

# 自駕車用高精地圖國際研討會

2019 INTERNATIONAL CONFERENCE ON HD MAPS FOR AUTONOMOUS VEHICLE

SMART  
MAPPING  
TECHNOLOGIES  
FOR  
INTELLIGENT  
WORLD



## 2019 Annual Autonomous Vehicle Achievements Manual

### Producer



中華民國內政部  
MINISTRY OF THE INTERIOR, R.O.C. (TAIWAN)



MOST 科技部  
Ministry of Science and Technology



國家發展委員會  
NATIONAL DEVELOPMENT COUNCIL



DOIT 經濟部技術處  
Ministry of Economic Affairs



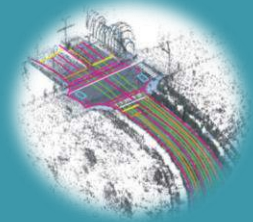
中華民國交通部  
MINISTRY OF TRANSPORTATION AND  
COMMUNICATIONS R.O.C.



HIGH DEFINITION MAPS  
RESEARCH CENTER  
高精地圖研究發展中心

### Advisor

BOST 行政院科技會報  
BOARD OF SCIENCE AND TECHNOLOGY, EXECUTIVE YUAN



## Fingerprint Base Map



The slide features the Civil Maps logo at the top left. The title 'Fingerprint Base Map™ and Localization' is centered in a large, orange font. On the left, a 'FEATURES' box lists: 500 KB - 1 MB per km², LIDAR Agnostic, OTA Map Update, Highly Scalable, Arm® Compatible, Simple Integration, Low BOM, and Patented Technology. On the right, a 3D visualization of a road with colored point clouds (green, red, blue) represents the fingerprint data. A legend at the bottom left of the image shows 'All Fingerprints' as green squares and 'Matched Fingerprints' as red diamonds. The bottom right includes the website 'www.civilmaps.com', the email 'info@civilmaps.com', and a QR code.

**Civil Maps**

### Fingerprint Base Map™ and Localization

**FEATURES**

- 500 KB - 1 MB per km²
- LIDAR Agnostic
- OTA Map Update
- Highly Scalable
- Arm® Compatible
- Simple Integration
- Low BOM
- Patented Technology

All Fingerprints  
Matched Fingerprints

www.civilmaps.com | info@civilmaps.com

**Civil Maps'** Fingerprint Base Map, offers a robust, scalable and precise solution for autonomous vehicle mapping and localization that forms part of the company's HD map. The base map can perform in challenging weather situations as well.

