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A Review on Accident Prevention System Using IOT For Car Safety

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Abstract. Car accidents are among the most catastrophic events. The causes of these accidents can vary, with driver inattention and excessive speed being significant factors. By utilizing IoT (Internet of Things) technology, we can work towards preventing and reducing the frequency of these incidents. IoT is rapidly advancing within the IT sector and aims to alleviate human burdens. This project proposes an innovative solution for accident prevention by developing an Accident Prevention System Using IoT for Car Safety. The system we are creating will monitor conditions to help minimize accidents. This paper outlines the development process of the accident prevention system. As the population grows, car usage has surged, resulting in a concerning increase in accident rates. The goal of this project is to prevent such accidents. Initially, we applied the Eclat algorithm to categorize accident locations into three levels: 0, 1, and 2.

Keywords: Eclat algorithm, Clustering, Classification, GPS tracking, Accident.

INTRODUCTION

The number of deaths caused by traffic accidents remains alarmingly high, highlighting a global road safety crisis. Annually, around 1.3 million people lose their lives, and approximately 50 million are injured in road incidents worldwide, averaging 3,287 fatalities each day. More than deaths, the figures are sharply rising in developing nations. The report also notes that 90 percent of road traffic fatalities occur in low and middle-income countries, which together account for only 48 percent of all registered vehicles. The statistics for India are particularly alarming, with at least 13 people dying every hour in road accidents, according to the latest data from the National Crime Records Bureau. Road safety experts suggest that the actual
half of these deaths occur among young adults aged 15-
numbers
middle-income countries, with the situation being even more dire in low-income nations. In India, the World Health Organization's (WHO) Global Status Report on Road Safety indicates that the country has the highest number of road accident deaths globally, surpassing even China. The report describes road fatalities as an "epidemic" that is projected to become the fifth leading cause of death worldwide by 2030. While wealthier countries have succeeded in reducing road accidents go unreported.

1 LITERATURE SURVEY

1) Mohanta et al. (2022): They introduced an ML- based accident prediction system using IoT sensor data. Employing algorithms like Random Forest, SVM, and Gradient Boosting, the system accurately predicted ac- cident risks based on variables such as driver behavior, speed, road conditions, and weather, helping to deliver timely alerts and improve transportation safety.
2)Fernandez et al. (2022): The authors proposed a fuzzy ontology-based system for classifying driver behaviors (e.g., safe, aggressive, distracted) using sen- sor data (GPS, accelerometer, gyroscope). Their hy- brid fuzzy logic and ontological reasoning model out- performed traditional ML in real-time classification ac- curacy, enhancing driver monitoring and road safety.
3) Onesimu et al. (2021): This research devel- oped an IoT- based intelligent system to prevent acci- dents caused by poor weather and road conditions. It collects real-time data on vehicle speed, driver behav- ior, and the environment, and uses ML to predict acci- dents, sending alerts and making adjustments to avoid potential collisions.
4) Thaduri et al. (2021): They proposed a CNN- based accident prediction model using traffic surveil- lance images. The system learned accident-prone pat- terns and outperformed traditional methods in predict- ing incidents, emphasizing the effectiveness of com- puter vision and deep learning in proactive road safety.
5) Mountain Road Safety System: This study fo- cused on mountainous regions, where sharp curves, fog, and landslides raise accident risks. The proposed IoT- GPS-GSM system monitors hazardous conditions and sends real-time alerts to drivers and emergency ser- vices. It a
may be even higher as many
monitoring and emergency response.
44, with around 4
6) Ajagbe et al.: The authors explored how IoT and CNNs can be integrated for applications like smart surveillance and object detection. They discussed tech- nical methods such as edge computing and transfer learning, addressed challenges like data quality and en- ergy use, and highlighted the potential for automation and real-time

decision-making in smart cities and trans- portation.

2 Han et al.: They introduced LMCA, a lightweight model for detecting anomalies in IoT network traffic. Using an optimized MobileNet and Coordinate Atten- tion, LMCA effectively detected anomalies with high accuracy and minimal computational cost, outperform- ing conventional models in precision and efficiency.

