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LANE LINE DETECTION IN AUTONOMOUS CARS

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Abstract— *This paper deals with an efficient method of lane line detection in self driving cars. In order to effectively realize the feature extraction of road image, reduce the complexity of calculation and the complexity of algorithm and improve the detection accuracy of lane mark, combined with the characteristics of lane line, in this paper, an effective image preprocessing scheme was selected and designed, and a detection method based on segmented ROI model which included close region, sub- close region and respective region was proposed.*

Keywords **—** *Region of interest, Edge detection, Hough transform*

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I. INTRODUCTION

With only 1 per cent of the world's vehicles, India accounts for 11 per cent of the global deaths in road accidents, the highest in the world, according to a report by the World Bank. The country accounts for about 4.5 lakh road crashes per annum, in which 1.5 lakh people die [1]. According to official statistics, at least 33 percent of all crashes happen when vehicles change lanes or veer off the road. With lane line detection lot of these accidents can be avoided and the disabled can have assistance in a comparatively safer driving experience.

With the ever-increasing number of automobiles on the road and the constant problems associated with it, self-driving cars are in more demand with each passing day. Lane line detections aims to help in the self-sufficient driving of cars and also help in minimizing traffic, accidents and help disabled people in driving cars. In our project we aim to do all this by detecting the lanes on the road, the white markings already there on the roads for detection while also detecting other objects on the road such as other vehicles, humans, animals, pedestrian sidewalk and also detection at poor weather conditions (like heavy rain). Lane detection is mostly done through GPS, vision, sound and certain radar types usually. Lane detection is usually divided into two parts; edge detection and line detection.

In our paper, we use a lane detection method that is suitable for all kinds of complicated road situations. We preprocess each frame of each image and then select the area of interest (ROI) [2] from the processed images. The area of interest is what we refer to the part of the road which we need for lane detection, it excludes the background sky, pavement, cars and everything else superficial to our needs.

Survey Existing System

The algorithm used for lane detection using single camera. Cluster algorithm was used to detect the road lane lines.

M. Dhana Lakshmi et al. [2012] discussed a novel algorithm to detect white and yellow colored lanes on the road. It uses both color and edge orientations. As the height of the camera was relatively constant with reference to the curved surface, the road portion of the image are often exclusively cropped by providing the coordinates, so that identifying the lanes became farmore efficient.

Cuong Le et al. [2012] discussed the task of finding the pedestrian lanes that are indicated by painted markers for the vision impaired people. An assistive navigation system has been developed for the blind by using geometric figures like line, parabola, or hyperbola. By combining color and native intensity information, this method detected correctly pedestrian marked lanes in several illumination and weather (sunny, cloudy, strong shadows, times of day).

Shan Xu et al. [2012] discussed a way of structured road lane detection for blind travel aid. Median Filter has been implemented to process image. The algorithm has been proved that it wasvery robust and real-time.

Zhao et al. [2013] discussed lane detection and tracking method supported annealed particle filter algorithm which combined multiple images with annealed particle filter. It has been found that the time cost of annealed particle filter algorithm for every frame is essentially reduced compared with conventional particle filter algorithm

Ma et al. Implemented a lane detection method based on K-means clustering based on CLELAB color features.

Yang et al. Proposed a lane detection and recognition algorithm based on RGB space colour.

Cao et al. Suggested the establishment of surface reflection model to process the image so as to weaken the other information points of the road.

Liu et al. proposed a lane detection method based on the pavement water reflection model and the symmetry feature.

The use of lane detection on Indian roads at the time of writing is very minimal with lot of scope for its use on busy Indian roads and poor traffic management.

II. Proposed System

In our proposed system we capture the footage of the road ahead of us through a camera fixed on top of the automobile with a wide field of view.

The colour image(s) captured through the camera is then converted into HSV colour space images.Then the HSV images are converted into Grayscale

We cannot separate color information from excessive luminance,. HSV or Hue Saturation Value is used to separate image luminance from color information. This makes it easier when we are working on or need luminance of the image/frame from each captured frame.

