Recognition of Vehicle number Plate for collection of toll

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Abstract-To design a real time application this will recognize the license plates automatically of vehicles. The proposed. License plate recognition (LPR) system is one kind of an intelligent transport system and is of considerable interest because of its potential applications in highway electronic toll collection and traffic monitoring systems. The purpose of this paper is to develop a real time application which recognizes license plates from vehicles. The image is given as input once the license plate is detected; its digits are recognized, display. In this system the yolov5 architecture is used to detect the license plate while tesseract is used to recognize the number plate.

I. Introduction

Automatic License Plate Recognition (ALPR) is also known as License Plate Recognition or License Plate Recognition. It uses image processing techniques to extract and recognize license plate information from images or video frames. The extracted information can be used in various applications such as electronic payment gateway systems, parking payment systems, road monitoring systems, and traffic control systems [1-3]. In real-world applications, ALPR researchers have to deal with a variety of challenges, such as license plate type, font, license plate color and font, license plate location, and environmental conditions such as lighting, weather, and objects. I have. License plates become difficult to recognize and recognize [4]. License plate formats tend to vary by country, as follows: B. Different Colors, Languages, and Fonts. Some plates have a different colored border than the background surrounding the plate and some have a plain background, indirectly adding challenges in capturing and recognizing car plates will occur. Variations in environmental conditions such as lighting and image background also affect the license plate recognition rate [5]. The ALPR system can be divided into his four main phases: image capture, license plate localization, segmentation and character recognition. Figure 1 shows the overall flow chart of the ALPR system. To achieve high accuracy in license plate recognition, the image quality must be high. Several factors can affect image quality. This includes the type of camera used, the resolution of the camera, the lighting and orientation of the camera used to capture the input image. Automatic Number Plate Recognition (ANPR) is widely known, but we know it is not used because it uses old technology, but an application that uses the same technology to manage visitors in a residential area We propose to develop a GPU-centric algorithm. To train the system, we use GPU-centric algorithms such as YOLO to address various challenges faced in using ANPR in countries such as India. To do. India faces challenges such as the cameras in use are mainly used for surveillance purposes and not for training and testing deep learning models. The second challenge is that license plate sizes and letter patterns vary from vehicle to vehicle and are highly complex.

The main purpose of this project is to detect a license plate from a video provided by a camera. An efficient algorithm is developed to detect a license plate in various luminance conditions. This algorithm extracts the license plate data from an image and provides it as an input to the stage of Car License Plate Recognition. Extracted image of the number plate can be seen on monitor. The scope of this project is to detect the license plate from the given image and observe the output on monitor. This project can work as a base for future improvements in the field of image processing, especially in license plate extraction and plate number recognition.

In this system, the Yolo v5 is used for detection of number plate and tesseract is used for the recognition of the number plate.
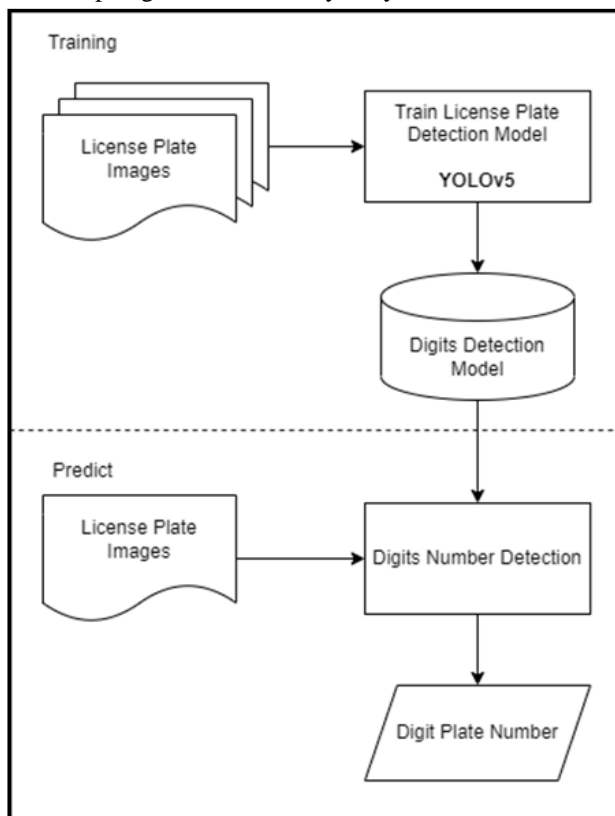
II.   Literature Survey

