Journal of Engineering Technology Vol. 10: 13-16, 2022
ISSN 2231-8798© 2013 UniKL BMI

Aquarium Monitoring System via IOT

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Abstract: Aquarium monitoring system via IoT solves dead marine life issues such as prawns and fish. The system applies mobile apps "Blynk" and Arduino IDE link to the NodeMCU aquarium microcontroller. Microcontroller ESP8266 NodeMCU with right sensor type is used in water and connected to NodeMCU ESP8266. From this project, the project clearly demonstrates how end-users know the appropriate pH, temperature and water level. The dosing system developed in this system is ideal for use in any aquatic life, such as aquaculture for breeding or home aquarium. It will encourage users to prepare their aquarium maintenance, such as water change and filtering device. As for recommendation, an ammonia sensor will be used to improve the effectiveness and reliability of this project to monitor the nitrogen cycle in an aquarium.
Keywords: Monitoring system, IoT Marine, Microcontroller.

1.0 INTRODUCTION

This project is one of initiatives that provide efficient and proper monitoring system to the aquarium lover. It also featured the dosing system to be used to dose various nutrient supplements to aqua life. Other than that, people always overspent their money as what if they are petting, or breeding is always dying. The problem occurs when their fish is not getting sufficient nutrient for them to live. People tend to forget about their aquarium and their wish will surely dead after starving for days. Next, often people don't realise what's happening inside their tank, and it's important to keep the aquatic life safe. This project helps you to monitor changes in water parameters continuously, alerting you to problems until they affect the fish.

A system that can handle and support aquarist and aquatic living more systematically must be created. This system must be created to sense the aquarium temperature, pH, water viscosity. These sensors must send a signal to the ESP8266 NodeMCU microcontroller. Thus this microcontroller should be able to communicate with Blynk's mobile apps to display on the mobile phone the reading of the aqua monitor device, so that people no longer have to manually check to feed the nutrients to the fish.

The aquarium monitor system also studied the function of each type of sensor. By implementing the microcontroller and mobile app feature, it can easily send and receive data from the hardware system to the software system [1].

The system could help aquarists to develop their fish petting system effectively. Finally, this project works with any aquarium and aquatic creature including crab, lobster, and prawn.

2.0 LITERATURE REVIEW

2.1 SMART Aquarium

The project's key concept is to sense the changes of temperature, pH and water level inside the aquarium via sensors [2]. These changes will be then processed by the Controller. The microcontroller mounted in the circuit performs the main control task. Controller sends commands to actuators in which the output part is observed to maintain the optimum conditions. Temperature sensor, turbidity sensor, PH-level sensor, water-level sensor, heater, feeder, LCD, and GSM Mobile will be available. The devices will be interfaced with the controller. If something changes, the controller begins working to achieve the ideal state. The Normal freshwater aquarium temperature is 28-30°C. If temperature exceeds, the controller will start the fan till the desired temperature is no achieved. If the temperature rises, the heater is on until the temperature reaches normal temperature [3-4].

2.2 ARDUINO BASED AQUARIUM MONITORING SYSTEM.

The main aim of this project is to develop an aquarium which can be monitored using the switches, remotes and through internet. Fish can be fed using the servo motor where it can be monitored, and the temperature sensor is used to keep track at the water temperature. Water temperature and outside temperature are displayed in LCD and it can be checked through the webpage through internet. Lighting systems can be operated using any of

three ways as mentioned, it proposes to ON the light only whenever needed. [5-6]

A reliable aquarium monitoring system is developed for the users that able to send the data about the real time condition in the aquarium by updating the data to the server. The servo motor is used to feed the fishes in proper time in case of user's absence. To make it more convenient and easier for users to maintain their aquarium from anywhere around the world [7-8]

3.0 METHODOLOGY

The project consists of two main parts which is the hardware and the software as shown in figure 1. The key component used in this project is water temperature sensor (waterproof temperature probe kit), water PH level sensor and ESP8266 NodeMCU microcontroller. The performance of this device is therefore the nutrient dosage using water pump 12V connected to the ESP8266 NodeMCU microcontroller. Aquarium setup kit and jumper wires for the other hardware parts.

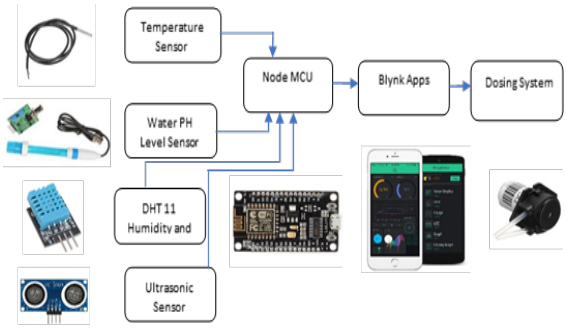

Figure 1: Aquarium Monitoring System block diagram.