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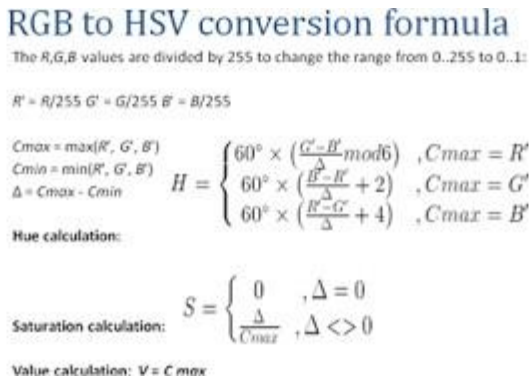

Figure 1.Conversion of RGB sequence into HSV [3]

Then the HSV images are converted into Grayscale

Figure 2. Applying Grayscale Filter to the HSV image

We then apply Gaussian Filter to the grayscale image. A Gaussian filter is a linear filter. It's usually used to blur the image or to reduce noise. If you use two of them and subtract, you can use them for "unsharp masking" (edge detection). The Gaussian filter alone will blur edges and reduce contrast.

Figure 3. Gaussian Filter applied on an image

We then apply the canny edge detection to detect the relevant lane lines.

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Figure 4. Image obtained after Canny edge detection.

To remove unnecessary lanes and edges of the surrounding fences, select the adaptive area of interest and perform region of interest masking (ROI).

Figure 5. Selection of Region of Interest

The linear Hough transform[4] algorithm gauges the two parameters that define a straight line. The transform space has two dimensions, and every point in the transform space is used as an accumulator to reveal or identify a line described by $r = x \cos\theta + y \sin\theta$. Every point in the detected edges in the image contributes to the accumulators.

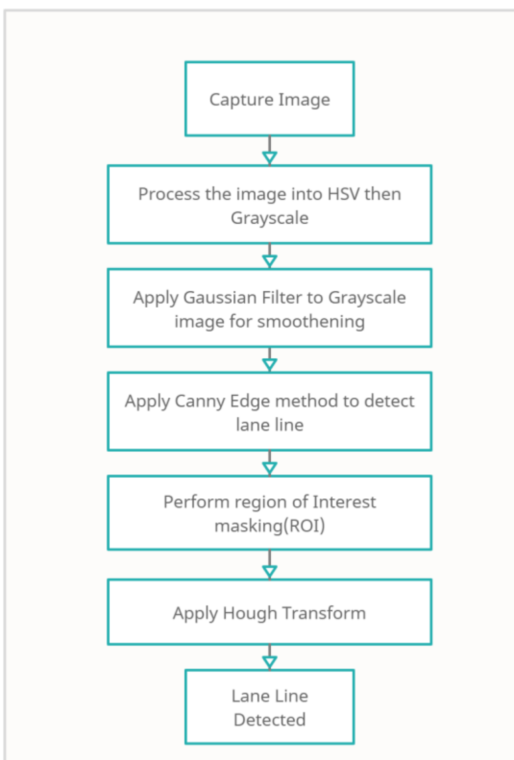
The dimension of the accumulator equals the number of unknown parameters, i.e., two, considering quantized values of r and θ in the pair (r,θ). For each pixel at (x,y) and its neighborhood, the Hough transform algorithm dictates if there is enough verification of a straight line at that pixel. If so, it will calculate the parameters (r,θ) of that line, and then look for the accumulator's bin that the parameters fall into, and add the value of that bin. By finding the bins with the highest values, typically by looking for local maxima in the accumulator space, the most likely expected lines can be extracted, and their (approximate) geometric definitions read off. The simplest way of finding these peaks is by applying some form of threshold, but other techniques may yield better results in different circumstances – determining which lines are found as well as how many. Since the lines returned do not contain any length information, it is often necessary, in the next step, to find which parts of the image match up with which lines. Moreover, due to imperfection errors in the edge detection step, there will usually be inaccuracies in the accumulator space, which may make it non-trivial to find the congruous peaks, and thus the appropriate lines.

The final result of the linear Hough transform is a two- dimensional array (matrix) similar to the accumulator—one dimension of this matrix is the quantized angle θ and the other dimension is the quantized distance r. Each element of the matrix has a value equal to the sum of the points or pixels that are positioned on the line constituted by quantized parameters (r, θ). So the element with the elevated values indicates the straight line that is most depicted in the input image

In the Hough Transform algorithm, the Hough Space is used to determine whether a line exists in the edge image.

Figure 6. Final image after detection of lane and line

III. Conclusion



We proposed lane detection preprocessing and ROI selection methods to style a lane detection system. The main idea is to feature white extraction before the standard basic preprocessing. Edge extraction has also been added during the preprocessing stage to boost lane detection accuracy with improved edge detection. We also placed the ROI selection after the proposed preprocessing. Compared with selecting the ROI within the original image, it reduced the non lane parameters and improved the accuracy of lane detection. Currently, we only use the Hough transform to detect straight lines to trace lane and do not develop advanced lane detection methods.

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