CPE ELEC 1
FireX – Soundwave Fire Extinguisher

SOUND WAVE FIRE EXTINGUISHER

SMART FIRE DETECTION
When a fire is detected, the alert system activates its audible warning and calls and texts the owner.

ENVIRONMENTAL FRIENDLY
NO HARMFUL CHEMICAL
When a fire is detected, the alert system activates its audible warning and calls and texts the owner.

INNOVATIVE & CHARGEABLE
When a fire is detected, the alert system activates its audible warning and calls and texts the owner.

INSTRUCTION TO USE

STEP 1
When a fire is detected, the alert system activates its audible warning and calls and texts the owner.

STEP 2
To generate the sound wave, turn on the switch, and it will produce sound waves. Extinguish the fire by directing the soundwave toward it.

STEP 3
Continue to direct the soundwave toward the fire until it is completely extinguished. When the fire is out, remember to turn off the switch.

HOW IT WORKS

Fire is created through a process known as combustion, which is a chemical reaction. This typically occurs when there is a combination of fuel, oxygen, and heat.

OXYGEN — HEAT — FUEL

- Sound waves are also pressure waves.
- They have the ability to extinguish fires.
- This is achieved by using the pressure from their vibrations to displace oxygen and fire.
- A specific frequency of sound wave can separate flame molecules from the surrounding oxygen.
- This effectively starves the fire and snuffs out the flame.
- The displacement of oxygen interrupts the chemical reaction of fire.
- The chemical reaction of fire requires fuel, heat, and an oxidizing agent (usually oxygen) to continue.
- By removing the oxygen, the fire is deprived of a key element that it needs to burn.
- Thus, the fire goes out.

REMINDER

Regular Testing: Regularly test the soundwave fire extinguisher to ensure it's working properly and can effectively extinguish flames.

Check Sound Frequency: Ensure the sound frequency is correctly set to the one that can separate fire molecules from oxygen.

Device Maintenance: Regularly check the device for any physical damage or technical issues that might affect its performance.

Ensure Accessibility: Make sure the extinguisher is easily accessible and not obstructed.

I.   INTRODUCTION

Fire safety is a critical concern worldwide, and the Philippines is no exception. The country has seen a significant increase in fire incidents, with a 40% rise recorded from April 1-26, 2023, compared to the same period the previous year. In 2022, the Bureau of Fire Protection reported 13,029 fires. The situation is particularly alarming in Catbalogan City, where significant fire incidents have been reported, with one incident in July 2022 affecting 17 houses and 22 families, and another in June 2023 causing an estimated half a million pesos in damages.

One of the challenges in combating these incidents is the lack of accessible and reusable fire extinguishing solutions. Many households do not possess a fire extinguisher due to their high cost and single-use nature. This gap in fire safety equipment presents a significant risk, especially considering that most fire incidents occur in residential areas. Moreover, traditional fire extinguishers contain chemicals that, while effective in extinguishing fires, can have adverse effects on the environment.

In response to this, the development of a fire extinguisher using sound waves offers a promising solution. This innovative approach aims to create a device that does not rely on harmful chemicals, making it safer for household use and the environment. More importantly, it is designed to be reusable and affordable, making it accessible to the general public. By leveraging technology, this smarter fire extinguisher could significantly reduce the number of house fires, not just in Catbalogan City, but across the Philippines.

This is a clear example of how technology can be harnessed to address real-world problems and improve safety in our communities. By developing a fire extinguisher that is not only more effective but also environmentally friendly, we can make a significant contribution to fire safety and environmental sustainability. This innovative approach represents a significant step forward in our ongoing efforts to create safer, healthier communities for everyone.

II.   OBJECTIVES

The objectives of **FireX - Soundwave Fire Extinguisher** are as follows:

1. **Develop a Chemical-Free Solution**: The primary objective is to create a fire extinguisher that does not rely on harmful chemicals. This not only makes the device safer for household use but also contributes to environmental sustainability.

2. **Address Affordability and Reusability**: The project aims to develop a fire extinguisher that is both affordable and reusable. This is in response to the current challenge where many households do not possess fire extinguishers due to their high cost and single-use nature.

3. **Improve Accessibility**: By making the device affordable and reusable, it becomes more accessible to the general public. This is particularly important in residential areas where most fire incidents occur.

