**Fire-Fighting Robot With SMS & Call Alert**



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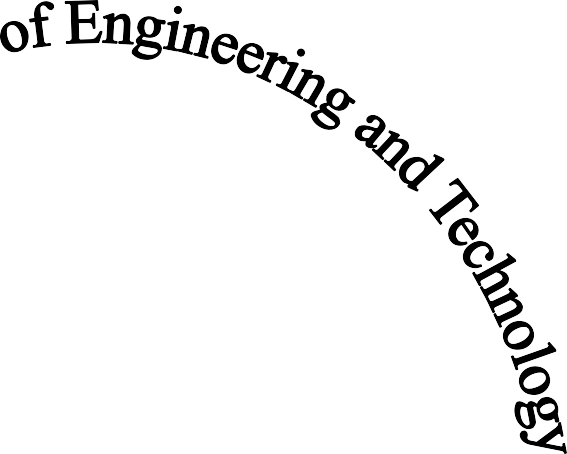
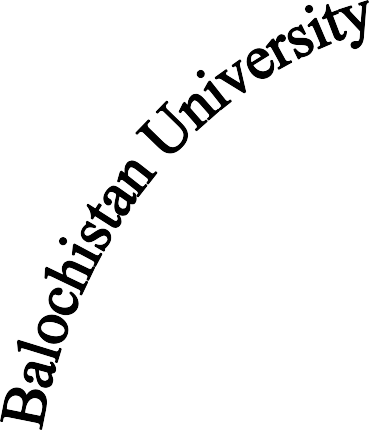
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Submitted in partial fulfillment of the requirement for the degree of Bachelor of Engineering in Computer Systems



Khuzdar

CSE&S Department

***Certificate***

This is certified that the work presented in this project thesis on **“Fire-Fighting Robot With SMS & Call Alert.”** is entirely written by the following students themselves under the supervision of **Engr Sher Muhammad.**

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Fire-Fighting Robot With SMS & Call Alert

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Bachelor of Engineering (Computer Systems Engineering)

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This dissertation is dedicated to my family for their endless support and encouragement.

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**ABSTRACT**

Fire risks are a common occurrence in developing countries like Pakistan, which results in the yearly loss of both human lives and property. Pakistan is one of these development nations. Fire emergencies occur when human involvement is not possible within the appropriate period or when the fire is situated in a risky and perilous environment that offers a major risk to human life and prohibits efficient fire suppression operations. Both of these scenarios are examples of conditions that may lead to a life-threatening crisis. There is a strong possibility that the design and development of a fire-fighting robot might provide a meaningful answer for society, therefore making a contribution to the protection of human lives.

The suggested system makes use of flame sensors for the purpose of detecting fire hazards, and a microcontroller is employed for the purpose of evaluating the data collected from these sensors and making educated judgments on the right steps to be taken in order to manage the fire danger. Initiation of the fire extinguisher robot is accomplished by the user via call and sms. The action in question causes a pump mechanism to become active, which in turn makes it easier to spray water onto the flames. The use of a servo motor allows for the synchronization of the direction in which the water's output is directed.

There are three flame sensors that are included in the robot's configuration. Each of these sensors has its unique purpose and is coordinated by esp32. A fire will be detected by the flame sensor, which will cause the servo motor to spin toward the source of the fire, the robot is designed to come to a halt before it comes into contact with the flame. In addition to this, the robot is able to put out fires at angles of 45 degrees for the top side and 45 degrees for the bottom side. In addition, the robot is equipped with an ultrasonic sensor that allows it to navigate around obstacles.

A real-time firefighting robot that travels at a constant pace, locates the source of the fire, and then extinguishes the fire with the assistance of a pumping mechanism is the subject of this

Project, which aims to provide information about such a robot. Not only does it have a small body and a lightweight construction, but it also has advantageous characteristics such as the capacity to automatically identify the location of a fire. The following is a list of some of these many qualities. It is possible to operate the robot in areas that have limited access or in locations that are constrained in space due to the fact that its construction is so small. This is due to the fact that there is a restricted number of people who may enter. In addition to the avoidance of epidemics and the provision of assistance to firefighters, the technology has the potential to be beneficial in a variety of other scenarios as well.

