MINI PROJECT

ON

FLAME DETECTION SYSTEM USING ARDUINO

Submitted in partial fulfilment of the requirements of the requirements for the degree of Bachelor of Engineering in **"Information Technology Semester-VI"**

By

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CERTIFICATE

This is to certify that the project entitled "**Flame Detection System Using Arduino**" is bonafide work of Akanksha Bele (VU4F2021124), Shreya Kurry (VU4F2021125), Harshank Sutar (VU4F2021128), Bhargavee Talekar (VU4F2021086) submitted to University of Mumbai in partial fulfillment of requirement for the award of degree of "**Bachelor of Engineering in Information Technology-Semester-VI**".

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Project Report Approval for T.E.

This project report entitled **"Flame Detection System Using Arduino"** by Akanksha Bele, Shreya Kurry, Harshank Sutar, Bhargavee Talekar is approved for the degree of "**Bachelor of Engineering"** in "**Information Technology"**.

Examiners

1. _____

2. _____

Date:

Place: Mumbai – 22

ABSTRACT

Fire outbreak is a major concern at homes, offices, industries etc. It is dangerous and requires high security and control 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 a given environment, sound an alarm/buzzer.

Fire Alarm Systems are very common in commercial buildings and factories, these devices usually contain a cluster of sensors that constantly monitors for any flame, gas or fire in the building and triggers an alarm if it detects any of these. One of the simplest ways to detect fire is by using an **IR Flame sensor**, these sensors have an IR photodiode which is sensitive to IR light. Now, in the event of a fire, the fire will not only produce heat but will also emit IR rays, yes every burning flame will emit some level of IR light, this light is not visible to human eyes but our flame sensor can detect it and alert a microcontroller like Arduino that a fire has been detected.

ACKNOWLEDGEMENT

We the students from **Vasantdada Patil Pratishthan's** College of Engineering, Mumbai of **THIRD Year Engineering** in the department of **'Information Technology'** have great pleasure in presenting our efforts of developing the project named as **"Harvestify".**

The success of our project on whole does not depend on an individual student but on the technical team work of entire group & faculty members. This would have difficult by an individual. So, we wish & acknowledge the precious guidance from those who willingly supported to us to make this project.The third-year project was a great chance of learning and developing in HTML (Hypertext Markup Language), CSS (Cascading style sheets), JS (Java Script), XML (Extensible Markup Language), Python and Bootstrap.

We are grateful to **Dr. Pradip Mane HOD (IT)** for giving us inspiration, timely guidance and valuable suggestions during the course of project. We are especially thankful to our Guide **Prof. Ashwini Phalke** who gave us the golden opportunity to do this wonderful project which helped us in doing a lot of Research and we came to know about so many new thing, we are really thankful to them.

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INTRODUCTION

Fire is the rapid oxidation of a material (the fuel) in the exothermic chemical process of combustion, releasing heat, light, and various reaction products. At a certain point in the combustion reaction, called the ignition point, flames are produced. The flame is the visible portion of the fire. Flames consist primarily of carbon dioxide, water vapor, oxygen and nitrogen. If hot enough, the gases may become ionized to produce plasma. Depending on the substances alight, and any impurities outside, the color of the flame and the fire's intensity will be different.

Fire in its most common form can result in conflagration, which has the potential to cause physical damage through burning. Fire is an important process that affects ecological systems around the globe. The positive effects of fire include stimulating growth and maintaining various ecological systems. Its negative effects include hazard to life and property, atmospheric pollution, and water contamination.[If fire removes protective vegetation, heavy rainfall may lead to an increase in soil erosion by water.Also, when vegetation is burned, the nitrogen it contains is released into the atmosphere, unlike elements such as potassium and phosphorus which remain in the ash and are quickly recycled into the soil.

PROPOSED SYSTEM

This project deals with developing a ‘Interior Design Website’. It provides the user with a list of the rooms with various styles available by the organization. For the convenience of the client and the Interior Design organization, it displays different rooms with a variety of styles. The clients can ask their query to the team in the organization from the enquiry section. The system is implemented using HTML, CSS, JavaScript and Firebase databases. To develop an Interior Design website, it is necessary to study and understand many technologies. Scope: The scope of the project will be limited to some functions of the interior design website. It will display designed rooms, clients can look for the type of the design they are looking for or can contact the organization for the style that they specifically want to apply. Clients can go through the client reviews to see the projects done by the organization. This project has great future scope. The project also provides security with the use of login ID and passwords, so that no unauthorized users can access your account. The only authorized person who has the appropriate access authority can access the software.

PROBLEM STATEMENT AND OBJECTIVES

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.Fire is the key element in safety considerations. This project study helps to design an Arduino microcontroller fire detector system.

