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CHENNAI

BECE409E- SENSORS TECHNOLOGY

PROJECT REPORT

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Abstract

The Optimized Aquarium Conditions Monitoring Device (OCMA) represents a groundbreaking solution for aquarium enthusiasts seeking to ensure the well-being and thriving environment of their aquatic companions. This innovative device integrates a suite of advanced sensors designed to detect and regulate key parameters, facilitating optimal conditions within aquariums of various sizes.

The OCMA system encompasses a range of sensors, including those for monitoring water temperature, pH levels, ammonia concentrations, and lighting conditions. This comprehensive set of data allows aquarium enthusiasts to gain real-time insights into their tank's ecosystem, enabling them to make informed decisions for the well-being of their aquatic inhabitants.

Designed with versatility in mind, the OCMA is suitable for application in both small home aquariums and larger institutional setups. Its user-friendly interface provides aquarists with a seamless experience, allowing for easy configuration and monitoring via a dedicated mobile application or web interface.

Key features of the OCMA include automated regulation mechanisms, alert notifications for critical conditions, and historical data tracking. These elements collectively empower users to maintain a safe, healthy, and thriving environment for their fish. The OCMA not only simplifies the process of aquarium maintenance but also promotes sustainable practices by minimizing the risk of environmental fluctuations that can impact aquatic life.

This report provides an overview of the OCMA, detailing its design, functionality, and the benefits it offers to aquarium enthusiasts. Through the integration of cutting-edge technology and a user-centric approach, the OCMA sets a new standard for aquarium monitoring devices, enhancing the experience of caring for aquatic life while fostering a commitment to responsible and informed aquarium management.

Introduction

In the realm of aquarium maintenance and fishkeeping, the demand for innovative solutions to ensure optimal living conditions for aquatic life has never been more pronounced. Recognizing this need, our team proudly presents the Optimized Aquarium Conditions Monitoring Device (OCMA), a sophisticated system designed to revolutionize the way aquarium enthusiasts manage and care for their aquatic ecosystems.

The OCMA represents a significant advancement in aquarium technology, integrating a suite of state-of-the-art sensors aimed at monitoring and regulating crucial environmental parameters. With a focus on simplicity, precision, and adaptability, this device is poised to redefine the standard for aquarium monitoring, catering to both small-scale home setups and expansive institutional aquariums.

This introduction provides a glimpse into the comprehensive features and benefits of the OCMA, emphasizing its role in promoting the well-being and thriving conditions of aquatic life. From automated regulation mechanisms to real-time data insights accessible through an intuitive interface, the OCMA promises to elevate the aquarium-keeping experience while fostering a commitment to responsible and informed aquarium management. Join us on a journey through the design, functionality, and potential applications of the OCMA, where innovation meets the art of maintaining healthy and vibrant aquatic environments.

Problem statement

Aquatic environments are intricate ecosystems, and the health and well-being of fish are intricately linked to a delicate balance of various environmental conditions. Unfortunately, many of these conditions are imperceptible to the naked eye, making it challenging for the average aquarium enthusiast to comprehend or detect potential issues. The consequences of overlooking or neglecting these factors can be dire, often resulting in poor health conditions and even fatality for the fish inhabitants.

The cumulative impact of these factors underscores the complexity of maintaining a suitable aquatic environment. The inability of a common individual to comprehend or detect these subtle yet critical variables highlights the need for advanced monitoring systems like the Optimized Aquarium Conditions Monitoring Device (OCMA). By providing real-time data on these parameters and facilitating automated regulation, the OCMA empowers aquarium enthusiasts to create and sustain environments that support the health, longevity, and vibrancy of their aquatic companions.

Components and sensors used

1. Temperature sensor
2. LCD display - 16x2
3. Breadboard
4. Arduino Uno
5. LEDs
6. Resistors
7. 9V Battery
8. Potentiometer
9. Relay SPDT
10. Wires
11. Ultrasonic sensor
12. Oxygen supply - Water pump

Functions

The OCMA has a temperature monitoring system that involves a temperature sensor. The input from the sensor is used to control heating and cooling systems in response to changes in the environment and temperature of the water. The system has connected LEDs to indicate the temperature range. When the temperature is below the optimal values, a blue LED switches on with subsequent activation of a heating system that utilises a light bulb.

