

ABSTRACT

The Project mainly focuses on the development of an automatic and unmanned firefighting robot designed to detect and extinguish fires. Fire accidents can occur in homes, workplaces, factories, or labs, making it crucial to have an effective system to handle such emergencies. Current systems, like smoke detectors, have limitations such as difficulty detecting small fires and insufficient coverage of water sprinklers. Additionally, they do not provide precise fire location information, leading to delayed responses. The proposed model, “Automatic Firefighting Robot with SMS Notification,” addresses these issues. It is easily deployable, operates wirelessly, detects small fires, and notifies users about fire incidents and their locations. The robot detects fire using thermal and IR sensors and moves toward the fire source to extinguish it using a water spray.

TABLE OF CONTENTS

Sl. No	Contents	Page No.
1	INTRODUCTION	01
2	LITERATURE REVIEW	02 - 04
3	PROBLEM STATEMENT AND OBJECTIVES	05
4	WORKING METHODOLOGY & IMPLEMENTATION PLAN Hardware/Software Requirements Tools and Technologies Used Implementation strategy	06 - 10
5	RESULT AND DISCUSSION	11
6	CONCLUSION AND FUTURE SCOPE	12-13
7	REFERENCES	14

CHAPTER 1

INTRODUCTION

Background of the Project:

In today's world, the integration of robotics with emergency response systems has become crucial for ensuring quick and efficient handling of critical situations like fires. The "Fire Fighter Robot with SMS and Notification" project aims to develop a robotic system that can autonomously navigate through a fire-prone area, detect fires, and notify authorities and emergency contacts via SMS.

Robots with different features, which are facilitated by different sensors that detect before the fire is out, every day, aims to develop microcontroller-based firefighting robot, nowadays the robot industry becomes visible as a model that is produced as an alternative to the human element in a new branch. Flying robots, wheeled robots, legged robots, humanoid robots, and underwater robots are some kinds of them. The growing world population is bringing involuntary problems together. Among all the problems Fires most important. The robotic industry has a lot of work in this area. Some of these are fixed mobile fire search and rescue equipment, mobile locating robots used for fire detection, and fire extinguishing robots in many different models designed to help firefighters in the fire. During the design and development of the mechanical system; draft drawings, measurements, computer-aided design, and solid modelling programs.

The fire security of the home, office, and building is important to human life. A fast response to detect the small fire can avoid unpredictable damage and losses to human. However, it is difficult to detect the small fire in the location that is hard to reach or see by a human. The human also takes more time to find the water source to extinguish the fire. This will cause the fire to be spread quickly, which can increase death. Hence, to extinguish the fire within a short period of time and reduce the damage, an automatic fire fighting robot is proposed. Fire safety is a matter of critical concern. Fires, both small and large, can cause devastating harm to lives and property

CHAPTER 2

LITERATURE REVIEW

- [1] "Fire Fighting Robot with SMS Alert System." Swapna Raghunath, Meghana Sara, NallapuRashmitha, Manisha Puneria. (Volume 11 Issue XI Nov 2023)**

The robot aims to detect fires and extinguish them while sending an SMS alert to a specified phone number. To detect fires, the robot uses flame sensors. These sensors are equipped with an Infrared Receiver (Photodiode) designed to identify the presence of a fire. In the occurrence of a fire, the emission of Infrared light from flames is detected by the IR Receiver integrated into the sensor. An operational amplifier (Op-Amp) is utilized to monitor voltage variations across the IR Receiver. Consequently, if the sensor detects a fire, it induces a 0V (LOW) signal at the output pin. Conversely, in the absence of a fire, the output pin maintains a 5V (HIGH) signal. These sensors will be connected to the Arduino board, which will continuously monitor the sensor readings. If the flame sensor detects IR rays from the flames or fire, the Arduino will consider it as a fire indication.

