

Turing Drive

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



Feb 2017-Apr 2018

Taoyuan Expo

- XBW
- NNs model
- Lane-following

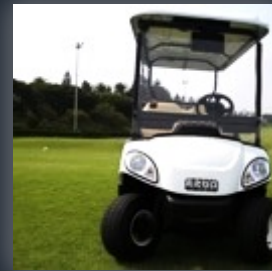
2019



July 2018-Aug 2020

Amusement park

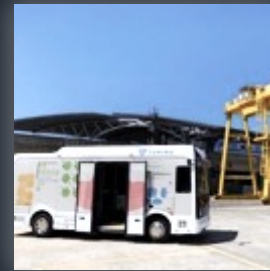
- 4 buses
- 2 shuttles
- Multiple routes & stops operation



July 2019-Apr 2021

Golf course

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

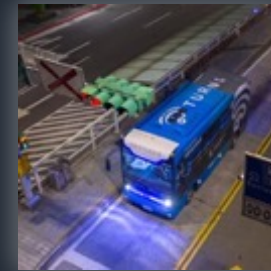


Sep 2019-Aug 2020

MRT depot

- Regular service
- Over 5,000 km

2020



May 2020 -Feb 2021

Taipei City bus lane

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

2021



Feb 2021-Oct 2021

Taoyuan open road

- Mixed traffic flow
- 7 V2I units

2022



Dec 2021-Oct 2022

Smart port solution

- 5G
- V2X
- Logistic
- Digital twins

Founding Members



Chairman
Hubert CHEN

Roles

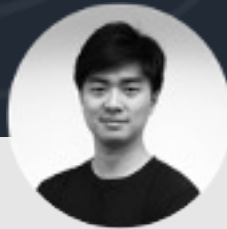
#Strategizing
#Investor Relations
#Finance

Expertise

financial planning
operations management
intellectual property
ITS Service Design

Experience

- Head, APTRC, NTU
- Sales Manager, Advanced Lithium Electrochemistry Co.
- Co-founder, JOBUS/Trivect Consultant/Mobeing



CEO
David SHEN

Roles

#Strategizing
#Industry Relations
#Product Roadmap

Expertise

transport planning
traffic data analysis
EV design & promotion
AV system integration

Experience

- Sales Manager, Advanced Lithium Electrochemistry Co.
- Co-founder, JOBUS/Trivect Consultant/Mobeing



CTO
LEE Sheng-Ta

Roles

#R&D
#System Architecture

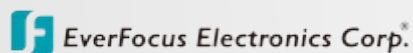
Expertise

deep learning
HPC & parallel computing
sensor fusion
NVIDIA CUDA

Experience

- Senior engineer, Foxconn
- Senior researcher, Whetron Electronic
- CTO, Mobeing

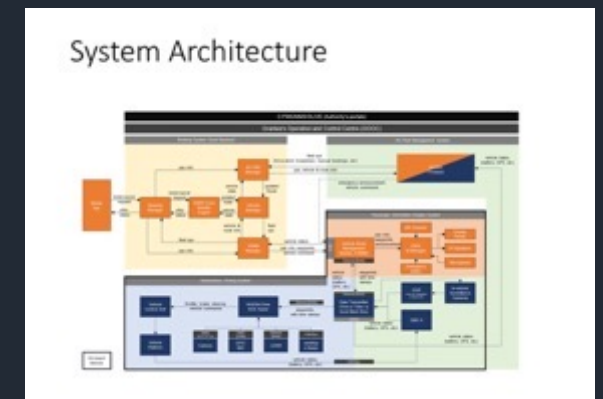
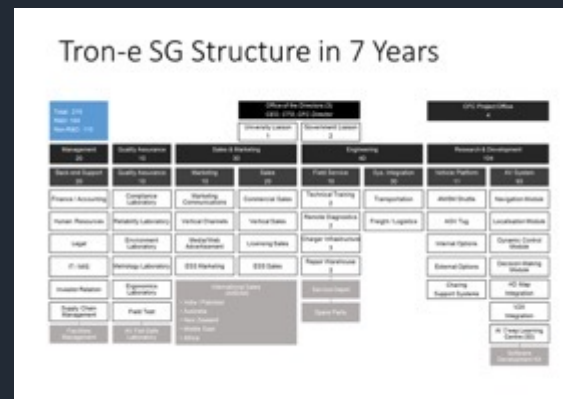
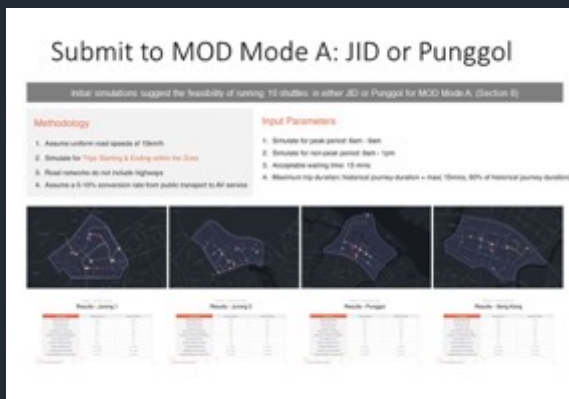
Partners



