

## Accident Prevention for Hairpin Bend

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**ABSTRACT:** People don't care enough to stay safe while driving on road. Mainly road accidents are caused due to High speed or when the driver is not aware of the other vehicles coming opposite to it especially in the deep curves. During a long travel accidents and deaths caused by them are the most serious issues now-a-days. Research in this project includes the main issues like hills road accidents and their impacts, causes of this accident, effect of accident, preclusion and control so that we can improve this state. It is not safe now-a-days to drive through the hills areas while turning in the hairpin bends. The percentages of accidents in hills sections are increasing day by day. Severity of these accidents is non-reparable. So firstly it is important to control this situation and have some safety measures in hairpin bends. This project includes some solutions and ideas to improve protection in hairpin bends and status monitoring using IOT.

**Keywords:** Road safety, Road accidents, High speed, Driver awareness, Opposite vehicles, Deep curves, Long travel, Hills road accidents, Hairpin bends, Accident causes, Accident effects, Accident prevention, Safety measures, Severity, Control, Protection, Status monitoring, IoT (Internet of Things), Hill areas, Non-reparable damages

### 1.INTRODUCTION

While the statistical incidence of Hairpin Bend as opposed to left-hand turns in the course of operation of a vehicle is extremely rare, the incidence of accidents while making a Hairpin Bend is extremely high. For this reason most local ordinances rigorously control the accident over Hairpin Bends in any stream of traffic. However, practicality dictates the vehicles crossing in the Hairpin Bends and put the signal in the other hand, particularly where the travel path arrangement and topography preclude a safer and more convenient change in direction of travel of the vehicle.

### 2.LITERATURE REVIEW

**1. R. S. Rakul has proposed "Implementation of Vehicle Mishap Averting System Using Arduino Microcontroller":** The Unit has been designed to prevent an accident by collision. The 'heart' of the Unit is Arduino microcontroller which performs all the vital tasks of the system. And it will be discussed in the following subsequent sections. This system will receive information from the Ultrasonic transceiver, and accordingly transmit the data via the Wi-Fi router to the controller. Through the buzzer indication, light emitting display, and liquid crystal display, the vehicle information will be shown to the vehicle users. The primary purpose of the system is to prevent collision between two or more vehicles when they take a turn on U-bends. Lorate Shiny1,

**2. A. Rajakumaran2, S. Vijay are proposed "Vehicle Control System with Accident Prevention by Using IR Transceiver":** Drivers go at very high speed usually near school zone or indulge in speeding causing inconvenience to the other vehicle users and pedestrians. Even though these are meant for the safety of the vehicles traveling and for the general public, it is not usually practiced and ignored by the vehicle drivers. The main objective of this paper is to design a Vehicle controller meant for vehicles speed control and monitors the zones, which can run on an embedded system. Vehicle Controller can be custom designed to fit into a vehicle dashboard and displays information on the vehicle.

**3. P. Aravind, V. Kishore are proposed "E-Vehicle- Automatic Speed Control Using Android Mobile Application":** In the rapidly changing world, the speed has become an important factor in humans' life. Everyone wants to get fast as much as possible. In the fast speed world, there are two perspectives, one is maintaining the speed and the other is to maintain the safety medium as well. In the smart speed world, the technologies play a major role. Smart phones are the key part of the growing technologies in the globe. Android application is a one which is ruling almost 75% of the crowd.

So, our objective is to ensure maximum safety to the person who is driving the vehicle and to the people on the road in all parameters through a mobile app.

**4. K. P. Sreevishakh et al has proposed an automatic accident prediction and the notification system using AMR and Sonar sensor:** The Unit has been designed to prevent an accident by collision. The 'heart' of the Unit is Arduino microcontroller which performs all the vital tasks of the system. And it will be discussed in the following subsequent sections. This system will receive information from the Ultrasonic transceiver, and accordingly transmit the data via the Wi-Fi router to the controller.

### 3. MODULES DESCRIPTION

- Sensor Module
- Data Processing & AI Module
- Communication Module
- Alert & User Interface Module
- Emergency Response & Monitoring Module

**Sensor Module:** The sensor module is crucial for detecting obstacles, vehicles, and road conditions in real time. It integrates LiDAR, ultrasonic, and infrared sensors to monitor blind curves and steep slopes, providing enhanced visibility in fog or low-light conditions. Additionally, accelerometers and gyroscopes assess vehicle motion to detect skidding risks, ensuring a proactive approach to collision prevention.

**Data Processing & AI Module:** This module leverages machine learning models to analyze sensor data and predict potential collisions. Kalman filters help refine vehicle tracking, while path-planning algorithms like A\* and Dijkstra's\* optimize safe routing. Edge computing allows immediate hazard detection, minimizing latency and ensuring that drivers receive timely alerts based on predictive analytics.

**Communication Module:** Reliable communication is key to a successful collision avoidance system. This module facilitates V2V (Vehicle-to-Vehicle) and V2I (Vehicle-to-Infrastructure) interactions, ensuring seamless data exchange. Technologies such as LoRaWAN, Wi-Fi, and cellular networks provide real-time updates, enabling vehicles to share location, speed, and road hazard information dynamically.

**Alert & User Interface Module:** To enhance driver awareness, this module provides LED indicators, dashboard warnings, and audio alerts to notify about potential hazards. Haptic feedback in steering systems and seats can reinforce warnings in critical situations. A mobile app and IoT dashboard allow drivers and authorities to visualize road conditions, enabling informed decision-making.

**Emergency Response & Monitoring Module:** In case of an accident, this module automatically sends SOS alerts to emergency services using GPS-based location tracking. It enables real-time monitoring of risk zones, helping authorities improve road safety policies. Additionally, cloud-based analytics assist in identifying accident-prone areas, leading to proactive safety measures and improved infrastructure planning.

### 4. RESULT AND DISCUSSION

The implementation and testing of the IoT-based collision avoidance system for ghat roads yielded significant insights into its performance, reliability, and adaptability under real-world conditions. The system demonstrated accurate obstacle detection, with sensors effectively identifying potential hazards within predefined safety thresholds. AI-driven predictive models, including algorithms such as A\* and Kalman filters, successfully anticipated collision risks, enabling timely alerts and corrective actions. Field testing under diverse environmental conditions, including fog, sharp curves, and varying traffic densities, highlighted areas for optimization. While the system maintained high accuracy in clear conditions,

challenges arose in extreme weather scenarios, necessitating further refinements in sensor calibration and data processing. Stress testing confirmed the system's resilience in handling sudden braking scenarios and vehicle interference, ensuring reliable performance in high-risk situations.

## 5.CONCLUSION

People have become much more dependent on transportation systems in recent years; transportation systems themselves face not only several opportunities but several challenges as well. Continuous growth of population all over the world creates a great challenge to the transport management systems. The conventional methods are no longer effective enough for solving complex and challenging transportation management problems. Knowledge from different research areas is needed for developing these systems. Very often complex transportation systems require integration of different methods from different branches of science. Our Collision Avoidance System consisting of a Arduino Uno, Esp8266, Ultrasonic sensors, warning LEDs when implemented has proven to be more effective than just a normal traffic mirror setup.

## 6.REFERENCE

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