

The authors of [2] developed an approach based on the Histogram of Oriented Gradients notion and utilized Firebase to store attendance data. The accuracy of the labelled faces was 99.38 percent.

The authors of [3] suggested a face recognition algorithm based on Eigenvector and Eigenvalue. Here they faced problems when the threshold value was less than the calculated value.

In [4], the planned system included a PC with the extremely useful and multi-functional machine language "MATLAB" as well as Microsoft Excel. They attached the camera to the PC and verified that the camera driver was correctly installed and compatible with MATLAB before acquiring the picture or video. Cropped faces are utilised for identification after detection. The suggested method compares these cropped faces to the face database, and after satisfactory recognition, the system records the attendance in an excel sheet.

In [5] the authors implemented a methodology where Deep neural networks (DNNs) were utilised for face recognition, and they had a unique combination of the YOLO V3 algorithm and the Azure Face API allowing our system to automatically register attendance in real time, saving time and ensuring correctness.

In [6], the authors have proposed a methodology where the attendance management system based on facial recognition offers correct attendance information to students in a simple manner and uploads the information to the server via Ethernet wire. This system is user-friendly, simple to operate, and provides enhanced security. This system provides student information, and if there are any absences, information will be communicated with the appropriate proctors and parents.

In [7] the LBPH algorithm for face recognition and the haarcascades for face detection are used in the proposed automated attendance management system. This system includes features such as photographing pupils and recording their information in a database, training the pictures in the database and on the camera, and tracking persons entering the classroom. When students enter the classroom, the system recognizes their faces from the camera and pre-processes them for subsequent processing.

In [8], the authors have used a methodology where they used Viola and Jones algorithm for face bounding box generation. Principal Component Analysis was used for further processing of data and attendance was marked in the database.

The authors of [9] employs the Viola-Jones Algorithm to detect objects, Principal Component Analysis to compress data, and Local Binary Pattern Histograms to quantify texture. However, with the Viola-Jones training approach, they encountered time difficulty.

The authors of [10] classified faces using eigen faces and fisher faces, and utilised LDA to extract further distinguishing traits from them. The sole disadvantage is that they may be vulnerable to extremes in exposure (brightness).

The writers utilised the notion of the Internet of Things in [11]. The suggested technique makes use of microcontrollers and personal area networking systems. The module is built using Internet of Things components. However, the data transfer rate is sluggish, and thus can only be used for a limited distance.

The authors of [12] employed a methodology based on CNN and mathematical methods to try to extract significant information from an image, encode it, and compare it to another image stored in a database for a face recognition system. The main drawback is that it needs a large volume of data.

The authors of [13] suggested a system for estimating the number of cameras needed to capture all students' faces at a given resolution for various classroom sizes for automated attendance using face. The only drawback is that employing numerous cameras might cause image shutter speed to slow down.

In [14] the authors have used a raspberry pi and the cloud-based approach for storing the captured attendance. But the drawback is that the data cannot be fetched in offline mode as it needs an active internet connection.

In [15], The viola Jones Algorithm and Local Binary Patterns of Histogram were used to accomplish face recognition. Images of students are discovered and recognized using these techniques. They had saved student photos in the dataset. The discovered photos are compared to those in the dataset. The kids who are correctly recognized are then automatically added to our database. When any individual other than the list of photos of pupils present in the dataset is found in the classroom, these unknown faces are flagged as invaders. When an intruder is spotted, a siren sounds as a warning signal.

In [16], the system was evaluated using three different algorithms, with the KNN method proving to be the most accurate at 99.27%. The system was evaluated under a variety of situations, including lighting, head motions, expressions, and student distance from the camera. When evaluated under various conditions, KNN outperformed the competition, earning an overall accuracy of 97 percent. When evaluated under the parameters described above, CNN had an overall accuracy of 95%, whereas SVM had an accuracy of 88%. CNN was shown to have minimal time complexity when it came to time complexity. SVM was discovered to have the highest time complexity of the three methods described.

In [17], the author discusses the intelligent classroom attendance system's general design concept before improving the AlexNet convolutional neural network. Furthermore, we examine the need and efficiency of the modification from several perspectives before introducing RFID into the system. Finally, the back-end attendance management system's function and description are completed. The experiment shows that a smart classroom attendance system based on facial recognition technology is both efficient and stable, lowering classroom attendance costs significantly.

The system was implemented utilizing LBPH (Local Binary Pattern Histogram) or facial recognition and detection in a specific region within the surveillance camera by the authors of this research [18]. After achieving good results from several experimental evaluations of this approach, they also have trustworthy outcomes for pose variance and lighting. This approach takes much less time to process the entire image.

