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DESIGN AND BUILD AN AQUARIUM PROTOTYPE BASED ON (IOT) INTERNET OF THINGS

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Abstract

The problem and obstacle currently experienced by aquarium users is that users have to check the condition of the food and water conditions by coming directly to the aquarium. This method can be annoying and waste a lot of the user's time working and it is certainly not easy if every time the user has to directly check the condition of the feed and water in the aquarium. So from this problem I designed a system, namely designing an aquarium prototype based on IoT (internet of things) which can help with the problems being faced by aquarium users. This system is a sophisticated manual system using Arduino Wemos D1, Turbidity sensors and Proximity sensors to determine the condition of fish food and water conditions in the aquarium. With this system, it can make it easier for users to know the condition of the feed and water conditions in the aquarium, so that the user's time is not wasted and the user does not need to bother taking care of the condition of the aquarium. From the results of water testing using the Turbidity sensor, the values for very turbid water conditions were 266, 272, 281, 283, turbid water 518, 526, 536, 544 and clear water 589, 590, 594, 595. In the Proximity sensor test, the has a value of 1 when the sensor detects the presence of food and the sensor has a value of 0 when it does not detect the presence of food.

Keywords: Turbidity, Proximity.

INTRODUCTION

In everyday life, whether in the city or in the countryside, there are many fish keepers in aquariums, both large, medium and small. Pets that we keep in aquariums must pay attention to feeding times so that the fish need regular and continuous food. Especially for ornamental fish, keeping ornamental fish is a hobby of many people who have enjoyed it from the past until now, because of the ease in keeping and caring for them. It's just that it's difficult when we have to travel for a long time, up to days, and we think about what happens to our pet fish. How can we feed these fish according to the user's wishes without having to interfere with our daily activities [1]. The problem and obstacle currently experienced by aquarium users is that users have to check the condition of the food and water conditions by coming directly to the aquarium. This method can be annoying and waste a lot of the user's time working and it is certainly not easy if every time the user has to directly check the condition of the feed and water in the aquarium.

Based on this background, researchers will design a sophisticated manual system to determine the condition of fish food and water conditions in the aquarium which can be controlled remotely or remotely, with the Telegram application on a smartphone connected to the WiFi on the Arduino Wemos. For this reason, the author chose a final assignment (TA) with the title "Design and Build an Aquarium Prototype Based on IoT (Internet of Things). Based on the problems that have been described, the problem formulations that can be formulated include: How to design a system that can determine the condition of the aquarium, How to check the condition of the water in the aquarium, How to check the condition of the food in the aquarium. The aim of this research is to produce a system that works manually in an aquarium where checking the condition of the feed and checking the condition of the water is carried out according to the user's wishes via telegram on a smartphone which can be accessed from near or far.

LITERATURE REVIEW

1. Aquarium

Aquarium in Latin (Aqua = which means water and rium which means place or building) is a place which is generally made of transparent glass or plastic, filled with water with fish and living plants in it [2]. An image of the aquarium can be seen in Figure 1.

Figure 1 Aquarium

2. Arduino Wemos D1

Wemos is an Arduino compatible development board specifically designed for IoT (Internet of Things) needs. Wemos uses a fairly well-known WiFi chip, namely the ESP8266. Quite a lot of WiFi modules use the ESP8266 SoC. However, Wemos has several advantages which in my opinion are very suitable for IoT applications [3]. Arduino Wemos can be seen in figure 2.

Figure 2 Arduino Wemos D1

3. Relays

A relay is a switch that is controlled by current. The relay has a low voltage coil that is wrapped around a core and a nominal current that must be met by the output of the driver circuit. The current used in the circuit is DC current [4]. The relay can be seen in figure 3.

Figure 3 Relay

4. Turbidity Sensors

Turbidity Sensor The turbidity sensor uses a principle like the proximity sensor or the sensor on the line follower robot, which uses light, so this turbidity sensor works, namely, one of them emits light and the other receives light [5]. The Turbidity Sensor can be seen in Figure 4.

