

# 2024 The 6th ESCI Best Practices Awards Program

ST-1: Energy Efficient Urban Transport Network  
Intelligent Transportation Systems(ITS)

## Tainan City Roadside Smart Parking System Build-Operate-Transfer (BOT) Project



01

# Project Background



# The Collision of Tradition and Modernity



Tainan is the ancient capital and the oldest city in Taiwan. The city was established based on the urban planning several hundred years ago. In the ancient urban area of Tainan, streets are narrow, blocks are short, monuments are plentiful. People in Tainan are accustomed to having their own cars. It causes a high ownership rate of vehicle. Over the weekend or holiday, tourists flood in to the city. How to bring the advantage of technology to the ancient urban area becomes a great challenge to the city.

Tainan mayor Huang Wei-che indicates that, it is not easy to increase the number of parking stalls in the existing space. Even if expropriating the land to widen the streets, it still cannot overcome the growth rate of vehicle. Thus, how to improve utilization rate of parking stalls is the key to resolve the parking issues in the city.

# The Challenge and The Opportunity

Traditionally Tainan City uses manual ticketing process to manage roadside parking stalls. Aging workforce, hazardous work environment, strict work hours make the management challenged. After merging Tainan county to become the special municipality of Tainan, the area to cover is wider, the number of stalls is higher, it makes the situation even worse.

## Tainan City in 2017

- 12,000 parking stalls
- 140 parking officers



## Workforce shortage

- Average 120-150 stalls/officer
- Only 50% of stalls are covered

In order to intellectualize roadside parking ticketing process, and provide convenient roadside parking environment and services, Acer ITS develop Smart Parking Meter System solution. Through government-industry-university alliance with Tainan University of Technology and Tainan City, the first smart roadside parking pilot project was engaged in Yongkang District. Due to the excellent results from the project, Tainan City launch 'Tainan City Roadside Smart Parking System Build-Operate-Transfer (BOT)' project. And Acer ITS is honored to win this project.

## Challenge – Dilemma of manual ticketing process

- Strict work hours
- Aging workforce
- Hiring freeze
- Hazardous work environment
- Parking officer on strike
- Parking revenue hit the bottom



## Opportunity – Smart roadside parking pilot project

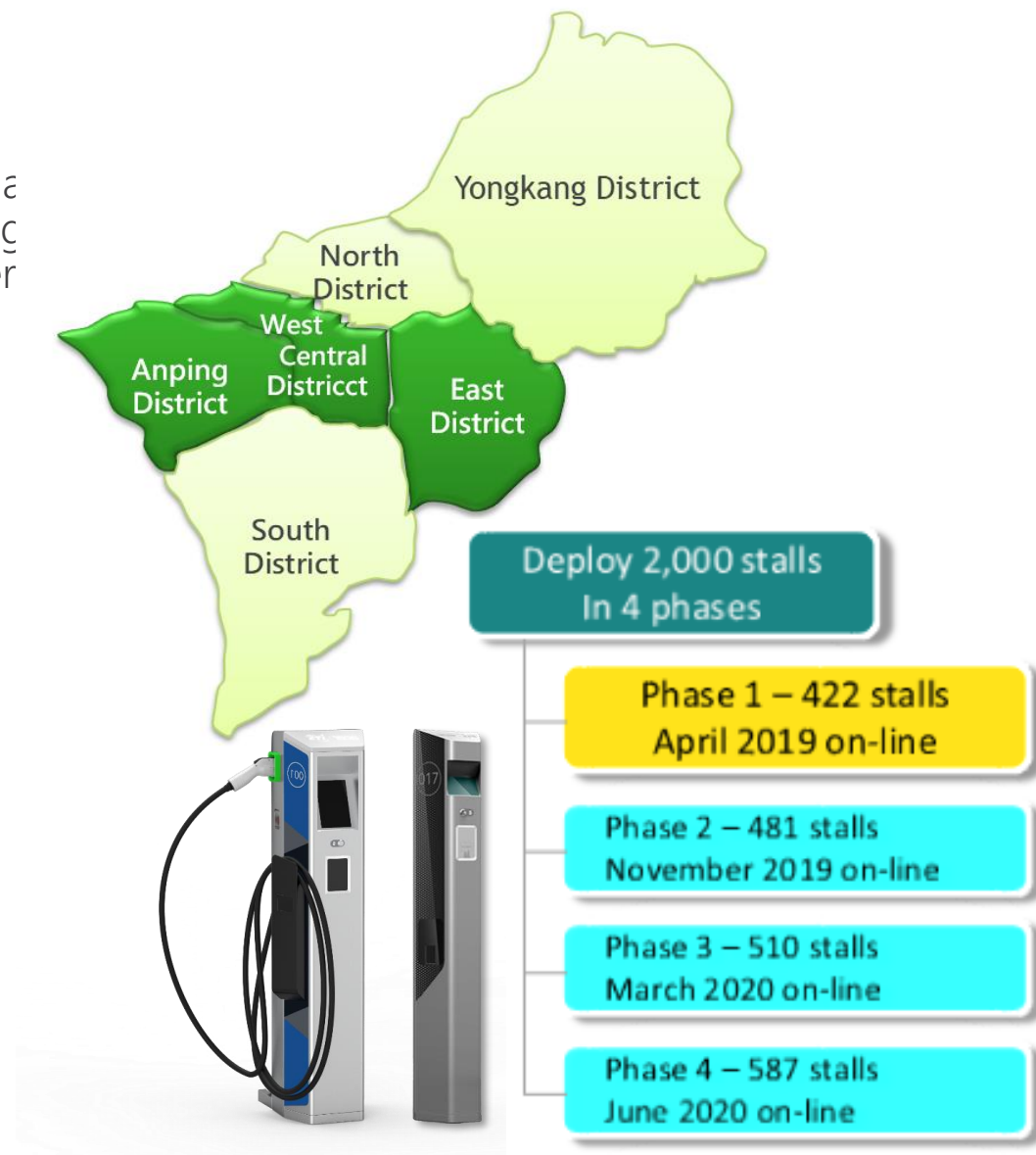
- Instant parking availability to increase turnover rate
- Prevent from circling around to reduce air pollution
- Provide multiple payment options
- Improve parking management efficiency
- Offset workforce shortage
- Paperless ticketing process for green environment



