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Vehicle detection in fog using LIDAR

A Safety Need

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Abstract : Parkway snag location is one of the most testing task continuously for self-sufficient vehicle route System. In India the majority of the individuals are died in street mishaps as opposed to by illnesses. As indicated by an overview close about 45% of people are kicked the bucket in street mishaps in a year. Vehicle crash shirking and snag location framework is one in all the chief basic factors inside the car drove. Inside the present, the greater part of the vehicles empower a ready framework which goes about as a security include for the travelers. During this work, propelled the route framework distinguishes and demonstrates the thing is utilized in self-governing vehicles to sufficiently explore through the path in haze. This method distinguishes the hindrance before of the vehicle, cautions the framework. The camera is utilized to distinguish moving or fixed articles. The LIDAR is encased with this method to registering the space of constant moving and thusly the fixed article. The most work adds to the discovery of obstructions sooner than the vehicle. The caution is given to the framework inside the vehicle with respect to the obstruction before all together that the framework helps in impact evasion. During this work, the space between the vehicle and hindrance is estimated by the LIDAR and article identification is finished by the camera. By melding both these sensor esteems the snag is identified and subsequently the separation is furthermore precisely estimated.

***Index*- Obstacle detection, raspberry pi, camera, LIDAR**

I. INTRODUCTION

In the previous decades many driving help frameworks were intended to upgrade the security of the driver and travelers, Many impediment location frameworks were presented which receive diverse dynamic sensors like millimeter wave radar [4], LIDAR sensor [9, 16], infrared laser sensor [7] and ultrasonic sensor [10]. Inserted innovation has increased colossal driving force in car ventures. So as to give security and transport proficiency, insightful car vehicles are utilized these days. The hindrance location framework is intended to decrease the unfavorable impacts of the mishap. This should be possible effectively by utilizing new innovations like radar, lasers, cameras and ultrasonic sensors to recognize impediments in the front side or back side of the vehicle. Joined Nations General Assembly insisted the time of 10 years from 2010 to 2020 as the time of activity which ought to be embraced for street wellbeing estimation.

The self-governing vehicle is equipped for dodging human mistakes. Examination like following of articles from pictures, moving far away from the hindrance and programmed estimation of the obstruction from the vehicle is finished. The obstruction location framework is principal intended to maintain a strategic distance from mishaps. The most up to date advancements like camera, ultrasonic sensor and raspberry pi are used in this strategy to distinguish deterrents any side of the vehicle. The sooner framework utilized the infrared sensor where the estimation go was less (25cms) when put close to the ultrasonic sensor. During this framework, the ultrasonic sensors are included to recognize the item's movement. Ultrasonic sensors are modest and have less force utilization. To keep away from impact of the vehicle this sensor gauges the exact good ways from the deterrent and transmits the deliberate information to the framework. The ultrasonic sensor is introduced during a way so impediments present on the front side of the vehicle are being recognized. The impediments inside the visually impaired zone are likewise recognized by the ultrasonic sensors. One among the most pieces of this hypothesis is to explore any sensibly hindrance out and about. For instance, fixed articles, individuals progressing are sure things that get inside the way which likewise are considered as impediments. These hindrances are identified by the framework and alarm the vehicle for protected and simple route. The nearness of walkers is identified.

With the assistance of picture preparing innovation the framework can be plan. This fast procedure alarms the framework very soon. Be that as it may, there are a few disadvantages inside the detecting innovations kind of a disappointment during severity conditions like mist, day off, downpour. The impediment identification framework likewise utilizes a radar sensor for separation count. Radar identifies the presence of items utilizing radio waves. Propelled driver help framework utilizes radar because of its benefits like longer identification run, position, run and guaranteed wellbeing. Be that as it may, these radar sensors are temperamental for prime temperature and are influenced with vibrations which in this way devalue the outcome. A dream based obstruction recognition framework is utilized during this savvy work, works with low-goals pictures, and with utilization of less force. An examination expresses that vision-based frameworks are obviously better and better when put next than laser and radar frameworks. A dream based sensor is embedded for recognizing the hindrance and staying away from the crash. Picture preparing calculations are acclimated expel the undesirable shakes and commotion inside the picture. Location exactness is accomplished by the development of the fame and division stage. There are two significant pieces of the executed framework, which is that the route and subsequently the hindrance shirking part are handled at the indistinguishable time

expanding the proficiency of the framework. The most work is to recognize the obstructions present before the vehicle. The framework cautions the moving vehicle to prevent the impact. During this work, ultrasonic sensor and camera are wanted to be embedded for the recognition reason as they will identify the thing from the moving vehicle while the hole between the vehicle and snag is recognized and consequently the separation is moreover precisely estimated.

