A

Technical Report

on

FIRE ALARM

Submitted to CMR Institute of Technology in the partial fulfilment of the requirement of

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in

CSE(AI&ML) DEPARTMENT

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Certificate

This is to certify that the technical report entitled "**FIRE ALARM**" is the bonafide work done and submitted by

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towards the partial fulfilment of the requirement of Social Innovation (SIL) Laboratory of **II B. Tech II-Semester** in **CSE(AI&ML)** is a record of bonafide work carried out by them during the period **Feb 2022 to June 2022.**

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INDEX

Topics		Page No
I.	INTRODUCTION	4
II.	EMPATHIZE	5
III.	DEFINE	6
IV.	IDEATE	7
V.	PROTOTYPE	8
VI.	TEST	9
VII.	FIRE ALARM	
1.	INTRODUCTION	10 - 13
2.	COMPONENTS REQUIRED	14 - 20
3.	CIRCUIT DIAGRAM	21
4.	SOURCE CODE	22 - 23
5.	WORKING	23
6.	CONCLUSION	24

INTRODUCTION

In the modern days we are facing many fire accidents, many people are losing their precious lives and properties. There are many rescue methods but some are costly and some are time taking. Existing solutions:

• Outline clear pathways to exit doors

• Install smoke detection systems.

• Maintain smoke suppression systems

These are some of the ways that can be used to save the fire accidents in many areas.

Our Idea: After analysing the above existing solutions, we have decided to come up with an idea by making fire alarm with low cost and of simple technology.

- Srinidhi suggested that we make something that is useful to the society. After discussing among the team, we have come down to making a firm alarm.

- Srinidhi and Saket arranged all the requires materials for the protorype.

- Hemanth, Jaswanth and Sreenith made the base required for the prototype such as a mall kind of building.

- Praveena and Srinidhi gave the connections to the prototype and then all of us together tested the working of our model.

I. EMPATHIZE

Empathize—Research your User's Needs

Empathy is crucial to a human-centred design process such as design thinking because it allows you to set aside your own assumptions about the world & gain real insight into users and their needs.

During this stage we did a task on finding or defining any 10 problem statements from surroundings. And after that we tried to understand the problem statements completely. After that we tried to find the possible solutions for the above problem statements. And then we discussed among ourselves and also with our fellow students. Everyone shared their ideas. And then we took 2 of the most crucial problems and we discussed. We have collected positive and negative comments from the students.

And we came out with possible outcomes for the above problem statements and tried to find a proper solution. Firstly, we collected the ideas shared with our friends and faculty.

Secondly collected information regarding to the problem statement and a possible report on it.

And finally we have surveyed the people about the above discussed problems.
We got their reviews and opinions which helped us to move further and define more problems like related to accidents, Traffic, water filtration, production of recyclable masks, cylinder blasts etc.,

By the end of this stage we came to know about empathy stage. That it's all about our observation and understanding of the problem. As it's the first step of design thinking process we can come out with many solutions

II. DEFINE

Define—State our user's needs and problems

During the Define stage, we put together the information we have created and gathered during the Empathise stage. This is where we analysed our observations and synthesized them in order to define the core problems that we and our team have identified up to this point. We should seek to define the problem as a problem statement in a human-centred manner.

The Define stage will have helped the designers in our team gathered great ideas to establish features, functions, and any other elements that allowed us to solve the problems or, at the very least, allow us to resolve issues ourselves with the minimum of difficulty. In the Define stage you will start to progress to the third stage, Ideate, by asking questions which can help us look for ideas for solutions by asking: "How might we…helps to encourage our product".

During this stage we defined the problems completely and studied about them. We kept group discussions on the selected problem statement and tried to find the possible solutions to it. And we discussed about the solutions with friends and faculty. We collected more details about our problem statement and its advantages, disadvantages. We also discussed how it would work and how it would change the lives of users.

