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Automatic License Plate Recognition

Prasanthi Guntupalli[1], M. Venkata Sravya[2], T. Bala Chandrika[3], K.Vikas[4]

Department of Computer Science and Engineering, Vasireddy Venkatadri Institute of Technology, Nambur, Guntur, Andhra Pradesh, India [1]

Department of Computer Science and Engineering, Vasireddy Venkatadri Institute of Technology, Nambur, Guntur, Andhra Pradesh, India [2]

Department of Computer Science and Engineering, Vasireddy Venkatadri Institute of Technology, Nambur, Guntur, Andhra Pradesh, India [3]

Assistant Professor, Department of Computer Science and Engineering, Vasireddy Venkatadri Institute of Technology, Nambur, Guntur, Andhra Pradesh, India [4]

ABSTRACT: This project "ALPR: Automatic License Plate Recognition: is about a automatic system can do automatic recognition of number plate using the image of vehicle (car). It is very smart & easy to use application. Just upload the image of vehicle (car), it will automatically detect the number plate from the image, after that it will recognize the license plate and give it in text format. It will store it in storage. The overall accuracy and efficiency of whole LPR system depends on number plate extraction phase as character segmentation and character recognition phases are also depend on the output of this phase. Higher be the quality of captured input vehicle image more will be the chances of proper extraction of vehicle number plate area. The approach used to segment the image is bilateral filtering algorithm and canny edge detection algorithm. Then we predict the license plate from processed image using py– tesseract OCR.

Technology is playing a very vital role in changing our life in many ways. There are many sectors which benefited after implementing technology in it. Now it's time for robotics & IOT kind of management system. We have seen in our country, not even in country but in all over world day by day number of cars is increasing. And it's creating traffic & parking management issues. In current scenario, there is no proper facility of parking in our country. People park their car in area which whatever they like. There is no proper management for parking & traffic solutions. So, with this feature of ALPR, we can implement smart traffic & parking management system in future. So, this is the first step to start implementing smartness in traffic and parking.

Keywords: Optical Character Recognition technique, Haar cascading Technique, Binary Thresholding algorithm, Tesseract OCR

I. INTRODUCTION

The main purpose of building this project is to create a smart technology for future. We can see numbers of cars are increasing day by day. It can create issues of accidents, crimes & traffic. Now our plan is that, we need a one smart system which can detect car number plate and recognize the number automatically. So, with this feature we can improve our traffic & parking solutions. Even we can prevent the crime also. It can automate the traffic & parking management in very smarter way. So, in this we are implementing our first step of Number Plate Recognition.

II. ANALYSIS OF CURRENT SITUATION

Technology is playing a very vital role in changing our life in many ways. There are many sectors which benefited after implementing technology in it. Now it's time for robotics & IOT kind of management system. We have seen in our country, not even in country but in all over world day by day number of cars is increasing. And it's creating traffic & parking management issues. In current scenario, there is no properfacility of parking in our country. People park their car in area which whatever they like. There is no proper management for parking & traffic solutions. India having too much population, so that's why number of personal vehicles is increasing. So that's why it's creating issues. Our

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system is the first step to automate the solution for traffic & parking. In our application user can be any security agencies or government. They need to upload the image of car. And they will get license plate image and license plate number as text image as output.

Study of Current System

In the current system, we have implemented Image uploader. You need to upload the image, it will automatically find the number plate from image, and it will automatically recognize the number plate and give it in a text format with cropped number plate image. From the live video, number plate detection work is pending. We are working on it. According to our study in Image detection accuracy is very well but camera position should be proper and camera should be HD (Good quality). Model accuracy will be depending on the image quality.

Problem of Current System

There are many limitations of our system, "A great feature always comes with hidden bugs", that's what I believe. This slogan is also true about our system. First problem of our system is we can't detect multiple
cars number plate. We can only do for one vehicle for now. So, in parking management we can use this feature. But when we are thinking of traffic management system then we need to improve our image accuracy. Another problem is, currently we are working with only images, we have tried on video, but the result was not good that much. So currently we are improving our system with images. These are the problems of our system.

APPROACH

Automatic Number Plate Detection: - After the getting a image of car by system, it will detect the number plate from car automatically, but the condition is that it should a clear means no dust or fancy number plateallowed on the car.