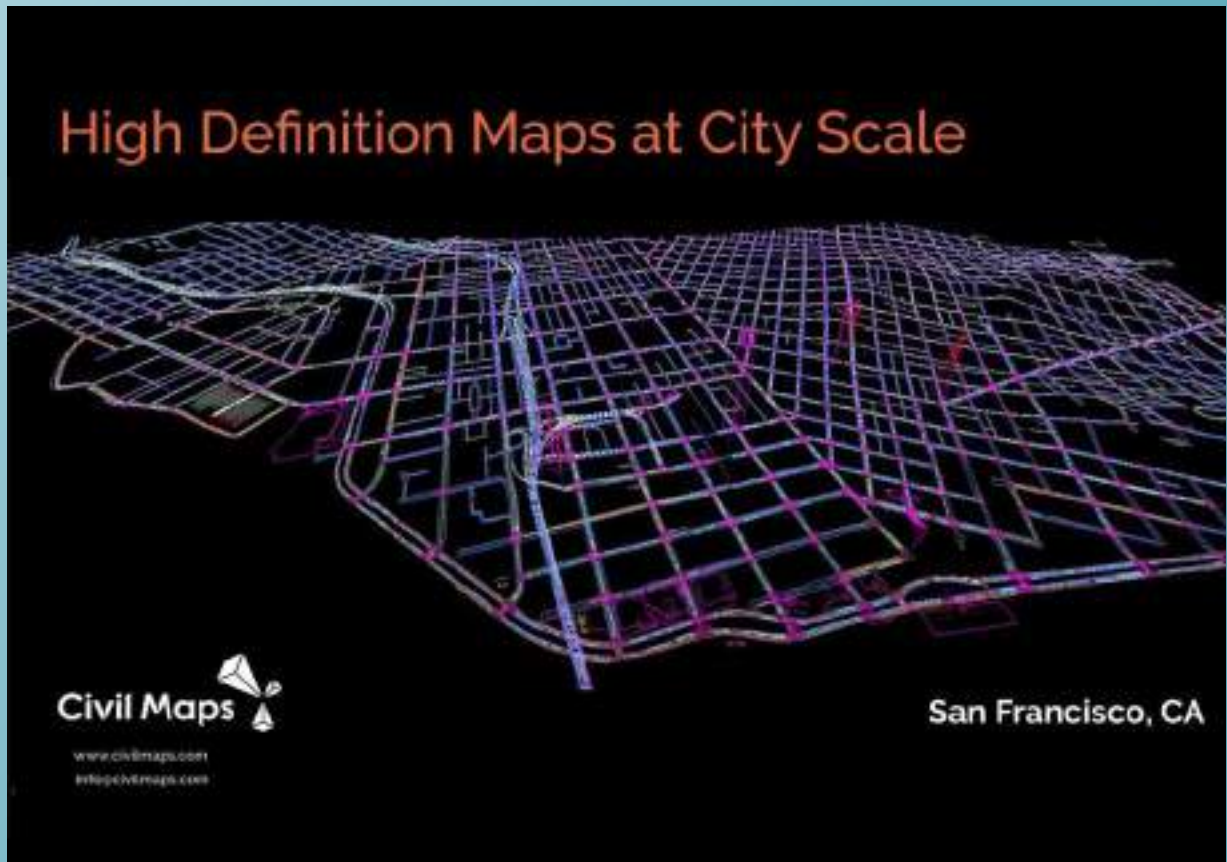
### Civil Maps

Address: 2720 Taylor St #320, San Francisco, CA 94133, United States

Tel : +1 (415) 812-7648

<http://www.civilmaps.com>

## HD Map at City Scale



**Civil Maps** utilizes highly scalable and patented technology to deliver city scale high definition maps, with 15-20 cm absolute accuracy and 1-5 cm relative accuracy.

