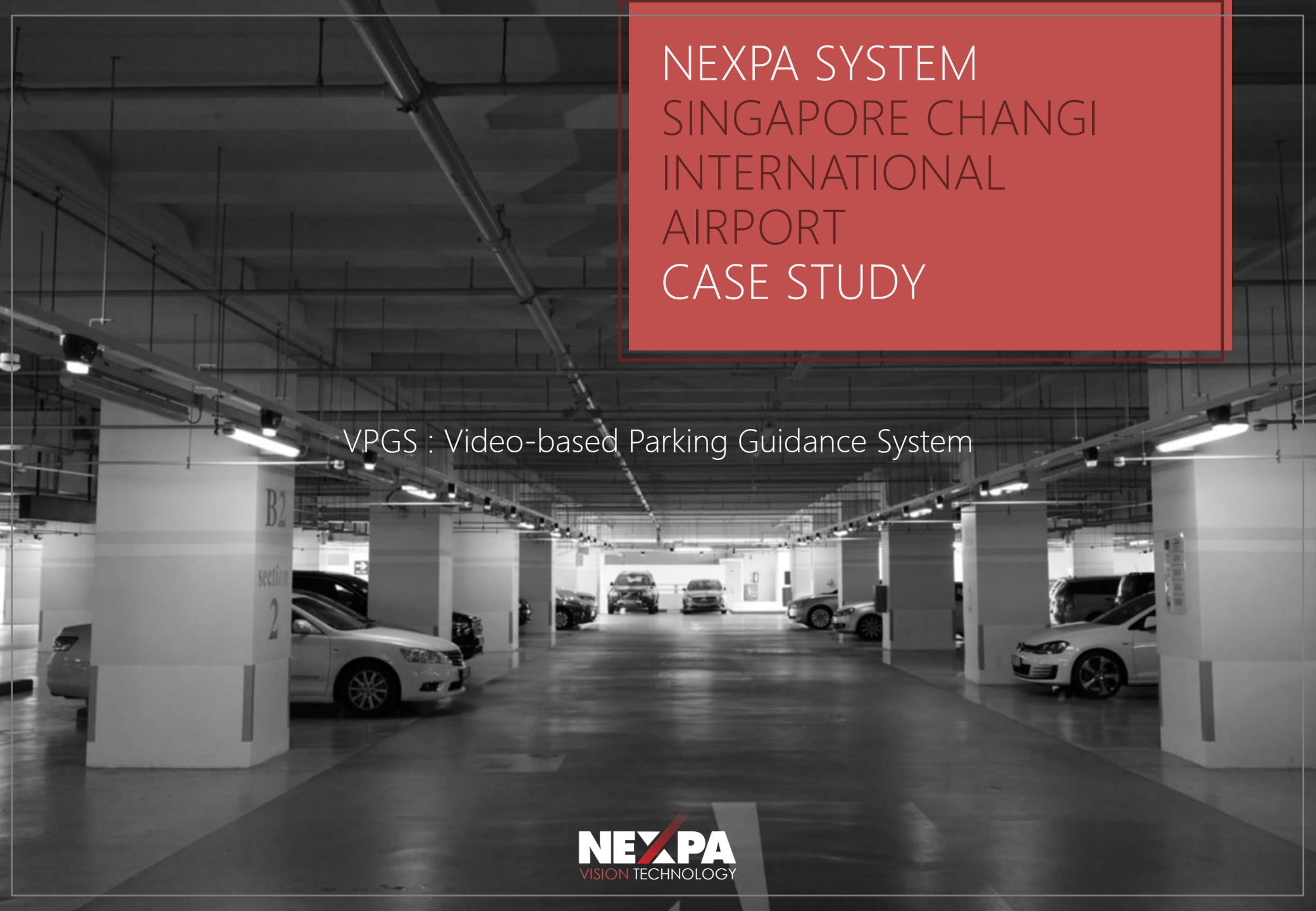


NEXPA SYSTEM SINGAPORE CHANGI INTERNATIONAL AIRPORT CASE STUDY

VPGS : Video-based Parking Guidance System

NEXPA
VISION TECHNOLOGY

TABLE OF CONTENTS

Introduction

- This case study has a purpose of introducing the project NEXPA has successfully completed for Singapore Changi International Airport.
- We, NEXPA SYSTEM has won the tender opened by CAG(Changi Airport Group) in 2016 and we has completed to install the entire system in the middle of 2017.
- Singapore Changi International Airport is No. 1 ranked the World's Top 100 Airports in 2017. And Changi International Airport has deployed this large-scale innovative solution provided by NEXPA firstly in Singapore. Also other aviation companies are already well aware of the necessity for this kind of smart and green system for future.
- We are sure that this case study would be very informative to whom is considering of new car park project for better environment.

Background NEXPA SYSTEM

- Founded in 2004, NEXPA Systems Co., Ltd. has been developing and implementing revolutionary technologies that drive the world of smart parking and public surveillance to the next level.

- At NEXPA, we constantly test and challenge our technology; we strive to offer smarter and convenient solutions to the businesses. With over 50 patents in video analytics and surveillance systems, we have the expertise and experience to provide solutions tailored to maximize the potential of smart parking solutions, transforming it to a pivotal asset for the business growth.

- Together with global partners like Cisco System, Inc., NEXPA looks to continuously develop advanced parking solutions as one of the key pillars of IoT(Internet of Things) domains. And as part of CIM(City Infrastructure Management) of Cisco Systems, Inc., we work towards the vision of a world with smart cities and communities in the future.

Project Master Plan Review

- Requirements :

  - License Plate Recognition
  - Parking Guidance
  - Video Surveillance
  - Central Management Operating System
  - Car-finding Application
  - Database Management

Site Survey

- Changi International Airport had already been using parking guidance system for their car park users. But it was a traditional solution by ultrasonic sensor. Ultrasonic sensor system will lead the car park users to find the available parking bay with a LED indicator. But it doesn't have other value added features for facilitating to operate car park and for improving car park user experience. CAG realized the need of more advanced parking guidance system which is a state-of-the-art video analytic solution.

