

Fire Detection System With Alert Functionality By Message And Call Using Arduino And GSM Module

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Abstract- Fire is one of the most common accidents that can happen anytime and anywhere due to this accidental fire, many people dies and fire also causes big financial loss, if we can create a system that can detect the fire in advance then we can easily take the measures to prevent the fire and can minimize the living and financial losses.

This is a IoT-based Fire Alarm System using Arduino UNO. In this project we can monitor and detect the fire. There is a flame and smoke sensor that detects the flame and smoke and give alert then can control using a water pump or another system.

GSM stands for global service for mobile use in this project because it doesn't need WIFI and Bluetooth device and nor it needs to be connected to any system. it just needs an area where your sim can work. When fire is detected by sensors it triggers the alarm and GSM module sends the message that fire is detected, after sending alert message it then gives call to registered mobile number to alert about fire.

We have used the MQ2 Smoke sensor & flame sensor for fire detection and the buzzer SMS message will be sent to multiple mobile numbers in case of fire. We are also showing the smoke & flame readings in real-time on the Display.

Keywords- Bluetooth, GSM, IoT, WIFI, Arduino, IoT, fire, sensors

I. INTRODUCTION

Due to increasing number of sensors and their advantages like low cost and reliability, widely available phone network, it is best to use these technologies against fire outbreak, it is considered as a cheap product in the terms of equipment and installation.

Since IoT technology is becoming more and more popular in the commercial market, its related systems and components is becoming more desirable and that include the wireless sensor network which is used in security and in our case security against fire outbreak. Wireless sensor network is considered as a practical method for security systems against

fire outbreak which have drawn a substantial amount of attention recently and it has been well established. Fire outbreak is likely to happen in anytime and everywhere, it considered as a sudden event which requires a predictable security system to counter this kind of risk. Fire sensors which are considered as a part of wireless sensor network plays an important role in monitoring and detecting any abnormal increasing in the temperature and humidity rate.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

Fire is one of the most common accidents that can happen anytime and anywhere due to this accidental fire, many people dies and fire also causes big financial loss, if we can create a system that can detect the fire in advance then we can easily take the measures to prevent the fire and can minimize the living and financial losses.

III. REQUIREMENTS AND SPECIFICATIONS OF COMPONENTS USED IN PROJECT

List of components :-

- 1) Arduino Uno
- 2) Flame sensor
- 3) MQ2 GAS sensor
- 4) Buzzer
- 5) LEDS
- 6) SIM900A GSM Module
- 7) Male to male jumper wire
- 8) Male to female jumper wire
- 9) Breadboard

- Arduino UNO :



Arduino Uno is a microcontroller board based on the ATmega328P microcontroller. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.

Arduino Uno Specifications :

MICROCONTROLLER	ATmega328P
OPERATING VOLTAGE	5V
INPUT VOLTAGE (RECOMMENDED)	7-12V
INPUT VOLTAGE (LIMIT)	6-20V
DIGITAL I/O PINS	14 (of which 6 provide PWM output)
PWM DIGITAL I/O PINS	6
ANALOG INPUT PINS	6
DC CURRENT PER I/O PIN	20 mA
DC CURRENT FOR 3.3V PIN	50 mA
FLASH MEMORY	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
CLOCK SPEED	16 MHz
LED_BUILTIN	13
LENGTH	68.6 mm
WIDTH	53.4 mm
WEIGHT	25 g

• **Flame Sensor :**

A flame-sensor is one [kind of detector](#) which is mainly designed for detecting as well as responding to the

occurrence of a fire or flame. The flame detection response can depend on its fitting.



Flame sensor specifications :

- Pin1 (VCC pin): Voltage supply ranges from 3.3V to 5.3V
- Pin2 (GND): This is a ground pin
- Pin3 (AOUT): This is an analog output pin (MCU.IO)
- Pin4 (DOUT): This is a digital output pin (MCU.IO)

• **MQ2 Gas Sensor :**



MQ2 gas sensor is a robust Gas sensor suitable for sensing LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentration in the air. MQ2 Gas sensor works on 5V DC and draws around 800mW.

It can detect **LPG, Smoke, Alcohol, Propane, Hydrogen, Methane** and **Carbon Monoxide** concentrations anywhere from 200 to 10000ppm.

Operating voltage	5V
Load resistance	20 KΩ
Heater resistance	33Ω ± 5%
Heating consumption	<800mw
Sensing Resistance	10 KΩ – 60 KΩ
Concentration Scope	200 – 10000ppm
Preheat Time	Over 24 hours

Specifications of MQ2 gas sensor :

- Buzzer :



An Arduino buzzer is also called a piezo buzzer. It is basically a tiny speaker that you can connect directly to an Arduino. You can make it sound a tone at a frequency you set.

The buzzer produces sound based on reverse of the piezoelectric effect.

