International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

A NOVEL ROAD LANE LINE DETECTION USING COMPUTER VISION TECHNIQUE

[1]M. SAI VENKAT SANJAY, [2]K. AKASH, [3]K. ABHILASH, [4]G. VIJAY KUMAR
[1,2,3]B. Tech Student, Dept. of CSE, CMR Technical Campus, Medchal, Hyderabad, Telangana,India.
mannesanjay20@gmail.com, akashkattempudi002@gmail.com, kollapuabhilash1289@gmail.com
[4]Assistant Professor, Dept. of CSE, CMR Technical Campus, Medchal, Hyderabad, Telangana, India.
gogula.vijaykumar585@gmail.com

ABSTRACT: As the need for an intelligent transport system is growing rapidly, lane line detection has gained a lot of attention recently. In recent times many technological advancements are coming in the domain of road safety as accidents has been increasing at an alarming rate and one of the crucial reason for such accidents is lack of driver's attention. Technical advancements should be there to reduce the frequency of the accidents and stay safe. One of the ways to achieve the same is through Lane Detection Systems which work with the intention to recognize the lane borders on road and further prompts the driver if he switches and moves to erroneous lane markings. Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs and take actions or make recommendations based on that information. Hence, in this work, a novel road lane line detection using computer vision technique is presented. The approach used in this work changes the image taken from the video into a set of sub-images and generates image-features for each of them which are further used to detect the lanes present on the roads. In this system Canny Edge Detection is used which is recent and efficient implementation to detects the edges of road images.

KEYWORDS: Road safety, Traffic, Road lane detection, Computer Vision.

I. INTRODUCTION

Lane detection is one of the key technologies in the field of intelligent driving. It has been widely used in vehicle driving assistance system, lane departure warning system and vehicle collision prevention system. With the rapid development of computer science, artificial intelligence and target detection technology, the research of end-to-end intelligent lane detection method is a new approach in the field of autonomous driving [3]. Lane line detection is an important part of intelligent transport systems, such as in traffic monitoring and autonomous cars. Therefore, the need for the lane line detection system is increasing in the industry [1].

Increasing safety, reducing road accidents and enhancing comfort and driving experience are the major motivations behind equipping modern cars with Advanced Driving Assistance Systems (ADAS). In the past couple of decades, major car manufacturers introduce many sophisticated ADAS functions like Lane Departure Warning (LDW), Lane Keep Assist (LKA), Electronic Stability Control (ESC), Anti-lock Brake System (ABS), etc. Both LDW and LKA functions are examples of how important for the car to detect and track the road lane lines or the road boundaries accurately and on time [4].

Future ADAS functions like Collision Avoidance, Automated Highway Driving (Autopilot), Automated Parking and Cooperative Maneuvering requires more and more fast and reliable road boundaries detection, which is among the most complex and challenging tasks. The road boundaries detection functionality requires localization of the road, the determination

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

of the relative position between vehicle and road, and the analysis of the vehicle's heading direction.The traffic safety becomes more and more convincing with the increasing urban traffic. Exiting the lane without following proper rules is the root cause of most of the accidents on the avenues. Most of these are result of the interrupted and lethargic attitude of the driver. Lane discipline is crucial to road safety for drivers and pedestrians alike. Actuate detection of lane roads is a critical issue in lane detection and departure warning systems. If an automobile crosses a lane confinement then vehicles enabled with predicting lane borders system directs the vehicles to prevent collisions and generates an alarming condition.

These kind of intelligent system always makes the safe travel but it is not always necessary that lane boundaries are clearly noticeable, as poor road conditions inadequate quantity of paint used for marking the lane boundaries makes it hard for system to detect the lanes with accuracy and other reasons can include environmental effects like shadows from things like trees or other automobiles, or street lights, day and night time conditions, or fog occurs because of invariant lightening conditions. These factors cause problem to distinguish a road lane in the backdrop of a captured image for a person.

Researchers are focusing more and more on advanced driver assistance system to prevent unwanted accidents since the last two decades. Lots of advancement has been done in the field of Intelligent Transportation System (ITS). In the vision-based system to detect lane, the video is captured from a camera mounted behind the front windshield to collect the lane information [2].

Computer vision techniques are the main tools that provide the capabilities of sensing the surrounding environment for the detection, identification, and tracking of road lane-lines. The detection of lanes consists mainly of the finding of specific patterns/features such as the lane markings (colored segments) on painted roads surfaces. Such kind of specification streamlines or guides the process of lane detection.

