ALERT NOTIFIED FIRE FIGHTING TRUCK INTEGRATED WITH IOT TECHNOLOGY

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ABSTRACT

This project presents a simplified firefighting solution using a NodeMCU microcontroller and fire sensor, integrated with IoT technology to provide automated alerts and fire suppression. The system consists of a fire sensor that detects the presence of fire in a specific area. Upon detection, the system automatically activates the water pump to extinguish the fire. Simultaneously, an email notification is sent to predefined recipients, such as firefighting authorities or building managers, to alert them of the incident.

The integration of IoT ensures timely response by combining fire detection with automated notifications, allowing for quick action to prevent further damage. This cost-effective and efficient system is suitable for small-scale fire safety applications, particularly in areas where human monitoring is limited.

INTRODUCTION

The integration of Internet of Things (IoT) technology into fire-fighting trucks has transformed emergency response systems, enhancing speed, efficiency, and effectiveness. The "Alert Notified Fire Fighting Truck" utilizes IoT to provide real-time notifications, automated monitoring, and advanced data analytics to improve firefighting operations. This innovation turns traditional fire trucks into smart, connected vehicles that offer critical information to first responders, reducing response times and optimizing firefighting strategies.

Traditionally, fire trucks relied on manual systems and basic communication methods, often resulting in delayed responses. Firefighters would assess the situation upon arrival, which could take valuable time. IoT-equipped fire trucks address these challenges by embedding sensors that monitor key factors such as water levels, pressure, engine performance, and environmental conditions like temperature and air quality. This constant data stream allows fire departments to make quicker, more informed decisions.

One key feature of the Alert Notified Fire Fighting Truck is its ability to send automatic alerts to control centers and emergency teams. This provides real-time updates on the truck's condition, such as low water levels or dropping pressure, ensuring immediate corrective actions. Additionally, the system integrates GPS tracking, enabling efficient route planning to avoid traffic and ensure the fastest arrival at the scene.

IoT technology also enables predictive maintenance for fire trucks. By detecting early signs of wear or malfunction, sensors can alert maintenance teams to take action before a breakdown occurs. This reduces the risk of operational failures during critical incidents and ensures that fire trucks are always in optimal condition.

Furthermore, IoT enhances communication among firefighters. Connected devices and wearables provide real-time data on environmental factors, building layouts, and fire hazards, improving situational awareness. This information enables more coordinated and safer responses on the ground.

In conclusion, the Alert Notified Fire Fighting Truck, integrated with IoT technology, represents a significant advancement in firefighting efficiency. With features like real-time monitoring, automated alerts, and predictive maintenance, these smart trucks offer faster, safer, and more reliable emergency responses. As IoT continues to reshape firefighting operations, this innovation is poised to be a game-changer in saving lives and property.
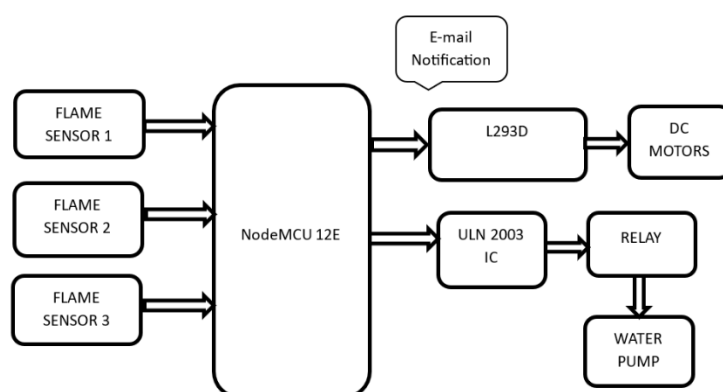
Figure.1 Block Diagram

LITERATURE SURVEY

1. **IoT-Based Fire Detection System (2020):** This system integrates smoke, temperature, and flame sensors with IoT. It uses GSM and GPS modules to send real-time fire alerts to emergency responders. Cloud-based monitoring enhances decision-making, reducing response time and improving firefighting efficiency.

