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ADAPTIVE CRUICE CONTROL

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ABSTRACT

Cruise control is a new technological development which incorporates a factor of comfort in driving. Safety is only a small benefit of this system. In short, cruise control can be said to be a system which uses the principles of radar to determine the distances between two consecutive moving vehicles in which either one or both of them is incorporated with this system. The electromagnetic rays from radar system are sensed by sensors in the vehicle which in turn rely commands to the throttle and brakes of the vehicle to perform according to the adjacent vehicle's distance. So cruise control is a system which provides comfort to drivers during long monotonous drives

I. INTRODUCTION

Every minute, on average, at least one person dies in a crash. If you read this article from start to finish 30 or more deaths will have occurred across the globe by the time you are done. Auto accidents will also injure at least 10 million people this year, two or three million of them seriously. All told, the hospital bills, damaged property and other costs will add up to 1 - 3 % of the world's gross domestic product according to the Paris based organization for economic cooperation and development. And, of course, the losses that matter most is not even captured by these statistics, because there is no way to put a dollar value on them.

Engineers have been chipping away at this staggering numbers for a long time. Many safety innovations in the areas of banking systems, air bags, seat belts, body structures, steering and suspension have had a beneficial effect. Air bags and seat belts save tens of thousands of people a year by preventing their head from crashing into the windshield. Supercomputers now let designers create car frames and bodies that protect the people inside by absorbing much of energy of crash as possible. As a result, number of fatalities per million kilometers of vehicle travel has decreased. But the ultimate solution and the only thing that will save far more lives, limbs and money are to keep out cars from smashing into each other in the first place.

That is exactly what engineers in the United States, Europe and Japan are trying to do. They are applying advanced microprocessors, radars, high-speed ICs and signal-processing chips and algorithms in R&D programs that mark an about face in the automotive industry: from safety systems that kick in after an accident occurs, attempting to minimize injury and damage, to ones that prevent collisions altogether.

The first collision avoidance features are already on the road, as pricey cruise control options on a small group of luxury cars. Over the next few years, these systems will grow more capable and more widely available, until they become standard equipment on luxury vehicles. Meanwhile, researchers will be bringing the first cooperative systems to market. This will take active safety technology to the next level, enabling vehicles to communicate and coordinate responses to avoid collisions. Note that to avoid liability claims in the event of cars equipped with cruise control systems, manufacturers of these systems and the car companies that use them are careful not to refer them as safety devices. Instead they are being marketed as driver aids, mere convenience made possible by latest innovative technology.

II. HOW TO SET CRUISE CONTROL

In modern designs, the cruise control may or may not need to be turned on before use – in some designs it is always “on” but not always enabled. Most designs have a separate “on” switch, as well as set, resume, accelerate and coast functions. The system is operated with controls easily within the driver’s reach, usually with two or more buttons on the steering wheel or on the windshield wiper or turn signal stalk. The cruise switches of a latest Ford car are shown in the figure below.

Fig.1

Driver should bring the car to speed manually and then use a button to set cruise control to the current speed. Most systems do not allow the use of cruise control below a certain speed to discourage use in city driving. The car will maintain that speed by actuating the throttle. Most systems can be turned off both explicitly or automatically, when the driver hits the brake or clutch. When the cruise control is in effect, the throttle can still be used to accelerate the car, although the car will then slow down until it reaches the previously set speed.

Fig.2

Now let us see the individual functions of each cruise switches in detail.

1. The **on** and **off** buttons really don't do much. Some cruise controls don't have these buttons; instead, they turn off when the driver hits the brakes, and turn on when the driver hits the set button.
2. The **set/accelerate** button tells the car to maintain the speed you are currently driving. If you hit the set button at 45 km/hr, the car will maintain your speed at 45 km/hr. holding down the set/accelerate button will make the car accelerate. On most cars, tapping it once will make the car go 1 km/hr faster.
3. If recently disengaged the cruise control by hitting the brake or clutch pedal, hitting the **resume** button will command the car to accelerate back to the most recent speed setting.
4. Holding down the **coast** button will cause the car to decelerate, just as if you took your foot completely off the gas. On most cars, tapping the coast button once will cause the car to slow down by 1 km/hr.
5. The **brake** pedal and **clutch** pedal each have a switch that disengages the cruise control as soon as the pedal is pressed. So you can disengage the cruise control with a light tap on the brake or clutch.

