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"SMART AQUARIUM USING IOT"

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Abstract: Being in the decade of developing information technology, as well as the development of lifestyle of every individual as pursuit for a better life, people became busy doing things to earn a living. Life is not all about earning and working cycle. People tend to have hobbies and one of these is taking care of fishes in an aquarium.

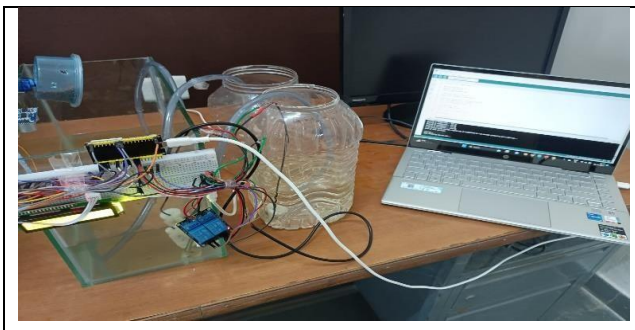
Smart Aquarium "the smart homes for aquatic animals" is an idea that provides an artificial environment that aquatic animals need for their survival. In modern days, many people have fish as their pets at home. The fishes have been fed by the aquarist in the aquarium tanks which demands a proper setup for maintenance. The problems faced are changes in water quality, feeding the fish, maintaining the temperature, controlling the lights, and difficulty checkingthe conditions of an aquarium manually. Therefore, it's necessary to monitor the physical parameters closely and enhance the water condition. So, this project proposes a system that is equipped with sensors to be operated in real- time. It performs temperature monitoring, water pH level detection, turbidity detection, and fish feeding. An IoT- based system is implemented to monitor and deliver the status of the aquarium to the user's web application. This, intelligent aquarium management has been implemented with a temperature sensor, pH sensor, and turbidity sensor so that the fish is neither over nor underfed and thereby reducing the manual effort required in the maintenanceof the aquarium. This research is significant towards IR4.0 system development in supporting fish pets and larger project for fish breeding in the pond can be sampled with this project that contributes to economy impacts for the country.

Keywords: IoT (Internet of Things), ESP, pH, Feeding, Internet, Temperature.

I. INTRODUCTION

Nowadays it's very difficult to maintain aquarium. Fish need utmost care because their environment is completely different from land animals, so they need specific conditions like a temperature range, pH. So Aquarium have to maintained properly to make the life of fish so healthy. This is not Easy or equivalent to the natural habitat. Even Many scientists have worked on the effects of meteorological and hydrological diversity with respect to thespatiotemporal scales. The maintenance of fish aquariums is a very difficult task itself. In the existing system personhave to manually monitor and control the parameters of an aquarium. like feeding of fish, lighting, temperature, etc. The fishes need to be fed twice a day even this requires the owner to walk up to the fish tank and feed the fish manuallywhich makes the task of maintaining an aquarium much more difficult. We came up with our project namely IOT Based Smart Aquarium System. It is a low-cost system with better efficiency. It can be placed in any aquarium to replace the manual maintenance procedure by its automated process. The project is an automated system to take careof fish. The Smart aquarium system is a simple system that helps a user to monitor the different conditions of water like temperature, pH value of water. Also, it allows the user to perform actions like fish feeding and controlling temperature and controlling lights.

Manually control aquarium



IOT based Smart Aquarium System

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II. OBJECTIVE OF THE STUDY

Generally, the study aims to develop SMART AQUARIUM USING IOT. Specifically, it aims to:

1. Plan the entire layout and organization of the SMART AQUARIUM USING IOT.
2. Analyze the problems in fish keeping and create solutions by the execution of the project.
3. Design the software and hardware that is cost-efficient, optimal, and environmentally-friendly.
4. Evaluate the over-all experience of the user with the system; and the over-all performance, reliability and accuracy of the whole system.

