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# Car Accident Detection And Prevention System

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*Abstract:* The rise in road accidents due to human error, particularly rear-end collisions, has become a significant concern for road safety. This project proposes the development of an Anti-Break System for Cars that utilizes modern sensor technologies to automatically detect obstacles and prevent collisions. The system is based on an ESP32 microcontroller integrated with various components such as an IR sensor, DC motors, L298N motor driver, GPS module, Bluetooth module, and an accelerometer. The core functionality of the system is to measure the distance between the vehicle and any obstacle in front using the IR sensor. When the distance falls below a pre-set threshold, the system triggers the brakes to prevent a collision. In the event of an accident, the system detects the impact using the accelerometer and immediately sends the car's location to emergency contacts through the GPS module. The use of Bluetooth allows for manual control and system monitoring, while Link IoT enables cloud-based monitoring and data logging. This cost effective solution enhances vehicle safety, reduces the risk of accidents, and ensures faster emergency response, making it a valuable addition to modern-day automotive safety systems.

*Index Terms* - **Accident Detection, Accident Prevention, Vehicle Safety, Real-Time Monitoring, Smart Vehicle System, Emergency Alert System.**

## I. Introduction

Road accidents are a major cause of losses and injuries worldwide, counting for a signi cant number of deaths every time. The adding number of vehicles and mortal crimes in driving frequently lead to accidents, numerous of which could be averted or eased with timely intervention. Traditional exigency response systems are reactive and frequently delayed due to the lack of immediate accident reporting, which can affect in loss of precious lives. To address this issue, this paper proposes a **Car Accident Detection and Prevention System** that integrates colorful detectors and communication technologies to cover vehicle conditions in real- time, descry accidents as they be, and instantly alert exigency services with the position and status of the vehicle. The system uses factors similar as a vibration detector to descry collisions, a GPS module to track the vehicle's position, and a GSM module to shoot cautions. also, it includes preventative measures similar as covering vehicle speed and detecting implicit hazards to avoid accidents before they do. This system aims to enhance road safety, reduce exigency response time, and eventually save lives through the perpetration of smart, automated technologies.

## II. Literature Survey

In [1] this paper presents a system that uses GSM and GPS modules for accident discovery and alert. It employs vibration and MEMS detectors to descry a crash and sends an exigency communication with position details to police or deliverance brigades. A switch allows the motorist to cancel false cautions. The system aims to reduce exigency response time. unborn advancements include adding a webcam for image prisoner.

In [2] this study proposes an accident discovery and alert system using an ATMEGA8A regulator, accelerometer, and GSM/ GPS modules. It activates cautions when the vehicle rolls over or crashes. A communication with GPS Page 1 of 2 equals is transferred to exigency askers. A homemade override button is included for minor accidents. The system emphasizes reducing deliverance time and saving lives.

In [3] ) this paper introduces a black box- grounded accident discovery and reporting system. It uses an ARM regulator with GPS, GSM, and MEMS detectors. When an accident occurs, it transmits the vehicle's position and records audio data. Google Earth integration allows accident shadowing. The system ensures precise reporting and records substantiation for unborn analysis.

In [4] the authors review business accidents at corners, fastening on statistical analysis of accident trends. They aim to identify unproductive variables and signi cant patterns through literature review. The work provides foundational knowledge for designing effective business safety interventions. It emphasizes the part of urbanization and increased vehicular business in rising accident rates.

In [5] literature check the paper discusses an automated business control system with an exigency precedence medium using PLC technology. Conventional business signals struggle to control overcrowding and traf c on speci c paths due to adding population. The system uses IR detectors to calculate vehicle viscosity and allocate green light, serving exigency vehicles like ambulances and re-armies. The python law results show it can be executed in real world scripts without affecting conventional business control systems.

