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EXTRACTION OF OWNER DETAILS WITH INTELLIGENT NUMBER PLATE RECOGNITION

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Abstract - *Extraction of Owner details with Intelligent number plate recognition (INPR) system uses image processing and character recognition technology for the identification of the vehicles. This technique can be utilized in highly populated areas and highly restricted areas to simply identify traffic rule violated vehicles and owner details are retrieved using this system. It is difficult for a traffic officer to identify the license number of vehicles who violates the rules from the speedy vehicle. Hence, it is essential to develop such system as solution to varied traffic problems. INPR systems are already available but efficiency isn't gained thoroughly. Systems ordinarily use infrared lighting to capture images. Various recognition strategies have been proposed for number plate recognition. This developed system proposes to take a step further, that is the acquisition of owners details along with the vehicle registration number.*

Key Words: **Intelligent Number Plate Recognition (INPR) system, Image processing, Localization, Character Segmentation, KNN Algorithm, Character Recognition.**

1. INTRODUCTION

Vehicle plate detection and recognition are utilized in many of the applications, including time estimation, car relying on highways, traffic violations detection, and surveillance applications. With the growing population, number of vehicles has also drastically increased. This made it difficult to seek out a parking lot lately for an outsized number of students and faculty at Educational Institutions. Most of the car parks are managed manually by security guards who might not keep records of the vehicles within the parking zone. Intelligent Number Plate Recognition (INPR) is additionally referred to as Automated License Plate Recognition (ALPR). Intelligent Number Plate Recognition or INPR is a technology that uses pattern recognition to read the license plates. In simple terms, INPR cameras capture the number plates of the vehicles that travel by violating the principles. This captured image is then fed during a computing system to seek out details about the owner of the vehicle and details about the vehicle itself. As a vehicle passes, INPR 'reads' Vehicle Registration Number and marks which is the number plates - from digital images, taken through cameras located either during a mobile unit, in-built in traffic monitoring vehicles. Computer vision and character recognition algorithms for license plate recognition play an important role within the recognition of the amount plate. Thus, forming the core modules in any INPR system. Parking lots would be benefited by this application. Tollgates are one of the simplest applications too. It's very difficult during a rush-hour for manual tollgate ticket generation. Hence these models are often utilized in coordination with employees. This would be very useful in terrible weather.

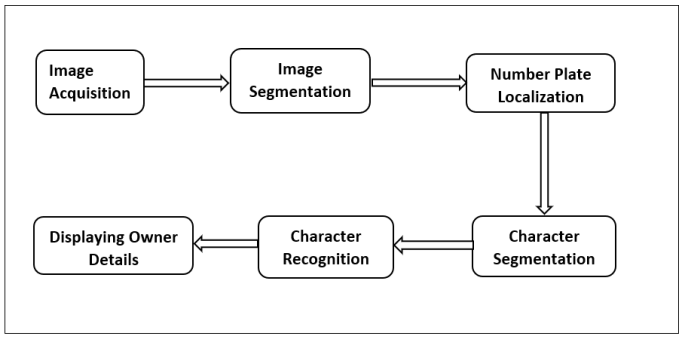

Fig1.1: - Block Diagram

2. LITERATURE REVIEW

Many Number Plate Recognition methods have been proposed. From 2004-2010 Number plate recognition method here first used Color Edge Detection and fuzzy maps then step considered were Pre-processing and OCR (Optical Character Recognition) [1], License Plate Segmentation, License Plate Processing, Plate Region Extraction, Extraction of an ROI. [3]. From 2011-2013 the approach was mainly based on Artificial Neural networks. Two separate ANN was used one for Character and other for character extraction as confusion was high when the combined approach was applied to both character and numbers, thus increasing the success rate separate ANN was implemented [4]. In [2013] real-time vehicle plate recognition was implemented mainly in two steps which are Plate Location Detection and License Plate Recognition.

P. Sai Krishna proposed Automatic License Plate Recognition using MATLAB in [2015]. In his thesis work, simple color conversion edge detection and removal of noise with the application of the median filter as one of the operators is attempted. Simple and efficient morphological operations,

filtering, and finding connected components for localization of Indian number plates were also presented. It highlights the identification of stolen cars which was tested on 20 samples and is found to extract both alphabets as well as numbers from vehicle license plates images with an accuracy of 90% for four-wheeler license plates [6].

