

Auto Module of Road Lane Detection Using Image Processing Techniques.

^[1] Vaibhav KN ^[2] Shreesha ^[3] S.Venkatarameswara reddy,

^[4] Rishabh Kumar, ^[5] Dr. Saravana Kumar.R

^{[1][2][3][4]} BE Students, Department of Computer Science and Engineering

^[5] Associate. Professor, Department of Computer Science and Engineering

^{[1][2][3][4][5]} Dayananda Sagar Academy of Technology and Management, Bangalore, Karnataka, India

Abstract:

Most of the world population uses road as their transport medium. More than 85% of people uses road transportation so the probability of road accidents is been increasing because of negligence done by people. More deaths are happening and more families suffered by road accidents. When we see Autonomous cars, they are actually a sign of modern and advance technology implementation for human safety and security actually consist of so many modules in it like Road lane detection, Traffic sign and signal detection, Vehicle and Object detection and many more application modules in it. In this paper we want to do one of the major module that is Road Lane Detection using completely the concepts of Image Processing Techniques and algorithms because most of these uses mixed domains like AI, ML etc.. Using only deep concepts of image processing, we achieved lane detection. Eventually, a critical overview of the methods of the techniques, algorithms are discussed. The proposed lane detection using image processing can detect only for different straight lines and also slight curvy lines only but the implementation is completely Image Processing and no need to learn other huge concepts like AI or ML.

Keywords: Image Processing, Open-cv, Canny edge detection algorithm, Hough line transform, HSL colour selection, Gaussian smoothing(filter), Gray Scaling techniques.

I. INTRODUCTION

Intelligent Transportation System is the today's curious and advance technology the whole world is looking forward to. Many of the Multinational companies like Tesla are investing Crores of Money in this field to discover Self Driving cars. Image processing is the useful, easy, feasible for automation, security and safety related applications of the mechanical and robotics industry. Image Significance of image processing and real time embedded systems applications are impacting the modern technology. Among the challenging tasks in further self driving safety cars is lane detection. Road Lane detection is the major module in self driving cars. Most of these implementations is actually of mixed domains where the coder needs to understand more advance technologies like AI or ML but in this paper we tried using completely using image processing. If video is the intermediate part in road detection then obviously video is a sequence of images, if we can process images it means indirectly we are processing video, by the time we reach final processing of image then we directly apply it on each frame of the video, so the input video will be camera captured video and output will be lane Detected video. We have series of image processing techniques which will be discussed further in detail. After researching many base papers we found so many algorithms and techniques like Canny edge detection for edge detection and Hough line transform for line detection and some filters to reduce noises occurs in images like Gaussian Filters and Gray Scale imaging for smoothing. We proposed an pipeline structure below explaining each algorithm implementation and all other methodologies. Our Model is able to detect most straightened lines as well slight curvy lines, because fully curved lines is out of this scope. We will first take images and make an calculation which is feasible and working fine for all those images then we will pore it on to video stream. Lane line in the test images are in white or yellow we need to specify correct colour selections, so we need to mask the yellow and white colour in the process. The entire paper is about how we are going to detect the road lanes lines So in this paper it's all about how we can achieve this thing entirely using image processing without even knowing knowledge Machine Learning, Artificial Intelligence and any other extra concepts.

The Major Algorithms or techniques used are Canny edge detection and Hough line transform which is an root of this project and once this algorithms are understood we can easily do the implementation part. Vehicle accidents remains one of the major cause for deaths and injuries in Malaysia and Asian countries documented many of lives and incapacitated thousands of people every year. Recently it is observed that Zimbabwe reached highest accident rate and India reached 60th rank in Road Traffic accidents. A more compelling justification for creating an intelligent car, though is to improve safety by entirely or partially automating driving functions. Upon these features, the road detection took an important part in self driving future systems that provides information such as road lane geometry and vehicle diagnostics relative to road lines.

II. Problem Description

The main reasons for road accidents is negligence of driver, vehicle inner problems, drowsiness of driver ,drink and drive and even the sort of road we are driving .We need some technology that provide safety and security for people whenever driving ,so self driving cars are the sort of vehicles the whole world Is looking forward ,upon all the modules of autonomous cars we are dealing with road lane detection ,its actually an major module ,our problem is to do detection of road lanes using completely image processing without even having knowledge on machine learning and artificial intelligence. Since video is the major intermediate in this process ,if we can process images it is something like indirectly processing video. There are so many things we have to do where most of these type projects won't do that is removal of noise ,smoothening of images, filtering out images to make this project work even in present of dust and fog. We need to detect lanes of the road so the input will be video stream and output will be lane detected video. For an real time embedded systems we may try this module implementation. By using different algorithms and techniques of image processing we want to detect the road lanes of both white coloured and yellow coloured.