A fire alarm system has several devices working together to detect and warn people through visual and audio appliances when smoke, fire, carbon monoxide, or other emergencies are present. These alarms may be activated automatically from smoke detectors, and heat detectors or may also be activated via manual fire alarm activation devices such as manual call points or pulsations. Alarms can be either motorized bells or wall mountable sounders or horns. They can also be speaker strobes that sound an alarm, followed by a voice evacuation message which warns people inside the building not to use the elevators. Fire alarm sounders can be set to certain frequencies and different tones including low, medium, and high, depending on the country and manufacturer of the device. Most fire alarm systems in Europe sound like a siren with alternating frequencies. Fire alarm electronic devices are known as horns in the United States and Canada and can be either continuous or set to different codes. Fire alarm warning devices can also be set to different volume levels. Manually actuated devices; also known as fire alarm boxes, manual pull stations, or simply pull stations, break glass stations, and (in Europe) call points. Devices for manual fire alarm activation are installed to be readily located (near the exits), identified, and operated. They are usually actuated using physical interaction, such as pulling a lever or breaking glass.

OBJECTIVES:-

- The main objective of this project is to design a circuit that detects high temperature and consequently triggers an alarm/buzzer which leads to extinguishing the fire.
- To minimize the risks associated with combustion .
- Flame Sensors, Smoke Sensors, Fire Alarms etc. are part of the safety equipment that help us in keeping our homes, offices and stores safe from fire accidents.
- Almost all modern houses, apartments, malls, cinema halls, theaters, office buildings and shops are equipped with such safety equipment and it is mandatory in some regions to use fire safety devices.

MODULES

HARDWARE REQUIREMENTS:

- Arduino Uno (any Arduino board can be used)
- KY-026 Sensor (Flame Sensor)
- Bread Board
- Buzzer
- Jumper wires

SOFTWARE REQUIREMENTS:

- Arduino IDE

MODULES DESCRIPTION

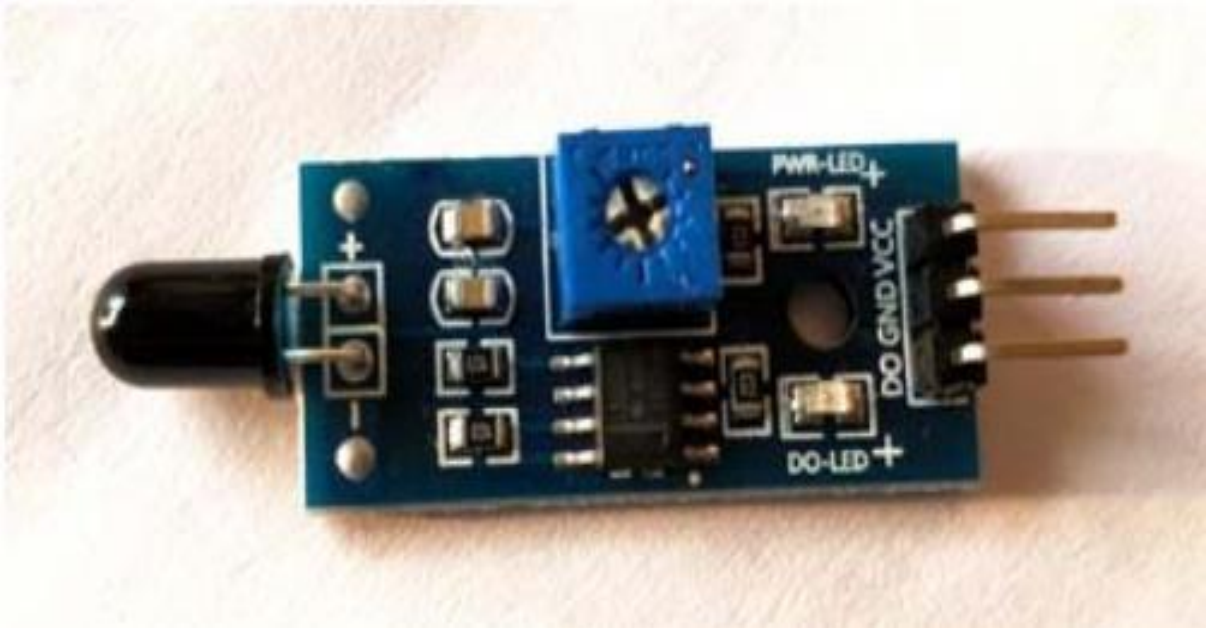
ARDUINO UNO

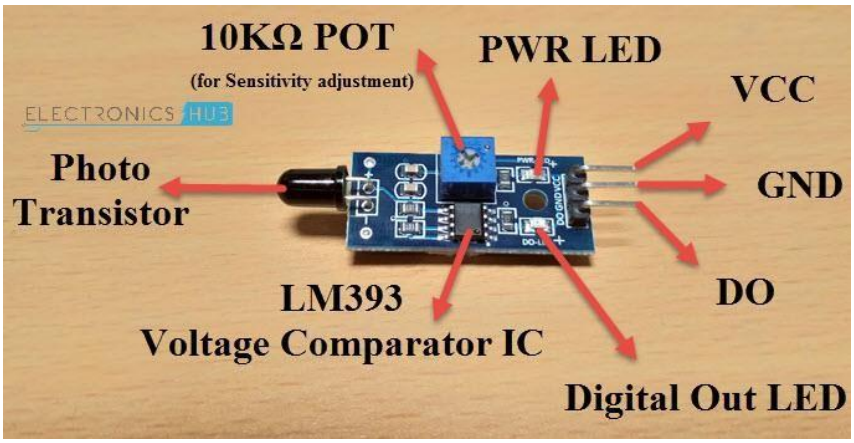
The **Arduino UNO** is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It is the most popular and widely used board among the **Arduino** boards.

