

自動駕駛商業化挑戰

台灣智慧駕駛 執行長 沈大維



講師介紹



沈大維

台灣智慧駕駛執行長

- 運輸規劃與交通工程
- 交通大數據分析
- 電動車開發
- 自動駕駛系統整合

畢業於台灣大學土木工程研究所，專長於智慧運輸、新能源載具以及新型態服務規劃設計，曾任職於智慧運輸顧問公司及電動巴士製造廠，具備跨領域專長與實務經歷。2018年主導我國第一輛國產電動自駕小巴開發，成功整合電動車、線控系統、平行運算、人工智慧等團隊，組成台灣智慧駕駛股份有限公司，專注於自動駕駛系統開發並致力於自動駕駛商業模式落地。

Autonomous Driving & V2X

- Founded in May, 2018
- \$2 million of capital
- 35 employees
- Investors include **JAG** (KKC, top-3 Japan GIS provider), **Tron-e** (electric bus maker), **Tonglit** (logistic service provider)

1st autonomous driving developer in Taiwan
 11 sites operation
 33,000 km travelled
 72,000 passengers

2018

2019

2020

2021

2022



Feb 2017-Apr 2018

Taoyuan Expo

- XBW
- NNs model
- Lane-following



July 2018-Aug 2020

Amusement park

- 4 buses
- 2 shuttles
- Multiple routes & stops operation



July 2019-Apr 2021

Golf course

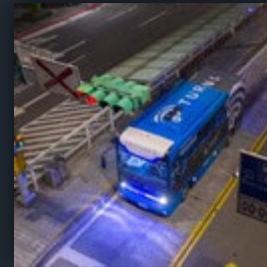
- All 18 holes
- Mission planner
- Cloud service
- RTK//IMU/vision localization



Sep 2019-Aug 2020

MRT depot

- Regular service
- Over 5,000 km



May 2020 -Feb 2021

Taipei City bus lane

- 12.5 km route
- V2I deployment
- 5G cloud service
- Urban canyon localization



Feb 2021-Oct 2021

Taoyuan open road

- Mixed traffic flow
- 7 V2I units



Dec 2021-Oct 2022

Smart port solution

- 5G
- V2X
- Logistic
- Digital twins

An isometric illustration of a city street scene in shades of light blue and white. It features various buildings, cars, buses, and a tunnel. The word 'TURING' is visible on some buildings and in the bottom left corner. The overall style is clean and modern.