In order to address the issues raised above as a result of lane boundary adjustments, a novel road lane line detection using computer vision technique is presented. The rest of the work is organized as follows: The section II describes the Literature Survey. The section III presents a novel road lane line detection using computer vision technique. The section IV evaluates the result analysis. Finally, the work is concluded in section V.

II. LITERATURE SURVEY

Huan Shen et. al., [5] describes Complex Lane Line Detection Under Autonomous Driving. An improved lane determination algorithm is presented to increase the accuracy and stability of the driving assistance system in an automatic driving system when determining the position of a lane in a complex driving environment. Based on the proposed single-scale Retinex enhancement and Gamma correction fusion image enhancement algorithm, we introduce a Hidden Markov Model improvement road segmentation algorithm to extract lane feature points by separating the region of interest and at the same time, we design a vanishing line detection technology based on improved V-disparity map. Experimental data show that the proposed algorithm has excellent detection capabilities and can detect main lanes in complex road environments such as shadows, traffic congestion, and uneven lighting.

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

Libiao Jiang, Jingxuan Li, Wandong Ai et. al., [6] describes Lane Line Detection Optimization Algorithm based on Improved Hough Transform and R-least Squares with Dual Removal. In this analysis, the road image is pre-processed to obtain the edge points of the lane line, and then two methods of lane line fitting are optimized to improve the accuracy and real-time performance of lane line detection. In the actual detection, a detection algorithm combining improved Hough transform and r-lsdr method is designed, and Kalman filter is used to track the lane line. The experimental results show that the optimized lane line detection algorithm improves the detection accuracy and operation efficiency.

Zaiying Wang, Ying Fan, Hao Zhang et. al., [7] describes Lane-line Detection Algorithm for Complex Road Based on OpenCV. In order to meet the requirements of the high accuracy and timeliness of lane line detection for the autonomous vehicle camera, a fast detection algorithm based on the combined gradient and color filtering of lane line pixel for the interest model was proposed. Firstly, based on the high contrast between the lane line and the surface of the structured road, the algorithm uses Sobel edge detection operator to detect the edge information of the lane. Then, according to the white and yellow color features of the lane line, the pixel of the lane line is extracted by filtering these two colors in the color space. Experiments show that the algorithm has high accuracy, fast speed and good robustness, and can meet the requirements of lane line detection under complex road conditions.

M Kodeeswari, Philemon Daniel et. al., [9] describes Lane line detection in real time based on morphological operations for driver assistance system. The objective of this paper is to use image processing techniques to identify the lane lines on the hilly road based on Hough transform. Vision based approach is utilized as it performs well in a wide variety of situations by extracting rich set of information compared to other sensors. The proposed method processes the live video stream from a monocular camera using matlab and extracts the position of lane markings and an algorithm is used to find the lane lines present on the road.

Huaizhong Chen, Zheliang Jin et. al., [10] describes Research on Real-Time Lane Line Detection Technology Based on Machine Vision. To keep an intelligent vehicle on the lane in the vision-based navigation, an image processing technology is proposed to detect the lane of a structured road. A way of lane marking recognition arithmetic being acclimated to structuring road is put forward. It makes use of Soble morphology gradient algorithm to coordinate with Hough transform, and authors used straight line to reconstruct 2D lane. As the test result, it proves that the system can fairly exactly detect the normative real-time lane lines and identify some important information.

III. A NOVEL ROAD LANE LINE DETECTION

In this section, a novel road lane line detection using computer vision technique is presented. The architecture of novel road lane line detection using computer vision technique is shown in Fig. 1.

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

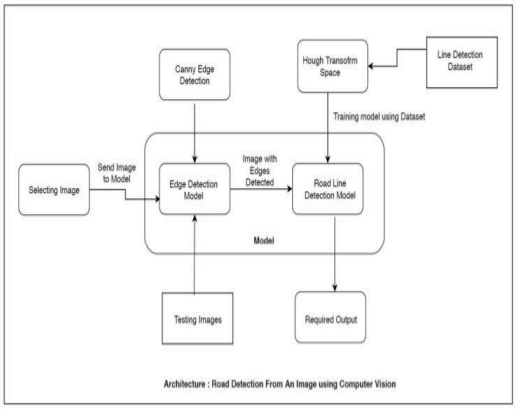

Fig. 1: Architecture of novel road lane line detection using computer vision technique

Dataset used for the training is taken from Internet sources. In this system Canny Edge Detection is used which is recent and efficient implementation in Python instead of MATLAB. Since, Python is the Scripting and Statistical Modelling Language it supports faster execution for mathematical functions which could be used by Canny Edge Detection technique. Secondly, Hough Transform Space is used for 3-Dimensional Object detection which could faster and accurate compared to single dimension object detection.

