



Smart Parking Technical Overview

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PREPARED BY

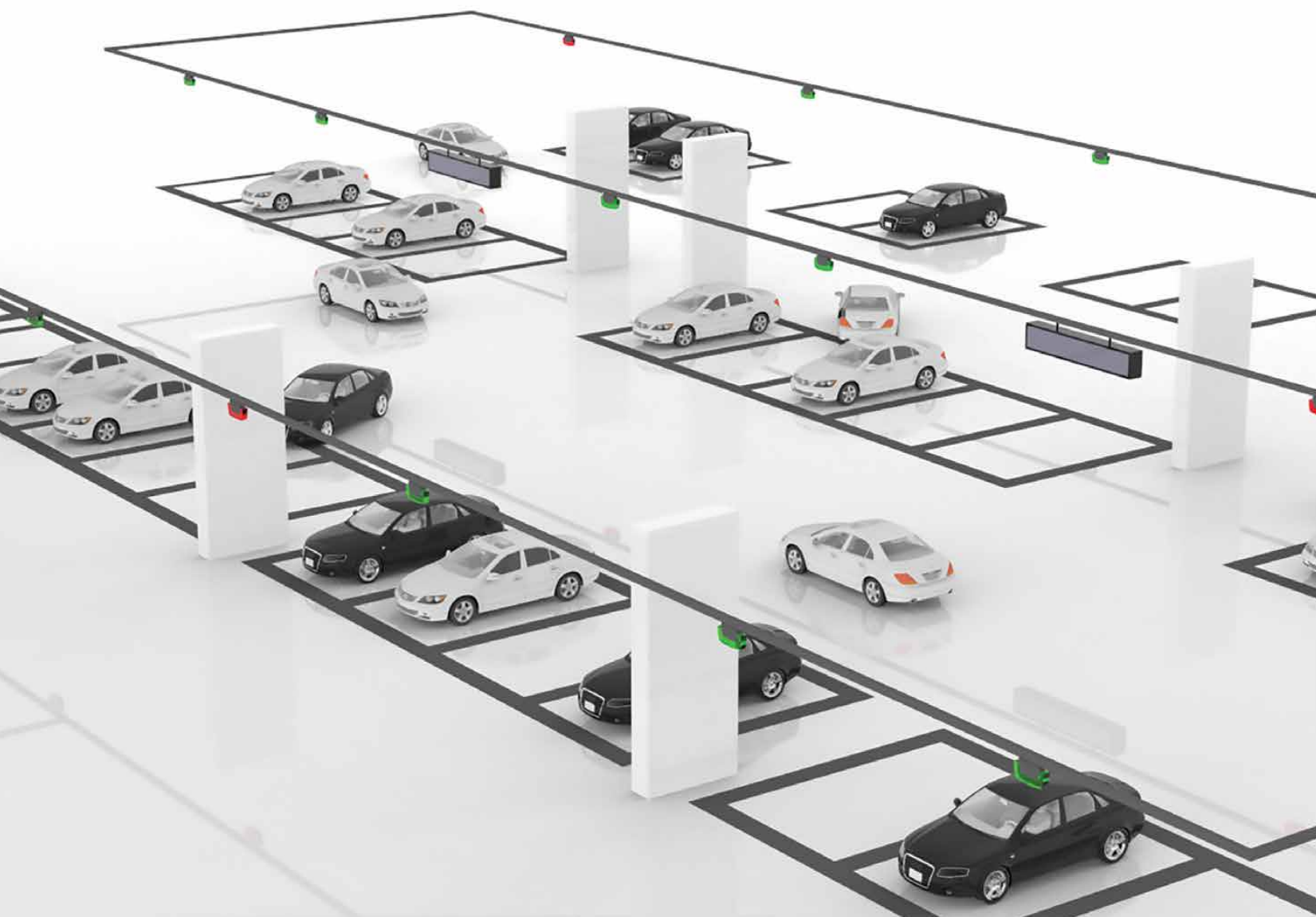
Stacy Kim
Director
604.780.3431

Matt Choi
Director
778.230.1484

Introduction

ParKo's Smart Parking System is one of the most innovative evolutions in the parking and security industries. Based on IP Cameras equipped with License Plate Recognition (LPR) and Video Analytics technologies to identify, track, and guide vehicles based on their license plate numbers, ParKo's solution integrates all aspects of smart Parking Management System (PMS), Parking Guidance System (PGS), and Auto Payment System (APS).

This innovative system also provides impeccable security and safety features with total real time video surveillance that covers the entire parking lot without a single dead-zone. This technology creates a holistic improvement in parking experience for drivers along with assurance of total security for individual vehicles.



> Benefits of ParKo's Smart Parking System

01

NEW REVENUE OPPORTUNITIES

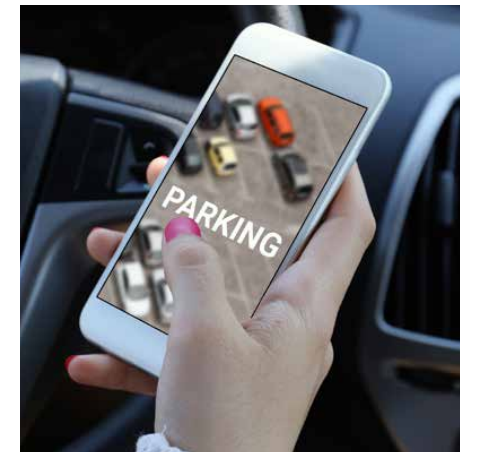
With ParKo's system, there are opportunities to build brand loyalty with customers satisfied with holistic improvement in parking experience, inciting repeated usage of the parking facilities.



