



EV and Autonomous Technology

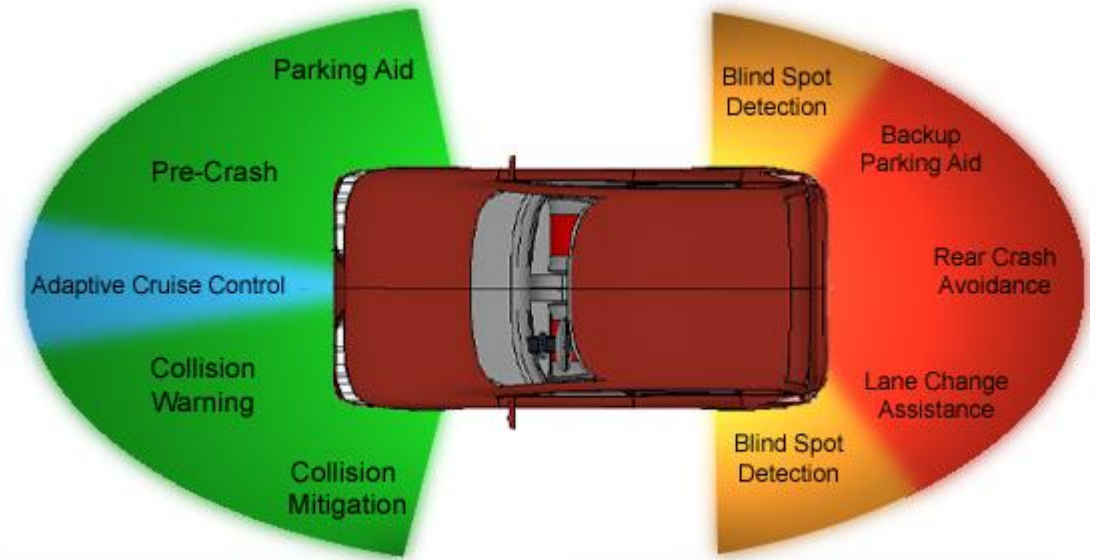
Automotive Platforms & Application Systems R&D Centre
Automotive and Electronic Division
Hong Kong Productivity Council



ADAS & Autonomous Driving

Advanced Driver Assistant Systems (ADAS)

- Categorized as Level 1-2 automation (SAE categorization)
- Prevalent Vehicle Safety systems, using :
 - *Computer vision + AI*
 - *Millimeter radar*
 - *Ultrasonic radar*
 - *Other radar system e.g. Lidar/laser ...*
- Warning alerts by visual, audible, haptic etc



