WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

IoT-Driven Vehicle Crash Detection and Tracking System with GPS Integration

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ABSTRACT :

The Internet of Things (IoT) has revolutionized connectivity, facilitating the integration of embedded computing devices into the existing Internet infrastructure. This paper focuses on a specific application of IoT: a vehicle accident detection and tracking system utilizing GPS modems. The system aims to enhance road safety by promptly detecting accidents, determining precise vehicle locations, and transmitting this information to emergency responders. Motivated by the alarming global statistics on road accidents, this research addresses the urgent need for efficient accident detection mechanisms to minimize casualties and property damage. By reviewing existing methodologies, this paper seeks to contribute to the development of smarter, more accurate systems for accident prevention and mitigation.

Keywords: Internet of Things, IoT, vehicle accident detection, GPS Modem, machine learning, accident prevention, emergency response.

Introduction :

The Internet of Things (IoT) has enabled the seamless interconnection of embedded computing devices within the framework of the Internet. This interconnected network offers advanced connectivity beyond traditional machine-to-machine communications (M2M), encompassing various protocols, domains, and applications. Among the myriad applications of IoT, one significant area is the development of vehicle accident detection and tracking systems. By leveraging IoT technologies, these systems can enhance road safety by promptly detecting accidents and facilitating rapid response from emergency services.

1.1 Objective: The primary objective of this research project is to develop an IoT-based vehicle accident detection and tracking system utilizing a GPS modem. The system aims to improve the safety of drivers and passengers by promptly detecting accidents and transmitting location information to emergency responders. Additionally, the system may offer features such as real-time vehicle monitoring and theft detection, contributing to overall road safety and accident prevention efforts.

1.2 Motivation: The motivation for this research stems from the alarming statistics regarding road accidents worldwide. With road traffic injuries ranking as the eighth leading cause of death globally, there is an urgent need to improve road safety measures. Prompt response to accidents is crucial in mitigating casualties, yet manual notification processes often result in delays, leading to increased fatalities. By developing automatic accident detection systems, we aim to expedite rescue operations and minimize casualties, thereby saving lives and reducing property damage. This paper reviews existing accident detection mechanisms, identifies their limitations, and proposes strategies for improving accuracy and effectiveness in accident prevention

1. Literature Survey :

Several researchers have conducted studies on accident detection systems, each proposing unique approaches to enhance road safety. Aishwarya S.R elucidated an IoT-based vehicle accident prevention and tracking system tailored specifically for night drivers. This system incorporates an Eye Blink Monitoring System (EBM) to alert drivers during states of drowsiness, aiming to mitigate the risks associated with fatigue-induced accidents.

In a similar vein, Sadhana B presented a Smart helmet intelligent safety solution designed for motorcyclists, utilizing Raspberry Pi and open CV technology. This initiative was spurred by the alarming increase in fatal road accidents, with a focus on promoting proper helmet usage among motorcyclists to reduce the severity of injuries sustained in accidents.

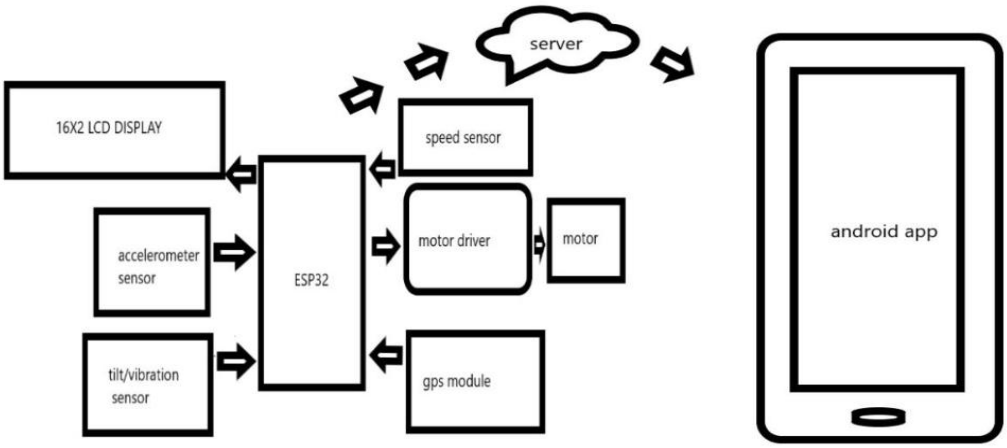
Furthermore, Sarika R. Gujar elaborated on an advanced Embedded System for Vehicle Accident Detection and Tracking, prioritizing the rapid identification of accident locations and prompt summoning of emergency services. Employing sensors for vehicle accident detection and integrating GPS and GSM modules facilitate efficient tracing of vehicles involved in accidents, enhancing emergency response efforts.

