**License Plate & Face Recognition for Driver Identification**

**1. Introduction**

As urban areas become more densely populated, the demand for intelligent surveillance and traffic enforcement systems has grown substantially. A critical component of these systems is the ability to monitor and identify vehicles and their drivers. The project titled \*License Plate & Face Recognition for Driver ID\* addresses this need by developing a prototype that accurately detects vehicle license plates and sets the foundation for integrating driver face recognition.

**2. Problem Statement**

Traditional vehicle monitoring systems often rely on Optical Character Recognition (OCR) or basic visual data, which can fail in cases of poor lighting, occlusions, or low-resolution inputs. There is a pressing need for a robust system capable of functioning effectively in diverse real-world conditions. The goal is to enhance vehicle identification accuracy by implementing reliable detection methods for license plates and eventually, facial recognition for driver verification.

**3. Proposed Solution**

The proposed solution utilizes a combination of computer vision techniques and a user-friendly interface to detect and highlight license plates in static vehicle images. The solution involves preprocessing images to enhance quality, applying a detection pipeline that uses sliding windows and template matching, and refining the outputs with Non-Maximum Suppression (NMS). This method allows for accurate localization of license plates under various lighting and environmental conditions.

**4. Methodology**

The methodology consists of several key phases:

Data Collection: Images of vehicles were collected under varied lighting and occlusion scenarios to ensure robustness and generalizability.

Preprocessing: Images were resized and underwent contrast enhancement to prepare them for effective detection.

Detection Pipeline: A classic computer vision approach was used:

1. Sliding Window & Template Matching: To search for potential license plate regions.

2. Non-Maximum Suppression (NMS): To eliminate overlapping boxes and retain the best candidates.

Output Display: The system displays the detected license plate region over the original image.

**5. Technology Stack**

The system is built using Python and Streamlit, enabling rapid development of an intuitive web interface. Streamlit allows users to upload vehicle images and view detection results directly within the browser, making the system easy to test and demonstrate.

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**6. User Interface**

A key feature of the project is the interactive interface built using Streamlit. It allows users to:

\* Upload vehicle images.

\* View output images with license plates detected and highlighted.

\* Experience a simple, responsive platform suitable for testing and showcasing the prototype.

**7. Results and Impact**

The detection system demonstrated strong performance even under challenging conditions like poor lighting and partial occlusion. It significantly outperforms basic OCR-based systems when it comes to robustness and practical utility. Applications of the system include:

* Accident Forensics: Helping authorities identify involved vehicles.
* Traffic Rule Enforcement: Automating identification of violators.
* Smart City Surveillance: Enhancing urban monitoring systems.

**8. Future Work**

While the current prototype focuses on license plate detection in static images, several extensions are planned:

* Driver Face Detection and Recognition: To enhance identification accuracy and enable driver-specific records.
* Real-Time Video Analysis: Incorporating CCTV footage for live monitoring.
* Deep Learning Models: Integrating YOLO or similar CNN-based models to improve detection speed and accuracy.
* Edge Deployment: Running the system on edge devices for real-time roadside operation.
* Multilingual Plate Support and Alerts: Expanding to global contexts and automating alert systems.

**9. Conclusion**

This project lays the groundwork for a comprehensive vehicle monitoring system. By combining classical vision techniques with a modern UI, it offers a reliable, scalable, and practical solution for urban surveillance and traffic enforcement. With future enhancements, it has the potential to become a core component of intelligent transportation system.

youtube link: <https://youtu.be/k1KDlXE6_1s>

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