A Review on Lane Detection In Vehicular Ad-hoc Network

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Abstract: Now- a- days, the traffic security has become more significant. Lane detection plays a vital role on highways to avoid accidents most of the problems are resulted from the disruption and weakness of the driver. Therefore, an organization that could provide a warning to drivers of a risk has a great potential to save a large number of lives. Systems that are designed to help the driver in its driving procedure are known as advanced driver assistance systems (ADAS). Lane departure system is also a part of this category. This paper gives an overview on lane detection. This system has a goal to detect the lane marks and to advise the driver in case the vehicle has a tendency to leave the lane.

I. Introduction to Vehicular Ad-Hoc Network

A Vehicular Ad-Hoc Network or VANET is system which use moving vehicle same as nodes inside a network set-up. VANET turn all motor vehicle into a wireless router or node, allow motor vehicle around 100 to 300 meters attach with each other and, make a system with a broad selection. It is a category of MANET in which the nodes refer to vehicles. As the movement of vehicle is controlled through roads, traffic rules we can set permanent infrastructure on dangerous location.

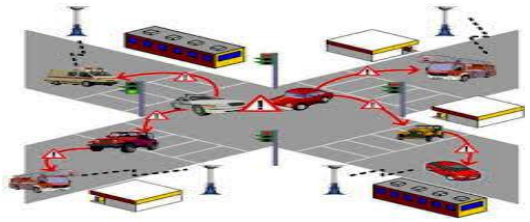

Fig.1. An ecample of a vehicular Ad-Hoc network

The main objective of VANET is to provide road protection procedures where information regarding vehicle's present rate, position coordinate are passed with or without the use of transportation. Apart from security procedures, VANET also provide significance additional services like message, auditory/video tape distribution etc.

Communication Types in VANETs

a) Vehicle to Vehicle (V2V)
b) Vehicle to Infrastructure (V2I)
c) Vehicle to Roadside (V2R)

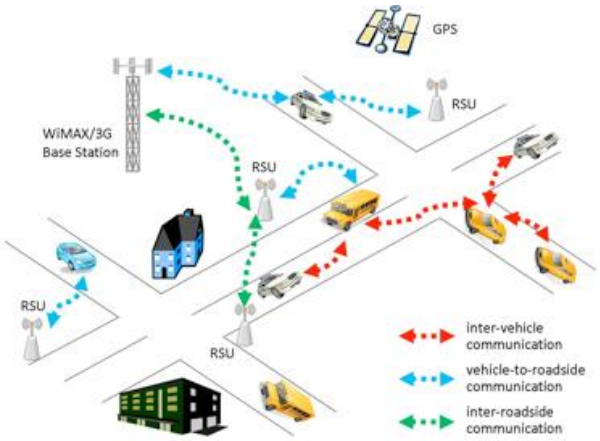

Fig.2. Communication types in VANETs

II. Introduction to Lane Detection

Lane detection is the process to locate lane markers on the road and then present these locations to an intelligent system. In intelligent transportation systems [6], intelligent vehicles cooperate with smart infrastructure to achieve a safer environment and better traffic conditions. The applications of a lane detecting system could be as simple as pointing out lane locations to the driver on an outer display, to more complex tasks such as predicting a lane change in the instant future in order to avoid collisions with other vehicles. Some of the interfaces used to detect lanes include cameras, laser range images, LIDAR and GPS devices [5].

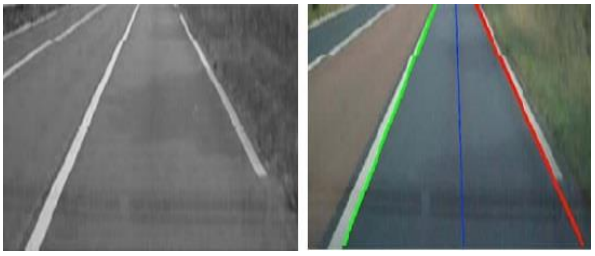

Fig.3. a) Input Image b) Detected Lanes[8]

In many proposed systems [6], the lane detection consists of the localization of particular primitives such as road markings of the surface of the painted roads. Various challenges like parked and moving vehicles, bad quality lines, shadows of trees, buildings and other vehicles, sharper curves, irregular lane shapes, merging lanes, writings and other markings on the road, unusual pavement materials and dissimilar slopes causes problems in lane detection. There have been active research on lane detection and a wide variety of algorithms of various representations, detection and tracking techniques, and modalities have been proposed [8].

Many approaches have been applied to lane detection, which can be classified as:

Feature-based: This methods detect lanes by low-level features like lane-mark edges [20-21]. These methods are extremely reliant on clear lane-marks, and suffer from weak lane-marks, noise and occlusions.

