International Islamic University Chittagong

আন্তর্জাতিক ইসলামী বিশ্ববিদ্যালয় চট্টগ্রাম

Department Electrical and Electronic Engineering (EEE)

Open Ended Lab Project

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Project Information:

Project Name:	Fire Detector Alarm System for Smart Home using Arduino
Course Code:	EEE-3506
Course Title	Microprocessor and Interfacing Sessional
Date of Assign	13.10.2022
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Submitted To:

Dr. Sikder Sunbeam Islam Associate Professor, Dept. of EEE, IIUC	Remarks:

Project Name: Fire detector Alarm System for smart home using Arduino.

About

Fire detector Alarm Systems are very common in commercial building and factories, these devices usual contain a cluster of sensors that constantly monitors for any flame, gas or fire in the building and triggers an alarm if it detects any of these. One of the simplest ways to detect fire is by using an **IR Flame sensor**, these sensors have an IR photodiode which is sensitive to IR light. Now, in the event of a fire, the fire will not only produce heat but will also emit IR rays, yes, every burning flame will emit some level of IR light, this light is not visible to human eyes but our flame sensor can detect it and alert a microcontroller like Arduino that a fire has been detected.
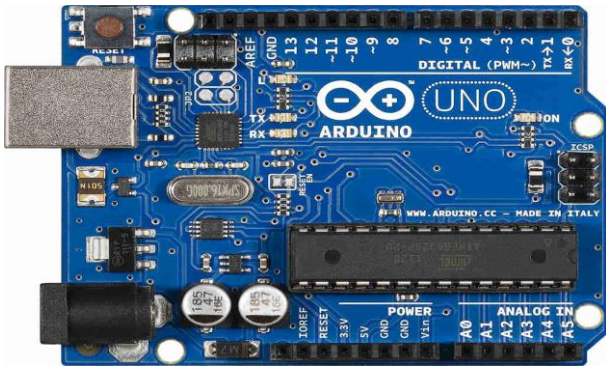
Equipment Required

- Arduino UNO
- Flame sensor
- Bread board
- Jumper wires
- Buzzer
- LED
- Personal computer (for uploading program)

Equipment Description

Arduino UNO:

Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects.

Flame Sensor

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. The IR Flame sensor used in this project is shown below, these sensors are also called Fire sensor module or flame detector sensor sometimes.
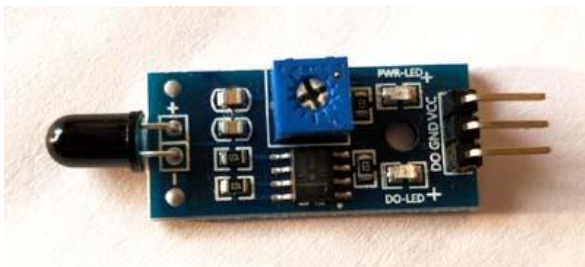
Buzzer:

This buzzer is an active buzzer, which basically means that it will buzz at a predefined frequency (2300 ±300 Hz) on its own even when you just apply steady DC power.

B. Software Description:

1. Arduino IDE: It is a software based on Embedded for assisting the projects based on ARDUINO. Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems.

2. Proteus 8 Professional: Proteus 8 Professional is software for drawing schematics, PCB layout, code, and even schematic simulation. It was developed by LaCenter Electronic Ltd B.

Applications of flame sensors

- Hydrogen stations
- Combustion monitors for burners
- Oil and gas pipelines
- Automotive manufacturing facilities
- Nuclear facilities
- Aircraft hangars
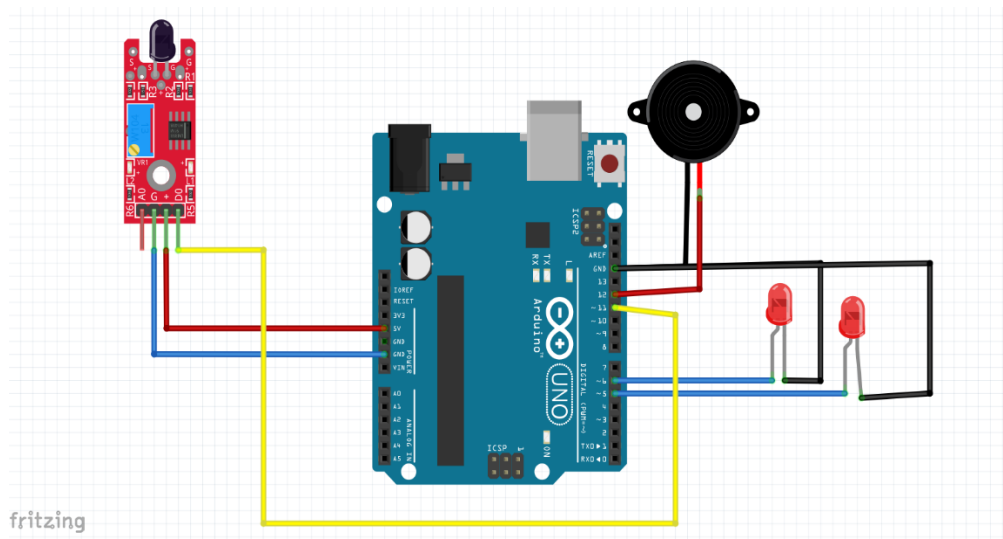- Turbine enclosures

