RETROFIT BLACKBOX FOR CARS

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Keywords:

Vehicle Black Box, Driver Behavior Analysis, Accident Data Logging, Predictive Maintenance, Retrofit System, Vehicle Health Monitoring, Event Timeline Analysis

Introduction:

1. Road accidents remain one of the leading causes of fatalities worldwide, with a significant number attributed to unsafe driving behavior and lack of post-incident data analysis. While modern vehicles are equipped with advanced warning systems, such features are limited to high-end models and do not provide detailed historical data for accident investigation.
2. To address this limitation, the proposed project focuses on the design and development of a **retrofit vehicle black box system** capable of monitoring, recording, and analyzing key driving parameters such as speed, acceleration, braking patterns, and impact detection.
3. Unlike conventional warning systems, this system emphasizes **continuous data logging and post-event analysis**, enabling users to understand the sequence of events leading to an accident. Additionally, the system incorporates **driver behavior analysis**, offering insights into risky driving patterns over time.
4. This solution aims to provide an affordable and scalable safety enhancement for existing vehicles, thereby improving road safety and accountability.
5. In addition to safety and accident analysis, the system incorporates **predictive vehicle health monitoring**, where driving patterns and system parameters are analyzed to identify early signs of mechanical issues. This helps in timely maintenance, reducing the chances of unexpected failures and improving overall vehicle reliability.

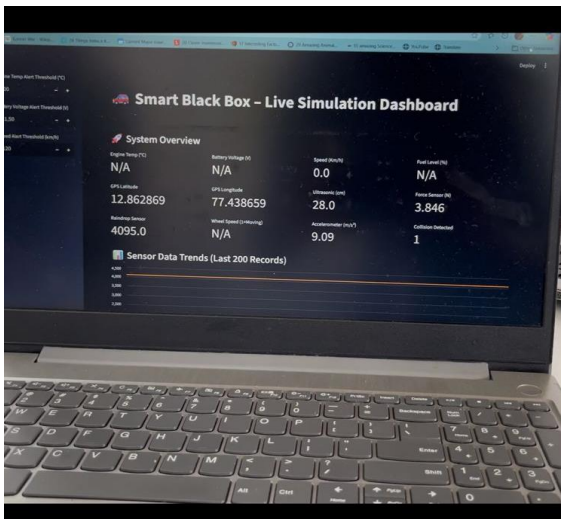

Figure 1: User Interface - Dashboard

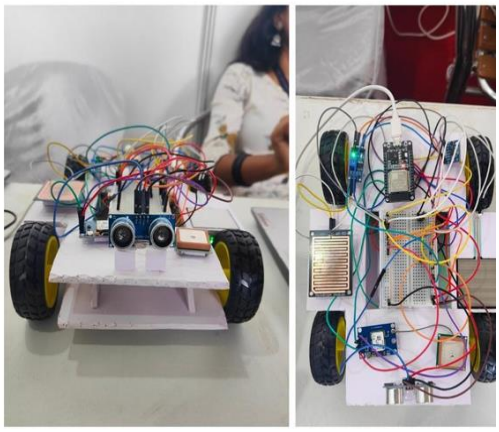

Figure 2 : Prototype

Objectives:

1. To design a compact and cost-effective vehicle black box system for real-time data acquisition
2. To record critical driving parameters such as speed, braking, and acceleration
3. To create a user interface for data visualization and report generation
4. To monitor vehicle health parameters and detect early signs of component wear
5. To implement predictive maintenance alerts based on driving patterns and system behaviour

Methodology:

The proposed system consists of sensors, a microcontroller unit, and a data processing interface.

1. **Data Acquisition:**
   Sensors are used to capture parameters such as speed, acceleration, and braking intensity.
2. **Data Processing:**
   A microcontroller processes incoming signals and identifies significant events such as harsh braking or sudden acceleration.
3. **Data Logging:**
   All parameters are continuously recorded and stored for future analysis.
4. **Event Detection:**
   The system detects abnormal conditions such as collisions or rapid deceleration and marks them as critical events.
5. **Analysis & Visualization:**
   A user interface is developed to display:
   - Driver behavior score
   - Event timeline
   - Accident analysis data

6. **Comparison Study:**
   The system performance is analyzed under different configurations to evaluate reliability and sensitivity.

Result and Conclusion:

1. The developed system successfully records and analyzes key vehicle parameters, providing a detailed timeline of events leading up to critical incidents. The driver behavior analysis feature enables identification of unsafe driving patterns, which can help in reducing accident risks.
2. The system demonstrates that a **low - cost retrofit solution** can effectively provide functionalities similar to advanced vehicle monitoring systems.
3. In conclusion, the project offers a practical and scalable approach to enhancing vehicle safety through **data - driven insights and accident analysis**, making it suitable for widespread adoption in existing vehicles.

References:

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Future Scope:

The future scope of this project includes:

1. Integration with cloud storage for remote data access
2. GPS-based tracking and location mapping
3. AI-based prediction of accident risks
4. Mobile application for real-time monitoring
5. Integration with insurance and fleet management systems