In Muhammad Tahir Qadri's paper, the recognition of the OCR techniques is used. It has limitations such as it can lead to misalignment and various sizes may not give proper results. The use of affine transformation can aid the OCR recognition from various size and angles. Various image processing techniques are used for identifying the vehicle and to map them with the stored database. [2] In the Paper by S. Kranthi, K. Pranathi proposed that Automatic Number Plate Recognition (ANPR) captures the vehicle image and confirmed the licensed vehicle registration number. It can be used in finding stolen vehicles. [3]

Abd Kadir Mahamad's paper explained a number plate inspection of the letter where detection was carried out by image processing and optical character recognition. Improvisation in the previous system has been created as a training interface using LABVIEW software. [5] A paper by Kuldeepak et al. stated that high accuracy is necessary for plate recognition while working with busy streets. Accuracy of 98% is achieved by optimizing different parameters. In the case of tracking for stolen vehicles, the system should possess complete accuracy. Therefore, to accomplish better performance and accuracy streamlining is mandatory. This work can be further boundless to minimize errors such as stains, blurred regions, smudges with various text styles and sizes because of them. [1] Paper by AmrBadr et al. explains an Automatic Number Plate Recognition System; which uses Techniques for plate localization and character segmentation such as Morphological operations, Histogram manipulation, and Edge discovery and Character classification and recognition Artificial Neural Networks is used. [5]

3. SYSTEM MODEL

The model is implemented in six steps, which are Image Acquisition, Image Segmentation, Number Plate Localization, Character Segmentation, Character Recognition, and Displaying Owner Details.

3.1. Image Acquisition

The first step is getting an image as an input to the system. The images captured are in RGB format. Images are further processed for plate extraction. Some details such as detailed information of the vehicle, images of the license plate, and other basic data are present in the database of the system.

Fig3.1. Captured Image

3.2. Image Segmentation

The captured image may contain noise and other undesirable elements. The presence of noise can degrade the quality of the image. To eliminate noise in the image pre-processing is carried out.

The pre-processing of images consists of segmentation of the image, Converting RGB image into the greyscale image, applying a certain threshold to the image, contouring the image, and then applying the KNN algorithm for Character recognition.

Segmentation is an essential and foremost step where the image is divided into several segments that have similar attributes using image segmentation. A pixel-wise mask for each object in the image is created by Image segmentation. For Character Recognition we will segment the words into individual characters which can be recognized individually. This step is important as poor segmentation can lead to misrecognition. The captured RGB image is then converted into a greyscale image. Converting a three-channel image (RGB) into a single channel (greyscale or binary image) and then a certain threshold is applied to this converted image.

Fig.3.2.1 Greyscale Image

Here threshold is applied to separate the image into two parts, in which all values below the threshold value are turned to black and all values above are turned into white. Thresholding is changing the pixels of an image to make it easier to analyse. It is used to select areas of interest in an

image while ignoring the unconcerned parts. After applying the threshold, the image can be seen clearly as seen in fig.3.2.2. Thus, it becomes easy for the system to recognize characters.

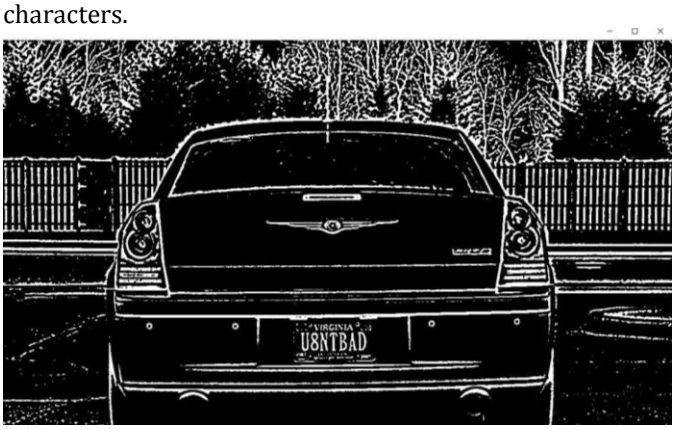

Fig.3.2.2 Thresholded Binary Image

After this, the next step is the contouring of the image. Contouring is a curve joining all the continuous points along the boundary which has the same intensity. It is used for shape and object detection. For Uniformity, all the images are resized into standard dimensions.