III. IDEATE

During the third stage of the Design Thinking process, designers are ready to start generating ideas. You've grown to understand your users and their needs in the Empathise stage, and you've analysed and synthesised your observations in the Define stage, and ended up with a human-centred problem statement. With this solid background, you and your team members can start to "think outside the box" to identify new solutions to the problem statement you've created, and you can start to look for alternative ways of viewing the problem.
There are hundreds of Ideation techniques such as Brainstorm, Brain write, worst possible idea and Scamper. Brainstorm and Worst Possible Idea sessions are typically used to stimulate free thinking and to expand the problem space. It is important to get as many ideas or problem solutions as possible at the beginning of the Ideation phase. You should pick some other Ideation techniques by the end of the Ideation phase to help you investigate and test your ideas so you can find the best way to either solve a problem or provide the elements required to circumvent it.

During this stage we discussed about problem statement and its modifications. We also got reviews and comments from students. We have done the research of design of the topic we have chosen.

We did a process of synthesis on what we saw and heard insights that lead to some solutions and opportunities for a change.

We have got ideas through brainstorming for the creation of product. Our mentors cleared the doubts. we have done group ideation and discussed the first idea we got.

IV. PROTOTYPE

The design team will now produce a number of inexpensive, scaled down versions of the product or specific features found within the product, so they can investigate the problem solutions generated in the previous stage. Prototypes may be shared and tested within the team itself, in other departments, or on a small group of people outside the design team. This is an experimental phase, and the aim is to identify the best possible solution for each of the problems identified during the first three stages.

The solutions are implemented within the prototypes, and, one by one, they are investigated and either accepted, improved and re-examined, or rejected on the basis of the users' experiences. By the end of this stage, the design team will have a better idea of the constraints inherent to the product and the problems that are present, and have a clearer view of how real users would behave, think, and feel when interacting with the end product.

We later build a rough presentation on above problem statement. we have collected logical and practical ideas which helped us to design our prototype in a proper way after the further modifications.

V. TEST

Designers or evaluators rigorously test the complete product using the best solutions identified during the prototyping phase. This is the final stage of the 5 stage-model, but in an iterative process, the results generated during the testing phase are often used to redefine one or more problems and inform the understanding of the users, the conditions of use, how people think, behave, and feel, and to empathise. Even during this phase, alterations and refinements are made in order to rule out problem solutions and derive as deep an understanding of the product and its users as possible.

VI. FIRE ALARM

1. INTRODUCTION

Major Fire Accidents Recorded in India

The year 2016- 2021

- Putting Fire Accident (2016)

To celebrate the mark of the regional New Year, thousands gathered to enjoy the firework on 10 April 2016. The accident started when a spark from the faulty rocket fell in a large stockpile of heavy firecrackers triggering a chain reaction. 111 people died with 378 devotees severely injured.

- Bawana Plastic Factory Accident (2018)

An Illegal firecracker manufacturing factory tells us why it is important to follow the government norms. Bawana, a plastic manufacturing company had an illegal unit to manufacture fireworks. Around 6 pm, the illegal unit was caught on fire risking the lives of the labourers inside as their exit was blocked for other construction activities. This accident took away the lives of 17 people on January 20, 2018.

- Kamala Mills Fire Tragedies (2017)

The fire started from Kamala Mills – rooftop bar's hookah due to flying ambers which lit the nearby flammable materials such as curtains and other decorative items. The fire moved to the adjacent roofs leaving people in chaos and panic as there was no immediate emergency exits or fire safety equipment. This accident took 14 lives and over 55 injured forcing authorities to recheck the safety norms.

- Dharavi's Cylinder Blast (2021)

A leaking gas cylinder caught fire on a narrow lane opposite Hotel Mubarak on Sunday afternoon (29 August 2021). It was reported that someone dropped a cigarette nearby the gas cylinder leading to a blast affecting the people crossing its path. Two fire engines and one water tanker reached the place to rescue leaving 17 injured.

Year 2011 – 2015

- Nellore Train Fire (30 July 2012)

The fire caused by short-circuits in a sleeper coach endangered the sleeping passengers. It was just a matter of 20 minutes for the fire to spread fast as the train was moving at 70 mph. With very few options to escape, 15 people died and almost 25 saw a near-death escape who luckily used the rear and forward exists.

- Pipeline Explosion – 2014 (Gas Authority of India Limited)

On June 27, 2014, the underground faulty gas pipeline maintained by GAIL got blasted. It is recorded that the adjacent tea owner lit a stove early in the morning resulting in an explosion. Huge flames erupted from the damaged pipeline gutting the nearby houses, stalls and crop fields. 23 people lost their lives and around 40 were severely injured.