When the temperature is above the optimal values, a cooling system is activated, with a cooling fan that lowers the temperature of the water. The optimal conditions chosen in this experiment are those suitable for tropical fish. The LCD interface attached will display the corresponding values of temperature as well as the functioning of the cooling or heating systems.

The ultrasonic sensor in the OCMA detects the movement of fishes based on the principle of proximity. When the fishes come close to the pump that supplies oxygen, i.e when the distance is less than 20 cm, the ultrasonic sensor senses the fishes, sends a signal such that the pump stops rotating. This is for the safety of the fishes. Once the fishes move out from the proximity range, the pump starts rotating again to supply oxygen.

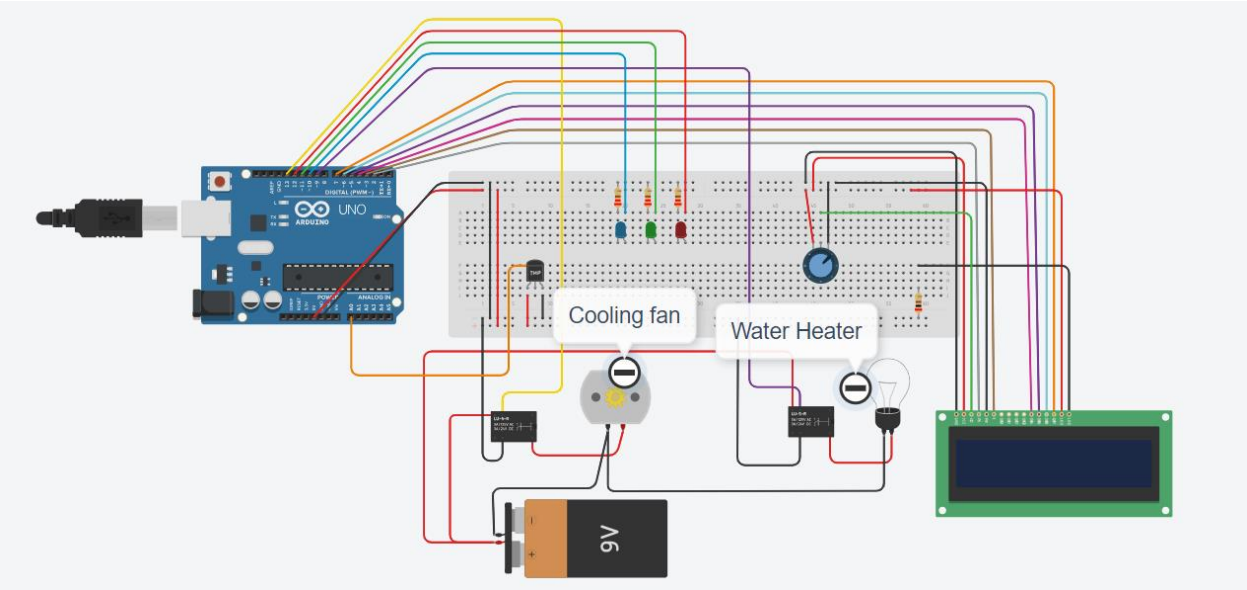
Working principle

The Optimized Aquarium Conditions Monitoring Device (OCMA) incorporates a sophisticated temperature regulation system, a crucial component in ensuring the well-being of aquatic life. This system not only accurately measures water temperature but also employs responsive mechanisms to maintain optimal conditions within the fish tank. The integration of a temperature sensor, LCD display, LEDs, and controlled cooling and heating elements forms a comprehensive solution for precise temperature management in aquariums.

