Bit-Tech

Vol.4, No.3, April 2022
Available online at: http://jurnal.kdi.or.id/index.php/bt

Smart Aquarium with IoT based as Monitoring in Fish Farming

Junaedi[1)], Hok Ki[2)]

[1)2)]*Universitas Buddhi Dharma*
Jl. Imam Bonjol No.41 Karawaci Ilir, Tangerang, Indonesia
[1)]junaedi@ubd.ac.id
[2)]hokki@ubd.ac.id

Article history:

Received 11April 2022;
Revised 18 April 2022;
Accepted 22 April 2022;
Available online 25 April 2022;

Keywords: {use 5 keywords}

Smart Aquarium
Internet of Things
Sensor
Monitoring
Blackbox

Abstract

The development of science and technology has developed rapidly at this time and will have a positive impact to facilitate human activities, including aquarium ornamental fish hobbyists. The problems encountered are, ornamental fish sellers who have difficulty monitoring all aquarium conditions and feeding and for people who are very busy and even indifferent to monitoring and feeding their ornamental fish. This tool has a water heater as well as a water temperature and pH sensor that can directly monitor the conditions in the aquarium. Arduino Uno is the mainboard that is used to control all sensors with Internet of Things (IoT) including : water temperature sensors, water turbidity sensors, water level sensors, water pH sensors, automatic lights, water heaters that will automatically turn on when the temperature is low and will automatically turn off when they reach the specified temperature and ESP8266-01 which functions to communicate between the Board and the smartphone, as well as the components of the tool and its uses are in accordance with requests from users obtained through Requirement Elicitation. Through the BlackBox trial, it includes low temperature testing of the water which makes the water heater automatically turn on and the water heater turns off when it reaches the specified temperature, monitoring water pH, water temperature, water level, water turbidity, on & off lights and feeding fish manually via a smartphone. And for the results of the Smart Aquarium trial, it can be operated with an Android smartphone, at least Android OS 4.3 and above.

I. INTRODUCTION

The development of science and technology has a major impact, both directly related to human routines and indirect routines [1] . An example is the development of technology that can be run automatically or controlled directly with a remotely connected device, such a technology is called the Internet of Things (IoT). The use of IOT can be applied to many fields, for example, it can be used by sellers or hobbyists of ornamental fish to control the condition of their fish remotely or automatically. Utilization in the field of technology like this can also be helpful for beginners or people who just want to keep ornamental fish, so that it is easy when they want to monitor the quality of aquarium water or in the schedule of feeding fish. The best frequency for feeding fish is every morning and evening according to the number of fish [2].

This tool that is built will greatly facilitate the task of the ornamental fish seller or the hobbyist himself to monitor every existing aquarium. This tool is able to provide automatic feed, monitor water conditions, monitor pH, monitor aquarium lights and drain water in the aquarium when the water is cloudy. It is very difficult to monitor multiple and separate aquariums and fish feeding when done manually. Therefore it will take a long time if you want to check the condition of the water temperature or pH levels of each existing aquarium, because temperature is very important for the life of ornamental fish where a drastic decrease in temperature changes will make fish stressed.

Likewise with the pH of the water, which if not paid attention to it will cause disease and disturbance to the health of ornamental fish. And no less important is in terms of feeding fish which will take a lot of time if done alone considering that there are some ornamental fish sellers who open their own business where all activities are only done alone. Therefore, it is very necessary to have things that can help with the help of technology in the care of ornamental

ISSN 2622-2728 (online) 2622-271X (print)
doi: 10.32877/bt.v4i3.441

fish automatically. The technology that can be applied to monitoring water conditions and ornamental fish is using IoT.

Utilization of IoT technology is also very useful for ornamental fish hobbyists who have a large collection of fish in one aquarium, where sometimes there is a condition that makes ornamental fish owners do not have time or are indifferent to pay attention or care for their ornamental fish, such as being on vacation. family or work demands that make these ornamental fish owners are required to leave the house or don't have time to take care of their ornamental fish.