**TABLE OF CONTENTS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CHAPTER** | | | | **TITLE** | **PAGE** |
|  | | | |  |  |
|  | | **DECLARATION** | | | **ii** |
|  | | **DEDICATION** | | | **iii** |
|  | | **ACKNOWLEDGMENT** | | | **iv** |
|  | | **ABSTRACT** | | | **v** |
|  | | **TABLE OF CONTENTS** | | | **vi** |
|  | | **LIST OF FIGURES** | | | **xii** |
|  |  | | | |  |
| **1** | **INTRODUCTION** | | | |  |
| **1.1** | | **Introduction** | | **1** |
| **1.2** | | Problem Statement | | **2** |
| **1.3** | | Motivation | | **3** |
| **1.4** | | **Existing System**  **4** | | **3** |
|  | **1.5 Objectives of the project**  **4**  **1.6 Scope of the project  1.7 Expected Results**  **4** | | | |  |
| **2** | **LITERATURE REVIEW** | | | |  |
| 2.1 | | Introduction | | **6** |
| 2.2 | | Autonomous Firefighting Robot with Sensor-Based | |  |
| **2.3** | | Detection and Extinguishing Mechanism | | **6** |
|  | | Fire Detection and Control Using Arduino-Based Robotics | | **7** |
| 2.4 | | GSM-Based Fire Alert System for Automated | |  |
|  | | Firefighting Robots | | **7** |
| 2.5 | | Intelligent Fire Detection System with Mobile | |  |
|  | | Communication | | **7** |
| 2.6 | | Mobile Robot for Fire Detection and Suppression | |  |
|  | | in Indoor Environments | | **8** |
| 2.7 | | IoT-Based Firefighting Robot with Real-Time | |  |
|  | | Monitoring | | **8** |
| 2.8 | | Development of an Autonomous Firefighting Robot | |  |
|  | | with Multi-Sensor Integration | | **8** |
| 2.9 | | AI-Based Fire Detection and Response System | |  |
|  | | for Autonomous Robots | | **9** |
| 2.10 | | GSM and IoT-Based Smart Firefighting Robot | |  |
|  | | for Remote Monitoring | | **9** |
| 2.11 | | Wireless Communication-Based Fire Extinguishing | |  |
|  | | Robot | | **9** |
| 2.12 | | Arduino-Controlled Fire Detection Robot with Water | |  |
|  | | Sprinkler System | | **10** |
| 2.13 | | Smart Firefighting Robot with Obstacle Avoidance | |  |
|  | | and Fire Mapping | | **10** |
|  |  | | | |  |
| **3** | **METHODOLOGY** | | | |  |
| 3.1 | | Introduction | | **11** |
| 3.2 | | Conceptual design | | **12** |
| 3.3 | | Hardware selected | | **12** |
|  | | Arduino Microcontroller | | **12** |
|  | | Servo Motor | | **13** |
|  | | Flame Sensor **14**  **14** | | **14** |
|  | | GSM 800L12V Water Pump **15** L293 Motor Driver **3.3.7 Lm2596s** | | **14** |
| 3.4 | | Software selected | | **15** |
|  | | 3.4.1 Arduino Ide | | **15** |
|  | | 3.4.4 MS Word for report writing | | **15** |
| 3.5 | | Design | | **16** |
| 3.6 | | Block Diagram | | **17**  **17** |
| 3.8 | | Debugging | | **18** |
| 3.9 | | Coding | | **18** |
| 3.10 | | Flowchart Diagram | | **24** |
|  | |  | |  |
| **4** | **RESULTS** | | | |  |
| 4.1 | | Introduction | | **25** |
| 4.2 | | System Startup | | **25** |
| 4.3 | | Detection on Front Side | | **26** |
| 4.4 | | Detection on Right Side | | **27** |
| 4.5 | | Detection on Left Side | | **28** |
| 4.6 | | Conclusion | | **28** |
| 4.7 | | Future Work | | **29** |

**3.7 Installation**

**REFERENCES 30**

**SDG GOALS 32**

**LIST OF FIGURES**

**FIGURE TITLE PAGE**

[**3.1 Arduino 13**](#_Toc188285748)

[**3.2 Servo Motor 14**](#_Toc188285749)

[**3.3 Flame Sensor 19**](#_Toc188285750)

[**3.4 Gsm 800l 15**](#_Toc188285751)

[**3.5 12V Water Pump 16**](#_Toc188285752)

**3.6 L293 Motor Driver 16**

**3.7 Lm2596s 17**

**3.8 Arduino Ide Interface 18**

**3.9 Design 19**

**3.10 Block Diagram 20**

**3.11 Flow Chart 27**

**4.1 Start button project 29**

**4.2 Detection on front side 29**

**4.3 Detection on right side 30**

**4.4 Detection on left side 31**

**4.5 Sustainable Development Goals Courtesy Caritas 35**

**CHAPTER 1**

**INTRODUCTION**

**1.1 Introduction**

Individuals, in reaction to the development of technology, are the ones who are often the driving force behind the installation of automated processes or systems. It has been determined that the automation system is dependable and serves the organization's aim in an efficient manner. Over the last several years, the fire extinguishing business has seen a dramatic rise in the number of occupational dangers that its workers is exposed to. For the purpose of protecting fire extinguishing professionals from the dangers of burns and the inhalation of poisonous fumes and volatile chemicals, fire-fighting robots have been used. This is especially important in instances when there are restricted and constricted places. The use of these robotic devices is an essential component in the process of making the workplace safer for individuals who are engaged in the fire suppression industry.

A robot machine is a term that is used in the realms of science and business to describe an electromechanical device that is used for the aim of automating human operations or carrying out certain activities. It often has the capacity to interact with its surroundings and visually imitate a human person, as well as the capability to carry out its duties in a way that is like to that of a human. The term "robotic unit" is occasionally used to refer to a computer that is more sophisticated and can be customized to meet the requirements of an individual. Within the realm of modern engineering, the field of robotics has recently seen a breakthrough that is of great significance. As a result of their increased mobility, robot legs and artificial hands are able to move about freely throughout the production line. To be more specific, robot legs demonstrate extraordinary agility, which enables them to do basic operations such as welding and painting in a more expedient manner.

