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# MORRIS (SHRIMP PONDS WATER MONITORING SYSTEMS) BASED ON IOT

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***Abstract***

Indonesia, a maritime country with numerous islands, relies heavily on shrimp farming. Monitoring the water conditions in shrimp ponds is crucial to ensure their viability and prevent large-scale product failures that can result in significant losses for farmers. Poor water quality is a leading cause of shrimp production failures. Implementing proper water sourcing and quality maintenance measures can significantly enhance pond productivity, aligning with the primary objective of meeting the market demand for shrimp. Currently, shrimp farmers employ various tools to monitor different water parameters, which is time-consuming and labor-intensive. This research aims to offer alternative solutions by developing a shrimp pond monitoring system with integrated temperature, TDS, and pH sensors in an Android-based device. The sensor data is transmitted to an Android application and web platform via a Wi-Fi network. The study utilizes field tests, black-box testing, SUS analysis, and SWOT analysis methods. The test results reveal technical issues with the MORRIS tool, particularly frequent Wi-Fi disconnections during field testing.

***Keywords**: Shrimp ponds, IoT, temperature, TDS, and pH*

# 1. INTRODUCTION

## 1.1 Preface

Indonesia is an archipelagic country that has potential in the field of fisheries. The results from the sea are used by the Government of Indonesia to export to other countries. One of them is shrimp which is the mainstay of fishery export commodities for Indonesia. Reporting to the Ministry of Maritime Affairs and Fisheries of Indonesia, the export volume of fishery products reached 1.26 billion kilograms (kg) with a value of US$ 5.2 billion in 2020 with shrimp as the largest export commodity with a volume of 239.28 million kg and a value of US$ 2. 04 billion.

The spread of shrimp in Indonesia almost covers all Indonesian waters, from the western waters of Indonesia to the waters in the east (Adnyana, 1992). This is evidenced by the number of fishermen who cultivate shrimp on the Indonesian sea coast using ponds. High water temperatures can increase the metabolic activity of shrimp (Salmin, 2005; Sahrijanna, 2017; Karim, 2007). Sahrijanna (2017) argued that in ponds, temperature greatly affects photosynthetic activity and the solubility of the particles in it. In the physiological life of aquaculture organisms, if the temperature rise reaches certain limits, it will increase the growth rate of shrimp. In addition, Simajuntak (2009) argues that the condition of dissolved oxygen in the waters is influenced, among others, by temperature, salinity, water mass movement, atmospheric pressure, phytoplankton concentration, and oxygen saturation level around it, and the stirring of water masses by the wind. The range of dissolved oxygen can be affected by temperature (Komarawidjaja, 2006). The low salinity range can reduce dissolved oxygen in the water, besides that it can cause thin shrimp shells (Syukri, 2006). Meanwhile, the high salinity range causes the molting process to be hampered so that shrimp growth is inhibited. The life of various types of plankton in the waters can be affected by variations in sanitation. The plankton community is higher in coastal waters with low salinity which causes oxygen competition between plankton and shrimp. This affects dissolved oxygen levels to be limited.

Some shrimp pond ecosystems in Indonesia are currently still far from standard environmental requirements. The pond water ecosystem is one of the closed and stagnant aquatic ecosystems, so it is vulnerable to stability and balance for water quality. Environmental criteria for shrimp ponds water under standard conditions include PH 7-8, Salinity 0-5 per mil, inundation height 80-120 cm, water temperature 26°C-30°C, water brightness 25-45 cm, dissolved oxygen / Dissolved Oxygen (DO) 5-7 ppm, Total Dissolved Solids (TDS) 300-600 ppm, carbon dioxide 2-12 ppm, and Ammonia ($NH_3$) < 2 ppm.

Seawater that has a high TDS value will result in high salinity and electrical conductivity (Effendi, 2003). Meanwhile, Oktaviana (2008) states that if the salinity is high, the DO concentration will be low, or vice versa if the salinity is low, DO will be high. Therefore, the availability of dissolved oxygen (DO) for cultured shrimp can be reduced if the TDS concentration is not maintained.

