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

5G帶動智慧交通技術與服務創新及產業發展計畫
5G-Driven Intelligent Transportation Technology, Service Innovation and Industrial Development Program

ITS Asia-Pacific Leaders Forum

5G AIoT Driven ITS Technologies for Innovative Services and Industrial Developments

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and

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ITS TAIWAN

APTRC NATIONAL TAIWAN UNIVERSITY

The 19th ITS Asia Pacific Forum

Jakarta, Indonesia, May 27~31, 2024

Agenda

1. Update of ITS Taiwan

2. Overview of the 5G/AIoT Projects

3. Framing, Implementation and Achievements

4. Concluding Remarks

2017.11.22

2018.07.05

Background Information and Update of ITS Taiwan

Taiwan and ITS Development

- Taiwan: 36,000 sq km, Population 23.1 mi

Car- 7.8 mi, Motorcycle- 14.3 mi;

Highly motorized: 957 Vehs/1,000 (619 M/Cs + 338 Cars)

- Freeway Network: 1,000 Km MLFF Distance-Based Charge System since Nov. 2004(ETC)
- Modern Traffic Management and Travel Information Centers
- Smart Card issued for e-Purse and Mobile Payment since June 2002: more than 75 mi cards issued
- GPS Bus: 100% (2017); e-Tag Car: 94% (2010); e-Payment: 94% (Public Transportation) ; i-Taxi: 78%
- National Transportation Data Sharing Platform (TDX) for MaaS and Value-Added Applications/ Services
- T-Pass: A Pre-MaaS National Program
- Inclusive Mobility: 430 DRTS Routes/ MOD Services
- Smart Railways (High Speed Rail and Conventional Rail)

High Speed Rail: the journey b/w Taipei and Kaohsiung (360km) 90min.

Transportation Technology Industry Board formed by MOTC in 2019 and reformed on 2022

- Intelligent Electric Motorcycle
- Railways Industry
- Big Transport Data
- **Intelligent Public Transportation Services**
- Smart Harbor, Airport, and Logistics
- Drone Technology
- Big Data and Test Fields of 5G/AIOT Applications
- Bicycle and Tourism

Goals: ITS[5]
Safe
Smooth
Seamless
Sharing
Sustainable

2025~
GO Safe
GO Smart
GO Green

New Governance and Institutional Reform (2023.09.15):

– **Department of Information, Science and Technology in Ministry of Transportation and Communications (From Two offices: Information Center and Advisory Office of Sciences and Technologies)**

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Net Zero Transportation Policy

- **3+2 Policy and Roadmap**
- **3**: (i) Green Transportation, (ii) Zero-Emission and Electrified Mobility; (iii) Management of Car and Motorcycle
- **2**: (2-1) **TOD** + (2-2) **Green Living & Behavior Change**
- **Technology-based** Approach and **Evidence-based** Decision for NZ Goals
- **Green Transportation**: Public Transportation + Active Mobility + Shared Mobility + MaaS and **SDGs+ ESG**
- **TDM** and Management of Motorcycles and Cars:
  - Low Carbon Zone
  - Parking Management
  - Shared e-Mobility and Public Bike
- **Zero Emissions** and Electrified Mobility Policy:
  - **2030**: All City Buses are Electrified
  - **2035**: **40%** New Motorcycles and Cars are Electrified
  - **2040**: **100%** New Motorcycles and Cars are Electrified

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Road Safety and Vision Zero

In the past 10 years……

- Fatalities：> 35,000
- Injuries：> 3,000,000　　Serious Injuries: >　400,000
- Social/ Economic Loss: > 15 Bi. /Year (= 3.12% GDP)
- In 2022: 8 Fatalities, 1,368 Injuries / Day
- High Risk Group: (1) 15~24 Young Generation (6 Fatalities/ week)
  (2) > 65 Seniors（ 35% ）

Sources: MOTC, CT, UDT, LT,

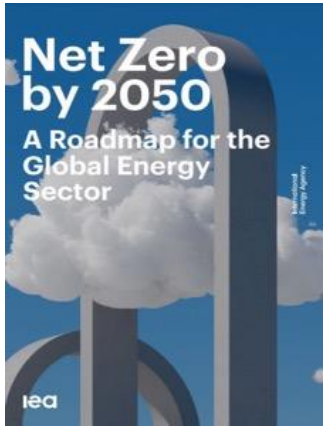
Prime Minister Chen finally announces $1.35 Bi National Road Safety Program (2024~27) in August 2024 and President Lai has committed Vision Zero: 50% Fatality Reduction by 2030!

