M.KUMARASAMY
COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
Approved by AICTE & Affiliated to Anna University
ISO 9001:2015 & ISO 14001:2015 Certified Institution
Thalavapalayam, Karur – 639 113.

A Minor Project Report

On

FIRE ALARM USING ARDUINO

Submitted in partial fulfilment of requirements for the award of the

Degree of

BACHELOR OF ENGINEERING

In

ELECTRONICS AND COMMUNICATION ENGINEERING

Under the guidance of

Mr. SUDHAKAR K

Submitted By

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DEPARTMENTOF ELECTRONICS AND COMMUNICATION ENGINEERING

M.KUMARASAMY COLLEGE OF ENGINEERING
(Autonomous)

KARUR – 639 113

DEC – 2021

BONAFIDE CERTIFICATE

Certified that this **18ECP105L -** Minor Project III report **"FIRE ALARM USING ARDUINO"** KAVIYARASEN BC(20BEC4074), KIRUBAKARAN R(20BEC4079), LATHIKESH S(20BEC4087),LOGANATH S(20BEC4091)is the bonafide work who carried out the project work under my supervision in the academic year 2020-2021.

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Signature of the Guide **Signature of the HoD**

Vision and Mission of the Institute and Department

Vision

To emerge as a leader among the top institutions in the field of technical education.

Mission

- Produce smart technocrats with empirical knowledge who can surmount the global challenges.
- Create a diverse, fully-engaged, learner-centric campus environment to provide quality education to the students.
- Maintain mutually beneficial partnerships with our alumni, industry and professional associations.

Department of Electronics and Communication Engineering

Vision

- To empower the Electronics and Communication Engineering students with Emerging Technologies, Professionalism, Innovative Research and Social Responsibility.

Mission

- Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects.
- Inculcate the students in problem solving and lifelong learning ability.
- Provide entrepreneurial skills and leadership qualities.
- Render the technical knowledge and industrial skills of faculties.

PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

- **PEO1**: Graduate will have successful career in the core areas of Electronics and Communication Engineering and also in allied discipline.
- **PEO2**: Graduates will provide Engineering solution by demonstrating technical competence and by applying knowledge in Electronics and Communication Engineering.
- **PEO3** : Graduates will demonstrate sustained learning, adapting to a constantly changing world for contributing to the needs of society through professional development and lifelong learning

PROGRAM OUTCOMES(PO's)

- **PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
- **PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- **PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
- **PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- **PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
- **PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

- **PO7: Environment and sustain ability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
- **PO8: Ethics :**Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- **PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- **PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
- **PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
- **PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSO'S)

- **PSO1**: Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.
- **PSO2**: Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations**.**

MAPPING OF PROJET WITH PO's AND PSO's

Abstract	**Matching with PO's , PSO's**
Arduino uno, ATmega328 chip, Buzzer, Flame sensor.	POs1,POs2,POs3,POs4,POs5,POs6,POs7, POs11,POs12

ABSTRACT

A Flame Sensor is a device that can be used to detect presence of a fire source or any other bright light sources. There are several ways to implement a Flame Sensor but the module used in this project is an Infrared Radiation Sensitive Sensor. Using this particular type of Flame Sensor, you can detect Infrared Light up to a distance of 100cm within its 60 degrees of detection angle. Flame Sensor has three pins (some may have four pins): VCC, GND and DO. Connect VCC and GND to +5V and GND of the power supply (can be connected to Arduino's +5V). the DO (short for Digital Output) is connected to Digital I/O Pin 11 of Arduino. In order to indicate the detection of a flame or fire, a Buzzer is used. The Buzzer circuit consists of a 1KΩ Resistor, an NPN Transistor (like 2N2222 or BC548), a 5V Buzzer and a PN Junction Diode. Make the necessary connections and upload the code to Arduino UNO. To test the functionality of the flame sensor, place a fired lighter or a match stick in front of the sensor. Under normal conditions, the output from the Flame Sensor is LOW. When the sensor detects any fire, its output becomes HIGH. Arduino detects this HIGH signal on its input pin and activates the Buzzer.

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Acronyms/List of Abbreviations

Acronym	Abbreviations
ADC	Analog to digital convertor
12C	Phillips protocol Serial Bus
IC	Integrated Circuit
ICSP	In Circuit serial Programming
IDE	Integrated Development Environment
USB	Universal Serial Bus

1.INTRODUCTION

- Fire alarm systems are perhaps the most essential elements of any building's life safety systems.
- Not only do they save countless lives every year, they often regulate other systems in the building and property owners save huge amounts of money by reducing damage to their structures.
- Let's review the components of different fire alarm systems and how each can influence safety and function.

1.1 Problem Statement

Safety is a crucial consideration in the design of residential and commercial buildings in order to safeguard against loss of life and damage to property.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.

1.2 Objectives

Flame sensor module has a photodiode to detect the light and an op-amp to control the sensitivity. It is used to detect fire and provide a HIGH signal upon the detection. Arduino reads the signal and provides alert by turning on the buzzer and LED.

