

Architecture Level Document

VEHICLE NUMBER PLATE DETECTION

TRAFFIC SURVEILLANCE

Abstract:

The escalation of vehicles on roads has exacerbated issues such as traffic congestion and accidents. To address these challenges, a meticulous examination of factors like adherence to traffic regulations is imperative. Thus, continuous surveillance of traffic on highways and major thoroughfares is essential. An Automatic License Plate Detection System emerges as a viable solution to these issues. This system facilitates real-time monitoring and analysis of vehicle movement, enabling insights to be drawn from the collected data for enhanced traffic management and safety measures.

1. Introduction:

Why this Architecture Level Document?

This document aims to provide a comprehensive overview of the License Plate Detection System. It will elucidate the system's purpose, features, interfaces, functionalities, operational constraints, and responses to external stimuli. Intended for

stakeholders and developers, it will be proposed for approval by higher management.

Objective:

The primary objective of the project is to develop a License Plate Detection System capable of accurately identifying and localizing license plates from images. Leveraging Electronic Health Record (EHR) data, the system aims to streamline traffic monitoring and management processes, ultimately enhancing safety and security on roads.

Features:

The License Plate Detection System will:

- Accurately detect and localize license plates within images.
- Provide real-time monitoring and analysis of vehicle movement.
- Generate insights from collected data to improve traffic management.
- Enhance safety measures through proactive identification of vehicle-related issues.

Operational Constraints:

The system must operate under various environmental conditions, including different lighting and weather conditions. It should also handle diverse vehicle orientations and backgrounds effectively.

Response to External Stimuli:

The system will adapt to changes in input data, such as variations in image quality or lighting conditions, to maintain accurate license plate detection. It will also incorporate error-handling mechanisms to ensure robust performance in real-world scenarios.

This document serves as a foundation for the development and implementation of the License Plate Detection System, guiding stakeholders and developers towards achieving the project's objectives effectively.

The License Plate Detection Application aims to accurately detect and recognize license plates from images, facilitating various applications in law enforcement, security, and traffic management.

2. Components:

Data Acquisition: Images containing vehicles are captured from cameras or uploaded by users.

Preprocessing: Images undergo resizing, normalization, and noise reduction to prepare them for detection.

License Plate Detection Model: Utilizes deep learning models like InceptionResNetV2 for accurate detection and localization.

Character Recognition: Optical character recognition (OCR) algorithms extract alphanumeric characters from detected plates.

Data Storage: Stores extracted plate numbers and associated images in a database for further analysis.

User Interface: Provides a user-friendly interface for image upload and result display.

Integration: Can be integrated with other systems like law enforcement databases for seamless data sharing.

Scalability and Performance: Designed to handle large volumes of data and real-time processing efficiently.

3. Workflow:

- User uploads image via the interface.
- Preprocessing techniques applied to enhance image quality.
- License plate detection model locates plates within images.
- OCR algorithms extract plate numbers.
- Result displayed to the user, including image with highlighted plate and extracted number.
- Data stored in the database for future reference.

4. Technology Stack:

Programming Languages: Python

Libraries/Frameworks: TensorFlow, OpenCV, Streamlit, EasyOCR

Database: CSV database for storing data

5. Deployment:

Cloud Deployment: Can be deployed on cloud platforms like AWS, Azure, or GCP for scalability and accessibility.

On-premises Deployment: Deployed on local servers for specific security or compliance requirements.

6. Security Considerations:

Encryption: Secure transmission of data between client and server.

Access Control: Restrict access to sensitive data and system resources.

Data Privacy: Compliance with data protection regulations to safeguard user privacy.

7. Performance Metrics:

Detection Accuracy: Measure of the system's ability to correctly identify license plates.

Processing Speed: Time taken to process each image and extract plate numbers.

Scalability: System's ability to handle increasing workload and data volume.

8. Future Enhancements:

Real-time Detection: Implement real-time processing for live video feeds.

Vehicle Type Recognition: Extend system to recognize vehicle types and models.

Integration with External Systems: Integrate with traffic management systems or toll booths for automated processing.

This Architecture Level Document provides a comprehensive overview of the License Plate Detection Application, detailing its components, workflow, technology stack,

deployment options, security considerations, performance metrics, and future enhancements.