In [19], the authors have implemented the system using Dlib library. Face detection was done using YOLO model and was stored to the database. In the later part they used Amazon Web Services face recognition API for detecting the faces in real time. When comparing the recognition accuracy of the face recognition library with the LBPH classifier, AWS performs better. The Face recognition library is equally simple to use and does its objective with 99.38 percent accuracy using Dlib. Even a person wearing a mask may be detected using the AWS recognition API, which can function in low-light conditions. However, the other two approaches all require resolution augmentation algorithms to function in low light, and they will be unable to distinguish someone wearing a mask on their face. The Flask framework was used to deploy the various models for real-time testing.

III. METHODOLOGY

The proposed approach focuses primarily on safety measures, and all precautions should be taken when it comes to aquaculture.

All sensors, such as turbidity sensor, dissolved oxygen sensor, temperature, water level sensor, and pH sensor, as well as actuators such as water pump and water filter, are coupled to the ESP 32. All of the sensors and actuators are linked to the ESP 32 in the block diagram illustrated in Figure 1. NodeMCU-ESP32, comfortable prototyping is possible with simple programming via Luascript or the Arduino IDE and the breadboard-compatible design. This board has 2.4 GHz dual-mode Wifi and a BT wireless connection. The turbidity sensor measures the amount of dust particles present in the pond, In this prototype, the upper limit is set to 250.

These sensors are placed inside the water tank and also actuators like water pump and water filter connected to ESP 32 and then stops after the turbidity level is controlled.

When the water level is low, the water level sensor will monitor the water level in the pond. In terms of aquaculture monitoring, pH is the most important factor. The pH in this system is kept between 5 and 9, and a sudden shift in this causes the outflow water motor to be automated in the same manner that fresh water is pumped into the pond. The pH sensor in this module is version 1.1, which provides the highest level of water pH accuracy.

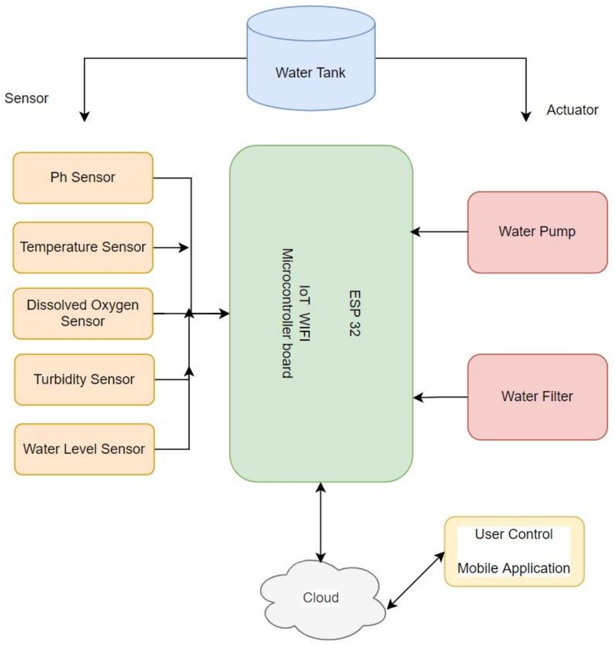

Fig.1. Block diagram of the system

Another important factor in aquatic species' proper growth is dissolved oxygen. The oxygen level should be kept between 3.5 and 5 mg/L for optimal development. The software is set up so that if the level falls below or above this threshold, the oxygen booster kicks in and increases the oxygen content in the water. The temperature in this prototype is kept between 28 and 40 degrees Celsius. If the temperature rises beyond the set point, the cooling tubes will activate, chilling the water and making it ideal for aquatic life growth. module is v1.1 which gives the maximum accuracy of the water pH levels.

A Wi-Fi module is included inside the ESP 32. The data from the sensors and the state of the actuators is transferred to the cloud server through Wi-Fi, and the user may watch all of this data using an Android mobile application built in MIT App Inventor. In the event of an emergency, a message message will send to farmer directly through GSM module.

IV. ALOGRITHM

Step1: Set up all five sensors and actuators.
Step2: From time to time, collect sensor data and who will relay it to the controller.
Step3: The processor processes the data and enables/deactivates the corresponding actuators depending on the conditions created by the controller using the sensor data.
Step 4: Using Wi-Fi port in ESP 32 it will update the state of actuators/sensors on the Android application
Step5: In the event of an emergency, an SMS will be sent to the farmer via GSM for the required actions.
Step6: Repeat the Step2 through step5.

V. CONCLUSION

As India is a developing country it must evolve into technology and should increase the GDP. Aquaculture is at the forefront of growing the economy through this proposed system, we can increase the quantity and quality of aquaculture production and can save labor costs by switching to automated technology. This system can be expanded by the addition of a feeding system, camera to detect the movement of the fishes.

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VI. REFERENCES

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