Finalist of 2019-2020 Singapore CFC



- R&D and Commercialisation plan
- Operations Control and Monitoring
- Vehicle Technical Requirements
- Passenger Information Display System
- Bus Ticketing System
- Autonomy Requirements
- Booking System for Shuttles
- Autonomous Vehicle Fleet Management System
- Electric Chargers
- Operation and Maintenance Services for Vehicle & Electric Chargers
- Vehicle Security Requirements
- Cyber Security for Shuttles
- Cyber Security for AV FMS
- System Safety Requirements
- Reliability, Availability and Maintainability
- Project Management, Technical Reviews and Acceptance Tests
- Test and Evaluation
- Performance Management System
- Incident Management Plan
- Infrastructure Requirements
- Regulatory Requirements
- Liability Requirement
- Public Education Programme
- Extension to the Pilot Deployment Period
- Legal and Intellectual Property



Key Results



Home-grown core technologies

In-house core technologies for autonomous driving, from localization, sensor fusion, motion planning to vehicle control.



Team of talent & strong partners

40 people of various backgrounds from computer science, Intelligent transportation, to vehicle engineering.

Strong technical support from JAG/KKC (HD Map) and Tron-e (vehicle tech).



Reputation & market position

Known as best AI/AV startup in Taiwan. Recognized with awards and over 500 media reports.

Turing Drive has been invited to all policy-making discussion about AV and HD Map.

TAOYUAN AGRICULTURE EXPO

Nov 2017 - Apr 2018

Confined ODD

- 4,000 passengers
- 660 trips in 40 days
- The team overcame obstruction by various weather conditions and managed to complete testing amid crowds of visitors.



LIHPAO LAND AMUSEMENT PARK

Jul.2018 - Jun.2020

Versatile park

- 6-bus fleet (mini and median)
- among hotel, mall/outlet, racing track
- Multiple routes & stops operation



TAOYUAN MRT SHUTTLE SERVICE

Sep.2019 - Jun.2020

Industrial ODD with regular service

- 09:00-17:00 over 8 months
- 5,169 passengers
- 10,000 km on autonomous mode



TAIPEI CITY BUS LANE

May 2020 – February 2021

Downtown Off-peak

- Workday 00:30-02:30
- 12.3 km round-trip
- 127 days, 848 trips
- 2,561 passengers
- 1,430 km on autonomous mode
- 5G and V2X applications