# Project Planning

Acer IT signed 'Tainan City Roadside Smart Parking System Build-Operate-Transfer (BOT)' project with Tainan City on June 1<sup>st</sup> 2018. It is a twenty-year agreement from June 1<sup>st</sup> 2018 to 2038 May 31<sup>st</sup>, deploying and operating 2000 roadside parking spaces with smart parking meter system in East District, Anping District and West Central District.

The project deployed in four phases. Acer ITS took over manual ticketing process and replaced with smart parking meter to perform automatic ticketing process. During the project period, the parking spaces can be increased or decreased in quantity of 600 according to city's requirements. In response to the trend of electric vehicle (EV) proliferation and to address charging issues, we have prioritized the installation of 60 smart parking and charging stations (including 20 smart poles) at high-traffic and key transportation nodes. To date, 40 smart parking and charging stations have been completed, continuously fostering an EV-friendly environment.



# 02

## Project Execution Philosophy and Vision



# Project feasibility is rigorously evaluated through government-industry-university alliance



Through the corporation of Acer ITS, Tainan City and Tainan University of Technology, the pilot project gathered the parking data from smart roadside parking testing zone on Zhengnan 5th Street. After data analysis, the result show that the usage rate and daily average revenue per stall both are both more than double. It becomes solid basis for scaling up the project scope of applying smart parking meter system.

- Project location: Zhengnan 5th Street, Yongkang District
- Project schedule: 2017-01-01 ~ 2017-12-31
- Project results:



Item	Automatic Ticketing	Manual Ticketing	Improvement
Average Usage Rate	79.9%	33.2%	141%
Average Turnover Rate	27.3%	23.1%	17%
Daily Average Revenue per Stall (NT dollar)	223	100	123%

# Superb and consistent quality, self-developed, and local participation



Acer, one of the world's famous ICT companies, has been in ITS business since 2004. Now, Acer is the largest bus traffic ticket system and smart parking meter system supplier in Taiwan. To be more focus on ITS-related solutions, a spin-off company, Acer ITS Inc., was established in September 2017. In order to provide stable and reliable products and services to clients, Acer ITS holds strong design and development capabilities. When designing products, the development team overcomes the obstacles by referencing years of operation experiences, especially for smart parking meter. The meter is a delicate equipment. It has to be waterproof, sunlight and high temperature resistance, so that it can work under hazardous outdoor environment. Put together all the considerations, the development team produce this high quality, fashionable and exquisite meter, and consequently, receive recognitions from significant awards.

## Achievement Recognition

(Smart Parking Meter System)

- 2021 Ministry of Finance, 19<sup>th</sup> Golden Thumb Award, the Superior Award in the Private Team Award
- 2020 Ministry of Finance, 18<sup>th</sup> Golden Thumb Award, the gold medal in the Government Agency Award (support Tainan City)
- 2020 Ministry of Transportation and Communication, Smart Transportation System Development Plan Evaluation, Excellence Prize
- 2020 Ministry of the Interior, 13<sup>th</sup> Intelligent Living Space Creative Design Competition, Nest to the future, Silver Prize
- 2020 Ministry of Finance, 28<sup>th</sup> Taiwan Excellence Award
- 2019 COMPUTEX Taipei, D&I Awards
- 2018 Intelligent Transportation Society of Taiwan, ITS Application Award
- 2018 The Asian-Oceanian Computing Industry Organization (ASOCIO), Outstanding ICT Company Award
- 2018 World Congress on Information Technology (WCIT) Global ICT Excellence Award- Private Sector Excellence



# Cooperate with national develop on smart city, elevate city promotion

The Tainan BOT project is not only in line with the requirements of national development policy and also in line with the greater Tainan smart city policy. This is a great opportunity to apply smart roadside parking technologies to real situations. The experiences are unvaluable to Tainan City and even to Taiwan. The outcome of the project demonstrates the determination of Tainan City to pursue better living environment for its people. The effectiveness and innovation shape a clear image for the city to promote as a smart city practitioner.



