PH AND TEMPERATURE DETECTION FOR FISH POND

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CHAPTER 1: INTRODUCTION

1.1 Research Background

In fish farming, many factors whether the farming will be successful or not. Among these many factors, the 2 most influential are pH and temperature. Fish will die if these two factors suddenly change or are in an abnormal period. To maintain the pH, farmers need to extract some solution to keep pH within normal limits. The solution needed must be calculated carefully so that it is not too little or too much. pH test is needed to know how much pH is inside the pond. There's some variation in the pH test today. Like using Lakmus Paper and using a sensor. The Lakmus paper is too simple and does not give a specific number. And for the sensor, need a device to calculate data from it and to process what to do with the data.

The temperature in the pond also needs to be maintained. Fish are so sensitive to temperature and can't live long with temperature change. To maintain the temperature, farmers also need some device to calculate the temperature inside the pond. This act can be done with a thermometer or a sensor placed inside the pool.

1.2 Research Purposes

This research aims to make a device to detect pH and temperature in fish ponds, specifically in catfish ponds. This device can alert farmers if there's something unusual happening in the pond. Whether the pond pH rises abnormally or the temperature is not suitable for the catfish. This device only works in artificial ponds, not natural ponds. Because the natural pond has too many variables to calculate.

CHAPTER 2: LITERATURE REVIEW

Fish ponds have two types, natural pond and artificial pond. A natural pond is a pond that forms naturally and is generally large. Usually, this type of pond is in a small lake or near a beach. This type can't be controlled by hand, so in this type, it's impossible to manipulate pH and temperature. There's no purpose for this device to work at this type of pond. The next type is the artificial pond. The artificial pond is a pond made by humans, usually using either concrete or tarpaulin. The pond environment can be controlled manually, so fish farmers can make the pond pH and temperature as specific as they want.

Catfish is one of the most common fish to farm in Indonesia. Catfish can be farmed anywhere, but to maximize the profit, usually farmers use artificial ponds to farm this type of fish. Catfish need a specific pH and temperature to grow effectively. pH catfish needed is around 6 and 8 more or less than that, catfish can die or stress and make most of them eating each other. For the temperature, catfish can live optimally around 28 to 30 degrees Celsius. If the pond goes too hot or too cold, catfish also can die because of it. So, when farming catfish those two variables must taken seriously for maximizing the profit.

CHAPTER 3: METHODOLOGY

3.1 System Design

3.1.1 Components

There are some components used in this device. There are:

a. DFRobotV2 Sensor

DFRobot V2 sensor is a pH sensor we use. The specification is:

- Working Voltage: 3.3 ~ 5.5V
- Working current: 5 - 10mA
- Range detection pH : 0 ~ 14
- Working temperature: 5 ~ 60 ° C
- Accuracy: ± 0.1pH (25 ℃)
- Response Time: ≤ 1 Minute
- Service Life: 0.5 Year
- Module Size: 43 x 32mm
- Price: IDR 550.000

b. DS18B20 Sensor

DS18B20 is temperature sensor that using current difference to tell temperature around the sensor. The specs are:

- Usable temperature range: -55°C to +125°C
- Operating voltage: 3V to 5V
- Accuracy: ±0.5°C
- Output resolution: 9-bit to 12-bit (programmable)
- Unique 64-bit address enables multiplexing

c. Arduino Uno

Arduino uno is the core of system. This microcontroller used to retrieve data from sensor. Then use the data to control lamp and LCD we use. The specs are:

- 14 digital input/output pins (6 can be used as PWM outputs)
- 6 analog inputs
- 16 MHz ceramic resonator
- USB connection (USB-B connector)
- Power jack (7V ~ 12V external power)
- ICSP header
- Reset button

d. LCD I2C

We use LCD for interface of the system and displays data measurement results from sensor. We use the I2C version to simplify the wiring we use to connect to Arduino Uno. The specification is:

- Compatible with Arduino Board or other controller board with I2C bus.
- Display Type: Dual colour LCD, Negative white on Blue backlight.
- I2C Address: 0x20-0x27 (0x20 default), 0x38-0x3F (0x3F default).
- Supply voltage: 5V.
- Interface: I2C to 4bits LCD data and control lines, I2C/TWI x1, Gadgeteer interface x2.
- Contrast Adjustment: built-in Potentiometer.
- Backlight Control: Firmware or jumper wire.
- Display capacity: 16 character x 2 row.

