

# Geekplus AMR Picking System Technical Proposal

Feb 2021



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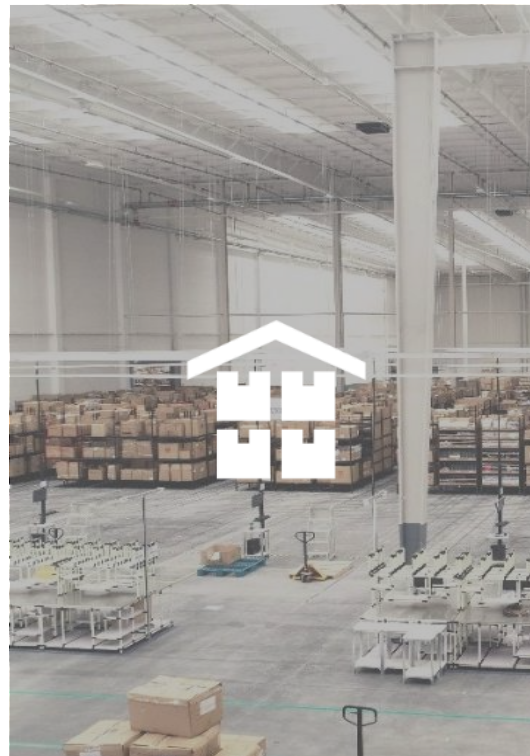


# Our Vision

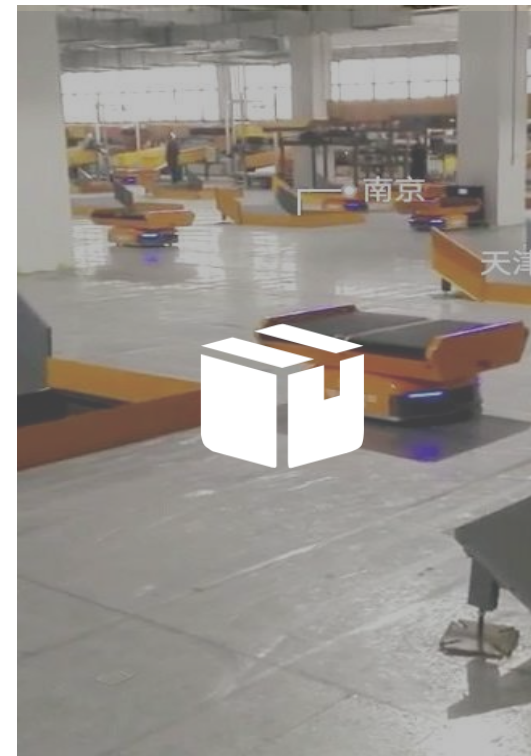
To be a world-class **AI & Robotics** company, we are building the **Infrastructure Network for Smart Logistics** and achieving **Intelligent Supply Chain** for our partners across all industries



