

Future Mobility In Taiwan



Agenda

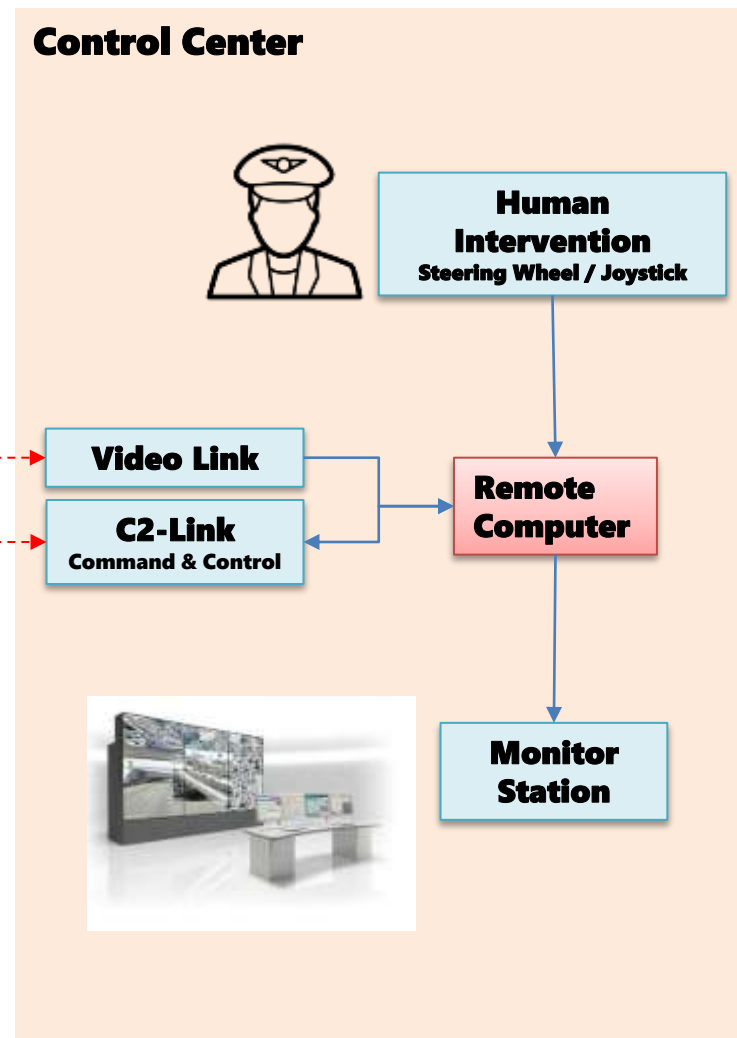
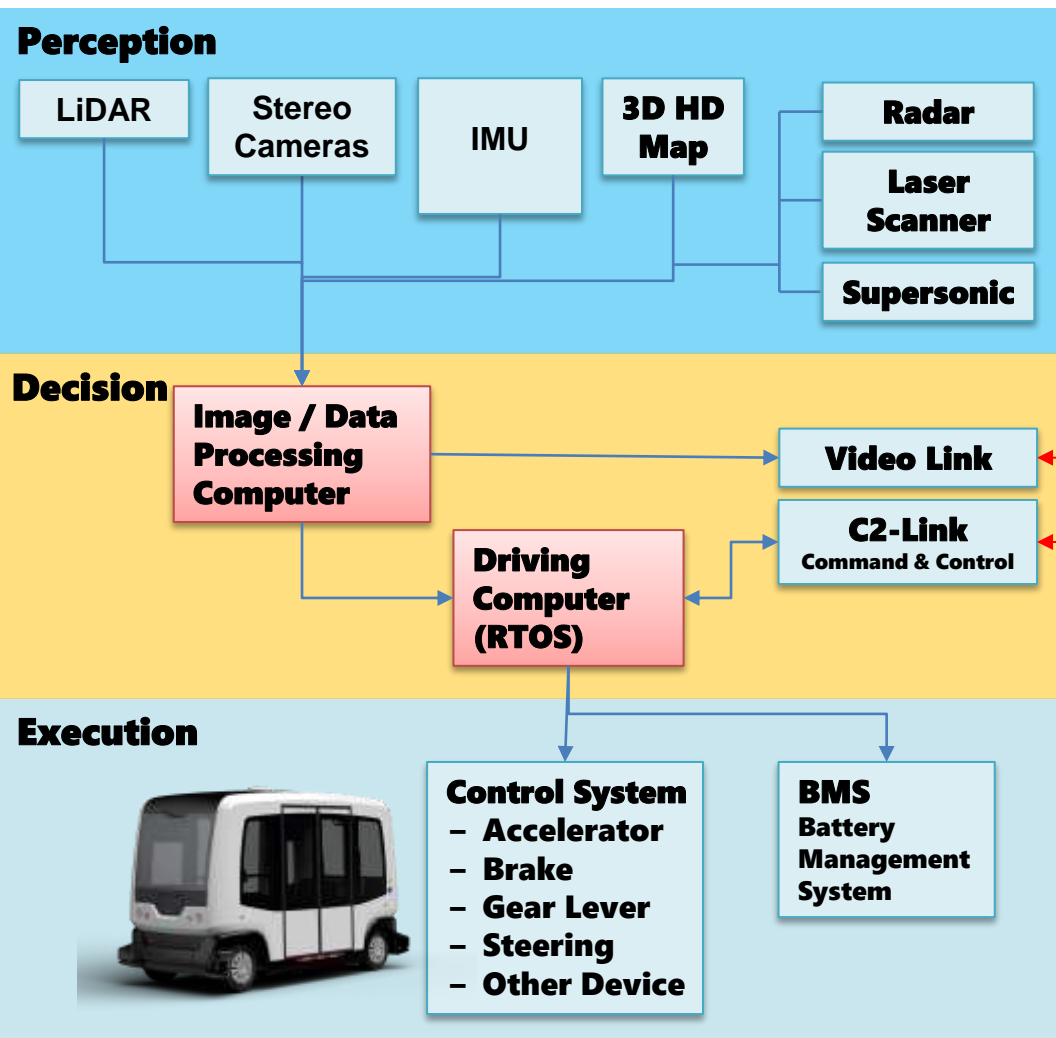
- 0. Level 4 Autonomous Shuttle**
 - 1. Vision of Shared & Connected Mobility in Smart City**
 - 2. Smart Connection Development**
 - 3. How to Adapt Self Driving Bus into Public Transport**
 - 4. Shared Mobility & Logistics: Changhua Green Corridors**
 - 5. Data Driven Mobility On Demand**
 - 6. Smart Street & Future Platform**
- Eco-System of Smart & Shared Connection**

