IoT-Based System for Automated Accident Detection

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Abstract: Road accidents in urban areas often lead to significant delays in emergency response due to the reliance on human reporting and the challenges of locating accident sites. This project proposes an IoT-based system for automated accident detection, aiming to enhance the speed and accuracy of accident reporting. The system utilizes limit switches placed on the front and rear of a vehicle to detect collisions. Upon detection, the system sends an immediate alert through a cloud-based platform to a mobile application. Additionally, it incorporates a DHT11 sensor to monitor surrounding temperature and humidity, along with a smoke sensor to detect potential fire hazards. This comprehensive approach ensures real-time notifications and provides critical environmental data, significantly improving emergency response times and situational awareness. The proposed system exemplifies how IoT technology can transform accident management, leading to faster, more effective interventions and ultimately saving lives.

Keywords: MQTT Protocol, Node MCU, Dht-11,MQ-3, Blynk cloud.

I. INTRODUCTION

Accidents, particularly in urban areas, are an unfortunate but frequent phenomenon, contributing significantly to both fatalities and injuries. A critical factor in the survival and recovery of accident victims is the response time of emergency services. The sooner the victim receives medical attention, the higher the chances of survival and reduced long-term impacts. However, nighttime accidents pose unique challenges, primarily due to reduced visibility and the difficulty of accurately locating the accident site. [1]

In urban areas, road accidents are a frequent occurrence, often leading to significant loss of life and property. The response time to such accidents is a critical factor in determining the severity of the consequences and the likelihood of survival for the victims. Traditional methods of accident reporting rely heavily on human witnesses or the accident victims themselves to alert emergency services. This can result in significant delays, especially if the accident occurs at night or in areas with low visibility, where the victims may be unconscious and unable to seek help. In light of these challenges, there is a pressing need for a system that can automatically detect accidents and alert emergency responders without human intervention. [2] The advent of the Internet of Things (IoT) has opened up new possibilities for creating such systems, enabling real-time data collection and communication across a network of connected devices.

The cloud-based architecture of the system ensures that data and alerts are processed and delivered in real-time, facilitating quick and coordinated responses by emergency services. [3] The mobile application serves as the user interface, providing instant notifications and critical accident data to users, thereby enabling swift action and potentially saving lives.

This paper outlines the design, implementation, and potential benefits of the IoT-based accident detection system. It highlights the system's capability to provide a reliable, automated solution for accident detection and response, addressing a significant need in urban traffic management and emergency response frameworks. [5] The system is designed to detect collisions and other critical events involving a vehicle and to promptly notify relevant parties through a cloud-based mobile application. [4] The proposed system not only addresses the delays associated with traditional accident reporting methods but also provides additional environmental data that can be crucial for emergency response and post-accident analysis. [6]

Given these challenges, there is a pressing need for a system that can automatically detect accidents and provide precise, real-time notifications to emergency services. [7] An automated solution would ensure that accidents are detected immediately, regardless of the

presence of eyewitnesses or the ability of the victims to report them. [8] This would significantly reduce response times, potentially saving lives and reducing the severity of injuries.

II. PROPOSED SYSTEM

This paper proposes an IoT-based system for automated accident detection and notification. The system utilizes modern sensor technology and cloud-based communication to create a robust network for real-time accident reporting.

- Automatic Collision Detection: The system is equipped with limit switches placed at the front and rear of a vehicle. These switches detect collisions instantly and send alerts through a cloud-based platform to a mobile application. This ensures immediate reporting of accidents, allowing emergency services to respond swiftly.
- Environmental Monitoring: The system integrates a DHT11 sensor to measure the surrounding temperature and humidity, providing valuable contextual data that can be crucial for emergency response. Additionally, a smoke sensor is included to detect the presence of smoke, which may indicate a fire or the release of harmful gases, thereby enhancing the safety of the vehicle occupants.
- Real-Time Alerts: The collected data is transmitted to a cloud-based platform, which processes the information and sends real-time alerts to the designated mobile application. This ensures that emergency responders receive accurate location information and environmental data, enabling them to take timely and informed action.

