LIDAR BASED ADAPTIVE CRUISE CONTROL SYSTEM

(SELF DRIVING AUTOMOBILE)

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Abstract : Due to an increase in population, transportation has increased a lot these days. So here we have developed an automated driving system which will drive the car automatically. The main goal is to save people's time by changing the use of the car fundamentally. A technology for car is developed which will drive the car automatically. We have designed an automated vehicle that will give automated driving experience to the user. The car is capable of sensing the surrounding, navigating and fulfilling the transportation capabilities with any input of the humans. LiDAR is used for sensing the environment it continuously sense the environment and if any obstacle is found vehicle will move around and will avoid the obstacle. The main advantage of an autonomous car is fewer traffic collisions, increased road capacity and less congestion in the traffic. We believe the autonomous car is the necessity of human life as it overcomes the obstacles without any human input and also human life has to be safe and secured. It is also the efficient, cost-effective and comfortable means of transport.

Keyword: LiDAR (Light Detection and Ranging)

I. INTRODUCTION

Technology has been developed for cars that drive it automatically. We have designed an automated vehicle that is basically focused to give automated driving experience to the user. The spinning object we see on most top of the cars is the LiDAR. It fires out millions of laser beams, measures how long they take to bounce back and then uses the data to build a 3D map that is rather more precise for computers to understand than a 2D camera image. It's also crazy expensive, hard to manufacture at scale and nowhere near robust enough for a life of potholes and even in extreme temperatures. Dozens of start-ups and tech giants are pouring millions of dollars fixing it.

Our goal is to prevent accident and save people's time by changing the car use fundamentally. Due to the development of various sensors including Radars, LiDARs, camera systems and also wireless communication autonomous vehicle have made significant advances in recent years. The major requirements which are imposed on autonomous vehicle are ability to cover long distance in safer way while decreasing the rate of accidents and traffic and also obeying the traffic rules and this all to be followed without any human interaction. There are more than millions of vehicles driven every year with a lot of complexity and novel conditions generating situations in which autonomous vehicle could fail miserably. The highly intelligent systems of an autonomous vehicle should take into account a broader a range of information about current road situation and car itself on the same way as human driver.

II. EXISTING SYSTEM

The SAE sets some standards for driving automation and these are divided into six levels of driving automation. Level 0, level 1, level 2, level 3, level 4, level 5 driving automation.in this paper we are focused on the adaptive cruise control system.

Adaptive cruise control system:

The existing adaptive cruise control ACC as well as its collision mitigation braking system CMBS now both of these systems are a part sense which is an available suite for safety and driver-assistive technologies. The most important pieces used for ACC and CMBS are a millimetre wave radar which is located upfront concealed behind the grille and a camera that is mounted between the rear view mirror and the front windshield radar is good for measuring the distance of vehicles ahead and their change in speed that said any metallic object can return a signal that's where the camera comes in as it's much better object recognition though not as good at judging distance. adaptive cruise control work the primary purpose of the system is to travel at the speed selected by the driver just like traditional cruise control however if the vehicle detects another car in front of it that is travelling at a slower speed the vehicle will reduce its speed to match that the detected car and then maintain a selected interval behind the car.

The system works by emitting radar waves which bounced off of vehicles ahead and returned to the unit this informs the system of the distance between the two vehicles and changes in that distance inform the system of the vehicles relative speeds throttle position is adjusted to maintain a set following interval or light braking can be applied now how does the collision mitigation braking system work the goal of the system is to alert the driver if a collision with a detected vehicle is likely and then to apply the brakes to reduce the severity of a collision if it's unavoidable the system scans up to certain distance of the road in front of the vehicle and works in three stages if the driver begins to come close to a vehicle detected ahead for Stage one the system flashes a brake warning and can also provide an audible warning for Stage two the system provides visual and audible alerts and applies light braking for Stage three strong braking is applied to minimize forces of the collision once it's determined to be unavoidable sometimes the system will skip one or both of the first two steps.

III. PROPOSED SYSTEM

The proposed system will enhance the Adaptive cruise control system to another extent. The proposed system uses a 360-degree 2-d LiDAR, instead of front-facing LiDAR. It will help the automobile to aware of it surrounding

Enhanced Features: The use of 360 LiDAR s make the automobile more aware of surrounding and it allows the automobile to overtake the front automobile and hence increasing the capabilities of the adaptive cruise control system. As we know that the adaptive cruise control system slows down the vehicle based on the front vehicle but in the proposed system first the vehicle check the surrounding if on the side no vehicles are present vehicle turn to the side with increases speed and take over the vehicles and enter into the same line. By sensing all around surrounding it also help to protect the vehicle from sides and back of the vehicle.

Final result: By adaptive to a 360 surrounding LiDAR system the cruise control system will become enhanced and the overall vehicle will become faster and safer

IV. SYSTEM DESIGN

The fig 4.1 is the block diagram of the overall system. In the centre, we have the microcontroller Atmrga 328p and all the other components are connected to it. The components we use here are rectifier, regulator, servo motor, LiDAR, power supply. The LiDAR is used to sense the objects that are around the vehicle and notify that to the microcontroller so that the microcontroller can take the appropriate actions, the servo motor takes care of the movement of the wheels and move according to the obstacles detected and move the vehicle in the better manner. Power supply is used to power up the entire system.