III. Related Works

Learning all the required techniques and particular algorithm is the first task and the major task, we researched so many base papers for this project and learnt two major algorithms canny edge detection and hough line transform ,which is most briefly and compulsorily used techniques in all the papers. In one of the paper to detect road line paintings and lane patterns various techniques are used including Hough Transform for line detection, Canny edge detection algorithm for edge detection , bilateral filter for smoothing and other purposes.

The best edge detection features are Gooddetection,Goodlocalization,Minimal Response. Thus noise,fog,dust and other factors may reduction the precision of the real time embedded systems.To avoid that they used bilateral filters ways and means to enlarge the outcome. In one more paper they have used an technique called Adaptive road Mask using Vanishing Point detection scheme .This method is so robust and computationally effective and efficient. Like every other paper they also used edge detection and hough line transform at their first step ,then they used an ROI adaptation ,which means selecting only the region of interest of the image consisting of road lanes. In one more paper they did the selection of region in first step only because the images are actually in RGB format and there are so many information on image which is difficult to handle and store ,that's y they are going to take only the region which consists of lanes so that supressing the amount of unnecessary data present in image. Processing the image only on particular region makes the program run faster and makes efficiency of algorithm,after this they actually did Image preprocessing because it consists of so many noise and been involved it to grayscale conversion,gray stretch,median filter for all the removal of noise,they used two types of filtering namely domain filtering and spatial domain filtering and last step is to detect the edges around objects. But in this they also included one more edge detection called spiking neural network because the edge detection is so efficient,which they said more efficient edge detection technique than canny edge detection and then they used Hough line transform for as usual line detection which is one of the image processing techniques.It actually joins two points came from edge detection to make a line. In other paper , they used the lanebd algorithm does is to eliminate the falsification and regulate the alignment using a camera calibration routine ,then image is converted to colour spaces like HSL conversion,HSV conversion etc. and they used to source out white and yellow line patterns,then they marked the region in rectangle for better visualization.Then they did an spatial gradient computation on image using Sobel Operator.They used vertical mask in sobel for getting vertical edges to more visible and getting horizontal edges from horizontal mask,the both edge elements on either of sides are enhanced and bright in color.

In some papers they detected the lines by taking polygon over a particular region so that it is one more method to erase out unnecessary image part out from image frame and focus only one required lanes.

Some papers also did hyperbola fitting for finding the exact lines on the image frame.

Different implementations are implemented and impact on fastness,robustness,effectiveness

A perspective transform maps the points in a given image to different and desired image points with a new perspective.but this project is even able to even detect lane curvature also which is actually an toughest implementation,because it is actually out of image processing scope,they implemented deep computer vision techniques.Then finally they did HSL conversion,HSV conversion,LAB conversion and YUV conversion etc..and then they did lane boundary detection pipeline and then atlast they did parameter tuning by testing with so many images and calculations correction to maintain accuracy for all the different images and only to incorporate this to video. By all the above we took the required informations and proposed an pipeline structure so that implementation part will be easy.

IV. Methodology and Materials

After researching so many papers, for edge detection most of them used canny edge detection and spiking neural network, we found that *canny edge detection* is universally used, easy and efficient one.

For color selection we researched that for RGB images, HSV images, HSL images, we came to know that *HSL color Selection* is best.

To fasten the working of algorithm instead of taking the entire image, one of the paper chose only *region of interest* required for lane detection.

For line detection most of them used *Hough line transform* algorithm, so we also chose that one only.

So we are clubbing all the methodologies after comparing all of the above techniques

a) Algorithm

Two algorithms which have been observed to be present in all the papers are Canny edge Detection and Hough line transform.

Canny edge detection: The Canny edge detection is an edge detection algorithm, which only takes the one with high intensity edge pixels to take only the pixels of high intensity. In order to measure the strength of the gradients, it uses a filter based on the derivative of a Gaussian. The Gaussian reduces the noise effect present in the picture. Then, by eliminating non-maximum pixels of gradient magnitude, possible edges are thinned down to 1 pixel curves. Finally using hysteresis threshold, edge pixels are maintained or removed.



Fig.a.Canny edge output

Hough line transform: Using an appropriate edge to find all the edge points in the picture scheme for detection. Quantize the space of m, c into a two dimensional matrix H with suitable levels of quantization. Initialize the H to zero matrix. The outcome is a histogram matrix.