III. IMPORTANCE OF THE STUDY

This paper reviews studies ease of fish keeping. Fishes are protected by law as stated in the Fisheries Act (Act No. 4003) and Act No. 2590 and thus the study is believed to promote the law, by keeping the fish healthy environment thus, making the fishes also healthy.

Primarily, the fish owners will benefit from this project since they can have real-time monitoring of the aquarium without any technical interventions.

The fishes will be definitely considered pets, not urban prisoners in the implementation of the system.

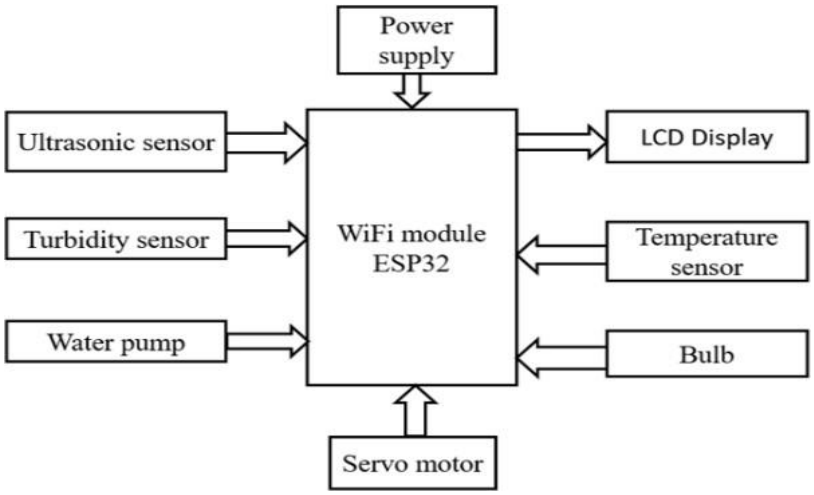
The environmental and animal care advocates will benefit from the project since the system promotes their advocacy of not harming animals.

The government will benefit from the system, especially the Bureau of Fisheries and Aquatic Resources, since the use of the system ensure healthy environment for fishes that minimizes their problems of monitoring if there are fish keeping malpractices in households which is obviously different to monitor in real-time.

IV. BACKGROUND AND RELATED WORK

This paper reviews studies of some of the journal papers have implemented an IOT based system which monitors and controls the whole aquarium automatically and provides real time status on the user's Smartphone application. It contains water quality management in which it will monitor the physical changes in the water and will maintain it to the ideal conditions, with required changes. The aquarium will perform all the steps automatically like temperature control, turbidity level control, light monitor, feeding, water renewal etc. The sensor node, we will use the Arduino Nano board and SX1278 LoRa-02 Transceiver module. Then we will interface multiple sensors like capacitive soil moisture sensor v1.2 to measure the quantity of water present in the soil. DS18B20 waterproof temperature sensor to measure the temperature of the soil. Similarly, in the cold season plants die due to fog and low temperature. Thus, DHT11/DHT22 Temperature & Humidity sensor is used to measure the temperature and humidity of surroundings. A5V Single channel relay module and water Pump are used for an automatic irrigation system. The authors of summarized the management process or guide for a successful fish culture. The aqua culturist monitors the pond in time domain and takes.

V. METHODOLOGY



Block Diagram of System

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Block Diagram of System In this system the main objective of the project is to setup an aquarium which can be monitored using sensors via the internet. The fish feed dispenser is setup using the servo motor where it can be monitored and controlled in mobile application. Temperature sensor is interfaced to keep track on the temperature ofwater.

A lighting system is introduced, with manual turn on/off option to be controlled at specific time. PH sensor is used to check the water quality and update to the mobile application. Main Objective of this system is: To control motor activity, lighting. To design an aquarium controller with an automated fish feed system. To monitor fish movement, temperature, water pH level. To alert the user in case of undesired variation in physical aspects of the aquarium. To feed the user with data regarding the conditions in the aquarium via mobile application.

1. ESP32:ESP32 is a series of low-cost, low-power on a chip microcontroller with integrated Fi and dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules.