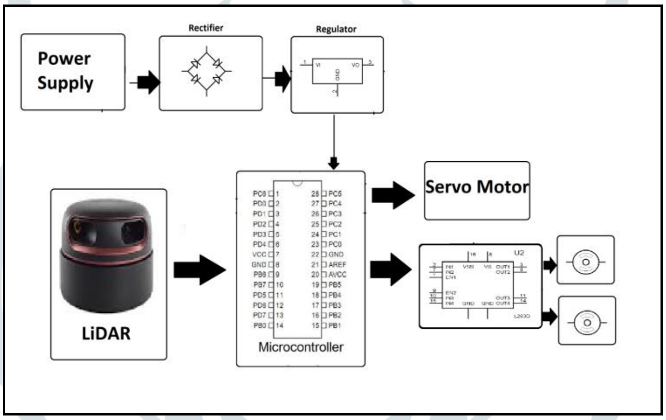

Fig 4.1: Block Diagram

Flow Diagram :

The below figure 4.2 demonstrates exactly how the data flows in the system and how exactly the working is carried out in the proposed system. Initially the motor is started, once the motor is started than the LiDAR that is placed on top of the vehicle starts to rotate in 360 degree, and throws the beam of rays, when the rays hit a certain object then they fall back to the LiDAR stating that there is an object in the surrounding. This way LiDAR helps in detecting the object. Once the object is detected than the movement of the wheels is taken care ,suppose the object is on the left than ,slight right movement is taken by the wheel, if the object is in the right ,then left turn is taken and so on this continues for all the cases.

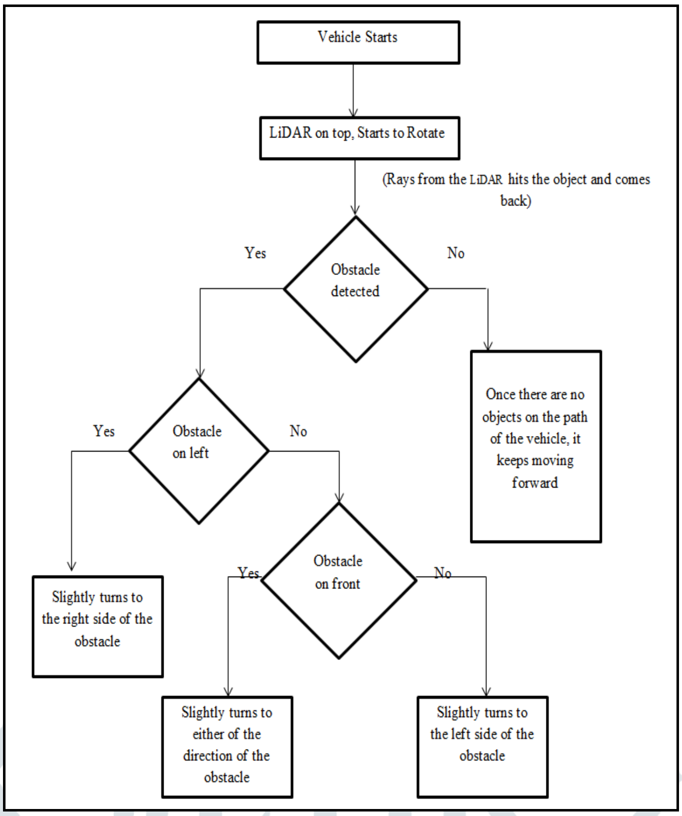

Fig 4.2 Flow Diagram

Algorithms Used

Below are the algorithms used for the possible cases.

Case 1.When obstacle on Right or Left side

Step 1: Start

Step 2: Start the vehicle

Step 3: LiDAR starts to rotate and throws the rays all around the vehicle

Step 4: if the rays come back from the certain direction go to step 5 Else, drive normally.

Step 5: LiDAR sends the data to the microcontroller

Step 6: Microcontroller interprets the signal and moves the vehicle slightly towards the Left or Right side

Step 7: Stop

Case 2.When obstacle in front of the vehicle

Step 1: Start

Step 2: Start the vehicle

Step 3: LiDAR starts to rotate and throws the rays all around the vehicle

Step 4: if the rays come back from the certain direction go to step 5 Else, drive normally.

Step 5: LiDAR sends the data to the microcontroller

Step 6: when the obstacle is in front than the vehicle will stop and check both the direction left and right and Then starts moving in the direction where there are no objects.

Step 7: Microcontroller interprets the signal

Step 8: Proper direction is taken by the vehicle

Step 9: than the vehicle moves normally

Step 10: Stop.

V. CONCLUSION

So this paper that we made was all about the autonomous vehicle system. Currently, in the era of growing technologies there are many different technologies that are available that can assist increasing autonomous vehicle systems. Technologies such as GPS, automated cruise control and lane keeping assistance are available in the market for the consumers on some luxury vehicles. The combination of different technologies and different systems such as video lane analysis, steering and brake systems and the necessary components will become fully automated. The main problem here is winning the people's trust to allow a non-living being to drive a vehicle for them, because of this there are lot of research and work going on to make this automation system a useful and a successful one ,the product or the technology that are used may not be used or accepted instantly, but as the time passes and the technologies are used more than people might realise the benefits behind the automation and they can believe that computers can work for them at times when required and we hope that computers can gain the human trust and eventually replace them when required.

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