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Smart Fish Tank System Using Artificial Intelligence Based Internet of Things

Santhosh G R
B.Tech, Information Technology
National Engineering College,
Kovilpatti
1915046@nec.edu.in

Jai Kumar C S
B.Tech, Information Technology
National Engineering College,
Kovilpatti
1915033@nec.edu.in

Surya Prakash M
B.Tech, Information Technology
National Engineering College,
Kovilpatti
1915055@nec.edu.in

Dr.R.Muthukkumar
Professor, B.Tech, Information Technology
National Engineering College,
Kovilpatti
muthukumar@nec.edu.in

***Abstract*—In the last few years, peoples were interested in breeding the pets. Fish farming is one among them. The peoples have to spend lot of time in on feeding, changing the water, monitor the oxygen level, managing the lights and temperature in the tank. Hence it is important to automate the above said process by using various recent technologies. In this paper, the smart fish tank system is used to monitor the fish and to control the process inside the tank. It uses artificial intelligence - based internet of things (IOT) technology that is combined along withthe sensors to get real-time operation for controlling the fish tank. This system performs detecting the pH level in water, monitoring the temperature, aeration of the system, as well as water renewal efforts. It improves survival rates of fishes in the tanks. The users able to monitor and control the process with the help of the mobile application. This system also helps the farmers in reducing their manual work which is required for maintaining the fish tanks.**

Keywords: Smart Fish Tank, IoT, Internet of Things, Automatic Fish Feeder, Smart Aquarium

I. INTRODUCTION

The Smart Fish Tank System using Artificial Intelligence is an innovative way to make the lives of fish owners more convenient. It uses AI technology to monitor the water quality and provide automated maintenance for the tank. The system can detect temperature, pH levels, and other environmental factors in order to provide the best possible environment for the fish. It can also maintain a consistent level of food and oxygen in the water, as well as alert the owner when something is off or if the fish needs to be fed. This system will make the lives of fish owners easier and more enjoyable, as they can trust that their fish are being taken care of without having to worry about it.

It is a revolutionary new technology that can revolutionize the way we keep and maintain our fish tanks. This system uses advanced artificial intelligence algorithms to analyze the water temperature, pH levels, and other parameters to provide a healthier environment for the fish. It can also detect and prevent disease, allowing fish to live longer and healthier lives. The system can be set up to monitor the tank and provide notifications when something needs to be changed or adjusted. This system can also be used to provide automated feeding and cleaning schedules, so that the fish can get the best care possible. With this system, we can ensure that our fish are getting the best possible care and are living in the most comfortable environments.

This project aims to create a smart fish tank system that uses artificial intelligence (AI) to monitor and manage the temperature, water level, and other environmental conditions of the tank. The system will use sensors to detect changes in the environment, and use AI algorithms to analyze the data and make decisions to adjust the environment based on the data. The system will also provide feedback to the user, such as alerts if the water level is too low or the temperature is too high. Additionally, the system will be able to suggest food types and feeding schedules for the fish. To develop a smart fish tank system using artificial intelligence. The system will be equipped with sensors and cameras to monitor water quality and the surrounding environment, as well as to monitor the behavior of fish in the tank. The system will use AI algorithms to detect and analyze data from the sensors and cameras, and then use this data to make decisions about the environment and the health of the fish in the tank. The system will be able to adjust the water parameters, such as temperature and pH, to ensure the health of the fish, and will be able to provide timely alerts when the conditions are not suitable for the fish. The system will also be able to suggest changes in feeding and other activities to ensure the health of the fish.

This system will be able to detect and recognize fish, monitor their health, and provide appropriate environmental conditions for their well-being. The system will be able to monitor water parameters such as pH, temperature, salinity, and oxygen levels. It will also be able to detect and identify any disease or other health issues in the fish. The system will then be able to provide targeted treatments and advice on how to improve the fish's health. Finally, the system will be able to provide information on the fish's behavior, enabling the user to better understand and interact with the fish. This project will improve the fish-keeping experience and increase the overall happiness of fish owners.

