AMEIRCAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)

FACULTY OF ENGINEERING

MICROPROCESSOR AND EMBEDDED SYSTEMS [F]

Summer 2021-2022

Project on

Fire Security System using Arduino & Flame Sensor

Supervised by

MD. ALI NOOR

Professor

Department of Electrical and Electronic Engineering

Group – 04

Submitted by:

Serial	Name	ID	Department
1.	DEB KABYO	19-40242-1	CSE
2.	RAHMAN MD AKIB UR	19-40279-1	CSE
3.	PARVIN MONOWARA	19-39578-1	CSE
4.	RAISA, TASNUBA KADER	19-39616-1	CSE
5.	RAIYAN,MD YAH-YA	19-41752-3	CSE
6.	MORUL, MD.RAKIB HOSSAIN	19-39374-1	CSE
7.	MD.FERDUS ALVI	19-41317-3	CSE

Date of submission: 10 August, 2022

Table of Contents

Abstract:

A fire security system is essential for maintaining and monitoring the safety of all types of surroundings and scenarios. However, the utility of many existing fire alarm security systems is well established, but they can be expensive to construct. As a result, it is out of reach for low-income individuals. The primary goal of this project is to create a low-cost fire security system. The detecting system, the monitoring system, and the appliance system seem to be the three key systems in the project. A flame detector is used in the detecting system. This paper describes the design and implementation of a fire security system using the ARDUINO UNO R3 as the system's controller. The detectors are arranged in parallel at various levels. The monitoring system monitors any signal from the detector at any level. The appliance system includes components for stopping the fire with a fire extinguisher fan and indicating the location of the fire. The microcontroller controls the entire system. The microcontroller is programmed in this manner using C programming with the ARDUINO IDE. According to the completed project, the System can detect smoke, flame, heat, and so on. This is followed by the monitoring system, which signals smoke, light, flame, heat, and so on at that specific level. Finally, when the sensors from each level are triggered independently, the extinguisher begins to operate. The extinguisher fan is then directed to the afflicted area to extinguish the flames.

Introduction:

Background:

The ability to detect the presence of fire is a vital part of an overall fire safety strategy. Fire protection, through application of science and engineering principles aims to protect people, property and the environment from a devastating fire. From ancient times people have realized that early detection of fire has a positive effect in the fire control. Now-a-days automatic fire detection and control is becoming very essential to reduce the fire in the building and industry. Automatic fire detection system provides real time surveillance and monitoring. A key aspect of the fire protection is to identify a developing fire emergency in a timely manner and to alert the building’s occupants and fire emergency organizations. A fire detector is usually implemented as a smoke sensor due to its early fire detection capability, fast response time and relatively low cost. Other options for the fire detection are based on gas sensors or temperature sensors fire detectors that use a single sensor, generally a smoke sensor, and present high false-alarm rates due to

temperature changes. In order to prevent fires from occurring or minimize their impact, accurate and early detection is essential. Fire detectors are designed to respond at an early stage to one more of the four major characteristics of combustion, heat, smoke, flame or gas. No single type of detector is suitable for all types of premises or fires. Heat detectors respond to the temperature rise associated with a fire and smoke detector respond to the smoke or gas generated due to fire.

Description of the project:

This system is a kind of stand-alone embedded system. It is a self-contained device. It takes either digital or Analog inputs from its input ports, calibrates, converts, and processes the data, and outputs the resulting data to its attached output device, which either displays data, or controls and drives the attached devices. So, we designed a smart fire detection model. Parameters like, temperature and smoke level will be controlled by microcontroller. Each of these parameters is measured by a sensor that is set at a specific range, if this sensor signals any change in that range, the system will take the appropriate action required and that may contain rotating the fan or any fire suppression activity. Here we have connected a fan as a detection component.

Objective:

The purpose of our project is to make a fire control system with low cost. In our project there will be fire detection system, monitoring system and appliance system .Actually this system will be an automated system. Once we deploy the system it works automatically. This technology will allow people to locate the fire occurred location as there will be automatically fire alarm system when fire occurred. Moreover, this technology has an emergency flame sensor to detect the fire and there will a fan to prevent the fire.