ParidiSwaroop et al. [4] present a comparison of applications and methods using template matching. Templates are primarily sub-parts of objects that match completely different objects. The template matching technique is flexible and generally easy to use, making it one of the most popular object localization strategies. Template matching is performed in many areas such as image processing, signal processing, video compression, and pattern recognition. The following template matching techniques are used: Naive template matching, image correlation matching, sum of absolute differences, sum of squared differences. Lucky Kodwani et al. [5] present a fully functional vehicle detection, tracking, and license plate recognition system. It consists of vehicle recognition, license plate recognition and character recognition modules. Here, foreground estimation is first performed by a Gaussian mixture model, and then a real-time and robust license plate extraction method based on block variance techniques is proposed. License plate extraction is a key step in license plate recognition for automated transportation systems. The extracted license plate is split into individual characters using a region-based approach. The detection scheme combines adaptive iterative thresholding and template matching algorithms. Riazul Islam et al.[6] show a successful method for identifying vehicle license plates. The proposed technique is based on morphological manipulations based on various structural elements to maximally exclude regions of no interest and improve object regions. The system was tested using a database of license plates and simulation results show a significant improvement over other conventional systems. Muhammad Tahir Qadri et al. [7] provide an efficient automated licensed vehicle identification system based on vehicle registration numbers. The system has been implemented at the entrance of security checkpoints in highly restricted areas such as military areas, or in areas around high-level government agencies. Congress, Supreme Court, etc. The developed system first recognizes the vehicle and then captures an image of the vehicle. Vehicle license plate regions are extracted using image segmentation within the image. Optical character recognition technology is used for character recognition. The data obtained is used to obtain specific information such as vehicle owner, registration location, address, etc., compared to records in the database. AniruddhPuranic et al. [8] shows that India's urban areas are becoming more and more prosperous, necessitating car ownership. This has led to an unexpected civil society problem: traffic control and vehicle identification. Automatic Number Plate Recognition (ANPR) systems play a key role in solving these problems, from parking permits to city traffic monitoring to car theft tracking. Numerous ANPR systems based on different methodologies are currently available. In this article, we'll review different techniques and how to use them. The ANPR system was implemented using template matching and its accuracy was found to be 80% 8% of India's number. Byeong-Gil Han et al. [9] presents a new method for recognizing automatic license plates in real-time with high-definition video. Extensive research on license plate recognition has been conducted since his 1970s, but the proposed approaches derived from such research have difficulty processing high-resolution images in real time. Here we propose a new cascade structure that is the fastest available classifier by most efficiently rejecting false positives. Additionally, we train a classifier with core patterns for different license plate types to improve both the computational load and accuracy of license plate recognition. To demonstrate its superiority, we compare our approach with other state-of-the-art approaches. Additionally, we collected 20,000 images of him, including license plates from real traffic scenes, for a comprehensive experiment. The results show that the proposed approach significantly reduces computational load compared to other state-of-the-art approaches with comparable performance accuracy. NighatNaaz Ansari [10] Recognition of characters on license plates is proposed. A method used to recognize characters from a license plate based on template matching. In this method, the license plate image is first taken as input, then preprocessing steps such as grayscale image transformation, dilation, erosion, and convolution are performed to remove noise from the input image. Each letter on the license plate is then segmented. Segmentation is based on connected components. Next, after clipping, a template is applied to the clipped characters to recognize the characters. Matching is based on correlation between the extracted characters and templates in the database. In the final step, the numbers and letters recognized from the input image are displayed in a text file. The car plate is displayed in various types of character styles in one or two columns, varying in size, spacing, and number of characters. With such variability, even locating or detecting these plates becomes a time-consuming process. In existing systems, foreground estimation is performed by Gaussian mixture models, and a real-time and robust method for extracting license plates based on block-variance techniques is proposed. License plate extraction is a key step in license plate recognition for automated transportation systems. The extracted license plate is split into individual characters using a region-based approach. The detection scheme combines adaptive iterative thresholding and template matching algorithms.

III. PROPOSED SYSTEM

The block diagram of the proposed system is shown in Fig.1. The system consists of number plate detection and number plate recognition.