This project uses Arduino IDE as the software component to write the code where it will burn into the ESP8266 NodeMCU. In this case, C++ language was used to write the code. Others, for the mobile phone, Blynk apps has been used as it comes with multifunctional apps for the user.

3.1 Input

This project consists of four sensors connected to the ESP8266 NodeMCU microcontroller. First the DS18B20 Waterproof Temperature Sensor is connected to determine the water temperature in the fish tank. The sensor is dipped into the water to obtain the sensor's correct temperature reading value. Next the water pH level sensor is located next to the DS1B20 in the sensor box. The pH sensor is a key sensor to assess water safety for any aquatic life. If the pH is not calibrated correctly, it will cause inaccurate reading led to dead fish due to wrong monitoring. Hence the pH sensor is calibrated using a buffer solution to make it accurate as shown in figure 2. Thirdly, the ultrasonic sensor HC-SR04 will determine the distance from the tip to the water level surface. This is a distance sensor; it was done using 3 LEDs in Blynk apps.

If the distance is low, the high LED will be turned on since the distance of the water and the ultrasonic sensor is close which is 2cm programmed in the Arduino IDE. Lastly, the DHT11 is connected in the system to determine the humidity and the temperature of the surrounding of the fish tank. DHT11 will displays different values with the DS18B20 since the water temperature is lower than surrounding. However, if the temperature of water raises up same to the surrounding hot temperature. The cooling system of the water needs to be turn on as the fish will not stand high temperature in their surroundings.

Figure 2: Calibrating pH sensor using 3 buffer solution.

3.2 Process

The microcontroller ESP8266 is the main device in this system. The sensors connected to this NodeMCU to analog and digital input of the ESP8266. The pH sensor is an only analog sensor. As we noticed in ESP8266 only have one analog pin. The water pH level sensor SEN0161 is connected directly to the analog pin while other were connected into the digital pins. The coding for analog pin is quite different in calculating the values read by the sensors. After all sensors were connected to NodeMCU, the authentication code from Blynk apps will be sent to email for connecting IOT feature. Therefore, the Blynk apps will process the value read by sensors and will be displayed in the Blynk apps.

3.3 Output

Nutrient Pump which is a normal 12V Water Pump is ground connected to 12V batter

y and Vcc connected to a 5V relay and connected to the microcontroller ESP8266 NodeMCU. Whenever user wanted to make a nutrient injection to the water, the execution button in Blynk apps must be toggled and the nutrient will be dispersed into the water in the fish tank. The values displayed on the mobile apps is for monitoring aspects such as pH, temperature, and water level of the aquarium. The flowchart of the system is shown in figure 3.

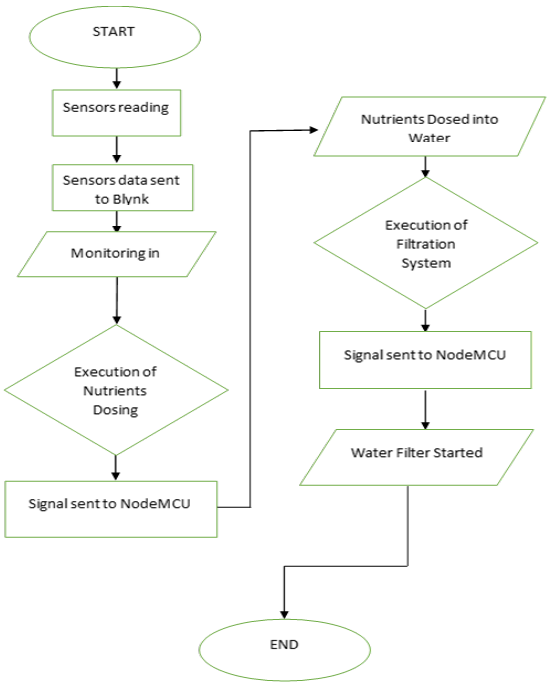

Figure 3: Project flowchart.

Blynk is designed for the Internet of Things. It can remotely control hardware, display sensor data, store data, visualize it, and do a lot of other cool things. Besides, there are three major components in the platform which are Blynk app, Blynk server, and Blynk libraries. The prototype of the system is shown in figure 4.

Figure 4: The prototype of Aquarium Monitoring System.