In [6] this paper presents an Arduino- grounded vehicle accident alert system using accelerometers, GSM, and GPS modules. The system detects unforeseen stir changes and sends the accident position via SMS. It aims to overcome the challenge of delayed exigency services. The system is a cost-effective result to enhance road safety using simple electronics.

In [7] this exploration implements an accident discovery system using MEMS detectors, Arduino, GSM, and GPS. On detecting an impact, it automatically sends a position grounded alert to exigency services. The focus is on reducing response time and furnishing timely backing. It proposes an robotic way to inform hospitals or authorities during extremities.

In [8] the paper proposes a wireless accident discovery and alert system using accelerometers, GPS, and GSM. It detects accidents and sends a communication with position and victim's particular pro le( name, blood group, connections). This helps askers act snappily and identify the person. It addresses the critical issue of delayed medical help.

## III. METHODOLOGY

The proposedAnti-Break System( ABS) integrates colorful tackle modules with an ESP32 microcontroller to produce an intelligent, low- cost result for precluding hinder- end collisions and detecting accidents in real- time. The system armature includes multiple detectors for environmental data collection, modules for actuation and waking, and wireless technologies for remote monitoring and exigency announcement.

- **Sensor Integration and Environment Monitoring**

The system uses an **Ultrasonic sensor** and an **IR sensor** to measure the distance between the vehicle and any obstacle or vehicle in front. These sensors continuously send distance data to the ESP32 microcontroller. When the measured distance falls below a pre-defined safety threshold, indicating a potential collision, the ESP32 processes the data and initiates braking. To detect accident impact, an **ADXL345 accelerometer** is employed. It monitors sudden changes in motion or tilt. If the sensed value exceeds the defined g-force limit, it is treated as an accident scenario.

- **Automated Control via Actuators**

Upon detecting a hazardous proximity or an accident:

- The ESP32 activates the **Motor Driver Module (L298N)**, which in turn operates the **DC Motor** to simulate automatic braking.
- Simultaneously, it triggers a **Buzzer** and **LED** as visual and audio warnings for nearby vehicles and pedestrians.

This real-time decision-making and control logic reduces reliance on driver reaction time, significantly improving safety during emergencies.

- **Location Tracking and Emergency Alerting**

If an accident is detected, the **GPS module** captures the current geographical coordinates (latitude and longitude) of the vehicle. These details are either sent through a **Bluetooth module** to a connected smartphone or uploaded via **Blynk IoT platform** for cloud-based real-time alerting. Emergency contacts can access the live location and respond immediately.

- **Remote Access and Mobile Monitoring**

The system leverages the ESP32's inbuilt **Bluetooth** for short-range communication and **Blynk IoT** for remote monitoring. Through a mobile app interface, the user or emergency responder can:

- Receive real-time alerts.
- Monitor braking status.
- View location coordinates in case of an accident.

This dual communication method enhances accessibility and ensures that the system is functional even in areas with no internet access.

