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Autonomous Car Data Collection and Analysis

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***Abstract*-Autonomous car is driverless car, which can work without any human interaction. To design fully automated car the different sensors like Radar, Lidar, Camera, GPS and Ultrasonic sensor are used. These sensors perceives surrounding environment and collects different data. This data can be used to give instructions to car while driving, so analysis of data is very important. To analyze the sensors data this project provides different tools which are used for data Collection and analysis i.e, Drivers who go on drive use Dan View to record the vehicle Radar information, LIDAR Data, GPS and CAN frames. Drive Cal is used to calibrate the lidar sensor. Drive List is used to collect information about driver and drive details. Drive Store stores all drive data in the data base in cvw file format. Drive Trigger searches the data for specific events to be analyzed. Drive Scope tool is visualization tool, which allow user to analyze the drive data.**

***Keywords*- Autonomous Car,Radar,Lidar, Camera, Drive cal, Drive Store,DriveScope**

I. INTRODUCTION

Autonomous car is driverless car which is able to operate itself without any human interaction. According to recent research from National Highway Traffic Safety Administration (NHTSA) it is proved that 94% of the accidents are happened due to the human mistakes while driving.

The reasons for these mistakes are as follows:

- The driver is not able to see the objects properly from his position
- Lack of Attention from his position while driving
- During bad weather condition driver is not able to see the road properly. For example in Fog weather, Cloudy weather etc.
- Reflection of lights while driving.
- Lack of good driving skills to drive in curve areas to avoid accidents.

To overcome all the above problems the Autonomous vehicle came into existence. The study of Autonomous vehicle starts from 1920. In initial days of AV development the different DARPA competitions are conducted in 2004, 2005 and 2007 to test the autonomous vehicle in the different test environments like urban road, highways etc.

The Autonomous car consists of ADAS (Advanced Driving Assistance System). The ADAS is system which involves different sensors like LIDAR, RADAR, GPS, and CAMERA etc, to perceive the surrounding environmentand store this data. The data which is collected from the sensors is used to detect the objects like surrounding vehicles on road, pedestrians, lanes on road, traffic signs etc. To detect all these objects the different algorithms are applied like, Support Vector Machine (SVM), Convolutional Neural Network (CNN), Region based Convolutional Neural Network(R-CNN), Fast R-CNN, Faster R-CNN, You Only Look Once (YOLO). These algorithms use technologies like Machine Learning, Deep learning and Computer Vision.

The workflow of the different sensors with the Autonomous car is showed in the below figure. All the sensors grasp its surrounding environment and collect data; based on that data ADAS will take decision the driving controls such as speed of car, acceleration, break and so on.

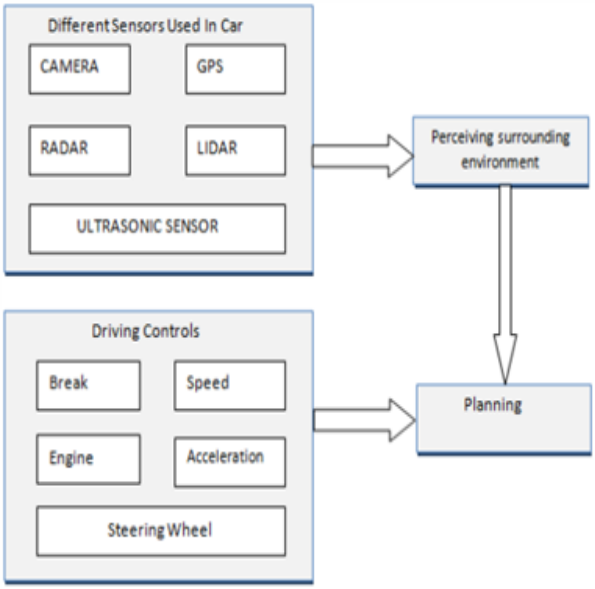

Fig 1. Workflow of Sensors with Autonomous Car.

II. REVIEW OF LITERATURE

1. About Autonomous Car:
Once after the development of self driven ship, boats and autopilot airplanes. Now the dream is to design Autonomous car. Autonomous car is also known as driverless car, robot car. These cars are the technological development in the automobile industry.

Autonomous car consist of advanced driver assistance system (ADAS) system [1]. This system helps in sensing surrounding environment without human input [3]. It contains variety of sensors such as RADAR, LIDAR, GPS, Odometry, Ultrasonic sensor and so on and sensors data is used for the object detection.

These cars depend on sensors, complex algorithms, powerful processes, machine learning, artificial intelligence and deep learning. These cars are capable of making its own decision while driving.

There are different challenges in designing fully autonomous cars, which are as follows [8]:

- Creating map for the autonomous car is difficult task.
- Handling these cars in the different situation.
- Safety of the customer during self driving.
- Handling traffic conditions and road conditions.
- Handling accident situations while driving.

