Perspective

Adaptive Cruise Control: An Overview

Jharana Nayak*

Department of Engineering, Utkal University, Bhubaneswar, Odisha, India

PERSPECTIVE

Adaptive cruise control (ACC) is a cruise control advanced driver-assistance system for road cars that changes the vehicle speed automatically to maintain a safe distance from vehicles ahead. As of 2019, it has 20 different names that all express the same core functionality. Dynamic cruise control is another name for this. Sensor data from on-board sensors is used to control the vehicle. Such systems may employ a radar or laser sensor, as well as a camera system, to allow the vehicle to brake when it senses another vehicle approaching from behind, then accelerate when traffic permits. ACC is largely recognised as a critical component of future generations of intelligent automobiles. By maintaining proper vehicle separation and eliminating driver errors, they affect driver safety and convenience while also enhancing road capacity. According to SAE International, vehicles having autonomous cruise control are classified as Level 1 autonomous vehicles. The vehicle is classified as a Level 2 autonomous vehicle when it is paired with another driver assistance function such as lane centering.

Adaptive cruise control does not enable complete autonomy: it just assists the driver and does not drive the vehicle on its own. Mitsubishi was the first to introduce Debonair, a lidar-based distance detection system, to the Japanese market in 1992. This device, marketed as "distance warning," alerts the driver without affecting the throttle, brakes, or gear shifting. Laser-based systems are unable to detect and track automobiles in inclement weather, as well as unclean (and thus non-reflective) vehicles. The sensor (a very large black box) is often situated in the lower grille, offset to one side. Radar-based sensors can be concealed beneath plastic fascias, however the fascias may differ from those on a vehicle without the technology. Mercedes-Benz, for example, hides the radar behind the upper grille in the centre and a solid plastic plate with painted slats to mimic the rest of the grille.

The most prevalent radar systems are single radar systems. Multiple sensor systems employ either two comparable hardware sensors, as in the 2010 Audi A8 and 2010 Volkswagen Touareg, or one central long range radar with two short radar sensors located on the vehicle's corners, as in the BMW 5 and 6 series. The binocular computer vision system, which Subaru launched to the US market in model year 2013, is a relatively recent development. These systems use digital processing to derive depth information from the parallax between the two cameras' viewpoints. They have front-facing video cameras positioned on either side of the rear view mirror.

Assisting systems

Radar-based ACC is frequently sold in conjunction with a precrash system, which alerts the driver and/or offers brake support if a collision is imminent. When the cruise control system is active, it is also incorporated with a lane maintaining system, which provides power steering aid to lessen steering input stress on turns..

Multi-sensor systems

Sensor fusion can be used in systems with many sensors to integrate data and improve safety and/or driving experience. Geographic elements such as a freeway off-ramp can be detected using GPS data. Driver behaviour such as brake lights and/or a turn signal could be detected by a video system. This could allow a trailing car to read a turn signal from an exit as meaning that the following car does not need to slow down because the leading car will exit. Multi-sensor systems might also pay attention to traffic signs and signals, ensuring that they do not, for example, run a red light while following a vehicle that crossed before the signal changed.

Predictive systems

Predictive systems change the speed of a vehicle based on the behaviour of other cars. Such systems can make more gradual, earlier modifications to projected behaviour, boosting passenger safety and comfort. Predicting the possibility of a vehicle in a nearby lane moving in front of the controlled vehicle is one example. One system can predict lane changes up to five seconds ahead of time.

Norms and regulations

ISO 15622 is the European standard that governs adaptive cruise control. Performance standards and test methodologies for intelligent transportation systems with adaptive cruise control.

An ACC, according to this standard, is a partial automation of longitudinal vehicle control that reduces the driver's burden on roadways that are closed to non-motorized vehicles and pedestrians. It doesn't work with objects that aren't moving.

The FSRA (full speed range) and the LSRA (limited speed range) are two types of ACC systems, according to this specification (limited speed range).

Correspondence to: Jharana Nayak, Department of Engineering, Utkal University, Bhubaneswar, Odisha, India, E-mail: jharana.n@gmail.com