## IV. Block Diagram and Implementation

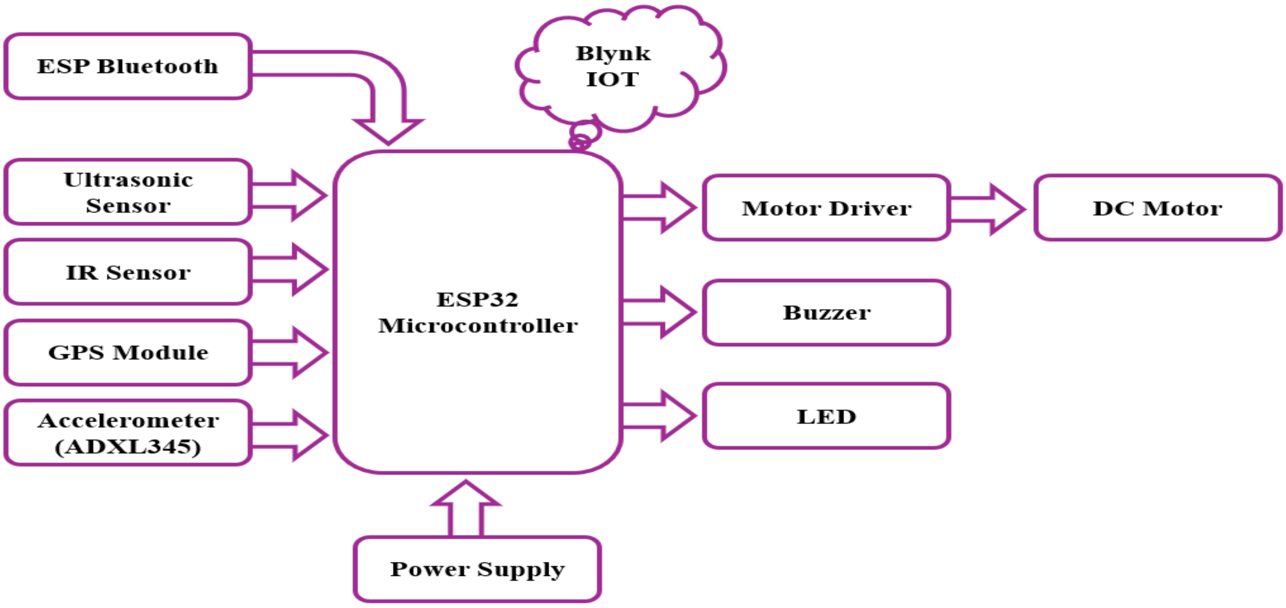


**Figure 1: Block Diagram of the System**

The proposed Anti-Break and Accident Detection System is designed around the ESP32 microcontroller, which serves as the core processing unit responsible for managing all inputs and outputs of the system. The block diagram illustrates the integration of various sensors, actuators, and communication modules with the ESP32 to ensure real-time response to potential collisions and accidents. On the input side, the system incorporates an ultrasonic sensor and an infrared (IR) sensor to continuously monitor the distance between the vehicle and any object in front of it. These sensors play a critical role in detecting potential rear-end collisions by sending distance data to the ESP32. If the detected distance is below a defined threshold, the microcontroller triggers an automatic braking response.

To enhance safety further, an ADXL345 accelerometer is employed to monitor sudden changes in motion or tilt, which may indicate an accident. When such motion is detected, it acts as an immediate trigger for emergency alert activation. A GPS module is also connected to the ESP32 to capture the real-time geographical location of the vehicle, which is particularly vital during emergencies, allowing for swift communication of location details to rescue teams or pre-registered emergency contacts.

On the output side, the ESP32 sends signals to a motor driver module (L298N), which controls a DC motor to simulate the braking mechanism of the vehicle. In parallel, the system activates a buzzer and an LED as audible and visual alerts to indicate an emergency or braking situation. These alerts not only warn the driver and nearby pedestrians but also signal the activation of the safety system. Communication and remote control are facilitated through an ESP Bluetooth module, enabling smartphone-based access and monitoring. Additionally, Blynk IoT integration allows cloud-based data transmission, remote notifications, and real-time status visualization through a mobile application, making the system intelligent and user-friendly.

The entire system is powered by a regulated 12V DC supply that ensures uninterrupted operation of all modules. The seamless integration of these components enables the vehicle to respond autonomously to dangerous situations, reduce human reaction delays, and send timely alerts during emergencies. This comprehensive setup ensures both accident prevention and efficient post-accident response, offering a significant contribution to smart vehicle safety systems.

## V. RESULTS AND DISCUSSIONS

The proposed Anti-Break System was developed and tested on a custom-built prototype using the ESP32 microcontroller, ultrasonic sensor, IR sensor, ADXL345 accelerometer, GPS module, and motor driver with DC motors. The system was designed to autonomously detect potential rear-end collisions and accident scenarios and respond accordingly through automated braking and emergency alert mechanisms. During testing, the ultrasonic and IR sensors effectively detected obstacles placed within a range of 5 to 50 cm. When an object was detected below a safety threshold (20 cm), the motor driver immediately halted the DC motor simulating a braking action. This proved the system's ability to respond in real-time to avoid collisions caused by sudden stops of vehicles ahead.

