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
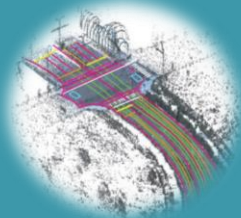
DOIT 經濟部技術處
Ministry of Economic Affairs

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

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

Advisor

B☀ST 行政院科技會報
BOARD OF SCIENCE AND TECHNOLOGY, EXECUTIVE YUAN

Fingerprint Base Map

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.
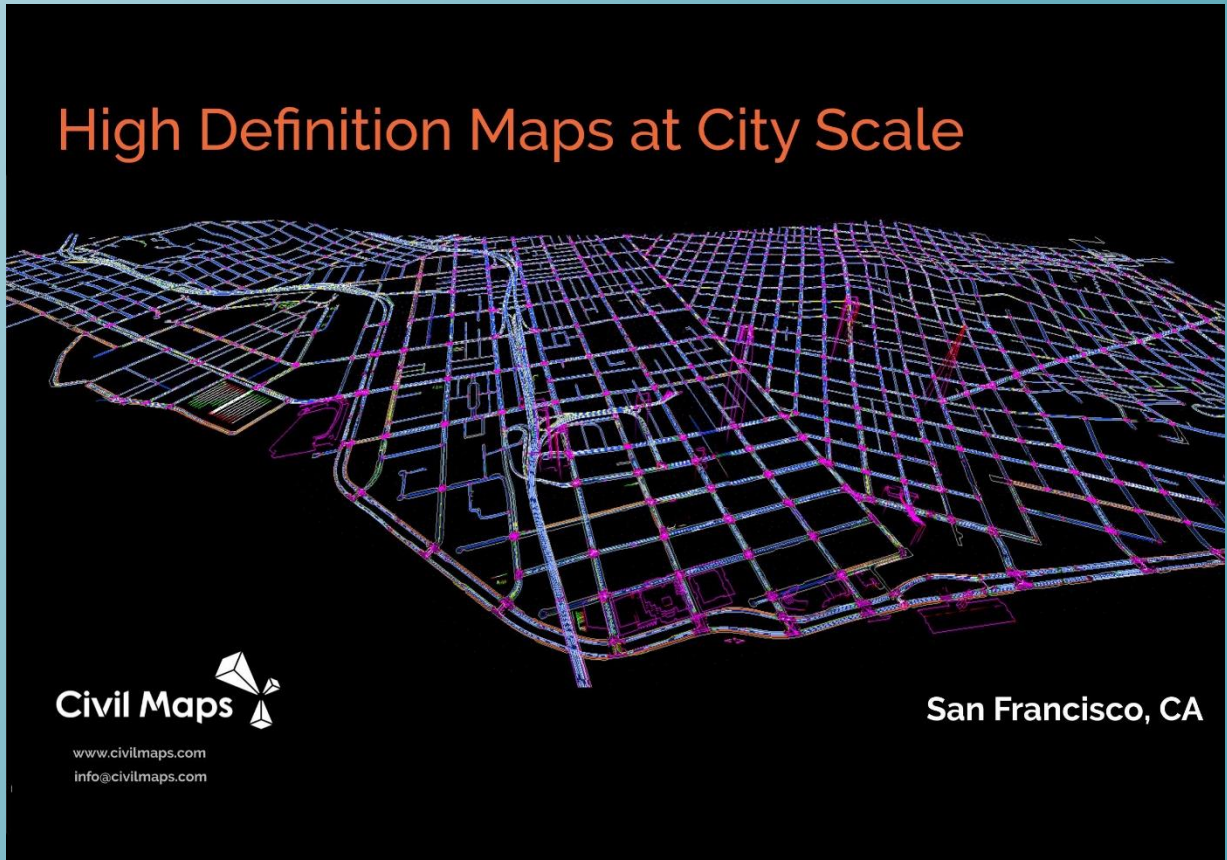
Civil Maps
Address: 2720 Taylor St #320, San Francisco, CA 94133, United States
Tel : +1 (415) 812-7648
http://www.civilmaps.com

HD Maps

Industry | Government | Academia

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
Address: 2720 Taylor St #320, San Francisco, CA 94133, United States
Tel : +1 (415) 812-7648
http://www.civilmaps.com