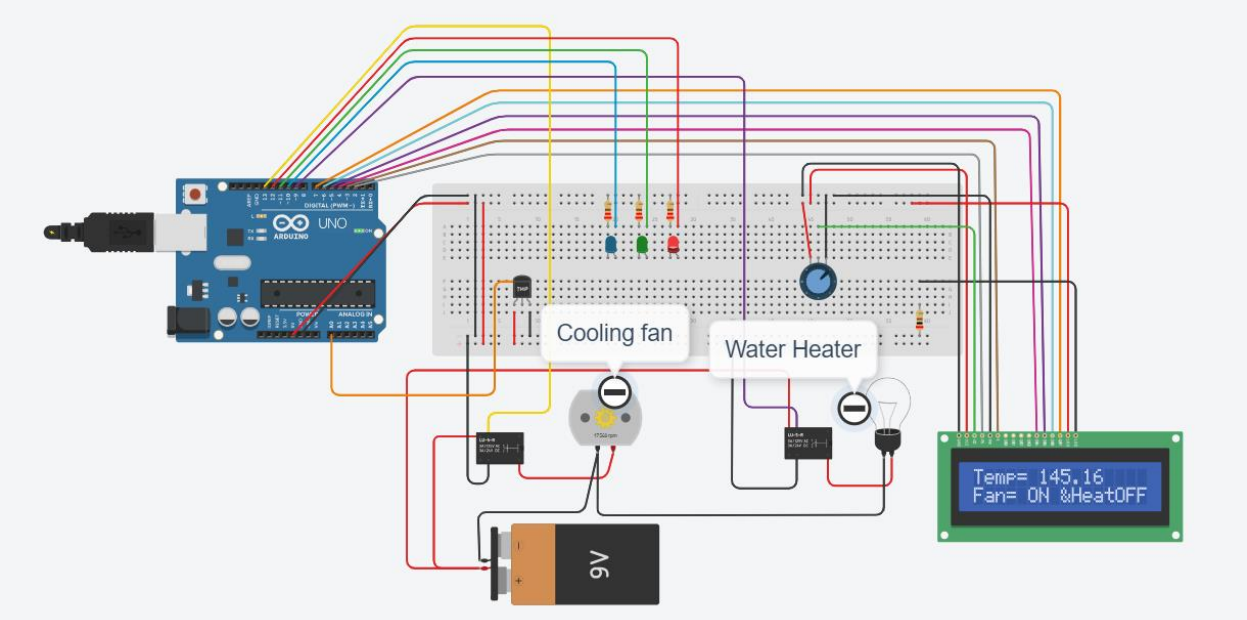
1. The heart of the OCMA's temperature regulation system lies in its precision temperature sensor. This sensor is strategically positioned within the fish tank to capture real-time temperature data. The acquired information is then vividly displayed on the LCD screen, providing users with immediate insights into the current state of the aquatic environment.
2. Complementing the LCD display, the OCMA incorporates LEDs that visually represent the temperature range. The LEDs emit varying colors or intensity levels, offering an intuitive visual cue to users about the ambient temperature in the fish tank. This feature ensures quick and easy monitoring, allowing users to assess temperature conditions at a glance.
3. The OCMA takes temperature regulation to the next level with its dynamic cooling and heating elements. In response to the detected temperature, the OCMA activates either the cooling fan or the heater, maintaining the desired temperature range for the specific needs of the aquatic species. This intelligent system prevents temperature fluctuations that can stress or harm fish, promoting a stable and comfortable environment conducive to their well-being.
4. Recognizing the diverse requirements of different aquatic species, the OCMA allows users to set custom temperature preferences. This user-friendly interface empowers aquarium enthusiasts to tailor the temperature conditions to suit the specific needs of their fish, ensuring a personalized and optimal environment.