Canny edge detection is a technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. It has been widely applied in various computer vision systems. Canny has found that the requirements for the application of edge detection on diverse vision systems are relatively similar. Thus, an edge detection solution to address these requirements can be implemented in a wide range of situations. The general criteria for edge detection include:

Detection of edge with low error rate, which means that the detection should accurately catch as many edges shown in the image as possible. The edge point detected from the operator should accurately localize on the center of the edge. A given edge in the image should only be marked once, and where possible, image noise should not create false edges

To satisfy these requirements Canny used the calculus of variations – a technique which finds the function which optimizes a given functional. The optimal function in Canny's detector is described by the sum of four exponential terms, but it can be approximated by the first derivative of a Gaussian. Among the edge detection methods developed so far, Canny edge detection algorithm is one of the most strictly defined methods that provides good and reliable detection. Owing to its optimality to meet with the three criteria for edge detection and the simplicity of process for implementation, it became one of the most popular algorithms for edge detection.

The process of Canny edge detection algorithm can be broken down to five different steps: i) Apply Gaussian filter to smooth the image in order to remove the noise, ii) Find the intensity gradients of the image; iii) Apply gradient magnitude thresholding or lower bound cut-off suppression to get rid of spurious response to edge detection; iv) Apply double threshold to determine potential edges and v) Track edge by hysteresis: Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges.

The image's dimensions are chosen to include the road lanes and identify the triangle as our region of interest. Then a mask with the same dimension as the image is constructed, which is effectively an array of all zeros. Now we'll fill the triangular dimension in this mask with 255 to make our region of interest dimensions white. Now we'll combine the canny image with the mask in a bitwise AND operation to get our final region of interest.

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure. This voting procedure is carried out in a parameter space, from which object candidates are obtained as local maxima in a so-called accumulator space that is explicitly constructed by the algorithm for computing the Hough transform. The Hough transform is a popular feature extraction technique that converts an image from Cartesian to polar coordinates. Any point within the image space is represented by a sinusoidal curve in the Hough space.

The algorithm followed in this work is to detect lane markings on the road by giving the video of the road as an input to the system by using computer vision technology and primarily designed with the objective of reducing the frequency of accidents. System can be installed in cars and taxis in order to prevent the occurrence of accidents due to reckless driving on the roads. In school buses as it will guarantee the safety of the children.

Lane discipline is crucial to road safety for drivers and pedestrians alike. The system has an objective to identify the lane marks. It's intent is to obtain a secure environment and improved traffic surroundings. The functions of the presented system can range from displaying road line positions to the driving person on any exterior display, to more convoluted applications like detecting switching of the lanes in the near future so that one can prevent concussions caused on the highways.

IV. RESULT ANALYSIS

In this section, a novel road lane line detection using computer vision technique is implemented using python. The result analysis and implementation of novel road lane line detection using computer vision technique is demonstrated here. The Fig. 2 shows the application after implementation.

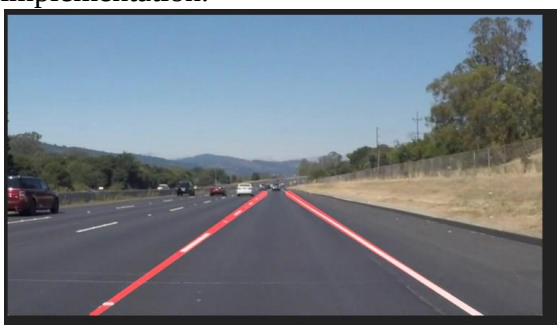

Fig. 2: After application Implementation

The fig. 3 shows the road lane line.

Fig. 3: Road Lane Line

The Fig. 4 shows the detection of error.

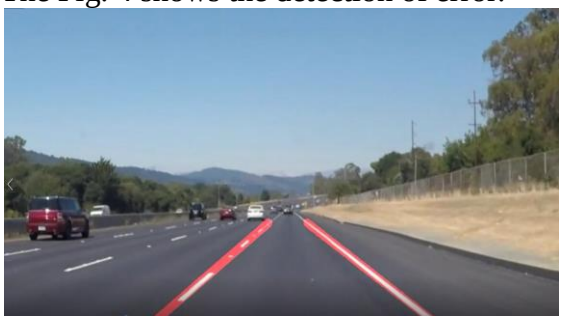

Fig. 4: Error Detection

The Fig. 5 shows the region of interest.

