IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 8, August 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.542

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 8, August 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0908022 |

Real Time Vision Based Road Edge Detection Model using Image Processing

Mr. Ajit Y Gandawwagol, Dr. Deepak B Kulkarni

PG Student, Dept of ECE (AEL), KLS's Gogte institute of Technology, Belagavi, India

HOD, Dept. of E&E (AEL), KLS's Gogte institute of Technology, Belagavi, India

ABSTRACT: Every passing year around 1.3 million people across globe lost life due to accident on roads. Further, 20 to 30 million of people are injured. A best way to overcome this problem is to build a road detection mechanism. It plays a critical part of various vision navigation system for building intelligent transport or vehicle guidance system. In recent time number of computer vision based autonomous navigation system has been presented by various research in various social and industrial applications. Thus, this paper conducts an extensive survey of various state-of- art model for designing road edge detection model. From survey it can be seen these methods are broadly classified into model driven, feature driven and activity driven. Further, the existing model detection outcome is severely affected due to presence of noise in image (due to fog and other environmental condition). To overcome research problem, this paper gives a research direction for modelling efficient road edge detection mechanism for identifying exact location, speed and size of obstacles and direction of road extension.

KEYWORDS: Autonomous robots, Computer vison, Edge detection, Intelligent transport system.

I.INTRODUCTION

Provisioning safety and reliable autonomous driving assisting model aid in reducing strain or distress of vehicular user (driver) and provide good potential in future autonomous driving assistance system. Recently, extensive work has be carried out to improve road safety and improve traffic management. A unique problem is self-accident where vehicle getting collided with trees, divider, median and poles etc. this kind of accident occurs due to collision with obstacle such as tree, rollover crash, running off road when travelling in road (specifically highway) accidentally. Upgrading infrastructure of road such as guardrails aid in reducing the accident (i.e., prevent death) by employing passive safety mechanism. As described by European Union (EU), there is a reduction of 36% of self- accident in last decade, self-accident is still a major problem which is accountable for one third of accident in European countries [1], [2]. Thus, non-urban road and country roads is accountable for accident (i.e., poor road infrastructure).

Another area that benefits from dependable highway road limit recognition is independent driving. Capacity to explore and navigate imperative element for a complete autonomous system and portable robotic automated framework. To guarantee this it turns out to be basic to perceive urban roads region and remain out and about locale while exploring from source to end point. With proximity sensing device one can distinguish the ground plane yet it winds up close to difficult to perceive shape and different properties of the ground. Thinking about these actualities, the present research concentrates more on smart vision-based route approaches. With advancement in vehicle innovation and urban road transportation framework mishaps are additionally expanding. It has turned out to be basic to create frameworks that can help driver while exploring or travelling on a highway. Highway roads edge identification framework system can tremendously support the reason. The road edge identification method is generally classified into following classes such as feature based, activity based and model based [3].

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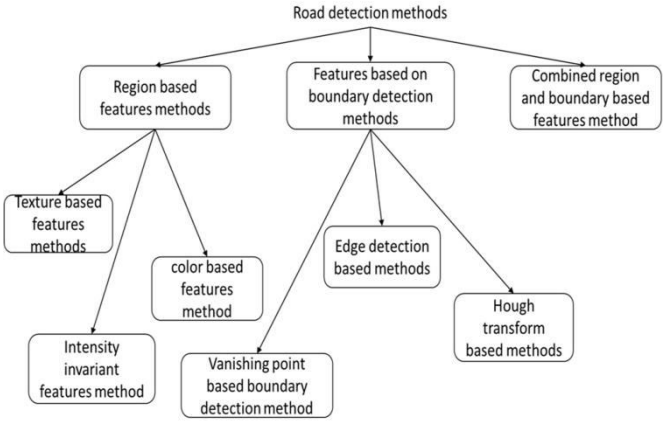

Fig. 1. Classification of road detection methods

This, paper conduct extensive survey of various existing method for road edge detection. Road sign board identification and road edges discovery assumes an imperative part in the security of every vehicle user. Along these lines, this exploration field has been analyzed by numerous analysts. A large portion of the trials dependent on utilizing shapes and color features to distinguish traffic signal and signs.Edge is one of the essential attributes of the picture, which conveys a large portion of the data of a picture [4]. Edge attributes are in this way essential in performing analysis of multimedia data processing, specifically, in the field of extracting and detecting important features of an image [5]. To decide the area of the picture edge, the modification feature point of the picture signal must be resolved and established, which give the position of picture profile.

