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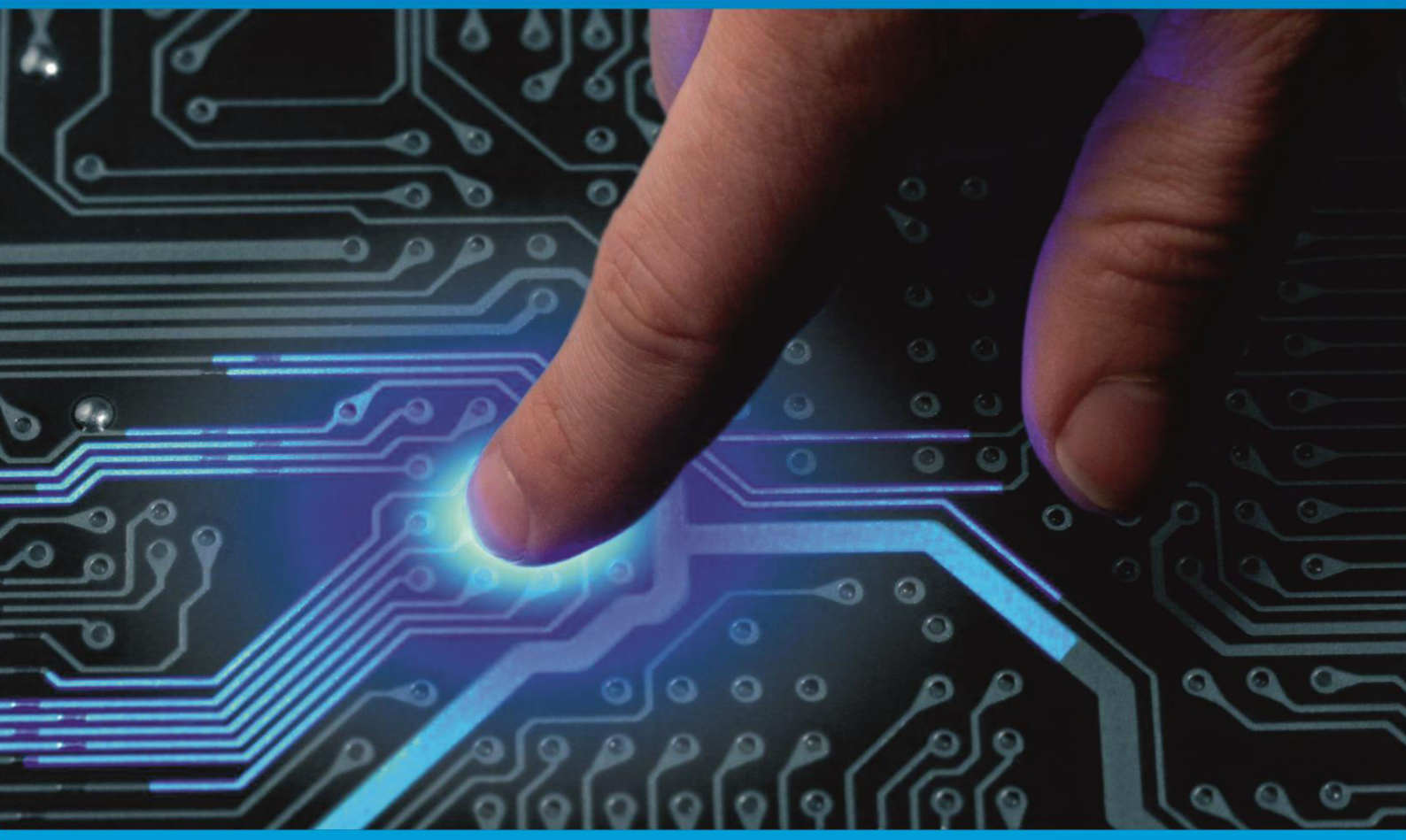

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Smart Aquarium System Supporting Remote Monitoring and Controlling of Functions using Internet of Things

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ABSTRACT: Many people feed pet fish in the aquarium tanks that need to be properly set up and maintained, or the fish will be destined to an unpleasant and short life. Therefore it is critical to monitor water conditions closely and improve the water quality for the mini aquarium tanks. Based on an IoT solution called IoT Talk, this paper proposes the FishTalk system that utilizes the aquarium sensors to drive the actuators in real-time. We describe the relationship between the aquarium sensor and the actuators and give concrete examples of various water conditions. As an example, we implement an intelligent fish feeding mechanism such that the fish are neither over nor underfed, and at the same time, the fish owner can enjoy watching fish feeding remotely. We have also developed an analytic model, simulation, and measurement experiments to investigate the effect of IoT message delays and loss on water condition control.

KEYWORDS: Water control, water quality monitoring, IoT, Ultrasonic sensor, Ph sensor, water flow sensor, water level sensor, NodeMCU.

