International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 06 | June - 2022 Impact Factor: 7.185 ISSN: 2582-3930

Lane and Curve Detection

Shikhar Gupta[1], Ayush Kumar[2], Tarun Sharma[3], Devyansh Sharma[4], Sidhant Singh[5]
[1]Department of Computer Science, Chandigarh University
guptashikhar7305@gmail.com
[2]Department of Computer Science, Chandigarh University
ayushanshu04@gmail.com
[3]Department of Computer Science, Chandigarh University
tarunsharma1152137@gmail.com
[4]Department of Computer Science, Chandigarh University
sharmadevyansh77@gmail.com
[5]Department of Computer Science, Chandigarh University
ankitsingh88590@gmail.com

Abstract - *Developing new features is one of the most important step in distribution arising time for forthcoming machine sector which ensures the auto-mobilist's safety and dropped the number of roads accidents.*

Indeed, the road and lane discovery is truly complex and challenging task. It includes localisation of the road and the determination of the relative position between vehicles and Road digital cameras on the vehicle will capture the picture of road and lanes using various programming algorithms. The lanes are pulled using Hough transfigure through a brace of hyperbolas which are fitted to the edges of the lanes. The proposed lane discovery system can be applied on both painted and unpainted roads as well as crooked and straight road in different downfall conditions. The proposed system does not bear any spare information analogous as lane range, time to lane crossing and neutralize between the centre of the lanes. In addition, camera estimation and coordinate transformation are also not demanded. The system was excavated under various situations of changing illumination, and murk Goods in various road types without speed limit.

Keywords:

Hough Transformation, Canny Edge Detection, Bilateral filter, Greyscale, Region of Interest (ROI), Convolutional Neural networks (CNN), Recurrent Neural Network (RNN).

1. INTRODUCTION

With the fleetly adding number of vehicles and business on roads, road safety has came the moment's precedence. According to colourful checks in India there's three deaths in every 10 twinkles due to road accidents. that accounts to 16 accidents per hour. roughly4.69 billion road accidents are logged by State out of which 33.9 bike two-wheeler accident and rest are other heavy vehicles accidents. However, also maturity of the accident is done due to neglectfulness of motorist and due to lack of Lane marks, if we ignore the 30 of accident. maturity of these cases will be reduced if there's proper Lane discovery and system installed in vehicles which can help the motorists in real time base, similar system will give warning admonitions and signals to the motorist hence have great impact in saving people's life. Advanced Driving Assistance Systems (ADAS) bear the capability to model the curvature of road and align the vehicle accordingly. Although, the main reason to make intelligent vehicles is to ameliorate the safety conditions by the entire or partial

robotization of driving tasks. Among these tasks, the road discovery took an important part in driving backing systems that provides information Similar as lane structure and vehicle position relative to the lane. Still, vehicle crashes remain the leading cause of accident death and injuries in Malaysia and Asian countries which claiming knockouts of thousands of lives and injuring millions of people each time. Utmost of these transportation deaths and injuries do on the nation's roadways. The United Nations has ranked Malaysia as 30th among countries with the loftiest number of fatal road accidents, registering an normal of4.5 deaths per registered vehicles (Benozzi etal., 2002). Thus, a system that provides a means of warning to a motorist for a peril has been considered as a implicit way to save a considerable number of lives. The main technology utilised here in this tasks is computer vision which becomes a important tool for seeing the terrain and has been extensively used in numerous operations by the intelligent transportation systems (ITS). In some proposed systems similar as Tsugawa and Sadayuki, (1994), the lane discovery consists of the localization of specific savages similar as the road markings of the face of painted roads. Some systems achieves good results, but detecting the road lane remains a grueling task under tough conditions that are frequently met in real driving situations. Under similar conditions, the system should at least switch off automatically and not report a false discovery, nonetheless, two situations can disturb the process. If it detects that some other vehicle is there ,then it may Block incompletely the road markings ahead of the vehicle are the presence of murk caused by trees, structures etc. This paper presents a vision-grounded approach which is able of reaching a real time performance in detecting and shadowing of structured road boundaries (painted or uncolored lane markings) with slight curve and shadow conditions. Road boundaries are detected by fitting a resemblant hyperbola dyads to the edges of the lane after applying the edge discovery and Hough transfigure.