- Red, Green, White LEDs :



These are simple LED having two pins one for ground and one for Vcc ground is negative and Vcc is positive

- SIM900A GSM Module :



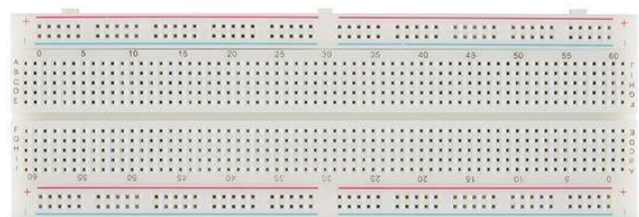
SIM900A a GSM modem, which can be integrated into a great number of IoT projects. This module uses to accomplish almost anything a normal cell phone can; SMS text messages, Make or receive phone calls, connecting to internet through GPRS, TCP/IP, and more!

SIM900A Modem is built with Dual Band GSM/GPRS based SIM900A modem from SIMCOM. It works on frequencies 900/ 1800 MHz SIM900A can search these two bands automatically. The frequency bands can also be set by AT Commands. The baud rate is configurable from 1200-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. SIM900A is an ultra-compact and reliable wireless module. This is a complete GSM/GPRS module in a SMT type and designed with a very powerful single-chip processor integrating AMR926EJ-S core, allowing to benefit from small dimensions and cost-effective solutions.

Specifications of sim900a

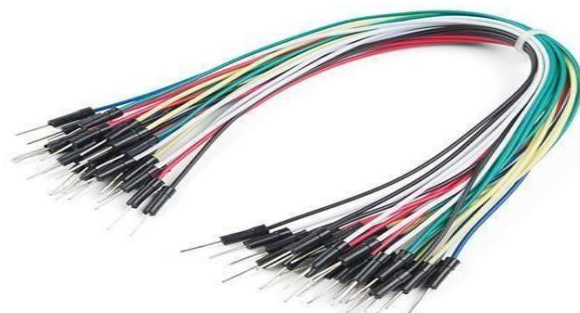
- Dual-Band 900/ 1800 MHz
- GPRS multi-slot class 10/8GPRS mobile station class B
- Compliant to GSM phase 2/2+
- Dimensions: 24*24*3 mm
- Weight: 3.4g
- Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
- Supply voltage range : 5V
- Low power consumption: 1.5mA (sleep mode)
- Operation temperature: -40°C to +85 °

- Breadboard :



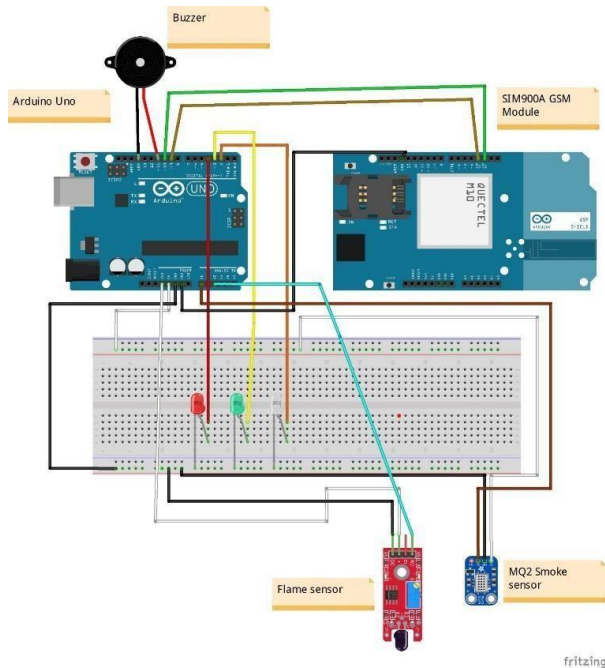
Breadboard is used to extend existing pins of Arduino uno

- Male to male and male to female jumper wire :



Jumper wires are used to connect different pins.

