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Traffic Sign Detection System

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***Abstract*: In today's world with the increasing number of vehicle day by day it's not possible to manually keep a record of the entire vehicle. With the development of this system it becomes easy to keep a record and use it whenever required. In this project a system for off-line traffic sign and license plate detection is shown. MATLAB image-processing toolbox is used for this purpose. The vision-based traffic sign detection module developed in this work manages colour images in RGB (Red, Green, and Blue) format. First step in which we use recursive method to detect the image, second step we use recursive function to recognize the image and at third step it will indicate the sign to driver. It is usually tackled in three stages: detection, recognition and tracking, and evaluated as a whole. The three tested algorithms: Contour Fitting, Single Pixel Voting, and pair-wise voting scheme, all use colour and edge information and are based on geometrical models of road signs. To progress towards better algorithms, we focus on the first stage of the process, namely road sign detection. In Traffic surveillance, tracking of the number plate from the vehicle is an important task, which demands intelligent solution. In this document, extraction and Recognition of number plate from vehicles image has been done using Matlab. It is assumed that images of the vehicle have been captured from Digital Camera. Alphanumeric Characters on plate has been Extracted and recognized using template images of alphanumeric characters. This paper presents a new algorithm in MATLAB which has been used to extract the number plate from the vehicle in various luminance conditions. Extracted image of the number plate can be seen in a text file for verification purpose. Number plate identification is helpful in finding stolen cars, car parking management system and identification of vehicle in traffic. The main objective of this paper is to develop an algorithm so that we can automatically recognize traffic signsand the number plate in digital images. This work uses basic image processing technique for automatically recognizing two different traffic signs-stop sign and yield sign in an image. The proposed method detects the location of the sign in the image, based on its geometrical characteristics and recognizes it using colour information. The image is first threshold on RGB domain to separate out the regions with red colour, which is those traffic signs usually have, then we do region mapping due to which the rest of the parts which are too small or too large are removed since they are unlikely to be a traffic sign. Here we get the signs whose shapes are octagon or triangular thus major axis to minor axis ratio is one. Hence the regions which are very large are eliminated**

***Keywords*: Traffic sign detection, Traffic sign recognition, Color-based description, Shape-based description Uncontrolled, Environments, Multi-class classification**

1. Introduction

The number of vehicle is increasing in today's world it's not possible to manually keep a record of the entire vehicle. There need to be a man standing 24*7 to note down the number. It's a time consuming process and require manpower. Furthermore, the data stored manually is not readable after a long time. So to overcome all these limitations here we tried to develop a system which would automatically detect the number plate and store it in its database. Later on when the information is required one can get it and use it. This process also helps to get the correct result compared to manually one. The process of working involves that as soon as the vehicle enters the secured area the system automatically captures the images and stores it. The processing of the image is done through the software stored in the system. If the vehicle matches the already stored information then it's allowed to pass the gate. And if the vehicle is not recognized or if it's marked in the blocked list then it's not allowed to cross the gate and further checking process are followed.

More than 50 million new vehicles are manufactured each year [Plunkett Research, Ltd., 2009]. Advanced onboard sensors, such as sonar, radar, and cameras, is becoming commonplace as part of commercial driver-assistance systems. With power steering, power brakes, standardized feedback from the CAN bus, cars are basically robots – they only need a brain. A key component of these augmented vehicles is the perception system, which allows the vehicle to perceive and interpret its surroundings. Humans have engineered the driving problem to make it easier. For example, lanes are delineated by lines painted on the road, traffic lights indicate precedence at intersections, brake lights show when other vehicles are decelerating, and turn signals indicate the driver's intentions; all these cues are intended to simplify the perception task. Perception systems can use these driving aids, but in many cases they are able to use alternative sensing modalities, such as radar or lieder, instead of vision. In addition to these other sensing modalities, vehicles can often leverage prior maps to simplify online perception. Using a prior map that includes stop signs, speed limits, lanes, etc., a vehicle can largely simplify its onboard perception requirements to the problem of estimating its position with respect to the map (localization), and dealing with dynamic obstacles, such as other vehicles. In this paper, we used a localization system that provides robust onboard localization accuracy of <15 cm, and focus on the problem of perceiving traffic lights. Traffic lights are a special perception problem. Efforts have been made to broadcast traffic light state over radio [Audi MediaInfo, 2008], [Huang and Miller, 2003],

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but this requires a significant investment in infrastructure. A prior map can be used to indicate when and where a vehicle should be able to see a traffic light, but vision is the only. General traffic light types that are detected by our system.