2. LITERATURE REVIEW

J. Long, E. Shelhamer, and T. Darrell, in 2015, proposed the Lane Detection Techniques. When it involves detecting lanes effectively both Recurrent Neural Network (RNN) and Convolutional Neural networks (CNN) detectors are used. A camera is attached on the vehicle to induce picture of the road. To scale back the processing time, image is translated by greyscale. Filters like gaussian, bilateral and trilateral can be used to get rid of the noises so that accurate detection of edges can be captured. Edge detector can be used to produce an edged image which also uses canny filter by using machine generated thresholding to get the edges. With the help of line detector left and right sides of the lane boundary can be detected. Using the RGP colour codes white and yellow are obtained as a result. Methods involving techniques used for detecting lanes have been studied in this paper in which many resulted in improper conclusions. To increase the efficiency, Hough Transformation can be changed in the future by someone so that it can precis straight and curved roads because current approach gives inaccurate results in bad environmental conditions like cloudy, rainy, and stormy days.

S. Zheng, S. Jayasumana, in 2015, proposed an approach to Robust Lane Detection at Night. To exclude unnecessary objects such as Street Lights, Signs, Sky etc from an image Region of Interest (ROI) is needed to be reduced. Cropping is another good method to improve accuracy of the lane detection system. The only pre-processing used in this lane detection system is the conversion of colour image into grey scale.

Jae-Hyun Cho in 2014 applied Hough transform with optimising the accumulator cells in the four ROI in parallel and detects lanes with high efficiency.

To detect the lane markers, **Chan Yee Low** in 2014 presented a robust road lane marker detection algorithm. The algorithm had optimization of Hough Transform and Canny edge detection system. Hough transform perform lane generation whereas Canny edge detection performs features

recognition. Hough Transform is used to find pertinent lines that can be used as lane boundaries.

For detecting the road region, **Dajun Ding** in 2013 proposed an algorithm based on road ROI determination using information of line segments and vanishing points. For reducing amount of computation in input images nonessential information was analysed.

A new algorithm for colour road image edge detection was proposed by **Hongli Fani** and **Weihua Wang** in 2013. Algorithm had high resistance to noise and retain better edges for colour road image detection than previous algorithm as shown by the results.

Lane detection method which consists of dynamical threshold choosing, image pre-processing, binary processing and Hough transform model fitting was proposed by **N. Phaneendra** in 2013. Kalman filter was used instead of instead of Hough transform for improving lane detection performance.

The accuracy of the method of the road region extraction based on regional growth is high, when selected seed points are correct. This was found by **Wang Jian** et al.(2013). The method used by Wang Jian is very helpful in detecting the lanes correctly.

An algorithm that helps in detecting the lanes and edges of the road and thus gives guidance to the drivers by determining the travelling direction was proposed by **F. Mariut** (2012).

An algorithm for detecting unexpected lane changes was proposed by **Kamarul Ghazali et al**(2012). This algorithm was based on H-maxima and improved Hough Transform was proposed which defines region of interest.

In 2009, **ZhiyuanXu**, presented a method based on CLAHE for removing the effect of fog, thereby limiting the noise in an image while enhancing the contrast.

B.M. Broggi in 1998 presented a model known as the GOLD system which has been proved very helpful in detecting the edge based lane boundaries.

C.Kreucher in 1998 proposed a LOIS algorithm where shapes described the set of all possible ways that the lane edges could appear in the image.

Y.Wang in 2004 used B-Snake spline as a geometric model that can represent the road. The results were robust but were uniform.

3. OBJECTIVE

The objectives of the project are:

- To avoid accidental deaths and provide a better safety on roads, by use of advanced technologies in driving assistances system.
- To identify the lane marks. Its intent is to obtain secure environment and improved traffic surroundings. The proposed system can range from displaying the lane and edge boundaries and also the turns to the driver or any external display, to more convoluted applications like detection of the switching of the lanes in the near future so that one can prevent confusions on the highways and expressways.
- To give assistance and details to pedestrians and drivers.
- To ensure uniformity of the markings as it is an important factor in minimizing confusion and uncertainty.

4. PROBLEM STATEMENT

Nowadays, with the growth of society, automobiles are now common use of transport and travel. There are every type of vehicles on the road and increasing over the year . With the increase of this innovation there is also increase in injuries and even deaths due to car accidents . Today there are lot researches over "Lane and curve detection method" ,however there is a requirement to

implement this method with good accuracy to avoid future accidents.

