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Fire Fighting Robot with SMS Alert System

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Abstract: ***The Arduino-based Fire Fighting Robot with SMS Alert System is a robotic system designed to detect and extinguish fires in indoor environments. The robot uses flame sensors to detect the presence of a fire. Once a fire is detected, the robot moves towards the source of the fire and sprays water to extinguish the flames. The robot is equipped with a GSM module that can send SMS messages to alert the user when a fire is detected. This allows for prompt action to be taken to minimize damage and save lives. The components of the robot include an Arduino board, motor drivers, sensors, and a GSM module. The software code is written in the Arduino IDE and controls the motors, reads sensor data, and communicates with the GSM module. The robot is tested and debugged to ensure that it functions correctly and safely in different scenarios. Overall, the Arduino-based Fire Fighting Robot with SMS Alert provides a reliable and efficient solution for fire detection and suppression with the added benefit of remote communication and control.***

Keywords: Fire-fighting Robot, SMS Alert System, GSM module, Arduino IDE, flame sensors

I. INTRODUCTION

Fire safety is a matter of critical concern. Fires, both small and large, can cause devastating harm to lives and property. Fires are unpredictable and can escalate rapidly, engulfing entire structures and endangering lives within moments. In such critical situations, timely communication and immediate action are vital. The conventional methods of combating fires often rely on human intervention, which can sometimes result in delays. Automation, combined with real-time communication, can significantly enhance the ability to respond promptly and effectively to fires.

An autonomous robot is a machine that can sense its surroundings, process information to make decisions, and act in the real world. Several studies have demonstrated the potential benefits of robots in the fields of industry [1], medical [2], rehabilitation [3] and rescue operations .

With the advancement of technology, fire safety has seen significant advancements. Smart fire detection systems utilize advanced sensors and algorithms to detect fires accurately and rapidly. Prior research has focused on employing sensors like ultrasonic, LIDAR, and infrared to enable robots to navigate through complex and dynamic environments. A line-following robot is utilized to track and navigate through a maze of lines while avoiding obstructions and put out any sources of fire based on Light Dependent Resistors' (LDRs') [4]. Thermite and FireRob are two current available fire fighter robots that have been used widely in industry [5]. One notable study developed a fire extinguishing robot with an SMS alert feature, designed to detect fires using a flame sensor and sound an alarm to occupants of a building. The robot utilizes Arduino technology to move to the fire source and send messages to any phone on the GSM network through a modem [6].

Moreover, another project aimed to develop an autonomous firefighting robot capable of detecting and extinguishing fires using Arduino technology [7]. Research on the application of humanoid robots is actively being conducted in an effort to reduce the number of firefighter fatalities and injuries while also raising output, security, effectiveness, and work quality [8].

The robot can increase the safety, productivity, efficiency, and quality of the fire safety. It is more compact and more flexible compared to other robots. Additionally, having a compact size and automatic control also allows the robot to be used when fire occurs in small and narrow spaces with hazardous environments such as tunnels or nuclear power plants [9] [10].

II. METHODOLOGY

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 [11]. 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.

Once a fire is detected, the Arduino will trigger the robot to extinguish the fire. For this, the robot uses a water pump and a sprinkler system. The water pump will be connected to a water source, and the sprinkler system will be placed strategically to cover the fire area. When the Arduino detects a fire, it will activate the water pump, causing water to flow through the sprinkler system and suppress the fire. The Arduino uses L293 motor driver to move and navigate.To monitor and be informed of the situation even in remote situations, the robot combines an SMS functionality. The Arduino will be equipped with a GSM module that allows sending and receiving SMS messages. In case of a fire, the Arduino will send an emergency SMS to a predefined contact or a fire department, informing them about the fire incident at the its location. Fig.1 shows the block diagram that explains about the working and operation of the robot while Fig.2 shows the flow of processing in the robot.

The proposed system comes with many advantages. It's really effective at quickly detecting fires, ensuring a prompt response. It boosts overall safety thus making operations more efficient. It also of reduces the risk to people by swiftly addressing potential fire threats.

