IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Drive Assist - A Road Lane Line Detection System: Review

[1st] Anuja Nikam
Department of Computer Engineering, Sandip Institute of Technology and Research Centre,
Nashik, Maharashtra, India

[2nd] Sakshi Chavan
Department of Computer Engineering, Sandip Institute of Technology and Research Centre,
Nashik, Maharashtra, India

[3rd] Devyani Binnar
Department of Computer Engineering, Sandip Institute of Technology and Research Centre,
Nashik, Maharashtra, India

[4th] Aishwarya Kapade
Department of Computer Engineering, Sandip Institute of Technology and Research Centre,
Nashik, Maharashtra, India

[5th] Prof. Namrata Ghuse
Department of Computer Engineering, Sandip Institute of Technology and Research Centre,
Nashik, Maharashtra, India

***Abstract*— According to the WHO, street traffic accidents endanger the lives of a large number of individuals each year. Between 30 to 60 million people suffer from non-fatal injuries, sometimes leading to disabilities. Injuries due to road traffic brings substantial economic losses not only to victims but also to their families, and nation as a whole. With increase number of road accidents, it's led to concern over the sort of accidents. So, we came up with the thought of building lane detection system which could assist the actuation. Our proposed system (Drive Assist) is amongst the foremost main features of the fashionable vehicles to guarantee driver's safety and reduce the amount of accident on roads. Evidently, determining the relative position of car and road is a hard and nearly difficult process.**

This system acquires the ahead view and detects the lane lines by using few processes. The lane lines are discovered using a pair of hyperbolas which are contoured to the sides of the lane lines using Hough transform. This technique is used on painted as well as unpainted roads. This method doesn't require any additional information like width, lane, time for lane offset and crossing between the center of the lane. This method was tested under varying situations of adjusting brightness of sunshine, and effects of shadow in various types of roads. This Drive Assist system has exhibited fast performance for detection of the road lanes under discrete varying lighting conditions.

Keywords*— *Hough transform, Lane Detection, Lane detection system, Lane Tracking, Intelligent Cars.

I. INTRODUCTION

Autonomous Driving Car is one of the unruliest upheavals in AI. Charge by various deep learning algorithms, they're continuously directing our society ahead and generating new chances within the advancing sector. Autonomous driving has progressed from "hardly possible" to "certainly doable" to "inevitable" to "how did anyone ever think this wasn't inevitable?" in the last ten years. The autonomous car has the feature that they can go anywhere an ordinary car can go. It is very important to coach the system properly and one amongst the various steps entangled for the training of an autonomous car is detection of lane, which is the basic stage. Apparently, the road lane detection is complicated and most challenging tasks that includes the localizing of the road and therefore the finding of the comparative position between road and vehicle.

One of the existing systems where [11] developed a Canny Edge detection algorithm for feature extraction finally allows a suitable adjust to lane lines and could be versatile to convoluted environment of road. Also, in 2014, [8] suggested the advancements to the Canny-Edge detection can successfully accord with varying sounds in the environment of road. [7] put forward Sobel edge which is used in image processing and computer vision. However, there were still handful of incorrect edges after detecting which affected the lane detection. Sobel operator and Canny edge are the most familiar and successful methods for edge detection.

The existing methods are not capable of providing accurate and fast lane information, which leads to increase in the difficulty of lane detection. Therefore, in this paper, user proposes a approach using computer vision that is competent

of getting as far as a real time performance in tracking and detecting of lanes as well as curves. The boundaries of the road are detected by adjusting a parallel hyperbola pair to the edges of the lane using the Hough Transform and Edge Detection. Compared with existing methods, our system is indifferent to changes in road surface of a vehicle when the vehicle is about to move across either a central line or edge line. Our system can extract lane markers accurately and reliably in a variety of road and lighting circumstances, allowing the user to drive more efficiently.

II. LITERATURE SURVEY

The existing system consists of locating the distinct primitives such as the markings of road on the surface of painted roads. These technologies use various sensor such as Radar and Lidar which are used for obstacle detection and vision sensors which are used for vehicle detection and lane detection. Moreover, these technologies are today are less costly, higher quality than before and smaller. For all of these reasons, engineers and academics are interested in vehicle and lane detection utilizing vision sensors.

In 2018, a novel approach of ROI selection and preprocessing was proposed in "Lane Detection Based on Connection of Various Feature Extraction Methods." In the pre-processing stage, the lane detection approach uses the HSV colour transformation to extract the white feature detection and add preliminary edge detection features, before picking the ROI based on the proposed preprocessing techniques. – [1].

In 2018, “Robust Lane Detection and Tracking for Real-Time Applications IEEE Transactions on Intelligent Transportation Systems” proposed algorithm consists of initialization, lane detection, and lane tracking. The lane detection methods detect and tracks the lane markings within the ROI, furthermore, the suggested approach outperforms others for road conditions with noisy components. – [2].