TAOYUAN CITY MRT SHUTTLE

February 2021 – October 2021

Mixed traffic flow

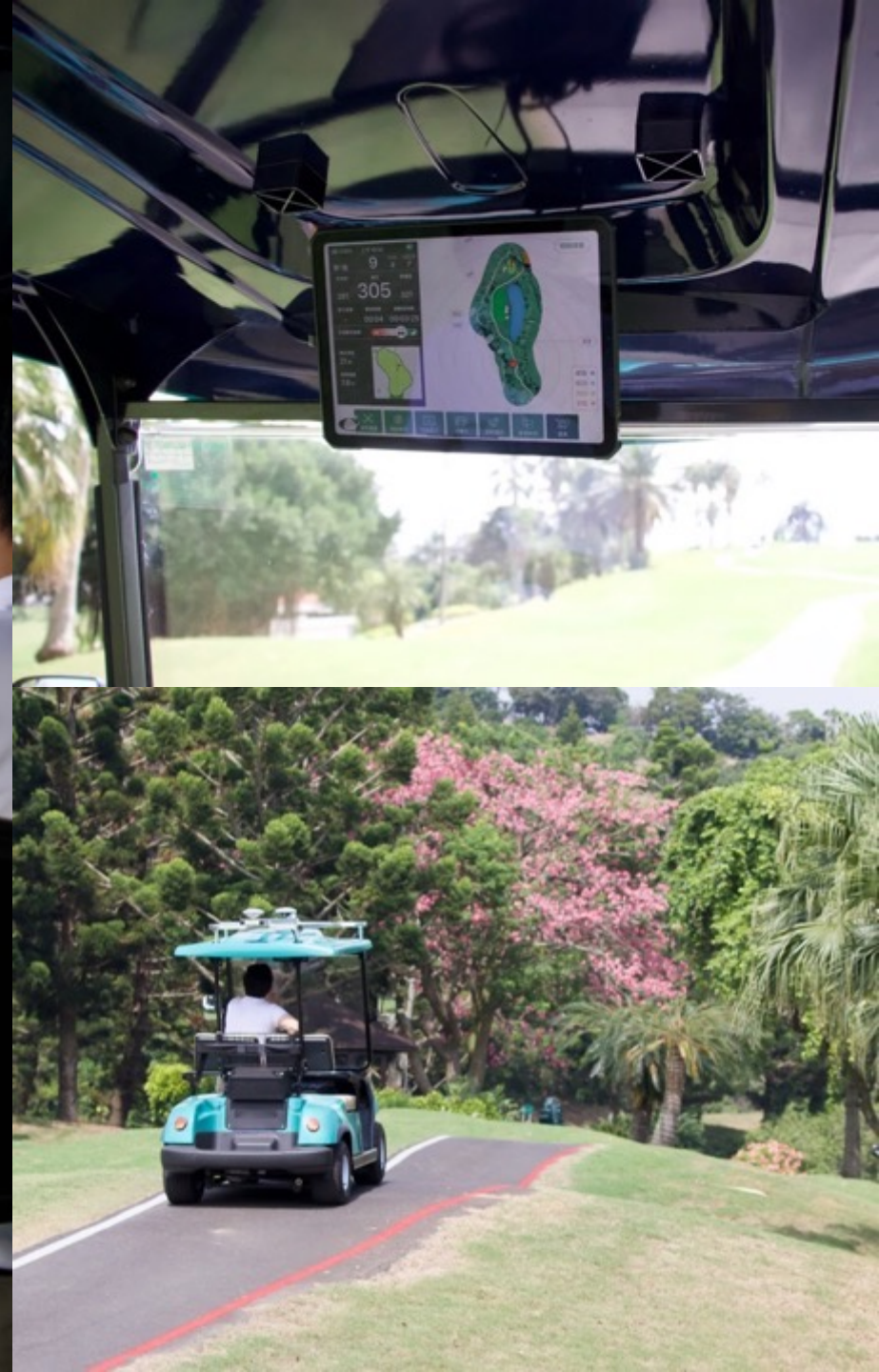
- Workday 10:00-16:00
- 140 days, 2,242 trips
- 2 km circular route, 3 stops
- 1,035 passengers
- 3,813 km on autonomous mode



GOLF COURSE TOTAL SOLUTION

LSV Sharing service

- Overcomes difficulties on the Golf course
- Industry-leading solutions
- Allow golf course to operate during off-peak hours, create extra revenue, and reduce the cost of hiring a caddy.
- Manage driver's behavior to avoid damages in the golf course.



