SUBSECTION B.3: Literature Review and Theory

1.

Sensors

The thing that separates autonomous cars from normal cars is sensors. Sensors are used to detect the surroundings around the cars, by taking various types of data and then using processing systems to determine a safe path for the vehicle.

Radar

Radar uses radio waves. They send out radio waves which then reflect back to the Radar sensor and then it determines the distance and speed of vehicles and other objects around it. There are two types of radar sensors used, long-range and short-range. The long-range radar sensor is used in automatic distance control and brake assistance. The short Range radar system is used in blind-spot monitoring, ideal lane-keeping assistance, and parking help.

Radar systems have no issues in identifying objects during fog or rain.

Radar system faces issues in pedestrian identification. This is a safety risk. Also the 2-D radars commonly used are not able to determine the object’s height, as they are able to measure only horizontal distances which can cause problems when driving under bridges or road signs.

LIDAR

LIDAR sensors work on the same principles as the RADAR, with the only difference that LIDAR uses light instead of radio waves. LIDAR measures distances to various objects on road as well as it helps to create a 3-D image of detected objects. Also it can be used to make a 360 degree map of the surroundings.

LIDAR sensors are very expensive as the materials used for making them are rare earth metals. Natural elements such as snow and fog affect the functioning of LIDAR sensors.

Camera Sensors

Cameras form a very crucial part in self-driving systems. They are able to form images of objects around the vehicle, and determine objects around it. They have a 360 degree view of the surroundings. 3-D cameras are used to make a 3-D surrounding around the vehicle. The cameras capture the images and automatically determine pedestrians, cars, cyclists, road markings, traffic signals, bridges and guard rails.

In poor weather conditions like heavy rain, fog, or snow, the cameras are unable to take clearer images around them.

2.

In this paper the researchers have tried to make a system to detect intersection points in real time for autonomous vehicles. The solution they propose is based on the use of LIDAR technology.

When the beam is sent and obstructions like trees, vehicles, pedestrians and road curbs are identified. Except trees all other vehicles and pedestrians are removed from the grid map. The process of identifying different type of obstructions on the road and then removing them is done by-

Making a r\*r grid and then identifying the varying elevation levels.

Above particular elevation level they are allotted 1 and rest others as 0.

Then the pedestrians and vehicles are identified and then removed.

The remaining grid map is used for intersection identification.

First a series of beams are launched from the same launching point, within the adaptive distance of the autonomous vehicle. The beams are sent out in all the angles from 1 degree to 359 degree, each varying from other by a degree. This is done so that the width of beam is little more than the autonomous vehicle. Then beams are launched with a special distance which depends on vehicle speed. The special distance is more if the speed is higher and the special distance is less if speed is less. If the beam is blocked then there is an obstruction like a vehicle or pedestrian, if the beam isn’t blocked then there isn’t any obstruction.

Graph is plotted and in case of normal roadway, two peaks are obtained, in case of T intersection 3 peaks are obtained, and in case of +, 4 peaks are obtained.

Issues

Sometimes when the vehicle is travelling in desert area (on road), then if there is an intersection, in that case the LIDAR would not be able to detect any intersection, as there are no trees or obstructions on the side of the algorithm would interpret it as a vast barren land only.

BONUS Questions (OPTIONAL)

2.

To

PR Executive

OLA

Subject: Requesting sponsorship our team Abhiyaan

Sir

We are a team of enthusiastic people committed towards building autonomous, intelligent, robust, precise and safe ground navigation systems. All the members of our team are students of IIT Madras. Currently we have developed an autonomous bot- Viraat and an autonomous golf cart BOLT.

Virat is an autonomous bot, which has the capability to travel between two GPS points. It can ride its way through obstacles. Virat was presented at IGVC 2019, where we were placed 2nd globally.

BOLT is our biggest and most advanced project to date. We have completely developed and test run the vehicle in IIT Madras. BOLT is designed to be an urban vehicle powered by cameras, computer vision based classification of traffic signals, lanes and traffic. The link to the video can be found here- <https://www.youtube.com/watch?v=jDvOGqxwLMs>. We are planning to present BOLT in the self drive challenge of IGVC.

IN the future we have even more ambitious plans, we are planning to design and manufacture a mars rover, and collaborate with ISRO to test it and deploy it in the near future. Currently we have completed the design of the rover.

All these ambitious projects require funds in order to develop them and make them market-ready. We spend all of our money on procuring and developing technology.

We act as ambassadors for our sponsors in all the competitions we participate in. Currently, we participate in the international level competition IGVC where autonomous vehicle developers around the world come to participate. We secured 2nd position overall in the 2019 edition among teams all around the world. We also represent our sponsors in Shaastra, the official technical fest of IIT Madras. In addition to that, OLA is itlesf in the cab industry. Somewhere in the future it needs to develop and deploy self driving vehicles on road to keep in pace with the market. UBER is currently testing its self driving technology in US. And has achieved significant success in this regards. We propose to share our technology with OLA in order to help the company retain its position in the market. Team Abhiyaan can also collaborate with OLA to develop even better technology for autonomous vehicle. Starting to develop self drive tech from scratch would take some time and cost, so we can collaborate together to develop this tech together.

So we seek an amount of Rs.10,00,000 each year for three years.(Total – Rs. 30,00,000). We can talk about extension of the deal on the completion of 3 years.

During that time Abhiyaan would have logo of OLA on all its vehicles and act as ambassador of the company in future competitions. Also we propose to collaborate on development of self driving technology.

Do reply to us if you find our project interesting and worthy of investing.

Thanking You

Yours Sincerely

XYZ

Head, Abhiyaan