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IoT-Based Smart System For Avoidance Of Fire Accident On Running Bus

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Index Terms- MQ-2Smoke sensor, relay module, GPS System, ESP32 Microcontroller, GSM Module.

INTRODUCTION

The automotive industry is currently transitioning towards intelligent and connected vehicles, with a focus on integrating advanced technologies for enhancing vehicle performance, reliability, and safety. One of the key aspects of this transformation is the shift towards predictive maintenance, which involves forecasting potential failures before they occur, thereby improving vehicle uptime and minimizing maintenance costs. This approach contrasts with traditional maintenance methods, which rely on fixed schedules or reactive measures, often leading to unplanned downtime and increased operational costs.

The system will collect and process data from various vehicle sensors, including accelerometers, gyroscopes, strain gauges, and temperature sensors. This data will be combined with historical maintenance records and vehicle usage patterns to create a comprehensive dataset for model development. Machine learning algorithms will be employed to identify patterns, anomalies, and degradation trends in component behaviour. The resulting predictive models will provide valuable insights into component lifespan and enable proactive maintenance strategies. By implementing this data-driven approach, the automotive industry can significantly improve vehicle reliability, reduce maintenance costs, and enhance overall customer satisfaction.

Literature Survey

IG. Ram Sankar, 2P. Abhishek, 3 B. Bharathwaj, 4K., 5B. Sam kingshlin.

1.Assistant Professor, Adhiyamaan College of Engineering, Hosur, south India. 2.3.4.5Student, Adhiyamaan College of Engineering, Hosur,

This paper explores off-board chargers for electric vehicles (EVs), focusing on AC-DC and DC-DC power stages connecting the power network to the EV battery. Off-board chargers, essential for DC fast and ultrafast charging, significantly reduce EV volume and weight. Leveraging IoT and Power Factor Correction (PFC),

we assess their advantages like enhanced charging capacity monitoring, while acknowledging limitations such as a restricted maximum Charge rate (2022).

2.UNAIZA ALVIR 1, ASAD WAQAR MALIK 1. (Senior Member, IEEE).

AND SHER RAMZAN MUHAMMAD

A Comprehensive Study on IOT Based Accident Detection System for Smart Vehicles.

3.VennelaPriyadarshni, P. Gopi Krishna and K. Sreenivasa Ravi "GPS and GSM Enabled Embedded Vehicle Speed Limiting Device" in Indian Journal of Science and Technology, Vol 9(17), DOI: 10.17485/IJRT/2016/v9i17/93045, May 2016

This paper aims to offer simple and effective solution for controlling the speed of the vehicle automatically. Methods/Analysis: The framework makes utilization of ARM microcontroller which is the core device.

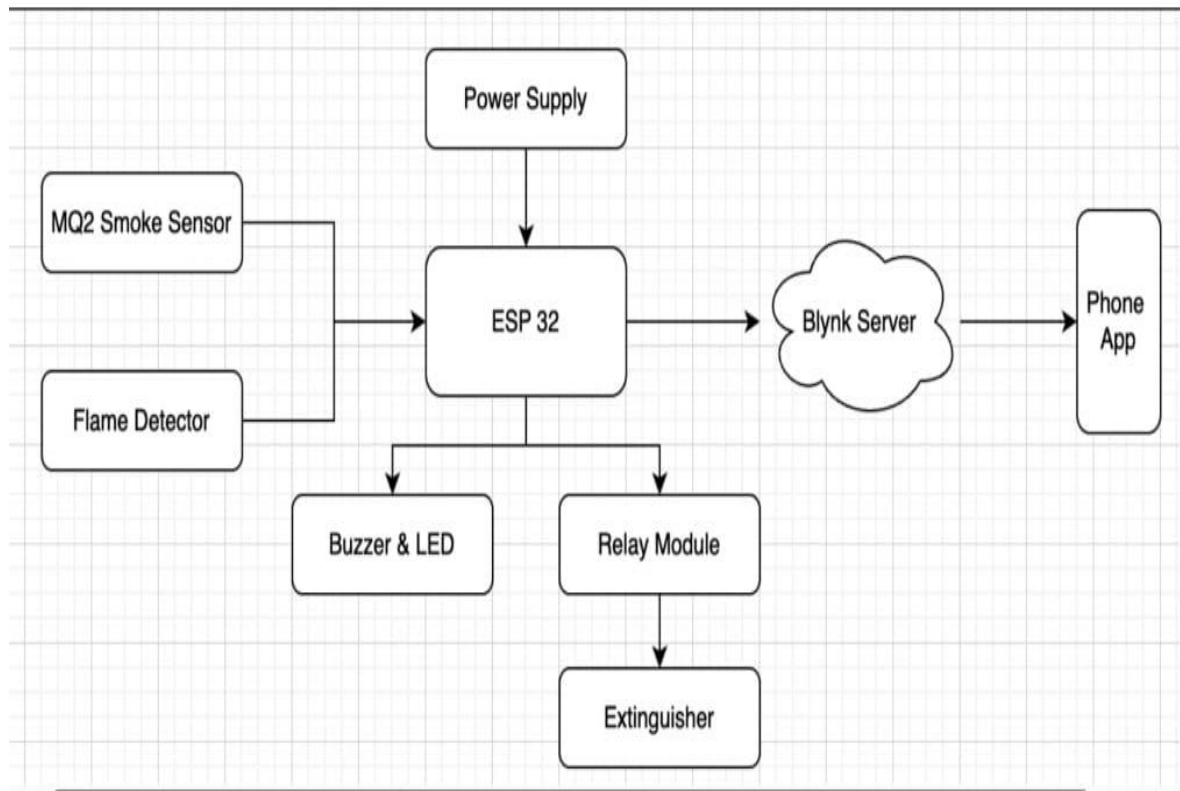
Findings: An expansion to the current system was enhanced in this paper which naturally controls the speed of the vehicle based on its location determined by the GPS coordinates and a switch initially present in on state enters into off state where the user uses this in crisis situation allotted by sending a message to nearby traffic control unit with usage of GSM. Novelty/ Improvement: Based on the obtained GPS values the speed of the vehicle is controlled.