III. ADAPTIVE CRUISE CONTROL

There is a new type of cruise coming onto the market called adaptive cruise control. Two companies, TRW and Delphi Automotive Systems are developing a more advanced cruise control that can automatically adjust a car's speed to maintain a safe following distance.

Adaptive cruise control is similar to conventional cruise control in that it maintains the vehicle's pre-set speed. However, unlike conventional cruise control, this new system can automatically adjust speed in order to maintain a proper and safe distance between vehicles in the same lane.

These adaptive cruise control (ACC) systems, which add $1500 to $3000 to the cost of a car uses laser beams or forward looking radars to measure the distance from the vehicle they are in to the car ahead and its speed relative to theirs. If a car crosses into the lane ahead or if the lead vehicle slows down, say, and the distance is now less than the preset minimum (typically a 1 or 2 second interval of separation) or if another stationary object is detected, the system applies brakes, slowing down the vehicle, until it is following at the desired distance. If the leading car speeds up or moves out of the lane, the system opens the throttle until the car has returned to the cruise control speed set by the driver.

In May 1998, Toyota became the first to introduce an ACC system on a production vehicle when it unveiled a laser-based system for its progress compact luxury sedan, which it sold in Japan. Then Nissan followed suit with a radar-based system, in the company's Cima 41LV-2, a luxury sedan also sold only in Japan. In September 1999, Jaguar began offering an ACC for its XKR coupes and convertibles sold in Germany and Britain. Delphi Delco Electronic Systems supplies the radar sensing unit; TRW Automotive Electronics, the brake control; and Siemens, the assembly that manipulates the throttle. Last fall, Mercedes-Benz and Lexus joined the adaptive cruise control movement. Lexus offers an ACC option for its top-of-the-line LS430; at the movement, it is the only ACC system available in the United States. Mercedes' system is an option on its C-Class and S-Class models, which are available in Europe.

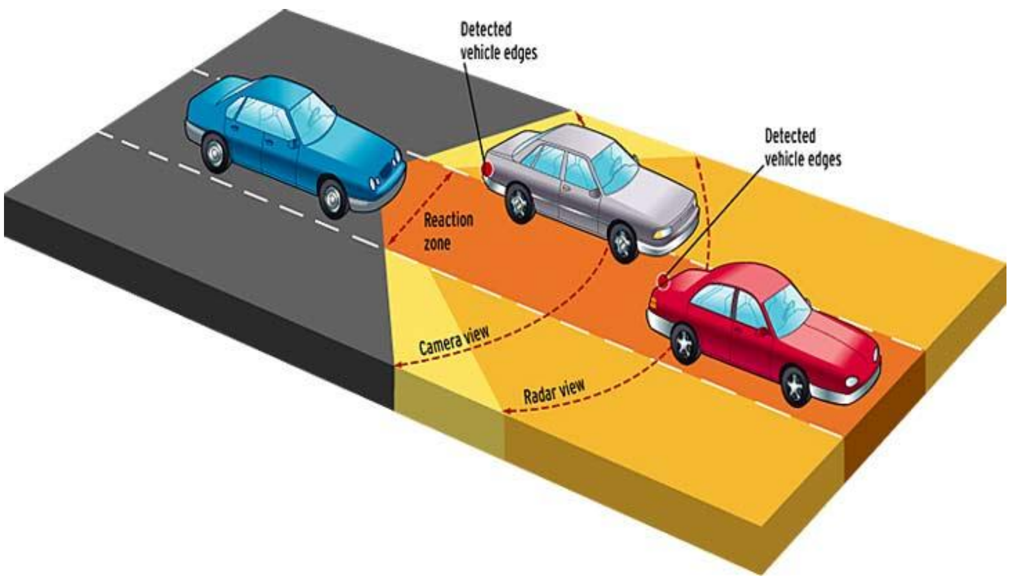

Fig.3

All of the ACC systems available today are built around sensors that detect the vehicle ahead through the use of either radar or lidar (light detecting and ranging, the laser based analog to radar). The choice of sensors presents classic design tradeoffs. We will see the radar-based system in detail later. Lidar is less expensive to produce and easier to package but performs poorly in rain and snow. The light beams are narrower than water droplets and snowflakes, pushing down the signal-to-noise ratio in bad weather. Another problem is that accumulations of mud, dust or snow on the car can block lidar beams.