Computerized multimedia image edge discovery is that the advanced picture has a unique feature of gray scale optimization in orientation, position, and estimation. The motivation behind edge recognition is to recognize these unusual and unstable circumstance and unpredictable structure of the change point in the picture, and afterward to give the futuristic element status prerequisite to the processing and computing of multimedia image. Edge feature construction process is the major part in the multimedia image investigation and identification, on which object recognition, identification and picture segmenting process depend [6].Generally, when the smart vehicle is safely travelling on the highway environments, the accurate connections among automobiles and urban or highway roads must possess knowledge/information of environmental condition it's operating on. Practically, 90% of the data is received through vision, for example, traffic signs, traffic signals, path, vehicles, road deviation shape, street markings and presence of obstacle [7]. In smart vehicle frameworks, the implementation of machine vision for urban roads condition data ought to be considered. So in urban and highway road edge location is vital and feature extraction aids in analysis it. The direction and navigation of the urban road expansion and the particular area location, size and speed of obstacle in the line of sight on roads [8]. In this manner, vehicle user may decide if the driver is required to maintain a strategic distance from obstacle and whether the user is driving out of viable region of the highway roads [9].

The research contribution of this work are as follows

- Firstly, this work conducted extensive survey of various road edge detection algorithm for building efficient autonomous vehicles driving assistance system.
- Presented dehazing technique for natural scene image based on color analysis and restoration with road edge detection using canny edge and prewitt edge detection methods and experiment are conducted. Further, present a future possible solution to design efficient autonomous vehicles driving assistance system.

The manuscript is organized as follows. In section II, literature survey is presented. In section III research and industry gaps are identified and research solution is given. Lastly, the research is concluded with future research direction of work.

II. LITTERATURE SURVEY

This section extensive survey of various method presented for road edge detecting for building efficient autonomous transport system. In [10], indicated each year 1.3 million individuals worldwide are slaughtered on highway roads, and somewhere in the range of 20 and 50 million are harmed and are in trauma. A responsive answer for this issue is

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creating machines, which take into record nature. That is the reason today, safe auto driving is turning into a well-known subject in numerous fields, from little ventures to substantial vehicle industrial facilities. Anyway, this subject additionally brings up numerous issues and issues. There is a need to characterize the width of the edges of the urban roads, perceive street signs, traffic lights, and people on foot, and different articles which contribute the driving securely. There are numerous techniques for resolving these tasks and functionality. Here they considered answer for identification edge of the highway, protests out and about, traffic lights and traffic signs. Here are a portion of the techniques which will be considered in their work: limit, canny edge recognition and SURF – calculation, Hough strategy.

System[11], presents an examination of an ideal algorithm for edge identification so as to use in the urban road path discovery process. The principal issues, including the speed parameter, the precision, and the restricted assets, were taken to consider for the acknowledgment on the FPGA innovation. The edge discovery algorithm of Prewitt, Canny, Roberts and Sobel were observed. In [2] present a flexible and practical recognition approach for identifying urban roads limits by intertwining video and radar. The urban roads limit is characterized as the change from highway roads surface to non-road territory. We demonstrate the coordination of a multi-path recognition framework into the identification algorithm, which makes the methodology free of the quantity of paths and the perceivability of path designing. In [4] presented extensive survey of state-of-art edge detection method such as **Robert's operator:** Robert's operator which utilizes partial differential operators to discover the edge is the least complex operator. As indicated by the rule that any pair difference of mutually perpendicular direction can be utilized to compute the inclination, the distinction between two adjoining corners to corner bearing pixels is determined. **Sobel operator:** The standard of Sobel edge identification operator is to utilize partial differential operator to discover the picture edge. It can successfully diminish the noise which impacts on the yield picture, **Prewitt administrator:** Prewitt administrator [14] is the main request differential operator. It utilizes gray distinction top to end, left to right neighboring