### Civil Maps

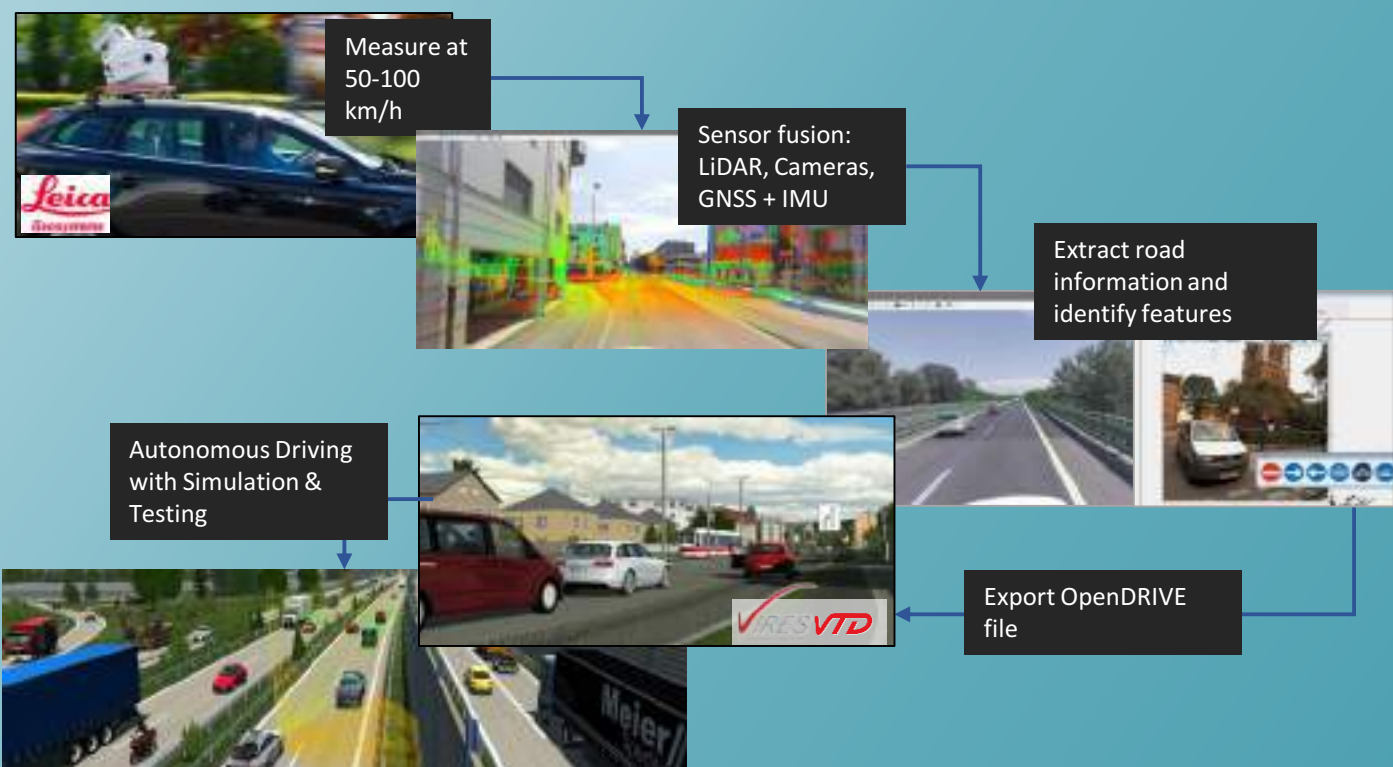