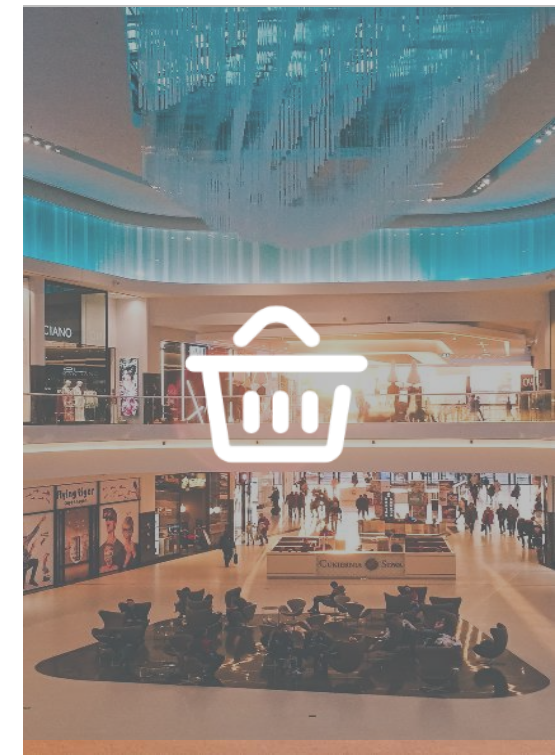
Manufacture Logistics



Warehousing Logistics



Express Logistics

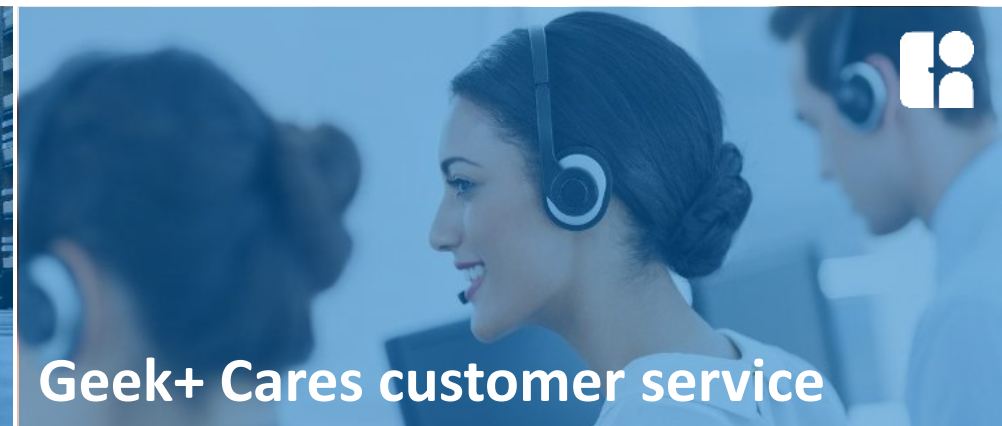
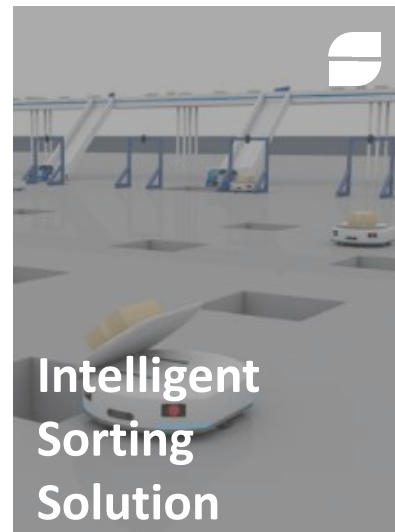


Business Logistics



# Product Profile & Scenario

Providing AI driven robot solutions and services in different industries and scenarios.



The game-changing picking system boosts efficiency improvement by 200%+

Goods-to-Person

Bin-to-Person

Order-to-Person



P200 P500 P800 P1200



C200S V1.0



C200M V1.0



A60



A200



## Picking Efficiency

- Up to 2-3 times compared to manual operations
- Picking rates up to 600 pieces / hr / picking station
- Storage Space saving
- Labor cost reduction



## Flexibility

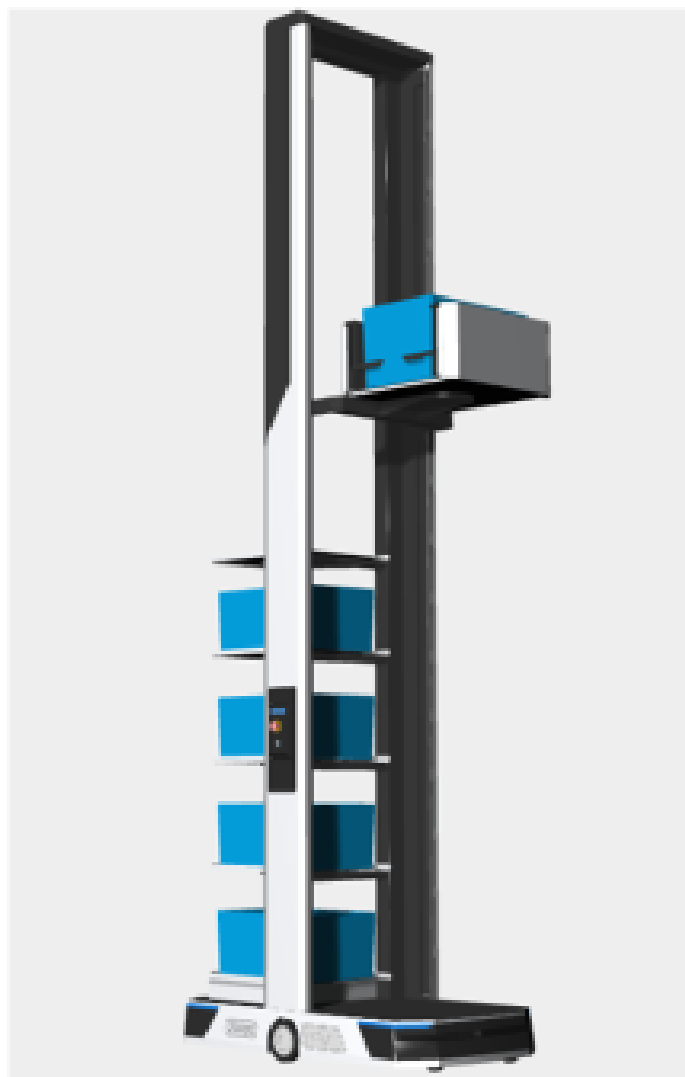
- Peak time management
- Robot-as-a-Service: Leasing or Renting
- Re-location

