LICENSE PLATE DETECTION AND LANE DETECTION SYSTEM

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ABSTRACT

The process of identifying the number from the license plate of any vehicle is the task of detecting license plates and the process of ensuring that a specific vehicle is moving in its own lane is lane detection. It is one of the most current issues at hand. It consists of four basic steps for identifying the number plate: obtain or capture the image[7] from camera or through a video source, some pre-processing tasks, number plate detection, effective character segmentation and efficient character recognition. Lane detection systems work on the priority basis as the fundamental and foremost aim of these systems is to avoid accidents and promote safety. Such systems are intended to detect the lanes by recognizing marked lines and generate warning to alert the driver if the vehicle deviates from the respective lane. The flow diagram in brief is given in Figure 1. Due to rapid use of advanced technology and easy access to resources, there has been a tremendous increase in the number of vehicles and therefore the need has been felt to detect the license plates of the vehicles which can further be used in a variety of applications that can add to national throughput of the country, for ex- monitoring road traffic, automated tolling applications, determine parking lot time, stolen vehicle detection, etc.

Keyword: - *LICENSE PLATE DETECTION, LANE DETECTION, REGION OF INTEREST (ROI), CHARACTER RECOGNITION.*

1. INTRODUCTION:

Each License plate or a vehicle number plate has a unique number assigned to it for vehicle identification. Its identification and character recognition can be fulfilled by the implementation of certain set steps or we can call it algorithms. For the purpose of detecting license plates several techniques can be implemented to attain practical and sustainable results. The techniques are as follows:

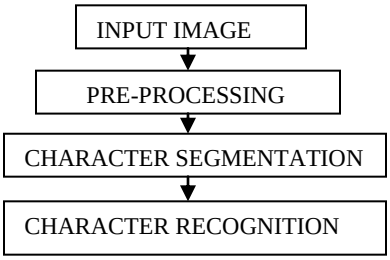

Fig. 1: Flow Diagram

1.1 EDGE DETECTION AND CONTOUR DETERMINATION:

Edge detection and contour determination is the first step to move forward. There should be a sharp focus upon recognizing right characters otherwise erroneous results may crawl, which will lead to inefficient end results. The input is fed in the form of properly demarcated region of the license plate often referred as the region of interest. Preprocessing tasks are necessary in order to eradicate the existing noise in the images. These can include morphological operations which when applied to the images; they result in the properly segmented output which is fed for character recognition facilitated by detecting contours. While detecting contours,[1] if the contour being checked looks like a character it is added to the list otherwise it is discarded.

Later to provide certain standard dimensions to the region, a "region of interest" is constructed around these contours. This technique involves gathering frames from a video and then working upon the segregated frames to obtain the desired output. The series of steps primarily include the pre- processing tasks. The flow chart of this process is given in Figure 2.This is then cropped and used for OCR (optical character recognition)[1]. This is given a workable shape using two functions: first the cleaning part which implies calculating edges using canny and then detecting lines using HoughDetect. Character recognition can be done using machine learning using python.
The entire project had seen an effective use of various python packages without which the entire system wouldn't have been possible.
There are few packages that have been of immense help and are installed using pip command such as requests, moviepy for demarcating lane lines in the video, flask, cv2, numpy, matplotlib, pandas, and keras etc.

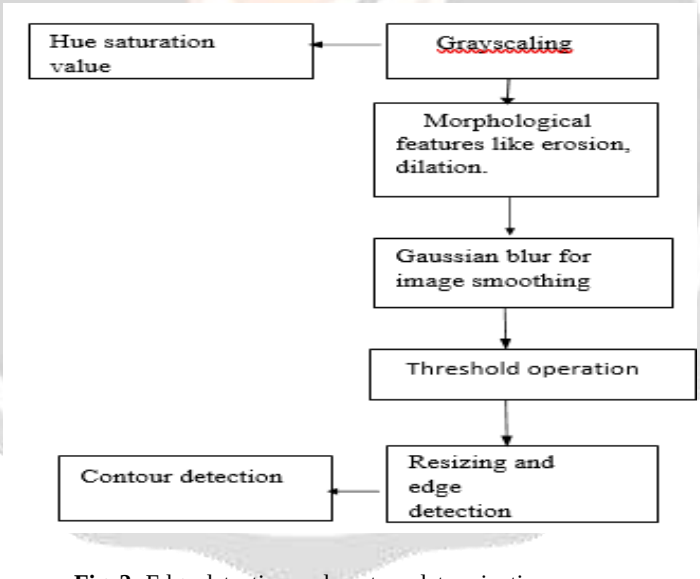

Fig. 2: Edge detection and contour determination

1.2 LICENSE PLATE DETECTION USING ALGORITHM FOR "K NEAREST NEIGHBOUR" (KNN):

This will detect license plate using KNN methodology after creating training data and later testing the accuracy. The steps begin with the training process; labeling application can be used for collecting the cropped images. Next is the process of segmentation and then comes the turn of extracting features and ultimately the outcome of training is stored in the form of saved features. KNN[2] has several advantages such as simplicity in structure, robustness and effective training parameters. KNN eases the complex nature of network models and also the efficiency of classification is increased.
Steps to apply KNN on the data:
(a) Load the data

