Faculty of Engineering
Cairo University

FIRE ALARM SYSTEM

TASK SHEET

Name	SEC	BN	GRADE
Youssef Ahmed Kamel	35	27	
Youssef Suliman Ahmed	35	57	
Youssef Ahmed Shawky	35	63	
Yasser Ammar Rahma	35	65	
Yasmin Elsayed Mohamed	35	5	
Yasmin Saad Mahmoud	35	6	
Yasmin Mahmoud Salah	35	8	
Yaqeen Ibrahim Hammad	35	18	

GEN001 Practical and Engineering Application (Physics Part)

Under Supervision of: ENG Mahmoud Mostafa

Abstract

Fire disasters are a great threat to lives and property. Automatic fire alarm system provides real-time surveillance, monitoring and automatic alarm. It sends an early alarm when the fire occurs and helps to reduce the fire damage. Wireless sensor networks have become the most important technology in environmental monitoring and home or factory automation in recent years. In this paper, an automatic fire alarm system based on wireless sensor networks is developed, which is designed for high-rise buildings. In order to provide early extinguishing of a fire disaster, large numbers of detectors which periodically measure smoke concentration or temperature and detect flame too are deployed in buildings.

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Chapter 1: Introduction

Fire\flame detection technology is something crucial to have in a modern, technologically advanced world. After years of rigorous research and testing, various types and models of fire detectors were developed and are now available for civil use. Among these types are : photoelectric detectors, aspirating systems and open-beam detectors. They differ mainly in their ranges, area of use (military, residential , etc..) and the type of sensor used

1.1. Motivation and justification

Early fire detection is crucial and plays a vital role in protecting and saving lives. Having a fire detection system can significantly reduce damages and magnifies fire control efforts.it doesn't matter which industry sector it is, all business owners need to be aware of the fire risks within the workplace. In the event of a fire emergency, A few seconds can save lives.

Small children unknowingly playing with fire or matches inside the home are one of the leading causes of house fires. Older kids who know what fire can do - and just want to see what happens - are equally dangerous. In order to reduce the danger of these housefires we do need a fire alarm system so we can help the fire faster and before things just get out of hands. Fire detection systems increase response times, as they can alert the correct people in order to extinguish the fire in time. This thus reduces the amount of damage to the property. We find fire alarms useful for busy moms when they don't pay attention to what their children are doing.

Therefore, we adapted the idea of the fire alarm due to the idea of making people live better and safer, we got the passion and the inspiration from the important role that the fire alarms play in lives of people.

1.2. Necessary background

Important skills and knowledge:

1. **Programming**: we need to program the Arduino in order to use the sensor and connect the components. The language we will use is Arduino c, and the compiler is Arduino Uno.
2. **Physical background**: we need to study sone electrical physics to can deal with photodiode that convert light to electric current.
3. **Connection background**: to connect the electric current come out from photodiode and use it to send waves to the buzzer and the led we use to warn people from fire.

What are the main aspects of fire alarm?

Our fire alarm model consists mainly of five things:

1. Arduino Uno Board
2. Actuators (LEDs and Buzzer)
3. IR sensor
4. Gas sensor
5. .LM -35 temperature sensor.

1. Microcontroller Module

We will use an Arduino Uno board, which is an easy-to-use programmable microcontroller board that can be used in a variety of projects. It will receive the signal and use the program code written in Arduino IDE, where the programming language used is C++, to evaluate the input and activate the Buzzer and LED.

2. Sound Module

A Buzzer as shown is used as the sound module in this project. It is activated when the microcontroller (Arduino) receives a high signal from the flame sensor. Its main purpose is to further alert residents or personnel of the fire as the red flare may pass unnoticed.

3.IR Sensor

The IR flame sensor shown is the sensory module we will use, which will detect the fire. It contains a photodiode, which receives the Infrared radiations emitted from the flame, and an operational amplifier (OP-AMP), which controls the sensitivity and amplifies the received signal

4.Gas Sensor

The gas sensor is used to measure the concentration or presence of gas in the atmosphere. It is also used to detect smoke in the air. Based on the gas, a potential difference is generated by changing the resistance of the material present inside the sensor. The output is measure in terms of Voltage.

5. LM-35 Temperature Sensor

LM-35 Temperature Sensor gives an analog output based on the instantaneous temperature value. This analog output is proportional to the instantaneous input.

Chapter 2: literature survey

2.1. History

In the 19th century, as cities continued to be crowded, authorities began using bell towers as city wide fire alarms. Their central locations were ideal for maximizing the effectiveness of fire alarms and helping to report firefighting faster than ever before. The city of Philadelphia rebuilt its bell tower and developed unique ringing patterns to alert citizens to where the fire was burning. Even with this development, response times remained poor due to the apparent inaccessibility of the site. Several 19th century inventions fundamentally changed fire detection to better. The first city wide fire alarm system was built in Boston, Massachusetts. This system took the idea of a central bell tower and turned it into a central station.

The first fire alarm system ever was invented way back in 1852 by Dr. William F. Channing and Moses Farmer. The system consisted of two fire alarm boxes that each had a telegraphic key and a handle. If a fire was detected in a home or business, someone would have to reach inside one of the boxes and crank the handle in order to send an alert about the fire to a nearby alarm station. An operator at the station would then take the message and alert a fire department about it so that they could send help. As you can see, it was quite a process and required several steps.

The first electric fire alarm system was invented almost four decades later in 1890 by Francis Robbins Upton. He recognized that, in most cases, people wouldn't have time to stand around and crank a handle inside of a box when a fire started. Therefore, his electric system eliminated the need for this step. Surprisingly, the design for his system wasn't all that popular when it was first introduced, but over time, people started to realize the need for a more advanced fire alarm system like this one.

Since then, fire alarm systems have changed a lot, and today, home and business owners really don't have to do anything except evacuate the premises during a fire. Even basic fire alarm systems are designed to send an alert to a central alarm station, where an operator will quickly check on your well-being before sending help from a fire department to check on your home. The entire process

is much than it used to be, and modern fire alarms have become a must-have for many people.

2.2. Theory

In the simplest terms, the role of a fire alarm is to detect fires and alert both building occupants and emergency personnel from a centrally monitored and controlled location.

An IR sensor is a device that detects infrared radiation falling on it. The heart of the sensitive fire alarm circuit is an infrared transmitter and infrared receiver. In normal operating conditions when infrared light is shining from the infrared transmitter from the infrared receiver it will have low impedance. So, the voltage at the base will be low and the transistor will not work. In case when a fire is observed an infrared beam will not be able to pass to a receiver. The resistance of the receiver will rise up and the voltage at the base will be positive causing an alarm to activate.