TWO Zero Challenges:

- ✓ Net Zero
- ✓ Vision Zero

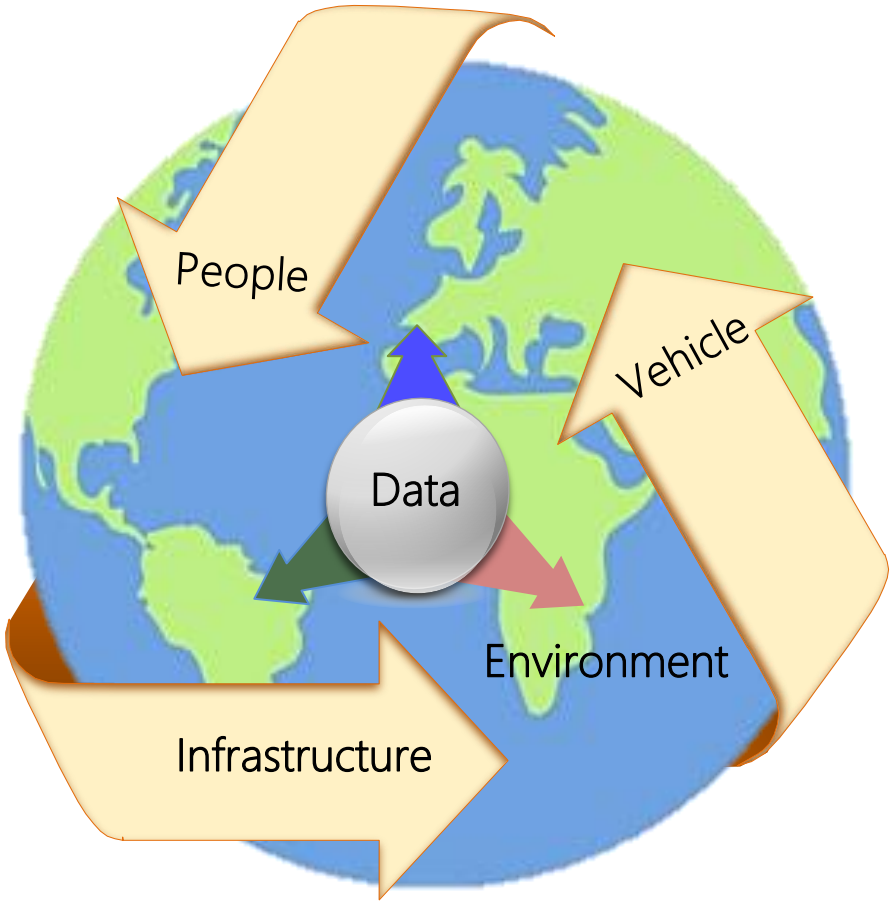
"Achieving the 2050 Net Zero Goal is hopeless without deep decarbonization in transport sector"
Othmar Karas, The First Vice President, European Parliament (April 2023)
+ Keith Howells, President of Institute of Civil Engineers UK (June 2022)

How digital technologies can help of achieving the goals of 2 Zeros?



ITS Policy: Go Safe, Go Smart and Go Green

People, Vehicles, Infrastructures, Data and the Environment are key elements for improving inclusive services to all People and for achieving ESGs and Net-Zero Goals.



- Equity and Harmony in Transportation Systems
- Green Transportation Services
- Enhancement of Smart Network and Services
- Connected Veh. & Infrastr. Technologies
- Data-driven Resilience Management

People: Disadvantaged Users

Vehicle: Green Modes and Services

Infrastructure & Network: Digital / Smart / Automated

Data: Standardized / Cross-domain / Security

Environment: Institution/ Cybersecurity / Legal Adaption

Go Safe

People-centered, Shared values

Go Smart

Technological innovation, Industrial upgrades

Go Green

Green sustainability, Smart Net Zero

Overview of the 5G x AIoT Driven ITS Deployment Projects

Smart Railway POC

Smart Highway Corridor Applications

Smart Harbor Management POC

i-Services in Airport Terminal

Smart and Eco-Tourism POC

D-City: Field for Various and Integrated Trials

Objectives and Implementation Approach

Strategic Objectives

Public Benefits
Needs of General Public

5G Transportation Services

Industrial Business
Industrial cooperation & Innovative Applications

5G ITS Industry

National Welfares
R&D in Taiwan and World Market

International Partners and Collaboration for Green Economies

Implementation Approach

MOTC initiates trials to enable the 5G/ AIoT industry to demonstrate their technologies in providing innovative services and safety for the transportation systems. Fundings from 5G concession fees are provided for enhancing collaboration of public and private sectors to develop innovative applications in various demonstration sites.