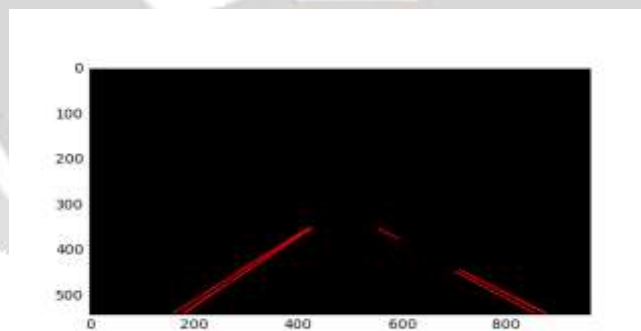


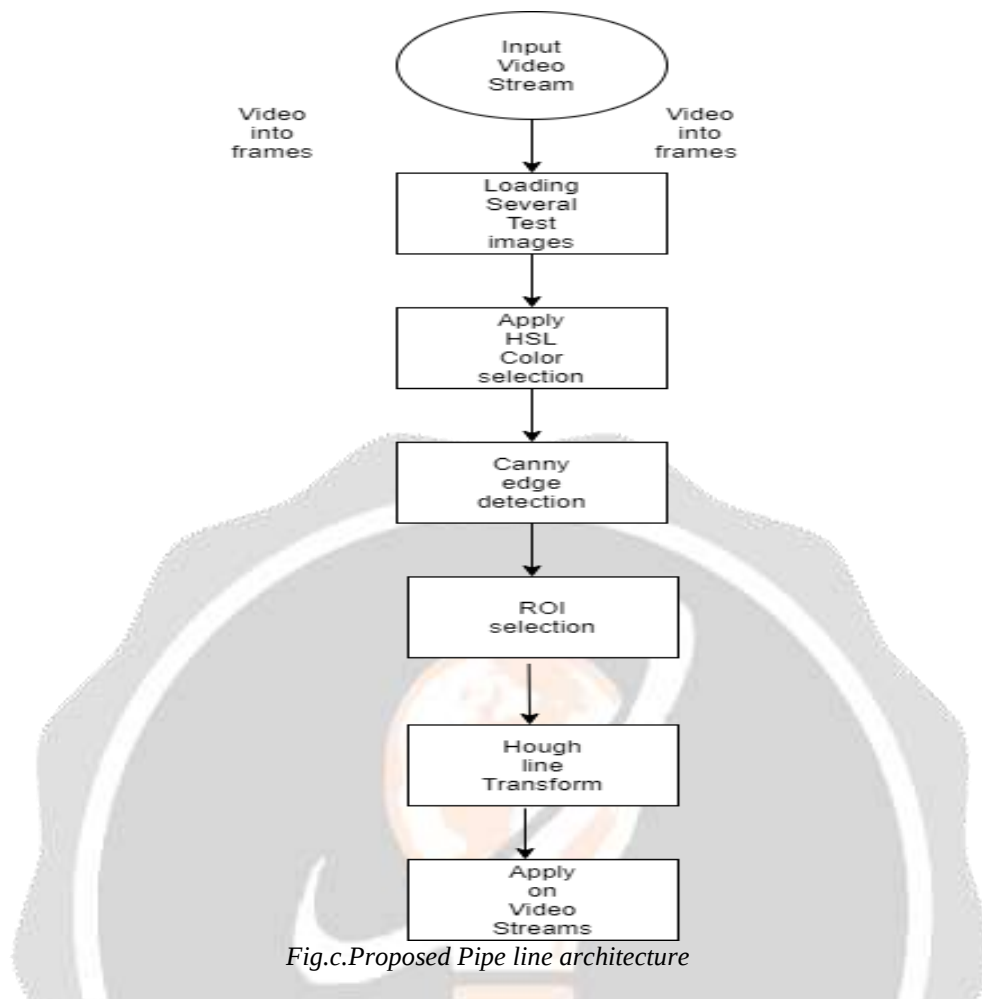
Fig.b.Hough line Transform

b) Methodology

After overall look up of so many techniques we chose an feasible, efficient, effective methodologies and algorithms we prepared an pipeline structure for the implementation part.

Lane lines on roads are actually in white color and yellow. We need to select the most fitting color space that clearly highlights the lane lines.

We decided to apply HSL color selection because after researching all we found out that using HSL will be the best color space to use and we mask their yellow and white color space. Then we apply Canny Edge detection for edge detection and the algorithm has been already explained in short above. We're interested in the area facing the camera, where the lane lines are found. So, we'll apply region of interest to cut out everything which we not required else. The Hough line transform is a procedure that can be used within an image to separate features of a specific shape. For each lane line, we have several lines detected.



Now to detect lines from video stream we just apply all the above functions so that it will be seen as video processed. First we will test one image with road lanes and make it work and then we increase the number of test images and modify and alter the code as is and make it more universal. Once we got output on all images then we will start applying it on different videos, first on solidwhitelines and then on solidyellowlines and then on our challenging video slightly curved lane detection .By the time we reach our final stage we will be able to detect straight road lanes accurately and slightly curved ones . Testing with more test images will be able to increase accuracy of the project and for the better real time implementations also.All the methods and techniques were choosen by all the base papers we studied and researched ,each methodology is dumped by different papers.

