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PLATE PRECISION:ADVANCING AUTO IDENTIFICATION WITH OCR AND OPENCV

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Abstract
Abstract—Automatic License Plate Recognition (ANPR) is a revolutionary technology that uses Optical Character Recognition(OCR) to automatically identify vehicles. It uses techniques like edge detection, color filtering, and template matching to separate plates in complex scenes. Character segmentation divides individual characters for precise recognition using connected component analysis and morphological operations. ANPR's coreuses feature extraction and pattern recognition algorithms. It uses Canny Edge Detection method to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. The system uses easyocr and opencv as well.EasyOCR may be used with OpenCV, a well- known computer vision library, to detect licence plates. After preprocessing the image with OpenCV's image processing tools, use EasyOCR to extract text from the area of the identified number plate. This combination makes number plate identification precise and efficient. However, ANPR faces challenges from variations in lighting, reflections, and plate formats, necessitating strong algorithms and context-aware adaptation. Researchers are exploring domain specific training sets, adaptive thresholding, and noise reduction filters to address these challenges. The
emergence of intricate and multilingual plate formats demands adaptable and expandable OCR models that can process a wide range of data. ANPR has numerous applications, including automated toll collection, security applications, intelligent traffic management systems, anomaly detection, vehicle tracking, and crime prevention. This abstract provides a comprehensive overview of ANPR, revealing the hidden identities of cars and opening the door to a more intelligent and secure transportation environment.
Keywords: ANPR, OCR, OpenCV, Canny Edge Detection.

I. Introduction

A technique called optical character recognition (OCR) turns handwritten or scanned text images into editable text that can be processed further. It combines the human body's visual and mental faculties to enable machines to identify and comprehend the extracted text. Installed in 1955, the first commercial system was used to enter sales reports intocomputers. Since then, it has proven useful in computerizing paper-based office documents. OCR is useful for a number of tasks, such as recognising number plates, extracting text from scanned documents, and extracting images from natural scenes. OCR software comes in different flavours, including Desktop, Server, and Web versions, and its accuracy ranges from 71 percent to 98 percent. Only a small number,though, are free and open-source. One method of automatic vehicle identification that is vital to upholding traffic laws and law enforcement is number plate recognition. Its three primary components are Optical Character Recognition(OCR), Character Segmentation and Vehicle License plate extraction. After identifying the vehicle number plate, number plate extraction pre-processes it to eliminate noise before sending it to segmentation, which separates the number plate's characters one at a time. After the characters have been segmented, they are normalised and fed into an OCR algorithm, which translates the optical character data into encoded text. A string of characters must be the final product's format. OCR (optical character recognition) is a technology used by Automated Number

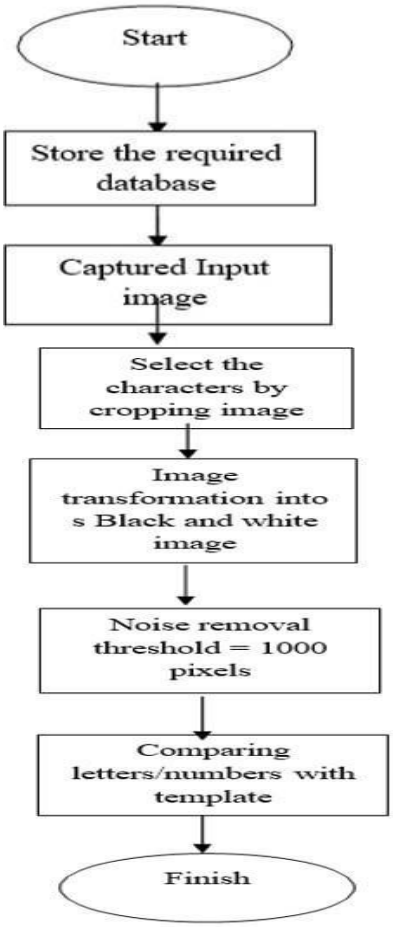
Plate Recognition (ANPR) to extract text from vehicle number plates. For applications like parking management, traffic control, and law enforcement, its significance has grown.Vehicle identification and monitoring have been transformed by ANPR systems, which have increased speed, accuracy, and efficiency. The OCR-based ANPR system consists of several stages, from the acquisition of images to the extraction of text. With the advent of ANPR technology, the identification and monitoring of vehicles has become faster, more accurate, and more efficient. Because they provide a quick and dependable method of obtaining information from licence plates, ANPR systems are essential for today's law enforcement and traffic management organisations.

