FIRE ALARM SYSTEM USING ARDUINO

A Project Report

Submitted by

VISWESWARAN.A - 312318104188
SASHIKUMAR.N - 312318104144

in partial fulfillment for the award of the Degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

St. JOSEPH'S COLLEGE OF ENGINEERING

(An Autonomous Institution)

St. Joseph's Group of Institution

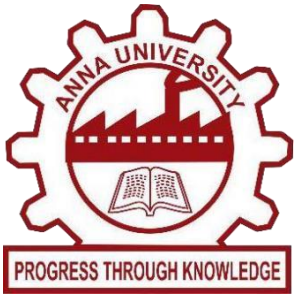
Jeppiaar Educational Trust

OMR, Chennai 600 119

ANNA UNIVERSITY: CHENNAI

April 2021

ANNA UNIVERSITY: CHENNAI 600 025



BONAFIDE CERTIFICATE

Certified that this project report on **FIRE ALARM SYSTEM USING ARDUINO** *is the bonafide work of* **VISWESWARAN A (312318104188)** *and* **SASHIKUMAR N (312318104144)** who *carried out the project under my supervision during* ***the academic year 2020 - 2021.***

Signature
Ms. K. Sudha M.E.
Assistant Professor
Department of Computer Science and Engineering
St. Joseph's College of Engineering
OMR, Chennai- 600119.

Signature
Dr. A. Chandrasekar M.E., Ph.D.
Professor and Head
Department of Computer Science and Engineering
St. Joseph's College of Engineering
OMR, Chennai- 600119

CERTIFICATE OF EVALUATION

COLLEGE NAME : St. Joseph's College of Engineering,
OMR. Chennai - 600 119.

BRANCH : B.E. - Computer Science and Engineering

SEMESTER : VI

Sl. No	Name of the Student	Title of The Project	Name of the Supervisor with Designation
1. 2.	VISWESWARAN A (312318104188) SASHIKUMAR N (312318104144)	**FIRE ALARM SYSTEM USING ARDUINO**	**Ms. K Sudha** M.E. Assistant Professor

The report of the project work submitted by the above students in partial fulfillment for the award of the Degree of Bachelor of Engineering in Computer Science and Engineering at Anna University is confirmed to be report of the work done by the above students and then evaluated.

Submitted to Project and Viva Examination held on_____.

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ACKNOWLEDGEMENT

At the outset, we would like to express our sincere gratitude to our beloved **Dr. Babu Manoharan M.A., M.B.A., Ph.D.** ***Chairman, St. Joseph's Group of Institutions*** for his constant guidance and support to the student community and the Society.

We would like to express our hearty thanks to our respected ***Managing Director*** **Mrs. S. Jessie Priya M.Com.** for her kind encouragement and blessings.

We wish to express our sincere thanks to the ***Director*** **Mr. B. Shashi Sekar, M.Sc.** for providing ample facilities in the institution.

We express sincere gratitude to our beloved ***Principal*** **Dr. Vaddi Seshagiri Rao M.E., M.B.A., Ph.D., F.I.E.** for his inspirational ideas during the project.

We express sincere gratitude to our beloved ***Dean (Research)*** **Dr. B. Parvathavarthini M.Sc., M.B.A., M.E., Ph.D.** for her inspirational ideas during the course of the project.

We wish to express our sincere thanks to **Dr. A. Chandrasekar M.E., Ph.D.** ***Head of the Department, Department of Computer Science and Engineering, St. Joseph's College of Engineering*** for his guidance and assistance in solving the various intricacies involved in the project.

We would like to acknowledge our profound gratitude to our supervisor **Ms. K. Sudha** for her expert guidance and connoisseur suggestion to carry out the study successfully.

Finally, we thank the **Faculty Members** and **our Family**, who helped and encouraged us constantly to complete the project successfully.

TABLE OF CONTENTS

INTRODUCTION

Ever since mankind first began building structures out of wood rather than stone, fire has been a part of the learning process. In fact, so common have these infernos been throughout history that nearly every major city in the world has been largely burnt to the ground at one time or another in its history.