Successful use case

TAIPEI PORT

Autonomy & digitalization
smart port solution

100 million NTD POC

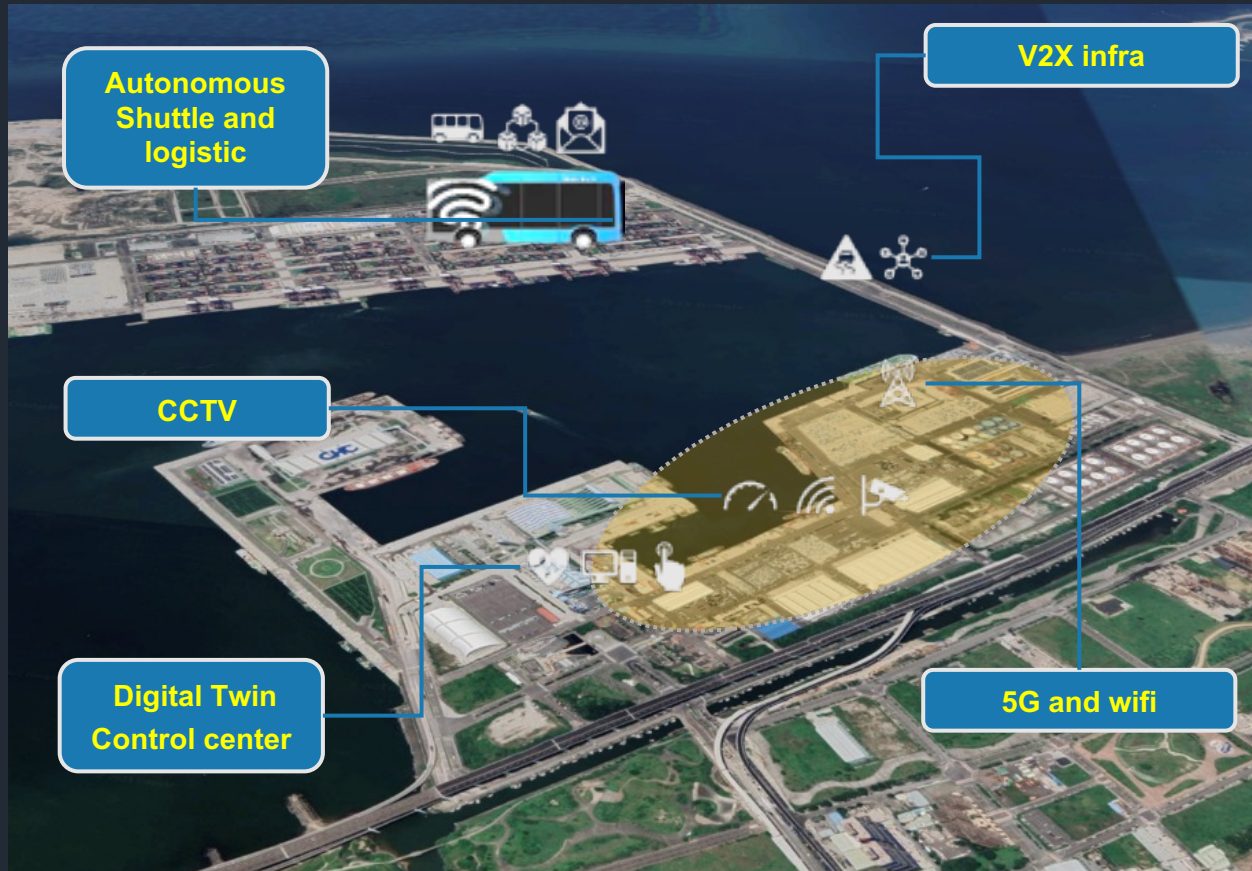
- Autonomous logistic and transportation service in port
- V2X & RSU
- Digital twin interface for management



Autonomy & Digitalization of Smart Port

Pain point

- No information to analyze and management
- Only the entry and exit management of the gate, cannot control the path and location in the area
- Infrastructure inspections cost time and effort, and are difficult to budget for maintenance



A dark blue van is centered in the frame, viewed from a slightly elevated front angle. The background is a dark blue gradient with numerous horizontal white lines of varying lengths, creating a sense of rapid motion or speed. The text 'Product Turing Init.' is overlaid in the center of the van's body.