Figure 4 Turbidity Sensor

5. Water Level Sensors

Water Level Sensor is a tool used to provide a signal to the alarm / automation panel that the water level has reached a certain level. The sensor will provide a dry contact (NO/NC) signal to the panel. This detector is useful for providing alerts or for activating other automation devices [6]. An image of the water level sensor can be seen in Figure 5.

Figure 2.5 Water level sensor

6. Servo Motor

A servo motor is a device or rotary actuator (motor) that is designed with a closed loop feedback control system (servo), so that it can be set-up or adjusted to determine and ensure the angular position of the motor output shaft [7]. An image of a servo motor can be seen in figure 6

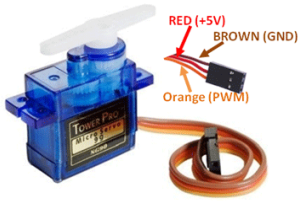

Figure 6 Servo motor

7. Water pump

Aquarium pumps have a very important role. This tool functions to drain water, send water to the filter tank (filter), and various other functions. By sending water to the filter tank, dirt and leftover food will remain in the filter and be destroyed by bacteria [8]. An image of a water pump can be seen in Figure 7.

Figure 7 Water Pump

8. Telegram

Telegram is a free and non-profit cloud-based multiplatform instant messaging service application. Telegram clients are available for mobile phone devices (Android, i OS, Windows Phone, Ubuntu Touch) and computer device systems (Windows, OS X, Linux). Users can send messages and exchange photos, videos, stickers, audio, and other types of files [9]. The telegram image can be seen in figure 8.

Figure 2.8 Telegram

9. Infrared Proximity Sensor

The E18-D80NK type infrared Porximity sensor is a sensor for detecting the presence or absence of an object. If the object is in front of the sensor and can be reached by the sensor, the sensor circuit output will be logic "1" or "high" which means the object is "there" [10]. The turbidity sensor image can be seen in figure 9.

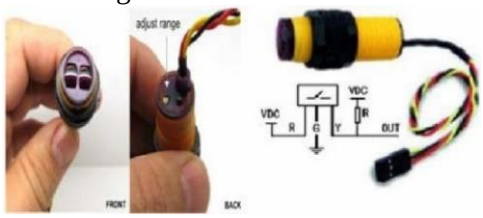

Figure 2.9 Infrared Proximity Sensor

10. Push Button Switch

A push button switch is a simple device/switch that functions to connect or disconnect the flow of electric current with a push unlock (non-lock) working system [11]. The push button image can be seen in Figure 10.

Figure 10 Push Button Switch

METHOD

1. System planning

System design is the stages that will be carried out to create a system for checking food conditions, checking water conditions, draining water and filling water in the aquarium. This system design is divided into several stages, namely: creating a system block diagram, creating a system flowchart and user interface.

2. Block Diagrams

The block diagram or description of the system design can be seen in Figure 3.1

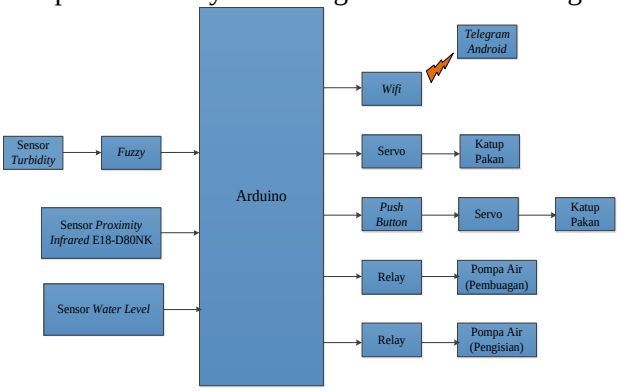

Figure 3.1. System Block Diagram

The block diagram in Figure 3.1 illustrates the connection that occurs between the equipment in the aquarium and the telegram. This design includes the installation stage of the Turbidity (turbidity) sensor, Proximity infrared sensor E18-D80NK, Water Level sensor, installation of a servo on the feed valve, installation of a relay on the water pump. Programming the aquarium system is generally done at the final stage, after the hardware mechanical design and

system design are complete. This is done because in the programming process the programmer often tests the tool to find out whether the tool components can be operated.

Flow chart

The design of an aquarium system can be described using a flowchart diagram. The feed system and water system are shown in figures 3.2 and 3.3.

