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Accident Prevention System Using IOT for Car Safety

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Abstract: ***Car accidents truly can be considered as one of the most disastrous phenomena. Thoughthe reasons can be different for those accidents like the main problem can be driverâs unawarenessas well as speed. With the help of IoT we can try to prevent as well as reduce thenumber of accidents.IoT (Internet of things), is one of the most growing technology in IT industries and is used to decrease theburden of human beings.With the help of IoT we are creating a solution for the accident prevention.This is an inten- tion to implement an innovative solution for this problem by developing An Accident Prevention System Using Iot For Car Safty. In this project, we are developing a system which will monitor and help tore- duce those accidents.This paper discusses the process of developing a accident prevention system.With the growing population the use of car as became superfluous and this has led to increase in the number of accidents at the alarm rate. This project aims at preventing the accident.In this project, we first applied Eclat algorithm to group the crime locations into 0 level, 1 level, 2 level accident location.***

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

I. INTRODUCTION

The number of fatalities resulting from traffic accidents remains alarmingly high, underscoring a global road safety crisis. Each year, approximately 1.3 million peo- ple are killed, and around 50 million are injured in road accidents worldwide, which translates to an average of 3,287 lives lost every day. More than half of these fa- talities occur among young adults aged 15-44. Around 400,000 individuals under the age of 25 die annually in traffic accidents. Even in countries with robust road safety measures, the number of road traffic deaths con- tinues to rise year by year. Over 90 percent of these deaths occur in middle-income countries, and the sit- uation is even worse in low-income nations.In India, the World Health Organization's (WHO) Global Status Report on Road Safety has revealed that more people die in road accidents in India than anywhere else in the world, surpassing even China. The report calls road fatalities an "epidemic" that is expected to become the fifth leading cause of death globally by 2030. While wealthier nations have managed to reduce road fatali- ties, the numbers are sharply rising in developing coun- tries. The report further states that 90 percent of road traffic deaths happen in low and middle-income coun- tries, which collectively account for just 48 percent of all registered vehicles. The statistics for India are par- ticularly grim, with at least 13 people dying every hour in road accidents, according to the latest report from the National Crime Records Bureau. Road safety experts believe the true numbers may be even higher, as many accidents go unreported.

II. LITERATURE SURVEY

Azhar et al. (2023): This study reviewed the use of deep learning techniques like CNNs, RNNs, and LSTMs for traffic accident detection and prediction. By integrating data from traffic cameras, sensors, and GPS, the authors demonstrated how deep learning can effectively identify anomalies and patterns in traffic, improving road safety through proactive accident prediction.

Fernandez et al. (2022): The authors proposed a fuzzy ontology-based system for classifying driver behaviors (e.g., safe, aggressive, distracted) using sensor 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.

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.

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.

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.

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 addresses gaps in existing systems by improv- ing monitoring and emergency response.

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.

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.

III. PROPOSED SYSTEM

The proposed system enables real-time identifica- tion and categorization of accident spots using IoT de- vices and the Eclat algorithm. It allows police to mark accident locations and classify them into danger lev- els (Level 0, 1, 2) for public awareness. Government authorities can monitor all data, enhancing road safety through informed decision-making and timely alerts.:

A. Government Admin:

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

B. Police:

Police will integrate the accident spot of accidentâs and then decide the level of accident according to adminâs police decided the danger level of that spot level wise. All spots are to be declared as level wise like Level 0, Level 1, Level 2. These levels are define by using Eclat Algorithm, using this algorithm the accidentâs spot will be define in above three level of dangerous zone from which people can be alerted and safely choose their path of travelling.

C. Transport Ministry:

The Transport Ministry serves as the central authority overseeing all accident-related data and reports submit- ted by the Government Admin and Police. It has ac- cess to a comprehensive dashboard that displays acci- dent spots categorized into danger levels (Level 0, 1, and 2) as determined by the Eclat Algorithm. This en- ables the ministry to analyze high-risk areas, identify accident trends, and make data-driven decisions to im- prove road safety. Using this information, the ministry can implement preventive measures, plan infrastructure upgrades, allocate resources efficiently, and coordinate with emergency services.

IV. OBJECTIVES

The primary objectives of this project are as follows:

A. Speed Alert System:

This system detects vehicles exceeding speed limits using real-time monitoring. Instant alerts are sent to drivers to prevent overspeeding-related accidents. It promotes safe driving by encouraging speed awareness.