I. INTRODUCTION

Pet ownership has been increasing at a steady pace in the last 20 years. After cats and dogs, the most popular pet is now the freshwater fish. The maintenance of fish aquariums is a very difficult task itself. Whenever you have to clean up your aquarium or you have to feed, you have to do a lot of things. You have to turn off your aquarium's powerhead/air pump and feed manually and turn on the air again after an hour. In the current system, all equipment such as the light, heater, and filter are to be controlled manually using electrical switches for this the person needs to come near the aquarium and manually control the electrical switches to turn on /off the equipment. The fishes need to be fed twice a day even this requires the owner to walk up to a fish tank and feed the fish manually which makes the task of maintaining an aquarium much more difficult. At times when the owner is on vacation, he has no control over the aquarium and also can't feed the fish. The project with which we came up is a Smart Aquarium. The project will be more efficient than the systems available in the market, nowadays. In addition to the efficiency, it will be of lower cost as well. The project's audience is the group of people interested to keep fishes at home or offices but doesn't have time to take care of, or they are worried to keep asking their neighbors to take care of the fishes in their absence. The project is an automated system to take care of fishes. It will replace the manual maintenance of fish aquarium with its automated functions. As the trend of keeping pets increases, people are keeping all sorts of animals at home and it is not a new concept in any way. The strong connection between pets and their owners is evident from a report by Micheal Gross [1]. All of these animals require special care and sometimes humans cannot attend to their needs and these days many people are fighting to protect the ethical rights of animals like PETA [2]. Out of these animals, fish require the utmost care because their environment is completely different from land animals, so they need specific conditions like a temperature range, pH, suitable oxygen, and CO2 levels. Normally aquariums have oxygen pumps, heaters, and filters. This is not enough or equivalent to the natural habitat. Many scientists have worked on the effects of meteorological and hydrological diversity concerning spatiotemporal scales [3]. Maintaining these conditions is very hard manually, so automating thing so automating this process will greatly reduce the fish death rate and will create great convenience for the owners.

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II. LITERATURE SURVEY

The method suggested by Min-Chie Chiu, A Multifunctional Aquarium Equipped with Automated Thermal Control/Fodder-Feeding/water Treatment using a Network Remote Control System consists of a PC as the center of the system which control and managed the whole system. It is really expensive to allocate a whole PC just to manage the aquarium system. The second is the portability of the product. The use of PC as the center part of the system makes it difficult to move the product from one place to another. The Design and Development of Automatic Fish Feeder System using PIC microcontroller by M. Z. H. Noor, A. K. Hussian, M. F. Saaid, M. S. A. M. Ali, and M. Zolkapli, cannot change the DC motor speed remotely by the user because the microcontroller is not connected to the internet. The microcontroller just automatically dispenses pellets on the desired area using a DC motor at the scheduled time. If the user wants to change the DC motor speed or the scheduled time, he has to do it manually. This restricts the user from getting full control of the system. A.N.Prasad, K.A.Mamun, F.R. Islam, and H.Haqva, a paper about Smart Water Quality Monitoring System say that the cost of the product is too high for the user to afford. The Waspmote microcontroller board Plug & Sense! SE-PRO Lo Ra - 868 which is 415€, the total cost of the whole system is approximately 3790€. The European user might think the cost is affordable but for the Asia users, it is very high and no one will ever spend that much money just to monitor their aquarium. The An Embedded Fuzzy Decision System for Aquaculture by Taotao Xu and Feng Chen sends the result of the decision-making to the aquaculture farmers via GPRS or messages. The farmers will be unaware of the sensor values for example the temperature value or the pH value of water. Besides that, the user/farmer also not able to see the sensor value in real-time for example with a real-time graph plotting with time-domain through the internet because this system is not IOT based system. Real-time graph plotting with the time domain is very important because if there is something wrong with aquaculture. The method suggested by Mackenzie Banker, Charlie Brooks, Jake Halverson, and Rachel Huntley, Automatic Fish Feeder does not have a battery backup. This device is powered by a wall outlet, meaning that the fish wouldn't be fed if there were to be a power outage. This device comprises only a feeding mechanism.

III. DEFINITION

Usually, Aquarium caretakers face several problems in the maintenance of health and vitality of Fishes along with the presentation of the Aquariums. Some of the problems faced are changing the aquarium water feeding the fish, maintaining the temperature of the Aquarium, and controlling the Lights. So the idea is to minimize the problem of fish keepers or aquarists by shifting it from manual to automatic mode. Fish keepers or aquarists now would not have to watch out and keep an eye on their Aquarium and Fish again and again. The SMART aquarium will be there if any problem occurs.

IV. OBJECTIVES

1. To develop a reliable aquarium monitoring system for users this can be able to send the data about the aquarium to the users from time to time by updating the data to the server.
2. The servo motor is used to feed the fishes in proper time in absence of the user
3. Understood and operated this project by nontechnical users easily without the need for any advanced technical knowledge.
4. To make it more convenient and easier for users to maintain their aquarium from anywhere around the world.