- No. of parking bay : Total 6,646 bays

  - Terminal 1 : 1,021 bays
  - Terminal 2 : 1,321 bays
  - Terminal 3 : 1,718 bays
  - Jewel : 2,586 bays

Challenges

"Make the solution reliable and easier"

Sensor type PGS, we call it as a traditional solution because future PGS will be towards VPGS. And we are one of the leading companies that drive the market into VPGS to make the World be smart.

Sensor type PGS detects not only vehicle's presence but also other objects on the parking lots. However NEXPA's VPGS solution is based on IP camera. Our solution detects vehicle's presence with images that is much more reliable way.

One of the advantages of VPGS is to recognize vehicle license plate number unlike sensor type traditional PGS solution. Vehicle license plate number recognition enables to add the various valued functions, for example, Find-My-Car using KIOSK. This feature is essential for the large sized car park like Changi International Airport project to give the users convenience.

Challenges

"Improve safety against terrorist attacks and incidents"

These days, we are under the threats of terrorist attacks globally and Singapore is one of the countries where they care about this issue very seriously. Our solution needs to lessen the worry.

NEXPA's PGS solution has the surveillance feature too, as we use IP camera to detect car's presence and recognize the license plate number. But we can not cover the place where there is no parking bays. For this case, we will install the additional surveillance camera not to allow any dead zones to monitor the entire car park.

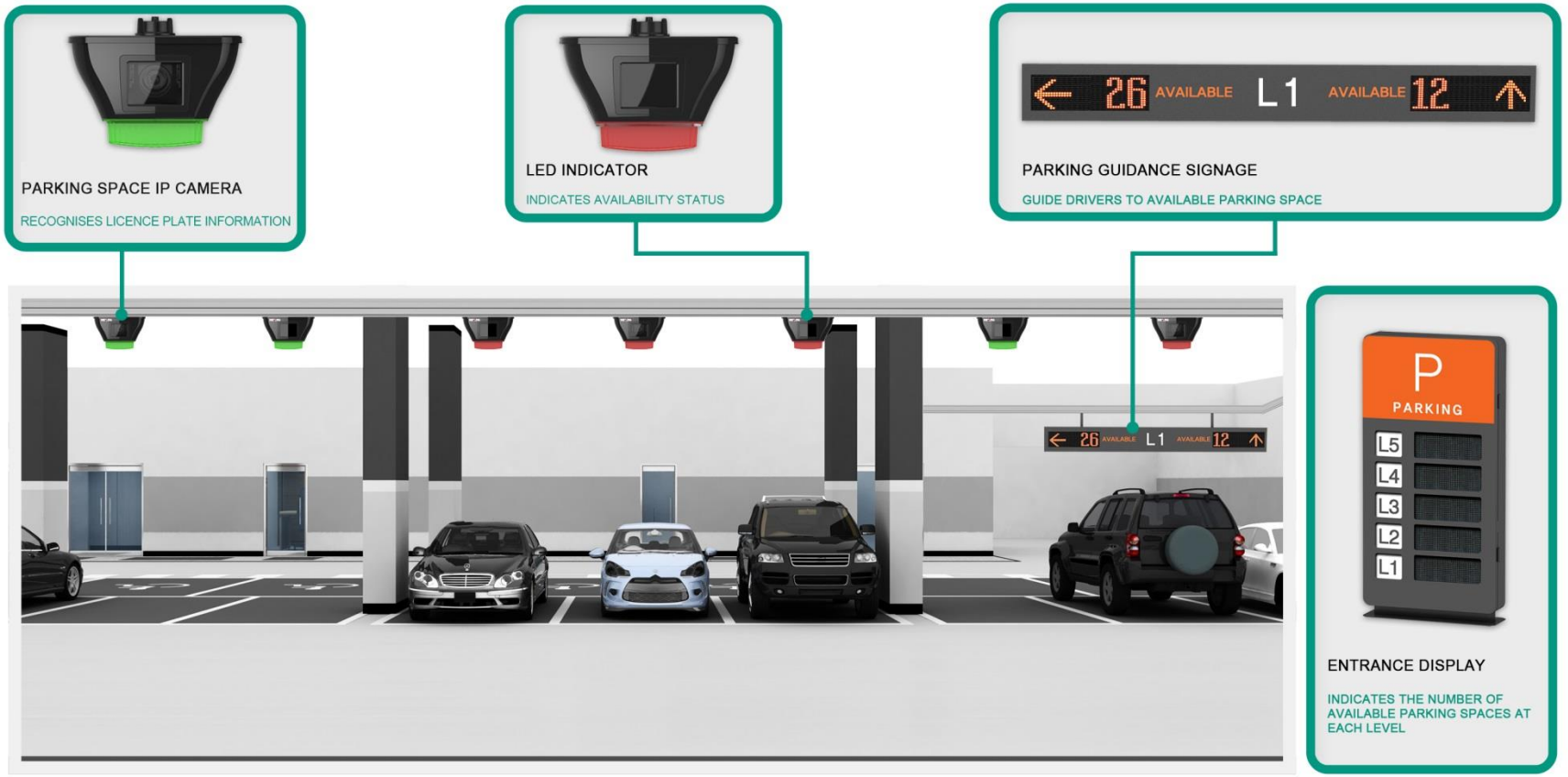
When any incident occurred in the car park, it is necessary to arrest the suspect as soon as possible to prevent the second offense. We will allow to track the vehicle utilizing IP camera.

NEXPA Proposed Solution Features

SMART	NEXPA's solution guide drivers through the entire parking process in car park from the entry to exit. NEXPA's patent video analytics technology runs the system automatically
Green	NEXPA's solution helps to reduce searching time of available parking bay. This is an low emission solution
Security	NEXPA's solution doesn't need the additional surveillance camera. IP camera for car detection and license plate recognition also acts as surveillance camera not allowing any dead zone
Integration	NEXPA's solution interfaces with existing device and application
Customer Satisfaction	NEXPA's solution is easy to run for car park operator and convenient to use for car park visitors.