## 1 In line with national development policy

- Executive Yuan – National Construction Five Governance Goals – Intelligent Country
- Ministry of Transportation and Communication – Intelligent Transportation System Development Plan

## 2 In line with Tainan City smart city policy

- The Greater Tainan Smart City Policy
- The Greater Tainan Smart Transportation Data Integration Platform

## 3 Strive for opportunities to promote intelligent transportation

- Smart Roadside Parking Meter System is not only the first in Taiwan, but also receives attention from other counties. Acer ITS shares experiences and promote its solutions with foreign media in the international conferences, such as Global City Teams Challenge and ITS World Congress, etc..

# 03

## Operation Model and Strategy



# Front-end: Smart Parking Meter – fully automatic, high performance intellectualized ticketing system

Acer ITS integrates vehicle detection, license plate recognition, intelligent ticketing, multi-payment together into smart parking meter for the front-end device of this project. It provides automatic, intelligent, and high-performance ticketing process and multiple payment services.



# Front-end & Back-end Integration: to ensure ticket issuance accuracy

- Accuracy rate above 99%
- Self-developed AI LPR, object recognition, trace tracking system
- Consistent evolution - AI algorithm training for roadside parking
- Utilize multiple AI algorithm with multiple-layer filtering
- Accumulate millions of license plate data

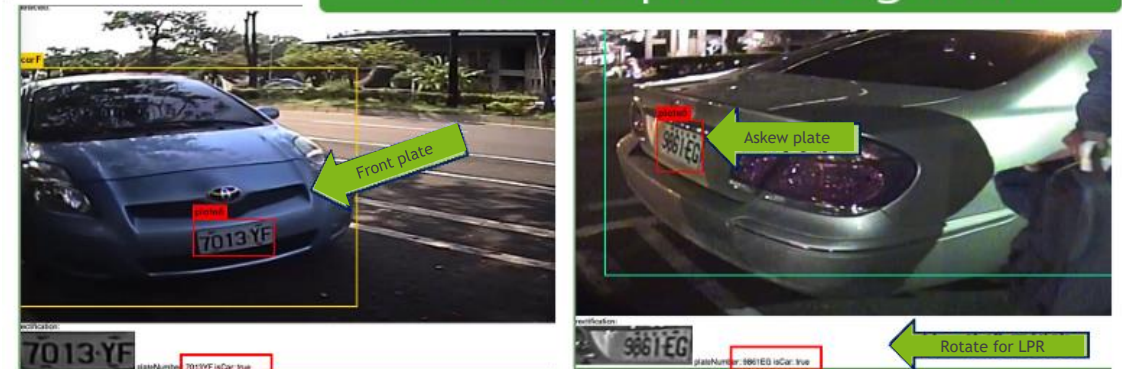
## Full of challenge on roadside parking scenario