License Plate Recognition using Threshold:

Extraction:- Image conversion is done after apprehending the image into gray scale and then in binary which consists only 1's (white) and 0's (black) on the basis of threshold. Then a threshold of fixed value is applied, such that every edge with magnitude less than that is considered false edge and is set to 0. The sub-image thus obtained determines the exact location of the license plate.

Segmentation: - In this technique the vehicle license plate is segmented to obtain each character individually. Applying certain filters such as Gaussian filter or sobel operator separates characters from each other. Then normalization is applied. This is done to avoid extra whitespace surrounding the character.

Character Recognition: - In order to recognize the detected characters, we'll match each segmented image with a standard character template and accordingly the output will be printed on the notepad.

Image pre-processing:- The poor text segmentation which is a consequence of non-uniform image background can be dealt with. A pre-processing technique called binarization is used to remove the background variations and improve text segmentation. Along with binarization, Morphological reconstruction can also be done to produce a cleaner image for OCR. However, noise issues still persist and some of the discrepancies such as false recognition of letters remain intact. This error in case of two character shaving similar shapes and OCR function becomes inefficient and is unable to determine the best classification for a specific character. So, in order to get rid of such a problem the locateTextmethod, that supports regular expressions so that irrelevant text can be ignored, is used.

Image processing: - Image processing is the main part of this system. We can't feed a direct frame to our system; we need to do some pre-processing on the image. We need to add a filter like Gray Image, Dilate, Erode, and thresholding. But it will do automatically by system.

Automatic Text Recognition from Number Plate: - Yes, we are using Optical Character Recognition technique to detect a registered number of cars from license plate. It is very fast & accurate. It will give you the text output of number plate. We just need to feed the number plate image to OCR. But system will operate this thing automatically.

Haar Cascading Technique: - Haar cascade is a one kind of classifier file (.XML) which contains pixels values of any one object. With this classifier we can track that object from any image/video. We have used open source Haar cascade which is particular for the License Plate Recognition. If we want to train our own haar cascade then we need to have thousands of images of object and negative images which don't contain that object. We can train it using C++. There are also GUIs available for this cascade training. We have passed our Image which is selected by user to Haar cascade. It will crop number plate.

Image Cropping & Adjusting: - Image processing is the main component of our project. After the getting the coordinates of License Plate from the Haar cascade, we will do the cropping of the number plate, now we need to

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process that image of the number plate. There are lots of ready-made filters available in the OpenCV. But our license plate image is in Black & white, so we will increase the threshold value of the image. So, our image will be sharper. So here our Image pre-processing part is done.
Optical Character Recognition: - OCR is known as Optical Character Recognition. It is used to fetch the text from the Image. There are many open source OCR engine is available in the market. But we are using the OCR engine called Tesseract, which is developed by Google. We just need to pass the pre-processed image to our engine. It will give the text of that image. We will get the License Plate Number in the Text format.

II. REVIEW OF LITERATURE

Our existing system has limitation, let see with example, if we have multiple cars in frame so system can be lag and we might get a wrong prediction. I have read some of the researcher papers regarding this. So, I and they use a Deep Learning, OpenCV techniques. Result is also good. We are approaching in different way. First of all we are taking image then using cascading technique we are fetching license plates from image. After that we are applying BGR filters on extracted plate image. After that we have increased the brightness of image. Then we feed image to OCR engine. It extracts the text from image and store the plateand text in storage. The proposed concepts are as follows:

1. A Comparative Study on Thresholding, OCR and Machine Learning Approaches

Problem Addressed: - Their objective is to bring forth a comparison based upon the considerations like average accuracy, precision and recall between algorithms according to threshold values, character recognition. The system thus formulated captures real-time input image. It identifies the license plate from extracted image. The work presented in this paper mainly focuses on classification and recognition of characters using Viola Jones Machine learning algorithm. Since, our existing system has limitation, let see with example, if we have multiple cars in frame so systemcan be lag and we might get a wrong prediction. I have read some of the researcher papers regarding this. So, I and they use a Deep Learning, OpenCV techniques. Result is also good. We are approaching in different way. First of all we are taking image then using cascading technique we are fetching license plates from image. After that we are applying BGR filters on extracted plate image. After that we have increased the brightness of image. Then we feed image to OCR engine. It extracts the text from image and store the plate and text in storage. The proposed concepts are as follows:

