REVIEW OF RESEARCH
ISSN: 2249-894X
IMPACT FACTOR : 5.7631(UIF)
UGC APPROVED JOURNAL NO. 48514
VOLUME - 8 | ISSUE - 9 | JUNE - 2019

OBSTACLE DETECTION TO NAVIGATE DRIVERLESS CAR IN STATIC AND DYNAMIC ENVIROMENT

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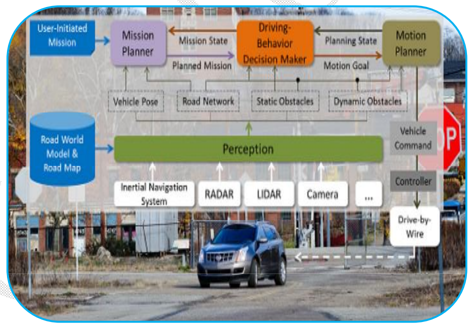
ABSTRACT:
An intelligent vehicle (IV) can achieve road obstacle detection by knowing its environment. Obstacle and Vehicle Detection play a basic role. In fact, an intelligent vehicle must be able to detect vehicles and potential obstacles on its path. Advanced driver-assistance systems intend to understand the environment of the vehicle contributing to traffic safety.It has been considered important that intelligent vehicles identify obstacles around a host vehicle and estimate their positions and velocities precisely. In this context, many systems have been designed to deal with obstacle detection in various environments.



KEYWORDS: *intelligent vehicle , Obstacle and Vehicle Detection play.*

INTRODUCTION

Radars **(Khalid Aaqib et al., 2018, Horne Dylan et al., 2016)** laser range finder **(Kirchner A et al., 2000, Parent M et al.,2001)** stereovision **(Tongtong Li et al., 2018, Dehnavi M et al., 2018, Gehrig Stefan et al., 2017, Xuachen Zhang et al., 2017, Rodriguez Quinonez et al., 2017, Hattori H et al., 2000)** and multisensory fusion are used on structured roads. Several approaches to obstacle detection based on the localization of specific patterns (features such as shape, symmetry, or edges). In **(Bovcon Borja et al., 2018, Dai Xuerui et al., 2019)** the stereo matching is used in many applications, like obstacle detection, 3D-reconstruction, autonomous vehicles and augmented reality The vision-based obstacle detection for the outdoor here we provide a brief review of the state of the art in vision-based obstacle detection. The vision-based obstacle detection for environment can be classified into monocular and multi-camera methods. In Monocular vision-based methods we find some techniques like optical flow was used for robotics obstacle detection in **(Coombs D et al., 1998)**and Appearance-based method **(Ulrich I et al., 2000)** applied only appearance or color feature to discriminate the obstacles. Recently, some researches on 3-D reconstruction from single still image were presented to detect obstacle **(Saxena A et al., 2008, Klarquist et al., 1995, Rajagopalan A N 2004)**. However these methods have weak points in estimating an obstacles position, velocity, and pose, and this has been considered one of the most challenging tasks in computer vision for a long time. The V-disparity and G-disparity image was designed to detect obstacles by estimating the disparity of the ground plane automatically.Since a decade, autonomous driving technologies have emerged with the potential for increased safe and efficient driving **(Ziegler J et**