The **Arduino UNO** can be programmed using the **Arduino** programming language, which is based on C++. It uses a simple and intuitive programming environment, making it easy for beginners to get started with microcontroller programming. The **Arduino UNO** can be connected to various sensors and actuators to control different devices and perform different tasks. For example, it can be used to control motors, read data from sensors, display information on an LCD screen, and communicate with other devices via serial communication protocols such as I2C and SPI.

The word "**uno**" means "one" in Italian and was chosen to mark a major redesign of the Arduino hardware and software.[7] The Uno board was the successor of the Duemilanove release and was the 9th version in a series of USB-based Arduino boards.Version 1.0 of the Arduino IDE for the Arduino Uno board has now evolved to newer releases.The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use a FTDI USB-to-UART serial chip. Instead, it uses the Atmega16U2 (Atmega8U2 up toversion R2) programmed as a USB-to-serial converter.The Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX).

KY-026 SENSOR





The **KY-026 sensor** is a flame sensor module that is often used with Arduino and other microcontroller-based projects. It detects infrared signals in the range of 760nm to 1100nm, which are typically emitted by fire flames. The sensor module includes a photodiode which is sensitive to infrared signals and a comparator circuit that generates a digital output when the infrared signals exceed a certain threshold.

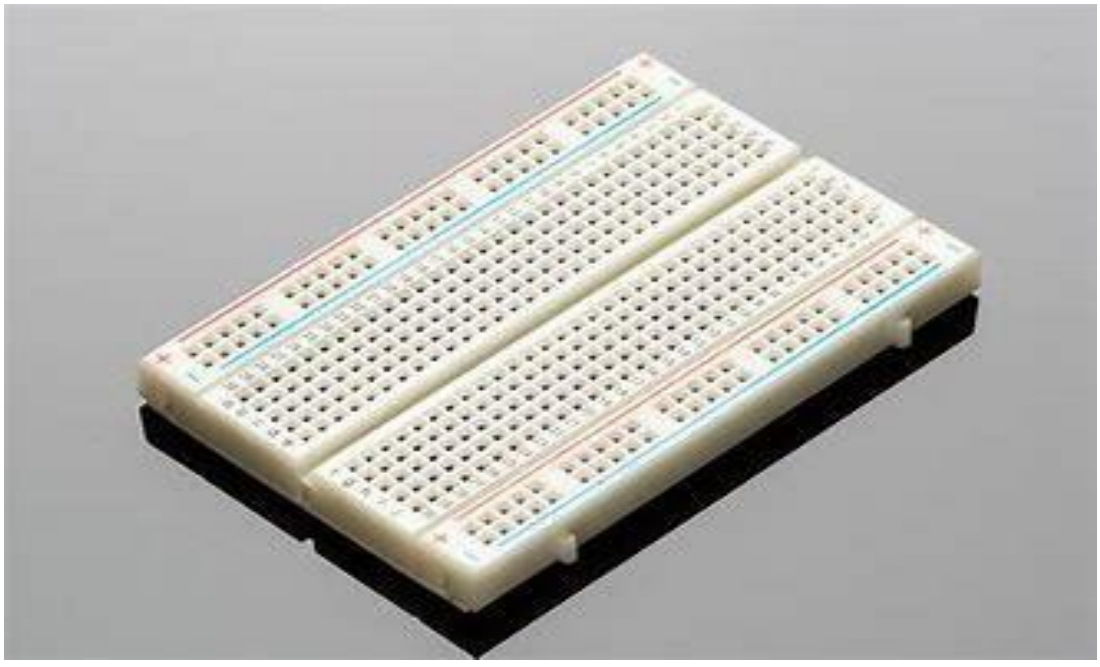
The **KY-026 sensor** typically has four pins: VCC, GND, AO and DO. The VCC pin is connected to a power source (usually 3.3V or 5V), the GND pin is connected to ground, the AO pin is the analog output pin and the DO pin is the digital output pin.

The digital output pin sends a high signal when the module detects a flame and a low signal when no flame is detected.

The **KY-026 sensor** can be used to detect flames in a wide range of applications such as fire alarms, gas detectors, and other safety systems. It can be used as a part of the fire detection system, where it can detect the flame and raise an alarm or notify the fire department.In Arduino, the digitalRead() function can be used to read the output of the sensor, and the values can be used to make decision and raise an alarm or notify the fire department.