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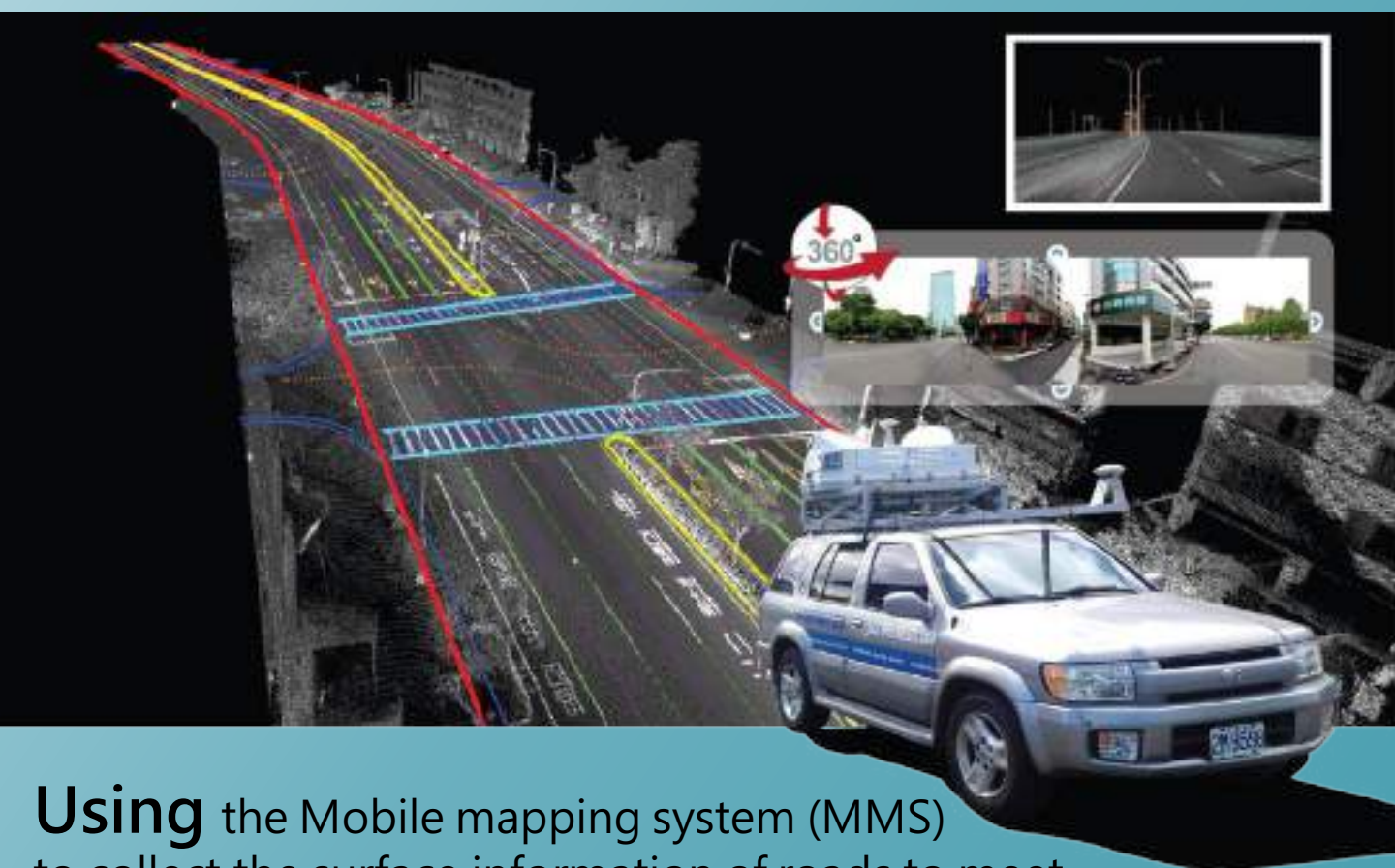


