

# 1/3 of Autonomous Car

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## Introduction

Autonomous vehicles have to sense their environment to match their intentions with the real world. Radars, lidars and cameras are currently the most attractive perception sensors.

The hardware costs and software efforts of this functionality makes a considerable part of all the costs of autonomous vehicle. Typically its main elements are:

- Digital environment model and wireless connectivity
- Perception capability and vehicle control ← *sensor rack*
- Chassis, engine, transmission, suspension, interior, ...

## Sensor rack

Made for perception system development and fast prototyping. Currently it consists of the following sensors:

### 77GHz radar

Coverage 16° x 4°, ~200m. Cycle time 30-60ms.\*

### 24GHz radar

Coverage 150° x 12°, ~50m. Cycle time ~33ms\*\*.

### Lidar (laser scanner)

Coverage 180° x 0.1°, ~50m. Cycle time ~50ms.

### Stereo camera

Coverage 72° x 54°, ~65m. Frame rate 25Hz.

### Thermal camera

Coverage 24° x 18°, ~60m. Frame rate ~8Hz.

\* depending on model

\*\* depending on prototype



Figure 1. Sensor rack.

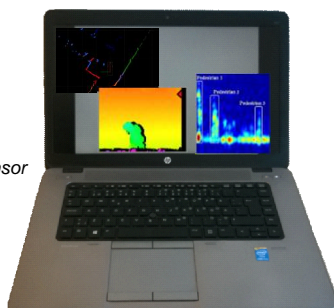


Figure 2. Visualisation of sensor signals.

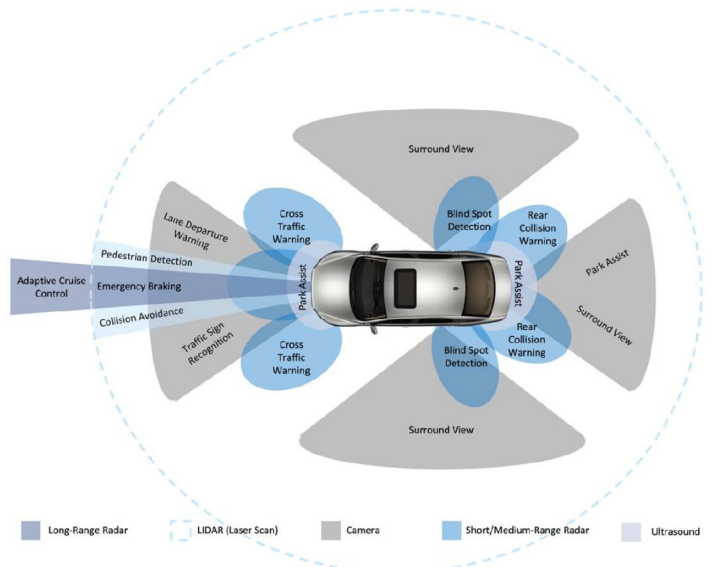


Figure 3. Typical sensing ranges of advanced driver assistance vehicles and autonomous vehicles. (Goldman Sachs Global Investment Research)

## Perception challenges and solutions

Harsh weather and dirt form one set of challenges. Even more challenging is to categorise what the detected object is, especially if it has to be done quickly and reliably. In the latter case it is often necessary to use at least two different sensing technologies.

Instead of investing in higher quality sensors, sensor data enhancement and sensor data fusion are algorithmic means to achieve better recognition accuracy and reliability in varying conditions. Cost effectively.

## Also for your case

The rack and VTT expert is a rapid way to explore, what part of your problem could be solved using modern environment perception sensors and algorithms.

Especially if the case includes human detection or/and safety regulations.

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