# Technical Data of C-200S




Model	C200S	
Basic Parameter	Dimensions	950*702*2500mm
	Weight	270kg
	Maximum speed	2m/s
	Maximum lifting payload	40kg
	Full range lifting time	8s
	Operation cycle time (take or return container)	10s
	Stop accuracy	<10mm
	Container lifting accuracy	1mm
	Drive mode	Two-wheel differential drive
	Rack height	225mm~2050mm
	Standard Container Dimension	600*400*350mm(L*W*H)
	Navigation	Inertial + QR code visual navigation
	Power supply	Lithium-ion battery, DC50.4V (typ), 39Ah
	Battery life	Full charging and discharging >2000 cycles
	Charging mode	Auto
	Run time	Charging for 5 minutes, working for two hour * Support user-defined charging time and run time
	Communication	WIFI, 2.4G/5G, IEEE802.11 b/g/n
	Obstacle detection	Infrared
	Obstacle avoidance detection distance	2m
	Status indicator	Support
Certification	CE	

# Robot: C200M



Parameter	
Dimension	1440*870*4465mm (For Single Position) 1490*870*4465mm (For Double Position)
Self weight	<350kg
No load max speed	1.8m/s
Full load max speed	1.5m/s
Lifting payload	5 bins, 200kg
Lifting time(full path)	15s
Pick/Retrieval time	10s (Single Bin Position) 15s (Double Bin Position)
Rotation speed	90° /2s, 180° /3s
Accurate	<10mm
Bin height	200mm~400mm
Shelf height	215mm~4265mm (Customizable)
Standard bin size	600*400*350mm(L*W*H)
Battery	Li, DC50.4V, 42Ah
Battery life	>2000 cycle
Charging mode	Automatic charging
Operation time	Charge 10 minutes, operating 2-3 hours
Communication mode	WIFI, 2.4G/5G, IEEE802.11 b/g/n
Status indicator	support

# Standard Picking Products

Appearance				
Model	P500R	P800R	C200M	A100
Dimensions	L950*W702*H275mm	L1090*W830*H275mm	1490*870*4465mm	L740*W500*H1500mm
Weight	170kg	195kg	<350kg	85kg
Maximum lifting payload	600kg	1000kg	40kg	100kg
Maximum lifting height	60mm		4265mm	--
Minimum lifting time	3s		15s(full path)	--
Maximum speed	2m/s without load, 1.6m/s full load		1.8m/s without load, 1.5m/s full load	1.6m/s
Maximum rotation speed	90°/1.5s, 180°/2s		90°/2s, 180°/3s	90° /1.5s, 180° /2s
Maximum slope angle	2.5° (slope 4.4%)		Within 1 square meter, the height difference does not exceed 3mm	2.5° (slope 4.4%)
Stop accuracy	<10mm		<10mm	<10mm
Navigation	Inertial sensors + QR code		Inertial sensors + QR code	Lidar SLAM
Obstacle detection distance	2m infrared / 3m laser		Front 3m laser/ back 2m laser	3m
Power supply	Lithium-ion, DC50.4V, 39 Ah		Lithium-ion, DC50.4V, 42 Ah	Lithium-ion, DC50.4V, 25 Ah
Battery life	Full charging and discharging >2000 cycles		Full charging and discharging >2000 cycles	Full charging and discharging >2000 cycles
Run time	Charging 10 minutes, working 2~3 hours		Charging 10 minutes, working 2~3 hours	Charging 10 minutes, working 1~1.5 hours
Certification	CE/FCC	CE/FCC	CE	CE
Payload size	880*880~1000*1000mm	1000*1000~1500*1500mm	400*300*100~600*400*400mm	2 bins: 600*400*350mm 4 bins: 400*300*250mm
Working temperature	-20~50°C		-20~50°C	-20~50°C