Based on the existing problems, the background for developing a monitoring and monitoring system for water quality in shrimp ponds water with parameters such as temperature, TDS, and pH based on IoT, namely MORRIS. With the measurement of these parameters, it is expected that shrimp farmers can obtain direct information on the condition of proper shrimp ponds water so that shrimp of good quality will be produced.

## 1.2 Problems

1. How to make a tool that can monitor the conditions of temperature, TDS, and pH of shrimp ponds water in real-time?
2. How to test the effectiveness and convenience of MORRIS with standard testing methods?
3. What are the advantages and disadvantages of MORRIS?

## 1.3 Purposes

1. Make a tool that can monitor the conditions of temperature, TDS, and pH of shrimp ponds water in real-time.
2. Test the effectiveness and convenience of MORRIS with standardized testing methods.
3. Determine the advantages and disadvantages of MORRIS.

### 1.4 Advantages

1 Public
- Helping the community to find out the condition of shrimp ponds water in real-time using an easy-to-use tool.
- Can be a solution for the community to produce quality shrimp.

2 Researcher
- Adding researcher's insight into programming science and aquaculture.
- Increase the experience of researchers to make scientific works that are true and accurate.

### 1.5 Basic Theory

#### 1.5.1 ShrimpPonds

Pools are usually used for ponds on land with freshwater, while ponds are for brackish or saltwater. One of the functions of ponds for aquatic ecosystems is the enrichment of air biota species (Biggs et al, 2005). The increase in the type of biota comes from the introduction of the cultivated biota. Aquaculture in ponds is a production process that requires control and its success will depend on both technical and non-technical factors (Cholik&Arifudin, 1989). Animals that are cultivated in ponds are aquatic, especially fish, shrimp, and shellfish. "*Tambak*", is taken from the Javanese language *nambak* (holding water with embankments, so that it collects in one place) and is used to describe a pond near the coast.

#### 1.5.2 IOT

Internet of Things (IoT) are sensors that connect to the internet and behave like the internet by making connections open all the time, sharing data freely, and enabling unexpected applications, so computers can understand the world around them. them and become part of human life. (Making Sense of IoT, Kevin Ashton).

#### 1.5.3 Wemos D1 R32

Wemos D1 R32 is an ESP32-based microcontroller with a clock speed up to 240Mhz which is a wireless (Wifi) microcontroller module. This microcontroller has 32 pins installed, digital and analog pins, and uses a USB cable to connect to the source. This microcontroller can be programmed using the Arduino IDE by using the library assistance provided in the application.

#### 1.5.4 DS18B20

Temperature is a measure of cold or hot conditions or something else. The unit of measurement for temperature that is widely used in Indonesia is degrees Celsius. Meanwhile, the unit of measurement that is widely used abroad is the Fahrenheit degree (Ir. Sarsinta, 2008). The DS18B20 is a digital thermometer that provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply. Each DS18B20 has a unique 64-bit serial code, which allows multiple DS18B20s to function on the same 1-Wire Bus. Thus, it is simple to use one microprocessor to control many DS18B20s distributed over a large area. Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control systems.

#### 1.5.5 TDS Meter V1.0

TDS is the number of dissolved solids in the form of organic ions, compounds, and colloids in water (WHO, 2003). TDS Meter V1.0 supports 3.3 ~ 5.5V wide voltage input, and 0 ~ 2.3V analog voltage output, which makes it compatible with 5V or 3.3V control systems or boards. The excitation source is an AC signal, which can effectively prevent the probe from polarization and prolong the life of the probe, meanwhile can help increase the stability of the output signal. The TDS probe is waterproof, it can be immersed in water for a long time measurement.