Levels Of Autonomous Vehicle





Autonomous Vehicle Control Diagram





Autonomous Driving Strategy

Lay 0. Management Layer

Fleet
Magt

V2V
AIoT

大數據
Big Data

MaaS
公共運輸



Lay I. Perception Layer

核心

視覺
CAMERA

光達
LIDAR

立體地圖資訊
3D Map

公分級GPS系統
N-RTK

輔助

慣性感測元件
IMU

雷達
Radar

超音波
Supersonic

通訊
V2X



Lay II. Decision Layer

高性能車載 GPU Server

AI 物體辨識
Recognition

感知融合
Sensor
Fusion

目標規劃
Higher Level
Planning

執行規劃
Lower Level
Planning



Lay III. Execution Layer

電動車

能源/電池
BATTERY

電機
Motor

電控
Controller

充電
Charging

致動系統
Control by Wire

電控單元
ECU

電動轉向
EPS

剎車致動
Braking

車內網絡
CANbus

1. Vision of Shared & Connected Mobility in Smart City

自動駕駛
**Self-Driving
Services
Application**

智慧交通
**Smart City
Solution**





7StarLake Achievements

Changhua
彰化縣田中
高鐵特區 接駁



Yunlin
雲林 台西
安西府 綠能專區



Kaoshiung
高雄駁二特區
無人小巴 輕軌



Taipei
台北市信義路夜間
無人小巴

President Tsai
蔡英文總統 ECO
Mobility





Signing MOU with Kaoshiung City Gov. in Eco Mobility Exhibition

2017 April Kaohsiung



Signing MOU with Taipei City Gov. for Night Operation on Xin-Yi Bus Lane

2017 August Taipei





Signing MOU with Changhua County Gov. for HSR Changhua Station Connection in District

2017 Oct. Changhua



Holding Events with Yunlin County Gov. in Tai-Xi Green Energy Park for Rural Area Transportation

2018 Jul. Yunlin





Taipei 101

2018 Oct. Taipei





7STARLAKE 喜門史塔雷克

NTU、

Kaohsiung Pier-2 Art Center

台大、高雄駁二

車、人流混合測試

Mixed traffic road testing
(pedestrians and vehicles)

Taipei city, Xinyi Bus Lane

台北市 信義路 公車專用道

- NRTK GPS 定位解析
- LiDAR 基礎建設測試

Kaohsiung

Light Rail C7~C8

高雄 輕軌 C7~C8

- 與大眾運輸結合
- 實現最後一哩路

Taipei NTSEC、

Nangang MRT station

台北士科場域、南港捷運站

- 共享接駁 App 預約叫車
- 結合地方商家、智慧零售
- V2i 智慧路口 DSRC 整合

- **APP in demand**
- **Smart Retail**
- **V2I & DSRC**

- **Successful NRTK GPS operation**
- **LiDAR & Infrastructure testing**
- Combined with Public Transportation
- Last Mile **connection**

2017/07

2017/08

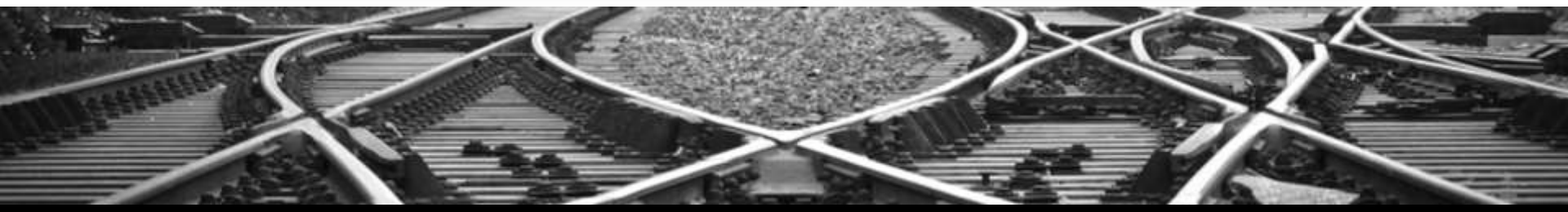
2017/11

2018 ~



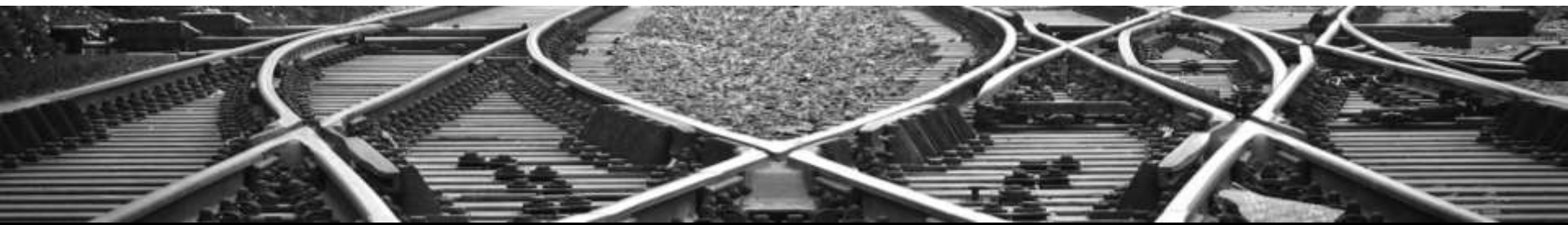
Challenge Of Future City – **Mobility**

	人口	地鐵	Ridership	每公里 乘客	公共運輸 人口使用率
香港	734萬	231 KM	5,490,141	23,767	74%
東京	1361萬	326 KM	9,845,070	30,200	72%
首爾	2400萬	331 KM	7,436,620	22,467	31%
上海	2418萬	637 KM	9,580,282	15,040	40%
巴黎	1100萬	214 KM	4,225,352	19,745	38%
台北	650萬	145 KM	2,601,408	17,941	40%





Smart City Shared Mobility Powered by Green Energy



Intelligent Transportation driven by AiOT :

Developing A Smart Transportation System for Urban & Rural Connection

Mega City

Checkerboard
Smart Lane System



Smart Eco-Town

Shared & Connected
Green Transportation



Sharing Green Mobility in Town !