Similarly, Shailesh Bhavthankar proposed a Wireless System for Vehicle Accident Detection and Reporting, leveraging Accelerometer and GPS sensors to detect crashes and relay vehicle locations in real-time. Upon detecting an accident, automated messages are dispatched to pre-programmed contacts, such as family members or emergency medical services, via GSM communication.

Lastly, Jagdish A. Patel detailed a Raspberry Pi-based smart home system, focusing on basic home automation functionalities and security measures. This system utilizes camera interfacing for surveillance purposes, with algorithms implemented in the Python environment provided by Raspberry Pi.

Block Diagram :

Fig (1)



The central component of the block diagram is the ESP32 microcontroller, acting as the system's core processor. Interfaced with a range of sensors and modules, including the LCD display, GPS module, accelerometer sensor, tilt vibration sensor, speed sensor, and motor driver, alongside a Wi-Fi module for internet connectivity, the ESP32 orchestrates real-time monitoring and control of the system's functionalities. The LCD display facilitates user-friendly visualization of sensor data, while the GPS module enables precise location determination for navigation purposes. Acceleration, tilt, and vibration data are captured by the accelerometer and tilt vibration sensors, informing system stability assessment. The speed sensor calculates motor speed, regulated by the motor driver, which receives control commands from the ESP32. Utilizing a Firebase server, the ESP32 communicates data via Wi-Fi, enabling storage and retrieval of system metrics for subsequent analysis. This integrated system offers versatile applications, such as vehicle or machinery performance monitoring, with potential for data-driven insights and optimization strategies.

4. Advantages & Disadvantages :

Advantages

- **Improved response time:** By leveraging real-time data transmission and accurate tracking capabilities, the IoT-based vehicle accident detection and tracking system significantly reduces the time taken to detect and respond to accidents. Emergency services can be promptly dispatched to the precise location of the incident, potentially saving lives and minimizing damage.
- **Accurate tracking:** The use of a GPS modem enables precise tracking of vehicle locations, allowing for accurate identification of accident hotspots and patterns. This data can be utilized to implement targeted safety measures and optimize emergency response strategies.
- **Reduced fatalities:** The timely detection and response to accidents facilitated by the system contribute to a reduction in fatalities and severe injuries. Rapid communication of distress signals and location information enables emergency responders to reach victims promptly, increasing the likelihood of successful interventions.
- **Efficient use of resources:** By streamlining emergency response operations and optimizing resource allocation, the system promotes the efficient utilization of emergency services and infrastructure. This leads to cost savings and improved overall effectiveness in managing road safety incidents.
- **Lower insurance costs:** The implementation of an IoT-based vehicle accident detection and tracking system can result in lower insurance premiums for vehicle owners. The system's ability to mitigate risks and improve safety outcomes may lead to reduced accident rates and associated insurance claims. • **Improved road safety:** Ultimately, the deployment of such a system contributes to enhanced road safety by

enabling proactive accident prevention measures, swift emergency response, and data-driven policy interventions. By identifying and addressing potential hazards in real-time, the system helps

Disadvantages

- **Privacy concerns:** The continuous monitoring and tracking of vehicles raise privacy concerns among users. The collection and storage of location data may infringe upon individuals' privacy rights, leading to resistance or opposition to the implementation of such systems.
- **Reliance on technology:** The effectiveness of the system is contingent upon the reliability and accuracy of the underlying technology, including GPS modems and communication networks. Any technical failures or disruptions in connectivity could compromise the system's ability to detect and respond to accidents promptly.
- **False alarms and inaccuracies:** Despite advancements in technology, IoT-based accident detection systems may still be susceptible to false alarms and inaccuracies. Environmental factors, technical glitches, or misinterpretation of data could result in erroneous alerts or responses, potentially causing inconvenience or confusion for both users and emergency responders.
- **Cybersecurity risks:** The interconnected nature of IoT devices and data networks introduces cybersecurity vulnerabilities, including the risk of unauthorized access, data breaches, and malicious attacks. Safeguarding sensitive information and ensuring the integrity of communication channels are critical challenges in deploying IoT-based accident detection systems.
- **Cost and infrastructure requirements:** Implementing and maintaining an IoT-based vehicle accident detection and tracking system entails significant costs, including the procurement of hardware, software development, infrastructure setup, and ongoing maintenance. Moreover, ensuring adequate network coverage and infrastructure support in remote or rural areas may pose additional challenges and expenses.