#### 1.5.6 Vernier PH Sensor

The pH sensor is a sensor used to determine the degree of acidity (Rozaq, Yulita, Setyaningsih, &Kunci, 2018). The pH sensor used is the Vernier PH-BTA pH sensor. This sensor can read the pH value from 0-14 where when the pH is 7 then the sensor will produce an output voltage of 1.75 Volts. This sensor has criteria where every decrease in pH measurement results there will be an increase in the output voltage value of 0.25 Volt/pH and for every increase in pH measurement results, there will be a decrease in an output voltage of 0.25 Volt/pH. So that the minimum output voltage that can be generated is 0 Volts when pH is 14 while the maximum output voltage that can be generated is 3.5 Volts when pH is 0.

#### 1.5.7 Blynk

Blynk is a new platform that allows quickly building interfaces to control and monitor hardware projects from iOS and Android devices. After downloading, the Blynk app can create project dashboards and set buttons, sliders, graphics, and other widgets onto the screen.

#### 1.5.8 Thingspeak

Thingspeak is an internet service that provides services for "Internet of Things" applications. Thingspeak is a service that contains applications and APIs that are open source to store and retrieve data from various devices using HTTP (Hypertext Transfer Protocol) over the internet or via LAN (Local Area Network). Thingspeak can create sensor logging apps, location tracking apps, and social networks of anything connected to the internet with status updates. This application can help us monitor lights, temperature, and many other parameters remotely as long as there is an internet connection.

## 2. METHOD AND EXPERIMENTAL DETAILS

### 2.1 Method

The research aims to develop a prototype for monitoring and maintaining water quality in ponds, utilizing IoT technology with Wemos D1 R32 as the microcontroller. The qualitative analysis involves testing the tool's functionality through field testing, Black Box Test, and performance evaluation using SUS analysis and SWOT analysis. In addition, a quantitative method is employed to assess the accuracy and reliability of the monitoring tool by collecting numerical data on temperature, TDS, and pH levels in the ponds. This combined qualitative and quantitative approach ensures a thorough evaluation of the prototype's effectiveness and performance.

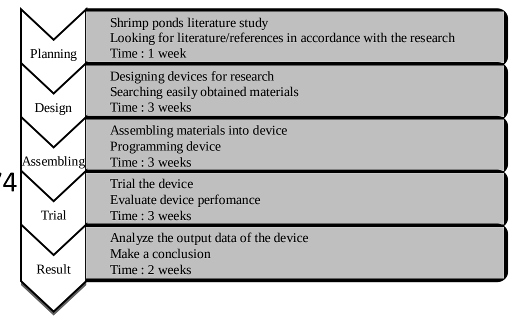
### 2.2 Time and Place

The research was conducted from March 2022-June 2022 including a literature study on shrimp ponds, designing MORRIS tools for research, assembling MORRIS tools, testing tools (black-box test, field testing, and SUS analysis), analyzing and discussing the results of the tests.
The location of the tool making is in SMA Negeri 3 Semarang. For the testing stage of the MORRIS, the tool was located in two locations, namely Victory Fishing Spot, PuriAnjasmoro Street 1, Tambakharjo, West Semarang. Secondly, Baron Fishing Spot, PuriAnjasmoro Raya Street N1, Tawangsari, West Semarang.

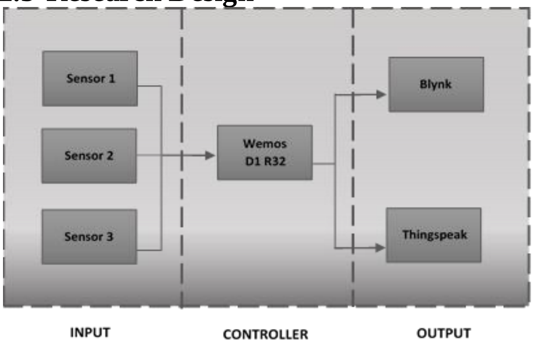
### 2.3 The Parties Involved

The research involves the entire range of Victory Fishing Spot and Baron Fishing Spot staff and Drs. AgusPriyatno, M. Pd as the supervisor.