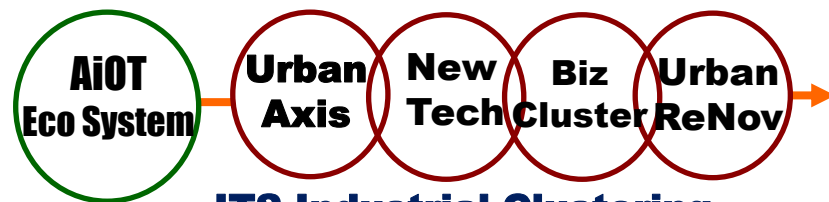
共享智慧接駁帶來城鎮新視野



AiOT Smart & Connected Eco-System :

Developing International Innovation Incubator

Urban Renovation accelerated by Driverless Tech. & Smart Connection



ITS Industrial Clustering to be AiOT Eco-System

AiOT Smart Connection Applications & Scenarios

Driverless Bus Connection Service

Closed Campus

Smart Connection Door2Door Limited Area

Point to Point

Future Network Smart Checkerboard Smart Bus Lane

City Pipeline



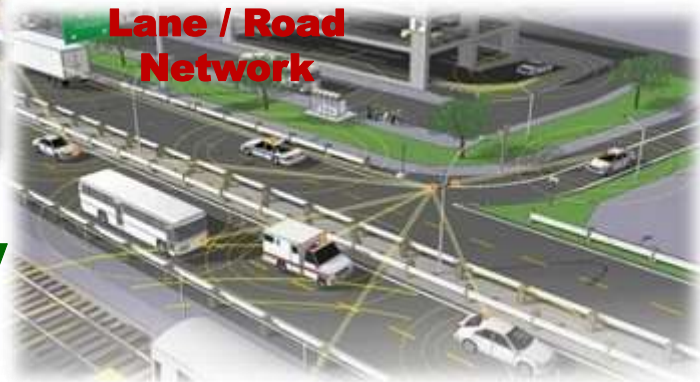
PTS Connection

First -Last Mile



Efficient First-Last Mile Connection

Smart Checkerboard Lane / Road Network



Shared & Connected Mobility

Checkerboard Network & Smart Platform



City Probes for Traffic & Security

Future Asia – Who will Operating This?