Nowadays, some factories and buildings have proper installation and fire safety and control arrangements such as fire alarm, fire extinguishers, water supply system etc. But the problem is these conventional fire extinguishing systems are not enough to take prompt action during fire outbreak and hence, save life. The best way to reduce these losses is to respond to the emergency as quickly as possible. So, there comes the necessity of a standalone fire detection systems. This project therefore seeks to design a fire alarm and control system that will continuously monitor the presence of significant amount of heat and activate an alarm extinguish the fire as a safety measure to contain the situation.

It is important to have a basic understanding about how a fire occurs and behaves within a building. Essentially, fire is a chemical reaction. A carbon-based material (fuel) mixes with oxygen (usually a component of air) and comes in contact with something hot enough to heat this mixture so that combustible vapors are produced. If these vapors dissipate, then nothing happens. However, if they encounter an ignition source such as open flame, a fire occurs. Depending on the combustibility of the ignited fuel, the fire may start as a slow-growth scenario with a long smoldering period or it may grow rapidly with almost no smoldering time. In either instance, once visible flames appear, the fire's destructive forces increase exponentially.

The flaming stage of a fire will start with a rapid rise in heat levels, initially along the room's ceiling, and then throughout the entire space. During the first two to three minutes, ceiling temperatures can reach 1,000°C (1,800°F). Over the next few minutes, these temperatures will spread throughout the room as the ceiling's layer of hot gases migrates. Ultimately, this gas layer acts like an oven's broiler, superheating and igniting all combustibles in the room. At that point, the room and all within it are destroyed.

The fire can then spread through open doorways and wall penetrations, or through concealed wall and ceiling cavities to other spaces in the building. Ultimately, if not suppressed, the fire can lead to a total loss of the building and its contents, not to mention the loss of lives.

Hence the proposed system helps to act quick and alarm the people in the building and quickly execute the fire.

SYSTEM ANALYSIS

PROPOSED SYSTEM:

Fire outbreak is a major concern at most of the places we visit. It is dangerous and requires high measures to avoid destruction of lives and property. One of the preventive measures to avoid the danger is to install an automatic fire alarm detector at vulnerable locations, hence the Arduino based fire alarm detection and control system was proposed. It is capable of automatically detecting heat in each environment, sound an alarm, and spray water to reduce the intensity of fire and open the exhausts.

The existing fire alarm system in market nowadays is too complex in terms of its design and structure. Since the system is too complex, it needs regular maintenance to be carried out to make sure the system operates well. Meanwhile, when the maintenance is being done to the existing system, it could raise the cost of the system.

The fire alarm system described works with a gas detection sensor that detects smoke caused by fire and the exhausts are opened and the sprinkler system is initiated.

This chapters below about the system design and construction through Hardware and software development. In addition, the chapter elaborates the hardware and the software stage by stage. All the operations of hardware and software are also included.

SPECIFICATIONS REQUIRED:

1 Arduino UNO.

2 Gas Detection Sensor.

3 Piezo Buzzer.

4 Breadboard.

5 Alphanumeric LCD (16x2).

6 DC Motor.

7 RGB common cathode

8 Resistor 220 ohm

9 Resistor 10 kohm

10 Jumper Wires.

11 LED Strips.

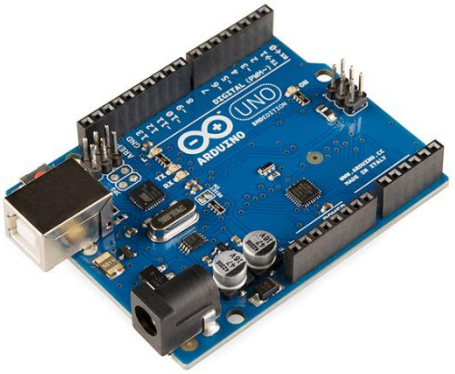
12 Potentiometer

13 Light Bulb.

SPECIFICATIONS INFORMATION

ARDUINO UNO:

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices.



