Smart cars, Smarter Cities: The power of V2X Communication

Introduction

V2X Is vehicle to everything communication. It allows vehicles to communicate with its surroundings such as other vehicles, pedestrians and infrastructure.

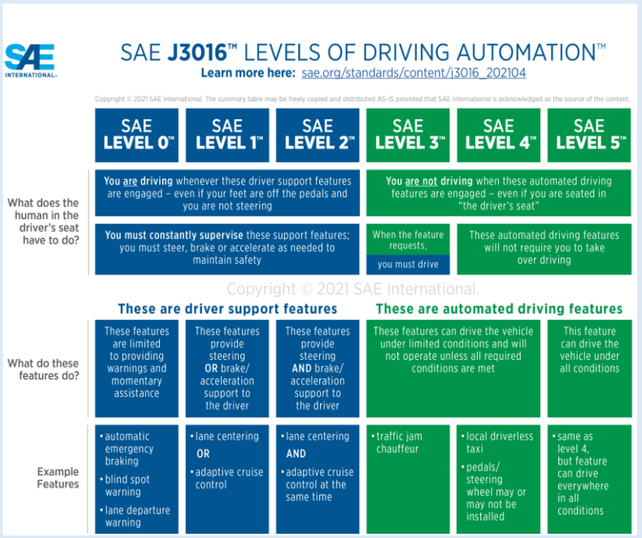

Figure 1: Levels of driving automation: https://www.sae.org/blog/sae-j3016-update

V2X plays a crucial role from level 3 onward, typical vehicles utilise sensors like LiDARS, cameras and radars to execute objects identification, acceleration and braking however automation is limited to only the vehicle's line of view.

V2X however operates over long distances improving not only efficiency but awareness and responsiveness.

The efficiency and reliability of these information exchange has a positive impact on road safety. For example, V2X reduces congestions leading to an improved route planning and less fuel usage, reducing the emissions of green-house gases.

Another problem with metropolitan cities is finding parking, there is significant time and fuel loss that occurs because of this. With V2X, it communicates with OBUs in neighbouring vehicles via RSUs in parking lots, providing information on whether there is parking space eliminating the need to search.

Communication Protocols and Signal Processing.

Devices such as RFID readers, signage, cameras and streetlights provide a wireless, bidirectional network that exchanges information between infrastructure and vehicle.

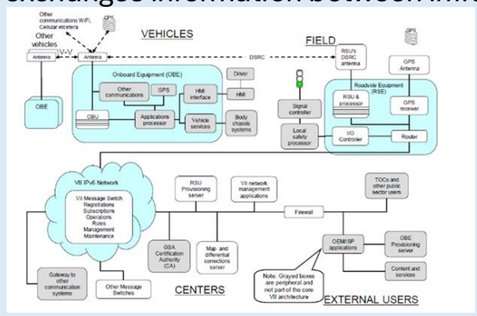

Figure 2: example of V2I systems architecture
Source: ITS joint programme office

V2P: Vehicle to pedestrian

V2P operates with three phases. Detections, tracking and projectile prediction; identifying pedestrians, estimating time-to-collision (TTC), and activating warnings or braking to prevent crashes.

In the unidirectional method, pedestrian warning systems (available via mobile apps) use wearable technology, cameras, or infrastructure to notify pedestrians to impending automobiles via audio, visual, or vibratory signals.

Bilateral collision alert systems use point-to-multipoint communication to notify both drivers and pedestrians, resulting in a local wireless network. These systems use DSRC, WiFi, and GPS to function regardless of light, weather, road condition, or vehicle speed. They detect invisible obstructions and notify all individuals involved, delivering a considerable safety benefit.

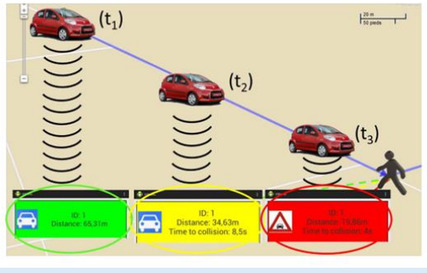

Figure 3: V2P for a vehicle approaching a pedestrian.
Source: farnell.com

Power Exchange: Energy management in V2X Systems.

V2G: Vehicle to grid

Fundamentally, this technique comprises using parked and unutilised EVs as a source of power for the energy grid during moments of high demand, while also returning that power to the same EVs during downtime. This method allows the grid to draw on the stored energy of EVs to meet abrupt surges in power demand, such as when families turn on high-powered electrical appliances, such as kettles, at half-time in a football game. The EVs' battery power is recharged in the early hours of the morning, when people are asleep and electricity demand is low.

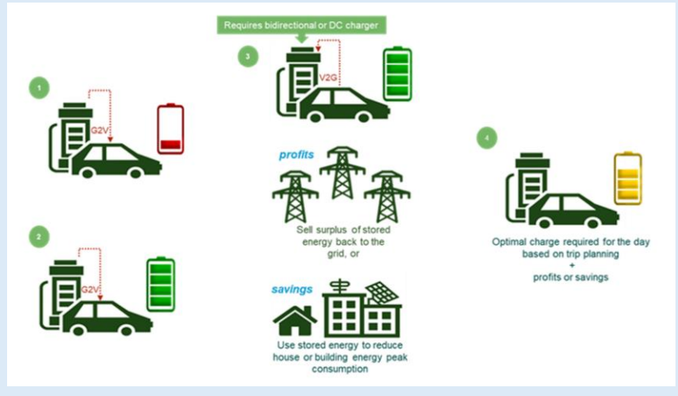

Figure 4: The image depicts the bidirectional energy flow between an electric vehicle (EV) and the grid.
Source: ABI Research