HD Maps Bridging Autonomous Simulator (OpenDRIVE Format)

Measure at 50-100 km/h

Sensor fusion: LiDAR, Cameras, GNSS + IMU

Extract road information and identify features

Autonomous Driving with Simulation & Testing

Export OpenDRIVE file
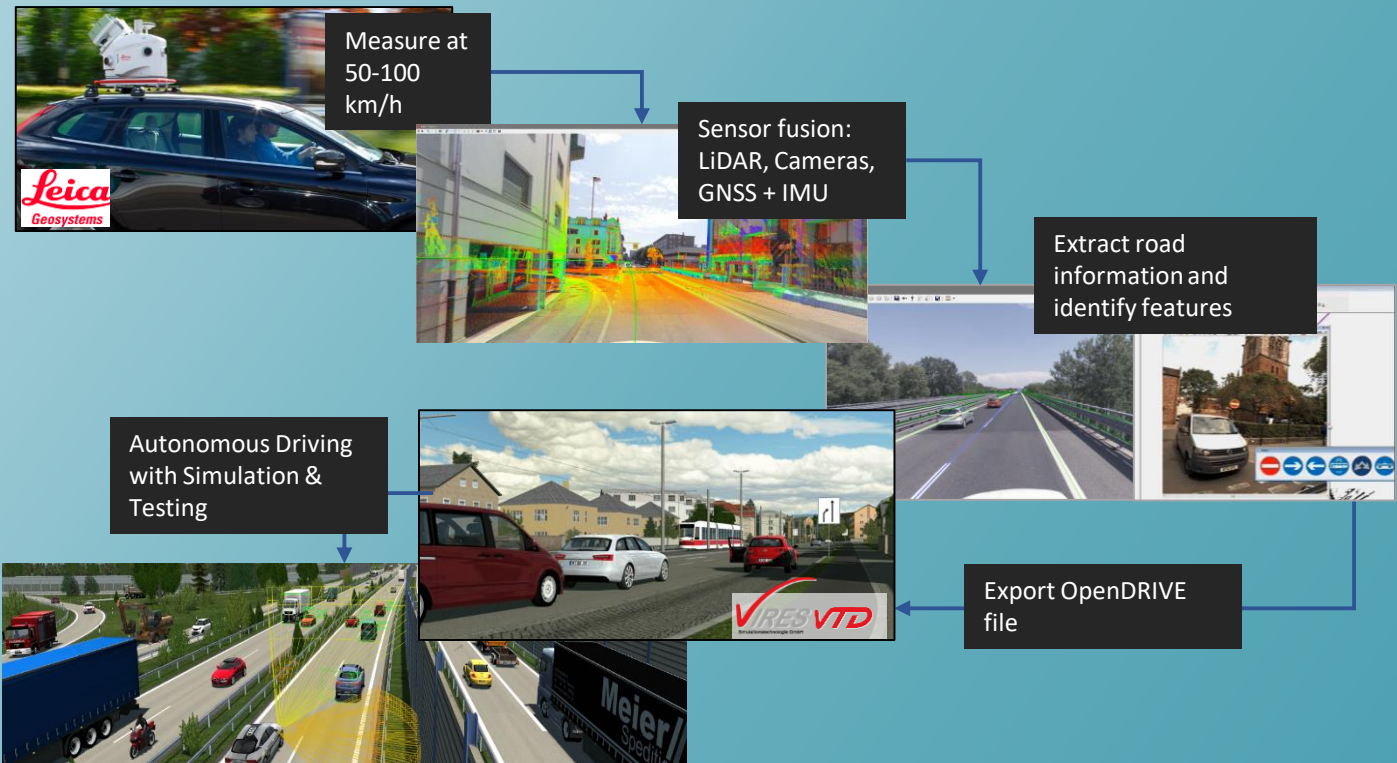