Milli-meter radar



Laser



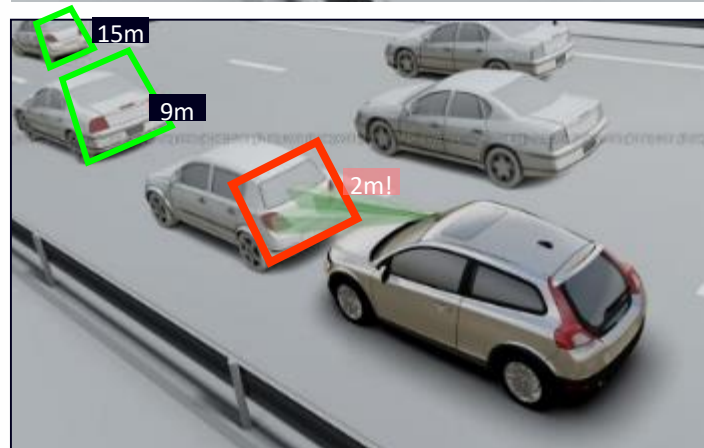
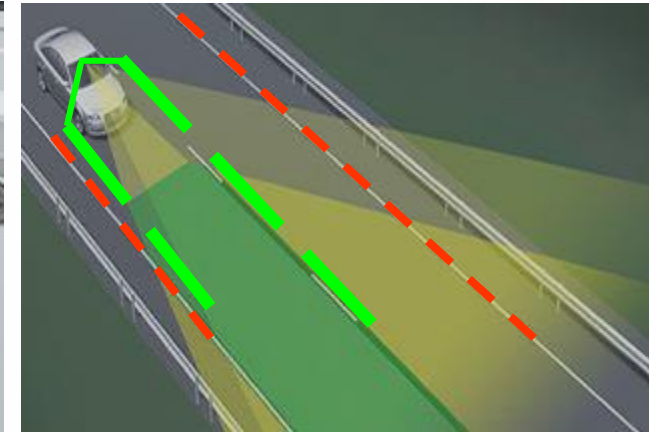
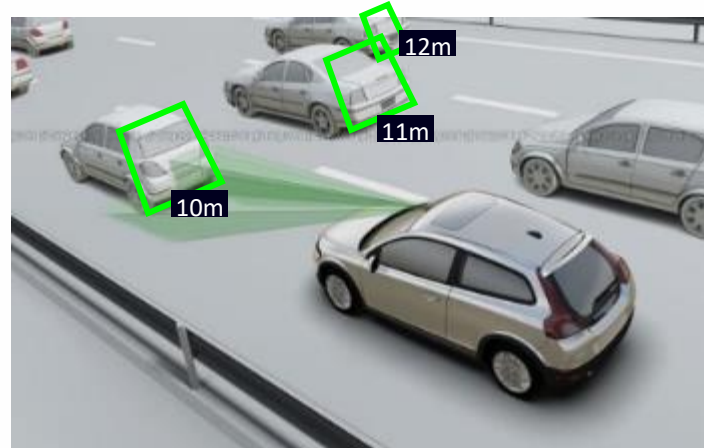
Ultrasonic radar



Vision cameras

ADAS & APAS/HKPC

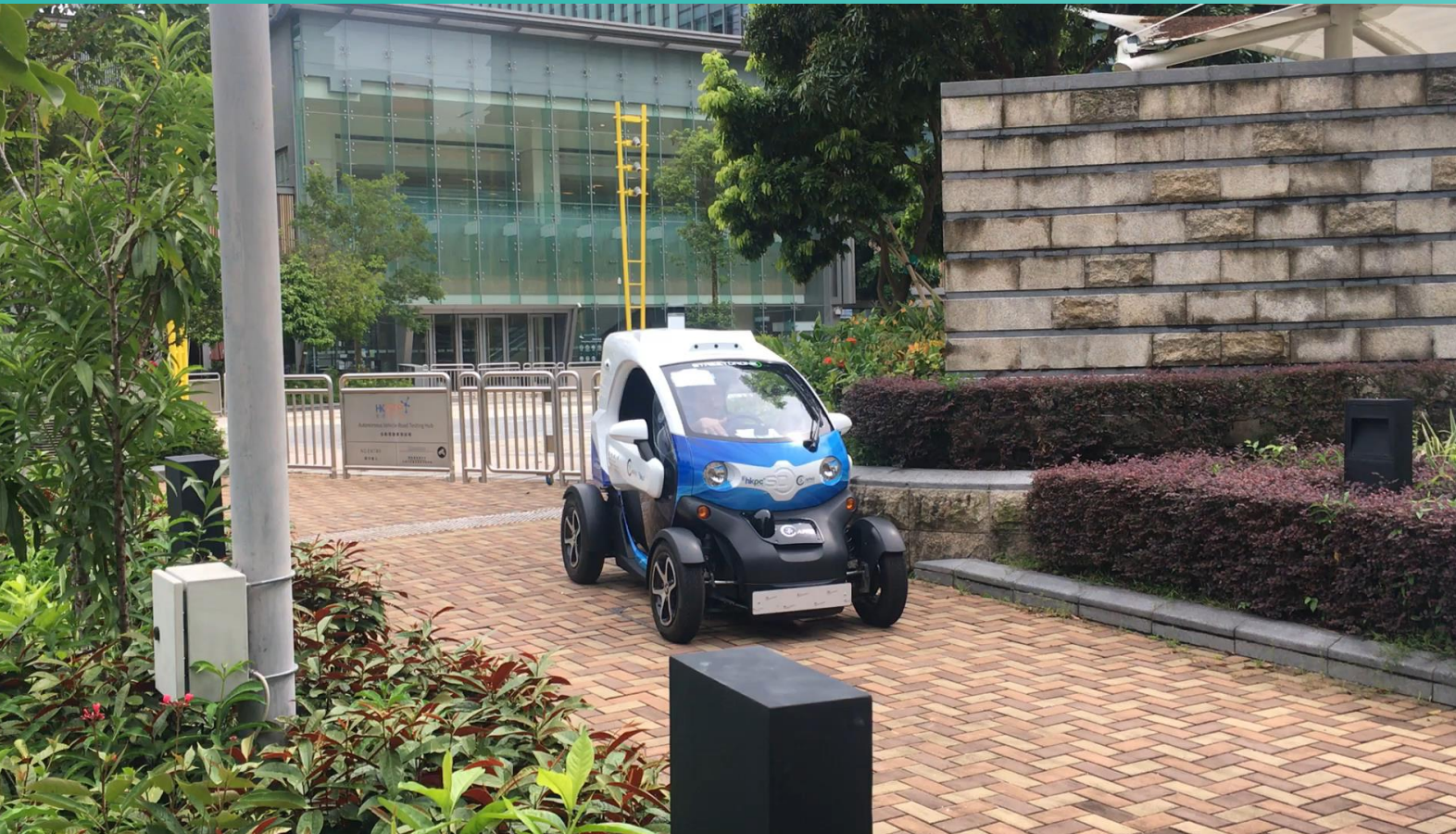
- APAS/HKPC developed ADAS systems, e.g. using image processing, including:
 - *Frontal collision warning (FCW)*
 - *Lane departure warning (LDW)*
 - *Blindspot detection warning (BDW)*
 - *Pedestrian Warning (PdW)*