3 PROPOSED SYSTEM

The proposed system facilitates the real-time identification and classification of accident locations through the use of IoT devices and the Eclat algorithm. It enables law enforcement to mark accident sites and categorize them into different danger levels (Level 0, 1, 2) for public awareness. Government authorities can oversee all data, improving road safety through informed decision-making and timely notifications.

3.1 Government Admin: The Government Admin can add police stations, which in turn can log all accident locations similar to crime scenes on a map. The Government Admin has the ability to view all collected data.

3.2 Police: The police will input accident locations and determine the danger level of each incident as per the admin's guidelines. Each location will be classified into levels such as Level 0, Level 1, and Level 2. These classifications are established using the Eclat Algorithm, which categorizes accident sites into three levels of danger, allowing the public to be alerted and choose safer travel routes.

3.3 Transport Ministry: The Transport Ministry acts as the main authority overseeing all accident-related data and reports submitted by the Government Admin and Police. It has access to a detailed dashboard that displays accident locations categorized by danger levels (Level 0, 1, and 2) as defined by the Eclat Algorithm. This allows the ministry to analyze high-risk areas, recognize accident patterns, and make data-driven decisions to enhance road safety. With this information, the ministry can implement preventive strategies, plan infrastructure improvements, allocate resources effectively, and coordinate with emergency services.

3.1 Government Admin:

Government Admin add the police station, police station can add all accident spot like crime location on map. Government Admin can view all data.

of travelling.

4 OBJECTIVES

The primary objectives of this project are as follows:

4.1 **Speed Alert System:** This system identifies vehicles that are exceeding speed limits through real-time monitoring. It sends immediate alerts to drivers to help prevent accidents related to speeding, promoting awareness of safe driving practices.

4.2 Accident Prevention via GPS: Utilizing GPS and mapping data, this system continuously monitors road and vehicle conditions. It alerts drivers to areas prone to accidents and unsafe conditions, aiding in accident prevention through timely warnings and information.

4.3 Location Tracking System: This feature tracks vehicles and accidents in real-time using Google Maps, allowing users and authorities to see precise locations for prompt action. It facilitates quicker responses and improved route planning.

4.4 Traffic Data Analysis: This component scientifically analyzes traffic patterns, accident trends, and road usage. It identifies peak traffic times and risky behaviors through data analysis tools, supporting the implementation of data-driven improvements in road safety.

4.5 Accident Hotspot Detection: This system uses pattern recognition algorithms to pinpoint areas with frequent accidents. The Eclat algorithm categorizes these locations based on the severity of incidents, enabling targeted safety measures in critical areas.

5 System Analysis and Feasibility :

The Accident Prevention System utilizing IoT for Car Safety combines various technologies and devices to monitor and promote safe driving. It integrates sensors, GPS, and real-time data analysis to identify potential road hazards. Additionally, it offers alerts and real-time information to drivers, contributing to a reduction in road accidents. The system's feasibility relies on the effective implementation of hardware, software, and communication protocols to ensure rapid response times and accurate hazard detection.

6 Tools and Technologies Utilized

6.1 Front-End

- **CSS:** Cascading Style Sheets (CSS) are used to de- sign the layout and style of web pages, ensuring an aesthetically pleasing user interface for the system.

- **JavaScript:** Used to create interactive elements on web pages, JavaScript enhances the user experi- ence by enabling dynamic updates and responsive actions on the dashboard.

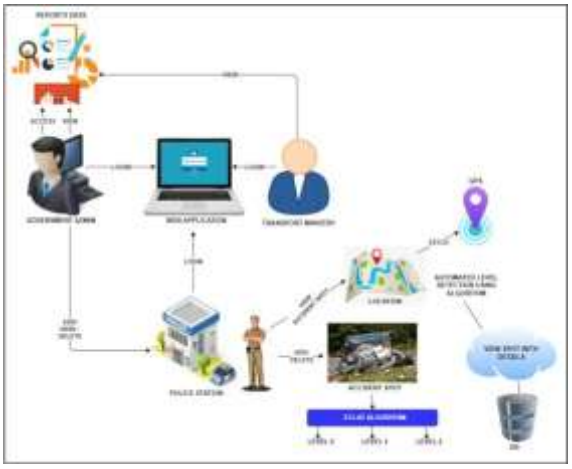
6.2 MySQL

MySQL is an open-source relational database manage- ment system (RDBMS) used to store the system's data,

such as car information, driver profiles, accident data, sensor logs, and maintenance records. Its robustness and scalability make it ideal for handling large volumes of real-time data.