Model Based: Model-based methods characterize lanes as a type of curve model which can be determined by a few critical geometric parameters and are less sensitive to weak lane appearance features and noise.

III. Literature Survey

M. Aly (2008) [3] proposed an efficient, real time, and robust algorithm for detecting lanes in urban streets. The algorithm was based on taking a top view of the road image, filtering with Gaussian kernels, and then using line detection and a new RANSAC spline fitting technique to detect lanes in the street. This algorithm was able to detect all lanes in still images of urban streets under various conditions. This achieved better results to other algorithms that only worked on detecting the current lane boundaries, and had good results for detecting all lane boundaries. This method has problems due to stop lines at cross streets, at cross walks, passing cars and confused writings.

Z. Kim(2008) [4] presented a robust lane-detection-and-tracking algorithm to deal with challenging scenarios such as a lane curvature, worn out lane markings, lane changes, and emerging, ending, merging, and splitting lanes. The algorithm was based on random sample consensus and particle filtering. The algorithm was proposed to produce a large number of hypotheses in real time as compared to other algorithms.

O. O. Khalifa et al. (2009) [5] proposed a real time lane detection algorithm based on video sequences taken from a vehicle driving on highway. This algorithm showed a robust behaviour to lighting change and shadows. The lanes were detected using Hough transformation with restricted search area. It could be applied in both painted and unpainted road, as well as slightly curved and straight road in different weather conditions. This algorithm proved to be robust and fast enough for real time requirements as compared to other algorithms. Vehicles are assumed to move on flat and straight roads or with slow curvature. This algorithm does not work well on sharp curves and in presence of shadows.

M. Meuter et al. (2009) [6] proposed a new robust approach for camera based lane recognition for lane detection and tracking system. This detection algorithm was combined with a tracking algorithm which combined two Extended Kalman filter using the Interacting Multiple Models (IMM) algorithm. The algorithm was linear in time and robust in the presence of noise and weak markers. The algorithm could be used to detect the position and the slope of the lane segments.

S. Zhou et al. (2010) [8] proposed a road detection algorithm on the marked roads based on Geometrical model and Gabor filter. This algorithm can be used for Lane Departure Warning System or other auxiliary driving system. Gabor filter is adopted to estimate orientation in each pixel and to filter the image along the line of lane model. This algorithm can overcome the universal lane detection problems due to inaccuracies in edge detection such as shadow of tree and passengers on the road. As compared to other methods, the algorithm achieved high accuracy and was robust to the noise and other interferences such as shadow.

Q. Lin et al. (2010) [12] proposed a real time vision-based lane detection system to find the position and type of lanes in each video frame. In this method, lane hypothesis was generated and verified based on an effective combination of lane-mark edge-link features. During the searching process of lane mark candidates, an extended edge linking algorithm with directional edge gap closing is used to produce more complete edge links. The continuity of lane is estimated using a Bayesian probability model. In this algorithm, there were no special requirements for camera parameters, background models, or any other road surface models. Therefore, the algorithm was more adaptive to various road environments.

Z. Teng et al. (2010) [13] proposed an algorithm which integrated multiple cues, including bar filter which has been efficient to detect bar-shape objects like road lane, color cue, and Hough Transform. To guarantee the robust and real-time lane detection, particle filtering technique has been utilized. This algorithm improved the accuracy of the lane detection in both straight and curved roads. It has been effective on a wide variety of challenging road environments. This

method fails for the lane tracking when it is to be applied to particle filter in the dashed lane situation.

F. Mariut et.al (2012) [17**]** proposed an algorithm that automatically emphasizes the lane marks and recognizes them from digital images, by the use of Hough transform. This method also detects lane mark's characteristics and has the ability to determine the travelling direction. A technique that extracts the inner margin of the lane is used to ensure the right detection of the lane mark. The algorithm works very efficiently for straight roads but fails in some cases of curved roads.

N. Phaneendra et al. (2013) [20] proposed a vision-based lane departure warning system. The lane departure decision making is based on distance between lanes and the center of the bottom in captured image coordinate, which needed less parameters. The lane detection performance has been improved by making use of Kalman filter, compared to the usual method of using Hough transform. The model proved to be efficient and feasible as compared to other systems. This system failed to detect the lanes correctly when the situations on the road are more complex.

S. Srivastava et al.(2013) [23] proposed an efficient ways of noise reduction in the images by using different filtering techniques in this paper. The main objective was to design, develop, implement and subsequently simulate an efficient lane detection algorithm which will provide high quality results in the case when noise is present in the signal. Various filters used for comparison were median, wiener, and hybrid median filters.