II. Related Works/Literature Review (Optional)

A. Internet of Things

Describes the many uses and processes that result from assigning a network address to something and adapting it to sensors [3]. This conjunction of sensors, objects, and networks has become an important and increasingly important part of the internet experience. When we equip objects around us with sensors and connect them to a network, they acquire new abilities - in this case we call these skills.

B. Arduino

According to Abdul [4] Arduino Uno is a product labeled Arduino which is actually an electronic board containing an ATMega328 microcontroller (a chip that functionally acts like a computer). This device can be used to realize electronic circuits from simple to complex, light control to robot control can be implemented using this relatively small chipboard. You can even add certain components, this device can be used to monitor patient conditions in hospitals or control equipment at home.

C. Turbidity Sensor

Turbidity sensor is a sensor that functions to measure water quality by detecting the level of turbidity. This sensor detects suspended in water by measuring the transmittance and scattering of light which is directly proportional to the level of Total Suspended Solids (TTS) [5].

D. Water level sensor

Water Level itself is a set of tools used to measure the water level in different places in order to get comparative data. The simplest water level is a pair of pipes connected to each other at the bottom [6].

E. Servo Motor

Taken from the website [7] Servo Motors are electrical devices used in industrial machines that usually function to push or rotate objects with precise and accurate control. If you want to rotate and orient the object at certain angles or distances, then you must use a Servo Motor.

F. Temperature Sensor

Temperature Sensors are components that can process heat quantities into electrical quantities so that they can detect the phenomenon of temperature changes in certain objects. The temperature sensor takes measurements of the amount of hot/cold energy gained by an object thus allowing you to understand or detect the phenomenon of temperature changes in both Analog and Digital output formats [8].

G. Water Heater

Taken from the website [9]. A water heater is a device that uses a thermodynamic process by using an energy source to heat water above its initial temperature.

H. Ph Meter Sensor

PH Meter is an electronic device used to measure the pH (acidity or alkalinity) or base of a solution (though special probes are sometimes used to measure the pH of semisolid substances) [10].

I. ESP8266

Taken from the website [11]. ESP8266 is a wifi module that functions as an additional microcontroller such as Arduino so that it can connect directly to wifi and make TCP/IP connections .

J. Node MCU

Taken from the website [12]. NodeMCU is a microcontroller that is equipped with an ESP8266 WIFI module in it, so NodeMCU is the same as Arduino, but the advantage is that it already has WIFI, so it is very suitable for IoT projects.

K. Black Box Testing

Black box testing technique focuses on the information domain of the software, by conducting test cases by partitioning the input domain of a program in a way that provides in-depth test coverage [13].

L. Flowchart

According to Lamhot [14], Flowcharts are problem solving steps written in certain symbols. In order to describe an algorithmic flow that is more structured and easy to understand by others (especially for programmers in charge of implementing the program), a flowchart is needed.

M. Mit App Inventor 2

Taken from the website [15]. MIT App Inventor is a platform to facilitate the process of creating simple applications without having to learn or use too many programming languages. We can design android applications as we wish by using a variety of layouts and components available.

III. METHODS

For the method in this study the author applies the Internet of Things as a liaison between the device and smartphone for smart aquariums. And the design of the smart aquarium and the design of the tool system can be seen below:

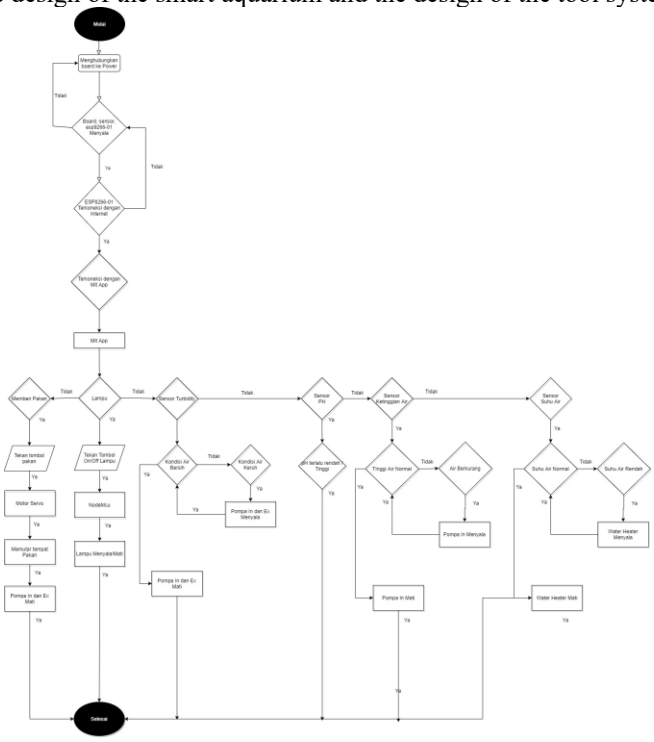

Fig. 1 Design of the tool system

In fig 1 above, a flow design of a tool system is described. Where later this tool will be applied above an aquarium. This tool will function to monitor the activities that are in an aquarium with the internet of things method that will connect the tool made with a smartphone, so that the device and smartphone can communicate with each other whether it is receiving information or sending information..

IV. RESULTS

A. Application View

In the program view this time the author uses the MitApp application which has a display like the following:

Fig. 2 Application main view

1) The graph menu shows the contents of the graph of temperature, pH, water level and water turbidity can be displayed as shown below:

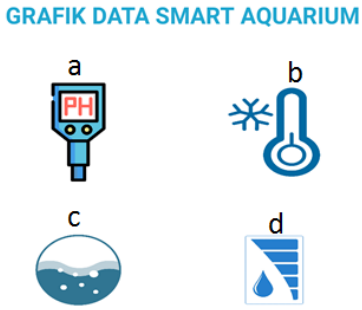

Fig. 2 Smart Aquarium Graphics

a) Graphical display of PH in real time following the clock from the smartphone

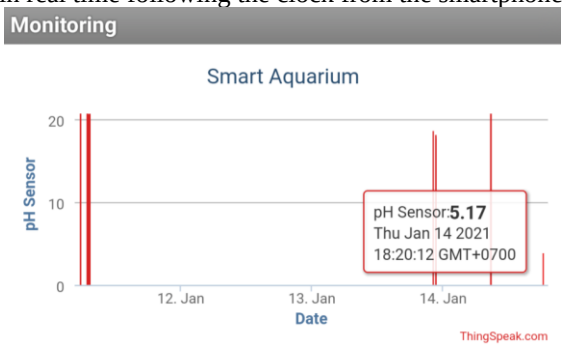

Fig. 3 Ph Sensor Graph

b) The graph of the temperature that can be updated when the temperature is low the heater automatically turns on and when the temperature is high the heater automatically turns off.