## 2. Picking Solution Introduction

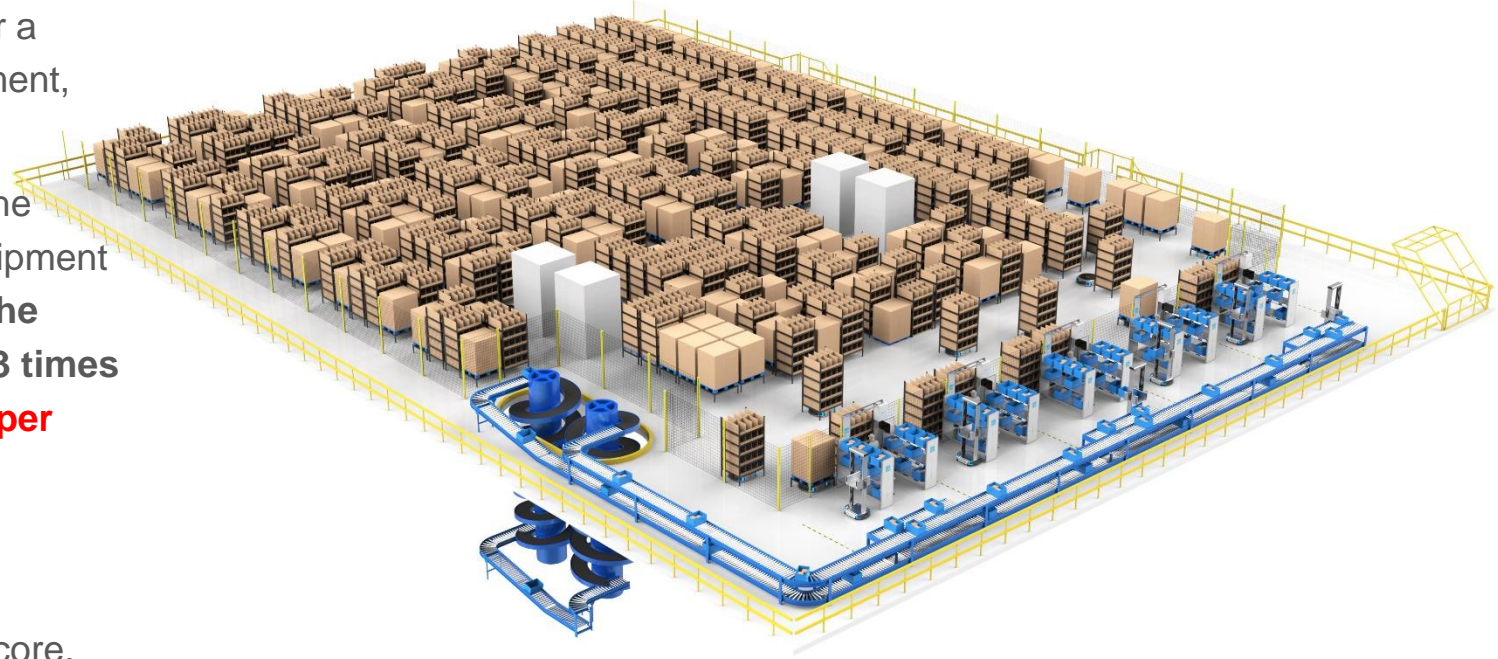
- Goods to person
- Bin to person



# Solution: Goods-to-Person Picking

P-series robots are used in Goods-to-Person Picking solution, to handle the mobile shelves or pallets to the workstation for a series of operations such as putaway, picking, replenishment, tally and stocktake.