Basic Experiment

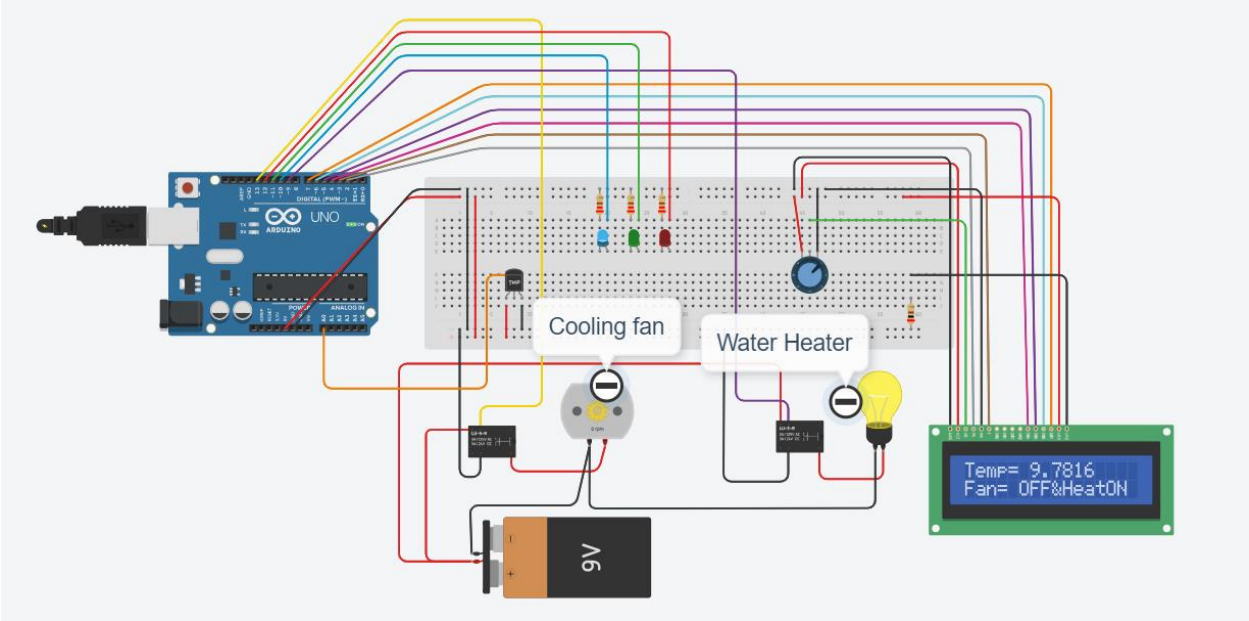
The simulation for the basic experiment is given below along with individual explanations for the working of the OCMA.



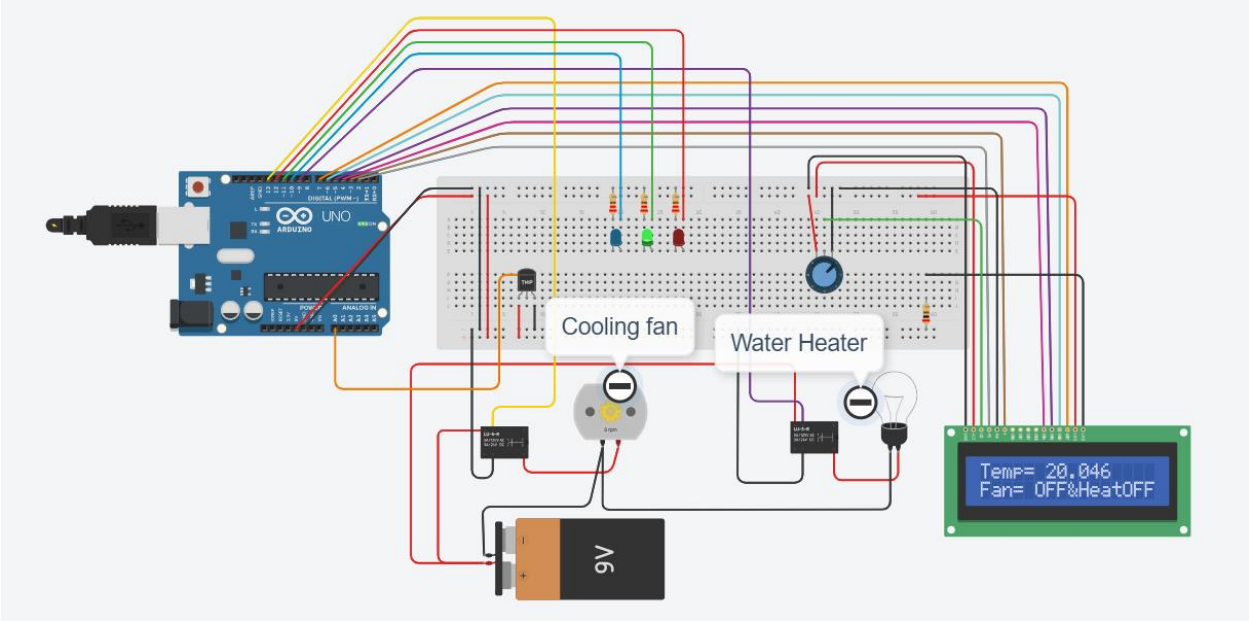
1. If the temperature of the tank is above 28 degrees Celsius, the cooling fan is turned on to bring the temperature to the optimum temperature. And the red LED glows.



