International Journal of Future Generation Communication and Networking
Vol. 13, No. 3, (2020), pp. 42 – 47

Lane Keeping System Using Real Time Pathway Detection

Sivasanker.N. P[1], Ashish Anand[2], Nishant Raj[3] and R. Sathya[4]
Computer Science and Engineering
SRM Institute of Science and Technology
Chennai, Tamil Nadu 600089
[1]*sivasnp97@gmail.com,*
[2]*ashishanand608@gmail.com,*
[3]*nraj2425@gmail.com*
[4]sathyaraman76@gmail.com

Abstract

This paper deals with the detection of lanes present on the road and thus act as a driver assistance system to ensure road safety. The vision-based system begins with processing the image captured by the camera and undergoes different step-by-step process starting with RGB to grayscale conversion, various filtering methods to remove the noise present in images, methods to omit out unwanted details from the image and finally detection of straight lines using Hough transform. The paper also proposes various application that can be used after detecting the lanes and it includes automatic braking system, steering torque and various alarm systems including seat vibration and beeping sound. These methods can provide the driver a helping hand in driving and thus avoid accidents caused due to driver's carelessness.

Keywords —*Advance Driver Assistance System (ADAS), Vision-based Driver Assistance System; Gaussian filter; Canny edge detection algorithm; Hough Transforms.*

I. INTRODUCTION

The most challenging situation for an automobile industry is to control the level accidents, moreover how to avoid it. But considering the increase in population, it is a difficult task to control accidents manually. In such a busy world people are always in a hurry to get things done and with these, accidents can occur and the person to be blamed is the driver alone. Other reasons are drunken driving, sleeping while driving, etc. The government considered the situation and provided various awareness methods, but they are a big failure. So, the automobile companies came up with the plan of ADAS, which assist the driver during the journey and thus can put a control over the accidents.

The ADAS comes up with two different systems, Lane detection System and Lane keeping system. A Lane detection is supposed to detect the lanes with the help of a stereo camera with the help of various image processing techniques including Grayscale conversion, Median filtering, Thresholding, Histogram equalization and Hough transform. In this system, if the vehicle does a lane departure, then the system signals the driver of incoming collision with the help of beeping sound and seat vibration. This act as an alarm system and doesn't take any step to avoid collision.

The Lane Keeping System act as a collision avoidance system, where the primary aim of the system is to keep the vehicle with in the Lane. Once lane departure takes place, the system signals the diver of the same. If no action is taken by the driver, the system overrides the vehicle and produces a torque on to the steering wheel and thus stops lane departure. As an application to this system, we propose various additional collision control techniques and these includes automatic braking system which keeps the vehicle speed under control. It can be achieved with the help of infrared sensors attached within the sides of the vehicle.

ISSN: 2233-7857 IJFGCN

The sensors are used to calculate the distance of other vehicles or objects from our car. Each car should be separated with a gap of 15meters. If the distance falls below that 15meters, the system automatically applies a braking system to slow down the car and maintains the distance. We use the concept of image processing and use it within the lane keeping system and provides additional application facilities to the system.

II. LITERATURE SURVEY

The Existing system works based on various conditions which includes position of the camera attached to the vehicle, weather conditions and most importantly the lane marking present on the road. Most of the system uses monocular camera which is placed at windshield of the vehicle. The camera is supposed to take video at regular intervals and each frame of the camera is processed with various image processing techniques. The image is supposed to be processed with very less response time, but most of the time the system fails to justify it. The camera fails during raining or foggy weather conditions and without lane marking the entire system fails. The system provides only an alarm system to warn the driver, but doesn't take any necessary step to avoid the accident.

i. Advances in Vision based Lane Detection Algorithm Based on Reliable Lane Markings, uses Image Processing Technology RGB, Grayscale but its time taking and expensive.
ii. Lane Detection with a High-Resolution Automotive Radar by Introducing a New Type of Road Marking, uses LIDAR,
Light Detection and Ranging but Works only on high contrast lane marking.
iii. Real Time Multi-Lane Detection Using Relevant Lines Based on Line Labeling Method, uses Real Time Multi Lane detection using monocular camera but works only on High Complexity and cannot produce accurate reading all the time.

iv. Lane Detection of Curving Road for Structural High-way with Straight-curve Model on Vision uses Hough Transform but requires High processing time and requires more data.
v. Unstructured Lane Identification Based on Hough Transform and Improved Region Growing uses gaussian filter and its processing time is very high.