## HD Maps Bridging Autonomous Simulator (OpenDRIVE Format)



**Bridging** HD Maps and autonomous Simulator by OpenDRIVE , start from collect point cloud by LIDAR , extract information and produce OpenDRIVE format , import it to simulator like VIREX VTD to streamline the feasibility and accuracy for ADAS design and self driving testing .

## HD map production with autonomous vehicle



**Using** the Mobile mapping system (MMS) to collect the surface information of roads to meet the standard which the absolute precision better than 30 cm and relative precision better than 10 cm. Moreover, some necessary metadata including centerline, nodes, and vectors of the lane, and marked lines, signs, crosswalk could be extracted from point cloud to produce high-resolution maps.

**Chung Hsing Surveying Co., Ltd.**

No.159, Zhongren St., West Dist.,  
Taichung City 403, Taiwan (R.O.C.)  
886-4-22242788

[www.chsurvey.com.tw](http://www.chsurvey.com.tw)



中興測量有限公司

專業。誠信。服務

# Autonomous Driving

Industry

Government

Academia

No.

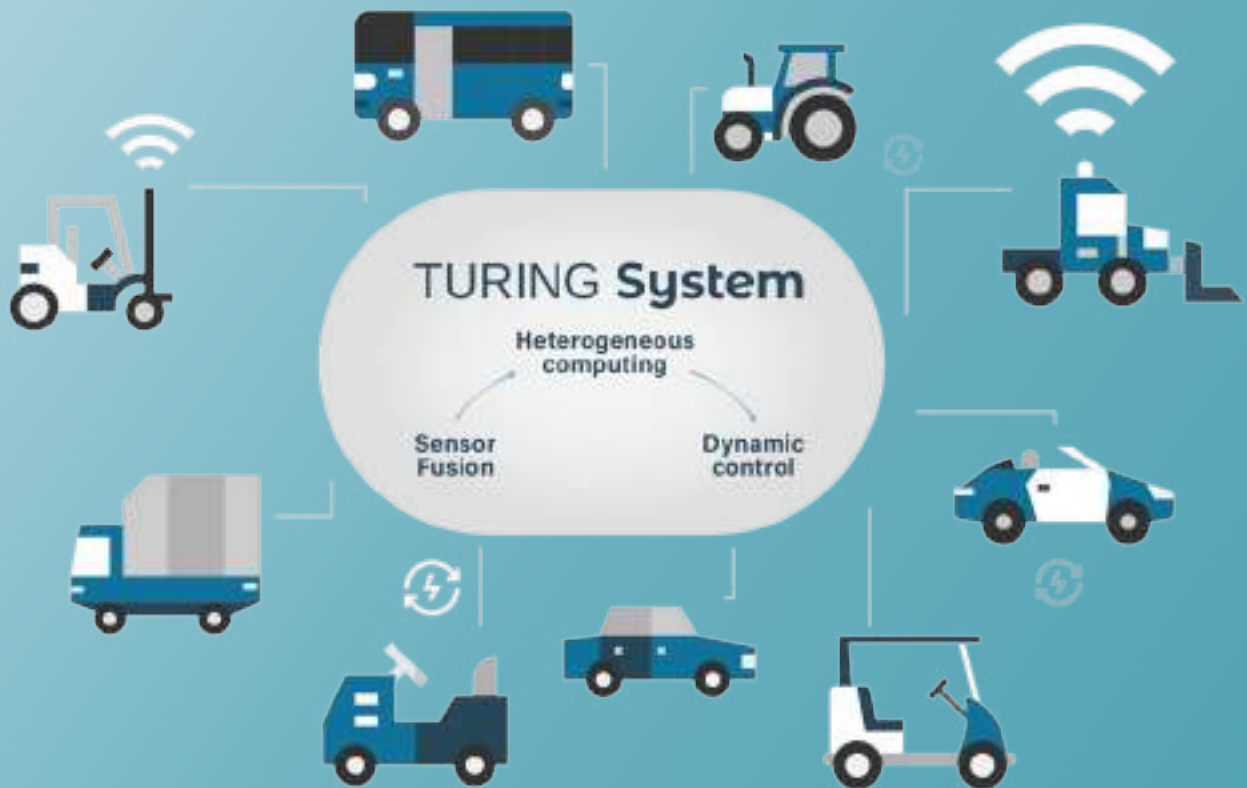
Sensing

Control

Planning

Others

## Autonomous Driving System



**TURING DRIVE** aims to develop the core autonomous driving technologies. Turing has mastered the three key factors of autonomous driving: sensor fusion, heterogeneous computing and dynamic control.

The fusion of multiple sensors allows the self-driving system to precisely perceive the environment, ensuring vehicle stability and safety. Turing has been applying its solutions to a variety of passenger cars and commercial vehicles.

**Turing Drive Inc.**

Tel : 02-27066918

Web : <http://www.turing-drive.com/>

Address : 4F., No. 97, Sec. 4, Chongxin Rd., Sanchong Dist., New Taipei City 241, Taiwan (R.O.C.)





## All-Round Lidar Application

### ◆ Mobile Mapping System



● Laser Scanner



● Panoramic Camera



● POS/INS



Hi-Res. Point Cloud



Vector Map



Panoramic image



Vessel



Railway



### ◆ Airborne Lidar Systems



UAS

AGL:~100m



Helicopter

AGL:~1,000m



Aerial Survey

AGL:500m~3,000m



Official



Video

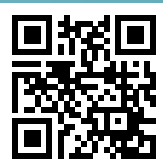


Page



自強工程顧問有限公司

Strong Engineering Consulting Co.,Ltd.



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New Taipei City +886 2 2225 2200  
<http://www.strongco.com.tw>

# Autonomous Driving

Industry

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Sensing

Control

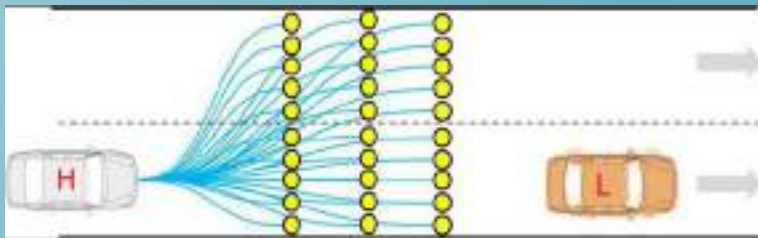
Planning

Others

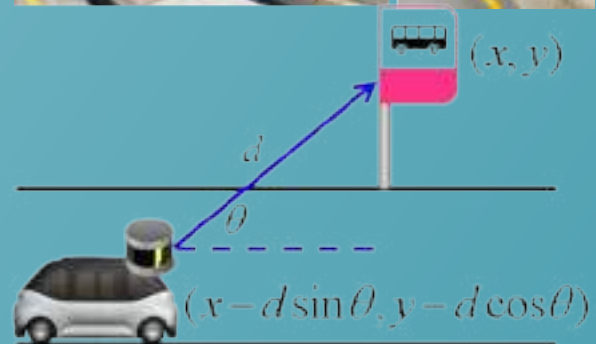
## Applications of HD Maps on Autonomous Driving