2. If the temperature is below 15 degree celsius, the light bulb glows and acts as a heater to increase the temperature to the optimum temperature. And the blue LED glows.

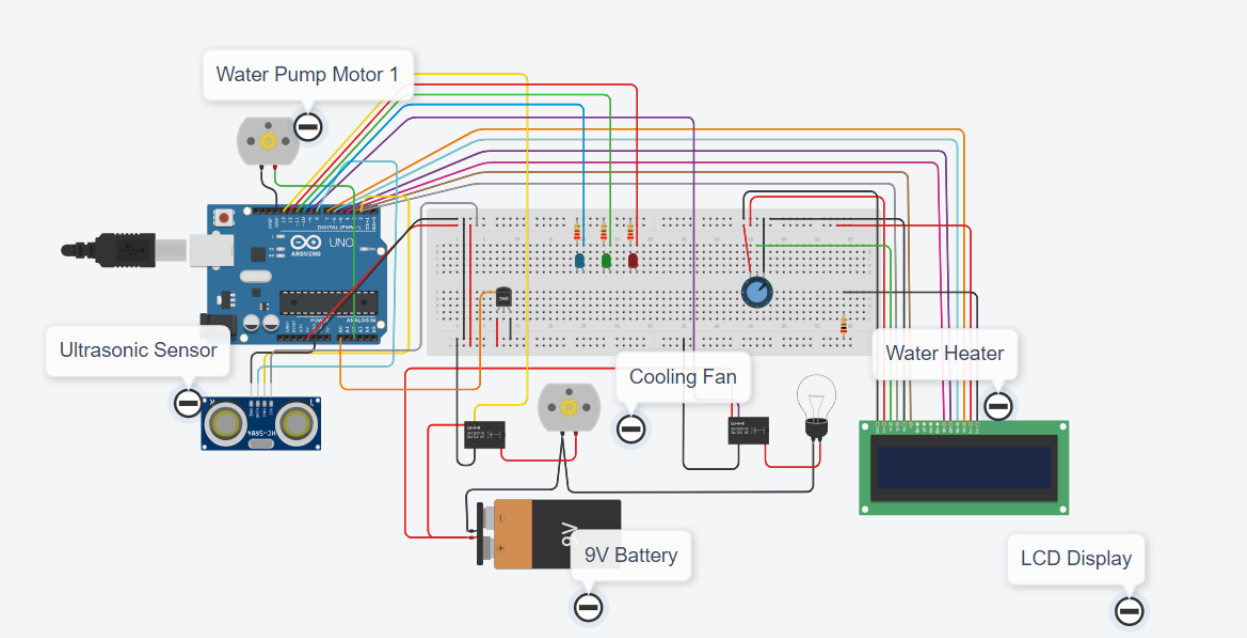


3. When the temperature is between 15 and 28 degree celsius, that is the optimum temperature, both the cooling fan and heater are turned off. And the green LED glows.



Advanced Simulation

The advanced simulation has the added feature of an oxygen/water pump represented here in the form of a fan. The presence of fish at a certain distance from the ultrasonic sensor causes the fan to resume pumping oxygen.



Software Code for Advanced Simulation

```
// Libraries included
#include <LiquidCrystal.h>

// Declare constants
const int LM35 = A0;
const int motor= A2;
const int heater = 9;
const int LedRed = 12;
const int LedGreen = 11;
const int LedBlue = 10;
const int trigpin=2;
const int fan=13;
```

