**Abstract for ABBS (Automotive Black Box System)**

Road safety in India faces persistent challenges due to high accident rates, delayed emergency response, and limited availability of reliable post-crash data. This project proposes the development of an Automotive Black Box System **(ABBS)**, an advanced event data recorder designed for both passenger and commercial vehicles. Unlike conventional dashcams or telematics devices, the ABBS combines

1. Multi-sensor crash data acquisition
2. Synchronized video recording
3. Secure storage
4. Automated emergency communication

into a single retrofit-friendly module.

The system continuously records vehicle telemetry (speed, braking, throttle, steering angle, yaw, IMU-based acceleration), GPS location, and dash-cam footage within a ring-buffer memory. In the event of a crash, the device preserves the last 30–60 seconds of pre-crash and post-crash data, while simultaneously transmitting an **automated emergency signal** to nearby services or central emergency networks. The data is securely encrypted, digitally signed, and stored locally while being uploaded to the cloud for **forensic analysis, insurance claims, and academic/industrial R&D use**.

Key differentiating features include:

1. **Multi-sensor fusion crash detection** (IMU, GPS, CAN/OBD-II, audio) for high-accuracy classification.
2. **Automated e-Call functionality** with enriched crash packets (location, severity score, airbag deployment, occupant presence where possible).
3. **Fleet integration** for commercial vehicles: route history, driver behaviour monitoring, predictive maintenance alerts, and liability management.
4. **Secure tamper-proof design** with chain-of-custody data export for legal and insurance purposes.
5. **Edge AI algorithms** to filter false alarms, detect driver distraction, and assess crash severity.
6. **Scalable communication** via LTE/5G with fallback to SMS or satellite in low-connectivity regions.
7. **Forensic and R&D database contribution** aggregated anonymized crash data can significantly aid Indian automotive manufacturers in designing safer vehicles, improving crash models, and refining road safety policies.

The system is designed with **retrofitting feasibility** in mind, particularly for **commercial fleets in India**, where the majority of vehicles lack built-in event recorders. Retrofitting involves a plug-and-play **OBD-II/CAN** interface, external power integration, and modular mounting of cameras and sensors, enabling quick deployment at scale. For fleet operators, the **ABBS** not only improves safety and reduces liability but also enables insurance discounts, optimized driver training, and faster settlement of accident-related disputes.

In the Indian context, where road accident fatalities remain among the highest globally, this solution has strong societal and commercial relevance. It can serve as a bridge technology until fully integrated Event Data Recorders (EDRs) and e-Call systems become standard in all new vehicles. The anonymized crash data collected across thousands of vehicles will also provide a **valuable dataset for motor companies and researchers**, improving vehicle crashworthiness, enhancing ADAS (Advanced Driver Assistance Systems), and supporting future autonomous vehicle development tailored to Indian road conditions.

Comparison with Current Technologies

**Currently available solutions**

1. **Event Data Recorders (EDRs):** Found in many modern cars, they capture pre- and post-crash telemetry but lack video integration and are not easily retrofit.
2. **E-Call systems (mandatory in EU):** Automatically notify emergency services after severe crashes, but are not yet mandated or widely available in India.
3. **Dashcams with G-sensors:** Record video and lock footage on collision, but do not capture comprehensive telemetry or transmit emergency signals.
4. **Fleet telematics devices:** Offer GPS tracking and driver behavior logging, but rarely provide tamper-proof forensic data or direct emergency connectivity.

**Our Advantages**

1. **Comprehensive integration** — merges EDR data, dashcam video, and telematics into one unit.
2. **Retrofit-ready** — designed for quick installation in **existing commercial fleets** and private vehicles in India.
3. **Enriched emergency response** — goes beyond e-Call by sending severity score, sensor data, and live video/audio options for better triage.
4. **Secure & tamper-proof** — digitally signed storage ensuring admissibility in legal and insurance cases.
5. **Edge AI intelligence** — real-time crash validation, distracted driving alerts, and injury-likelihood estimation.
6. **Connectivity resilience** — supports multi-channel communication (LTE/5G + SMS/satellite fallback).
7. **R&D and policy value** — creates a structured crash data repository to support Indian motor companies in designing safer vehicles, and helps policymakers build data-driven road safety regulations.
8. **Fleet ROI** — reduces liability, enables insurance discounts, and improves operational efficiency through predictive maintenance and driver analytics.