In the event that the robotic entity is faced with a fire problem, it is able to efficiently extinguish the flames by using a pump motor that is attached to a reservoir that is filled with water and is strategically positioned on its structural framework. When the buzzer is engaged following the detection of a signal, it indicates the existence of a fire incident by the tone that is released. There is a considerable worry in the modern day about the topic of fire protection. The investigation and development of a wide variety of firefighting strategies is now being carried out by a large number of authors.

**1.2 Problem Statement**

It is well known that fires can kill a lot of people and destroy a lot of property. Firefighting robots will be useful for putting out fires in places where firefighters can't reach or work because of high temperatures or the presence of possibly dangerous materials. So, it can make people less likely to get hurt in a fire.

It is essential for human existence that the house, laboratory, office, industry, and building all have good security measures in place. A fire prevention robot that is equipped with a sensor is included into the security system that we create. We are able to be notified of any odd or hazardous condition that is detected by the security system. In the first step of the process, we create a fire defense robot equipped with an extinguisher for the intelligent system. In addition, it was rather difficult for humans to identify the minor burns that were caused by electrical equipment. This is the amount of time that the user takes to put out the fire. It is possible for the user to spend a long time to put out a fire, such as searching for a supply of water capable of putting out a fire when they wish to put out the fire. There are challenges associated with detecting the fire in areas that are tiny and in locations that are difficult for the user to access. There are occasions when difficult fires are extinguished, such as when places are difficult to view. In addition to the expense, the loss that was incurred in the case of a fire that was sluggish to act.

In spite of the fact that the men and women who work in the fire department are well-equipped and have received extensive training, the majority of the time, as a result of the unexpected environment that fires produce, the firefighters end up being hurt or even dying while they are doing their responsibilities.

In the contemporary technological space, this is something that is not desirable. In order to ensure that their job is both safe and effective, firefighters should be provided with improved working conditions.

**1.3 Motivation**

In the course of their efforts to save lives and preserve property from flames, firefighters put their lives in danger in order to react as fast as possible to fires. They do all in their power to save lives and safeguard property. There have been a few efforts made to automate firefighting for the navy (Shipboard Autonomous Firefighting Robot, n.d.), (firefighting robot,) and those attempts have been unsuccessful.

**1.4 Existing System**

Traditional firefighting techniques often make use of fire brigades, hand-held extinguishers, and sprinklers. Traditional response times are notoriously long because of factors such as the time it takes to dispatch the fire department, navigate heavy traffic, and arrive at the scene of the accident. Additionally, portable extinguishers aren't exactly a lifesaver because they're usually stashed in inconvenient spots and require regular servicing. But, if the sprinkler pipes are defective, they won't be able to provide enough pressure to adequately protect big areas, making the smoke detector and sprinkler system a very unreliable option.

**1.5** **Objectives of the Project**

The objectives of the project are as below:

* To Build a robot that can detect fire and send SMS or call alerts to the owner.
* To Design a system that sprays water to put out the fire automatically.

**1.6** **Scope of the Project**

The aim of this project is to develop a functional prototype of a **firefighting robot with an SMS and call alert system**. This involves the **design and assembly of hardware components,** including flame sensors, a motor driver, a relay circuit, and a water pump. The project also includes the **integration of software modules** for fire detection, autonomous movement, and real-time communication via a **GSM module.** Additionally, the system will be tested for **fire detection accuracy, suppression effectiveness, and response time**, ensuring reliable performance in emergency situations.

**1.7 Expected Results**

The following are the outcomes that are anticipated from this project:

* The ability to search, locate, and extinguish flames in regions that have been burnt.
* Put out the fire on the wall at an angle of 90 degree on top side.
* The robot is capable of turning through a full 360 degrees.
* Using the red led, send a notice to the recipient

inconvenient spots and require regular servicing. But, if the sprinkler pipes are defective, they won't be able to provide enough pressure to adequately protect big areas, making the smoke detector and sprinkler system a very unreliable option.

**CHAPTER 2**

**LITERATURE REVIEW**

1. **Introduction**

In this section, the previous research and progress on Firefighting Robot with SMS and Call alert will be summarized. Firefighting Robot with SMS and Call alert are explained in details regarding the various functionalities and technologies integrated into it and their development throughout time.

1. **Autonomous Firefighting Robot with Sensor-Based Detection and Extinguishing Mechanism**

The authors developed an autonomous firefighting robot that detects and extinguishes fires using flame sensors and a water pump system. The robot utilizes infrared flame sensors to locate fire sources and then navigates toward them using a motorized platform. A relay-controlled water pump is used to extinguish the fire. The paper highlights the challenges in fire detection accuracy and proposes improvements using machine learning-based sensor fusion techniques for better reliability. (M. K. Reddy, 2021).

1. **Fire Detection and Control Using Arduino-Based Robotics**

This study presents an Arduino-controlled robotic system designed to detect and suppress fires. The system integrates a combination of temperature and flame sensors to identify fire outbreaks. Once a fire is detected, the robot moves towards the fire source and activates an extinguisher mechanism. The authors discuss the effectiveness of using GSM modules for remote alerts and suggest integrating IoT for real-time monitoring and improved response time. (A. Singh, 2020).

1. **GSM-Based Fire Alert System for Automated Firefighting Robots**

In this research, a fire detection system using a GSM module is explored to provide real-time SMS and call alerts to users. The robot, controlled by Arduino, detects fire through multiple flame sensors and autonomously moves to extinguish it. The paper highlights the importance of real-time notifications and suggests further improvements, such as integrating GPS for location tracking and response coordination. (R. Ahmed, 2022).