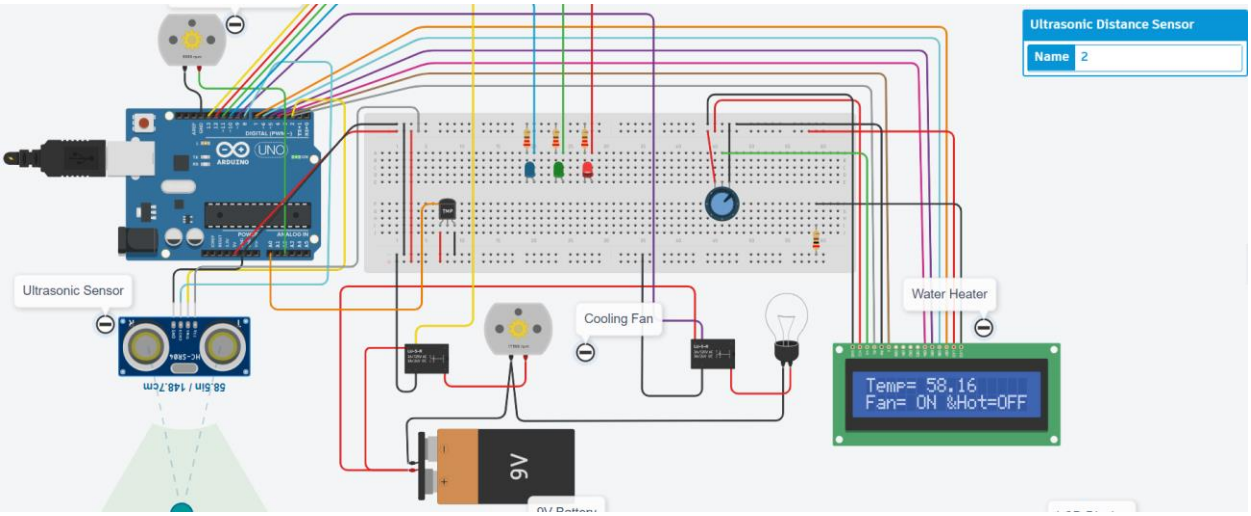
```
const int echopin=8;

// initialize the library with the numbers of the interface pins
   LiquidCrystal lcd(2, 3, 4, 5, 6, 7);

void setup() {
  Serial.begin(9600);
  lcd.begin(16, 2);
  lcd.print("Smart Fish Tank");
  delay(1000);
  pinMode(fan, OUTPUT);
  pinMode(motor,OUTPUT);
  pinMode(heater, OUTPUT);
  pinMode(LedRed, OUTPUT);
  pinMode(LedGreen, OUTPUT);
  pinMode(LedBlue, OUTPUT);
  delay(2000);
  lcd.clear();
  lcd.print("Temp= ");
  lcd.setCursor(0,1);
  lcd.print("Fan= ");
  lcd.setCursor(8,1);
  lcd.print("&");
  lcd.setCursor(9,1);
  lcd.print("Hot= ");
  //pump Motor
   pinMode(A2, OUTPUT);
  pinMode(trigpin,OUTPUT);
  pinMode(echopin,INPUT);
  Serial.begin(9600);
}

void loop() {
  // Section for the temperature sensor
  int value = analogRead(LM35);
  float Temperature = value * 500.0 / 1023.0;
  lcd.setCursor(6,0);
  lcd.print(Temperature);

  // Section of the fan and heater
```

```
  if (Temperature >28){//if temp high fan will work and red led
    digitalWrite(fan, HIGH);
    digitalWrite(heater, LOW);
    digitalWrite(LedRed, HIGH);
    digitalWrite(LedGreen, LOW);
    digitalWrite(LedBlue, LOW);
    lcd.setCursor(5,1);
    lcd.print("ON ");
    lcd.setCursor(13,1);
    lcd.print("OFF ");

  }
  else if(Temperature < 15) {//if temp is low heater and blue led will glow and water heater turns
on.
    digitalWrite(fan, LOW);
    digitalWrite(heater, HIGH);
    digitalWrite(LedRed, LOW);
    digitalWrite(LedGreen, LOW);
    digitalWrite(LedBlue, HIGH);
    lcd.setCursor(5,1);
    lcd.print("OFF");
    lcd.setCursor(13,1);
    lcd.print("ON ");
  }
  else {//if temp between 15 and 28 green led will work and fan and heater stop
    digitalWrite(fan, LOW);
    digitalWrite(heater, LOW);
    digitalWrite(LedRed, LOW);
    digitalWrite(LedGreen, HIGH);
    digitalWrite(LedBlue, LOW);
    lcd.setCursor(5,1);
    lcd.print("OFF");
    lcd.setCursor(13,1);
    lcd.print("OFF ");
  }

   delay(1000);

  //Fan
  long dur;
```

