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Implementation of mutable distance feature in vehicle

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ABSTRACT

As the advancement of vehicular technology improves, so does the need for providing safer and more efficient vehicles for transportation. With a large increase in the number of vehicles on the roads, new technological involvement like Advanced Driver Assistance System is becoming a necessary part of every automobile. Basically, ADAS works for comfort in driving and active safety. In this paper, we discussed the implementation of a system with distance control feature for the vehicle. To improve the safety of the vehicle, we have developed a system where user can set maximum and the minimum distance between the vehicles. The warning is given to the driver before the collision which leads to help the driver to maintain distance between two objects. If in case the driver has kept this system on active in rainy weather to prevent collision the system will alert and will maintain a safe distance.

Keywords— *Warning system, Adaptive cruise control, Advance driver assistance system, Decision algorithm, Vehicular technology*

1. INTRODUCTION

With large increase in the number of vehicles on the roads, new technological involvement like Advanced Driver Assistance System is becoming necessary part of every automobile. To make it more useful and helpful to driver ADAS comes to development. ADAS is a safety package which include features such as rear view assist, lane assist. The conventional cruise control system is one of this. It provides a vehicle with one mode of control, that is. speed control. On the other hand, ACC provides with two modes of control, speed and distance control where it not only adjusts the distance between your car and lead car but also adjust speed accordingly.

Latest development in many technologies also leads to cause many problems. The increase in number of vehicle leads to increase in numbers of accidents, pollution of air, pollution of sound, and decrease in the source of natural resources and so on. The development of ADAS is done to help driver and to reduce accidents. If numbers of vehicle are increasing at a faster rate, thus there occurs a need of managing this huge traffic efficiently, so as to avoid fatalities due to accidents. A survey shown that more than 2.2 of the total deaths recently have occurred because of the road crashes which could have been prevented. Also, if the same statistics are at play in future, then the World Health Organization by 2020, road fatalities will be the third highest threat to the public health, outranking most of the dangerous health problems [2]. The number of accidents can be avoided if driver safely drives and road conditions are good. One of the ways is to broaden the road size and make it good but vehicles can be the part of it.
The main aim of the project is to improve the existing system by adding some features to it. This system has four fold objectives which are as follows:
(a) The system will drive the vehicle with a fixed speed set by driver.
(b) To work with set minimum and maximum inter-gap distance.
(c) The system should take proper steps according to the situation where the distance between the objects is not secure.
(d) To detect the presence of rain and give alert to driver.

2. EXISTING SYSTEM

The existing Adaptive Cruise Control system includes two control modes which are the cruise control mode and the space control mode. ACC system achieves cruise control when there is no obstacle in front of host vehicle and achieves space control function when there are obstacles in front of host vehicle. It assists the driver in maintaining the predefined minimum distance to the preceding vehicle based on the information of the sensors. The whole operation of the Adaptive Cruise Control depends on the safe distance between the host vehicle and lead vehicle. This safe distance is calculated and computed by the Sensor installed in the front along with other parameters. Based on the safe distance the host vehicle tries to maintain the distance or time gap with respect to the lead vehicle. There are some lacks such as many cars with ACC was often used during free driving and busy traffic (that is. speed between 70 and 90 km/hr on the high ways).

3. IMPLEMENTED SYSTEM AND RESULT

In implemented system, to overcome these problems, a system with less inter-gap distance between the vehicles and with collision warning system in rainy weather is implemented. The implemented system is consist of ultrasonic sensor to detect object and get the inter gap distance, the rain sensor for the detection of the rain, and we used raspberry pi as a controller.

The implemented system is basically consisting of two parts: one is to adjust the intergap distance and another is warning system to prevent the collision. The working of implemented system is as per shown in below figure. At the first step, after the driver starts the vehicle, the system will check for the weather. If driver wants to run vehicle in cruise control mode then the system will start detecting objects. The distance is maintained using decision algorithm. The vehicle will be successfully run at set speed if no object is detected. Driver can view speed as well as inter gap distance. Another part of collision warning system is takes its control when any object is there in front of host vehicle, the alert will be given to driver. Afterward, if the distance is too close, the system will stop vehicle. This implemented system will also work in rainy weather with low speed. If break is manually applied by the driver then vehicle will stop.