感知



決策與控制



定位

ARTC has utilized HD maps on the applications of autonomous driving. The features and attributes on the HD maps are used to facilitate the perception, localization, and decision and control of the vehicles. Based on the HD maps, the autonomous driving has been realized.

### Automotive Research & Testing Center

Address : No.1, No.6, Lugong S. 7th Rd., Lukang, Changhua County 50544, Taiwan (R.O.C.)

Tel : +886-4-781-1222

Mail : [service@artc.org.tw](mailto:service@artc.org.tw)

Web : <https://www.artc.org.tw>





# Proving ground

Industry

Government

Academia

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Sensing

Control

Planning

Others

## Taiwan CAR Lab



**Taiwan CAR Lab** is 1.75 hectare. Simulating the low road speed of 0-30 km/h in Taiwan in its design, it offers self-driving small vehicles or medium buses to conduct various tests of mixed traffic flow in its closed field. Targeting at the key procedures of self-driving: "perception", "decision-making" and "control" to have a comprehensive examination, it provides evaluation reports for contractors as references to conform to the "Act for Autonomous Vehicle Technology Innovations and Experiments" in the future.

### National Applied Research Laboratories Taiwan CAR Lab

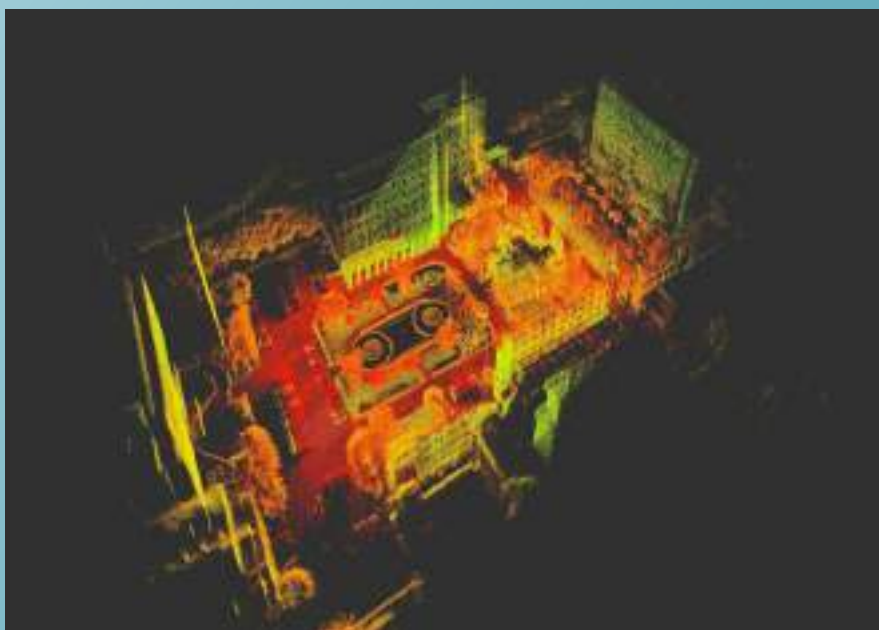
No. 2, Guiren 13th Rd., Guiren Dist., Tainan City, Taiwan

(06) 06-3032-868

<http://taiwancarlab.narlabs.org.tw/>

**NAR Labs** 國家實驗研究院  
National Applied Research Laboratories

## HD Maps for autonomous driving



**The first HD map** that meets the needs of the NVIDIA system has been applied to self-driving cars. Kingwaytek technology collects map data and satellite imagery via a mobile mapping system. Also the mobile mapping system can do field measurements and use AI to distinguish traffic signs, road traffic marking, and traffic images. Through the cloud processing capability, uploading high-definition images with high-efficiency and establishing HD maps for autonomous cars with centimeter-level accuracy. It greatly improves the correctness and efficiency of the self-driving system and removes the load for the system to discriminate distinguish a lot of confusing information.