6.3 Arduino Uno

The Arduino Uno, a microcontroller board, is used to interact with sensors such as accelerometers, GPS, and other IoT devices. It enables the system to collect data and send real-time alerts based on the vehicle's conditions.



6.4 Buzzer

A buzzer alerts the driver to a potential hazard or accident by producing an audible sound. It operates with low voltage and has a high sound output (80dB), ensur- ing the driver hears the warning clearly.

6.5 LCD

A 2.4-inch TFT-LCD screen displays real-time data like speed, distance, and hazard alerts to the driver. This display is critical for providing immediate feedback on the vehicleâs status and any danger detected by the system.

6.6 Accelerometer

The accelerometer is used to measure changes in the vehicle's acceleration. It helps detect sudden deceleration or movement, which can be indicative of an accident or collision. The accelerometer data is processed and used to trigger alerts if needed.

7 Database Design

The database stores all critical information related to the vehicles, drivers, IoT devices, sensors, accidents, and maintenance. It includes the following entities and attributes:

Car: Make, model, year, license plate, VIN, and owner details.

- **Driver:** Name, contact information, driver's license number.
- **IoT Devices:** Device type, make, model, IP address, and location.
- **Sensors:** Type, make, model, location, and data collected.
- **Accidents:** Date, time, location, involved vehicles, severity, and casualties.
- **Maintenance:** Maintenance date, type, cost, and parts replaced.

8 Methodology

The proposed Accident Prevention System uses IoT-based sensors to continuously monitor vehicle parameters such as speed, acceleration, and location. Data from sensors is processed in real-time using a micro- controller (Arduino), which triggers alerts when poten- tial hazards are detected. The system uses cloud-based storage to record data and generate real-time reports ac- cessible through a web interface. Java and MySQL are employed to build a robust platform for managing user and vehicle data, ensuring scalability and efficient per- formance.

Figure 1: System Architechture

9. RESULTS AND DISCUSSION

The IoT-based Accident Prevention System effectively facilitates real-time monitoring and management of accident-prone spots through coordinated efforts of multiple authorities—Police Admin, Government Admin, and Transport Ministry Admin.

* Police Admin Role:* Police personnel can promptly add new accident spots into the system immediately after incidents occur. This ensures timely data collection and helps in creating a dynamic accident database.

* Government and Transport Ministry Admin Role:* These authorities access detailed reports generated from police inputs. They analyze the frequency and severity of accidents at each spot. Based on the number of accidents reported at the same location, the system automatically assigns an accident level (e.g., low, medium, high risk).

* Accident Level Assignment:* This feature helps prioritize interventions by highlighting hotspots with frequent accidents, enabling the government and transport ministry to allocate resources efficiently, enforce traffic regulations, or plan infrastructure improvements.

* System Impact:* The integration of IoT devices for data collection ensures accuracy and immediacy, reducing delays in reporting and response. It promotes proactive safety measures and policy-making based on real data, rather than reactive management.

* Challenges and Improvements:* While the system improves coordination among departments, continuous updating and validation of accident data is essential.
Future enhancements could include automated alert systems for nearby drivers and integration with emergency services for faster assistance.

10 CONCLUSION

We have proposed a system aimed at accident prevention, with the goal of making the world a safer place to live. The other on detecting the accident location to assist in tracking and rescue efforts. The proposed system is designed to provide information about the occurrence and location of an accident, making it easier to offer timely assistance to the victims. This system uses a GPS module to locate the vehicle and GSM technology to send accident alerts. The results of the proposed system are promising. The core objective of the accident prevention system is to reduce the chances of fatalities in accidents that are unavoidable. Once an accident is detected, paramedics are alerted and can reach the specific location to improve the chances of saving lives. Ultimately, this system aims to reduce the death toll and fatalities in countries like India and will have significant impact on daily life. article

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Overall, the system demonstrates promising capabilities in accident prevention through collaborative monitoring, data-driven decision-making, and effective resource management.

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