al., 2014). While one can expect autonomous driving technologies to be deployed first in structured environments such as highway driving and low-speed parking **(Becker J et al., 2014)**other scenarios, such as urban driving, arguably pose a greater challenge due to the presence of non-autonomous road users, e.g. pedestrians, cyclists, and other vehicles. Hence, the research focus needs to be directed to deriving models for predicting the stochastic behavior of human road users, while also avoiding collisions with them.One of the enabling technologies that deeply contribute to an Advanced Driving Assistance System (ADAS) proliferation is the low-cost embedded MEMS (Micro-Electro-Mechanical Systems) sensors, which are becoming cheaper compared with last decades. Affordable memory and important computing resources contribute moreover to the advances in ADAS and intelligent vehicles. These systems allow to enhance road safety and resolve some of the traffic issues. One of the main challenges for self-driving vehicles is related to navigation issues in uncertain or a non-static environment. Nevertheless, artificial intelligence and computer vision offer potential solutions for autonomous vehicles' navigation in an unstructured environment, scene analysis, classification, etc. One of the solutions is a system vision that could be based, either on one monocular camera with morphological image processing operator **(Assidiq A A M et al., 2008, Miao Xiaodong et al., 2012)** fusing road geometry and B-Snakes **(Teoh E K et al., 1999)** or several cameras for advanced processing like interobjects distance estimation and 3D objects reconstruction **(Nunez P et al., 2009, Aliakbarpour H et al., 2009)**. However, road lane detection is still a difficult task for intelligent vehicles. This is essentially due to the huge amount of data that should be processed in real time. The algorithms should recover the road state and uncertainties issues, shadows, vehicles' vibration, sensors' noise, etc. To overcome such constraints; new methods should be fused with the traditional image processing algorithms to improve them and to better target the region of interest and to minimize the computational cost for the real-time applications. With the emerging of new technologies in different field of science the human life has become more comfortable and effortless. Advancement of embedded technologies in automotive industries makes the human life safer and convenient for living. According to a survey there about 1.3 lac deaths in India which are caused by road accidents. The obstacle detection in real time is the most versatile and challenging task for road vehicle and passenger safety. The very first obstacle detection system was developed by Delco System Operations, Goleta of California in 1988. This system was basically a safety system which detects the obstacle on rad and alerts the driver. This system was also capable of detecting the moving objects on nearby lane. After this system, another object detection technique is implied in automotive that make use of infrared sensor, radar and ultrasound sensors. The increasing demand of embedded technologies in automotive industry provides a better and reliable safety feature for the passenger and driver safety. A number of obstacle detection system are introduced which provides safety measures and increase the transport efficiency. Autonomous vehicle technology are implemented in most of the vehicles nowadays which includes a number of sensors to detect the obstacles in front, side and rear of the vehicle. The main work of this paper contributes to the detection of obstacles in lateral blind spot of the vehicle and in front of the vehicle. The system will alert the driver so that the driver may apply brakes or steer the wheels and avoid collision. In this proposed ultrasonic sensor are planned to be implant for the detection purpose as they can detect the object very close to the vehicle and have an immediate response and generates an accurate distance between the obstacle and the vehicle. Previous works of obstacle detection involves the use of infrared sensors which were widely used as proximity sensor for obstacle avoidance. As IR sensor resembles non linearbehaviour and the basic concept depends on the reflection from surrounding object, it produces error in the measured distance. So these sensors were not reliable for precise measurements. Thus these sensors are suitable only for short distance measurement upto 25 cms. The image/vision technology are also introduced for pedestrain safety and detection. It is the most challenging task as fast processing is needed to alert the driver as soon as possible. Pedestrian has to be detected in every frame in which it appears. But the system using image/vision technologies have some drawbacks. The system fails in some unfriendly whether situations like fog, harsh and extreme rainy environment. The system sometimes produces error to differentiate between shadows and pedestrian.

The system requires high resolution cameras and implementation of such system is a difficult task as it produces error due to damping and vibrations of the vehicles.