## Trace tracking and object recognition

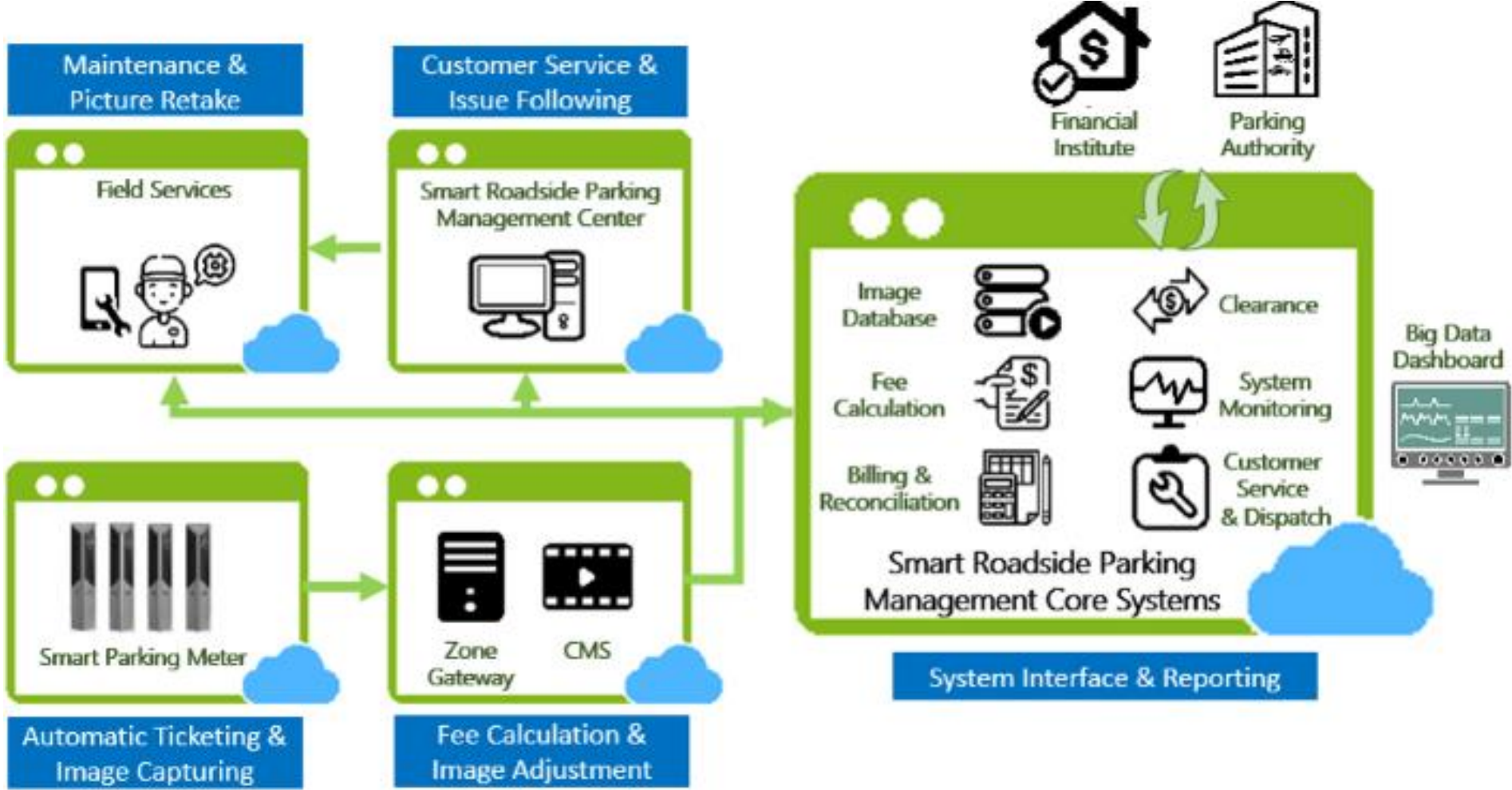


## AI license plate recognition



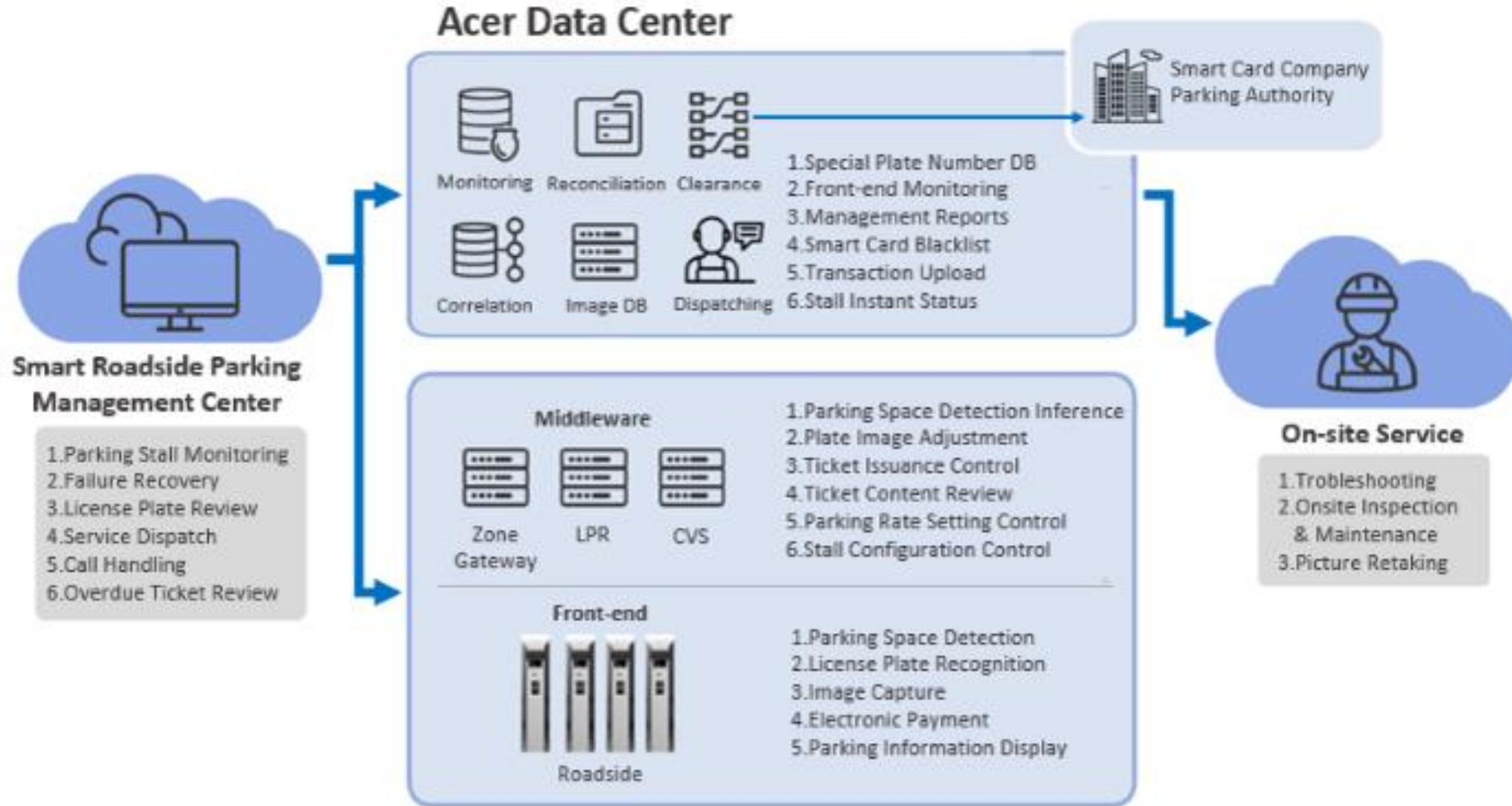
# Front-end & Back-end Integration: a complete smart roadside parking management system