Circuit Diagram

Fig 1: Fire Alarm circuit diagram

Working of Flame Sensor with Arduino

Arduino Uno is an open-source microcontroller board based on the ATmega328p microcontroller. It has 14 digital pins (out of which 6 pins can be used as PWM outputs), 6 analog inputs, on-board voltage regulators etc. Arduino Uno has 32KB of flash memory, 2KB of SRAM and 1KB of EEPROM. It operates at a clock frequency of 16MHz. Arduino Uno supports Serial, I2C, SPI communication for communicating with other devices. The table below shows the technical specification of Arduino Uno.

Microcontroller	ATmega328p
Operating voltage	5V
Input Voltage	7-12V (recommended)
Digital I/O pins	14
Analog pins	6
Flash memory	32KB
SRAM	2KB
EEPROM	1KB
Clock speed	16MHz

The flame sensor detects the presence of fire or flame based on the Infrared (IR) wavelength emitted by the flame. It gives logic 1 as output if a flame is detected, otherwise, it gives logic 0 as output. Arduino UNO checks the logic level on the output pin of the sensor and performs further tasks such as activating the buzzer and LED, sending an alert message.
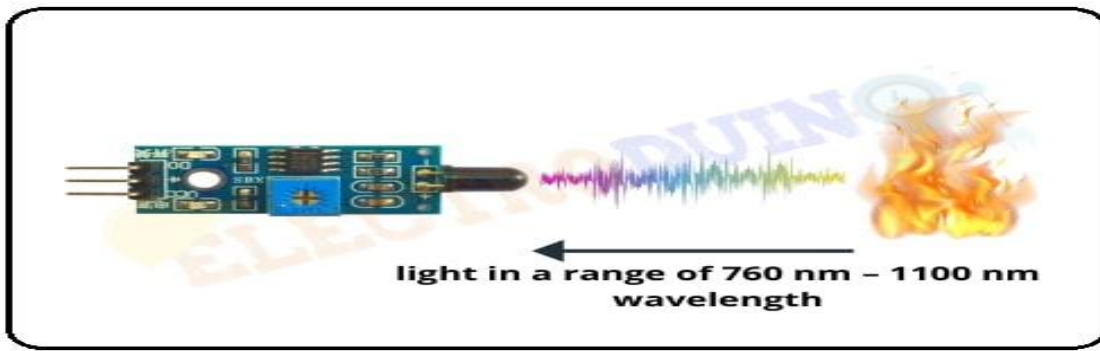
Fig 2: How flame sensor detects fire