e. Buzzer 5-12 V

This buzzer is for indicator and alert if something goes wrong. Like the temperature too low or too high from normal. This specification is:

- Rated Voltage: 12V DC
- Operating Voltage: 8V DC to 16V DC
- Rated Current at Rated Voltage: 30mA
- Sound Output at 10cm, at rated voltage: ≥85dB
- Resonant Frequency at rated voltage: 2,300 ±300Hz
- Operating Temperature: -20°C to +70°C
- Storage Temperature: -30°C to +80°C
- Weight: 2g

f. Pilot Lamp 12 V DC

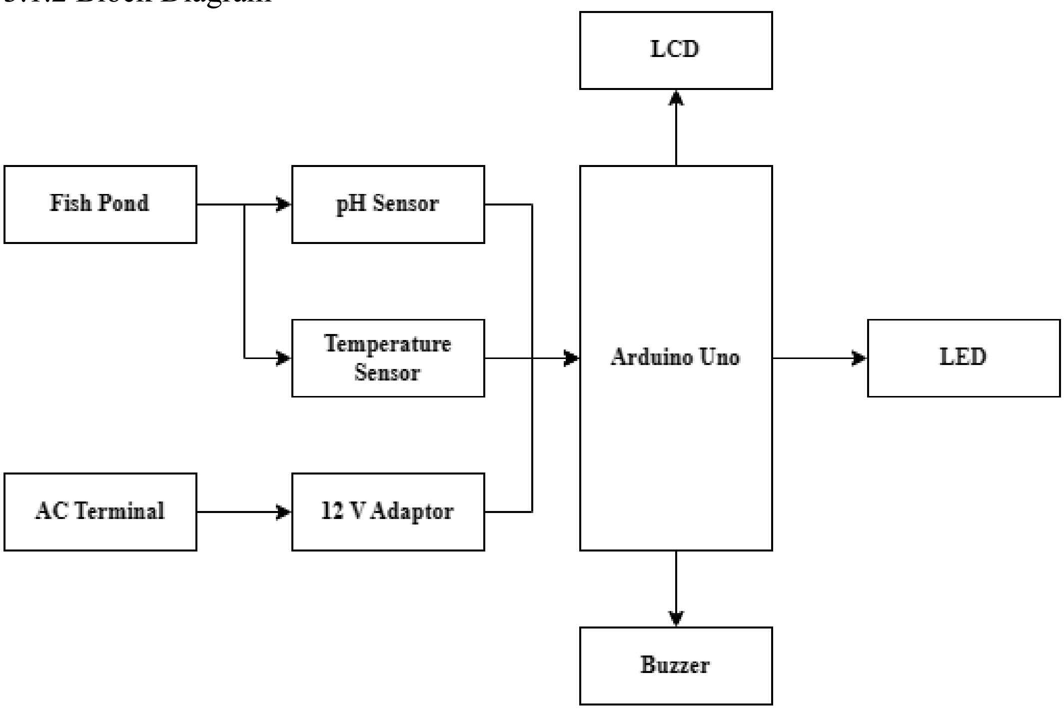
This lamp is indicator whether the temp or pH goes abnormally. The specification is:

- Model: AD16-22DS
- Operating voltage: 12 V DC
- Color: Red, Blue, Green, Yellow
- Luminescent Material: High Brightness
- LED Lamp head diameter: 30mm
- Installation hole diameter: 22mm