II. Related work

Optical Character Recognition (OCR) is a commonly used system which interprets and converts images of characters into text that is understood by the machine, eg. ASCII. It can identify characters but the performance depends upon the quality of input given to the system. The OCR is performed offline.

- According to the author [1] Kim et. al. is mainly designed for Korean plates. It was designed to produce average character recognition results and a system implementing for SVMs. It [2][3]. introduced most OCRs in a 2D-plane only have a restriction over the visible angle and distance in which we are supposed to maintain a high success rate.
- According to Pan's paper[4] proposed a dual stage hybrid identification software combining statistics and structure of the model. The similar characters are separated using local structural features and a system architecture is developed. Then there are a few other classifiers inside classifiers that singly identifies each character and then results are concatenated using another method called Bayesian theorem. Next, if the identified characters are in the set of similar variation characters the second stage is utilized for upcoming processes.
- Paper [5] presented the ability to identify the license number in the obtained picture taken from camera. The otsu method binarizes image, the gradient operator is used to locate the likely number plate area, and template matching is used for recognition. The formula used to determine how similar a binary image and prototype are is called the root-mean-squared error, or RMSE.
- According to the author [6] provides a OCR-based artificial neural network algorithm for vehicle backbone chassis number identification. This method ensures relatively elevated value for accurate detection rate along with no wrong detection rate. This author [7] presents automated vehicle number detection software. The OCR methods in this have limitations to misalignment and to different sizes.

2.1 Proposed Work



The procedures we are following in this paper are given above. The first step is to use a camera to take a picture at a distance of about 5 ft from the licence plate. The goal is to obtain a distortion-free, sharp image. The number plate is cropped from the taken picture in the second step. The input for the character recognition is the cropped image. The recognition of characters is the third step. The character is recognised using the OCR technique. The flowchart of the presented work is given.

2.2 Working

A. Image Acquisition

The system is developed to effectively work in all possible dynamic environments and helps the system in license no. recognition. For any ANPR system,camera is the main part, this system is built to gain access to every camera using their IP address. Image capturing can be done using CCTV camera recording of controlling traffic, tracking of stolen cars,etc. The video clips are converted into frame by frame and every frame is processed for the detection of the vehicle.

B. Detection of vehicles

The next step is vehicle detection. The software is trained to detect cars.

C. Dataset Preparation

Excel file of regarding vehicle registration details provided by us.

D. Localization of number plate

This is a method where the license no. from the larger image is extracted. The geographically axes of the license no. is detected and the output is a cropped image containing the vehicle

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license no. . For the purpose of character recognition, every detected registration plate is kept in a different folder.

E. Character Segmentation

The images obtained of the license plate are transformed to gray scale using specific computer operations. After that, a bi-filter is applied on the grayscale photo. Bilateral filter is a filter that smoothes the images, reduces noises , keeps the edges intact. Each pixel is substituted with the intensity values that have a certain weight of the neighborhood pixels. In particular, it will eliminate the noise from the image while maintaining the edges. Canny's edge detection is then used after that. There are five steps in the edge detection process:

- The application of gaussian filter for the removal of noises from the image
- finding the intensity gradients in the picture
- to get rid of false responses from edge detection Non- maximum suppression is applied.
- Potential edges are determined by applying double threshold.
- Use hysteresis for edges .