### 2.4 Timeline



## 2.5 Research Design




**Input Block**

The Input Block consists of 2 sensors with different functions and the aim is to provide input of detected temperature, TDS, and pH of the water then the data will be sent to the Controller Block to be processed and sent to the Blynk Application via the Wemos D1 R32.

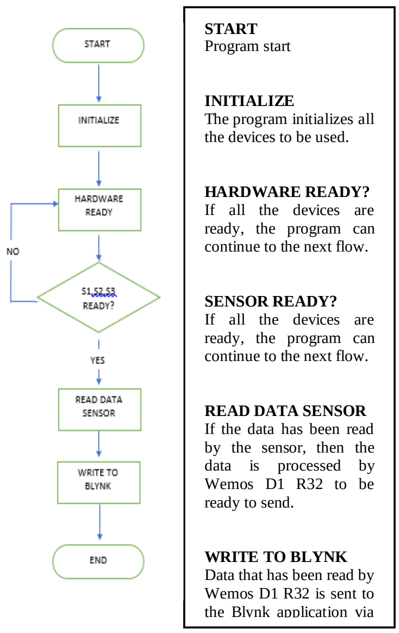
**Controller Block**

The controller block consists of the central controller unit, namely the Wemos D1 R32 as a means of communication via the wifi line to the Output Block. Data received from the Input Block will be sent via the wifi line to the Output Block.

**Output Block**

Block Output is a Blynk application and Thingspeak that functions to receive data from the Controller Block, then display it.

## 2.6 Flowchart




## 2.7 Testing Procedure

### A. PH Testing

**Calibration PH Sensor**

```
void setup() {
// initialize serial communication at 115200 bits per second:
Serial.begin(115200);
}
// the loop routine runs over and over showing the voltage on A7
void loop() {
// read the input on analog pin A7:
intsensorValue = analogRead(A7);
// Convert the analog reading (which goes from 0 - 1023) to a voltage (0 - 5V):
float voltage = sensorValue * (5.0 / 1023.0);
// print out the value you read:
Serial.print(sensorValue);
Serial.print("  ");
Serial.print(voltage/4*2.8);
Serial.print("  ");
Serial.println(voltage);
delay(300);
}
```

Testing Sensor PH

```
floatcalibration_value = 21.34;
intphval = 0;
unsigned long intavgval;
intbuffer_arr[10],temp;

void setup()
{
Serial.begin(115200);
Serial.println("Selamatdatang");
}

void loop() {
for(inti=0;i<10;i++)
 {
buffer_arr[i]=analogRead(A7);
delay(30);
 }
for(inti=0;i<9;i++)
```

```
{
for(int j=i+1;j<10;j++)
{
if(buffer_arr[i]>buffer_arr[j])
{
temp=buffer_arr[i];
buffer_arr[i]=buffer_arr[j];
buffer_arr[j]=temp;
}
}
}
avgval=0;
for(inti=0;i<10;i++)
avgval+=buffer_arr[i];
float volt=(float)avgval*5.0/1024/10;
floatph_act = -5.70 * volt + calibration_value;
Serial.print("pH Val:");
Serial.println(ph_act);
delay(1000);
}
```

**B. TDS and Thermo Testing**

```
#include "GravityTDS.h"
#include <OneWire.h>
#include <DallasTemperature.h>
#define ONE_WIRE_BUS 8
#define TdsSensorPin A0

OneWireoneWire(ONE_WIRE_BUS);
DallasTemperaturesensors(&oneWire);
GravityTDSgravityTds;

float temperature ,tdsValue = 0;
floatCelcius=0;

void setup()
{
Serial.begin(115200);
gravityTds.setPin(TdsSensorPin);
gravityTds.setAref(5.0); //reference voltage on ADC, default 5.0V on Arduino UNO
gravityTds.setAdcRange(1024); //1024 for 10bit ADC;4096 for 12bit ADC
gravityTds.begin(); //initialization
sensors.begin();
}

void loop()
{
sensors.requestTemperatures();
Celcius=sensors.getTempCByIndex(0);
temperature = Celcius; //add your temperature sensor and read it
gravityTds.setTemperature(Celcius); // set the temperature and execute temperature compensation
gravityTds.update(); //sample and calculate
tdsValue = gravityTds.getTdsValue(); // then get the value
Serial.print(tdsValue,0);
Serial.println("ppm");
Serial.print(" C ");
Serial.println(Celcius);
delay(1000);
}
```

