Automatic Fetching of Vehicle details using ANPR Camera

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Abstract - Traffic Management of the vehicle nowadays becomes necessary due to the large number of vehicles. Besides this when something wrong happens with the vehicle many times it becomes difficult to recognize the number of vehicles because many times its noisy and of low illusion. This must be done carefully otherwise the reorganization of numbers present on the vehicle becomes wrong. Many authors provide different methodology for the recognition of the number plates. All the authors try to identify the numbers by implementing systems in different languages and provide the result. In this paper, we introduce the single camera-based number recognition system used for this system that recognizes vehicle number plates on one lane by using a single camera. Due to the increased cost of the installation and maintenance thereof, there is a growing need for a multi-lane-based number recognition system. When the single camera-based number recognition system is used for multi-lane recognition, the recognition rate is lowered due to a difference in vehicle image size among lanes and a low-resolution problem.

Therefore, in this study, we applied a character extraction algorithm using connected vertical and horizontal edge segments-based labeling to improve multi-lane vehicle number recognition rate and thereby to allow application of the single camera-based system to multi-lane roads.

Key Words: Automatic Number Plate Recognition, Character recognition, Multi-lane Detection, Vehicle Image Processing, Real-Time Traffic Information, Template Matching, Edge Detection.

1.INTRODUCTION

ANPR system is an image-processing innovation which is used to recognise vehicles by their license plates. This Recognition System also takes out the abnormal state information from the digital image captured. The useless homogeny includes the dimension and the outline of the License Plate.

The ANPR system consists of following steps: -

i. Vehicle image capture.

ii. Pre-processing.

iii. Number plate extraction.

iv. Character segmentation.

v. Character recognition.

The initial step of ANPR system is location of the vehicle and capturing the image of vehicle, the second step is the localization of Number Plate and then the extraction of vehicle Number Plate is done. The final step uses image segmentation strategy. Segmentation is done for individual character recognition. This sums up the purpose of the ANPR camera in this system. Next, the number is searched through the database available at the traffic control room. This database includes all the information regarding the owner. This process is followed for multiple vehicles in the traffic at a given time simultaneously. Finally, the vehicles disobeying the traffic rules are marked and the numbers are sent to the official on-duty to check. This part is done by the use of text to speech converters used in the system.

1.1 Methodology

- The process of ANPR starts with identifying a registration plate of the vehicle.
- It involves the algorithms used which are able to identify the rectangular area of the registration plate from an original picture.
- This is achieved through video cameras capturing images that are analyzed using Optical Character Recognition (OCR), which scans each group of pixels within the images and estimates whether or not it could be a letter and replaces the pixels with the ASCII* code for the letter. (*)
- ANPR cameras need to be of a special type and set up within certain designated parameters.
- The identification and recognition process takes place in four phases mainly.

  (1) Preprocessing of Image

  (2)Localizing Registration Plate

  (3) Segmentation of Characters

  (4) Recognition of Actual number plate.

- The implementation is started by capturing the number plate of the vehicle.
- When the number plate is of sufficient size for the OCR software the frame is scanned and the registration number is converted to ASCII code and held in a list.
- This continues for a series of images according to the speed and position of the vehicle ensuring that the optimum view of the license plate is achieved.
- The contract extension and median filtering techniques enhance the gray level of registration plate image.
- Next is the character segmentation part which further segments the character individually from the extracted number plate.
- For easy comparison of the input character with the character in the database the result is normalized into the character set as the size of the images in the database.
- Finally, it's time to apply Optical Character Recognition.
- Optical character recognition is a recognition method in which the input is an image and the output is a string of characters.
- Template matching is one of the approaches of OCR.
- OCR automatically identifies and recognizes the characters without any indirect input.
- The characters on the number plate have uniform fonts then the OCR for number plate recognition is less complex as compared to other methods.
- The edge detection and gray scale filter is applied initially as a preprocessing for selected images to isolate the number plate region which is a smaller part from the extracted image.

1.2 Equipment and System Required:-

Multi-lane vehicle number plate recognition systems can be divided into a camera unit and enclosure unit. The camera unit is composed of a housing, a camera, a lens, an IR LED controller, and an IR LED board. Theenclosure unit includes an enclosure, a controller and an SMPS The camera is a device for acquiring images, and the IR LED controller and the IR LED board are devices for lighting at night or in the rain.

Camera specifications are as follows:. The number of pixels of the image to be photographed is proportional to the square of the number of lanes. A camera of 2.8 megapixels was used for two-lane ANPR, and in order to obtain the same level of image quality, a camera and lens were used for three lanes and 11.2 megapixels for four lanes.