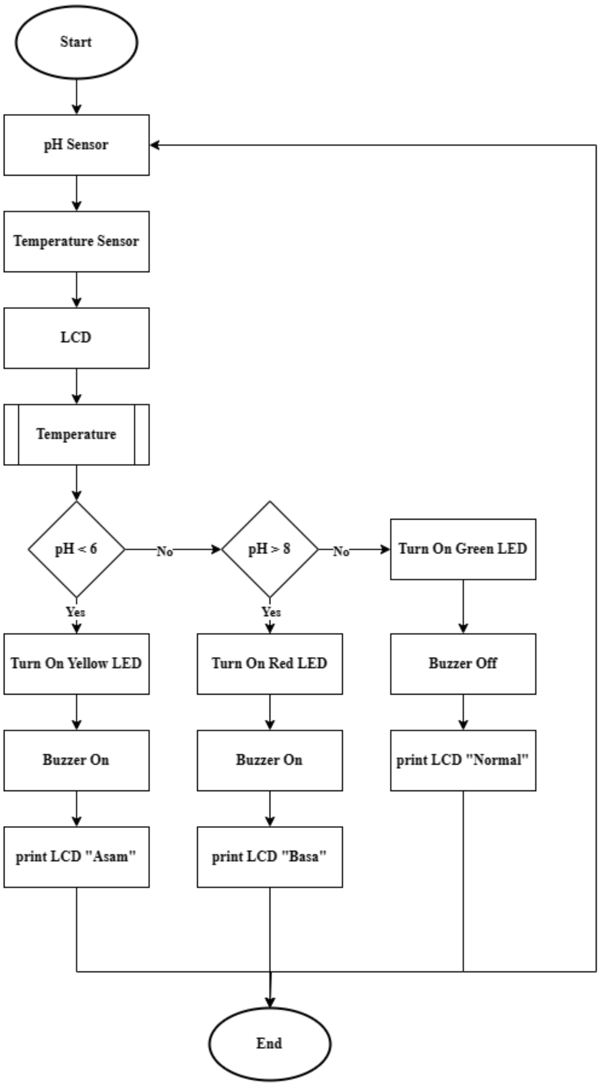
g. Adaptor AC/DC 12 V

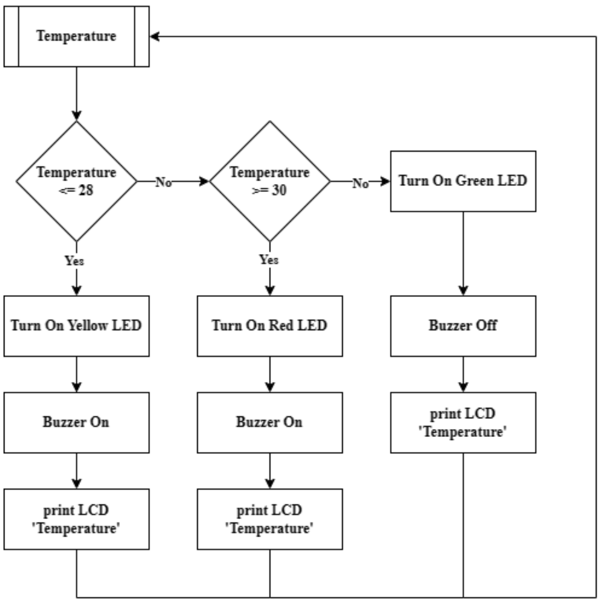
This adaptor we use for the device. This is for converting AC to DC, so our device can run safety and normally.

3.1.2 Block Diagram



3.1.3 Flowchart





3.2 Making Process

To make the device, several conditions needed to be inputted as a code variable and used to run the device. To start, we need an input variable in the code for pH. In this case, we need to maintain a pH between 6 and 8. That's because catfish and several types of fish only can survive between that range of pH.