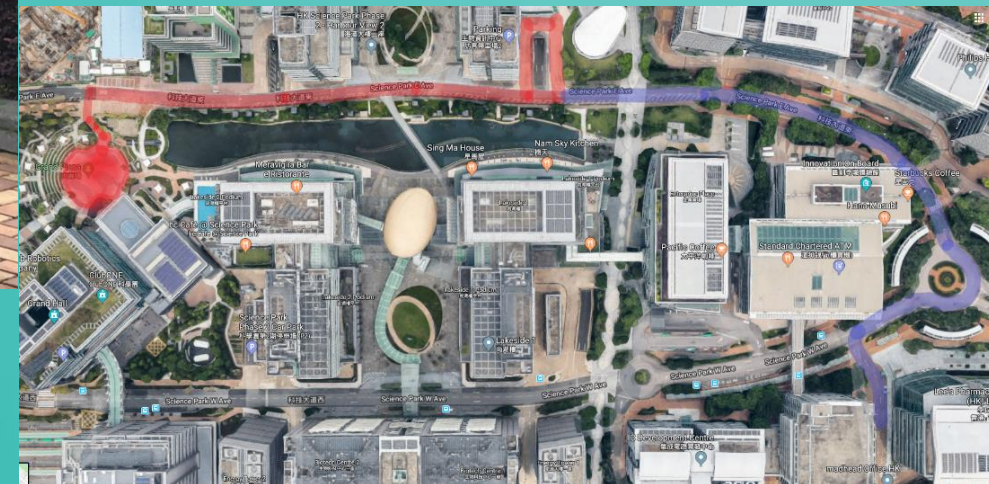
Levels of Automation : ADAS → Autonomous



Development of Autonomous Driving tech



- Location: Hong Kong Science Park
- Time: Aug-2019
- Routes: Sci Park Avenue East