**C. Final Testing**

```
{
   // Connect or reconnect to WiFi
   if(WiFi.status() != WL_CONNECTED){
   Serial.print("Attempting to connect to SSID: ");
   Serial.println(ssid);
   while(WiFi.status() != WL_CONNECTED){
   WiFi.begin(ssid, pass); // Connect to WPA/WPA2 network. Change this line if using open or WEP network
   Serial.print(".");
   delay(5000);
     }
   Serial.println("\nConnected.");
     }
   baca_TDS();
   baca_pH();
   tampil_thingspeak();
   Blynk.run();
   timer.run();
}
```

**2.8 How Do The MORRIS Work?**

a. Setting the Wifi (Hot Spot) on HP
b. Turn in Wifi ON
c. Open Blynk Application

d. Open Thingspeak Portal
e. Turn on MORRIS
f. Wait for minutes until blynk is connected with MORRIS
g. Check the data that appears in Blynk and Thingspeak (a little bit more time).

### 2.9 Field Test

Field tests will be carried out in various places and the data obtained will be entered into the table as follows.

| Location : | | | | |
|---|---|---|---|---|
| Spot | Time | Temperature | TDS | pH |
| | | | | |
| | | | | |
| | | | | |

### 2.10 Black-Box Testing

Software testing in terms of functional specifications without testing the design and program code to find out whether the functions, inputs, and outputs of the software are following the required specifications.

| No | Name | Expected Outputs | Validity | | Score |
|---|---|---|---|---|---|
| | | | T | F | |
| 1 | Ds18b20 | Temperature | | | |
| 2 | TDS Meter V1.0 | TDS | | | |
| 3 | Vernier PH-BTA pH sensor | pH | | | |
| 4 | ISP Sensor | Wi-Fi | | | |
| 5 | Mainboard | | | | |

### 2.11 SUS Analysis

SUS is one of the most popular usability testing tools. SUS was developed by John Brooke in 1986. SUS is a usability scale that is reliable, popular, effective, and inexpensive. SUS has 10 questions and 5 answer options. The answer choices ranged from strongly disagree to strongly agree. SUS has a minimum score of 0 and a maximum score of 100.
Here are 10 questions from the System Usability Scale (SUS):

1. I think I will use this system again
2. I find this system complicated to use
3. I find this system easy to use
4. I need help from someone else or a technician in using this system
5. I feel the features of this system are working properly
6. I feel many things are inconsistent (not compatible with this system)
7. I feel others will understand how to use this system quickly
8. I find this system confusing
9. I feel there are no obstacles to using this system
10. I need to get used to it first before using this system

SUS analysis has 5 answer choices

| Answer | Score |
|---|---|
| Strongly Disagree (SDS) | 1 |
| Disagree (DS) | 2 |
| Uncertain (UC) | 3 |
| Agree (AR) | 4 |
| Strongly Agree (SAR) | 5 |

**SUS Calculating Rules**

After collecting data from respondents, the data is calculated. In using the System Usability Scale (SUS) there are several rules for calculating the SUS score. The following are the rules when calculating the score on the questionnaire:

1. For each odd-numbered question, the score of each question obtained from the user's score will be deducted by one.
2. Each question has an even number, the final score is obtained from the value of 5 minus the question score obtained from the user.
3. The SUS score is obtained from the sum of the scores for each question which is then multiplied by 2.5.

The rules for calculating scores apply

$$\bar{x} = \frac{\sum x}{n}$$

$\bar{x}$ = Average Score
$\sum x$ = Total Score
$n$ = Total Respondent

to 1 respondent. For further calculations, the SUS score of each respondent is sought for the average score by adding up all scores and dividing by the number of respondents.

