VEHICLE COLLSION AVOIDANCE AND ALERT SYSTEM USING ANDROID APPLICATION

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ABSTRACT

The Vehicle Collision Avoidance and Alert System is designed to improve road safety by utilizing modern technology to prevent accidents and provide timely assistance during emergencies. This system leverages an Android application as the user interface, combining components such as a 360-degree for front-end and backend using ultrasonic sensor, tilt sensor, and GCM communication for real-time vehicle monitoring. The ultrasonic sensor detects obstacles within a 40 cm range and alerts the driver through the app with a voice prompt, reducing the risk of collisions. In the event of a vehicle rollover or a flat-down scenario, the tilt sensor activates, and the system automatically sends an SMS with the vehicle's location to an authorized person using GCM technology. This integration of collision detection and emergency alert features ensures prompt action during critical situations, making driving safer and more secure. The system’s design focuses on user friendliness, reliability, and efficiency, offering a comprehensive solution to improve driver awareness and response during potential accidents.

Key Words: Smart Vehicle System, Accident Prevention, Real Time System, Bluetooth Connectivity, GPS Tracking.

I INTRODUCTION

The Vehicle Collision Avoidance and Alert System is designed to improve road safety by utilizing modern technology to prevent accidents and provide timely assistance during emergencies. This system leverages an Android application as the user interface, combining components such as a 360-degree for front-end and back-end using ultrasonic sensor, tilt sensor, and GCM communication for real-time vehicle monitoring. The ultrasonic sensor detects obstacles within a 40 cm range and alerts the driver through the app with a voice prompt, reducing the risk of collisions. In the event of a vehicle rollover or a flat-down scenario, the tilt sensor activates, and the system automatically sends an SMS with the vehicle's location to an authorized person using GCM technology. This integration of collision detection and emergency alert features ensures prompt action during critical situations, making driving safer and more secure. The system’s design focuses on user-friendliness, reliability, and efficiency, offering a comprehensive solution to improve driver awareness and response during potential accidents.

II LITERATURE REVIEW

One notable study by Jorge Zaldivar, Carlos T. Calafate, Juan Carlos Cano, and Pietro Manzoni (2022) explores the integration of smartphones with vehicles using the OBD-II interface to detect accidents. Their system monitors critical vehicle data, such as the force experienced by passengers during a frontal collision, in conjunction with airbag triggers to determine the occurrence of an accident. This combination of data is used to detect accidents in real-time, moving vehicles closer to the smart vehicle paradigm by providing new functionalities like automated accident detection and passenger safety monitoring. Another innovative approach, proposed by Aditi Padayar, Dipali Jadhav, Priti Pashte, Shweta Lagade, and Prof. S. K. Srivastava (2022), uses IoT and microcontrollers to prevent drunk driving.

Their system employs an MQ3 alcohol sensor to measure the alcohol content in the driver's breath. If the alcohol concentration exceeds a predefined limit, the system automatically turns off the car to prevent impaired driving.The study utilizes the 8051 family (89s52) microcontrollers for processing sensor data, emphasizing the importance of integrating alcohol detection and IoT technologies to mitigate accidents caused by driving under the influence. In a similar vein, Mahesh A. Rakhonde, Prof. Dr. S. A. Khoje, and Prof. R. D. Komati (2021) developed a system combining vehicle collision detection with pollution monitoring. The primary goal of their study is to reduce accidents by detecting critical factors such as tire pressure in real-time and implementing accident detection through MCU nodes. Additionally, the system employs the MQ7 sensor to monitor pollution levels, providing dual benefits: improving vehicle safety and raising awareness about environmental conditions. This study highlights how the integration of environmental data with vehicle safety can contribute to more sustainable and safer driving practices.The study by P. Ramya, R.K. Kavin, R. Rathish, M. Sathees Kumar, and R. Karthi Kumar (2021) addresses driver fatigue and alcohol impairment as critical factors in preventing accidents. Their proposed system detects driver fatigue by monitoring driving behavior, such as excessive travel distance. In addition to fatigue detection, the system incorporates an alcohol sensor to lock the vehicle's ignition if the driver is found to be intoxicated. If the system detects any abnormalities, it also has the capability to control the vehicle's direction and alert authorities or vehicle owners via a GSM module. This system showcases a comprehensive approach to vehicle safety, integrating alcohol detection, fatigue monitoring, and emergency communication features to mitigate potential accidents. A study by Adnan M. Al-Smadi, Wasan Al-Ksasbeh, Mohammad Ababneh, and Manar Al Nsairat (2020) presents an Intelligent Automobile Collision Avoidance system that uses ultrasonic sensors to detect imminent collisions. The system works by measuring the distance between two vehicles moving in the same lane and direction.