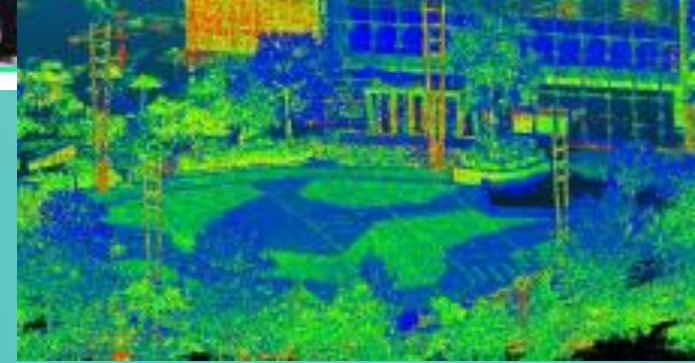
Tele-operation trials conducted at HKPC/APAS



- Real-time HD front video streaming
 - Steering control
 - Brake control
 - Throttle control
- } Drive-by-wire (Dbw)



Self Driving Delivery Mover



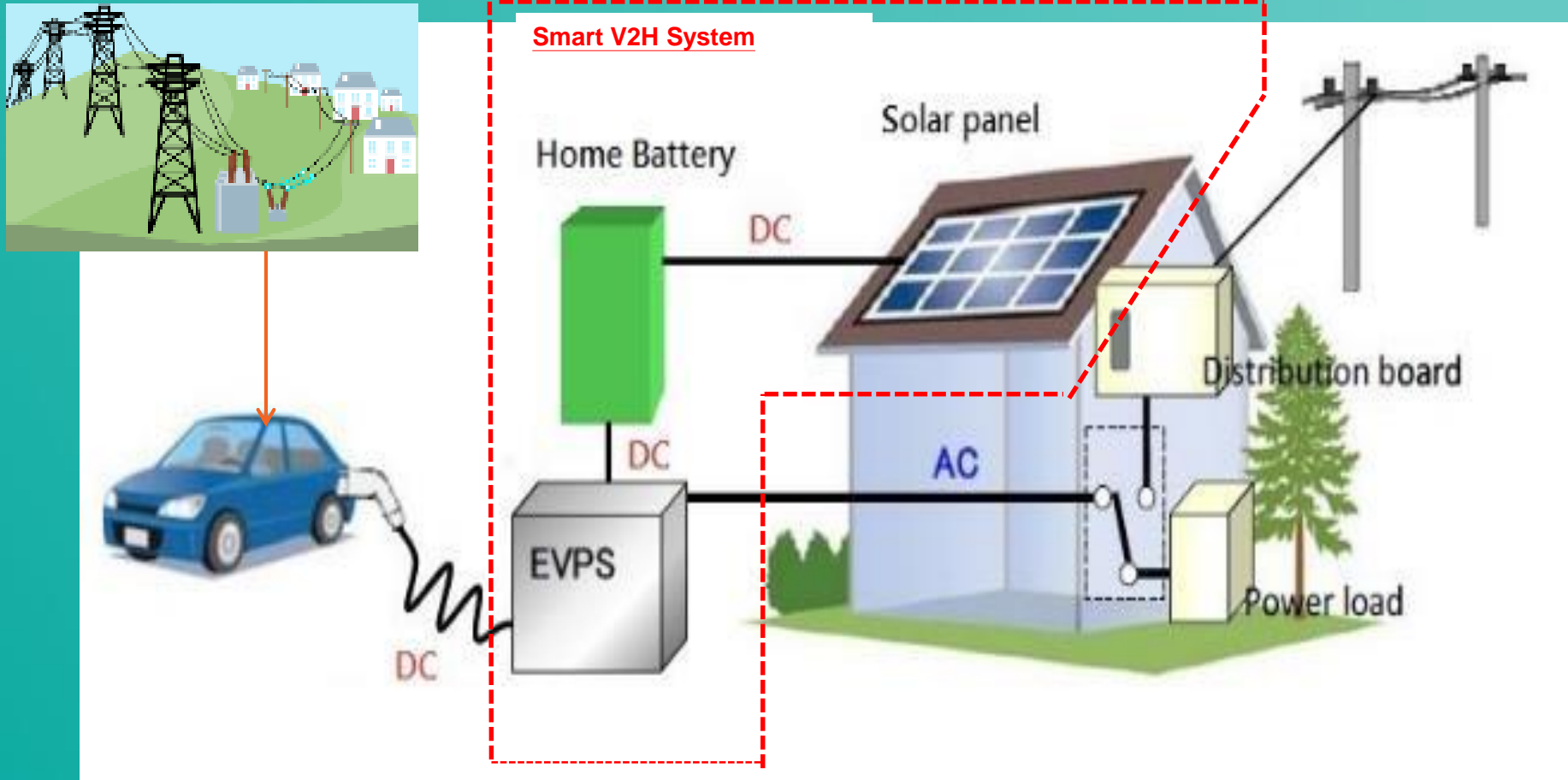
- Equipped with a sensor suite that comprises camera, DGPS, IMU, LiDAR & Ultrasonic
- Through deep learning & sensor fusion, MiniMover can conduct path planning w/ collision avoidance from stationary/moving obstacles