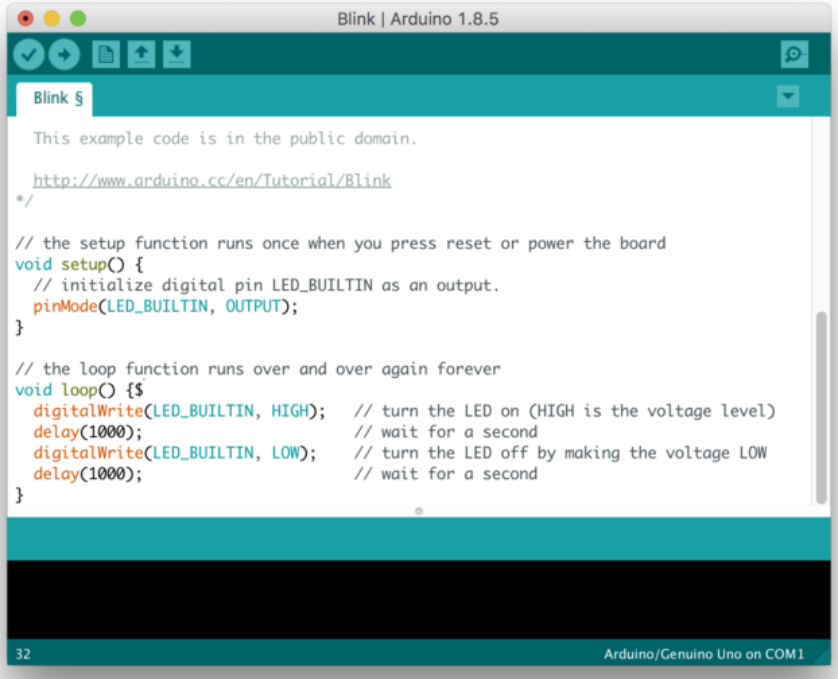
Arduino boards are available commercially from the official website or through authorized distributors. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (for prototyping) and other circuits.

The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the "Arduino language".

ARDUINO IDE:

The Arduino IDE is a cross platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also with the help of third-party cores. The source code is written in the Arduino IDE and is uploaded to the board to execute the given code.

The **Arduino** Integrated Development Environment - or **Arduino** Software (**IDE**) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the **Arduino** and genuine hardware to upload programs and communicate with them.



GAS DETECTION SENSOR:

A **gas sensor** is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage. Based on this voltage value the type and concentration of the gas can be estimated.

The type of gas the sensor could detect depends on the **sensing material** present inside the sensor. Normally these sensors are available as modules with comparators as shown above. These comparators can be set for a particular threshold value of gas concentration. When the concentration of the gas exceeds this threshold, the digital pin goes high. The analog pin can be used to measure the concentration of the gas.

PIEZER BUZZER:

In simplest terms, a piezo buzzer is a type of electronic device that's used to produce a tone, alarm or sound. It's lightweight with a simple construction, and it's typically a low-cost product. Yet at the same time, depending on the piezo ceramic buzzer specifications, it's also reliable and can be constructed in a wide range of sizes that work across varying frequencies to produce different sound outputs.

BREADBOARD:

A **breadboard** is a solderless device for temporary prototype with electronics and test circuit designs. Most of the electronic components in electronic circuits can be inter connected by inserting their leads or terminals into the holes and then making connections through wires where appropriate.