Algorithm Used: -Viola Jones object detection algorithm was initially proposed by Paul Viola and Michael Jones in 2001 and improved by Rainer Lien hart in 2002. Usually called Viola-Jones, its original motivation was face detection, but they have trained it to detect different object classes.
Conclusion: - Mahima Satsangi proposed work is license plate recognition using Viola Jones algorithm. They compared the output obtained from this with outputs of threshold and OCR technology. Among the three proficiencies tested, they conclude that the machine learning approach that made use of untrained viola Jones algorithm was the most efficient.

2. Real Time License Plate Detection Using OpenCV and Tesseract

Problem Addressed: -The implementation of image to text conversion. The paper describes various steps required to extract text from any image file (jpeg/png) and creates a separate text file consisting of information extracted from image file. It considers the shortcomings of various image processing applications available and works on overcoming them by employing variable level of image processing and filtration. The CV2 OpenCV library using Python language is used for image processing and Tessaract is used for text extraction from the processed image.
Algorithm Used: -A few images of license plates were taken for processing. The images were in different states in terms of quality. Processing of these images by a single common code would not yield equal results. Therefore, a common code with various stages of processing was decided upon, with output of each stage fed to the Tesseract OCR. The best output from the OCR would be taken as the converted text value.

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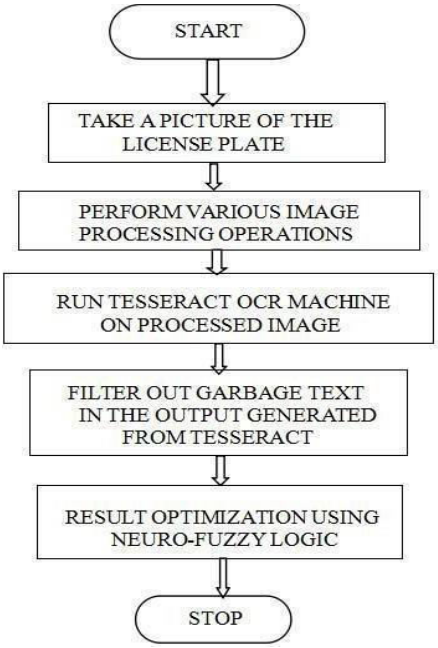

Conclusion: - Rahul first applied image processing algorithms to images and then those images were used in Tesseract software to obtain the text from the images. Different images have different text styles, length, width and font, so different images require different levels of digital image processing techniques. For this reason rahul have obtained image results after every level of processing i.e. thresholding, Gaussian blur, dilation and erosion. Out of these image results for a single image the best suited image is then applied to Tesseract for obtaining the text from an image. Therefore after digitally processing an image rahul have achieved better and near to perfection outputs.

3. Iraqi Car License Plate Recognition Using OCR

Problem Addressed: - An automatic license plate recognition system for the three different Iraqi car licenseplates was proposed in this paper. Differentiating between the three styles were done depending on the plate size. An optical character recognition (OCR) is used with correlation approach and templates matching for plate recognition by segmenting each number, character and word into sub images. The software used is MATLAB R2014a. The algorithm is successfully constructed with sample of images correctly identified.

Algorithm Used: -LPR SYSTEM ALGORITHM

The steps of the proposed system are summarized in the following points shown below:

1. The first step in the system is the car image acquisition.
2. Locating the LP from the car image using intensity detection and mathematical morphologicaloperations.
3. Distinguishing between the three styles of Iraqi LP based on the size of the plate.
4. Converting the LP image to binaryusing Otsu's thresholding.
5. Image preprocessing including (image dilation and clean up (removing unwanted pixels)).
6. Resizing the LP for correct dividing.
7. Dividing the LP into parts (number, province, letter and type).
8. The final step is the recognition byusing Optical Character Recognition (OCR).

