International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Implementation of Fire Fighter Robot By Using Arduino

Dr.N.P.Giradkar[1],Twinkle Bawane[2], Ankita Saratkar[3] ,

Adityi Bawane[4], Kalyani Thakare[5]

[1]Associate Professor , [2345]B .Tech Students, Department of Electronics and Telecommunication
Smt. Radhikatai Pandav College of Engineering, Nagpur Maharashtra, India.

Abstract: Fire accidents pose a severe threat to life and property, making early detection and rapid response crucial for minimizing damage. This paper presents the design and development of a Fire Extinguisher Robot utilizing Arduino Uno and an integrated SMS alert system. The robot is equipped with flame sensors to detect fire and autonomously navigates towards the affected area using DC motors. It employs a servo-controlled water spray mechanism for effective fire suppression. Additionally, the system integrates a GSM module that sends real-time SMS alerts to predefined contacts upon fire detection, enabling immediate human intervention. By operating autonomously, the robot significantly reduces human risk while enhancing fire safety measures. This is cost-effective and efficient solution for residential, industrial, and commercial applications, minimizing fire-related damages and improving overall prevention strategies.

Keywords: Fire Extinguisher Robot, Arduino Uno, SMS alert system, flame sensors, DC motors, servo-controlled water spray mechanism, GSM module, fire safety, autonomous operation, fire prevention.

Introduction

Fire accidents are unpredictable and can cause severe damage to life and property. Traditional fire-fighting methods require human intervention, increasing response time and risk. To enhance fire safety, this paper presents an **autonomous fire extinguisher robot** using **Arduino Uno**, integrated with an **SMS alert system** for real-time notifications.

This system Equipped with **flame sensors** for fire detection, **DC motors** for mobility, and a **servo-controlled water spray mechanism** for suppression, the robot operates independently. The **GSM module** enables instant alerts to authorities, ensuring a swift response.

This cost-effective and reliable system minimizes human risk while improving fire safety in homes, industries, and commercial spaces. By combining automation and real-time communication, it offers an efficient solution for early fire suppression.

I. Literature Survey

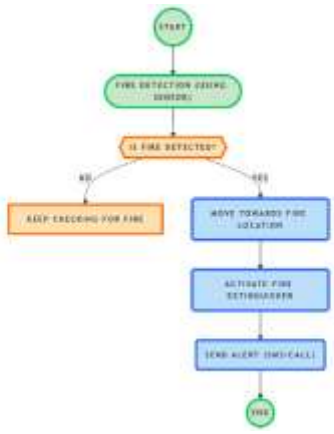
Numerous studies have explored the development of fire-fighting robots using various approaches. An Arduino-based fire-fighting robot with fire detection sensors and an autonomous navigation system was designed to enhance fire suppression capabilities [1]. Another study introduced a robot equipped with SMS and call alert functionalities, enabling real-time communication for immediate human intervention [2]. A similar system integrated fire detection sensors and a mechanical arm, improving performance and simplifying the design for effective firefighting [3]. Other research focused on high-accuracy navigation for fire-fighting robots, ensuring precise movement in complex environments [4]. An Arduino-based fire extinguisher robot was developed with real-time SMS alerts, improving situational awareness during fire incidents [5]. A study also demonstrated a fire-fighting robot with call and message-based alerts, ensuring rapid emergency responses [6].Additionally, research explored cost-effective and reliable fire-fighting solutions, integrating DC motors and servo-controlled water spray mechanisms to enhance fire suppression efficiency [7]. Another system focused on human-following robots, which could be adapted for fire detection in occupied spaces, increasing operational flexibility [8]. A different study emphasized optimized navigation algorithms, reducing response time and improving autonomous movement in hazardous environments [9].Several other works highlighted real-time detection and suppression techniques, such as integrating GSM modules for continuous monitoring and alerts [10]. Another study introduced a fire-fighting robot with mechanical stability improvements, ensuring durability and effectiveness in industrial and commercial settings [11]. Further developments included the use of Arduino-controlled systems with multiple flame sensors, enhancing the detection accuracy of fire outbreaks [12].Recent advancements focused on AI-driven fire detection and robotic automation, increasing precision and reliability in fire emergencies [13]. Finally, a study demonstrated the implementation of wireless control mechanisms, allowing remote operation and minimizing human exposure to fire hazards [14]. Based on these studies, the proposed fire extinguisher robot will integrate fire detection sensors, autonomous navigation, GSM

communication, and real-time alert systems to ensure efficient and autonomous firefighting with minimal human intervention.

II. Connection Details

The fire extinguishing robot is developed using an Arduino Uno microcontroller as the main controller. The system integrates multiple flame sensors, a servo motor for directional control of the extinguishing system, a motor driver for wheel movement, and a GSM module for alert notifications.The left flame sensor is connected to analog pin A0 of the Arduino Uno, the right flame sensor to analog pin A1, and the center flame sensor to analog pin A2. These sensors continuously monitor the presence of fire.For motor control, an L298N motor driver module is used. Its IN1 and IN2 pins are connected to digital pins 6 and 7 of the Arduino Uno respectively, to control the left motor. Similarly, IN3 and IN4 are connected to digital pins 8 and 9 to control the right motor. The ENA and ENB pins, which enable motor movement, are connected to digital pins 5 and 10 respectively. The motor driver is powered using a 12V battery connected to its VCC pin, while its GND and 5V pins are connected to the Arduino's GND and 5V lines respectively.

