Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 6, Issue 05, May -2019

A REVIEW ON LANE DETECTION TECHNIQUES USED IN ADAS

Nuthan B. G.[1], Vinayaka K. U.[2]

[1]*Dept of Electrical and Electronics Engineering, SIT Tumakuru*
[2]*Dept of Electrical and Electronics Engineering, SIT Tumakuru*

Abstract —*Road accidents are one of the major concern in present heavy traffic flow. Road accidents are caused by miss-judgments, driver drowsiness, negligence of surrounding objects while driving, unintended lane change, weather conditions and not following traffic rules, etc. It is essential to overcome these issues for promising autonomous vehicle technology. For an autonomous vehicle to drive the vehicle in a safe roadway, it is necessary to detect the lanes on the roads, the vehicle position, and state, and take the remedial actions such as alerting or assisting when the vehicle unintentionally drifting towards the lane. In this paper, different lane detection techniques detailed by different researchers are discussed.*

Keywords-*Advanced-Driver Assistance Systems (ADAS)***,** *lane detection algorithm, lane types, lane departure warning and lane keep assisting*

I. INTRODUCTION

Most of the vehicle collision take place because of human errors. According to the statistics, 3% of the traffic accidents are caused by technical problems in the vehicle. Over 97% of the accidents were the consequence of the wrong verdict of the human driver. So as to decrease the quantity of mishaps by accounting Vulnerable Road User safety as well as to advances the driving comfort, ADAS was developed. According to the European mishap insights, 2/3 of the mishaps with genuine result could have been avoidable by consolidating ADAS highlights. So the automated vehicles are performing the key role in reducing the accidents and severity of the accidents.

A. ADAS

ADAS is supplemented in an autonomous vehicle to minimize the errors humans make. These systems will alert the driver by giving the warning message when there is a risk in maneuver or assist by controlling the steering, acceleration or brake, thus avoids the collision. If there is any hazard vehicle detects, ADAS will issue a warning message through user interface system and furthermore, on the off chance that it isn't sufficient, help frameworks will naturally mediate to control the vehicle with which the result of mishaps can be alleviated. Such intercession might be a very late crisis braking, which altogether decreases the dynamic vitality of the vehicle before the crash occurs.

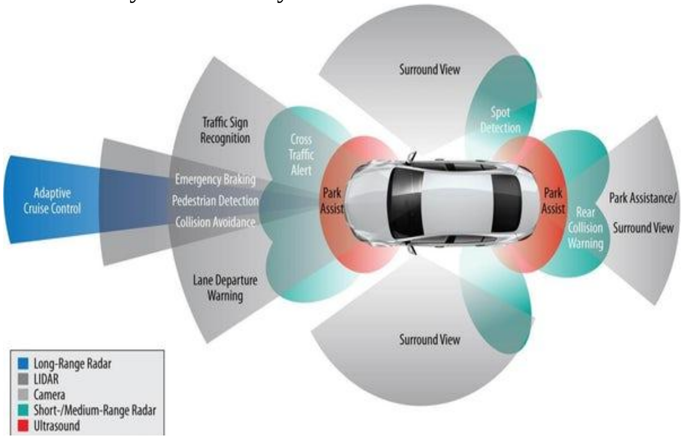

Fig 1. ADAS in autonomous cars

B. LANE

Lane is a portion of the main road in which the edges are marked by paintings. To control the traffic movement and to guide the drivers, a lane will provide a direction to travel in a specific way. There will be a minimum of 2 lanes in a road to move traffic in both directions.

1.1 Lane specifications

There are different types and color of lanes which yields different implication to the traffic flow. Lane marking is of two colors; white and yellow. The path markings can be either broken, strong, twofold strong or mix of the strong and broken path. The wrecked lines permit crossing with tact if traffic circumstance grants. They are tolerant in nature. Be that as it may, the strong paths are confining in character and does not permit the intersection with the exception of passage or exit from a side street or to stay away from any stationary impediments. Twofold strong path indicates seriousness in limitation and does not allow to cross aside from if there should arise an occurrence of crisis. Strong and broken blend path shows the strong path can be traversed with attentiveness if the wrecked path of path mix is closer to the course of movement. Vehicles from opposite side are not permitted to cross the path.