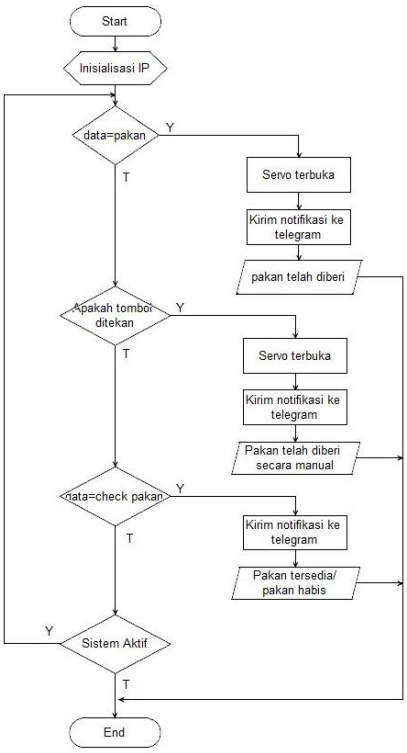

Figure 3.2 Feed System Flowchart

The following is an explanation of the feed system flowchart:

1. First, the IP initialization process.
2. Checks whether the data is feed. If the condition is correct then the servo will open and the system sends a notification to telegram namely "feed has been given" and if it is not correct then the system will execute the feed button condition.
3. Checking whether the feed button is pressed, if the condition is correct then the servo will open and send a notification to the telegram "feed has been given manually". If it is not correct, the system will run a feed check condition.
4. Check whether the data is check feed. If the conditions are correct, the system will send a notification to Telegram "feed available/out of feed". If the condition is not correct the system will run the active system condition and return to the initial process.

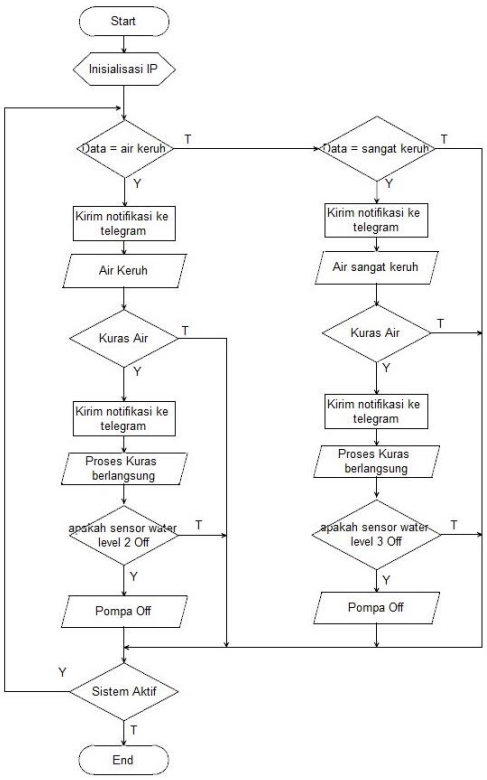

Figure 3.3 Water System Flowchart

The following is an explanation of the water system flowchart:

1. First, the IP initialization process.
2. Checking whether the data is cloudy water, if the condition is correct then the system will send a notification to the telegram "Muddy water".
3. Checking whether the data is draining, if the condition is true then the system will send a notification to Telegram "The draining process is in progress".
4. Check whether the condition of the water level 2 sensor is off, if the condition is correct then the pump is off and enters the active system condition. In the water drain condition and whether the water level 2 sensor is off, if the condition is not correct then the system enters the active condition.
5. Check if the condition is active. If the condition is correct the system will return to the initial process and if the condition is not correct the system will complete.
6. Check whether the data is very turbid water, if the condition is true then the system will send a notification to telegram "Very turbid water".
7. Checking whether the data is draining, if the condition is true then the system will send a notification to Telegram "The draining process is in progress".
8. Check whether the condition of the water level 3 sensor is off, if the condition is correct then the pump is off and enters the active system condition. In the water drain condition and whether the water level 3 sensor is off, if the condition is not correct then the system enters the active condition.
9. Check if the condition is active. If the condition is correct the system will return to the initial process and if the condition is not correct the system will complete.