02

IMPECCABLE SAFETY & SECURITY

As ParKo's system is equipped with IP camera sensors that also function as CCTV cameras, there will be no dead-zones within a parking lot, and the cameras are able to monitor individual parking lot 24/7 while archiving video data up to 30 days. Video files can be retrieved by identifying individual vehicle plate numbers or parking lot numbers to mitigate dispute arising from minor collisions.



03

HIGH PERFORMANCE AND ENHANCED PROFITABILITY

ParKo's system is designed to provide the most comprehensive range of services to eliminate additional capital expenditures to maintain a parking lot. Remote parking lot management, vehicle access control, real-time surveillance, visual parking guidance, and automated payment system are integrated onto one single platform for seamless operation.



04

ENHANCED PARKING EXPERIENCE

ParKo's smart parking system provides simple, automated guidance based on individual vehicle license plates, resulting in pleasant, hassle-free parking experience.

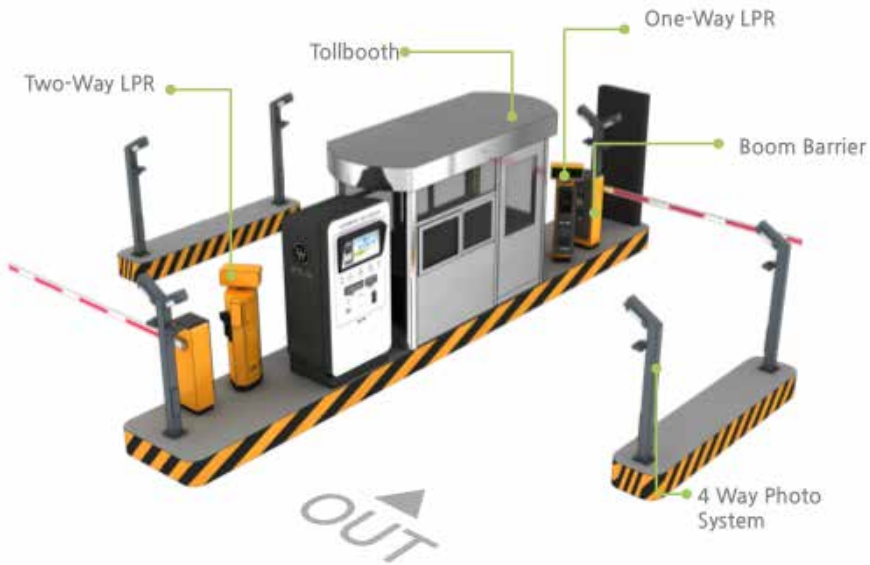
Parking Management System (PMS)

ParKo’s end-to-end solutions comprise the flagship LPR (License Plate Recognition) machines at each gate along with the APS, access-list management, IP (VoIP) based command system, and CCTVs for incoming vehicles for complete parking lot management.

As individual vehicles enter a parking lot with ParKo’s system installed, license plate numbers of incoming vehicles will be recognized instantly by the LPR machine, and the vehicle information will be timestamped and stored in the database. All of this happens within a second, and once vehicles are recognized, ParKo’s smart boom barrier will open up for the vehicles to proceed into the parking lot without full stops for a card or ticket dispensing. Likewise, when a vehicle is approaching ParKo’s smart boom barrier at exit, the system reads vehicle license plate numbers to run a check internally for parking fee calculation and against payment status. Upon successful checks, the boom barrier

opens automatically, and vehicles can drive out without stopping. Parking fee calculation can also be integrated with the traditional RFID (Radio Frequency Identification) card reader or ticket system to provide bullet-proof revenue control system.

Being a video-based PMS, it can co-work with the PGS for more flexible vehicle access management, such as identifying Residents, Tenants, VIPs, Staff, and Monthly Parking Customers by referring to a pre-registered vehicle list within the system. In addition, the PMS coupled with the PGS allows “preferential parking rates” (different rates for different parking zones).



LPR machines incorporated for a compete parking lot management.

> LPR Machines

At the core of ParKo’s PMS are the LPR machines, which are typically installed at gates. There are many model line-ups of our LPR machines for easier adaptation and model selections based on constraints of each gate and different use-cases (ex. LPR for motorcycles, LPR for Two-way (front and rear LPR), LPR for One-way, etc).

- 1 Two-Way
- 2 One-Way
- 3 Mini-LPR
- 4 Boom Gate (w/ Built-in LPR)



> Specifications

PRODUCT	DUAL CAMERA LPR SYSTEM	SINGLE CAMERA LPR SYSTEM
Method	Visually analyses front/ back plates of vehicles	Visually analyses front plates of vehicles
IP Camera Unit	Digital CCD, 1.3-megapixel x 2EA	Digital CCD, 1.3-megapixel
Shutter Speed	Auto	Auto
Recognizing Speed	Within 0.85seconds	Within 0.85seconds
Lens	5~50mm	5~50mm
Light	High brightness infrared LED	High brightness infrared LED
Recognition Rate	Above 99%	Above 98%