Smart Roads for Autonomous Vehicle

INTRODUCTION OF FULLY AUTONOMOUS SAE LEVEL 4-CAPABLE VEHICLES

NEXT SMART Sharing Services

EBIKES

ELECTRIFIED VEHICLE POPULATION INCREASES

AEV Bus Fleets as Future Infrastructure

CROWD-SOURCED, DYNAMICALLY-ROUTED SHUTTLE SERVICE

V2G/G2V Management

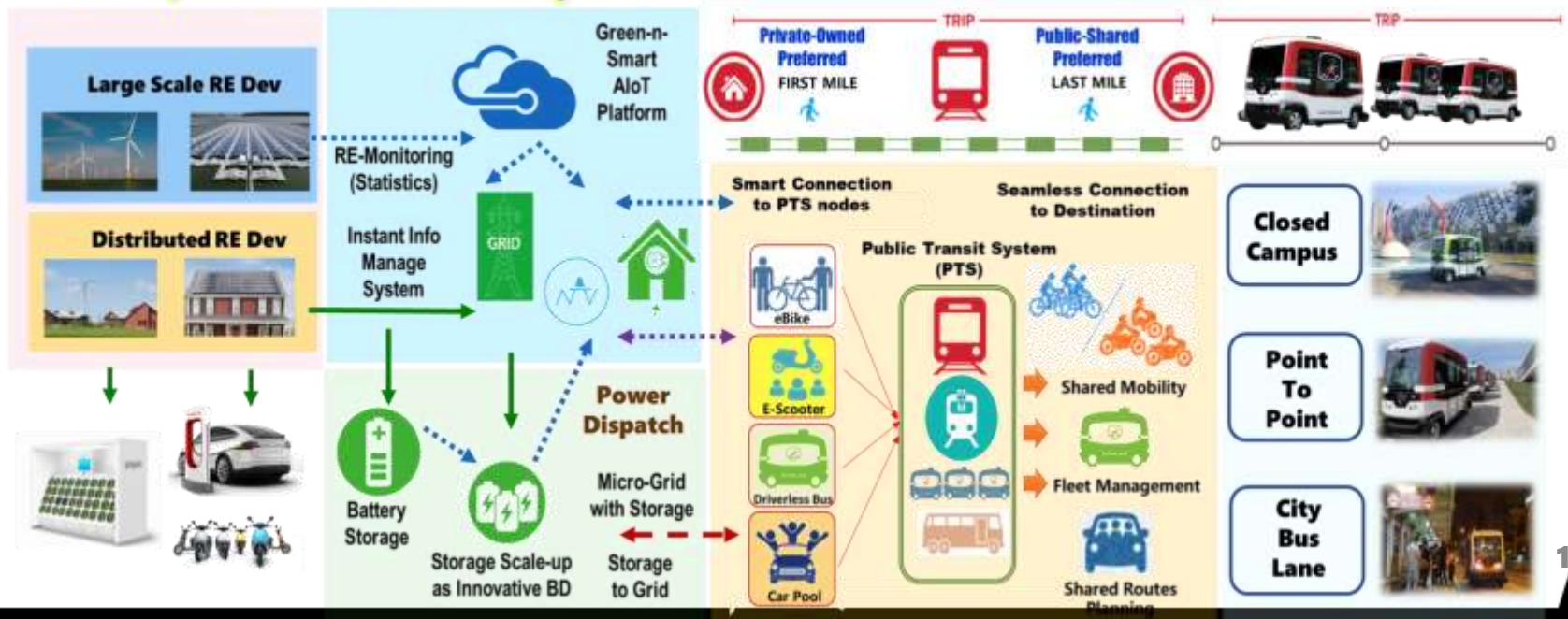
WIPELESS

Renewable Energy Development

Smart Grid Distributed System

Shared & Connected Mobility

Autonomous Fleets as Smart Mobile System





共享接駁自動駕駛系統

Shared & Connected System

自動接駁的系統
Bus No Driver



虛擬軌道的捷運
Metro no Rail

應用情境



封閉
園區接駁車

Closed Campus



短程點對點運輸
〈專用道〉

Point to Point



市區接駁路網
〈專用道〉

City Bus



Phases of Smart Mobility Development

Phase I

Closed Campus

Industrial Park

School Campus

Theme Park



Phase II

Rural Area

Countryside Routes

Suburban / Local
Connection

Remote Sites
Corridor Service



Phase III

Smart City

City Bus Lane

Community
Commuting

Rapid Transit
Connection

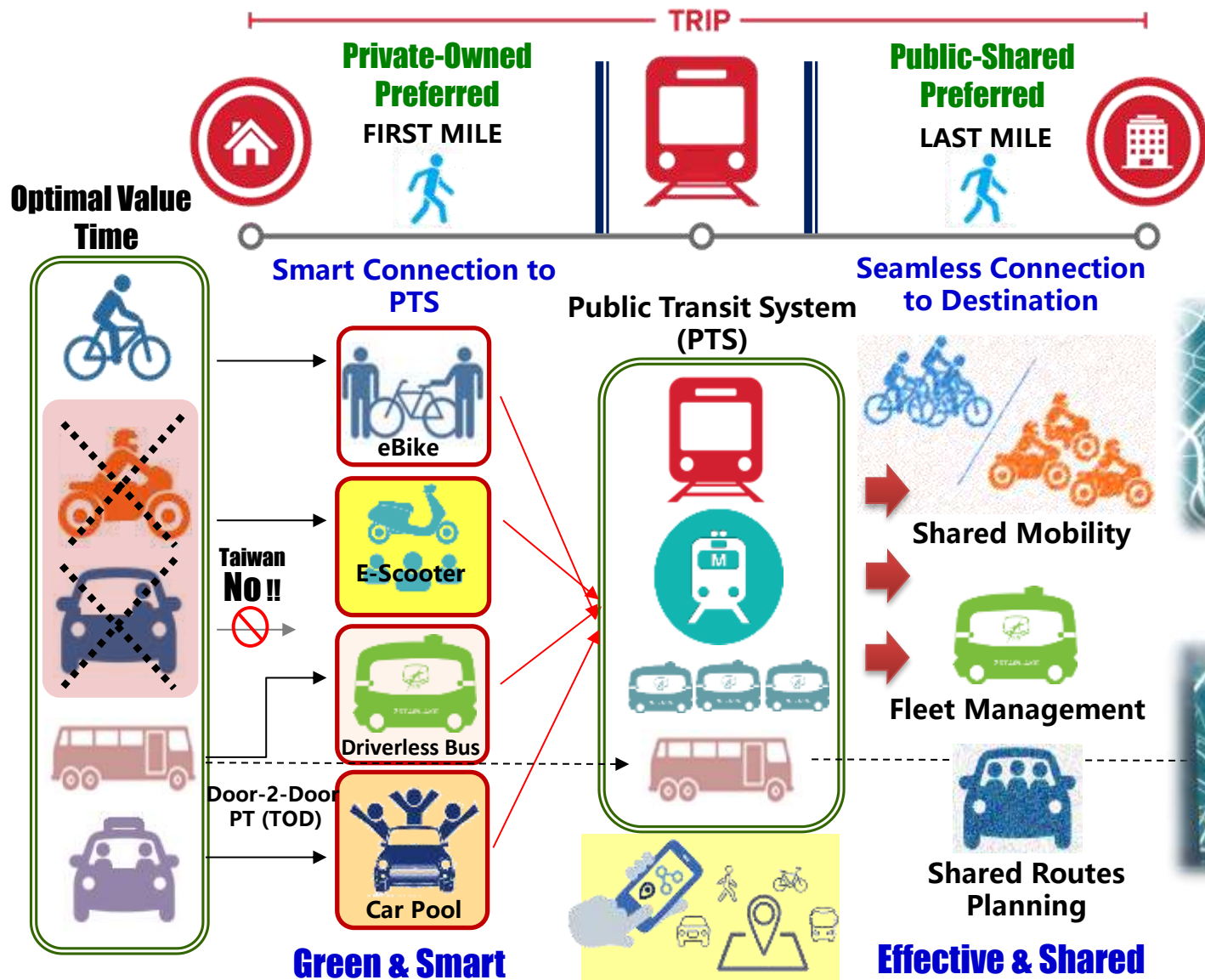


2. Smart Connection Development



Shared & Connected Mobility

ITS for Transit-Oriented Commuting



Smart Mobility Assistant



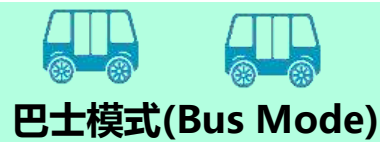
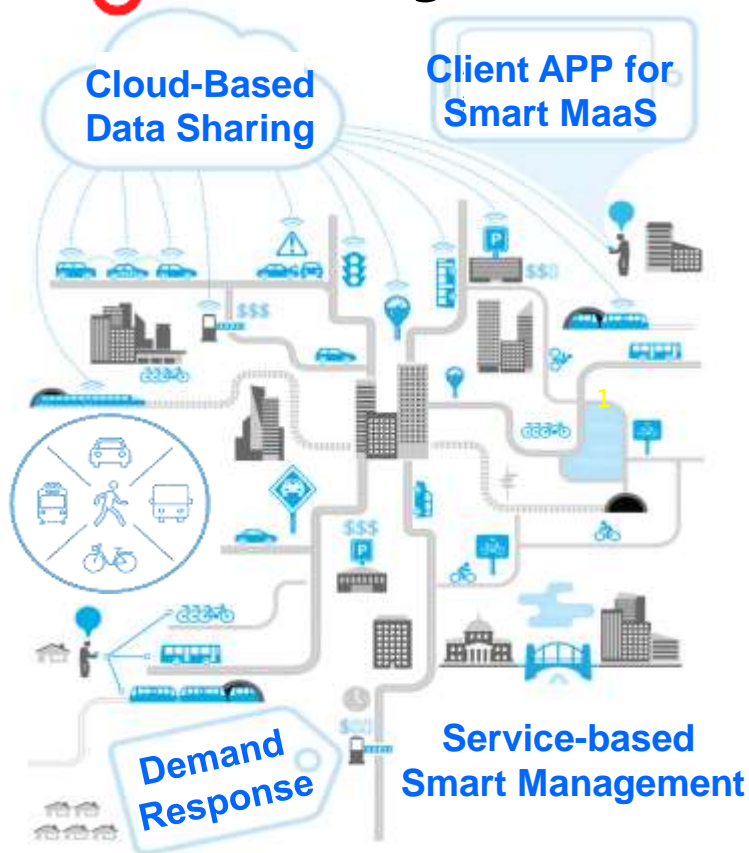
Smart Connection Wizard