自動駕駛落地所面臨的瓶頸

自動駕駛要能順利落地需要倚靠多方的協力合作，而非單一智慧車輛的技術實現。

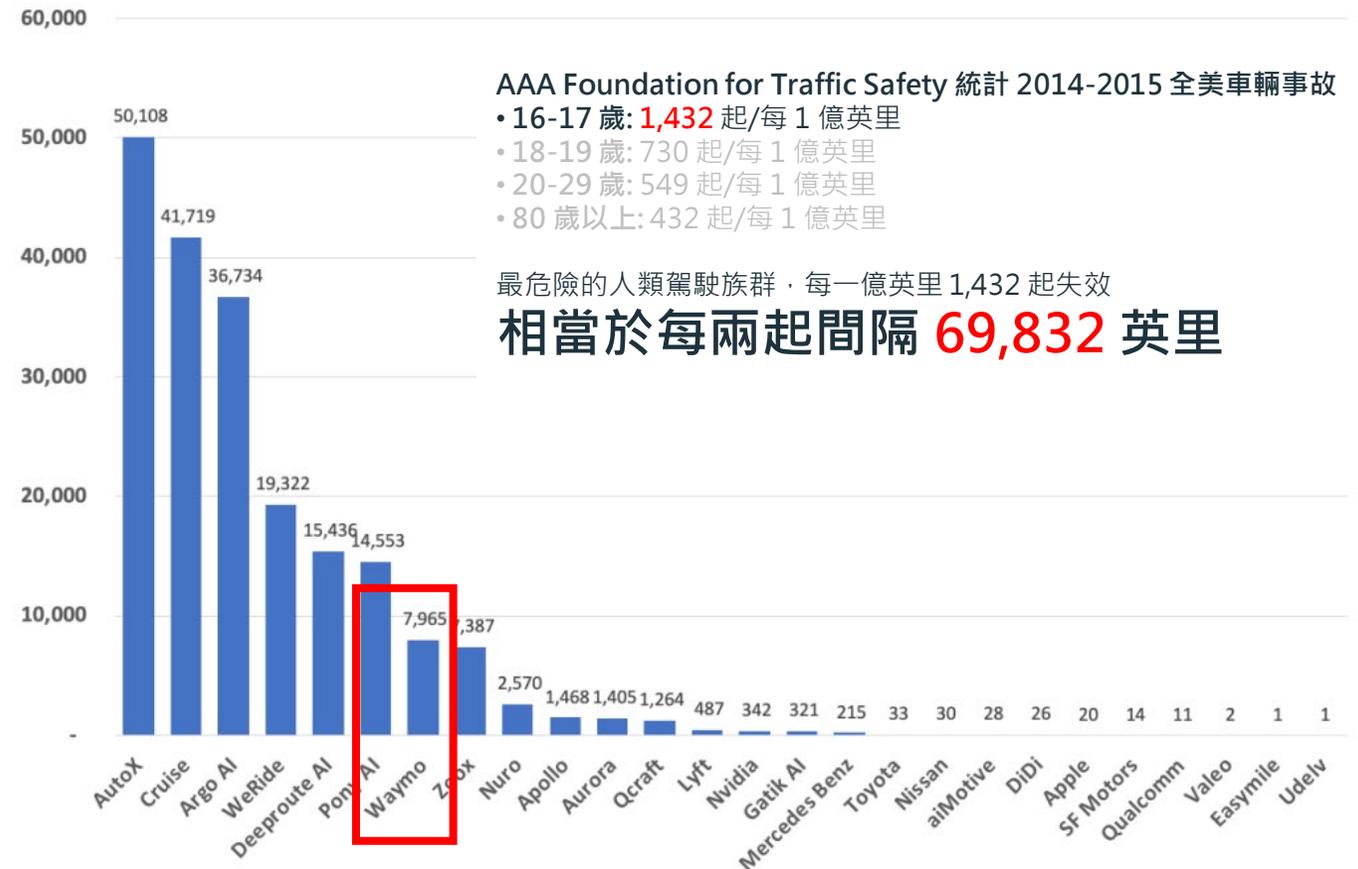
California DMV 2021 Disengagement Report

加州DMV 2021自动驾驶测试数据 (有安全员, 按测试总里程排名)

排名	公司	车辆数量 (台)	测试总里程 (英里)	车均测试里程 (英里)	总脱离次数	MPD
1	Waymo	693	2325842.90	3356.19	292	7965.22
2	通用Cruise	138	876104.72	6348.58	21	63659.35
3	小马智行	38	305616.73	8042.55	21	14553.18
4	Zoox	85	155125.00	1825.00	21	7386.90
5	Nuro	15	59100.02	3940.00	23	2569.57
6	梅赛德斯-奔驰	17	58613.00	3447.82	272	215.49
7	文远知行	14	57966.25	4140.45	3	19322.08
8	AutoX	44	50108.00	1138.82	1	50108.00
9	滴滴	12	40744.67	3395.39	1	40744.67
10	Argo AI	13	36733.87	2825.68	1	36733.87
11	元戎启行	2	30872.00	15436.00	2	15436.00
12	英伟达	6	28004.00	4667.33	82	341.51
13	丰田	4	13959.00	3489.75	419	33.32
14	苹果	37	13272.00	358.70	663	20.02
15	Aurora	7	12647.07	1806.72	9	1405.23
16	Lyft	23	11200.10	486.96	23	486.96
17	轻舟智航	2	6320.00	3160.00	5	1264.00
18	Almotive	2	2976.00	1488.00	0	无脱离
19	Gatik	3	1924.00	641.33	6	320.67
20	高通	3	1635.00	545.00	143	11.43
21	百度Apollo	5	1467.50	293.50	1	1467.50
22	小康汽车 (SF Motors)	2	874.69	437.35	61	14.34
23	尼桑	5	508.00	101.60	17	29.88
24	法雷奥	2	336.00	168.00	205	1.64