This solution completely eliminate the invalid walking of the operators, avoid searching time through the auxiliary equipment at workstation, **improve the picking accuracy, reduce the labor intensity, improve the picking efficiency by 2 ~ 3 times compared with the manual operation. Up to 220 lines per hour** per workstation



The picking system takes the intelligent algorithm as the core, achieves the most labor savings with the least number of robots, also improves the storage capacity. The main functions are as follows:

- Order optimization combination picking
- Dynamic wave flow picking
- Goods heat analysis and putaway recommendation
- Inventory adjustment
- Storage capacity management and intelligent tallying
- Task balance among workstations and robots

Automatic RFID stocktaking

- Rich features and strategies, can be flexibly configured

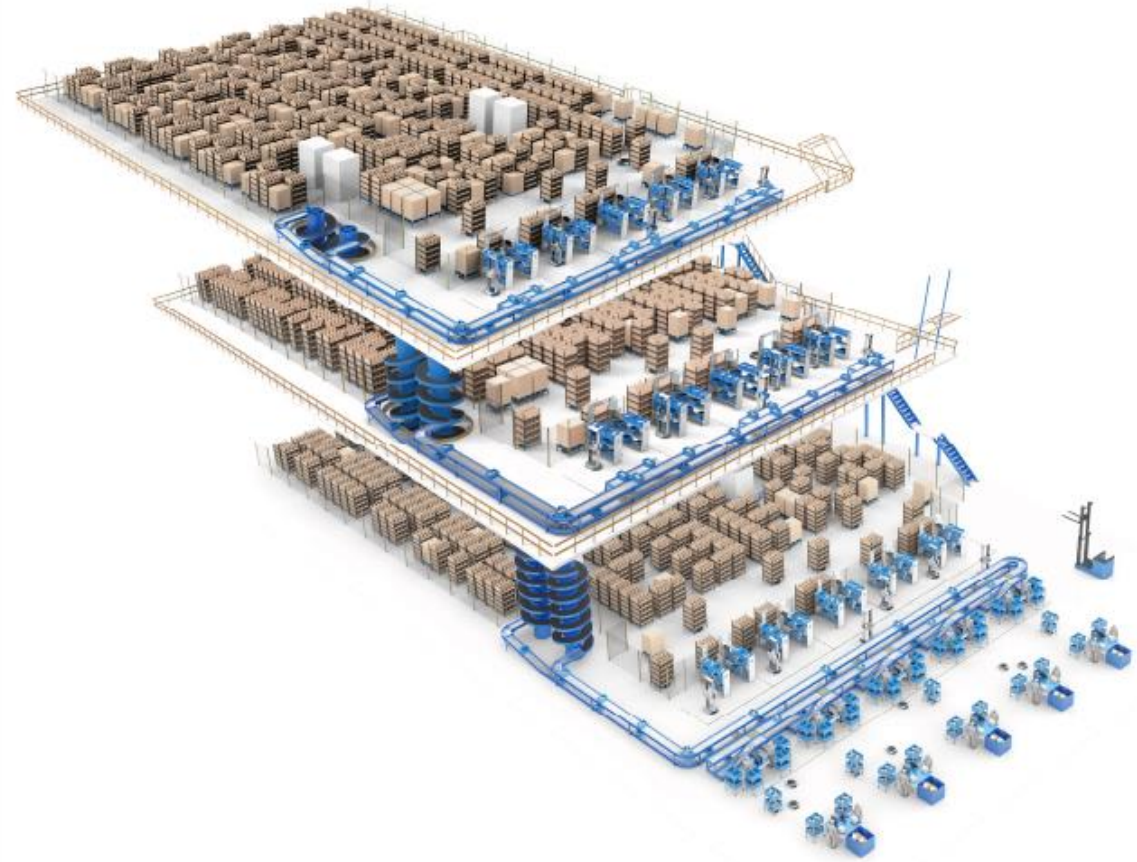


# Solution: Multi-floor Goods-to-Person Picking

Based on the original single floor picking system, Geek+ Multi-floor Picking System integrates P-series robots, lifts, mezzanines, conveyors and other equipment to achieve multi-floor picking and mobile rebin wall to person, to cope with **high-volume and multi-SKU order scenarios**.

## Features:

- Deployment by stage or by floor, expand easily according to business development
- Mobile rebin wall is optional, to handle sorting, order collection, goods collection and other processes
- Cross-floor order can be merged on one floor
- Unified scheduling of all robots through the integrated lifts
- Customized picking and storage methods, such as multi-floor picking in parallel, multi-floor sequential picking, and independent picking on each floor