3.Project methodology

3.2 Proposed System

The project is designed with a low cost and all level users can have one for a safety purpose. This project therefore seeks to design a fire alarm system that will continuously monitor the presence of significant amount of heat and activate an alarm simultaneously switch off the mains of the building,

send a Short Message Service(SMS) alert and extinguish the fire as a safety measure to contain the situation**.**

3.3 Block Diagram

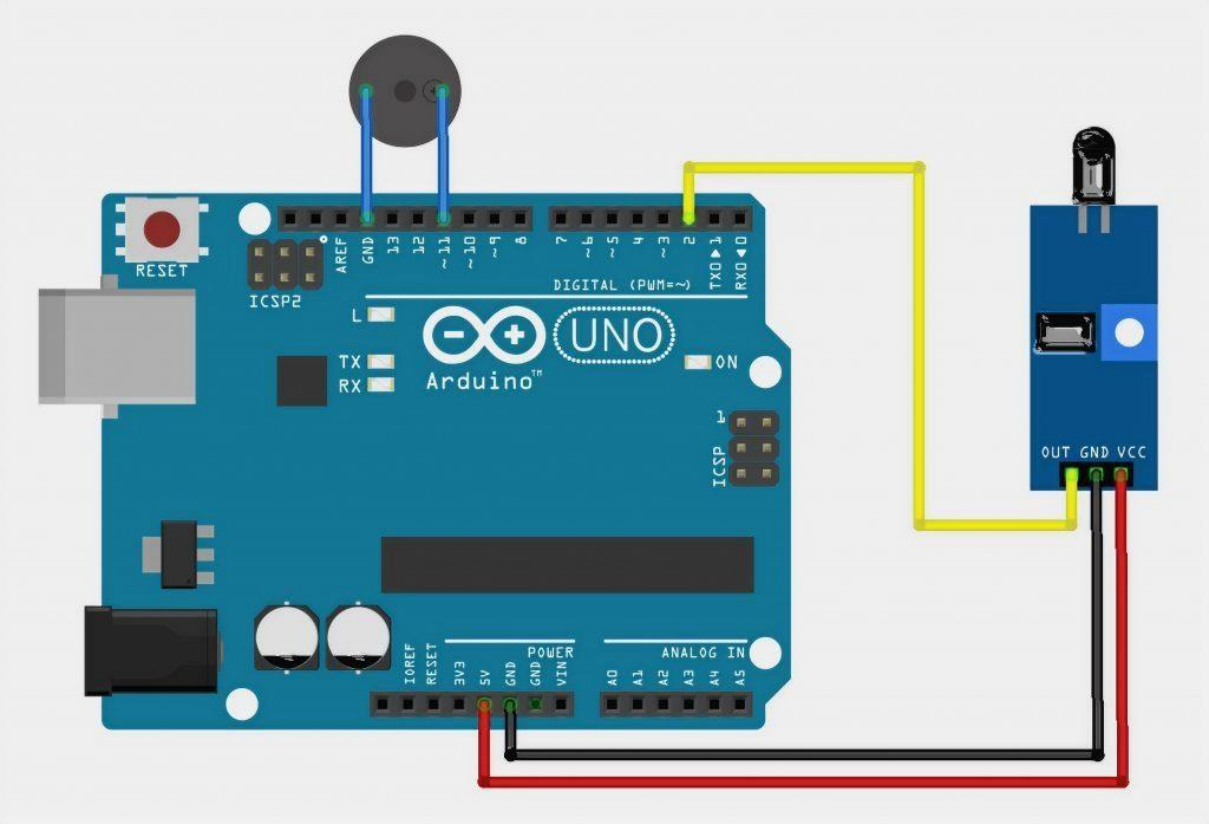


Fig no.3.3.1

3.4 COMPONENTS

USB CONNECTOR

This is a printer USB port used to load a program from the Arduino IDE onto the Arduino board. The board can also be powered through this port.

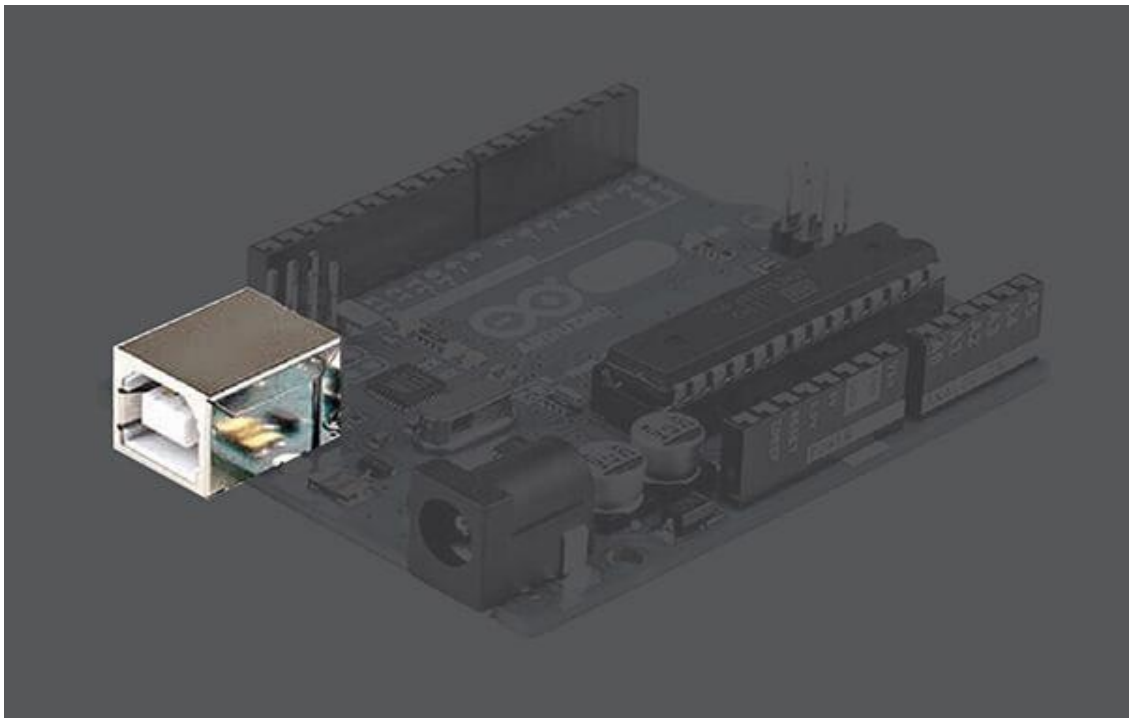


Fig no.3.4.1

Power Port

The Arduino board can be powered through an AC-to-DC adapter or a battery. The power source can be connected by plugging in a 2.1mm center-positive plug into the power jack of the board.

