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FIRE DETECTION AND ALARM SYSTEM

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Under the guidance of:

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UNDER THE COURSE

Course Code: CSE3009

Course Title: Internet of Things

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I also wish to thank our team support for dividing the work and support for which helped me to complete the project in due time .

I also wish to thank my parents and friends who supported for doing this project during a wide pandemic.

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SYNOPSIS

As in India ,there are more accidents caused due to fire mainly due to poor maintenance as well as carelessness , so if there is any low cost device in such a way that every people could afford it , can ultimately reduce these accidents. It has been found in a survey that 80% of losses caused due to fire would have been avoided if the fire was detected immediately. Arduino fire detectors and alarm systems are solutions to this problem.

In this project, we have built a fire alarm using Arduino Uno which is interfaced with a temperature sensor, a smoke sensor, and buzzer. The temperature sensor senses the heat and smoke sensor senses any smoke generated due to burning or fire. Buzzer connected to Arduino gives us an alarm indication. Whenever fire is triggered, it burns objects nearby and produces smoke. A fire alarm can also be triggered due to small smoke from candlelight or oil lamps used in a household. Also, whenever heat intensity is high then also the alarm goes on. Buzzer or alarm is turned off whenever the temperature goes to normal room temperature and smoke level reduces. We have also interfaced LCD display and Relay to the Arduino board.

The fire detection system combines the simultaneous measurements of smoke, carbon monoxide, and carbon dioxide. The security of campus against intruders moving in laboratories, classrooms, staff rooms . The fire alarm system consists of Fire detectors (which can be smoke detector, heat), control unit and alarm system. A fire detection system is developed based on the simultaneous measurements of temperature and smoke. The fire detection system with the alarm algorithm detected fires that were not alarmed by smoke sensors, and alarmed in shorter times than smoke sensors operating alone. Previous fire detection algorithms used data from sensors for temperature, smoke, and combustion products. The smoke sensor alarms when the analog output signal exceeds or equals the threshold value. The node includes analog sensors to measure smoke, carbon monoxide (CO) and temperature. A fire alarm system should reliably and in a timely way notify building occupants about the presence of fire indicators, such as smoke or high temperatures.

INTRODUCTION

Fire and Gas detection alarm systems are important tools for safeguarding our residence home, building, office, market, and other places. A well designed fire and gas system is intended to detect and in some cases automatically mitigate fire, flammable gas and toxic gas hazards. Proper placement of detectors is critical in the design of a fire and gas system to ensure that coverage is adequate to detect hazards at their incipient stage, in order to prevent escalation. The rates of increase of these three components are used in the fire alarm algorithm to determine the presence of a fire. The smoke sensor provides a means to detect smoke and to serve as an early fire warning. Heat detectors are the oldest type of automatic fire detection device [5]. They respond either when the detecting element reaches a predetermined fixed temperature or to a specified rate of temperature change. If a fire shouldresult, systems can be attached to extinguish the fire and protect other areas from the actions of the fire. Generally, the fire detection system and gas detection system is combined into one fire and gas system. A separation that may be made is to have onefire and gas system for the processing areas and another sub-system for the usefulness or office/accommodation areas.

Fire alarm systems include: Conventional fire alarm system, Addressable fire alarm system, Analogue addressable fire alarm system, and Wireless fire alarm system. Wireless fire alarm systems are an effective alternative to traditional wired fire alarm systems for all applications. It is a simple concept, which provides many unique benefits and is a full analogue addressable fire detection system without the need for cable. These systems can provide several main functions. First they provide a means to identify a developing fire based on smoke and gas through automatic methods and second, they alert building occupants to a fire condition. Another common function is the transmission of an alarm notification signal to the fire department or other emergency response organization. They may also shut down electrical, air handling equipment or special process operations, and they may be used to initiate automatic suppression systems. A fire sensor system based on the simultaneous detection CO, CO2, and smoke concentrations, is demonstrated [6]. A fire detector is usually implemented as a smoke sensor due to its early fire detection capability, fast response time and relatively low cost.