1. **Intelligent Fire Detection System with Mobile Communication**

The study proposes an intelligent firefighting robot that combines fire detection with remote communication capabilities. The robot uses flame sensors for fire detection and an Arduino-based controller for movement and water spray activation. The GSM module enables remote alerts via SMS and calls, ensuring timely human intervention. The study discusses challenges like sensor accuracy and proposes deep learning algorithms for enhanced fire detection reliability. (H. Patel, 2023).

1. **Mobile Robot for Fire Detection and Suppression in Indoor Environments**

A mobile robotic system designed for fire detection in indoor environments is developed in this study. The robot uses a combination of infrared flame sensors and temperature sensors to accurately locate fire sources. It then moves towards the fire and sprays water using an automated pump system. The paper evaluates the robot’s response time and fire suppression efficiency and suggests improving mobility using AI-based path planning techniques. (S. Lee, 2021).

1. **IoT-Based Firefighting Robot with Real-Time Monitoring**

This paper explores the integration of IoT in autonomous firefighting robots to enable remote monitoring and control. The system employs a cloud-based interface where users can track fire incidents and robot movements in real-time. The authors discuss the advantages of IoT in enhancing firefighting efficiency and propose AI-driven algorithms for autonomous navigation and fire detection in large-scale environments. (J. Zhang, 2024).

1. **Development of an Autonomous Firefighting Robot with Multi Sensor Integration**

The authors designed a robotic system that integrates multiple sensors for enhanced fire detection and suppression. The system combines flame sensors, gas sensors, and temperature sensors to improve fire detection accuracy. The robot moves autonomously using a motor driver and employs a relay-controlled water pump to extinguish flames. The study emphasizes the importance of multi-sensor data fusion and suggests implementing AI-based decision-making for faster fire response. (L. Chen, 2023).

1. **AI-Based Fire Detection and Response System for Autonomous Robots**

This research introduces an AI-driven approach for fire detection in robotic firefighting systems. Instead of relying solely on flame sensors, the robot uses a computer vision-based fire detection algorithm trained on deep learning models. The system enhances accuracy in detecting fire under varying environmental conditions. The study suggests combining AI-based image processing with traditional flame sensors for better detection reliability. (T. Kumar, 2022).

1. **GSM and IoT-Based Smart Firefighting Robot for Remote Monitoring**

The paper explores the integration of GSM and IoT technologies in firefighting robots. The system enables real-time communication by sending SMS and call alerts to emergency responders when a fire is detected. The robot is controlled using an Arduino-based microcontroller and navigates towards the fire using infrared sensors. The study discusses how IoT connectivity can improve response time by providing live location tracking and fire severity updates. (M. Ali, 2021).

1. **Wireless Communication-Based Fire Extinguishing Robot**

This research presents a fire suppression robot controlled via a wireless communication system. The robot detects fires using a flame sensor and sends the information to a central monitoring system using Wi-Fi. The paper highlights the advantages of wireless communication over GSM, emphasizing real-time data transmission and remote control functionality. Future work includes integrating LoRaWAN for extended communication range. (R. Das, 2020).

1. **Arduino-Controlled Fire Detection Robot with Water Sprinkler System**

The study introduces an Arduino-based fire detection and suppression robot. The robot uses flame sensors to locate the fire and a relay circuit to activate a water pump for extinguishing. The system operates on a 12V power supply and is equipped with DC motors for movement. The paper evaluates the efficiency of different fire suppression methods, including water spraying and CO₂ extinguishing systems. (H. S. Wong, 2019).

1. **Smart Firefighting Robot with Obstacle Avoidance and Fire Mapping**

This research develops an autonomous firefighting robot with real-time fire mapping capabilities. The robot uses an ultrasonic sensor for obstacle avoidance and a combination of thermal and flame sensors for fire detection. The study discusses the use of mapping algorithms to visualize fire incidents and suggests integrating GPS for outdoor firefighting applications. (P. Gupta, 2023).

**CHAPTER 3**

**METHODLOGY**

1. **Introduction**

The methodology provides a structured approach for developing the **firefighting robot with an SMS and call alert system.** This includes defining the **design concept**, selecting the **hardware components** such as flame sensors, a motor driver, a relay circuit, and a GSM module, and integrating the **software components** for fire detection, autonomous movement, and communication. The development process ensures that all components work together to achieve the desired functionality. The firefighting robot is designed for **efficient fire detection and suppression**, ensuring reliability and quick response in emergency situations. Through a well-structured construction process, this project aims to provide a **practical and effective solution** for fire safety, combining **automation, real-time alerts, and firefighting capabilities..**

1. **Conceptual Design**

The conceptual design of the **firefighting robot with an SMS and call alert system** focuses on its dual functionality: **autonomous fire detection and suppression,** along with **real-time alert notifications**. The design integrates **hardware components** such as **flame sensors, a motor driver, a relay circuit, a water pump, and a GSM module** with **software algorithms** to detect fire, navigate towards it, and extinguish it effectively. The **robot's modular structure** ensures scalability for future upgrades, such as improved navigation, enhanced fire detection accuracy, and additional communication features. The overall design maintains a balance between **efficiency, reliability, and cost-effectiveness,** making it a practical solution for fire safety applications.