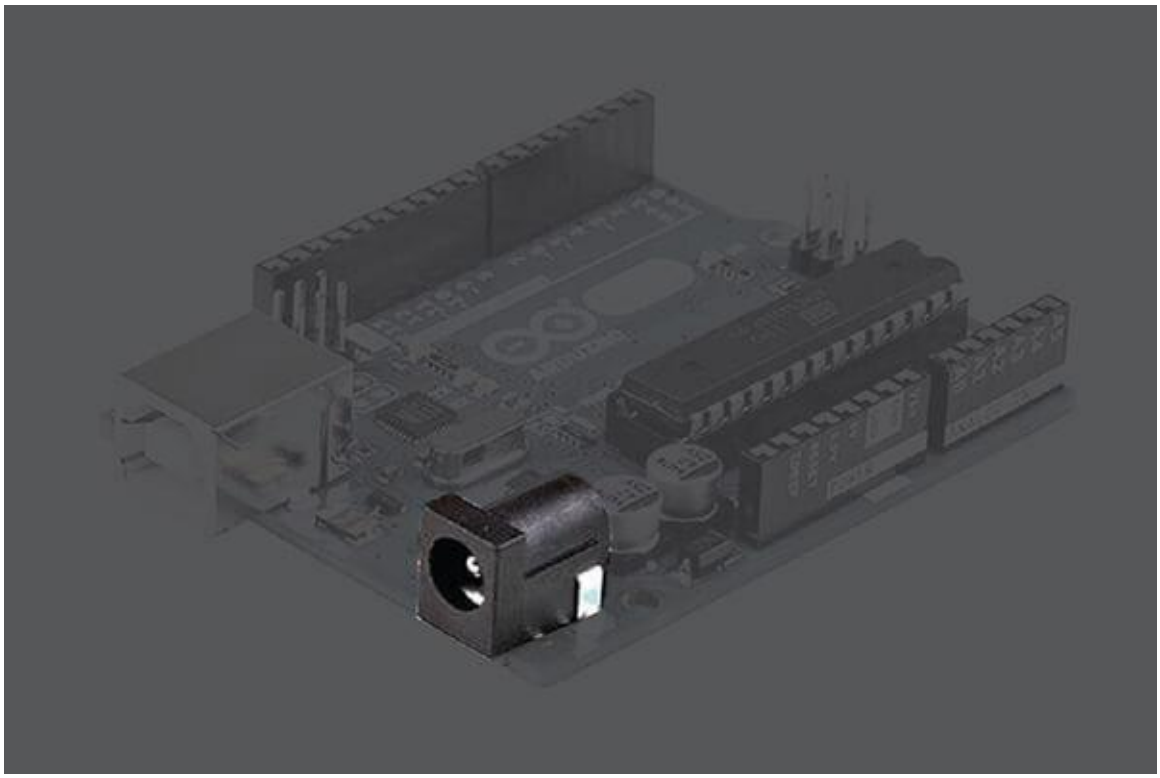


Fig no.3.4.2

Micro Controller

It is the most prominent black rectangular chip with 28 pins. Think of it as the brains of your Arduino. The microcontroller used on the UNO board is Atmega328P by Atmel (a major microcontroller manufacturer). Atmega328P has the following components in it:

Flash memory of 32KB. The program loaded from Arduino IDE is stored here.
RAM of 2KB. This is a runtime memory.
CPU: It controls everything that goes on within the device. It fetches the program instructions from flash memory and runs them with the help of RAM.
Electrically Erasable Programmable Read Only Memory (EEPROM) of 1KB. This is a type of nonvolatile memory, and it keeps the data even after device restart and reset.
Atmega328P is pre-programmed with bootloader. This allows you to directly upload a new Arduino program into the device, without using any external hardware programmer, making the Arduino UNO board easy to use.