LITERATURE SURVEY / STUDIES

We went through the following papers to know about the existing fire alarm system and learned what are the issues in the existing systems and tried to solve those issues with our project.

- Arduino based Fire Detection and Alarm System Using Smoke Sensor. International Journal ofAdvances in Scientific Research and Engineering (ijasre) Volume 6, Issue 4April - 2020

- Design of an Arduino-based home fire alarm system with GSM moduleJournal of Physics: Conference Series, Volume 1019, 1st International Conference on Green and Sustainable Computing (ICoGeS) 2017 25–27 November 2017, Kuching, Sarawak, Malaysia

- Sensor Based Smart Fire Detection and Fire Alarm SystemProceedings of the International Conference on Advances in Chemical Engineering (AdChE) 2020

- Fire Safety and Alert System Using Arduino Sensors with IoT IntegrationICSCA 2018: Proceedings of the 2018 7th International Conference on Software and Computer ApplicationsFebruary 2018

- Smart Fire Alarm System Using ArduinoInternational Journal of Emerging Technologies in Engineering Research (IJETER) Volume 7, Issue 5, May (2019)

PROPOSED WORK

As the name of the project(Fire detection and alarm system) suggest our main objective was to detect the fire early by detecting the smoke and then as the temperature increases and reaches the threshold values relative to the humidity values our system displays a fire alert and sounds an alarm for alerting the people with led glowing.so the main modules in our project are displaying temperature ,humidity and smoke values;Detection of smoke;Detection of fire.

Displaying temperature ,humidity and smoke values:

So for getting the temperature and humidity values we have used the DHT11 sensor. It is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. You can get new data from it once every 2 seconds, so when using the library from Adafruit, sensor readings can be up to 2 seconds old.

For sensing smoke we have used a MQ-2 gas sensor that can detect or measure gases like LPG, Alcohol, Propane, Hydrogen, CO and even methane. The module version of this sensor comes with a Digital Pin which makes this sensor operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas. When it comes to measuring the gas in ppm the analog pin has to be used, the analog pin also TTL driven and works on 5V and hence can be used with most common microcontrollers.

Detection of smoke:

So as the smoke value reaches beyond the threshold value there will be a smoke alert displayed on the serial monitor and the buzzer starts buzzing to alert the people around which is helpful for the early detection of fire.

Detection of fire:

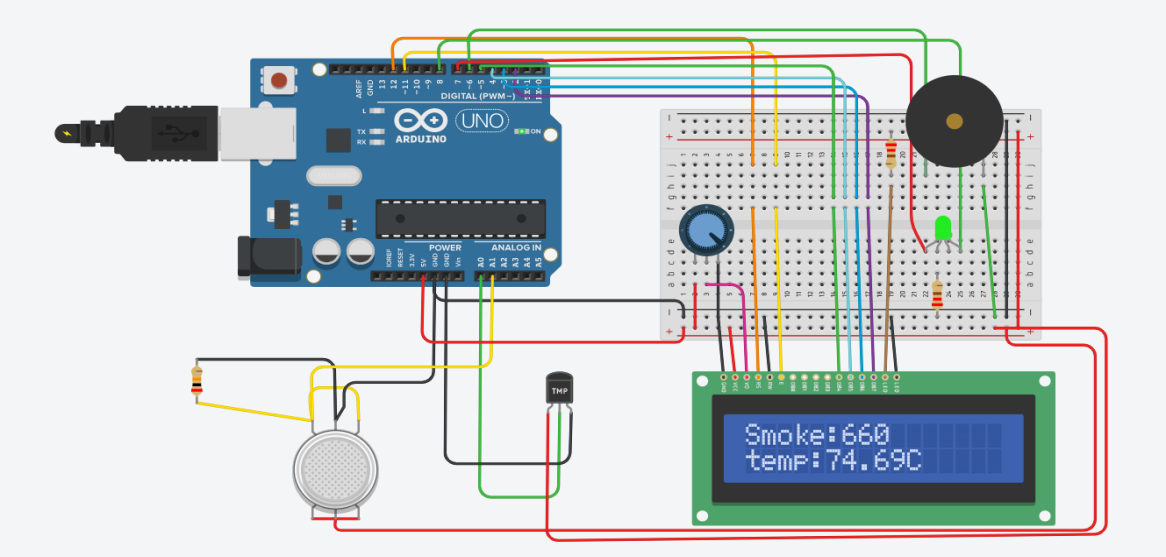
Humidity is a very important feature in detecting a fire. In case of fire the air will be dry thus decreasing the humidity. This Decrease in humidity and increase in temperature can give us indications of forest fires. The DHT-11 sensor can be used to detect humidity in the range of 20-90% RH with the accuracy of ±5% RH. DHT-11 uses a resistive type humidity measurement component. So as the temperature increases and the relative humidity decreases more than the threshold values there will be a fire alert displayed on the serial monitor and the buzzer starts buzzing alerting the people around with the LED glowing.