Bridging HD Maps and autonomous Simulator by OpenDRIVE，start from collect point cloud by LIDAR，extract information and produce OpenDRIVE format，import it to simulator like VIRES VTD to streamline the feasibility and accuracy for ADAS design and self driving testing。
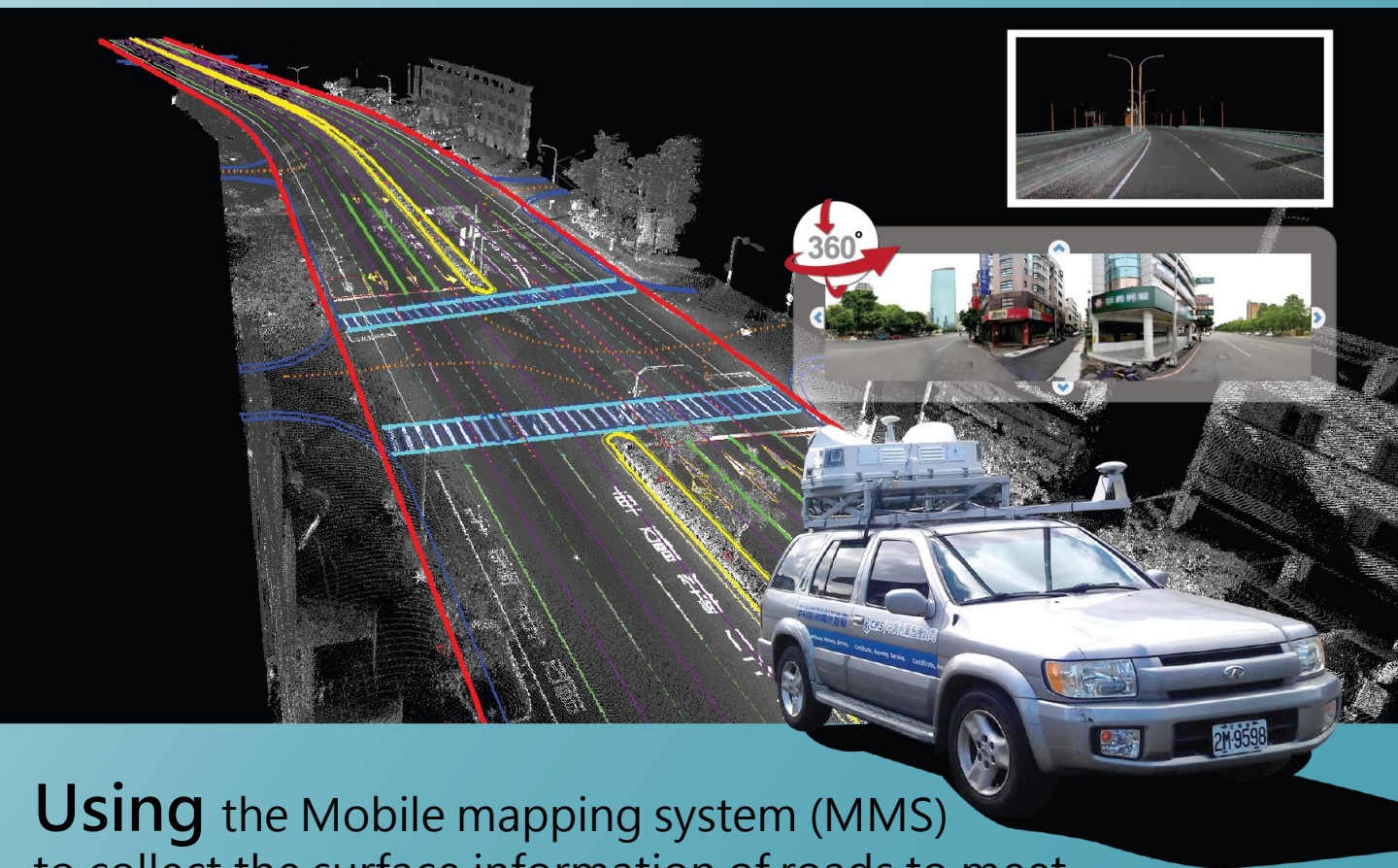
MSC Software Taiwan