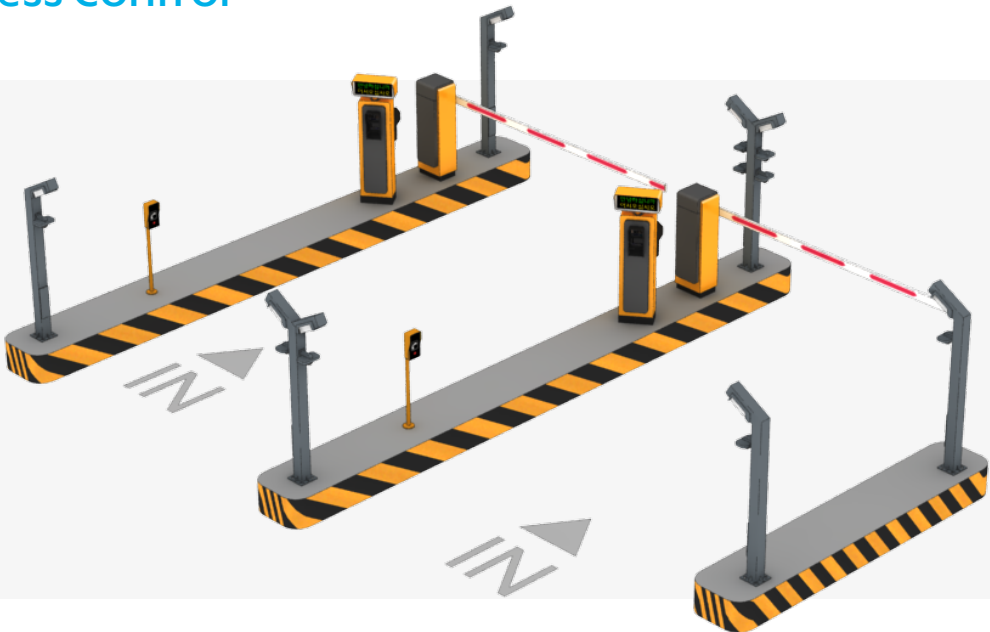
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ParKo’s LPR machines are individually activated by loop coils and have synchronization and control units integrated with our smart boom barrier and other devices. It has internal LED lights for day & night operations and can be configured to have visible or invisible flashing lights. The sophisticated LPR cameras employ adjustable “frames per second” using the Global Shutter technologies as compared to Rolling Shutter for moving vehicles. In other words, each frame taken will be analyzed for license plate number extraction by ParKo’s robust video analytics engine, which will elect the best result by comparing license plate numbers of each in frame with one another amongst multiple frames taken for one every license plate. This superior technology allows for an industry-leading accuracy when it comes to license plate number recognition and therefore complete ticket-less solution.

The entire processing time is less than 1 second, and the entire cycle of “activation-to-boom-barrier-open” is almost instantaneous that, virtually, a vehicle does not have to make full stop at the gate.

> Unmanned Access Control

Vehicle traffic and the sub-systems will be monitored and managed by the operator at the Command Centre.



All entrances will be unmanned; no personnel will be stationed at the entrance gates for the LPR operations. This means all the entrance gates will be fully equipped with the LPR machines and fully integrated into the PMS. Vehicle traffic and the sub-systems will be monitored and managed by an operator utilizing our Command Centre software.

As a vehicle approaches the exit gate, the LPR machine will take the license plate number of the vehicle and pass the information to the PMS for vehicle identification and verification as part of parking fee payment control and enforcement. The license plate number and the picture of the vehicle can be stored up to 30 days.

> Optional 4-Way CCTVs

Optionally, ParKo’s 4-Way CCTV System can be installed, and it will add more enhanced security measures to personal safety and accident claims. Having all 4-side images of the vehicle associated with the license plate number recognized will allow driver recognition at the exit gate (driver face image at the entrance can be retrieved and viewed by the cashier at the exit gate) and will protect the parking lot owner from any false claims.