(b) Initialize the value of k
(c) For getting the predicted class, iterate from 1 to total number of training data points

1. Calculating the distance(Euclidean, etc) between test data and training data. Here we will use Euclidean distance as our distance metric since it's the most popular method.
2. Sort the results obtained in ascending order based on distance values.
3. Select top k rows from the sorted list.
4. Choose the class that occurs most of the times.
5. Return the predicted class.

Process of using KNN (Fig. 3):

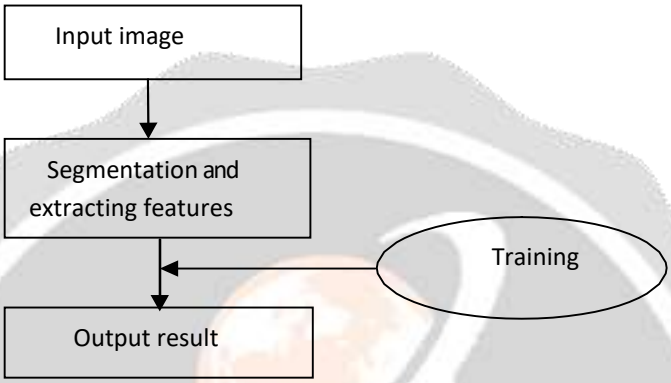

Fig. 3: Use of KNN

1.3 THEFT DETECTION:

There are multiple data records that can be obtained from authentic government sources regarding vehicle registration, theft etc. Thus, such a system assures transparency and authenticity in results. Here, we have tried to match up the license number obtained from the number plate and to further check this vehicle registration number with the police records. This will skim out the results if the vehicle is under seize or is stolen. The process of vehicle theft tracking is demonstrated with the help of diagrammatic flow chart below:

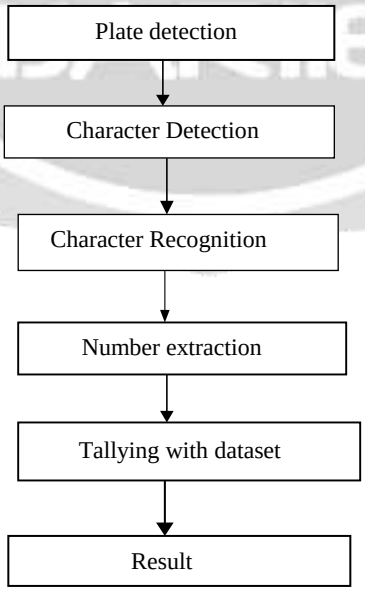

Fig. 4: Theft detection

Fig. 5: License plate detected

2. LANE DETECTION:

In this approach, the work flow starts by simple video as input data and process it to find the lines of the lane which in turn detects the lane within which the vehicle is moving. Then finding an exemplary line representative for both the left and right lane lines and rendering these representations back out to the video. This approach will be heavily based on details about how to use the libraries available in the Python computer vision[8] ecosystem to solve this problem. The process of Lane detection starts with the single image taken from the video, after all the video is a collection of frames of images then we move on to implement the methodology on multiple frames in a sequential manner (frame-by-frame). As a final solution to the original problem of processing, an entire input sequence (video) for lane detection. The lane markers is clear to any human observer. We process the image intuitively, humans are blessed with the sight that can identify multiple objects simultaneously without doing any specific efforts such as the other vehicles, some road signs alongside the road, and even the mountains, the rivers, trees, animals and other things visible on the horizon.[4] While many of these objects are complex in visual interpretation and inference, it could be said that the lane markers are actually some of the primitive structures possible in the image[10].

2.1 REGION OF INTEREST:

First, define a set of points which describe the region of interest .In computer graphics the point origin (0,0) can be assumed in the upper left corner coordinates of the image. This is not easy to accept. Universally as the rules for general mathematics tend to deviate here, in case of general mathematics the coordinates are assumed in such a way where the origin is at the bottom left corner. Figure 5 shows the region of interest. Region of interest is that fully contains the lane lines. Now the question arises what can be a fulfilling shape that can simplify the process. The answer is triangle that begins at the bottom left, reaches till the center and then from there follows to the bottom right corner and It can also be done by using the distortion of the 3D images into 2D.

Fig. 6 : Region of interest

3. CONCEPT OF LANE DETECTION:

We have to follow the certain steps in series to detect the lane of the road. These steps are given below in the form of sub headings.