Participants PPP

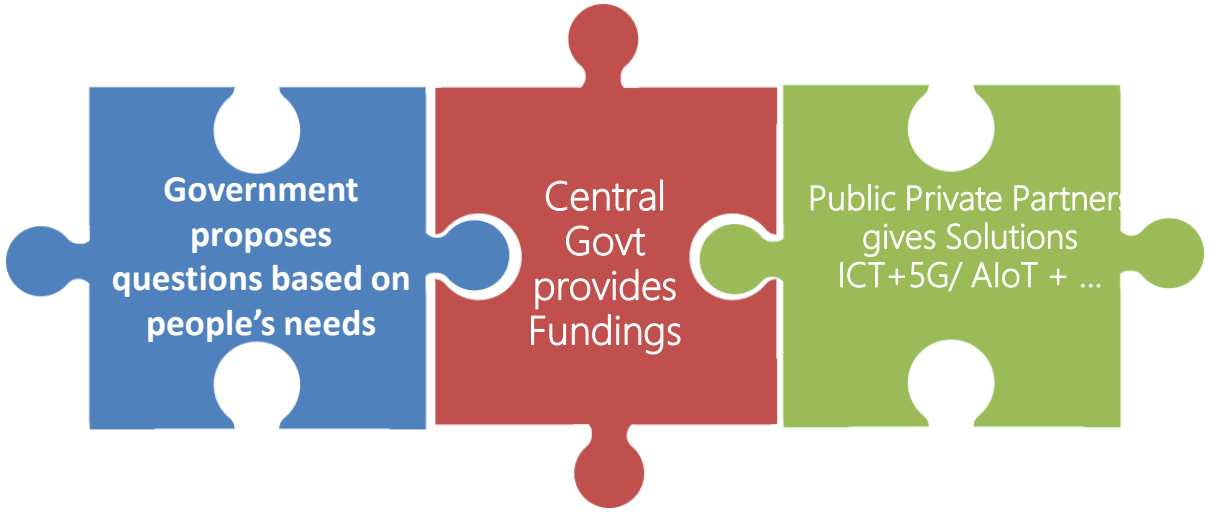
Taoyuan International Airport
Taiwan Port Company
New Taipei Mass Rapid Transit
Taiwan Railway Administration
MOTC Highway Bureau
Kaohsiung Mass Rapid Transit
Taiwan Highway Administration
Sun Moon Lake Administration
交通部觀光署 Tourism Administration, MOTC




Promotion Framework and Project Management

Formulation of Public-Private Cooperation in Transportation Fields

Create a smart transportation ecosystem consisted of field services, technological innovation, and ICT industry.



A. 3 major features of 5G technology: Broad connections, Low latency, and Wide bandwidth
To demonstrate these features will be beneficial to transportation systems and 5G/ AIoT Industry.
B. Integration of drones, autonomous Vehicles, Internet of Vehicles, MaaS will inspire **innovative service ideas** and **business models** for applications of 5G and other digital technologies.

Create a New Market for 5G AIoT Integrated and Intelligent Transportation Systems

Coaching schemes for 5G Applications and cross-domain cooperations

STEP. 1 — **Select Demonstration Sites**
Service quality, operation efficiency
safety, convenience, cross-industry ...

STEP. 2 — **Assess 5G Environment**
Digital network capabilities
Common standards, cloud computing...