4. User Interface

In this section, Telegram is used as a User Interface to find out commands and notifications from the system.

1. Telegram bot Main View

In the main display, this telegram bot supports things like a remote control which functions as control via smartphone, as shown in figure 3.4.

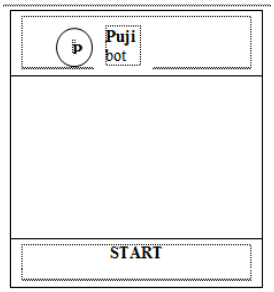

Figure 3.4 Main View of the Telegram bot

2. User and System Views

The User and System View displays commands sent to the system and the system displays notifications of the results of the system running as shown in Figure 3.5.

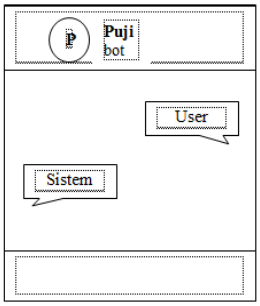

Figure 3.5 User and System View

RESULTS AND DISCUSSION

The results of testing the feed system and water system in the aquarium produce data in the form of water condition values and the condition of the feed in the aquarium.

Contents of Discussion Results

This section contains the main sub-discussions written in Times New Roman 12 font. The sub-discussions are written systematically. It is hoped that the numbering in the sub-discussion should not be written too much.

1. Implementation of Aquarium Device Series

Installation of the device circuit is carried out to determine whether the system has a circuit error or not, the circuit display can be seen in Figure 4.1

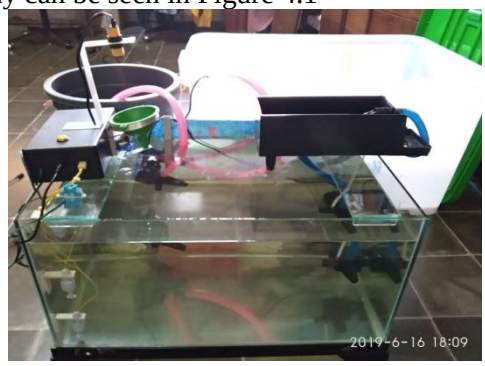

Figure 4.1 View of the Aquarium Circuit

2. Process of Sending Orders and Notifications on Telegram

The process of sending commands and receiving notifications on the system is displayed on the Telegram praise bot. The following is a display of the praise bot test results.

a) Telegram Main View Praise Bot

Telegram Puji Bot is the main screen or main display when you first open Telegram Puji Bot. The Start button will appear at the bottom of the display. This button functions to start commands on Puji Bot as shown in Figure 4.2.

Figure 4.2 Main View Praise the bot

b) Display /start Command and Notifications

The Praise bot display sends Start commands and notifications, which function to display the commands that will be used to run the system, as shown in figure 4.3.

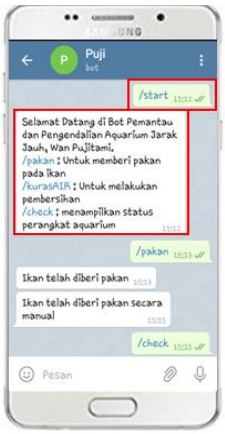

Figure 4.3 Display of the /start command and notifications

c) Display Commands /feed, Push Buttons and Notifications

The Puji bot display sends the /feed command which functions to run the fish feeding system automatically and the Push Button functions to open the feed valve manually, then displays a notification that the fish food has been successfully provided, as shown in figure 4.4

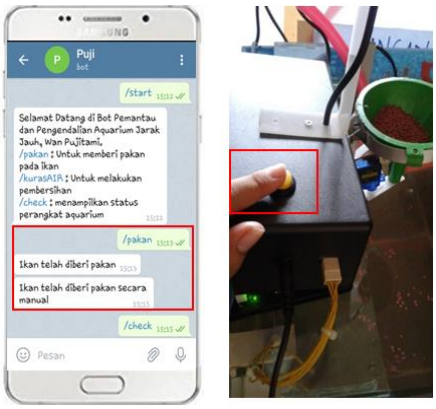

Figure 4.4 Display of the /feed command, push button and notification

d) Display of the /check command and notifications

The Puji bot display sends the /check command which functions to check all the conditions of the aquarium system, namely the condition of the feed, the condition of the water and the condition of the pump, which then shows the conditions in the notification that comes to the Puji bot, as shown in Figure 4.5.

