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Smart Aquarium Design Using Raspberry Pi and Android Based

Khairunisa[1], Mardeni[2], Yuda Irawan[3]*
[1,2] Department of Computer Science, STMIK Hang Tuah Pekanbaru, Pekanbaru, Indonesia
[3] Department of Information System, STMIK Hang Tuah Pekanbaru, Pekanbaru, Indonesia
Email: [1] khairunisa6494@gmail.com, [2] mdn@htp.ac.id, [3] yudairawan89@gmail.com
*Corresponding Author

***Abstract*—From this problem, a smart aquarium device was designed to feed aquaculture fish automatically, namely Smart Aquarium Design Using Android-Based Raspberry Pi, designed to provide convenience in the process of maintaining fish in an aquarium. This aquarium can perform several actions such as fish feeding automatically can be done using Android via the internet network and control the aquarium decorative lights. To move the fish feeding valve, it uses a servo motor to drive the fish feeding valve and also uses a relay as an on / off aquarium decorative light. Fish feed machines can feed fish on a scheduled basis if the user forgets to feed fish. Smart aquarium is also equipped with a water filter so that aquarium water does not need to change water.**

Keywords*— *Aquarium, Android, Motor Servo, Rasberry pi, Relay

I. INTRODUCTION

For aquarium owners, sometimes their daily activities are busy with other busy activities was studied by nusantara [1]. With this density of activity, it often makes it difficult for fish aquarium owners to provide fish with the feeding process, which is usually done manually when at home was studied by pasha [2].

Nowadays, technology is developing rapidly in everyday life. Where the development of these technologies provides advantages and disadvantages of each. One of the advantages is the technology can remotely control the aquarium to feed the fish with android was studied by irawan [3].

Research with the theme Smart Aquarium has been done before, such as vishwas [4] with the title Smart Aquarium Application based on Mobile and Short Message Service, which is to automatically feed fish by entering the program on Arduino by sending an SMS to a predetermined phone number was studied by fatmawati [5].

With the technology available today, showing additions and changes to features in previous studies including automatic feeding of fish with android is done by setting a predetermined schedule was studied by daut [6]. With the feeding that has been designed automatically, the user does not need to worry about forgetting and having to be there when feeding his pet fish was studied by muhardi [7]. In addition, this tool can also control the lights in the aquarium was studied by Tolentino [8].

Based on the above background, the authors provide a solution by designing a tool for the thesis entitled "Smart Aquarium Design Using Android-based Raspberry Pi" was studied by sohor [9]. To adjust the tool that will be made with developing technology, the tool will be made using the Android-based Raspberry Pi was studied by harani [10]. Where, Android will be the interface between the aquarium and the tools to be made was studied by irawan [11]. Android is a Linux-based information system used for smartphones was studied by ulum [12]. By using Android on a smartphone, the aquarium owner can feed fish anytime and anywhere was studied by shin [13].

Raspberry Pi, or commonly abbreviated as Raspi, is a single-board circuit microcomputer module was studied by jorda [14]. Has the size of a credit card and has a digital input output port like on a microcontroller board was studied by wahyuni [15]. Raspi can be used to run office programs, computer game programs, and as a media player to high-resolution videos was studied by afifah [16]. The advantages of the Raspberry Pi compared to the microcontroller board are that it has a port / connection for a display in the form of a TV or PC monitor and a USB connection for the keyboard and mouse was studied by irawan [17]. The goal of creating the Raspberry Pi was to make an inexpensive device that would improve programming skills and hardware understanding at the pre-university level was studied by Budiman [18]. Due to its small size and affordable price, it can quickly be adopted by electronics enthusiasts, makers and hobbyists for projects that require more than a basic microcontroller (Raspberry device) was studied by irawan [19].

II. METHODS

In this study, the authors used the Prototype Model research method. In the Prototype model, the process of creating a system that is made will be structured was studied by salim [20]. How many stages must be passed in the making, namely gathering needs, designing and evaluating was studied by Abdullah [21]. If the final stage states that the system that has been created is not perfect or still has flaws, the system will be re-evaluated and will go through the process from the beginning was studied by irawan [22]. The stages in this prototype model are as follows:

1. Data Collection

Researchers will collect data that will be managed as consideration or study in this research in order to make decisions at a later stage was studied by kim [23].

2. Building Prototyping

The design is done quickly and the design represents all known aspects of the hardware device and this design forms the basis for the manufacture of a clothesline lifting device in the form of a prototype was studied by cater [24].

3. Evaluation of Prototyping

Furthermore, after the prototyping development stage, the researcher will define the format and requirements of the entire device, identify all requirements, and an outline of the system to be made.

