

# Adaptive Cruise Control

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## Abstract

The present world is a result of advancement and continuous change in technology. The automobile industries are trying to improvise with dynamic features by accepting new technology. Nowadays, vehicle owners are more interested in the speed of the vehicle. But as speed increases, the same results in decrease in safety. But the advanced technology like Adaptive Cruise Control controls every section of the car and provides safety and comfort. Results from this report show a budget aftermarket adaptive cruise control system is feasible and should be continued with further research. A prototype demonstration unit is being implemented. Full testing of the system will be carried out using a model car to simulate traffic in front. This system will be able to adapt to the simulated changes in traffic, and react with according braking and accelerating levels.

**Keywords: features; working; advantages; disadvantages**

## I. INTRODUCTION

The present highway capacity is not capable of smooth traffic flow which results in traffic congestion, unnecessary delays and accidents. Roadways are becoming more congested in cities and accidents are an everyday risk. The current protocol to combat congestion is to widen roadways, an option that is extremely expensive and in many cases, impractical. A second approach is to improve the way the vehicles travel and react to changing conditions.

By removing the driver from controlling the vehicle's acceleration and braking, inherent human limitations will also be removed. This not only has the effect of speeding up traffic but will also limit rear end collisions and enhance driver convenience. Such a technology will be a boon to the society.

Adaptive Cruise Control (ACC) is an automotive feature that allows a vehicle's cruise control system to adapt the vehicle speed to the environment. This operation is to allow the ACC vehicle to autonomously slow down and speed up and this is controlled via engine throttle control and limited brake operation.

## II. HOW DOES IT WORK?

An Adaptive cruise control system is mostly used in luxury vehicles like imported and high end cars. In many model cars there exists the cruise control system but they are not fully automatic, they are exclusively semi-automatic, this mode is activated only after attaining a pre-set speed in case break or accelerator is applied the mode normally deactivates and it turns to manual.

Adaptive cruise control can increase or decrease your car's speed to maintain a following distance that you set. Advanced versions can even slow and stop your car in traffic jams, then accelerate for you. ACC keeps the vehicle at a constant speed. If a car with ACC detects a slower moving vehicle ahead, then the vehicle automatically slows down and then follows the slow moving vehicle at a set distance as shown in figure 1. Once the road ahead is cleared, again the ACC accelerates the car to the previous speed.

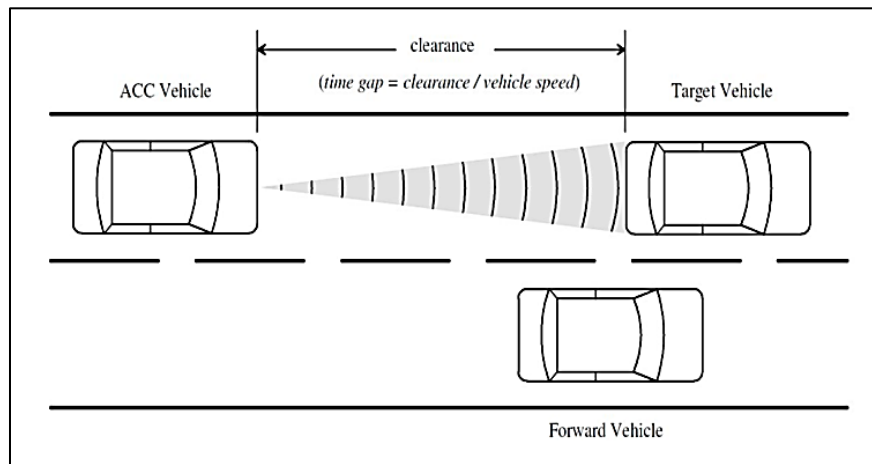


Fig. 1:

Automatic cruise control (ACC) is an intelligent form of cruise control that slows down and speeds up automatically, partial ACC only works at speeds of 20 or 25 mph. ACC works and night, but its abilities are hampered by heavy rain, fog, or snow. Adjusting a car's speed to maintain a safe following distance; wherein a sensor is installed behind the grill of vehicle, to detect the speed and the distance of the vehicle ahead. It maintains the vehicles pre-set speed and automatically adjusts the speed in order to maintain a proper distance between vehicles in different lane.