**Kingwaytek Technology Co.,Ltd.**

4F, No.100, Sec.2, Roosevelt Rd., Taipei 10084, Taiwan

Tel: (02)23635445

<http://www.kingwaytek.com.tw/>





# Planning System

Industry

Government

Academia

No.

Sensing

Control

Planning

Others

## Autonomous driving based on connected System



**Kingwaytek technology** built planning systems for autonomous cars. The planning system combines with our HD map, integrating the AI planning system and telematics services to develop a telematics platform for autonomous cars that realizes automatic navigation planning. There are lots of sensors in our autonomous cars for verification. Our services of telematics operation platform in our cars include audio-visual entertainment, voice control and multi-application information, which allows drivers to really enjoy their time and feel at ease in our autonomous cars.

**Kingwaytek Technology Co.,Ltd.**

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<http://www.kingwaytek.com.tw/>



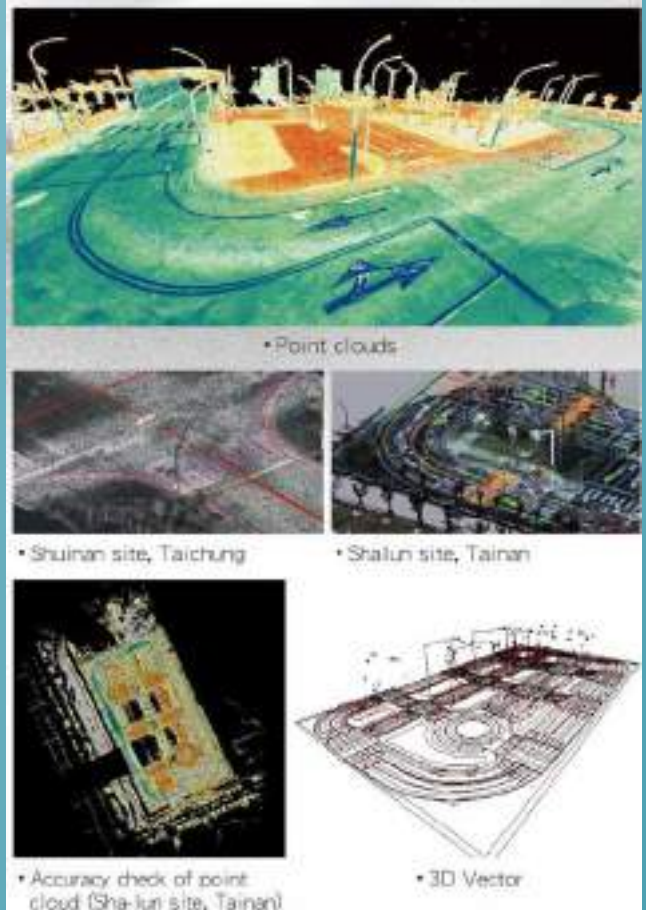


## High Definition Mapping

### LiDAR System



### The Production of HD mapping



### Mapping Process



High definition map is critical element for autonomous driving system that can be considered as the guide of unmanned vehicles. We produce high definition maps by using high precision instrument and rigorous method. Our 3D HD map trial conducted in Shalun (Tainan) and Shuinan (Taichung) in 2018 achieved accuracy better than 6 cm. These high definition maps can be used for autonomous car application and improve mapping technology for future self-driving.