pixels to get the extreme edge. The standard of Prewitt operator is like Sobel operator, Laplace - Gaussian operator: Laplace - Gaussian operator [15] (for the most part alluded to as the LOG operator) is the second- order differential operator. It will produce a steep zero-crossing in the edge of the picture. So as to lessen the noise interference, the initial step needs to utilize Gaussian function to filter the picture, and afterward to get second-order derivative of the picture. Canny operator: Canny operator [16] is a moderately new edge detection operator, which has been generally utilized. The fundamental thought of Canny operator is to make the picture gradient operation, and then to produce the edge by checking a local maximum gradient magnitude of pixels. In [17], showed presence of noise such as fog severely affects the state-of-art edge detection methods. Further, the existing method are computationally very heavy. Thus, a novel edge detection method is required which overcomes issues of noise and obstacles for provisioning real-time edge detection mechanism.

III.RESEARCH/INDUSTRIAL GAP WITH FUTURE POSSIBLE SOLUTION

Independent and autonomous driving vehicles with different dimensions of mechanization from semi-autonomous driving advancements, for example, lane-keeping assist systems (LKAS), adaptive cruise control (ACC) to fully-autonomous driving vehicles are currently economically accessible available. While ordinary advanced digital maps for vehicle route GPS navigation are made for human drivers and have road-level resolution, map suppliers are currently concentrating on creating computerized maps with a moderately high resolution. The presence of lane-level advanced maps diminishes the weight of limit and in the end the expense of each autonomous driving vehicle.

Utilizing traditional advanced maps with road-level goals, an individual automation driving vehicle worries about unreasonable concern to completely comprehend its surroundings to settle on a choice. For instance, if the vehicle needs to turn comfortable next intersection, it needs to make sense of the absolute number of paths out and about and the path that the vehicle is as of now in so as to move to the furthest right path securely before achieving the intersection. Be that as it may, if a path level guide were given to the vehicle, the way arranging procedure would turn out to be extensively more straightforward and more secure so the individual vehicle would be less committed to be furnished with extravagant sensors and processors.

Nothing like the road-level computerized map generating process, a huge piece of which is robotized and automated, the way of producing a path-level advanced guide normally requires manual work at numerous stages. Path or lane identification on a urban road is progressively troublesome in view of multiple paths and lanes, specifically diversion roads and signs on the ground and complex path disturbance at the intersections.

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On account of road-level map generating, it is imperative to mirror the direction and the curvature of the urban road precisely (because of quality haze and other natural condition), just as the presence of inclines and bridges. Path-level map generation requires more subtleties; along these lines, the individual paths must be effectively procured by means of precise urban road line identification pursued by suitable parameterization. If the urban road chance is basic and has just two or three urban road with no road signs on the ground other than the road lines the generation of a urban road-level map and a path-level map won't be altogether different. Notwithstanding, an intricate road in a urban region has various Paths or lanes and different urban roads signs blended with urban road lines. For this situation, quick and precise urban road line identification turns into an essential issue in road-level map producing.

A significant number of the traditional urban road line identification strategies utilizing LiDAR information about 10 years back concentrated on identifying only two lines on each side of the vehicle, so as to decrease the unintended lane departures of an independent driving vehicle [18] [19]. However, these models are profoundly influenced because presence of noise and ambiguity are computationally overwhelming. The proposed imagined technique is computationally less intricate and can be connected progressively without acquaintance of any bogus shading with improves the difference of the scene objects. We will likewise consider road limit identification utilizing two unique systems a) Boundary following b Hough transform. road limit recognition is a part of division. The reason for the present strategies exclusively relies on Hough transform pursued by certain edge recognition process. The thought proposed by [20] is vision- based road limit identification. The very formulating for the optimal way depends on Dynamic Programming (DP) trailed by the utilization of randomized Hough Transform. Attributable to the utilization of Dynamic Programming the assessed computational time is observed to be very substantial bringing about uncertainty. In [21] Hough Transform e with 2D filter is utilized for fast track recognition framework. Here, picture binarization is performed independently which is only an additional progression, as far as unpredictability. In [22] edge identification for road limit is proposed. The downsides of first technique are defeated in the second strategy utilized for urban road edge identification. The calculation time taken continuously strategy is additionally less and progressively reasonable for constant applications which we will consider for execution.