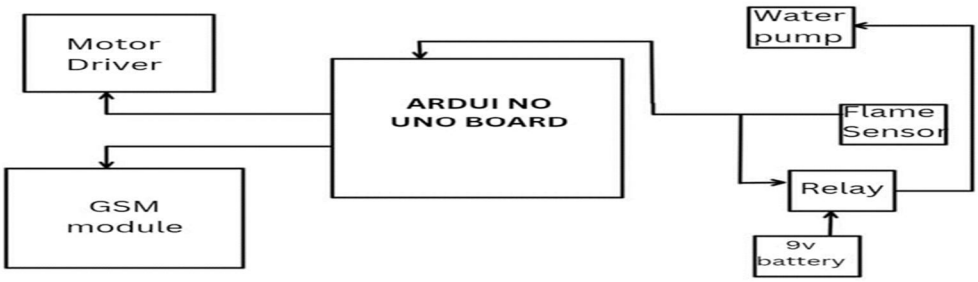


Fig.1 Block Diagram

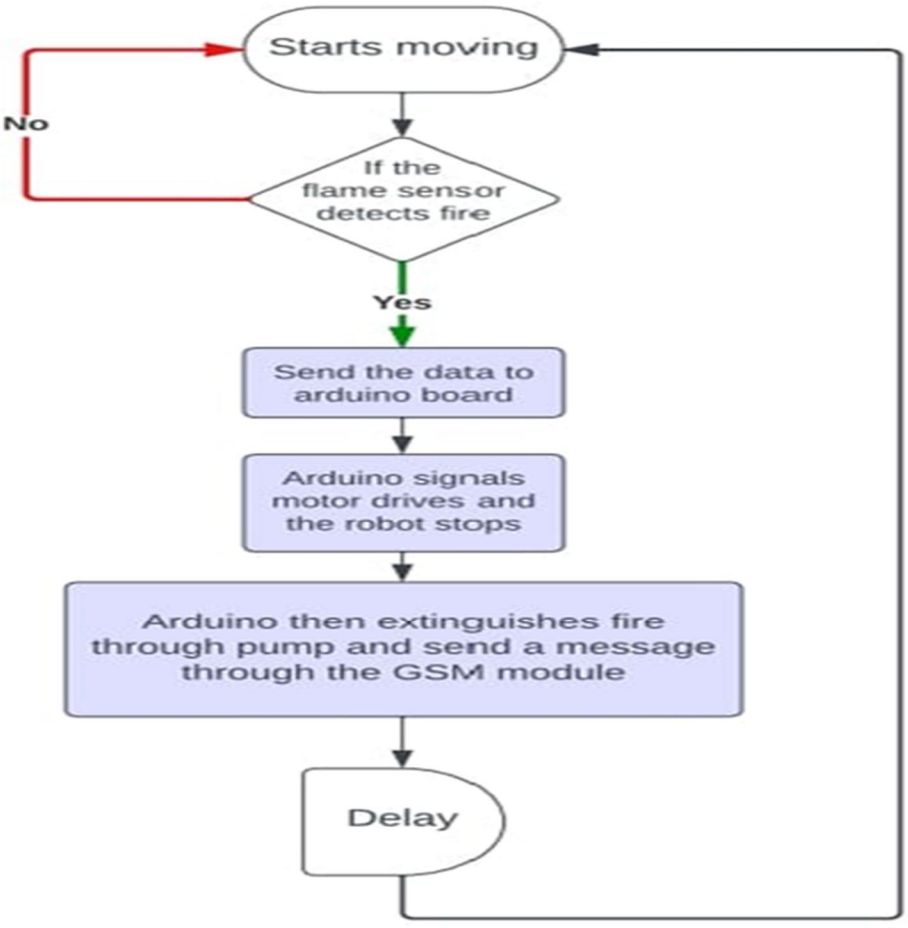


Fig.2 Flowchart

III. RESULTS

The robot effectively detected fires extinguished the fire source by spraying water. The robot was able to detect the fire at different intensities (760nm to 1100nm). The robot can detect small fires from roughly 0.8 metres. Once the fire is detected the robots starts the water sprinkler to extinguish it within few seconds. The GSM modules helps send the message simultaneously as soon as the fire is detected. Through testing, the system demonstrated its reliability and safety. This robot mainly for residential purposes due to its structure and design [12]. Fig.3 – Fig.6 show how the robot operates when it detects the fire to extinguish it. Fig.7 shows the message sent to the registered phone number.

