

ANDROID-CONTROLLED FIREFIGHTER ROBOT WITH AUTONOMOUS FIRE DETECTION AND SUPPRESSION SYSTEM

Dr.R.Senthil Kumar¹ | A.Jeeva² | A.Logeshwaran³ |M.MohamedWasim Fazil⁴ |K.Mukesh⁵

¹Assistant Professor, Department of EEE, Sri Shakthi Institute of Engineering and Technology, Coimbatore.

^{2,3,4,5} B.Tech, Students, Department of EEE, Sri Shakthi Institute of Engineering and Technology, Coimbatore.

ABSTRACT

Fire incidents pose significant risks to life and property, often leading to devastating consequences due to delayed detection and response. Leveraging advancements in robotics and sensing technologies, the Firesafe Bot Guardian project aims to address this critical issue by developing an autonomous firefighting robot capable of detecting and extinguishing fires at an early stage. Equipped with specialized sensors including light and smoke detectors, the robot swiftly identifies fire outbreaks even in remote or inaccessible.

1.INTRODUCTION

Traditionally, Fire Fighting Robots were controlled by onboard electronic devices, limiting their functionality and control capabilities. However, with the rapid advancement of technology, these robots can now be controlled remotely using smartphones, significantly enhancing their flexibility and usability. This project aims to exploit this advancement by developing an Android application to control a firefighting robot. The primary objective of this paper is to design and implement an Android application capable of controlling the operations of a firefighting robot. enhanced safety and security. By utilizing such robots, firefighting efforts can be expedited making operations more efficient regardless of security concerns Android devices have emerged as powerful mobile tools, widely popular due to their portability and extensive features. Leveraging this popularity and functionality, we propose to develop an Android application to remotely control a firefighting robot equipped with navigation capabilities. The core aim of this project is to design an intuitive and user- friendly Android interface . Android devices have emerged as powerful mobile tools, widely popular due to their portability and extensive features. Leveraging this popularity and functionality, we propose to develop an Android application to remotely control a firefighting robot equipped with navigation capabilities.

The core aim of this project is to design an intuitive and user-friendly Android interface for controlling the firefighting robot, which is equipped with essential components such as a fire extinguisher and fire detection sensors including smoke and light sensors. The robot is designed to patrol designated areas and effectively extinguish fires, thereby aiding firefighters in their crucial tasks while ensuring enhanced safety and security. By utilizing such robots, firefighting efforts can be expedited, making operations more efficient regardless of security concerns.

II. LITERATURE SURVEY

(A) Intelligent Firefighting Tank Robot by Kristi Kosasih

Kosasih and colleagues developed an intelligent firefighting tank robot using a combination. The robot features key components including two servo motors, a thermal array sensor, two DC motors, a flame detector, ultrasonic sensor, IR and photo transistors, sound activation circuit, and a micro switch sensor. The primary goal of their work is to enable the robot to patrol designated areas, detect fires, and extinguish them effectively. Activation of the robot is achieved through a DTMF transmitter and receiver system. Android interface for controlling the firefighting robot,

(B) Firefighting Robot Integrated with Embedded System by Sahil Shah

Shah and his team introduced a firefighting robot integrated with an embedded system to address fire incidents efficiently. Their prototype system is designed to detect and extinguish fires, with a specific focus on reducing air pollution caused by fireout.

(C) Integration of Robotics and Automation in Firefighting

Prior research has explored various approaches to integrating robotics and automation in firefighting operations. From autonomous drones equipped with thermal imaging cameras for aerial fire monitoring to ground-based robots capable of extinguishing fires in hazardous environments, there is a growing trend towards leveraging advanced technologies to enhance firefighting capabilities

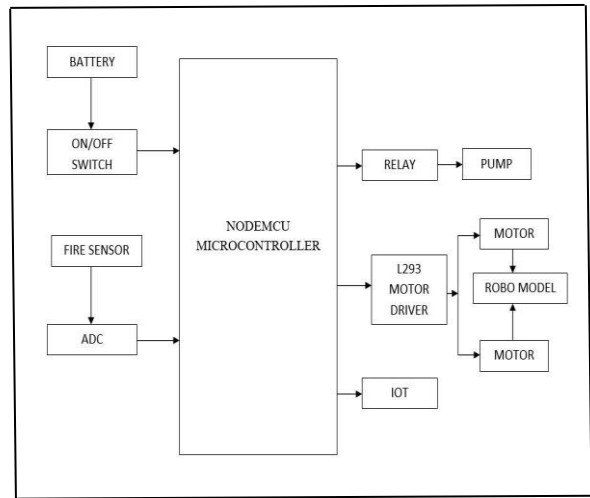
(D) Robotic Solutions for Firefighting

Various researchers have explored the development of robotic systems tailored for firefighting applications. These solutions encompass a wide range of technologies, including advanced sensors, intelligent algorithms, and robust mechanical designs. For instance, some studies have focused on the design of autonomous effect.

