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License plate recognition using template matching

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Abstract
Automatic range plate recognition could be a real time embedded system. It identifiers the characters openly from the image of the vehicle plate and a borough of research. This method is residential supported digital images and might be effortlessly functional to park system for the operation of documenting right of entry of parking services, secure usage of parking homes and additionally to stop automotive problems. The planned algorithmic program is predicated on a grouping of morphological operation with space criterion check for range plate localization. Segmentation of the plate typescript was accomplished by region professionals perform in Matlab, classification and fill hole approach. The character recognition was consummated with the optical characters by the access technique of template matching.

Keywords: number plate, wavelets, transformation

1. Introduction
Recent year, due to people's life and citizen's income is increasing incessantly, grounds general people own the vehicle rate is supplementary and more high, in adding to the government spread energetically unplanted movement, the automobile not only is a pointer of identity but also is a tools of take transportation and unsown for people. So vehicles organization of parking lots, electronic toll compilation management of highway, locating vehicles stolen and monitor of road and so on, all become new safety demand for people with vehicles management and vehicles stolen avoid [1]. license plate recognition system, we can not only tracking the go through vehicles but also save most of manpower to improve recognized efficiency. The use of automatic license plate recognition structure, precisely can reach enhanced professionally that find out the stolen vehicles, also control significance road and tracking the uncertain vehicles to reduce the violation of traffic rules.

1.1 Motivation
Today's world increases progressively with number of the threats. The diversity of them is also enormous. It variety from the pilferages to acts of terrorism. As a response many countermeasures are taken. In most of metro cities observation systems are installed. They considerably reduce the number of acts of damage, robberies, car stealing etc. On the other hand many cameras in the city remain unused, due to the fact that the acquired image must be proscribed by the operator. The police do not have enough staff to watch everything at the same time. There is also another difficulty of such systems. Stock up the video watercourse from all cameras necessitates tremendously high capacities [2]. The solution of this problem might be replacing the human operative by an intelligent classification that incessantly analyzes the obtain image and detects some perhaps hazardous circumstances. For this difficulty we are annoying to intend a healthy system to monitor vehicles mechanically. As far as the vehicle robbery difficulty is worried, the observation system without mentioned disadvantages can be urbanized.

1.2 Aim and Scope of the Work
The main aim of this work is to produce the component for routine surveillance system. This component should take delivery of a part of the acquired image as the input and is projected to go back the quantity inevitable form of license plate. Generally, the scheme is planned to distinguish all types of license plates. The variety of them is huge. They are of dissimilar figure and colors, letters can be prearranged in more than one row. A for instance in India license plate is white background with black letters. Now the High Security Registration Plate Scheme (HSRP) Scheme was launched in 2011, different from the old format. It has chromium-based hologram with 'IND' in blue is emblazoned using hot stamping foil and a unique Permanent uninterrupted Identification Number [3]. In this work only the solitary row plates with black letters on white background are assumed as the accurate only. The vehicle number plate in India consist country code, state code, district code, type of vehicle and finally the actual registration number as shown in the figure 1.1.

Fig 1: Indian Licence Plate Format

1.3 Problem Statement
To plan and expand a real-time detection, tracking and license plate recognition scheme that will work professionally under

the circumstances of slow moving substance and the objects that are merged into the background due to a temporary stop and becoming foreground again, adaptive to different traffic environment conditions, robustness against progressive or sudden illumination changes.

But in India, the license plate is purely localized and people don't follow the standard pattern assigned by Indian government, so the recognition process is quite difficult. Some of the Indian license plates with variations in shape, script, etc.

2. Literature Review

This presents a brief introduction to nature of the problem with present challenges. Such introduction is necessary as in the image processing multiple solutions were proposed for individual problem. For the efficient method for License plate detection we need to study and compare different approaches for same as well as different environment. Back in the early nineties, auto identification has attracted wide attention around the world; people began to study the auto identity - issues related to automatic license plate recognition.

2.1 Earlier Research Background

For the identification of license plate location in complex environments, various authors proposed different methods. By using multiple features of the image were used by different methods to detect and recognize numbers in the license plate. Researchers studied in many countries for automatic vehicle identification, which is the suitable way of license plate image analysis, and automatic extraction of the license plate number to determine vehicle owner information.