One or more sensors – radar, laser, ultrasonic or computer-connected cameras – read the road ahead of you for traffic. They are capable of reading and responding to any cars that are in front of you in your lane.

If the lead vehicle slows down, or if any another object detected, the system sends signal to the engine to decelerate. Once the road is clear, the system will re-accelerate the vehicle. Automatic Cruise Control (ACC) technology improves the function of standard cruise control by automatically adjusting the vehicles speed and distance to that of target vehicle. ACC uses a long range sensor to detect a target vehicle up to 20 meters in front and automatically adjusts the ACC vehicles speed and gap accordingly. Automatic Cruise Control decelerates or accelerates the vehicle according to the speed and distance settings established by the driver.

Things to be noted in ACC are

- 1) Be aware that ACC may not work effectively in certain types of weather conditions including heavy fog or rain; dirt, snow or ice covering the sensors; or when the roadways are slippery; or even in tunnels.
- 2) ACC allows you to spend less energy maintaining your following distance with the cars in front of you. You should use this opportunity to pay more attention to the traffic mix, including cars ahead of you and in adjacent lanes.
- 3) Check your owner's manual to see if your ACC is capable of slowing your car to a stop, or if you need to stop on your own.

### III. IMPLEMENTATION AND LOGIC

This practicable system featured a redundant distance measurement unit. This used an ultrasonic range finder in order to have a backup distance measurement for speed, and following distance calculation. The Raspberry Pi, a credit card sized single-board computer is used as the controller. Once the sensory inputs were functioning correctly they were handled by an ACC algorithm. This algorithm was verified by the output acceleration, and braking levels of the host vehicle.

Implementation in case of a prototype is given by the following flowchart shown in figure 5. In a prototype car, the ECU can be replaced using a Raspberry pi microcontroller and the ACC algorithm can be implemented using python.

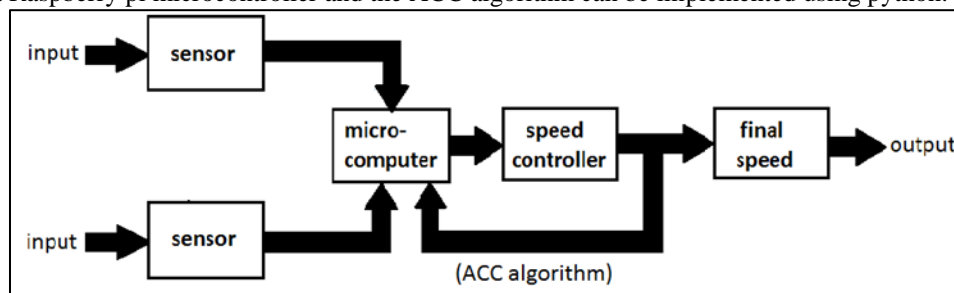


Fig. 2:

#### A. Module 1 (Sensors):

They provide the necessary input to the ACC in order to run the ACC algorithm to give a suitable output.

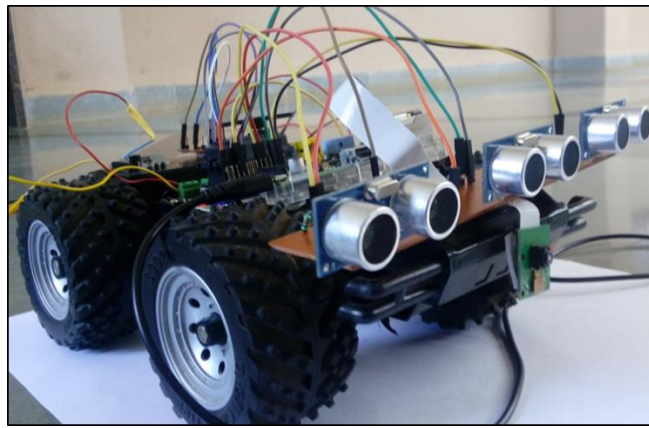


Fig. 3:

On considering laser, radar and ultrasonic sensors, we consider ultrasonic sensors to be the best option for our prototype. We plan to use the HC-SR-04 sensors as it will provide a more precise input to our prototype. In case of actual automobiles, radar sensors are used instead of HC-SR04.