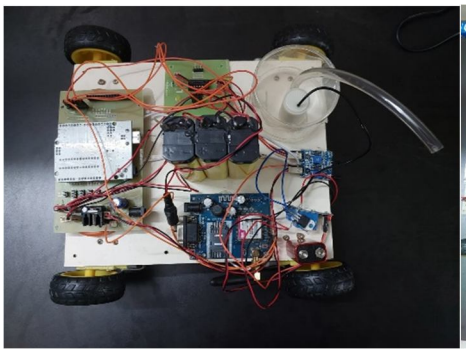


Fig.3 Linear motion of robot

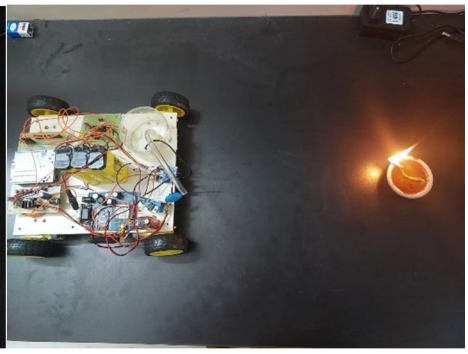


Fig.4 Robot detects fire

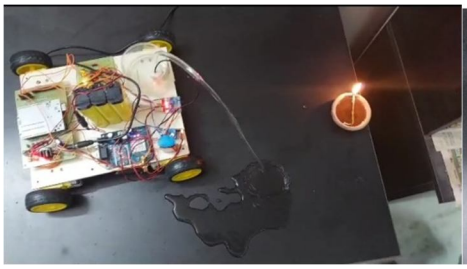


Fig.5 Robot starts exhausting

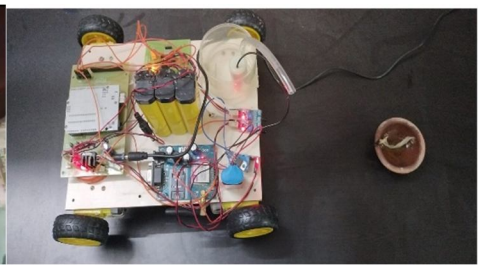


Fig.6 Fire is put out

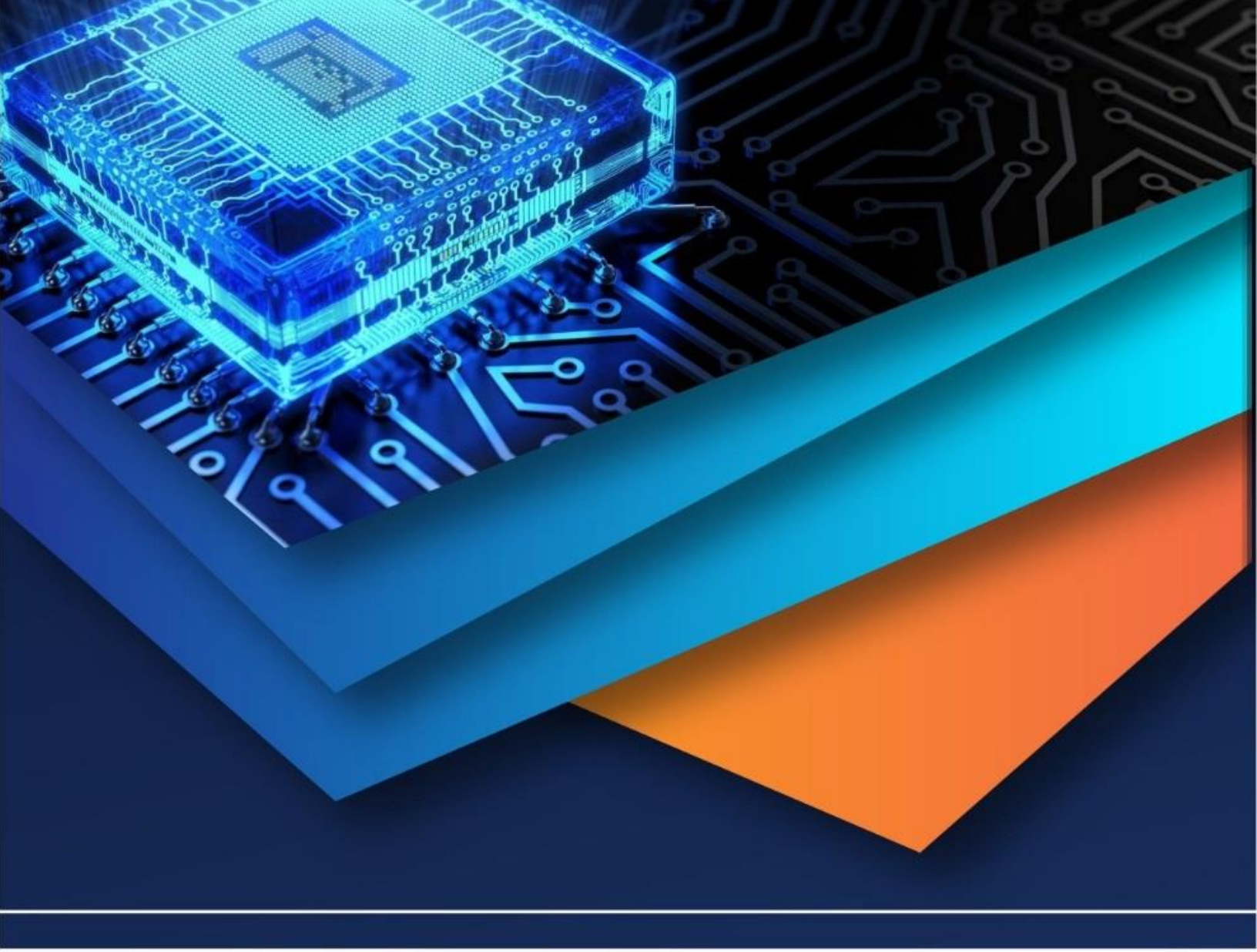
IV. CONCLUSION

The Arduino-based Fire Fighting Robot with SMS Alert System is a game-changer for fire safety in indoor spaces. The robot has achieved its objectives. In suitable conditions, the robot works quite efficiently, but it has a few limitations. By implementing ultrasonic sensors, gas sensors, LED displays, and smoke sensors, the robot can be made more ready to deal with complex practical situations.

REFERENCES

[1] Jeelani S, Dany A, Anand B, Vandana S, Maheswaran T, Rajkumar E., "Robotics and medicine: A scientific rainbow in hospital.," J Pharm Bioallied Science, 2015.
[2] M. Aliff, S. Dohta and T. Akagi, "Trajectory control of robot arm using flexible pneumatic cylinders and embedded controller," in IEEE International Conference on Advanced Intelligent Mechatronics (AIM), 2015.
[3] C. Xin, D. Qiao, S. Hongjie, L. Chunhe and Z. Haikuan, "Design and Implementation of Debris Search and Rescue Robot System Based on Internet of Things," in International Conference on Smart Grid and Electrical Automation (ICSGEA), 2018.

[4] K. Altaf, " Design and Construction of an Automated Fire Fighting Robot," in Proceedings of International Conference on Information and Emerging Technologies , 2007.