Here's the formula for calculating the SUS score:

**How to Calculate SUS**

How to use the System Usability Scale (SUS) is the result of data from respondents in excel or other applications. An example of a data recap is shown in the table below. For Q1 to Q10, the number of questions is the number of questions and the numbers are the answers of the respondents. The results of the assessment by respondents will be stated in a table as follows.

| No | Respondent | Data | | | | | | | | | | Total | Score (Total × 2,5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | Average Score | | | | | | | |

## 3. RESULT AND DISCUSSION

### 3.1 Result

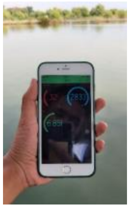


Figure MORRIS TOOL Display

Blink on Cellphone

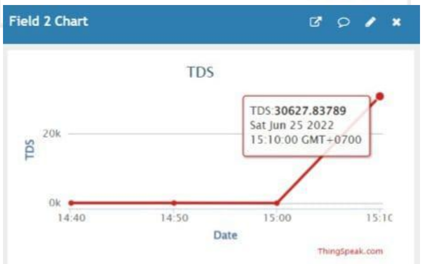
Thingspeak Display on Laptop

Field Test

Location 1: Victory Fishing Spot, PuriAnjasmoro Street 1, Tambakharjo, West Semarang.

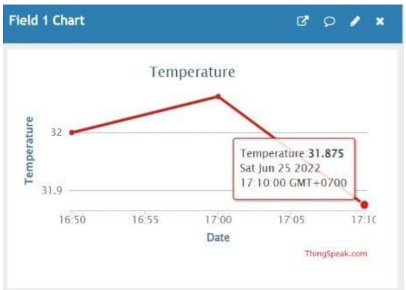
Spot 2

Time: 15:30:00

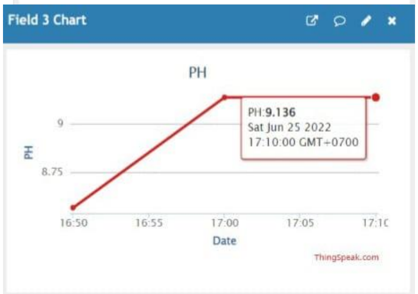





Location 2: Baron Fishing Spot, PuriAnjasmoro Raya Street N1, Tawangsari, West Semarang.
Spot 3
Time: 17:10:00









The Result of Field Test

| Spot | Time | Temperature | TDS | pH |
|---|---|---|---|---|
| Location 1: Victory Fishing Spot, PuriAnjasmoro Street 1, Tambakharjo, West Semarang. | | | | |
| 1 | 14:20:00 | 32 | 28460 | 6.856 |
| 2 | 15:10:00 | 31.43 | 30627 | 6.856 |
| 3 | 16:10:00 | 31.68 | 30937 | 9.136 |
| Location 2: Baron Fishing Spot, Anjasmoro Raya Street N1, Tawangsari, West Semarang. | | | | |
| 1 | 16:30:00 | 31.43 | 31220 | 8.56 |
| 2 | 17:00:00 | 32.06 | 3933 | 9.13 |
| 3 | 13:20:00 | 31.87 | 29152 | 9.13 |

For the TDS, MORRIS uses a comparison between the TDS meter and the TDS V1.0 sensor. The ratio is 1:3 which means that the TDS output on MORRIS will be divided by 3.

| Spot | Time | Temperature | TDS | pH |
|---|---|---|---|---|
| Location 1: Victory Fishing Spot, PuriAnjasmoro Street 1, Tambakharjo, West Semarang. | | | | |
| 1 | 14:20:00 | 32 | 9486 | 6.856 |
| 2 | 15:10:00 | 31.43 | 10209 | 6.856 |
| 3 | 16:10:00 | 31.68 | 10312 | 9.136 |
| Location 2: Baron Fishing Spot, Anjasmoro Raya Street N1, Tawangsari, West Semarang. | | | | |
| 1 | 16:30:00 | 31.43 | 10406 | 8.56 |
| 2 | 17:00:00 | 32.06 | 1311 | 9.13 |
| 3 | 13:20:00 | 31.87 | 9717 | 9.13 |

### 3.2 Field Test Analysis

1. Temperature
   Field test results show that the temperature in shrimp ponds does not have a significant difference. The temperature value in the ponds is in the range of 26°C -29.37°C. While the normal temperature in shrimp ponds is in the range of 26°C-30°C.