Year 2006-2010

- Meerut Trade Fair Fire Accident (2006)

The fire caused by a short circuit lit the 100 m long tent covering the event endangered the visitors due to lack of emergency exits. The incident killed 65 people and injured 150 with several injuries.

Year 2001 – 2005

- Kumbakonam School Fire Accident

Dated on 16 July 2004, this accident took away the lives of 94 innocent students aged from 4 to 10 as the result of a fire that started from the school’s kitchen log while preparing food. It was an easy spread as it was a thatch-roofed 3 storey building. The thatched roof & its supporting bamboo poles were caught on fire; it fell on children also blocking the exit. Madras High court charged and convicted the responsible staff including teachers, department officials and municipal officers.

Year 1995 – 2000

- Uphaar Film Theatre Fire (1997)

This is one of New Delhi's worst tragedies as fire broke out at Uphaar Cinema hall. The smoke emerged from the parking lot but the audience didn't suspect fire as they assumed it was a part of the theatre's effect. But later, they realized that the blaze spread by the leaking oil from the transformers already burnt 27 parked vehicles.

The incident recorded 59 deaths and over 100 people severely injured with the stampede while screening the Bollywood movie, "Border" on June 13, 1997.

So what went wrong?

With extensive precautions, many lives would have been saved. Probably, applying the right safety measures at the right time would have prevented such ill-fated accidents.

Top 5 Reasons for Fire accidents:

- Improper use or storage of flammable materials

Flammable materials should be properly contained in a temperature-controlled ventilated area. Avoid placing the materials near igniting sources & keep them accessible to fire-fighters. All materials must be properly labelled with preventive signs to alert the users or passer-by.

- Unattended and overloaded electrical equipment

Equipment on the use or overnight machinery must adhere to the safety instructions before leaving it unattended. No heavy equipment must be overloaded above its capacity. Regular inspection and optimal usage of equipment will reduce the risks involved.

- Blocked fire exits

This is the topmost cause of many disastrous fire accidents as it restricts the emergency exit during an event. It is advised to conduct mock-drill or periodical inspection/auditing to ensure a less chaotic escape plan from dangers.

Fire exit is the first step of emergency rescue strategy followed for any fire accident. Thereby, it is the duty of every individual to be well-informed about the emergency plan and a systematic way to exit when an incident occurs.

- Defective products/ machinery

Defective products will endanger may cost lives on prolonged usage. It is highly recommended to stop using it and replace it with a better product to avoid its adverse effect. Every product must go through periodical quality inspection and preventive safety actions to safeguard it from dangers.

- Bypassing the safety rules and limitations

After many fire investigations, it is found that not complying with the guidelines of national, regional and municipal laws lead to an unsafe and vulnerable environment. Alternative procedures for a safety method can be implemented with approval in case of temporary conditions.

2. Components Required:

→ Buzzer:

An audio signalling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

Buzzer Pin Configuration

The **pin configuration of the buzzer** is shown above. 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.

→ Arduino UNO:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning an LED, publishing something online.

Arduino UNO is a microcontroller board based on the **ATmega328P**. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

Here you will find the technical specifications for the Arduino UNO R3.

Board	**Name**	Arduino UNO R3
	SKU	A000066
Microcontroller	ATmega328P	
USB connector	USB-B	
Pins	**Built-in LED Pin**	13
	Digital I/O Pins	14
	Analog input pins	6
	PWM pins	6
Communication	**UART**	Yes
	I2C	Yes
	SPI	Yes
Power	**I/O Voltage**	5V
	Input voltage (nominal)	7-12V
	DC Current per I/O Pin	20 mA
	Power Supply Connector	Barrel Plug
Clock speed	**Main Processor**	ATmega328P 16 MHz
	USB-Serial Processor	ATmega16U2 16 MHz
Memory	**ATmega328P**	2KB SRAM, 32KB FLASH, 1KB EEPROM
Dimensions	**Weight**	25 g
	Width	53.4 mm
	Length	68.6 mm

→ Flame sensor:

A sensor which is most sensitive to a normal light is known as a flame sensor. That's why this sensor module is used in flame alarms. This sensor detects flame otherwise wavelength within the range of 760 nm – 1100 nm from the light source.