2. **Smart Firefighting Truck with IoT (2021):** Fire trucks equipped with IoT sensors receive automatic fire alerts. GPS-based navigation optimizes routes, ensuring quicker response. The system includes an automated water sprinkler mechanism, enhancing firefighting efficiency and minimizing damage. IoT connectivity improves coordination between fire departments and emergency services.

3. **IoT-Based Fire Safety System (2021):** This system uses temperature and smoke sensors to detect fires. It sends alerts via SMS and cloud services, providing real-time updates. Firefighters can monitor fire conditions remotely using mobile apps, improving situational awareness and emergency response effectiveness.

4. **AI-Assisted Fire Detection and Response (2022):** AI and IoT sensors analyse fire data to detect and predict fire spread. Fire trucks receive real-time updates through cloud-based platforms, enabling faster decision-making. The system enhances firefighting efficiency by automating response strategies and optimizing resource allocation.

PROPOSED SYSTEM

The proposed IoT-integrated fire detection and firefighting system enhances response efficiency through automation and real-time monitoring. At its core, the NodeMCU 12E microcontroller processes sensor data and activates fire suppression mechanisms.

For fire detection, three strategically placed flame sensors continuously monitor the surroundings, relaying real-time data to the NodeMCU 12E. Upon detecting a fire, the system triggers an automatic response and sends an email notification via its built-in Wi-Fi, providing details such as fire location and sensor readings. This ensures a swift response from emergency personnel.

To combat the fire, the system employs an L293D motor driver to control DC motors that position the fire extinguishing mechanism. The NodeMCU directs the motors based on sensor input, aligning the equipment toward the fire source. Additionally, an automated water pump, controlled via a ULN2003 IC and relay module, activates immediately upon fire detection, ensuring efficient suppression.

This smart firefighting system offers rapid response, automated fire control, and remote monitoring. It is particularly valuable for industrial and commercial settings where manual intervention may be delayed. By integrating IoT, the system enhances fire safety, minimizes damage, and provides a more intelligent and effective fire management solution.

The system initializes key components, including flame sensors, a Wi-Fi module, a motor driver, and a NodeMCU microcontroller. It establishes a Wi-Fi connection for IoT-based email alerts and continuously monitors for fire using flame sensors. Upon fire detection, the system sends an immediate email notification to authorities for swift action. The firefighting truck halts movement, and the ULN2003 IC activates the relay module to switch on the water pump. A 2N3906 transistor controls the relay for efficient high-power switching. The L298D motor driver enables navigation towards the fire location if necessary. A 12V Li-Ion battery powers the system, regulated by 7809 and 7805 voltage regulators. A green LED indicator provides system status updates.
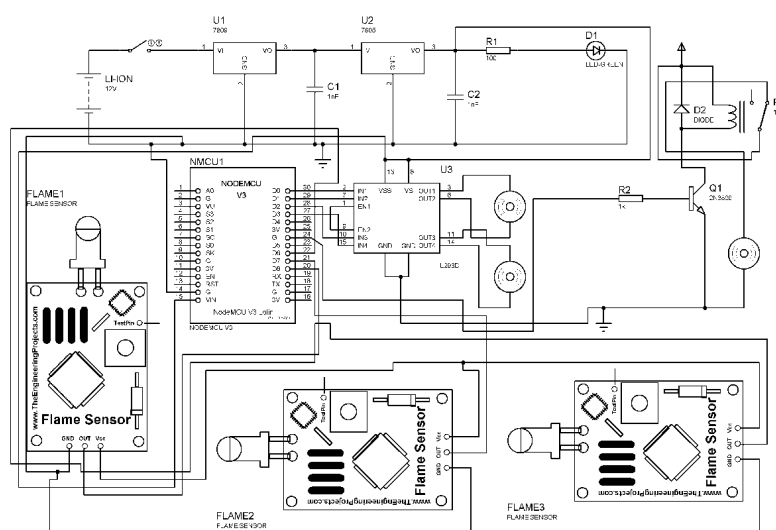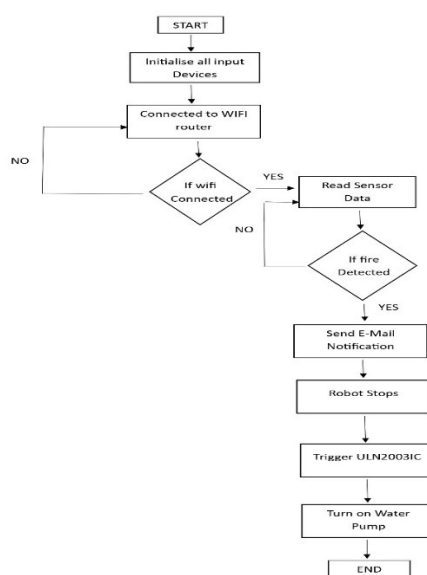