In safety equipment, flame sensors, fire alarms, and smoke sensors play a major role because these sensors assist us in maintaining our offices, homes, or stores very safe from fire accidents. Generally, safety equipment is used in almost all apartments, modern homes, cinema halls, offices, and shopping malls, and in some regions, it is compulsory to fire security devices. To overcome this problem, a flame sensor is used to protect all these from fires or flames. This article discusses an overview of a **flame sensor** – working with applications.

BREADBOARD



A **Breadboard** is simply a board for prototyping or building circuits on. It allows you to place components and connections on the board to make circuits without soldering. The holes in the breadboard take care of your connections by physically holding onto parts or wires where you put them and electrically connecting them inside the board. The ease of use and speed are great for learning and quick prototyping of simple circuits. More complex circuits and high frequency circuits are less suited to breadboarding. Breadboard circuits are also not ideal for long term use like circuits built on perfboard (protoboard) or PCB (printed circuit board), but they also don't have the soldering (protoboard), or design and manufacturing costs (PCBs). It is easier to mount components & reuse them. Since, components are not soldered you can change your circuit design at any point without any hassle. It consist of an array of conductive metal clips encased in a box made of white ABS plastic, where each clip is insulated with another clips. There are a number of holes on the plastic box, arranged in a particular fashion. A typical bread board layout consists of two types of region also called strips.

BUZZER

A **buzzer** is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

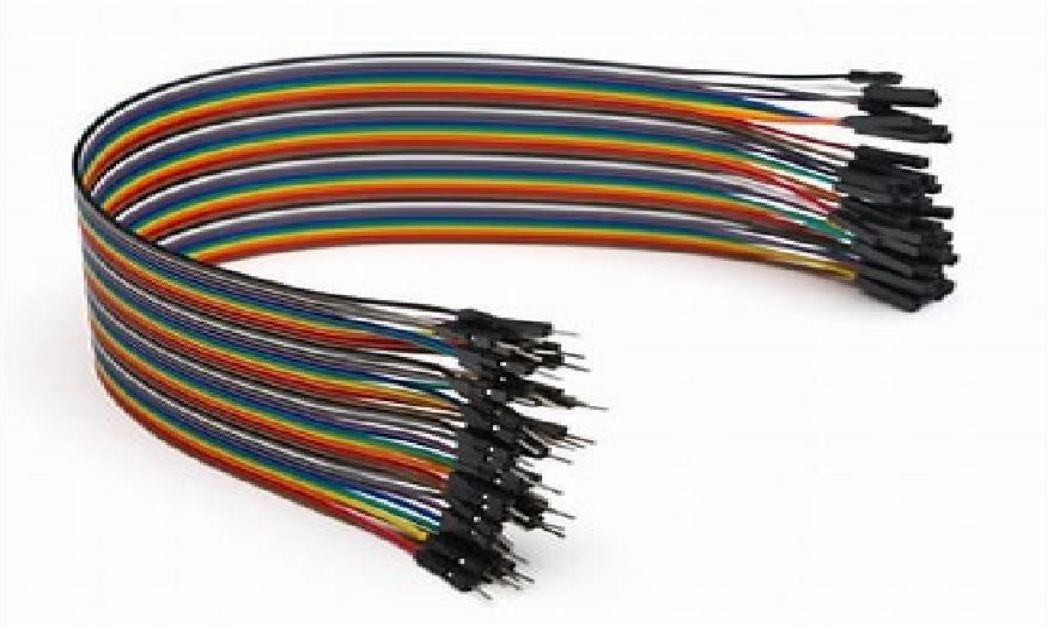
There are two types of buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customised with help of other circuits to fit easily in our application.

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply.

The pin configuration of the buzzer is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal. A buzzer is available in different types which include the following.

- Piezoelectric
- Electromagnetic
- Mechanical
- Electromechanical
- Magnetic

JUMPER WIRES



A **jump wire** (also known as **jumper**, **jumper wire**, **DuPont wire**) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Generally, jumpers are tiny metal connectors used to close or open a circuit part. They have two or more connection points, which regulate an electrical circuit board. Their function is to configure the settings for computer peripherals, like the motherboard. Suppose your motherboard supported intrusion detection. A jumper can be set to enable or disable it.

Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering. You can use jumper wires to modify a circuit or diagnose problems in a circuit.

Further, they are best used to bypass a part of the circuit that does not contain a resistor and is suspected to be bad. This includes a stretch of wire or a switch. Suppose all the fuses are good and the component is not receiving power; find the circuit switch. Then, bypass the switch with the jumper wire. How much current (I) and voltage (V) can jumper wires handle? The I and V rating will depend on the copper or aluminum content present in the wire. For an Arduino application is no more than 2A and 250V. We also recommend using solid-core wire, ideally 22 American Wire Gauge (AWG).

