Autonomous Cruise-Control an Innovative Model

S. Sakthivel[1] and K. Krishna Das[2]

[1]S.Sakthivel, Department of mechanical engineering, SRM University, vadapalani, Chennai, India
ssv.vel@gmail.com
[2]K.Krishna das, student, Department of mechanical engineering, SRM University, vadapalani, Chennai, India
kdas1993@gmail.com

ABSTRACT

In today's world according to a mechanical engineer, the greatest boom is in the automotive industry. Here technical experts and scientists are researching on concepts to make vehicles to automate with increased efficiency. What we are going to see here is how a vehicle's cruise control can be completely automated with the concept of electromagnetic induction. So, now let us discuss in detail about the above mentioned concept.

Keywords — Four-Wheelers, Automated Cruise Control, Electro-Magnetic Induction.

1. INTRODUCTION

According to passenger in a vehicle (be it a four-wheeler or any other heavy vehicle used to transport people) cruise control in driving of a vehicle may seem a luxury but when it comes to the drivers' point of view it becomes a need than a want. A known fact about a majority of road accidents taking place anywhere in the world is due to the uneasiness or the difficulty (big or small) faced by the driver during the drive. So, it is very necessary to make the driver stay very comfortable by letting the engine of the vehicle give its best during the drive so that they enjoy the drive. During a drive if the engine fails due to technical reasons, it means the engine is efficient in certain aspects. So, an engine's efficiency is determined by it smoothness of its functioning, effectively. So, the engine has to be maintained in a very good manner to get the best out of it. Hence, it is necessary to not only maintaining the vehicle but also take care of it that it is being drove in the best manner for such conditions of the engine certain features like cruise-control are needed.

2. CRUISE-CONTROL

Cruise control (sometimes known as speed control or auto cruise, or tempo mat in some countries) is a system that automatically controls the speed of a motor vehicle. The system takes over the throttle of the car to maintain a steady speed as set by the driver. Some modern vehicles have adaptive cruise control (ACC) systems, which is a general term meaning improved cruise control. These improvements can be automatic braking or dynamic set-speed type controls:

2.1 Automatic Braking Type:

The automatic braking type use either a radar or laser setup to allow the vehicle to keep pace with the car it is following, slow when closing in on the vehicle in front and accelerating again to the preset speed when traffic allows. Some systems also feature forward collision warning systems, which warns the driver if a vehicle in front—given the speed of both vehicles—gets too close (within the preset headway or braking distance).[1]

2.2 Dynamic Set Speed Type:

The dynamic set speed uses the GPS position of speed limit signs, from a database. Some are modifiable by the driver. [1]

Cruise control is an invaluable feature on American cars. Without cruise control, long road trips would be more tiring, for the driver at least, and those of us suffering from lead-foot syndrome would probably get a lot more speeding tickets. Cruise control is far more common on American cars than European cars, because the roads in America are generally bigger and straighter, and destinations are farther apart. With traffic continually increasing, basic cruise control is becoming less useful, but instead of becoming obsolete, cruise control systems are adapting to this new reality -- soon, cars will be equipped with adaptive cruise control, which will allow your - car to follow the car in front of it while continually adjusting speed to maintain a safe distance.[2]

3. CRUISE CONTROL DEVICES

To have a cruise control system in a vehicle, we need some essential devices for the system to be installed effectively and efficiently in any vehicle. Some of the components are:

- Radar or Lidar.
- Longitudinal controller.

3.1 LIDAR:

Laser-based ACC systems do not detect and track vehicles in neither adverse weather conditions nor do they reliably track extremely dirty (non-reflective) vehicles. Laser-based sensors must be exposed, the sensor (a fairly large black box) is typically found in the lower grille offset to one side of the vehicle. [3]

3.2 RADAR:

Radar-based sensors can be hidden behind plastic fascias; however, the fascias may look different from a vehicle without the feature. For example, Mercedes packages the radar behind the upper grille in the center, and behind a solid plastic panel that has painted slats to simulate to the look of the rest of the grille. [3]

4. THE CONCEPT

In this concept we are introducing three magnets placed in such a way that the magnets are facing each other at a angle of 60˚. This system is installed in the 4 wheels of the car. Initially the car starts with petrol and keeps going burning the fuel and when it reaches a speed of 80 kmph, this system gets switched on wherein the auxiliary power (from the battery) is used to drive this system. In this system the shaft of the system connected to axle rod is mounted with three electromagnetic coils whose poles are reversed with a very high frequency so that they get attracted and repelled from the magnets which in turn will cause rotary movement of the wheels. The engine power is resumed from ACC only when the brakes or the clutch of the vehicle is operated manually. Also when the brakes are applied the electromagnets are tend to get attracted towards the magnets which are mounted externally.

5. CALCULATIONS

Taking into consideration the following specification for the battery: The 24 kWh battery pack consists of 48 modules and each module contains four cells, a total of 192 cells, and is assembled by Automotive Energy Supply Corporation (AESC).[4]

Weight of each car = 1400 kg

Force exerted by car in the accelerated direction

$= (1400 \times (22.22 \div 60))$ $(kg \times m/s^2)$

$= (518.466 \div 9.81)$ (kg)

$= 52.8507$ (kg)

Therefore, weight, W_1= 1400 kg

$W_2 = 52.8507$ kg

Calculating the resultant = $\sqrt{(1400^2) + (52.8507^2)}$

$= 1400.997$ kg

This load cannot be driven by a battery as suggested earlier. So, what we intend to do here is to reduce the engine speed and give some auxiliary power from the battery and some power(by burning of petrol) to retain its inertia of movement.