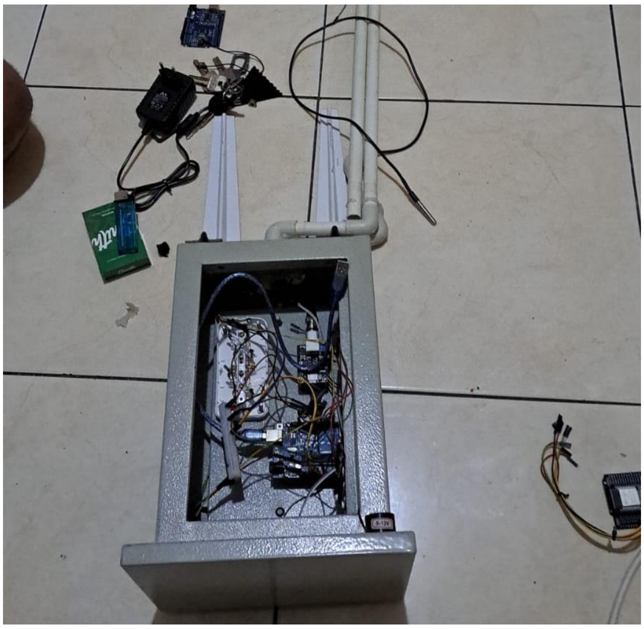
For the next variable, we need to make sure the temperature inside the pond is between 28 and 30 degrees Celsius. This is from the data collected before and is important to maintain so the fish do not die. So, there's the code made from that several conditions.

```
#include "DFRobot_PH.h"
#include <OneWire.h>
#include <DallasTemperature.h>
#include <LiquidCrystal_PCF8574.h>
#include <Wire.h>
#include <toneAC.h>  // Tambahkan library toneAC

LiquidCrystal_PCF8574 lcd(0x27);

#define sensor_ds18b20 2
OneWire oneWire(sensor_ds18b20);
DallasTemperature sensors(&oneWire);

int sensorPin = A0;
float tegangan, nilaiph;
int suhu;
DFRobot_PH ph;

const int redLedPin = 3;
onst int yellowLedPin = 4;
const int greenLedPin = 5;

const int redLedPin2 = 7;
const int yellowLedPin2 = 8;
const int greenLedPin2 = 9;

const int buzzerPin = 10;

void setup()
{
    Serial.begin(9600);
    ph.begin();
    sensors.begin();
    lcd.begin(16, 2);
    lcd.setBacklight(255);
    lcd.setCursor(0, 0);
    lcd.print("MONITORING PH AIR");
    lcd.setCursor(0, 1);
    lcd.print("IKAN LELE");
    delay(2000);
    lcd.clear();
```

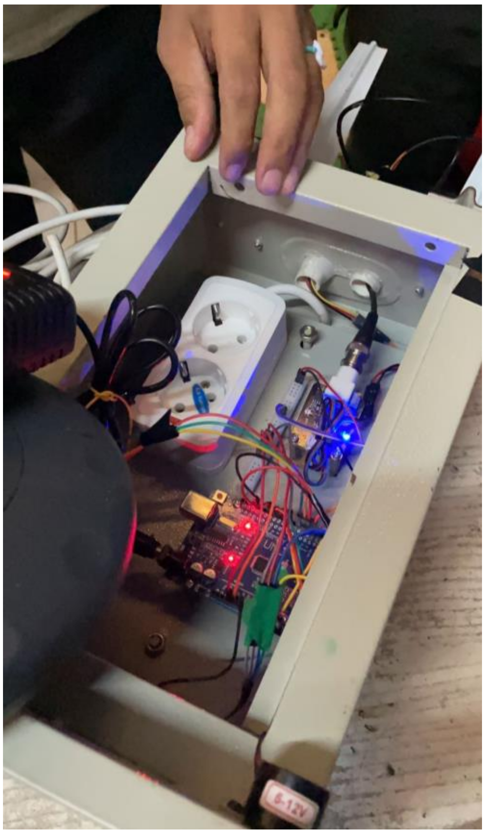
```
    pinMode(buzzerPin, OUTPUT);
    digitalWrite(buzzerPin, LOW);
}

void loop()
{
    sensors.requestTemperatures();
    static unsigned long timepoint = millis();
    if (millis() - timepoint > 1000U)
    {
        timepoint = millis();
        tegangan = analogRead(sensorPin) / 1024.0 *
5000;
        suhu = sensors.getTempCByIndex(0);
        nilaiph = ph.readPH(tegangan, suhu);

        Serial.print("Celsius temperature: ");
        Serial.print(suhu, 1);
        Serial.print("°C  pH:");
        Serial.println(nilaiph, 2);

        lampu();

        lcd.setCursor(0, 0);
        lcd.print("Suhu: ");
        lcd.setCursor(0, 5);
        lcd.print(suhu, 1);
        lcd.print((char)223);

        lcd.setCursor(0, 1);
        lcd.print("PH :");
        lcd.setCursor(4, 1);
        lcd.print(nilaiph, 2);

        lcd.setCursor(10, 1);
        if (nilaiph < 6){
            lcd.print("Asam  ");}
        else if (nilaiph > 8){
            lcd.print("Basa  ");}
        else {
            lcd.print("Normal");}
    }
    ph.calibration(tegangan, suhu);
}

void lampu()
{
    if (nilaiph > 8)
    {
        digitalWrite(redLedPin, HIGH);
        digitalWrite(yellowLedPin, LOW);
```

```
            digitalWrite(greenLedPin, LOW);
            toneAC(buzzerPin, 1000);
        }
        else if (nilaiph < 6)
        {
            digitalWrite(redLedPin, LOW);
            digitalWrite(yellowLedPin, HIGH);
            digitalWrite(greenLedPin, LOW);
            toneAC(buzzerPin, 1000);
        }
        else
        {
            digitalWrite(redLedPin, LOW);
            digitalWrite(yellowLedPin, LOW);
            digitalWrite(greenLedPin, HIGH);
            noTone(buzzerPin); // Matikan buzzer jika pH
    = 7
        }

        if (suhu <= 28)
        {
            digitalWrite(redLedPin2, LOW);
            digitalWrite(yellowLedPin2, HIGH);
            digitalWrite(greenLedPin2, LOW);
        }
        else if (suhu >= 30)
        {
            digitalWrite(redLedPin2, HIGH);
            digitalWrite(yellowLedPin2, LOW);
            digitalWrite(greenLedPin2, LOW);
        }
        else
        {
            digitalWrite(redLedPin2, LOW);
            digitalWrite(yellowLedPin2, LOW);
            digitalWrite(greenLedPin2, HIGH);
        }
}
```