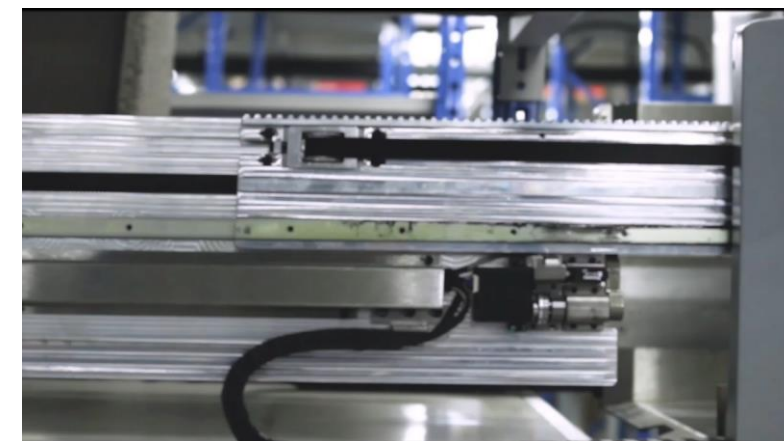
# Solution: RoboShuttle (Bin to person)

RoboShuttle system combines bin-carrying C200 series robot with normal mezzanine racks and bin lift to realize “goods to person” picking system as a **cost-effective, high-storage-capacity and highly flexible solution**.

Compared with Multishuttle, Roboshuttle has the following advantages:

- More flexible and adaptable to the existing shelves and mezzanine racks
- Less cost, shorter term ROI
- Shorter implementation period on site, lower ground load-bearing requirement
- No need for high precision track, easy to maintain
- Denser bins, higher storage density
- High efficiency, up to **250 lines or 600 pieces per hour** per workstation

RoboShuttle has won the certificate of the **Best in Intralogistics** product of **IFOY** in Germany, and is highly recognized by customers and industry experts.



## 3. Picking System Introduction



# Robot Management System (RMS)

The Geek+ Robot Manage System (RMS) provides complete solutions for multi-robot applications in structured environments, such as order picking and parcel sorting in warehouses, and material handling in the factory. The RMS connects to all the robots in the system via the wireless network, updates the robot status information, assigns tasks to the appropriate robot, determines which robot automatically charges, simultaneously plans the path for the robot, controls the robot to perform the task correctly, and dispatches the robot path to avoid collisions. Moreover, RMS can manage the location of shelves in the system.



## RMS Function Module

Task Management

Resource Management:  
Maps & Cells

Resource Management:  
Robots

Resource Management:  
Shelves Pallets & Containers

Route Plan

**RMS ≈ WCS**

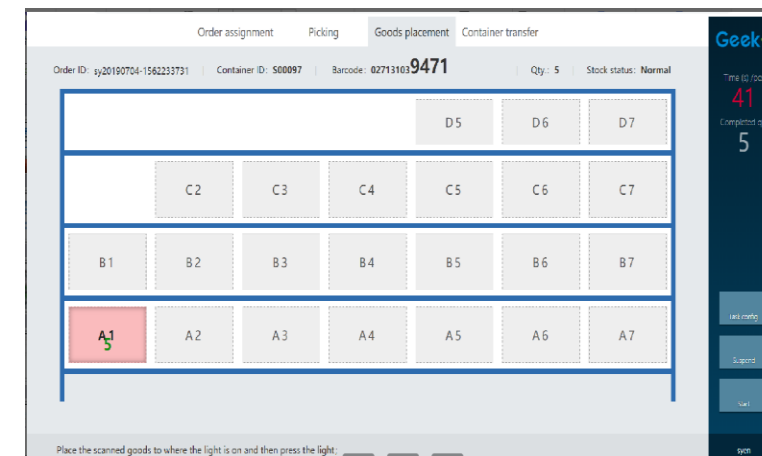
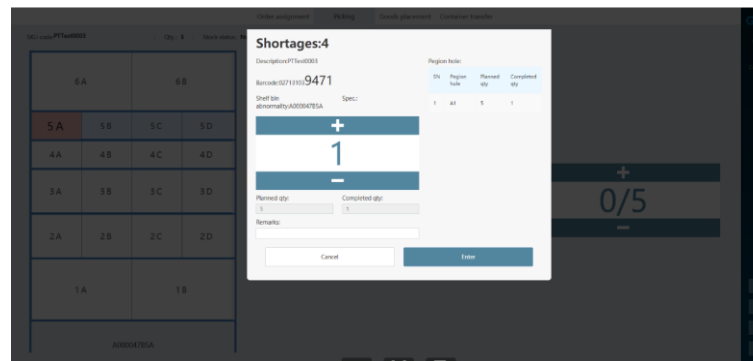
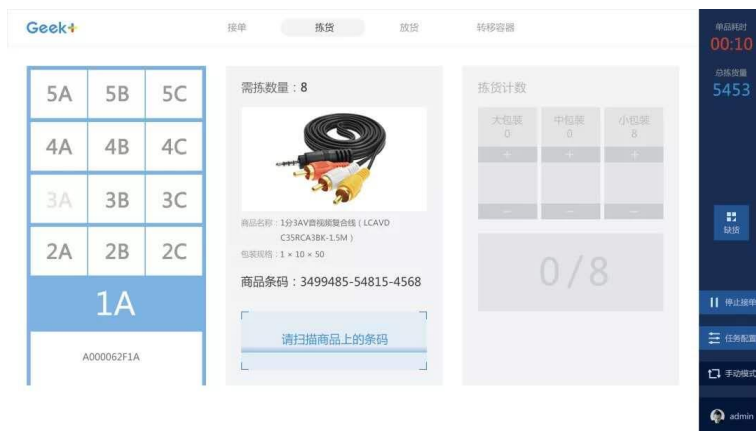