Conclusion: - In this paper, Safaa designed the application software for the recognition of car license plate.Firstly Safaa extracted the plate location, and then separate the plate characters individually by segmentation and finally applying template matching with the use of correlation for recognition of plate characters. This system is designed for the identification for Iraqi license plates and the system is tested over a 40 images. Finally it is shown that 87.5% for extraction of plate region and 85.7% for the recognition unit accurate, giving the overall systemperformance of86.6% recognition rate.

4. Automatic Number Plate Recognition for Motorcyclists Riding Without Helmet

Problem Addressed: - Kulkarni proposed system first does background subtraction from video to get moving objects. Then, moving objects are classified as motorcyclist or non motorcyclist. For classified motorcyclist, head portion is located and it is classified as helmet or non-helmet. Finally, for identified motorcyclist without helmet, number plate of motorcycle is detected

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and the characters on it are extracted. Kulkarni proposed system uses Convolutional Neural Networks trained using transfer learning on top of pre-trained model for classification which has helped in achieving greater accuracy. Experimental results on traffic videos show an accuracy of 98.72% on detection of motorcyclists without helmet.
Algorithm Used: - Implementation of system for this problem statement is done using CNN classifiers. One CNN classifier is used to classify between motorcyclist and non-motorcyclist and another CNN classifier is used to classify between helmet and non-helmet.
Conclusion: - In the paper, Kulkarni have described a framework for automatic detection of motorcycle riders without helmet from CCTV video and automatic retrieval of vehicle license number plate for such motorcyclists. The use of Convolutional Neural Networks (CNNs) and transfer learning has helped in achieving good accuracy for detection of motorcyclists not wearing helmets. The accuracy obtained was 98.72%. But, only detection of such motorcyclists is not sufficient for taking action against them. So, the system also recognizes the number plates of their motorcycles and stores them. The stored number plates can be then used by Transport Office to get information about the motorcyclists from their database of licensed vehicles. Concerned motorcyclists can then be penalized for breach of law.

5. Real Time Indian License Plate Detection using Deep Neural Networks and Optical Character Recognition using LSTM Tesseract
Problem Addressed: - The goal of this paper is to design a robust technique for License Plate Detection (LPD) in the images using deep neural networks, Pre-process the detected license plates and perform License Plate Recognition (LPR) using LSTM Tesseract OCR Engine.
Algorithm Used: -Jaskirat and Bharath Proposed a process of ANPR consists of three important steps explored in the subsections below.

1. License plate Detection (LPD)

2. Pre Processing RGB to GrayScale Conversion Gaussian Blurring Binarization

3. License Plate Segmentation (LPS) and Optical Character Recognition (OCR) using LSTM Tesseract

Conclusion: - In this research paper Bharath proposed an expert ANPR AI system for Indian LPs using DL methodology, Image Preprocessing techniques and OCR. Faster RCNN Inception V2Coco Model was used for detection of LPs and Tesseract LSTM RNN OCR Engine was used for segmentation and recognizing text within a cropped LP. Bharath's methodology shows superiority in both accuracy and performance in comparison with traditional NPRS methods which usually requires a high-resolution camera to capture high quality images and an expensive computer to process the complex algorithms for recognition of NP.

III. PROPOSED SOLUTION

This system accepts the image as an input and extracts the number plate from the whole image. By using image processing, Tesseract OCR and GUI development using tinker. Our aim is to detect and extract the number plate from an image and the extracted number plate with high accuracy. For making this model we followed the below process and steps.

PROCESS

Image processing is the main part of this system. We can't feed a direct frame to our system. So, we need to do some pre-processing on the image. We use some pre-processing techniques like Gray Image, Dilate,
Erode and Thresholding. Thresholding is a type of image segmentation where we can change the pixels of an image to make the image easier to analyze.
We use binary Threshold algorithm in this project which converts an image into digital form. To convert it there is need of image processing. By using this method we get an enhancement image by extracting someuseful information from the image. This entire process is like signal dispensation in which input is image, like a video frame or photograph and output may be image or characteristics associated with that image.

STEPS TO OBTAIN LICENSE PLATE FROM AN IMAGE:

By using the Binary Threshold Algorithm, we convert an input image into a binary image in two phases.