有安全测试员

Miles/Disengagement



<https://finance.sina.com.cn/stock/usstock/c/2022-02-10/doc-ikyamrma0097603.shtml>

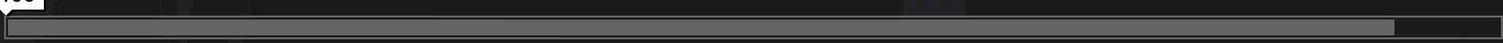
<https://thelastdriverlicenseholder.com/2022/02/09/2021-disengagement-report-from-california/>



Pause



00:00



開放道路發展瓶頸和受限

載人場景受限於基礎建設、政策法規、規模化成本等，潛在市場尚未打開

基礎建設

開放場景面臨更強的挑戰，單車自動駕駛技術難以克服所有開放道路挑戰，要實現高級自動駕駛需依靠智慧城市、智慧交通的基礎建設

政策法規

由於在開放道路的載人情境對安全性要求更高，現階段自動駕駛法律規範仍需進一步完善

規模化成本

商業化進程處於示範區試運營階段，還未形成規模化生產，自動駕駛核心硬體成本處於高位，運營成本與測試成本也不容小覷，在規模化成本上仍然受限

全球首個 Level 4 產業標準

僅限於慢速車；考量 ODD



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EN

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ICS > 03 > 03.220 > 03.220.20

ISO 22737:2021

Intelligent transport systems — Low-speed automated driving (LSAD) systems for predefined routes — Performance requirements, system requirements and performance test procedures

ABSTRACT

PREVIEW

This document specifies:

- requirements for the operational design domain,
- system requirements,
- minimum performance requirements, and
- performance test procedures

for the safe operation of low-speed automated driving (LSAD) systems for operation on predefined routes. LSAD systems are designed to operate at Level 4 automation (see ISO/SAE PAS 22736), within specific operational design domains (ODD).

This document applies to automated driving system-dedicated vehicles (ADS-DVs) and can also be utilized by dual-

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FORMAT

LANGUAGE

✓ PDF + EPUB

English

PAPER

English

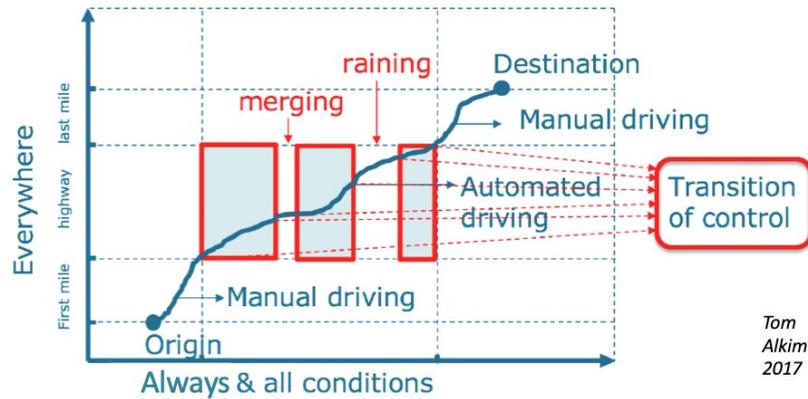
CHF 158

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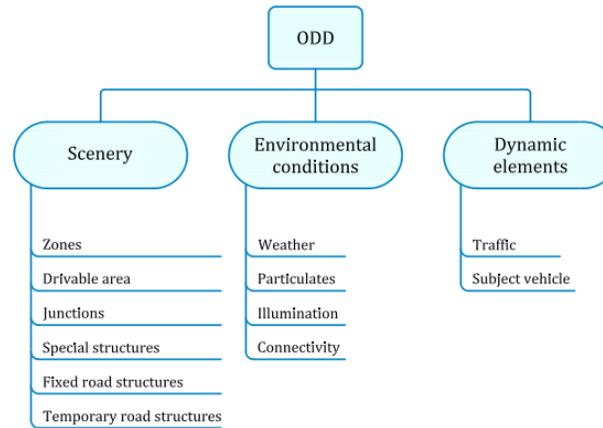
ODD 概念日趨普及