1.2 Use of lanes in ADAS

ADAS has created numerous dynamic security highlights including Lane Departure Warning and Lane Keep Assist. Lane Departure Warning system will provide an alert message when the ego vehicle touches or about to touch the lane marking intentionally or unintentionally. Similarly, Lane Keep Assist system will assist through the steering when the ego vehicle intentionally or unintentionally drifting towards the lane marking. So in order to operate these lateral control of the system effectively, it is required to recognize the path checking in which the vehicle is voyaging.
At present, two well-known techniques are there to detect lanes by using the sensor inputs; feature based strategy and model-based strategy. The feature-based strategy is well appropriate for clear lane markers and has a drawback on powerless path markers, clamor, and hidden objects. Model based strategy portrays path as a type of a bend which can be dictated by a couple of parameters. These strategies are less presented to frail path markings and clamor when contrasted with a feature based technique. Path discovery points of interest to recognize the position and condition of the vehicle in the conscience traffic path and furthermore underpins the driver to drive without mischief and easily.

C. General framework

The video images of ahead of the vehicle are captured using the camera. Captured videos are allocated into frames. Then the frames are reallocated into memory for additional processing. After pre-processing, the edge of the lane is spotted. Then using detection algorithm like Hough transform or any other methods, the lanes and curves are perceived. Decision module will use the lane detection outcomes to recognize the position and condition of the vehicle in the conscience traffic path. Decision module will compute the offset from the lane marking and based on that, the controller will issue a warning through a user interface system or actuate assist function based on the driver's preferences. Choice module will take contribution from various sources. For instance, if the turn indicator is active, the controller will decide the lane change is purposeful and the system will go to standby state in that situation.

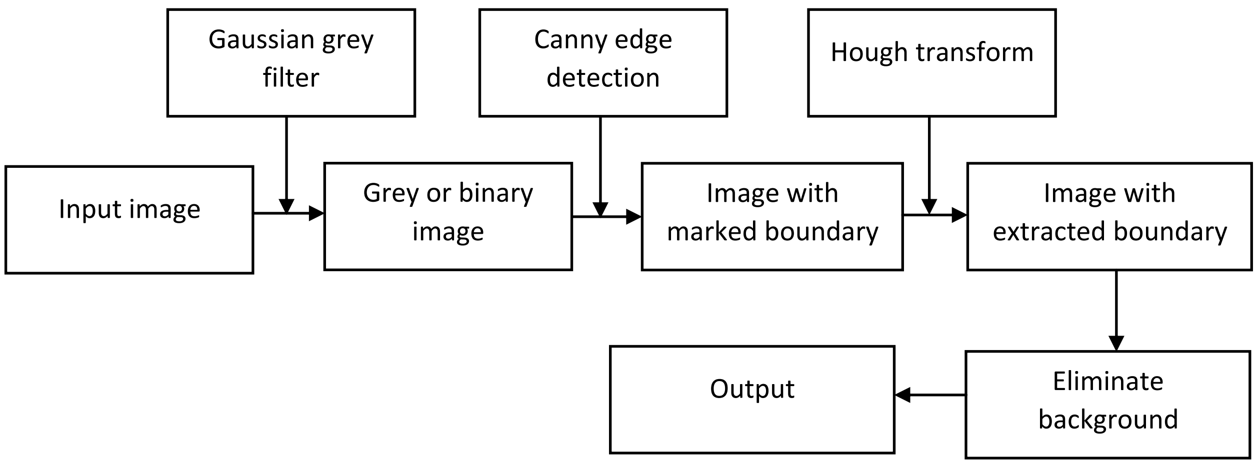

Fig 2. Bock diagram of lane detection

II. LITERATURE SURVEY

Various algorithms have been proposed to identify the path markings. This paper focuses on the different algorithms used to identify the lanes and compare the results of the same.
W. Yue, T. Eam Khwang and S. Dinggang [1] presented “Lane detection and tracking using b-snake”. In this, path identification is cultivated without thinking about the camera. Instead, the b-snake model is utilized to depict the path arrangement. B-spline is used to construct any subjective lanes and the shape of the lane is reformed using a set of control points. The prospective parallel line conception has been used to identify the two sides of the lane stripe which form the lane. So as to give an upgraded starting position for b-snake, CHEVP, a powerful algorithm is projected. Also, Minimum Mean Square Error (MMSE) is recommended to characterize the control purposes of the b-snake model. This technique can be applied to dashed and solid lane roads. It will work regardless of whether the lane markings is existing or not. This method is more robust in contrast to shadows, noises, and reflections in the road images.
A. Mohamed [2] proposed "A real-time detection of lane markers in urban streets". This algorithm of sensing lanes will give superior efficiency in urban streets. In order to diminish the prospective effect and to produce the top vision of the road images, inverse perspective mapping method is used. In that image, the Gaussian kernel is used as a filter. The lanes

are distinguished using the RANSAC fitting technique. This technique will contribute some false positive and except that this is robust and will work in all weather conditions. The major drawback of this technique is, it will not give more precise result for detecting lanes.