ITS Operation Center



Shared & Connected Mobility



Smart Connection Scenarios



Synergy Scenario: Shuttle + Logistics





Roadmap of Shared & Connected Mobility (e.g. Green EV Shuttle)



**Route
Optimization**



Integrating Public Transit and Multiple Modes of Transportation

Enhancing IT-based Operation Platform to
Develop Seamless & Smart Connection of
Multiple Transportation Modes

Goal: Smart Dispatch for Best Leveraging Capacity



Introducing EV Shuttles for Institutes (e.g. Hospitals)

Redundant Investment with Uneven Capacity
Longer ROI and Slower Emission Mitigation

Goal: Improving Efficiency and Air Quality



Smart Sharing of EV Shuttle

Optimizing Shuttle Routes and Sharing Capacity
(of Shuttle Fleets) to Increase Investment
Benefits + Reduce O&M Costs of Green Shuttle

**Goal: Develop AI-supported Smart Operation
Platform to Improve Efficiency**



Operating Autonomous Shuttle in Smart Connection

Exploring New Connection Models
based on Autonomous EV Shuttle;
Developing AEV Operation Platform

**Goal: Smart Dispatch for Best
Leveraging Capacity**





Phases of Smart Connection Development

Phase I

Closed Campus

Industrial Park

School Campus

Theme Park



Phase II

Rural Area

Countryside Routes

Suburban Connection

**Remote Sites
Corridor Service**



Phase III

Smart City

City Bus Lane

Community Commuting

Transit Stop Connection






3. How to Adapt Self Driving Bus into Public Transport

Kaohsiung Self Driving Bus Plan:
Last Mile Connection of Tram & Metro





Kaohsiung Self- Driving Bus Plan

Area	Phase 1 Pier-2 Art Center	Phase 2 Hama Star Park	Phase 3 Asia's New Bay Area
			
Time	2017/June /7 th ~8 th	2017/October/1 st ~10 th	2017/Nov/6 th ~30 th
Feature	Passenger self- driving bus / bike	Passenger self- driving bus / tram	Passenger self- driving bus/bike
Route full length	Inside the park / 250m	Closed area/400m	Inside the park /1000m
Speed	5~7 KM / Hour	Up to 15 KM / Hour	Up to 15 KM / Hour
Goal	test run/test ride	test run/test ride	test run/test ride
Operation Tim / Ridership	2 day/300 passenger	10 day/3530 passengers	25 day/EST 5530 passengers





Phase 1: Pier 2 Art Zone – Future Street

KAOHSIUNG



THE PIER-2
ART CENTER
駁2藝術特區



Self-driving shuttle



 紅毛港駁二登船處
Hongmaogang Boarding Area

 捷運站
Kaohsiung Mass Rapid Transit



Phase 2: Hama Star Railway Park (2017 Oct. 10 Days)



President Tsai with EZ10



EZ10 passes the tram tack



EZ10 Cross Road



Phase 3 : Asia's New Bay Area

Tram C7 ~ C8 Station

Kaohsiung
Port
Terminal(unde
r construction

City
library

Kaohsiung
exhibition
center

China Steel
HQ

MLD

Softwar
e Park

**Tram C8
Kaohsiung
exhibition
center station**

**Tram C7
Software
park station**





Complete Network of Metro



4. Shared Mobility & Logistics: Changhua Green Corridors



Solar-Roof Bike Corridor @ Highway (Korea)

Changhua Offshore O&M Base Shared Mobility & Logistics



(Metro Mode)

(Bus Mode)

(On Demand Mode)