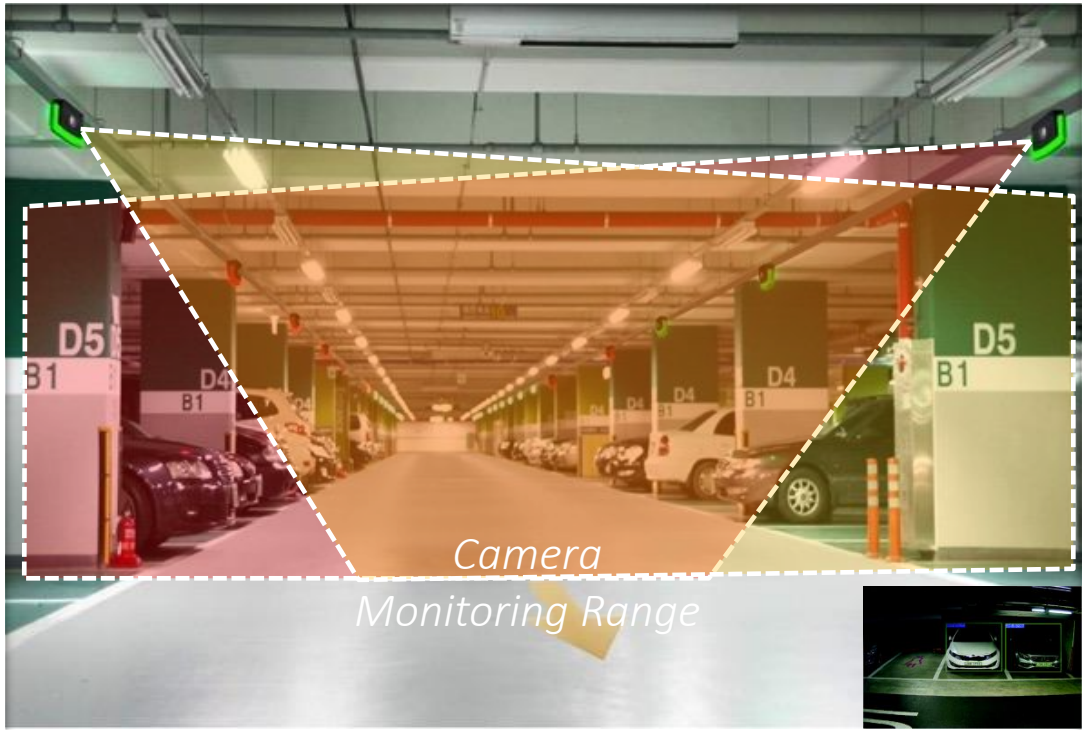
NEXPA Proposed Solution System Specification