STEP. 3 — **Teaming up Public-Private Partners**
Planning and feasibility studies
Business models, evaluation of benefits

STEP. 4 — **Expert Guidance and Proposal Assessment**

Smart Railways I

Integrated safety for railways plus 5G Internet of Vehicles for the safety of ground crossings

Pain Points

- Safe operation of trains
- Safety of drivers and work crews

Phase I Successes

Internet of Vehicle instant messaging, point-to-point 20 millisecond message broadcast.
Incidence rate of ground crossing accidents has dropped by more than 90%

Project:

1. 5G Smart Railway Safety Pre-Warning and Decision-making System Project (Phase I)
2. Smart Train Information Monitoring and Big Data Analysis Platform using 5G/AIoT Technologies (Phase II)

Lead Company

仁寶電腦 COMPAL

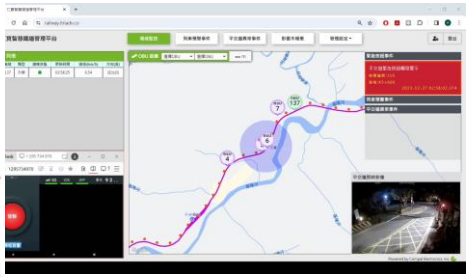
Solutions

Wood identification system

5G IoV Pedestrian Safety Warning

Lightweight warning vest for crews

iRailSafe cloud management platform



Phase II Expected Results

80% increased maintenance capacity
95% reduced risk of accidents, and warnings accuracy

Smart Railways II

5G x AI means full monitoring for total safety

Pain Points

- Safe operation of trains
- Train positioning
- Heavy manual works

Phase I Successes

Saves processing time and cost by more than 90%

Improves decision-making and operational efficiency by more than 90%

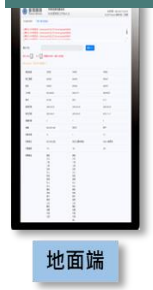
Project:

1. **5G Smart Railway Safety Pre-Warning and Decision-making System Project (I)**
2. **Smart Train Information Monitoring and Big Data Analysis Platform using 5G Transmission (Phase II)**

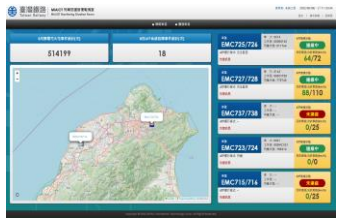
Lead Company: MiTAC

Solutions

ATP and TCMS Driving Systems	5G Dispatching and Dynamic Shift Adjustment System	Train Wires and Environments Abnormal AI Detection	5G Train Information Monitoring and Data Analysis Platform


地面端


列車端



Phase II Expected Results

Increase maintenance capacity by 90%
Save interpretation time by 96%
Reduce train operation risks by 95%
Train operation monitoring rate is 100%

Smart Railways III

Project: 5G Smart Transportation-- Innovative AI Inspection Deployment in Rail Transportation

Applying cutting edge technologies to create smart service and operation model for Kaohsiung Metro in a step toward active service

Paint Points

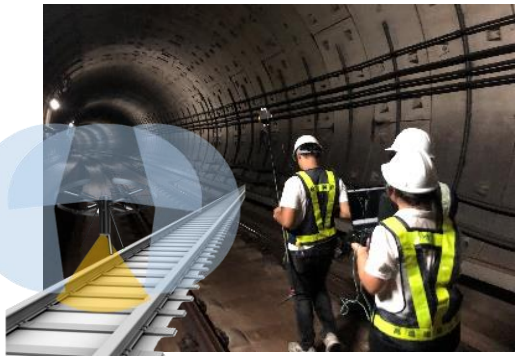
- **Lack of Inspection manpower**
- **Low detection efficiency and high personnel safety risks**
- **Inspection records are still kept on paper**

Lead Company wistron

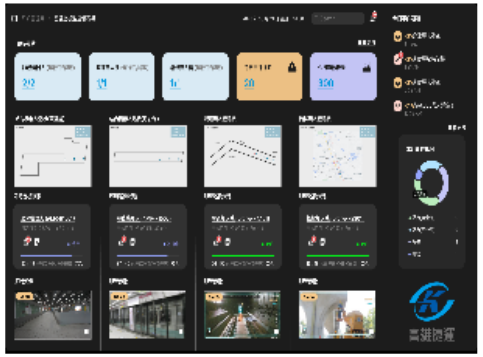
Solutions

Station Inspections

Bridge & Tunnel Inspections



Control Center



- Set up **Service Robots** to conduct station inspections and use 5G to transmit the captured images to the cloud for AI image judgment
- Provide **Drone Inspection Service on tunnels and bridges,** and by the aid of 5G transmission of data perform AI image judgment to reduce personnel operating risks and improve operating efficiency
- **Control Center:** Integrated Management and Control System to replace paper inspection records, and, effectively improving the integrated data analysis capabilities with 5G/AI.

