



Self-Driving Cars

Shubhankar Sharma¹; Vatsala Arora²

Department of Computer Science and Engineering, Amity University, India

¹shubhsharma2905@gmail.com; ²arora.vatsala09@gmail.com

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Abstract — 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. In this paper, we are exploring the possibility of.

Keywords—sensors, cameras, radars, algorithms, self-driving cars, automation, GPS

I. INTRODUCTION

Self-driving cars, a future accomplishment of tech industry can also be referred as an autonomous driving vehicle. A car which is capable of understanding and processing the surrounding environment and capable of moving soundly with small or no human intervention.

Autonomous vehicles or self-driving cars are equipped with variety of sensors, for instance, cameras, radars, lidars, GPS, lane detector and measurement units which ultimately assist and interpret sensory information. This information is used to check for navigation and differentiate between a stationary object and a moving object. Most importantly the vehicle should be able to differentiate between a human and a non-living thing which is the main priority of the self-driving cars.

Various projects are on different stages to develop a complete functional self-driving vehicle. There is plethora of technology implementations being applied in various self-driving car projects to develop a commercial car capable of driving automatically. Waymo is one of the many companies which is developing complete functional self-driving vehicle. We can also see a lot of development and revolution in self-driving cars that has been brought by the company Tesla. The company has brought up the competition in self-driving cars.

Automation, artificial intelligence, computer architecture and many other technologies are combined with each other to form a fully functional self-driving car. The main purpose of self-driving cars is to remove the need of human intervention with automatic decision-making system fully capable of controlling the car. The main requirement of a self-driving car is to have a navigation system, camera system for path planning and able to assume the movement of the surrounding environment.

II. GOALS AND OBJECTIVES

Our proposed system is theoretical system of that will help guide the self-driving cars to perform better and will be able to detect the turns, objects either living or non-living things. It relies on the different signals emitted via different cars and signal emitting systems placed on the side of the road at a particular interval that will then be received by the receivers in the cars. This system of emitting and receiving the signals by cars will help the cars achieve a new level of autonomous system. It will help also assist the drivers to be more relaxed and less focus on the roads. It will also require less human intervention than before as the cars will be able to more accurately collect and process the accordingly. This technology will also focus on the cloud mapping system which will help in pre-mapping the roads and will process the data accordingly.