Fire alarms are composed of many separated parts:

• Initiating devices: which detect fire by various kinds of sensors

• Indicating applications: which is a part of the system which sounds the alarm and alert detecting any fire occurrence

2.3. Methodology

A Flame Sensor module or Fire Sensor module is a small size electronics device that can detect a fire source or any other bright light sources.

Radiation in IR sensor:

The sensor is sensitive to a narrow band of radiation the infrared wavelength is between 0.75 and 1000µm and is separated into three regions:

. Near infrared - from 0.75 to 3µm

. Mid-infrared - from 3 to 6µm

. Far -infrared - higher than 6µm

Which are a predominant emission band for hydrocarbon-fuelled fires.

Infrared radiation is a characteristic of all objects that have a temperature higher than the absolute zero (0 Kelvin or -273 Celsius). Such objects have thermal energy and can emit infrared waves. IR sensors usually use infrared lasers and LEDs with infrared wavelengths. Additionally, the sun's radiation at this band is absorbed by the earth's atmosphere, making the IR flame detector solar blind. Single frequency detectors use a pyro electric sensor, which responds to changes in IR radiation intensity. In addition, they incorporate a low frequency band pass filter, which limits their response to those frequencies that are characteristic of a flickering fire. In response to a fire signal from the sensor, electronic circuitry in the detector generates an output signal.

Types of fires IR sensor is able to discover:

IR detectors are sensitive to most hydrocarbon fires (liquids, gases, and solids). Fires such as burning metals, ammonia, hydrogen and sulphur do not emit significant amounts of IR in the detector's sensitivity range to activate an alarm. IR detectors are suitable for applications where hydrocarbon fires are likely to occur and high concentrations of airborne contaminants and / or UV radiation sources may be present.

How does it work?

Active infrared sensors work with radar technology the radiation hits the objects nearby and bounces back to the receiver of the device. Through this technology, the sensor cannot only detect movement in an environment but also how far the object is from the device. This is especially useful in robotics to detect proximity. In order for the thermal energy to reach the IR sensor, it must use a transmission medium. Compatible mediums are the atmosphere, vacuum, or optical fibers. Optical lenses made from combinations of metals and minerals, such as quartz, calcium fluoride, polyethylene, germanium, aluminum, and silicon are used as radiation convergent. The converged or focused radiation is afterward detected by infrared detectors. Infrared detectors must additionally use pre-amplifiers to strengthen the signal.

:Gas sensor methodology

:Gas Sensors work with two main technics

(NDIR method (Non-dispersive infrared method .1

On-dispersive infrared (NDIR) spectroscopy analyzes the concentration of target gases based on their characteristic infrared absorption. In conventional NDIR gas sensors, an infrared detector has to pair with a band pass filter to select the target gas. However, multiplexed NDIR gas sensing requires multiple pairs of band pass filters and detectors, which makes the sensor bulky and expensive. Here, we propose a multiplexed NDIR gas-sensing platform consisting of a narrowband infrared detector array as read-out. By integrating plasmonic metamaterial absorbers with pyro electric detectors at the pixel level, the detectors exhibit spectrally tunable and narrowband photo

responses, circumventing the need for separate band pass filter arrays. We demonstrate the sensing of H2S, CH4, CO2, CO, NO, CH2O, NO2, and SO2. The detection limits of common gases such as CH4, CO2, and CO are 63 ppm, 2 ppm, and 11 ppm, respectively. We also demonstrate the deduction of the ..concentrations of two target gases in a mixture

In addition, it is applied in an environmental field are considered. Disadvantages of the non-dispersive infrared (NDIR) gas sensors include spectral interference and high detection limit. Efforts to improve these disadvantages are reviewed in this paper. Interference caused by water vapor and gas matrix has been partially solved using optical filters and interference correction factors. Limitations such as accuracy and sensitivity of the sensor were overcome by the improvements of inlet gas concentrations, infrared sources, optical designs (including optical filter and gas chamber) and detectors. These improvements are limited to a few gases, in particular, carbon dioxide. Drawbacks related to water vapor still remain and need to be adressed

.

Electrochemical method .2

In electrochemical sensors, the target gas interacts with an electrolyte causing electrochemical reactions, which produce a current. This current is dependent upon the concentration of the target gas (by either a linear or a logarithmic relationship) and can be measured. Currently in-use models of electrochemical sensor include the Alpha sense D-4 mini and the OMC-1108. In comparison to the MOS sensors, electrochemical sensors are often more expensive and larger in size, but do have advantages including lower power requirements, lower detection limits, and are less affected by interfering gases. They have relatively .short (approximately 1 year) operational lifetimes

LM35 Temperature Sensor methodology

LM35 is a temperature sensor that outputs an analog signal, which is proportional to the instantaneous temperature. The output voltage can easily

be interpreted to obtain a temperature reading in Celsius. The advantage of lm35 over thermistor is it does not require any external calibration. The coating also protects it from self-heating. Low cost (approximately $0.95) and greater accuracy make it popular among hobbyists, DIY circuit makers, and students. Many low-end products take advantage of low cost, greater accuracy and used LM35 in their products. It is approximately 15+ years to its first release but the .sensor is still surviving and is used in any products

Moreover, LM35 can measure from -55 degrees centigrade to 150-degree centigrade. The accuracy level is very high if operated at optimal temperature and humidity levels. The conversion of the output voltage to centigrade is also .easy and straightforward

The input voltage to LM35 can be from +4 volts to 30 volts. It consumes about 60 microamperes of current. Lm35 has many family members a few names are LM35C, LM35CA, LM35D, LM135, LM135A, LM235, and LM335. All LM35 family members work on the same principles but temperature measuring capacity .(varies and also they are available in many packages (SOIC, TO-220, TO-92, TO