System Concept Image

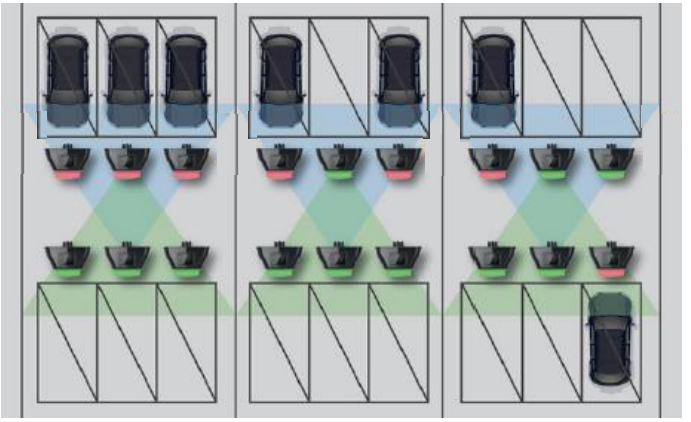


NEXPA Proposed Solution System Specification

IP Camera

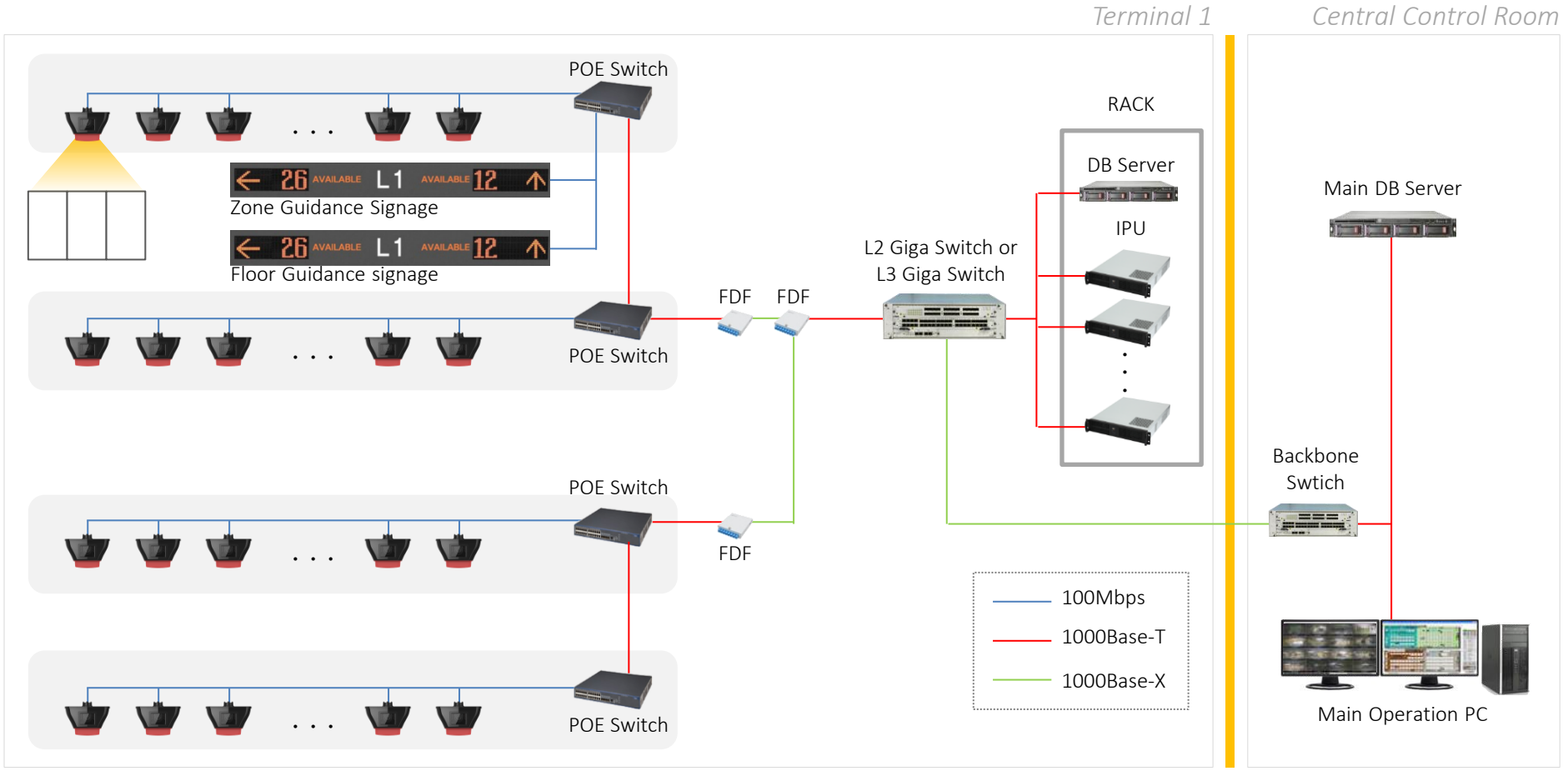


Each uni-directional IP camera covers up to 3 lots detecting cars in those 3 lots and recognizing plate numbers. Built-in LED indicates the status of parking lot, which designed for individual parking lot with additional LED light.



NEXPA Proposed Solution System Specification

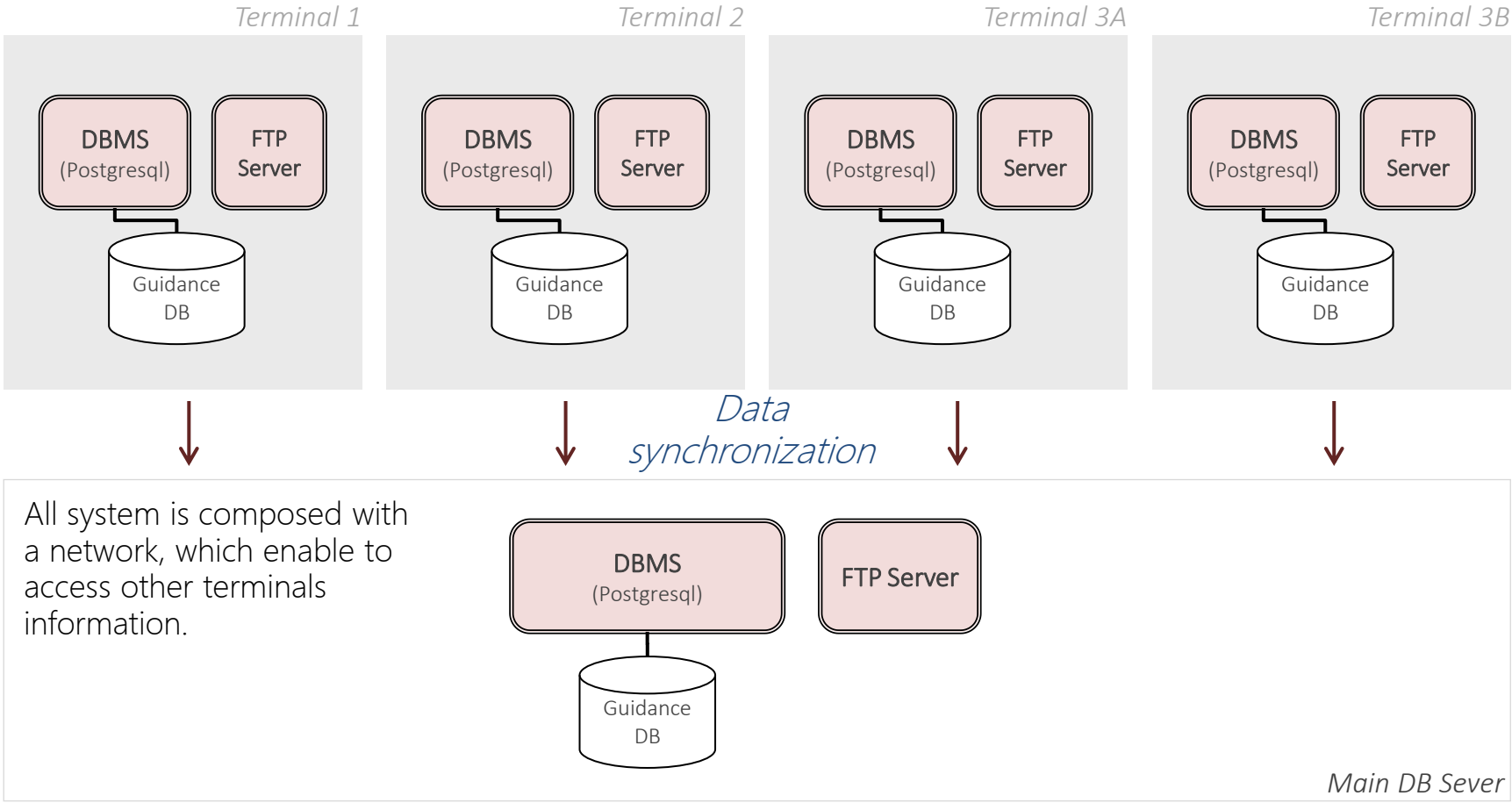
System Architecture



※ Terminal 2 and 3 have the same architecture with Terminal 1 in the above.

NEXPA Proposed Solution System Specification

Center Operation



NEXPA Proposed Solution Major Components

[Uni-directional IP camera – 5 MP/12MP (A Type)]

Raceway-mounted, WDR support for backlight areas, POE powered – one cable for both power and data transmission, IP66, 256 Programmable LED colors, Encoder – multi stream support, can detect and read 3 license plate numbers concurrently, 1.3MP for 24x7 continuous video streams for surveillance, Red LED for occupied/Green LED for available, LPR(License plate Recognition with accuracy of 95% or above)

[Uni-directional IP camera – 5 MP/12MP (B Type)]

Without LED indicator, Raceway-mounted, WDR support for backlight areas, POE powered – one cable for both power and data transmission, IP66, Encoder – multi stream support, can detect and read 3 license plate numbers concurrently, 1.3MP for 24x7 continuous video streams for surveillance, Red LED for occupied/Green LED for available, LPR(License plate Recognition with accuracy of 95% or above)

[Parking Lot LED Indicator]