B. Accident Prevention via GPS:

GPS and map data monitor road and vehicle conditions continuously. Drivers are alerted about accident-prone zones and unsafe conditions. It helps prevent accidents through timely information and warnings.

C. Location Tracking System:

Tracks vehicles and accidents using Google Maps in real time. Enables users and authorities to view exact positions for quick action. Aids in faster response and better route planning.

D. Traffic Data Analysis:

Analyzes traffic patterns, accident trends, and road us- age scientifically. Identifies peak hours and risky behav- iors using data analysis tools. Helps implement data- driven road safety improvements.

E. Accident Hotspot Detection:

Identifies frequent accident zones using pattern recogni- tion algorithms. Eclat algorithm helps categorize these areas based on severity. Supports focused safety mea- sures in critical spots.

F. Reduce Road Accident Deaths:

Smart alerts and monitoring systems aim to reduce fatal accidents. Early warnings and danger level classifica- tion improve driver safety. The ultimate goal is to save lives and make roads safer.

V. SYSTEM ANALYSIS AND FEASIBILITY

The Accident Prevention System using IoT for Car Safety integrates various technologies and devices to monitor and ensure safe driving. The system incorpo- rates sensors, GPS, and real-time data analysis to detect potential hazards on the road. It also provides alerts and real-time data to drivers, helping reduce road accidents. The feasibility of the system depends on the effective use of hardware, software, and communication proto- cols to ensure quick response times and accurate hazard detection.

VI. TOOLS AND TECHNOLOGIES USED

A. Front-End

1) *HTML:* HTML is used to structure the content of web pages, displaying information such as alerts, speed, and hazard warnings on the dashboard.
2) *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.

B. 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.

C. 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 condi- tions.

D. Buzzer

A buzzer alerts the driver to a potential hazard or acci- dent 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.

E. LCD

A 2.4-inch TFT-LCD screen displays real-time data like speed, distance, and hazard alerts to the driver. This dis-

play is critical for providing immediate feedback on the vehicleâs status and any danger detected by the system.

F. Accelerometer

The accelerometer is used to measure changes in the ve- hicle'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.

VII. 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 li- cense number.
- *IoT Devices:* Device type, make, model, IP ad- dress, and location.
- *Sensors:* Type, make, model, location, and data collected.
- *Accidents:* Date, time, location, involved vehi- cles, severity, and casualties.
- *Maintenance:* Maintenance date, type, cost, and parts replaced.

VIII. METHODOLOGY

The proposed Accident Prevention System uses IoT- based sensors to continuously monitor vehicle param- eters 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.

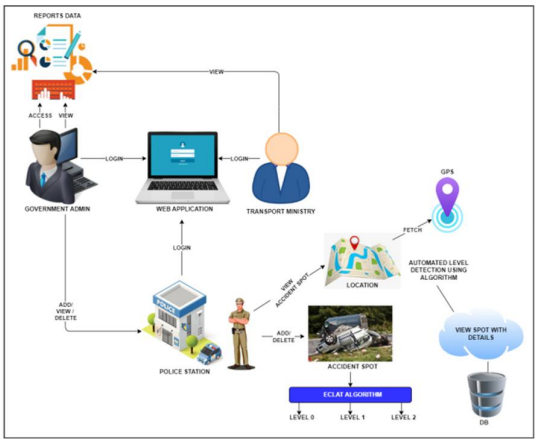


Figure 1: System Architechture

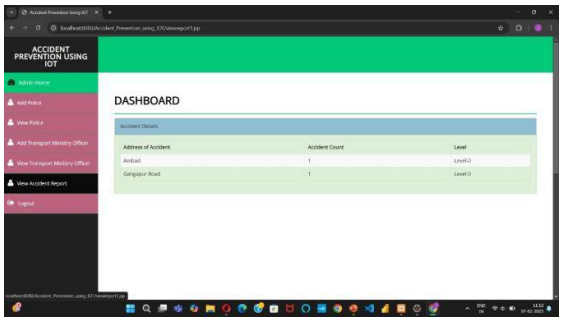
IX. RESULTS AND DISCUSSION

The proposed system successfully detects accident locations using GPS and transmits alerts via GSM to the nearest emergency services, ensuring timely assistance. The ECLAT algorithm effectively classifies accident-prone areas based on frequency, allowing the system to assign severity levels and prioritize emergency responses. The buzzer alert mechanism for driver drowsiness and overspeeding improves road safety by warning drivers in real time, reducing the likelihood of accidents. The modular system design, with separate interfaces for Government

Admin, Police, and Transport Ministry, ensures efficient data handling, monitoring, and response coordination across departments.