Image processing is one of the main drivers of automation, security and safety related application of the electronic industry. Most image-processing technologies involve several steps like treat the image as a two dimensional signal and apply standard signal processing techniques to it. Images are also handled as 3D signals where the third dimension is the time or the z-axis. Highly efficient, low memory and reliable solutions can be achieved by utilizing Embedded Systems and Image processing to bring out the benefits of both for applications. Google is one of the billion dollar companies who has demonstrated its own driverless car, a design that does away with all conventional controls including the steering wheel, and other astonishing technologies. In their driverless car, Google has not only included Image Processing, but also many other amazing technologies and one of the most important among them is Lidar, which stands for "Light Detection and Ranging". It consists of a cone or puck-shaped device that projects lasers which bounce off objects to create a high-resolution map of the environment in real time. In addition to helping driverless cars to "see", Lidar is used to create fast, accurate 3D scans of landscapes, buildings, cultural heritage sites and foliage. Some of the other technologies include Bumper Mounted Radar for collision avoidance, Aerial that reads precise geo-location, Ultrasonic sensors on rear wheels which detects and avoids obstacles, software which is programmed to interpret common road signs etc. Apart from these, there are altimeters, gyroscopes, and tachymeters that determine the very precise position of the car and offers highly accurate data for the car to operate safely. The synergistic combining of sensors is one of the most important factors in this autonomous car which includes the data gathered altogether by these sensors are collated and interpreted by the car's CPU or in built software system to create a safe driving experience. Apart from Google, many other companies like Tesla, Audi, Uber have also developed their own driverless cars and have tested potentially.

REVIEW OF LITERATURE

Many cars today already contain some elements of an autonomous vehicle. For example, as a driver approaches his or her vehicle with a key, a wireless chip may cause the doors to unlock automatically. As the driver shifts into reverse, sensors mounted in the front and rear corners of the car collect data via cameras and radar. That data, along with speed and other operating data, is collected by a processor in the car. Software algorithms that understand the relationship between speed and distance analyze the data and alert the driver or apply the brakes if an obstacle in the vehicle's path represents a collision risk. As the driver heads down the road, the vehicle's camera, radar, LIDAR and other sensors continue to observe the environment. These technologies send data back to the vehicle's processor to create a 3D image for analysis, and to prompt any actions that the software algorithm might deem necessary. In a fully autonomous vehicle, mapping software would also help identify when a vehicle should change directions. Currently, there is no standard platform for all of these technologies and so, for example, one automaker might choose to include multiple cameras while another might choose to use a single camera but more radar sensors. While great strides have been made over the past several years in the development of autonomous driving, fully autonomous vehicles have yet to be introduced on a large scale. Figure 2 highlights increasing Levels of driver automation as defined by the US Transportation Security Administration (TSA). To date, most people have only experienced Levels 0-2. However, Uber recently began operating Level 3 self-driving vehicles, which include drivers but operate in self-driving mode in a limited number of US cities. Meanwhile, in late 2016, Baidu ran a trial operating Level 3 autonomous vehicles from three Chinese automakers carrying passengers within a two-mile district. Level 3 was also successfully demonstrated in a recent real-world test conducted by Uber's self-driving truck company, Otto, in the US. The company partnered with beer brewer AB InBev to haul some 52,000 cans of beer across 120 miles of highway using a self-driving truck in which the human passenger only monitored the self-driving system from the back sleeping berth. The success of this test bodes well for the future adoption of autonomous trucking on a wider scale. For more details on US trucking see box on page 8 (Keep on truckin').

This section reviews relevant previous work in smart irrigation systems using Wireless Sensor Networks (WSN).

Khalid Zebbaraa et al., 2019: This paper presents a fast road obstacle detection system based on association and symmetry. This approach consists to exploit the edges extracted from consecutive images acquired by a stereo sensor embedded in a moving vehicle. The algorithm contains three main components: edges detection, association detection and symmetry calculation.The edges detection is achieved by using the canny operator and point corner to extract all possible edges of different objects at the image. The association technique is used to exploit relationship between the edges of two consecutives images by combining it with the moment operator. The symmetry is used as road obstacle validation; the road obstacles like vehicle and pedestrian have a vertical symmetry. The proposed approach has been tested on different images. The provided results demonstrate the effectiveness of the proposed method.

Ivo Batkovic et al., 2019: In this paper, we present a vehicle motion planning and control framework, based on Model Predictive Control, accounting for moving obstacles. Measured pedestrian states are fed into a prediction layer which translates each pedestrians' predicted motion into constraints for the MPC problem. Simulations and experimental validation were performed with simulated crossing pedestrians to show the performance of the framework. Experimental results show that the controller is stable even under significant input delays, while still maintaining very low computational times. In addition, real pedestrian data was used to further validate the developed framework in simulations.