Without Camera, one cable for both power and data transmission, IP66, 256 Programmable LED colors (available to set in accordance with a purpose: occupied, available, VIP, Accessible, and etc), Built in controller to control up to 2 adjacent Sub LED indicator

[Mini LPR (Wall/Ceiling Mount Type)]

1.3M pixel, IR or White LED, Indoor Type, Designed to install in constrained sites, Recognizes license plate number of vehicles entering car park, High-recognition rate by using infrared high-brightness LED or white LED even in dark environments and harsh weather, Record data of car plate number and image in embedded PC

NEXPA Proposed Solution Major Components

[PoE Switch]

24 port 10/100, Supply power to 24ea of 802.3af IP devices by PoE power support, PoE is a device which can optimize power and configure network, devices like wireless AP, Voice over IP(VoIP), IP surveillance camera

[Backbone Switch]

48 10/100/1000 port, 4 10GE Network Module (SFP), Innovative, secure, intelligent edge in the borderless network architecture,

[IPU(Image Processing Unit) / NVR(Network Video Recorder) Server]

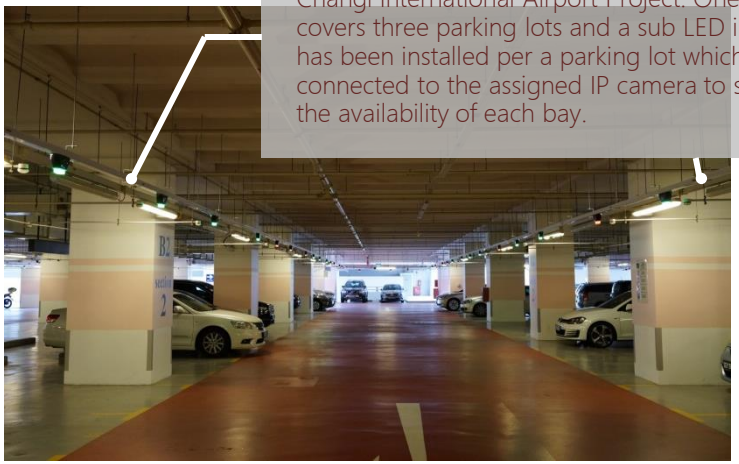
19" RACK mount, Image storing and processing device, Image management S/W included, Recognize vehicle number by transmitted image and store, Video streams archive (HD quality) from camera (24x7),

[DB Server]

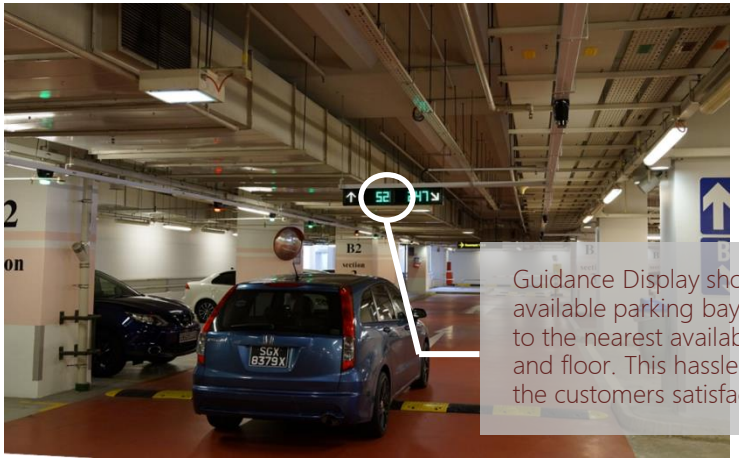
19" RACK mount, OS & DBMS included, Installed in the server farm, Manage camera IP address to check video per vehicle plate number or time, Manage channel by setting for operator to check parking lot status at any time, Integrate DB to combine all data generated from parking spots, Provide necessary data for parking management in real-time, Provide reports, statistics and current status of the entire PGS system

Installation

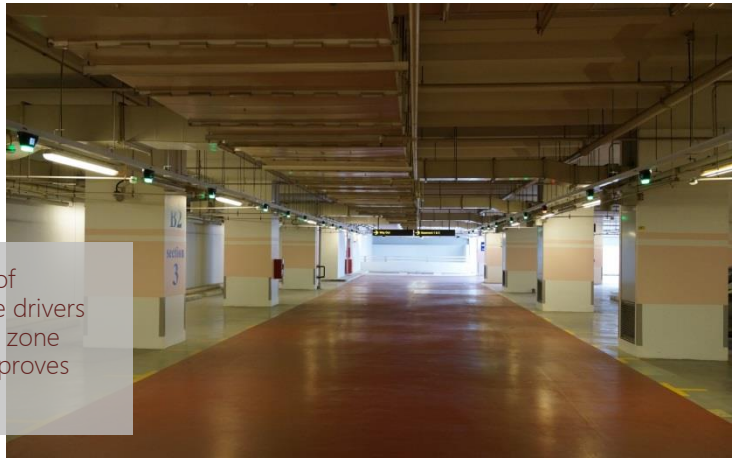
NEXPA continues to do the challenges to provide a limitless solution to the customers. In this project, IP camera(LED indicator embedded) has been installed with outdoor environment in certain areas for the site situation. This is our unique design. (Camera IP rate : IP66)



NEXPA deployed Uni-directional IP camera for Changi International Airport Project. One camera covers three parking lots and a sub LED indicator has been installed per a parking lot which is connected to the assigned IP camera to show the availability of each bay.



Guidance Display shows the number of available parking bays. This guides the drivers to the nearest available parking lot by zone and floor. This hassle-free solution improves the customers satisfaction.

