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LIDAR Self Driving Car

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Abstract: Increasing population is the major issue of transportation nowadays. People who live and work in the major cities of the world are faced with increasing levels of congestion, delays, total travel time, costs, frustration, accidents and loss of life. The objective of this project is to help prevent traffic accidents and save people's time by fundamentally changing car use. The system would have sensors to detect the obstacles and to be able to react according to their position. In this project we have developed an automated driving system which drives the car automatically. We have developed a technology for cars that drives it automatically using LIDAR. This car is capable of sensing the surroundings, navigating and fulfilling the human transportation capabilities without any human input. It continuously tracks the surrounding and if any obstacle is detected vehicle senses and moves around and avoids the obstacle. An autonomous car navigation system based on Global Positioning System (GPS) is a new and promising technology, which uses real time geographical data received from several GPS satellites to calculate longitude, latitude, speed and course to help navigate a car. As we know the development of gps is more improved now the accuracy of gps we can see centimetre also so Like for our car to go at specific inputted location we use this gps technology.Lidar is used for sensing the surroundings. Like radar, lidar is an active remote sensing technology but instead of using radio or microwaves it uses electromagnetic waves.

Keywords: Congestion, Traffic Accident, LIDAR sensor, Global Positioning System, Electromagnetic waves

I. INTRODUCTION

Every year around in the world approx 1.5 million death caused by road accident. Around age 18 or Generally the new learner who are just learning how to drive , its scary for me to think of the about accident Because what if the Accident occur due to some one else mistake . On the top of that, as we know that amount of traffic we have it just create the useless/unnecssary frustration for nearly every 9 people out of 10. This was the main reason for deciding our project that is Self Driving Car which is also known as autonomous car (A car which can run without Driver or also known as robotic Car). It is a vehicle that is capable of sensing its surrounding and also navigating the input without any help of human. These type of car uses variety of techniques like Lidar ,radar, laser light gps and computer vision . Due to which this type of car also known as human brain because of the ability to sense the surrouding and also give the input by itself. According to research there have been testing and experiment going on to develop self driving car for over a 40-45 year. This type of vehical requires wide range of technologies and infrastructure to operate properly. With the development of technology, there have been driverless cars . It is a concept which is pushed and supported by Google, and various other company.

As we know as the Development in technology increases the concern for the technology safety is also increases .the main concern is the security of the car .the way we human drive the car is much different the way robotic brain think like example we say the miscommunication between car and the passenger we human can drive at our own will to make passenger happy but self driving car will only use the safest and only route which are provided to it. it is difficult to think that if the car make some kind of mistake like crossing at high speed or ignoring signal because of technology failure how it can correct it mistake on its own.

And the second most important concern our that people will never be able to trust the machine as they trust the our fellow humans without understanding the logic of the car and how its operate. It is important to understand the issues that surround the logic that has been used in the car .There are many more concern regarding robotic car . here our some question i.e. Will it be possible to have changes in the places where the owner of the driverless car want to go? What if I want to change where I am going? if there any communication barrier how can we communicate with the system or car?

For our project we have collected our data from the university of Hesai Inc. and Ford Motor Company as we have decided to work on it i.e. Self Driving Car by using Lidar to sense the surrounding. We hope the dataset will be useful to the robotics algorithm. Since 2016, self-driving cars have moved toward partial autonomy, with features that help drivers stay in their lane, along with ACC technology and the ability to self-park.

Developer of self driving car use the vast number of data from various dataset such as image recognition machine learning and neural network to build system which can work in normal surrounding.