1. **Hardware Selected**

The following are the selected hardware:

* 1. **Arduino Microcontroller:**

The **Arduino microcontroller** plays a crucial role in the **firefighting robot with an SMS and call alert system**, acting as the **central processing unit** that controls all components. It is responsible for **reading sensor data,** processing inputs, and executing commands to operate the robot effectively.

**Key Functions of Arduino in the Firefighting Robot**

 **Fire Detection & Sensor Input Processing**

* The flame sensors continuously monitor the surroundings for fire.
* The Arduino reads data from these sensors and determines if a fire is detected.

 **Motor Control & Navigation**

* The motor driver (L298) is controlled by the Arduino to move the robot towards the fire.
* Based on sensor readings, it decides the direction and speed of the DC gear motors for navigation.

 **Fire Suppression System**

* Once near the fire, the relay circuit activates the water pump to extinguish the flames.
* The servo motor may help position the nozzle towards the fire.

 **SMS & Call Alert System**

* The GSM module is controlled by the Arduino to send SMS alerts and calls to notify users about fire incidents.

 **Power Management**

* The LM2596S voltage regulator ensures the Arduino and other components receive the required power supply from the 12V battery.

Figure 3.1 Arduino

* 1. **Servo Motor**

The **servo motor** in the **firefighting robot with an SMS and call alert system** plays a key role in accurately directing the **fire suppression mechanism**. It helps in positioning the **water nozzle or fire-extinguishing system** towards the fire for effective extinguishing. Show below in figure 3.2

Figure 3.2 Servo Motor

* 1. **Flame Sensor**

The **flame sensor** is a critical component in the **firefighting robot with an SMS and call alert system.** It is responsible for **detecting fire** by sensing infrared (IR) radiation emitted by flames. The robot uses **three flame sensors** to determine the **direction and intensity** of the fire, allowing it to respond effectively. Show below in figure 3.3

Figure 3.3 flame Sensor

* 1. **GSM 800L**

The **SIM800L GSM module** is an essential component of the **firefighting robot with an SMS and call alert system,** enabling **wireless communication** to send real-time alerts about fire incidents. It allows the robot to **send SMS notifications and make phone calls** to a predefined contact, ensuring quick emergency response. Show below in figure 3.4

Figure 3.4 Gsm 800l

**3.3.5 12V Water Pump**

The **12V water pump** is a crucial component in the **firefighting robot with an SMS and call alert system**, responsible for **extinguishing fire** once detected. It is controlled by the **Arduino microcontroller** through a **relay circuit**, ensuring that water is pumped effectively to suppress the flames. Show below in figure 3.5

Figure 3.5 12v Water Pump

**3.3.6 L293 Motor Driver**

The **L293 Motor Driver** is a key component in the **firefighting robot with an SMS and call alert system**, responsible for **controlling the movement of the DC gear motors.** Since the **Arduino cannot directly drive high-power motors**, the **L293 motor driver** acts as an **interface** between the **Arduino** and the **DC motors**, allowing smooth and controlled movement. Show below in figure 3.6

Figure 3.6 L293 Motor Driver

**3.3.7 Lm2596s**

The **LM2596S** is a **DC-DC step-down (buck) voltage regulator** used in the **firefighting robot with an SMS and call alert system** to ensure a **stable and safe power supply** for different components. Show below in figure 3.7

Figure 3.7 Lm2596s

1. **Software Selected**

Following are the selected software:



**3.4.1 Arduino Ide**

The **Arduino IDE (Integrated Development Environment)** is the software used to **write, compile, and upload code** to the **Arduino microcontroller**, which controls the **firefighting robot with an SMS and call alert system.** It serves as the **primary programming platform** for developing and testing the robot’s functionality. Show below in figure 3.8