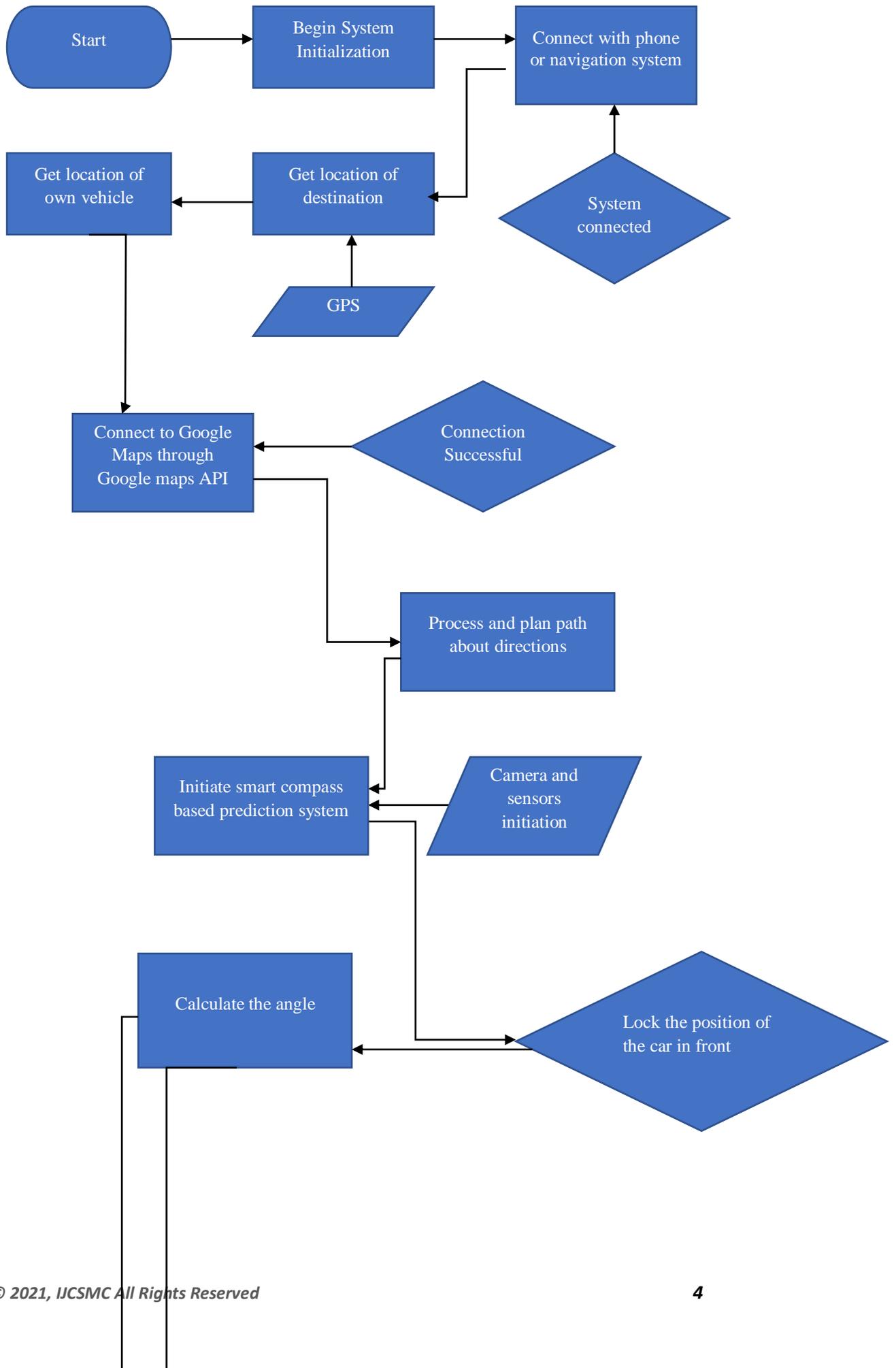
III. PROPOSED METHODOLOGY

The first and the most basic step for a car is to identify the car's own location and the destination it needs to travel to, which in case of manual cars is easily identifiable via human intervention. But in case of self-driving car, it needs to be able to identify its location. This can be easily solved via car's own navigation system or a mobile-device connected to the system of a car. GPS help the car to receive the longitude and latitude information of the car via satellite. From there on path planning needs to be done, with the use of path planning algorithms (Dijkstra algorithm, Bellman-Ford algorithm) and the map database it will serve as a source data for the path planning.

Environment perception it also a very important factor in self-driving cars. An autonomous car should be able to assume and take decision with respect to its surroundings. Various types of sensors are used to perceive the environment. Laser sensors, Radar sensors are the basic sensors which are used to comprehend the information of the surrounding information and process it to perceive the environment.

The self-driving cars will be linked through the navigation system maybe of the car itself or user's phone to guide themselves in a low visibility area to make turns and avoid crashing. The steering can then be assisted via the navigation system to make decisions to make turns. The maps can be connected through clouds. What can assist in better self-driving cars is the fact that cars not only detect the person or turns but it can analyse the person or object via signal mechanism from the roads itself. A compass system will be integrated in the cars that will assist in assuming the movement of the other cars moving in front of them. The compass will be calibrated in such a way that it will lock the position of the vehicle in front and form an angle with respect to the movement of the vehicle. A threshold angle will be set which will determine what actions need to be performed by the car. This will allow a car to better understand and plan the movement of the obstacles and cars that can be a major challenge to steer the car. It is extremely important for an autonomous car to beware of the surroundings. The surroundings of a car are ever-changing, therefore these sensors are important.

In Fig. I, first step, for the car will be to initialize the system and connect to all the systems internally without fails. This step is extremely important as it is the base for the car to drive. The car will either connect with the inbuilt navigation system or the navigation system of the mobile device. This will help to plan the path of the journey. GPS from the car's navigation system or the device will help in identifying the coordinates of the car. This is the first step in path planning required by the intelligent system of a car. The data collected through the digital maps and GPS will help in planning a route to a destination without human intervention. Here we use the Dijkstra algorithm which allows us to find the shortest path to the destination. This will require the coordinates of the car at the starting position. The algorithm then expands spirally from the point of start to the outermost layers till the end point of the journey has been reached. This algorithm plans the shortest distance between the two points. Next step is to initiate the camera systems and other sensors such as laser sensors and radar sensors to perceive the surroundings of the car. This will in turn help the system to automatically take decisions to steer, brake and accelerate. The sensors and cameras can be said one of the most important items of a self-driving car. Without these the car cannot be automatically drive itself. Object Detection algorithms will mainly rely on the sensors of the cars to work. The cameras, radars, lidars are the basic need for object detection algorithms, these algorithms are extremely complex as the AI continuously need to balance and adapt with the movement of the car. The most basic requirement for these algorithms is that they need to work extremely fast so that there is no lag of decision making which can result in a collision. The ridiculous amount of data and images that need to be processed makes it very complex. R-CNN(R-Convolutional Neural Network), YOLO (You Only Live Once), Fast R-CNN are some methods in detecting the objects. R-CNN is a slow method as first step for this method is to find the area that contains possible objects and then analyse the area. However in Fast R-CNN and YOLO works at a fast pace by simultaneously finding there are with possible objects and analysing the area as well. A compass based angle detection system is initiated which is very crucial to identify the movement of the car majorly in front of the vehicle or around the vehicle. It is set up in such a way that it automatically locks on to the position of the car in front and calculate the angle simultaneously. A threshold value of angle is set if the value of the angle crosses the threshold value than the self-driving car should steer and apply brakes to avoid collision. Decision making algorithms are constantly being used to perfectly and timely execution of different decisions to avoid collision and for safe journey. Decision trees, deep reinforcement learning are the basic algorithms that are used for decision making by car. This will help in avoiding harmful collisions between vehicles. Creating space and steering to avoid obstacles and objects will help the car to continuously move to the coordinates of the destination.