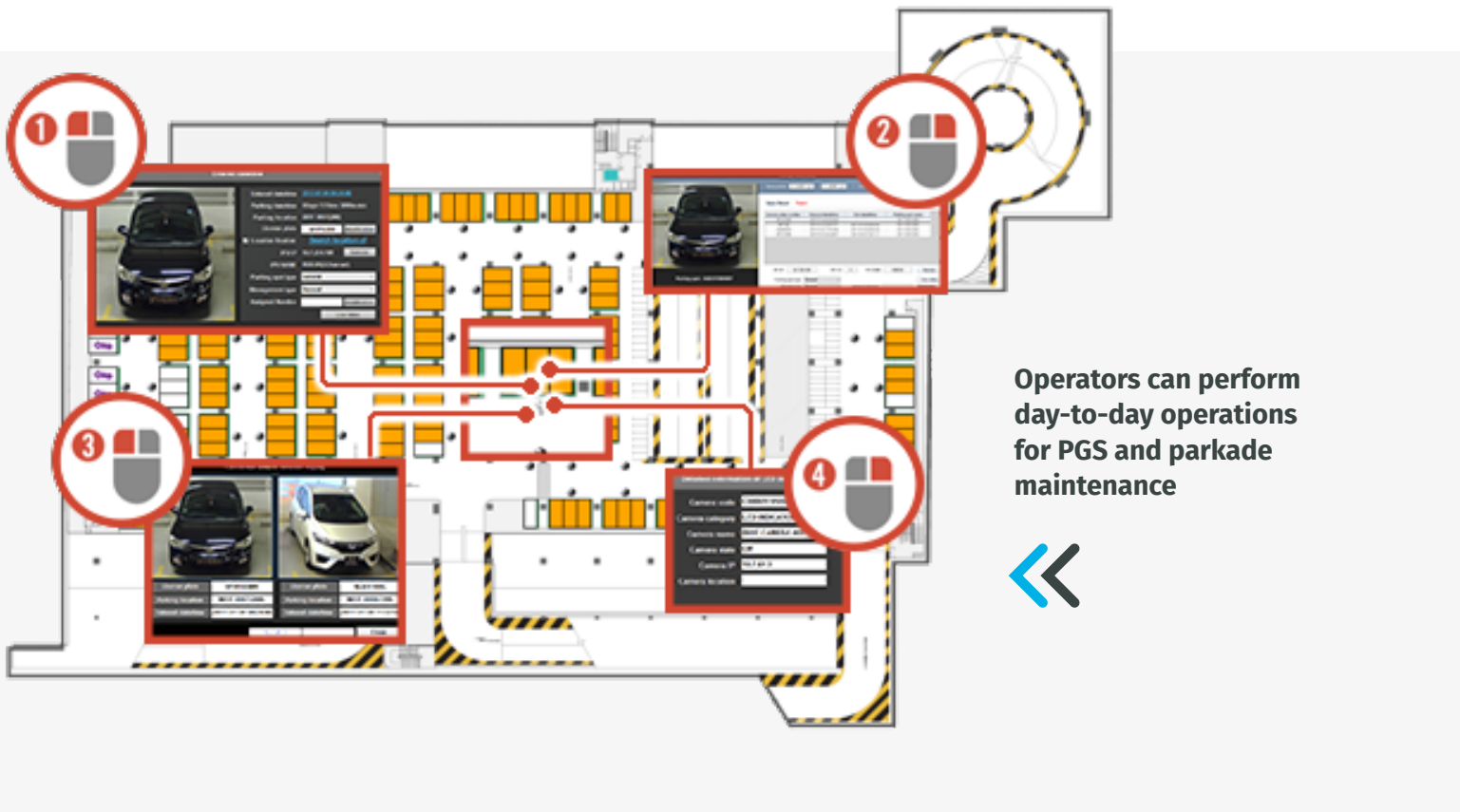
> Surveillance



The same cameras used for LPR in the PMS and the PGS also function as CCTVs delivering continuous 24/7 video streams. While the video stream is being archived in the NVR server, corresponding meta-data is also created in the central database so that, at later times, retrieving video clips based on a license plate number or a parking lot (space) number or date/time range is a breeze and very effective – no more brute force searching for the intended video clips. **The main advantage of ParKo’s video surveillance is its coverage area.** Virtually, with ParKo’s PGS, the entire parking lot is covered by our cameras with everything recorded leaving no dead-zones. Every corner is being recorded for greater security, which may lead to enhanced user experience resulting in customer royalty, deterrence of any offenses within a parking lot, and even insurance premium reduction for its comprehensive evidence management.

> Day-to-Day Operations

With simple mouse clicks on the floor maps, operators can perform day-to-day operations for PGS and parking lot maintenance. Also, the floor maps clearly display parking status (occupied, available, VIP, handicap, not recognized, etc.) along with the camera health indicators. With simple mouse clicks, operators can bring intended video clips or live monitors right on the screen.



Operators can perform day-to-day operations for PGS and parkade maintenance

PREFERENTIAL PARKING RATES

Optional Feature

ParKo's PMS can set up different parking rates based on different parking zones (parking fee differentiation based on floors, hours, proximity to gates, etc). The preferential parking rate calculation will assist landlord in adopting strategic parking revenue collection model.

SPECIAL AREA MANAGEMENT

Optional Feature

"Special Area" (ex. 10 Min Parking Only) can be more effectively monitored and enforced with ParKo's PMS. Any vehicles stayed in such area for more than given time can be alerted for appropriate actions.

> Additional Management Features

At the Command Centre, as part of the PMS, operators can monitor, control and perform day-to-day PMS operations such as maintaining Access Lists (ex. Residents, Black List, VIP, Staff, and Monthly Parking) and LPR alert management, handling of the un-recognized license plates, monitoring CCTVs for gates and devices, and conducting regular maintenance.

In addition, following analytics tool can be provided upon Landlord's request:

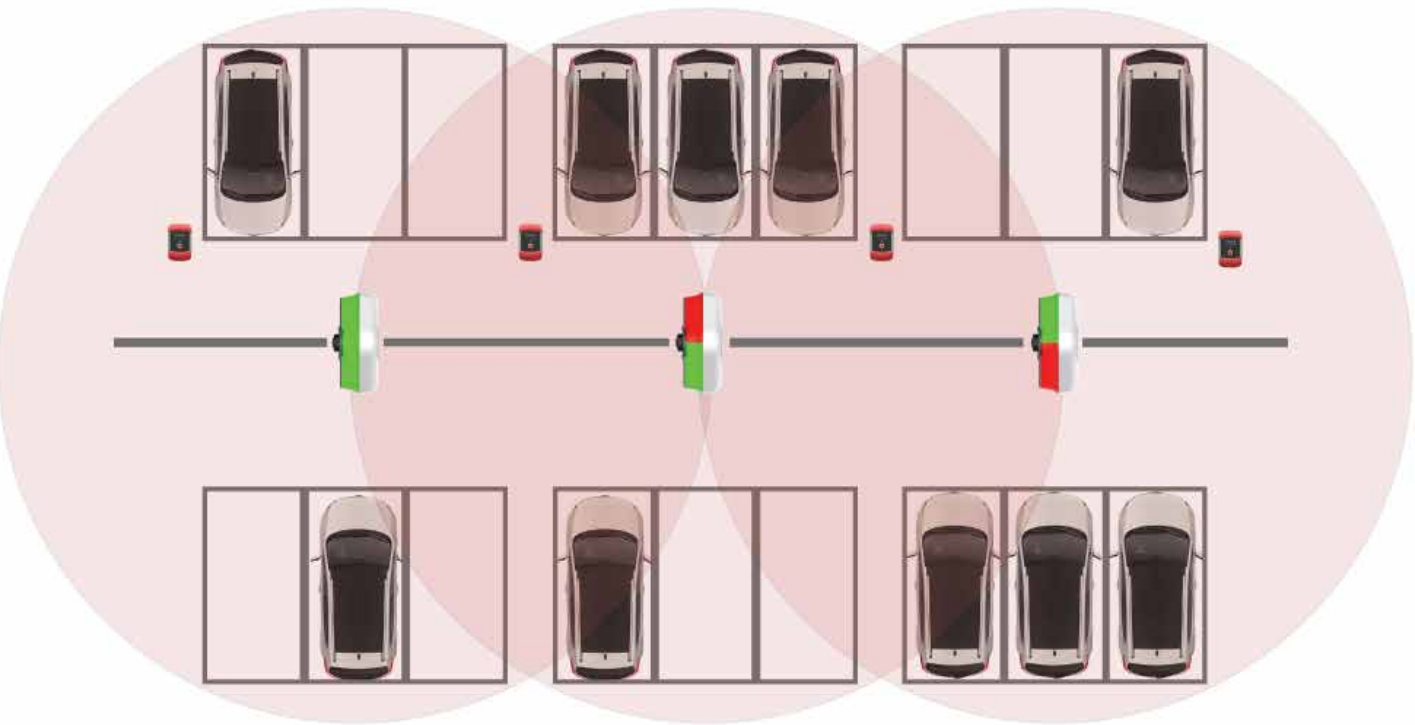
- » Parking history report for each parking stall or the entire parking lot – with information such as license plate number, time-in/time-out, parking lot number/zone number/floor, picture of the license plate and the car, etc.
- » Real-time parking status/statistics reports for individual zone/floor/entire parking lot, along with graphical representation of parking period (different colors for different hours being parked).
- » Meta-data-based archive retrieval (based on the parking lot number, license plate number, date/ time range or combination of both).
- » Live monitoring, surveillance monitoring of various configurations and centralized archiving of the video streams from all cameras.
- » Emergency alarm system management - all integrated for two-way communication and automatic pop up screen of nearby cameras for instant monitoring of the situation.
- » Resident/Tenant/VIP/Blacklist/Handicap/ Monthly Permit/Reserved/Car Rental lists management with automatic alarm for any violations at the management console and optional P.A (Public Announcement) system to deter offense drivers – a speaker can be plugged into a nearby camera.



ParKo's PMS is protected, by its login credentials, from any unlawful access to the server. The authorized login IDs and password can be created for access through the system and every login attempt (whether authorized or unauthorized) will be logged in the system.

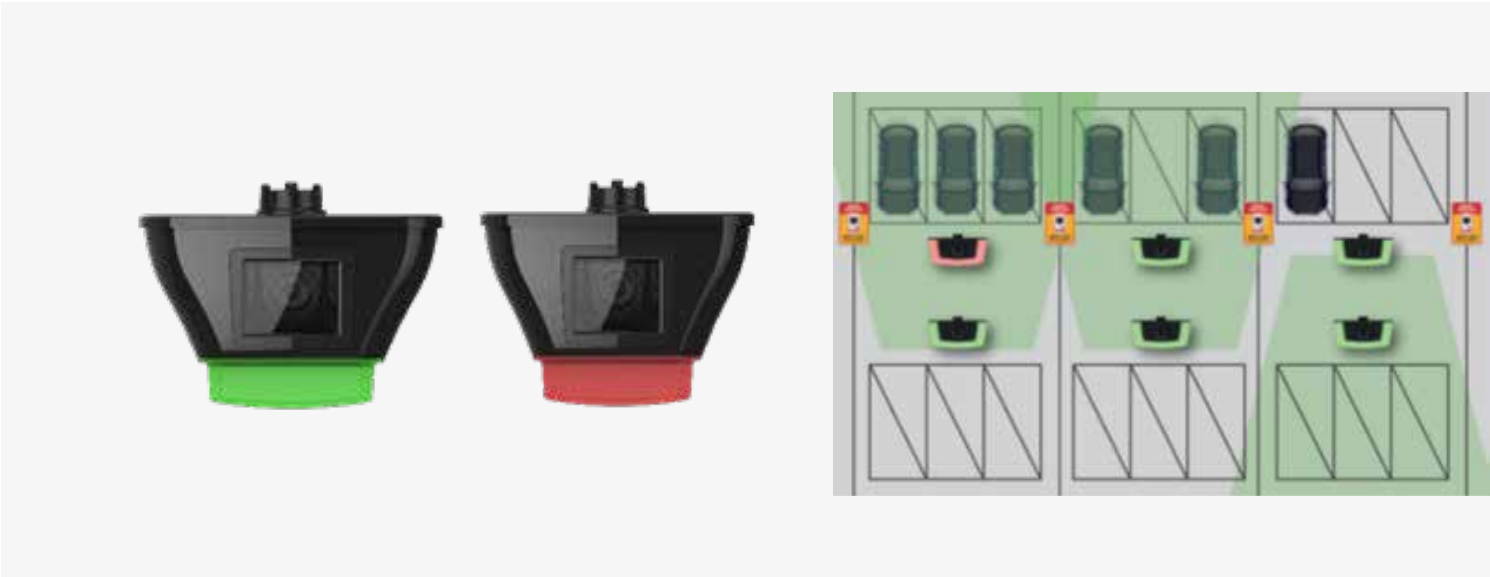
Parking Guidance System (PGS)