2.2 Earlier research

Currently, there is a ration of research on license plate recognition in recognition area. Usually, license plate recognition is separated into five parts: input image, image pretreatment, license plate location, character separation, character recognition. In the first two shares, some common approaches are usually used, such as Grayscale image, Intensity Transformation Image. The function of the first two stepladders is to help search for the license plate in a more accurate way.

S. Wang and H. Lee [6] mutual edge statistics with morphological steps to remove unwelcome edges in the treated images. On the other hand, some methods take advantage of color features.

Lin Luo [7] makes a new and effective method of license plate location. The following three key sections are involved in this planned algorithm. Firstly, Sobel operative is used to cutting the vertical edges of the vehicle image. Then, HSV color space and integral image are employed to locate candidates in yellow license plates and non-yellow license plates. Lastly connected component examination is used to find the license plate precisely.

Similarly, Yao-quan [8] also usages a color-based technique, but in which the color information from the colored image is sensibly utilized to importantly reduction the edge points. With this technique, it also eradicates the turbulences of the fake plate region whose structure and texture are comparable to the vehicle plate but do not match the plate fixed color collocation.

3 Experiment Setup

Experiments are shown to estimate the presentation of proposed approaches. Planned corrected technique applied in MATLABR2013 and run on individual computer with shape as Core i3-6006U CPU 2.0 GHz and 4 GB RAM under the process system of Window 10. In the experiments, the set of test images exposed in Figure 4.1 is rummage-sale as the cover-images. For the embedded secret data, 10 sets of chance produced message bit-stream are used. Investigational results of the proposed technique are obtainable and deliberated in next sections.

3.1 Proposed Algorithm /Work Flow Process

Step 1: Capture of Image: Read the image of vehicle number plate from the hard-disk.

Step 2: Pre-processing: Convert the captured image to gray level image.

Step 3: Filtering: Apply the order static filter (median filter) to remove the noise.

Step 4: SE: Design the structure element for morphological operation**.**

Step 5: Dilation: Perform the dilation operation with structure element.

Step 6: Intensity: Improve the brightness of edge using convolution.

Step 7: Thining: Filling the all regions.

Step 8: Erosion: Perform the erosion operation with structure element.

Step 9: Remove the small object from binary image.

Step 10: Region Properties: Measure properties of image regions.

Step11: Controlling: Take box of the character/Number.

Step 11: Real Letter and matching with template.

Step 12: Show the extract vehicle number plate in notepad.

3.2 Experimental Results

This section gifts the simulation results of the established ANPR system. Differentimages of cars having different colours and construction types are taken and stowed in PC. The screenshot of the simulation and are displays below.

Templates

We have suggestion that pattern affects the correctness of the license plate recognizer. If we have more relevant template, then the result will be better. The sample font type is quite different. We found that the font called certificate template is the closest one.

Input Image

License plate recognition (LPR) is one form of ITS (Intelligent Transport System) knowledge that not only distinguishes and counts the number of vehicles but also differentiates them.

Fig 2: Vehicle License Plate Number

Matlab Based Vehicle License Plate Plate Recognition Software Model: The first and the most important part in this procedure is the software model. The software model uses the image processing knowledge. The programs are realized in MATLAB. The algorithm is alienated into following parts: Capture image, Pre-processing, Plate region extraction, Segmentation of character in the removed number plate, Character recognition, Comparison with template matching and Indicate result in .txt format. There are various steps in this approach and these are implementation in MATLAB.

In Software model click on Number Plate Recognition one new window will be open to browse the input image (Number Plate) algorithm would be processed and in few second result would be display in .txt format with new window of notepad.

This algorithm was verified using several input images having different resolution. The images contained vehicles of different colors and varying intensity of light. With all such images, the algorithm correctly recognized the number plate.

The algorithm was tested using different license plates having various background conditions, light condition and image quality. Some of the output results are shown below:

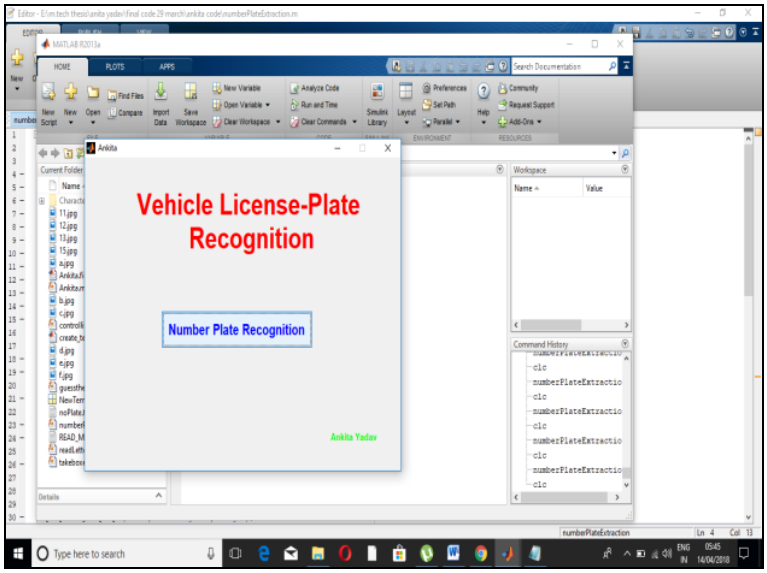

Fig 3: Vehicle License Plate Recognition System

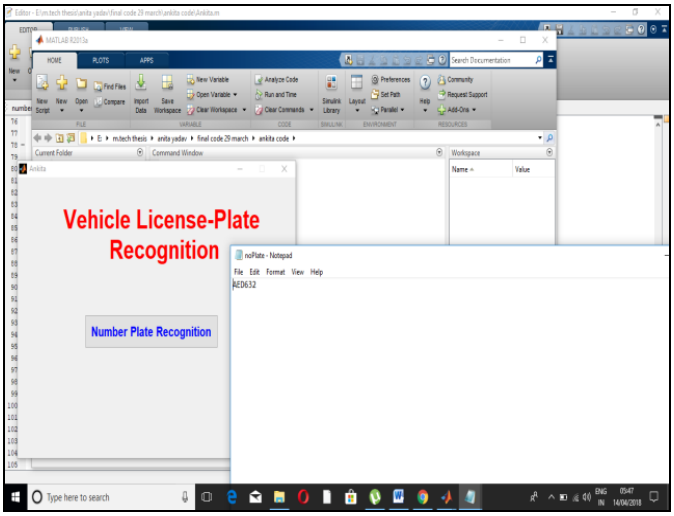

Fig 4: Result with 1.jpg

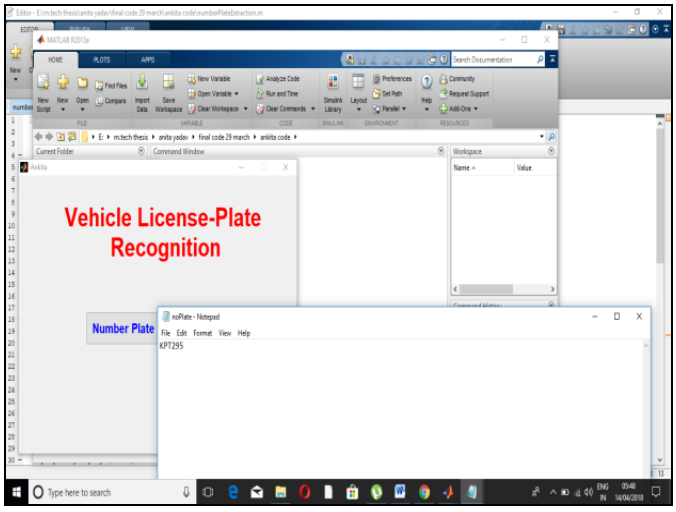

Fig 5: Result with 2.jpg

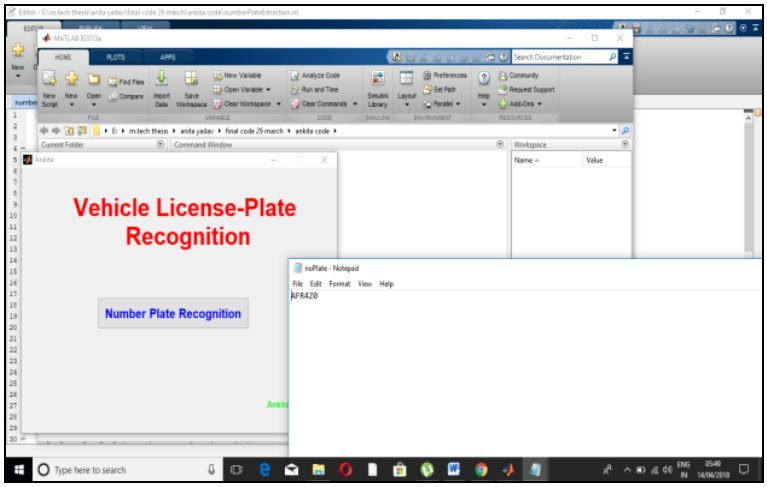

Fig 6: Result with image 3.jpg

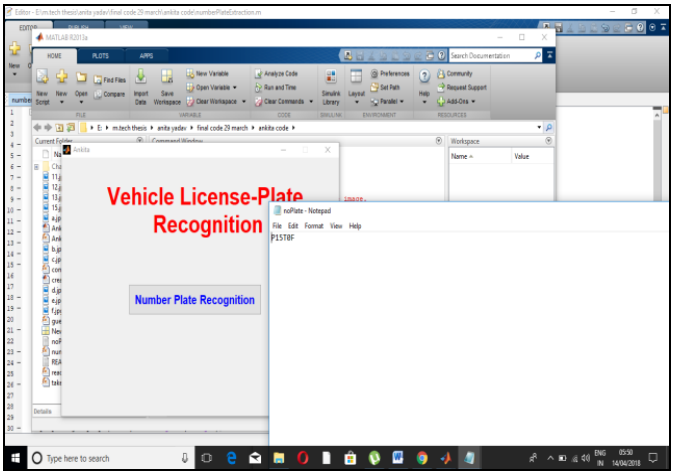

Fig 7: Result with image 4.jpg

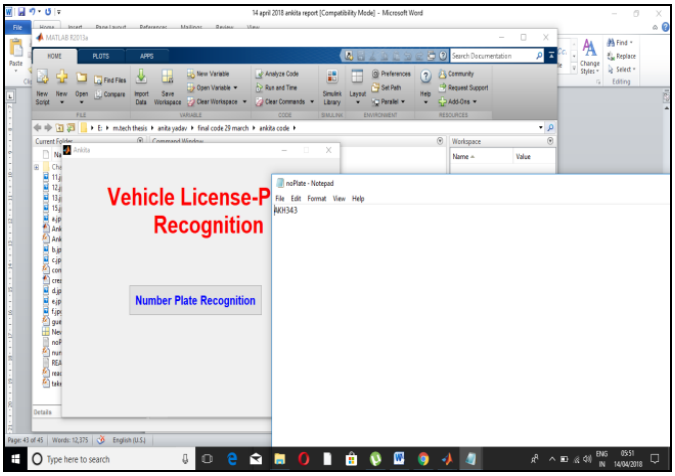

Fig 8: Result with image 5.jpg

The accuracy of recognition

Table 1: Capture Rate for plate Detection

Type of License	Number of image	Correctly Recognized license Plate	Capture rate in %
Standard License Plate	10	10	100
License Plates with good Contrast	10	10	100
License Plates with proper lighting condition	10	10	100
License Plates with low resolution	10	8	80

Comparsion with other Methods

Table 2: Results from character Recognitions

Technique	Method/features	Successes	Accuracy
Template matching	Correction Coefficient	58	72.5%
Template Matching	Pixel Subtraction	44	55%
Neural Network	Pixel Counting	60	75%
Proposed Method (Template Matching)	Convolution Coefficient	10	100%

4. Conclusions

In this thesis, an industrial, robust and reliable ANPR system for high speed applications is proposed. The main benefit of our scheme is its high detection and recognition precisions on dirty plates. To attain reliable assessments, different input image with different resolution and used in this thesis. The accuracies of our system are 100% with some input image quality condition or font size of number plate. In vehicle counting application, the detection rate are 100.We have verified this system one openly available English plate data set

as well and attained an overall accuracy of 100%. The planned system is likened to many reported ANPR systems from different point of views. By seeing the practical aspects, numerous copies of our ANPR scheme have been installed in different connections. These systems have been verified day and night over a year and obtainable robust and reliable performances, in dissimilar weather conditions, such as rainy, snowy, and dusty. The character recognition part of our system has been tested unconnectedly over the mist data set and achieved 100% accuracy, with comparably low computational requirement. The presented methods, algorithms and parameter setting measures, along with our data sets and related assessments, deliver a complete set of solutions to subjects and encounters involved in incorporating ANPR systems in numerous ITS applications.

5. Future Scope

The system works acceptably for wide differences in illumination conditions and dissimilar types of number plates usually found in India. It is certainly a better other to the current manual systems in India.Moreover, we would last the further study for license plate recognition in some complex surroundings, such as vehicles at dark night or in heavy rains and so on. If we could achieve all of the purposes, this application would have a very hopeful future.

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