4. **Minimize Environmental Impact**: The project also aims to minimize the environmental impact of fire extinguishing solutions. By eliminating the use of harmful chemicals, the device is not only safer for users but also less harmful to the environment.
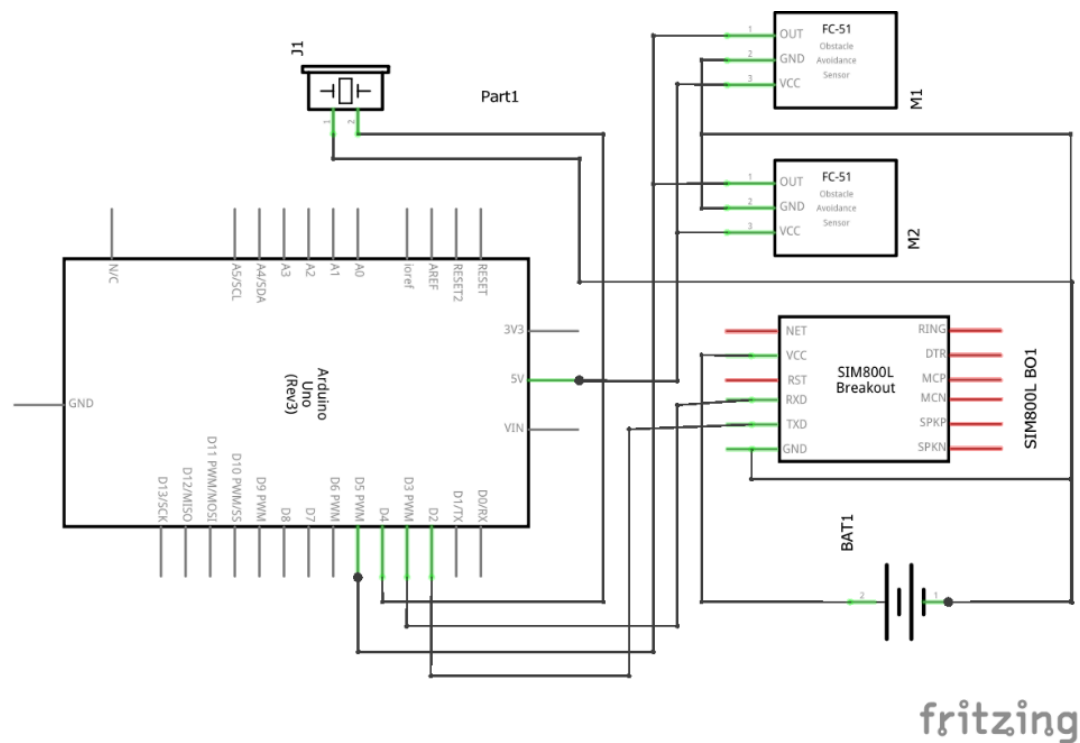
III. DEVICE SCHEMATIC DIAGRAM

Schematic diagram from fire detection system and warning system.