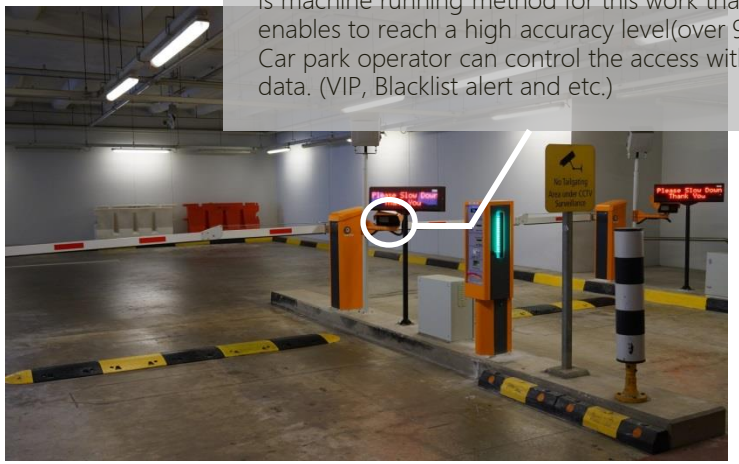


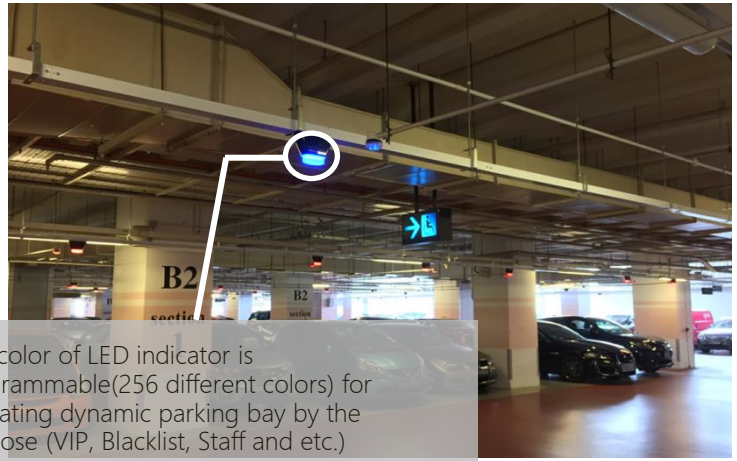
January 2017 ~ June 2017

99% of Accuracy Rate

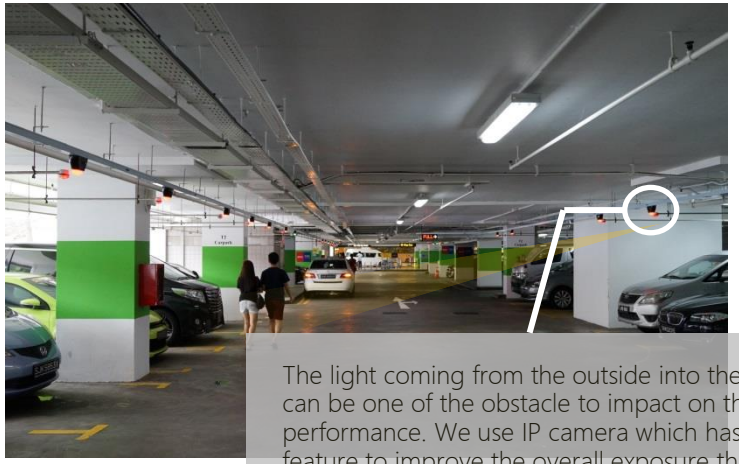
Installation

The LPR machine detects car's presence and recognizes the vehicle license plate number. NEXPA uses our own developed algorithm which is machine running method for this work that enables to reach a high accuracy level(over 99%). Car park operator can control the access with the data. (VIP, Blacklist alert and etc.)





The color of LED indicator is programmable(256 different colors) for allocating dynamic parking bay by the purpose (VIP, Blacklist, Staff and etc.)

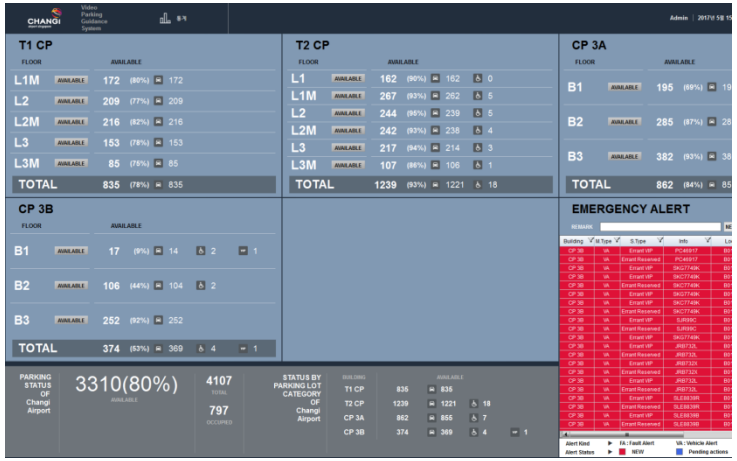


The light coming from the outside into the building can be one of the obstacle to impact on the camera's performance. We use IP camera which has WDR feature to improve the overall exposure throughout the entire image in dark shadow to recognize license plate number.