Smart roadside parking management system consists of several core systems that provides smart roadside services. The front-end systems are in charge of detection, information collection and user interface. The back-end systems are in charge of recognition, transaction process, customer service and reporting. The front-end systems and back-end systems work hand-in-hand to provide a complete parking service for drivers. The big data analytics engine collect all the data from the systems and produces valuable insight for us to refine the systems and service process and ultimately provide a refreshing experience for drivers.



# Back-end: automatic detection, proactive dispatch

In order to accommodate a large scale of operation, Acer ITS develop a 7x24 operation system. During business hours, the system monitors the network status, the performance of front-end devices and back-end systems. It also detects recognition flaw and ticket error. All the error messages are routed to management center. The operators will attempt to remedy the situation on-line and dispatch the tasks to on-site service when necessary. During off hours, the operation system watches the performance and loading of the network. It makes sure the transaction data correctly and completely transfer to smart card companies and parking authority and receive feedback files from corresponding organization for reconciliation. The operation system guarantee the stability and reliability of the whole service process.



# 04

## The Path of Evolution



# Keep Pace With the Times, Continue Optimization, and Embrace Innovation

During the project execution, the project team encountered numerous challenges. The largest challenge was to resolve the issues come from road characteristics. The road characteristics effect the angle to capture image, the direction to track vehicle trace, meter installation location, utility connection, the way the drivers to operate and so on so forth. It almost effects all aspect of the meter. In order to conquer all the challenges, the develop team made every effort to resolve the issues. The second generation meter can face roadway or sidewalk, has wireless network connection and battery. The light version meter with roadside auto payment kiosk can apply to even more challenged situations. Acer ITS keeps exploring the possible opportunities to improve its solutions to provide better products and services. For the future of green environment, the smart parking meter even integrates with EV charger and will continuously evolve to provide a better life style in the city.





# The Birth Smart Parking Meter

## LED light

The LED light is embedded under the hood and illuminates during the night to embellish the street