V. PROPOSED SYSTEM

The block diagram of NodeMCU based aquarium monitoring system is shown in figure NodeMCU is used as the main controller to monitor and control the sensors, lights, heater. The NodeMCU is a small microcontroller. Here the power relay is used to control the aquarium lights, the dc motor is used to fish feeding purpose, the temperature sensor is used to sense the water temperature and sends the notification every 10 minutes, if the water temperature is low the heater is used to adjusts the normal temperature. The LCD is used to display the temperature and by seeing the LCD. We can operate the lights and dc motor for feeding fishes and This project can be operated in three different modes. Internet Of Things (IoT), sends updates every 10 minutes so we can monitor the aquarium temperatures when we are away from home.

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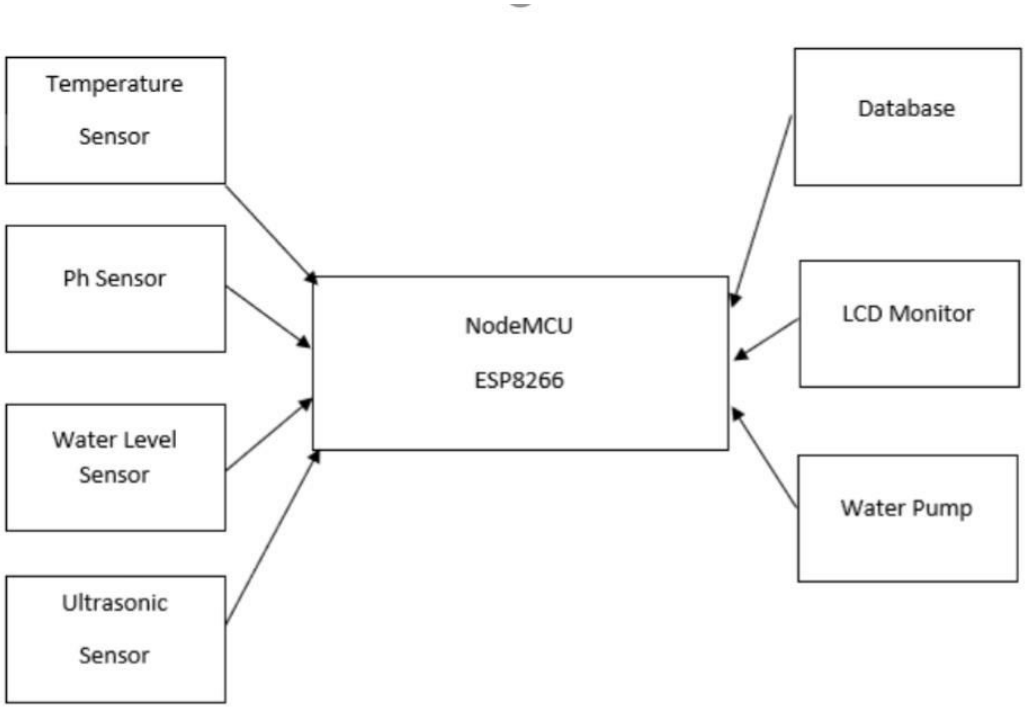

Fig.1. System Architecture

VI. SYSTEM MODULES

1) Power module: The power module we opted for is more eco-friendly. The power module comprises of solar panel, charge controller, battery, DC-DC converter. The solar panel is used to extract the heat from the sun and convert it into electrical energy and is given to the charge controller it is used to charge the battery at constant voltage, as a result, the life of the battery increases. The battery is mainly used to supply power during the night because water quality parameters mainly alter during the night. A DC-DC converter is used to supply power to the microcontroller module which can operate at 5V. A DC-DC converter is used to supply constant voltage.

2) Sensor module: The sensor module comprises several sensors such as Dissolved Oxygen, Ammonia, pH, Temperature, Salt, Nitrate, and Carbonates. These sensors are mounted on Raspberry pi and are used for sensing the water quality parameters from time to time.

3) Microcontroller module: It is considered the heart of this architecture. NodeMCU is used as a computer in this project. NodeMCU a low-cost, small computer board with Linux as the operating system. It has several advantages when compared to other micro-controllers such as inbuilt Wi-Fi modules. The Program for collecting the sensor data is written in python language and sends that data to the cloud database. The server-side program continuously monitors the sensor values whether they are within the threshold range. If the values deviate from the threshold range a feasible solution was sent to the output module.

4) Output module: Aqua farmer mobile is taken as an output module. An app has been loaded on the mobile which consists of two buttons 1) Get data 2) History. When we press the get data button current water quality parameters values have been displayed on the farmer's mobile. Message alerts will be sent to the farmer if there is a deviation from the threshold range with the necessary action to be taken

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VII. CONCLUSION AND FUTURE WORK

The simulation results showed that the proposed algorithm performs better with the total transmission energy metric than the maximum number of hops metric. The proposed algorithm provides energy efficient path for data transmission and maximizes the lifetime of entire network.As the performance of the proposed algorithm is analyzed between two metrics in future with some modifications in design considerations the performance of the proposed algorithm can be compared with other energy efficient algorithm. We have used very small network of 5 nodes, as number of nodes increases the complexity will increase. We can increase the number of nodes and analyze the performance.

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