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.

This sensor/detector can be built with an electronic_circuit using a receiver like electromagnetic radiation. This sensor uses the infrared flame flash method, which allows the sensor to work through a coating of oil, dust, water vapor, otherwise ice.

Features & Specifications

The features of this sensor include the following.

- Photosensitivity is high
- Response time is fast
- Simple to use
- Sensitivity is adjustable
- Detection angle is 600,
- It is responsive to the flame range.
- Accuracy can be adjustable
- Operating voltage of this sensor is 3.3V to 5V
- Analog voltage o/ps and digital switch o/ps
- The PCB size is 3cm X 1.6cm
- Power indicator & digital switch o/p indicator
- If the flame intensity is lighter within 0.8m then the flame test can be activated, if the flame intensity is high, then the detection of distance will be improved.

Applications

These sensors are used in several dangerous situations which include the following.

- Hydrogen stations
- Industrial heating
- Fire detection
- Fire alarm
- Firefighting robot
- Drying systems
- Industrial gas turbines
- Domestic heating systems
- Gas-powered cooking devices

→ 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.

There are different types of jumper wires. Some have the same type of electrical connector at both ends, while others have different connectors. Some common connectors are:

- Solid tips – are used to connect on/with a breadboard or female header connector. The arrangement of the elements and ease of insertion on a breadboard allows increasing the mounting density of both components and jump wires without fear of short-circuits. The jump wires vary in size and colour to distinguish the different working signals.
- Crocodile clips – are used, among other applications, to temporarily bridge sensors, buttons and other elements of prototypes with components or equipment that have arbitrary connectors, wires, screw terminals, etc.
- Banana connectors – are commonly used on test equipment for DC and low-frequency AC signals.

- Registered jack (RJnn) – are commonly used in telephone (RJ11) and computer networking (RJ45).
- RCA connectors – are often used for audio, low-resolution composite video signals, or other low-frequency applications requiring a shielded cable.
- RF connectors – are used to carry radio frequency signals between circuits, test equipment, and antennas.
- RF jumper cables - Jumper cables are a smaller and more bendable corrugated cable which is used to connect antennas and other components to network cabling. Jumpers are also used in base stations to connect antennas to radio units. Usually the most bendable jumper cable diameter is 1/2".

→ Arduino power Adapter:

All Arduino boards need electric power to function. A power supply is what is used to provide electric power to the boards and typically can be a battery, USB cable, AC adapter or a regulated power source device.

There are different ways to power your Arduino board. The most common way is through the USB connector available on every board, but there are a few other possibilities to power your board. If you like to know more about this, the different ways to supply power to your board are listed below:

- USB

Arduino boards can operate satisfactorily on power that is available from the USB port. It provides 5V DC voltage and can be sourced from the port from a PC, wall socket adapter or portable power bank.

- AC socket

Some Arduino boards like UNO, MEGA and DUE, come with an AC socket that can be used to power the boards and to supply additional voltage if needed. A power supply adapter that provides from 7 to 12V (Volts) of DC (Direct Current) is required. The adapter is plugged onto the wall socket and the other end goes directly onto the board's AC socket.

If you find that additional power is required from your Arduino board to operate it properly, or if you need to operate the Arduino board disconnected from a USB port.

The AC adapters are commonly available in retail stores for use with consumer products are often suitable, but make sure that it has the proper

connector for plugging into the power socket on your Arduino board: **5.5mm** diameter cylindrical plug with **2.1mm** pin hole, and that provides Positive voltage on the inside pin hole and Negative (or common/ground) voltage on the outside cylindrical sleeve of the connector plug.

- Battery

Some boards come with a Li-Po (Lithium-ion Polymer) battery socket that fits this kind of batteries. For example, MKR boards (except MKR FOX and WAN 1300) come with this feature. These types of batteries supply 3.7V, are rechargeable and they can provide higher energy than other lithium batteries.

Please make sure the battery connector suits your board's battery connector. For MKRs the connector is JST PHR-2.