II. LITERATURE SURVEY

Just lately improvements in IOT have aided in the digitization of fish tanks, where several smart systems are either commercially available or have been published in the literature, allowing for the control and monitoring of various

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parameters inside these systems. onetheless, clever fish feeding practices that efficiently and precisely determine feeding parameters (such as frequency and pellet release rate) have not received considerable research.An earlier study examined the use of fish feeding The use of computer vision in a sustainable aquaculture feeding system was examined [6]. This research looks at the appetites of fish in a fish tank using computer vision to eventually distribute pellets automatically or manually. Another study employed a PIC microcontroller to construct a pellet dispenser system for managing the release of pellets in smart fish tank environments [8].The focus of this study, however, was on the mechanical device of the feeder rather than effective feeding of fish based on fish tank conditions. Furthermore, a previous study proposed an IOT-based fish feeder system that feeds fish at regular intervals at specific times and measures user-specified time parameters using various sensors. [9]. Despite the fact that this food feeder system was discovered to boost feed efficiency and decrease time consumption. An earlier study examined the use of fish feeding The use of computer vision in a sustainable aquaculture feeding system was examined. Similarly, a Raspberry Pi-based fish feeder system was created, with users able to access feeding procedures via a web application [10]. This system's interface allows for manual fish feeding, setting and changing the feeding daily schedule, and a camera that monitors the fish tank and allows the user to verify tank status. In essence, recent time some smart fish feeding systems have been presented in the literature, but there has been a limited amount of work done in fish tanks to integrate the factors of accuracy or specific time to determine the amount of food feed for fish to be released by the fish feeding system. As a result, the gap addressed in this publication is significant to research..In[11] the author proposed a system for monitoring the fish tank environment. In this system, the data of the fish tank environment was monitored by using sensors. The sensors are placed indifferent locations within the fish tank. The sensors are used to sense the light, temperature, pH level, and oxygen level in the fish tank. Hence the data's of the fish tank environment is monitored by the sensors fit in fish tank that display in the webpage where data transmitted from the microcontroller. The microcontroller is used to process the data and sends it to the server. The data are stored in database using server. The data of the fish tank environment is monitored by the sensors and transmitted to the microcontroller. The micro controller is used to process the data and sends it to the server. The server data are reset in the database. The data stored in database can be accessed by the user using the web application. The data of the fish tank environment is monitored by the sensors and transmitted to the microcontroller. The microcontroller is used to process the data and sends it to the server. The user can view and accessed the data in the web application.

III. METHODOLOGY

In the proposed system, the water quality from the fish tank and the data from the fish tank is pushed to cloud and the data can be viewed in the web application and android application and other modules work accordingly.

Live Data Accessibility

The sensor collects the data from the water present in the fish tank using the sensors such as DS18B20 to measure water temperature sensor, Analogue pH sensor with Amplifier Circuit to measure the pH quality of the water in fish tank, HC-SR04 Ultrasonic sensor to measure the water level in the fish tank, Turbidity sensor with module to measure the turbidity of the fish tank. The raw data from the sensors is received by the Arduino and process the data and transfer the processed data to the Raspberry Pi through serial port and it publishes the data from the Arduino using MQTT protocol on specific topics. The published data is received by subscribing to the specific topics at the web application and android application. So that the user can view the live data of the fish tank. The figure 1 describes the process flow.

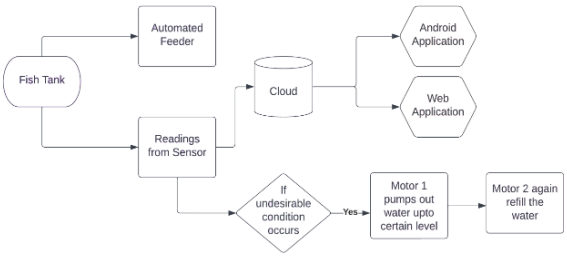

Fig. 1 Proposed System Block Diagram

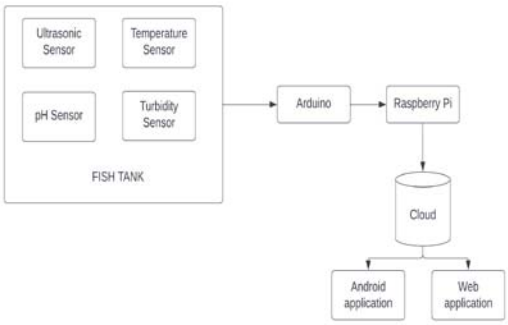

Fig. 2 Live Data View Process

Water Replacer

If the water inside gets contaminated that, if the quality of the water gets changed and it gets nearer to the non-suitable condition for fishes to survive in it. Then the water inside the fish tank is pumped out by the motor 1 to Auxiliary tank 2 the certain level (up to the minimum level in which fishes can survive). After pumping out the water from the fish tank, the fresh water in the auxiliary tank 1 which has suitable condition for the survival of fishes is pumped into the fish tank up to the certain level which is often monitored by the ultrasonic sensor. When the particular level gets reached the pumping process gets stopped. The Figure 3 describes the process of water replacer process. Here we use the 12 volts water submersible motor for the pumping processes in both fish tank and auxiliary tank.