4. Encoding the System

At this stage, the correct prototyping will be translated into programming in the form of the C programming language.

5. Testing the Device

At the testing stage of the device, the coding that has been previously made will be tested whether it can run well or if there are still parts that need to be repaired or whether there are still parts that are not as expected.

6. Evaluation Device

Device evaluation is not a prototyping evaluation, device evaluation is evaluating the entire finished device whether it is as desired or not. If not, then the device will be revised again and return to stages 4 and 5. If the system has been said OK and has passed the test, then the device is ready to use.

III. IMPLEMENTATION

A. *Hardware Design*

The diagram block design applied in this study can be seen in Figure 1.

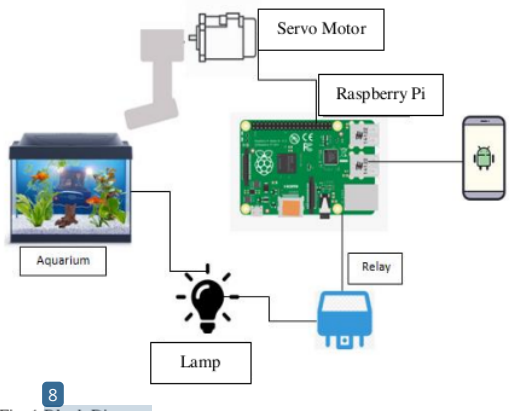

Fig. 1 Block Diagram

Figure 1 shows the system process flow used in this study. In the picture there is a servo motor, raspberry Pi, relay, decorative lights and android. Fish feeding in the aquarium can be set on Android. When it's time, the raspberry pi will give an order to the servo motor to open the food valve, then the food will come out. This tool can control the on or off of decorative lights where the decorative lights will turn on at 6 pm and will turn off at 6 am, the raspberry pi will be connected to a decorative light relay.

The research design is needed to make it easier for researchers to carry out and achieve goals according to a predetermined flow. The following is the design of the research tool that will be made as follows:

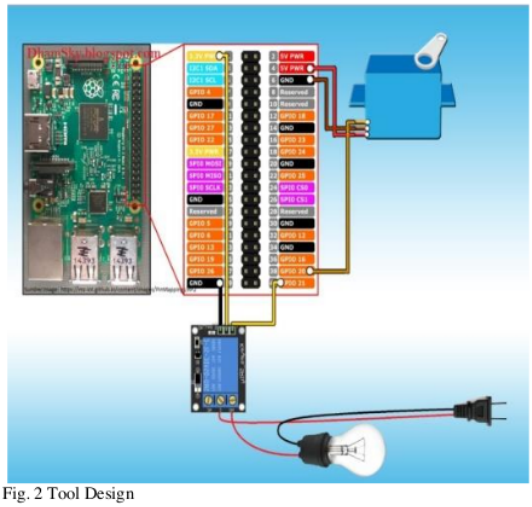

Fig. 2 Tool Design

Figure 2 shows a series of motor safety systems consisting of several devices (hardware), each component has its respective duties including:

1. Raspberry pi as a microcontroller which controls the connected devices.
2. The servo motor functions as a valve driving the fish food cover.
3. The relay functions as a connecting switch and an electric circuit breaker in decorative lamps

The Arduino Uno pins that will work on this system are:

1. GND pin as negative current for all devices.
2. 3.3V VCC pin for decorative lamp electric current.
3. The 5V VCC pin for the electric current at StepDown, which will later be lowered to 4V for the electric stress on the servo motor.
4. Pin PIO 21 & PIO 20 as a data receiver.

IV. RESULTS OF TOOL IMPLEMENTATION

The results of the study with the title "Smart aquarium design using android based raspberry pi" were implemented in accordance with the design in CHAPTER IV. The results can be seen in the Figure 3 and Figure 4.

This smart aquarium using an Android-based raspberry pi uses several hardware components to be able to perform a work system. The hardware components are raspberry pi, relay, decorative lights, servo motor, oxygen pump, water filter, while the software component that supports the smart aquarium working system is an android application.

In this tool there is a decorative lamp that is connected to a light relay mounted on the aquarium wall. For the location of fish food, it is made in the form of a tube at the end of

which there is a servo motor that can open the valve to drop fish food when the application user enters the fish feeding schedu according to the desired schedule. Prototype results can be seen in Figure 5.