HEXAGON | MSC Software

地址：104 台北市中山區林森北路577號7樓之2

電話：(02)25851228

https://www.mscsoftware.com/zh-hans/page/tai-wan-fen-gong-si-jian-jie

HD Maps

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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

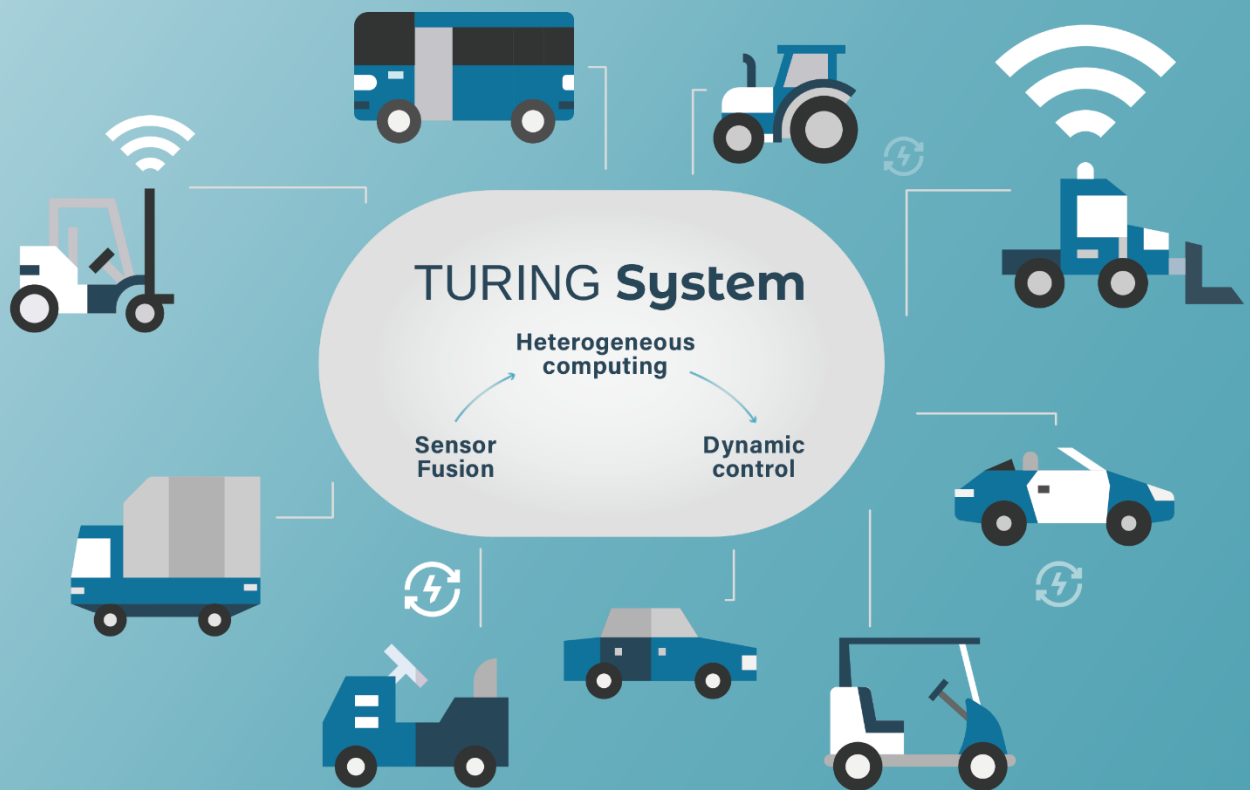**CHIS**

中興測量有限公司

專業．誠信．服務

Autonomous Driving System

TURING System

Heterogeneous computing

Sensor Fusion → Dynamic control

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 solitons 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.)

TURING
台灣智慧駕駛股份有限公司

HD Maps

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No.	
Sensing	Control
Planning	Others

All-Round Lidar Application

◆ Mobile Mapping System

Hi-Res. Point Cloud

RIEGL LASER MEASUREMENT SYSTEMS
● Laser Scanner

Vector Map

FLIR POINT GREY Innovation in Imaging
● Panoramic Camera

Panoramic image

iMAR Navigation & Control
● POS/INS

Vessel | Railway

◆ Airborne Lidar Systems

UAS — AGL:~100m
Helicopter — AGL:~1,000m
Aerial Survey — AGL:500m~3,000m
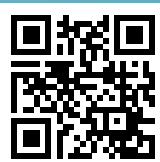
Applications of HD Maps on Autonomous Driving