A. Proposed solutions

The main purpose of this project is to detect a license plate from an image provided by a camera. An efficient algorithm is developed to detect a license plate in various luminance conditions. This algorithm extracts the license plate data from an image and provides it as an input to the stage of Car License Plate Recognition. This algorithm is downloaded onto Texas Instrument's TMS320DM6437 digital video development platform. The image of a vehicle is given as an input from the camera. Extracted image of the number plate can be seen on television for verification purpose.

Proposed system detects and recognizes both the traffic light and traffic sign board. The proposed system consists of two stages: candidate extraction stage and the recognition stage. The detection stage identifies the region of interest and mostly performed by using colour segmentation which is followed by shape recognition. Detected candidate are either identified or rejected during recognition stage using template matching. General traffic light detection method mainly focuses on locating the traffic lights in each frame and understanding their control semantics. It mainly aims to determine location of traffic light in each frame and later recognize them as different light types. The colour of the emitting units will vary under dynamic light condition with video cameras.

2. Hardware requirement

A. RAM 512 MB

- Sensor
- Camera

B. Software requirement: Matlab

1) Description

Developments in computer and information technologies have led to great progress in traffic sign identification technologies. Existing methods generally pre-process relevant videos or images, and then segment the figure according to colours or shapes to produce the final extraction. In this system traffic sign are detected and name of the sign will be displayed as output. Here we implemented image processing steps to detect traffic sign. In this project we use recursive function and recursive method instead of algorithm.

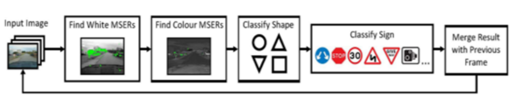

Fig. 1. Process

C. Modules

- To Detect Image: In this we use the recursive method. In which shape of the sign board is Detect using this formula. a(n)=a(n-1)+2
- To Recognize Image: In this we use recursive function. In which it recognize the image i.e. Capturing the image from that sign board using this function.
```
void A()
{
A();
return;
}
```
- To Indicate the Image: In this we use mathematical expression to indicate the sign.

Throughout this section paper explains the steps that are carried out for the detection and recognition process of the proposed system.

1) Image acquisition

The first step is collection of images of traffic signs, data. The collection and storing of images are referred to as image acquisition. The real time traffic lights and road sign board images are used as data. Data's that are freely available from an online are not used. These images are collected at an average speed of 20 frames per second from high speed vehicles under different illumination conditions. Captured image in RGB form is converted to grey scale image. Grey scale images measures light intensity. Since each colour image has several intensity levels detection process will be complex. Hence the input images are converted to grey scale format.

2) RGB to grey conversion

Grey scale images contain brightness information. Each pixel value corresponds to amount of light. Each pixel is represented by a byte or word. An 8 bit image have a brightness variation from 0 to 255 and 0 represents black and 1 represents white. This conversion makes calculations performed in every image simpler, it reduce complexity in performing mathematical operations in the image.

3) Image enhancement

In order to extract every detail in the given image it needed to be enhanced. It improves the quality of information in every image which provided better quality to the image and can be used for many applications. Enhancement process is manly carried byeither suppressing the noise or by increasing the image contrast. Enhancement algorithms are used to sharpen or smoothen image features for analysing. Median filter is employed in the proposed system. Each output pixel contains median value in MxN neighbourhood around the corresponding pixel in the input image. It pads the image with zeros on the edges, so the median value of points is within [MN]/2.

4) Thresholding

The enhanced image is then converted to binary image by thresholding. The process is completed by grouping pixels with same intensities. The threshold value of output image is chosen as 0.1 by trial and error method. The input image with luminance greater than the level of 0.1 is treated as 1 and below

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0.1 is treated as 0. That is now the image has been converted to binary image, pixels with combination 0 and 1. This converted image is then made set for morphological operations to extract the required area of interest. Here shapes based detection is carried out to find whether the received image by the camera is traffic light or traffic sign board.