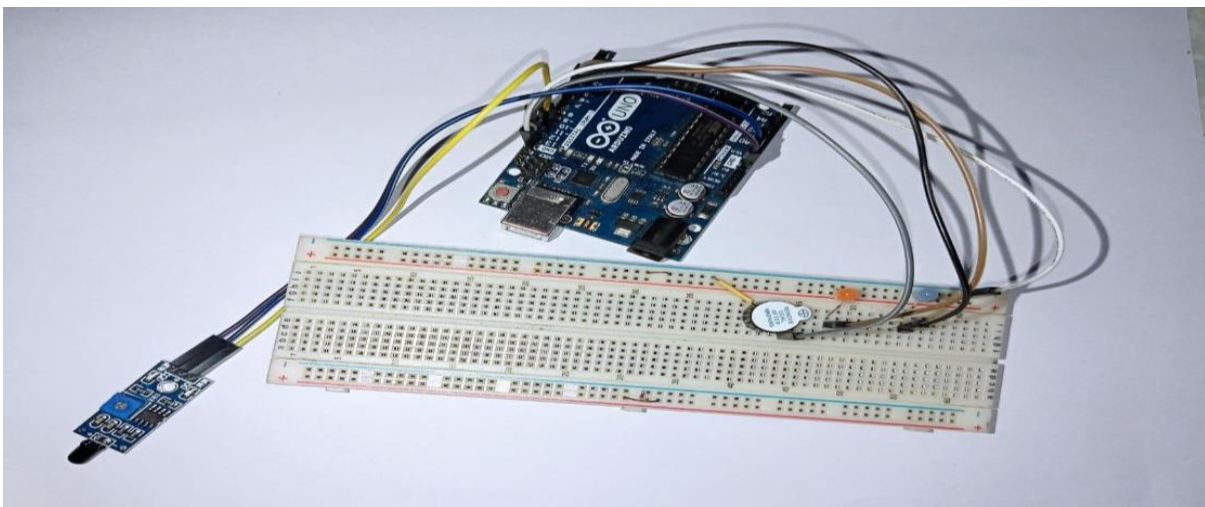**Proteus Simulation Output and Hardware Snapshot:**
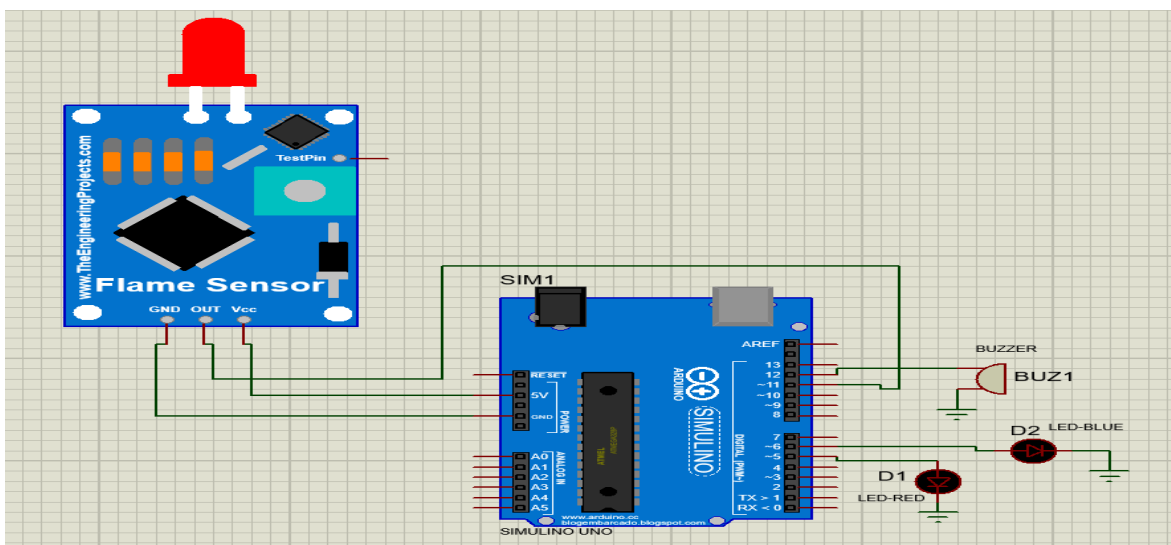