- [2] " Arduino Fire Fighting Robot with SMS & Call Alert." Mr. S.Y. Divekar, Ms. Asmita Pravin Ahirrao, Mr. Uday Dadasaheb gale, Mr. Yash Sandeep Bhagyawant, Ms. Rupa Mohan Gole. (Volume 12, Issue 4, April 2023).**

According to National Crime Records Bureau (NCRB), it is estimated that more than 1.2 lakh deaths have been caused because of fire accidents in India from 2010-2014. Even though there are a lot of precautions taken for Fire accidents these natural/man-made disasters do occur now and then. In the event of a fire breakout, to rescue people and put out the fire we are forced to use human resources which are not safe. With the advancement of technology especially in robotics it is very much possible to replace humans with robots for fighting the fire. This would improve the efficiency of firefighters and would also prevent them from risking human lives. In this project, we will learn how to build a simple robot using Arduino that could move towards the fire and pump out water around it to put down the fire. It is a very simple robot that would teach us the underlying concept of robotics; you would be able to build more sophisticated robots once you understand the following basics. So let's get started. This advanced firefighting robotic system independently detects and extinguishes fire. In the age of technology, the world is slowly turning towards the

automated system and self-traveling vehicles, firefighters are constantly at risk of losing their life. Fire spreads rapidly if it is not controlled. In case of a gas leakage there even may be an explosion. So, in order to overcome this issue, and safeguard lives of our heroes, our system comes to the rescue.

[3] "Ardiuno based firefighting robot" Mr. KondetiChirunadh, Mr. G. Sai Varaprasad Goud, Miss. G. Tejaswini, Mr. B. Srinivasa Rao (Volume:05/Issue:06/June-2023) Srinivasa Rao (Volume:05/Issue:06/June-2023)

The design of the firefighting robot Flame detectors represent one of the major types of automatic detection method and imitate the human sense of sight. They are the line of sight devices that operate on either an infrared, ultraviolet or combination principle. As radiant energy in the approximate 400 to 700 nanometers range occurs, as indicative of a flaming condition, the sensing equipment recognizes the fire signature and sends a signal to the fire alarm panel. Kim etal had studied a fire alarm vision system based on flame detection algorithm of infrared images. From their studies, the presented flame detection algorithm measures the luminance variation of candidate flame blocks of the infrared image, then calculates the luminance variation value to determine the existence of fire. By using the test images, they performed the simulation of flame detection algorithms and tested the implemented fire alarm vision system. The basic elements of this firefighting robot are the three flame sensors that monitor the temperature continuously. When the fire is detected, it is extinguished by water in the tank attached to the robot. But, if the temperature of the fire site is above 40oC, the alarm will be ringing so that the operator can control the firefighting robot to go back and avoid the damage of it.

[4] "Robotic Fire Fighting Vehicle with GSM SMS And Call Alert" JONAH A. WABBA, FELIX I. EGBUJO (Volume 7, Jan 2024)

Technology today is fast evolving and has led to the automation of many processes and tasks to make life easier and safer for humans. In today's world, machines, otherwise known as robots, are being used to perform specific tasks that may be dangerous or difficult for humans to carry out efficiently. Problem Statement The level of damage caused by fire accidents in homes, offices, laboratories, factories, etc., demands that more ways of securing these facilities from fire incidents and outbreaks be developed. Placing humans in charge of

detecting and monitoring buildings for fire incidents is not reliable enough. Aim of the Project This project is aimed at the design and implementation of a robotic fire-fighting vehicle that has an embedded GSM SMS and call alert system with the following objectives; 1) To program an Arduino to enable communication between sensor modules and interconnected digital components. 2) To design and construct a robotic vehicle with flame detection abilities to detect fire within its vicinity and navigate automatically to where the flame is to extinguish the fire. 3) To implement a GSM SMS and Call alert system to notify home and office owners of fire detected by the robotic fire fighting vehicle. Scope of the Project This project is confined to the following scopes; 1) The robotic vehicle will be able to detect fire within a distance of 0-50cm in front and behind it. 2) The robotic vehicle will be able to automatically navigate to the detected fire, stop at a distance of about 5cm from the fire, and attempt to extinguish the fire using a built-in water pump system

CHAPTER 3

Problem Statement

To develop a Fire Fighting Robot that integrates Fire accident detection, a SMS Notification based emergency alerts to enhance safety.