Conversion of RGB to GRAY. Conversionof GrayScale to BINARY.
Steps to retrieve the number plate:

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1. Conversion of an image into a Binary Image

The first step is to convert an input image into gray image because gray image helps us to identifyimportant edges (i.e., step change in the pixel values and some other features).
The value of each pixel is a single sample representing only an amount of light, that is, it carries only intensity information in digital photography, and colorimeter a gray scale or gray scale image.
This gray scale image contains wider range of values ranging from 0 to 255. So in order to overcome that,this gray scale image is further converted into binary image which has only values 0 and 1.
G(x, y) = 1 if f(x, y) > T

0 if f(x, y) <= T

The cvtColor() function of a OpenCV computer vision library allows to convert image from color space into another. Converting to binary is used to find the region of interest in our image. Here our region of interest is only the license plate of the vehicle. Thresholding technique is used to binarize the image.
Enlarging the boundaries of regions of foreground pixels (i.e., white pixels, typically) will be done by this dilation operator. While holes with in those regions become smaller than the areas of foreground pixelsgrow in size. Erosion is much similar to dilation. The difference is that the pixel value calculated minimumrather than the maximum in dilation. While it decreases in white shade or brighter side.

4.1 Dilated Image

2. Detecting plate from an image

Haar cascading technique is a machine learning object detection algorithms. Haar cascade is a one kind of classifier file (.XML) which contains pixels values of any one object. With this classifier we can track that object from any image. We have used open source Haar cascade which is particular for the License Plate Recognition. We have to pass our Image which is selected by user to Haar cascade. It will recognize and crops number plate by using the value of pixels.
The main goal of Haar cascading technique is to detect Plate from Car image.

4.2 Cropped Image

3. Character Segmentation

The next step is to recognize, extract and display the detected car plate number. Character segmentation is a difficult step of OCR systems as it extracts meaningful regions for analysis. This step decomposes the images into classifiable units called character.
A poor segmentation process leads to incorrect recognition or rejection segmentation process carried after out only after the pre-processing of the image accurately.

4.3 Text Recognition

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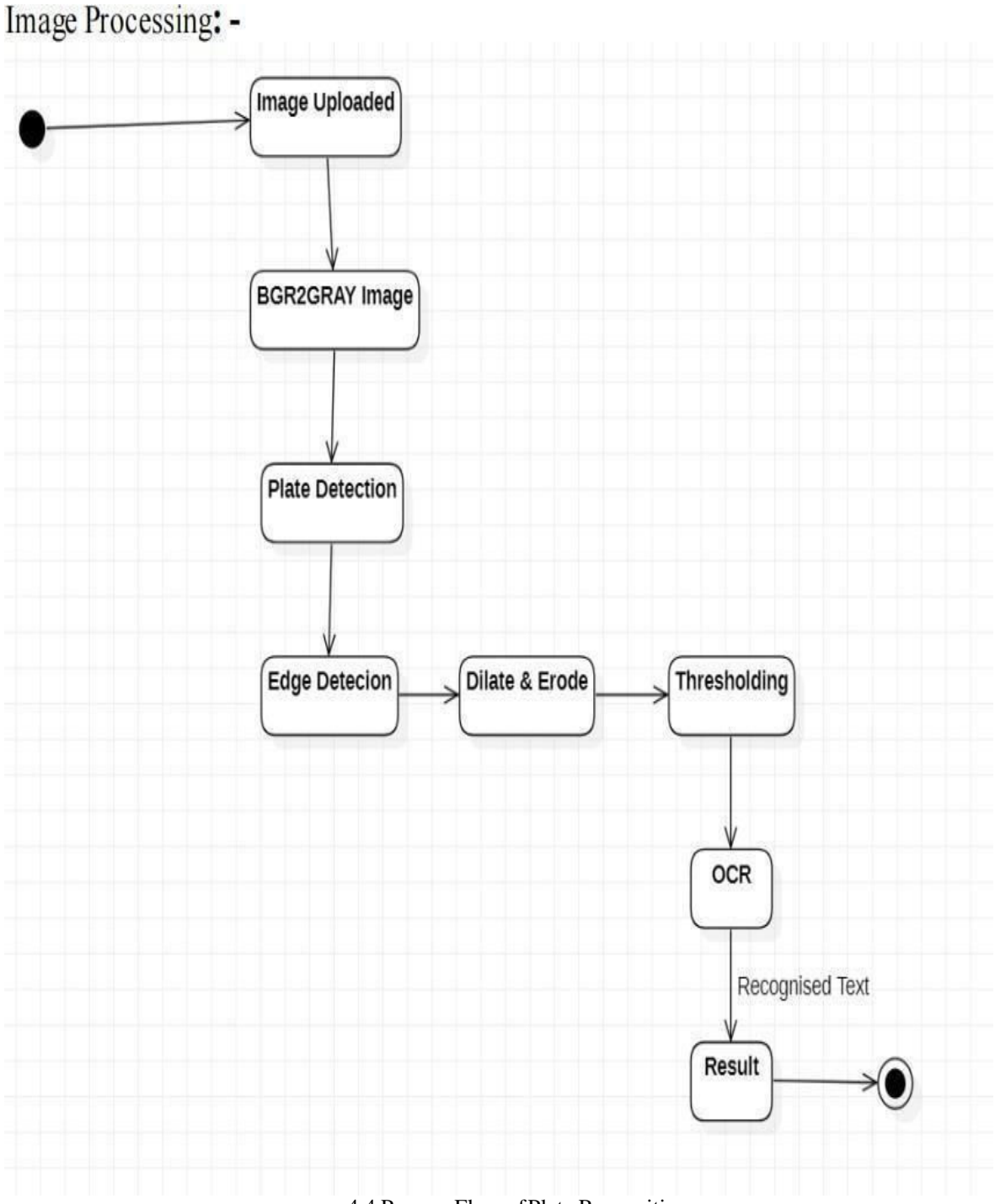