Fig3: Hardware snapshot Ready circuit

Fig 4: Initial circuit in proteus

Code and Description

```
const int buzzerPin = 12;  // select positive pin for buzzer
const int FlamePin = 11;   //select digital pin of flame sensor
int Flame = HIGH;          //state of sensor
int redled = 5;            //select positive pin for red LED
int blueled = 6;           //select positive pin for blue LED
void setup() {
  pinMode(buzzerPin, OUTPUT);  //using buzzer as a output
  pinMode(redled, OUTPUT);     //using red LED as a output
  pinMode(blueled, OUTPUT);    //using blue LED as a output
  pinMode(FlamePin, INPUT);    //using flame sensor as input
}
void loop() {
  Flame = digitalRead(FlamePin);  //reading from the sensor
  if (Flame == LOW)               // applying Condition
  {
    digitalWrite(buzzerPin, HIGH);  //if state is low then turn on buzzer
    digitalWrite(redled, HIGH);     //if state is low then turn on  red LED
    digitalWrite(blueled, HIGH);    //if state is low then turn on  blue LED

  } else  //otherwise
  {
    digitalWrite(buzzerPin, LOW);  //if state is high  then turn off buzzer
    digitalWrite(redled, LOW);     //if state is high  then turn off red LED
    digitalWrite(blueled, LOW);    //if state is high  then turn off blue LED
  }
}
```
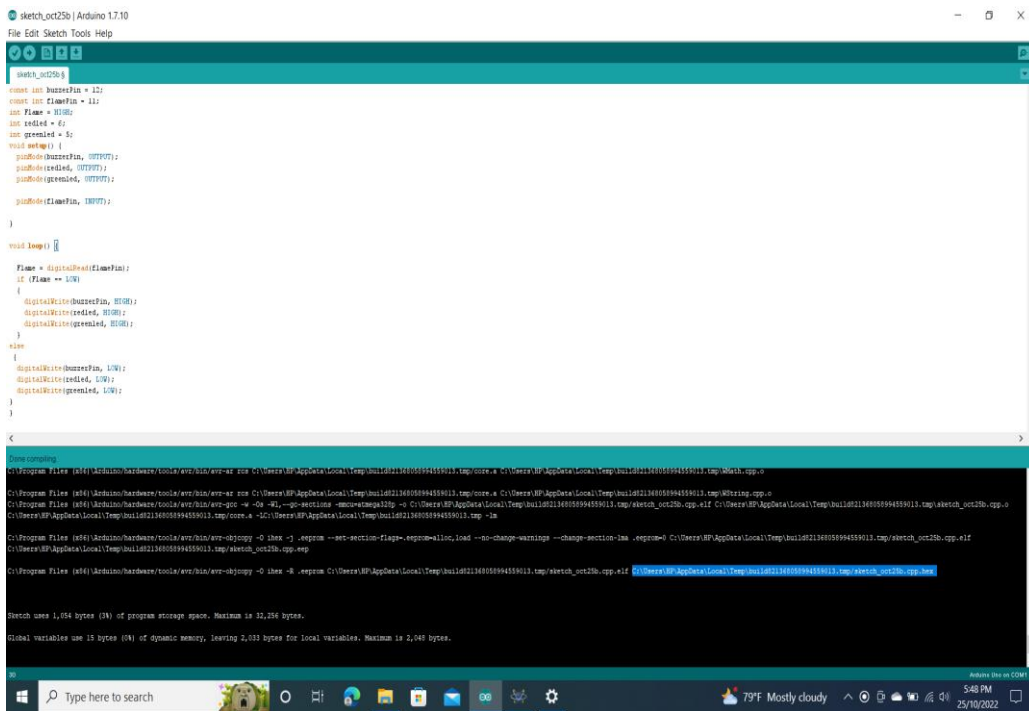
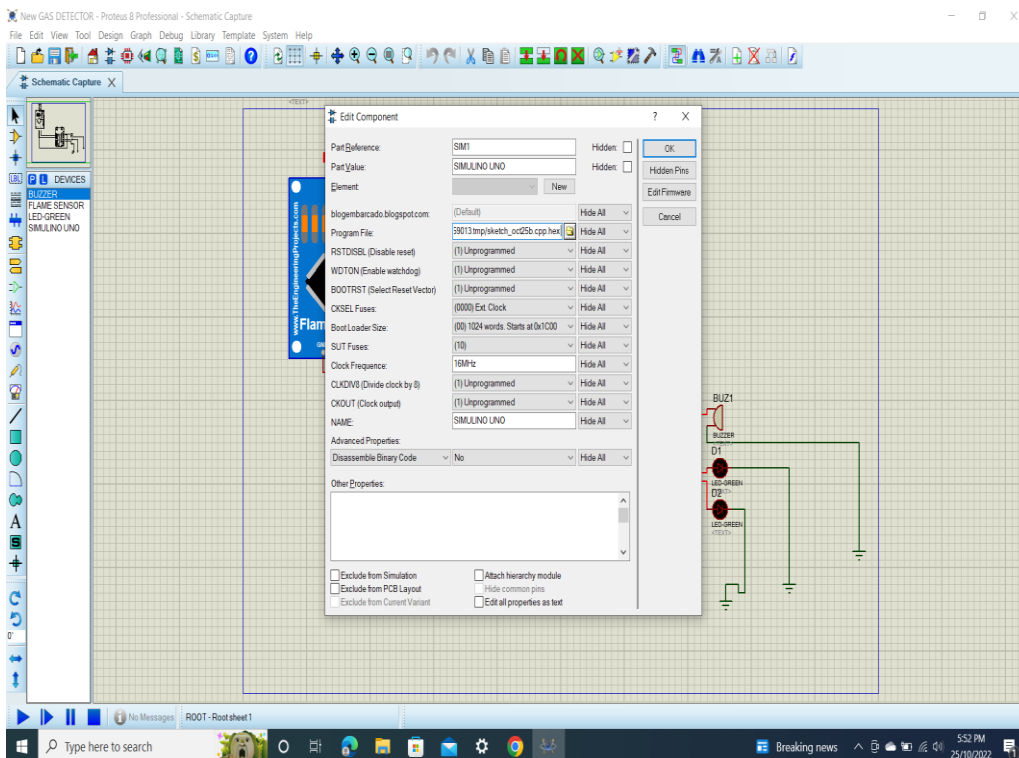Fig 5: Creating hex file in Arduino
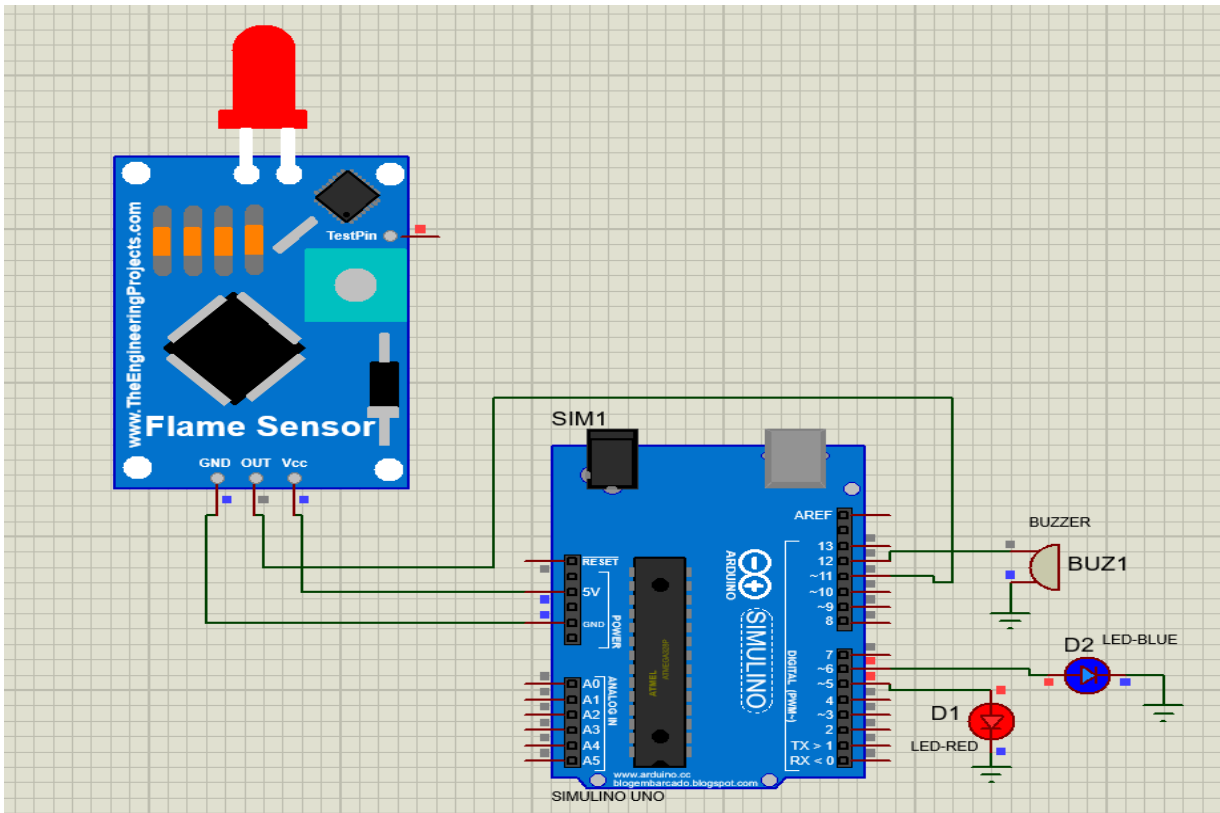