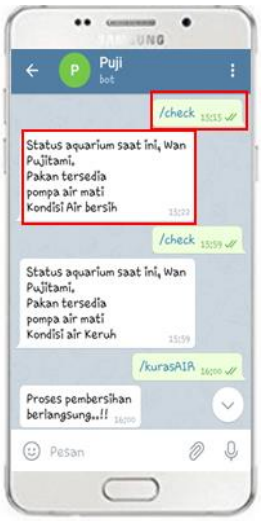

Figure 4.5 Display of the /check command and notifications

e) Display of the /drainwater command and notifications

The Puji bot display sends the command /drainAir which functions to run the pump system to drain the water when the water is in a murky or very turbid condition, and then notification of the condition of the draining taking place and completion will go to the Puji bot. After draining is complete, the water will automatically be refilled and a notification will appear that the aquarium is clean when the water filling process is complete, as shown in figure 4.6.

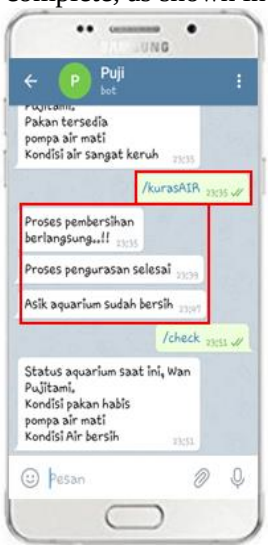

Figure 4.6 Display of the /drainwater command and notifications

3. Testing of the E18-D80NK Infrared Proximity Sensor

In this test, 2 (two) comparisons of different conditions were carried out, namely:
[1] No Object
[2] There is an Object

Based on the 2 (two) comparison conditions above, in [1] No Object, namely the condition of the sensor not detecting the presence of feed in the "Feed Out" container. In [2] there is an object, namely the condition of the sensor detecting the presence of available feed in the "Available Feed" container.

a) Testing access to the E18-D80NK Infrared Proximity sensor in conditions of no feed as can be seen from figure 4.7.

Figure 4.7 Image of the E18-D80NK Infrared Proximity Sensor in No Feed Conditions

Based on Figure 4.7, the sensor condition does not detect the presence of feed in the container. The distance between the sensor and the container is 14 cm, the infrared light on the sensor does not light up and the sensor has a value of "0".

b) Testing access to the E18-D80NK Infrared Proximity sensor in the presence of food as can be seen from figure 4.8.

Figure 4.8 Image of the E18-D80NK Infrared Proximity Sensor in the Condition of Feed

Based on Figure 4.8, the condition sensor detects the presence of feed in the container. The distance between the sensor and the feed is 13 cm, the infrared light on the sensor is on and the sensor has a value of "1".

4. **Testing of Sensors**Turbidity

In this test, 3 (three) different water ratios are carried out, namely:

[1] Clear Water

[2] Murky Water

[3] Very Turbid Water

a) Tests carried out in the Aquarium, access the sensor to clear water to determine the sensor value when the water is clear as can be seen from figure 4.9.

Figure 4.9 Sensor Testing in Clear Water

b) The next test was carried out in murky water conditions, namely mossy pool water, to determine the sensor value when the water was murky as can be seen from Figure 4.10.

Figure 4.10 Sensor Testing in Turbid Water

c) The final test was carried out in very turbid water conditions, namely dirty water due to feed to determine the sensor value when the water conditions were clear as can be seen from figure 4.11.

Figure 4.11 Sensor Testing in Very Turbid Water

5. Test Results Data for the E18-D80NK infrared Proximity Sensor

Data from the results of the E18-D80NK Proximity infrared sensor testing that have been carried out can be seen in table 4.1.