LCD DISPLAY:

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc

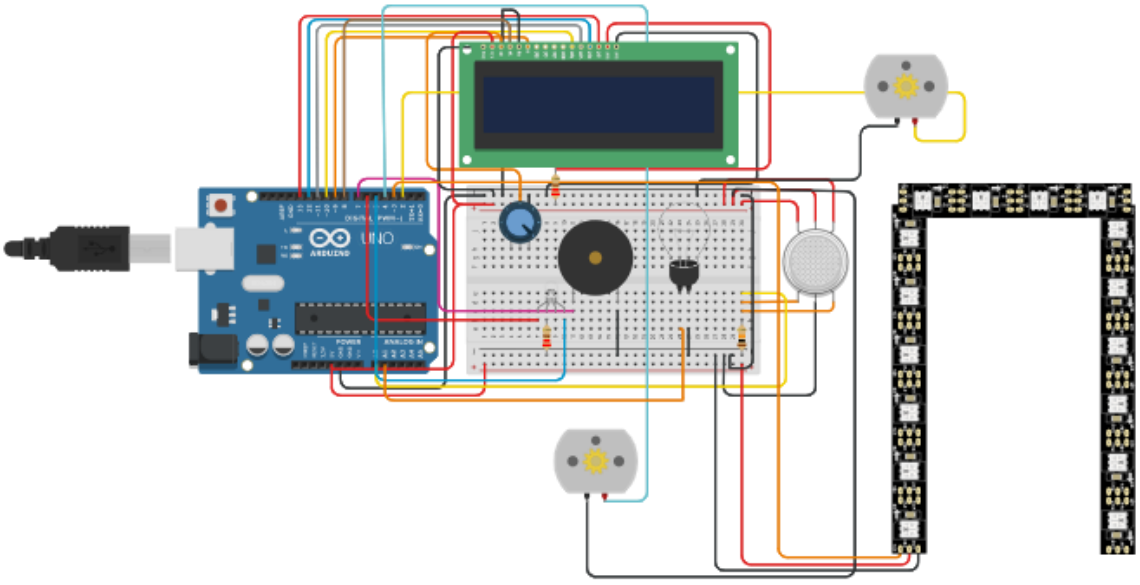
JUMPER CABLES:

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools to make it easy to change a circuit as needed.

SYSTEM DESIGN

CIRCUIT DIAGRAM:

The given circuit diagram shows the components of the circuit and the wire connections between the components.

