FIRE FIGHTING ROBOT

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Abstract - The increasing frequency and intensity of fire incidents worldwide is maximizing without determined solution hence, there is a growing need of solution for fire extinguishing methods. This system is operated manually with wireless connection, navigates through complex environments to identify and combat fire in diverse setting. Its mobility is enhanced by all terrains such as rough landscapes detecting the obstacle and moving beside to reach the fire accident spot. It is equipped with real time communication capabilities, enabling it to communicate with the coordinator and emergency response team. This advanced system would shape future for efficient and effective firefighting operations by reducing response time, enhancing safety.

Keywords – Fire fighting robot, flame sensors, smoke sensor, temperature sensor, motors, water pump, ESP32 camera, ESP32 microcontroller.

1.INTRODUCTION

A firefighting robot with a call and SMS alert system is designed to enhance productivity in confined working areas. The robot is equipped with three sensors to detect flames, temperature and smoke. The system is controlled manually and when a fire is detected, it will automatically triggers an alert system that sends a call and SMS to the designated personnel or emergency services. This immediate notification allows for quick response and helps prevent the spread of fire, minimizing potential risks and damages. Additionally, the robot can be remotely controlled to navigate through narrow spaces and extinguish the fire using various methods, such as water or foam. This project combines robotics, communication technology, and fire safety measures to create an efficient and effective solution for occupational safety in confined working areas.

2. Body of Paper

2.1 LITERATURE SURVEY

In the paper ‘Journal of Robotics and Automation’ provides a thorough review of the current state of the art in firefighting robots, various methods and tack ticks using the modern technology. It covers various aspects, including mobility, sensing technologies, autonomy, and collaboration with human firefighters. The authors analyse existing models and highlight key challenges and opportunities for future development to reduce reaction time and human direct involvement in various dangerous incidents of fire acts. In the paper sensors-based fire extinguishing, provides a depth analysis of sensor technologies used in firefighting robots, emphasizing fire detection capabilities. It covers infrared cameras, gas sensors, and other advanced sensors that enable robots to identify and assess fire situations. The authors discuss the strengths and limitations of each sensor type which can be a great advantage and disadvantage in detecting the fire and extinguish it.

2.2 METHODOLOGY

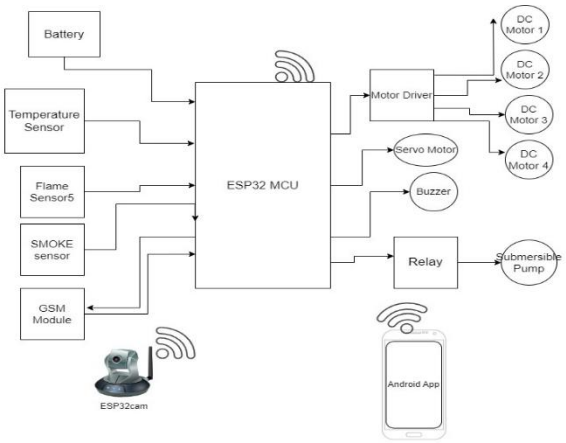

Fig -1 Block diagram

The wired connections and wireless connections are made as shown in the above diagram. The operator will observe the fire disaster area through ESP32 Cam and the operator will command the direction through external controller manually and the command will be received by microcontroller and it will pass the command to Motor driver module which will manage the DC motors to move according to the commanded direction and as soon as the system approaches near the fire incident spot the IR Flame sensor, Smoke sensor, Temperature sensor will detect the fire and send the signal to microcontroller which will send the command to relay to release the water through DC Pump and stops after fire has been extinguished automatically. The flame sensor senses the fire and send the information to the microcontroller as programmed earlier.

The flame sensor senses the fire intensity and send the information to the microcontroller. It will take the action according to the condition and information getting from the sensor and will give the commands to the motors to start in the walk in the desired direction by taking the command as high-low for clockwise direction and low-high for anticlockwise direction. if left sensor

detects the fire, then the microcontroller will run the servo motor in left direction, same for the front and right-side direction. It uses a sim 800L to send message and call the robot will stop near to the fire and start watering to it till the fire will be under control. The appropriate code makes the respective robotic system act accordingly.

2.3 OVERAL WORKING DESCRIPTION

After all the connections, the robot system is checked for live video display through WIFI from ESP32 Cam to external controller. The external controller has LED display buttons of the system movement for Right, Left, Forward, Backward movement. The operator will operate the robot system by external controller which will send the signal through WIFI to the microcontroller board. According to the preprogram applied, the microcontroller will send the command signal to Motor Drive which will manage to move the DC Motor wheels accordingly. The ESP32 will help the operator to watch and ward the movement of the robot system in other safe place without any life risks and direct interaction. The operator will manually control the system and moves towards the fire prone spot and as soon as the system approaches the spot it will automatically detect the fire with the help of IR flame sensor which will detect the flame intensity and MQ2 gas sensor which will identify the gaseous particle emitted from flames in density and temperature sensor which will detect the temperature rise of the flames in degree Celsius and send signal to microcontroller simultaneously. The microcontroller will receive the signal from all the sensors and send the signal to single channel relay which will allow the mini-DC pump to sprinkle the water to the spot. When the flames are detected on right side of the robotic system, the servo motor will only rotate from straight to right direction of 90-degree angle, if the flames are detected on left side, the motor will rotate toward left direction only. When the flames are extinguished, the sensor will sense that there is no flames and sends the signal to the board which will immediately stops the water by commanding the relay automatically. The LCD display is also included in the system which displays the flames detection, smoke detection and temperature detection in numerical. If

temperature is above 45 degrees, then the water is sprinkled immediately on the spot. After the fire extinguished, immediately the message alert is sent to the preprogrammed number weather the fire is detected on the right side or left side of the system and smoke detected will be send then the temperature information is also messaged. Then the call alert will also be operated with the help of SIM 800L.

3. CONCLUSIONS

The Fire Fighting Robot with SMS & Call alert project represents a significant advancement in the realm of automated emergency response systems. By integrating cutting-edge technologies such as robotics, sensors, and communication modules, the project aims to enhance the efficiency and effectiveness of firefighting operations. The implementation of a robotic platformequipped with fire detection sensors and the ability to navigate through challenging environments allows for rapid and precise identification of fire incidents. The incorporation of SMS and call alert features adds a layer of real-time communication, enabling quick response and coordination among emergency situations. This innovative solution addresses the limitations of traditional firefighting methods, particularly in scenarios where human intervention may be delayed or restricted. The autonomous nature of the robot reduces the riskto human lives and provides a swift response to mitigate potential damages caused by fires. In essence, the Fire Fighting Robot with SMS & Call Alert project stands as a testament to the transformative power of technology in enhancing the capabilities of emergency services, ultimately contributing to the safety and well-being of communities.

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