Smart Vehicle-to-Home (V2H) System for Electric Vehicles



Smart Vehicle-to-Home (V2H) System

- The Smart Vehicle-to-Home (V2H) System uses the electricity stored in the battery of an electric vehicle (EV) to provide power to a home.
- The System complies with EVPOSSA (Electric Vehicle Power Supply System Association) V2H (EVPS-002) / V2L (EVPS-004) standards.



Smart V2H System Configuration

The Smart V2H System consists of three major components:



Electric Vehicle Power System (EVPS)

- Electric Vehicle Power System (EVPS) controls the power flow among the Smart V2H System by implementing EVPOSSA V2H (EVPS-002)/ V2L (EVPS-004) protocol.
- A DC/DC converter in EVPS is used to transfer power from Home Battery to EV Battery or vice versa.
- A DC/AC inverter in the EVPS is used to deliver power from Home Battery or EV Battery to household appliances.
- According to EVPOSSA standard, output power from EVs shall be less than 10kW.



Home Battery Power Storage System



- Home Battery Power Storage System gathers the power from renewable energy generation unit (Solar Power System) or EV.
- Supply power to household during emergency or on-demand situations.
- Including a small DC/AC converter inside, it can provide AC power to household appliances without the EVPS.

Home Battery Power Storage System



Characteristics	6.4kWh	24kWh
	Value	Value
Nominal voltage	320V	288V
Energy	6.4kWh	24kWh
Charge voltage (max)	380V	336V
Discharge cutoff voltage	250V	200V
Rated charge current	20A	24A
Discharge current (max continuous)	40A	240A
Communication	Isolated CAN bus	Isolated CAN Bus
Cell balance	Yes	Yes

Solar Power System

- Solar Power System provides renewal power to Home Battery.
- Solar Power System includes solar panels and a DC/DC converter.
- The DC/DC converter includes Maximum Power Point Tracking (MPPT) function which can maximize power extraction from the solar power system.