Types of Jumper Wires

Jumper wires come in three versions:

- Male-to-male jumper
- Male-to-female jumper
- Female-to-female jumper

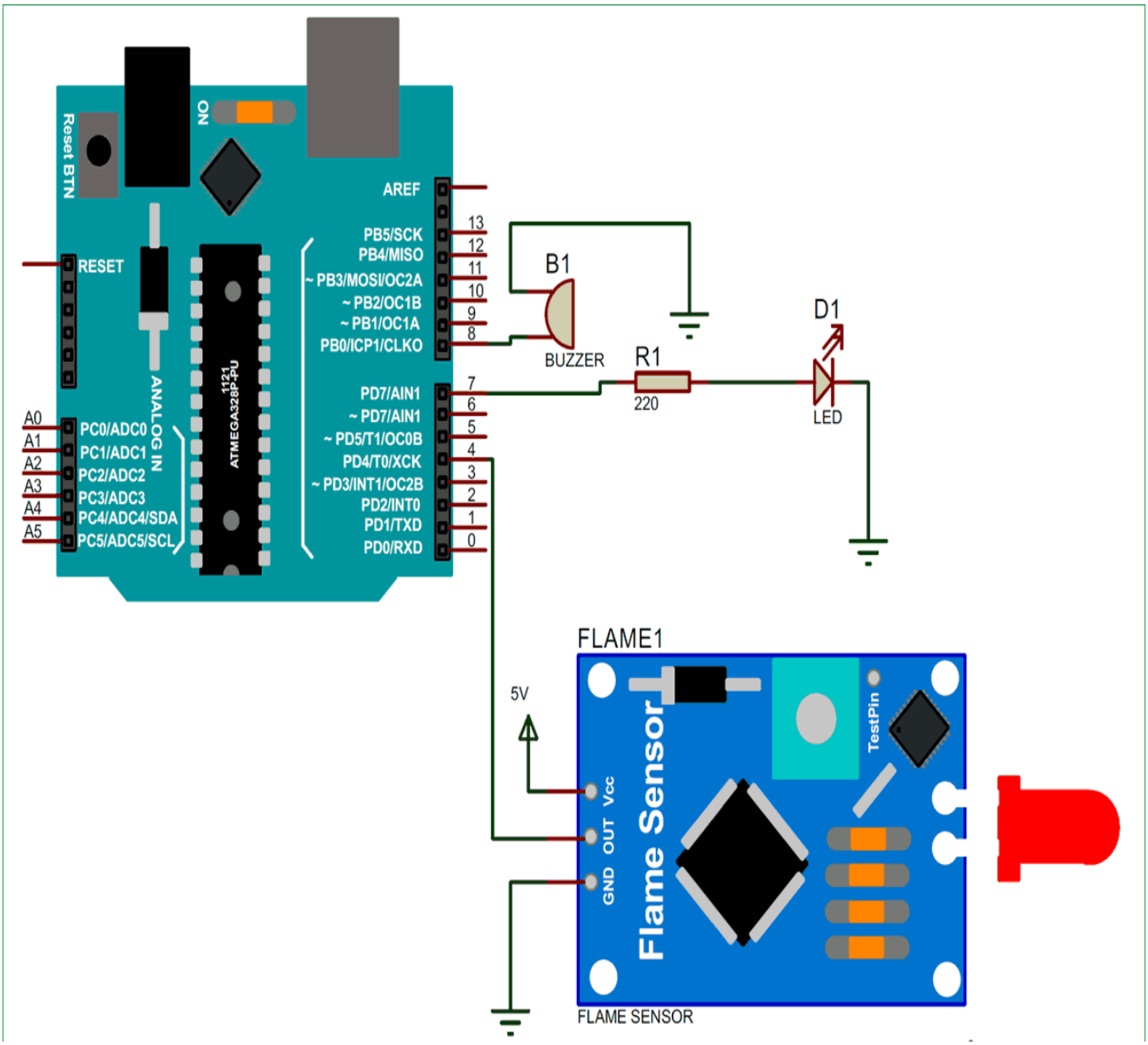
And two types of head shapes: **square head** and **round head**.

The difference between each is in the *endpoint* of the wire. Male ends have a pin protruding and can plug into things, while female ends do not but are also used for plugging.

Moreover, **a male connector is referred to as a plug** and has a solid pin for centre conduction. Meanwhile, **a female connector is referred to as a jack** and has a centre conductor with a hole in it to accept the male pin.