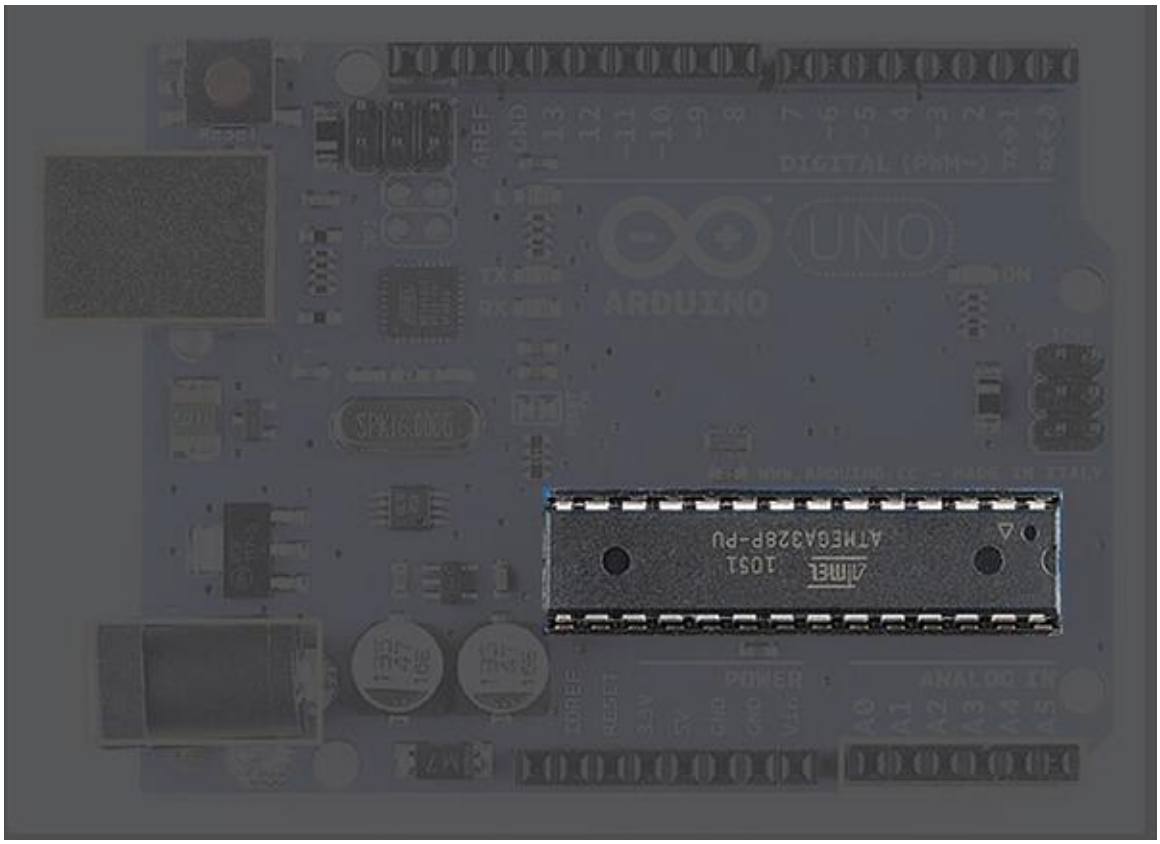


Fig no.3.4.3

Crystal Oscillator

This is a quartz crystal oscillator which ticks 16 million times a second. On each tick, the microcontroller performs one operation, for example, addition, subtraction, etc.

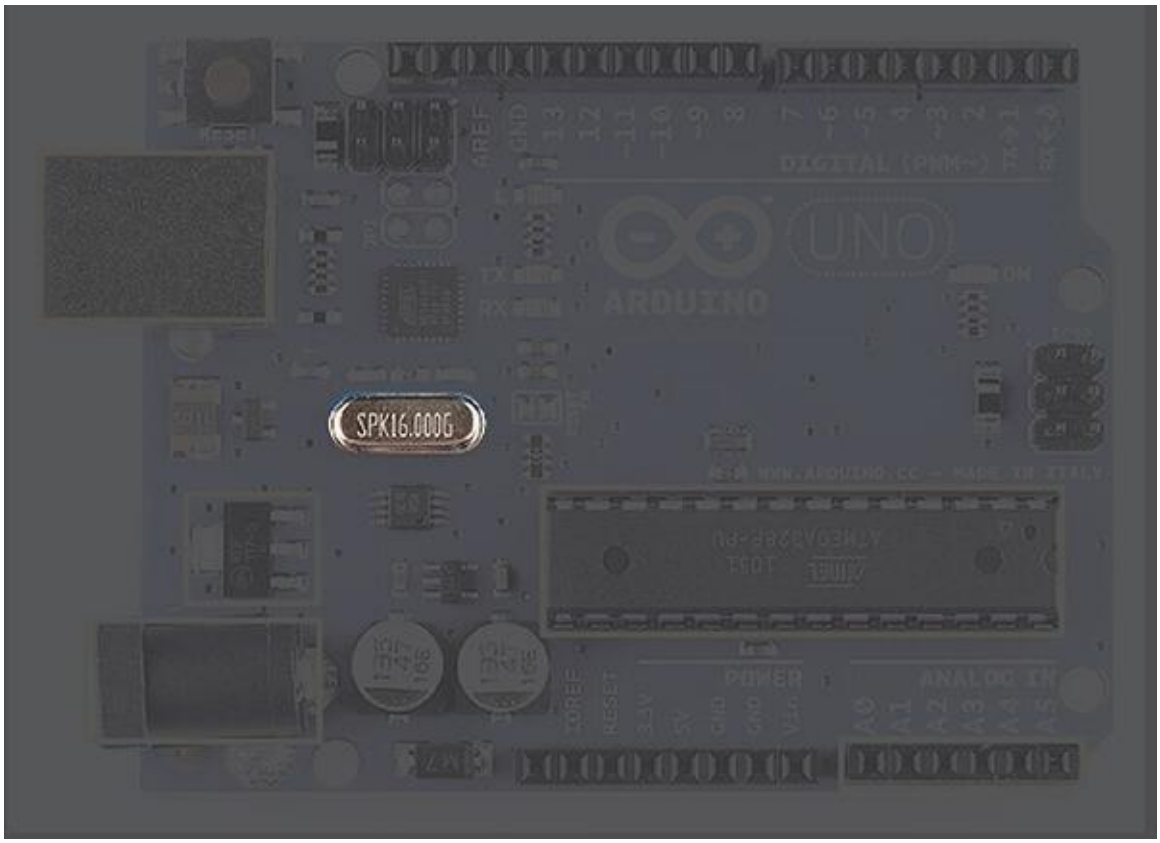


Fig no.3.4.4

USB Interface Chip

Think of this as a signal translator. It converts signals in the USB level to a level that an Arduino UNO board understands.