Objectives

- 1.Real-time Detection: To detect smoke and flames in a bus using the MQ2 smoke sensor and flame phones.
- 2Automatic Fire Suppression: To activate a fire extinguisher through a 5V relay module when an excessive fire or smoke is detected.
- 3.Wireless Alerts: To send real-time fire alerts and system status to the user's mobile phone using Blynk IoT.

Methodology

This project focuses on the development of an IoT-based fire detection in Runing Bus. The block diagram of the prosed method is shown in figure. The proposed idea consists of a fire detector, buzzer, water motor and a GPS module are connected to the controller which continuously monitors the whole vehicle automatically when the engine turns ON and it will be OFF state when engine turns OFF. When the surrounding value crosses the rage of fire detector the design comes in to an active state when fire is detected our proposed idea consists of a design that gives an alert to passengers and driver by alarming, pre-recorded voice through speakers in the bus (fire detected alight the bus immediately), water will be sprinkled, and the locations longitude and latitude is shared automatically to fire stations and police stations and hospitals by using GPS module. Through human loss can be avoided and human loss as well cell phone detection system



Block Diagram

A. Hardware Specification:

A high-gain operational Amp. We had implemented a design to prevent the fire accidents on running buses. The design consists of node MCU, Fire sensor to detect fire, DC motor for water sprinkler system, GPS module to send the location and buzzer to produce a sound. The main component of our design is node MCU which act as central controller and is connected to the bread board and the power to node MCU is given by USB cable by using a system. Mainly to detect fire there must be a sensor and we had used Thermistor to detect fire. The working of thermistor is, when there is smoke, fire on the surroundings it will detect. For the water sprinkler system, we had used a DC motor, in a typical DC motor, there are permanent magnets on the outside and a spinning armature on the inside. The permanent magnets are stationary, so they are called the stator. The armature rotates, so it is called the rotor. And it is placed in water tub. GPS (Global positioning system), it does not need any user to transmit the data it automatically tracks the location by trilateration principle. And another component is buzzer it comes to active state when fire is detected. The whole design is implemented by writing a certain code in Arduino software, and the code is dumped in to node MCU by using USB cable, and the power is also given by that cable. Connections are made as shown in the circuit diagram. And to check our design fire is too kept at sensor and when it detects it, the device comes to active state, and there is alert to the passengers and driver in the bus in the form of a sound will be produced by buzzer, and there will be LED blink, and share location by using GPS module Lifer used for signal amplification.

MQ2 Smoke Sensor:

Sensitive to a variety of gases and smoke. The sensor has an Analog output that can be connected to the ESP32 to measure smoke levels.

Flame Sensor:

Detects the presence of a flame in the sensor's range. It outputs a digital signal when a flame is detected.

ESP32:

A powerful dual-core microcontroller with integrated Wi-Fi and Bluetooth capabilities. It allows for real-time communication with the Blynk app and manages the sensor data and relay control.

Relay Module:

A 5V relay used to control higher-power devices, such as activating the fire extinguisher in this case.

Neo-6M GPS:

A GPS module that tracks the bus's real-time location and sends the coordinates to the Blynk app.

Blynk IoT App:

A user-friendly application for visualizing and controlling the system. The app provides a real-time interface for monitoring the bus's fire detection status and location.

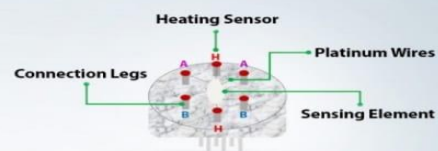




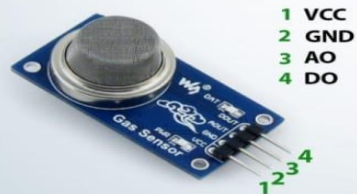
MQ-2 Smoke/Gas Sensor



MQ-2 Smoke Sensor



MQ-2 Smoke Working



MQ-2 Smoke Pinout



MQ2 Gas Sensor Pinout

MQ-2 Smoke : Pinout, Datasheet, Price, Packages, Working Principle, Features, Power Ratings, Electrical Characteristics, Equivalents, Uses, Applications.

VI. Conclusion

This Fire Accident Prevention System for buses is a critical step toward improving passenger safety. By integrating smoke detection, flame sensing, real-time GPS tracking, and automatic fire suppression, this system provides an effective and proactive solution to prevent fire accidents. The Blynk IoT integration ensures that the system can be monitored remotely, providing bus operators with real-time data and alerts. The automated response mechanism, such as the activation of the fire extinguisher, ensures that the system reacts swiftly and effectively, reducing the risk of injury and property damage. This project can be further improved with additional sensors, more advanced fire suppression techniques, and enhanced user interfaces to provide a more comprehensive solution for fire safety in buses and other public transport focused and distraction-free environment in designated areas, By effectively detecting the presence of cell phones and other Devices.

Acknowledgement

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression, "One of us (R. B. G.) thanks..." Instead, try "R. B. G. thanks". Put applicable sponsor acknowledgments here; DO NOT place them on the first page of your paper or as a footnote.

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