Product Turing Init.

Turing Init.

Autonomous Driving Development Platform

XBW vehicle platform



Sensor package



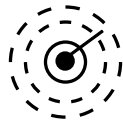
Processor



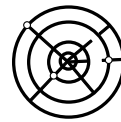
Camera



IMU



LiDAR
perception



LiDAR
localization



RTK



ADLINK AVA-XV-V1

NVIDIA® Jetson AGX Xavier™ AI GMSL2 Platform



ADLINK is an authorized
seller of **Turing Drive**
Autonomous Driving
Development Platform.



Turing Init. to Thailand

- October 2021 – November 2022
- 3 autonomous driving platforms
- To Chulalongkorn University
- Including training and on-site demo





AutonoMaaS for All

Empower autonomous mobility on your territory, your way

Low-Speed Vehicle (LSV) for people and goods

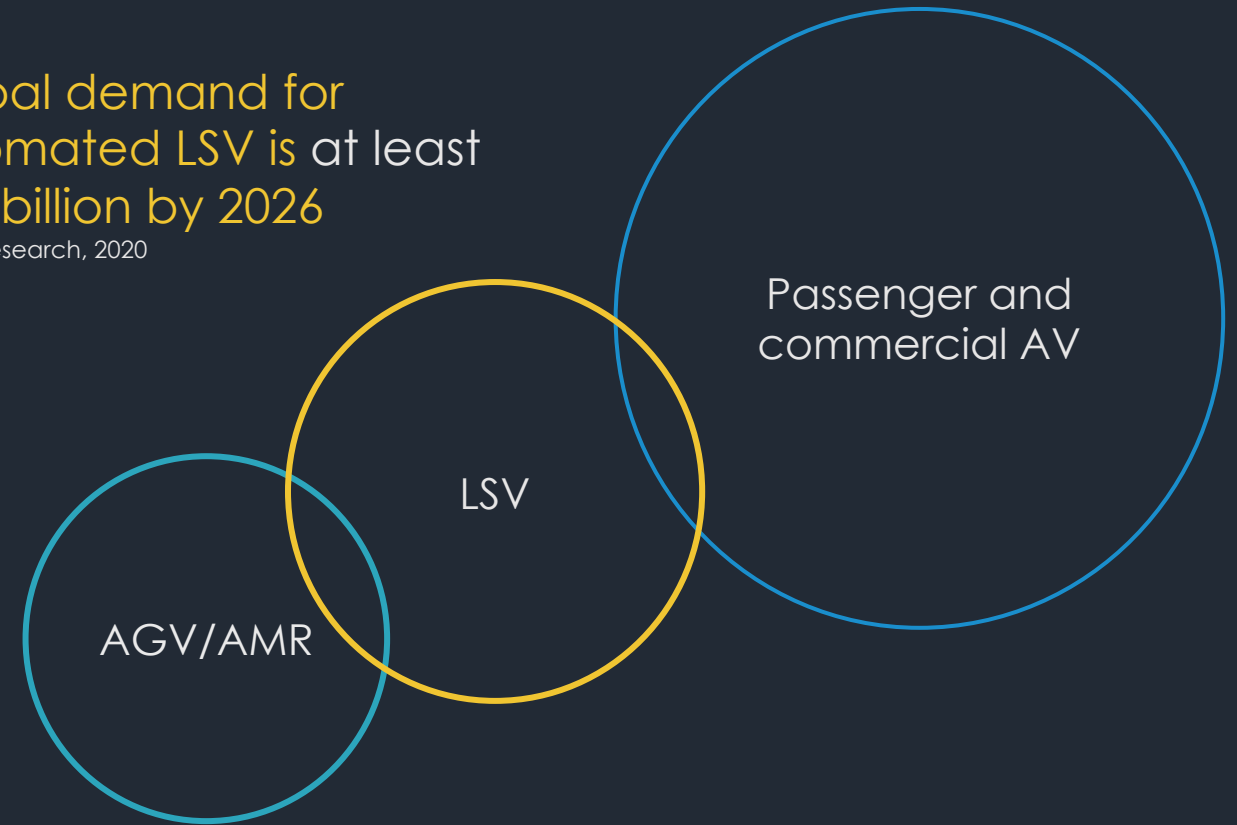
low-speed/personal/utility vehicles



Number of players

Global demand for
automated LSV is at least
\$8.5 billion by 2026

By i360Research, 2020



complexity

Size= capital investment

Target Market: Site Owner/Operators

A. Demand for **shared mobility**

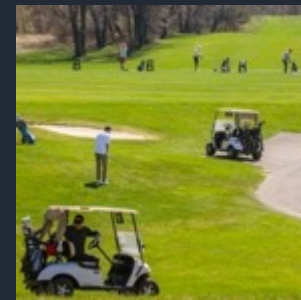
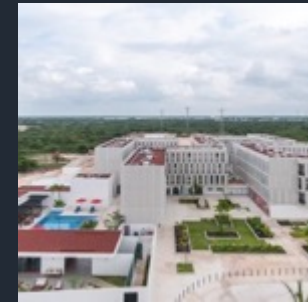
long distance, tricky terrain, frequent, large visitor number

- Golf course
- Hotel & resorts
- Touristic attractions, e.g. geo park
- Gated communities

B. Demand for **higher productivity**

long hours, repetitive, highly-distributed

- harbor area
- Industrial park
- Airports



Pain Point: Stolen Productivity

Cost and constraints

- Shortage of driver
- Labor and management
- High cost of AGV
- Limited service area
- Limited service hours

Safety risks

- Human make errors
- Inexperienced drivers
- Tourists get lost



Solution: AD-LSV MaaS for people & goods

AD-LSV features

- Speed below 40 kph
- Operational design domain (ODD)
 - ✓ outdoor
 - ✓ confined area
 - ✓ predefined route
 - ✓ diverse terrain
- Automated emergency braking, lane keeping, follow me (ACC)

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.



MaaS operation tools for operators

API & SDK, by verticals

- Vehicle status
 - ✓ Location
 - ✓ Speed
 - ✓ Battery