4.4 Process Flow of Plate Recognition

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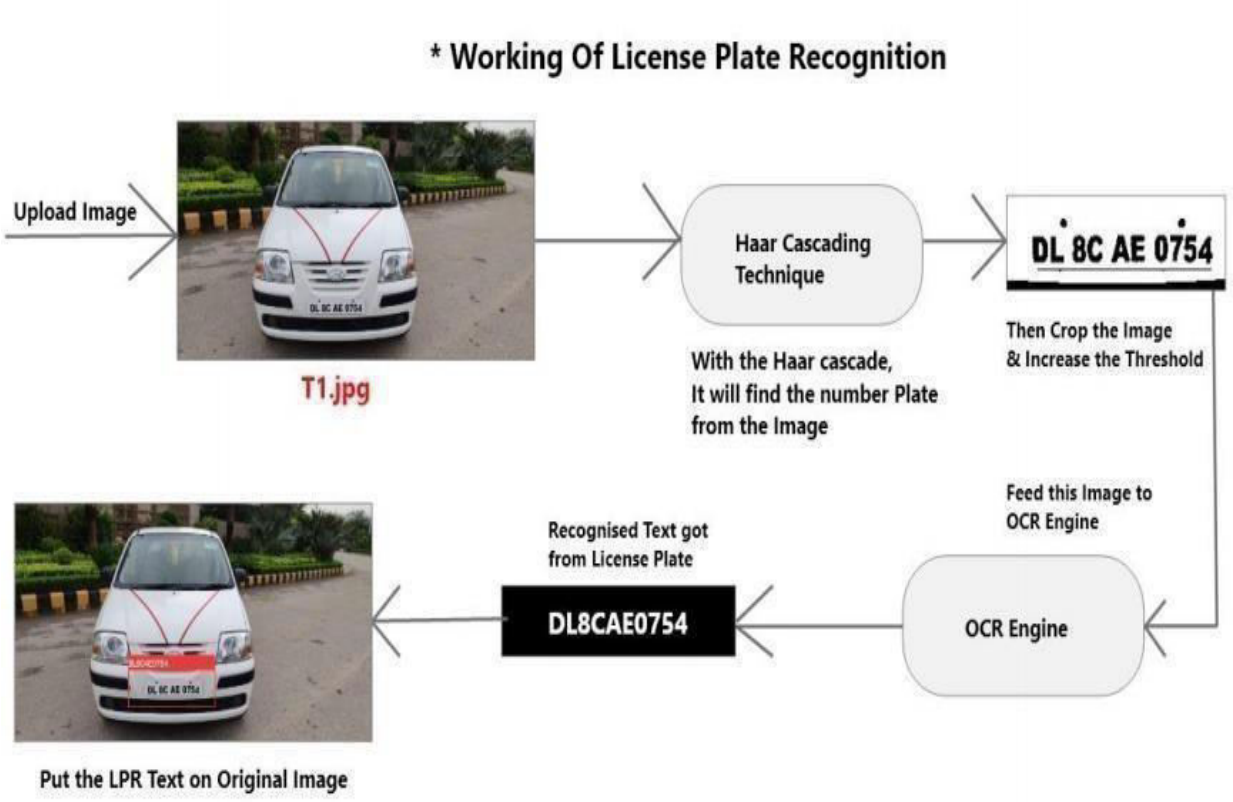