**B. Module 2 (microcomputer):**

It provides the predefined computational modifications to provide the desired output with respect to the algorithm.

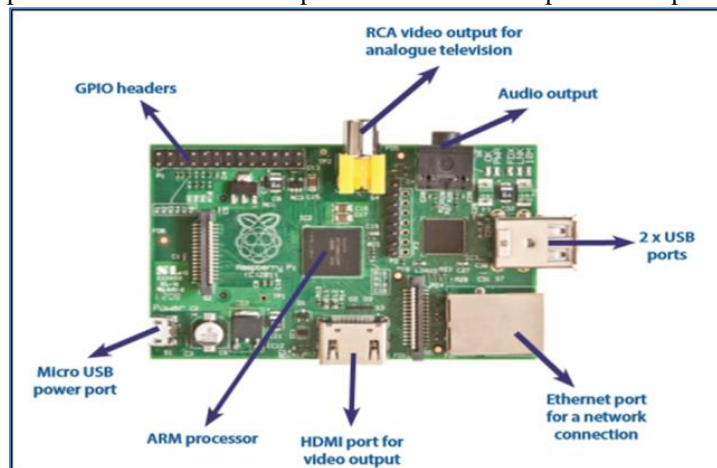


Fig. 4:

The Raspberry Pi which is a microcomputer has extensive features at a lower cost. It has 17 GPIO (General Purpose Input Output) pins which give out 3.3V. The Raspberry Pi has a SD card that must contain the OS, programs and data needed to run the Pi and is used for starting up and storing the information.

**C. Module 3 (ACC algorithm):**

This provides the steps to be followed with respect to the input in order to give a suitable desirable output.

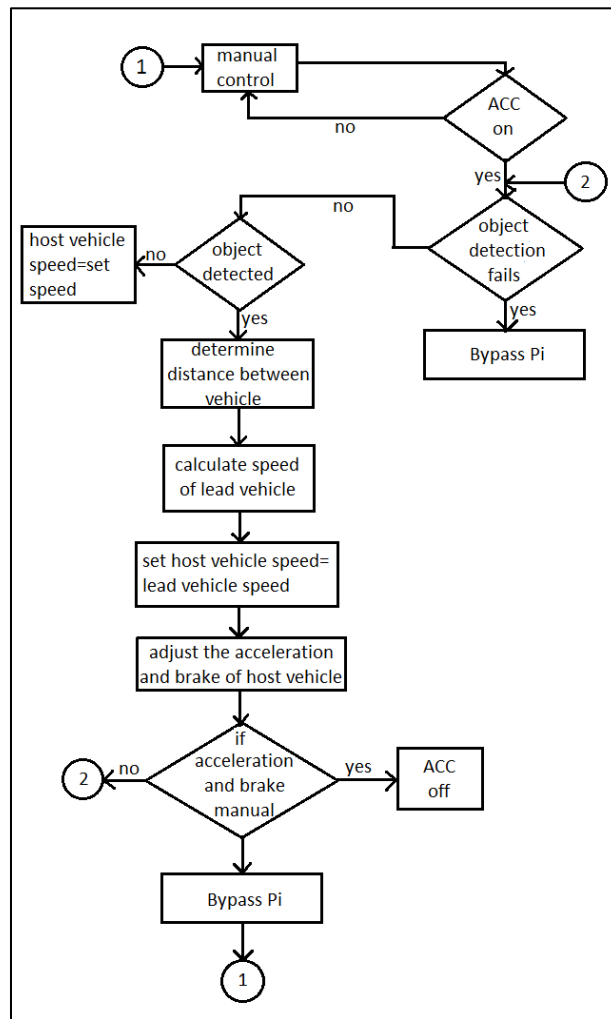


Fig. 5:

**D. Module 4 (speed controller):**

This is the calibrated output to be given to the motor to provide the desired output. This also provides a feedback to the ACC algorithm.