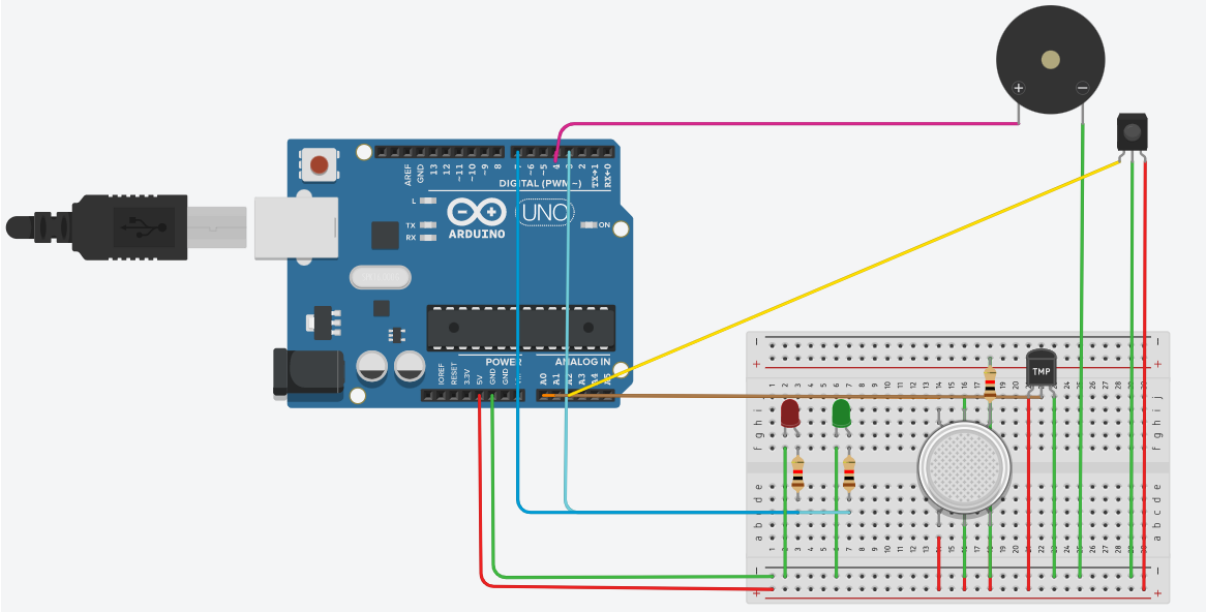
:LM35 Working Principle

In order to understand the working principle of LM35 temperature sensor we have to understand the linear scale factor. In the features of LM35, it is given to be +10 mills volt per degree centigrade. It means that with increase in output of 10 mills volt by the sensor vout pin the temperature value increases by one. For example, if the sensor is outputting 100 mills volt at vout pin the temperature in centigrade will be 10-degree centigrade. The same goes for the negative temperature reading. If the sensor is outputting -100 mills volt the tLM35 can be used in two circuit configurations. Both yield different results. In the first configuration, you can only measure the positive temperature from 2 degrees Celsius to 150 degrees Celsius. In this first configuration, we simply power lm35 and connect the output directly to analog to digital converters. In the second configuration, we can utilize all the sensor resources and can measure the full range temperature from -55 degree centigrade to 150-degree centigrade. This configuration is a little complex but yields high results. We have to connect an external resistor, in this case, to switch the level of negative voltage upwards. The external resistor value can be calculated from the

formula given below the configuration circuit. The second configuration circuit can be made in various ways. To see about the second configuration circuits visit the LM35 datasheet by Texas Instruments. Texas Instruments data sheet .enlists the circuit with clear component values

Although the first configuration did not need a resistor at the output side, I recommend connecting an 80 k to 100 k resistor between vout and gnd pin. When I performed several experiments, I noticed that the readings some time fluctuate and the vout pin floats. Therefore, a resistor between vout and gnd tights the vout pin low and prevents the pin from floating. Temperature will be .-10 degrees Celsius

Chapter 3: Design



3.1. Circuit connections

The circuit connections are as follows.

Firstly, we need to connect one line of the breadboard to the ground and the other to the power supply. This is done by connecting the 5V pin of the Arduino Board to one line of connection pins on the breadboard. The other line of the breadboard is connected to the ground terminal of the Arduino Board. These lines will be connected to other devices.

First the Temperature sensor has three pins. Ground, Vout, and Vs (Supply). The Vs pin that has a range of 4-20V is connected to the power supply line of the breadboard. The Ground terminal of the sensor is connected to the ground line of the breadboard. The Vout terminal of the temperature sensor is connected to one of the Analog pins of the Arduino Board, A1.

Second, the Gas sensor. This sensor has 6 pins. 3 pins of the gas sensor are directly connected to the power supply line of the breadboard. Amongst the other 3 pins of the sensor, one pin is connected to one of the Analog pins of the Arduino Board, A0. The pin in the middle is connected to the ground line of the breadboard. The third pin of the sensor is connected to a resistor and then connected to the ground line.

Third, the IR sensor has three pins. Ground, Power, out. The Ground terminal of the sensor is connected to the ground line of the breadboard, The Power terminal of the sensor is connected to the power supply line of the breadboard, our terminal is connected to the digital pin, PIN 6 of the Arduino Board.

The piezo buzzer is externally connected to the circuit. The ground pin of the buzzer is connected to the ground line of the breadboard. Another pin of the buzzer is connected to the digital pin, PIN 4 of the Arduino Board.

Lastly, the 2 LEDS are connected to the breadboard. The cathode of the both LEDS is connected to the ground line of the breadboard and the anode of the 2 LEDS is connected through resistors, the Red LED connected digital pin, PIN 7 of the Arduino Board, the Green LED connected digital pin, PIN 3 of the Arduino Board.

3.2. Code

```
float temp ;
float vout;
float vout1;
int redLED = 7;
int greenLED =3;
int gasSensor;
int IRsensor;
int piezo =4;
void setup ()
{
pinMode(A0,INPUT);
pinMode(A1,INPUT);
pinMode(A2,INPUT);
pinMode(redLED,OUTPUT);
pinMode(greenLED,OUTPUT);
pinMode(piezo,OUTPUT);
Serial.begin (9600);
```

```
void loop ()
{
 vout=analogRead(A1);
 vout1=(vout/1023)*5000;
 temp=(vout1-500)/10;
gasSensor=analogRead(A0);
IRsensor =analogRead(A2);
if (gasSensor>=200 ||IRsensor>=100|| temp>90 )
{
   digitalWrite(piezo,HIGH);
  digitalWrite(redLED,HIGH);
  digitalWrite(greenLED,LOW);
  delay(1000);
}
else
{
 digitalWrite(piezo,LOW);
 digitalWrite(greenLED,HIGH);
 digitalWrite(redLED,LOW);
  Serial.print("safe");
  Serial.println();
  delay(1000);
```

```
if (gasSensor>=200)
{
  Serial.print( "smoke detected");
  Serial.print (" ");
  Serial.print (" ");
  Serial.print("Gas sensor = ");
  Serial.print(" ");
  Serial.print(gasSensor);
  Serial.println();
}
if (temp>=90)
{
  Serial.print( "FIRE DETECTED");
  Serial.print (" ");
  Serial.print (" ");
  Serial.print("TEMP in cel = ");
  Serial.print(" ");
  Serial.print(temp);
  Serial.println();
}
if (IRsensor>=100)
{
Serial.print ("Flame Detected");
Serial.print (" ");
  Serial.print (" ");
  Serial.print("IR  = ");
  Serial.print(" ");
  Serial.print(IRsensor);
  Serial.println();
```

First, we declare the components pins in the Arduino.