[5] Nuţă, I., O. Orban, and L. Grigore, , 2015., "Development and Improvement of Technology in Emergency Response.," Procedia Economics and Finance, 2015.
[6] F. D. O. O. B. A. A. A. J. O. Samuel Oluyemi Owoeye, "Development of a Fire Extinguishing Robot with SMS Alert System," in Proceedings of the 3rd International Conference on Engineering Innovations as a Catalyst for Rapid Economic Growth tagged COLENG, 2021.
[7] 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.
[8] Jong-Hwan Kim, Seongsik Jo, Brian Y. Lattimer, "Feature Selection for Intelligent Firefighting Robot Classification of Fire, Smoke, and Thermal Reflections Using Thermal Infrared Images," Journal of Sensors, 2016.
[9] Raju, S. S. Mohammed, J. V. Paul, G. A. John and D. S. Nair, "Development and implementation of Arduino microcontroller based dual mode fire extinguishing robot," in IEEE International Conference on Intelligent Techniques in Control, Optimization and Signal, 2017.
[10] Tushar Nandkishor Satbhai, R.M.K., Anant Vijay Patil, Manish Patil, "Fire Fighting Robot," International Journal on Recent and Innovation Trends in Computing and Communication (IJRITCC), 2016.
[11] M. Diwanji, S. Hisvankar and C. Khandelwal, "Autonomous Fire Detecting and Extinguishing Robot," in 2nd International Conference on Intelligent Communication and Computational Techniques (ICCT), 2019.
[12] J. Suresh, "Fire Fighting Robot," in IEEE International Conference on Computational Intelligence in Data Science(ICCIDS), 2017.



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