Fig3.2.3. All Contoured Image

3.2.1. KNN Algorithm

The KNN algorithm is employed for classification. It is often used for Regression also as for Classification, it's majorly used for the Classification. It's a non-parametric algorithm, that's it doesn't make any assumption on underlying data. It is also mentioned as a lazy learner algorithm because it doesn't learn from the training set immediately instead it stores the dataset. At the time of classification, it acts on the dataset. KNN algorithm at the training phase just stores the dataset and when it gets new data, then it classifies that data into a category that's much almost like the new data.

The working of the algorithm is explained in the following steps:

Step 1: Select the value K of the neighbors

Step 2: Calculate the Euclidean distance of K number of neighbors

Step 3: Take the K nearest neighbors as per the calculated Euclidean distance.

Step 4: Among these k neighbors, count the data points in each category.

Step 5: Assign the new data points thereto category that the number of the neighbor is maximum.

Step 6: Our model is prepared.

By calculating the Euclidean distance, we get the closest neighbors.

Euclidean Distance= $\sqrt{(X_2-X_1)^2+(Y_2-Y_1)^2}$

Steps to implement the KNN algorithm:

o Data Pre-processing step

o Fitting the KNN algorithm to the Training set

o Predicting the test result

o Testing accuracy of the result (Confusion matrix)

o Visualizing the test set result.

The system discovers the k nearest neighbors to classify a new character. This is often done using Euclidean distance between test points and therefore the reference points, the distances are then arranged in ascending order and therefore the smallest Euclidean distance is taken into consideration. To pick the value of K that's appropriate, the algorithm is run several times with different values of K. We choose the K that reduces the number of errors that are encounter while maintaining the algorithm accuracy to make predictions when it's given data it hasn't seen before. KNN algorithm assumes the similarity between the new case/data and available cases and put the new case into the category that's most almost like the available categories. KNN algorithm stores all the available data and classifies a new data point based on the similarity. This suggests when new data appears then it is often easily classified into a good suite category by using the KNN algorithm.

By using the KNN algorithm for character recognition, we get a different number of possible plates present within the scene which is represented by the red boxes within the image.

Fig.3.2.4. Vector of possible plates

3.3. Number Plate Localization

Identification of number plate size is the main Intuition in recognition of Number Plate. Mostly number plates are rectangular. The mat lab toolbox function provides a region props function which quantifies a set of properties for each marked region in the matrix. To gauge the properties of the image region we have used a bounding box. Owing to the labelling of the associated components, the region can be differentiable from the image. Thus, the Number plate localization becomes visible.

Fig.3.3. Number Plate Localization

3.4. Character Segmentation

Character segmentation from the localized number plate plays an important role in the system. The next step after region growing is recollecting one or more criteria that satisfy the requirements of the desired portion. Soon after setting the standards, the image is searched for any pixels that meet the requirements, and if the pixel matches, its neighbours are checked if any of the neighbours matches the necessities, both the pixels are measured and are checked against an area with an equivalent region. Vertical and horizontal scanning techniques are used to get individual character and number images. Segmented characters can be seen in fig.3.4

Fig.3.4. Segmented characters

3.5. Character Recognition

Character Recognition is a crucial step in detecting the Vehicle Number plate. It consists of techniques used to order and then recognize characters separately. The classification of characters is predicated on the feature extraction, features that were extracted are arranged using either the statistical, syntactic, or neural methodologies. Various strategies are used for character recognition and numbers. It ends with the calculation for similar features where characters are unclear or similar make second identification with the highest point matching. Another way is that when the lines in an extracted number plate are separated, the line separation procedure is easy for the connected segment, therefore individual characters are separated. The separated individual characters are stored in separate variables. The extracted characters are taken from the number plate. Following this is template matching, it may be a proficient algorithm for character recognition. The characters' image is match up to our given database and therefore the best resembling is considered. Templates will exist for all alphanumeric values which consist of A-Z and 0-9 in the database.

Fig.3.5. Successful recognition of characters

3.5.1. Template Matching

Recognition of a fixed-sized character is done appropriately by Template matching. Other applications are the detection of objects generally in face detection and medical image processing. There are two categories of template matching: Feature-based matching and Template-based matching. Generally, a template-based approach is useful whereas the feature-based approach is useful only when the image has prominent features. In Prathamesh Kulkarni's paper, to achieve 85% of the character recognition rate statistical feature extraction method is used [9]. In the paper [10] on Automatic License-Plate Location and Recognition Based on Feature Salience, several features and extracted and salient is computed based on training characters. To adjust all characters with uniform size a linear normalization algorithm is used. In a test amongst 1176 images, a recognition rate of 95.7% was observed. An SVM based approach deployed for feature extraction of Chinese, Kana, and English, Numeric characters, and achieved a success rate of 99.5%, 98.6%, and 97.8% for numerals, Kana, and address recognition respectively. A template-based approach is proposed in the paper by Ch. Jaya Lakshmi [11]. They used a low-resolution template matching method to figure with a lower resolution image like 4 X 8. The authors used similarity function to measure similarity between patterns.