X. IMPLEMENTATION

The implementation of this system leverages IoT de- vices, GPS technology, and machine learning models to ensure accurate detection and timely communication of accident risks. The core objective is not only to min- imize accident response time but also to prevent acci- dents before they happen by monitoring vehicle speed, driver alertness, and environmental conditions. With the integration of modules for government authorities, police, and transport ministries, the project ensures ef- ficient data sharing and decision-making. Reduce hu- man fatalities, and support real-time decision-making through automated alerts and data-driven insights.



XI. CONCLUSION

We have proposed a system aimed at accident pre- vention, 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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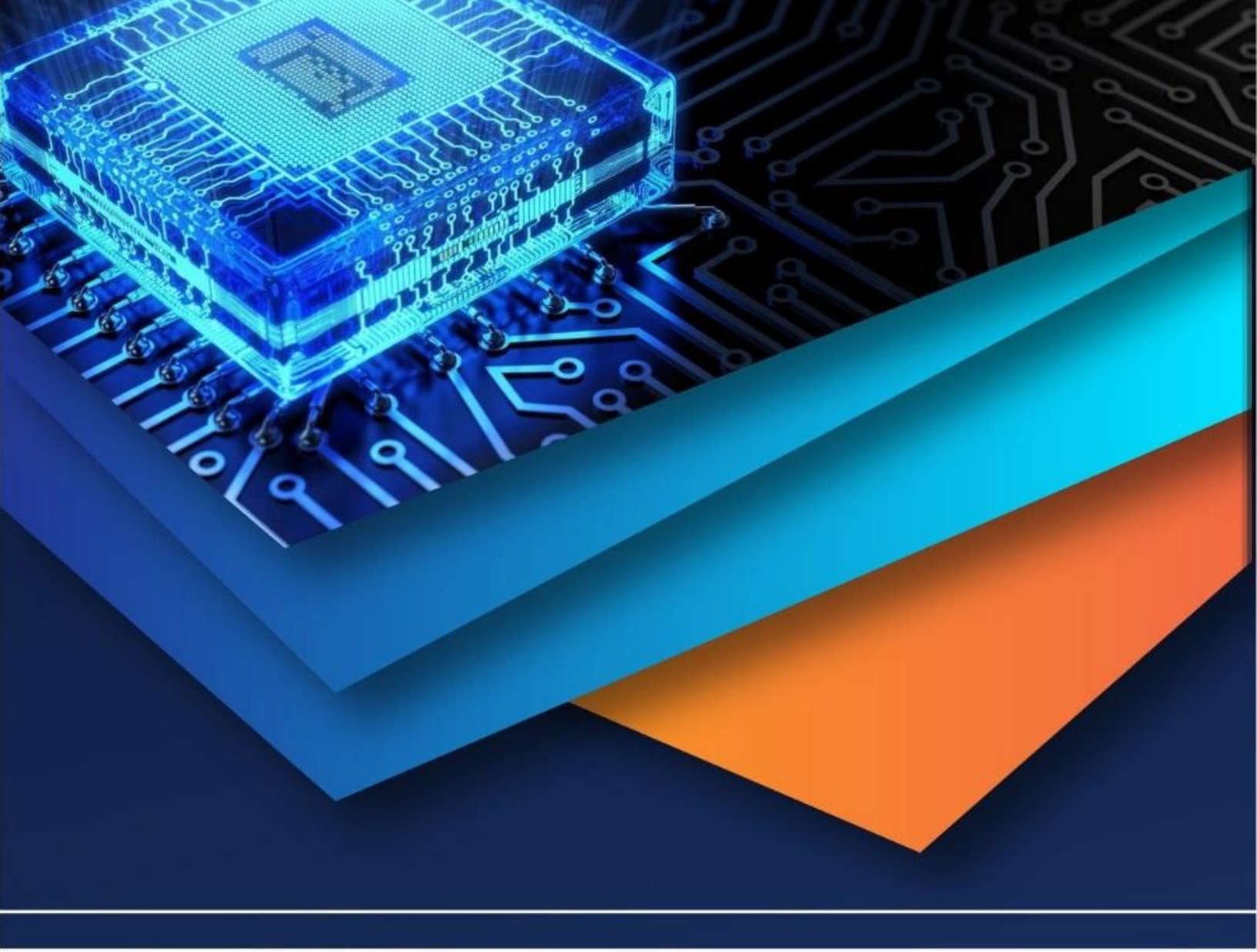

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