The servo motor used for aiming the extinguisher nozzle is connected to digital pin 3 for signal control. Its power lines are connected to the 5V and GND pins of the Arduino.A GSM module is incorporated to send SMS alerts in case of fire detection. The TX pin of the GSM module is connected to digital pin 2 of the Arduino Uno, while the RX pin is connected to digital pin 4 through a voltage divider to ensure proper logic level shifting. The module is powered through a regulated 5V supply connected to its VCC pin, and the GND pin is connected to the Arduino's ground.All components are grounded to a common GND rail, and proper power regulation is maintained to ensure reliable performance.



SOFTWARE (4.2 SOFTWARE DESIGN):

This Arduino code is for a fire-fighting robot that uses flame and smoke sensors to detect fire and smoke in its surroundings. When fire is detected through any of the three flame sensors (left, right, forward), the robot moves toward the fire source and activates a water pump through a servo motor to extinguish it. Simultaneously, if smoke is detected, it sends an SMS and makes a call using the GSM module (SIM800L) to notify the user. The code controls the movement of the robot using DC motors and a servo motor to direct the water spray. It includes functions for moving the robot in different directions, stopping it, sending alerts, and activating the fire-extinguishing mechanism.

III. Conclusion

This Study Shows that the Fire Extinguisher Robot provides an innovative solution for autonomous fire detection and suppression, using sensors, AI, and GSM communication for quick responses with minimal human intervention. Its autonomous navigation, real-time updates, and energy-efficient design improve safety and efficiency, paving the way for future advancements in emergency response systems.

IV. Result

Fig: Prototype and the output

The Fire Extinguisher Robot was tested successfully and met its design objectives. It detects fire within a 10 cm range and covers a 180° field of view. The water spray system, with a 15–20 cm radius, effectively extinguishes fire when the robot aligns toward the source.

Fig: SMS and Call detection output

The GSM module reliably sends SMS and calls upon fire detection. Test scenarios confirmed consistent fire detection, alert sending, and extinguishing performance, making the robot suitable for indoor environments like homes, labs, and offices.

V. References

[1] Mr. S.Y. Divekar, Ms. Asmita Pravin Ahirrao, Mr. Uday Dadasaheb Agale, Mr. Yash Sandeep Bhagyawant, Ms. Rupa Mohan Gole "Arduino Fire Fighting Robot with SMS & Call Alert" International Journal of Innovative Research in Science, Engineering and Technology (LJIRSET)Volume 12, Issue 4, April 2023

[2] Durgesh Sharma, Harshala Gaikwad, Kartavya "Fire Extinguishing Robot Using Arduino" International Research Journal of Engineering and Technology (IRJET) Volume: 08 Issue: 06/June 2021

[3] Kharga Bahadur Kharka1, Tashi Rapden Wangchuk Bhutia , Lalita Chettri, Neetes Luitel, Roshan Subba, Eshant Giri, Samuel Lepcha "Human following Robot using Arduino Uno" International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal) Volume:03/Issue:07/July-2021

[4] Aryan Verma, Naman Yadav, Harshita Chaubey, Aditya Srivastava, Dr. Ajay Sharma "Arduino Based Fire-Fighting Robot with SMS Alert" journal of emerging technologies and innovative research (JETIR)2023, Volume 10, Issue 5, May 2023

[5] Mr. Kondeti Chirunadh, Mr. G. Sai Varaprasad Goud, Miss. G. Tejaswini,Mr. B. Srinivasa Rao' "Arduino Based Fire Fighting Robot" International Research Journal of Modernization in Engineering Technology and Science Volume:05/Issue:06/June-2023

[6] Chithrashree K S. Harish E, Kiran R D. Madan S N.Akshatha R Hegde "Fire Fighting Robot" International Journal of Advances in Engineering and Management (JAEM) Volume 5, Issue 5, pp: 1040-1043 May 2023.

[7] Amol A. Bhosle, Shardul S. Bodhe, Sakshi. U.Bodhe, Madhura. M. Birajdar, Sharvari, V. Bodas "Fire Fighting Robot" International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 10 Issue XII Dec 2022

[8] Mr. M. Raja Shekar, B. Rakesh, S. Aravind, K. Yogesh "Fire Fighting Robot using Arduino with Call and SMS Alert" Vol. 03, Issue 06, June 2023, pp: 130-133 www.ijprems.com

[9] Jay Sathe, Vrushabh Raut. Rahul Peddapelli, Janardhan Waghchaure. Mr.V.W.Bembrekar "Design And Development of Fire Fighting Robot" International Research Journal of Engineering and Technology (IRJET)JET Volume: 10 Issue: 05, May 2023

[10]Deore Jagruti, Zalte Priyanka. Waghchaure Dhanashree. Shelke Pratiksha."Arduino Based Fire Fighting Robot" Volume 12 Issue 1@2024 IJIRMPS | ISSN: 2349-7300

[11] Abhilash Dhumatkar, Sumit Bhiogade", Shashank Rajpal, Datta Renge, "Automatic Fire Fighting Robot" ISSN 2350-1022 International Journal of Recent Research in Mathematics Computer Science and Information Technology Vol. 2, Issue 1, pp: (42-46), Month: April 2015 September 2015,

[12] S. Kavitha, Krishna rajendra sagar, Mohamed Tousif, Nishanth CR, Likith. V "Fire Fighting Robot" International Journal of Innovative Science and Research Technology Volume 6, Issue 5, May-2021

[13] Shiv Nath Dwivedi, Smriti Shukla, Supriya Tiwari "Fire Fighting Robot" International Journal of Advanced Technology in Engineering and Science Vol. No. 09, Issue No. 07, July 2021

[14] Lokesh Venkata, Ramana Talabhaktula, Veerraju Daliparthi, "A Novel Fire Fighting Robot with Arduino" Research Paper©2012 UFANS. All Rights Reserved UGC CARE Listed (Group -1) JournalVol.10, Iss. 1, Jan2021