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IMPLEMENTATION OF FIRE CONTROL ROBOTIC VECHILE OVER IOT TECHNOLOGY

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ABSTRACT

Fire accidents have been occurring frequently these days, with or without the intervention of humans. A fire incident is a disaster that can potentially cause the loss of life, property damage, and permanent disability to the affected victims. Firefighters are primarily tasked to handle fire incidents, but they are often exposed to higher risks when extinguishing the fire, especially in hazardous environments such as nuclear power plants, petroleum refineries, gas tanks, etc. They also face other problems, especially if a fire breaks out in a small, cramped area, as they need to explore the ruins of buildings and obstacles to extinguish the fire and save the victim. In the case of high barriers and risks in firefighting activities, innovation can be used to assist the fire brigade. When the Robot detects a fire, it gives a message to the nodeMCU which will automatically sense the fire update the data on to blynk server and control the robot and start the water pump. It assists firefighters in extinguishing the fire. And it will perform its operation where firefighters can’t reach. This will save the risk of fire fighters' life and avoid any further damage.

INTRODUCTION

In order to put out fires and preserve lives, firefighters must be experienced and trained to enter dangerous places. This is a risky and difficult work. To improve the security and effectiveness of firefighting operations, firefighting robotic vehicles have emerged as a potential alternative thanks to recent breakthroughs in robotics technology. Unmanned vehicles that are outfitted with sensors and firefighting gear may enter risky settings and carry out duties that would be too dangerous or complex for human firefighters. These vehicles are called firefighting robotic vehicles. These robotic devices may be operated remotely and are frequently furnished with firefighting tools. The ability of robotic firefighting vehicles to enter dangerous settings without endangering the lives of human firefighters lowers the possibility of injury or death. This is one of the key benefits of these vehicles. Robotic systems can also work continuously for extended periods of time without stopping or resting, which is useful in circumstances where time is of the importance. To sum up, robotic firefighting vehicles provide a viable way to improve the security and effectiveness of firefighting operations. These systems are anticipated to grow increasingly complex, adaptable, and efficient in solving the issues encountered by firemen in hazardous areas as robotics technology continues to progress.

OBJECTIVE OF THE PROJECT

The objective of this project is to mitigate the risks associated with fire incidents by deploying an innovative solution that utilizes robotics and IoT technology to assist firefighters in extinguishing fires. With fire accidents becoming increasingly common, whether caused by human intervention or natural factors, it is imperative to enhance the capabilities of firefighting teams while reducing their exposure to dangerous environments.

Specifically, the project aims to achieve the following objectives:

Develop a robotic system capable of detecting fires autonomously in various environments, including hazardous locations such as nuclear power plants, petroleum refineries, and gas tanks.

Integrate IoT technology, specifically nodeMCU and Blynk server, to enable real-time communication and data updates when a fire is detected. This includes transmitting fire alerts to firefighting teams and controlling the robotic system remotely.