- VIN

Another way to power your board is by supplying voltage from a regulated power source directly to the VIN pin. Just need to connect the positive wire from your power supply to VIN and the negative to GND. Follow your board power specifications to figure out the voltage range that your board can handle.

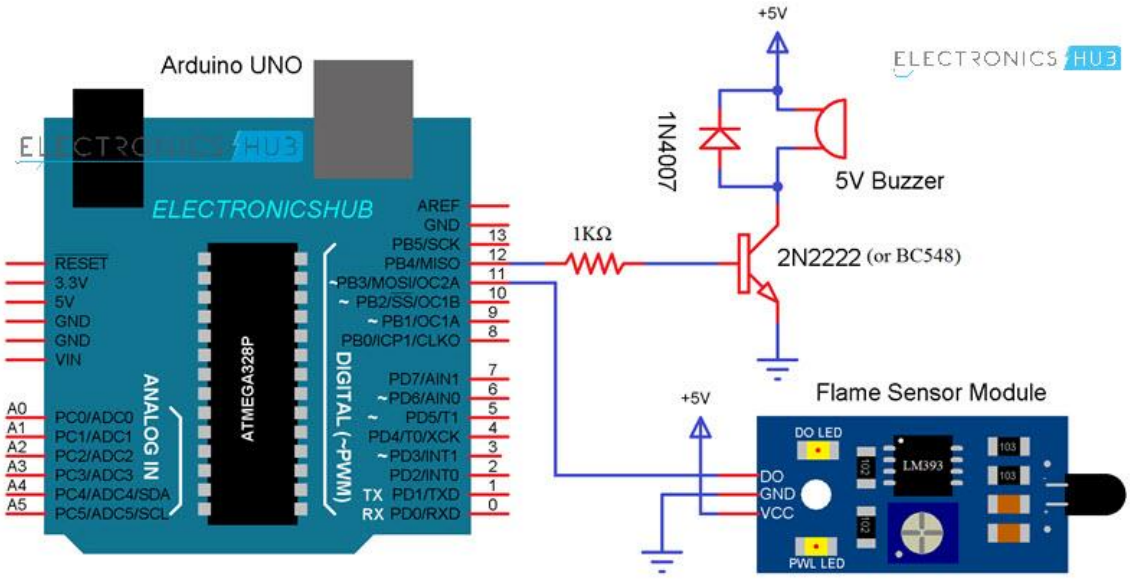
VIN pin is an INPUT only.

- Screw terminal (only MKR FOX and WAN 1300)

These boards come with a screw terminal for a pair of either AA or AAA batteries where to plug a 3V battery pack (not included). Make sure you respect the polarity of the connector as labelled on the board.

For most applications, 1A (Amp) of current supply capacity is sufficient, but you may find that you'll need more if you have a specific Shield module that needs it, or a stack of several Shield modules that along with the Arduino board draws a higher total current.

3. Circuit Diagram:



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.

The Buzzer is driven through Digital I/O 12 pin of Arduino UNO.

4. Source 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 hardware to upload programs and communicate with them.

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. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right-hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

 *Verify* Checks your code for errors compiling it.
 *Upload* Compiles your code and uploads it to the configured board. See uploading below for details.
 *New* Creates a new sketch.
 *Open* Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.
 *Save* Saves your sketch.
 *Serial Monitor* Opens the serial monitor.

Additional commands are found within the five menus:
File, **Edit**, **Sketch**, **Tools**, **Help**. The menus are context sensitive, which means only those items relevant to the work currently being carried out are available.

```
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);
}
```

5. Working:

- Firstly, we have to take the Arduino UNO and a Buzzer and a Flame sensor
- The Vcc pin of flame sensor is connected to Vcc pin of Arduino UNO
- Ground pin of flame sensor is connected to GND of Arduino UNO
- DO(output) of sensor is connected 8 th pin of Arduino UNO
- Then moving to Buzzer positive of buzzer is connected to 9th pin Arduino UNO
- Negative of buzzer is connected to GND of Arduino UNO.

6. Conclusion:

In this way we have done our project and we are trying to design this project as a working model in future.
We would like to implement many more functionalities to our current prototype.