Fig 6: Coping hex file in Proteus

Fig 7: After loading hex file in proteus
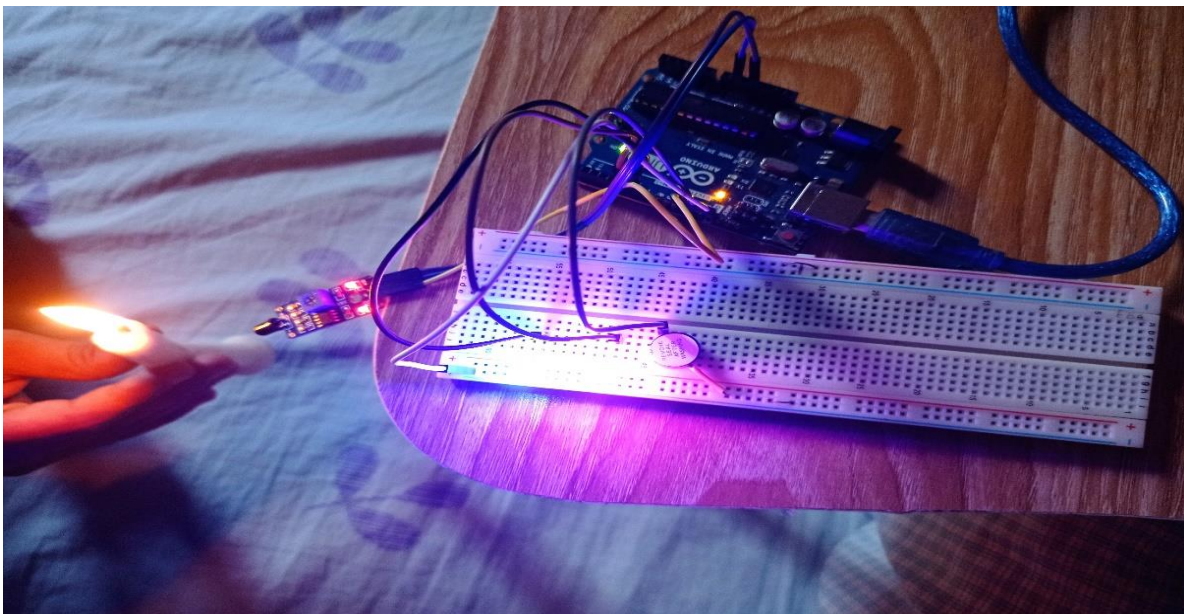
Fig 8: Hardware snapshot after loading program in Arduino

Component Price:

S.l	Component	Quantity	Price (Tk)
1	Arduino UNO	1	1100
2	Flame sensor	1	50
3	Active Buzzer	1	20
4	LED	2	2
5	Breadboard	1	100
6	Jumper wire	As needed	10
	Total		1282tk

Comparing Cost with Reference

Ref.	Tittle	Cost
1.	Fire alarm system for Smart home.	1542tk
2.	Fire Detection System Using Arduino and SMS Gateway	2982tk
Progress project	Fire Detector Alarm System for Smart Home using Arduino	1282tk

Comments

1.This project is made by MQ-2 gas sensor and TSB smoke sensor. There device is different but used for the same purpose. The price of Gas sensor MQ-2 is 160tk and TSB smoke sensor price is 150tk, which is too much costly than flame sensor. There total cost is about 1542 tk.

2. This project is made by Sensor DS18B20, Sensor MQ2, GSM module Sim900.Here, GSM module Sim900 is used for send a message to owner to indicate that there is fire in his home and Sensor DS18B20is for measure temperature with a minimal amount of hardware and wiring. The price of Sensor DS18B20 is 470tk, Sensor MQ2 150tk, GSM module Sim900 is 1600 tk. There total cost is about 2982tk.

Reference

(1) Ransing, Rasika S., and Manita Rajput "Fire alarm system for Smart home." 2015 International Conference on Nascent Technologies in the Engineering Field (ICNTE). IEEE, 2015.

(2) Suwarjono, S.; Wayangkau, I.H.; Istanto, T.; Rachmat, R.; Marsujitullah, M.; Hariyanto, H.; Caesarendra, W.; Legutko, S.; Glowacz, A. Design of a Home Fire Detection System Using Arduino and SMS Gateway. *Knowledge* **2021**, *1*, 61-74.

Discussion:

In this project we use Arduino UNO and Flame Sensor. In this project the main attraction or component is flame sensor. We searched a lot in google scholar to find a fire detector alarm project using flame sensor. But we failed to find it. We saw there, this project is made by gas sensor (MQ-2). So, we can say that our project is unique. Flame sensor is more effective than gas sensor MQ-2. We full fill the condition of P1, P2, P3, P4. In this project we try to reduce the cost. And we succeed to do it. Where the price of reference 1 is 1542tk and reference 2 is 2982tk, there our project cost is only 1282tk. We able to make this project ready by using a new device, which is cheap than another device.