At present, only one automaker, Lexus, uses a laser-based ACC system, in its LS430 luxury sedan. System engineers have acknowledged lidar's shortcomings and taken steps to make the system unavailable in situations where the weather may limit its effectiveness. According to the LS430 owner's manual, the system will automatically shut itself off if the windshield wipers are turned to a rapid setting, indicating heavy rain or snow; if something activates the anti-lock braking system (which helps the driver maintain a steering control and reduces stopping distances during emergency braking situations); or if the vehicle skid control system detects the slipping of tires on turns that is common in wet weather.

Fig.4 The Lexus LS430 laser sensor built into the front grille

IV. PARTS AND WORKING

We have already seen the working of a laser-based ACC system, its limitations and all. Now let us take a look at how radar-based ACC system works, in detail.

The main components of a typical radar-based ACC system are the following.

1. Fusion sensor
2. Headway control unit
3. Throttle
4. Brake
5. Dashboard display

Fusion sensor is a combination of sensors and processors. The fusion sensor consists of the following components.

1. Millimeter-wave radar
2. Stereo camera
3. Image processor
4. Fusion processor

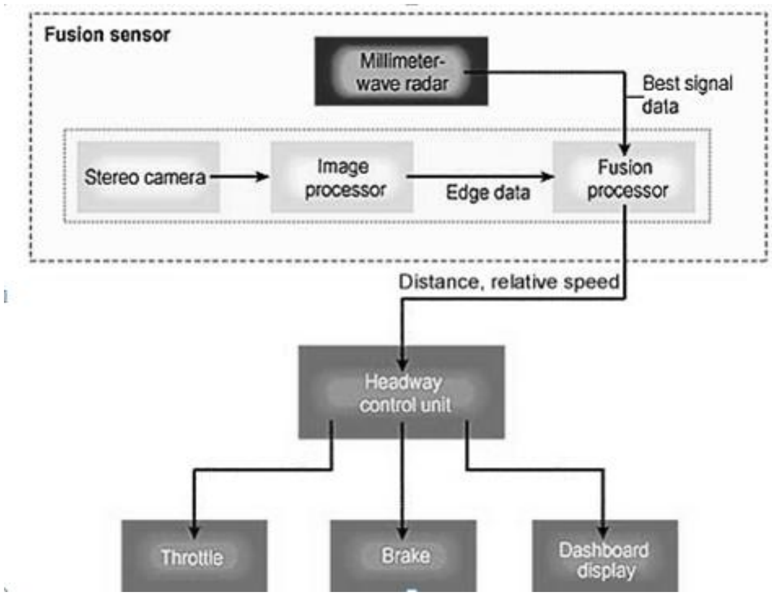

Fig.5Architecture of a radar-based ACC system

Let us take a close look at each of these components, their individual roles, in detecting hazards in the roadway and responding in the correct manner so as to avoid those detected hazards

V. CONCLUSION

This paper has described about the cruise control systems that are commonly seen in luxury cars now a day. Fully autonomous car is probably not viable in the foreseen future. The Intelligent Vehicle Initiative in the United States and Ertico program in Europe are among dozens of groups working on technologies that may ultimately lead to vehicles that are wrapped in a cocoon of sensors, with a 360 view of their environment. Then nearby vehicles would be in constant communication with each other and act co-operatively, enabling groups of cars to race along like train cars, almost bumper to bumper, at speeds above 100 km/hr.

It will probably take decades, but car accidents may eventually become almost as rare as plane crashes are now. The automobile, which transformed the developed world by offering mobility and autonomy, will finally stop exacting such an enormous cost in human lives.

REFERENCE

Websites

[1]. www.howstuffworks.com
[2]. www.cars.com/features/adaptivecruisecontrol
[3]. www.autorepair.com
[4]. www.narticle.com
[5]. www.ukcar.com