Smart IoT-Based Highway Accident Detection & Alert System Using ESP32

Theme: Road Safety

PRAKRAM-2541

IDE BOOTCAMP EDITION 2- PHASE II

Ministry of Education
Government of India
सत्यमेव जयते

AICTE
All India Council for Technical Education
योगः कर्मसु कौशलम्

MoE's INNOVATION CELL
(GOVERNMENT OF INDIA)

WADHWANI FOUNDATION

THE OVERVIEW

This project aims to create an IoT-based accident detection system for highways using ESP32, a vibration sensor(SW420), and an accelerometer & gyroscope(MPU6050). The system can detect sudden impacts, rollovers, or high-speed collisions and instantly send alerts to emergency responders and nearby vehicles. The system ensures a faster response time in accident scenarios, potentially saving lives.

2. The Problem

🚨 **Problem**

- Delayed emergency response after accidents.
- No real-time accident detection & alerts.
- Increased fatalities due to late medical help.

👥 **Customer Pain Points**

- Victims don’t get immediate assistance.
- Emergency services lack real-time accident data.
- No automated system for remote highways.

🎯 **Target Customers**

- Government (Smart Cities & Highway Management).
- Vehicle manufacturers & fleet operators.
- Insurance & emergency response services.

The Solution

A low-cost, real-time accident detection system using ESP32, vibration sensors, and IMU (accelerometer & gyroscope).

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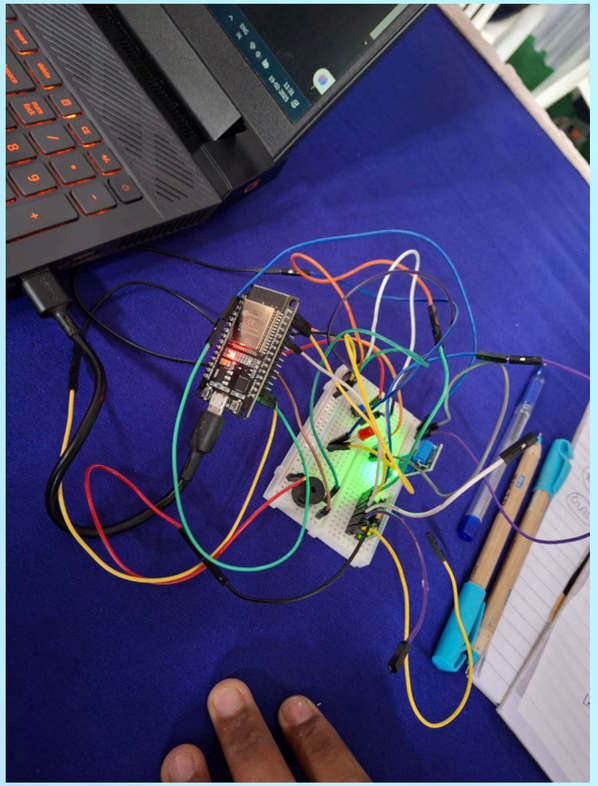
The system detects sudden jerks, flips, or collisions based on threshold values and sends an instant alert.

A buzzer system alerts nearby vehicles to prevent further accidents.

4. The innovation

🎯 **Value Proposition**
✅ **Affordable & scalable – Deployable for all vehicles.**
✅ **Instant emergency alerts – Saves lives with faster medical response.**
✅ **AI-powered accuracy – Reduces false alarms for precise detection.**

🌍 **Impact & Benefits**
🚑 **Faster emergency response, reducing fatalities.**
📶 **Connectivity in remote highways, ensuring real-time alerts.**
⚡ **Improves road safety, supporting smart city infrastructure.**
💰 **Reduces insurance fraud, providing real-time accident logs.**



5. Market & Opportunity

Total Addressable Market (TAM): 🌍
Approximately 1.4 million fatalities and 50 million injuries occur annually due to road accidents worldwide.

Serviceable Addressable Market (SAM): 🛣️
Focus on high-risk regions with elevated accident rates, such as national highways and urban centers.
Targeting commercial fleets, public transportation, and private vehicles in these areas.

Target Market: 🎯
Initial focus on commercial fleet operators and public transportation agencies in India's top 10 accident-prone states.
Gradual expansion to private vehicle owners and rural areas.

Research Insights: 📊
The Indian government aims to reduce road traffic deaths and injuries by 50% by 2030, highlighting the need for effective accident detection and response systems.

6. The Technology/Innovation

- **ESP32 for communication and processing.**
- **MPU6050 (Accelerometer & Gyroscope) + Vibration Sensor for accident detection.**
- **GSM, LoRa, or Wi-Fi for sending alerts.**
- **Google Cloud / Firebase for real-time data storage.**
- **GPS Module for location tracking.**
- **AI-based anomaly detection to minimize false alerts.**

7. Competitive Landscape

✅ **Solution**

- **IoT-based accident detection using ESP32, accelerometer, gyroscope & vibration sensor.**
- **Instant alerts with GPS location via Wi-Fi, GSM, or LoRa.**
- **Cloud-based monitoring with AI-powered anomaly detection to reduce false alerts.**

🏆 **Competitive Landscape**

🔹 **Alternatives: Manual reporting, CCTV-based monitoring, vehicle airbags with emergency alerts.**

🔹 **Competitors: Smart helmets, in-car accident alert systems (e.g., OnStar, Tesla Emergency).**

🚀 **Competitive Advantage**

- **Real-time detection & automatic alerts for all vehicles (not just premium cars).**
- **Low-cost, scalable, and deployable in highways & remote areas.**
- **Multi-communication options (GSM, LoRa, Wi-Fi) for uninterrupted alerts.**

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01 Problem

Delay in accident response, lack of real-time detection

02 Customer Segments

Government, smart cities, vehicle manufacturers, fleet operators

03 Unique Value Proposition

Instant accident detection & alert system with cloud monitoring

04 Solution

IoT-based system with ESP32, sensors, and AI algorithms

05 Cost Structure

Sensor hardware, cloud hosting, R&D

06 Revenue Streams

Subscription model for cloud services, device sales, partnerships

Business Model

01
Hardware sales

(IoT kits for highways, vehicles, and fleet operators).

02

Cloud-based SaaS model for real-time monitoring.

03

Integration with existing traffic management systems for government projects

04

Insurance companies can use the system for automated claim processing.

05

Calibration with Motors company

The Team

Tushar Chand Gupta

Expert in IoT, PCB design, and hardware development. Leads prototyping & system integration.

Vishal Gauatm

Develops cloud integration, API connectivity & data processing.

Ashutosh Saini

AI & Sensor Expert

Mayank Sahu

Ui Design and SMS Integration

Thankyou