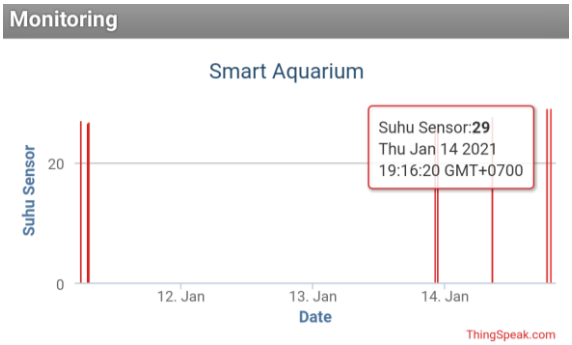

Fig. 4 Temperature Sensor Graph

c) Graphic display from water level

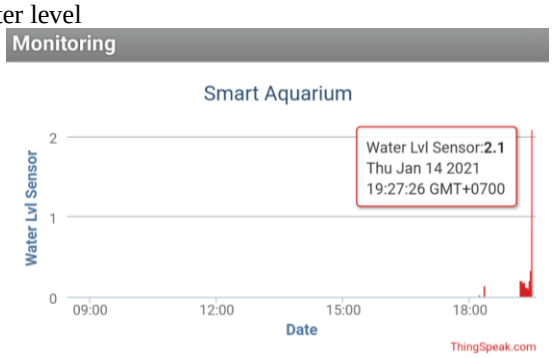

Fig. 5 Water Level Graph

d) Display of the water turbidity sensor

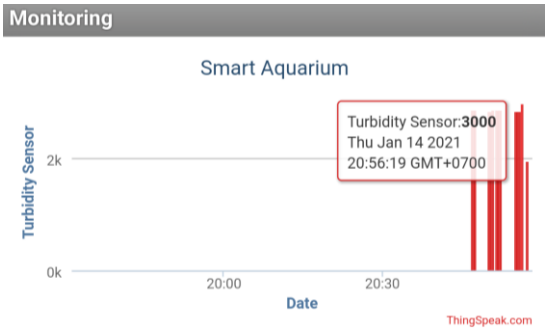

Fig. 6 Turbidity Sensor Graph

2) The display of the fish feeding menu button, we can feed by pressing the button and the last time to feed will be displayed.

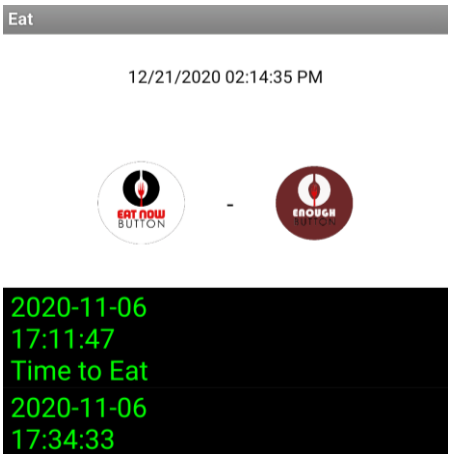

Fig. 7 Feeding History

3) On and Off light remote display

Fig. 8 Lamp View

B. Tools Display and System Testing (BlackBox)

1) Tools Display

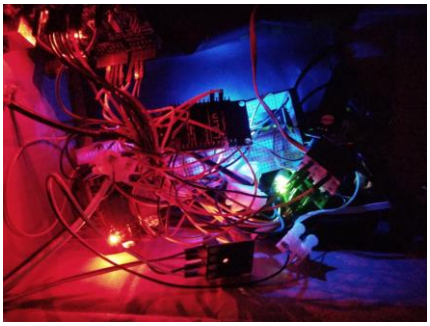
Fig 9. Tool Inside View

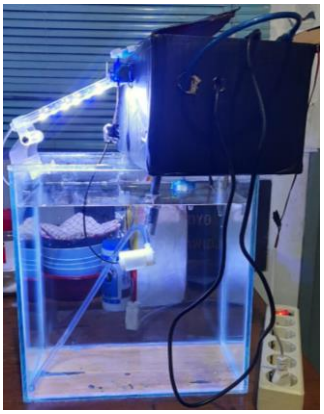
Fig. 10 Overall View

2) System Testing (BlackBox)

In testing the system this time will use the BlackBox method where the method that the author uses is to determine the function status of each component and sensor whether it is running well or not. Tests will include low temperature conditions in the aquarium, highest temperature conditions in the aquarium, lowest pH conditions in the aquarium, testing of button feeding fish.

V. DISCUSSION

The working principle of this tool is when the Arduino Uno gets a 12v inflow which will then be divided with the regulator that is included in the Arduino Uno board to become several 5v ports which are used to supply power to the

water temperature and pH sensors, servo motors, 2 Channel relays, Turbidity sensor, Water level sensor, lights, Heater, and esp8266. Furthermore, after the esp8266 is supplied with current, the esp8266 will automatically connect to the access point that has been determined to access the internet as an intermediary for the Arduino Uno board with the internet.

When the water condition is dirty or less than the specified limit, the pump will automatically turn on and replace the water until it feels in its proper condition, and if the water is too low, the heater will automatically turn on and will automatically turn off when the aquarium is in a temperature condition. normal, then Arduino Uno will synchronize the Mit App data and then use it to be able to do feeding by moving the servo motor automatically to automatically rotate the fish food container, then we can also adjust the lights so that they can turn on and off automatically by pressing the existing light button.