II. LITERATURE REVIEW

1) *Ford Campus Vision:* They have presented a time-registered vision and navigational data set of unstructured urban environments. They believe that this data set will be highly useful to the robotics community,especially to those who are looking toward the problem of autonomous navigation of ground vehicles in an a-priori un-known environment. The data set can be used as a benchmark for testing various state of the art computer vision and robotics algorithms like SLAM, iterative closest point (ICP), and 3D object detection and recognition. The KITTI **:** In this paper, they have presented a calibrated, synchronized and rectified autonomous driving dataset capturing a wide range of interesting scenarios. We believe that this dataset will be highly useful in many areas of robotics and com-puter vision. In the future we plan on expanding the set of available sequences by adding additional 3D object labels for currently unlabeled sequences and recording new sequences,for example in difficult lighting situations such as at night, in tunnels, or in the presence of fog or rain. Furthermore, we plan on extending our benchmark suite by novel challenges. In particular, we will provide pixel-accurate semantic labels for many of the sequences.
2) *Oxford RobotCar:* In this paper they have presented the Oxford RobotCar Dataset, a new large-scale dataset focused on long-term autonomy for auto-tonomous road vehicles. With the release of this dataset we intend to challenge current approaches to long-term localisation and mapping, and enable research investigating lifelong learning for autonomous vehicles and mobile robots. In the near future we hope to offer a benchmarking service similar to the KITTI benchmark suite4 providing the opportunity for researchers to publicly compare long-term localisation and mapping methods using a common ground truth and evaluation criteria. We also encourage researchers to develop their own application-specific benchmarks derived from the data presented in this paper, e.g. using the open source structure-from-motion of [28] or the optimisation package of [29], which we will endeavour to support. David Pfeiffer Daimler AG **:** In this contribution, they presented an improvement of the state-of-the-art 3D Stixel intermediate representation by exploiting stereo confidence information in a probabilistic fashion. It is shown that the intuitive approach to sparsify. The disparity maps based on confidence allows to reduce the false positive rate by a factor of three. Instead of simply ap-plying such a threshold, using confidences in a Bayesian manner yields an additional improvement by a factor of two while maintaining the same detection rate. These find-ings have been obtained from an extensive evaluation over a large database containing more than 76, 000 frames of mostly challenging video material. A subset of this database containing 3D ground truth object data is considered to be made publicly available.The best performing metric “Local Curve”, a quality measure for the sub-pixel curve fit, comes at no extra com-putational cost. The same holds true for integrating confidence information into the subsequent Stixel processing step. We are convinced that similar improvements can be achieved in other stereo-driven tasks.Future work will further extend the usage of the aggre-gated confidence up to the object level. Also, when using Stixels with motion information, the identical concept can be applied for using optical flow confidence information.
3) *Kaifeng Gao, Gang MEI:* In this paper, they have proposed a fast method, which uses a GPU-based parallel IDW interpolation algorithm to impu-tate the incomplete road point cloud datas obtained by IoT technology to enhance the safety of autonomous driving. Two groups of benchmarks have been conducted to evaluate the performance of the proposed method. We have found that:(1) the known point cloud data within 5 meters around the obstacle vehicle are sufficient to guarantee the imputation accuracy; (2) when the weight parameter of the IDW inter-polation is 4, the efficiency and accuracy of the imputationcan be optimally balanced; and (3) it takes approximately 0.6 seconds to imputate the incomplete dataset consisting of 15 million points, while the imputation error is approxi- mately 5 millimeters. The proposed method is capable of effi-ciently and effectively imputating the incomplete road point cloud data that are induced by obstacle vehicles, and outper-forms other interpolation algorithms and machine learning algorithms. The ApolloScape **:** In this work, they present a large-scale comprehensive dataset of street views. This dataset contains 1) higher scene complexities than existing datasets; 2) 2D/3D annotations and pose information; 3) various annotated lane markings; 4) video frames with instance-level annotations. In the future, we will first enlarge our dataset to achieve one million annotated video frames with more diversified conditions including snow, rain, and foggy environments. Second, we plan to mount stereo cameras and a panoramic camera system in near future to generate depth maps and panoramic images. In the current release, the depth information for the moving objects is still missing. We would like to produce complete depth information for both static background and moving objects
4) *Argoverse:* They focus on the ADE and FDE for a prediction horizon of 3 seconds to understand which baselines are less impacted by accumulating errors. Constant Velocity is out- performed by all the other baselines because it cannot capture typical driving behaviors like acceleration, deceleration, turns etc. NN+map has lower ADE and FDE than NN because it is leveraging useful cues from the vector map.NN+map has lower error than NN+map(oracle) as well, emphasizing the