IV. PERFORMANCE ANALYSIS

This section shows dehazing technique for natural scene image based on color analysis and restoration with road edge detection using canny edge and prewitt edge detection methods. Images used for analysis is shown in Fig. 2. The proposed method was implemented in MATLAB R2015a on a personal computer equipped with Intel Core i3-3210 7th GEN CPU 3.20 GHz, 4GB RAM and 64-bit operating system. The fig 3 shows, image dehazing based on color analysis for road edge detection using canny and prewitt detection method. The Fig. 4, shows, after elimination of RGB. The Fig. 5 shows resultant dehazed image Using canny edge detection. The Fig. 6, shows Resultant dehazed image Using prewitt edge detection. The fig. 7, shows using Prewitt after road boundary tracing. The output image that we get appears lighter in regions of high contrast and darker towards regions of low contrast in the complemented image. Denser the haze is in the original image darker will be the regions in the complemented image. Thus, on adding some constant value-k to the darker regions of the complemented image we can enhance the color transmission of that region. Similarly, the portions of very high contrast appear completely white in the complemented image so on reducing a minimum constant value-c from the complemented image we can make the corresponding regions in the original image look less white. The value of k and c both have been kept constant at 45 each.

Fig. 2. Input image used for performing dehazing.

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Fig. 3. Image dehazing based on color analysis for road edge detection using canny and prewitt detection method.

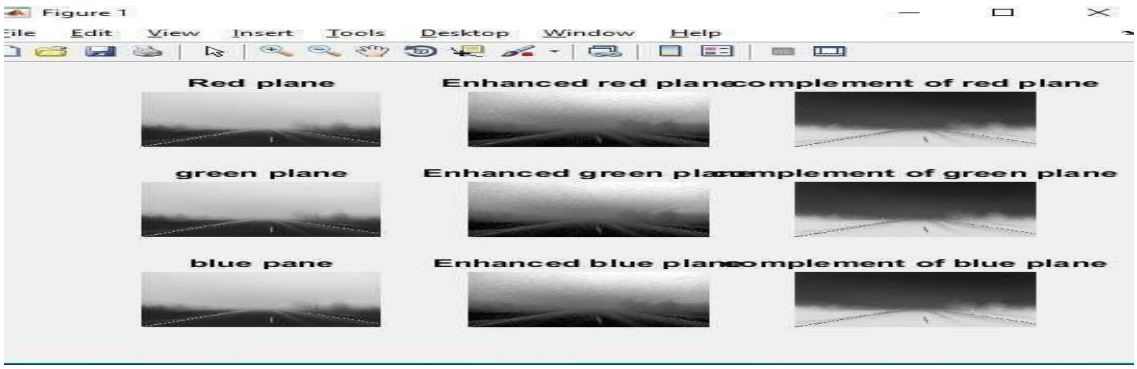

Fig. 4. After elimination of RGB.

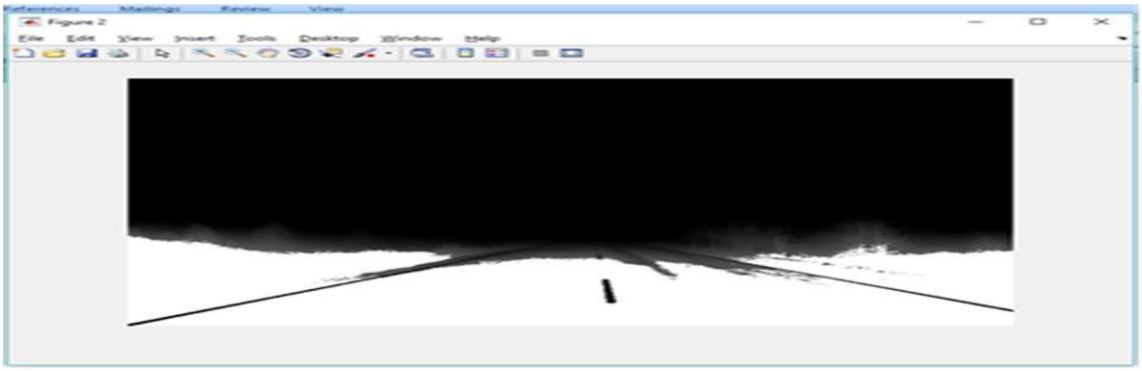

Fig. 5. Resultant dehazed image Using canny Edge Detection.

