

Automated Vehicle License Plate Detection System Using MATLAB

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Abstract - With rising industrialization, the demand for vehicles has risen proportionally, which has introduced various challenges in vehicle management and traffic control. An efficient system for vehicle monitoring and safety has become essential to resolve these issues. Hence, an automated license plate detection system using OCR plays a vital role in improving security and accurate vehicle identification. The proposed system utilizes advanced image processing techniques to detect vehicle license plates and extract plate information efficiently. This system ensures fast and accurate identification, capturing vehicle details as they enter a monitored area. With the growing demand for smart and automated solutions, the implementation of such technology can significantly enhance traffic management, security enforcement, and transportation efficiency. In this paper, we focus on various aspects of image processing implemented in our system to simplify processing. This system efficiently detects vehicle license plates and extracts the plate information. The system is based on MATLAB software to improve detection accuracy. Our proposed system covers applications related to security and law enforcement. It is particularly useful at places where vehicle monitoring is essential. By using cameras and software, the system ensures accurate vehicle detection and enhances security.

Key words- Industrialization, Image Processing, OCR, MATLAB, Law Enforcement.

1. INTRODUCTION:

It is widely acknowledged that due to rapid industrialization the number of vehicles are rising, leading to various challenges in traffic management and security. This increase in vehicles has introduced several issues, including traffic congestion and security risks, with no guaranteed solutions currently in place.

To resolve these concerns, there is a growing demand for efficient and automated systems in the security sector. Considering these factors, the following study presents a

system designed to perform Automated License Plate Detection System using MATLAB. This system enhances vehicle security by utilizing advanced image processing techniques

Our system effectively detects vehicle license plates under various conditions, including front and rear view of vehicle in different lighting scenarios, day and night time images, also the designed system could be used for regional language license plate by adding respective character templates, our proposed system works for English alphanumeric characters. The system acquires images from camera, processes them using MATLAB and accurately extracts license plate details for future analysis. The proposed system has a wide range of applications, including use at toll gates, parking management systems and restricted areas such as schools and colleges, by incorporating image processing techniques and software(MATLAB), it offers robust and efficient solution for real time vehicle monitoring and security enforcement.

2. LITERATURE SURVEY

We studied various research papers on license plate detection. These studies provided insights into effective methodologies, including image pre-processing, segmentation techniques, and character recognition. We analyzed previous research projects and reverse-engineered existing detection systems to understand their performance.

1. Vivek Singh¹, Yogesh Verma², Tejas Bhavsar³, Sandeep Saini⁴, Garvit Gupta⁵ "Vehicle Number Plate Recognition using MATLAB". International Journal of Electrical, Electronics and Computers Vol-6, Issue-3 | May-Jun, 2021. This paper works on the basis of number plate localisation, that is from a given input image the license plate region is extracted successfully. It is carried out using image processing principles and MATLAB image processing toolbox.
2. Manisha Rathore and Saroj Kumari "TRACKING NUMBER PLATE FROM VEHICLE USING

MATLAB". International Journal in Foundations of Computer Science & Technology (IJFCST), Vol.4, No.3, May 2014. This study has illustrated about obtaining characters from localised license plate, using template matching algorithm used in optical character recognition, It is also performed using MATLAB

3. Ragini Bhat, Bijender Mehendia "RECOGNITION OF VEHICLE NUMBER PLATE USING



MATLAB. INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING Vol. 2, Issue 8, August 2014. This study has a strong foundation on image pre-processing part, It covers mostly all the areas required for successful pre- processing of a image, It is pre-processed using MATLAB's inbuilt functions.

4. Mr. G. T. Sutar 1, Prof. Mr. A.V. Shah 2' "Number Plate Recognition Using an Improved Segmentation". International Journal of Innovative Research in Science, Engineering and Technology Vol. 3, Issue 5, May 2014. This paper is excellent in terms of accuracy as it adds an additional stage of skew detection and correction, which is implemented using RADON transform, Hence the images in skewed angles are successfully detected and further using template matching and OCR the number plate data is extracted. This study had a accuracy of 96%.
5. Faizal Patel, Jaimini Solanki, Vivek Rajguru, Ankit Saxena's "Recognition of Vehicle Number Plate Using Image Processing Technique". Volume 2 Issue 2 | 2018. This study is much similar to earlier studies but it utilizes bounding box method for character segmentation which is an efficient method for successful segmentation of characters.