In accident detection simulations, the accelerometer successfully detected abrupt motion, vibrations, and tilting angles beyond the preset threshold. Upon impact detection, the system triggered a buzzer and LED and simultaneously sent the GPS coordinates to a connected smartphone via the Blynk IoT. The received GPS data accurately reflected the vehicle's location, confirming the system's suitability for real-world emergency alert applications. Additionally, through Blynk IoT integration, real-time status updates including braking events and location sharing were observed on the mobile app interface. This feature ensures that in the event of a crash, help can be dispatched more quickly, reducing emergency response time. The system demonstrated consistent performance across multiple test scenarios and environmental conditions. However, certain limitations were observed, such as slight delays in sensor response under noisy or highly reflective surfaces, and dependency on mobile device range when using Bluetooth instead of GSM.

Overall, the project successfully validates the use of low-cost, readily available components to implement an effective safety mechanism for vehicles. The smart integration of sensors and communication modules contributes to reducing accident-related fatalities and highlights the system's potential for wider adoption in entry-level automotive safety solutions

| **Test Case** | **Trigger Event** | **Expected Result** | **Observed Outcome** |
|---|---|---|---|
| Obstacle < 20 cm | Ultrasonic/IR detects nearby object | Automatic braking (motor stops) | Motor stopped successfully |
| Sudden tilt or impact | Accelerometer detects shock | Buzzer sounds, LED lights, GPS alert sent | All alerts triggered; location transmitted |
| Bluetooth command (stop) | Stop command sent via mobile app | Vehicle stops or responds as instructed | Real-time response observed |
| GPS tracking after crash | Crash detected | Location sent to pre-configured contact | Accurate GPS location received |
| IoT monitoring via Blynk | System runs under normal condition | Data visible on mobile dashboard | Status updates received successfully |