2. Power Supply: It is nothing but input given to the system which is in the form of AC. Input is AC because we are provided with AC in our household, offices or elsewhere.

3. Servo motor: Servo motors can be used to adjust the feeding mechanism in the aquarium. For example,they can be used to move a feeding arm to dispense the right amount of food at a set time.

4. Temperature Sensor: Temperature sensor plays an important role in many applications in the case of fish aquarium it is necessary to check the temperature. Temperature sensors are usually thermocouple orRTD. We have used a thermistor-based temperature sensor that is capable of monitoring water temperature. It works on the inverse time characteristics phenomena. The resistance of the thermistor decreases when temperature increases and gives the signal of a rise in temperature.

5. LCD Display: LCD display can be used to display the current status of the aquarium system, such as thewater temperature and water level. This can help the aquarium owner monitor the system and identify any issues that need to be addressed.

6. Water Pump: It is a mechanical device, used to pump the liquids from one place to another.

The working principle of the water pump is to convert the motor's energy from mechanical to fluid flow.

7. Relay Module: Microcontroller operates on DC Voltage around 5V but the electric components we useare AC voltage. Thus, Relay module is required. It is an electromagnet (a wire that becomes a temporarymagnet when electricity is passed through it. Initially, COM is connected to NC, NO is open. When current flows electromagnet becomes energized and COM is connected to NO.

NO – Normally Open NC – Normally ClosedCOM – Common

8. Turbidity Sensor: Turbidity sensor is used to measures the quality of the water in the aquarium and sendsthe data to the ESP32.When the water in an aquarium becomes cloudy due to suspended particles such as algae, uneaten food or fish waste, it can have a negative impact on the health of the fish and other aquatic creatures. By using a turbidity sensor, the level of suspended particles can be measured in real- time, and the system can automatically trigger a cleaning or filtration process.

9. Ultrasonic sensor: An ultrasonic sensor can be used to monitor the water level in the aquarium. This can be helpful in preventing overflows and ensuring that the fish have enough water. It is used to detect thepresence of fish in the aquarium. This can be helpful in monitoring the health and behavior of the fish.

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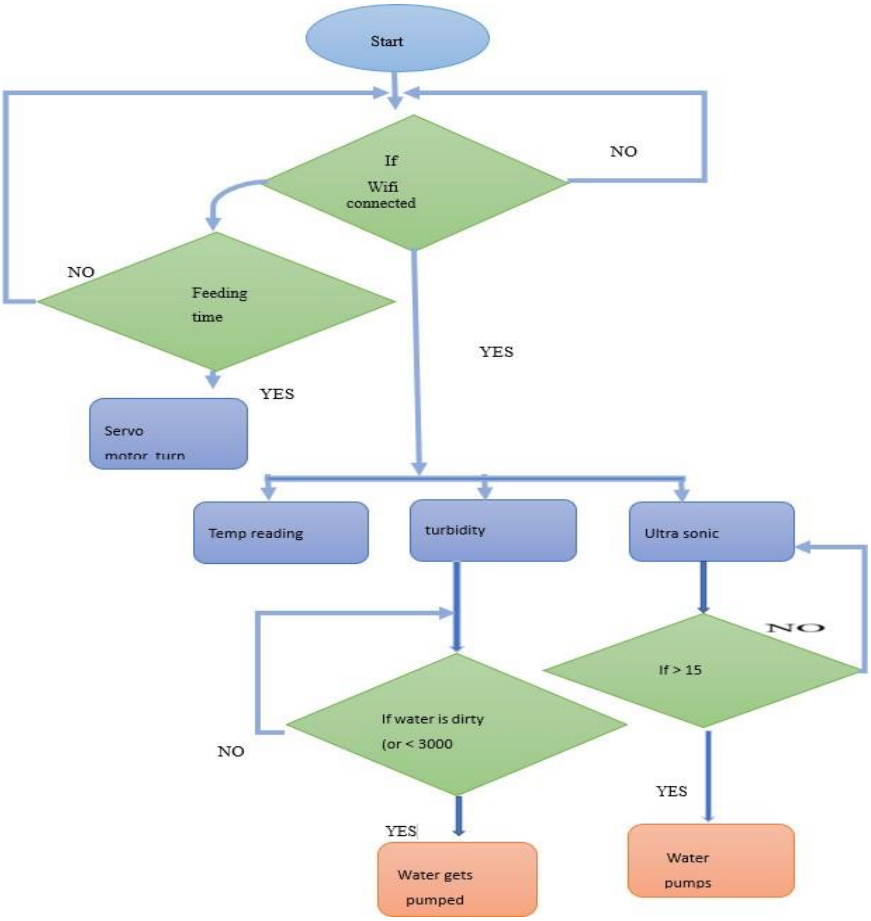