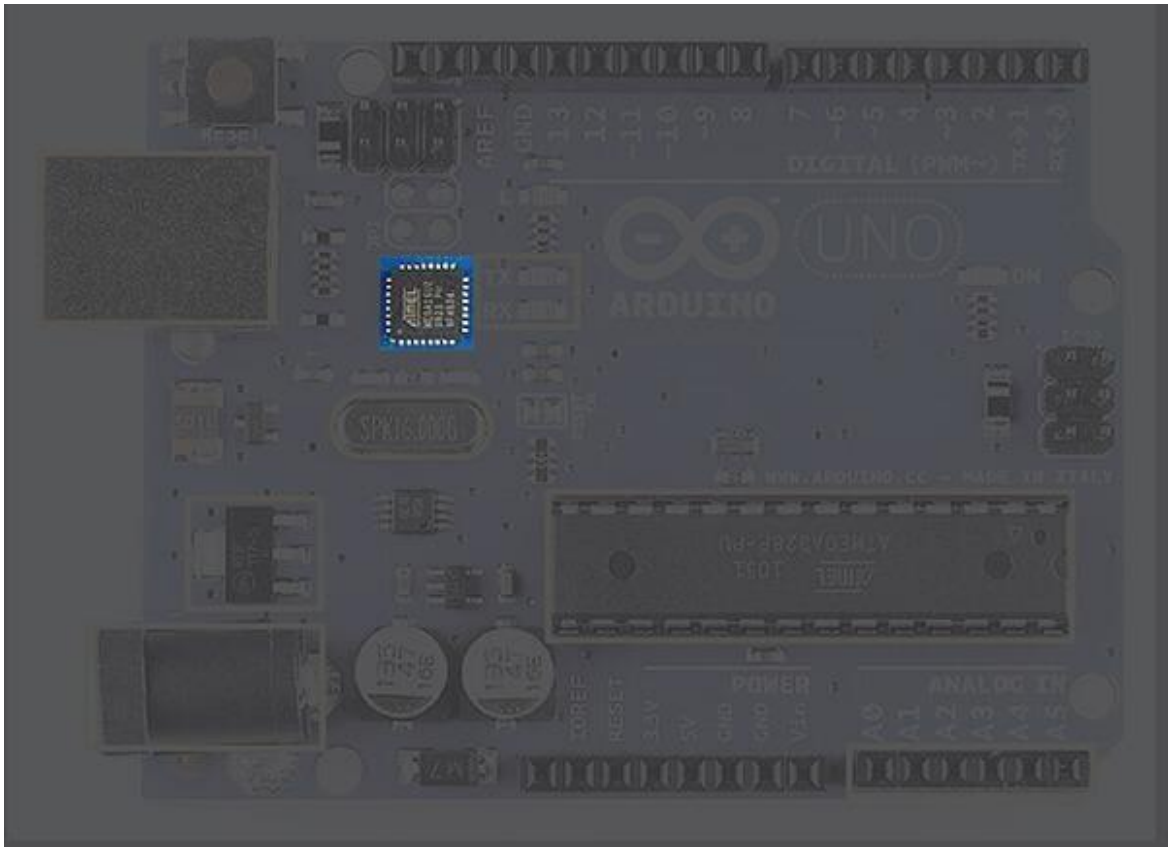


Fig no.3.4.5

TX - RX LEDs

TX stands for transmit, and RX for receive. These are indicator LEDs which blink whenever the UNO board is transmitting or receiving data.

Now that you have explored the Arduino UNO board, you have started your journey toward building your first IoT prototype. In the next article, we will discuss Arduino programming and do a few experiments with Arduino and LED