EXPERIMENTAL SETUP

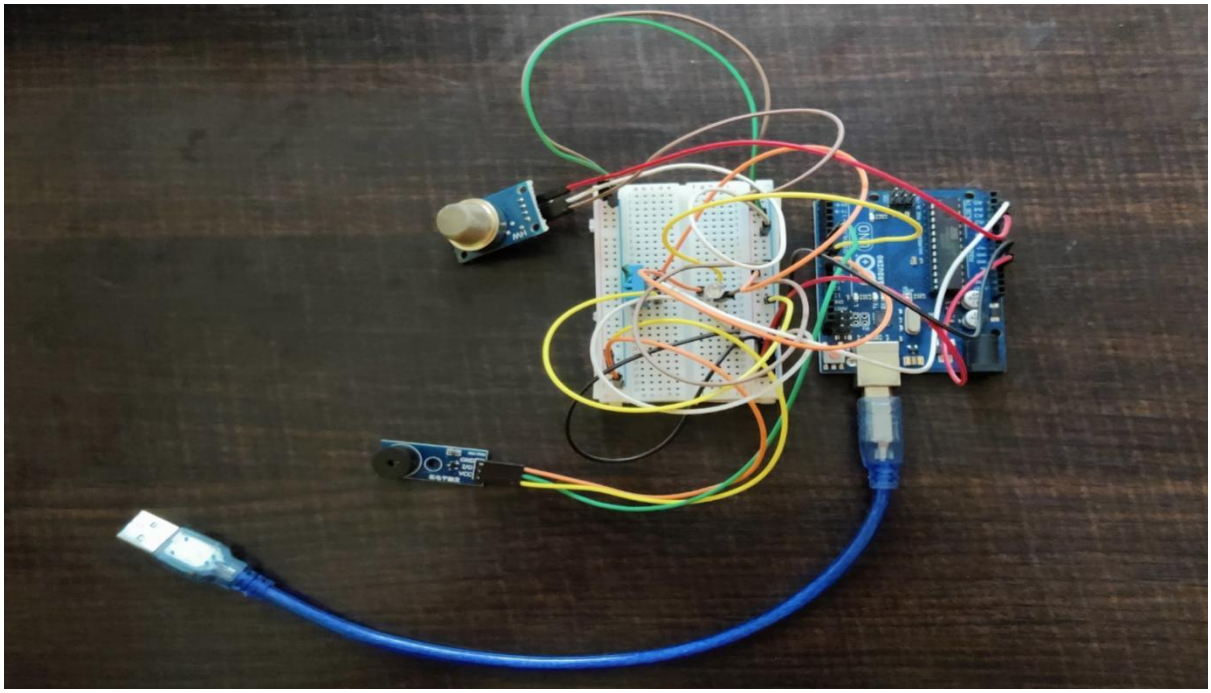
We have implemented our project in both software as well as hardware ways.