Fig: Flow Chart of the System

VI. SOFTWARE IMPLEMENTATION

To implement this project, it requires software code that will enable communication between the ESP32 microcontroller and the various sensors and actuators in the smart aquarium. Install the Arduino IDE, ESP32 board drivers, and necessary libraries for the sensors and actuators. Read sensor values for temperature, turbidity,and water level using appropriate functions and libraries. Control the water pump using appropriate functions based on the water level and turbidity readings. Send the sensor data to the cloud using appropriate communication protocols. Set up alerts and notifications for abnormal readings, low water levels, or other conditions.

VII. RESULTS & DISCUSSION

After developing the system with hardware and with suitable code the results are discussed. In this project it includes the monitoring of temperature, turbidity values and feeding the fish at regular intervals. The values are displayed on the web page where user can see the updated values of the temperature and turbidity values by usingthe mobile phone.

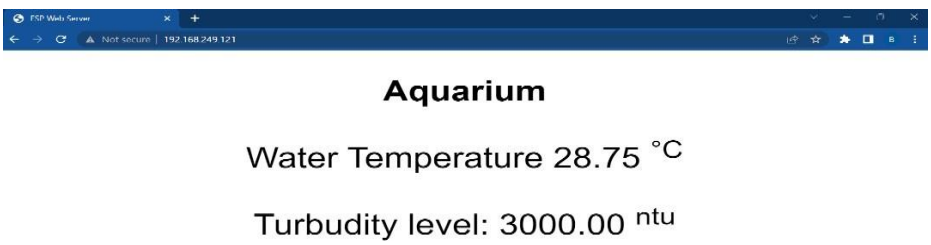

Fig: Result on web page

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ESP32 is used as controller and ultrasonic sensor, turbidity sensor and LCD display are interfaced with ESP32.LCD display is displaying the water level detected by the ultrasonic sensor and so on.

Fig: Result on LCD Display

VIII. CONCLUSION

The project was inspired by an idea, to create a system that could automatically take care of the fish. Now most of the operations happen by themselves like maintaining steady, turbidity, water level and temperature. By using an IoT platform, it can monitor these variables, visualize the data and even control some features manually, over the internet which is successfully implemented in this project. Another important feature was the mechanical design and implementation of the fish feeding system, which is an original design. It is a rather simple design, but it efficiently does the job, there are other designs but they are complicated, so this project achieves, simplicity, efficiency, time saving and cost saving. This project serves as a way to practically implement our skills to solve a very important management related problem and assist in achieving an ideal environment for fish in an aquarium.

IX. FUTURE SCOPE

Currently this system has less effective sensors and actuators. So, in future many more advance sensors such as pH sensor, salinity, oxygen level sensor and actuators should be added to the system in order to make the system more advance in monitoring the aquarium. Furthermore, in future the aquarium monitoring system should equipped with some artificial intelligent such as detecting odd pattern of sensors value for certain time or adding computer vision to detect and understand the behavior of one type of fish in the aquarium. Adding a mobile application to the system to enable the user to control them is also one of the future enhancements of this system.

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