M. Chunyang. And M. Xing [3] suggested “Lane detection based on object segmentation and piecewise fitting”. A camera is adjusted to catch the pictures and then by using a piecewise linear transformation method, the captured picture is then transmuted into a grey scale image. OTSU method is utilized to get the region of interest (ROI). The lanes in the road picture are recognized by means of Sobel edge detection technique. This strategy is increasingly powerful in noise, shadow, reflections in the image and lack of lane painting.

L. Yingmao, et.al. [4] proposed "Multiple lane boundary detections using a combination of low-level image features". In this method, the canny edge detector is applied to detect the edges in the region of interest (ROI). Then from the binary outcome of the Canny edge extractor, straight lanes are recognized by the concept of Hough transform. Along the estimated road edges, the local maxima features are implemented to eliminate the noise effect. The outside images are omitted using the RANSAC algorithm. Then in the remaining frames, lane tracking is accomplished using the Kalman filter technique.

W. Jun, et.al. [5] suggested “An approach of lane detection based on inverse perspective mapping”. In this method, by the concept of optimal threshold technique, the input captured is transformed into a binary image. In order to avoid the perspective effect, inverse perspective mapping technique is employed. N samples are considered first and they are segregated into k clusters, in which k specifies clustering is done. Then by considering all the group focuses as control inputs, lane markers are achieved using B-spline fitting technique.

S. Santosh Kumar, Manisha L. et.al [6] introduced "Improved lane detection using a hybrid median filter and modified Hough transform". The enhanced Hough transform and hybrid median filter (HMF) is united with a lane detection algorithm so as to condense the noise effect in the image. The captured image is improved into a grayscale image and it is handed to a hybrid median filter. Then lane marking is identified in the road images using edge detection and Hough transform. This method is more competent and the results are good with the images in the absence of noise.

Q. Lin, H. Youngjoon and H. Hernsoo [7] proposed "Real-time lane detection based on extended edge linking algorithm". This technique offers high significance to select a region of interest (ROI). With the Sobel operator technique, the edges pixels are determined in the particular region of interest (ROI). Raster scan strategy is utilized to discover the beginning stage of the edge. After edge detection, based on the direction edges terminating, edge linking is extended. Then in order to fill out the breaks, pixels are added along the situated edges to continue the edge detection. Small length pixels in the edges are detached. Then by lane hypothesis verification method, the color of the path is determined. Then to find out the value Θ and ῥ Hough transform technique is applied.

S. B. Vitor, et.al. [8] introduced “Adaptive region of interest based on HSV histogram for lane marks detection”. Path identification is completely dependent on the histogram procedure. So as to determine the region of interest earlier triangle model is adopted. Histogram of the taken image along with path frame is calculated and then the illumination changes among the two images are determined. Then by using Lucas Kanade tracking lane markings are distinguished and segmented from the region of interest.

G. Chunzhao, et.al proposed [9] "lane detection and tracking in a challenging environment based on a weighted graph and integrated cues". The captured image is transformed into an inverse perspective image and multiscale lane recognition is applied to the images. The similarity in the resultant pixels is found out using normalized cross relation. The lane color is recognized using the learning algorithm. The intensity and the geometry cues are unified to create a weighted chart which relates to pixels of lane marking. The lane boundary is determined using a particle filter. For curve lanes, split lanes, merging and demerging lanes, this algorithm will offer more truthful result.

Table 1. Examination of various Lane detection techniques utilized in ADAS

Sl. No.	Proposed technique	Merits	Demerits
1	Recognition and tracking of lanes with the help of b-snake	This will work for dashed and solid lane roads. Robust against shadows, noise and reflections in the road images.	Mid line of the lane isn't identified appropriately
2	Real-time identification of lane markers in urban streets	Work in all weather conditions.	This method will give some false positive and the accuracy is less.
3	Lane detection based on object segmentation and piecewise fitting	This method is more robust in noise, shadow, reflections in the image and lack of lane painting.	Minimal false path identification results on the grounds that the feature based strategy is generally influenced by the power of light.
4	Multiples lane boundary detections using the combination of low-level image features	More accurate results in straight lanes.	Poor execution in bended streets and surface based streets.

