International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-4, February 2020

Lane Keeping Assist System

K. Manoj Senthil, Vinod Ramachandra Dinnimani, R. Shobiga Sherline

Abstract: ***In urban areas, accident rate is increased due to the loss of concentration of the driver. To overcome this problem autonomous based driving vehicle is introduced and since autonomous vehicles needs to find the path to be travelled over the lane. Grid based estimation is introduced which will be helpful to find the correct position of the lane and if it deviates from the correct position it automatically comes to the correct path. Preprocessing method is used to find the correct path of the lane to avoid the false region over the lane images. This system will helpful to find the correct position of the vehicle over the lane. It also helpful to find the distance from the camera to the point of the image.***

Keywords: Autonomous vehicle, Edge Detection, Grid Estimation, Lane detection

I. INTRODUCTION

The autonomous vehicle reduces the accident rate and increases the fuel economy. Self- driving car makes the vehicles to move in the correct path and warns the system in advance so that the prior action towards the vehicle can be detected. The cost of the vehicle is high due to the many sensor connected to the device. This will increase safety and conservation of the energy and pollution rate is decreased and human driven vehicle will cause accident but self-driving car increases safety rate.

This paper briefly describes the previously used classification system techniques in section 2. Discussion about the proposed system is given in Section 3. In section 4, the results are discussed and analyzed. Section 5, discusses about conclusion and future work.

II. RELATED WORK

Jiajia Chen, Pan Zhao et.al., (2013) has proposed the efficient component to reduce the traffic accidents. The path planning of lane change is important in the autonomous vehicle field. Curvature -continuous method is used for the passage of the ego vehicle [2]. Safe lane change distance for autonomous vehicle and maximum curvature is calculated to verify the path of the vehicle and vehicle ride comfort-based yaw-rate of the vehicle [2]. The above condition should be applicable for the vehicle ride comfort.

Revised Manuscript Received on February 28, 2020.
***** Correspondence Author
Mr. Manoj Senthil*, Assistant Professor, Department of Electronics and Communication Engineering, Kongu Engineering College, Perundurai.
Mr. Vinod Ramachandra Dinnamani, Robert Bosch Engineering and Business Solutions Ltd.
Miss. Shobiga Sherline Ravindran, Department of Electronics and Communication Engineering in karunya institute of Technology and Science, Perundurai. E-mail: Shobigasherlin16@gmail.com.

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC-BY-NC-ND license http://creativecommons.org/licenses/by-nc-nd/4.0/

Joseph funke et.al, (2016) has demonstrated the emergency lane change to the vehicle based on friction and other constraints which causes the vehicle bi-elementary path in real time. Maximum curvature and friction cause the speed change over the path. This system changes the speed with respect to the vehicle steering input. As a result, emergency lane change maneuvers causes the vehicle should brake with maximum possibly entry speed with respect to the parameter of the path.

Behrouz mashadi et.al., (2014) has designed the autonomous ground vehicle with respect to the planning of the path. In the condition of the double lane change, autonomous vehicle detects the moving vehicle with respect to the speed and distance. The overtaking path is generated by the two-phase optimal path-planning problem. This system is designed to find the cost function is defined as lateral deviation and steering vehicle is identified.

Arup k. Nandi et.al, (2015) implemented the storage battery for the electrical vehicle This system analyses the acceralation with respect to the vehicle speed. The design of CODS is done by reducing the battery consuming duration and acceralation time. The acceleration jerk was maintained with respect to the quantify driving comfort.

Based on the system, response time should be low without sacrificing solution and they are constraining the jerk to a maximum level and minimizing the jerk as an optimization objective.

III. PROPOSED SYSTEM

In existing system path planning algorithm has been implemented. The proposed system can be divided into (i) discrete space planning and (ii) continuous space planning. The lane change maneuvers have the tube-based MPC. The section can be divided into two stages planning of discrete and continuous space Very recently, MPC camera is used for the lane detection. As for metrics required to validate the suitability of a lane change to avoid the collision rate. Each year, a lot of accident is happening to overcome this autonomous car is introduced. The autonomous car is sleep-deprived humans and distractible things humans. In urban scenario, autonomous vehicle. CAN protocol is used to communication with the other vehicle through message-oriented type. Insurance costs will be reduced due to the autonomous vehicle and also redesign parking in cities.