Solar Power System

Power Solar Panel

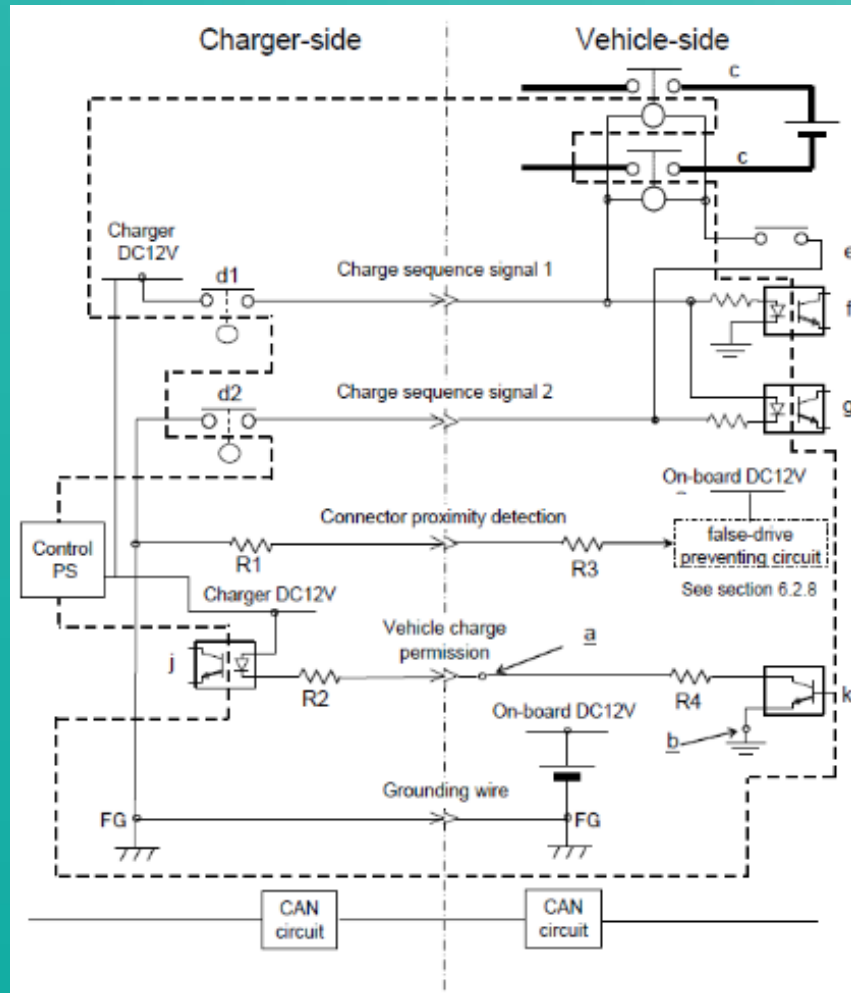
Characteristics	Value
Cell technology	Polycrystalline Silicon
Maximum Power	1000W
Maximum open circuit voltage	45V
Maximum system voltage	450Vdc
Total efficiency	>16%
Power tolerance	+/-3%
IP rating	IP65
Operating temperature	-20°C to 85°C
Dimension	8m ² (1m x 1.5m x 5pcs)

DC/DC Converter

Characteristics	Value
MPPT Range @ System Voltage	250 to 450Vdc
Max PV Input Voltage	450Vdc
Max PV Input Current	2.5A
Max PV Input Power	Up to 1000W
Nominal Battery Voltage	320V
DC Output Voltage	250 to 380Vdc
DC Output Current	Up to 10A
Maximum Power Pt Tracking (MPPT) Function	Included
Operating temperature	0°C to 50°C