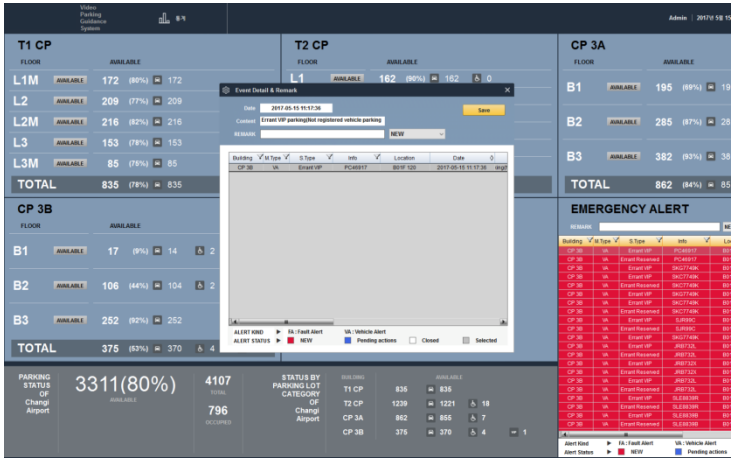
January 2017 ~ June 2017

99% of Accuracy Rate

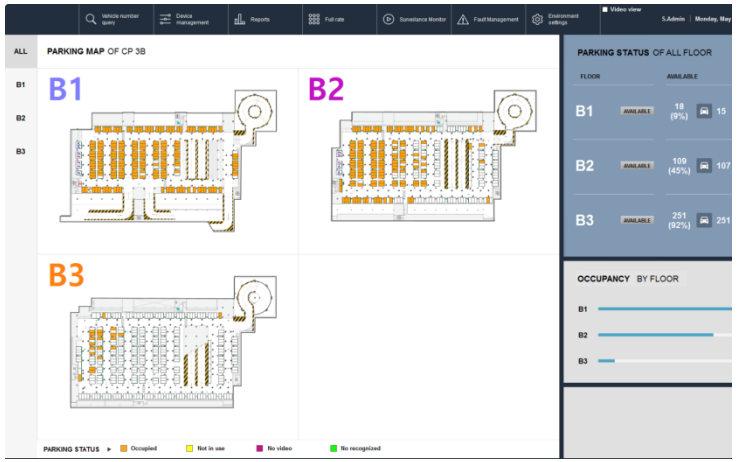
Operation



Main Screen



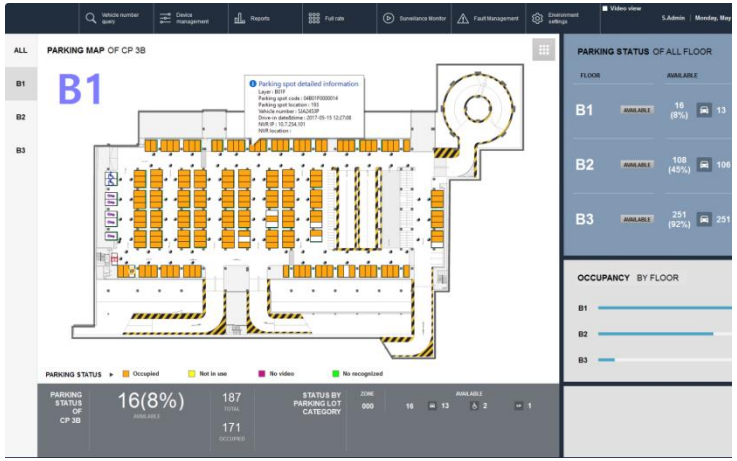
Main Log Screen



Terminal Default

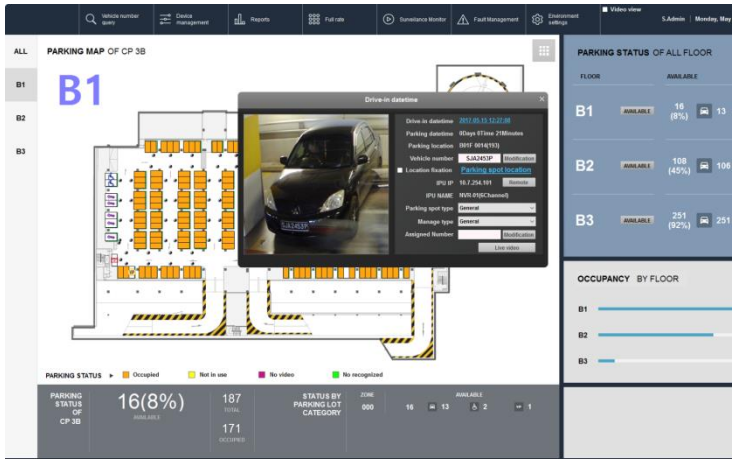
Terminal Select B1

Operation

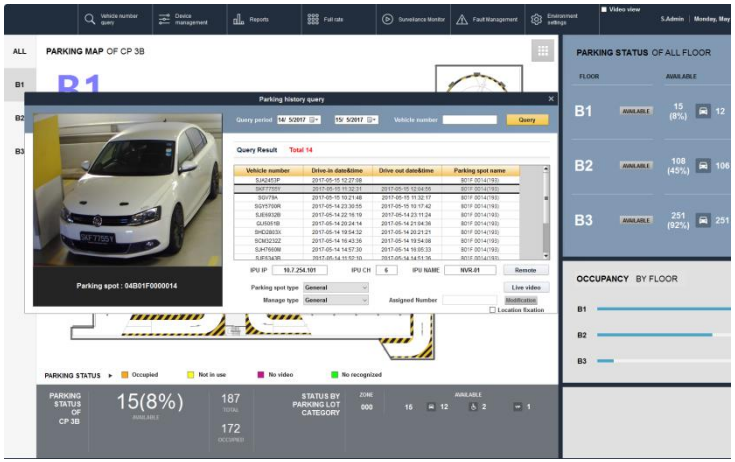


Terminal Popup Window

Terminal Guidance Light Status

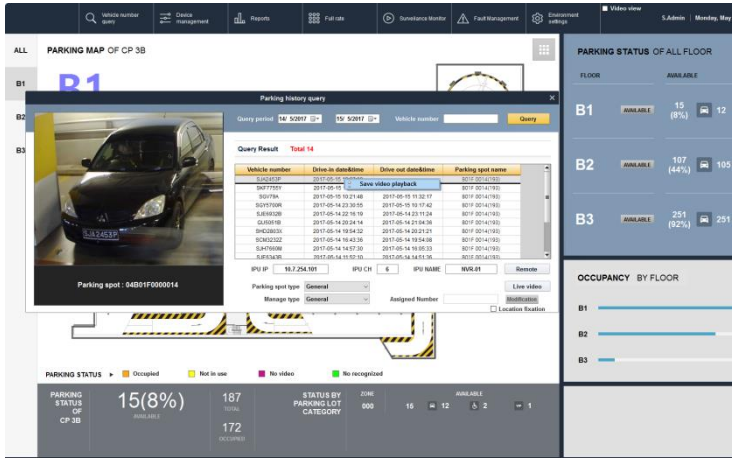


Terminal Check lot

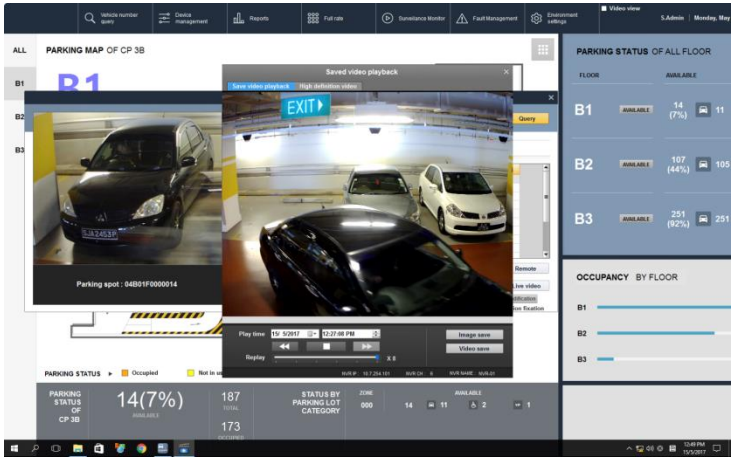


Terminal _ Parking History

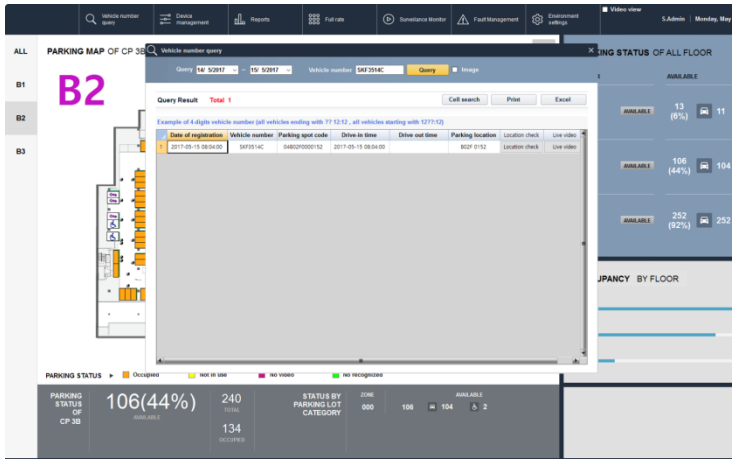
Operation



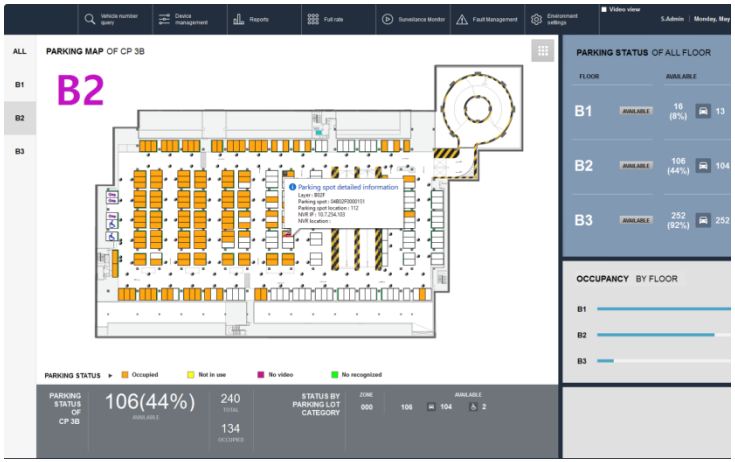
Terminal _ Video (Select)



Terminal _ Video 2 (Play)



Terminal Find My Car (Search)



Terminal Find My Car (Result)

Benefits

Car park User

Easy to find the available parking bay.

Guidance display LED indicator guides driver to the nearest parking bay from the entry. It prevents to waste of time to search and reduces congestion. It is related to low emission.

No need to remember where car parked

Find-My-Car feature shows where the car parked just with the license plate number using KIOSK and show the shortest way to get there too.

Do not worry about accident

In case of any accident, the car park users could find out the cause and get the evidences.

Car park Operator

Enable to operate car park efficiently using automated system

It is available to monitor the car park, manage the parking bay(Dynamic lot allocation), and use the statistics. It helps to increase in the utilization of car park and reduce the labor cost.

No need to install surveillance camera additionally

It covers the entire car park area without any dead zone. It reduces the cost of the whole car park system ultimately and provides car park users the safe environment monitoring 24/7.

Improve the parking service

It helps to enhance the user's parking experience and foster user's loyalty and finally operator's profit will be increased.

Media

CHANGI JOURNEYS
ISSUE 9 – JULY 2017

Smart Parking Guidance System

Security & efficiency. First of its kind in Singapore.

If you had parked your car at Changi Airport recently. You may have noticed that the parking guidance system in our car parks look slightly different from all the other systems in Singapore. And you are right.

Changi Airport has recently installed a new Video-based Parking Guidance System (VPGS) across the different car parks in the airport.