3.1 Lane Boundary Detection

Lane-change is one of the most common behavior in the blooming environment and also it is been an active field. The objective of the lane-change is to move to the acquired position with the corresponding constraints. In the constraints of the figure 1 autonomous features use to control the speed of the car, lane changing, also its helpful for over taking and interchange over the path.

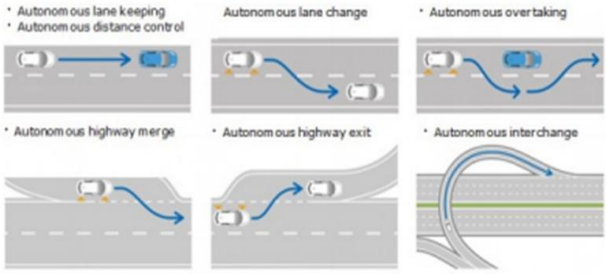

Figure.1 Autonomous lane detection

The lane detection planning was performed by reducing the risk of collision.

3.2 Velocity Estimation of Target Vehicles

MPC camera allows the tracking of the system over 360 degree. It also has the ability to track the objects with arbitrary shape (car). To minimize the number of accidents the with turn-rate augmented into the state vector and velocity estimation from the figure 2.

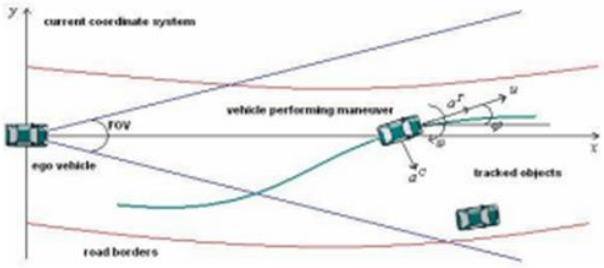

Figure.2 Autonomous lane detection

3.3 Lane-Keeping & Lane-Changing Assist

The road is recognized by the sensor and controls the steering angle with respect to the current lane. It alerts the driver when he deviates from the correct position.

The Safe Lane change is acquired with the relative position and velocity of the neighboring vehicle. The appropriate trajectories are generated. It is to be noted that there is difference between the lane changing condition.

3.4 Video Reading

Using the video data, object information is examined. The information from the object is video file which makes us to read data from the source. This system uses the video Reading function with respect to the video reader object and many information about the object properties and read the data using video reading function

3.5 Coordinate Systems

World: A fixed universal coordinate system in which all vehicles and their sensors are placed.

Vehicle: Anchored to the ego vehicle. Typically, the system coordinate is placed on the midpoint of the axis with respect to the ground

Sensor: It refers to the vehicle monitoring system such as camera, radars

or a radar.

Spatial: Information is captured from the image and it is expressed in units of pixels

Pattern: It is used to calibrate the camera based on the required position.

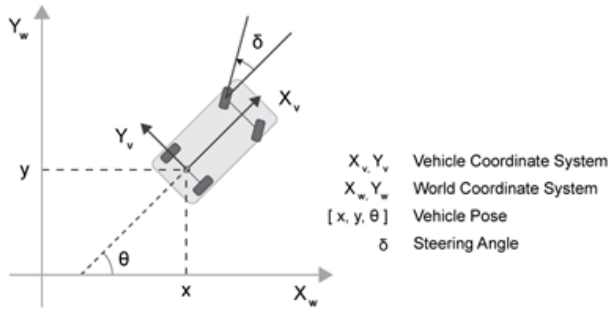

Figure.3 Autonomous lane detection

The vehicle coordinate system (XV, YV, ZV) used by reference for the ego vehicle. The term ego vehicle refers to the vehicle which contains the sensor and monitors the vehicle movement. Three position is taken according to the movement of the vehicle.

The XV axes movement points to the forward direction.

The YV axes movement points to the forward movement with respect to the left side.

The ZV axes movement points to the right-hand coordinate system with respect to the vehicle.

IV. METHODOLGY

Different preprocessing methods were performed over the image to remove the unwanted noise. Gaussian noise is used to remove the unwanted noise which is also effective noise and Cv2.Gaussian function is used. Median filter is used to remove the salt and pepper noise in the image and cv2.median function is used. Bilateral filter is smoothening the edges and find the true edges in the image.