A. Number Plate Detection

The primary purpose of license plate recognition is to store information from the vehicle related to license plate characters. So you can use this information to track your vehicle. Yolo V5 architecture is used to recognize license plates in the scene. YOLOv5 is a family of composite scaling object detection models trained on the COCO dataset. It includes simple functionality for Test Time Augmentation (TTA), model assembly, hyperparameter development, and export to ONNX, CoreML, and TFLite. YOLOv5 has four models, s, m, l and x, each with different detection accuracy and performance. A YOLOv5 implementation can be found at https://github.com/ultralytics/yolov5. This work uses YOLOv5 to classify each digit of a license plate number.

Fig. 1. Fig.1. Block diagram of the proposed system

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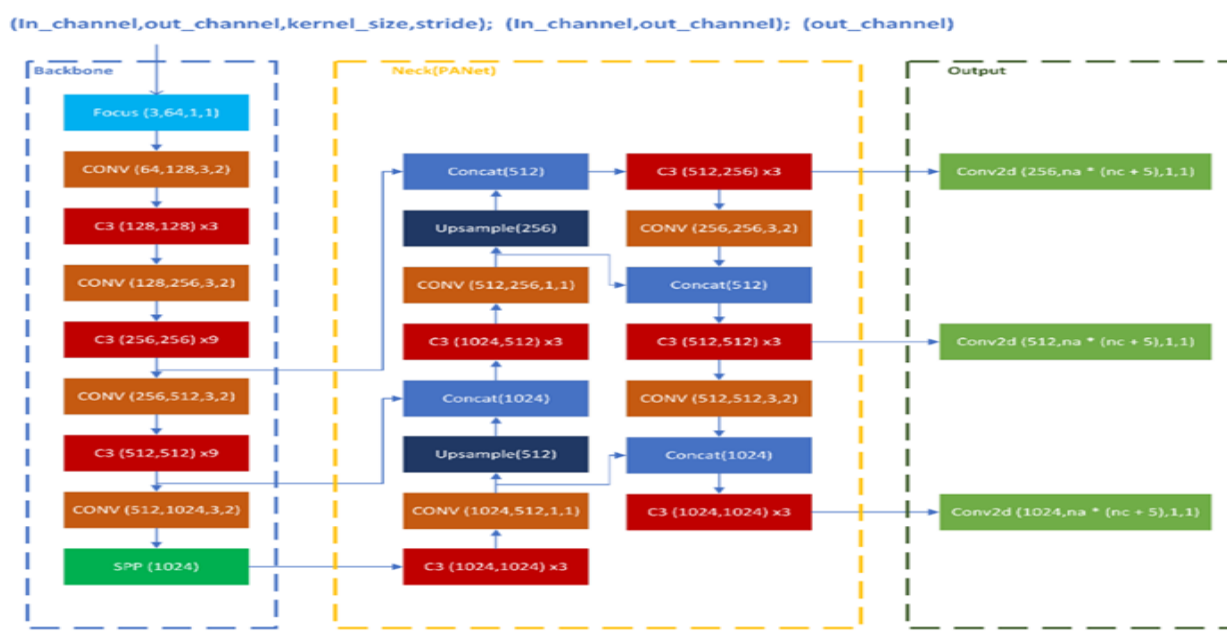*Eur. Chem. Bull. 2023,12(5), 1334-1341*

Fig. 2.   Model Structure Overview of YOLOv5

We used data from Open Images V6 vehicle images with license plates. Open Images is a platform that provides various image datasets. In this work, we used an image dataset of the vehicle registration number class. The total data used to train the license plate recognition model in YOLOv4 was 3368. A total of 3000 images were used as training data and 368 images were used as test/validation data.

Figure 3. Dataset

example About 100 license plate images were randomly collected from real traffic conditions, Google Video, parking lots in Pune, Delhi and Haryana with different but imperfect lighting conditions. Please note that the data does not include all types of additional license plate accessories. B. Acrylic housing and all possible camera orientations. B. Includes slope and angle. A standard license plate in India begins with two alphabetic characters indicating the region in which the vehicle is registered, followed by two digits indicating the RTO passage, followed by two alphabetic characters of the current series, then 0001 to 9999. followed by four numbers up to . Data from up to 100 collected license plate images are labeled for each character object contained in each image. Image annotation is done using the annotation library. The architecture of yolo v5 is shown in Figure 2.

