IOT BASED AUTOMATIC VEHICLE ACCIDENT DETECTION AND RESCUE SYSTEM

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Abstract: Our project proposes an IoT-based Automatic Vehicle Accident Detection and Rescue System (AVADRS) utilizing Arduino Uno, accelerometer, GPS module, GSM module, and NodeMCU. By integrating these components, our system aims to promptly detect vehicle accidents by analyzing accelerometer data for sudden changes in acceleration and GPS data for real-time location tracking. Upon detection, the GSM module initiates immediate communication with emergency contacts, providing vital accident details. Additionally, NodeMCU enables wireless connectivity for data transmission to cloud servers or mobile applications, facilitating remote monitoring and rescue coordination. Through rigorous testing and deployment, our project seeks to enhance road safety and emergency response capabilities, contributing to the ongoing efforts towards creating safer transportation systems.

Keywords: IoT, Automatic Vehicle Accident Detection, Rescue System, Arduino Uno, Accelerometer, GPS Module, GSM Module, NodeMCU

I. Introduction

In today's fast-paced world, road accidents remain a significant concern, leading to injuries, fatalities, and property damage. Addressing this issue requires innovative solutions that can promptly detect accidents and facilitate swift rescue operations. Our project focuses on developing such a solution in the form of an IoT-based Automatic Vehicle Accident Detection and Rescue System (AVADRS). By leveraging the power of IoT technology and integrating various hardware components, including Arduino Uno, accelerometer, GPS module, GSM module, and NodeMCU, we aim to create a reliable and efficient system to enhance road safety and emergency response capabilities. The core objective of our AVADRS is to automatically detect vehicle accidents and initiate rescue operations without delay. The system utilizes an accelerometer sensor to monitor changes in the vehicle's acceleration, which serves as a primary indicator of a collision. Concurrently, a GPS module provides real-time location data, enabling precise identification of the accident site. By combining these sensors, our system can swiftly identify accidents and respond accordingly, minimizing the time between the occurrence of an accident and the initiation of rescue efforts.

The integration of GSM modules enables immediate communication with emergency services and designated contacts in the event of an accident. Upon detecting a collision, the system sends SMS alerts or makes calls to predefined emergency contacts, providing

essential information such as the vehicle's location and the time of the accident. This feature ensures that relevant stakeholders are promptly notified, facilitating a coordinated and efficient response to the emergency situation.

Moreover, the inclusion of NodeMCU enables wireless connectivity, allowing for data transmission to cloud servers or mobile applications. This capability facilitates remote monitoring of vehicle status and accident alerts, empowering authorities and emergency responders to monitor road safety in real-time and take proactive measures to mitigate risks. Through the implementation of our AVADRS, we aspire to contribute to the ongoing efforts to create safer transportation systems and reduce the toll of road accidents on lives and livelihoods.

II. Existing system

The existing literature provides valuable insights into wireless data transmission and IoT-based vehicle accident detection systems. The paper "Wireless Data Transmission using ESP" offers a detailed overview of the ESP microcontroller's capabilities in transmitting data wirelessly, including performance metrics and power consumption characteristics. Additionally, academic studies such as Lu et al.'s "Design of a Vehicle Accident Detection System Based on IoT" provide insights into existing IoT-based accident detection systems, offering valuable knowledge for designing and implementing similar solutions. Furthermore, surveys like Al-Fuqaha et al.'s "Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications" provide a comprehensive overview of IoT technologies, which serve as a foundation for understanding the broader context of our proposed system. Additionally, Akram and Abu Bakar's survey on "Vehicular Ad Hoc Networks Routing Protocols in Urban Environments" offers insights into routing protocols relevant to vehicular communication systems, contributing to the overall understanding of related technologies.

III. Proposed system

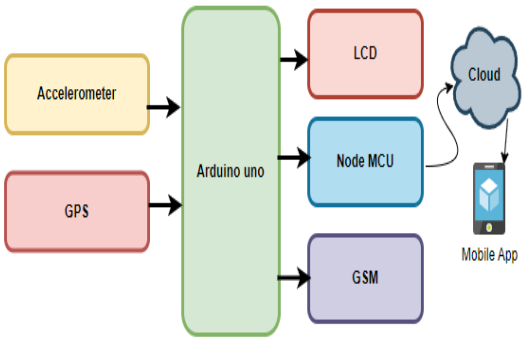

Fig 1: Block diagram of proposed system of accident detection

Building upon the existing literature, our proposed system aims to develop an IoT-based Automatic Vehicle Accident Detection and Rescue System (AVADRS). Leveraging wireless data transmission techniques discussed in the literature, our system will utilize the ESP microcontroller platform for efficient communication of accident data to designated emergency contacts and authorities. Insights from academic studies like Lu et al.'s research will inform the design and architecture of our AVADRS, enabling us to incorporate best practices and address challenges encountered in existing IoT-based accident detection systems. Furthermore, the broader

understanding of IoT technologies from surveys like Al-Fuqaha et al.'s work will guide the integration of various components and protocols necessary for the operation of our proposed system. Through this proposed system, we aim to contribute to the advancement of road safety technology by providing a reliable and effective solution for accident detection and rescue operations.