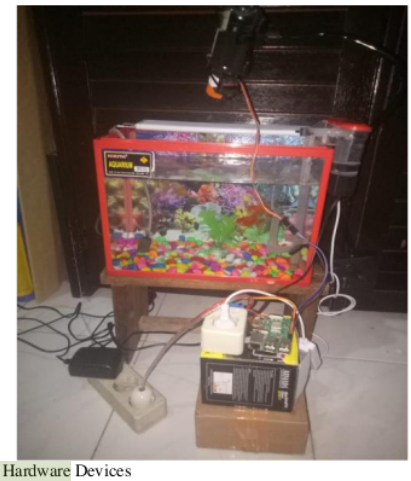

Fig. 3. Hardware Devices

Fig. 4. Fish Appearance

Fig. 5. Aquarium Decorative Lights

Android Interface

In Figure 6, you can see the initial display of this application, which is an Aquarium image that functions as information with a 3 second splash display. After 3 seconds, this display will direct the user to the next screen.

In Figure 7 is the main display result on the application for Smart Aquarium. This display displays the application logo, a decorative light notification image, an add schedule button and fish feeding schedule data on the smart akurium. In the schedule data, feeding hours, the level of food to be given and the user can delete the schedule that has been set.

In Figure 8 is the result of the added schedule display on the application for smart aquarium feeding. This view shows the application logo. The user can select the level of food to be given and the feeding hour which ends with the save button.

Fig. 6. Splash View

Fig. 7. Home Display

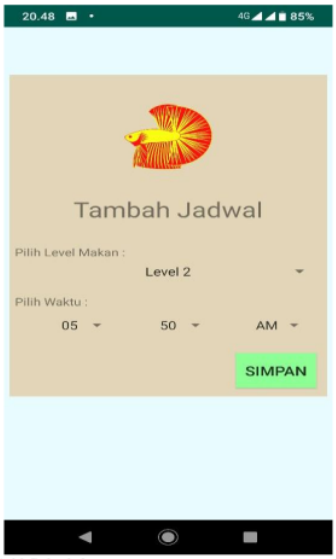

Fig. 8. View Add Schedule

B. Testing

The trial was carried out to find out whether this final project was going as desired. Some of the parameters that must be considered are as follows:

Testing the Performance of the Raspberry Pi

a. By making a simple program and checking the output whether it matches the program that has been made.
b. Make a program whether the smart aquarium can feed with instructions from android.
c. Testing the program to select the level of food that is issued by changing the time on the Android display.

Fig. 9. Raspberry Pi circuit

Fish Feeder Testing

This test is done by the user inputting the fish feeding schedule in the android application, which is in accordance with the schedule that has been set in the android application. If the request is fulfilled, the servo will turn the valve on the feeder according to the schedule that has been entered by the user, if the request is not fulfilled, the servo will close the feeding valve.

Fig. 10. Fish Appearance

Table I is a table for testing fish feeding using a smart aquarium application:

TABLE I. FISH FEEDER TESTING

Time	Eating Level			Weight	Information
	1	2	3		
09.30	√			0.1 gram	Food comes out for 0.5 seconds
09.30		√		0.3 gram	Food comes out for 1 seconds
09.30			√	0.5 gram	Food comes out for 1.5 seconds

C. Testing Aquarium Decorative Lights

This test is conducted to find out whether the decorative lights can turn on or not, the lights will turn on at 6 in the afternoon and will turn off at 6 in the morning. The Table II is a table for testing aquarium decorative lights.

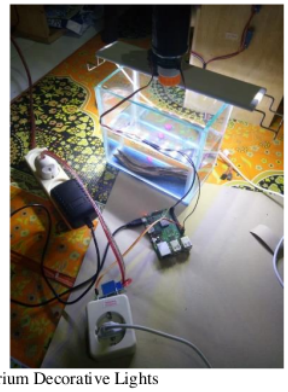

Figure 11. Aquarium Decorative Lights

TABLE 2. TESTING AQUARIUM DECORATIVE LIGHTS

Testing Time	Lamp Status	
	On	Off
06.00		√
21.00	√	
13.00		√
18.00	√	

IV. CONCLUSION

After conducting experiments on Smart Aquarium Design Using android-based raspberry pi, the following conclusions were drawn: The system design is in accordance with the design made. The design is a tool that can feed the fish automatically and can run its features. The android application-based interface is in accordance with the design, namely the Android application can perform monitoring. Based on the tests that have been done, this tool can feed fish on a scheduled or manual basis. The feeding process is done automatically; the servo will rotate the fish feeding valve. The process was tested 5 times with 100% success. The on / off process for decorative lamps is applied, in testing 4 times the success rate is 80%. Android sends data to the database later and the rasberry pi will read the data in the database.

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