2. TDS
   As a reference for farmers, a good TDS level for shrimp ponds is 300-600 ppm. Meanwhile, MORRIS shows results between 1311-10406 ppm. These results indicate that the field test location is not suitable for shrimp growth. TDS concentrations are too high or too low,

can inhibit the growth of life in water, and can cause death.

3. pH
   Field test results showed that the pH of the water contained in the shrimp ponds ranged from 6.28-9.13. This indicates that the water contained in shrimp ponds is water that tends to be alkaline. While the normal pH in shrimp ponds ranges from 7-8.

## 3.3 Black-Box Test Analysis

The Result of the Black-Box Test

| No | Name | Expected Outputs | Validity | | Score |
|---|---|---|---|---|---|
| | | | T | F | |
| 1 | Ds18b20 | Temperature | ✓ | | Valid |
| 2 | TDS Meter V1.0 | TDS | ✓ | | |
| 3 | Vernier PH-BTA pH sensor | pH | ✓ | | Valid |
| 4 | ISP Sensor | Wi-Fi | ✓ | | Valid |
| 5 | Mainboard | | ✓ | | Valid |

Based on data from the black-box test results, Ds18b, TDS Meter V1.0, Vernier PH-BTA pH Sensor, ISP sensor, and mainboard showed valid results, which means that these four components work well.

## 3.4 SUS Analysis

The Result of MORRIS Questionnaire Analysis Using SUS Method

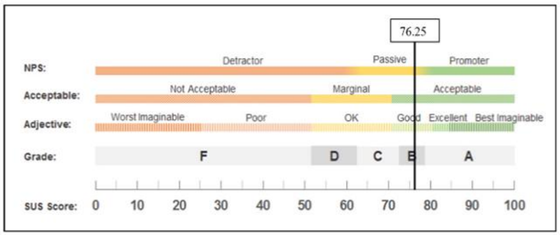
| No | Respondent | Gender | Score Data Control | | | | | | | | | | Total | Score (total x 2,5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | | |
| 1 | Shaula Dewi | F | 4 | 1 | 5 | 1 | 4 | 1 | 5 | 1 | 5 | 2 | 37 | 92,5 |
| 2 | Fayyaza Puan | F | 5 | 1 | 4 | 2 | 5 | 1 | 4 | 1 | 4 | 1 | 36 | 90 |
| 3 | Destina Widiasari | F | 4 | 2 | 3 | 4 | 4 | 2 | 4 | 2 | 2 | 3 | 24 | 60 |
| 4 | Agatha Naquita | F | 5 | 2 | 4 | 4 | 4 | 2 | 4 | 1 | 5 | 5 | 28 | 70 |
| 5 | Shaula Yokkaichi | F | 4 | 2 | 3 | 4 | 4 | 2 | 4 | 2 | 2 | 3 | 24 | 60 |
| 6 | Haikal Ilham | M | 4 | 3 | 4 | 4 | 3 | 2 | 4 | 1 | 4 | 5 | 24 | 60 |
| 7 | Oki Yudistira | M | 4 | 2 | 4 | 4 | 4 | 2 | 4 | 1 | 4 | 4 | 27 | 67,5 |
| 8 | Jelita Winner | F | 5 | 2 | 5 | 2 | 4 | 1 | 5 | 1 | 4 | 3 | 34 | 85 |
| 9 | Sahda Raisa | F | 5 | 2 | 5 | 2 | 5 | 1 | 5 | 1 | 5 | 3 | 36 | 90 |
| 10 | Amanda Charlendita | F | 5 | 1 | 5 | 2 | 5 | 1 | 4 | 1 | 5 | 4 | 35 | 87,5 |
| | | | | | | | | | | | | Total average score | | 76,25 |

The average SUS (System Usability Scale) score from many studies is 68, so if the SUS score is above 68 it will be considered above average, and a score below 68 is below average. If the score is below 68, it means that there is a problem with usability and needs improvement (Eddie Susilo, 2019).
From the results of the calculation of the SUS method questionnaire by 10 respondents, the total value of MORRIS is 76,25 in the SUS analysis score 76,25 is above the average.