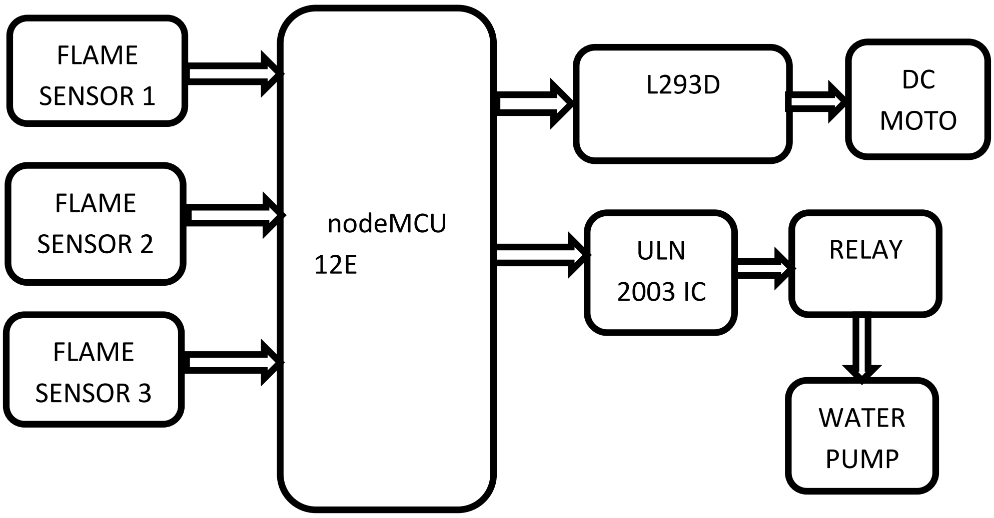

Figure.1 Block Diagram

LITERATURE SURVEY

1.Introduction to IoT in Fire Fighting:

Start by understanding the application of IoT in fire fighting and the need for advanced technologies to improve response time and safety.

Explore literature that introduces the concept of IoT-based fire fighting robots and their potential to assist firefighters in hazardous environments.

2. Design and Architecture of IoT-Based Fire Fighting Robots:

Investigate research papers and articles that discuss the design principles and architecture of IoT-based fire fighting robots.

Look for studies that describe the integration of sensors, actuators, microcontrollers, communication modules, and AI algorithms to enable autonomous operation and real-time data transmission.

3. Sensor Technologies for Fire Detection and Monitoring:

Review literature on the sensor technologies used in IoT-based fire fighting robots for fire detection and environmental monitoring.

Explore studies that discuss the deployment of sensors such as thermal imaging cameras, gas sensors, smoke detectors, and temperature sensors to detect and assess fire hazards.

PROPOSED SYSTEM

This project differs from existing firefighting solutions by combining robotics, IoT technology, and autonomous capabilities to detect and extinguish fires in hazardous environments. Unlike traditional methods reliant on manual intervention, this system operates independently, minimizing risks to firefighters and enhancing efficiency in firefighting operations, especially in inaccessible or dangerous areas