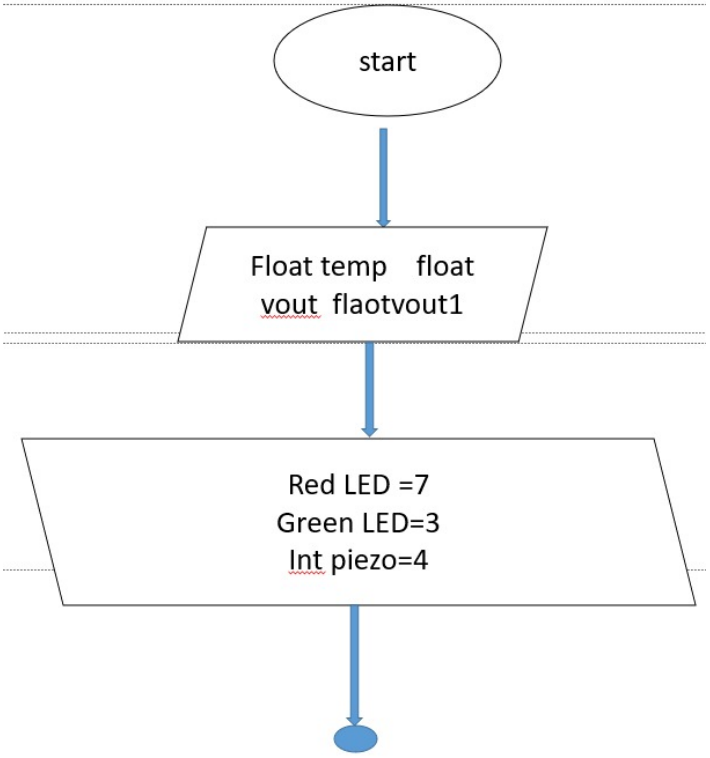
Second, define the components as Input and Output.

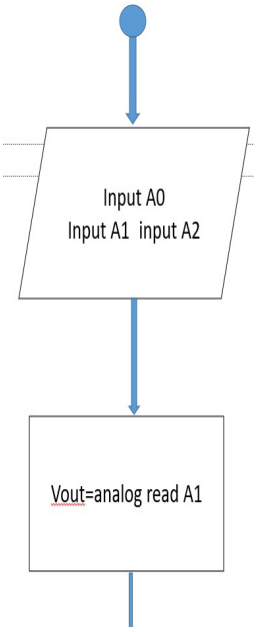
Third, write the equation of the temp sensor, then define the temp and smoke sensor as analogRead and the IR sensor as digitalRead.

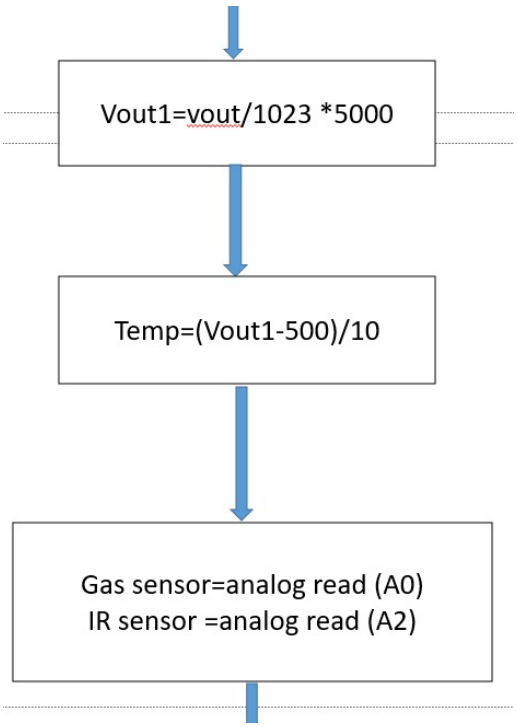
Fourth, IF condition line using OR to make the system use one buzzer and 2 LEDS, instead of using 3 buzzer and 6 LEDS. (Here we reduce the cost of the project about 30 %)

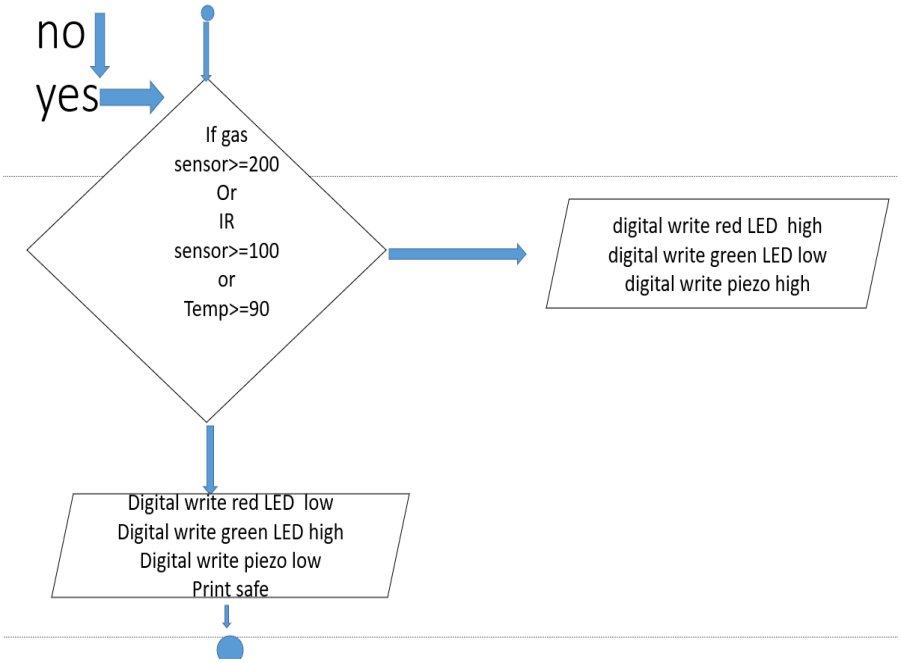
Fifth, Another IF condition lines give exact numbers for each sensor.