The most of the companies such as Google, Hyundai, Nissan, Autoliv, Mercedes- Benz, Toyota, Volvo, and Audi and so on are started research to build complete self driving car [6]. In the initial days of autonomous car differentDARPA competitions [4] [5] are conducted to test the cars.

2. Advantages of Autonomous car:
Some of the advantages of self driving car is as follows [8]:

- Reduces accidents due to human errors
- Decreases the harmful emissions from the vehicles.
- The United States Department of Transportation (USDOT), predicts that rise of autonomous car will decrease the traffic deaths by reducing the vehicle crashes.
- Reduces time taken to reach destination.
- Reduction in Fuel consumption.

3. About Sensors:
Three major sensors used in autonomous car are Radar, Lidar and Camera. All theses sensors grasp surrounding environment while driving and collects the data about pedestrians traffic signs, vehicles, lanes etc. The cameras are used for accurate visualization of world and are mounted on every side i.e; front, rare, left and right to get 360 degree of environment. Radar helps in low visibility of cameras like night driving. Radar works by radio waves, these waves hits the objects and come back to the sensors and give data about speed and location of the object. Radar and camera are the common sensors used for parking assistance and advance driver assistance.

To build complete driverless system lidar sensor came into existence. Lidar helps the self drivingcar to get 360 degree view of the driving environment. It gives the shape of the objects, pedestrians and road geography. The main advantage of lidar is, it works in low-light condition. This sensor is capable to give 3D picture from the signals which will come back instantaneously after hitting object. It creates point clouds to identify other vehicles to provide safety and to collect data. The below figure gives brief idea about the sensors mounted in the car.

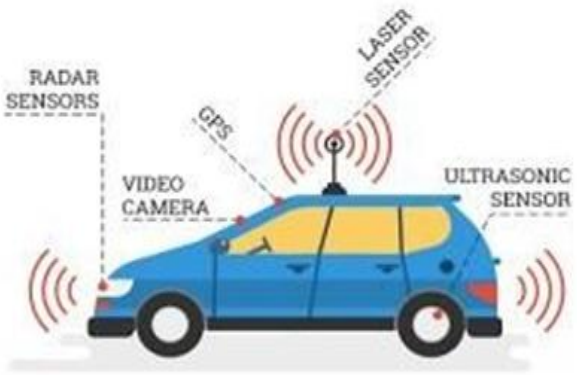

Fig 2. Autonomous car with sensors.

Ultrasonic senor is speaker which emits and receives ultrasonic sound. This sensor is used for various purposes such as fish finders, burglar alarms, drone applications, water level sensing etc. But in self driving cars this sensor is used to find parking area to park the vehicles automatically.

4. Sensor Fusion:
Sensor fusion is one of the crucial task in the autonomous car [7]. Fusion algorithm helps the vehicle to understand how many obstacles are there around the vehicle, exact location of those obstacles and speed of those obstacles.

This algorithm will consider different data from different sensors and aggregate all data andanalyze it properly and gives instruction to the vehicle regarding the obstacles around the environment or car. Based on these instructions only the vehicles take their decisions while driving, hence sensor fusion plays vital role in the autonomous car.

5. Algorithms:
After collecting data from the sensors, different algorithms are applied to collected data to recognize the objects properly. The different machine learning and deep learning algorithms which are used to recognize objects [9] are, Support Vector Machine (SVM), ConvolutionalNeural Network (CNN) [2], Region based

Convolutional Neural Network (R-CNN), Fast RCNN, Faster R-CNN, YOLO [10], YOLOV2, YOLO.

III. TYPES OF AUTONOMOUS VEHICLES

The SAE (Society of Automotive Engineers) gives different levels of automation based on the enhancements in automation driving. The five levels of automation are level 0, level1, level 2, level 3, level 4 and level 5. Each level has its own feature which is explained below.

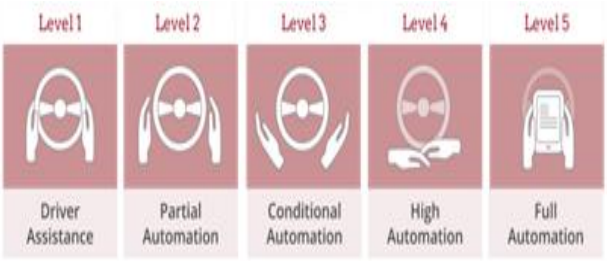

Fig 3. Different levels automation driving.

1. Level 0 : No Automation:
In this level there is no automation all the process like steering, acceleration is handled by the human only.

2. Level 1 : Driver Assistance:
This level involves both the human driver and system. Here some of the driving modes are handled by the system based on driving environment like anti-lock breaking system, stability control etc.

3. Level 2 : Partial Automation:
Level 2 involves partially automated cars, where the system handles driving activities by collecting information about surrounding environment. It involves Advance breaking system or collision avoidance

4. Level 3 : Conditional Automation:
In this level the driver can concentrate on other tasks while driving but they have to response immediately if there is any emergency alert from the car.