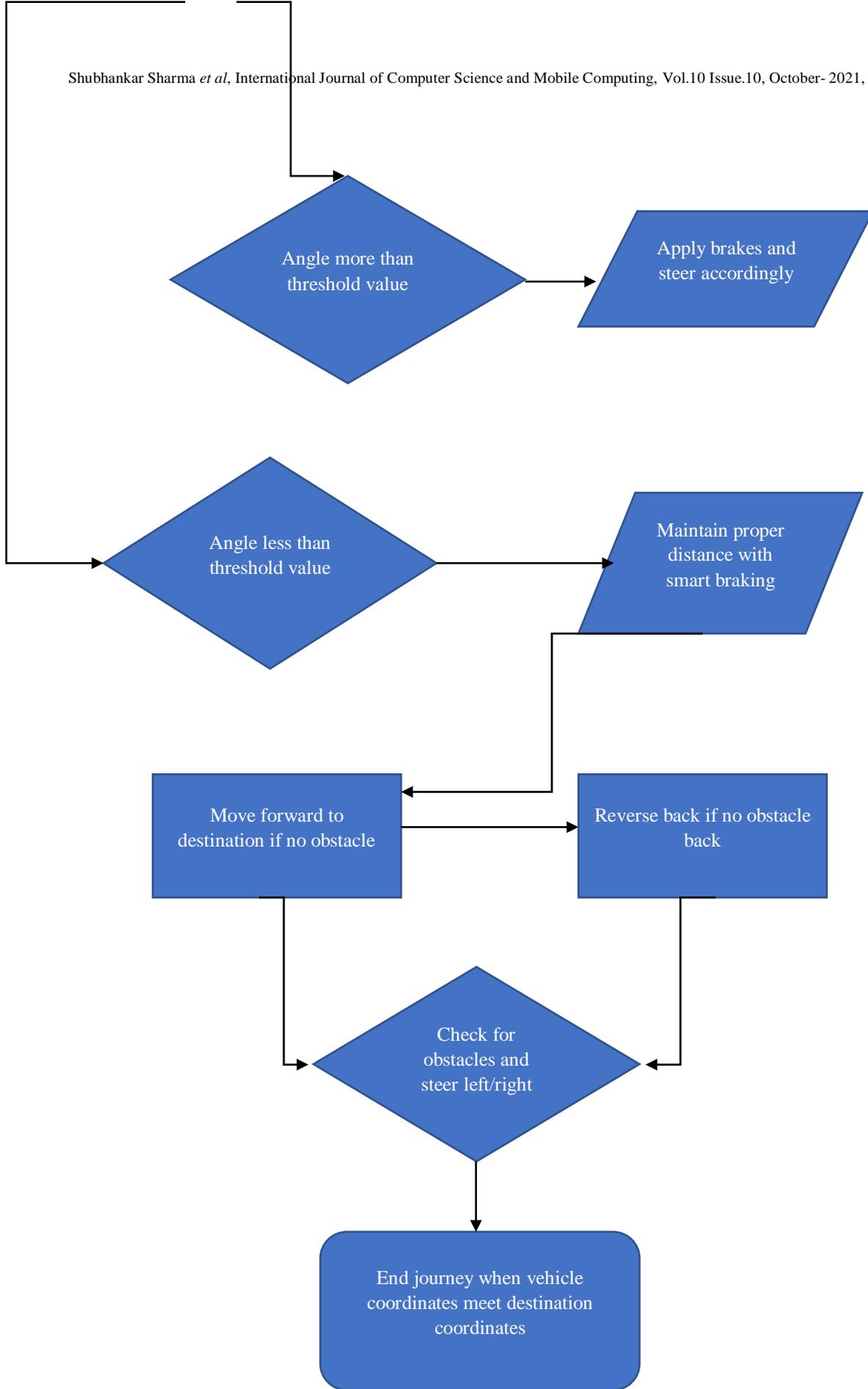


Fig. 1

IV. CONCLUSION

This paper describes an advance intelligent system for self-driving cars. This approach will help the self-driving cars with increased safety and efficiency of reaching the destination. The vehicle automatically set course to the destination using GPS. With the help of different algorithms and embedded technology using the various sensors like cameras, radars, lidars, etc. the car will align itself and manoeuvre in lanes. The car will take the shortest path and avoid collision using the compass-based angle calculation system which will predict the position of the vehicle ahead to take the decisions using decision-making algorithms to steer accordingly. This approach will efficiently be able to predict the movement of the cars whether they are going to turn or not by locking on the cars and then calculating the angle. The threshold value of angle set will assist in making the decisions on how to manoeuvre the car and what action along with steering needs to be performed. These self-driving cars are the future for travel and be will surely be of great advantages to old people and non-drivers who are not familiar with the whole process of driving the vehicle.

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