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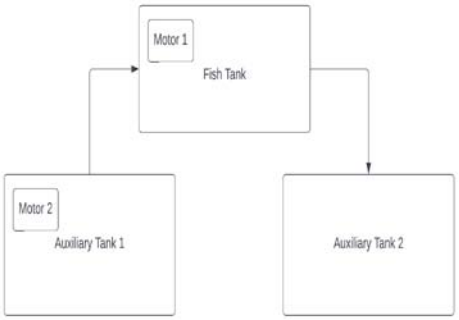

Fig. 3 Water Replacer Process

Automatic Fish Feeder using Artificial Intelligence

The smart fish feeders for IOT driven algorithms are limited. So in that case it is necessary to create the other. The smart fish feed is the essential one to comprehend such as feeding the fish within the fish tank. Various studies were conducted to comprehend the factors, and the key ones are summarized in table 1.

TABLE 1 FACTORS AFFECTING FISH INTAKE

Factors	Effects
Water Temperature	The water temperature increase can induce the increase in food intake like tracking the temperature of the water is critical in determining the amount of feed discharged in fish tank
Oxygen	The aquatic environment need oxygen to survive. If the water oxygen level drops, fish will consume less food and will require more frequent feeding. Monitoring the optimum oxygen level is also important.
pH	Various types of fishes requires different water pH levels but some of the aquatic animals tolerate higher pH level compared to other fishes. If the pH level falls outside of the range, the fish will get stressed, which may lower hatching and survival rates.
Stress	Stress causes discomfort and it results in physiological responses. It has a negative impact on growth, digestion and a change in eating behavior is a symptom of a behavioral response to fish stress. When fish are subjected to stressful situations, their food intake decreases and they grow slowly.
Light	Light influences the intake of fish food to an extent. It is a crucial aspect since an increase in light intensity promotes feeding and a drop in light level discourages feeding.
Ammonia	Ammonia is a harmful chemical that threatens aquatic ecosystems, and its prevalence is caused by overstocking and overfeeding. When the ammonia level in water rises, people consume less food.

The above factors are calculated from the fish tank using sensors though some of them cannot be calculated they can be left for the calculation. Although we can use the manual feeding method in which the feeding parameters such as amount of pellets to be feed, feeding time and feeding frequency. These can be automatically decided using the artificial intelligence based smart fish feeding algorithm. The outlook of the algorithm is

- Derive the values of the Factors
- Get number of fishes
- Adjust the amount of the feed(pellets)
- Adjust the frequency of the feed
- Adjust the time to feed

IVRESULTS

The Figure 4.1(a) shows the Web application's UI. On the left side of the UI we can see the parameters of the water and on the right side of the UI, we can see the value of that parameter which is generated from the sensor present in the Fish Tank. The value is transmitted through the MQTT protocol and the web UI is connected and subscribed to the MQTT by using JavaScript. The Figure 4.1(b) shows the Android application's UI. In the android application the live data is shown in the format of the graph (line chart). The android application also connected to the MQTT protocol and the live data is pushed to firebase so that old values can also be viewed and the graph shows the values of the last ten data inside the graph. Both the web application and the android application also haves the authentication pages and user registration pages for login.

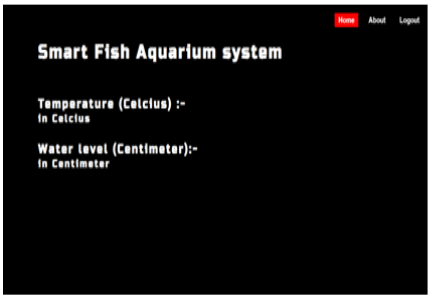

Figure 4.1(a)

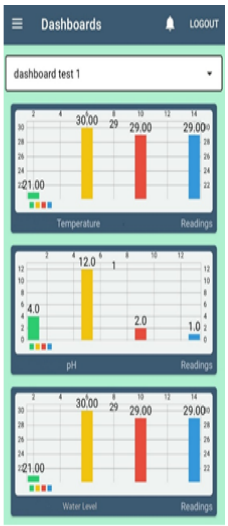

Figure 4.1(b)

V CONCLUSION

The smart fish tank system using artificial intelligence-based internet of things is to develop a system which can monitor the fish tank and provide information to the user about the fish tank. The system is designed using various sensors and controllers. The sensors are used to monitor the water level, temperature, pH level and the concentration of dissolved oxygen in the water. The controllers are used to control the water pump, aerator and the light. The system is also equipped with a camera which is used to take pictures of the fish tank. The system is connected to the internet and the user can access the information about the fish tank from any location.

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We acknowledge indicates this work is unique, has not been published anywhere, and is not presently being considered for publication elsewhere

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