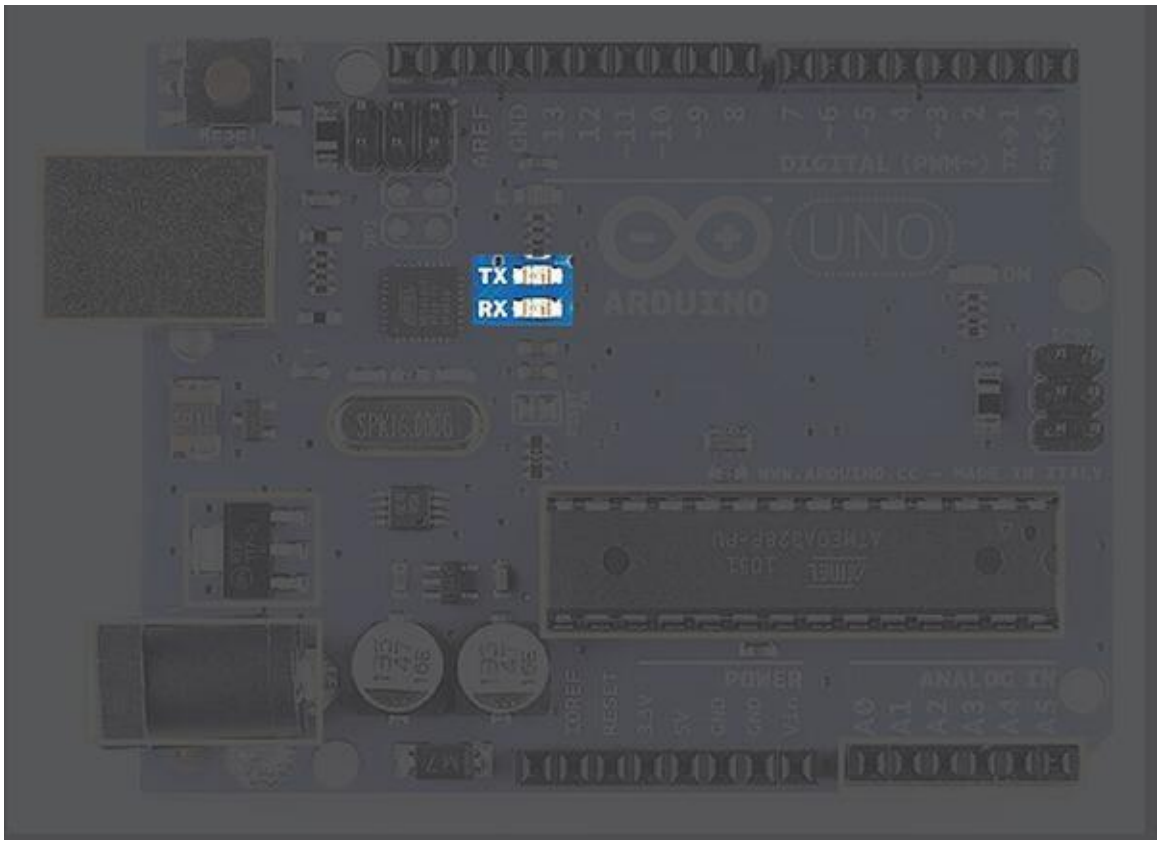


Fig no.3.4.6

Flame sensor

Flame sensor module has a photodiode to detect the light and an op-amp to control the sensitivity. It is used to detect fire and provide a HIGH signal upon the detection. Arduino reads the signal and provides alert by turning on the buzzer and LED.

Fig no.3.4.7

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.

Fig no.3.4.8

LED

To turn on an LED, the Arduino needs to send a HIGH signal to one of it's pins. To turn off the LED, it needs to send a LOW signal to the pin. You can make the LED flash by changing the length of the HIGH and LOW states**.**

Fig no.3.4.9

Writing Sketches

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .Ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors.

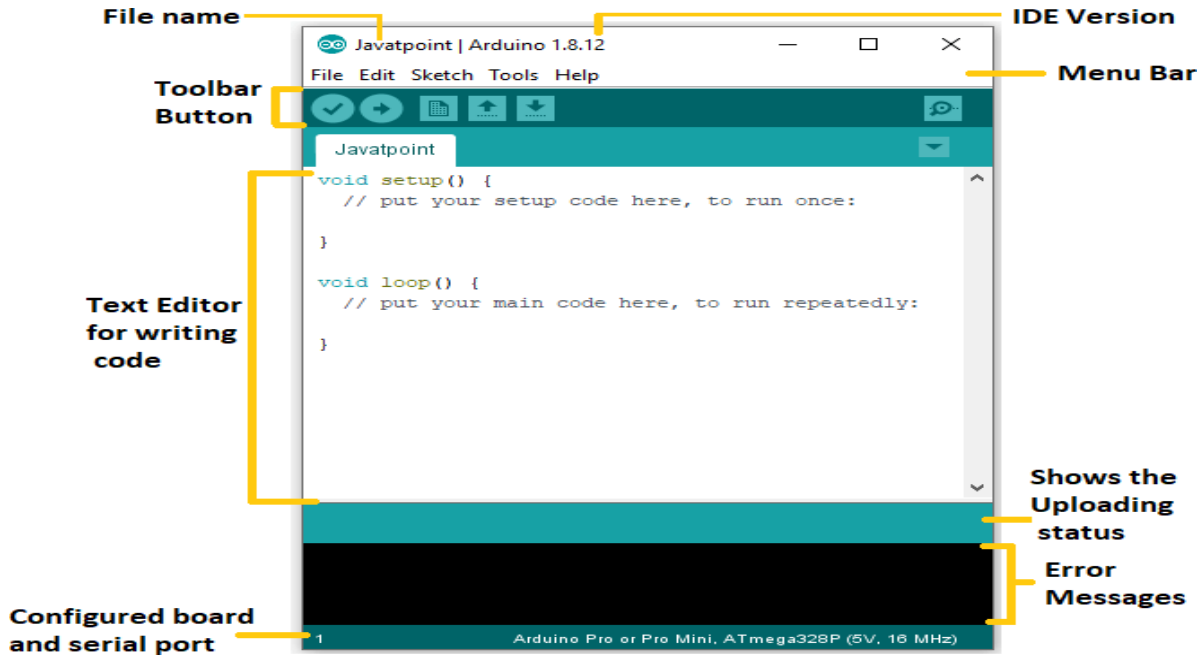


Fig no.3.4.10

4.Working Function

4.1. Circuit construction

Firstly we need to make the hardware connections.Connect a flame sensor to Arduino with digital pins (DO to Digital pin 8),ground to ground and VCC to +5v. Next , connect a piezo Buzzer to Arduino to make an alarm sound. There is no need to use resistor for the buzzer connection.Make the buzzer positive end to digital pin 9 and negative digital pin ground.Connect the LED bulb to Arduino for a flashing light for the fire alert warning.LEDs positive end to digital pin 10 and negative digital pin ground.We successfully made the hardware connections.