multimodal nature of predictions. LSTM ED does better than NN. LSTM ED+social performs simi-lar to LSTM ED, implying that the social context does not add significant value to forecasting. A similar observation was made on KITTI [10] in DESIRE [19], wherein their model with social interaction couldn't outperform the one without it. We observe that LSTM ED+map outperforms all the other baselines for a prediction horizon of 3 sec. This proves the importance of having a vector map for distant fu-ture prediction and making multimodal predictions. More- over, NN+map has a lower FDE than LSTM ED+social and LSTM ED for higher prediction horizon (3 secs). UC Berkeley: In this work, they presented BDD100K, a large-scale driv- ing video dataset with extensive annotations for heteroge- neous tasks. We built a benchmark for heterogeneous multi-task learning where the tasks have various prediction structures and serve different aspects of a complete driving sys-tem. Our experiments provided extensive analysis to different multitask learning scenarios: homogeneous multitask learning and cascaded multitask learning. The results presented interesting findings about allocating the annotation budgets in multitask learning. We hope our work can foster future studies on heterogeneous multitask learning and shedlight in this important direction.

5) *Carnegie Mellon University:* In this paper, we have studied how the choice of sensor configuration parameters and how various environmen-tal factors affect the performance of visual localization. We conducted an extensive series of experiments using both forward-facing cameras and virtual cameras extracted from panoramic imagery. Using an information-theoretic approach, we established a relationship between the infor- mation content of image regions and the usefulness of those regions for localization. Our findings reflect the intuition that the sides of the road provide the most benefit for lo- calization algorithms. Interestingly, many visual localization and mapping algorithms focus primarily on forward-looking Lidar
6) *IFTE Khairul Alam Bhuiyan:* The report presented the Light Detection and Ranging (LiDAR) Sensor and its application in autonomous driving as a potential companion for future safety roads. The Velodyne's HDL-64E is a High Definition Lidar capable of acquiring a large volume of high resolution 3-D data. The HDL-64E features a unique combination of high resolution, broad field of view, high point cloud density and an output data rate superior to any available Lidar sensor in the marketplace today. It is the ideal building block for applications such as autonomous vehicle navigation, infrastructure surveying and mapping display and retrieval, as well as many other applications requiring 3-D data collection. Those of us fortunate enough to be part of the ADAS and. autonomous driving markets understand the critical role that LiDAR will play in vehicles of the future

III. DISCUSSION

As the LiDAR sensor spins on top of the vehicle the digital data are collection of point clouds from the surrounding. The points come from a single emitter-detector pair over flat ground appears as a continuous circle. The Fig. 1 shows such 3D construction of image recorded with HDL-64E and there are no breaks in the circular data around the car in any of the point clouds. Fig. 1. Digital Sensor Recorder Display of HDL-64E Data This indicates that the laser pulse repetition rate and upper block to lower block duty cycles (emitter and detector arrays) are configured properly for the sensor. A repetition rate that is too slow would result in each of the circles would appear as dotted lines. The only areas of blanking, where there is no data, are between the point clouds or where a shadowing effect occurs, where a target is in the optical transmit path, and thus no information can be obtained from behind the target. The blanking behind the rear bed of the car is an example of this shadowing effect .

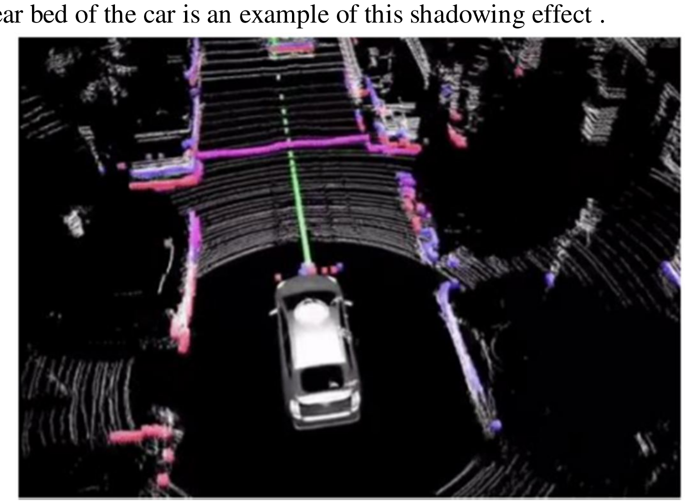

Fig. 9 Digital Sensor Recorder Display of HDL-64E Data

IV. CONCLUSION

In this paper, we presented the Light Detection and Ranging (LiDAR)Sensor and its application in the autonomous driving as a potential companion for future safety road. Increasing population is the major issue of transportation nowadays. So, here we have developed an automated driving system based on LiDAR which drives the car automatically. Our goal is to help prevent traffic accidents and save people's time by fundamentally changing car use.

