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Autonomous Tracking System for Vehicles

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Abstract: ***The increasing number of road accidents caused by driver negligence, drowsiness, alcohol consumption, and improper seatbelt usage has become a major safety concern. This paper presents an Autonomous Tracking System for Vehicles designed to enhance driver safety by continuously monitoring the driver's physical condition and enforcing safety measures. The proposed system integrates a drowsiness detection module based on eye blink and eye movement monitoring, an alcohol detection sensor, and a seatbelt detection mechanism using a Hall Effect sensor. If drowsiness or alcohol consumption is detected, the system triggers an audible alarm to alert the driver. Additionally, the vehicle ignition system is disabled unless the seatbelt is properly worn. By combining real-time monitoring, alert mechanisms, and preventive control, the system aims to significantly reduce accident risks and improve road safety. The proposed solution is cost-effective, reliable, and suitable for real-time vehicle safety applications.***

Keywords: Driver Safety, Drowsiness Detection, Alcohol Sensor, Seatbelt Detection, Autonomous Vehicle Monitoring

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I. INTRODUCTION

Road accidents are one of the leading causes of fatalities worldwide, with driver negligence being a primary factor. Common causes include drowsy driving, alcohol consumption, and failure to wear seatbelts. Traditional safety systems rely heavily on the driver's responsibility and awareness, which often leads to delayed or ineffective responses.

Recent advancements in embedded systems and sensor technology have enabled the development of intelligent vehicle safety systems. By continuously monitoring the driver's physical and behavioral conditions, these systems can detect unsafe situations and take appropriate actions in real time. This paper proposes an autonomous tracking and monitoring system that integrates multiple safety features to ensure safer driving conditions.

II.PROBLEM STATEMENT

Despite strict traffic regulations, road accidents continue to occur due to the following reasons:

- Driving under the influence of alcohol.
- Drowsiness and fatigue during long drives.
- Negligence in wearing seatbelts.
- Lack of real-time monitoring and enforcement of safety measures.

Existing systems either provide partial solutions or rely on manual intervention. Hence, there is a need for an integrated, autonomous system that can monitor, detect, and respond to unsafe driving conditions automatically.

III.OBJECTIVE

The main objectives of the proposed system are:

- To design a driver drowsiness detection system using eye blink monitoring.
- To implement an alcohol detection mechanism to prevent drunk driving.
- To ensure mandatory seatbelt usage using a Hall Effect sensor.
- To generate audible alerts in unsafe conditions.
- To disable vehicle ignition when safety conditions are not satisfied.

IV.SYSTEM ARCHITECTURE

The proposed system consists of multiple sensors interfaced with a microcontroller for real-time monitoring and control.

4.1 Block Diagram

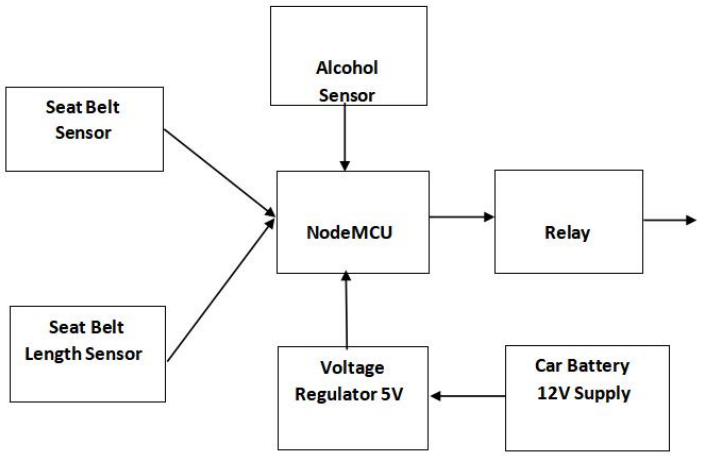

Figure 1: Block Diagram of Autonomous Tracking System for Vehicles

V.METHODOLOGY

Nodemcu is the main controller to make decisions as per we program it seat belt sensor is used to detect whether the belt is weared or not signal send to the nodemcu, if the belt is not weared then car ignition relay will not turn on so the car will not start. Similarly when the belt is weared then only the ignition relay will trigger so the car will start by key. alcohol sensor is use to detect if the driver is drunk, if alcohol detected then car will not start. all these data of date, time and status we can monitor online using cloud server.

5.1 Flowchart

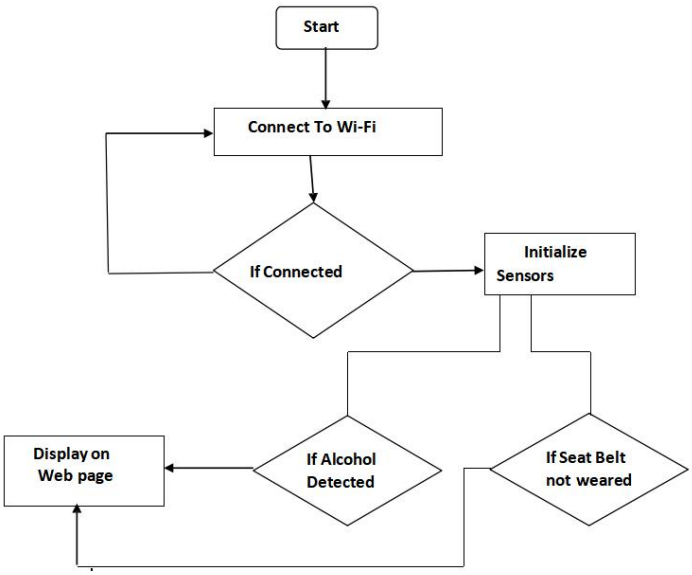

Figure 2: Flowchart of System Operation

VI.RESULT AND DISCUSSION

The prototype system was tested under different conditions such as normal driving, simulated drowsiness, and alcohol detection scenarios. The system successfully detected abnormal eye blink patterns and triggered timely alerts. Alcohol detection prevented vehicle ignition effectively. The seatbelt enforcement mechanism ensured compliance before vehicle startup.

6.1 Hardware Components Table

Table 1: Hardware Components Used

Component	Specification	Quantity
Microcontroller	Arduino / PIC / ESP	1
Eye Blink Sensor / Camera	IR-based	1
Alcohol Sensor	MQ-3	1
Hall Effect Sensor	Seatbelt Detection	1
Buzzer	Audible Alarm	1
Relay Module	Ignition Control	1
Power Supply	12V / 5V Regulated	1

VII.CONCLUSION

This paper presents an autonomous tracking system for vehicles that enhances driver safety through real-time monitoring and preventive control. By integrating drowsiness detection, alcohol sensing, and seatbelt enforcement, the system significantly reduces the risk of accidents caused by driver negligence. The proposed solution is reliable, economical, and suitable for implementation in modern vehicles.

VIII.FUTURE SCOPE

Future enhancements may include GPS-based vehicle tracking, GSM-based emergency alert systems, advanced image processing for improved drowsiness detection, and integration with smart vehicle dashboards.

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