Charging Connector

- CHAdemo



- EVPOSSA

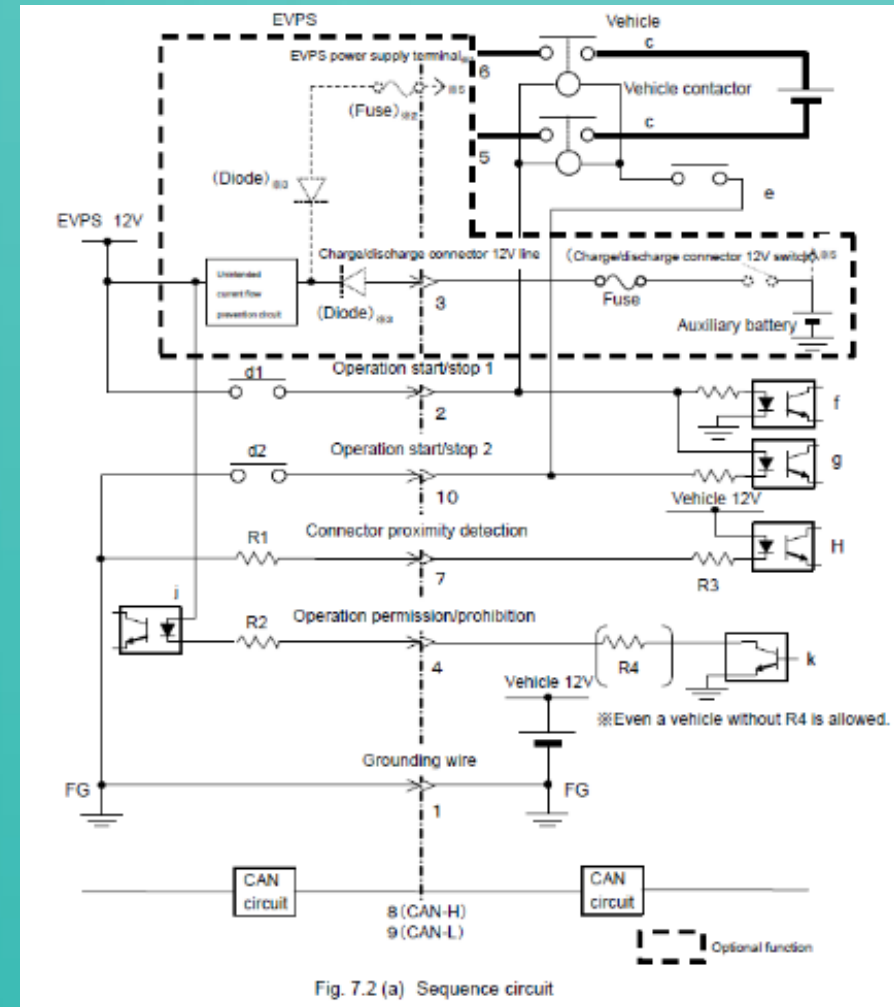
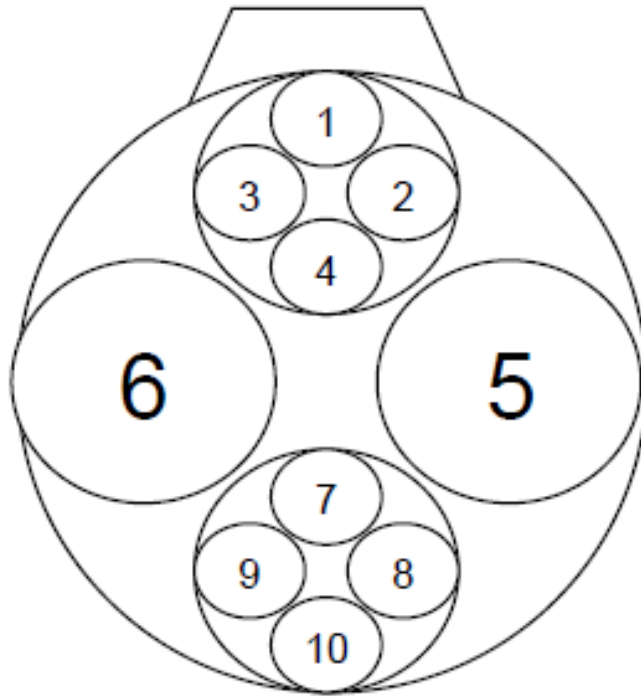


Fig. 7.2 (a) Sequence circuit

Connector pin layout



The surface of a charge/discharge connector viewed from a vehicle inlet

Pin No.	Name
1	Grounding wire
2	Operation start/stop 1
3	Charge/discharge connector 12V line
4	Operation permission/prohibition
5	DC (-)
6	DC (+)
7	Charge/discharge connector connection verification
8	CAN - H
9	CAN - L
10	Operation start/stop 2

Fig. 7.2 (b) Charge/discharge connector pin layout

Benefit of Smart V2H System

- For time variant tariff, EV users can charge their EVs by renewable energy sources or by power grid when the tariff is low.
- With V2H system installed, the electrical power stored in the EV batteries can then be transferred to households in peak hours when tariff is high.
- It saves electricity cost and also helps to relieve the high power consumption situation in peak load hours.
- EVs can now serve as emergency power sources when there are power outages.

Development in Future

- Establish V2L/V2H fundamental technology now and migrate to Smart Grid V2G (Vehicle-to-Grid) technology in future.
- Implement the mature EVPOSSA protocol now, expand to other V2H/V2G standards as needed in future.



Hong Kong Productivity Council
香港生產力促進局

HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong
香港九龍達之路78號生產力大樓
+852 2788 5678 www.hkpc.org

Automotive Platforms and Application Systems (APAS) R&D Centre
汽車科技研發中心

4/F, HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong
香港九龍達之路78號生產力大樓
+852 2788 5333 www.apas.hk