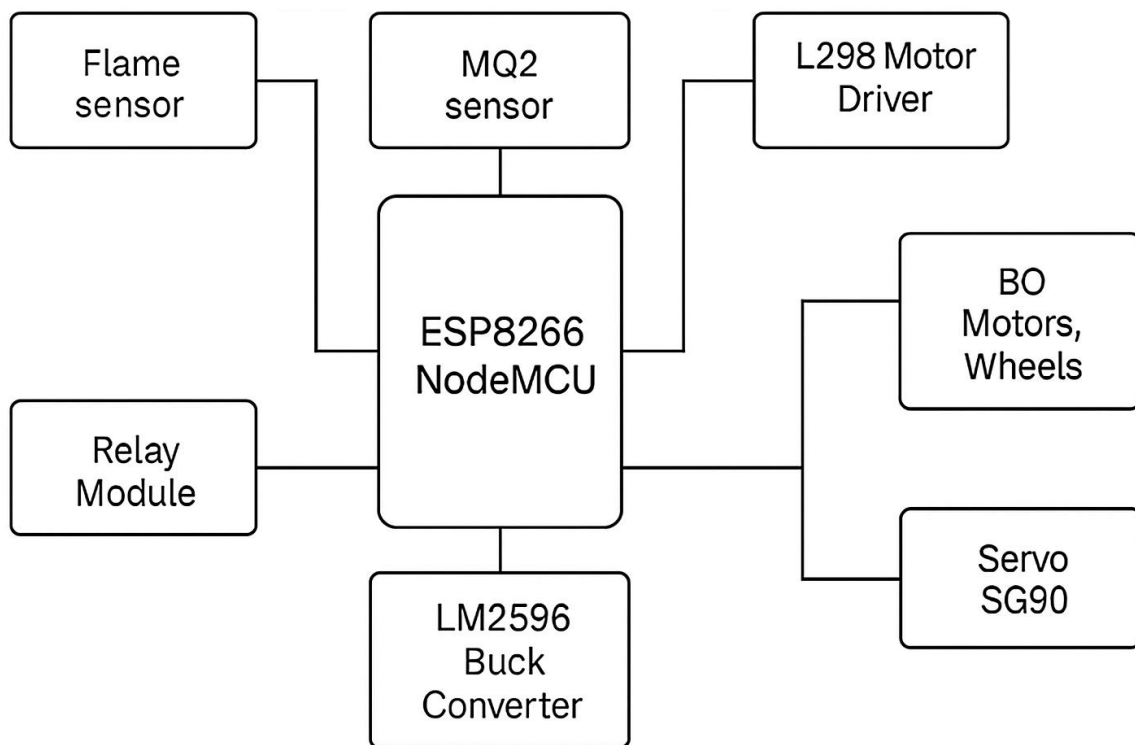
Objectives of the Project

1. Detect fire incidents using flame sensors to ensure early identification of fire hazards.
2. Send automated SMS Notification To contacts or authorities upon detecting a fire, ensuring timely intervention.
3. Automatically suppress fire using a water pump upon fire detection

CHAPTER 4

WORKING METHODOLOGY

To develop a fire-fighting robot with SMS and Notification capabilities, methodology would several key steps, including design, hardware selection, software development, and communication protocols. Detect fire in an indoor environment, navigate towards the fire extinguish it and, and send alerts via SMS Notification. Equip with water pumps to, extinguish fire. Selected a MCUESP8266 to process data and control components. Developed the Embedded C code to process sensor data and detect fire incidents. Implement control algorithms for navigating the environment and avoiding obstacles. Integrate the app module with the microcontroller for communication. Set up SMS Notification, including the content of messages



4.1 BLOCK DIAGRAM

Fire Fighting Robot

Fig 3.1 shows the circuit diagram of fire fighter robot, this circuit diagram only for reference. The circuit diagram shows a fire-fighting robot using an NodeMCU, powered by two 18650 batteries. The batteries power the motors and the Arduino via a relay module, which also controls the pump. The ESP8266 manages three flame sensors and an MQ2 gas sensor for fire and smoke detection respectively. A 5V-powered servo motor provides directional control. Mobility is handled by an L298N motor driver for two DC motors, powered by a 4.3V L regulator, sends alerts via SMS. This setup allows the robot to detect fire, move towards it, the water pump, and send notifications.