- Backbone

The main purpose of backbone is to extract the essential features of the input image. YOLOv4 used CSPDarknet53 as its backbone. The Cross Stage Partial (CSP) [5] architecture is derived from the DenseNet [8] architecture by taking the previous input and concatenating it with the current input before moving to the dense layer.Neck

A key role of the neck is to collect feature maps from different stages. YOLOv4 uses SPP (Spatial Pyramid Pooling) blocks to generate fixed-size features regardless of the size of the out-feature map [6], and PaNet to aggregate parameters from different backbone layers. [7].

- Head

For a one-stage detector, the key role of the head is to perform dense prediction. A dense prediction is a final prediction consisting of a vector containing the predicted bounding box coordinates, the confidence value, and the label of the prediction. As shown in Figure 2, YOLOv5 has a similar model architecture to YOLOv4. YOLOv5 is almost identical to YOLOv4 except for framework and configuration. YOLOv5 is based on the PyTorch framework and uses .yaml files for configuration. For the digit detection model, I trained his YOLOv5 model using the transfer learning

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method. You trained a model to classify each letter object in a license plate image. We trained the model on 330 license plate images and validated the trained model on 111 images to calculate the mAP value.

- Inference

We use the License Plate Detection model and the Digit Recognition model that previously trained in our License Plate Recognition System as follows: First, the system will receive a vehicle image as an input. Then, the image will be processed by the License Plate Detection model. The model detected and cropped the plate number object.

The cropped image will be processed by the Digit Recognition model. The model classified all the characters in the cropped image and returned a sequence of digit plate numbers.

- Digit Recognition with YOLOv5

As the results show, as a result of the YOLOv5 transfer learning model, using the existing dataset, the digit recognition model achieved F1 score values of 80-83% with an accuracy value of 82.11% and a recall value of 81.97%. can be generated. Also, this model can achieve 84% mAP at 50% IoU threshold. The total detection time required for this model is 13.5 ms. A digit recognition model using YOLOv5 shows satisfactory results even with a small data set.

B. Number Plate Recognition

Text recognition is the process of recognizing text from scenarios by understanding and analyzing the underlying patterns. Also known as Optical Character Recognition (OCR). It can also be used for a variety of applications, such as reading documents, searching for information, and identifying products from shelves. OCR can be trained or used as a pretrained model. His pre-trained OCR model is used. This very important process forms the final stage of the ANPR process. Here the Tesseract OCR engine is applied to the recognized disc to recognize alphanumeric characters on the disc. The Tesseract engine used is trained to increase the accuracy of the recognition process. For training, we created an image of the characters to be recognized using the expected font, and created a dictionary of possible combinations of characters (area code, suffix, license plate) on a license plate. The output of this stage is a text representing the vehicle number.
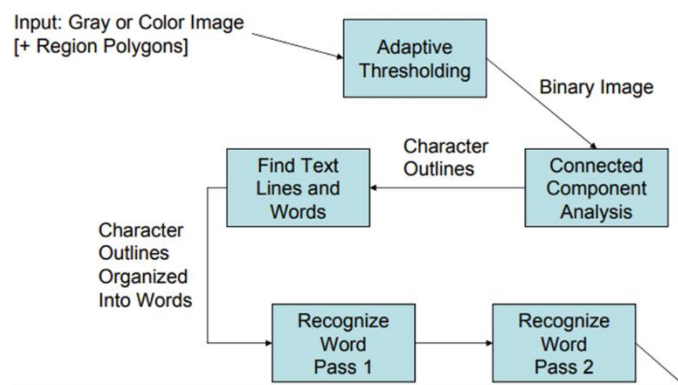

Fig. 3.   Processes involved in tesseract-based character recognition

- In the next step, letter outlines are extracted from words. Text recognition starts as a two-pass procedure. In the first pass, word recognition is performed using static classification. Each word is fully passed to the adaptive classifier in the form of training data. A second pass is run over the page using a new adaptive classification model that does not exhaustively inspect words to re-examine modules. • Many of the processes involved in implementing the methods presented are summarized here. • First, a collection of training images is provided. • The next step is to get a series of data points from the available annotated images. The data points are then converted to a .csvfile.Then, the records are generated in TensorFlow. In the next stage, a training model is created using Faster R-CNN with Inception V2 method.