Expected Results

In-station efficiency increased by 25%
Bridge Inspection Efficiency increased by 50%
Tunnel Inspection Efficiency increased by 10%

Smart Railways IV

Providing ”Smart Total Solution" Services by AIoT Vertically Integrated Technologies to Improve Management Efficiency and Service Quality.

Pain Points

- Strengthen platform management
- Increase passenger volumes
- Many management interfaces and technology applications

Project: 5G Smart Train FRMCS Application Platform for Operation Demonstration

Lead Companies

Taiwan Mobile Business solution

Taiwan Fixed Network Co., Ltd. (Taiwan Mobile Affiliated Company)

Solutions

- **5G TaaS transportation integrated application platform**
- **CCTV combines AI image recognition and remote monitoring services to determine ticket evasion**
- **AR passengers enjoy augmented reality interaction and city sightseeing guide**
- **Image detection and identification of safety, combined with AI automatic warning and data analysis**

Expected Results

- **Track safety image analysis AI recognition accuracy reaches 90%**
- **Increased frequency of defensive driving by 10%**
- **Effectiveness of fare evasion and fare replenishment passed 30%**

Smart Highways I

Create 5G smart highway services to improve the traffic control center's real-time warning capabilities

Pain Points

- Limited Manpower
- Equipment Stability
- Manual work and information dispersion

Phase I Key Achievements

Reduce CO2e emissions by 48.2% (43.22 tons/yr)
Average travel time reduced 10%
No. of processing images of vehicles – 20,000 (general traffic 90%, special vehicles 80%)

Project:

1. **5G integrated AIoT applications in a smart traffic control and management platform: a demonstration operation plan (Phase I)**
2. **Smart Transportation Verification Plan – Demonstration of 5G×AI Ecological Network for Integrated Innovative Traffic Management (Phase II)**

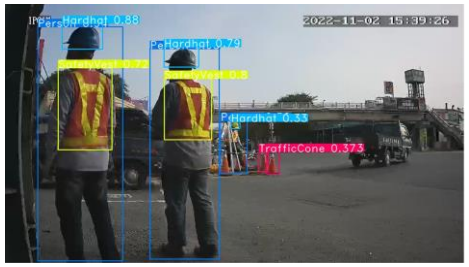
Lead Company 凌羣電腦 THE SYSCOM GROUP

Solution: Suao Highway Smart Control System

Smart control and alleviation of traffic jams

AI roads in tunnels accident detection system

Smart work zones monitoring system



Integrated IoT platform for smart traffic monitoring

Phase II Expected Results

Reduce CO2e emissions by 40 tons a year
Reduce travel time in peak hours by 20,000 hours (10%~12%)
Maintain peak average speed of 30kph