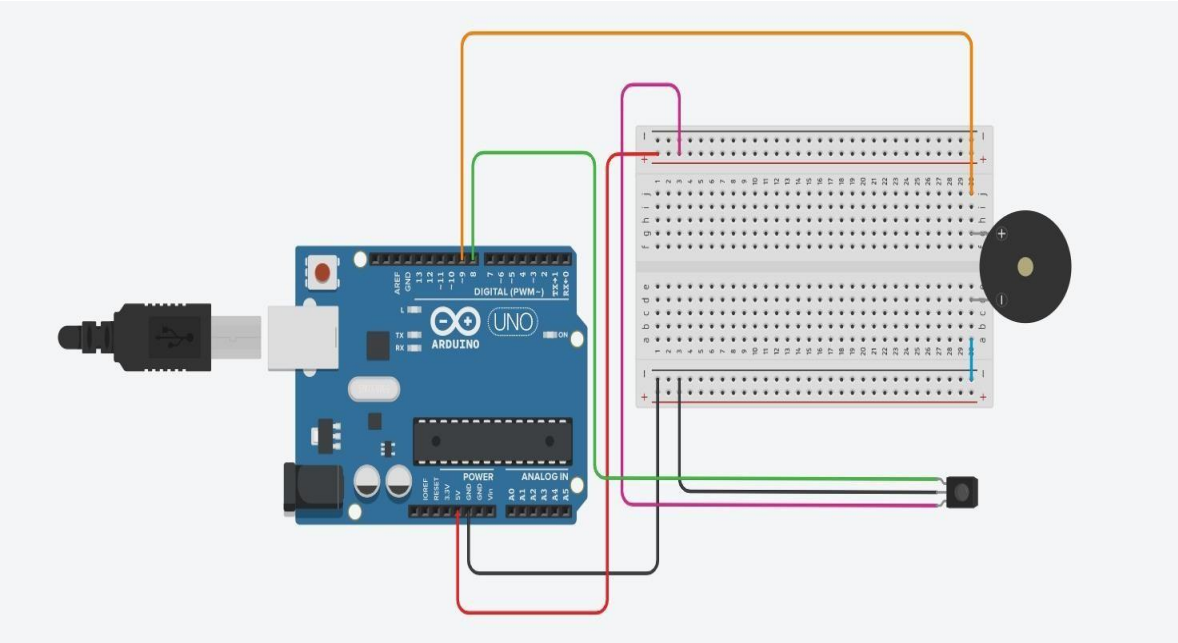
Male-to-male jumper wires are the most common and what you will likely use most often. For instance, when connecting two ports on a breadboard, a male-to-male wireis what you will need.

CIRCUIT DIAGRAM



Pin	Description
Vcc	3.3 – 5V power supply
GND	Ground
Dout	Digital output

SYSTEM ARCHITECTURE



• Requirement Phase:

In this phase, the project title had been selected. The project title for the system was Interior Design. This project started with brainstorming ideas with the supervisor and proposed the title of the project. An abstract and description of the project module has also been done and attached. Besides, the Gantt chart was also needed as a guideline and references for the project. This phase is to analyze the existing system and the article of the techniques or method that will be used for this project. In this phase also get all the requirements that are needed to design and develop the new system. Based on the collection of information through article, method and technique that is suitable has been decided.

• Design Phase:

In the design phase, all the data or requirements obtained during the planning and analysis phase transformed into the design. Diagrams to show the flow of the system will be developed in this chapter such as Context Diagram (CD), Use Case Diagram (UCD). These diagrams are designed as a guideline to developing the system. After that, will design the database and system interface.

• Development Phase:

This phase is where the design will be implemented into the coding. The system will develop regarding the user and system requirement. In this project, to develop the system will be to use Firebase server for the database and Visual Studio Code to code. This phase is a critical phase because the user part needed to fulfill and to make sure the objectives accomplish.

• Testing Phase:

When all the modules have been done as full systems, the system testing has been carried out. This testing phase will test the system to check the error and ensure the function runs well as a whole system. Any error or bugs will be fixed and repeated testing the system until all the functions can be used.

• Review Phase:

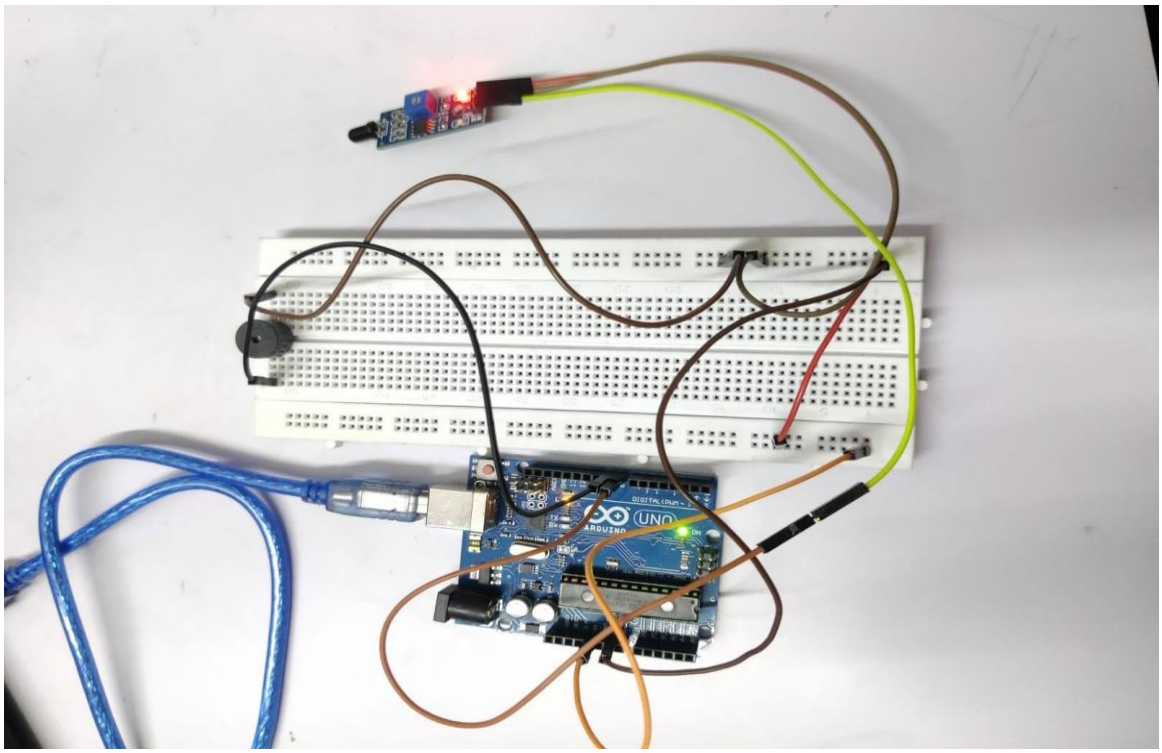
This phase got feedback and review from users for the maintenance. In this phase will follow-up with the user to upgrade the system to another version in the future.