**O&M Harbour
(for Offshore Wind)**

**Ribbon King
(Tourism Factory)**

**Brand's Museum
(Tourism Factory)**

**Hospital B &
Commercial Area**

**Industrial Base
for O&M 15ha**

**Industrial Base
for Green Energy
Eco-System**

128.77 ha

ARTC

Taiwan's Vehicle
Testing Ground



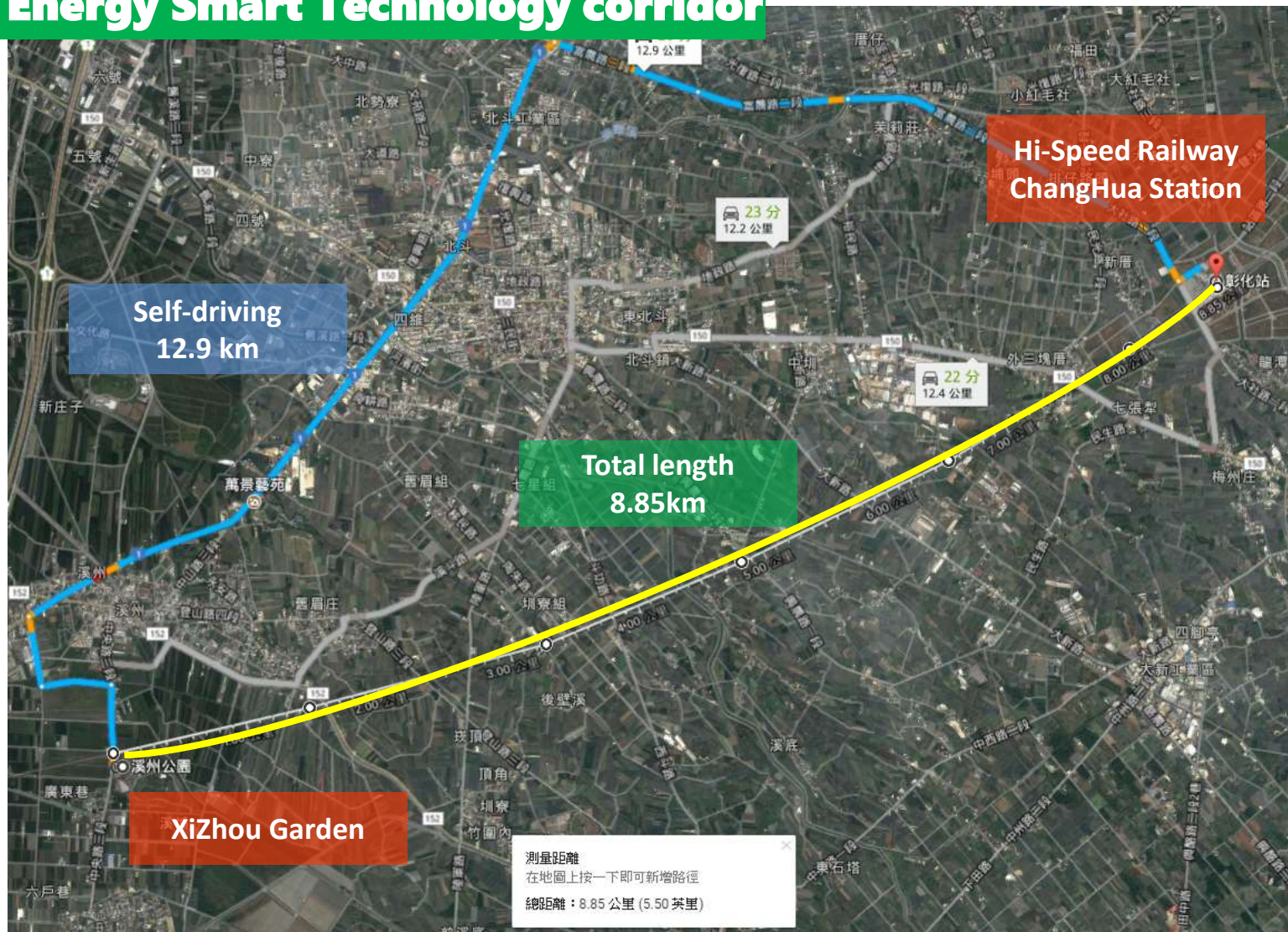
Solution



Synergy Scenario: Shuttle & Logistics

ChangHua Station – XiZhou Garden

Green Energy Smart Technology corridor





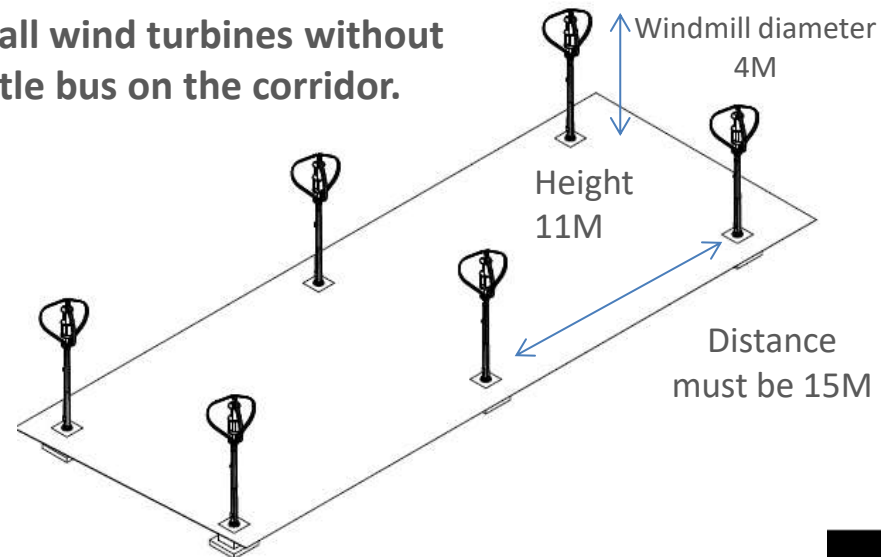
Green Energy & Autonomous Bus

Hi-Speed Railway Changhua Station to XiZhou Garden is the best way to create as the green energy smart corridor. This corridor is about 8.7KM.

Complementary type LED street lamp with wind and light power



Set up the verticality small wind turbines without noise and no driver shuttle bus on the corridor.



5. Data Driven Mobility On Demand



Data-Driven Service Analysis System

Example : Data From Taipei Night Shuttle Project



The Acceleration Record.

