Vision-based Road Lane Detection: A Review

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***Abstract*- In intelligent vehicles, road lane detection and recognition are main crucial phases to make the system smarter. In an advanced driver assistant system, a lane-detection algorithm plays a crucial role. Such algorithm guides and gives important information regarding safety of driving. The system faces many problems like, poor and lack of clear road lane markings, poor visibility. Such difficulties come into picture due to bad climate, illumination and light reflection, shadows, dense road-based instructions and thick-street based directions etc. In this paper, a review is presented in connection with a real-time vision-based lane detection algorithm.**

Index Terms- Advanced driver assistant system, Lane detection, Lane tracking, Region of Interest

I. INTRODUCTION

In intelligent vehicle applications, lane detection plays a key role and the applications are lane detection and warning, autonomous driving, cruise control etc. The lane detection and lane tracking are the two crucial tasks involved under the vision based location of lane boundaries [1].

The challenging tasks in ADAS (Advanced Driver Assistance Systems) are road lanes detection or boundary detection such as white and black lines on roads and obstacle detection such as vehicles, cars, trees, pedestrians etc. The collision avoidance is also major issue in ADAS [1].

II. LITERATURE REVIEW

In the ADAS, the lane-detection functionality plays a crucial role. It provides basic information for drivers such as the lane structure and the positions of other vehicles in the lanes [2].

A camera captures the 2-D image in the lane detection system. The image further analyzed by image processing. The system utilizes vision-based algorithm and can be categorized into two classes: model based and feature-based [2].

In the Road lane detection, image processing is used for capturing the 2D image from camera. There are two types of Vision-based methods: Feature-based and Model-based [2].

In this paper, for initialization, lane detection and lane tracking, robust and fast lane detection and tracking algorithm is used. There are advanced features are arrived in lane detection and lane tracking scheme such as a colored lane detection, scan line test, line clustering and statistical information tests. For verifying the lane marking, the proposed algorithm used the scan line method. The scan line method determines the validity of the detected lane markings. By using the accumulated statistical data, scan line method deletes the false lane markings and tracks the correct lane markings [2].

While driving, the autonomous vehicle must be aware of important lane information back and front side of the car and using the lane information vehicle can move to the left and right lanes if necessary.

In this paper [3], for lane detection a mixture of edge, binary and intensity value is used as feature. Binary image is also used as mask. In this paper by using the stereo camera, we introduce a method of separating roads from a vehicle and then by using the Dynamic programming on the separated roads and Kalman filter the road lanes are recognized.

There are four steps involved in lane detection: pre-processing, feature detection, fitting, and tracking. In the pre-processing stage, a system removes noise from the image and gives to the nest stage. The feature detection classified into two classes: lane-feature based method and the geometric-information-based method. Hough transforms and improved algorithms are the choices to detect straight lines in an image [4].

In vision-based lane detection system, camera captures images then the valuable features are

extracted using preprocessing. Images are captured using binocular cameras. It preserves both lane lines and depth information. This paper [5] focused on three functional modules: road segmentation, lane feature enhancement and identification of the lane. The flowchart is shown in Fig. 1 [5].

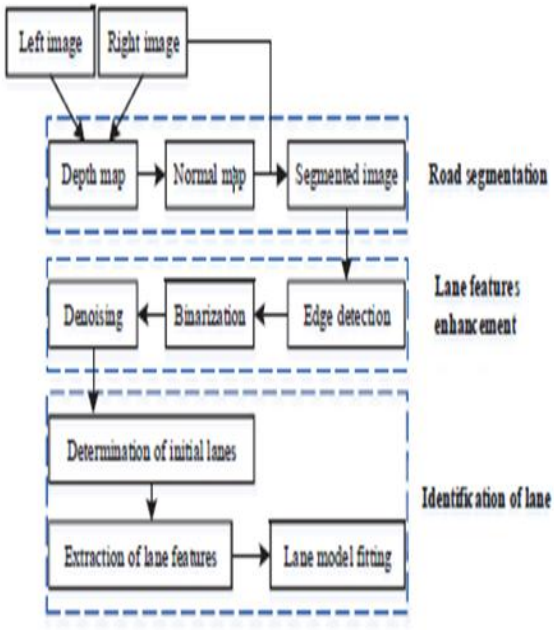

Fig. 1 Flowchart of Lane Detection method [5]

As per the review presented in [6], the authors concluded that the main perception aspects for human drivers are road color, texture, boundaries, and lane markings. This paper reviewed the lane detection system from the perspective of algorithms, integration methods, and evaluation methods.

In this paper [7], the authors proposed an ultra-low complexity linear block-based lane detection and departure warning system. The Fig. 2 shows that the proposed system flow chart, including the linear block-based lane detection and lane departure warning process [7].

IV. CONCLUSION

In this paper, a vision based algorithms are reviewed in connection with road lane detection. The complex and challenging tasks in ADAS are lane detection and obstacle detection. In this work, the literature review is presented in the field of ADAS considering lane detection. The future scope of this work is to explore deep learning based algorithm Road Lane Detection and Tracking.

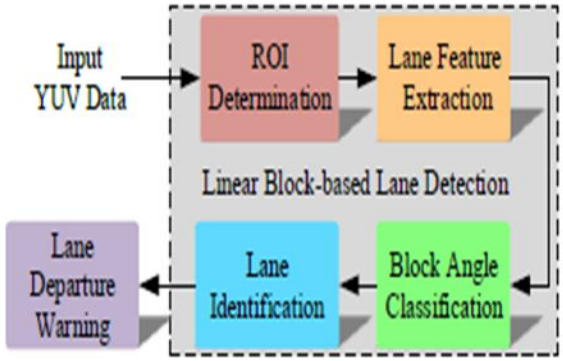

Fig. 2 System flow chart [7].

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