感知

決策與控制

定位

(x, y)

d

θ

$(x - d\sin\theta, y - d\cos\theta)$
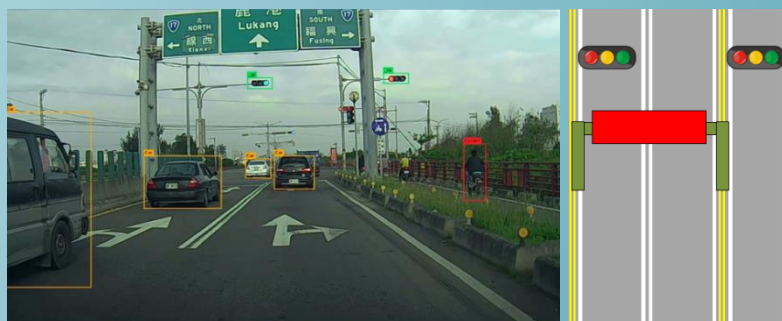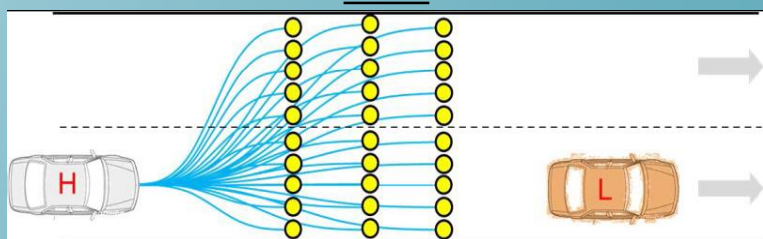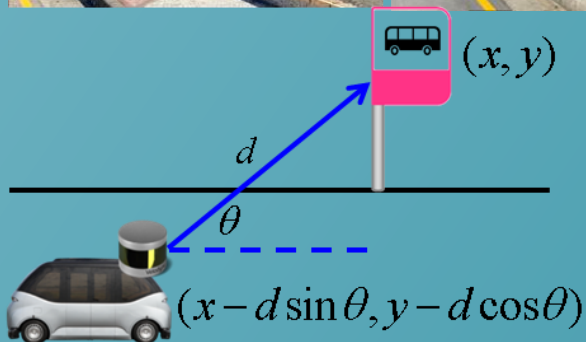
ARTC has utilized HD maps on the applications of autonomous driving. The features and attributes on the HD maps are used to facilitate the perception, localization, and decision and control of the vehicles. Based on the HD maps, the autonomous driving has been realized.

ARTC

Taiwan CAR Lab

Rain

Fog | Backlighting

T Junction | Metal Bridge | Tunnel
Roundabout
Variety of Curve Radii | Parallel Parking | Street Scenes | Various Road Surface
Shade | Railroad Crossing
Intelligent Bus Shelter
Intersection with Traffic Signal
Lane Reduction
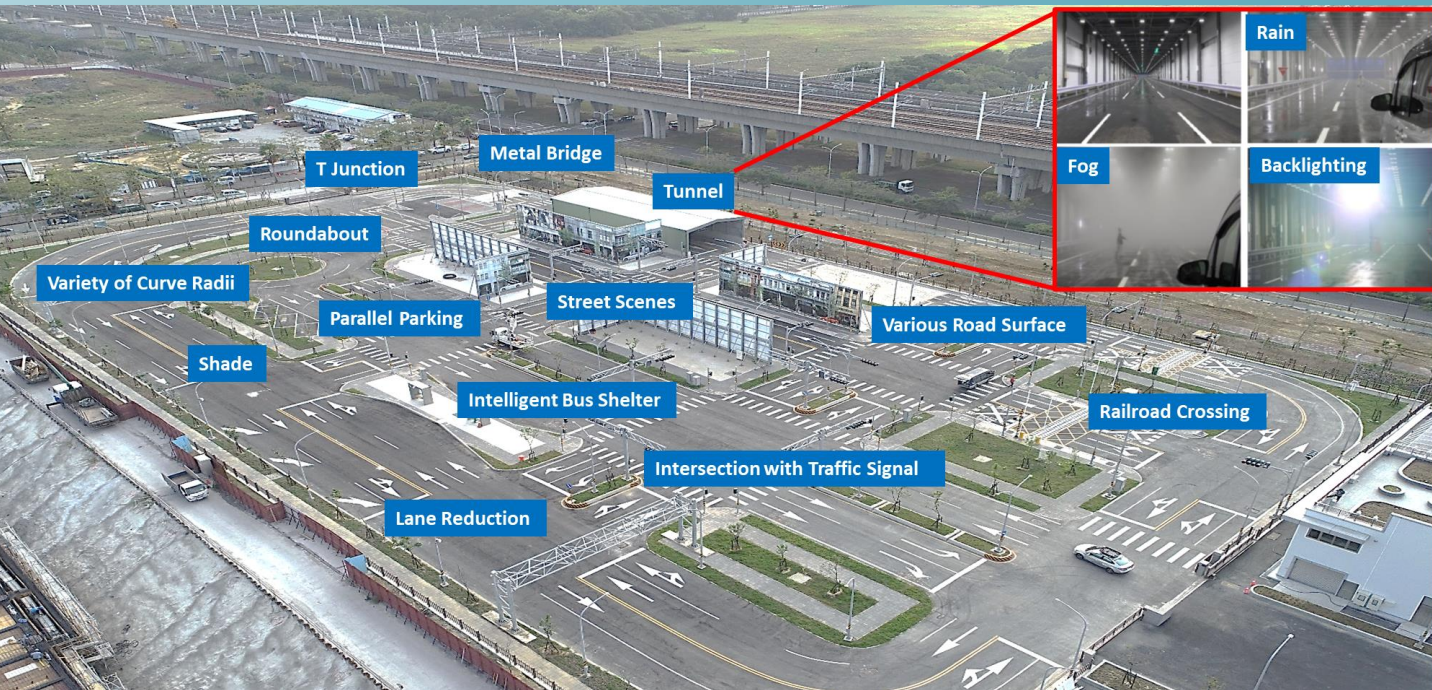
Taiwan CAR Lab is 1.75 hectare. Simulating the low road speed of 0-30 km/h in Taiwan in its design, it offers self-driving small vehicles or medium buses to conduct various tests of mixed traffic flow in its closed field. Targeting at the key procedures of self-driving: "perception", "decision-making" 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.