- CIRCUIT DIAGRAM / SCHEMATIC DIAGRAM

Software

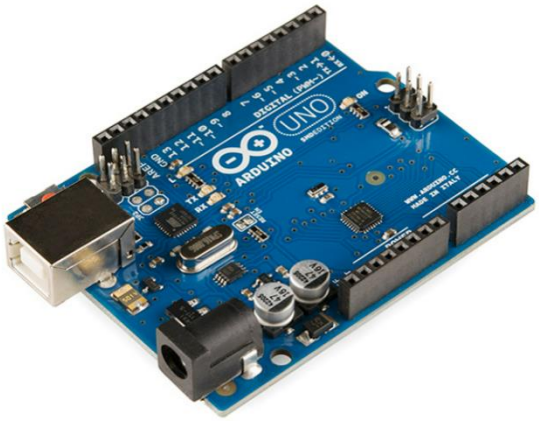


HARDWARE

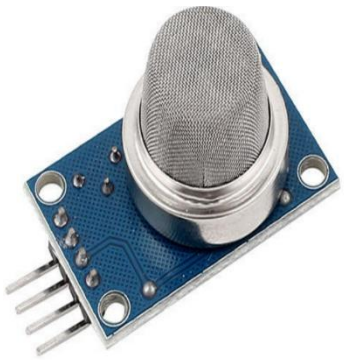


MATERIALS REQUIRED

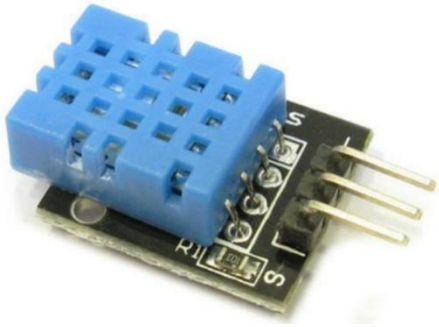
I.Arduino UNO



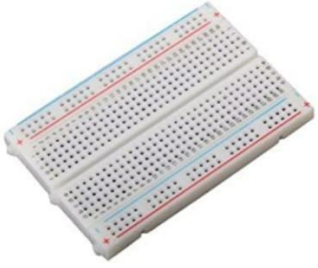
II. Gas sensor MQ-2



III. Temperature and Humidity sensor DHT11



IV. PCB



V. Active Buzzer

VI. LED

VII. Jumper wires

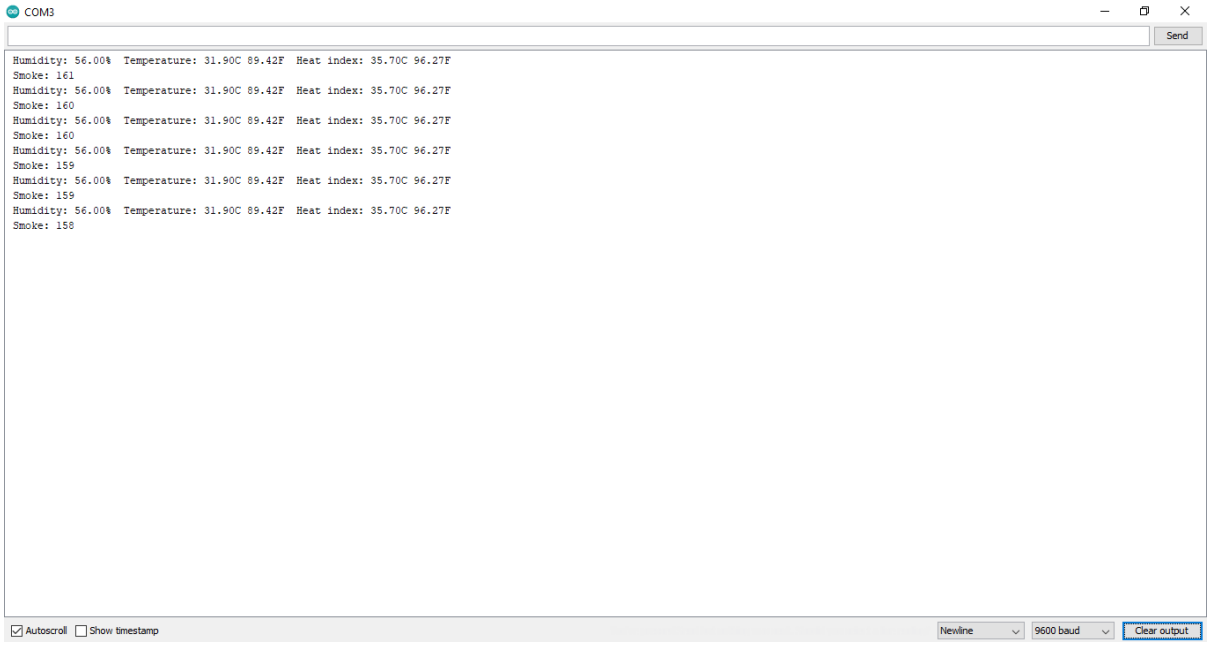
PROGRAM

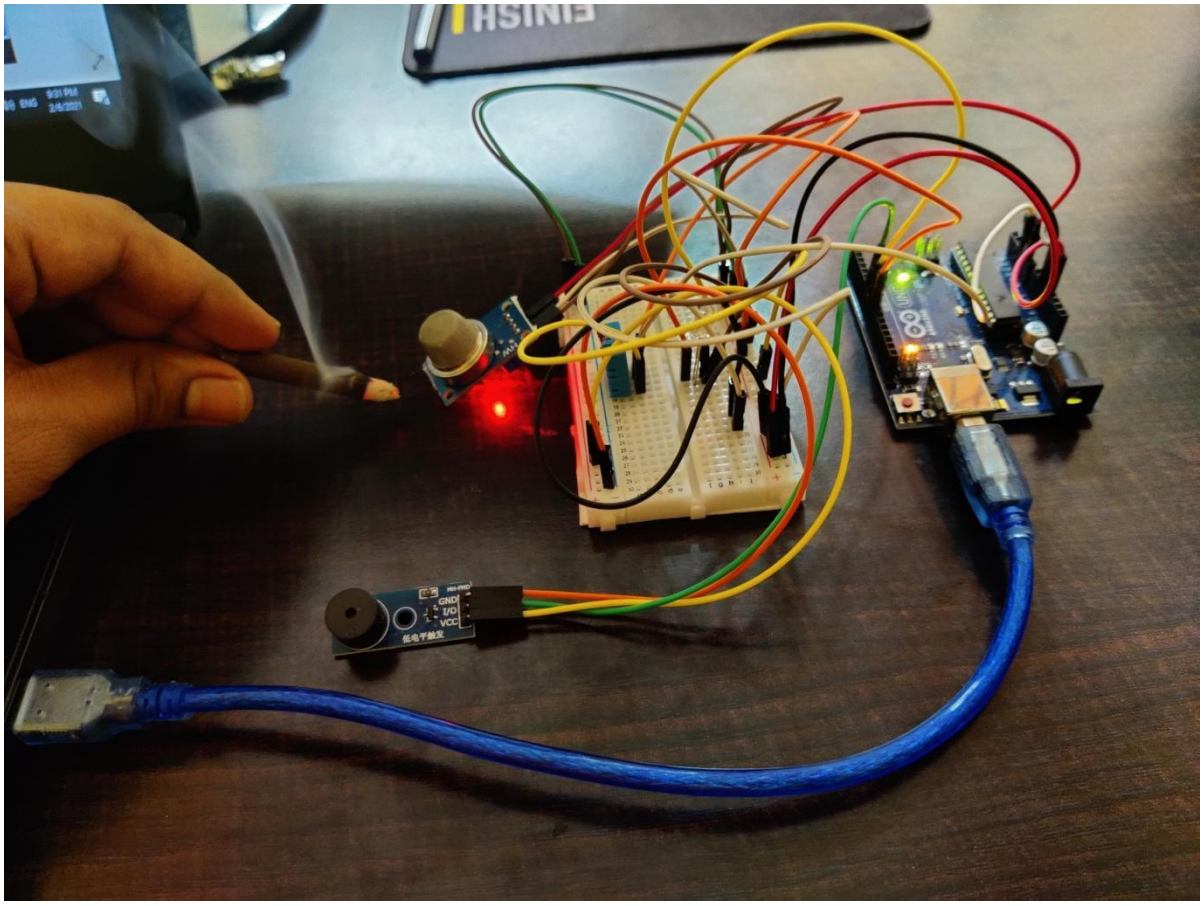
```
#include "DHT.h"
#define DHTPIN A2
#define DHTTYPE DHT11
int smokeA0 = A1;
int pin_red=8;
int pin_green=9;
int buzzer=6;
DHT dht(DHTPIN, DHTTYPE);

void setup() {
  Serial.begin(9600);
  pinMode(pin_red,OUTPUT);
  pinMode(pin_green,OUTPUT);
  pinMode(buzzer,OUTPUT);