# Geekplus Picking System (GPS)

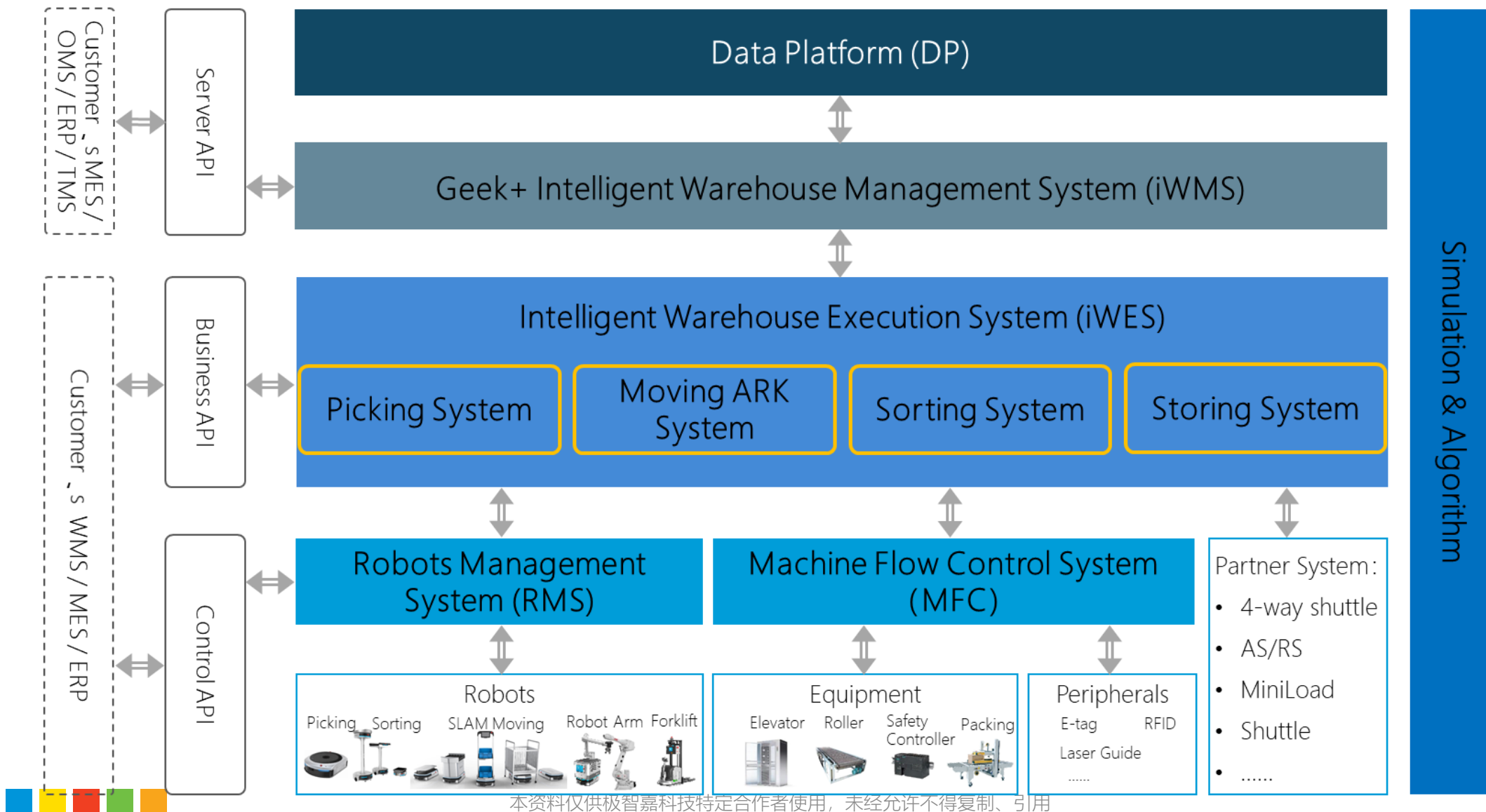
- GPS is a robot picking solution, supports 3 robot picking modes: goods-to-person picking, aisle picking, Roboshuttle picking. It is suitable for E-commerce, retail, 3PL, shoes and clothes, pharmaceutical and other industries.
- GPS provides flexible configuration and features for different industries, has interface with mainstream WMS system.
- GPS receives tasks from customers' WMS, optimize their combinations, then execute them efficiently and feedback the results.