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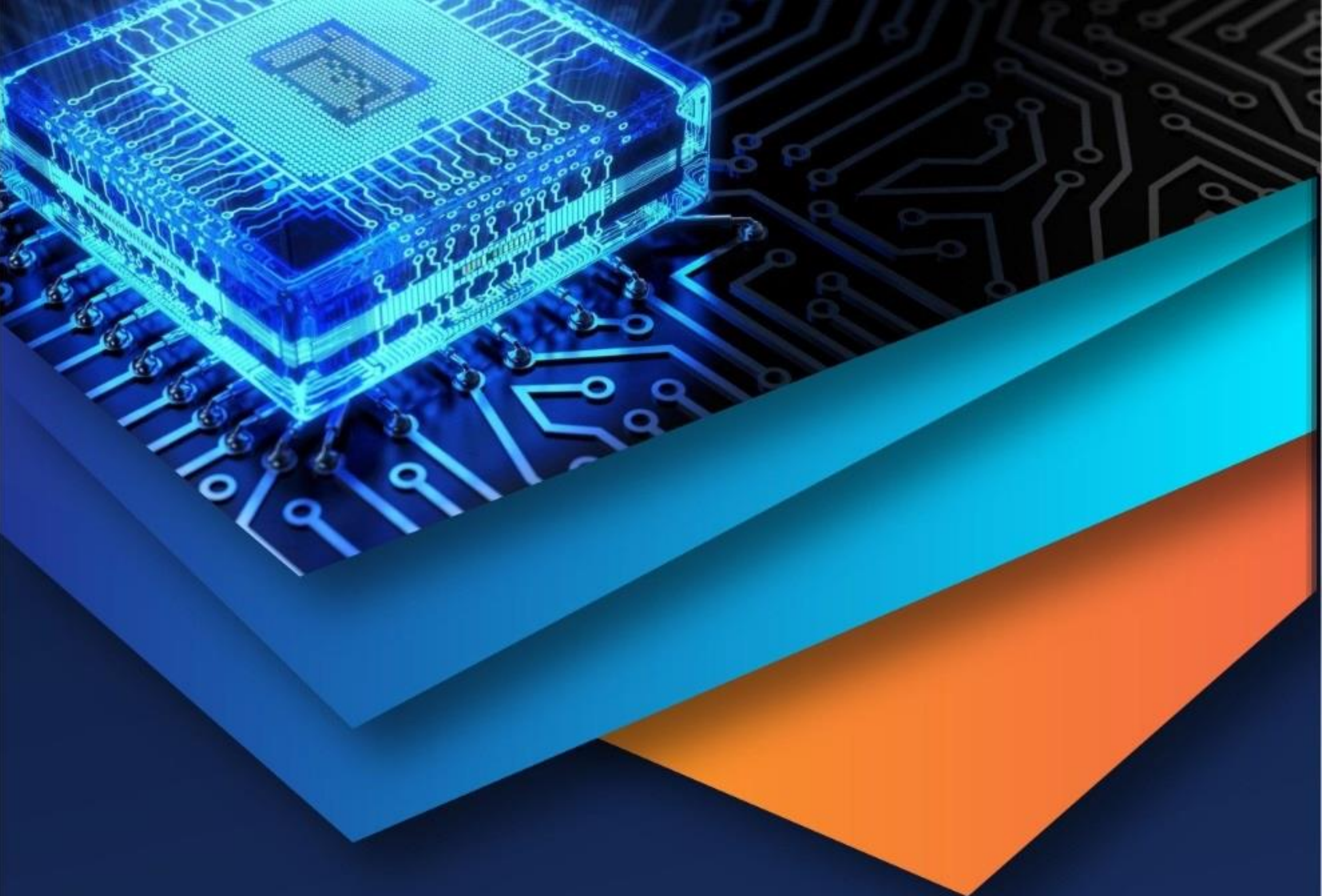

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