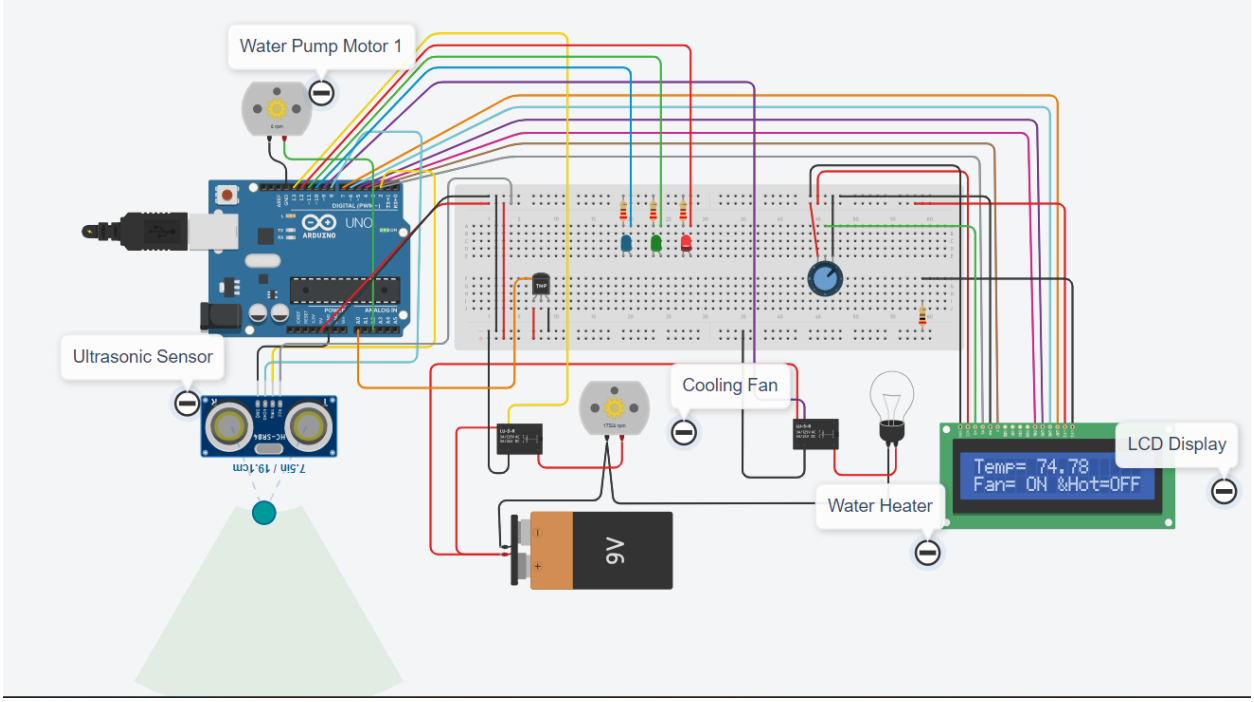
```
long dis;
long tocm;
digitalWrite(2,LOW);
delayMicroseconds(2);
digitalWrite(2,HIGH);
delayMicroseconds(10);
digitalWrite(2,LOW);
dur=pulseIn(8,HIGH);
tocm=microsecondsToCentimeters(dur);
  if(tocm<=100)
  {
    digitalWrite(motor,LOW);
  }
  else
  {
    digitalWrite(motor,HIGH);
  }

}
long microsecondsToCentimeters(long microseconds)
{
return microseconds / 29 / 2;
}
```

Working:

1. The distance of the fish from the pump is greater than 20cm in this case so the oxygen pump continues to operate. This pump acts as an oxygen supply in the fish tank.



2.
In this case the distance of the fish from the oxygen pump is less than 20 cm . So the pump halts operation to ensure the safety of the fishes.



Conclusion

Thus the OCMA uses sensors and a smart automatic system that can monitor temperature conditions of an aquarium in accordance to changes in the environment, while simultaneously controlling an oxygen system that is designed considering the safety of the fishes.