When the vehicles approach dangerously close to one another, the system triggers an alert to warn the driver and prevent rear-end collisions. This system aims not only to detect potential collisions but also to reduce the severity of the collision if it becomes inevitable by providing real-time warnings and alerts to the driver.

III EXISTING SYSTEM

In existing systems, technologies like automatic braking, lane departure warnings, and adaptive cruise control are used to enhance safety. By integrating VANETs (Vehicular Ad-hoc Networks), the effectiveness of collision avoidance systems can be significantly improved. VANETs enable vehicles to communicate with each other and with infrastructure, exchanging real-time information about road conditions, traffic, and nearby vehicles. This communication allows for more proactive safety measures, such as predicting potential hazards from other vehicles before they are visible or responding to sudden changes in traffic flow. The VANET-enhanced systems can improve decision-making in collision avoidance by providing a broader and more dynamic awareness of the driving environment, potentially reducing accidents caused by human error or sensor limitations.

IV DISADVANTAGES

Despite their benefits, VANET-enhanced systems face challenges such as high implementation costs and the need for widespread infrastructure and vehicle compatibility. They are also vulnerable to cybersecurity threats, such as hacking or data breaches, which could compromise safety. Additionally, reliance on continuous communication may lead to inefficiencies or failures in areas with poor network coverage or high latency.

V PROPOSED METHODOLOGY

The Proposed system uses a 360-degree for frontend and backend using ultrasonic sensor to detect obstacles around the vehicle within a threshold distance of 40 cm.

This data is transmitted to the Android app via a Bluetooth connection, which then provides the driver with immediate voice alerts, helping them avoid potential collisions.

The system also incorporates a tilt sensor that detects when the vehicle experiences an abnormal fall down, indicating a potential accident or rollover situation. In such cases, the system automatically initiates GCM communication to send an SMS alert to an authorized person, providing the vehicle's precise location and the nature of the incident. The proposed system offers a robust and efficient solution to enhance driver safety, combining advanced sensor technology, mobile communication, and user-friendly software to minimize the risk of collisions and ensure quick responses during accidents.

VI ADVANTAGES

The proposed system enhances driver safety by providing real-time obstacle detection and immediate voice alerts via an Android app, helping to prevent collisions. It also incorporates an automatic accident detection feature using a tilt sensor ensuring prompt SMS notify with precise location details during emergencies. Combining advanced sensors, Bluetooth connectivity, and intuitive software, this system minimizes risks and enables swift responses in critical situations.