V.CONCLUSION

From the above all paper, We choosen best technologies and learnt the importance of famous algorithms .The working scenario has been learnt and each paper has its own uniqueness and has its own advantages and disadvantages as well .By considering all those things we wisely took the necessary technologies and methodologies required for our project There are many challenges to be addressed, to overcome all these challenges we have proposed an pipeline architecture which will lead to the proper output and destiny of our road lane detection .We choosed canny edge detection and houghline transform , The reason to choose those algorithms is that they are very fast efficient and help us for real time embedded implementation.We also applied so many other image processing techniques like filters,color,selection,scaling images for different purposes in our project which determines the result.

VI. REFERENCES

- [1] Abdulhakam.AM.Assidiq, Othman O. Khalifa, Md. Rafiqul Islam, Sheroz Khan Department of Electrical & Computer Faculty of Engineering, Proceedings of the International Conference on Computer and Communication Engineering 2008
- [2] Anjali Goel Department of Computer Science Guru Nanak Dev University, Amritsar (Punjab) India International Journal of Computer Science and Mobile Computing, Vol.3 Issue.2, February- 2014, pg. 596-602
- [3] Chin-Pan Huang, Chaur-Heh Hsieh¹, Jin-Long Li Department of Computer and Communication Engineering, Ming Chuan University, Taiwan, R.O.C. The Proceedings of the International Conference on Digital Information Processing, Data Mining, and Wireless Communications, Dubai,.
- [4] Vidya Viswanathan vidyakv@uw.edu Department of Electrical Engineering University of Washington Bothell, 98011, USA Rania Hussein rhussein@uw.edu Department of Electrical Engineering University of Washington Bothell, 98011, USA International Journal of Image Processing (IJIP), Volume (11) : Issue (2) : 2017
- [5] Ping-shu Ge,¹ Lie Guo,² Guo-kai Xu,¹ Rong-hui Zhang,³ and Tao Zhang Hindawi Publishing Corporation Discrete Dynamics in Nature and Society Volume 2012, Article ID 273164, 16 pages doi:10.1155/2012/273164
- [6] Chowdhury, N. K., Rahman, M., Rezoana, N., & Kabir, M. A. (2020). ECOVNet: An Ensemble of Deep Convolutional Neural Networks Based on EfficientNet to Detect COVID-19 From Chest X-rays.
- [7] De Moura, J., García, L. R., Vidal, P. F. L., Cruz, M., López, L. A., Lopez, E. C., & Ortega, M. (2020). Deep convolutional approaches for the analysis of Covid-19 using chest X-Ray images from portable devices. *IEEE Access*, 8, 195594-195607.
- [8] R. Gopalan, T. Hong, M. Shneier, and R. Chellappa, "A Learning Approach Towards Detection and Tracking of Lane Markings" *IEEE Transactions on Intelligent Transportation Systems*, vol. 13, no. 3, pp. 1088-1098, 2012.
- [9] J. Melo, A. Naftel, A. Bernardino, and J. Santos Victor, "Detection and classification of highway lanes using vehicle motion trajectories," *IEEE Trans. Intell. Transp. Syst.*, vol. 7, no. 2, pp. 188–200, 2006.
- [10] L.W. Tsai, J. W. Hsieh, and K. C. Fan, "Vehicle detection using normalized color and edge map," *IEEE Trans. Image Process.*, vol. 16, no. 3, pp. 850– 864, 2007.
- [11] H. Y. Cheng, B. S. Jeng, P. T. Tseng, and K. C. Fan, "Lane detection with moving vehicles in the traffic scenes," *IEEE Trans. Intell. Transp. Syst.*, vol. 7, no. 4, pp. 571–582, 2006.
- [12] D. M. Gavrilu, S. Munder, "Multi-cue Pedestrian Detection and Tracking from a Moving Vehicle," *International Journal of Computer Vision*, vol. 73, no. 1, pp. 41–59, 2007.
- [13] J. C. McCall and M. M. Trivedi, "Video-Based Lane Estimation and Tracking for Driver Assistance: Survey, System, and Evaluation," *IEEE Transactions on Intelligent Transportation Systems*, vol. 7, no. 1, pp. 20-37, MARCH 2006.
- [14] P. Moghadam, J. A. Starzyk, W. S. Wijesoma, "Fast Vanishing-Point Detection in Unstructured Environments," *IEEE Transactions on Image Processing*, vol. 21, no. 1, pp. 425-430, 2012.