Kukkala Kumar Vipin et al., 2019: In this paper author talks about the advanced driver-assistance systems (ADASs) have become a salient feature for safety in modern vehicles. They are also a key underlying technology in emerging autonomous vehicles. State-of-the-art ADASs are primarily vision based, but light detection and ranging (lidar), radio detection and ranging (radar), and other advanced-sensing technologies are also becoming popular. In this article, we present a survey of different hardware and software ADAS technologies and their capabilities and limitations. We discuss approaches used for vision-based recognition and sensor fusion in ADAS solutions. We also highlight challenges for the next generation of ADASs.

Colquitt Jim et al., 2017 In this paper, author focus on the Disruptive technologies and trends are radically reshaping the investing landscape across sectors, asset classes andgeographies. This paper is the first in a series examining the investment implications of these innovations. We are at a point in history where computer science and technology are enabling the creation of products and services that previously existed only in the realm of science fiction. In this article, we consider the investment implications of one such game-changing innovation: autonomous driving technology, or driverless cars. The global market for these vehicles is expected to reach the trillion US dollar mark by 2025.1 We also explore the impact of the technology on key global industrial sectors, such as auto manufacturing, transportation services and freight. Continuing improvements in computer processing power, artificial intelligence (the ability to program computers to "learn" like humans) and the growing network of smart devices communicating directly with one another (often referred to as the "internet of things") have created a new ecosystem ripe for disruption and new entrants in global industry. Artificial intelligence began as a sub-discipline of computer science in the 1950s. The scope of what we continue to "teach" computers has become increasingly complex as input data sets grow larger and data scientists develop deeper "thinking" algorithms.

Viswanathan Vidya et al., 2017 According to this paper, Self-driving autonomous cars are going to be the future in the transportation sector. Many of the billion dollar companies including Google, Uber, Apple, NVIDIA, and Tesla are pioneering in this field to invent fully autonomous vehicles. This paper presents a literature review on some of the important segments in an autonomous vehicle development arena which touches real time embedded systems applications. This paper surveyed research papers on the technologies used in autonomous vehicles which includes lane detection, traffic signal identification, and speed bump detection. The paper focuses on the significance of image processing and real time embedded systems in driving the automotive industry towards autonomy and high security pathways.

Daily Mike et al., 2017: In this paper author presents Significant improvements in the last decade have greatly advanced self-driving car technology. These new capabilities will have profound global impacts that could markedly change society, not to mention the significant improvements they bring to the overall efficiency, convenience, and safety of our roadways and transportation systems. Addressing self-driving technology– related concerns is important, particularly given these broad potential impacts. Worldwide, 10 trillion automobile miles are driven each year, with complex and novel conditions generating millions of situations in which autonomous vehicles could fail. Yet there are many challenges that remain across all levels of system functionality. To give readers some context for the work covered in this special issue, we have provided a summary of ongoing work in Asia, Europe, and the United States, as well as in academia.

Felipe Jiménez et al., 2016: In this work author present, The advances in Information Technologies have led to more complex road safety applications. These systems provide multiple possibilities for improving road transport. The integrated system that this paper presents deals with two aspects that have been identified as key topics: safety and efficiency. To this end, the development and implementation of an integrated advanced driver assistance system (ADAS) for rural and intercity environments is proposed. The system focuses mainly on single-carriageways roads, given the complexity of these environments compared to motorways and the high number of severe and fatal accidents on them. The proposed system is based on advanced perception techniques, vehicle automation and communications between vehicles (V2V) and with the infrastructure (V2I). Sensor fusion architecture based on computer vision and laser scanner technologies are developed. It allows real time detection and classification of obstacles, and the identification of potential risks. The driver receives this information and some warnings generated by the system. In case, he does not react in a proper way, the vehicle could perform autonomous actions (both on speed control or steering maneuvers) to improve safety and/or efficiency. Furthermore, a multimodal V2V and V2I communication system, based on GeoNetworking, facilitates the flow of information between vehicles and assists in the detection and information broadcasting processes. All this, combined with vehicle positioning, detailed digital maps and advanced map-matching algorithms, establish the decision algorithms of different ADAS systems.