III. PROPOSED SYSTEM

The proposed system is a lane detection and avoidance system which detect the lane at the same time takes necessary steps to avoid collision caused by the drivers' carelessness. The lane detection takes place with the help of a stereo camera attached to the vehicle and after detecting the lane, it makes sure that the vehicle is kept on the lane. If the lane departure is taking place and if it can cause collision, the system overrides the vehicle and produces an automatic torque on the steering wheel and thus resists the vehicle from crossing the lane and avoid collision. Also, the system provides an automatic braking system which will put a control over the vehicle speed and avoid accidents caused by over speed.

IV. PROPOSED METHODOLOGY

The proposed lane detection system takes place with the help of a stereo camera, which takes regular video. Each frame of the video is an and its is processed to obtain an optimal image to detect lane and thus proposes lane keeping system. This takes place as a step by step process as given in Fig 1.

ISSN: 2233-7857 IJFGCN

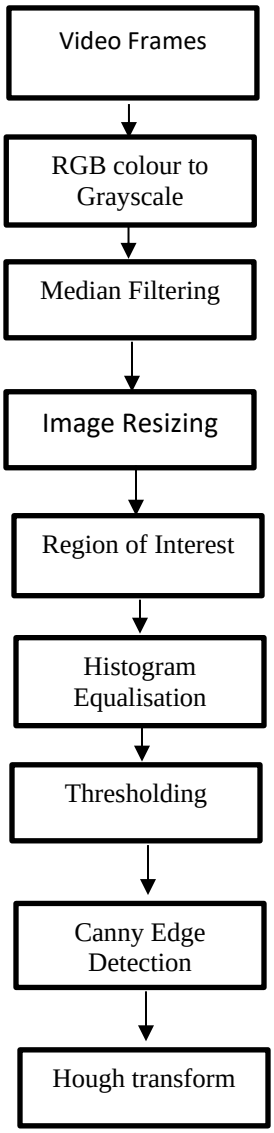

Fig.1 Proposed Methodology

a. Video Frames

A stereo camera is attached to the windshield of the vehicle. The video camera takes regular video and each frame of the video act as an image. This RGB image will be the primary input for further processing steps.

b. RGB to Gray Conversion

RGB image obtained cannot be processed further because of high complexity of the image. So to make the process faster and more efficient, its required to convert the image to grayscale. So, grayscale conversion is done.

c. Filtering

Filtering is done to improve the quality of the image. Unclear image can increase the processing time and also can fail to producing the output accurately. So, to remove the noise present in the image, filtering methods like Median filtering are used.

d. Resizing

After filtering methods, the image stability will be reduced. So, resizing is done to provide strength or dimensional stability of the image.

e. Region of Interest

The Region of Interest or ROI is used for elimination purpose. An image will be having different kinds of details which are not required for the processing. So, its required to eliminate all those unwanted details from the image to make the processing faster and efficient.

f. Histogram Equalization

This is an image processing technique used for the contrast adjustment. This process helps to acquire a large contrast to the less contrast part and vice versa. This process is more helpful in the case where the image is represented by close contrast value.eg.

g. Thresholding

Thresholding is a binarization process used to create a large contrast between the road area and the lanes present in the road.

h. Edge detection

Edge detection is used to identify the edges present in the image. It makes a sharp contrast between the surface of the road and the lanes in the road. Its is a necessary element to identify the lane edges and by doing so can reduce the amount of data wasted in the processing.

i. Hough transforms

Hough transform is the final detection technique, in which the entire image is scanned to obtain lines. Its is method used to detect straight lines on the image.