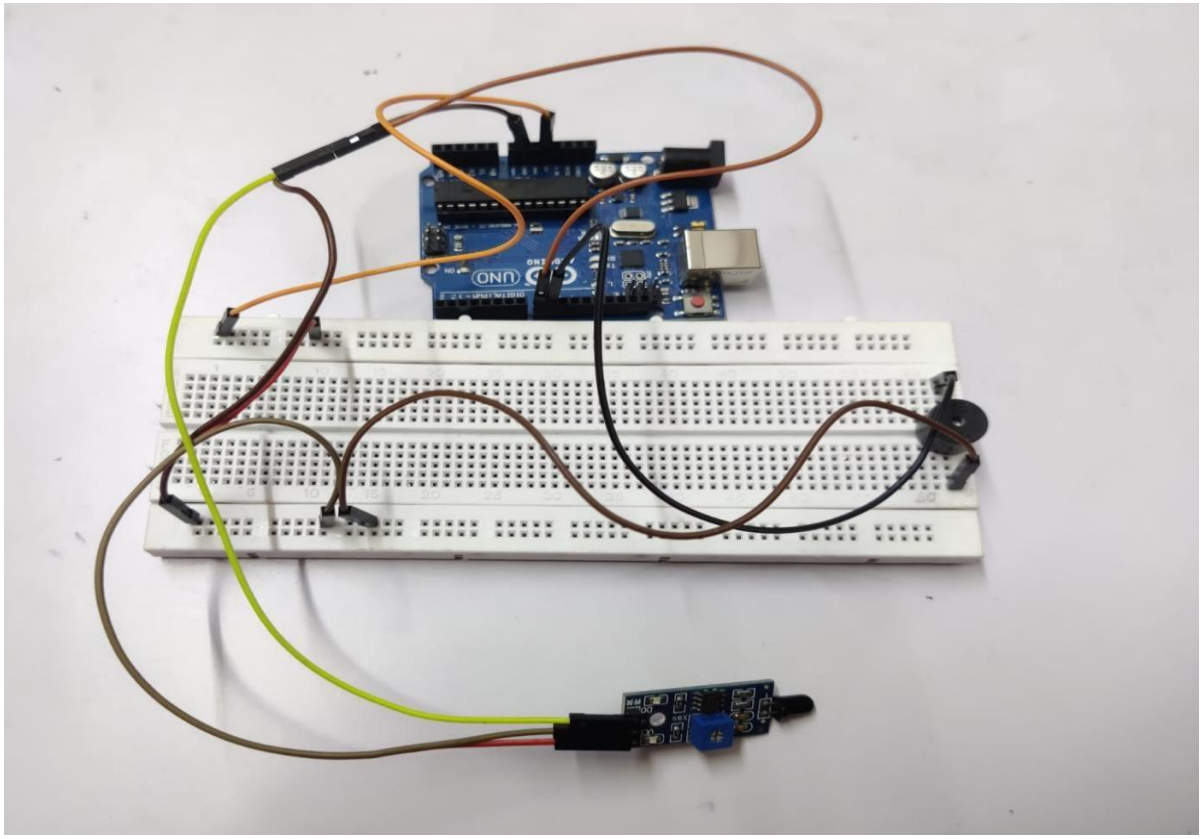
IMPLEMENTATION

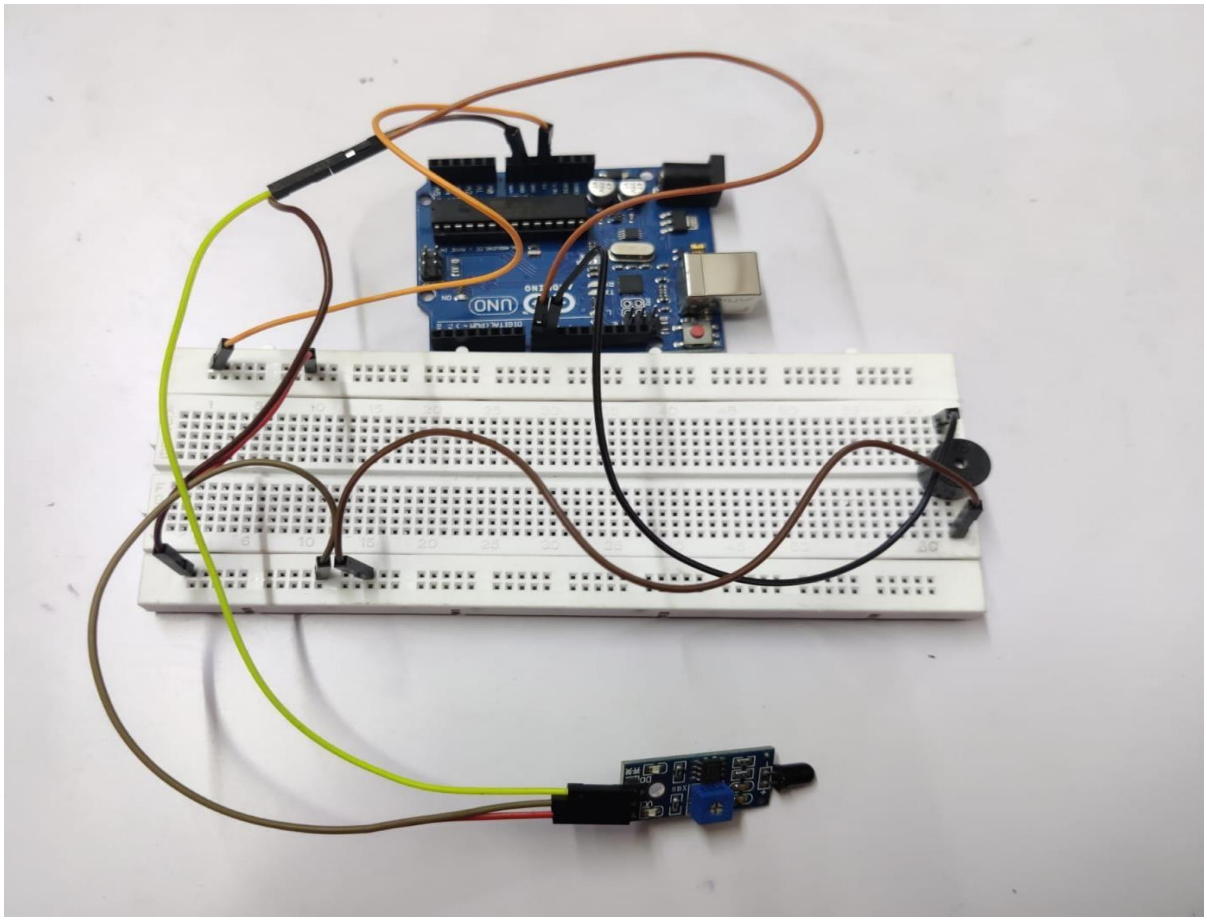
CODE:-

```
const int buzzerPin = 9;
const int fireSensorPin = 8;
void setup() {
Serial.begin(9600);
pinMode(buzzerPin, OUTPUT);
pinMode(fireSensorPin, INPUT);
}
void loop() {
int fireValue = digitalRead(fireSensorPin);
Serial.println(fireValue);
if (fireValue == 0){
digitalWrite(buzzerPin, HIGH);
delay(5000);
}
else {
digitalWrite(buzzerPin, LOW);
}
delay(500);
}
```

SCREENSHOTS AND PHOTOS







CONCLUSION

The developed prototype in this work is made for a user to control the fire alarm system remotely. This helps the user if he/she is not in the building or even unaware of an emergency condition. The use of this prototype will avoid unpredictable situations or any critical situations from occurring in the residential areas without the awareness of the resident. The home alert system is observed to be functional by triggering the fire extinguisher. The use of a coupled temperature sensor and the smoke detector was found to be more appropriate than the use of only one of them. Though the prototype was able to extinguish the fire the portability can be significantly improved by efficient assimilation of the different modules. This system should also take care that each module of it can be easily replaced by a better sensor and equipment with updated technology.

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