3.5.2. Other Methods

In some algorithms, character recognition is consummated by the offered Optical Character Recognition (OCR) tool. There are various software's offered for the OCR process. One of the open-source OCR tools with multilingual support is Tesseract [7], [8] that is maintained by Google. It is deployed for character recognition. The author changed it to gain a 98.7%. Character recognition rate. The OCR tool can be utilized directly to extract printed text from images. It is compatible with many programming languages and

frameworks. Tesseract can be used with the existing layout to analysis to recognize text within a large document.

3.6. Displaying Owner Details

After successful detection of the number plate, the next and final step is to display the owner's details. When the registration number is obtained by the system, it finds details of the owner associated with that specific registered vehicle number. The system maps the vehicle registration number with the database and produces output in the form of owner name, contact number, and mail ID.

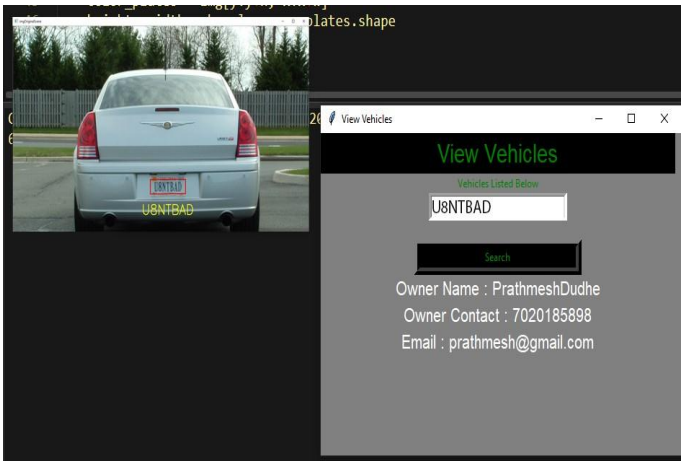

Fig.3.6. Owners details as Output

4. CONCLUSIONS

In this paper, an intelligent number plate recognition system is proposed. The system enables the user to get details of the owner of the vehicle against the registered vehicle number. The developed system uses the KNN algorithm to recognize the vehicle from the system database. It works efficiently in a wide variety of conditions and distinctive sorts of vehicle number plates. In the existing work, number plate detection has been done on contorted number plates and character recognition using neural networks standard classifiers. The implemented system enables the user to get the Owners details in addition to correct detection of vehicle registration number from the license plate. This will even be utilized in the case of car usage in terrorist activities, smuggling, invalid number plates, stolen cars, and other illegal activities. It also can be used in highway electronic toll collection. We proposed this system in case the car gets stolen and the owner reports it, then wherever the car crosses some camera, it gets detected and the police will get notified. If any fake number plate or number is used then also it recognizes that the number is not in the database and the number plate might be a fake number plate. It is definitely clear that INPR system is difficult system due to its different phases and it is not yet possible to achieve 100% accuracy as each phase is dependent on previous phase. Factors which may affect the performance of INPR are noise in the image, shadows non-uniformity of license plate character, fancy fonts and background color and the design of the car. Very few of these systems are developed for India [9], [14]. So, there is a wide scope to implement such system for India.

5. FUTURE SCOPE

The future scope of the implemented system can be extended for the recognition of number plates of multiple vehicles in a single image frame by using multi-level genetic algorithms. Also, a more sophisticated version of this system can be implemented by taking inputs from the live video feed and selecting the best vehicle frame for the classification of the type of vehicle and recognizing the number plates with the aid of neural networks. It can be further used for vehicle model identification traffic control, speed control and vehicle location tracking. This system is cost effective for any country. If the system gets implemented by any country, then the system should be feed with the official vehicle database which consist of all the information and details of owner and vehicle, respectively. For low resolution images, algorithms like super resolution [12], [13] of images should be implemented.

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