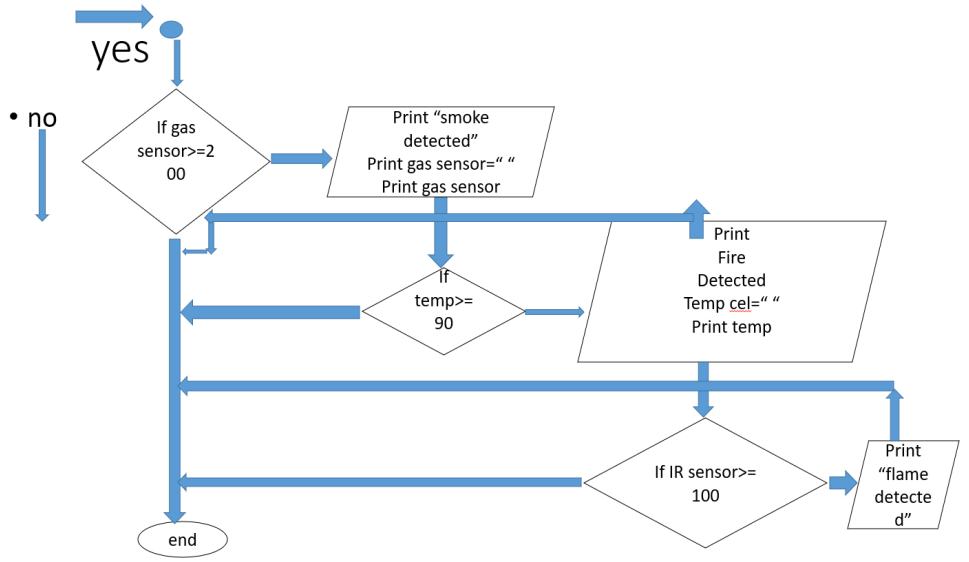
3.3. The flow chart of the project






Vout1=vout/1023 *5000
Temp=(Vout1-500)/10
Gas sensor=analog read (A0)
IR sensor =analog read (A2)


no
yes
If gas sensor>=200 Or IR sensor>=100 or Temp>=90
digital write red LED high
digital write green LED low
digital write piezo high
Digital write red LED low
Digital write green LED high
Digital write piezo low
Print safe


yes
• no
If gas sensor>=200
Print “smoke detected”
Print gas sensor=“ “
Print gas sensor
If temp>= 90
Print Fire Detected
Temp cel=“ “
Print temp
If IR sensor>= 100
Print “flame detected”
end

Chapter 4 : System Description

4.1. Overview

Basically, the system depends on a number of elements, mainly Hardware (main components which can be classified as either INPUT or OUTPUT devices) and Software (necessary coding), all of which come together as one in order to insure the factuality of the system's previously set objectives, which were to detect any signs of a potential fire in a swift, effective manner and promptly alert residents of the possible threat.

4.2. System components

I. Generic Components

Arduino Uno

The heart of the system, where both hardware and software parts meet. It is a microcontroller board which has become extremely popular in the last few years due to it being easily programmed and reprogrammed by using a USB cable to upload a C or C++ code, previously developed on Arduino IDE. Supposedly, the uploaded code entails that should any of the three sensors connected to the system receive stimuli that meet the set limits, the code will set the circuit in action and activate the proper actuators.

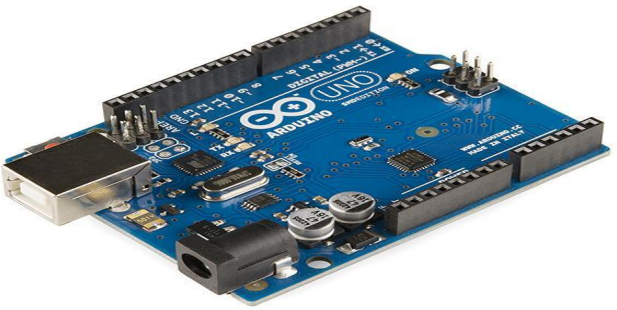


Fig 1 ' Arduino Uno'

Breadboard

It is also known as *"Protoboard".* Its most prominent feature is that it does not require soldering, which makes it easily reusable. This has resulted in it being widely popular among students and those who are experimenting and are in a frequent need for various prototypes.

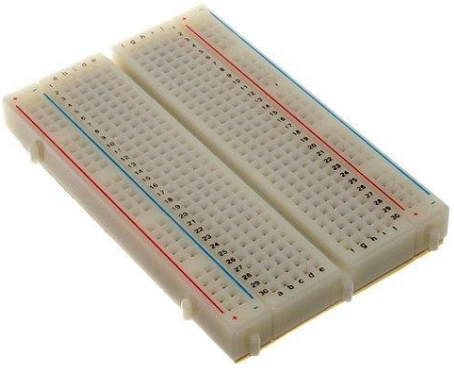


Fig 2 ' Breadboard'

We use the breadboard as an extension, to further spread the desired circuit and neatly organize it, as the Arduino will most likely not have sufficient space.

Jumper Wires

They are wires that are typically used with breadboards. There are three types of jumper wires which are: Male-to-Male, Female-to-Female and Male-to-Female. They differ in the shape of the endpoint of the wire, and each has its own usages depending on what it's connected to. Usually, a person who is designing a circuit using jumper wires will color-code them according to what they represent. We will use them to connect different parts of the project together (Arduino, breadboard, sensors, and actuators).

Fig 3 ' Jumper Wires'

Resistors

They are common elements in electronic circuits. The electrical function of a resistor is defined by its resistance. Resistors exist within a range of resistances, each used in their appropriate setting, and are marked with colors to indicate their type. We will connect 1K Ohm resistors to various parts of the circuit in order to reduce the current flow and prevent excess current which can burn out the components.

Fig 4 ' Resistors'

II. Sensors

MQ5 Gas Sensor

It is a sensor with adjustable sensitivity that can detect many types of gasses that could be indicators of a starting fire or a harmful gas leakage such as: Hydrogen, Carbon Monoxide, Alcohol, Methane, LPG, …etc. It has a filament which in clear air has a relatively lower conductivity. When it comes in contact with a combustible gas such as LPG, the gas is ionized and absorbed by the filament. This creates a potential difference on the filament, which in turn causes the resistance of the filament to change. The amount of change in the resistance can indicate the equivalent concentration of the gas.

Fig 5 ' MQ5 Sensor'

IR Sensor

Fig 6 ‘ IR Sensor’

The IR flame sensor is a type of sensor that can detect motion, fire or flame by detecting heat radiations, usually in the Infrared spectrum. It has a LED which can emit radiation to hit objects, a photodiode which receives the reflected\emitted radiations, and an operational amplifier (OP-AMP), which controls the sensitivity and amplifies the received signal. IR Sensors are usually faster and more accurate than smoke or thermal detectors. We use them to detect any near flames that may be caused by a starting fire.