In 2017, suggested a technique based on Gabor filter and edge extraction in "A Real Time Lane Detection and Tracking Algorithm". – [3].

In 2017, “Robust hypothesis generation method using Binary Blob Analysis for multi-lane detection,” proposed an improved lane hypothesis generation method using a reliable binary blob analysis – [4].

In 2016, "A real-time lane marking localization, tracking, and communication system" presented an invehicle computing system capable of localizing lane markings and communicating them to drivers. – [5].

A new open-access dataset and benchmark for road area and inner-lane detection were proposed in 2013, "A new performance measure and evaluation benchmark for road detection algorithms." – [9].

A fuzzy rules-based lane detection and departure warning system was suggested in 2010 by the system "Applying fuzzy approach to vision-based lane identification and departure warning system." – [11].

In 2006, “A Real-Time Lane Detection Algorithm Based on a Hyperbola Pair”, proposed a real-time lane detection algorithm based on a hyperbola-pair lane boundary separately – [12]

III. SYSTEM METHODOLOGY

In this paper, a vision- based perspective is proposed that's able to achieving a real time performance in detecting and monitoring of lanes in addition to curves. The steps involved in the proposed system are explained further.

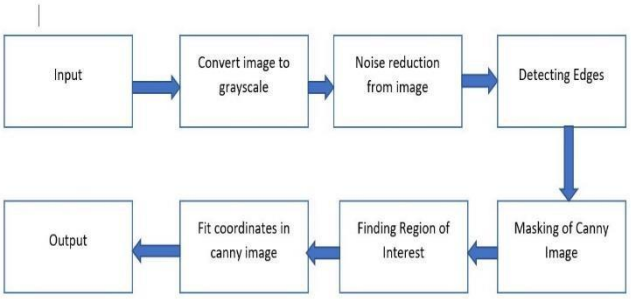

Fig: Block diagram for Proposed System

A. CAPTURING OF IMAGE:

The input file was color picture frames taken from a running vehicle. The image is being captured employing a Video Capture object and after it's been captured every video frame is decoded.

B. CONVERTING TO GRAY SCALE:

For retaining the information about color additionally on road segment from the lane boundaries, edge detection becomes difficult and consequently affects the interval. The road surface can have many alternative colors because of pavement style, age or shadows, which lead to a change of the color of the lane markings and road surface from one region of image to a different region. Therefore, there's a desire to convert the color image into grayscale. As the processing of grayscale pictures became less in comparison to a color picture.

Fig: The image in grayscale – [22]

C. *NOISE REDUCTION:*

The next step is to reduce the amount of noise in the image. This implies that the undesirable part of the image should be removed in order to obtain the realm, which is useful for detecting lanes. Edge detection is used on both the invariant picture and the original image to create a shadow edge image. It has been implemented to choose the perimeters that exist in the original image but not in the invariant image and reconstruct the image free of the shadow by deleting the perimeters from the initial image with the help of a pseudoinverse filter.

Fig: Noise reduction – [24]

D. *DETECTING EDGE:*

The edges of an image contain the majority of the information about its shape. To begin, locate the sides of an image and, using these filters, improve the sections of the image that involve edges. The sharpness of the image will improve, and the shot will also become clearer. The 'Canny edge' detection technique was employed to detect the sides. The thresholds will be chosen automatically by this edge detection technique. It accepts a grayscale image as input and employs a multi-staged algorithm. The stages involved in detecting a picture's edges.

1. Using a Gaussian filter, remove noise from the input image.
2. Calculating the gradient of picture pixels using the derivative of a Gaussian filter to obtain magnitude in the x and y axes.
3. Suppress the non-max edge contributor pixel points by considering a group of neighbours for any curve in a direction perpendicular to the provided edge.
4. Finally, utilize the Hysteresis Thresholding method to keep pixels over the gradient magnitude and ignore those below the low threshold value.

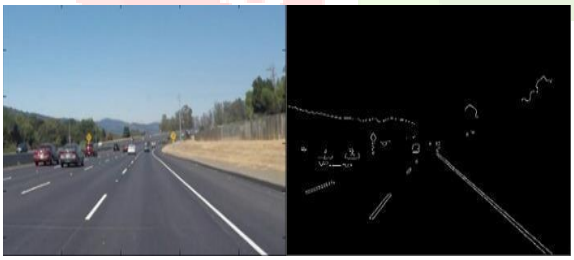

Fig. Finding the region of interest – [25]

This phase involves merely taking into account the area covered by the road lane. A mask is created that is the same size as our road image. The mask is then applied after a bitwise AND operation is performed on each pixel of the canny image. It masks the resulting image and reveals the tracked area of interest using the mask's polygonal contour.