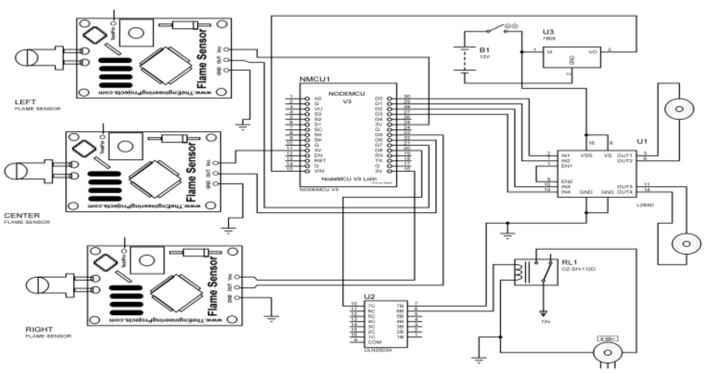

Figure.2 Schematic Diagram

RESULTS

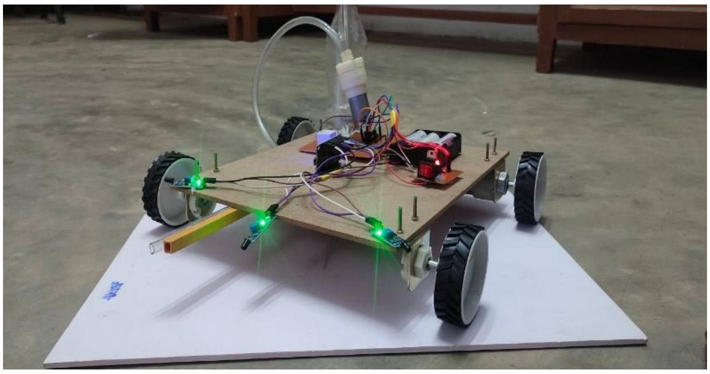

Figure.3 Working Kit

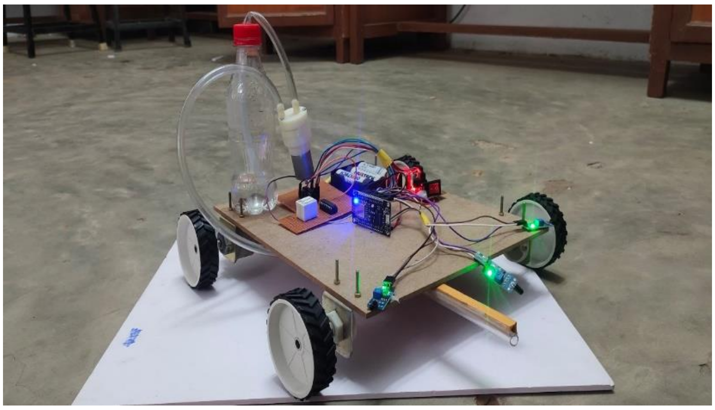

Figure.4 Testing

The above picture shows the prototype model of fire control robotic vehicle. Based on the direction of the fire the flame sensors will activate and the data is analysis by the blynk server and operates the water pump to mitigate the fire. The blynk app will show the direction of the fire on the blynk app. based the fire direction the LED will glow and helps to know the fire direction for operator and also for the nodeMCU.

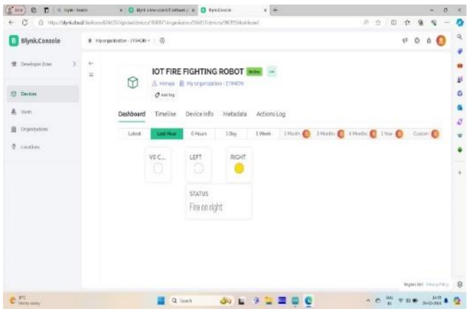

Figure.5 Status of fire at right on Blynk

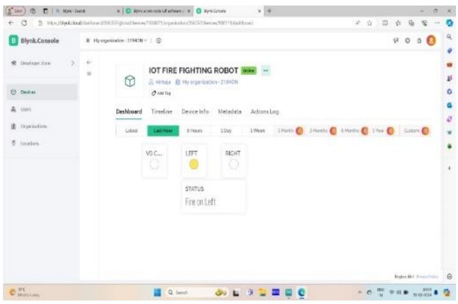

Figure.6 Status of fire at left on Blynk

ADVANTAGES

Reduced Risk to Humans: By entering hazardous environments like burning buildings or confined spaces, robots can minimize the risk to firefighters from heat, smoke inhalation, and toxic fumes.

Faster Response: Equipped with advanced sensors and autonomous navigation, robots can detect and reach fires quicker, potentially containing the blaze before significant damage occurs.

Precision: Sensors and AI algorithms can enable robots to accurately locate and target the fire source, minimizing water use and collateral damage.

Remote Operation: Firefighting robots can be remotely operated from a safe distance, allowing firefighters to assess the situation and control the robot without directly exposing themselves to danger.

CONCLUSION

In conclusion, the development of our firefighting vehicle incorporating advanced technologies such as the nodeMCU, flame sensor, DC water pump, and integration with the Blynk server represents a significant leap forward in firefighting capabilities. By harnessing the power of IoT and real-time data transmission, our vehicle offers enhanced responsiveness and efficiency in combating fires.

The nodeMCU enables seamless connectivity and control, allowing for remote monitoring and operation of the vehicle's functions. The inclusion of a flame sensor enhances safety by providing early detection of fires, enabling prompt intervention to mitigate risks effectively.

FUTURE SCOPE

Enhanced Sensor Integration.

Smoke detectors: Adding smoke detectors alongside flame sensors can provide a more comprehensive fire detection system, improving accuracy and early warning.

Temperature sensors: Integrating temperature sensors can help identify potential fire hazards before flames erupt, allowing for preventive measures.

2. Advanced Navigation and Path Planning:

LiDAR or ultrasonic sensors: Implementing LiDAR or ultrasonic sensors can offer superior obstacle detection and mapping capabilities, enabling the robot to navigate complex environments more efficiently.

Path planning algorithms: Integrating path planning algorithms can optimize robot movement, allowing it to reach fire sources quickly and safely while avoiding obstacles.

3. Machine Learning and AI Integration:

Real-time fire recognition: Utilizing machine learning models trained on image or sensor data

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