VI. CONCLUSIONS

At the end of the design and manufacture of the smartfrish tool so that it can be useful as a tool that will help ornamental fish sellers and hobbyists who maintain ornamental fish in terms of routine feeding of fish and monitoring conditions in the aquarium temperature, it can be concluded that the tool that has been made completed on time and according to the design and operating well. The test is carried out using the Black Box method which aims to determine whether the function of each sensor component is working properly. The results of the trials that have been carried out are as follows:

a. Applications and tools that have been made, are in accordance with the chapters that have been described previously and most have met the requirements of user requests through requirements elicitation.
b. This tool can be controlled using a smartphone that is connected to the network so that it can directly monitor conditions in the aquarium even though it is not near the aquarium.
c. This fish feeder can monitor the condition of water temperature, water level, water turbidity or pH in the aquarium, all of which can be displayed on a graph in the application. After testing the sensor works well.
d. This fish feeder has a water heater that will automatically turn on when the temperature in the aquarium is too low. After testing the water heater works well.

REFERENCES

[1] H. S. Weku, E. V. C. Poekoel, R. F. Robot, and M. Eng, "Rancang Bangun Alat Pemberi Pakan Ikan Otomatis Berbasis Mikrokontroler," *J. Tek. Elektro dan Komput.*, vol. 4, no. 7, pp. 54–64, 2015.
[2] M. Sudrajat and W. Setyogati, *Pembenihan Ikan Mas Koki*. Yogyakarta: Deepublish, 2020.
[3] M. Bunz and G. Meikle, *The Internet of Things*. 2017.
[4] A. Kadir, *Panduan Praktis Mempelajari Aplikasi Mikrokontroler dan Pemrogramannya Menggunakan Arduino*. 2013.
[5] M. T. Sulistyo, "Sistem Pengukuran Kadar Ph , Suhu , Dan Sensor Turbidity Pada Limbah Rumah Sakit Berbasis Arduino UNO Waterproof Temperature Sensor DS18B20," *J. Elektro SI ITN Malang*, pp. 1–10, 2019.
[6] Taharica, "Pengertian Sensor Water Level Dan Cara Kerja," *loggerindo.com*, 2018. https://www.loggerindo.com/pengertian-sensor-water-level-dan-cara-kerja-109
[7] E. Schneider, "Apa itu Servo Motor dan Kegunaannya ?," 2019. https://www.se.com/id/id/faqs/FA374507/
[8] I. G. Widharma, "SENSOR MAGNET PADA SISTEM INSTRUMENTASI," 2020.
[9] Mediawiki, "Apa itu Water Heater / Pemanas Air?," *www.mediawiki.org*, 2018. https://www.mediawiki.org/wiki/Topic:U9961l7h306rtp7s
[10] N. B. Sitorus, "Pendeteksi pH Air Menggunakan Sensor pH Meter V1.1 Berbasis Arduino Nano," *Jiti*, no. X, pp. 1–5, 2014.
[11] T. Widiyaman, "Pengertian Modul Wifi ESP8266," *www.warriornux.com*, 2021. https://www.warriornux.com/pengertian-modul-wifi-esp8266/
[12] Kelas Robot, "Apa itu NodeMCU ESP8266," *www.kelasrobot.com*. https://kelasrobot.com/apa-itu-nodemcu-esp8266-bagaimana-cara-pakenya/
[13] G. W. Setiawan, "Pengujian Perangkat Lunak Menggunakan Metode Black Box Studi Kasus Exelsa," *J. Inform.*, vol. 3, p. 286, 2011, [Online]. Available: https://repository.usd.ac.id/32377/2/055314010_Full.pdf
[14] S. Lamhot, *Algoritma dan Pemrograman*. Yogyakarta: CV. ANDI OFFSET, 2015.
[15] Unisayogya, "Apa Itu MIT App Inventor, Berikut Penjelasannya," *6 Januari*, 2020. https://psti.unisayogya.ac.id/2020/01/06/apa-itu-mit-app-inventor-berikut-penjelasannya/