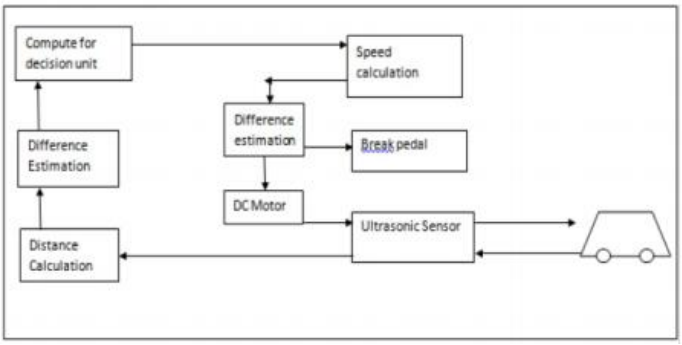

Fig. 1: Architecture of system

Table 1: Requirement of ACC system

Requirements	Description
Purpose	By Maintaining Distance between cars, control the cruising of car
Inputs	• Ultrasonic Sensor • Speed • Break Status
Signals, Event and notification	• User Command For ACC ON - OFF • User Command to set distance • Safe, mid and critical distance notification • Alert signals • Rain Notification
Outputs	• Transmitted signal by sensor • Alarms • Break Control
Control Panel	• Cruise control system starts by user input. An ultrasonic Sensor system maintains distance between cars and warns according. • Distance is computed by various function • Difference of distances • Presence of Rain
Functions of System	• Cruise control system starts by user input. A ultrasonic Sensor system maintains distance between cars and warns according • Distance is computed by function • Difference of distances • Presence of Rain
Design metrics	• Power source: Electricity Transformer-DC Motor • Resolution: 50cm inter-car distance • Performance: Safe distance setting above 50cm , mid distance is in between and critical distance is 30cm

3.1 Decision Algorithm

The implemented algorithm of this system is as follows:

Step 1: Start the vehicle.
Step 2: Select the Mode as ACCON or ACC Off. If ACCON is selected then go to step 3 otherwise go to step 12.
Step 3: Set the minimum and maximum distance within the range.
Step 4: Check for rain condition if clear then go to step 5 otherwise go to step12.
Step 5: If break is applied then go to step 13 otherwise go to step 6.
Step 6: If target object detected then go to step6 otherwise go with set speed.
Step 7: Calculate the inter distance.

Step 8: If distance is greater than safe distance then go with set velocity otherwise go to
Step 9: If distance is mid distance then give warning to driver and slows down vehicle and update distance, If not then go step 10.
Step 10: If distance is critical distance then give warning to driver and go to step 14.
Step 11: Repeat step 4 to step 11 until Acc is on.
Step 12: If it is raining then Go with speed of set velocity and go to step 11
Step 13: Deactivate the ACC and give control to driver.
Step 14: Stop the Vehicle

3.2 Implementation

When the driver wants to drive the vehicle the system will show message as Driver mode when driver wants to drive the vehicle in our system mode, he selects cruise control mode, the system starts working if object is beyond the sight of host vehicle, or the distance between the object and vehicle is greater than safe distance, the vehicle will cruise with set speed by the driver.

When the object is detected and distance is mid distance, the system will give alert by indicating with Led and Buzzer. It will slow down the speed of vehicle. When the distance between object and vehicle is too close that is. critical distance, the vehicle will stop immediately by giving warning to the driver in the form of Led and Buzzer.

When driver activates the cruise control mode and rain starts, the rain sensor will detect the presence of rain and will give warning to the driver. It will slow down the vehicle's speed and the vehicle will cruise with the 20kmph speed.