LM-35 Temperature Sensor

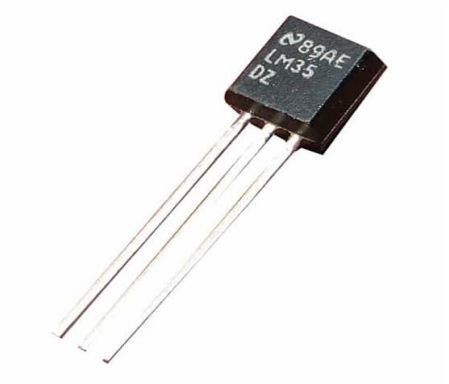


Fig 7 ' LM-35 Sensor'

It is a type of temperature detector that displays an analog output which is linearly proportional to the measured centigrade temperature. When the temperature increases, the voltage change across it changes which when amplified can generate the analog signal. It is also known to be prone to electromagnetic interference, which can cause errors and fluctuations in the output signal. This can usually be solved by connecting it to a 1K Ohm or 2K Ohm resistor.

III. Actuators

Piezo Buzzer

Fig 8 ' Piezo Buzzer'

A buzzer is an audio signaling device that can be mechanical, piezoelectric, electromagnetic, …etc. A piezoelectric buzzer can be activated in an oscillating electronic circuit. When a sensor detects a stimulus the Arduino will execute the code which in this case will direct the circuit to activate the buzzer, resulting in a beeping sound that should alert us of the fire.

LEDs

Fig 9 ' LEDs'

LEDs or Light Emitting Diodes are among the most commonly used electronic components. They are used widely in a range of fields going from simple projects and prototypes to flashlights and traffic signals. In our prototype we used 2 different LEDs, one green and one red. The green one should always be lit as long as it is safe and no fires or gas leakages are detected. In case of a sensor detecting a stimulus, the Arduino will turn off the green LED, and light the red one instead along with the buzzer, so that the alerting system is complete and we can notice the threat and deal with it before it prevails.

Chapter 5: Market Research

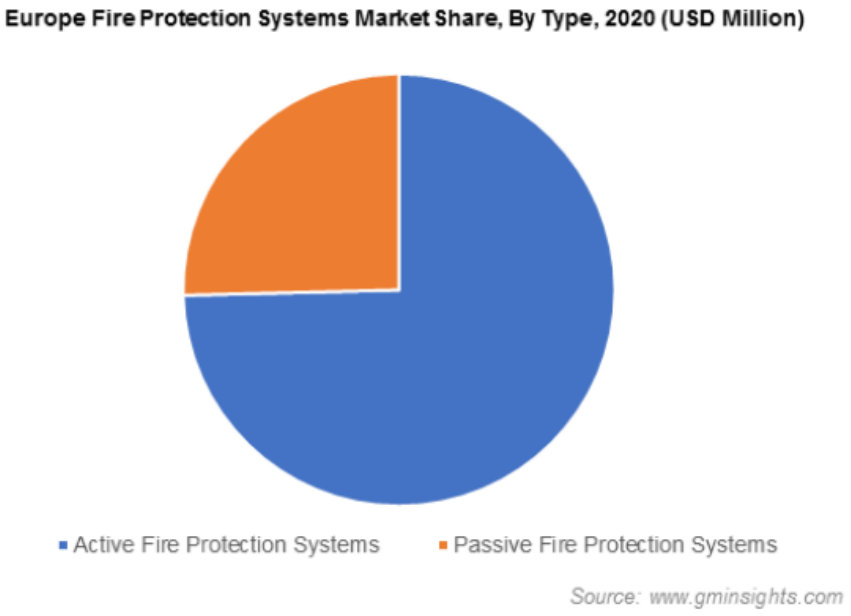
The global fire alarm and detection system market was valued at $60.51 billion in 2020, and is projected to reach $98.90 billion by 2030, registering a CAGR of 5.00%.
I will divide the research to two sections
1. International market
2. Form done by our colleagues in the university

5.1. International market

First: Type of the fire protection system

Active or Passive protection system?

About 75 % of people prefer Active to the passive but why?
SO, we have to know what are the difference between active and passive fire protection systems?
In basic terms, Active fire protection is about detecting, stopping and escaping fire. Whereas passive fire protection means containing the fire and preventing it from spreading further.



Since then, in our project, we know that you need both an active and passive fire safety system working together to prevent, detect and alert, restrict and

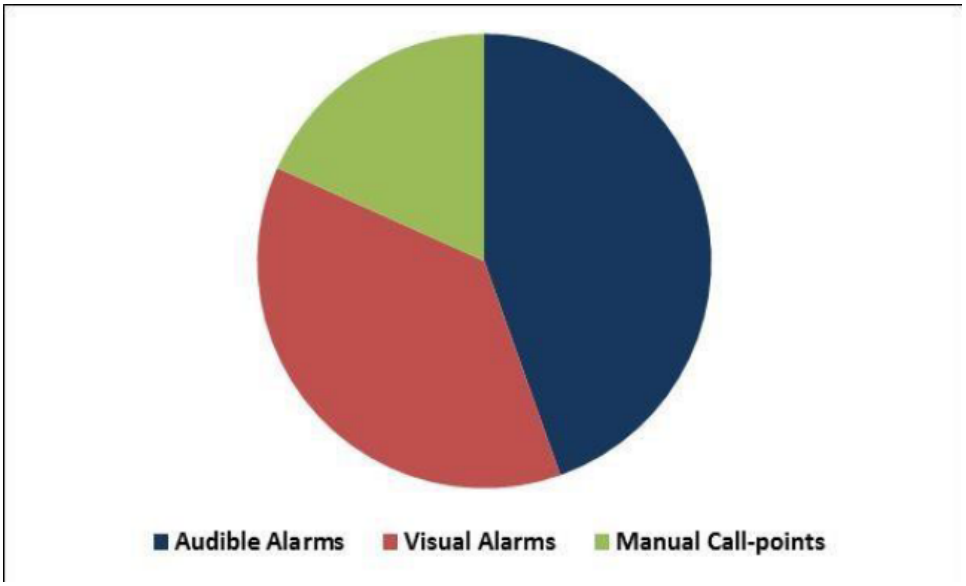
potentially suppress a developing fire. Both systems work simultaneously and in tandem with each other.