  dht.begin();
 }

void loop() {
  delay(2000);
  delay(1000);
  float h = dht.readHumidity();
  float t = dht.readTemperature();
  float f = dht.readTemperature(true);
  if (isnan(h) || isnan(t) || isnan(f)) {
    Serial.println(F("Failed to read from DHT sensor!"));
    return;
  }
  float hif = dht.computeHeatIndex(f, h);
  float hic = dht.computeHeatIndex(t, h, false);
  Serial.print(F(" Humidity: "));
  Serial.print(h);
```

```
Serial.print(F("%  Temperature: "));
Serial.print(t);
Serial.print(F("C "));
Serial.print(f);
Serial.print(F("F  Heat index: "));
Serial.print(hic);
Serial.print(F("C "));
Serial.print(hif);
Serial.println(F("F"));
int analogSensor = analogRead(smokeA0);
Serial.print(" Smoke: ");
Serial.print(analogSensor);
Serial.println("");
if(analogSensor>200&&t<40){
  Serial.println(" !Smoke Alert");
  tone(buzzer,800,800);
  delay(200);
  tone(buzzer,600,800);
  delay(200);
  delay(1000);
}
if(t>40&&h<35){
  Serial.println(" !Fire Alert Evacuate");
  tone(buzzer,800,800);
  delay(200);
  tone(buzzer,600,800);
  delay(200);
  delay(1000);
 set_outputs_plus_ground(pin_red,pin_green);
 delay(1000);
}
else{
```

```
    digitalWrite(pin_red,LOW);
    digitalWrite(pin_green,LOW);
  }
}
void set_outputs_plus_ground(int pin_plus, int pin_ground)
{
  //set both pins low first so you don't have them pushing 5 volts into each other
  digitalWrite(pin_plus,LOW);
  digitalWrite(pin_ground,LOW);
  //set output pin as high
  digitalWrite(pin_plus,HIGH);   }
```

