ACCIDENT ALERT SYSTEM

[1] A. Pavani, [2] J. Sairohith, [3] M. Sushank, [4] G. Sainath Reddy, [5] K. Phanindra Kumar
[1] Assistant Professor, medamunipavani@gmail.com
[2, 3, 4, 5] Students, Teegala Krishna Reddy Engineering College
[2] julurisairohith@gmail.com, [3] madurisushank27@gmail.com, [4] gotikesainathreddy@gmail.com,
[5] chakri1712@gmail.com

Abstract: *The rapid growth of technology has significantly improved daily life; however, this advancement has also led to an increase in traffic hazards, resulting in a higher ratio of road accidents. Often, the loss of life occurs due to delayed emergency response and inadequate facilities. To address this issue, various systems have been proposed to detect accidents and enhance human safety. This study introduces an Android-based Automatic Vehicle Accident Detection system that incorporates GPS technology for location tracking, offering a comprehensive solution for accident detection and prevention. The system is divided into four modules, each addressing specific functionalities to ensure a robust and integrated response. The proposed application builds on existing research, such as smartphone-based accident detection systems, intelligent traffic monitoring solutions, and mobile edge computing for real-time responses. Additionally, it leverages advancements in participatory sensing and middleware technologies for social and emergency applications. By utilizing these technologies, this system aims to reduce response times and improve overall road safety.*

Index Terms - *Accident Detection, Road Safety, Emergency Response, GPS Technology, Android Application, Traffic Hazard Prevention, Real-Time Monitoring, Mobile Edge Computing, Participatory Sensing, Vehicle Safety System.*

1. INTRODUCTION

Traffic accidents are one of the leading causes of fatalities worldwide, with survival rates heavily influenced by the time between an accident and the arrival of emergency medical personnel. Delays in providing assistance, especially in isolated areas or during nighttime, often result in unnecessary loss of life due to inadequate emergency response facilities. Studies have highlighted that reducing the time from accident occurrence to the dispatch of first responders significantly decreases mortality rates (Ali and Alwan, 2014) [1].

To address these challenges, our project proposes an Accident Alert System designed to notify authorities and relatives immediately in case of an accident. The system leverages an Android application that sends alerts to pre-configured emergency contacts using a combination of accelerometer sensors, GPS, and GSM modules. Such real-time notifications ensure rapid response and aid at critical moments, thereby improving survival rates [2], [3].

The system is user-friendly, cost-effective, and capitalizes on the widespread adoption of smartphones, making it accessible to a large population [4]. While the system's accuracy may be influenced by network connectivity issues, its simplicity and affordability enhance its practicality and usability. By integrating emerging technologies into mobile applications, this system offers an optimal solution to the limitations of existing emergency response mechanisms.

2. RELATED WORK

The growing concern over road safety and the increasing frequency of traffic accidents has prompted the development of various accident detection and notification systems aimed at reducing fatalities and improving emergency response times. These systems utilize a variety of technologies, including mobile applications, GPS, accelerometers, and sensors, to detect accidents and send alerts to authorities and emergency contacts.

Hamid M. Ali and Zainab S. Alwan (2014) proposed a car accident detection and notification system using smartphones. Their system integrates the accelerometer and GPS technology to detect sudden decelerations or crashes and sends immediate notifications to emergency services and contacts. This approach highlighted the importance of leveraging smartphones for accident detection due to their wide availability and built-in sensors [1].

Similarly, a study by Rehka Jadhav, Jwalant Patel, Darshan Jain, and Suyash Phadhtare (2014) focused on emergency management systems using Android applications. The system aimed to improve the timeliness of emergency medical responses, especially in rural or isolated areas, by automatically alerting authorities and relatives via a mobile application. The study emphasized the efficiency of mobile technology in enhancing emergency management in road accidents [2].

The importance of rapid emergency response is further supported by Osnat Mokryn et al. (2012), who developed an opportunistic smart rescue application. Their work demonstrated how mobile applications can be used in disaster and accident scenarios to provide real-time alerts, facilitating quicker responses from medical and rescue teams [3].

Advancements in the integration of mobile technology with accident detection are also seen in systems that utilize fog computing. Bilal Khalid Dar et al. (2019) proposed a delay-aware accident detection and response system using fog computing. This system aims to reduce latency in accident detection and ensure timely communication with emergency services, thus mitigating the consequences of accidents [6].

Other studies, such as those by Arif Shaik et al. (2018) and Nejdet Dogru et al. (2017), have focused on smart car accident detection systems. These systems employ IoT-based sensors to monitor vehicle conditions and trigger alerts in case of an accident. These solutions are effective in reducing response times and improving safety on the roads [7] [8].

In the domain of traffic accident detection using machine learning, Naji Taaib Said Al Wadhahi et al. (2018) explored the use of infrared (IR) sensors to detect accidents. Their system, which aims to reduce traffic hazards, uses IR sensors for real-time detection and prevention, and is another example of integrating sensor technology for accident mitigation [9].