At the core of ParKo’s Parking Guidance System (PGS) are IP cameras embedded with LED indicator lights and ParKo’s powerful video analytics software in the back-end side. The IP Cameras detect availabilities and license plate numbers, and transmit relevant information to the Command Centre for 24-hour surveillance. The information is also used to locate individual vehicles based on plate numbers at different kiosks or ParKo’s mobile app. The cameras also indicate availabilities by illuminating green for available and red for unavailable parking stalls.



> Uni-Directional IP Camera

Each uni-directional IP camera covers up to 3 stalls, detecting vehicles and recognizing license plate numbers in those 3 stalls. Built-in LED Light indicates real time status of the 3 parking stalls.

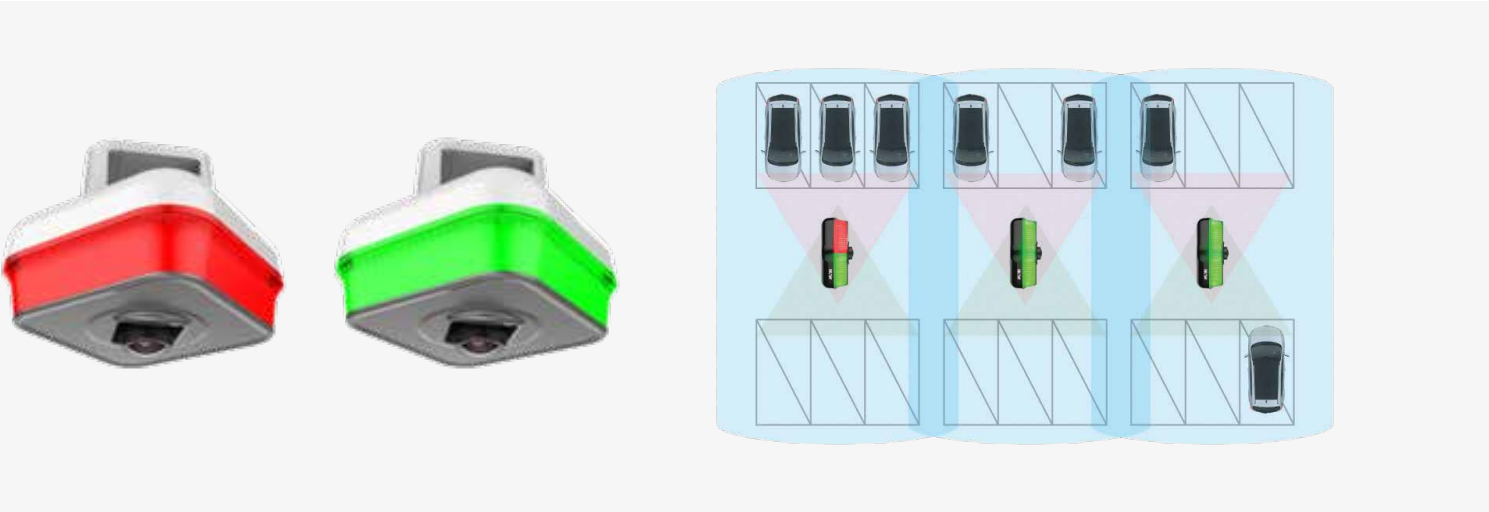


> Specifications

PRODUCT	UNI-DIRECTIONAL IP CAMERA
Photographic Device	1/2.5" COLOR 12M CMOS (12-megapixel)
Communication Method	100M Ethernet
Minimum Illumination	1.2~1Lux @ F1,2
Sync Method	Internet trigger
S/N Ratio	38dB
Shutter Speed	Auto
Frame	1.3-megapixel 5FPS(15FPS max), 12-megapixel 1pic/2sec (1FPS max)
Type	Raceway attached
Video	H.264
Video File Extension	JPEG
Detection Range	3 stalls per camera

> Omni-Directional IP Camera

The 360° IP Camera monitors and detects up to 6 stalls in 360° radius concurrently. The 360° video will then be uploaded to the Command Centre where the Video Partitioning/ Distortion Correction module divides the visual into 4 separate screens for accurate recognition of plate numbers and easy monitoring of vehicles.