3.1 EDGE DETECTION:

Edge detection comes up with detecting contours that occur due to difference in intensity levels. There are various techniques involved in edge detection such as canny edge detection, sobel edge detection and there are other image processing techniques that can help in achieving the desired region of interest. A digital image in concise is stored and represented by a matrix that stores the RGB or BGR or HSV(whichever color region the image pixel belongs to) value of each pixel in rows and columns. The derivative function of this stored matrix is calculated by the operator called as Laplacian[6]. In order to calculate this, we will need to calculate the result of first two derivative functions, which are called as derivatives of Sobel, each of which takes as an input the values of gradient changes or variations in a specific direction or angle such that one can be horizontal and the other can be vertical.

- Sobel derivative in horizontal directi on (Sobel x): It is obtained after the convolution of the image with a matrix called kernel which has always odd size. The kernel with size 3 is the simplest case.
- Vertical derivative of sobel (Sobel y): It is obtained after the convolution of the image with a matrix called kernel which has always odd size. The kernel with size 3 is the simplest case.
- Image is the actual matrix of pixel values and filter is the kernel which is superimposed over the image.

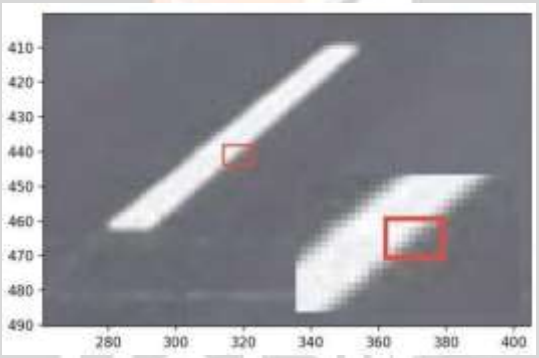

Fig. 7: Detecting edge of the lane**.**

Fig. 8: Applying Gradient functions

3.2 LINE GENERATION:

Now, determining a region that appears to be a line, and notice that the edge pixels have something in common. We can assume all possible lines that may pass through each pixel, but the points share only a few specific lines in common. These common lines can be understand as the alternatives or preliminaries for the actual line.

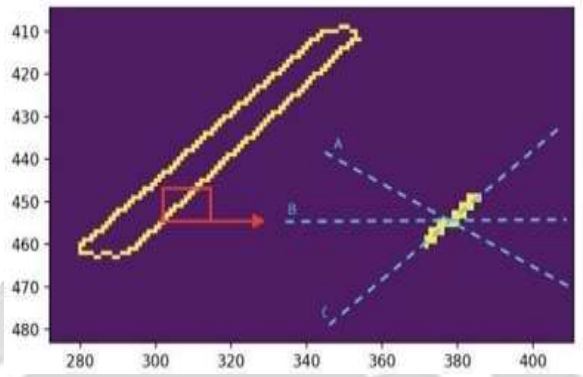

Fig. 9: Generating lines from the lane

Hough Transform is the technique to find out lines by identifying all points on the line. This is done by representing a line as point. And points are represented as lines/sinusoidal. Problem of line generation can be solved by Hough Transform. Using the concept of Hough Transform, transform all pixels of the edges into a different form that can be comprehended mathematically.[5] Once the process of transformation is culminated, each pixel of the edge in "Image-Space" will have transformed into a curve or line in "Hough-Space".

3.3 RENDERING OF LANE LINES:

The last thing to be done with line detection is rendering the lines that were detected back onto the image itself, to give a sense of the reality in the scene which is being focused upon and creating the left and the right lanes by determining which lines are in the left group, and which are in the right group[8],

The slope of any line measures the angle of that line with a reference of horizontal line having some slope as they are angled from the bottom of the image towards the center at the horizon (Fig. 8). In the above images, all the markings on the left have slopes with negative values which means that the lines travel in upward direction towards the horizon as one sees from left to right along the lines[7]. On the other side, all the markings on the right have slopes with positive values which travel downwards towards the image's bottom. This will be the point of distinction and use to group the right and left lines and this can also be done by Histogram to identify potential right and left lanes marking and then applying the whole procedure on the whole video and by using the coordinates of lines integrate an alert system for the alertness of the drive[10].

Fig. 10 : Lane Detected

4. CONCLUSIONS AND FUTURE WORKS

The license plate detection system developed investigates the possibility of automating the whole process of license plate recognition for a wide range of environments. Given an input image, the system extract extracts the license plate, isolates the characters, and finally identify the characters.
The paper presents a lane detection system using computer vision based technology that can efficiently detect the lanes on the road. Different techniques like thresholding, grayscaling , perspective transform are fused together to complete the task.

There are possibilities that new technologies that are in processing nowadays can give more efficient results in future.

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BIOGRAPHIES

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