The importance of combining vision-based systems with real-time traffic accident detection was explored by Zu Hui et al. (2014), who proposed a vision-based accident detection system. Their system uses computer vision algorithms to monitor traffic conditions and identify accidents in real-time, enhancing the ability to respond rapidly [10].

Mobile edge computing is increasingly being used to optimize traffic accident detection systems. Chunxiao Liao et al. (2017) developed an intelligent traffic accident detection system based on mobile edge computing. This system integrates mobile and cloud technologies to improve detection speed and reduce latency, providing a more efficient response to accidents [5].

Finally, the integration of participatory sensing for real-time road accident detection was examined by M. V. Ramesh et al. (2013). Their system combines wireless sensor networks with user participation, enabling a network of users to collaboratively detect and report accidents, thereby improving system reliability and effectiveness [4].

These studies demonstrate the evolving landscape of traffic accident detection and response systems. They showcase how integrating mobile technology, IoT, sensors, and cloud computing can significantly reduce accident response times and improve overall road safety. However, challenges such as network connectivity and sensor accuracy remain important considerations in the design of these systems.

3. MATERIALS AND METHODS

The proposed system focuses on enhancing traffic sign recognition by integrating deep learning techniques with real-time analytics. A Convolutional Neural Network (CNN) is employed to classify traffic signs based on a predefined dataset, leveraging its ability to automatically extract and learn features from images, ensuring high accuracy and adaptability to varying conditions. The system processes input images, categorizes the traffic signs, and delivers voice alerts to drivers, providing critical information for timely decision-making [2].

To address challenges such as false positives and varying environmental conditions, the system utilizes a robust CNN architecture fine-tuned on diverse traffic sign datasets, incorporating techniques like data augmentation and transfer learning to improve performance. Additionally, the integration of real-time data analytics ensures minimal latency, making the system suitable for ITS applications [9]. This solution aims to enhance road safety and support autonomous and driver-assistance systems.

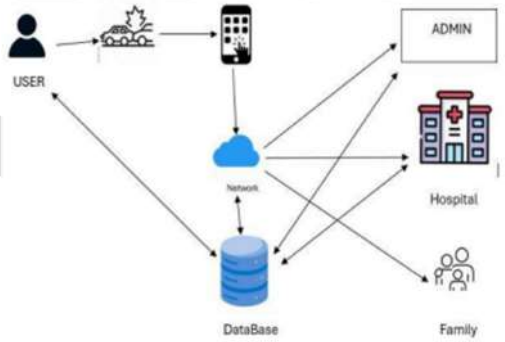

Fig.1 Proposed Architecture

This image [Fig.1] describes its major components, their relationships, and how they interact with each other. Software architecture and design includes several contributory factors such as Business strategy, quality attributes, human dynamics, design and IT environment. Software Architecture typically refers to the bigger structures of a software system, and it deals with how multiple software processes cooperate to carry out their tasks. Software design refers to the smaller structures and it deals with the internal design of a single software process.

i] Login Module

The login module is essential for both users and administrators to access their respective accounts. For users, the login page allows them to access the system using their username and password, providing secure access to

personal accident detection features and family contact management. The admin login page is a dedicated interface where administrators can log in with their credentials to manage the system's backend, including adding or removing hospital information. The login process ensures that only authorized personnel and users can interact with the system, protecting sensitive data and ensuring appropriate roles are enforced.

ii] Admin Dashboard

The admin home page provides an overview of the system's management tools, allowing the admin to perform tasks such as adding new hospitals, viewing hospital details, and deleting users or hospital records [5]. This page serves as the central hub for administrators to maintain the system's data integrity and ensure the accuracy of emergency contact information and hospital details. It plays a critical role in ensuring real-time and accurate notifications are sent to the correct hospitals and authorities during an accident.

(a) Add New Hospital Module: This module allows administrators to add the details of hospitals into the system. It is an essential part of the backend management, ensuring that the database of available hospitals is always up to date. Admins can input necessary hospital details such as name, location, contact information, and specialty. These details are used by the system to route accident notifications to the most appropriate medical facility. The ability to manage and update hospital data helps ensure that emergency medical teams can respond efficiently to accident notifications.

iv] Hospital Deletion Module

The delete user feature allows administrators to remove hospital data from the system when required, ensuring that outdated or incorrect information is not used during emergency responses. By clicking on the "Delete Hospital" button, the administrator can eliminate specific hospital records from the database, ensuring that only relevant and current information is available to users. This helps maintain the system's accuracy, ensuring that users receive notifications about the nearest and most appropriate hospital.

v] User Registration Module

The user registration module allows new users to create accounts in the system. Users must fill out a registration form with their details, including personal information and emergency contact numbers. This data is stored securely to ensure that, in case of an accident, emergency responders can immediately access the user's details. Upon successful registration, users can log in to the system and manage their family contact details for emergency notifications. This module plays a key role in enabling the system to function effectively by ensuring that users can be reached in times of emergency.