Second: Types of alarm people mostly choose

We found that majority of them leans towards the Audible alarms and in the second place there is the Visual alarms and the lowest percentage choose the manual call-points

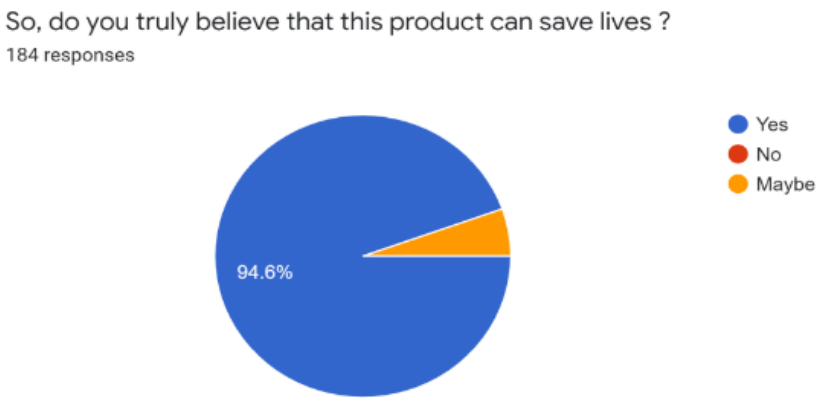
People prefer the sound alert than the light as they may be sleep or don't give attention to the light alert. People who choose the Manual call-points may be from the elderly people who don't trust the technology.

In our product we have both Audible and Visual alerts to reassure our customers.

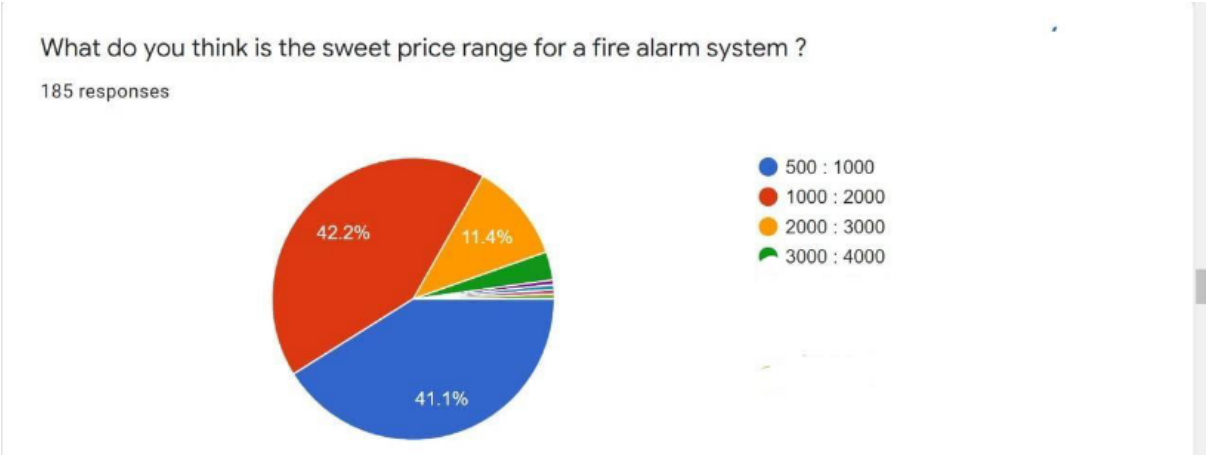


3.2) Form filled by our colleagues in the university

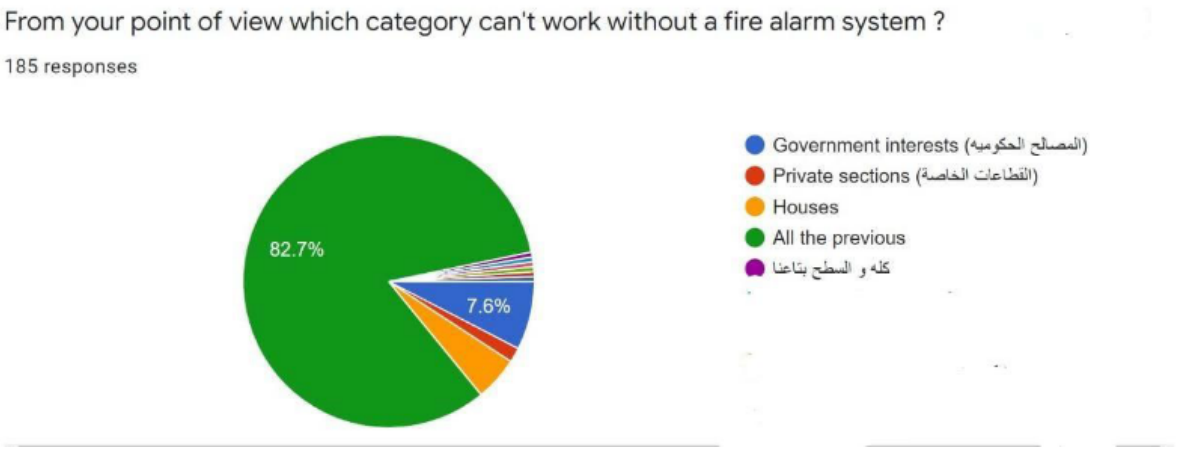
1. Almost all of them see that our product saves lives.



2. when we ask about price, they were equally as shown, so we decide to make it in the middle, which is 1000 L.E, So We take into account the price without affecting the quality.



2.They gather on that all closed buildings should include fire alarm system



4.Finally we ask them what we can add to our product they choose smoke detector and try to find out a way to remove the smoke to keep the environment clean from co, Sox, NOx.

Chapter 6: Specification

First to get a fire alarm system we used:

1. Arduino uno
2. Breadboard
3. piezo buzzer
4. 2 LEDs (Red and Green)
5. 1k ohm resistance
6. Temperature sensor LM35
7. Gas sensor MQ5
8. IR sensor.
9. Wire jumpers (male to male), (male to female)

Arduino board is a microcontroller that is used to accept inputs from sensors connected and provide an output action on the desired device connected to it.

The breadboard is the basic component of any circuit building process. All components, be it input sensors or output display devices are connected to the power supply, microcontroller using wired connections through a breadboard. The holes in the breadboard are in series.

Buzzer is an electrical component that generates a beep sound on receiving an input. It works on the principle of piezo crystal.

Light Emitting Diode is a commonly used light source. It is a semiconductor that emits light when current flows through it.

Resistors are passive devices that restrict the flow of current or divide the voltage through the circuit. The input power passes through these resistors and then to the sensors to avoid damage.

LM35 sensor is rated to operate over a -55 deg.Celsius to 150 deg.Celsius temperature range.