II. LITERATURE REVIEW

In paper [1] Fuzzy inference system framework to priorities the deployment of resources in low visibility traffic conditions by Luz c.ortega and Luios Daniel Otero presents a fuzzy inference system framework to help transportation managers with prioritizing the deployment of resources to areas of low visibility originated by fog. Symbolic logic is taken into account a decision-making technique that could be effectively applied within the area of operational meteorology when dealing with ambiguous, imprecise and sophisticated variables like fog. e.g., visibility forecasting. The framework was developed using GUIDE, a User Interface design environment, and therefore the symbolic logic Toolbox of MATLAB. The use of symbolic logic provides decision makers the flexibility to feature, modify or maybe delete parameters and MFs supported their particular needs without having to incur in expensive architectural system modifications of the framework. The approach accustomed determines the priority of resource deployment in low visibility conditions, which takes into consideration fog also as and road conditions.

In paper [2]Techniques of car detection in fog Dec 2016 by Rahul Singh, Sumeet Singh and Navjot Kaur have described the technique to detect a vehicle in a foggy environment. The image which is received from the camera within the foggy condition is distorted and blurred and it'll not clear up to the required level so the vehicle before is visible to us, so to deblur our image and make it clear we'll use Adaptive Gaussian Thresholding Technique. In this technique threshold value is that the weighted sum of the neighbourhood pixel values which can make our image clearer and clean as compared to the initial image. Additionally to the camera we are using low-cost LiDAR which consists of a laser and a camera both of those devices are combined to live accurate distance up to 10 meters. This LiDAR are wont to measure the gap from the front vehicle and supply warning in line with the measured distance. To utilize the structural information to assist vision-based techniques for vehicle detection and classification, Use a low-cost LIDAR model which is formed of the combination of a camera and a laser. it's accurate and of low cost as compared to the LiDAR. LIDAR utilized in this technique cost is extremely high. Cost LiDAR which consists of a laser and a camera both of those devices are combined to live accurate distance up to 10 meters. This LiDAR are wont to measure the gap from the front vehicle and supply warning in line with the measured distance.

In paper [3] Raspberry Pi based vehicle collision avoidance system by R.Surya Kumar, Kingstone Stanley they mentioned the Advance navigation system which detects and avoids the thing, is employed in autonomous vehicles to soundly navigate through the trail. This technique detects the obstacle before of the vehicle, alarms the system and moves away. The camera is employed to detect moving or stationary objects. The ultrasonic sensor is enclosed with this system to computing the gap of real-time moving and therefore the stationary object. the most work contributes to the detection of obstacles sooner than the vehicle. The alarm is given to the system within the vehicle regarding the obstacle in front so the system helps in collision avoidance. During this work, the gap between the vehicle and obstacle is measured by the ultrasonic sensor and object detection is finished by the camera. By fusing both these sensor values the obstacle is detected and therefore the distance is additionally accurately measured. The outcome of those heads to a far better understanding of the image by identifying objects using Open CV by adopting python.

In paper [4]Raspberry Pi based cost-effective vehicle collision avoidance system using image processing 10, April 2015, by Lohit Ujjainiya and M. kalian Chakravarthi proposed work Raspberry Pi Camera module is utilized for object detection and image acquisition. a radical investigation is performed on a test image to validate the simplest algorithm suitable for edge detection of images. A sufficient analysis is performed to consolidate the results. Based on the results it may be concluded that the canny edge detection technique provides better and legible edges than its other counterparts. The system fails in unfriendly climate like foggy, harsh and extreme rainy environment. It produces a blunder in differentiating between shadows and pedestrians and requires high-resolution cameras and implementation.

III. PROPOSED SYSTEM

The vehicle detection framework is almost intended to give better wellbeing and make the vehicle self-governing. This framework is utilizing a Camera and a LiDAR for recognition of vehicle. These sensors recognize the vehicle, protest, passerby and so forth and give data to the principle control unit and it settles on the choice as per it and controls the vehicle and give the notice flag to the driver. Figure 1 shows the basic block diagram of proposed system. The proposed system consist if raspberry pi, buzzer, Pi Camera, TF Mini LIDAR