3. METHODOLOGY

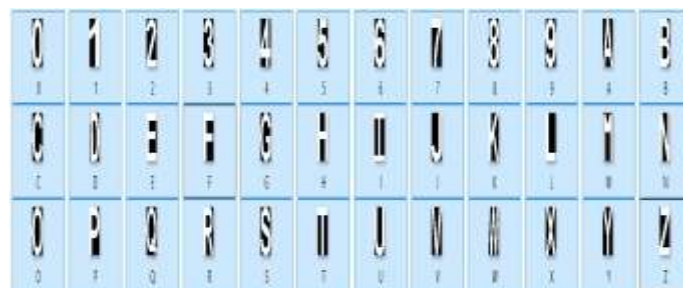
This project aims to automatically detect and read a number plate from a vehicle image (mainly 4-wheeler) using image processing techniques in MATLAB. The input image must be clean and clear for accurate extraction and identification of license plate. The images used in dataset are abiding government rules and regulations for their license plates.

3.1 Character Template Creation

First, we create a template set of all alphabets (A–Z) and numbers (0–9) having extension of .bmp

These templates are images of each character which are resized to a fixed size (24x42).

All these templates are stored in an array for future matching.



3. 2: Image Pre processing

- a) Read the input image of vehicle, the image could be in format of .jpg, .jpeg, .png.

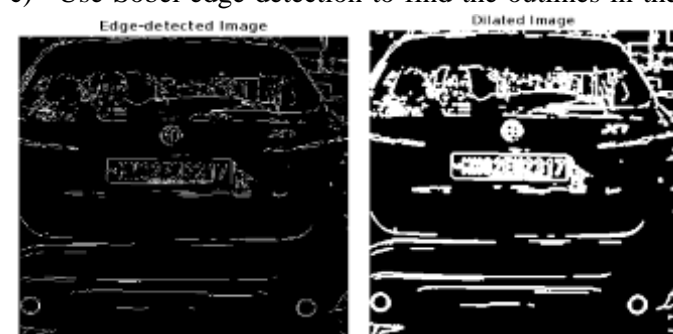


- b) Convert this input image to grayscale and then to



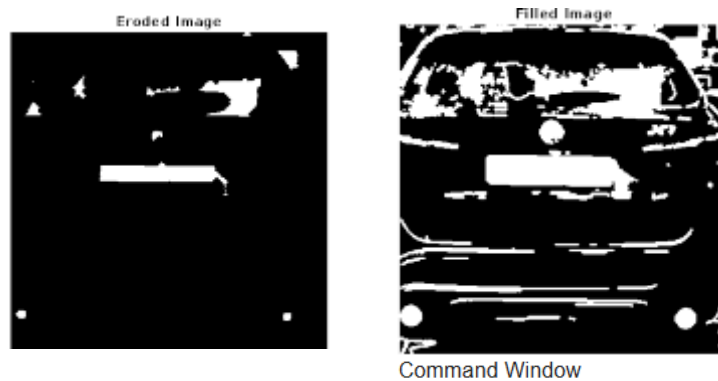
binary (in form of 0's and 1's)

- c) Use Sobel edge detection to find the outlines in the



image

- d) Use dilation to make edges thicker and fill holes to make the number plate part solid.



Command Window

- e) Use Erosion to remove unnecessary areas.

New to MATLAB? See resources for [Getting Started](#).

3.3: Plate Localization

Use region props to find all the connected objects (blobs) in the image.

Measure their area and bounding boxes.

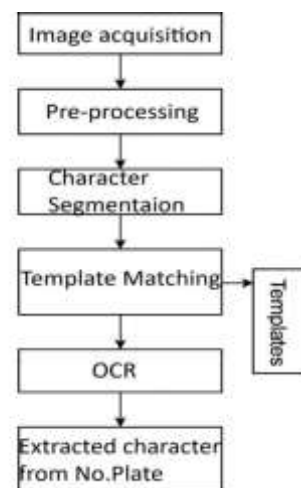
The largest area is assumed to be the number plate.

Now crop the image using bounding box to isolate the number plate region.



```
noPlate =  
'MH02EU2317'
```

3.7: General flow of program:



3.4: Character Segmentation

- 1) Resize the number plate image for better visibility.
- 2) Use morphological operations to remove noise.
- 3) Use region props again to find and isolate each individual character in the number plate.
- 4) A green box is drawn around each character for better visualization.



3.5: Character Recognition

Each segmented character is compared with the standard templates using correlation (corr2).