The project is also been designed to be further working vision using minimum hardware at the lower level of processing. These systems are directed at specific applications. Our objective is to design a fire detection and prevention system that would fulfill the following:

- To indicate the room in which fire erupted
- To indicate the location where the fire is occurred
- To prevent fire
- To rotate the fan if fire occurs

Literature review:

Fire Alarm System is designed to alert us to an emergency so that we can take action to protect ourselves, staff and the general public. There is many fire alarm system available in the market. Unfortunately, these systems did not provide very much detail and often directed the fire department to the wrong location. But with the advent of the telegraph, invented in the early 1840ís by Samuel F. B. Morse, firefighters were given a faster and more accurate fire reporting system. In 1847, New York became the first American city to begin construction of a municipal fire alarm system required by ordinance to construct a line of telegraph, by setting posts in the ground, for communicating alarms of fire from the City Hall to different fire stations, and to instruct the different bell-ringers in the use of said invention. The Automatic Fire Alarm Telegraph is operated by any dangerous Heat, and detects the presence of fire at its commencement. The apparatus, usually set at 125 Fahrenheit, is placed on the ceiling at regular intervals in every room, office, closet, and elevator in the building the alarm is given directly to the Insurance patrol and fire department. It tells the exact location of the fire to the companies before they leave their station, giving the particular building and floor. Each instrument performs the service of a constant, vigilant watchman, ready to act in time of danger in every part of the building. Fire spread within the building can be affected by various factors such as the geometry, dimension, layout and usage of the building. In order to provide fire protection in the building, it is very important to detect fire at its early stage. The most common fire and smoke detection methods include the use of point type detectors (i.e. ionization smoke detectors, photoelectric detectors, heat detectors), line type detectors etc. These detection methods based on the use of fire signatures such heat. Fire is a chemical reaction known as combustion. It is defined by the rapid oxidation of a combustible material accompanied by release of energy in the form of heat. In order for ignition to occur, the presence of both a fuel and a heat energy source is required. When the two come together, with the appropriate proportions, either by a lack of separation or by some type of active interaction, a fire occurs. FINAL THESIS PROJECT 2010 E.C Adigrat University Fire Detection and Prevention System Page 5 The creation of the faster evacuation technologies and safer living conditions at affordable cost for everyone This paper discuss the automatic fire detection system, the composition and working principle. The principle of the proposed circuit is derived from the physical principles of ionization. Fire detectors using two-wire method to reduce the wall alignment, improve reliability, and ease of construction and installation. This describes the overall structure of the fire detection system and control software in the design. Low-cost fire detection

and control system based on heat detection is proposed. It is comprised of a combination of electrical/electronic devices/equipment's working together to detect the presence of fire and alert people through audio or visual medium after detection. These alarms may be activated from heat detectors which, when detects fire. Then, it automatically operates a relay which can be used to turn Alarm Buzzer "ON", and Turn the fan "ON".

Theory and Methodology:

So, In this project, The main things we used the Arduino UNO board to connect all the necessary stuffs along with Arduino IDE to run the code. Based on that we developed a C++ code which executes according to our needs continuously until we stop the process. All the necessary components and their theory have been discussed below:

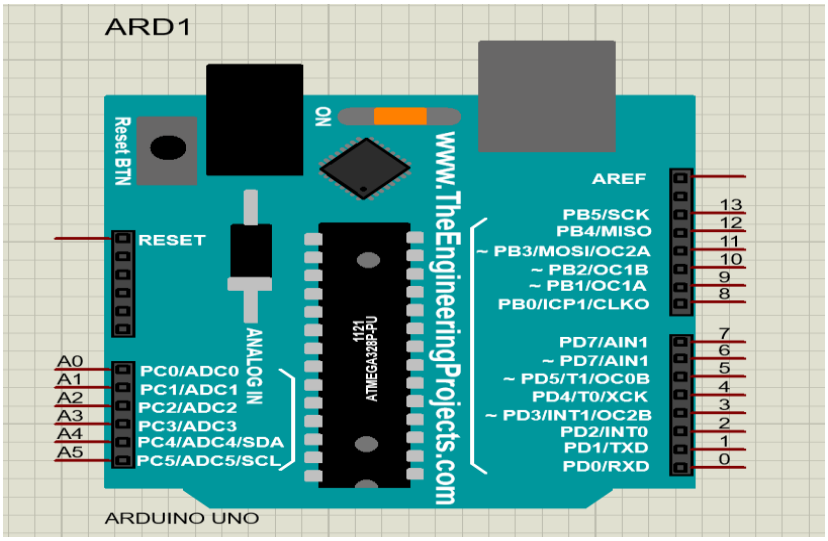

Figure 1: Arduino UNO Board

Figure 1 shows the first and most important component that we had to use for our experiment is the Arduino UNO board which is a microcontroller board based on the ATmega328P (datasheet). 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.

Figure2: Arduino IDE

The next most important thing is the Arduino IDE (Shown in Figure 2) which is an open-source platform that may be used to make interactive electronics projects. Arduino is basically made up of a programmable microcontroller and IDE (Integrated Development Environment) software that runs on your computer and is used to write and upload computer code to the microcontroller board. To load new code into the board, the Arduino Uno does not require a hardware circuit (programmer/burner). Using a USB cord and the Arduino IDE (which utilizes a simplified version of C++ to write code), we can quickly load a code into the board.

Figure 3: 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. It includes an alarm system, a natural gas line, propane & a fire suppression system. This sensor is used in industrial boilers. The main function of this is to give authentication whether the boiler is properly working or not. The response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame.

Figure 4: Relay Module

A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit

Figure 5: 12V DC FAN

A Dc fan used to security system when a fire is occurring then the dc fan start working and removed the fire

Figure 6: 12V Battery

Battery used for Dc power supply in fan .It is used for power supply in different hardware application .

Figure 7: Red LED Light

LEDs are small, powerful lights that are used in many different applications. To start, we will work on blinking an LED, the Hello World of microcontrollers. It is as simple as turning a light on and off.

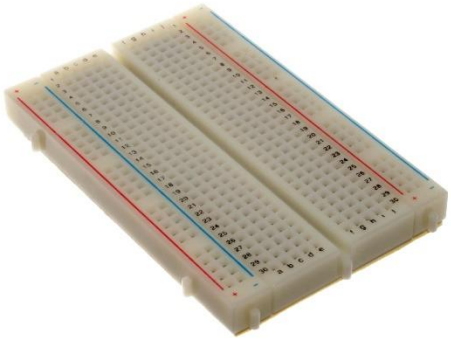

Figure 8: Breadboard

A breadboard, solderless breadboard, protoboard, or terminal array board is a construction base used to build semi-permanent prototypes of electronic circuits. Unlike stripboard (Veroboard), breadboards do not require soldering or destruction to tracks and are hence reusable. For this reason, breadboards are also popular with students and in technological education

Figure 9: Jumper wire

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

Apparatus:

- Proteus Software
- Arduino UNO board
- Relay Module
- Breadboard
- Flame Sensor
- 12v DC Fan
- 12V battery
- LED Lights
- Jumper Wire

Simulation Setup/Schematic Diagram:

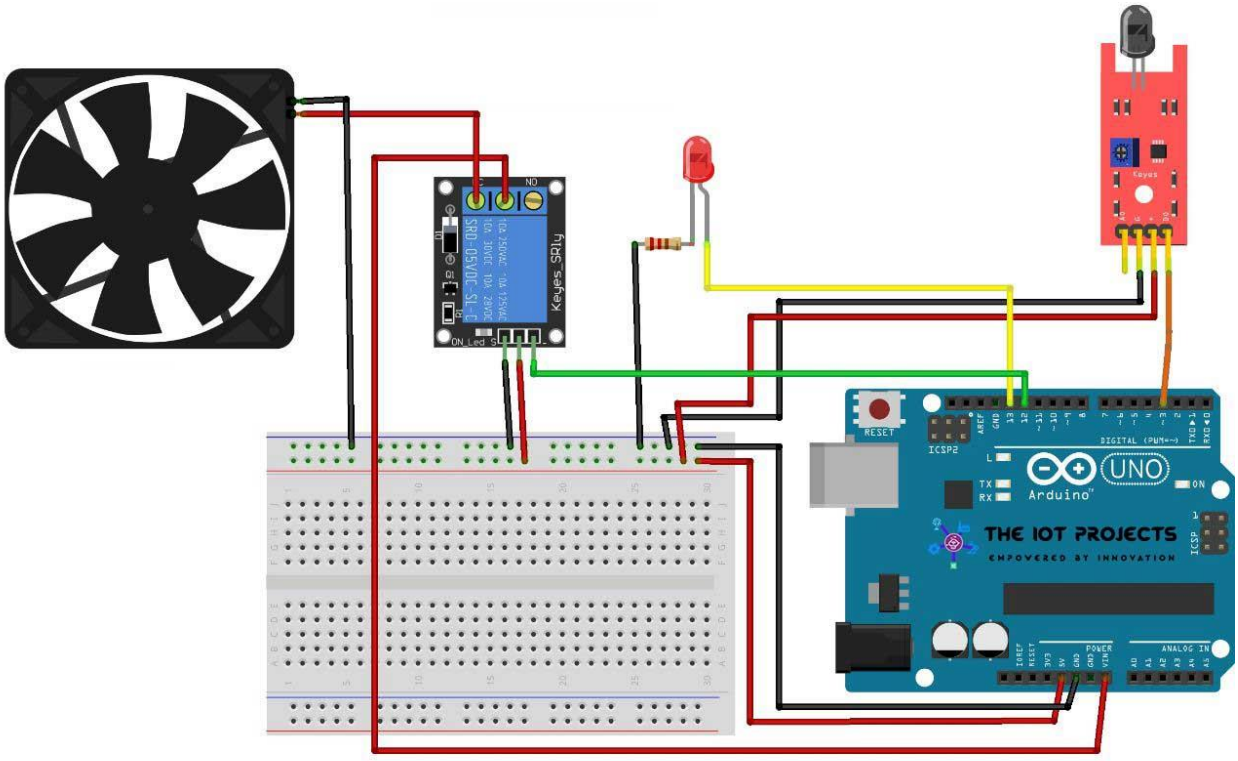

Fig : Fire Security System using Arduino & Flame Sensor

Code:

```
int LED = 13;
int RELAY = 12;
int Flame_sensor = 3;
int Flame_detected;
void setup()
{
  Serial.begin(9600);
  pinMode(LED, OUTPUT);
  pinMode(RELAY, OUTPUT);
  digitalWrite(RELAY, HIGH);
  pinMode(Flame_sensor, INPUT);
}
void loop()
{
  Flame_detected = digitalRead(Flame_sensor);
  Serial.println(Flame_detected);
  //delay(100);
  if (Flame_detected == 0)
  {
    Serial.println("Flame detected...! take action immediately.");
    digitalWrite(LED, HIGH);
    digitalWrite(RELAY, LOW);
    delay(500);
  }
  else
```

```
  {
    Serial.println("No Flame detected. stay cool");
    digitalWrite(LED, LOW);
    digitalWrite(RELAY, HIGH);
  }
}
```

Conclusion:

The design and construction of "Fire Security System by using Arduino & Flame Sensor" was successfully carried out and tested effectively. The system did not pose any extraordinary constraint and the components and materials used it the project were conforming to engineering standard. A close look at the circuit diagram of the Flame detector sensor revealed that all the components used were all locally sourced and available. We tried to be flexible to purchase the components and mostly kept our faith on local materials just because we wanted to make it reasonable for everybody. Finally, the project design was challenging because it gave an expression into the practical application of theoretical knowledge in solving problems associated with design and construction most especially in developing countries but at the end we managed to finish the project and it works perfectly.

References:

[1] International Journal on Engineering Performance-Based Fire Codes, Number l, p.21-23, 2010

[2] Fire safety design guidelines for federal buildings by George V. Hadjisophocleous and Noureddine Benichou

[3] https://www.ijert.org/research/design-of-gsm-based-smoke-detection-and-temperature-monitoring-system-IJERTV2IS4152.pdf

.