A. BREADBOARD VIEW
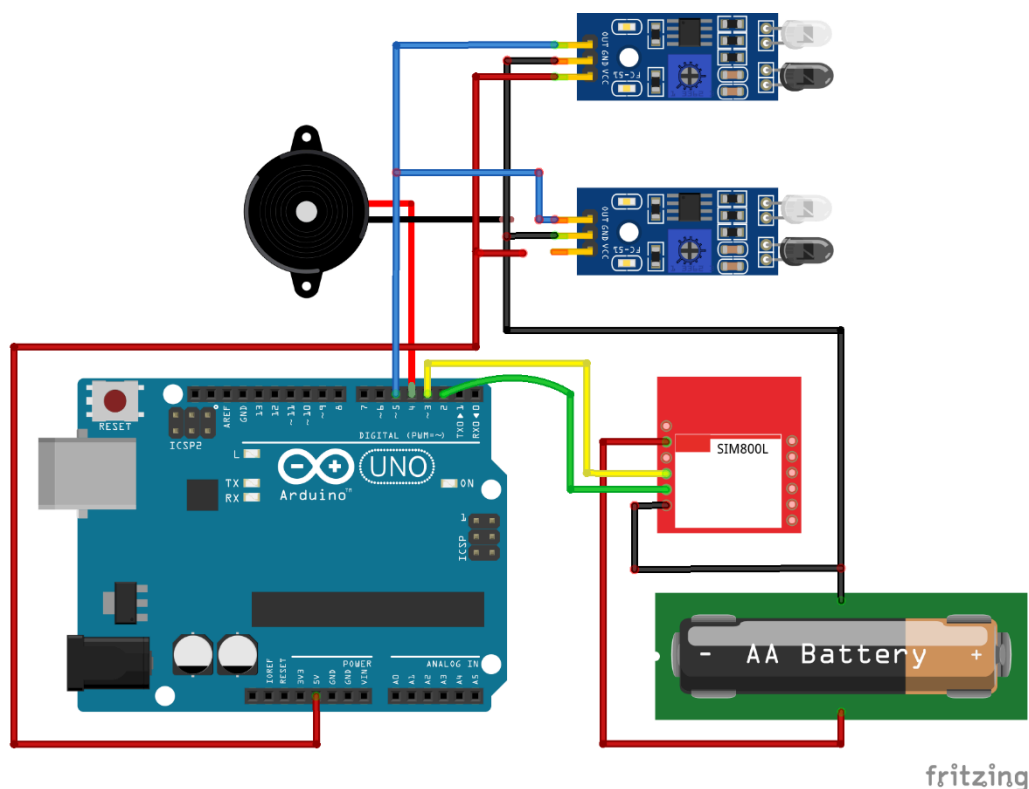
B. SCHEMATIC VIEW

C. CODE VIEW

```
#include <SoftwareSerial.h>

const String PHONE_1 = "+639760906261";
const String PHONE_2 = "+639760906261"; //optional
const String PHONE_3 = "+639630521405"; //optional

#define rxPin 2
#define txPin 3
#define flame_sensor_pin 5
#define buzzer_pin 4

SoftwareSerial sim800L(rxPin, txPin);
boolean fire_flag = false;

void setup() {
  Serial.begin(115200);
  sim800L.begin(9600);

  pinMode(flame_sensor_pin, INPUT);
  pinMode(buzzer_pin, OUTPUT);
  digitalWrite(buzzer_pin, LOW);

  Serial.println(sim800L.available());
  sim800L.println("AT");
  delay(1000);
  sim800L.println("AT+CMGF=1");
```

```
      delay(1000);
    }

    void loop() {
     while (sim800L.available()) {
       Serial.println(sim800L.readString());
     }

     int flame_value = digitalRead(flame_sensor_pin);

     if (flame_value == LOW) {
       digitalWrite(buzzer_pin, HIGH);
       if (!fire_flag) {
         Serial.println("Fire Detected. Please Extinguish the fire.");
         fire_flag = true;
         send_multi_sms();
         make_multi_call();
       }
     } else {
       digitalWrite(buzzer_pin, LOW);
       fire_flag = false;
     }
    }

    void send_multi_sms() {
      send_sms("Fire is Detected. Please extinguish the fire.", PHONE_1);
      send_sms("Fire is Detected. Please extinguish the fire.", PHONE_2);
      send_sms("Fire is Detected. Please extinguish the fire.", PHONE_3);
    }

    void make_multi_call() {
      make_call(PHONE_1);
      make_call(PHONE_2);
      make_call(PHONE_3);
    }

    void send_sms(String text, String phone) {
      Serial.println("Sending SMS...");
      delay(50);
      sim800L.print("AT+CMGF=1\r");
      delay(1000);
      sim800L.print("AT+CMGS=\"" + phone + "\"\r");
      delay(1000);
      sim800L.print(text);
      delay(100);
      sim800L.write(0x1A); // ASCII code for ctrl-26
      delay(5000);
```

```
}

void make_call(String phone) {
  Serial.println("Making call to " + phone + "...");
  sim800L.println("ATD" + phone + ";");

  while (!sim800L.find("OK")) {
    delay(0);
    Serial.println("Waiting for call to connect...");
  }

  Serial.println("Call connected!");

  delay(50000);

  sim800L.println("ATH");

  while (!sim800L.find("OK")) {
    delay(200);
    Serial.println("Waiting for call to disconnect...");
  }

  Serial.println("Call disconnected!");
}
```

Schematic diagram from sound wave generator system

IV.   MATERIAL USED & COSTING

COMPONENTS & MATERIAL	IMAGES	QUANTITY	PRICE
ARDUINO UNO		1pc	₱150
SIM800L Module		1pc	₱140

6" Subwoofer		1pc	₱430
1F PVC pipe		1pc	₱40
Buzzer		1pc	₱9
3.7 Chargeable Lithuim Battery		2pcs	₱80
1GB SD Card		2pcs	₱50
frit		1pc	₱200
Flame (IR) Sensor Module		2pc	₱60
Switch		2pc	₱10
Connecting Wires		---	---
		TOTAL	₱1169

V.   REFERENCES

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https://mb.com.ph/2022/07/12/catbalogan-city-fire-17-houses-gutted-22-families-affected/.

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https://www.gmanetwork.com/news/topstories/regions/652591/fire-guts-300-houses-in-catbalogan-city/story/.

Firefighting chemicals are dangerous for the environment. Can that change?

https://slate.com/technology/2022/07/firefighting-foam-chemicals-wildfires-pfas.html.