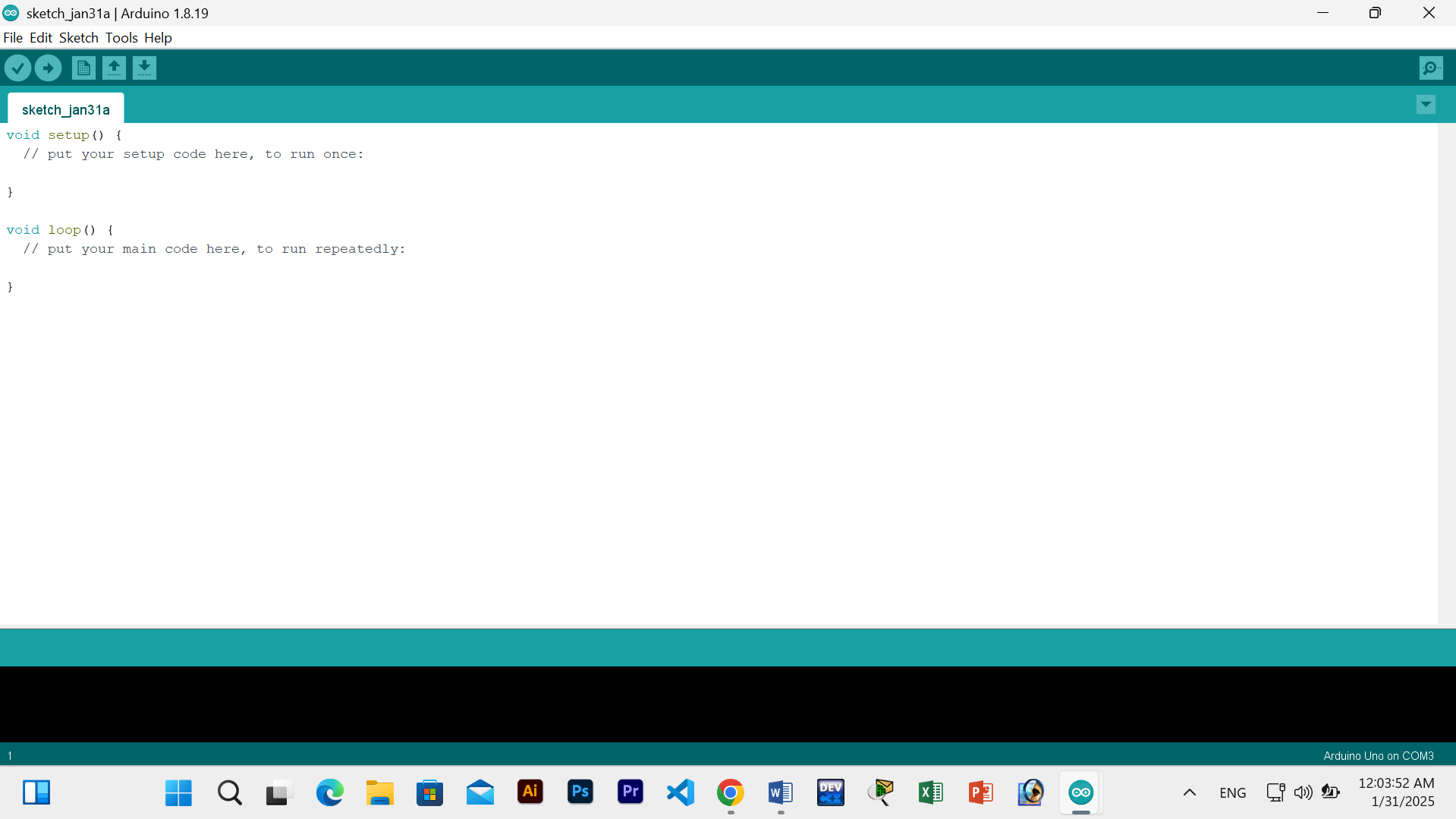


Figure 3.8 Arduino Ide interface

**3.4.2 MS word for report writing**

Microsoft Word is a computer application program used for the creation of written documents. It was first made available on 25 October, 1983 as Multi-Tool Word for Xenix systems.

1. **Design**

The system has a straightforward design. An **Arduino microcontroller** is connected to **three flame sensors** to detect fire. The **Arduino** is also connected to a **motor driver** and **DC motors** for movement. A **GSM module** is linked to the Arduino for sending **SMS and call alerts** when a fire is detected. The system is powered by a **12V battery,** which is regulated by an **LM2596S voltage regulator** to supply the correct voltage to different components. A **water pump** and **relay** are used for the fire suppression mechanism. Show in below figure 3.9

Figure 3.9 Design of the project

* 1. **Block Diagram**

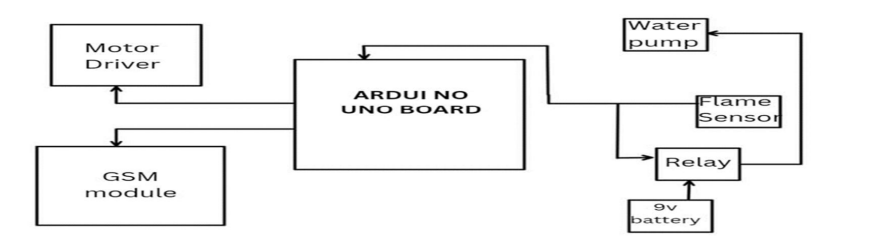


Figure 3.10 Block Diagram

1. **Installation**

The proposed system uses the **Arduino microcontroller** as the main controller for the firefighting robot. The **Arduino IDE** is installed on a computer to program the microcontroller. After installing the IDE, connect all the hardware components (flame sensors, motor driver, DC motors, GSM module, relay, water pump, and voltage regulator) to the **Arduino** according to the circuit diagram. Then, power up the system using a **12V battery.** Once powered on, open the **Arduino IDE** on the computer and upload the code to the microcontroller. The Arduino will then begin executing the programmed tasks, such as detecting fire, moving towards it, and sending alerts.

**3.7.1 Commands**

 Open **Arduino IDE** and go to **Sketch > Include Library > Manage Libraries**.

 Search and install libraries for:

* **GSM Module**: (e.g., "GSM.h")
* **Motor Driver**: (e.g., "AFMotor.h" for motor control)
* **Sensor Libraries**: (e.g., for flame sensors)
  1. **Debugging**

Once the Arduino code was written, it needed thorough testing to ensure proper functionality. Debugging, which involves fixing errors and optimizing performance, was a significant part of the process. Techniques included verifying sensor inputs and communication with hardware. Simulated tests were used to observe and correct the system's behavior.

* 1. **Coding**

The following code is the overall program for the Arduino microcontroller.

