

# **INTRODUCTION**

Car number plate detection is a crucial application in the field of image processing, with widespread use in traffic management, law enforcement, and automated parking systems. This project aims to develop an efficient system for automatically detecting and recognizing vehicle number plates using MATLAB.

Traditional methods for number plate detection are often manual, time-consuming, and prone to errors. These challenges necessitate an automated solution that can handle high volumes of data with speed and accuracy. By leveraging MATLAB's powerful image processing toolbox, this project seeks to address these challenges through robust algorithms capable of detecting number plates in varying conditions.

## **SCOPE**

The project facilitates group creation, project abstract submission, and management for educational institutions, enhancing collaboration and efficiency.

Digitizing group management reduces paper usage, promoting sustainability, while fostering teamwork and communication skills among students, preparing them for professional environments.

## **PROBLEM STATEMENT**

Developing an Efficient and accurate identification of vehicle number plates is a critical requirement in modern transportation and security systems. However, manual methods of identifying and recording vehicle details are time-consuming, error-prone, and inefficient, especially when dealing with large volumes of vehicles in real-time applications such as traffic monitoring, toll collection, parking systems, and law enforcement.

# SYNOPSIS

This project involves detecting and extracting a car's number plate from an image using image processing techniques in MATLAB. The process includes steps like image preprocessing, edge detection, and filtering to isolate potential regions of interest (ROI) corresponding to the number plate.

## Steps Involved:

### 1. Image Acquisition:

- The input image, which contains a car with a visible number plate, is loaded using the `imread` function.
- The image is displayed using `imshow` for visualization.

### 2. Gray Conversion:

- The color image is converted to grayscale using `rgb2gray`, simplifying the image data for further processing.

### 3. Noise Removal (Morphological Operations):

- A dilation operation is performed to enhance important features and reduce noise in the image. This is done by iterating over each pixel and comparing its neighbors.

### 4. Edge Detection:

- Horizontal and vertical edge detection is applied to identify potential edges in the image, which are key for locating the number plate.
- The edge differences are calculated and plotted in histograms for both horizontal and vertical directions.

#### **5. Histogram Smoothing:**

- A low-pass filter is applied to the horizontal and vertical histograms to smoothen the edge information and reduce noise.

#### **6. Thresholding:**

- Dynamic thresholding is applied to filter out less significant edge information, leaving only the most relevant features, especially those that correspond to the number plate.

#### **7. Region of Interest (ROI) Detection:**

- Based on the smoothed and thresholded edge histograms, probable regions corresponding to the number plate are identified.
- The image is divided into columns and rows, and the regions where the edges of the number plate are most prominent are selected.
- A bounding box is created around the most probable number plate location.

#### **8. Region Filtering:**

- The probable number plate regions are analyzed further, and irrelevant regions are removed by zeroing out the pixels that do not match the detected edges.

#### **9. Result Visualization:**

- The final result, showing the detected number plate region, is displayed using imshow.

### **Tools & Techniques Used:**

- **Image Preprocessing:** Grayscale conversion, dilation, and erosion to remove noise.
- **Edge Detection:** Horizontal and vertical edge detection to highlight key features of the image.
- **Histogram Processing:** To identify significant changes in edge patterns.
- **Thresholding:** To eliminate irrelevant information and enhance number plate features.
- **Region of Interest Extraction:** Identification and isolation of the number plate based on the detected edges.

This method can be applied to various images of cars to automatically detect the number plate region, useful for applications such as Automatic Number Plate Recognition (ANPR) systems.