5	A methodology of path identification dependent on inverse perspective mapping	Suitable for urban lane detection	Not work well in shadow region and gives some false alarms.
6	Improved path identification using hybrid median filter and improved Hough transform	Fewer parameters are expected to recognize the path	Accuracy is less when there is noise in the road images captured.
7	Existent lane detection based on expanded edge linking procedure	Work in practically all kind of street conditions	Results in false positives.
8	Adaptive region of interest based on HSV histogram for lane marking detection	Robust against light reflections and in shadow conditions	False positive rate is high
9	Detection and tracking of lanes in challenging environment based on a weighted graph and integrated cues	Work in almost all climate condition and hearty against enlightenment changes.	Less accurate in hefty curved roads

A. Benefits of Lane Detection

- Provide assistance to drivers while driving.
- Homogeneity of the lane markings is a very essential characteristic in minimizing the misperceptions and vagueness about their significances.
- Permit drivers to drive the vehicle safely and comfortably
- Warning indication will attentive the passengers also
- Lane detection is a very key factor in a completely driverless vehicle. As the vehicle could travel on its own path, lane information decides the direction which the vehicle has to go.

B. Limitations

- Lane Departure System and Lane Keeping System absolutely depend on visible lane markings. These systems are imperfect with faded, inappropriate or absence of lane marking. Lane markings enclosed by fog or snow can obstruct the performance and precision of the systems.
- Most of the existing algorithms work well for straight roads, but they will contribute poor result with curvy roads.

III. CONCLUSION

In this paper, we talk over different lane detection techniques. Lane recognition is useful in detecting the position of the vehicle as well as the direction of travel. By and large, the framework involves path demonstrating, include extraction, edge location, path identification, path following, and lane departure alerting modules. In the literature survey, we have conversed the lane detection algorithm by different scholars with good accuracy rate, less false positives, good detection efficiency. Still, a good lane detection algorithm ought to the subsequent characteristic to have an additional scope.

- The framework must be hearty, for example, it ought to distinguish the paths altogether climate conditions.
- Path identification method ought to be quick adequate to fulfill the ongoing guidelines.
- The system should identify lanes with a high traveling speed of the vehicle and further complex situations.
- The system should be cost-effective.

IV. REFERENCES

[1].W. Yue, T. Eam Khwang and S. Dinggang, “Lane Detection and Tracking using B-snake”, Image and Vision Computing, vol.22, no.4, pp. 269-280, 2004.
[2]A. Mohamed, "Real-time detection of lane markers in urban streets", IEEE Intelligent Vehicles Symposium, pp. 7-12, 2008.
[3]M. Chunyang. And M. Xing, "Lane detection based on object segmentation and piecewise fitting", TELKOMNIKA Indonesian Journal of Electrical Engineering, vol.12, no.5, pp.3491-3500, 2014.
[4]L. Yingmao, et.al, "Multiple lane boundary detections using a combination of low-level image features", 17th International IEEE Conference on Intelligent Transportation Systems, pp.1682-1687, 2014.
[5]W. Jun, et.al, "An approach of lane detection based on inverse perspective mapping", 17th Inernational IEEE Conference on Intelligent Transportation Systems (ITSC), pp.35-38, 2014.
[6]S. Santosh Kumar, Manisha L. et.al, "Improved lane detection using a hybrid median filter and modifies Hough Transform", International Journal of Advanced Research in Computer Science and Software Engineering, vol.4, no.1, pp.30-37, 2014.
[7]Q. Lin, H. Youngjoon and H. Hernsoo, "Real-time lane detection based on extended edge lining algorithm", Second International Conference on computer research and development, Seoul, South Korea, pp.725-730, 2010.

[8]S. B. Vitor, et.al, "Adaptive regions of interest based on HSV algorithms for lane marking detection", Robot Intelligence Technology and Applications 2, Springer International Publishing, pp.677-687, 2014.
[9]G. Chunzhao, et.al, "Lane detection and tracking in challenging environments based on a weighted graph and integrated cues", IEEE/RSJ International Conference on Intelligent Robots and Systems, pp.5543-5550, 2010.