(a) Accident Detection Module : The accident detection page is one of the most critical components of the system, designed to detect accidents in real-time using sensors embedded in Android smartphones. By leveraging the device's accelerometer, the system can identify sudden changes in speed or impact, triggering an accident alert. Once an accident is detected, the system immediately initiates communication with emergency contacts and hospitals, alerting them to the accident's location and details [10]. This module uses real-time data to provide timely assistance, which is crucial for saving lives during critical moments.

(b) Emergency Message Sending Module: The emergency message sending module is activated once an accident is detected, and it sends alerts to pre-registered family contacts. The system uses SMS or internet-based communication to notify the user's emergency contacts, informing them of the accident and the user's location. The messages include vital information such as GPS coordinates, enabling faster and more efficient medical

response. This feature ensures that family members are alerted in a timely manner, enabling them to take appropriate action or coordinate with emergency services.

(c) Update Family Details Module: The update family details module allows users to manage and update their emergency contacts within the system. This feature ensures that, in the event of an accident, the system sends alerts to the correct people. Users can add or modify family members' contact information, including phone numbers and relationships to the user, making it a critical part of the system's reliability. The ability to keep contact information current increases the likelihood of a timely and effective emergency response. This module ensures that the most relevant contacts are notified when an accident occurs, providing a vital link to emergency assistance.

These modules together form a comprehensive accident detection and emergency response system that utilizes modern mobile technology to improve road safety and emergency management.

4. RESULTS

5. CONCLUSION

The Android application developed for accident detection and emergency response plays a crucial role in enhancing public health and safety during critical situations. It helps users quickly find nearby hospitals, ambulance services, and even check the availability of blood, addressing common challenges faced in medical emergencies. The app is designed for both normal and registered users, with the latter offering more detailed information, such as family contact details. This personalization ensures that, in case of an emergency, the system can immediately notify the user's family and medical authorities about their condition and location. The high alert feature, which sends messages and GPS locations to family members, hospitals, and ambulance services, is essential for timely intervention. It allows for faster medical response times, potentially saving lives. Additionally, the system supports ad hoc [3] communication during emergencies, especially when traditional networks fail. By integrating mobile devices and sensors like accelerometers and GPS, the app offers a real-time

solution for emergency management, significantly improving disaster response times and ensuring that help is provided when it is most needed.

Future work for this system can focus on improving the accuracy of accident detection through advanced machine learning algorithms, such as the Random Forest classifier, which has shown promise in enhancing traffic accident detection. Additionally, integrating real-time traffic data could optimize routing for ambulances and emergency services, as suggested by. Expanding the system to include integration with IoT devices could provide more comprehensive health monitoring and automated alerts during emergencies. Enhancing the system's scalability and offline functionality will also be crucial for rural areas with limited network connectivity.

REFERENCES

[1] Hamid M. Ali1 , Zainab S. Alwan, 2014"Car Accident Detection and Notification System Using Smartphone.

[2] Rehka Jadhav, Jwalant Patel, Darshan Jain, Suyash Phadhtare Emergency Management System Using Android Application

[3] Osnat (Ossi) Mokryn Dror Karmi Akiva Elkayam Tomer Teller\Help Me: Opportunistic Smart Rescue Application and System","2012 The 11th Annual Mediterranean Ad Hoc Networking Workshop (Med-Hoc-Net).

[4] D. Horowitz and S. Kamvar, "The anatomy of a large-scale social search engine," in Proceedings of the 19th international conference on World wide web. ACM, 2010, pp. 431–440.

[4] J. Fajardo and C. Oppus, "A mobile disaster management system using the android technology," WSEAS TRANSACTIONS on COMMUNICATIONS, vol. 9, no. 6, pp. 343–353, 2010.

[5] A. Pietilainen, E. Oliver, J. LeBrun, G. Varghese, and C. Diot, "Mobi Clique: middleware for mobile social networking," in Proceedings of the 2nd ACM workshop on Online social networks. ACM, 2009, pp.49–54.

[6] Bilal Khalid Dar, Munam Ali Shah, Saif Ul Islam, Castren Maple, Shafaq Mussadiq, and Suleman Khan," Delay-Aware Accident Detection and Response System Using Fog Computing", IEEE 2019.

[7] Arif Shaik, Natalie Bowen, Jennifer Bole, Gary Kunzi , Daniel Bruce , Ahmed Abdelgawad , Kumar Yelamarth," Smart Car: An IoT Based Accident Detection System", IEEE Global Conference on Internet of Things (GCIoT), 2018.

[8] Nejdet Dogru, Abdulhamit, Subasi," Traffic Accident Detection Using Random Forest Classifier", IEEE 2017.

[9] Naji Taaib Said Al Wadhahi, Shaik Mazhar Hussain, Kamaluddin Mohammad Yosof, Shaik Ashfaq Hussain, Ajay Vikram Singh, "Accidents Detection and Prevention System to reduce Traffic Hazards using IR Sensors ", IEEE 2018.

[10] Zu hui, Xie yaohua, Ma lu, Fu Jiansheng "Vision-based real-time traffic accident detection" IEEE 2014.