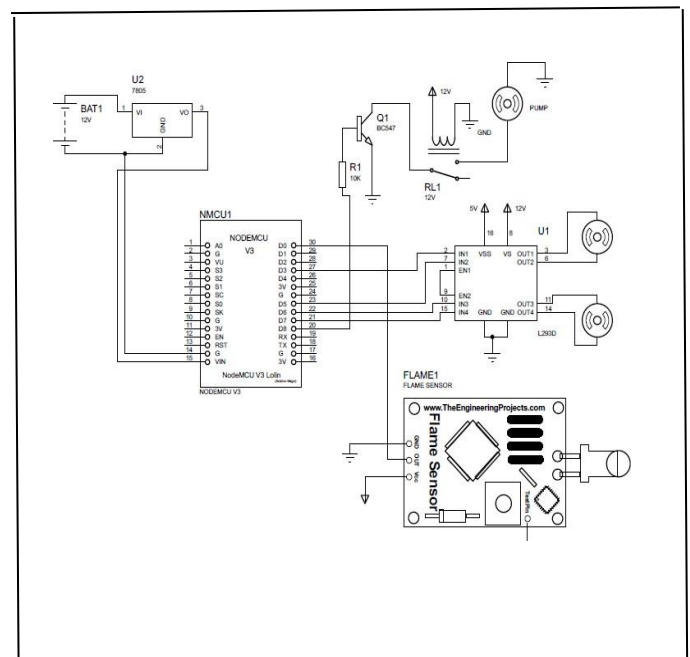
III. PROPOSED SYSTEM

Our project aims to develop an Android application for the remote operation of a firefighter robot equipped with a fire extinguishing system. The system is designed to activate once the sensors detect a fire. Two types of sensors, namely a smoke sensor (based on light intensity) and temperature sensors, are employed for fire detection. When both sensors are simultaneously triggered, the presence of a fire is confirmed. The fire extinguisher is mounted on the robotic vehicle, which is controlled wirelessly. The transmitting end utilizes an Android device running the application, through which commands such as forward turn are sent to the robot. On the receiving end, the commands are processed by a microcontroller, which interfaces with three motors. Two motors are responsible for the robot's movement, while the third motor controls the as a remote control interface . The receiver component of the robot is equipped with a wireless device connected to the microcontroller. Actuators are positioned on top of the extinguisher and are used to activate the sensors upon detection of a fire. The receiver component of the robot is equipped with a wireless device connected to the microcontroller firefighting tasks in diverse environments.

IV. BLOCK DIAGRAM

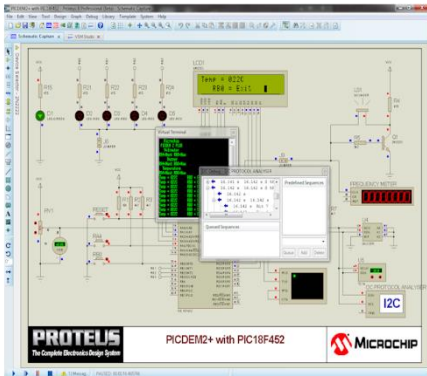


V. CIRCUIT DIAGRAM



VI. PROTEUS SIMULATION

Proteus is a comprehensive and highly regarded software platform widely employed in the field of electronics for its capabilities in electronic design and simulation. This versatile tool caters to a broad spectrum of users, including engineers, students, and electronics enthusiasts, offering a rich set of features that facilitate the development and testing of electronic circuits. Proteus is a complete development platform from product concept to design completion.



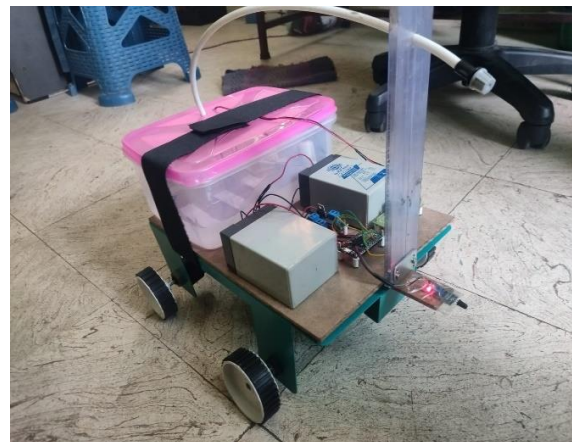
Proteus is Software used to draw and design and integrate electronic circuits. After designing circuits by taking various parts like Switch, Microcontrollers, LED it also provides to simulate and test designed circuit. After testing in real-time we can go to make this circuit practically in our physical world. Proteus circuit simulation software blends mixed-mode SPICE simulation with world-leading fast microcontroller simulation, providing a complete prototyping solution for the embedded systems engineer. Proteus is a software tool primarily used for electronic design automation (EDA) and simulation of electronic circuits. It offers a comprehensive suite of tools for schematic capture, PCB (printed circuit board) layout, and SPICE (Simulation Program with Integrated Circuit Emphasis) simulation. provides a comprehensive library of electronic components, including resistors, capacitors, inductors, diodes, transistors, integrated circuits (ICs), microcontrollers, sensors, actuators, and more. These components can be easily dragged and dropped into circuit schematics.