V. SYSTEM ARCHITECTURE

The proposed architecture consists of stereo camera at the windshield, four different ultrasonic sensors kept at all the four sides of the vehicle, with which alarm system is executed and finally the Collison mitigation system called the Advanced Driving Assistance System, which will provide the driver a helping hand in avoiding accidental collisions. The ADAS comes up with various different features including, Torque system to avoid accidental lane departure, Speed control system with the help of Automatic Braking system , which will avoid collision due to over speed and with respect to all these control features, a suspension feature is added in-order to warn the driver of incoming collision.

ISSN: 2233-7857 IJFGCN

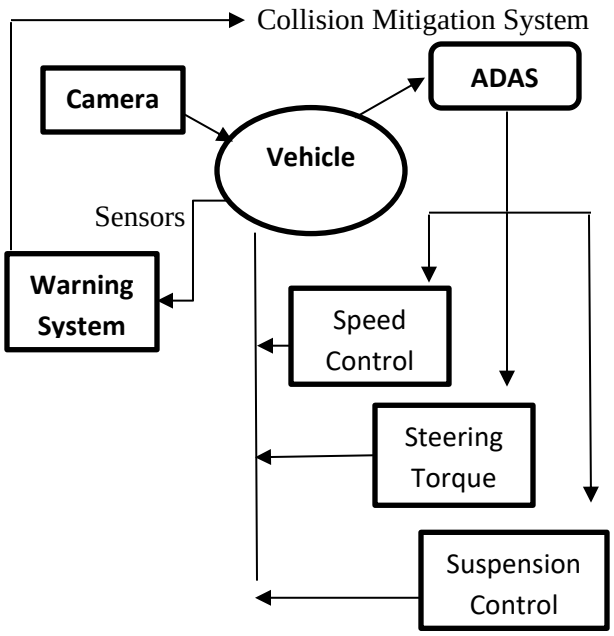

Fig 2 System Architecture

a. Stereo Camera

Stereo camera is attached to the center of windshield of the vehicle. It's a wide area video camera which analyses the front view to get a detailed picturization of the surrounding and process with respect to it. Frames are processed in various sequential steps to produce an accurate view of the lane.

b. Warning System

When the vehicle crosses the lane or when a lane departure takes place the system alerts the driver to take necessary steps to avoid collision. It works with the ultraviolet sensors attached to the vehicles. The sensors sent waves and when these waves come in contact with any real object or other vehicle, the waves get reflected back to its origin, providing the distance of the object from the vehicle. These obtained distances are taken as the input by ADAS system to avoid collision mitigation.

c. Collision Mitigation: ADAS

In-order to avoid accidental collision, ADAS comes into play. Here, ADAS automatically gets activated after its found that, no action is taken by the driver after signaling the alarm for incoming danger. Distance between each vehicle is set as 20m. The ultrasonic sensors keep a watch on the distance of closing vehicles and when its found that, its is below 20m, the system alarms the driver and overrides the system and automatically tries to control the speed of vehicle by automatic braking system and keeps the distance above 20m.

ISSN: 2233-7857 IJFGCN

VI. CONCLUSION

In this paper, it deals with Lane detection and ways the to avoid collision caused due to carelessness of the driver. The video camera captures regular videos and each frame of the video act as an image. The image undergoes various image processing techniques to remove image noise, unwanted image details and finally straight-line detection with Hough transform. By these techniques' lane can be detected. After detecting the lanes, the next step is to take necessary steps to avoid collision and it includes automatic braking system and torque system and it is achieved with the help of infrared sensors. The main aim of the proposed system is to provide a driving assistance for the driver by which the rate of accidents happening can be reduced.

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ISSN: 2233-7857 IJFGCN