EXPERIMENTAL RESULT



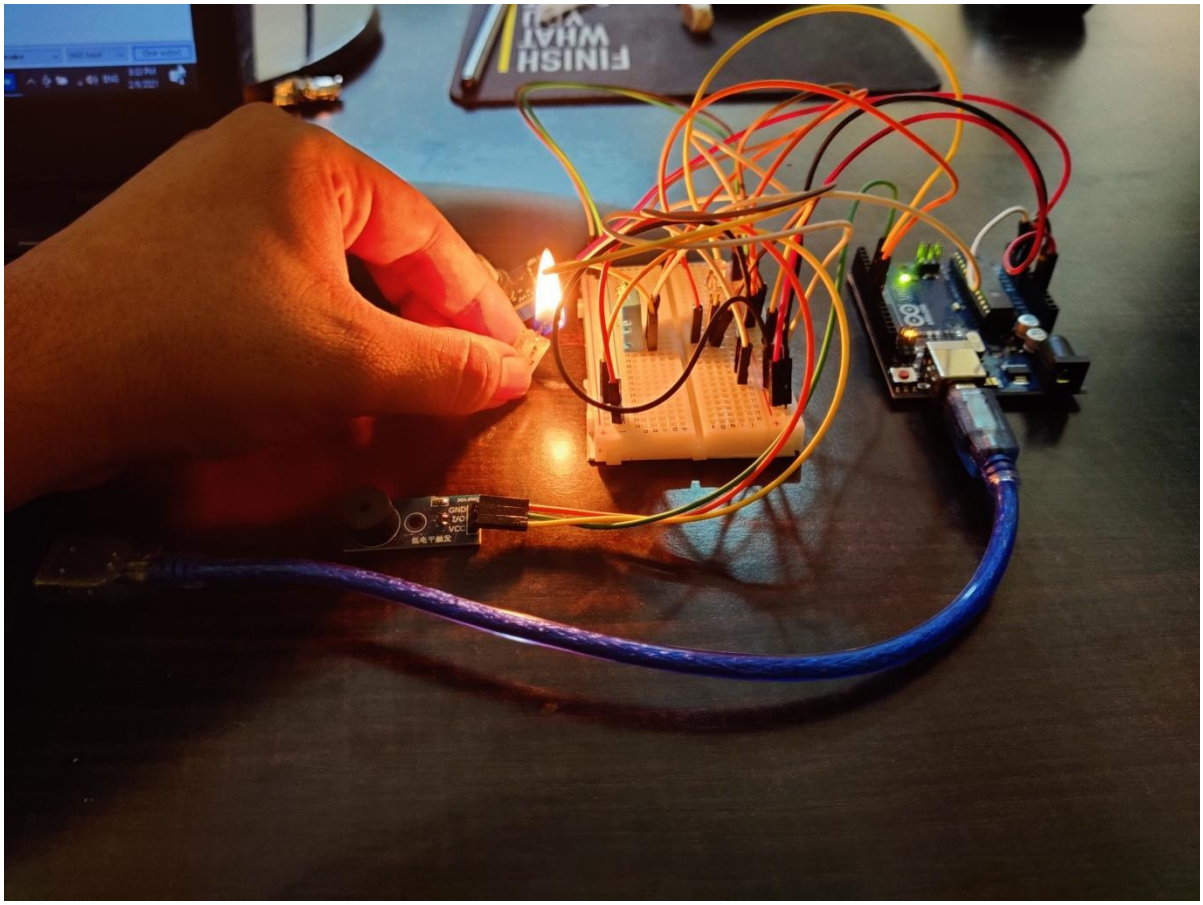


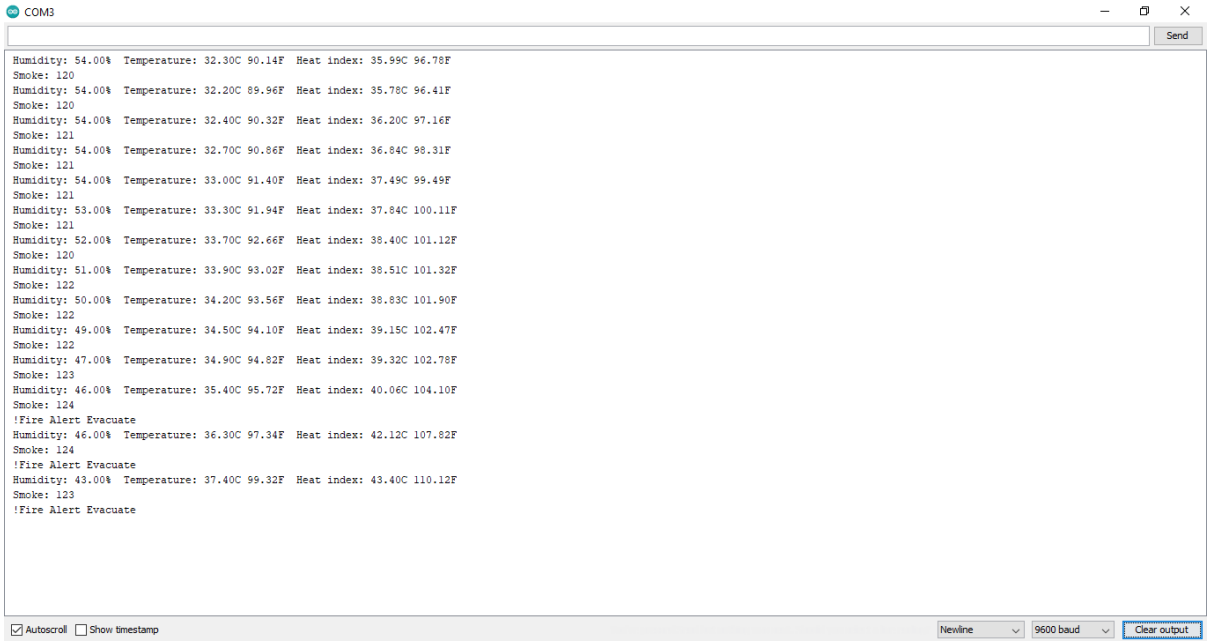
COM3

Send

```
Humidity: 55.00%  Temperature: 32.20C 89.96F  Heat index: 36.06C 96.91F
Smoke: 132
Humidity: 55.00%  Temperature: 32.20C 89.96F  Heat index: 36.06C 96.91F
Smoke: 134
Humidity: 55.00%  Temperature: 32.20C 89.96F  Heat index: 36.06C 96.91F
Smoke: 135
Humidity: 55.00%  Temperature: 32.20C 89.96F  Heat index: 36.06C 96.91F
Smoke: 134
Humidity: 55.00%  Temperature: 32.20C 89.96F  Heat index: 36.06C 96.91F
Smoke: 246
!Smoke Alert
Humidity: 54.00%  Temperature: 32.90C 91.22F  Heat index: 37.27C 99.09F
Smoke: 243
!Smoke Alert
```

Autoscroll Show timestamp Newline 9600 baud Clear output




COM3
Send
Humidity: 54.00% Temperature: 32.30C 90.14F Heat index: 35.99C 96.78F
Smoke: 120
Humidity: 54.00% Temperature: 32.20C 89.96F Heat index: 35.78C 96.41F
Smoke: 120
Humidity: 54.00% Temperature: 32.40C 90.32F Heat index: 36.20C 97.16F
Smoke: 121
Humidity: 54.00% Temperature: 32.70C 90.86F Heat index: 36.84C 98.31F
Smoke: 121
Humidity: 54.00% Temperature: 33.00C 91.40F Heat index: 37.49C 99.49F
Smoke: 121
Humidity: 53.00% Temperature: 33.30C 91.94F Heat index: 37.84C 100.11F
Smoke: 121
Humidity: 52.00% Temperature: 33.70C 92.66F Heat index: 38.40C 101.12F
Smoke: 120
Humidity: 51.00% Temperature: 33.90C 93.02F Heat index: 38.51C 101.32F
Smoke: 122