5) Edge Detection

Required shape features are extracted by morphological operations. The proposed system detects whether the captured image is traffic light or sign by considering the shape. The captured image is checked for circular shape of required area and if system recognizes the circular region of interest of specified size, the image is recognized as traffic light else image is detected as traffic sign board. So in order to detect required shapes a flat shaped structuring element with specified radius R is created. For application purposes R is chose as 5. Image dilation operations are also used for gray scale, binary or packed binary image returning the dilated image. Function is used to extract structural element, object or array of structuring elements are returned. In order to extract element details image should be flat as possible. So to attain that, required area is removed from binary image. All connected components that are fewer than 300 pixels produce another image, by area opening.

6) Morphological Operation and Recognition

Morphological operations capture the essence of the features such as shape in an image. These operations remove unwanted pixels and highlight the required operations of the image. Every image has a background information as well as region of interest. These morphological operations are used to extract the required region.

D. Flowchart

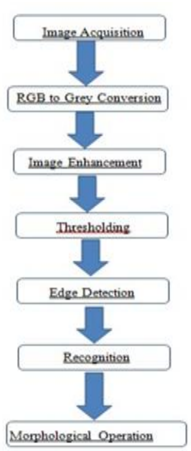

Fig. 2. Flow chart

Methodology is shown in flowchart. Step by step process is followed for pre-processing of image. MATLAB provides all image processing function and toolbox. MATLAB have large library functions and set of tools. Main features of MATLAB are following:

- It provides advanced algorithm for high numerical computation.
- Ability to define user define unction's and large collection of mathematical functions.
- For plotting and displaying data, two and three dimensional graphics are supported.
- Online help is present which is very much helpful for new user.
- Powerful, effective and efficient matrix and vector oriented high level programming language is provided by MATLAB.
- Several toolboxes are providing for solving domain specific problems. Some of toolboxes are Image processing toolbox. Fuzzy logic, Digital signal processing toolbox, neural network toolbox etc.

Step 1: Image Acquisition: In this step image is captured from digital camera. Image should be taken from fixed angle parallel to horizon. Vehicle should be stationary. Input image is shown in figure.

Step 2: Convert into Grey image: This algorithm works on Grey level image, for pre- processing and identifying the required information. In this step coloured image is converted into the Grey scale image. Grey scale image is shown in figure.

Step 3: Dilation of an Image: In this step, image has been dilated. Dilation is a process for filling holes in an image, sharpen edges of an object maximize brightness and connect the broken lines. Dilation can remove unwanted noise from image. Dilated image is shown in figure.

Step 4: Horizontal & Vertical edge processing: Horizontal and Vertical histogram denotes the column wise and row wise histograms. These histograms represent the row wise and

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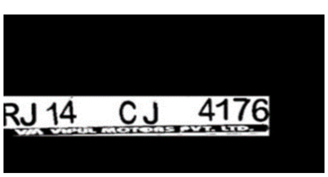
column wise sum of difference of Grey scale values among neighbouring pixel values. Firstly, horizontal histogram is calculated by traversing each column then vertical histogram is calculated by traversing each row.

Step 5: Passing histograms through low pass filter: Histogram values are passed through low pass filter because values of histogram between consecutive row and column changes drastically, to minimize loss of information smooth out changes. In this step histogram value is averaged out among both sides. This step is performed for both horizontal and vertical histograms. Filtering removes all the unwanted regions of an image.

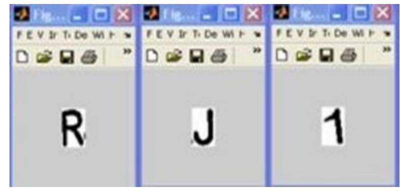
Step 6: Segmentation of Region of Interest: Image has been segmented. In this step all the regions which have probability of license plate has been identified and coordinates of such probable region has been stored. The following figure shows the segmented region. The segmented regions are shown in figure.

Step 7: Extraction of region of interest: From above segmented image, region with maximum histogram value is taken as the most probable region for number plate. Among all the regions, the region with highest horizontal and vertical histogram value is identified. This region is considered as highest possibility of containing number plate and is extracted shown in figure.

Step 8: Convert into Binary Image: Image is converted into binary image from Grey scale. Intensity change value is calculated easily as compared to Grey scale and colour image. Binary image is shown in figure.