4.1. Contour Detection

Contour helps to find the closed curve of points or line segments and represent the boundary of object in the image and shapes of the object till the visible region. The overall area of the green surface will be estimated. The input of the image will be of Binary image or RGB image and perform the thresholding operation on image and estimate the contour over the green surface of the lane.

4.2. Canny Edge Detection

The Canny edge detector is used to detect the edges in the image which operates in the multi-way. By applying Canny detection to these Gaussian blurred images. In this algorithm that detects edges based on gradient change. First step of Canny Edge detection is image smoothing with default kernel size, it still applies explicit Gaussian blur images.

4.3. Perspective Mapping

Perspective mapping is used to overcome the parallel lines in the image over the wide region it seems to be exist but it is a false one. To overcome the bird eye view is taken over the image to find the lane line and apply the wrapping and transform the image.

4.4. Grid based Estimation

Grid based estimation over the lane is used when autonomous car travels the path of the lane when it moves.

It is used for the lateral and longitudinal view in the region of interest and ROI should be wide one and applying the perspective transform and apply over the inverse perspective over the image we get the grid-based estimation over the lane image.

4.5. Hough Transform

Visual information provides the lots of the accurate data in it. Other vision-based algorithm is intensive and it takes the storage requirement high or processing time. Hough transform will produce the parametric shape without any match with the local and neighboring-pixel information. It is stable with the random image data. By using edge images, and have found that the line and circle detection works good with a small set of image points.

V. RESULT AND DISCUSSION

5.1. Contour Method

Contour detection is used to find the shape and boundary of the image. The exact position of the vehicle boundary in the image is found out. Contour detection done on the image. The output of contour image in the figure 4. Thus, the outer boundary of the image is detected and shown in the above figure4.After this Canny edge detected for the lane path of my autonomous vehicle.

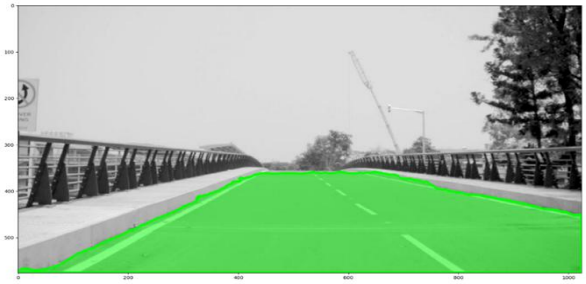

Figure.4 Output Image of Contour Method

5.2. Perspective View

Perspective view is used to find the bird eye view of the image and wrap the image and find the grid of known size to it. Lane road appears to be converged due to parallel lines and facing camera due to perspective. In order to keep parallel lines to be in the correct view bird eye view should be applied. Original image describes how much range it will takes on the path of images for lane lines detection. In the figure 5 original image and warped Undistorted image can be applied for a perspective transform to rectify binary image.

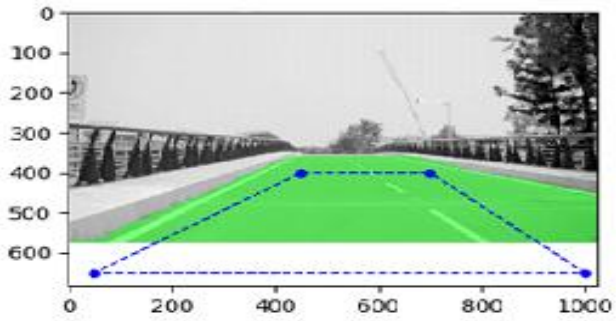

Figure.5 Output Image of Perspective View (original Image)

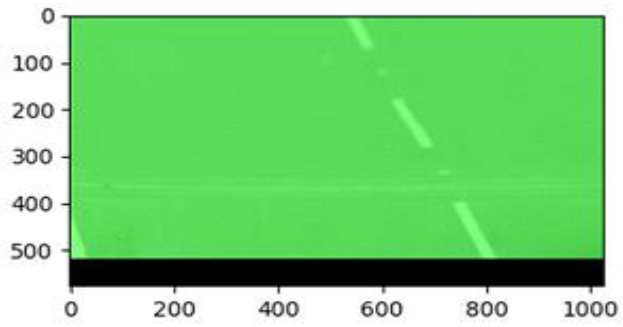

Figure.6 Output Image of Perspective View (Undistorted Image)

5.3. Canny Edge Detection

Canny Detection is used to detect the edges and it takes the grey scale image as input because of the single channel analysis of the edges. Operations can perform by an image using the Canny () method. From the input image figure 7 adjust the threshold of the image to get edges. In the figure 8 result of after apply canny edge detector.