Humidity: 50.00% Temperature: 34.20C 93.56F Heat index: 38.83C 101.90F
Smoke: 122
Humidity: 49.00% Temperature: 34.50C 94.10F Heat index: 39.15C 102.47F
Smoke: 122
Humidity: 47.00% Temperature: 34.90C 94.82F Heat index: 39.32C 102.78F
Smoke: 123
Humidity: 46.00% Temperature: 35.40C 95.72F Heat index: 40.06C 104.10F
Smoke: 124
!Fire Alert Evacuate
Humidity: 46.00% Temperature: 36.30C 97.34F Heat index: 42.12C 107.82F
Smoke: 124
!Fire Alert Evacuate
Humidity: 43.00% Temperature: 37.40C 99.32F Heat index: 43.40C 110.12F
Smoke: 123
!Fire Alert Evacuate
Autoscroll
Show timestamp
Newline
9600 baud
Clear output

CONCLUSION

In these days IOT has the potential to dramatically increase the availability of information / data, and is likely to transform companies and organization in virtually every industry around the world.

As our project will gain higher level in this generation where everything is automated .

The future of IOT has a potential to be limitless , and our project will be more used in countries like India.

This project gave us different view to technologies and sincere thanks to our professor.

REFERENCES

[1]https://www.academia.edu/42819689/Arduino_based_Fire_Detection_and_Alarm_System_Using_Smoke_Sensor

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[5]https://www.ijeter.everscience.org/Manuscripts/Volume-7/Issue-5/Vol-7-issue-5-M-01.pdf