**Table 1: Functional Testing of the Anti-Break and Accident Alert System**

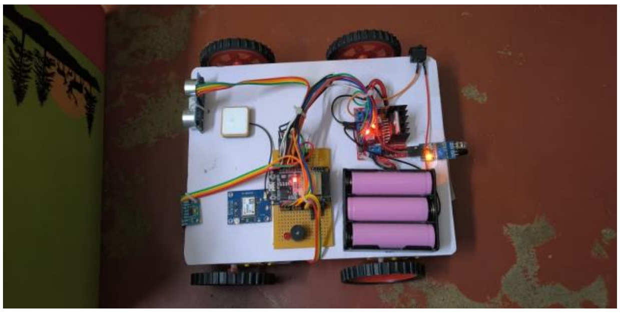

**Figure 2: Crash Simulation Test**

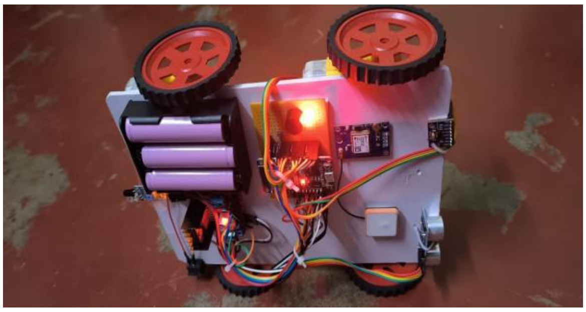

**Figure 2: Detecting obstacle**

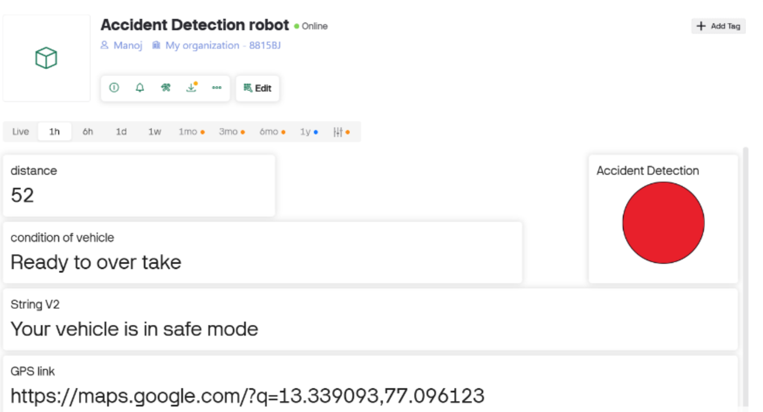


**Figure 4: Live Dashboard Monitoring via Blynk IoT Platform**

## VI. Conclusion

The proposed Anti-Break and Accident Alert System successfully demonstrates the practical application of embedded systems and IoT technologies to enhance road safety. By integrating an ESP32 microcontroller with distance-sensing modules (ultrasonic and IR sensors), the system efficiently detects potential rear-end collisions and automatically triggers the braking mechanism, reducing dependency on human reaction time. The incorporation of an ADXL345 accelerometer allows accurate detection of accidents, while the GPS module ensures real-time location tracking. The system also includes a robust alert mechanism through Bluetooth and IoT-based communication, enabling immediate notification to emergency contacts in case of a crash. The use of the Blynk IoT platform allows remote monitoring and visualization of system status, further strengthening its real-time functionality.

Testing and validation confirm the system's reliability, cost-effectiveness, and suitability for integration into both new and existing vehicles. Overall, the project offers a smart and affordable safety solution that can significantly reduce accident-related fatalities and injuries, particularly in developing regions where high-end commercial safety systems may be unaffordable.

## VII. References

1. C.Prabha , R.Sunitha, "Automatic Vehicle Accident Detection and Messaging System Using GSM and GPS Modem" Assistant professor, Dept. of ECE, Bellari Institute of Technology and Management, Bellary, Karnataka, India International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 3, Issue 7, July 2014 .
2. S. Parameswaran, "Automatic Vehicle Accident Detection and Messageing System "Assistant Professor,Department of Ece,Nandha College of Technology,Erode. Special Issue – 2016 International Journal of Engineering Research & Technology (IJERT) Volume 4, Issue 11.

3. Dr.J.L.Mazher Iqbal, "Automatic Vehicle Accident Detection and Reporting With Black Box" Madanapalle Institute of Technology & Science, Angallu International Journal of Applied Engineering Research , ISSN 0973-4562 Vol. 10 Issue 2017.
4. Ekta Sharma, Khushbu Bhatt, S. M. Damodariya, "Literature Review on Accident Studies at Intersections" Parul Institute of Engineering and Technology, Vadodara, Gujarat, India Volume 2 | Issue 3| APR 2018.
5. GOWSHIKA. B "VEHICLE ACCIDENT DETECTION SYSTEM BY USING GSM AND GPS" Dept of Electrical and Electronics Engineering, Vivekanandha college of Engineering for Women[Autonomous], Namakkal, India International Research Journal of Engineering and Technology (IRJET) Volume: 06 Issue: 01 | Jan 2019.
6. Jayati Routh, "Automatic Vehicle Accident Detection and Messaging System Using GPS and GSM Module" International Journal of Engineering Trends and Technology (IJETT) – Volume 67 Issue 8| FEB 2020.
7. Pranav Patil, Kishor Gangurde ,"Accident Detection and Alert System using Accelerometer" Assistant Professor, Department of Computer Engineering Pune, Maharashtra, India International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 6, Issue 1, June 2021.
8. D.BALA ADITYA, "ACCIDENT DETECTION AND ALERT SYSTEM",Department Of Electronics And Communication Engineering ACE engineering college,Ghatkesar Vol 14 Issue 06,2023.