有助於技術發展與評估

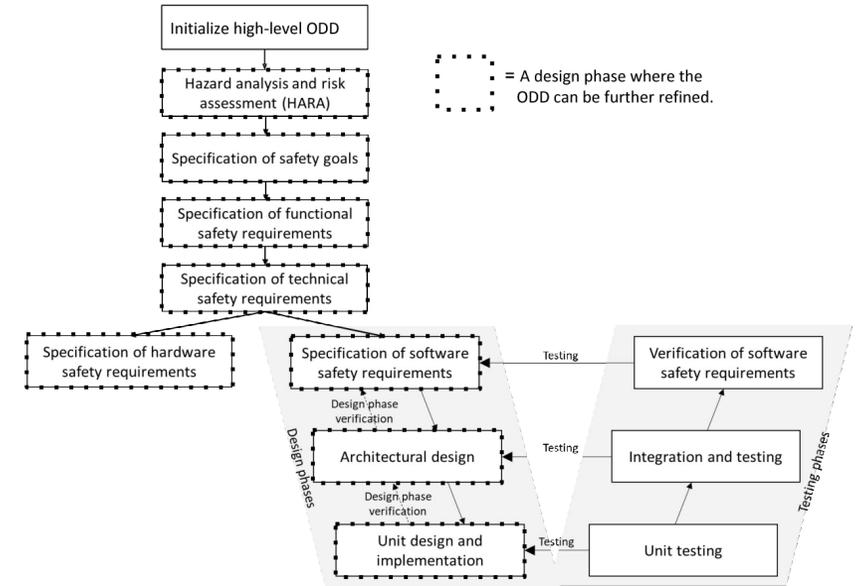
區分自動駕駛作動情境



窮盡環境影響因子



規劃產品開發及測試驗證



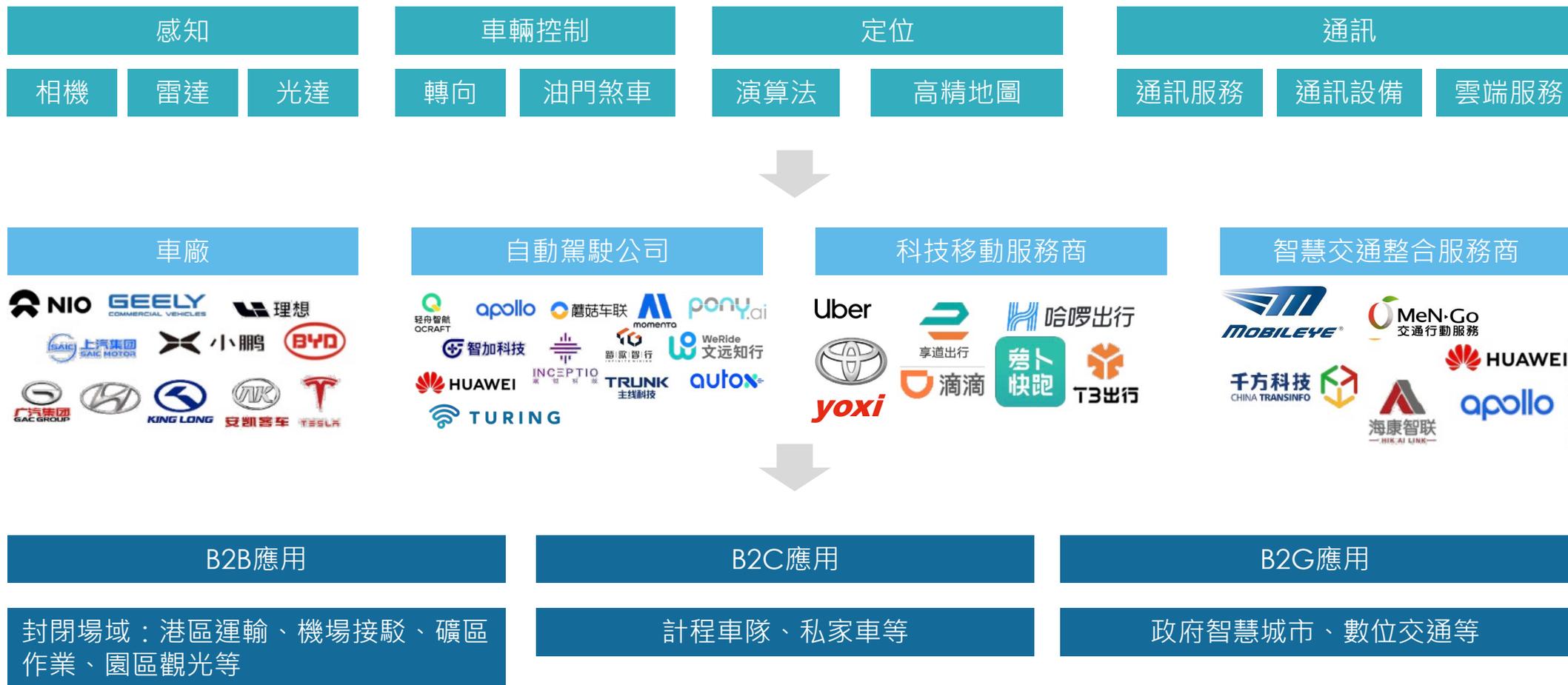


自動駕駛應用發展趨勢

自動駕駛車輛起源是運輸的發展逐漸面臨嚴峻的考驗，我們需要更安全及有效率的交通，來降低道路事故、提升更順暢的道路環境、同時減少能源汙染對環境的衝擊。隨著軟硬體技術提升，萬物聯網逐漸普及人工智慧崛起，為交通帶來了發展自動駕駛的技術基礎與能力。

自動駕駛產業鏈

產業融合態勢正逐漸形成，隨著生態多元化，互聯網、科技企業、計程車隊等跨界企業開始加速佈局自動駕駛行業，車輛商業模式將重新定義。



自動駕駛應用廣泛



無人計程車

無人卡車

最後一哩物流

固定路線接泊

特殊場域應用

Truck Capacity on Demand

Through the TuSimple Autonomous Freight Network (AFN) we provide game changing autonomous freight capacity as a service to both shippers and carriers, leading to transformational change for the trucking industry.



Shipper Benefits



Carrier Benefits



Fleet Benefits

Eric Fuller, CEO at U.S. Xpress talks about working with TuSimple



Carrier Partner



Play Video



Carrier Benefits

Carriers can purchase autonomous trucks and operate them on the AFN as well as tap into TuSimple's autonomous capacity when they need it.