With an image taken by the camera which is on the vehicle on a moving road and this image will store in database to start the process ,then road detection will detect the road in the image so that it can be part in driving system automation. After this we will use some algorithms for curve and edges detection to increase the working accuracy of the project and we will do this with the help of canny edge detection and Hough transform space .

This project will search different methods for road and lane detection and how they can be implemented on RTOS(real-time operation system).

5. METHODOLOGY

The Lane and curve detection process follows a series of steps which include capturing of the image through the vehicle , image processing, detection of lanes and curves through various algorithms such as the Hough Transform algorithm and Canny Edge detection algorithm and finally displaying the results so that the vehicle can drive safely. This can be illustrated by the flowchart in the below image:

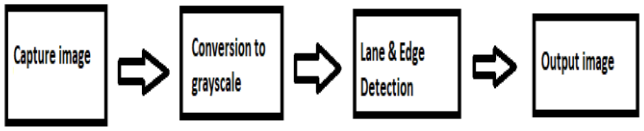

Figure 5.1: Steps for lane and curve detection

These steps are further discussed below:

Capturing of the image:

The first step in the Lane and Curve detection process is the capturing of image through the cameras installed in the vehicles. The image is then sent to the system where the rest of the operations are performed to produce the final image output.

Image processing:

Image processing is a method which performs certain operations on the image to get an enhanced image or to extract some important information from the image. It is a type of signal conditioning in which input is the image captured through the cameras installed in the vehicles and output is the enhanced image which has more information than the captured one.

The process of image conversion to grayscale comes under image processing.

Conversion to grayscale: Grayscale conversion is the process of conversion of RGB image to shades of gray. This process is performed to reduce the image processing time.

There are various other steps in the image processing such as the segmentation and object separation of the image which are helpful in extracting details from the image.

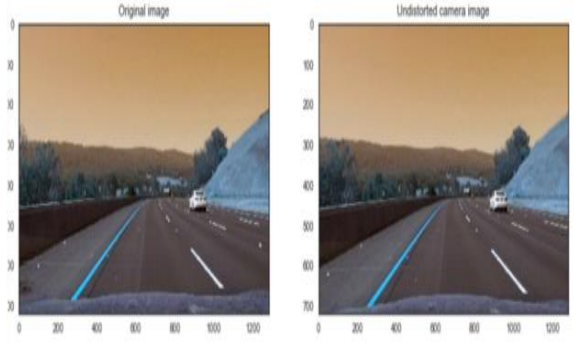

Figure 5.2: Distorted and undistorted images

Detection of Lanes and Curves:

This is the main step in the methodology which detects the lanes from the given image or video. In this project, we have used the Hough Transformation technique and the Canny Edge detection technique for detection of lanes.

Hough Transformation technique: Hough Transformation technique is a feature extraction technique used in digital image processing and computer vision. It is a technique which converts

an image from Cartesian to polar coordinates which makes it easier for the system to detect lanes and curves precisely. In the development stage of the Hough Transform technique, the technique was only able to detect lines from the image but now the technique is able to detect positions of arbitrary shapes, most commonly ellipses or circles.

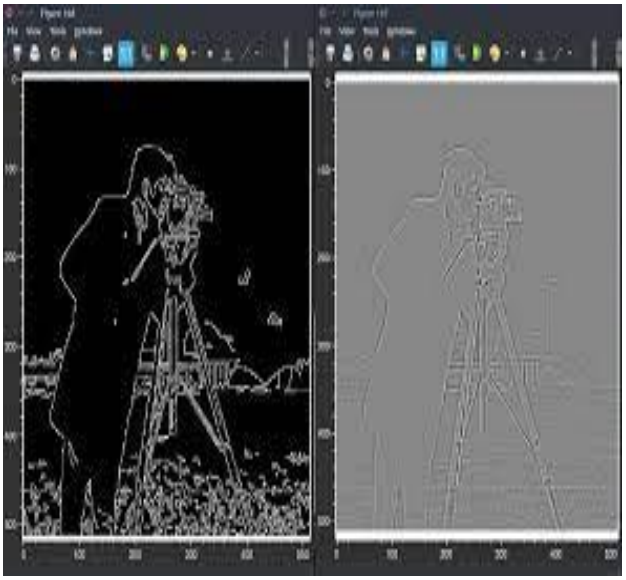

Figure 5.3: Hough Transform

Canny Edge Detection Technique: The Canny Edge Detection technique was developed by John F. Canny in the year 1986. It is basically a multi-stage algorithm to detect a wide range of edges in images.