After the completion of edge detection, tracing of contours begins. The input for the needed detection is given by the extracted characters.

F.Optical Character Recognition(OCR)

OCR is widely used for the transformation of photos of text into a text which is understood by the machine. This system uses EasyOCR and Pytorch. The software is installed in jupyter using Git. The path must be known and edited in your computer system. The input is given to the OCR in the form of characters. The OCR will recognize those characters. The identified data is stored in an excel sheet.

III. Results

- Step 1. UAV captures the number plate of the vehicle which is illegally parked.
- Step 2. OCR scanning takes place. Optical character recognition is known as OCR. We use cameras to capture fast-moving images of number plates in order to recognise and validate the character sequence. We then use image processing algorithms to translate the number plate image into text. It converts the colored image to black n white image for better processing.

Img.1. Input image

Img. 2 black and white image

Img. 3 cropped image

Img. 4 cropped black and white image

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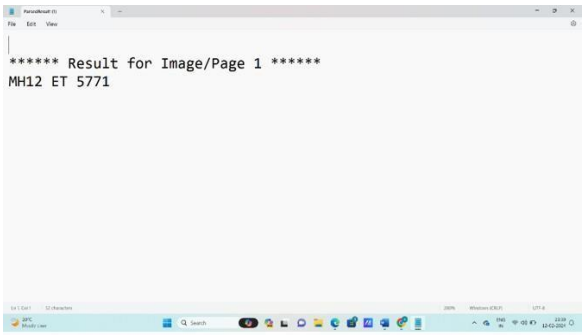

Img.5. Ocr scanned number

Fig 1

- Step 3. The software crops the image so that it can get the number plate only as its input for processing and it removes all the background object. The picture is converted to binary (black and white) or grayscale format. This separates the text from the background, making character identification easier. Methods are used to eliminate extraneous data, such as picture noise or small flaws that might hinder character recognition. To make character extraction easier, the image can be rotated so that the text lines are horizontal. A technique is used to straighten the text lines if they are curved.
- Step 4. Text line detection: Algorithms locate specific text lines in an image. Analysing line patterns and pixel densities may be necessary for this. Character segmentation: To aid in recognition, each line is further split up into individual characters. Overlapping characters, touching fonts, or intricate layouts can make this difficult. Algorithms concentrate on particular traits that are essential.
- These attributes might consist of:
  – Line intersections and ends
  – Curves and loops inside of characters
  – Direction and thickness of strokes
- Step 5. Output: It converts the recognized characters into a text format. It gives us the number from the number plate.

3.1 Results from various angles

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Fig 3

Fig 4

3.2 Results of limitations in the software

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Fig 4

Fig 5

IV. Future Scope

Numerous research directions in optical character recognition (OCR) for number plate recognition (NLR) are promising precision, adaptability, and integration into multiple applications, making OCR technology poised for revolution NLR OCR research needs to go beyond standard plate and investigate non-standard formats such as foreign plates motorcycles, and historical registrations. Robust recognition in difficult environments can be facilitated by automatically identifying damaged or obscured plates through the integration of object detection algorithms. OCR's real value in NLR can be found in its smooth integration with real-world applications like automated vehicle tracking, real time processing, video stream analysis, multi-camera fusion, vehicle type and class identification, and advanced data analytics. Better security, law enforcement, traffic analysis,traffic management, and urban planning will all be made possible by these developments.

V. Conclusion

We have examined and assessed the OCR technique's accuracy in this paper. The effectiveness of license plate recognition is impacted by template matching. We have discovered that a few factors, such as font type, image noise, tilting, etc., influence how well the OCR-based template matching technique works. Future research on these elements may focus on even more for improved outcomes. The proposed ANPR system used a processing time of 0.2 seconds to finish the entire process. The system has a accuracy rate of 70% for recognizing the plates. With additional training, this system will generate results that are more accurate. Opencv helps in pre processing of image followed by EasyOCR to extract the information hence providing more accurate results than any other algorithm.

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