E. DETECTING LANE USING HOUGH LINE TRANSFORM

In image analysis, the Hough transform is a feature extraction approach. It is commonly used to distinguish the characteristics of any regular curve, such as lines, circles, ellipses, and so on.

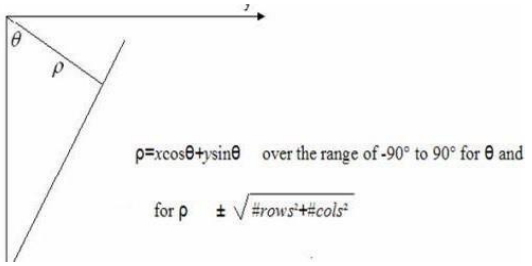

Fig: Hough transform searching methods - [23]

In actuality, any line that does not fall within a specific area may be ignored. A horizontal line, for example, may no longer be the lane limit and will most likely be rejected. With the help of right and left Hough lines, the horizon is computed by projecting them to their intersection. It is quite easy to implement Hough Transform in OpenCV Python with the assistance of the built-in function cv2.HoughLines(). Lines = cv2.HoughLines(image, image, rho, theta, threshold)

Fig: The image with Hough Line segments

RESULT AND DISCUSSION

Fig. Original image from video

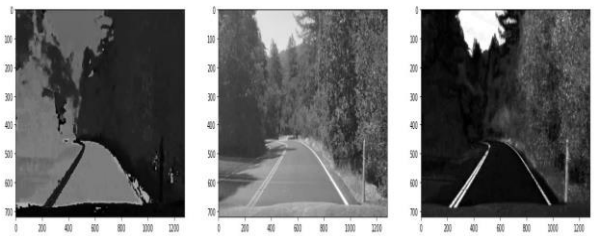

Fig. The original image in grayscale

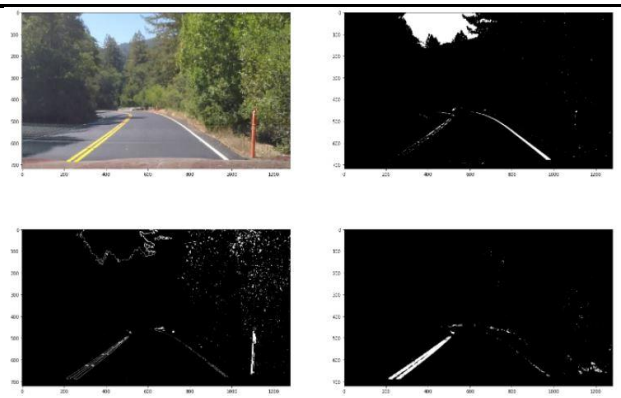

Fig. The image after applying Canny Edge Algorithm

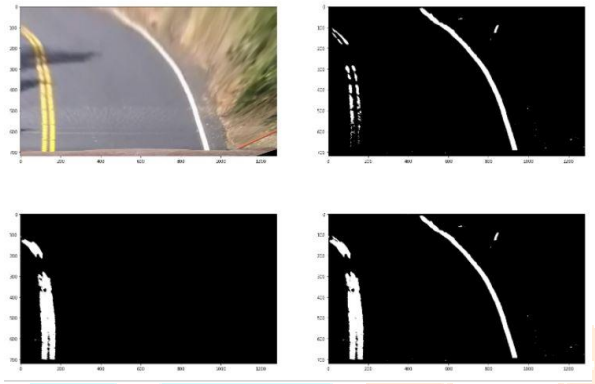

Fig. Image after finding Region of interest

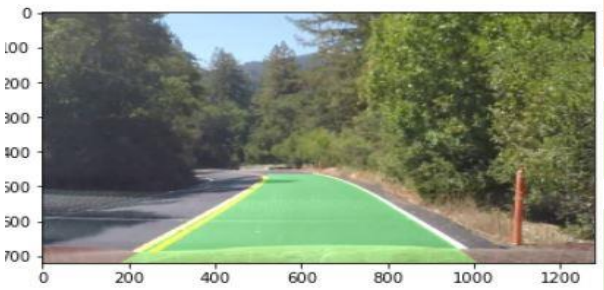

Fig. The image after detecting lanes using Hough Transform

CONCLUSION

A real-time vision-based Lane detecting system was proposed in this system. For the purpose of precisely computing the parameters used in the curved line model, a line detection approach based on Hough transformation is proposed, while a curved line detection method based on Canny Edge detection is proposed.

Experiments are conducted to validate the newly proposed hybrid detection approach, and the results reveal that the system meets the required condition of providing the driver with a faultless lane detection system in order to ensure safety. The proposed lane detection method's effectiveness will also be used to sophisticated driver support systems in smart cars, not just self-driving car systems.

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