## Camera

When detect the vehicle, take picture and vehicle information

## mmWave radar

Tracking vehicle trace to determine parking activity

## Button

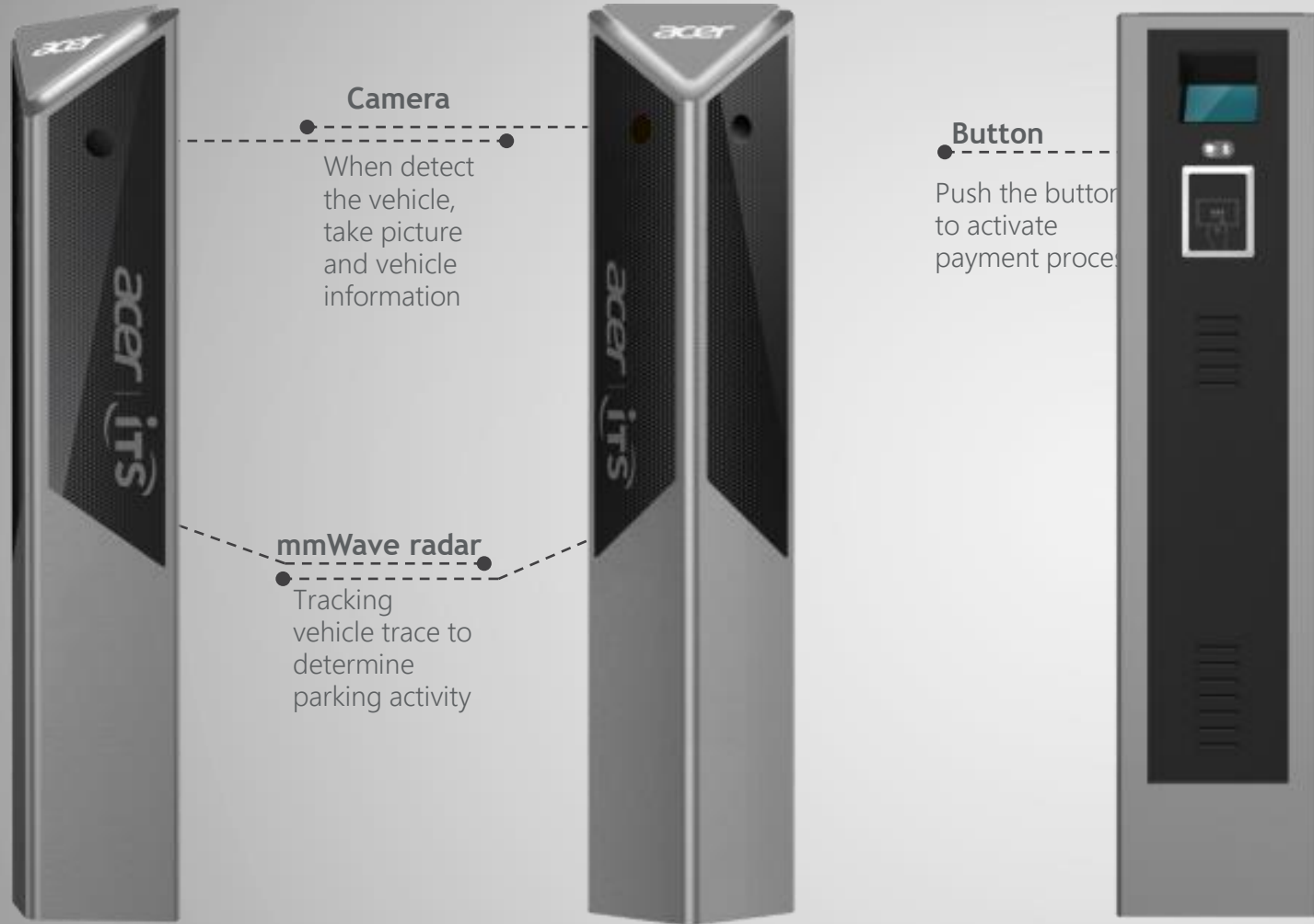
Push the button to activate payment process

## Display screen

Display parking duration and payment information

## Scan area

Smart card touches the scan area for payment



# The Next Generation Smart Parking Meter

- Roadway or sidewalk facing
- Choice of Power line and battery
- Parking space status indicating light
- Payment status indicating light
- Operate in clear and simple style



# Smart Parking Meter Light Version

- Best for usage rate less than 20%
- Vehicle detection  
License Plate Recognition  
Parking ticket issuance
- Work with roadside auto payment kiosk
- Modularized design & fast installation



# Roadside Auto Payment Kiosk

- Touchscreen
- Contactless interface
- Multi-payment QR Code
- Receipts printing
- Extendable for processing all parking tickets



# Smart Parking Meter & EV Charger Integration

- The first in Taiwan
- Can be implemented for both on-street and off-street parking



# Re-evolution – Smart Pole

- Parking fee collection
- EV Charging fee collection
- Variable message board/  
digital signage
- Water level detection
- Smart lighting



# 05

## Project Achievement



# The Largest Scale Multi-payment Roadside Parking Project in the Country. Approach 70% Non-cash Payment Rate

Tainan City indicates that smart parking meter system reduces the cost of parking management. In the past, 85% of people paid parking fee at the convenience stores. Since implemented smart parking meters, the percentage of paid on-site has been up close to 50%. It not only reduces the percentage to pay at convenience stores, it also reduces the service fee paid by the city. Tainan City than can utilize these savings to provide better parking rates for drivers and more reasonable wages for parking officers.