- Upon the completion of training model, new input images are provided to the system as shown in the figure.

- When new input images are provided, the Faster RCNN model detects the number plate at first instance correctly.

- Then, the text is recognized with the help of PyTesseract.

- Finally, the text in the vehicle number plate is identified correctly.

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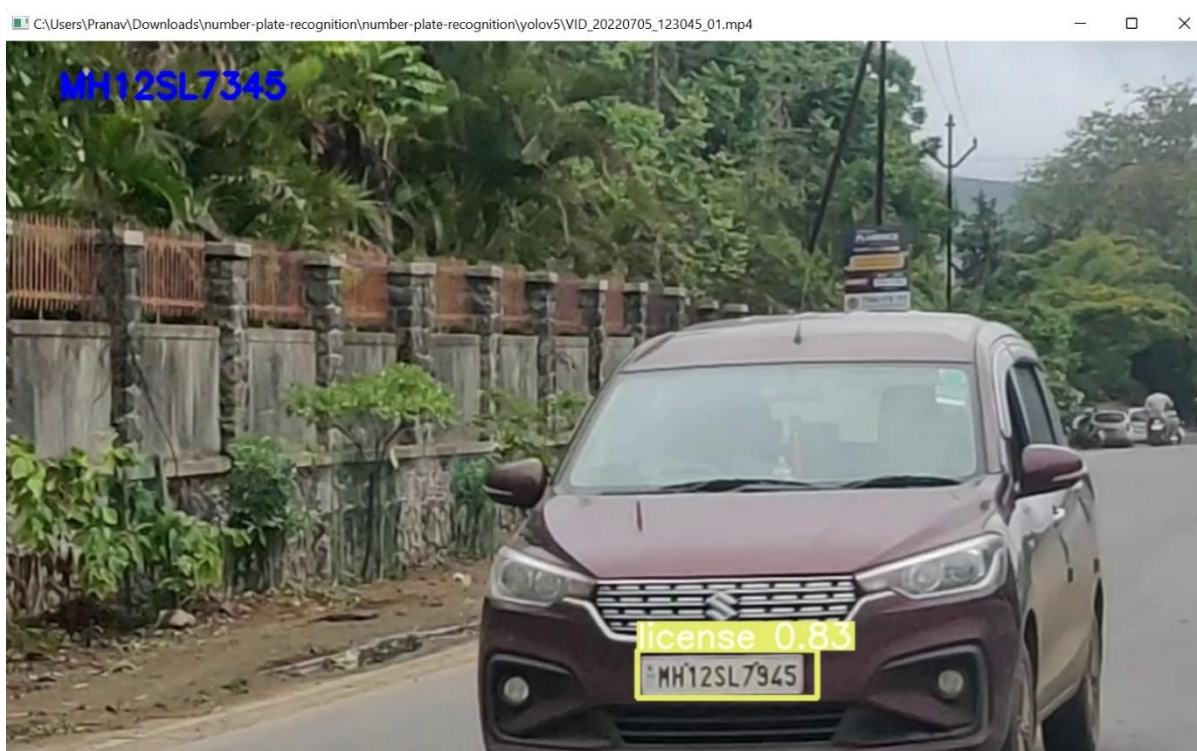*Eur. Chem. Bull. 2023,12(5), 1334-1341*

IV. RESULTS

The proposed system is implemented for license plate recognition in a real-time environment. License plate recognition uses Yolo V5 architecture and license plate recognition uses Tesseract. The results of the proposed system are shown below.

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V. Conclusion

ALPR applications are becoming increasingly complex in the context of India with tremendous exponential growth in the automobile, motorcycle and automotive industries. ALPR applications such as automatic toll collection, automatic charging systems in parking lots, managed vehicles in parking lots, and traffic monitoring have brought new research challenges to his ALPR in a newer dimension. We developed an automatic license plate recognition software by taking input from a live video feed. Character segmentation is implemented on the extracted license plates. Finally, we'll use the Tesseract engine to recognize license plates. The proposed system shows promising results in license plate recognition and recognition. The proposed system implementation can be extended to recognize multiple vehicle license plates in a single frame. Develop easy-to-use Android applications for traffic monitoring and management systems. Also, for higher accuracy, character recognition can be performed using various deep learning algorithms. With GPU you can get more performance in terms of computation time.

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