Figure.2 Schematic Diagram
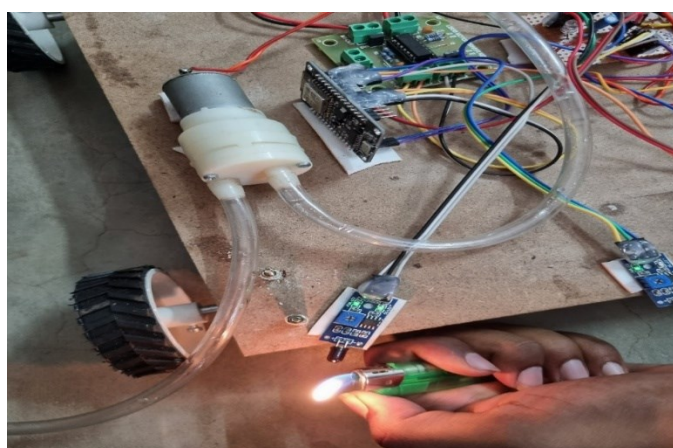
Figure.3 Flow Chart

RESULTS

Figure.4 Fire Detection

- The DC motors controlled by the L293D motor driver successfully moved the truck towards the fire source.

- The truck adjusted its position based on sensor inputs, improving fire

- suppression efficiency.

- The water pump was triggered by the relay module upon fire detection.