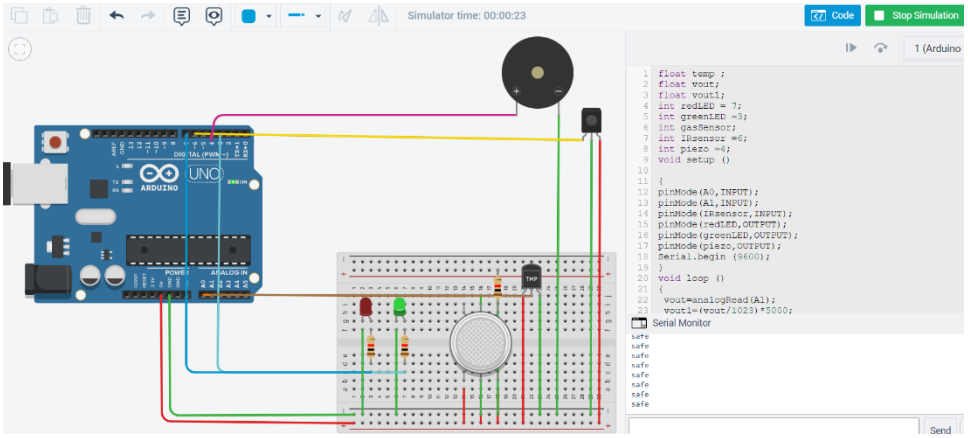
Gas sensor MQ5 is well known for its wide detecting scope, stability, long life, fast response and high sensitivity.

The IR sensor is reliable device, has a quick response time in addition to working in a harsh environment and detect the fire by the color of its flame

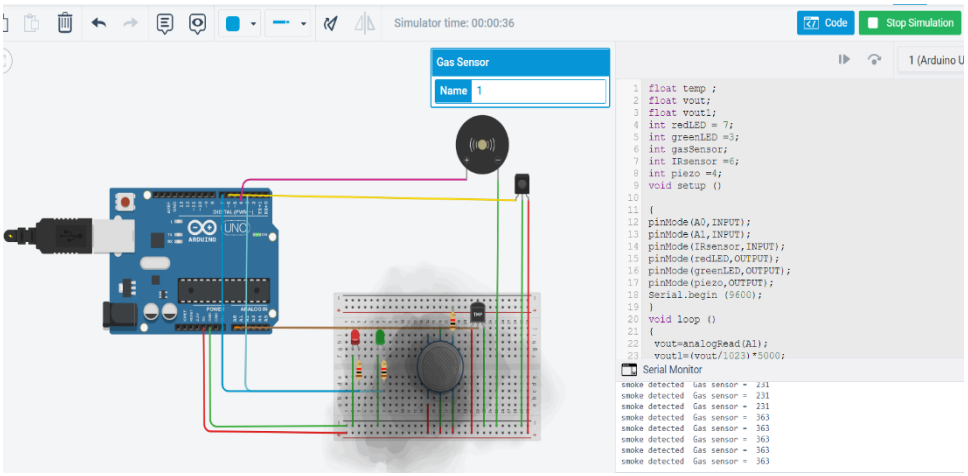
These are the main components that are used to establish the connections between different devices of the circuit.

Chapter 7: simulation

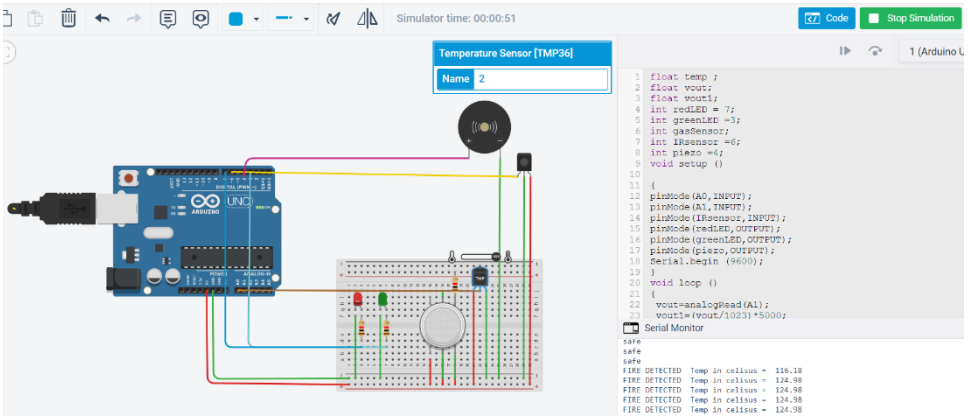
1.Safe mode



2.GAS ON



3.HIGH TEMP



Chapter 7: Results

Fire phenomena are of an extremely complex nature. Certainly, it would be desirable to establish precisely all fire danger influence factors, but it is also a fact that the scientific basis for a more accurate treatment of the problem is still largely lacking. Therefore, The Fire Alarm Manufacturers Association has developed a proposed method for evaluating fire risk. Moreover, here we present the results of these actions:

Advantage:

1. Fire alarms give you early warning so you can get outside quickly.

2. Fire alarms are highly effective at reducing fire deaths and injuries.

3. Your ability to get out of your house during a fire depends on advance warning from fire alarms.

4. A safe work space for customers and employers.

5. Preventing and reducing the risk of fires for students and teachers in schools as a result of fire detectors.

6. Having a fire detection system can significantly reduce damages and maximize fire control efforts.

7. Fire alarms may qualify you for insurance discounts.

8. Fire alarms shorten your recovery time: Less building damage means shorter downtime until you can reopen for business.

Properly maintained there are no real downsides but then you get clients involved who don't want to pay for the biannual or 5 yearly (depending on manufacturer) battery replacement so here are some of disadvantages:

Disadvantages:

1. Very sensitive, which can lead to false alarms as a product of cooking.

2. Use of radioactive material is a concern.

3. The life of the batteries in the detectors & IR models, especially the older models are short.

Chapter 8: Conclusion and Future work

Let us start with the Future work

1. In the short term, we have a deal with another project in our section who will make a security system using motion sensors, to merge together and make a fully safe home, company, etc...
2. In the long term, we will search for a chemical way to get rid of the smoke from, during the fire, and try to use it as a power source.

Finally, we reached the end of the project related to fire alarm, which we preferred to choose for a project among many topics due to its importance these days.

We tried, as much as possible, to analyze and detail what we need to install, how it works, and the importance of installing it in most houses, factories, and buildings, which can be summed up in saving lives.

The fire alarm is made to alert people immediately when a fire occurs, by means of a sound notification. without it, the lives of those who are inside the buildings are placed at a high risk in the event of an emergency.

In the end, we hope that we have succeeded in explaining our project and its application and clarifying its purpose in life, environmentally and economically.

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Thank you 😊