Official Website

GEOSAT FB



## HD Maps(OpenDrive)

MMS-RIEGL VMX250

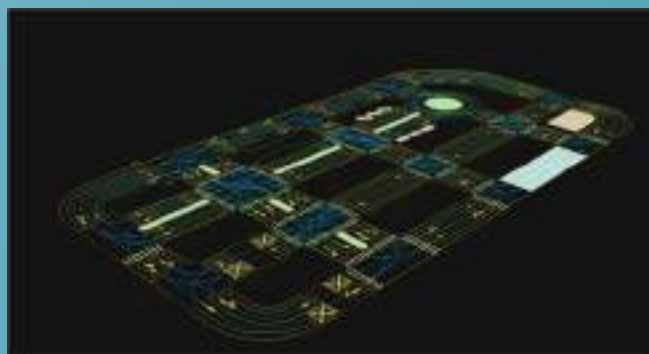
Ladybug

GNSS/IMU

Scanners

Cameras

DMI



**RealWorld** Surveying and Geomatics Corp is a company with OpenDrive experience in Taiwan. High-precision point clouds and images are obtained using a mobile lidar (Riegl VMX-250) and a spherical camera (Ladybug5). Based on our 45 years of mapping experience, we developed mapping technology to generate various HD maps.

**RealWorld Surveying and Geomatics Corp.**

Address : 5F-1, No.159, Sec.1, Xintai 5th Rd., Xizhi District,

New Taipei City, TAIWAN, R.O.C

Tel : +886-2-26439699 <http://www.chuanhwa.com.tw/>



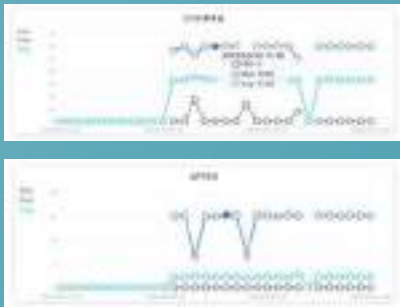


## OCC Platform for Autonomous Vehicles

**OCC platform** collects sensor data from self-driving vehicles with the visualized charts and allows the user to monitor real-time information from the self-driving vehicles like on-map moving location, routed trails, car camera, sensors data, event log etc.

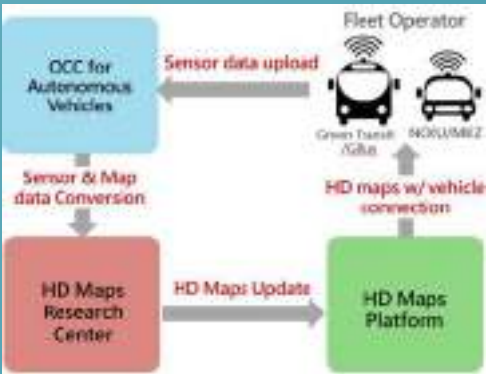


AV Real-time Monitoring System



Sensor Historical Data Charts

The OCC platform can analyze and transmit static and dynamic messages of vehicles, roads, and clouds through low-latency communication mechanisms to establish HD maps to vehicle interface, to sense data sharing and HD maps recycling mode.



For more product information and sales inquiries, please contact

[AVOCC@wistron.com](mailto:AVOCC@wistron.com)  
<https://www.wistron.com/>



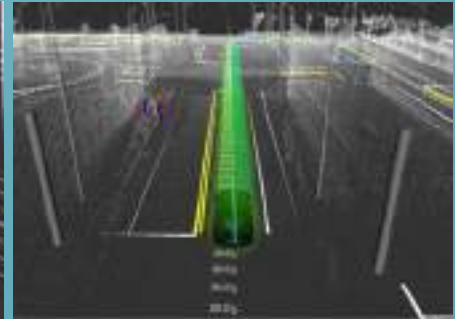


## How to create HD Maps?

### Data Collection

### Data Processing

### Verification



**ThinkTron Ltd.** was established as a joint venture by Japanese company, Kokusai Kogyo Co., Ltd. and Taiwanese company, Sinotech Engineering Consultants, INC. Owing to the combined strength of both, ThinTron Ltd. has finished several HD map of limited areas such as Sha-lun autonomous pilot site, airport MRT, campus and theme park.

There are 3 steps to create HD Maps:

1. Collect road data by Mobile Mapping System.
2. Extract the vector data and adding the required attributes.
3. According to the regulation of MOI, the vector data should be verified. The accuracy must be better than 20 cm in horizontal, 30 cm in vertical.



**ThinkTron Limited**

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**THINKTRON**  
興創知能股份有限公司

日本日亞集團・財團法人中興工程顧問社 合資公司  
Japan Asia Group・Sinotech Engineering Consultants, Inc. Joint venture