5. Level 4 : High Automation:
In level4 all the driving activities like steering acceleration and monitoring of environment through map are handled by system itself. If the driver does not respond appropriately during alert is also no problem in this level.

6. Level 5 : Full Automation:
Level 5 involves fully automated car which can drive in any environment and weather conditions.

The level 4 and level 5 are still a challenge to the industry. To design these 2 levels we need to monitor the environment properly through the sensors and through these sensor data the objects has to recognize while driving using different algorithms. To design these levels of car this project involves development of the tools like Drive Installer, Drive cal, Drive List, Dan View, Drive Store, Drive Snip, Drive Scope, Drive Trigger. These tools help in collection of data from the sensors, verification of the sensors and helps in visualization of live data and recorded data.

IV. PROBLEM DEFINITION

1. Existing System:
Autonomous car contains multiple sensors, collecting the data from all the senor is very important. After collecting data, analysis of these data is also very important. In the existing system only the radar data is collecting and it is analyzed and also it does not contain different tools, which can store sensor data, analyze these sensors data and to select particular signals which the users want to analyze.

2. Proposed System:
In the proposed system user can collect and validate all the sensors data like RADAR, LIDAR, and CAMERA. This system consists of different tools which can handle all the scenarios.

The advantage of proposed system is as follows:
- Collection of all the sensor data.
- Storage of sensors data into database.
- This system consists can able to analyze part of the data and also particular signals which the user wants.
- This system allows user to analyze data through Drive scope tool.
- Identification of object through YOLO.

V. OBJECTIVE

The main objective of this project is to check the configuration of the sensor before going to driving and to collect data from the different sensors like RADAR, LIDAR, CAMERA, Video Server and CAN. This data is used to drive the car without the driver. The data which is collected from sensors will be in the form of the.cvw file format. The Drive series tools are developed to check sensor configuration, data analysis and visualization of collected data.

Following are the set of tools present in Drive series:
- Drive Installer is one shop for installing all the Drive Series tools.
- Drive Cal to calibrate the LIDAR setup with supported ground truth systems to ensure accurate analysis. Drive Store to upload the drive data and writes metadata in a SQL database for tracking and retrieval.
- Drive Trigger finds events of interest and enters them into the SQL database for faster analysis.
- Drive Snip cuts the continuous data files into smaller files for developer analysis and sensor debug.

- Drive Scope opens drive data and allows detailed examination of all data streams.
- Dan view to collect data from sensor and verify sensor configurations. Drive Series tools have taken many inputs from the larger Global community.

VI. CONCLUSION

The objective of this project is achieved successfully as shown in results. The different tools has been developed like drive cal for calibration of lidar, dan view to collect data, drive list to get drive information, Drive store to store data into database, drive trigger to select particular events, drive snip to take part of file from large file and drive scope for the visualization of the data through the grids and graphs. Results section gives clear idea about icon of each tool, their main window and workflow of the tool. Finally the tools collect and analyses the huge amount of data and gives the visualization of the data for small or large .cvw files.

REFERENCES

[1] EkimYurtsever, Jacob Lambert1, Alexander Carballo, and Kazuya Takeda, "A Srvey of Autonomous Driving: Common Practices and Emerging Technologies", IEEE-2020.
[2] SadanandHowal, Aishwarya Jadhav, ChandrakirtiArthshi, SapanaNalavade, Sonam Shinde, "Object Detection for Autonomous Vehicle Using TensorFlow", 2019.
[3] Mike Daily, Swarup Medasani, Daimler Protics, Trivedi, San Diego, "Self-Driving Cars", IEEE-2019.
[4] M. Buehler, K. Iagnemma, and S. Singh, Eds., the 2005 DARPA Grand Challenge: The Great Robot Race, vol. 36. Berlin, Germany: Springer, 2007.
[5] M. Buehler, K. Iagnemma, and S. Singh, Eds., The DARPA Urban Chal- lenge: Autonomous Vehicles in City Traffic, vol. 56. Berlin, Germany: Springer, 2009.
[6] R. Rajamani, Vehicle Dynamics and Control, vol. 25. Berlin, Germany: Springer, 2006, p. 471. [7]. Jelena Kocic, Nenad Jovicic, and VujoDrndarevic, "Sensors and Sensor Fusion in Autonomous Vehicles", TELFOR – 2018.
[7] Rasheed Hussain, SheraliZeadally, "Autonomous Cars: Research Results, Issues and Future Challenges"
[8] Aysxegu, Ucxar, Yakup Demir and Cu neyt Gu zelis, "Object recognition and detection with deep learning for autonomous driving applications".
[9] Geethapriya.S, N.Duraimurugan, S.P. Chokkalingam, "Real-Time Object Detection with YOLO", IJEAT-2019.