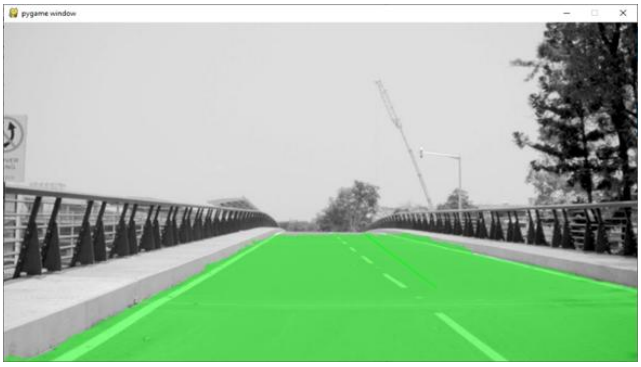

Figure.7 Input Image of Canny edge Detection

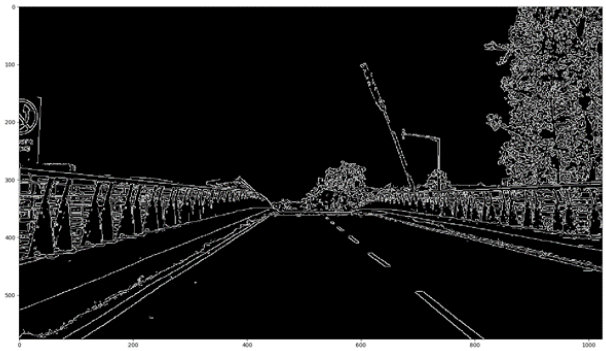

Figure.8 Output Image of Canny Edge Detection

5.4. Grid Estimation Over the Lane

Grid of known size is estimated with the particular Region of Interest and the lateral and longitude distance in the image is divided for the perspective view with the required number of grid on the lane is shown on the figure 9 and sum the distance of view with the pixel per distance. In the Figure 10 placing the grid over the lane perform the inverse perspective and over the perspective image in the original image of the lane and grid estimation view is obtained.

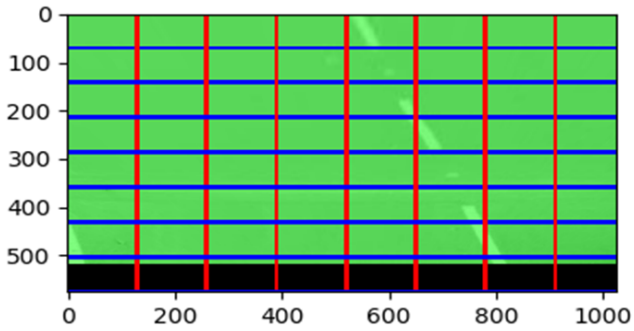

Figure.9 Grid of Known Size

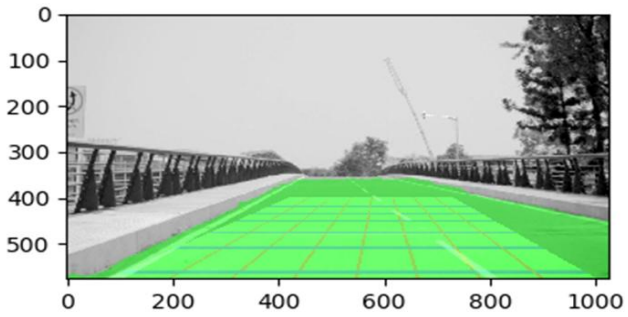

Figure.10 Grid Estimation view

Grid estimation view is designed by selecting the Region of Interest of the lane and detecting the edges of the lane and drawing the estimated grid over the system .From grid over the particular area is calculated and it suits all the lane roads Now when the autonomous vehicle moves ,by the base grid drawn over the lane it automatically calculate the width and distance of Ego vehicle and it automatically paves the way for the ego vehicle .