 - ✓ mileage
- Trip planning
 - ✓ booking
 - ✓ scheduling
 - ✓ navigation
 - ✓ pick-up/drop-off points
- Accessibility
 - ✓ lock/unlock the vehicle
 - ✓ geofence
- Driving behavior
 - ✓ driving pattern, violation

Applications for Site Owner/Operator

Flexible Routing



Fixed Schedule



On-Demand Service



Port of Taipei
in operation



Shared Mobility



Special Access



Surveillance



Golf courses
in operation



Parcel Delivery



Food Delivery



Hazardous Materials



Resorts
in contact



Smart golf cart mission statement

Increase availability for golf clubs

Highlight

- Shortage of caddies/drivers and high management cost
- 40% of inventory (time) is wasted.
- Smart, geofenced golf cart that allows players to drive safely

Partner

Golface



Smart golf carts provided to country clubs for free. Country clubs gain additional revenues.

Smart golf cart

Players pay for smart golf cart service.

Smart golf cart
NT\$480
per person per ride

Country club

Green fees.

Player

Smart golf cart for players



Turing Now values for fleet

- Less reliance on driver workforce and ensuing management issues
- To collect personalized information from users
- Customized scheduling and booking service for users
- Location-based service and business opportunities



Turing Now features

Autonomous system and advanced fleet management

Offline functions



Automatic Emergency Braking



Precise vehicle positioning via sensor fusion technology



Lane departure warning and assistance braking

Cloud functions



Hazardous zone alert



Geofence



Lane-keeping and remote control



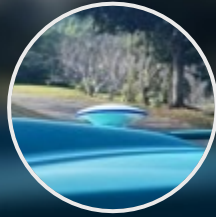
Remote locking and unlocking



Event data recorder



Front view video recorder (optional)



Sensor mounting



User ID verification

Integration with navigation/FMS.



Precise positioning & geofence

Integration with navigation/FMS.

Lane departure protection

Vehicle will be slowed or deactivated.



Alarm at risky road section/area

Integration with navigation/FMS.



Autonomous for ALL

台灣智慧駕駛
Turing Drive Inc.