Ding et al. (2013) [21] has shown that the Road conditions can provide important information for driving safety in driving assistance system. The input images usually include unnecessary information and road conditions need to be analysed only in a region of interest (ROI) to reduce the amount of computation. A vision-based road ROI determination algorithm is proposed to detect the road region using the positional information of a vanishing point and line segments. The line segments are detected using Hough Transform. The road ROI can be determined automatically and adaptively in every frame. The proposed method is applied to various video images from black boxes, and is verified to be robust.

Payam et al. (2013) [22] has introduced a new approach to the lane detection problem based on Fourier-based line detection approach. The proposed approach has shown a superior performance due to the following reasons; 1) being independent of prior edge detection; 2) the use of Fourier-based HT to detect accurately the location and the orientation of the potential lines. Because the standard HT is only applicable for binary images, an adaptive threshold algorithm has been used for converting the grayscale image to black and white and highlight the prominent edges. In addition to the extra computational time that the edge detection requires, some of the significant segment information may also get eliminated during the binarisation and threshold process.

IV. GAPS IN LITERATURE

Following are different gaps found in earlier work:

1) Most of the existing work has focused only on the straight lane marking. Thus, it is interesting to develop the detection algorithm for curved lane markings.
2) How to deal with the road edge detection under the complex environment still needs to do further research like foggy images, night time images etc.
3) The most of the existing working is done by using the Hough transform; the modification of Hough has been neglected by many researchers.

V. NEED OF THE LANE COLORIZATION

Lane colorization allow vehicular drivers to drive safely by telling them that where the actually lanes exists on the road and prevent accidents. As there exist much less chance of accidents when vehicles not cross the lanes. As lane coloration technique has to locate the lane edges without any prior knowledge of the road geometry, and do so in situations where there may be a countless clutter in the road image. This clutter can be because to the noise, dust, shadows, puddles, oil stains, tire skid marks, etc. Thus it becomes a major issue when noise is present in the input image. Thus need of the proposed algorithm is clear and straight to improve the existing lane detection algorithm[25].

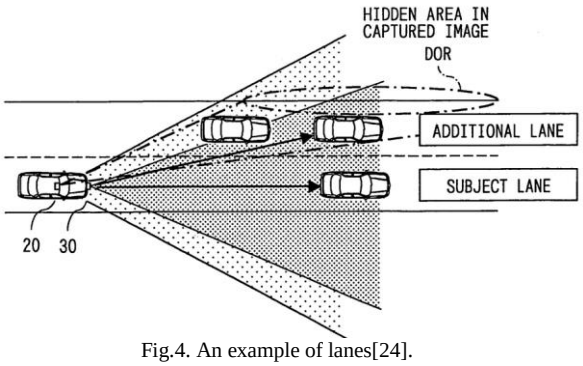

Fig.4. An example of lanes[24].

V. SCOPE OF THE PROBLEM

Lane coloration is becoming popular in real time vehicular ad-hoc network. So this research work focus on providing better performance in lane coloration algorithms. The proposed algorithm has a significant

scope in the adverse environment conditions and in Vehicular Adhoc Network. Also it has a great scope in dealing with the road curvature.

VI. How lane detection works

Figure 3 shows the different steps required to achieve the lane colorization.

Step 1: Read the Road image

Step 2: Apply filter to remove noise from the input image.

Step 3: Convert image into the grey scale if it is in color plane.

Step 4: Now apply binarization algorithm .

Step 5: Now apply edge detection to detect lane edges.

Step 6: Now apply modified Hough transform and dynamic thresholding based algorithm to detect the lanes.

Step 7: Now just color the lanes.

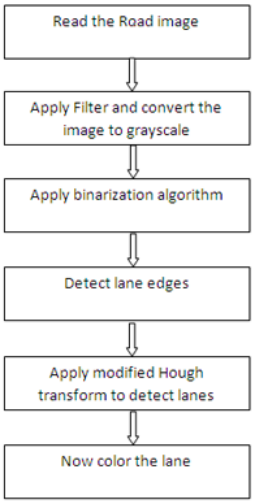

Fig.4.Proposed algorithm

VII. Conclusions And Future Scope

Lane coloration has become popular in vehicular ad-hoc network. Various methods have been developed so far which are working very efficiently and producing good results in case when noise is not present in the images. But problem is that they fail or not give efficient results when there is any kind of noise in the road images. The noise can be something like dust, light, puddles, oil stains, tire skid marks, etc. In future the existing work will be extended to propose a new strategy which will use switching median filter to remove noise.

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