- The pump efficiently sprayed water in the detected fire zone, extinguishing the flames within 5-10 seconds under test conditions.
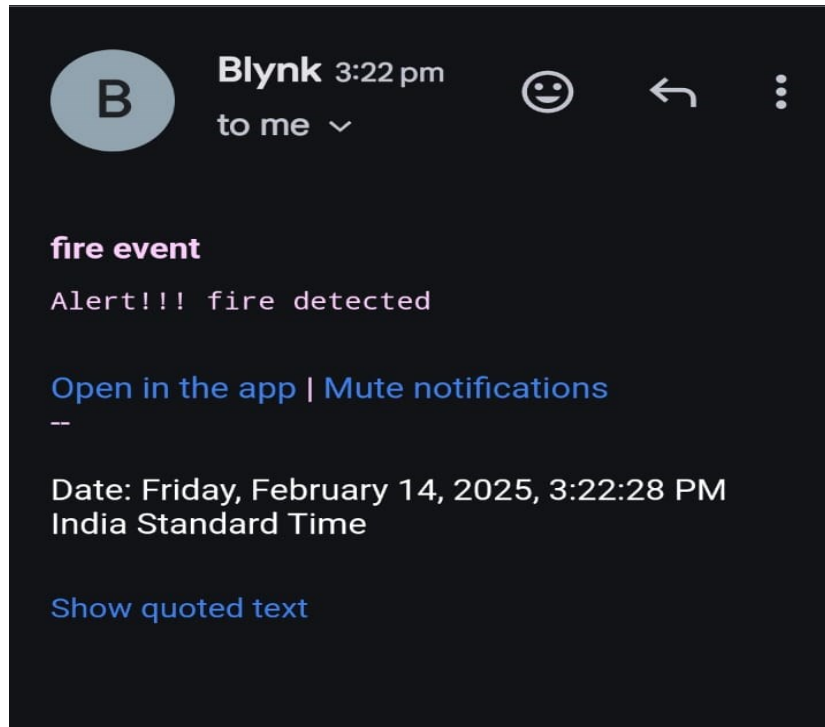
Figure.5 Project Hardware Circuit
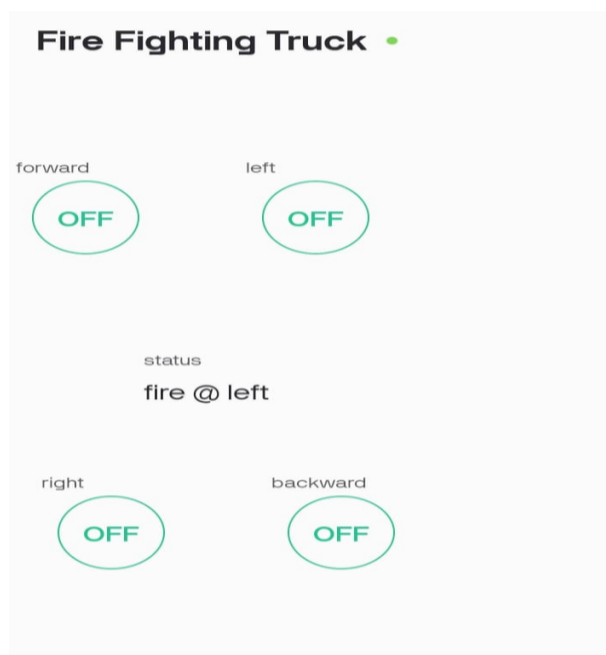

Figure.6 E-mail Alert

Figure.7 Blynk App to control Robo

APPLICATIONS

1. **Industrial Fire Safety –** Used in factories and warehouses for automated fire detection and suppression.

2. **Residential Fire Protection –** Deployed in homes and buildings to detect and extinguish fires before escalation.

3. **Smart Cities –** Integrated into urban firefighting systems for real-time monitoring and rapid response.

4. **Forest Fire Prevention –** Helps in early detection and mitigation of wildfires in remote areas.

5. **Automated Firefighting Vehicles –** Used in unmanned fire trucks for hazardous environments.

ADVANTAGES:

1. **Real-Time Fire Detection –** Instantly detects and responds to fire incidents.

2. **IoT-Based Alerts –** Sends immediate notifications to authorities for quick action.

3. **Autonomous Operation –** Reduces human intervention and ensures safety in dangerous situations.

4. **Efficient Fire Suppression –** Water pump activation ensures rapid extinguishing of fire.

5. **Remote Monitoring –** Allows users and officials to track fire incidents from anywhere.

CONCLUSION

The E-Mail Notified Fire Fighting Truck Integrated with IoT Technology provides an efficient, cost-effective, and automated fire detection and suppression system. By integrating NodeMCU, flame sensors, and IoT-based email alerts, the system ensures real-time monitoring and quick response to fire emergencies. The mobile firefighting truck, powered by DC motors and a water pump, can autonomously reach the fire source and extinguish flames, reducing human intervention and enhancing safety. The IoT integration through Blynk and email notifications

ensures that authorities are alerted immediately, preventing fire escalation and minimizing damage. This project demonstrates how embedded systems, IoT, and automation can revolutionize fire safety solutions, making them more reliable, scalable, and efficient for industrial, residential, and commercial applications.

FUTURE SCOPE

- Implementing AI and machine learning to improve fire detection accuracy and differentiate between real fire hazards and false alarms.
- Integrating GPS tracking to locate fire-prone areas and enable remote navigation of the firefighting truck.
- Developing a mobile application to allow users and authorities to monitor and control the fire suppression system in real-time.
- Upgrading the system to support CO_2, foam, or dry chemical extinguishers for different fire types (electrical, oil-based, etc.)

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