**Code:**

#include <Servo.h>

#include <SoftwareSerial.h>

SoftwareSerial GSM(2, 3); // RX, TX

Servo myservo;

#define enA 10 // Motor1 Enable

#define in1 9 // Motor1 Direction

#define in2 8 // Motor1 Direction

#define in3 7 // Motor2 Direction

#define in4 6 // Motor2 Direction

#define enB 5 // Motor2 Enable

#define ir\_R A0 // Right Sensor

#define ir\_F A1 // Front Sensor

#define ir\_L A2 // Left Sensor

#define pump 4 // Pump Control

int s1, s2, s3, flag = 0; // Sensor values and flag

int Speed = 160; // Motor speed

const char \*phone\_no = "03353345069";

const char \*msg\_no[] = {

"Welcome to FireFighting Robot",

"Fire detected Alert...!!!"

};

void setup() {

Serial.begin(9600);

GSM.begin(9600);

pinMode(ir\_R, INPUT);

pinMode(ir\_F, INPUT);

pinMode(ir\_L, INPUT);

pinMode(enA, OUTPUT);

pinMode(in1, OUTPUT);

pinMode(in2, OUTPUT);

pinMode(in3, OUTPUT);

pinMode(in4, OUTPUT);

pinMode(enB, OUTPUT);

pinMode(pump, OUTPUT);

myservo.attach(A5);

myservo.write(90); // Start with the servo at center position

Serial.println("Initializing....");

initModule("AT", "OK", 1000);

initModule("ATE1", "OK", 1000);

initModule("AT+CPIN?", "READY", 1000);

initModule("AT+CMGF=1", "OK", 1000);

initModule("AT+CNMI=2,2,0,0,0", "OK", 1000);

Serial.println("Initialized Successfully");

// Send welcome message

sendSMS(msg\_no[0]);

}

void loop() {

s1 = analogRead(ir\_R); // Right sensor

s2 = analogRead(ir\_F); // Front sensor

s3 = analogRead(ir\_L); // Left sensor

// Print sensor values for debugging

Serial.print("Right Sensor: "); Serial.print(s1);

Serial.print("\tFront Sensor: "); Serial.print(s2);

Serial.print("\tLeft Sensor: "); Serial.println(s3);

delay(50);

analogWrite(enA, Speed);

analogWrite(enB, Speed);

if (s1 < 250 || s2 < 450 || s3 < 250) { // Fire detected

handleFireDetection();

if (s1 < 250) {

moveServoTo(30); // Move servo to the right

turnRight();

} else if (s2 < 450) {

moveServoTo(90); // Keep servo in the center

forward();

} else if (s3 < 250) {

moveServoTo(150); // Move servo to the left

turnLeft();

}

} else {

// No fire detected

digitalWrite(pump, LOW); // Ensure pump is off

Stop();

}

if (s1 >= 900 && s2 >= 900 && s3 >= 900) {

flag = 0; // Reset flag if no fire is detected

}

delay(10);

}

void handleFireDetection() {

Stop();

if (flag == 0) {

flag = 1;

sendSMS(msg\_no[1]);

makeCall();

}

// Continuous check and spray control

while (s1 < 250 || s2 < 450 || s3 < 250) {

digitalWrite(pump, HIGH); // Turn on the pump

delay(200); // Small delay for quicker response

// Recheck sensor values during spraying for better targeting

s1 = analogRead(ir\_R);

s2 = analogRead(ir\_F);

s3 = analogRead(ir\_L);

if (s1 < 250) {

moveServoTo(30); // Adjust servo to the right

} else if (s2 < 450) {

moveServoTo(90); // Adjust servo to the center

} else if (s3 < 250) {

moveServoTo(150); // Adjust servo to the left

}

}

digitalWrite(pump, LOW); // Turn off the pump after fire is extinguished

}

void sendSMS(const char\* message) {

GSM.print("AT+CMGS=\"");

GSM.print(phone\_no);

GSM.println("\"\r\n");

delay(1000);

GSM.println(message);

delay(300);

GSM.write(byte(26));

delay(5000);

}

void makeCall() {

GSM.print("ATD");

GSM.print(phone\_no);

GSM.println(";");

delay(30000); // Call duration (30 seconds)

GSM.println("ATH"); // Hang up the call

}

void initModule(String cmd, const char \*res, int t) {

Serial.println(cmd);

GSM.println(cmd);

delay(100);

char resBuffer[100];

strncpy(resBuffer, res, sizeof(resBuffer));

resBuffer[sizeof(resBuffer) - 1] = '\0'; // Ensure null-termination

while (GSM.available() > 0) {

if (GSM.find(resBuffer)) {

Serial.println(res);

delay(t);

return;

} else {

Serial.println("Error");

}

}

delay(t);

}

void forward() {

digitalWrite(in1, HIGH);

digitalWrite(in2, LOW);

digitalWrite(in3, LOW);

digitalWrite(in4, HIGH);

}

void backward() {

digitalWrite(in1, LOW);

digitalWrite(in2, HIGH);

digitalWrite(in3, HIGH);

digitalWrite(in4, LOW);