Grading Scale for SUS

| Grade | SUS | Percentile Range | Adjective | Acceptable | NPS |
|---|---|---|---|---|---|
| A+ | 84.1-100 | 96-100 | Best Imaginable | Acceptable | Promoter |
| A | 80.8-84.0 | 90-95 | Excellent | Acceptable | Promoter |
| A- | 78.9-80.7 | 85-89 | | Acceptable | Promoter |
| B+ | 77.2-78.8 | 80-84 | | Acceptable | Passive |
| B | 74.1-77.1 | 70-79 | | Acceptable | Passive |
| B- | 72 .6-74.0 | 65-69 | | Acceptable | Passive |
| C+ | 71.1-72.5 | 60-64 | Good | Acceptable | Passive |
| C | 65.0-71.0 | 41-59 | | Marginal | Passive |
| C- | 62.7-64.9 | 35-40 | | Marginal | Passive |
| D | 51.7-62.6 | 15-34 | Ok | Marginal | Detractor |
| F | 25.1-51.6 | 2-14 | Poor | Not Acceptable | Detractor |
| F | 0-25 | 0-1.9 | Worst Imaginable | Not Acceptable | Detractor |

Sources: (Lewis & Sauro, 2018; Sauro, 2018).




The interpretation of these results shows that the score is in grade B with a percentile range of 70-79 (way above the average of 68). The classification shows that respondents assess the MORRIS as Good (adjective) and acceptable (acceptability).
This shows that MORRIS can be used but deserves to be developed further because there are problems with the Wi-Fi connection that need improvement.

## 3.5 SWOT Analysis

### 3.5.1 Strength

1. Can detect temperature, TDS, and pH in shrimp ponds water in a few minutes, and is easy to use for all circles.
2. Can be remotely portable for use and doesn't take much time to collect the data.

### 3.5.1 Weakness

Wi-Fi connection that often disconnects when used.

### 3.5.2 Opportunity

There are no tools like MORRIS before that are used to detect temperature and pH in shrimp ponds water, especially using Wemos D1 R32 as a microcontroller, Thingspeak, and Blynk App.

### 3.5.3 Threat

1. Unpredictable weather conditions in the field.
2. The condition of the shrimp farm is too dirty so MORRIS cannot detect it.

Based on the results of field tests, black-box testing, SUS values, and SWOT analysis, the MORRIS tool based on Wemos D1 R32 is feasible to use but needs to be further refined because there are still many shortcomings in the Wi-Fi connection.

## 4. CONCLUSION

1. Based on the test results data, MORRIS can detect the shrimp pond's water quality with temperature, TDS, and pH parameters. The MORRIS tool successfully monitors temperature, TDS, and pH in real-time using IoT technology. It employs sensors like DS18B20 for temperature, TDS Meter V1.0 for TDS, and Vernier PH-BTA pH sensor for pH.
2. MORRIS underwent field tests at locations such as Victory Fishing Spot and Baron Fishing Spot. Temperature readings fell within the normal range (26°C-29.37°C), but TDS levels varied (1311-10406 ppm), indicating unsuitable conditions for shrimp growth. Frequent Wi-Fi disconnections were identified as a technical issue during field testing.
3. Advantages of MORRIS include providing real-time data for shrimp pond water quality, ease of use, and potential to enhance shrimp production. Disadvantages include occasional Wi-Fi disconnections during field testing, requiring further improvement.

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