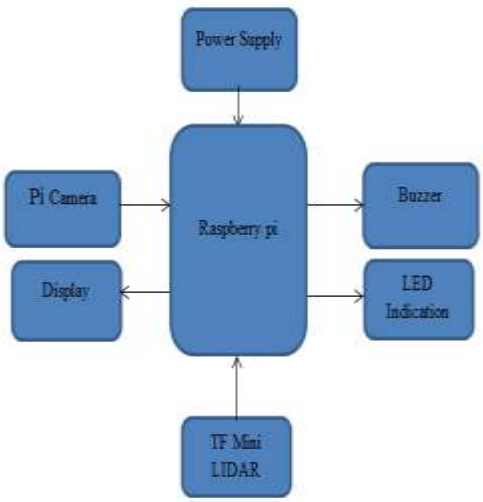

Figure 1: Block diagram of proposed system

3.1 Raspberry – Pi Model B+

Raspberry Pi is a small sized single board computer like credit card with a basic size of 85mm x 56mm developed by Raspberry Pi Foundation. The raspberry pi is mainly depended on Broadcom BCM2835 SoC (system on chip) with a core architecture of 32-bit ARM11 processor, CPU ARM1176JZFS having an operating frequency of 700MHz. The B+ model has a memory of 512 Mb SDRAM, 40 GPIO pins, 4 USB-2.0 ports, one Ethernet socket, video output, audio output, 15 pin MIPI camera serial interface with a micro SD card slot. any of the programming language like python, C/C++, Java, Ruby and Pearl.

Figure-2: Raspberry – Pi Model B+.

3.2 Software required

The basic software required for this work in Raspberry – Pi is OpenCV and the programming language adopted here is Python. OpenCV (Open Source Computer Vision) is an open source machine learning and computer vision software library of programming functions in real time. It was officially launched in 1999 by Intel Research and currently supported by Willow Garage and Itseez. OpenCV is free for use for both commercial and academic use and is released under open source BSD licence. It was developed to provide basic infrastructure for computer vision applications and to enhance the use of mechanical perception for commercial products. The modification of code is easily done in OpenCV. The OpenCV library contains more than 2500 optimized codes and algorithms such as face detect, tracking movements, video capturing, extraction of 3D model of objects, produce 3D points clouds from stereo camera, Hough transform etc. The primary interface of OpenCV is written in C++ but it supports other interfaces also such as C, Python, Java and MATLAB/OCTAVE. The operating systems which support OpenCV are Linux, Windows, Android, FreeBSD, OpenBSD and Mac OS. In this system the programming language used is Python. It is a high level programming language which allows expressing the concept with the help of inbuilt libraries.

3.3 LiDAR

LiDAR uses laser light to measure partitions. It is used as a piece of various courses, from evaluating climatic condition, shooting a laser bar to getting speeders in street movement with a handheld laser-speed locator. There are some laser-checking advancement which are invested critical energy in different field for example flying machine based kind of LiDAR that provides for an extraordinary degree exact, low down 3-D estimations of the ground, vegetation and structures. In open, level regions, ground shapes can be recorded from a plane flying overhead giving precision inside 6 creeps of genuine stature. In steep, forested zones accuracy is routinely in the extent of 1 to 2 feet and depends on upon various segments, including thickness of shade spread and the isolating of laser shots. The speed and precision of LiDAR made it feasible to control enormous districts with the kind of detail that before had quite recently been possible with repetitive and expensive ground survey groups, LiDAR essentially tackle the head of speed and separation:

Distance = (speed of light * Time taken)/2.

4.3 Flowchart

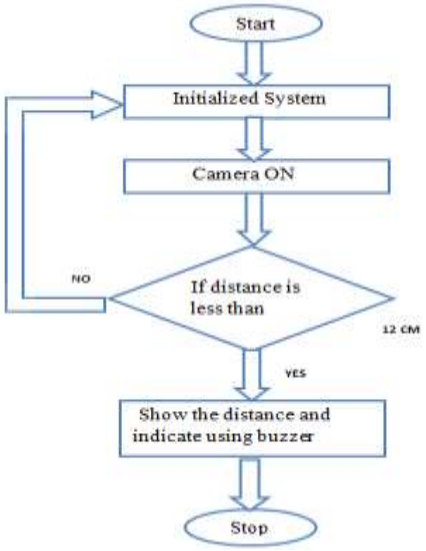

Figure 3: System operational flowchart

Problem definition for the project is to avoid collision of vehicles occurring due to the presence of fog in hilly areas and increasing smokes in metro cities because of increasing pollution.

When we are driving our car in hilly areas in foggy weather then it's very difficult to grasp or see the objects or vehicle distance before people because of foggy conditions as there's whole whiteness before people. So because of these changes within the colliding of vehicles are on high therein condition and almost it's an observation that 3% of the accidents happen thanks to the explanation for the fog condition as vehicle collides on others surprisingly. So, during this case, to detect object or obstacle before of our car is vital so we could reduce this percentage of accidents as we'll be able to know the space of fore coming objects in real-time while we are driving our car.

So solution to the current during this project is to style a system to avoid such condition or collision by detecting the objects and their distance is to be designed. For the purpose here use of Pi-camera interfaced with Raspberry-Pi is been used and the Lidar sensor which is employed to detect the thing and its distance is employed. So with help as objects distance are going to be measured and with information to the driver incidents is avoided from happening.