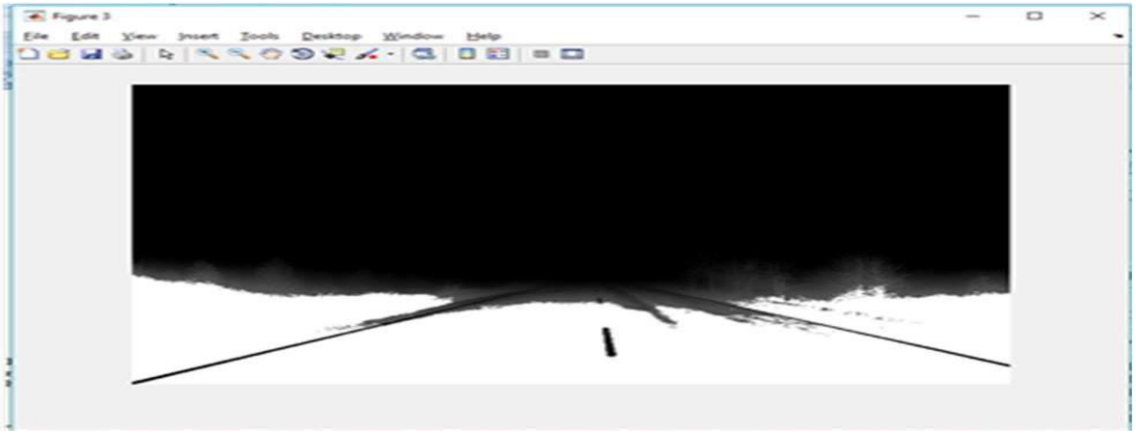

Fig. 6. Resultant dehazed image Using Prewitt Edge Detection

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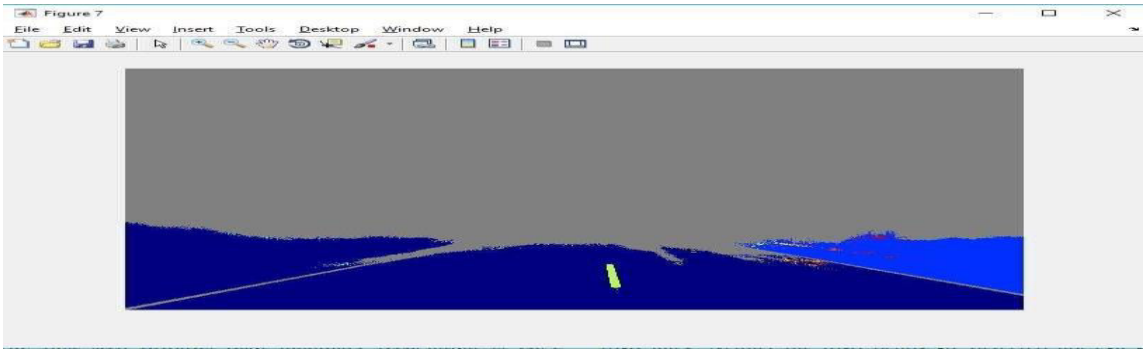

Fig. 7. Using Prewitt After road boundary tracing.

V. CONCLUSION

This work conducted a deep-rooted survey of various edge detection method for designing efficient autonomous vehicle management system. From survey it can be seen edge detection are affected due to presence of noise such as fogs in image. Further, these models are computational very heavy and time consuming. Thus, future edge detection method must overcome these issues for provisioning efficient autonomous transport system. Thus, future work we would consider road edge detection using Hough transformation using 2D filter rather than using dynamic programming method. Further, binarization of image is done individually. Thus, the proposed envisioned model can be used for real-time without inducing any noise (i.e., color) to improve the contrast of the sight objects.

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| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

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