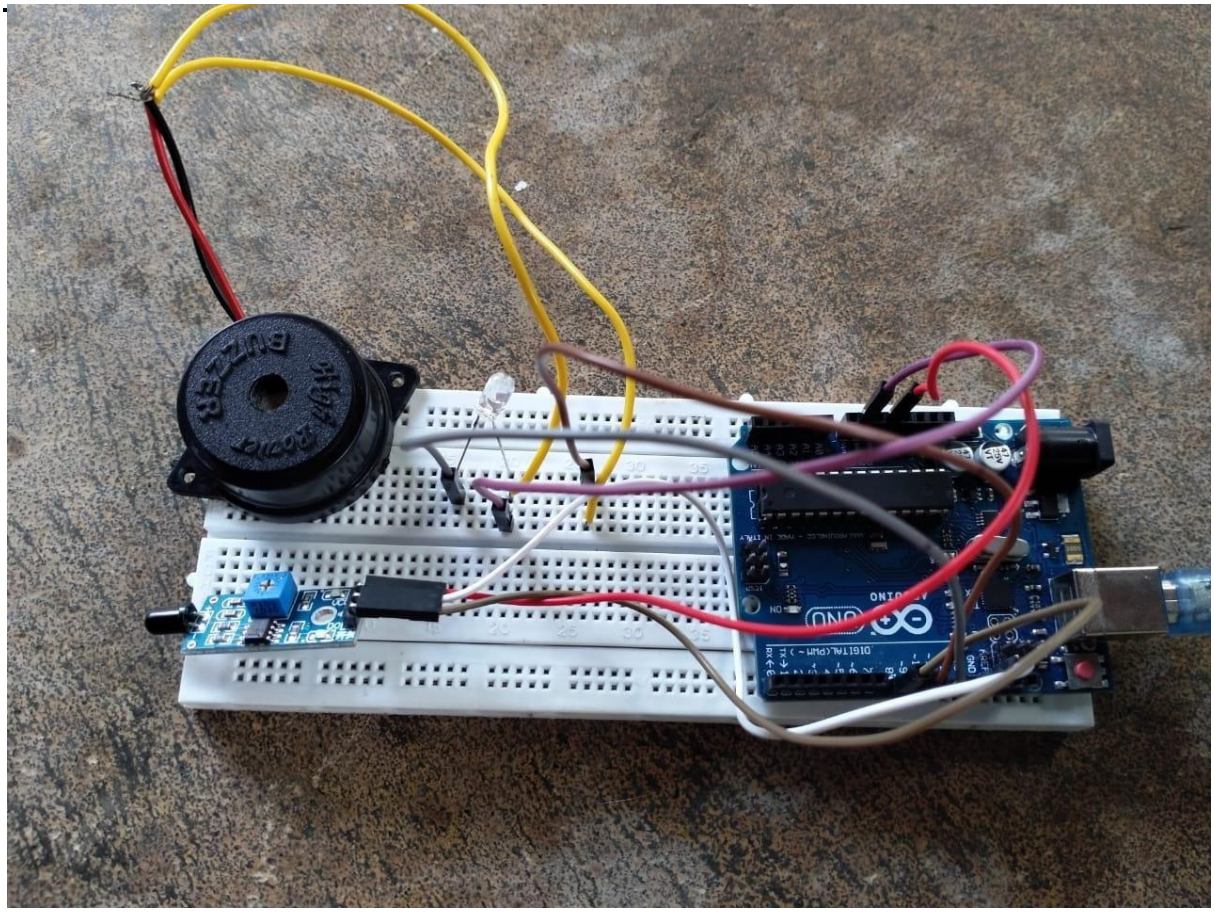


Fig no.4.1.1

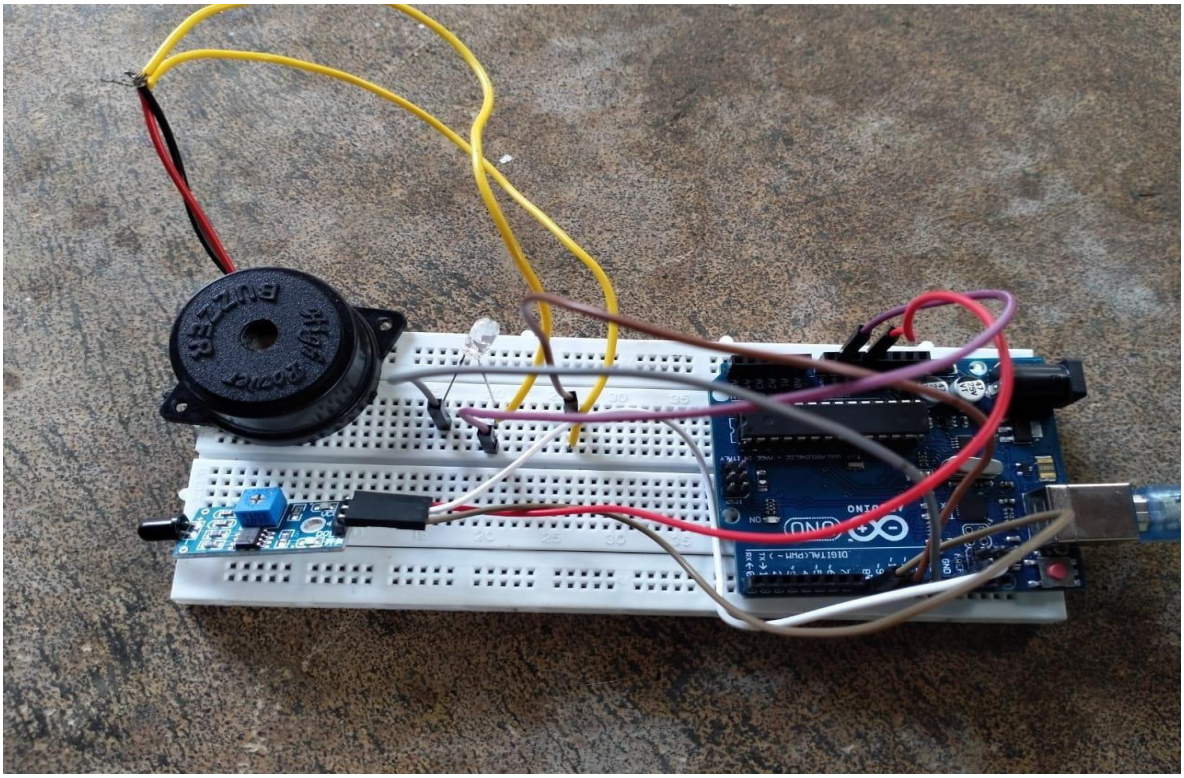
4.2. CODE USED

```
#defineFire_sensor 8
#define Buzzer 9
#define Light 10
#define  ldelay 500
#define bdelay 500
void setup() {
Serial.begin(9600);
pinMode(Fire_sensor, INPUT);
pinMode(Buzzer, OUTPUT);
pinMode(Light, OUTPUT);
}
void loop() {
   if (int a = digitalRead(Fire_sensor) == LOW) {
alert();
  } else {
digitalWrite(Buzzer, LOW);
digitalWrite(Light, LOW);
   }
}
void alert() {
digitalWrite(Light, HIGH);
digitalWrite(Buzzer, HIGH);
   delay(ldelay);
digitalWrite(Light, LOW);
digitalWrite(Buzzer, LOW);
   delay(ldelay);
digitalWrite(Light, HIGH);
digitalWrite(Buzzer, HIGH);
   delay(ldelay);
digitalWrite(Light, LOW);
digitalWrite(Buzzer, LOW);
```

```
    delay(ldelay);
digitalWrite(Light, HIGH);
digitalWrite(Buzzer, HIGH);
    delay(ldelay);
digitalWrite(Light, LOW);
digitalWrite(Buzzer, LOW);
    delay(ldelay);
}
```

4.3. Functional Explanation

A Flame Sensor is a device that can be used to detect presence of a fire source or any other bright light sources. There are several ways to implement a Flame Sensor but the module used in this project is an Infrared Radiation Sensitive Sensor. Using this particular type of Flame Sensor, you can detect Infrared Light up to a distance of 100cm within its 60 degrees of detection angle. Flame Sensor has three pins (some may have four pins): VCC, GND and DO. Connect VCC and GND to +5V and GND of the power supply (can be connected to Arduino's +5V). the DO (short for Digital Output) is connected to Digital I/O Pin 11 of Arduino. In order to indicate the detection of a flame or fire, a Buzzer is used. The Buzzer circuit consists of a 1KΩ Resistor, an NPN Transistor (like 2N2222 or BC548), a 5V Buzzer and a PN Junction Diode. Make the necessary connections and upload the code to Arduino UNO. To test the functionality of the flame sensor, place a fired lighter or a match stick in front of the sensor. Under normal conditions, the output from the Flame Sensor is LOW. When the sensor detects any fire, its output becomes HIGH. Arduino detects this HIGH signal on its input pin and activates the Buzzer . Buzzer gives audio signal where as LED gives visual signal to alert the people during the emergency conditions.