3.5 Its cause and effects:

There are many places where there are foggy weather and low visibility because of pollution. In such a case, there are possibilities of accidents and road jams. To overcome this problem we've got made this project called vehicle detection in fog using LIDAR. Due to this project, we are able to avoid an enormous number of accidents that happen due to the foggy weather and low visibility. This method can even be implemented in many other vehicles like trains, motorcycles. In India especially this method isn't implemented in every vehicle, so this proposed project is helpful. it's an accident avoidance system. It alerts the person driving the vehicle. Sensors utilized in the project are smaller in size, therefore it's not bulky. The security of the vehicle is maintained. Though it would not be economical

IV. PERFORMANCE ANALYSIS

Raspberry pi is commonly accustomed detect objects and find the space, whereas a vision-based detection is accountable for real object verification and final classification. As compared with others, the benefit of this approach is to utilize structural information to assist vision-based techniques for vehicle detection and classification. During this approach, we are employing a low-cost Raspberry pi model which is created of the mix of a camera and a laser. It accurate and of low cost as compared to the Raspberry pi. In this, an illustrative comparative analysis is performed on the test image captured by PI Camera and therefore the edge detection operations are performed in OpenCV on Raspberry – Pi board. Supported the results it may be concluded that the canny edge detection technique provides better and legible edges than its other counterparts. This could be seen from the results that are obtained after performing canny edge detection the results of which result in distinguish objects and better depth analysis of the image. This entire work has been performed in OpenCV by adopting Python because the programming language. And LIDAR used for distance measuring algorithms based on Time of Flight principle to live the space between the objects and vehicles and efficiently minimize the chance of accidents especially in areas densely infested with people. The alternatively other method are also available for the same. The image which is received from the camera in foggy condition is totally distorted and blurred and it will not clear up to the desired level so that the vehicle in front is clearly visible to us, so in order to deblur our image and make it clear we will use Adaptive Gaussian Thresholding Technique. In this technique threshold value is the weighted sum of the neighborhood pixel values which will make our image clearer and clean as compared to the original image. In addition with camera we are using low cost LiDAR which consists of a laser and a camera both of these devices are combined to measure accurate distance up to 10 meter. This LiDAR will used to measure the distance from front vehicle and provide warning according to the measured distance.

4.1 Expected Results

For showing the expected result, hear some of reference results have been presented. Figure-5 (I) Shows the test image on which these various algorithms are applied and the results so obtained are analysed. (II) Laplacian edge detection.(III) Canny edge detection. (IV) Sobel edge detection X – axis.

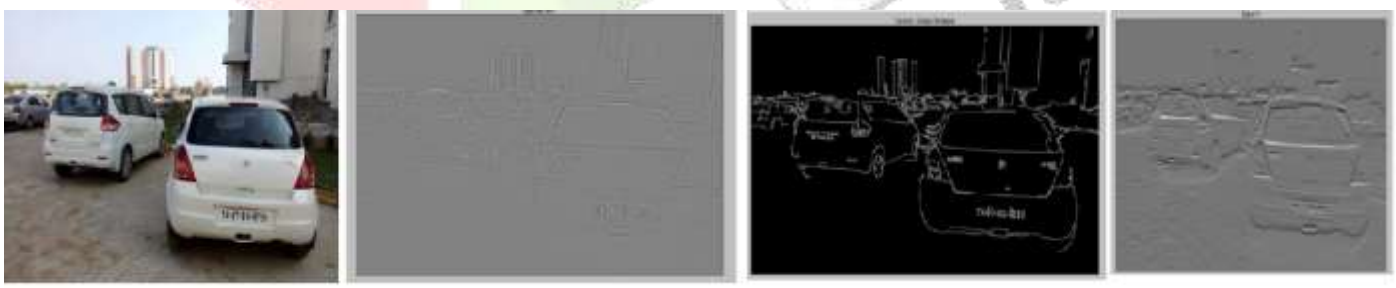

Figure-4 (I) (II) (III) (IV)

V. CONCLUSION

It is a great challenge to detect vehicles under various foggy climatic scenarios. Surrounding objects such as pedestrians, trucks, trees and bicycles distract the system and cause the results to deviate from the actual scenario. LiDAR are often used to detect objects and find distance, whereas a vision based detection is responsible for real object verification and final classification. As compared with others, the benefit of this approach is to utilize the structural information to help vision based techniques for vehicle detection and classification. In this approach we are using low cost LiDAR model which is made up of the combination of a camera and a laser. It is accurate and of low cost as compared to the LiDAR.

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