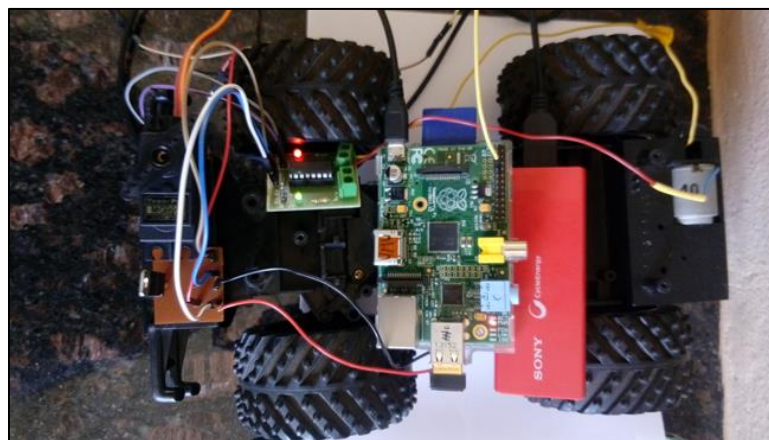


Fig. 6:

Servomotor is to be mounted on the Front wheel shaft of the chassis to turn the prototype. We've selected the TowerPro MG995 Servo Motor for our purpose. Each motor has a built-in processor that responds to electrical pulses sent to it. The DC motor is equivalent to a car engine in the cars. It will be used to drive the prototype and mounted on the rear wheel shaft.

**E. Module 5 (final speed):**

If there are abrupt changes in the speed computation this provides for a correction to be provided to the motor. This is the final stage of the ACC.

**IV. ADVANTAGES & DISADVANTAGES**

**A. Advantages:**

- 1) The driver is relieved from the task of careful acceleration, deceleration and braking in congested traffics.
- 2) A highly responsive traffic system that adjusts itself to avoid accidents can be developed.
- 3) Since the breaking and acceleration are done in a systematic way, the fuel efficiency of the vehicle is increased.

**B. Disadvantages:**

- 1) A cheap version is not yet realized.
- 2) A high market penetration is required if a society of intelligent vehicles is to be formed.
- 3) Encourages the driver to become careless. It can lead to severe accidents if the system is malfunctioning.
- 4) The ACC systems yet evolved enable vehicles to cooperate with the other vehicles and hence do not respond directly to the traffic signals.

**V. CONCLUSION**

This project aim is to avoid accidents happening in highways. Despite the introduction of the system to market, these are still to be advanced. The current system can measure up to 150m ahead of a car and reduces the cars speed if an obstacle appears. Whatever happens, the automobile market looks to explode. In 2002 there are not more than 100,000 vehicles equipped with ACC, but now it is set to reach millions in future years, with Europe, South Asia, East Asia and the US. Around 17% of European built cars are likely to have ACC fitted as standard. Some automakers use two radars — one for close range out to about 100 feet and a second that sees out to about 600 feet

**ACKNOWLEDGMENT**

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**REFERENCES**

- [1] <http://automobiletechinfo.blogspot.com/2013/09/adaptive-cruise-control.html>
- [2] J. Pauwelussen and P. J. Feenstra, "Driver behavior analysis during ACC activation and deactivation in a real traffic environment," *IEEE Trans. Intell. Transp. Syst.*, 11(2): pp. 329–338(2010).
- [3] N.Wu, F. Chu, S. Mammara, and M. Zhou, "Petri net modeling of the cooperation behavior of a driver and a copilot in an advanced driving assistance system," *IEEE Trans. Intell. Transp. Syst.*, 12(4), pp. 977–989 (2011).
- [4] M. Hoedemaeker, "Driving with intelligent vehicles: Driving behavior with ACC and the acceptance by individual drivers," in *Proc. IEEE Intell. Transp. Syst.*, Dearborn, MI, Oct.1– 3, 2000, pp.506–509.