6. DIAGRAMS

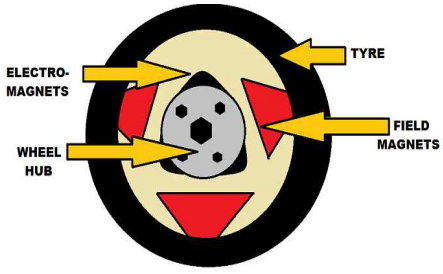

Fig-1: Concept impemented on the tyres

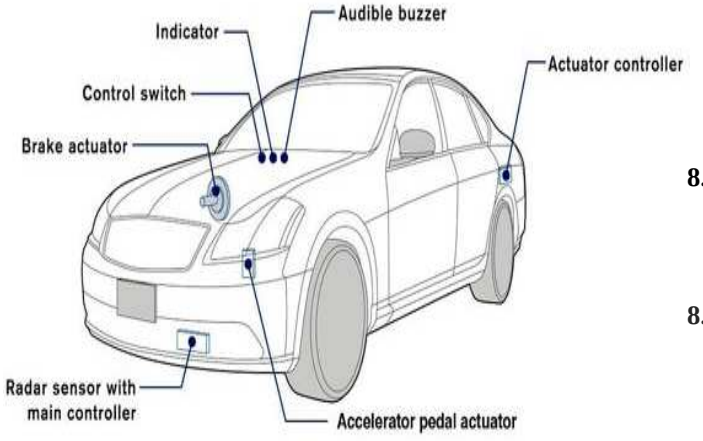

Fig-2: Structure of the system[5]

7. ABBREVIATIONS

- **ACC:** Autonomous Cruise Control

8. DEFINITIONS

8.1 Adaptive cruise control: Adaptive Cruise Control takes the technology further. A car equipped with this system will maintain a constant speed. When a car comes within a certain proximity of your car with the cruise control on your car will slow down automatically and maintain a constant distance from the car in front. If the car in front comes to a halt so will yours.[6]

8.2 Automatic braking type (ACC): The automatic braking type use either a radar or laser setup to allow the vehicle to keep pace with the car it is following, slow when closing in on the vehicle in front and accelerating again to the preset speed when traffic allows. Some systems also feature forward collision warning systems, which warns the driver if a vehicle in front—given the speed of both vehicles—gets too close (within the preset headway or braking distance).[7]

8.3 Brakes: A brake is a mechanical device which inhibits motion, slowing or stopping a moving object or preventing its motion. The rest of this article is dedicated to various types of vehicular brakes.[8]

8.4 Clutch: A **clutch** is a mechanical device that engages and disengages the power transmission, especially from driving shaft to driven shaft. Clutches are used whenever the transmission of power or motion must be controlled either in amount or over time (e.g., electric screwdrivers limit how much torque is transmitted through use of a clutch; clutches control whether automobiles transmit engine power to the wheels).[9]

8.5 Dynamic set speed type (ACC): The dynamic set speed uses the GPS position of speed limit signs, from a database. Some are modifiable by the driver.[10]

8.6 Electromagnets: An electromagnet is a type of magnet in which the magnetic field is produced by electric current. The magnetic field disappears when the current is turned off. Electromagnets consist of a large number of closely spaced windings of wire, very often wound around a magnetic core, a piece of ferromagnetic or ferromagnetic material such as iron, as this concentrates the magnetic flux.[11]

8.7 Field magnets: Field magnet refers to a magnet used to produce a magnetic field in a device. It may be a permanent magnet or an electromagnet.[12]

8.8 Lidar: Lidar (also written LIDAR or LiDAR) is a remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light. Although thought by some to be an acronym of Light Detection And Ranging, the term lidar was actually created as a portmanteau of "light" and "radar."[13]

8.9 Radar: Radar is an object-detection system that uses radio waves to determine the range, altitude, direction, or speed of objects. It can be used to detect aircraft, ships, spacecraft, guided missiles, motor vehicles, weather formations, and terrain. The radar dish or antenna transmits pulses of radio waves or microwaves that bounce off any object in their path. The object returns a tiny part of the wave's energy to a dish or antenna that is usually located at the same site as the transmitter.[14]

9. CONCLUSION

Thus we have come across a new concept in the adaptive cruise control system, which may prove a breakthrough in the field of automation that is booming at a very rapid rate. We hope to give more in this concept in the near future as we are researching on the concept very keenly.

10. ADVANTAGES OF THIS SYSTEM

In this system we find that the significant advantage is that the vehicles' engine goes at an economy speed while vehicle goes at a higher speed. Literally speaking, delivering high speed with increased fuel efficiency partially using the power of batteries and magnets effectively also allowing the driver to resume control of the vehicle when needed just by operating the clutch or the brakes thereby interrupting the system and disengaging it.

REFERENCE

[1] http://en.wikipedia.org/wiki/Cruise_control
[2] http://auto.howstuffworks.com/cruise-control.htm
[3] http://en.wikipedia.org/wiki/Autonomous_cruise_control_system
[4] http://en.wikipedia.org/wiki/Nissan_Leaf
[5] http://www.zigwheels.com/news-features/auto-insight/adaptive-cruise-control-acc/9171/1
[6] http://www.zigwheels.com/news-features/auto-insight/adaptive-cruise-control-acc/9171/1
[7] http://en.wikipedia.org/wiki/Cruise_control
[8] http://en.wikipedia.org/wiki/Brake
[9] http://en.wikipedia.org/wiki/Clutch
[10] http://en.wikipedia.org/wiki/Cruise_control
[11] http://en.wikipedia.org/wiki/Electromagnet
[12] http://en.wikipedia.org/wiki/Field_magnet
[13] http://en.wikipedia.org/wiki/Lidar
[14] http://en.wikipedia.org/wiki/Radar