IV. Components Used and Description

Arduino Uno: The Arduino Uno serves as the main microcontroller in the system. It facilitates the integration and control of various sensors and modules, making it a central component of the AVADRS.

Fig 2: Arduino Uno

Accelerometer: An accelerometer sensor is employed to detect sudden changes in acceleration, which are indicative of a vehicle collision. This sensor measures the vehicle's acceleration in multiple axes and provides data for accident detection algorithms.

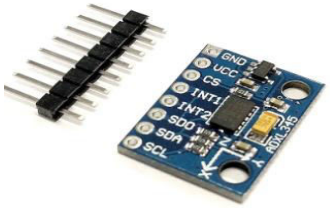

Fig 3: Accelerometer

GPS Module: The GPS module is utilized to obtain real-time location data of the vehicle. It communicates with satellites to determine the vehicle's latitude, longitude, and altitude, enabling accurate identification of the accident's location.

Fig 4: GPS Module

GSM Module: The GSM module enables communication over cellular networks. It is used to send SMS alerts or make calls to predefined emergency contacts upon detecting an accident. This module plays a crucial role in initiating rescue operations and notifying relevant stakeholders.

Fig 5: GSM Module

NodeMCU: NodeMCU is an IoT development board based on the ESP8266 Wi-Fi module. It facilitates wireless communication and data transmission to cloud servers or mobile applications. NodeMCU enables remote monitoring of the vehicle's status and accident alerts, enhancing the system's responsiveness and scalability.

Fig 6: Node MCU

LCD Display: In our AVADRS project, we incorporate an LCD (Liquid Crystal Display) to provide real-time feedback and enhance user interaction. The LCD serves as a visual interface, displaying critical information such as accident alerts, vehicle location, system status, emergency contact details, and initialization messages.

Fig 7: LCD Display

V. Working algorithm

Initialization: Initialize all sensors and modules (accelerometer, GPS, GSM, LCD). Set up communication protocols between Arduino Uno and NodeMCU. Display initialization messages on the LCD to indicate system readiness.

Continuous Monitoring: Continuously read accelerometer data to monitor vehicle acceleration. Check for sudden changes in acceleration that exceed a predefined threshold. If a significant change in acceleration is detected, proceed to the next step.

Accident Detection: Trigger the GPS module to obtain the vehicle's current location. Store the GPS coordinates and timestamp of the accident. Display an accident alert message on the LCD to notify occupants and bystanders.

Emergency Alert: Activate the GSM module to send SMS alerts or make calls to predefined emergency contacts. Include accident details such as location, time, and any additional information. Update the LCD display to show the alert status and confirm the transmission of alerts.

Rescue Coordination: Initiate communication with emergency services or designated contacts to coordinate rescue efforts.

Provide real-time updates on the vehicle's location to aid in locating the accident site.

Monitor responses from emergency contacts and display relevant information on the LCD.

System Reset: Once the emergency situation has been resolved, reset the system to its initial state. Clear the LCD display and return to continuous monitoring mode. Ensure all components are ready for future incidents.

VI. Results

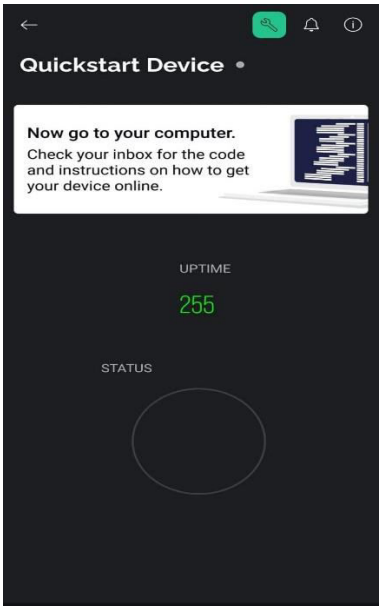

Fig 8: Figure showing device uptime message

This figure displays the device uptime message on the LCD display. The message

indicates the duration for which the AVADRS has been operational since its last reset. It provides valuable information about the system's reliability and continuous monitoring capability.