HD Maps for autonomous driving
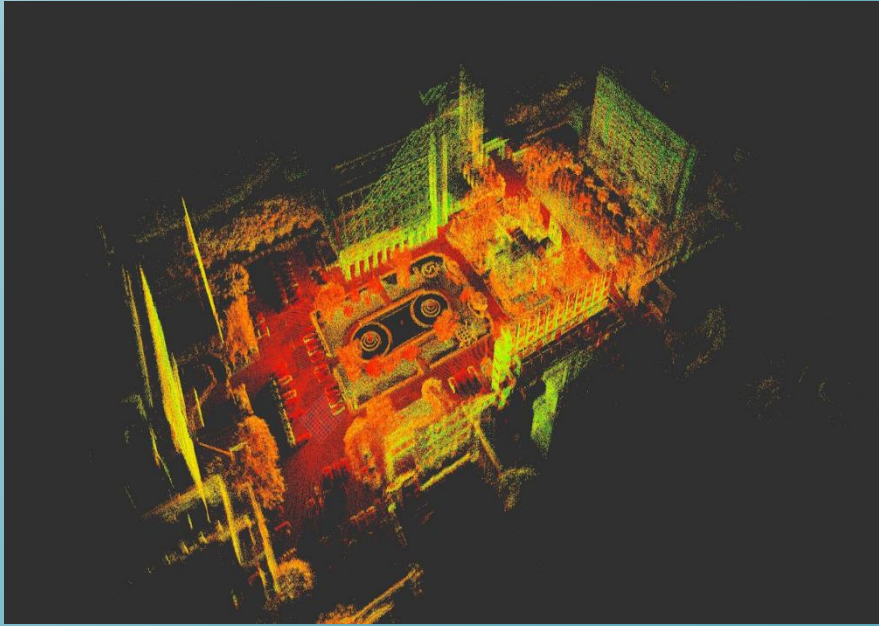
The first HD map that meets the needs of the NVIDIA system has been applied to self-driving cars. Kingwaytek technology collects map data and satellite imagery via a mobile mapping system. Also the mobile mapping system can do field measurements and use AI to distinguish traffic signs, road traffic marking, 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/

King WAY © 勤崴國際 KINGWAYTEK TECHNOLOGY

Autonomous driving based on connected System

虎頭山行車車外影像

園區俯視圖

自駕車
虎頭山小巴
行駛中

8
km/h

40 60 80
20 100
0 120
km/h

油門深度： 0.16
方 向 盤： 275.06
剎車深度： 0.11
檔 位： D

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.