After making the code, we must assemble the device. we use the component listed before and assemble it to work properly.



Picture 3.1 Progress on assemble the component



Picture 3.2 Maintaining the device

CHAPTER 4: RESULTS AD DISCUSSION

4.1 Test Result

After making the device, the device must be tested by hand to make sure it works properly. To test it, we prepared a few preparations to test several conditions. Like lemon juice for the acid test, soap solution for the alkaline test, hot water for the heat test, and ice water for the cold test. This test is for checking whether the lamp and the buzzer work as intended.

No	Test Solution	pH Lamp	Temperature Lamp	Buzzer
1	Lemon Juice	Yellow	Green	On
2	Soap solution	Red	Green	On
3	Hot water	Green	Red	On
4	Ice water	Green	Yellow	On
5	Mineral Water	Green	Green	Off

Picture 4.1 pH and temperature detector device

4.2 Results Analysis

From the result taken, we know that the device working as intended and not just showing the pH and the temperature, but also buzzing alarm when something goes wrong. If the sensor senses some acidic solution, the yellow lamp on the pH side will go on but the temperature lamp is still in green because the temperature is normal then the buzzer is on. When the sensor senses the soap solution, the red lamp on the pH side goes on the temperature lamp indicator is still in green and the buzzer is on. Next is when hot water is added near the sensor. The lamp on the pH side will stay green and, on the temperature, side will turn the red lamp on. Still, the buzzer is on. For the ice water, the lamp on the pH side is still green and the lamp on the temperature side will be yellow and the buzzer on. To make sure the device still can sense normally, a mineral water test was added so that when the mineral water is added near the sensor, the lamp should be all green and the buzzer should be off. When the test is done, the lamp is all green, and the buzzer is off. This device works as intended.

CHAPTER 5: CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

After making and testing pH and Temperature detection devices, there're several things can be gained. One of them is when making the device, make sure several sensors can be chosen to make the device work. To choose the sensor, we need to check its specifications and requirements to work on the device. There are also several tests needed to check if the sensor works properly and if we got the data we want. In the test, the red lamp goes on when the pH is too high or the temperature is too high. And when the yellow lamp goes on, the pH is too low or the temperature goes too low from the standard we inputted. When there's no harm in the pond, like high or low pH also high or low temperature, a green lamp goes on as an indicator.

5.2 Suggestions

In this device, some things can be improved. Like a sensor for oxygen levels inside the pond. And we can make an integrated network using IOT to make sure farmers can get notifications from the device. Like an alert and how much pH and temperature inside the pond.

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