SERVOTECH

Autonomous Vehicle Control System

Line Keeping

Adaptive Cruise Control

Rear view camera display

Auto Parking

- Camera Vision
- Radar Sensors
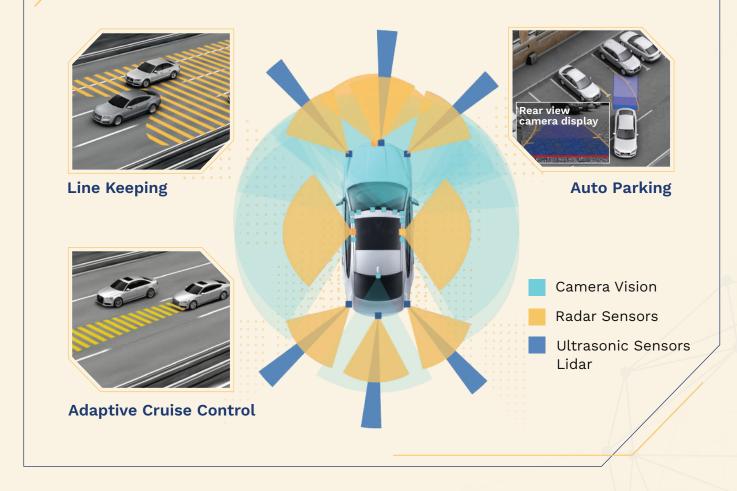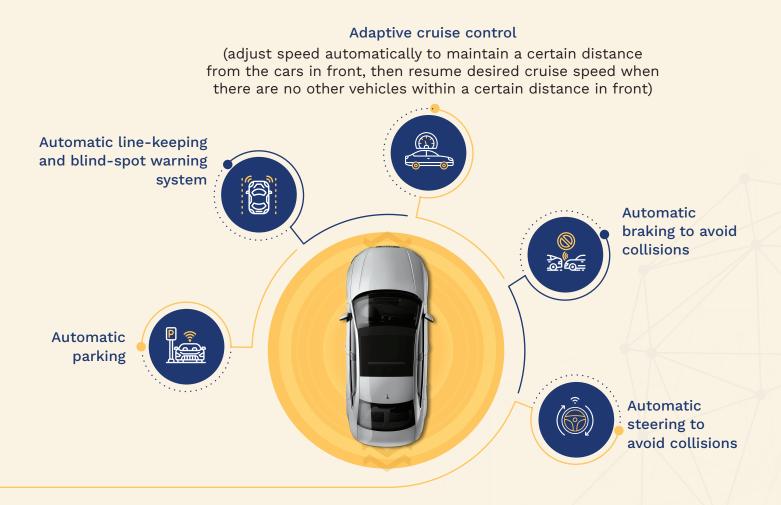- Ultrasonic Sensors Lidar

The self-driving car decides on the command signal to subsystems (throttle command, brake command, steering command) based on large collection of sensors. Each sub-system then would have its own closed or open loop local controllers to achieve the command signals. This requires the car to have an electronically controlled powertrain, and an electronically controlled steering system (which is called an "x-by-wire" control system). The biggest challenge in this technology is the accurate detection of other cars and objects around the car and road conditions.

This is referred to as the "perception" problem in autonomous driving. If we can accurately determine the actual road conditions, then in the software we can decide what to do. The intelligence of the self-driving car is the software running in the on-board embedded controllers (multiple embedded controllers with a local communication network, such as CAN bus) as well as the server software running in cloud computing platform on internet-connected supercomputers to assist and supervise millions of self-driving cars. It is important to note that the software involved in autonomous vehicle control involves software running on typically embedded controllers on the vehicle and software running on servers on the internet which communicates with the embedded controllers in real-time.

Autonomous Vehicle Control System

Current developments are grouped under the name of "autonomous driver assistance systems" (ADAS). These real-time control software modules are currently used for the following functions using ultra-sonic, lidar/radar, and vision sensors.

Adaptive cruise control
(adjust speed automatically to maintain a certain distance from the cars in front, then resume desired cruise speed when there are no other vehicles within a certain distance in front)

Automatic line-keeping and blind-spot warning system

Automatic braking to avoid collisions

Automatic parking

Automatic steering to avoid collisions

It is a huge challenge to develop sufficient confidence in embedded software to make completely autonomous control decisions and take control actions. Therefore, the current trend is to release these capabilities as autonomous (or automatic) driver assistance systems (ADAS). The ADAS software module is developed as real-time embedded signal processing algorithms that take the processed sensory data (GPS, camera, radar/lidar, ultrasonic sensors, etc.) and make decisions, then send control signals to the engine-transmission / EV motor-drive, brake, and steering sub-systems. Standardized approaches to software development are developed and practiced (i.e. AUTOSAR) in terms of communication between modules and software layers and are intended to increase reliability and reduce development costs by increasing reusability.