VI. CONCLUSION AND FUTURE WORK

Self-driving car plays the vital role in the trending field. When ego-vehicle proceeded lane, changes occurs with the environment of the lane and also it performs in the real time. It also provides the safety for the driving situation and vehicle followed will also be ensured with the safety concern. It is difficult to find the point to the image because image and real world is of different domain. To overcome this grid-based estimation is done in the lane and also helpful to find the exact position of the lane. Clothoid Curve is drawn over curvy lane with the third order polynomial. Hence the distance from the image to the vehicle is analyzed.

REFERENCES

1. Attia R, Orjuela R (June 2012) "Coupled longitudinal and lateral control strategy improving lateral stability for autonomous vehicle," in American Control Conference (ACC), 2012.
2. Chen J (2013) "Lane varying path planning based on the piecewise bezier curve for autonomous vehicle," in 2013 IEEE International Conference on Vehicular Electronics and Safety (ICVES), pp. 17–22.
3. Dovgan E, Tusar T, Javorski M, (2012)"Discovering comfortable driving using simulation based multi objective optimization," Informatica, vol. 36, no. 3, pp. 319–326.
4. Dingle P and Guzzella L, (Jun 2010) "Optimal emergency maneuvers on highways for passenger vehicles for four-wheel active steering," in American Control Conference (ACC), pp. 5374–5381.
5. Falcone P, Tufo M, Borrelli F, Asgari J, and Tsengz H, (Dec 2007) "A linear time changing model predictive approach to the integrated vehicle dynamics problem in autonomous systems," in Decision and Control, 2007 46th IEEE Conference on, pp. 2980–2985.
6. Funke J and Gerdes J. C, (May 2015) "Simple clothoid lane change for automated vehicles in friction constraints," ASME. J. Dyn. Sys., Meas., Control, vol. 138, no. 2, pp. 021 002.
7. Kritayakirana K and Gerdes J. C, (2012) "Autonomous vehicle control at the limits of handling," International Journal of Vehicle Autonomous Systems, vol. 10, no. 4, pp. 271–296.
8. Marino R, Scalzi S, "Nested {PID} steering control for lane keeping in autonomous vehicles," Control Engineering Practice, vol. 19, no. 12, pp. 1459–1467.
9. Mashadi B and Majidi M, (Sep 2014) "Two-phase optimal path planning of autonomous vehicles using pseudospectral analysis," Proceedings of the Institution of Mechanical Engineers, Journal of Multi-body Dynamics, pp. 30–37.
10. Meek S and Walton D.J , (Jun 2004) " A System of finding clothoids," Journal of Computational and Mathematics, vol. 170, no. 2, pp. 433–453.
11. Meek S and Walton D. J , (Sep. 2004) "An arc spline approximation to a clothoid," Journal of Computer Application , Math., vol. 170, no. 1, pp. 59–77.
12. Nandi A. K, Chakraborty D, and Vaz W , (Mar 2015) "Design of a comfortable optimal driving for electric vehicles using multi-level optimization," Journal of Power Sources, vol. 283, pp. 1–18.
13. Yeongho Son, Elijah S. Lee, Dongsuk Kum , (Jun 2019) Robust multi-lane detection and tracking using adaptive threshold and lane classification, Machine Vision and Applications, Issue 1.

AUTHORS PROFILE

Mr. Manoj Senthil working as an Assistant professor in the Department of Electronics and Communication Engineering of Kongu Engineering College, Perundurai. Currently doing research in the medical images abnormality detection and He got the project funding in the TNSCTC in the year of 2019-20.
kmanojsenthil@gmail.com.

Mr. Vinod Ramachandra Dinnamani working in Robert Bosch engineering and business solutions Ltd as the senior software engineer in driver assistance system. He is versatile in C,C++and experienced in protocol MIL-STD-1553B, knowledge on CAN, Arinc429.

Miss.Shobiga Sherline Ravindran completed her Bachelor's degree in the Department of Electronics and Communication Engineering in karunya institute of Technology and science, Coimbatore in 2018 And She is Currently Pursuing her Master's degree in Embedded System in Kongu engineering college, Perundurai. Shobigasherlin16@gmail.com.