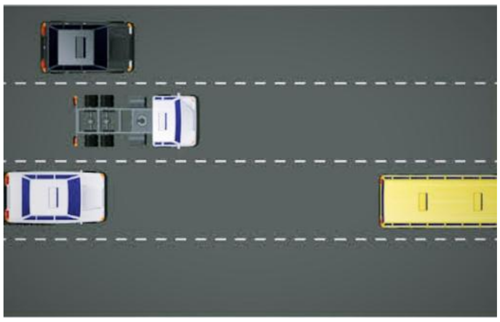

FIG:1

2. Steps Used in License Plate Recognition

(I) License Plate Detection: The first step is to detect the License plate from the car. We will use the contour option in OpenCV to detect rectangular objects to find the number plate. The accuracy can be improved if we know the exact size, color and approximate location of the number plate. Normally the detection algorithm is trained based on the position of camera and type of number plate used in that particular country. This gets trickier if the image does not even have a car, in this case we will take an additional step to detect the car and then the license plate.

(II) Character Segmentation: Once we have detected the License Plate we have to crop it out and save it as a new image. Again this can be done easily using OpenCV.

(III) Character Recognition: Now, the new image that we obtained in the previous step is sure to have some characters (Numbers/Alphabets) written on it. So, we can perform OCR (Optical Character Recognition) on it to detect the number

2.1 Following are the steps of License Plate Detection

- Resize the image to the required size and then grayscale it. The code for the same is given below
- Normally using a bilateral filter (Blurring) will remove the unwanted details from an image. Code will blur the image . **Syntax is *destination_image =cv2.bilateralFilter(source_image, diameter of pixel, sigmaColor, sigmaSpace)***. You can increase the sigma color and sigma space from 15 to higher values to blur out more background

information. This way we can avoid the program from concentrating on these regions later.

- The next step is interesting where we perform **edge detection**. There are many ways to do it, the most easy and popular way is to use the **canny edge method from OpenCV.** Destination_image = cv2.Canny(source_image, thresholdValue 1, thresholdValue 2). ThresholdVale 1 and ThresholdValue 2 are the minimum and maximum threshold values, and only edges with an intensity gradient above and below these values will be displayed.

- Now We are looking for contours on an image and sorting them from big to small and considering only the first 10 results. To filter the licence plate image, we loop through all the results and check which has a rectangle shape contour with four sides and closed figure. We save the right counter in a variable called screenCnt and draw a rectangle box around it to make sure we have detected the license plate correctly.

- Now We can mask the entire picture except for the place where the number plate is, as the remaining information is useless.

Character Segmentation The next step in Raspberry Pi Number Plate Recognition is to segment the license plate out of the image by cropping it and saving it as a new image. We can then use this image to detect the character in it.

Character_Recognition The Final step in this Number Plate Recognition is to actually read the number plate information from the segmented image. We will use the *pytesseract* package to read characters from the image, just like we did in the previous tutorial. The code for the same is given below.

3. Block Diagram And Flowchart

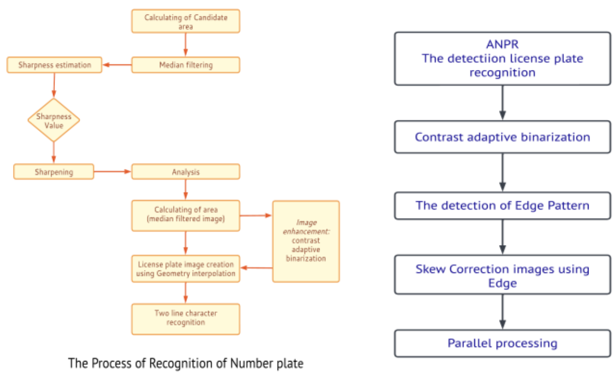

Fig -1: Name of the figure

The first step in the process of number plate recognition using ANPR camera is **The Detection License Plate Recognition.**

The process of license plate detection in number plate recognition involves locating and isolating the regions in an image or video frame that contain license plates. This step is crucial as it allows subsequent processing steps to focus specifically on the license plate region for character extraction and recognition. The process of license plate detection includes the following steps; Image Acquisition, Preprocessing, Vehicle Localization, Region Proposal, Region Filtering, Characteristic Analysis, Verification and Validation, Output.

The specific techniques and algorithms used in licence plate detection can vary depending on the number plate recognition system implementation, camera setup, lighting conditions, and other factors. Advanced systems may leverage deep learning approaches, such as convolutional neural networks (CNNs), for more accurate and robust licence plate detection.

The second step in the process of number plate recognition is **Contrast Adaptive Binarization.**

This technique is used to convert a grayscale image into a binary image. This process helps to enhance the contrast between the characters and the background, making it easier to extract and recognize the characters accurately. The process of contrast adaptive binarization includes the following steps; Image Preprocessing, Local Image Analysis, Local Contrast Calculation, Threshold Calculation, Binarization, Post-processing, Character Extraction and Recognition.

The contrast adaptive binarization process enables the conversion of a grayscale image into a binary image with optimised thresholds in different local regions, improving the accuracy and robustness of subsequent character extraction and recognition steps in number plate recognition systems.

The third step in the process of number plate recognition is **The Detection of Edge Pattern.**

The process of detecting edge patterns in the recognition of a number plate involves identifying and extracting the edges or boundaries of the characters present on the plate. This step is important as it helps in segmenting the characters from the background and provides valuable information for subsequent character recognition. The process of edge pattern detection includes the following steps; Image Preprocessing, Edge Detection, Edge Enhancement, Edge Pattern Analysis, Character Segmentation, Post-Processing, Character Recognition.