Bounini Faridi et al., 2015: In this paper author talks about the advanced Driving Assistant Systems, intelligent and autonomous vehicles are promising solutions to enhance road safety, traffic issues and passengers' comfort. Such applications require advanced computer vision algorithms that demand powerful computers with high-speed processing capabilities. Keeping intelligent vehicles on the road until its destination, in some cases, remains a great challenge, particularly when driving at high speeds. The first principle task is robust navigation, which is often based on system vision to acquire RGB images of the road for more advanced processing. The second task is the vehicle's dynamic controller according to its position, speed and direction. This paper presents an accurate and efficient road boundaries and painted lines' detection algorithm for intelligent and autonomous vehicle. It combines Hough Transform to initialize the algorithm at each time needed, and Canny edges' detector, least-square method and Kalman filter to minimize the adaptive region of interest, predict the future road boundaries' location and lines parameters. The scenarios are simulated on the Pro-SiVIC simulator provided by Civitec, which is a realistic simulator of vehicles' dynamics, road infrastructures, and sensors behaviors, and OPAL-RT product dedicated for real time processing and parallel computing.

Garethiya Sumit et al., 2015: In this work author talks about the Highway obstacle detection is the most versatile and challenging task in real time scenario. With the enhancement of emerging embedded technologies in automotive field, the life of people becomes more comfortable and provides safety against accidents. Now a day, almost in all vehicles an intelligent safety and alert system is implement which warns the driver to avoid accidents. In proposed work, advanced collision avoidance system is introduced which detects the presence of obstacle in front as well as in blind spot of vehicle and alert the driver accordingly. This system implants ultra sonic sensor for detection purpose of real time moving and stationary object under all weather environment.

NEED OF STUDY

As we know is present era several European &Asian countries including USA, China, Japan, Korea, Singapore, and India are making significant contributions to the field. Although these countries are in various stages of adoption with respect to connected and autonomous vehicles, more effort is needed before these technologies can be reliably deployed on a large scale. Customizing and improving the existing automated driving technologies to traffic patterns and specific scenarios relevant to Asia remains a major focus of research in this region. So as per present research there is lots of issues are there which are followings:

1. Time complexity: In existing solution time complexity is main challenge
2. Lack of Real time system: Currently there is no any solution which is able to provide selfdriving capability in terms of road detection and human detection.
3. Not Applicable for all features of the driverless cars system
4. Time & Quality management issue: There is no any approach which is able to make justice with both parameters.
5. Accuracy: There is lack of accuracy in most of the previous existing approach
6. Quality: In current existing approach there is issue with quality ,as per there extra time complexity there is no any approach who are able to provide good quality

OBJECTIVES

As per the previous research there is lots of research gap which need to be solved so in this work these are our objects which we will solve:

1. **Real time system: In this work we will devolve a system which is able to provide an intelligent system which will be able to take decision on driverless cars.**
2. **Reduction In Time complexity**
3. **Applicable for most of the features of driverless cars.**
4. **Improvement in Quality**
5. **Proper management in Time & Quality and try to make justice with both parameters.**
6. **Improvement in accuracy**

EXPECTED OUTCOME

In this work we are focus onReal time road & Passenger detection system for Driver less car using the concept of Machine learning and deep learning ,so as per our expectation we will able to improve the followings parameters through our novel algorithm:

1. Able to make justice with time & quality parameter.
2. Here we will try to reduce the time complexity with 20-30%.
3. Here we will try to improve the quality complexity with 30-35%.
4. Here we will try to make more accurate system.
5. We will make a real time system which is able to find fault on live camera
6. We are try to cover most of the features which are require for driverless cars.

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