MOBILEYE DATA SERVICES

Expedite Maintenance Operations with AI-Powered Road Survey Technology



Road Asset Survey

for efficient asset management & maintenance programs



Pavement Condition Monitoring

for data-driven road maintenance



Mobility Intelligence

for evidence-based urban planning





Dynamic GIS Data for Efficient and Sustainable Operations



Dynamic Mobility Datasets

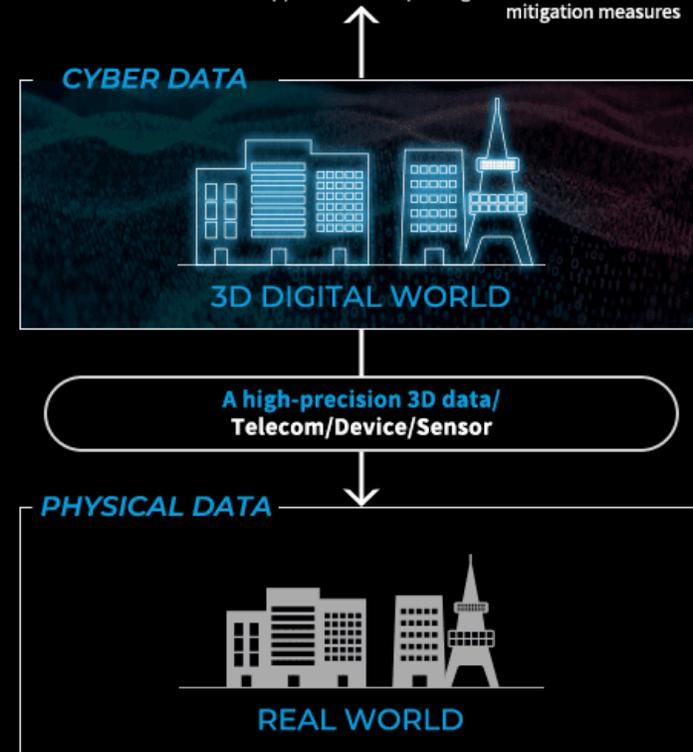
Enriching our customers' GIS platform with dynamic mobility datasets per road segment.



3D DIGITAL WORLD opens doors to a new world

The 3D DIGITAL WORLD requires high precision and reality in order to serve as the foundation of the digital twin, which simulates the future by recreating the real world in digital space, and the metaverse, which is built based on the real world, as well as for advanced driving support systems and automated driving.

The high-precision 3D data developed by Dynamic Map Platform will support a wide range of industrial fields by providing a highly accurate and realistic 3D DIGITAL WORLD in collaboration with other communication and device sensor technologies.





The Smart Infrastructure For Future Cities

By combining customized modular space on autonomous chassis, PIX builds robo-vehicles that bring services to people, wherever they are, autonomously. Pizza trucks, coffee car, and self-driving hotel will all become autonomously routed and freely moving parts of cities. PIX modular moving space enables small vendors to reach much larger audiences than previously possible with traditional brick and mortar storefronts. Meanwhile, PIX provides unique and interesting experiences, responding faster to various user needs.

Co-Creation

PIX is open to partnership with leading minds from diverse industries, who are dedicated to reshaping how cities are built. Real estate developer, retailing merchant, lifestyle service provider, chain brand, industrial park, university and institute, government, community and other visionaries, we'll turn self-driving technology into real-life applications with the co-exploration and development of self-driving service space based on PIX autonomous chassis.

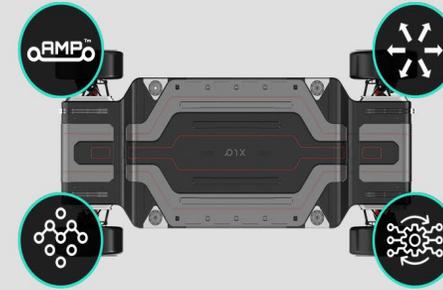


Autonomous Modular Platform

Integrating the automotive and robotics industries, built for the development of smart vehicles
OTA supported | Autonomous driving integrated

Open Autonomous Driving System and Ecology

High-level capacity for smart vehicle innovation
Reduce the lead time for smart vehicle launch



Algorithm-driven Vehicle Design

Flexible and expandable
Full size range for multi-scenario applications

Agile Digital Manufacturing System

Efficient product iteration capability
Cost-effective manufacturing



Suitable For A Wide Range Of Vehicles Types

Ultra-Skateboard™

The World's First Road-level Wheeled-Robot

- Software-defined modular design
- Support 14 level autonomous driving software stack
- Provides accessible hardware interfaces
- Vector Dynamics Matrix
- Delivers hardware safety redundancy
- Customizable chassis size

**We are creating a new generation
of smart mobility experience**



We develop automated driving solutions

+50% productivity for confined sites

Autonomous vehicles that enable site owners to **generate revenue without labor cost**