Figno.4.3.1

5.CONCLUSION

Hence electronic circuits can be designed for the fire based alarms and they provide high efficiency and can be used for the security reasons. Early fire detection is best achieved by the installation and maintenance of fire detection equipement in all rooms and areas of the house or building.

Earlier detection can enable us to reduce the severe damages and also it is helpful for firefighters to response quickly.

6. REFERENCES

1. Adekunle A., Umanah I.I., I be K.E. and Imonikosaye M.R. (2018) Statistical analysis of fire outbreaks in homes and public buildings in Nigeria.

2. Amy, T., et al. (2019) Boston fire of 1872.encyclopedia of world history.

3. Sarah, B. (2017) The great fire of nero and the ancient history of fire fighting.

4. Erik, A.. Influential innovator. Ctesibius, (2016).

5. Huang, Y., Zhang, W., Dai, X., Zhao Y. (2012).Study on water-based fire extinguishing agent formulations and properties. International Symposium on Safety

Science and Technology, (pp. 650 - 654)

6. Shehab, J. N. (2018) Design and Implementation of Factory Security System.

7. Qin, W. Jiashuo, C. and Chuang, Z. (2018) Intelligent Smoke Alarm System with Wireless Sensor Network.

8. Aydin, B., Selvi, E., Tao, J. And Starek , M. J. (2019) Use of Fire-Extinguishing Balls for a Conceptual System of Drone-Assisted Wildfire Fighting.

9. Bahrepour , M., Meratnia, N. and Havinga, P. (n,d).A Survey from Wireless Sensor Network Perspective, Automatic Fire detection.

10. Shin-Juh, C., Chris, H., Kristen A. P. and André, M. (2007) Fire detection using smoke and gas sensors.

11. Izang, A. A., Ajayi, S.W. Onyenwenu, C. B. And Adeniyi. F.(2018) An SMS Based Fire Alarm and Detection System.

12. Sonsale, p., Gawas, R., Pise, S. and Kaldate, A.(2014). Intelligent Fire Extinguisher System.

13. Warmack, R. J., Dennis, W. and Shane, F. (2015).Using Linear Discriminant Analysis.