VII BLOCK DIAGRAM

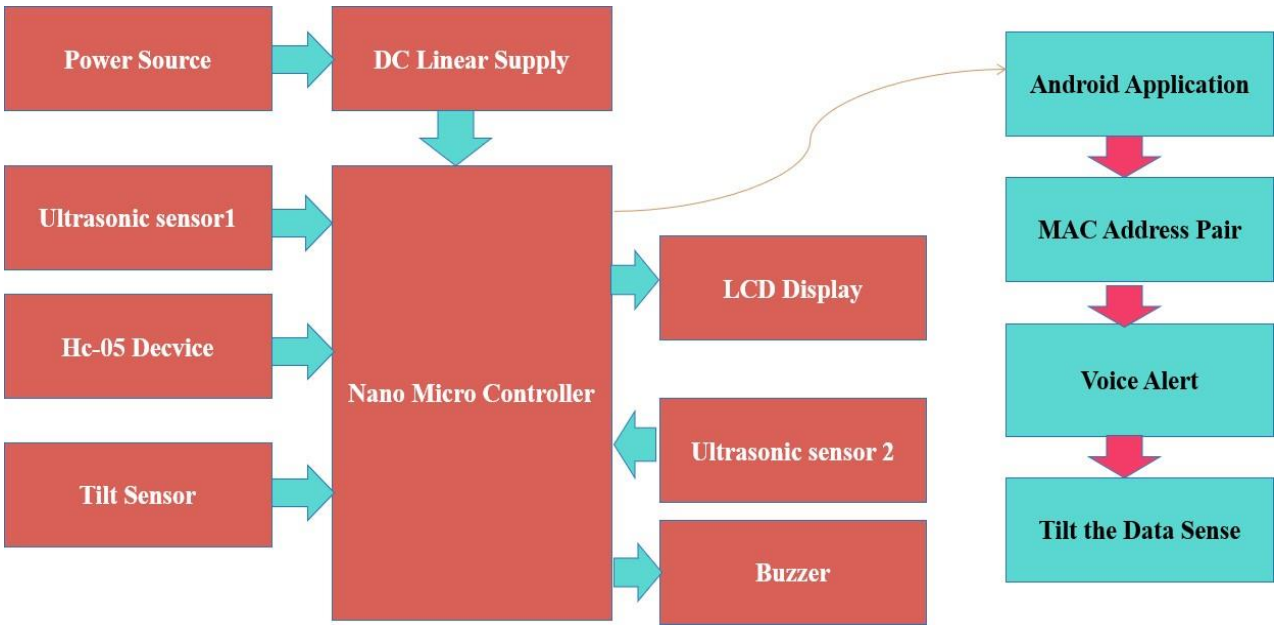

Fig 1: Basic Block Diagram of Work Flow

➢ HARDWARE SPECIFICATION

- Power source
- DC linear supply
- Nano microcontroller
- Ultrasonic sensor
- Tilt sensor
- HC-05 device
- LCD display
- Buzzer

➢ SOFTWARE SPECIFICATION:

- Software tool: Arduino idle
- Language used: Embedded

VIII APPLICATION

Personal Vehicle Safety: Assists individual drivers by providing real-time alerts to avoid collisions **Emergency Services**: Helps ambulances, fire trucks, and police vehicles avoid collisions during high-speed or emergency operations **Military and Defense Vehicles:** Provides safety solutions for military vehicles in rough terrains, minimizing rollover risks and enabling quick assistance during emergencies. **School Bus Safety:** Protects school buses from accidents by alerting drivers to potential obstacles or unsafe driving conditions.

IX RESULT & CONCLUSION

The Vehicle Collision Avoidance and Alert System enhances vehicle safety by integrating multiple features to prevent accidents and ensure prompt emergency responses. Using a 360-degree ultrasonic sensor, the system detects obstacles within a 40 cm threshold and communicates this information to an Android application via Bluetooth. When an obstacle is detected, the app triggers a voice alert, notifying the driver to take immediate action.