Smart Highways II

Project: The Next-Generation of Freeway C-ITS Service

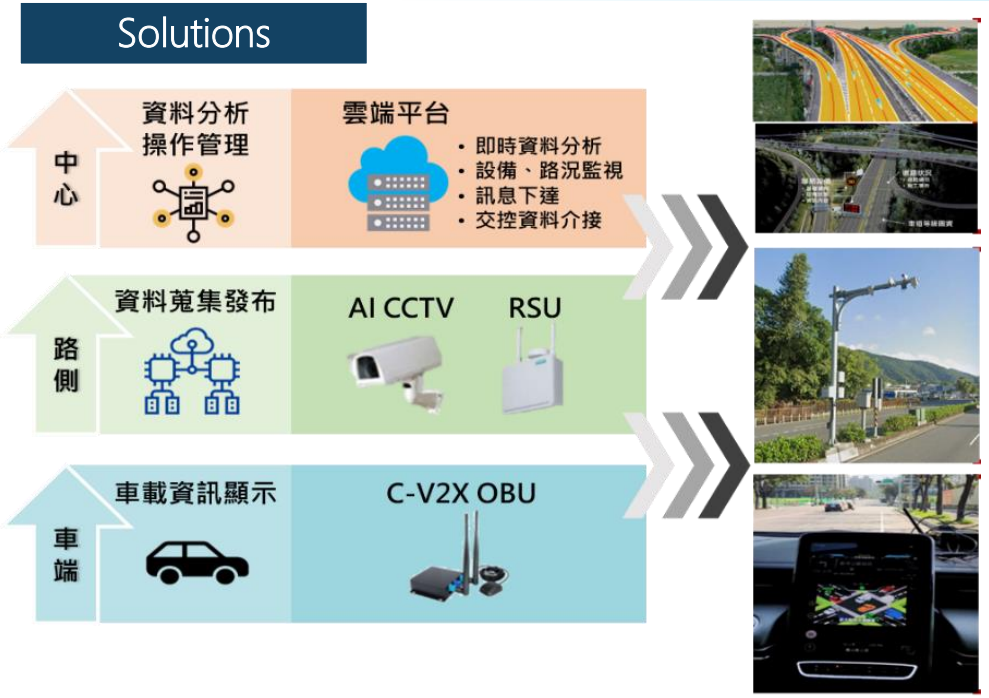
Lead Company Hwacom

Foresight Technology Applications
To improve safety and operation efficiency on National Freeway

Pain Points

- Congested road conditions on Freeway No.5
- Limited data collection
- Accuracy of traffic control information display
- Untimely information release

Solutions



- Digital Twin Traffic Management Platform Application Service
- AI Image Recognition and Traffic Data Collection Service
- C-V2X & IoV on Freeway Bus Providing Real Time Information

Expected Results

Travel time reduced by 5% on surface roads and 3% on Freeway No.5
Freeway accidents reduced by 3%

Alert Display Sign

Smart Harbor

Developed 5G smart harbor application services, creating the first UTM service verification field

Pain Points

- Difficulty in grasping the real-time status in a port environment.
- The port environment is difficult to be flexibly inspection.
- Underwater safety relies on manual inspection.

Phase I Key Achievements

Unmanned vehicles replaced humans in inspections 120 times, shortening inspection time and increasing efficiency by more than 60%.
Accuracy in identifying marine pollutants is close to 80%.

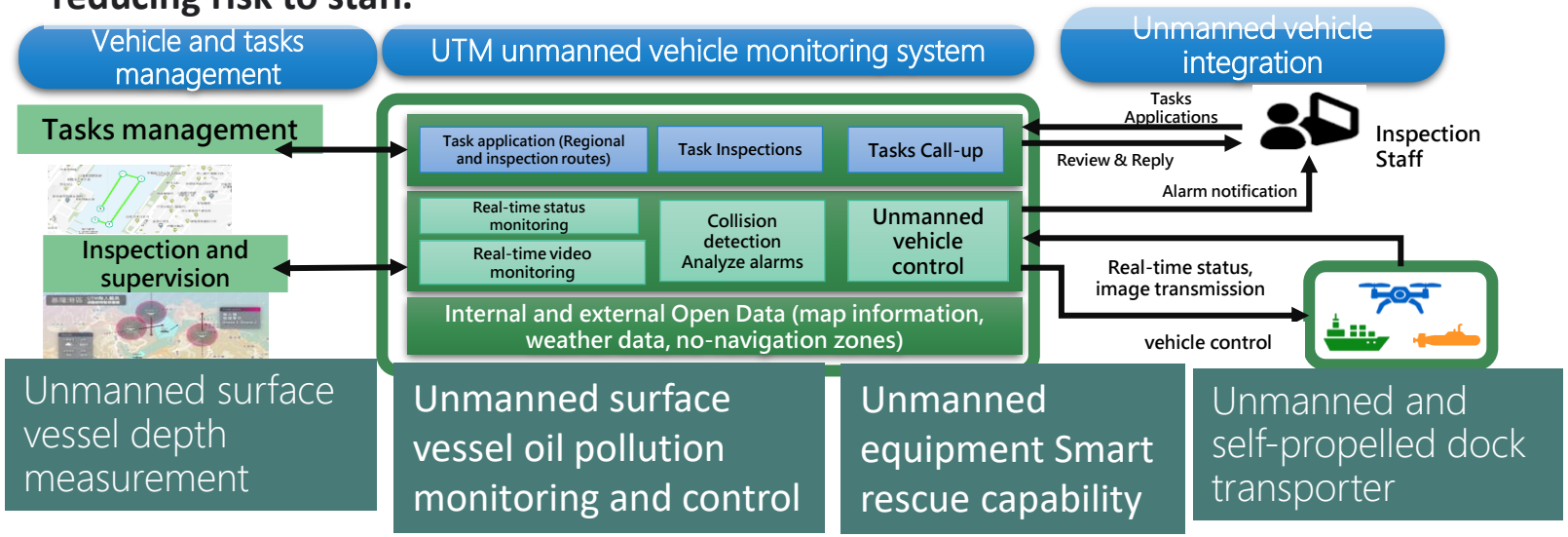
Project:

1. **5G Smart Seaport Unmanned Vehicle Application and UTM Service Function Verification (Phase I)**
2. **5G Smart Harbor 2.0 and Innovative Tourism Application Project (Phase II)**

Solutions

Lead Company 中華電信 Chunghwa Telecom

Multiple Unmanned Vehicles: drone inspection and underwater maritime robot shore wall inspection. **To solve inspection needs in different areas, improving efficiency and reducing risk to staff.**



Phase II Expected Results

- Oil pollution detection data collection rate is near 90%
- Robot terminal transportation: saves 50% of labor costs, 25% of travel time, and improves operating efficiency by 30%

Smart Airport Terminal

5GxAI smart applications to enhance passenger service quality and operation efficiency

Pain Points

- **Lack of inspection manpower**
- **Manual identification is inefficient**
- **Unable to monitor abnormal notifications in real time**

Phase I Key Achievements

Number of service experiences >2500 visitors
Smart mobile CCTV helps improve the power of security monitoring

Project:

1. **5G Smart Travel Service Demonstration (Phase I)**
2. **5G Security, Operation, and Caring Travel Service (Phase II)**

Lead Companies PAPAGO! (Phase I) Hwacom (Phase II)

Solutions

Traveler shuttle and information service | Autonomous Robots | AI CCTV security monitoring | Situation room services

- **The Love Electric Wheelchair** improves the convenience of independent mobility for passengers.
- **Autonomous Mobile Robots** combine voice and imaging functions for customer service services.
- The value-added travel transportation service automatically records the number of passengers and provides passengers with ride-hailing services and caring wheelchair services.
- **Use AI Recognition Technology** to assist in calculating security inspection service levels, monitor key areas, and provide analytical data to management units.
- **Integrated Platform** for the control center to integrate and coordinate operation management and improve service quality and operational efficiency.

Phase II Expected Results

- **Security monitoring and operating expenses reduced by NT$400,000**
- **Operating efficiency of shuttle service improved by 10%**
- **CCTV usage improved operational efficiency by 95%**

Smart Tourism

Project:

Low Carbon Smart Tourism System Integrating AR Guided Service, Smart Parking Management, and TaaS Applications

Lead Company **InComm**

Create a "one-stop digital tourism" travel service and value-added tourist experience quality

Pain Points

- Car rental service is operated manually
- Difficulty in parking management
- Scenic spots mainly rely on paper tickets for records

Solutions

TaaS Integrated Travel Service Platform

Electric two-wheel rental system
allows vehicle reservation and insurance information login

Smart parking pillar
to count down the parking time and provide timeout warnings

Scenic Area AR Navigation System

Expected Results

- **Site parking management labor costs reduced by NT$1.26 mil.**
- **Introduced short-distance mobile vehicles to scenic spots - two-wheeled electric vehicles resulted in a carbon reduction of 43.2 tons of carbon dioxide.**
- **Minimized paper ticket use for the cruise ship**

Concluding Remarks

1. Main Themes and Strategies of National ITS Development: Go Safe, Go Smart, and Go Green.
2. Applications of Digital Technologies for Achieving the 2 Zero Goals SDGs 30 and Net Zero 50: Challenges and Opportunities.
3. Evidence-based Decision and Technology-based Approach for Enhancement of Quality Service, Operation Efficiency, Industry Development, and e-Governance: PPPP Models for 5GxAIoT driven ITS Deployments.
4. Open Platform for Collaborations of NGOs, Academia, Industry, and Governments.
5. International Collaboration: Technical Exchange Platform and Investments.

Thanks

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APTRC 臺大先進公共運輸研究中心
Advanced Public Transportation Research Center

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Look forward to welcoming all of you in 2029 ITS World Congress @ Taipei