The detection of edge patterns plays a crucial role in segmenting and extracting the characters from a number plate, which is a key step in number plate recognition systems. By analysing the edges and boundaries, this process helps in separating the characters from the background and provides important cues for subsequent character recognition and interpretation.

The fourth step in the process of number plate recognition is **Skew Correction Images using Edge**.

Skew correction is a process used to rectify or straighten images that are captured at an angle or have a noticeable slant. In the recognition of a number plate, skew correction is essential to ensure accurate character extraction and recognition. One approach to performing skew correction is by utilizing edge detection techniques. The process of skew correction images using edges includes the following steps; Edge Detection, Hough Transform, Line Detection, Skew Angle Calculations, Image Rotation, Resampling, Post-Processing.

By utilizing edge detection and the Hough transform, the skew correction process identifies the dominant lines representing the edges of the number plate. Calculating and applying the appropriate rotation correction helps straighten the image, ensuring accurate character extraction and subsequent recognition in number plate recognition systems.

The final step in the process of number plate recognition is **Parallel Processing.**

Parallel processing is a process which involves dividing the computational tasks into smaller sub-tasks and processing them simultaneously on multiple processors or cores. This technique is used to accelerate the processing speed and improve the efficiency of number plate recognition systems. The process of parallel processing includes the following steps; Task Division, System Setup, Task Distribution, Task Execution, Data Sharing and Communication, Task Completion and Aggregation, Post-processing and Interpretation.

Parallel processing enables the simultaneous execution of multiple tasks, significantly reducing the overall processing time in number plate recognition systems. By leveraging the computational power of multiple processors or cores, parallel processing improves system efficiency and allows for real-time or near-real-time performance in applications that require fast and accurate number plate recognition.

Experiment and Results

Fig 1

Fig 2

Fig 3

Fig 4

Fig 5

Fig 6

Final Result

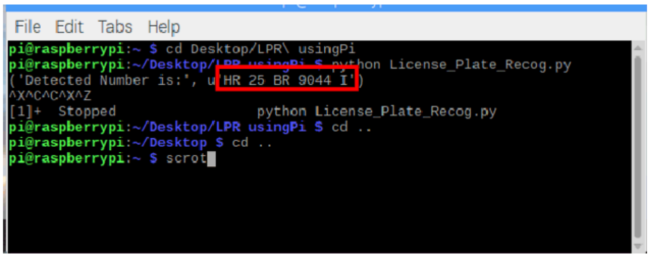

Fig 7

3. CONCLUSIONS

In conclusion, the automatic fetching of vehicle details using Automatic Number Plate Recognition (ANPR) cameras has proven to be a valuable technology with numerous benefits. This system involves capturing images of vehicles' number plates using specialized cameras and then using image processing algorithms to extract the plate information. The extracted data is then used to retrieve relevant details about the vehicle from a database, such as registration information, owner details, and any associated records.

One of the key advantages of ANPR cameras is their ability to automate and expedite the process of capturing vehicle information. This technology eliminates the need for manual data entry, reducing human error and saving time and resources. By rapidly scanning and processing number plates, ANPR cameras can efficiently identify and retrieve vehicle details, even in high-traffic scenarios.

Another significant benefit is enhanced security and law enforcement capabilities. ANPR cameras can be integrated with existing surveillance systems to monitor and track vehicles in real-time. This enables law enforcement agencies to quickly identify and apprehend vehicles involved in criminal activities or those associated with suspicious behavior. It also assists in locating stolen vehicles and managing traffic violations by automatically cross-referencing number plates against databases of wanted vehicles or registered offenders.

Additionally, ANPR cameras can contribute to effective traffic management and toll collection systems. By accurately identifying vehicles and retrieving information about their class, tolling authorities can automate the toll collection process, reducing congestion and improving overall traffic flow. Moreover, the data collected by ANPR cameras can be analyzed to generate valuable insights into traffic patterns, allowing authorities to optimize road infrastructure and plan for future developments.

While the automatic fetching of vehicle details using ANPR cameras offers significant advantages, it is essential to address privacy concerns associated with this technology. Striking a balance between efficient data retrieval and protecting individuals' privacy rights is crucial. Implementing robust security measures, strict access controls, and proper data handling protocols can help ensure the responsible and ethical use of ANPR systems.

In conclusion, the automatic fetching of vehicle details using ANPR cameras has proven to be a valuable tool in various domains, including law enforcement, traffic management, and toll collection. With proper implementation and consideration for privacy concerns, this technology has the potential to enhance efficiency, improve security, and optimize the overall management of vehicular operations.

ANPR can provide various benefits like traffic safety enforcement, security- in case of suspicious activity by vehicle and immediate information availability. It can be further extended as multilingual ANPR to identify the language of characters automatically based on the training data. For low resolution images some improvement algorithms like super resolution should be focused. Most of the ANPR focus on processing one vehicle number plate but in real-time there can be multiple vehicle number plates being processed.

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