IV. CIRCUIT DIAGRAM OF MODEL



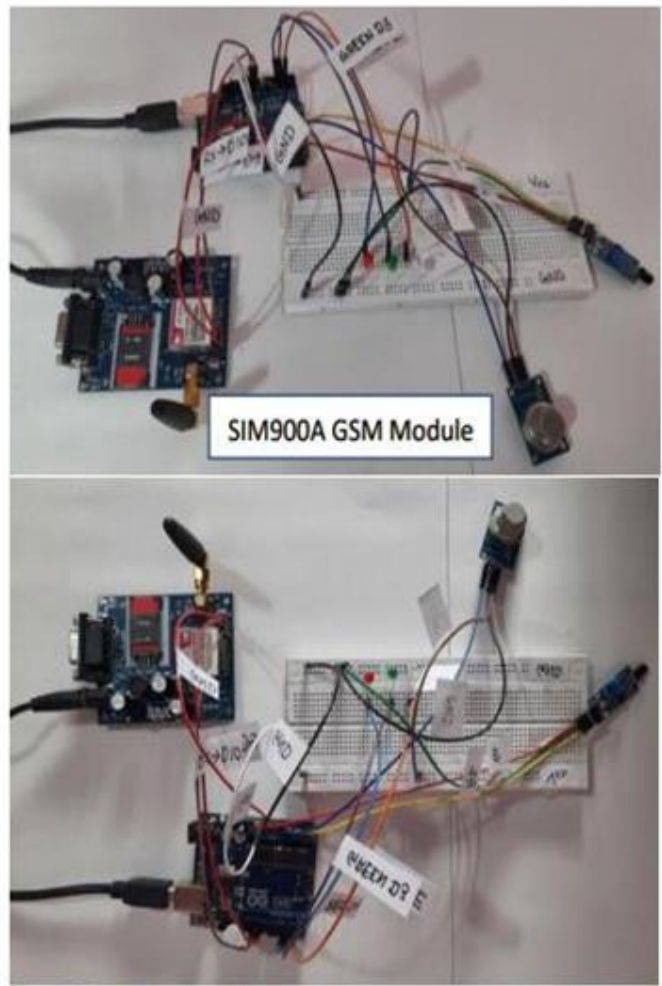
V. PIN CONNECTION

Sr. No.	Components	Component pin	Arduino pin
1	Flame sensor	D0	A2
		Vcc	3.3V+
		GND	GND
2	MQ2 GAS sensor	A0	A0
3	Buzzer	Positive	D11
		GND	GND
4	Red LED	Positive	D4
		GND	GND
5	Green LED	Positive	D3
		GND	GND
6	White LED	Positive	D2
		GND	GND
7	SIM900A GSM module	TX	D9
		RX	D10
		GND	GND

VI. WORKING

- 1) First when we power on the system it will take 20 seconds to warm up sensors after 20 seconds it will show white led on indicating that everything is working perfectly.
- 2) It will detect the flame value by flame sensor and smoke or gas value in ppm by mq2 gas sensor and these values will display in Realtime in serial monitor.
- 3) When there is no fire, Green LED will glow.

- 4) When flame sensor detects the fire, its value will decrease and if concentration of gas increased in air gas sensor will gives larger values.
- 5) Threshold values of flame or gas sensors are respectively 200 and 500.
- 6) If sensors detect the fire, then red LED will glow.
- 7) If flame sensors value decrease below the 200 or gas sensor value increase above the 500 the buzzer will start.
- 8) After detecting fire, it will trigger the buzzer and red led will glow then GSM module connected to Arduino get AT command to send fire alert message to registered mobile number.
- 9) After sending alert message it will call on registered mobile to give alert ones again.
- 10) In message we can send the location of place to the firefighters



VII. APPLICATIONS AND ADVANTAGES

- Fire alerting system have a wide range of applications. IoT based fire alarm system using Arduino can be used in

chemical factories, shopping malls, local shops, educational institutes, parking areas, companies etc.

- IoT based fire alarm notification system using wi-fi can be used as a pre-cautionary measure at all the places listed above, which can help in notifying the fire departments early. If appropriate and immediate action is taken as soon as the buzzer turns on, it can help in avoiding an accident.
- Future development of the IoT based fire detection system - this project can be enhanced to sense leakage of LPG gas.
- If we get fire alert message in advance then we can take suitable measures to minimize living and financial losses.
- Since this fire detection system is using vary basic components and low power-hungry Flame sensor MQ2 GAS sensor SIM900A GSM Module Flame sensor MQ2 GAS sensor LEDs SIM900A GSM Module Arduino Uno 8 sensors this system can be implemented in low cost.
- Operating cost of system is very low since total sensors, Arduino and GSM module all only take maximum 10 volts 1 ampere of input electric power.
- In this project to alert about fire we are sending SMS and giving call, therefore there are high chances of taking suitable measures in time.
- We can save contact numbers of ambulance and fire fighters in code so as soon as fire get detected we can send fire alert to them.

VIII. FUTURE SCOPE

- We can add the GPS module to existing system to send the live location of fire place to fire fighters and ambulance so they can reach to accident place easily.
- There might be possibility that after some time components like sensor, GSM module or Arduino may not work properly due to insufficient power or fault in components in this case we required a back up system to detect fire.
- In addition to this hardware system, we can use machine learning , artificial intelligence to detect fire by cameras and can run those models in specific hardware like TPUs and GPUs for accurate fire detection.
- We can build a system Using both hardware i.e Arduino, sensors and GSM module and software i.e machine learning to detect fire. This system will be more advance and accurate and can never stop working. If one of the part stops working, we can easily detect fire by other method. Thus, we can create most advance and reliable fire detection system.

REFERENCES

- [1] https://en.wikipedia.org/wiki/Internet_of_things
- [2] https://en.wikipedia.org/wiki/Arduino_Uno