**AI-Powered Overtake Assistance: Real-Time Vehicle Speed Detection and Safe Maneuver Guidance.**

**Abstract**

Overtaking on roads, especially highways, is a critical maneuver that requires precise decision-making to ensure safety. Misjudging the speed of the vehicle ahead or overtaking in unsuitable conditions can lead to accidents. This project proposes an **AI-powered Overtake Assistance System** that provides real-time guidance to drivers on whether it is safe to overtake, considering the speed of the vehicle ahead and road conditions.

The system leverages **computer vision, LiDAR, and IoT sensors** to detect the speed and distance of the vehicle ahead. It utilizes **machine learning models trained on real-world driving data** to predict safe overtaking opportunities. **Edge AI processing** ensures quick decision-making, reducing latency for real-time responsiveness. The system integrates with **GPS and HD mapping technologies** to assess road conditions, such as curves, intersections, and lane availability, ensuring the overtaking maneuver is executed in a legally permissible and safe environment.

Additionally, **sensor fusion technology** combines data from **cameras, radar, and ultrasonic sensors** to detect blind spots and oncoming vehicles from the opposite lane. The AI model evaluates parameters such as **vehicle speed, distance, acceleration rates, and road gradient** before making a recommendation. The driver receives alerts via an **intuitive dashboard interface, heads-up display (HUD), or voice assistance**, ensuring minimal distraction while driving.

**Key Highlights:**

* **AI-Powered Decision Making:** Uses machine learning to analyze road conditions and vehicle speeds for overtaking decisions.
* **Sensor Fusion Technology:** Integrates LiDAR, radar, and cameras to detect vehicles and obstacles in real time.
* **Real-Time Speed Estimation:** Computes the speed of the overtaken vehicle to ensure safe maneuverability.
* **Edge AI Processing:** Low-latency decision-making for quick responses.
* **Road Condition Analysis:** Uses GPS and HD maps to check road suitability for overtaking.
* **Driver Assistance Interface:** Provides alerts via a dashboard, HUD, or voice guidance for seamless user experience.
* **Advanced Safety Measures:** Detects blind spots and oncoming traffic to prevent hazardous overtakes.

By integrating AI, IoT, and advanced sensing technologies, this system enhances driver confidence and significantly reduces the risk of accidents during overtaking maneuvers. The proposed solution can be integrated into modern vehicles, contributing to the evolution of **autonomous driving and smart transportation systems**.