4. Advantages & Disadvantages :

- **Accuracy:** The precision of GPS positioning may be influenced by various factors, including environmental conditions like weather and terrain, as well as signal interference. These factors can introduce inaccuracies in the location data collected by the system, potentially compromising the efficacy of accident detection and tracking.
- **Reporting Delays:** The system may encounter delays in reporting accidents, attributable to issues such as suboptimal network connectivity or hardware malfunctions. Such delays could impede timely responses from emergency services or relevant stakeholders, potentially exacerbating the severity of incidents.
- **Limited Coverage:** The system's functionality may be constrained in regions with inadequate or nonexistent network coverage. In such areas, real-time data transmission may be hindered, adversely affecting the system's ability to detect and monitor accidents.
- **Cost Implications**: The implementation of an IoT-based accident detection and tracking system can entail substantial expenses, particularly for smaller entities or individuals. Costs associated with hardware procurement, software development, and ongoing maintenance may serve as deterrents to widespread adoption.
- **Privacy Considerations:** The accumulation and retention of location data by the system may raise privacy apprehensions, especially if data security measures are inadequate or if data sharing occurs without explicit user consent. Such concerns may give rise to potential misuse of personal information and pose legal and ethical challenges for the system.

4. Conclusion :

In conclusion, our implementation of an IoT-based vehicle accident detection and tracking system using GPS Modem signifies a pivotal advancement in enhancing road safety and emergency response capabilities, particularly in traffic control scenarios. By integrating various sensors and machine learning techniques, we achieve accurate accident detection and proactive prevention measures, ultimately contributing to mitigating road collisions and facilitating timely rescue operations. The transformative potential of IoT technology in optimizing system interactions and responses underscores its significance in addressing the escalating number of casualties resulting from road accidents, emphasizing the imperative of continued advancements in this field to safeguard lives and enhance overall road safety.

REFERENCES :

1. Aishwarya S.R, Ashish Rai, Charitha, Prasanth M.A, and Savitha S.C “An IoT based vehicle accident prevention and tracking system for night drivers” proc. IEEE, vol.3, no.4, pp.2320-9798 2015
2. Sadhana B Shabrin, Bhagyashree Jagadish Nikharge, Maithri M Poojary and T Pooja, “Smart helmet-intelligent safety for motorcyclist using raspberry pi and open CV”, proc.IEEE,vol.03, no.03 pp.2395-0056 2016
3. Jagdish A. Patel, Aringale Shubhangi, Shweta Joshi, Aarti Pawar and Namrata Bari discussed on “Raspberry Pi based smart home”, Proc. IEEE, vol.6, no.3, pp.2321-3361 2016
4. Dr. pankaj Tomar and preeti Mehta focused on “ An Efficient Management System based on Face Recognition using Matlab and Raspberry Pi 2”, Proc-IEEE, vol.3, no.5, pp.239 2016
5. T. Anitha and T. Uppalaigh focused on “Android based home automation using Raspberry pi”, Proc-IEEE, vol.04, no.01, pp-2351-8665 2016

6. Shailesh Bhavthankar and Prof. H.G.Sayyed discussed on" Wireless System for Vehicle Accident Detection and Reporting using Accelerometer and GPS", Proc .IEEE vol.6, no.8, pp-2229-5518 2015
7. Md.Shaad Mahmud, Honggang Wang, A.M.Esfar-EAlam and Hua Fang has focused on "A Wireless Health Monitoring System Using Mobile Phone Accessories", Proc- IEEE,vol.1, no.99, pp-2327-4662 2016
8. Sarika R. Gujar and Prof. A. R. Itkikar has focused on "Advanced Embedded System of Vehicle Accident Detection and Tracking System", Proc-IEEE, vol.5, no.2, pp- 2277 128X 2015
9. Zaobo He, Zhipeng Cai, Jiguo Yu, Xiaoming Wang, Yunchuan Sun, and Yingshu Li, has discussed on "CostEfficient Strategies for Restraining Rumor Spreading in Mobile Social Networks", Proc-IEEE,vol.66,no.3 2017
10. Hyung-Sin Kim, Hongchan Kim, jeongyeuo Paek and Saewoong Bahk has discussed on "Load Balancing Under Heavy Traffic in RPL Routing Protocol for Low Power and Lossy Networks", Proc-IEEE,vol.16, no.4, pp. 1536-1233