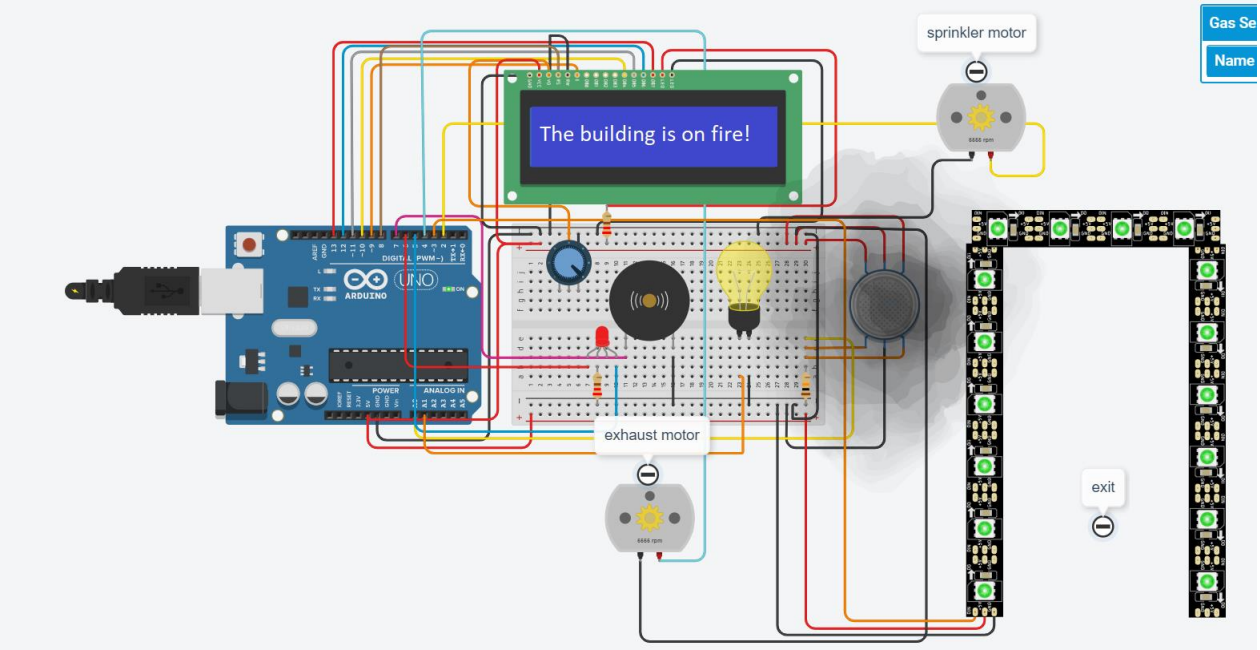


In the circuit when the gas sensor detects smoke, it sends signals to the device and the warning sign is initiated.

The light bulb along with RGB cathode is switched on. The buzzer gives the sound alarm around the building which alarms the people to get alert.

The light strips that are installed around the building are also turned on which leads to the emergency exit and helps the people inside the building get out without panicking.

The given circuit diagram below shows the working of the fire alarm.



It can be inferred from the diagram that when the smoke is encountered by the gas sensor, the lights are switched on and the buzzer is sounded.

In addition to that, the sprinkler motor is used spread water around the building to extinguish the fire and the exhaust motor is used to switch it on and let the air out.

At normal times, the lcd displays “The building is safe”. But when fire occurs it initiates the alarm and displays the message “The building is on fire!”.

SOURCE CODE:

The source code for executing the system is given below:

```
#include <Adafruit_NeoPixel.h>
#include <LiquidCrystal.h>
LiquidCrystal lcd(8, 9, 10, 11, 12, 13);
const int dinPin = 3;
const int numOfLeds = 16;
Adafruit_NeoPixel pixels = Adafruit_NeoPixel(numOfLeds,
dinPin, NEO_GRB + NEO_KHZ800);
int Gas_Sensor_Value = 0;
int Gas_sensor = A0;
int Piezo    = 7;
int RGB_red  = 6;
int RGB_green = 5;
int exhaust_motor = 4;
int sprinkler_motor = 2;

void setup()
{
  pixels.begin();
  pixels.setBrightness(80);
  lcd.begin(16, 2);
  pinMode(Gas_sensor, INPUT);
  pinMode(Piezo, OUTPUT);
  pinMode( RGB_red, OUTPUT);
  pinMode( RGB_green, OUTPUT);
  pinMode( exhaust_motor,OUTPUT);
  pinMode(sprinkler_motor,OUTPUT);
}
void loop()
{
   lcd.clear();
```

```
 Gas_Sensor_Value = analogRead(A0);

 if( Gas_Sensor_Value >= 700)
 {
for(int i=0;i<numOfLeds;i++){
pixels.setPixelColor(i, pixels.Color(0,255,0));
pixels.show();
}
  digitalWrite(sprinkler_motor, HIGH);
  digitalWrite(Piezo, HIGH);
  digitalWrite(exhaust_motor, HIGH);
  digitalWrite(RGB_red, HIGH);
  digitalWrite(RGB_green, LOW);
  lcd.print("The Building is");
  lcd.setCursor(0,1);
 lcd.print("on fire!");
   delay(1000);
 }
else
{
 digitalWrite( exhaust_motor, LOW);
 digitalWrite(sprinkler_motor, LOW);
 digitalWrite(Piezo,    LOW);
 digitalWrite(RGB_red,  LOW);
 digitalWrite(RGB_green, HIGH);
 lcd.print("The building");
 lcd.setCursor(0,1);
 lcd.print("is Safe");
  delay(1000);
}
}
```

CONCLUSION

In this work, an attempt has been done to design a fire alarm system using Temperature sensor and Micro controller for efficient use of electricity. It will help to reduce the wastage of electricity, save lives, reduce percentage of accident, and reduce waste of electric appliance. The results obtained from the given observations have shown that the system perform well under all the conditions.

The main objective of this project has been to design a circuit that detects smoke and consequently triggers an alarm, switch on sprinklers, switch on light strips to lead way to exit and extinguish the fire. These objectives were met since the systems works effectively.