- Ensures safety
- Reduce waiting time
- Increase vehicle turnover
- Removes driver



Looming market with no law

Market demand

- Labor shortage and post-COVID health concerns call for driverless mobility services
- New industry standard—[ISO22737:2021](#) Low-speed automated driving (LSAD) systems for predefined routes

Technology

- Reduced cost of sensors and increased computing power
- [AI/ML advancement](#) quickly overcomes specific site challenges.
- 5G and next-gen Wi-Fi secure connectivity

Gap to be filled

- No regulation for AV operation in confined area
- Low-speed vehicle makers lag behind in autonomy system thus [keen to embrace it](#)

Autonomous driving low-speed vehicle

Catered for commercial operation in special environment



Visual AI

For perception
and localization



Precise positioning

By GNSS/RTK
and multiple sensor fusion



24/7

Dynamic routing,
Scheduling,
and automated charging



Turing Drive is all set for commercialization

Commercial operation in progress

Customers are paying for assistive driving smart golf carts.

Vertical business partners

Vertical-specific partners, include golf App, logistics firm, and travel agency.

Robust, flexible, agile design and deployment

Loosely-coupled system design that ensures consistent localization quality under various ODDs, e.g. indoor and outdoor

11+ sites operation | 33,000 km travelled | 72,000 passengers

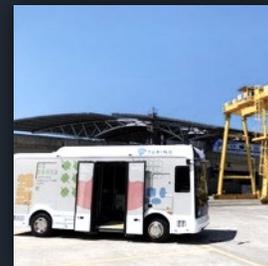
2018



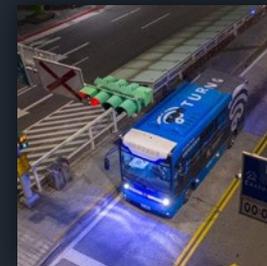
2019



2020



2021



Loss from unproductive and unsafe mobility

\$5 bn

inventory wasted
every year
due to caddie shortage
at East Asian golf courses



70%
golf courses
are short of
40% caddies

Why so?

- Golf becomes popular since COVID-19
- Aging caddies without young blood
- Post COVID-19 health concerns
- High cost of hiring, training and management

\$1.38 bn

insurance expenses
for low-speed vehicles
across target market



\$80-\$120 insurance expense/month

25% might be saved by autonomous driving

\$2.53 bn

unrealized business
from low-speed vehicles rental
across resorts/villas



Only 1 daily turnover now
at \$125 per rental

Benefits: automated, safe, and shared mobility

Golf courses

[Benefit] golf players can move safely without professional drivers (caddies)

[Outcome] reduced labor and insurance costs and increased sales for golf country clubs

From 4.2 to 0 caddies/per hole



Resorts

[Benefit] visitors of all ages and physical conditions can enjoy shuttle service anytime, anywhere, without renting and driving a vehicle for whole day

[Outcome] resorts profit from rental, and customers spend more time shopping and enjoying

From 1 to 4 turnovers per day



Product: autonomous vehicle

Turing Carrier

A whole-electric, low-speed vehicle with sensors and computer

- Speed below 40 kph
- Specific operational design domain

LiDAR

16-wire, 100m range sensor, 30 degrees vertical, 360 degrees horizontal detection range.

Camera

HD Camera, supports multiple FOV, IP67.



GNSS

Supports GPS/BeiDou/GLONASS

IMU

IP68, supports CAN bus 2.0b.

AI computing platform

NVIDIA Jetson AGX Xavier SoC.

Turing Dispatcher

SaaS framework, including API & SDK, integrated with Clients' front-end and back-end

Flexible Routing



Fixed Schedule



On-Demand Service



Shared Mobility



Special Access



Surveillance



Parcel Delivery



Food Delivery



Hazardous Materials



Autonomous for All



www.linkedin.com/company/turing-drive



TURING

www.turing-drive.com



www.youtube.com/c/TuringDrive

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