Bilateral Filter: It is a non-iterative scheme which smoothens the image while preserving the curves.

After the detection of the Lanes and Edges the final image is sent to the system which is then displayed on the vehicle to provide assistance to the drivers.

6. OUTPUT USING PYTHON

The Lane and Curve Detection Project has been carried out using Python Language. We have used the OpenCV library available on the Python environment. The program works by taking videos of lanes as input and then performs various operations on the raw input using Canny and Hough Transform Algorithms and finally produces the output.

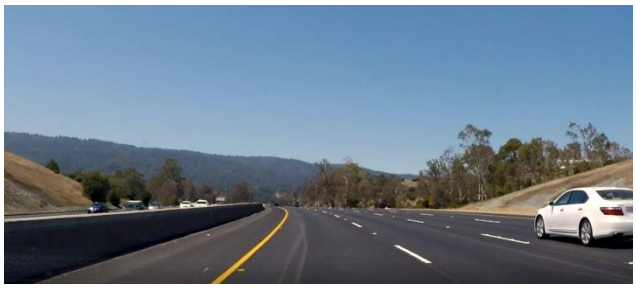

Figure 6.1: Raw input video screenshot

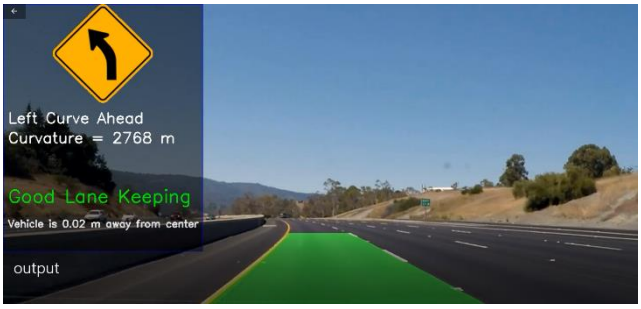

Figure 6.2: Output video screenshot

7. CONCLUSION

In short, lane and curve detection method have five stages . Firstly, we have to select the appropriate images for the process, and it is the most important part in the project . Chose an image from the dataset and it will be taken as input, and it is important because we need a right image as an input to start the process . Then we have to do pre-processing of selected image , it plays a very important role to get a required output and it helps in reducing the complexity of the algorithm. The selected image converts into grey scale which is considered as the first process in canny edge detection . Then image is cleared by the help of gaussian blur algorithm on the selected grey scale image . The grey scale converts the image from white to black which represents the colour mixture of other colours .The goal of this process is to make the image data ready for ML model to make it easier to analyse and process computationally as it is with image. After

grayscale image conversion we implement edge detection which is used to detect edges in the images irrespective of other details in image . There is canny edge detection algorithm we use, this technique involves four process . They are gaussian blur , gradient calculation, double threshold and strengthening of lines .And then image is ready as an input for Hough transform which is used for grouping and model fitting ,it is the complicated part of the project . It can detect lines even when they are partially occluded ,since each point is handled independently, parallel implementations are possible . Hough transform helps in fixed - size circles ,in unknown sizes and work even for ellipses and straight lines.

At the end we must evaluate the output and it is done through confusion matrix and accuracy metrices . When all images as an input pass for models than output is observed in every image and then we can note true and false positives and negatives .

There are many other methods introduced over the time of period and thus it is inappropriate to declare which methods demonstrate the highest performance since there lack of uniform way to evaluate the methods.

8. FUTURE WORK

The algorithm of the design system can be updated easy and the work of modification can be continued in future. we can use the pickle file of developed model or system and implement it in required area ,hence easily transform into new product . THIS will avoid the unnecessary repetitive work of compiling the such a large code every time .we can bring updates into the system by adding some more new features into it like dark vision so that the roads and lanes could be detected even in the dark at night or in Limited visibility condition like in heavy fog also some of the limitations of the current system will be overcome in near future work like present version of model cannot detect the lean in loamy soil which is very common in Indian villages and Indian climatic conditions. In this present new version is developed completely using Python, by future advancement it will also be made accessible in some more future-proof and advanced languages too.