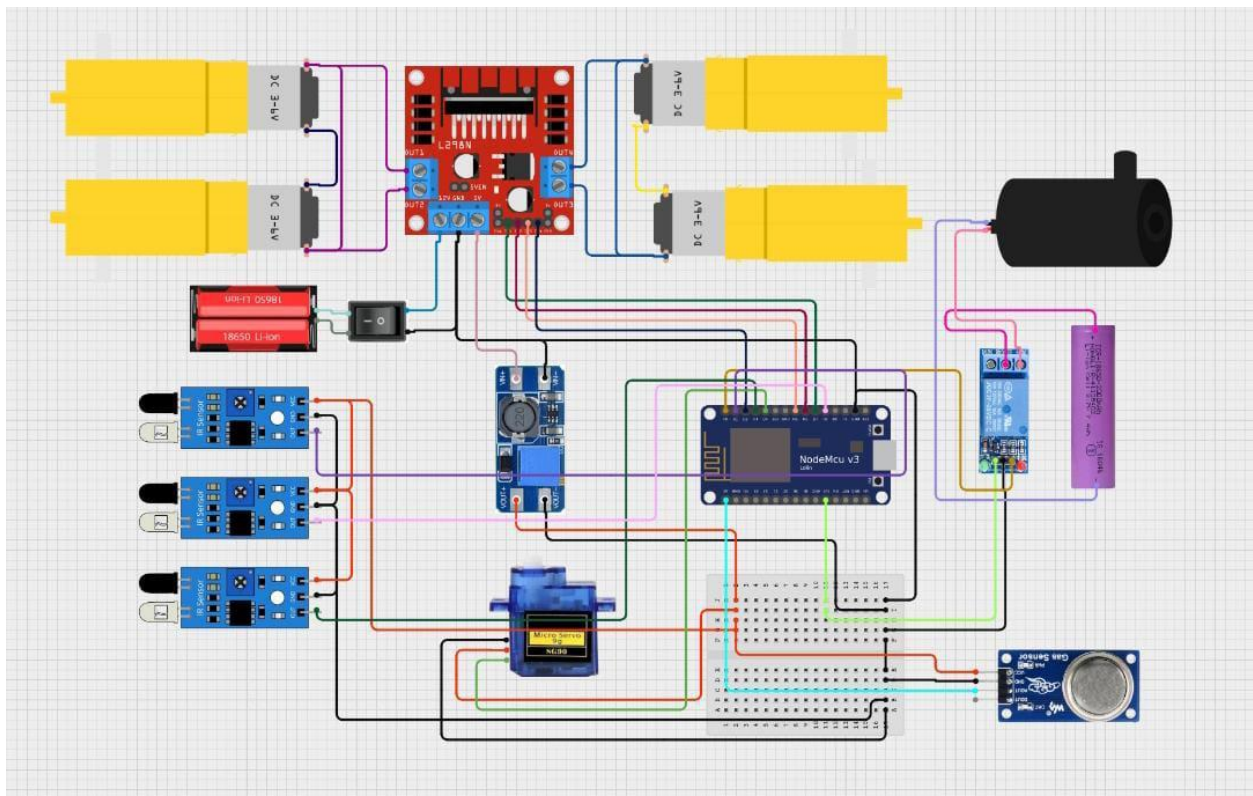


Fig 4.2 Pin Diagram

FLOWCHART

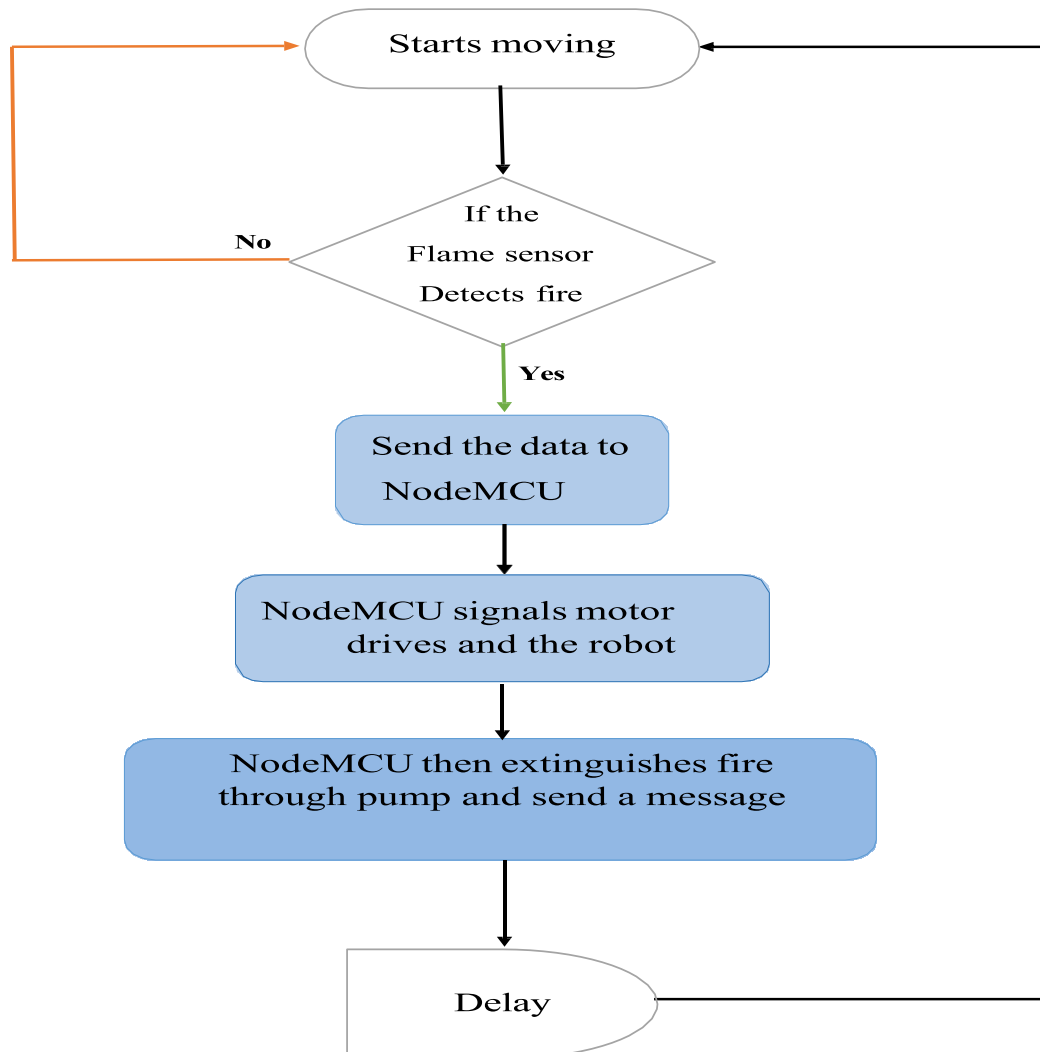


Fig 4.3: Flow chart

IMPLEMENTATION PLAN

Hardware/Software Requirements

Hardware Requirements:

- NodeMCU ESP8266
- Flame sensor
- MQ2 sensor
- L298 motor Driver
- Relay Module
- LM 2596 Buck Convertor
- Servo sg 90
- Mini Water pump(5v)
- BO Motors, Wheels

Software Requirements:

Arduino IDE

➤ **user Interface:**

- Editor: A text editor for writing code (also called sketches).
- Message Area: Displays error messages and feedback.
- Text Console: Displays detailed information while uploading and running code.

➤ **Code Writing and Compilation:**

- Sketches: Arduino programs are called sketches and are written in a language similar to C++.
- Libraries: A wide range of libraries are available to add functionality to sketches, such as handling sensors, displays, and communication protocols.
- Upload Button: Sends the compiled sketch to the connected NodeMCUESP8266 via USB.

➤ **Serial Monitor:**

- A built-in tool that allows for communication between the NodeMCUESP8266 and the computer.

Implementation Strategy

1. Component Testing

Testing individual components for accuracy and communication with NodeMCUESP8266.

2. Sensor & Module Integration

Connecting sensors,

3. Code Development & Calibration

Writing firmware and fine-tuning sensor thresholds.

4. Prototype Assembly

Embedding the system into a Robot with proper wiring.

5. Testing & Debugging

Conducting tests and refining detection accuracy.

6. Optimization & Power Management

Enhancing battery life and system efficiency.