4.5 Working of License Plate Recognition

IV. RESULTS

The input image is processed by using the binary Thresholding algorithm and the morphological image processing techniques, haar cascading techniques and obtains a cropped number plate with increase in the threshold value and the image will be feeded into the OCR engin the image.

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5.1 Image Capture

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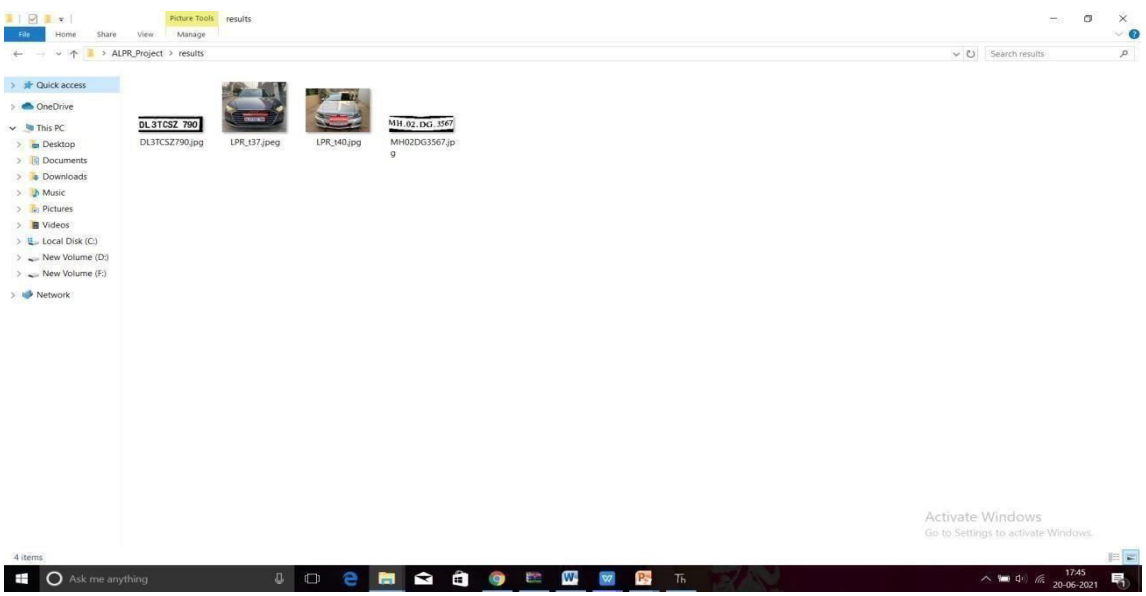
5.2 License Plate Recognition

On running the code the first step is to upload the image by clicking on the upload image button and it enables us to upload the image from our system. And on by clicking the detect License plate button it results the predicted plate. On by clicking the save image button, the resulted number plate image is stored in the results folder along with the car image.



5.3 Results

VI. CONCLUSION AND FUTURE SCOPE

In this real time number plate detection was proposed based upon the noises and algorithms. In this project, the input image is an RGB image of a vehicle number plate captured by a digital camera is being processed and segmented into characters. Due to this process vehicle number plate detection is more accurate. This system use image processing techniques for recognition of the vehicle from the database stored in the computer. The accuracy of extracting the number plate for low quiet mood can be increased, as well as we can detect the number plate that has different font size and also different font type. The future scope is to increase the robustness and accuracy of images taken by non high-resolution cameras.

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