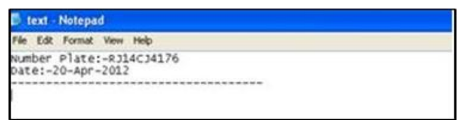


Step 9: Segmentation of alphanumeric character: Individual alphanumeric characters are segmented. Segmentation has been done by using smearing algorithms in both horizontal and vertical histogram. For filling space of inner part of each character the vertical smearing algorithm is applied and some threshold value is determined. Similarly, horizontal smearing algorithm is applied. Each individual alphanumeric character is extracted by finding starting and ending points of character in horizontal direction. These characters are shown in figure.



Step 10: Recognition of individual character: For Recognition of individual alphanumeric character, template based Recognition method is used. In template based algorithm, segmented image is compared with one image which is stored in database named as template image. In both images best matched similarity is compared. This similarity is matched with statistical method correlation. The image for which the correlation coefficient for template image is maximum that image is best matched.

Step 11: Storing in file: After extracting, number plate is stored in file with complete information like characters on number plate and date on which it is extracted. As shown in figure.



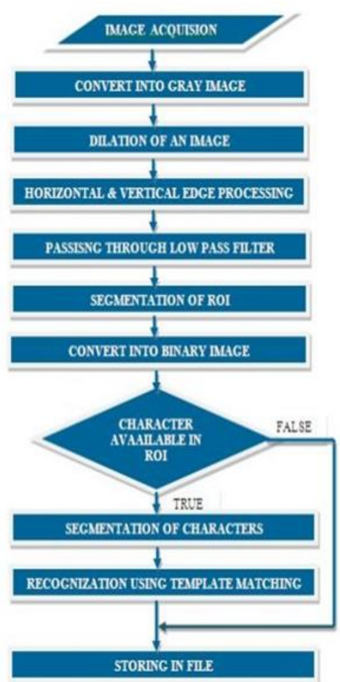


Fig. 2. Flowchart for License Plate

3. Conclusion

In this project we use recursion method and function to indicate the traffic sign. So that accident can be prevented.

Recursive method can detect every sign board. Function can recognize any sign from board. Reducing the number of accidents caused by driver distraction and to reduce the seriousness of such accidents. Precursors of what will eventually become fully automated driving by the year 2025. We propose a vision based method for traffic light and sign board detection which can be used under different illumination conditions. The main problem of existing system like failure in recognizing traffic signs under different climatic conditions were cured by using the proposed system. Here we suppress the background by setting a threshold for required area of interest depending on shape to detect the presence of traffic light and sign board. Experimental results provide that the method is fast and robust. The detection procedure is performed in real time. The proposed method can be implemented as hardware modules on vehicles.

4. Future scope

Road safety: The timely checking of the over speeding vehicle will reduce high percentage of road accidents. Automation in law enforcement: The system being completely automatic reduces the number of traffic police officers needed to deploy in the real field for checking speeding vehicles. With very few enhancements in the proposed system new features can be easily incorporated such as:

- *Vehicle security:* The lost out cases of the vehicle are increasing day by day; the stolen vehicle can be easily detected by comparing with the registered entry of stolen vehicles.
- *Parking:* The vehicles can be easily registered using automatic system with this system in the parking lounge or similar purpose complexes.
- *Visitor management:* This system can be effectively used to assist visitor management systems in recognizing guest vehicles.

Although LPR has seen significant progress in last decade, there is lot of work to be done to make LP detection robust. LPR system should work effectively under various environmental conditions, illumination conditions etc. With new technological advancements in the auto industry vehicles are getting faster and faster. So LPR has to also upgrade its technology to match the speed of vehicles in real time. Moreover, traffic may consist of variety of vehicles and motorcycles it is important for LPR to recognize each vehicle in real time. As already described in this survey, many algorithms utilize fixed plate geometry, colour, and character fonts for LP location, segmentation, and character recognition. There is a lot of scope for LPR in near future as new image processing techniques will evolve to solve the alarming problem of traffic & transportation management system. In the future, we hope to delve into the possibilities of Neural Networks and Machine Learning in these fields. If the system is able to learn different stop signs, through Neural Networks, you could hope to see almost 100% accuracy after a given period of use.

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