> Specifications

PRODUCT	UNI-DIRECTIONAL IP CAMERA
Photographic Device	1/2.5" COLOR 12M CMOS (12-megapixel)
Communication Method	100M Ethernet
Minimum Illumination	1.2~1Lux @ F1,2
Sync Method	Internet trigger
S/N Ratio	38dB
Shutter Speed	Auto
Frame	1.3-megapixel 5FPS(15FPS max), 12-megapixel 1pic/2sec (1FPS max)
Type	Raceway attached
Video	H.264
Video File Extension	JPEG
Detection Range	6 stalls per camera

> Guidance Digital Signage



Throughout the parking lot, One-Way or Two-Way LED signage displays are installed at the ceiling at strategic junctions or main artery driveways on each floor to effectively guide incoming vehicles to available parking spaces, which will reduce time to find available parking spaces, and smoothly guide the traffic. The signages have 3 different colors (Green, Yellow and Red) with LED Lamps to make information highly visible. The display content is controlled by the dedicated controller and the PGS database. Each signage goes through serial IP conversion by the gateway and is addressable by IP addresses. The availability information is processed and stored in the database, and the system constantly updates the signage whenever there are changes to parking space availability and car counting.

ParKo offers a variety of PGS signage displays for a variety of use cases. First, at the entrance, drivers can find birds-eye view of the entire parking lot by parking floors through the entrance signage board. Once the vehicle is inside the parking lot, signage displays will guide drivers to the nearest available parking space zones, and drivers can easily find available spaces by looking at the LED indicator lights that are part of the PGS cameras.

99.5%
Accuracy Level

Counting of occupied or available parking stalls against the total available happens on a real-time processing basis and exceeds the accuracy level of 99.5% as our PGS cameras can detect vehicles in each demarcated parking spaces regardless of the LPR accuracy.



> Find-My-Car



With ParKo's Find-My-Car, drivers can find their car by simply entering their license plate number. Find-My-Car can be integrated with the Automated Payment Kiosk or can be added to ParKo's mobile application. Upon landlord's request, Find-My-Car Kiosk can co-exist with other applications such as directory, store information, weather forecast, etc.

System Architecture

> POE Switch

The components for the PGS, such as the IP Cameras and the Emergency Support System, are supported with PoE (Power over Ethernet) technology that supplies power and transmits network data simultaneously. The PoE technology eliminates the need for power cables and saves the installation costs. The system is also backed up by UPS (Uninterruptible Power Supply) for safety measures from power overload or power outage.

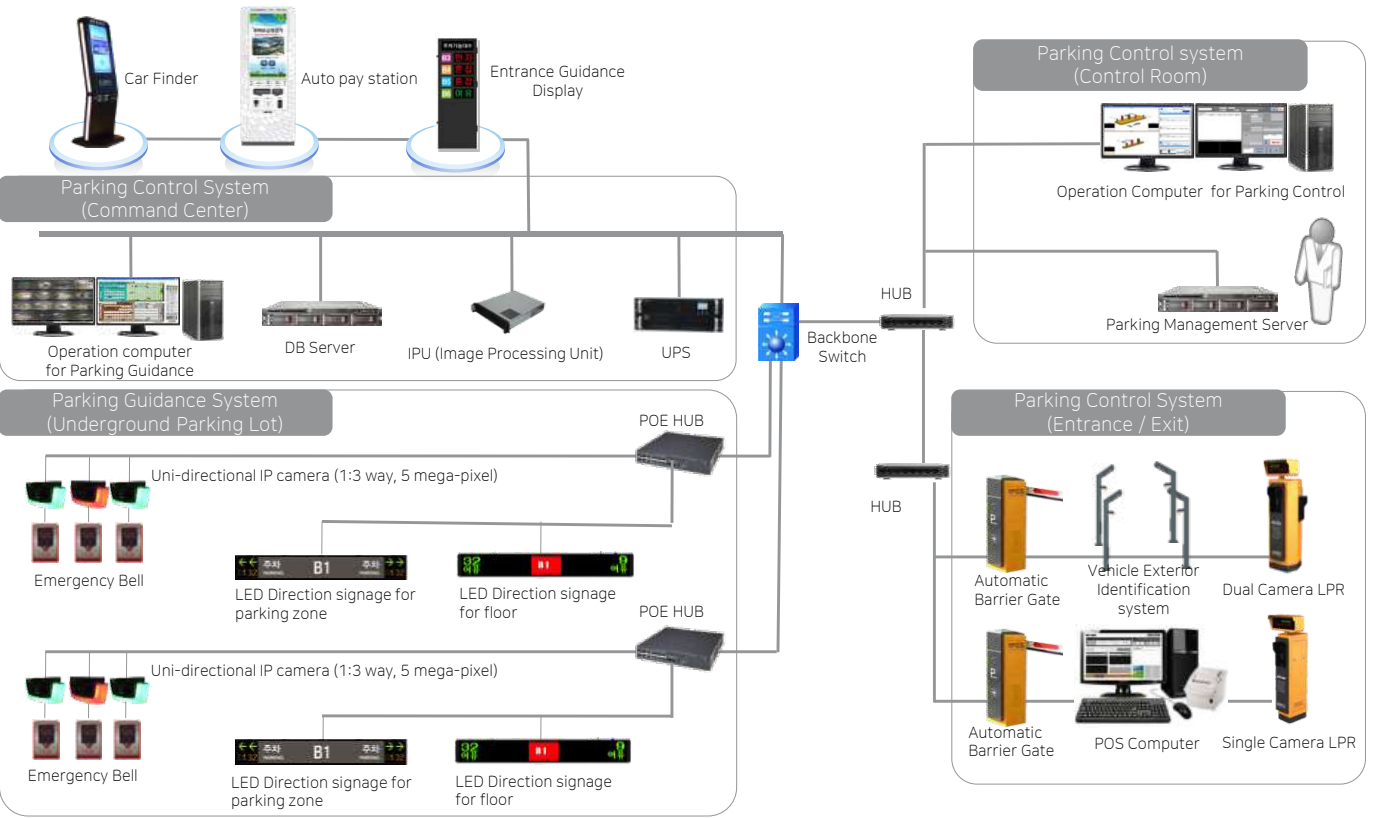


> Database Server

Parko’s database server is the key component for the video based PGS that processes information, controls, manages, presents and stores all aspects of the PGS system. After the evaluation of the parking operation requirements, appropriate database management platform will be proposed amongst MS SQL, MySQL, Oracle, or POSTGRESQL.