When rain detected and distance is close the implemented system shows output as warning and vehicle stop. Otherwise vehicle will move with low speed of 20kmph.

The working of implemented system is shown in figure 2 where the wheel is rotating and its measured distance is shows as a message to the user as figure 3.

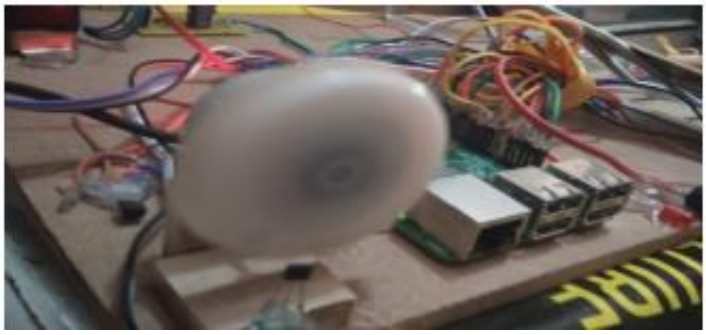

Fig. 2: Working system

Fig. 3: Message display

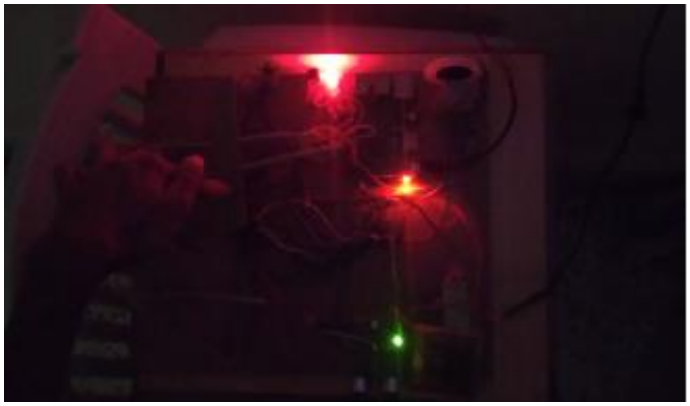

Fig. 4: Warning alert

Useful results depend on careful, rigorous and complete experimental design. Simple designs help to make the experiment practical, minimizing the use of time, money, personnel and experiments resources. An added benefit is that simple designs are easier to analyses than complex designs.

System: acc_project_v1

	Local				Cumulative			
Coverage Metric	Covered	Unreachable	Uncovered		Covered	Unreachable	Uncovered	
Branch	0	0	0	--	157	5	2	99%
Decision	0	0	0	--	30	0	0	100%
Condition	0	0	0	--	60	0	0	100%
MC/DC	0	0	0	--	25	0	5	83%
Total	0	0	0	--	272	5	7	97%

Fig. 5: Coverage report

Figure 5 represent the Coverage report generated by the Reactis after the model is tested against it. As we can see the project nearly covers all the decision, condition, and branches. Also it covers the 83% of MC/DC and the total coverage amounts to the 97%.Since the total coverage is above 90 percent therefore we do not need to cover the MC/DC manually. Thus the project successfully passed the test suite generated by the Reactis.

4. CONCLUSION

In this work, we have developed a system with mutable distance feature which controls the inter gap between the lead and host vehicle. The operation of the implemented system manages speed to a complete stop and resumes the set speed based on driver input. A sensing system attached to the front of the vehicle is used to detect whether slower moving vehicles are in the host vehicle's path. If a slower moving vehicle is detected, this system will slow the vehicle down and control gap between the host vehicle and the lead vehicle. If the system detects that the forward vehicle is no longer in the host vehicle's path, the system will accelerate the vehicle back to its set cruise control speed. Our decision algorithm is efficient as compared to existing algorithm as existing algorithm is mainly used in cars. So far we considered a straight highway lane. But on a road with curvature we must design a control system to handle such situations. In future, we can add Lane detection and Lane Departure system along with this system to give more comfort to the driver.

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