Now it's very high time to take the advancement in automobile sector to the next level for which developing a reliable and accurate system is very necessary which can save the human effort automobile sector which is around eight tickets sold have only seen the product where you man holding steering and shifting gears and putting its effort continuously throughout driving system will depart for the new upcoming automobile generation of self-driving car which will not only save the human efforts but will also reduce the number of accidents on road.

Right now, it's very difficult to make the clear choice of assessment about the Precision and accuracy level of the autonomous car will provide in real life but with the continuous update and advancement in technology it will be achieved very soon.

ACKNOWLEDGEMENT

We are very grateful because we managed to complete our Lane and Curve Detection Research paper within the time given by our teachers. This project cannot be completed without the effort and cooperation from our group members Shikhar Gupta, Ayush Kumar, Tarun Sharma, Devyansh Sharma and Sidhant Singh. We also sincerely thank our lecturer Dr. Shubham Negi and our supervisor Er. Kumud Sachdeva for the guidance and encouragement in finishing this project and also for teaching us in this course. Last but not least, we would like to express our gratitude to our friends and respondents for the support and willingness to spend some time with us to clarify our doubts for the project.

REFERENCES

[1] J. Long, E. Shelhamer, and T. Darrell, "LANE DETECTION TECHNIQUES" – A Review." in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 2015.

[2] S. Zheng, S. Jayasumana, B. Romera-Paredes, V. Vineet, Z. Su, D. Du, C. Huang, And P.H Torr, "A Layered Approach To Robust Lane Detection At Night." 2015.

[3] Cho, Jae-Hyun, Young-Min Jang, and Sang-Bock Cho. "Lane recognition algorithm using the Hough transform with applied accumulator cells in multichannel ROI." In Consumer Electronics (ISCE 2014), The 18th IEEE International Symposium on, IEEE, 2014.

[4] Low, Chan Yee, HairiZamzuri, and SaifulAmriMazlan. "Simple Robust Road Lane Detection Algorithm". IEEE, 2014.

[5] Ding, Dajun, Chanho Lee, and Kwang-yeob Lee. "An adaptive road ROI determination algorithm for lane detection." In TENCON 2013-2013 IEEE Region 10 Conference (31194), IEEE, 2013.

[6] Fani, Hongli, and Weihua Wang. "Edge Detection of Color Road Image Based on Lab Model." In Computational and Information Sciences (ICCIS), 2013 Fifth International Conference on, IEEE, 2013.

[7] Nalla, Phaneendra, GCL AbhiramanGoud, and V. Padmaja. "ACCIDENT AVOIDING SYSTEM USING LANE DETECTION." IJRECE 1, 2013.

[8] Jian, Wang, Sun Sisi, Gong Jingchao, and Cao Yu. "Research of lane detection and recognition technology based on morphology feature." In Control and Decision Conference (CCDC), 2013 25th Chinese, IEEE, 2013.

[9] Mariut, F., C. Fosalau, and D. Petrisor. "Lane mark detection using Hough Transform" In Electrical and Power Engineering (EPE), 2012 International Conference and Exposition on, IEEE, 2012.

[10] Ghazali, Kamarul, Rui Xiao, and Jie Ma. "Road lane detection using H-maxima and improved hough transform." In Computational Intelligence, Modelling and Simulation (CIMSiM), 2012 Fourth International Conference on, IEEE, 2012.

[11] Xu, Zhiyuan, Xiaoming Liu, and Na Ji. "Fog removal from color images using contrast limited adaptive histogram equalization." In Image and Signal Processing, 2009. CISP'09. 2nd International Congress on, IEEE, 2009.

[12] Broggi, B.M., 1998. GOLD: A parallel real-time stereo Vision system for generic obstacle and lane detection, IEEE Transactions on Image Processing, 1998.

[13] Kreucher, C., S.K. Lakshmanan. A Driver warning System based on the LOIS Lane detection Algorithm, Proceeding of IEEE International Conference On Intelligent Vehicles. Stuttgart, Germany, 1998.

[14] Y. Wang, E. K. Teoh, and D. Shen, "Lane detection and tracking using b-snake," Image and Vision Computing, 2004.