Toll Sentinal Ai:AI-Based Vehicle Identification & Verification System at Toll Plazas

Members

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Abstract

ProblemStatement:

Existing toll plaza monitoring systems rely on manual inspection and post-event CCTV analysis, which are inefficient and prone to errors. These methods fail to detect fake number plates, stolen vehicles, and unauthorized vehicle movement in real time. There is a need for an intelligent, automated system that can accurately detect vehicles, identify vehicle types and number plates, verify details using a database, and generate real-time alerts to improve toll plaza security and monitoring efficiency

Proposed Solution:

To overcome these limitations, this project proposes TollSentinelAI, an intelligent AI-based vehicle detection and verification system designed specifically for toll plaza environments. The system aims to automate vehicle monitoring and verification by analyzing video inputs and validating extracted vehicle details against existing records, enabling timely identification of suspicious or unauthorized vehicles.

Technical Methodology:

The system supports both user-uploaded recorded videos and live CCTV feeds through a web-based frontend dashboard. Video inputs are processed by a Python-based Django backend, where OpenCV is used to extract frames for analysis. YOLOv8 deep learning models are employed for real-time vehicle detection, vehicle type identification, and number plate detection. Optical Character Recognition (OCR) techniques are applied to extract vehicle registration numbers from the detected number plates. The extracted vehicle information is verified against a MySQL database containing registered and flagged vehicle records.

Key Features:

- Multi-Source Video Processing: Supports both live CCTV feeds and uploaded recorded videos for flexible analysis.

- Automated Vehicle Detection: Identifies vehicles, vehicle types, and number plates using deep learning models.

- Database Verification: Cross-checks extracted vehicle details with stored records to determine authenticity.

- Decision-Making Module: Evaluates verification results to classify vehicles as genuine or suspicious.

- Real-Time Alert System: Generates instant alerts for detected anomalies and notifies the control room via email, SMS, and WhatsApp, while simultaneously displaying results on the frontend dashboard.

Conclusion:

The proposed system enhances toll plaza security by reducing human intervention, improving detection accuracy, and enabling real-time vehicle verification. By integrating artificial intelligence with toll plaza infrastructure, the system offers a scalable and efficient solution for intelligent traffic monitoring and smart transportation systems.