4.0 RESULTS AND DISCUSSION

The result was obtained based on both software and hardware component. Temperature sensor, pH water level sensor and Ultrasonic sensor were place on top of aquarium. Temperature and pH sensor were dipped into the water to obtain the measurement. The Blynk apps will read the sensors on mobile phones as shown in figure 5.

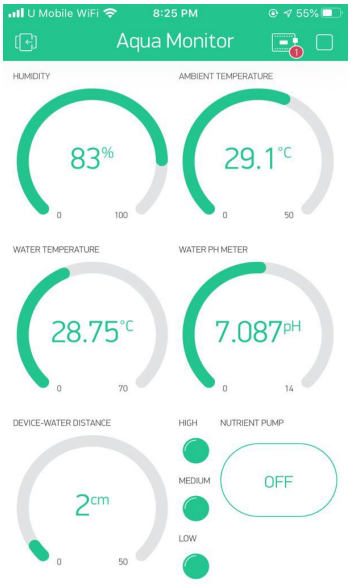

Figure 5: Blynk apps connected to obtain results.

Water Temperature Graph Results

The DS18B20 were used which is senses the temperature of the water continuously and displays the result on Blynk app. The following figure shows the results obtained from the temperature sensor were plotted into graph manually.

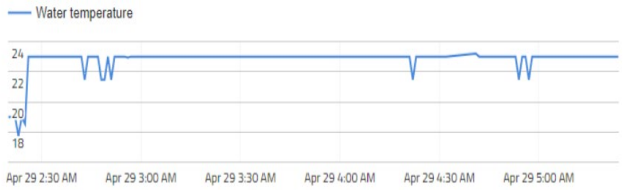

Figure 8: Water Temperature

Water pH Graph Results

As normal pH of water is 7, thus, during callibration of pH sensor we have obtained different values of pH. It gives the average values which are continuously changing beween 6 and 7 with respect to time.

Figure 9: Water pH Level

5.0 CONCLUSION

Aquarium Monitoring System's prototype was created and works well to be applied in marine application. Since the NodeMCU ESP8266 has several advantages that are cheaper than the other Wi-Fi module, it can be used for more than one sensor, making it very suitable for this project using many sensor types. It also compatible working for Blynk apps using Arduino IDE coding which give advantage among the users.

Next the temperature sensor is expected to provide accurate reading of temperature measurement which will notify the water temperature in the aquarium. The pH-level sensor is supposed to reliably measure or detect the water quality.

As conclusion, this aquarium monitoring system with the uses of modern technology was clearly stated the objective and the requirement that needed in this project where people nowadays can save their time and their beloved aquatics living. Finally, this project shows people the importance of technology in the aquarium.

REFERENCES

[1] Akindele Ayoola E, Awodeyi Afolabi I, Matthews Victor O, Alashiri Olaitan A, Idowu Oriyomi K, Olaloye Folarin J (2018), Development of an Electronic Weighing Indicator for Digital Measurement, Journal of Engineering and Technology (IRJET).

[2] A. N. Prasad, K. A. Mamun, F. R. Islam and H. Haqva, "Smart water quality monitoring system," 2015 2nd Asia-Pacific World Congress on Computer Science and Engineering (APWC on CSE), Nadi, 2015, pp. 1-6, doi: 10.1109/APWCCSE.2015.7476234.

[3] Khan, J. (2019). (PDF) Implementation of Smart Aquarium System Supporting Remote Monitoring and Controlling of Functions using Internet of Things. Retrieved from https://www.researchgate.net/publication/337567490_Implementation_of_Smart_Aquarium_System_Supporting_Remote_Monitoring_and_Controlling_of_Functions_using_Internet_of_Things

[4] Raj, A. (2020, August). Arduino based Fish Monitoring System. Retrieved from https://www.researchgate.net/publication/343703255_Arduino_based_Fish_Monitoring_System

[5] Bharat Bohara and Sunil Maharjan (2016), IoT Based Smart Home Using Blynk Framework, Zerone Scholar, VOL. 1, NO. 1

[6] Dlnya Abdulahad Aziz (2018), Webserver Based Smart Monitoring System Using ESP8266 NodeMCU Module, Journal of Scientific & Engineering Research.

[7] Mohamed FEZARI and Ali Al Dahoud (2018), Integrated Development Environment “IDE” For Arduino.

[8] Nirupam, Amit Krishna Dwivedi, Dr. S. S. Solanki (2015), Innovative Design of Dam Water Level Sensor, Sensors & Transducers, Vol. 189, Issue 6.