Fig. 5: Region of Interest

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

Hence, this approach has detected errors, RoI and road lane line very effectively.

V. CONCLUSION

In this section, a novel road lane line detection using computer vision technique is presented. In this approach, dataset is taken from the internet. The road detection region of interest (ROI), must be flexible. When driving up or down a steep incline, the horizon will change and no longer be a product of the proportions of the frame. This is also something to consider for tight turns and bumper to bumper traffic. This project is entirely based on image processing and road detection in self-driving vehicles in which has a great scope in future To achieve edge detection, OpenCV library and algorithms like the Canny Function are used. The Hough Transform method was then used to detect the straight lines in the image and identify the lane lines. According to theoretical and experimental analysis, our method can not only achieve high detection accuracy in various harsh environments, but also achieve fast, accurate and real-time detection in processing high-resolution images, which cannot be achieved by many neural network methods.

VI. ACKNOWLEDGEMENT

We thank CMR Technical Campus for supporting this paper titled "A NOVEL ROAD LANE LINE DETECTION USING COMPUTER VISION TECHNIQUE", which provided good facilities and support to accomplish our work. Sincerely thank our Chairman, Director, Deans, Head Of the Department, Department Of Computer Science and Engineering, Guide and Teaching and Non- Teaching faculty members for giving valuable suggestions and guidance in every aspect of our work.

VII. REFERENCES

[1] Gaoqing Ji and Yunchang Zheng, "Automatic Lane Line Detection System Based on Artificial Intelligence", Hindawi Journal of Electrical and Computer Engineering, Volume 2022, Article ID 5284185, 10 pages, doi:10.1155/2022/5284185

[2] Samia Sultana, Boshir Ahmed, "Robust Nighttime Road Lane Line Detection using Bilateral Filter and SAGC under Challenging Conditions", 2021 IEEE 13th International Conference on Computer Research and Development (ICCRD),DOI: 10.1109/ICCRD51685.2021.9386516

[3] Yuling Ding, Wanlin Li, Yameng Zhu, "Lane Line Detection Based On YOLOv4", 2021 IEEE International Conference on Signal Processing, Communications and Computing (ICSPCC),DOI: 10.1109/ICSPCC52875.2021.9565134

[4] Domagoj Špoljar, Mario Vranješ, Sandra Nemet, Nebojša Pjevalica, "Lane Detection and Lane Departure Warning Using Front View Camera in Vehicle", 2021 International Symposium ELMAR, DOI: 10.1109/ELMAR52657.2021.9550922

[5] Huan Shen, "Complex Lane Line Detection Under Autonomous Driving", 2020 5th International Conference on Mechanical, Control and Computer Engineering (ICMCCE), DOI: 10.1109/ICMCCE51767.2020.00139

[6] Libiao Jiang, Jingxuan Li, Wandong Ai, "Lane Line Detection Optimization Algorithm based on Improved Hough Transform and R-least Squares with Dual Removal", 2019 IEEE 4th Advanced Information Technology, Electronic and Automation Control Conference (IAEAC), DOI: 10.1109/IAEAC47372.2019.8997573

[7] Zaiying Wang, Ying Fan, Hao Zhang, "Lane-line Detection Algorithm for Complex Road Based on OpenCV", 2019 IEEE 3rd Advanced Information

Management, Communicates, Electronic and Automation Control Conference (IMCEC),DOI: 10.1109/IMCEC46724.2019.8983919

[8] Wael Farag, Zakaria Saleh, "Road Lane-Lines Detection in Real-Time for Advanced Driving Assistance Systems", 2018 International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies (3ICT), 978-1-5386-9207-3/18, 2018 IEEE

[9] M Kodeeswari, Philemon Daniel, "Lane line detection in real time based on morphological operations for driver assistance system", 2017 4th International Conference on Signal Processing, Computing and Control (ISPCC), DOI: 10.1109/ISPCC.2017.8269696

[10] Huaizhong Chen, Zheliang Jin, "Research on Real-Time Lane Line Detection Techonogy Based on Machine Vision", 2010 International Symposium on Intelligence Information Processing and Trusted Computing, DOI: 10.1109/IPTC.2010.124