}

void turnRight() {

digitalWrite(in1, LOW); // Right motor reverse

digitalWrite(in2, HIGH);

digitalWrite(in3, LOW); // Left motor forward

digitalWrite(in4, HIGH);

delay(200); // Add small delay for smoother turning

}

void turnLeft() {

digitalWrite(in1, HIGH); // Left motor forward

digitalWrite(in2, LOW);

digitalWrite(in3, HIGH); // Right motor reverse

digitalWrite(in4, LOW);

delay(200); // Add small delay for smoother turning

}

void Stop() {

digitalWrite(in1, LOW);

digitalWrite(in2, LOW);

digitalWrite(in3, LOW);

digitalWrite(in4, LOW);

}

void moveServoTo(int angle) {

// Ensure the servo is not moving unnecessarily

if (myservo.read() != angle) {

myservo.write(angle);

delay(500); // Small delay to allow servo movement}}

* 1. **Flowchart Diagram**

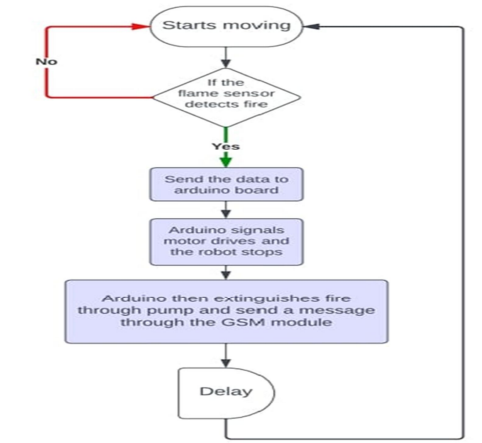


Figure 3.11 Flow Chart

**CHAPTER 4**

**RESULTS**

1. **Introduction**

This is the most important section of the report. This section shows the effort of the student as well as work of the student. These are all the of the model which we proposed for the final year project. Following are the results of the following model.

1. **System startup**

The following fig shows the starting of the model by push the on button.

Fig 4.1 shows the boot up process.

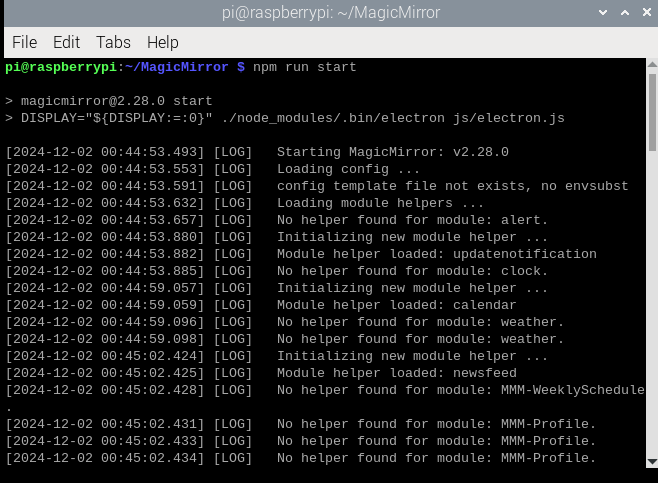


Figure 4.1 Start button Project

1. **Detection on Front Side**

When there is fire in front of robot the servo will not move because we put the pipe on front side and the water will spray on fire. Fire detection on front shown in below figure 4.2.



Figure 4.2 detection of front side

1. **Detection on Right Side**

When there is fire in right of robot the servo will move to right side and the buzzer will start and water pump also. Fire detection on right side detected as shown in below figure 4.3

Figure 4.3 detection of right side

1. **Detection on Left Side**

When there is fire in left of robot the servo will move to left side and buzzer will start and water pump also. Fire detection on left side detected as shown in below figure 4.4

Figure 4.4 detection of left side

1. **Conclusion**

The Firefighting Robot with SMS and Call Alert offers an efficient and automated approach to fire detection and suppression. It enhances safety by providing real-time alerts via SMS and calls, allowing for quick responses even when no one is present. The integration of flame sensors, a relay circuit, and a motor system ensures effective fire detection and extinguishing.

A working prototype successfully demonstrates the robot's functionality, with potential improvements to enhance efficiency and adaptability. Despite minor challenges, the project remains cost-effective and meets its primary objectives. Future enhancements could focus on improving mobility, increasing sensor accuracy, and integrating AI-based decision-making for better fire management.

1. **Future work**

The Internet of Things (IoT) may be installed on the robot so that it can be controlled manually from a different place. Increasing the number of sensors that are attached allows us to achieve higher performance, and it also allows us to minimize the amount of time it takes to discover the source of the fire. We are able to attain a wide field of vision by including a camera that rotates across 360 degrees. A water pipeline might be used in lieu of the storage facility in order to put out fires that originate from bigger sources. In terms of reliability, color detection of fire is not very good. It is thus possible to install a thermal camera rather than a USB camera in order to obtain better identification of the source of the fire determined by its intensity. It is also possible for us to increase the size of the hardware in order to accomplish the operation of picking up and placing an item in the affected region.

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**SDG Goals**

The Development of an IoT-Based Firefighting Robot with SMS and Call Alert is well aligned with Sustainable Development Goal 9 (Industry, Innovation, andInfrastructure), which emphasizes building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation.

This project integrates IoT technology, automated fire detection, and emergency alert systems to enhance safety and efficiency in fire prevention. By combining sensor-based fire detection, real-time alerts, and robotic movement, the system provides a practical and innovative approach to firefighting. A general outline of the system is shown in Figure 5.1.



Figure 5.1 *Sustainable Development Goals Courtesy Caritas*