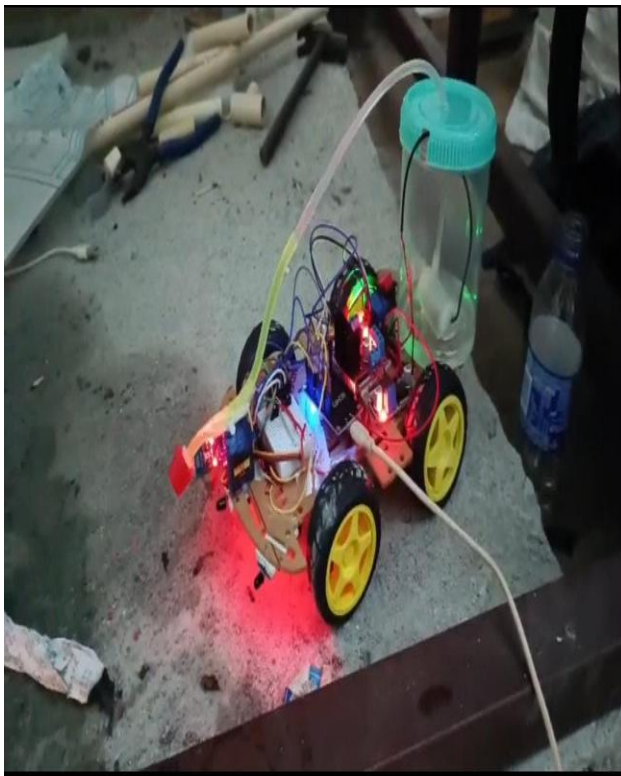
7. Documentation & Final Demo

Preparing reports and presenting the working prototype.

CHAPTER 5

RESULT AND DISCUSSION

The project has successfully addressed its core objectives and achieved its main goals by providing important results and insights through the implemented methods. The system effectively detects and responds to fire incidents, demonstrating its reliability and efficiency. To further enhance safety and response capabilities, integrating sensors to detect hazardous chemicals and toxic gases can be beneficial, allowing for more specialized and precise actions. Additionally, utilizing multiple communication channels such as social media, email, and emergency broadcast systems can help reach a broader audience quickly, ensuring timely alerts. Moreover, incorporating advanced algorithms can enable the robot to make more complex decisions autonomously, such as prioritizing fire sources or identifying potential structural hazards, further improving its effectiveness in fire emergencies.



5.1 Fire Detection Robot



5.2 SMS Notification

CHAPTER 6

CONCLUSION

Fire Fighting Robot project successfully met its primary objectives of detecting and extinguishing fire hazards autonomously while providing real-time SMS Notification alerts. By integrating flame and gas sensors with a NodeMCU ESP8266 microcontroller, the robot can efficiently identify fire sources and respond promptly using a water pump system. The system enhances safety in fire-prone environments and minimizes the need for human intervention during emergencies. The project demonstrates how embedded systems, automation, and IoT can work together to create an effective solution for real-time fire detection and control.

FUTURE ENHANCEMENT

- The project has successfully addressed the core objectives outlined at the start.
- This work has achieved its main goals. It has provided important results and insights using the methods.
- Sensors to detect hazardous chemicals and toxic gases can enhance safety and allow for more specialized responses.
- Using multiple communication channels (social media, email, emergency broadcast systems) to reach a broader audience quickly
- Advanced algorithms can enable the robot to make more complex decisions autonomously, such as prioritizing fire sources or identifying potential structural hazards.

CHAPTER 7

REFERENCES

- [1] "Fire Fighting Robot with SMS Alert System." Swapna Raghunath, Meghana Sara, NallapuRashmitha, Manisha Puneria. (Volume 11 Issue XI Nov 2023)
- [2] " Arduino Fire Fighting Robot with SMS & Call Alert." Mr. S.Y. Divekar, Ms. Asmita Pravin Ahirrao, Mr. Uday Dadasaheb gale, Mr. Yash Sandeep Bhagyawant, Ms. Rupa Mohan Gole. (Volume 12, Issue 4, April 2023).
- [3] "Ardiuno based firefighting robot" Mr. KondetiChirunadh, Mr. G. Sai Varaprasad Goud, Miss. G. Tejaswini, Mr. B. Srinivasa Rao (Volume:05/Issue:06/June-2023) Srinivasa Rao (Volume:05/Issue:06/June-2023)
- [4] "Robotic Fire Fighting Vehicle with GSM SMS And Call Alert" JONAH A. WABBA, FELIX I. EGBUJO (Volume 7, Jan 2024)
- [5] Md. Mahmudul Hasan and Nayeem Al-Tamzid Bhuiyan, "A multi-sensor based firefighting robot with wireless control and visual system," Recent Research in Science and Technology, vol. 12, no. 10, pp. 6-13, 2020.
- [6] J Jalani, D Misman, A S Sadun and L C Hong, "Automatic fire fighting robot with notification," Materials Science and Engineering, vol. 12, no. 02, p. 637, 2019.
- [7] Sushrut Khajuria, Rakesh Johar, Varenym Sharma and Abhideep Bhatti, "Arduino Based Fire Fighter Robot," International Journal of Scientific Engineering and Research (IJSER), vol.