On-Site  
iPass+Easycard+icash  
LINE PAY+PAKU APP  
icash Pay  
**46.3%**

Non-Cash  
payment  
**67.4%**

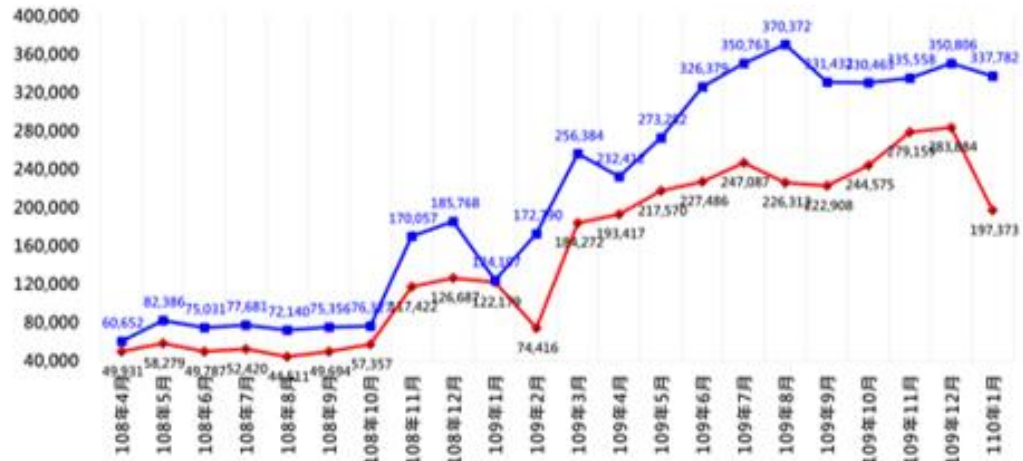
Paid in grace  
period  
**90.2%**

20.1% paid at convenience stores



# Smart Parking Meter System Effectively Enhance Parking Management Efficiency

Usage Rate



Turnover Rate



◆ Prior Year Manual Ticketing    ◆ Automatic Ticketing

By using smart parking meter, the usage rate is 38% and turnover rate is 23% higher than those of manual ticketing process. This is a significant improvement for parking stall utilization.

# Parking Analytics Platform Provides City Solid Basis for Parking Management Planning



Smart Parking Management System gathers all the data from Smart Parking Meter System and other related traffic information to provide an overall picture of parking activities in the city. Historical data analytics helps Tainan City gain insight of their operation and generate more realistic and accurate forecasts. The learning cycle produces invaluable experiences for the city to shape a better parking management plan in the future.

# Getting Parking Availability Information from PAKU APP to Reduce the Chance of Circling

Acer ITS develop PAKU APP to give drivers a refreshing experience on the road. Smart parking meters transfer instant availability data to parking APP through 4G network to provide drivers in advance the availability of parking spaces in surround area. It helps reduce the chances of circling around for drivers and prevent from excessive carbon emissions and traffic congestion.

 Provide intimate services for parking

<b>No. 1 APP</b>	Over 4,000,000 downloads
<b>Sufficient Information</b>	Over 8,000 parking garages
<b>Best Experience</b>	Rating 4.8 stars (APP Store)
<b>Services</b>	Parking guidance, traffic status, parking space booking
<b>Discounts</b>	Credit card discount, bonus redemption
<b>Payment Services</b>	Most cities' on-street/off-street parking payment services

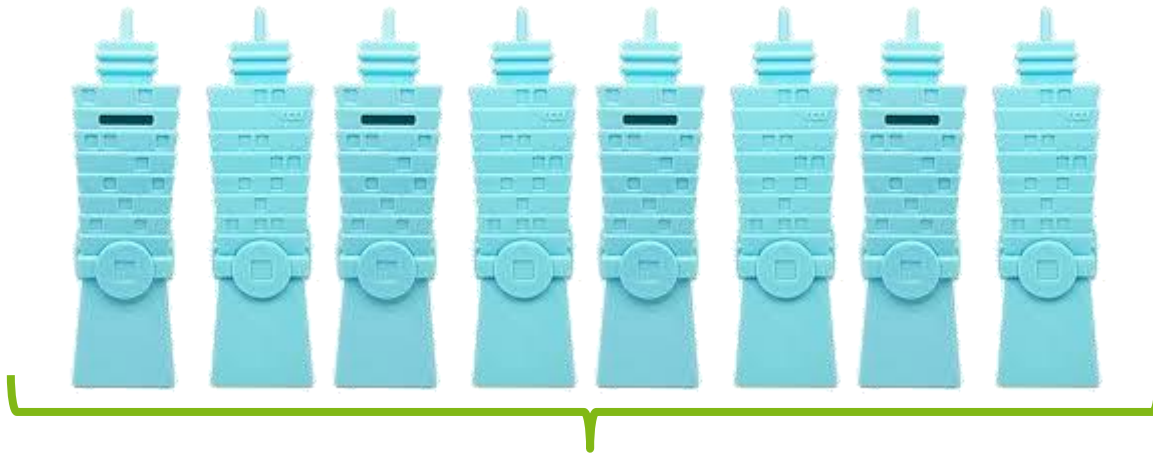


# Paperless Ticketing for Greener Environment

Up to April 2022, smart parking meters help save 3,297,385 paper tickets. It equivalent to 626,503 meters long of paper tickets.