Fig 9: Figure showing accident detection alert in LCD display

In this figure, the LCD display is showcasing an accident detection alert. The message on the LCD notifies users and bystanders that an accident has been detected by the system. It typically includes a warning message along with relevant details such as the location and time of the accident.

Fig 10: Figure showing notification received

This figure illustrates a notification received on a mobile device when an accident occurs. The notification is sent by the AVADRS system to predefined emergency contacts or authorities. It serves as an immediate alert, informing recipients about the accident and providing essential details for prompt action.

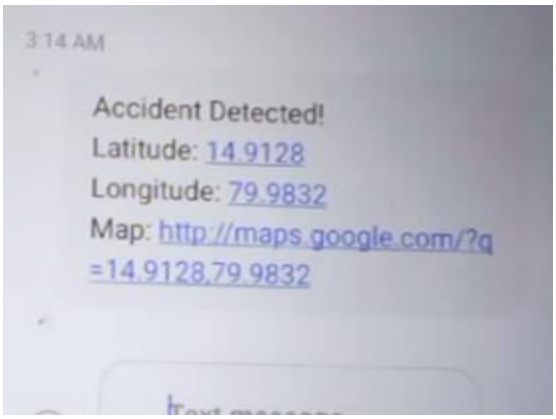

Fig 11: Figure showing SMS received with latitude and longitude message link

In this figure, an SMS message containing the latitude and longitude coordinates of the accident location is received on a mobile device. The SMS message includes a link that, when clicked, opens a map application, allowing recipients to view the exact location of the accident. This feature enhances the effectiveness of the AVADRS by providing precise location information to emergency responders.

VII. Conclusion

In conclusion, the IoT-based Automatic Vehicle Accident Detection and Rescue System (AVADRS) represents a pivotal advancement in road safety technology, offering a comprehensive solution to detect vehicle accidents promptly and facilitate swift rescue operations. Through the integration of Arduino Uno, accelerometer, GPS module, GSM module, NodeMCU, and LCD display, our system demonstrates its capability to detect accidents, communicate alerts to emergency contacts, and provide crucial location information for efficient rescue coordination. With its potential to

significantly reduce response times and mitigate the severity of accidents, the AVADRS stands as a testament to the power of technology in safeguarding lives and improving emergency response efforts on our roads.

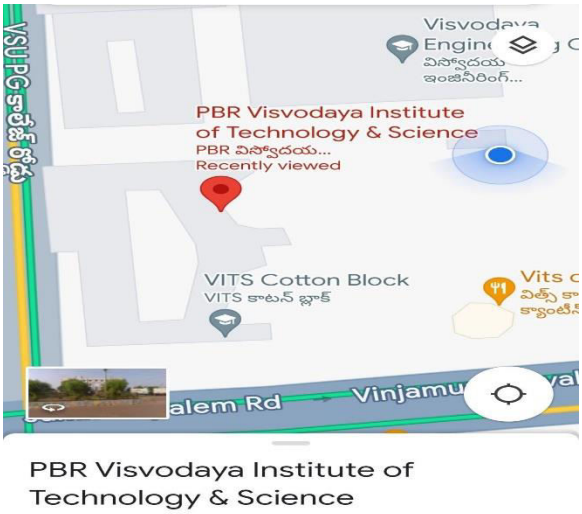

Fig 12: Figure showing location in map

References

[1] S. Nanda, H. Joshi, and S. Khairnar, "An IOT Based Smart System for Accident Prevention and Detection," in 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA).

[2] M. Syedul Amin, J. Jalil, and M. B. I. Reaz, "Accident detection and reporting system using GPS, GPRS and GSM technology," in 2012 International Conference on Informatics, Electronics & Vision (ICIEV), DOI: 10.1109/iciev.2012.6317382.

[3] N. T. S. A. Wadhahi, S. M. Hussain, K. M. Yosof, S. A. Hussain, and A. V. Singh, "Accidents Detection and Prevention System to reduce Traffic Hazards using IR Sensors," in 2018 7th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), DOI: 10.1109/icrito.2018.8748458.

[4] H. Lu, et al., "Design of a Vehicle Accident Detection System Based on IoT," in 2018 IEEE International Conference on Industrial Internet (ICII), IEEE, 2018.

[5] A. Al-Fuqaha, et al., "Internet of things: A survey on enabling technologies, protocols, and applications," in IEEE Communications Surveys & Tutorials, vol. 17, no. 4, pp. 2347-2376, 2015.

[6] R. A. Akram and K. Abu Bakar, "Survey on vehicular ad hoc networks routing protocols in urban environments," in Vehicular Communications, vol. 8, pp. 30-51, 2017.

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