HARDWARE REQUIRMENT

- NODEMCU MICROCONTROLLER
- BATTERY
- RELAY
- MOTOR
- FIRE SENSOR
- L293 MOTOR DRIVE

SOFTWARE REQUIRMENT

- ARDUINO SOFTWARE
- PROTEUS SIMULATION



VII. WORKING

Detection of fire at an early stage can avoid loss. Normally fire causes huge damage because of absence of human beings to detect fire. If fire is detected and extinguished at an early stage, one can avoid loss of life and property. Robotics has gained popularity due to the advancement of many technologies. Properly equipped Robot will detect fire. Once fire is detected equipped robot can be instructed to extinguish fire. The robot is mounted with sensors and fire extinguisher.

The Fire Fighting Robots were controlled by electronic devices mounted on them. This able to detect presence of fire using flame sensor and moves the robot to fire accident location. It contains motor driver to control the movement of robot. When it detects fire it communicates with micro-controller (Node MCU) and the robot will move towards the fire affected area. The fire extinguisher is mounted on the robotic vehicle which is then controlled over the wireless communication so that it extinguishes the fire automatically. However, with advancement in technology, the same robot can be using a smart phone. These sensors would continuously monitor the environment for signs of fire or abnormal temperature increases. Upon detecting a potential fire, the extension system would immediately initiate an alert system. The goal is to alert occupants of the building and emergency responders as quickly as possible.

VIII. CONCLUSION AND FUTURE SCOPE

This fire extinguishing robot using IoT is introduced to help fire men to avoid the risk situations. This proposed work presents an outline about the fire extinguishing robot using IoT and also gives objectives and advantages of the proposed system. It provides better features that make it a more practically usable robot in real time. By introducing this system in industries and other factories, fire accident rates can be decreased. Future iterations of the Fire Safe Bot Guardian may feature increased autonomy, allowing it to make more independent decisions in fire detection, suppression, and evacuation procedures. This could include the deployment of drones or robotic devices equipped with firefighting capabilities to navigate hazardous environments and assist human responders. Leveraging the Internet of Things (IoT), the Fire Safe Bot Guardian could utilize a network of interconnected sensors placed throughout buildings to gather comprehensive data on environmental conditions, occupancy patterns, and potential fire hazards. These smart sensors could communicate with each other and with the central control system to provide real-time insights and facilitate coordinated responses. Beyond fire detection, future versions of the Fire Safe Bot Guardian could incorporate sensors for monitoring air quality and environmental conditions. This could include detecting hazardous gases, particulate matter, and other pollutants, providing early warnings of potential health risks and enabling proactive measures to mitigate indoor air pollution.

VIII. REFERENCES

- [1] W. Budiharto, *Membuat Robot Cerdas*, Jakarta: Gramedia, 2006.
- [2] Ratnesh Malik, "Fire Fighting Robot : An Approach" , *Indian Streams Research Journal* Vol.2,Issue.II/March; 12pp.1-4.
- [3] Kristi Kosasih, E. Merry Sartika, M. Jimmy Hasugian, danMuliady, "The Intelligent Fire Fighting Tank Robot" , *Electrical Engineering Journal*, Vol. 1, No. 1, October 2010.
- [4] Lakshay,Prof.AmolJoglekar, "Cell Phone Controlled Robot with FireDetection Sensors",*(IJCSIT)*
- [5] Arpit SharmReeteshVerma, Saurabh Gupta and Sukhdeep Kaur Bhatia, "Android Phone Controlled Robot Using Bluetooth" , *International*.
- [6]*Journal of Electronic and Electrical Engineering*.ISSN 0974-2174, Volume 7, Number 5 (2014), pp. 443-448
- [7]Saravanan P, "Design and Development of Integrated Semi - Autonomous Fire Fighting Mobile Robot" , *International Journal*.
- [8]Swati A. Deshmukh, Karishma A. Matte and Rashmi A. Pandhare, "Wireless Fire Fighting Robot" , *International Journal For Research*.