- **Size : Value of data**
- **Pin Point : Location**

Humidity v.s Time

Temperature v.s Time

Acceleration v.s Time

Power BI : < [Link](#) >



移動中行駛位置



靠站時位置

On Demand & Ticketing System



AI Retail – New Digital Experience



Digital integration

1. Sensor : Digital quality of shopping area
2. Camera: Traffic management
3. Wifi: Digital enviroment

APP reservation



1. EZ10 reservation
2. Bus schedule info
3. Accessible space reservation
4. Digital payment

EZ10 operation



Smart retail

1. AR marketing info
2. Beacon for location & info of stores
3. LCS promotional ads





Reservation On-Demand Service



Vision-based Ticketing / Service Monitoring System



Real Time Capacity Monitor



Online Service Ticking System



On Demand & Ticketing System

iPASS, iCASH, EASYCARD



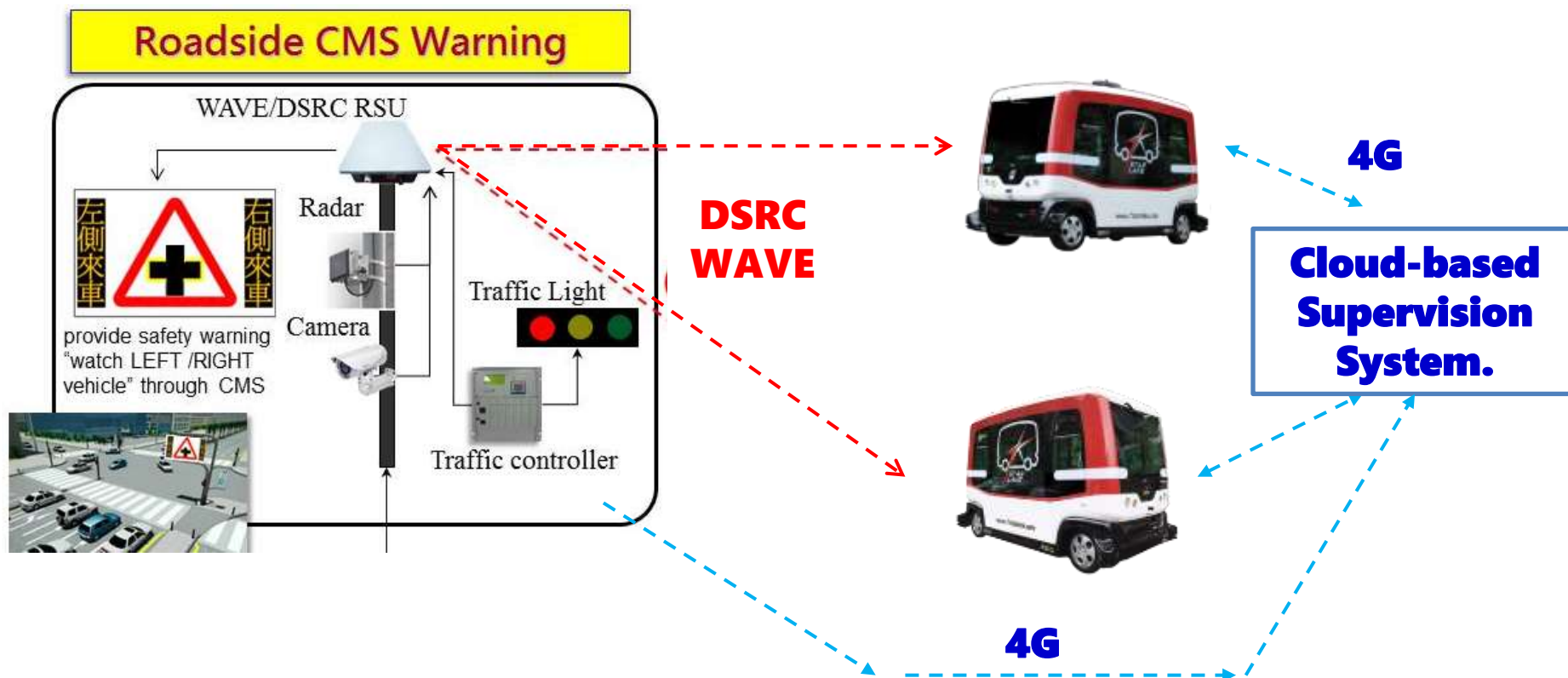


6. Smart Street & Future Platform V2i in Traffic Light Integration



Taipei Self Driving Bus Plan *Phase II*

V2i in Traffic Light Integration



Intelligent Transportation

V2I

1 TRAFFIC LIGHT

Audi Traffic Info Online – Cars communicate with traffic lights

Sensing / V2X

2 BIKE

Safe and quick ride through the city



Sensing / V2X

3 PEOPLE / SMART PHONE

Convenient access to all modes of transportation

V2I / V2X

4 PUBLIC TRANSPORT

Online timetable with all connections available in real-time



5 SMARTSHUTTLE

Constant traffic flow with Car-to-X and Car-to-Car communication



Cloud / V2I

6 TRAFFIC COMPUTER

Mastermind of a perfectly networked traffic system





1

Sensors

2

**Real Time
Service