4F, No.100, Sec.2, Roosevelt Rd., Taipei 10084, Taiwan
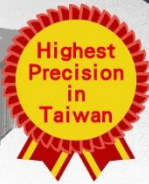
Tel: (02)23635445

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

King WAY© 勤崴國際
KINGWAYTEK TECHNOLOGY

HD Maps

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High Definition Mapping

LiDAR System

Pentax S-2100 high-speed phased-arrays laser scanner
- Scan rate：1 million points/sec
- Scan frequency：200 Hz
- Range：119 m
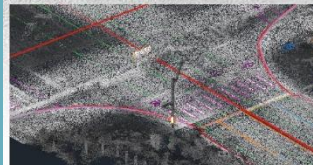- Precision：Less than 1 mm

Highest Precision in Taiwan

IMU
- Model：iMAR iNAT-RQT
- Precision：0.001 deg/hr drift

The Production of HD mapping
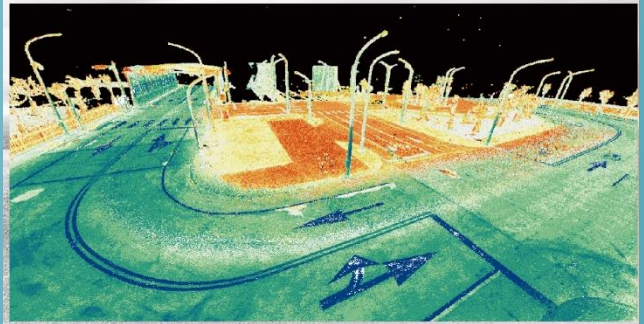
• Point clouds

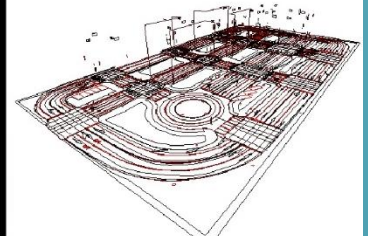• Shuinan site, Taichung

• Shalun site, Tainan
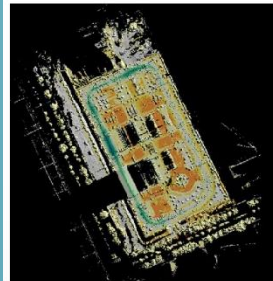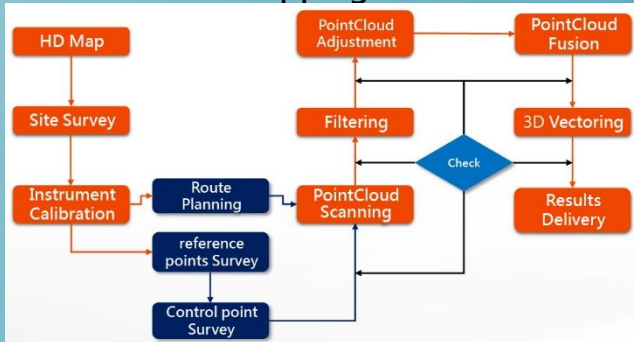
• Accuracy check of point cloud (Sha-lun site, Tainan)

• 3D Vector

Mapping Process

HD Map → Site Survey → Instrument Calibration → Route Planning → reference points Survey → Control point Survey → PointCloud Scanning → Filtering → PointCloud Adjustment → PointCloud Fusion → 3D Vectoring → Results Delivery → Check

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
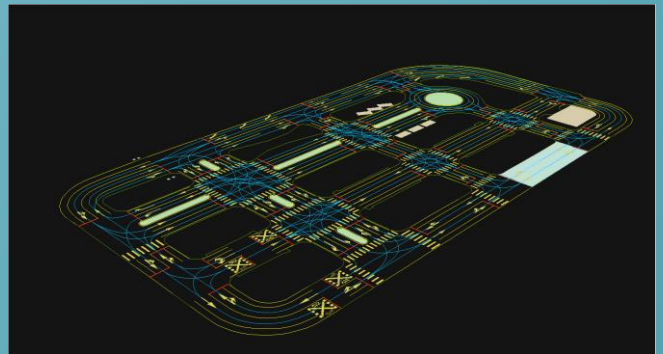
HD Maps(OpenDrive)