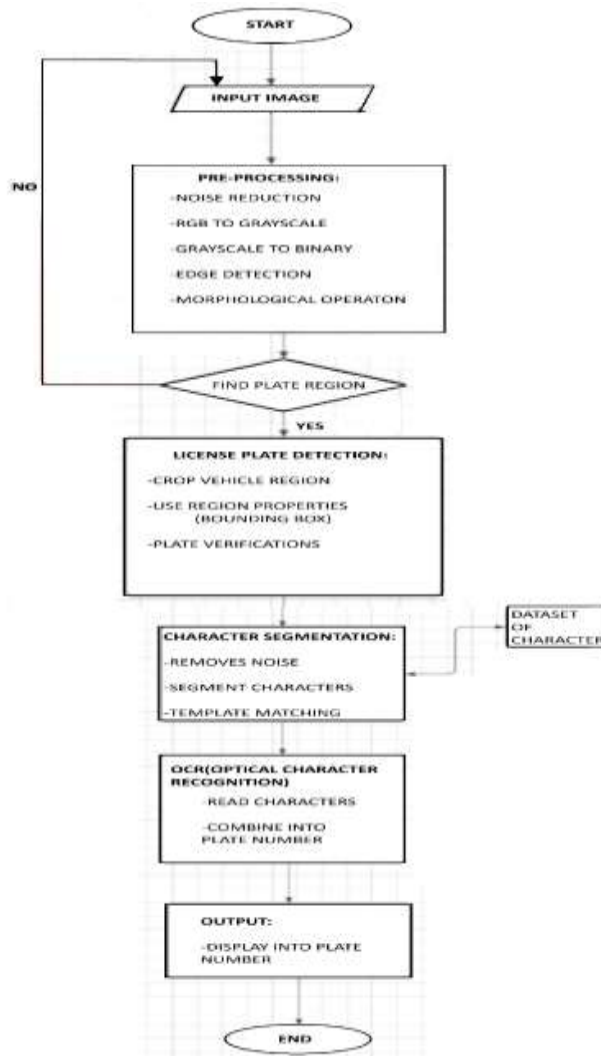
The most similar template is selected.

The matched character is added to a string called noPlate.

3.6: Output

The final number plate (as a string of recognized characters) is displayed or can be used further.

4.FLOWCHART:



This is the indepth flowchart showcasing each stage the input image goes through.

5. Implementation

1. System Development – Integrated multiple image processing techniques for accurate license plate detection.
2. Template Creation: Templates were created in matlab by extension of .mat using mat2cell keyword.
3. Processing Steps – Input image processing, license plate analysis, segmentation, feature extraction, and bounding box selection.
4. System Robustness – Ensures detection under varying conditions and adapts to different datasets.
5. Image Acquisition of LP Image – LP image extracted using camera inputs.

6. Preprocessing: It includes image processing principles like RGB to gray conversion, morphological processing, dilation, erosion, edge detection (sobel algorithm), etc

7. Character Segmentation – License plate region is isolated, segmented, and prepared for OCR.

8. Character Recognition (OCR) – Recognizes individual characters from segmented LP images.

6. DATASET PREPARATION:

We have collected a total of 50 images, some of them were collected online as well as some were captured in real time using cell phone's camera.

1. Objective – Detect and recognize vehicle license plates under various conditions.
2. Image Collection – 50 images captured under different day and night-time conditions.

3. Pre-processing and Labelling – Images converted to grayscale and noise-reduced. Plates were labelled manually or using automated tools.

7.RESULTS AND DISCUSSIONS:

1. Developed a system for accurate license plate detection.
2. System tracks vehicles through image processing and OCR.
3. Achieved an accuracy of 84% on 50 test images (42 successful detections).
4. Demonstrated improved detection efficiency and scalability.
5. Reliable identification under different lighting conditions as well as for images with tilted number plates.
6. Further improvements possible with better preprocessing and OCR enhancement.

8. CONCLUSION:

In this paper we have worked on the development of a high accuracy vehicle license plate detection system, to do so we have created a image processing pipeline, further the system is capable of working under different environmental conditions, lighting conditions. It could be used in enhancing security, monitoring and automation in areas such as toll booths, parking lots, schools, and security zones. The integration of OCR with image processing improves accuracy to a higher extent making detection easier. We have tested the system on 50 images and achieved an accuracy of 84%, showing that the system is effective and reliable for real-time use.

Further, The system is simple to implement, cost-effective, and works well with English alphanumeric plates. In the future, this system can be improved by adding machine learning techniques like CNN(convolutional neural network) by training models, also integration could be possible with IoT and AI.

9. REFERENCES:

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