> Sample System Architecture



> Database Recovery

A backup Database server is situated in the Command Centre and will act as the replication server for the Database servers. In case of the Database failure, the backup Database can be used to recover from the Database.

Auto Pay System (APS)

ParKo offers Automatic Payment Machine for combined functionality of Find-My-Car and parking fee payment before heading out to exit gate(s). One machine will assist the entire journey of a driver from finding their vehicle to paying for their stay.

This approach enables ticket-less parking operations since all the incoming/outgoing vehicles are recognized by license plate numbers and imposed rates based on different parking fee rates and advance payment status within given grace period once paid through the auto payment machines. The Automatic Payment Machine will accept all major credit cards (Visa, MasterCard, and American Express), debit, and cash.



> Reservation System

Through ParKo's mobile application, drivers can find and reserve available parking spaces prior to driving down to the intended parkade by entering the license plate number and other relevant information into the system.

Mobile Application

ParKo's mobile application has been designed to deliver all the features at the fingertips of all end-users.

> Residents

For residential users, real-time surveillance of their parking stalls will be provided through ParKo's mobile application. In case any unregistered vehicles enter designated residential parking lot, residents will be alerted through ParKo's mobile application. In addition, license plate numbers of visitors can be pre-registered prior to their visit to allow guest parking without walking down to concierge for parking passes and then to the guest parking lot to place them on dashboards. Elevator access can also be integrated for even more convenience.

> Pay-As-You-Drive

For commercial users, Find-My-Car, parking stall reservation, and auto-payment services are provided on ParKo's mobile application. In addition, as individual vehicles can be identified, Pay-As-You-Drive is possible when a credit card is linked with a license plate number in the mobile application for faster and easier parking payment.

> Monthly Parkers

For commercial monthly users, drivers' monthly permit will automatically can be set to automatically renew through our system by processing pre-authorized payment information. In case of any payment failure or expired payment information, our mobile application will notify the driver.



Emergency Support

ParKo’s Emergency Support System is very easy to install as it requires only a data cable from nearby POE switch, and yet it is versatile in its functionalities. When Alarm/Help push button is pressed, the siren and flashing light will go off automatically and inform the operator in the command center for visual and voice inspection.



> Specifications

PRODUCT	ALARM HELP BELL
Type	Wall mount
Warning method	Siren and Flashing LED Lights
Communication method	Microphone : 48dB/600Ω Condenser Microphone
Size	250(W) * 350(H) * 55(D)mm

Support and Maintenance

ParKo guarantees a minimum of 95% registration accuracy for its LPR products at initial installation with systematic support structure. The embedded deep-learning engine gradually enhances the accuracy level closer to 99.5%. In case of any mal-functioning, ParKo’s incident management starts with the identification of incidents and escalates through the support hot-lines for immediate maintenance and remedies. The support will range from remote control to on-site support with contingency stocks for immediate replacement.

> Priority Levels

Priorities are determined based on the severity of incidents and degree of impacts to the parking lot operations and revenues activities.



- LOW PRIORITY (NORMAL)**
Any incidents that exhibit periodical dis-functional behaviour but does not, immediately, have impact on the parking lot operations.
- MEDIUM PRIORITY (NORMAL)**
Any incidents that exhibit constant dis-functional behaviour and may or may not affect other components, but does not, immediately, have impact on the parking lot operations and other sub-component systems. The scope of incident is confined to component(s), not the entire system (not the overall operation stopper).
- HIGH PRIORITY (URGENT)**
Any incidents that exhibit constant dis-functional behaviour and affect other component(s) to create impacts on the parking lot operations or may cause mal-function of the critical systems such as payment collection, fee calculations, camera failures, server failure and etc.
- SEVERE PRIORITY (URGENT)**
Any indents that lead to system failure or simultaneous multiple occurrences of the High Priority incidents that have greater impact on the parking lot operations / revenue activities. This type of incident is considered as business critical and inflicting damages on the positive user experience of the parking lot.

> Support Service Protocol

Upon receipt of any incident report, ParKo and its associated local contractors will do the best to resolve and restore the system within reasonable timeframe.

For any incident that require on-ground support, ParKo's local contractor will be dispatched to fix or replace products with the spare items kept locally. The trained local contractors will provide the replacement and maintenance services. ParKo recommends 3% contingency products to be kept in the premises where the parking system is installed.

For any software related issues, our technical support team will provide remote support by entering the system from back-end. ParKo provides regular check-up of its software to prevent any system failure.

> Maintenance (After the First Year)

Under the default maintenance contract, the product warranty (1 year), technical support and on-site support / troubleshooting are included in the main contract. Maintenance on following years are negotiated between customers and the maintenance contractor. The maintenance contractor should keep spare parts for replacement services and periodic system checkups (inspections) including, but not limited to camera sensor and server/ network components checks.



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Thank you for your time and we look forward to the opportunity to work with you.

ParKo Solutions Inc.



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