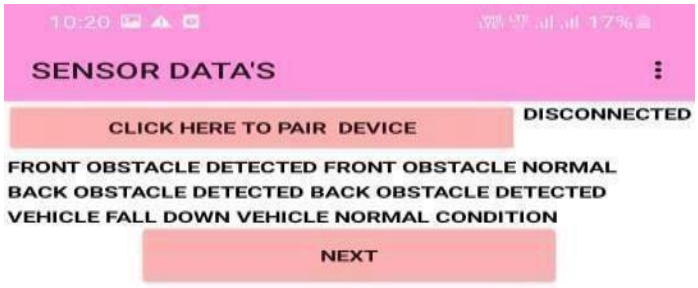

Fig 2: Welcome Page

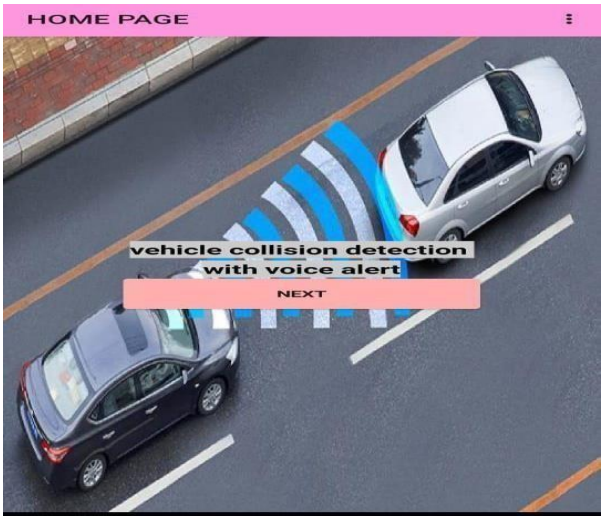

Fig 3: Login Page

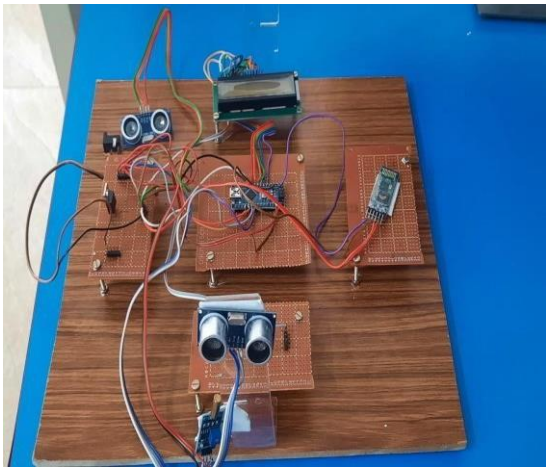

Fig 4: Result

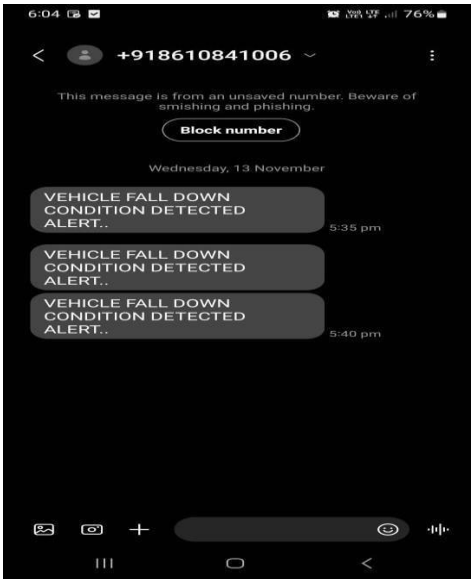

Fig 5: Alert

Additionally, the system includes a tilt sensor that detects if the vehicle has fallen or rolled over, signaling a potential accident. In such cases, the system automatically sends an SMS to an authorized person, using (GCM) Google Cloud Messaging to provide the vehicle's location and alert them to the incident. This real-time detection and communication mechanism helps to prevent collisions and ensures a rapid response in emergencies. In conclusion, the Vehicle Collision Avoidance and Alert System significantly enhances road safety by integrating advanced technologies such as ultrasonic sensors and tilt detection. This comprehensive approach not only mitigates the risk of collisions but also offers a reliable safety net during emergencies, making it a valuable tool for drivers seeking to enhance their safety on the road. Overall, the system exemplifies a proactive solution to vehicle safety challenges, promoting greater awareness and responsiveness in critical situations.

X FUTURE SCOPE

The future scope of the Vehicle Collision Avoidance and Alert System includes integrating advanced AI and machine learning algorithms for predictive analytics, enabling the system to anticipate potential hazards more accurately. Enhancements like GPS navigation for route optimization and connectivity with smart city infrastructure can further improve its functionality. Additionally, expanding the system to support vehicle-to-vehicle communication (V2V) and autonomous driving features could revolutionize road safety standards. These advancements would make the system indispensable in next-generation transportation networks.

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