Supervision**

3

**Vehicle
Status Log**



**On-Demand
Service**



**Predictive
Maintenance**

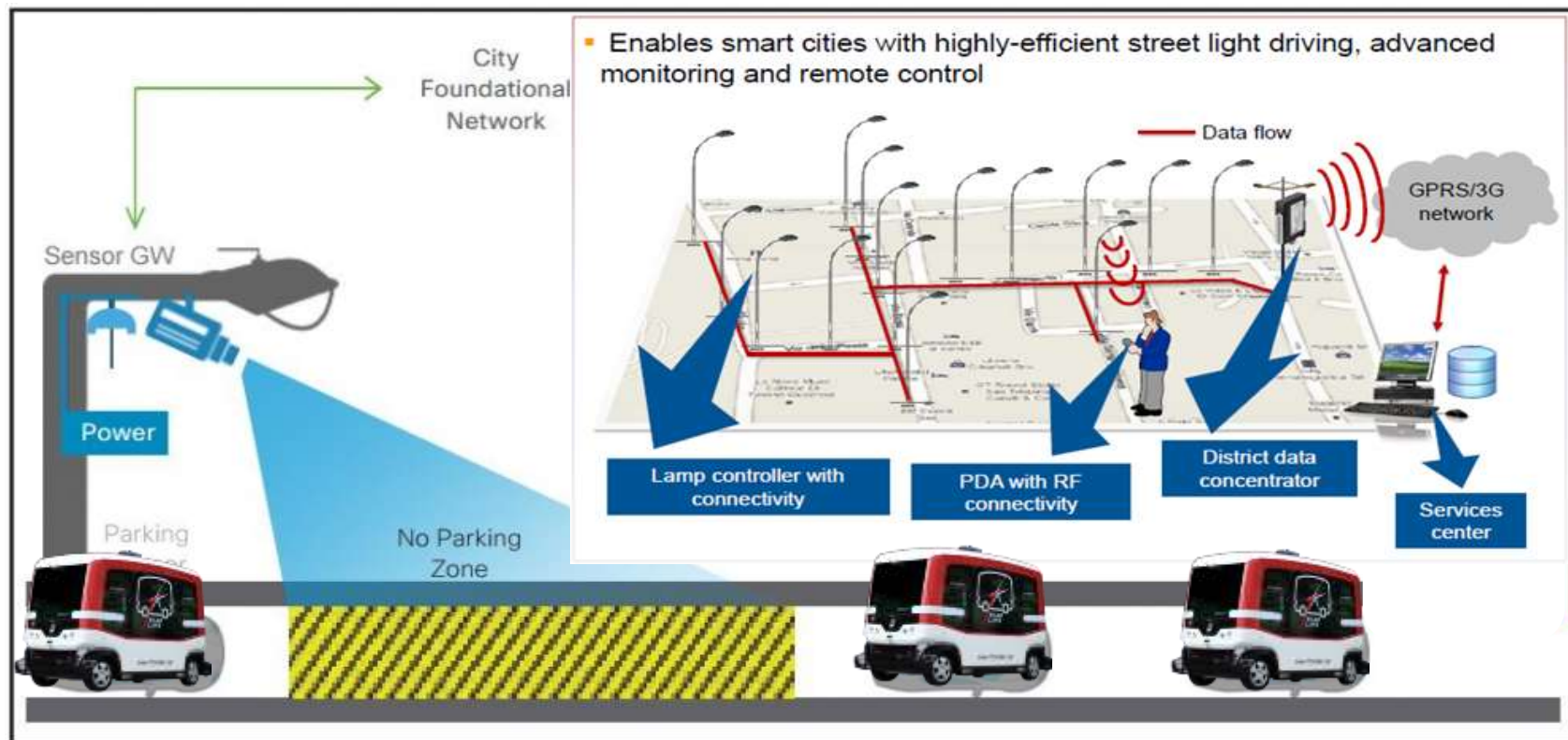
**Fleet
Management**



**Smart
City
Probe**

Smart Street

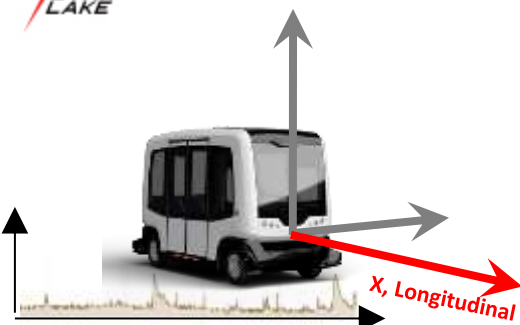
- **Smart lighting:** Sensor 、 CCTV Surveillance 、 WiFi to build up smart street.
- Sensor: smoke, temperature, humidity, CO2 changing, area environmental quality
- Surveillance: People, Traffic monitoring , Law Enforcement
- Data Stream:, Digital Environment for Data Economy .



Next Step : V2i Traffic Light & Crossroad



IOT by IMU



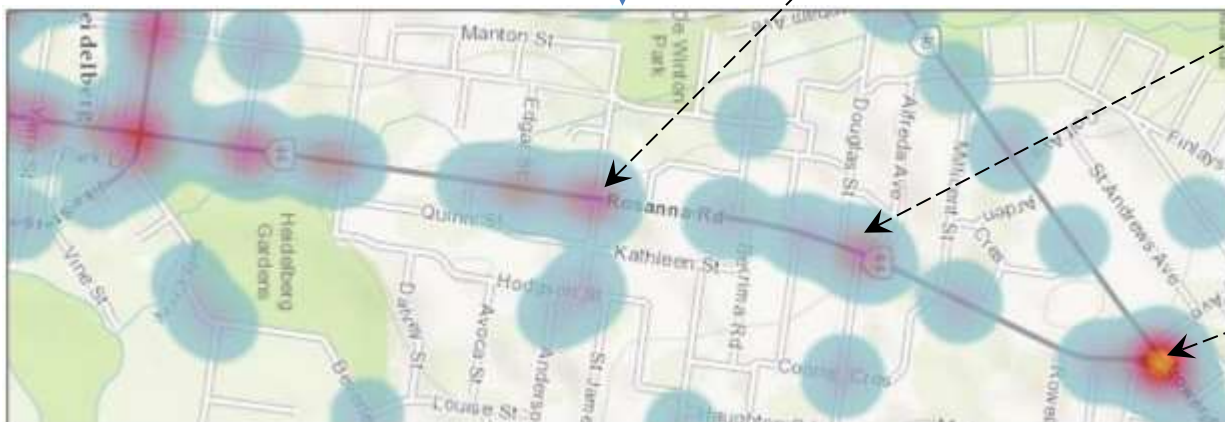
Brake Monitoring

Location Tracking



IoT Hub

Heat Map for Hazard



Potential Hazard Zone identification

Use the longitudinal acceleration to identify where the emergency brake or anti-collision triggered often.



Typical Hazards

City Probe



Hazard Type / Hot Zone
交通尖離峰

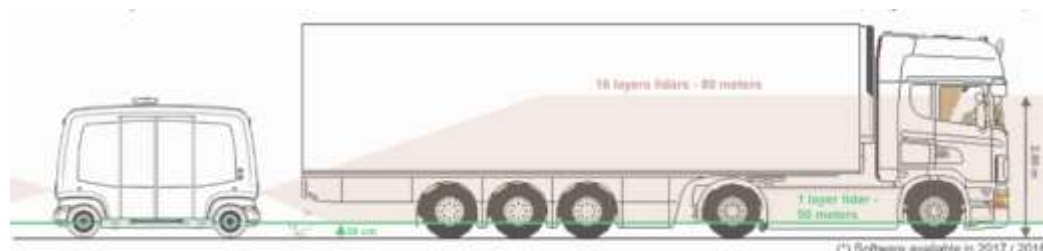


Road Degradation

基礎建設



Surrounding 環境公安



(*) Referrals available in 2013 + 2014

Future Platform

- 1.1 Shared Mobility
- 1.2 Smart Platform
- 1.3 Fintech
- 1.4 Experience Economy



**Service
Operation Center**

Business Intelligence



**Infrastructure
Info**

**Fleet & Scheduling
Info**



User Demand-Oriented Last Mile Development

● Demand Respond :

Call for Shuttle & Emergency Events

● Information + Marketing Content:

Info Board, APP Sharing



Client APP for Smart MaaS



User Demand-Oriented MaaS to Provide Info and Suggestion



Smart AR/VR Marketing

Smart Board



Commercial AD Board



Q & A