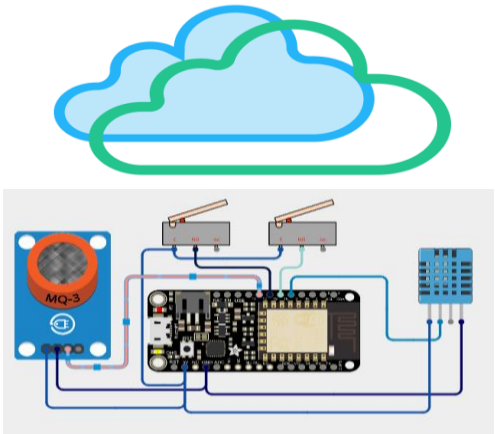

Fig.1: Proposed diagram

III. RESULT AND DISCUSSION

This project aims to develop an IoT-based system that automatically detects accidents and sends alerts to a mobile application via a cloud platform. The system is designed to ensure rapid notification and response, significantly reducing the time taken for emergency services to reach the accident site. The system utilizes limit switches strategically placed at the front and rear of a demonstration car model. These switches are designed to detect collisions by getting triggered upon impact. When an accident occurs, and either the front or rear limit switch is pressed, the system immediately identifies this as a collision event. This mechanism provides a simple yet effective way to detect impacts that may indicate an accident. Once a collision is detected, the system sends an alert through a cloud-based service. The cloud platform processes the data and ensures that the alert is transmitted in real-time to a designated mobile application. The mobile application receives the alert, providing immediate notification to the user or emergency services about the accident. This real-time alert system helps in reducing the response time by quickly informing the necessary parties about the incident. The system includes a DHT11 sensor that continuously monitors the environmental conditions surrounding the vehicle. The sensor measures the temperature and humidity levels, providing valuable context about the conditions at the time of the accident. A smoke sensor is integrated into the system to detect the presence of smoke in or around the vehicle. Smoke detection is crucial for identifying potential fire hazards or the release of toxic gases following a collision. In the event of smoke detection, the system sends additional alerts through the cloud to the mobile application, warning about the presence of smoke and potential fire risks. This early detection allows for prompt intervention to prevent further hazards and ensure the safety of the vehicle occupants.

In the first condition, there is no accident detected. The car is in a normal state, with no collision impact. The front and rear limit switches are not pressed, indicating that the vehicle has not experienced any collision. The DHT11 sensor monitors and reports normal surrounding humidity and temperature levels, confirming that environmental conditions are stable. The image shows a vehicle with no alerts or notifications on the mobile app. The status

indicators for temperature and humidity display normal values, as no significant changes or accidents are detected.

In the second condition, a collision is detected at the front of the vehicle. The front limit switch is pressed, indicating that the car has experienced an impact from the front. Upon detecting the front collision, the system sends an alert to the cloud. The cloud platform processes this alert and sends a notification to the connected mobile application. The image illustrates the vehicle with the front limit switch pressed. The mobile app displays an alert notification indicating a front collision, providing the exact location and status of the accident. Environmental data from the DHT11 sensor may still show normal values unless the collision has impacted the surrounding conditions.

In the third condition, a collision is detected at the rear of the vehicle. The rear limit switch is pressed, signifying an impact from the back. Similar to the front collision scenario, the system detects the rear collision and sends an alert to the cloud, which then notifies the mobile application. The image shows the vehicle with the rear limit switch pressed. The mobile app presents an alert notification indicating a rear collision, detailing the accident location and status. As with the previous conditions, the DHT11 sensor data may continue to display normal humidity and temperature levels unless affected by the collision.

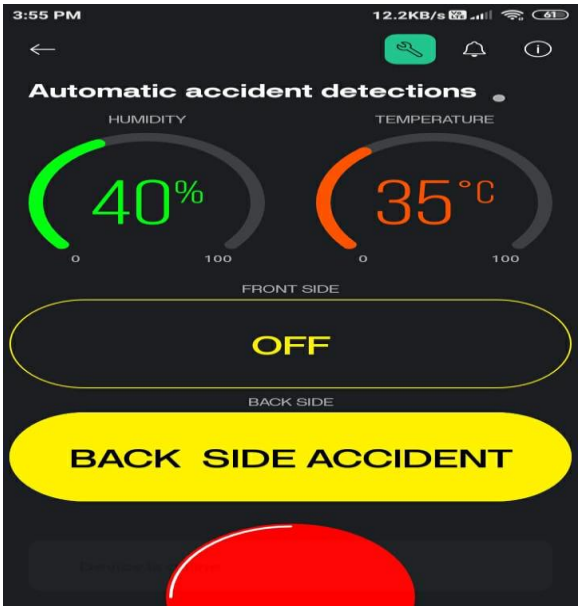

Fig.2: Mobile App alert notificaion

Advantages of Proposed System

- Fast recovery and quick process.
- Monitor all hazards and threats in both
- Network coverage and no network areas.
- Wireless monitoring and user friendly
- Reducing Response Times

IV. CONCLUSION

The IoT-based system for automated accident detection significantly enhances road safety by

providing real-time alerts and accurate location data through a cloud-connected mobile app. The use of limit switches for collision detection, coupled with environmental monitoring via the DHT11 sensor and smoke detection, ensures prompt and comprehensive reporting of accidents. This system not only reduces emergency response times but also provides critical contextual information, thereby improving the effectiveness of rescue efforts. The proposed solution exemplifies the potential of IoT technology to revolutionize accident management and emergency response, ultimately saving lives and reducing the impact of road accidents.

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