TABLE 4.1 E18-D80NK INFRARED PROXIMITY SENSOR DATA

No.	Condition	Mark	Light	Information
1	No Object	0	Lights Off	The feed is gone
2	There is an Object	1	Light On	Feed Available

In table 4.1, tests were carried out on the E18-D80NK Proximity infrared sensor in two conditions, namely in the first condition when there are "no objects" then the sensor value is "0" and indicates that "the feed is finished". Then in the second condition, when the sensor detects "an object is present", the sensor value is "1" and indicates that "feed is available".

6. Turbidity Sensor Test Results Data

In 3 (three) water conditions there are comparison values in the Arduino program, the comparison values can be seen in Figure 4.12.

```
//-------------------kondisi nilai air--------
int bersih = 570;
int keruh = 549 ;
int sangat_keruh = 500;
```

Figure 4.12 Comparison Value of Water Conditions

Based on figure 4.12, the value for clean water starts from 570. In turbid water conditions the value starts from 549 to the limit value for clean water and the value for very turbid water conditions starts from 500 until the limit value for turbid water.

Data from test results carried out in clean, turbid and very turbid water conditions, the values displayed on the serial monitor can be seen in figure 4.13.

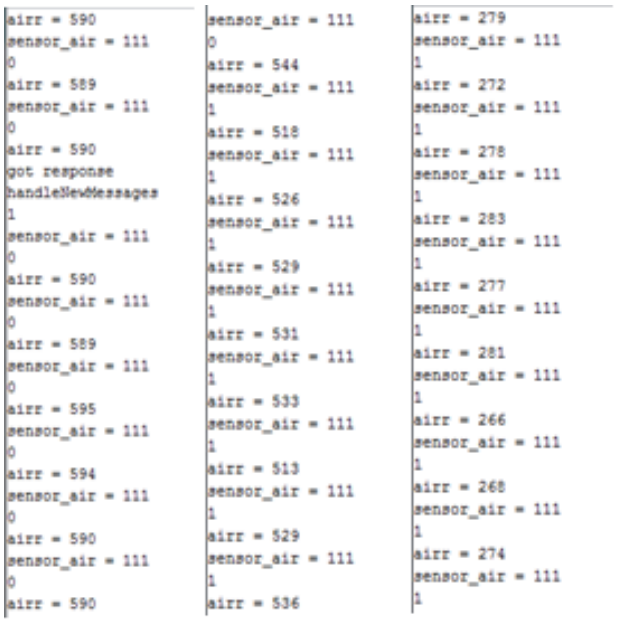

Figure 4.13 Test Result Data for Clean, Turbid and Very Turbid Water Values

Based on Figure 4.13, the values for clean water conditions are at 589, 590, 594, 595. The values for turbid water conditions are at 518, 526, 536, 544. Then for very turbid water conditions they are at values 266, 272, 281, 283.

CLOSING

Based on the design and testing that has been carried out previously regarding the design of an internet of things (IoT) based aquarium prototype using the Turbidity and Proximity Infrared E18-D80NK sensors, it can be concluded:

1. In designing the aquarium system, we use Arduino Wemos D1 which has an ESP8266 WiFi module. With the WiFi module, the system can connect to a smartphone via the hotspot on the smartphone. Then, the system will work if given an order via the Telegram application on the smartphone. On the system has
2. The test results in checking the condition of the three water conditions in the aquarium each have a value, in the Very Turbid condition the value is 266, 272, 281, 283, the Turbid condition is worth 518, 526, 536, 544 and the Clear condition is worth 589, 590, 594, 595 .the value that has been applied. To check the condition of the water, you must send the /check command via telegram and then the command will be received by the Arduino which will then be sent to the turbidity sensor. The sensor will work to detect the water value to determine the water condition. Next, the water condition will be sent back to Telegram in the form of a message or notification.
3. The test results of the E18-D80NK Infrared Proximity sensor in checking feed condition have two values, namely "0" and "1". The sensor has a value of "0" if the feed condition is exhausted then the sensor does not detect any objects. Then the sensor has a value of "1" if food conditions are available and the sensor detects an object. The sensor distance to detect feed is 13 cm and when it does not detect feed the sensor distance is 14 cm. To run the feed condition checking system, you must send the /check command via telegram, then the command will be received, processed and executed. Furthermore, when the command has been executed, a notification will be sent back to Telegram about the condition of the feed.

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