This new system- the first of its kind in Singapore in a large-scale parking facility- is designed to improve car park management and provide a stress-free parking experience for visitors. By using video analytics to identify license plate numbers, as well as detect vehicle presence and the entry and exit timings of all parked vehicles. VPGS helps to monitor the status of the car park in real-time.

In Addition, VPGS also helps to boost security – an extra benefit in our current security climate. While there is currently CCTV footage of critical locations in our car parks, *VPGS offers added CCTV coverage of all car park spaces.*

Read Article: http://www.changiairport.com/corporate/media-centre/resources/publication/changi-journeys/issue-9/smart-parking-guidance-system.html

Media

THE STRAITS TIMES
PUBLISHED AUG 28, 2017

Forget where you parked? Airport's got you covered

Carparks are getting smart too.

Those LED lights above parking spaces that indicate if a space is available have made life easier for motorists looking around for parking spaces, but drivers still have to remember where they parked their cars.

Changi Airport's new Video-based Parking Guidance System (VPGS), however, could help a hapless motorists who cannot locate his ride.

The first of its kind in such a large-scale parking facility, the system uses video analytics to give drivers a foolproof way to find their car if they cannot locate it. For Changi staff, this translates to an easier method to monitor the parking behavior of drivers.

Read Article: http://www.straitstimes.com/singapore/forgot-where-you-parked-airports-got-you-covered?utm_campaign=Echobox&utm_medium=Social&utm_source=Facebook&xtor=CS1-10#link_time=1503877369

Conclusion

- As the World's No. 1 International Airport, Changi International Airport wanted to deploy the high-end solution using the state-of-the-art technology. NEXPA won the bidding competing with other solution providers ifrom Europe and Asia countries including China. But we think that is not an end. We were continuously trying to find the much better solution tailored to the customer throughout all stages. Our main concern is always how to satisfy the car park operators and users with our solution.

- People who visit Changi International Airport and use the car park do not need to remember and try to find where they parked any more. This delicate user-friendly solution give a satisfaction to the users and help Changi International Airport to maintain its top position.

- NEXPA's solution is now attracting Singaporean medias and project owners all around world a lot. We proved our capacity once again through Changi International Airport Project.