# ENDURIDE
# The Low-Cost Telematics Dongle

## *Introduction*

This document provides an overview of the architecture for a low-cost telematics dongle designed to collect real-time vehicle data and display it on both a mobile app and an LCD touchscreen display. The system utilizes ESP32, MPU6050, and an LCD touchscreen to provide insights on speed, fuel amount, mileage, safety score, and vehicle health. Additionally, it incorporates multiple AI-based insights and securely stores data over the cloud, with blockchain implementation for security and encryption. We are also providing an Android app **ENDURIDE**, which is responsible for all the data processing, ensuring seamless analysis , visualization of real-time vehicle data and storing meaningful insights over the cloud based database .

## *System Components*

### Hardware Components

- **ESP32 Microcontroller**: Handles data processing and wireless communication.
- **MPU6050 Sensor**: Captures acceleration and gyroscope data.
- **LCD Touchscreen Display**: Provides a real-time graphical interface for vehicle data.
- **AC-2-DC converter**: Power source.

### *Software Components*

- **Embedded Firmware**: Custom firmware on ESP32 for sensor data collection, processing, and secure communication.
- **Mobile Application**: Connects via Bluetooth/Wi-Fi to display real-time vehicle data and analytics.
- **Cloud Database**: Enables secure cloud integration for real-time and historical data storage, as well as AI-driven analysis.
- **Blockchain Security**: Implements encryption and tamper-proof storage for critical vehicle and safety data, ensuring data integrity and privacy.

## *Data Flow*

**Data Acquisition**: The MPU6050 sensor collects acceleration and gyroscope data, while ESP32 transmits this data to a connected device (i.e., smartphone).

**Data Processing & Analysis**:

- The Android application acquires time-stamped data through ESP32, such as acceleration, gyroscope, and temperature.
- The application processes this data and displays speed, fuel, mileage, safety score, and vehicle health.

- It also stores meaningful insights such as trip history and similar analytics.
- The app detects accidents, makes an emergency call to a designated contact in such situations, and starts capturing camera, audio, and location information to store in the cloud database for further analysis.
- The app leverage blockchain technology to encrypt the data for increasing privacy

**Data Transmission**:

- Processed data is sent to the LCD display for in-vehicle visualization.
- The mobile app receives real-time data over Bluetooth or Wi-Fi.

**User Interface & Display**:

- The LCD touchscreen provides an interactive in-vehicle display.
- The mobile app presents graphical insights and notifications.

## *Communication Architecture*

- **Sensor-to-ESP32 Communication**: Uses I2C protocol for MPU6050 data transfer.
- **ESP32-to-Mobile App Communication**: Supports Bluetooth/Wi-Fi for real-time updates.
- **ESP32-to-LCD Communication**: Uses SPI/I2C for seamless data display.

## *Future Enhancements*

- Cloud-based analytics for fleet monitoring.
- AI-driven insights for predictive maintenance.
- AI-based vehicle theft detection.

## *Conclusion*

The total cost of making this prototype is **₹1139**, with an additional charge of **₹4.5 per vCPU hour** for AWS EC2. It offers a wide range of functionalities, including **vehicle health monitoring, speed tracking, mileage calculation, fuel consumption analysis, safety scoring, real-time accident detection, and call aborting**. This dongle is integrated with the **EnduRide app**, which performs advanced analyses and provides real-time insights. Additionally, the app offers **meaningful visualizations**, enabling users to make informed decisions about their driving behavior and vehicle performance.