(Length of paper ticket: 19 cm)



Equivalent to the height of 1,233 Taipei 101 building



# Excellent Service Satisfaction

The purpose of the Tainan BOT project is to effectively improve the utilization rate of parking hot spots in Tainan, increase parking supply and reduce the time searching for parking spot. The smart parking meter solution provides drivers easy access availability information, convenient payment interface and various payment options. All these characteristics make driving a smooth and delightful experience in Tainan. The satisfaction survey shows an outstanding result of these effects. This also helps Tainan mayor to gain a 76% high satisfaction rate.

## 2021 'Tainan Smart Roadside Parking' Service Satisfaction Research Report

Executed by National Cheng Kung University  
Department of Transportation and Communication Management Science

**92%** Tainan Smart Roadside Parking Overall Service Satisfaction

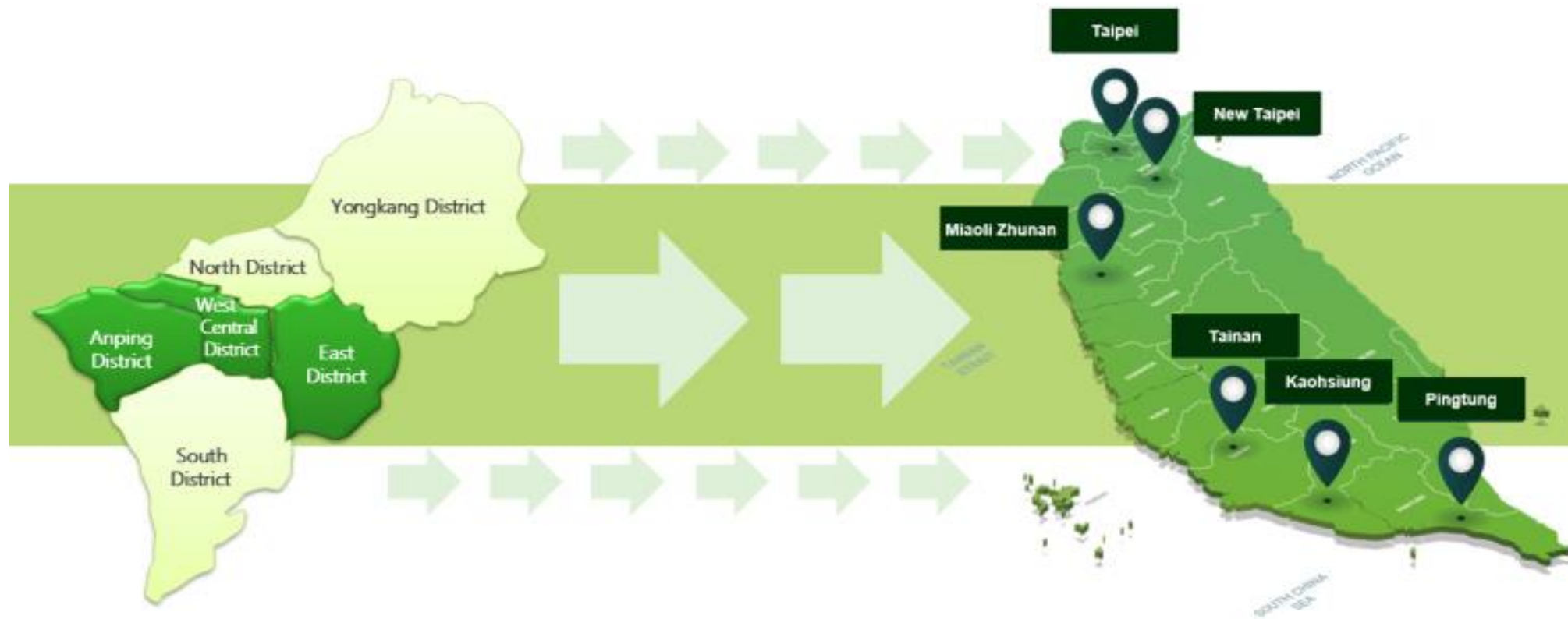
**95%** Support Tainan City to Continue on Smart Roadside Parking Services

**80+%**  
Average satisfaction in three dimensions (100%)



# Sustainable Technologies and Experiences Bring Innovation of Roadside Parking to the Brighter Future

From the BOT project in Tainan, Acer ITS has accumulated technical and operational experiences of smart roadside parking. Constantly, Acer ITS is aggressively exploring opportunities to apply these valuable experiences. In the last two years, Acer ITS has gained the trust from several local governments and won the projects from them. By the end of 2024, it will reach over 6,500 parking stalls operated in Taiwan. The next step for Acer ITS is bringing its solution to other countries in the world.



Total number of parking stalls operated in 2024 will reach **6,500** in Taiwan