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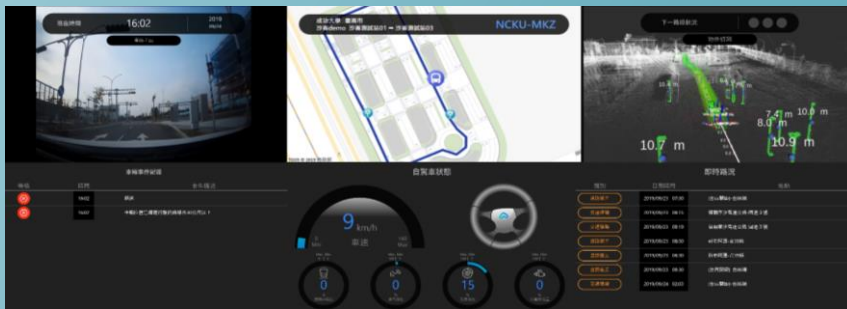
Tel : +886-2-26439699   http://www.chuanhwa.com.tw/

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.
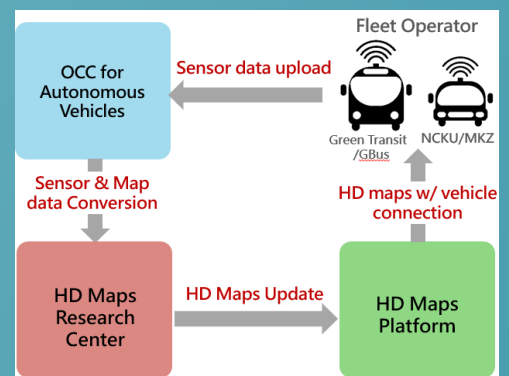
Platform Video

AV Real-time Monitoring System
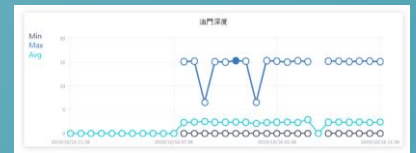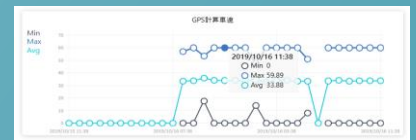
Sensor Historical Data Charts

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.

wistron

For more product information and sales inquiries, please contact

AVOCC@wistron.com

https://www.wistron.com/

HD Maps

Industry | Government | Academia

No.	

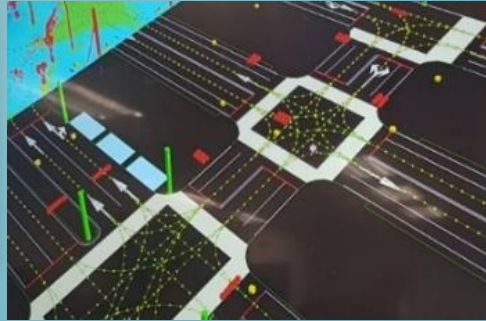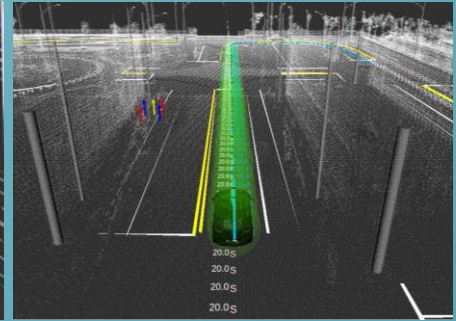| Sensing	Control
Planning	Others

How to create HD Maps?
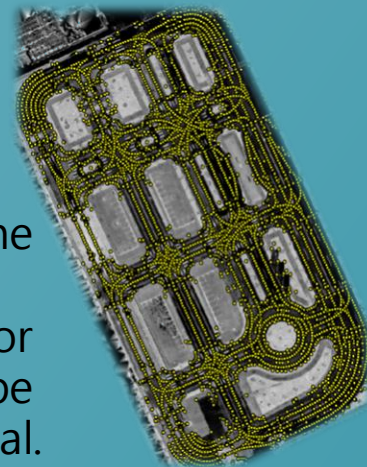
Data Collection   Data Processing   Verification

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.