## Key advantages:

- Rich characteristics of industries
- Flexible strategy and process configuration
- Covering mainstream robot picking scenarios
- Modularization, supports ways to integrated in customer's system
- Deploy on the cloud or local server

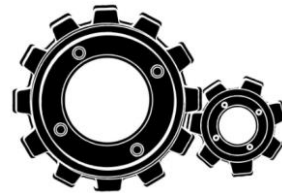
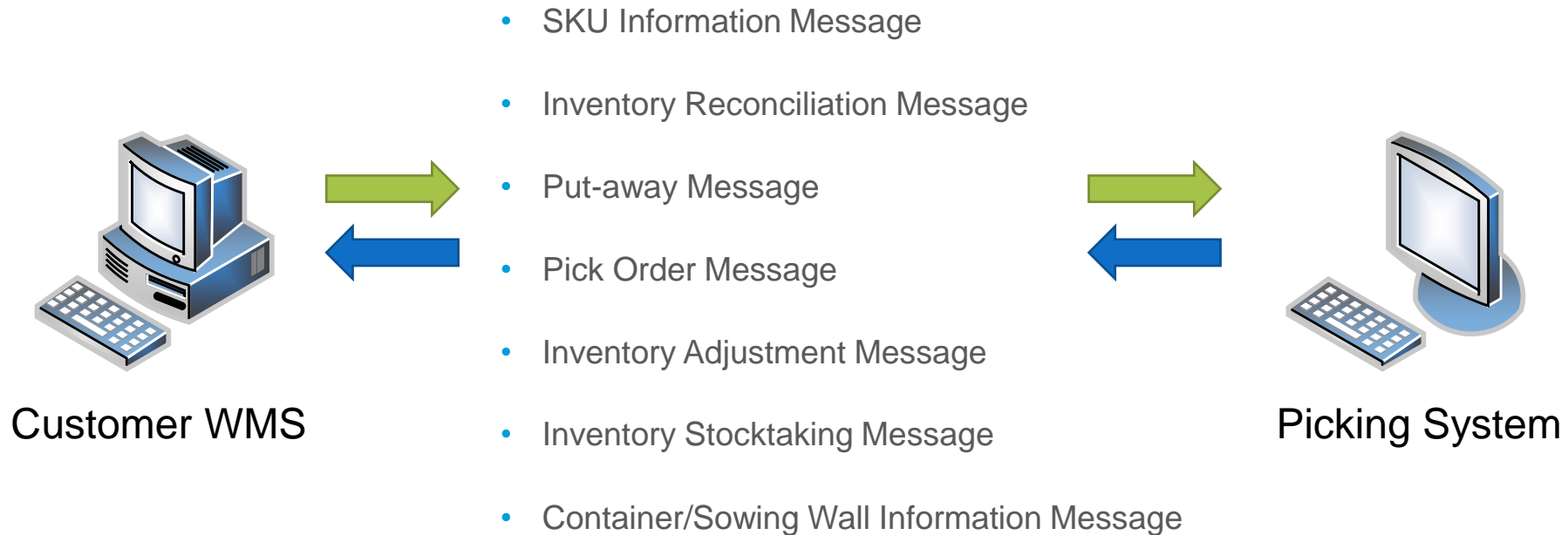


# GPS Architecture





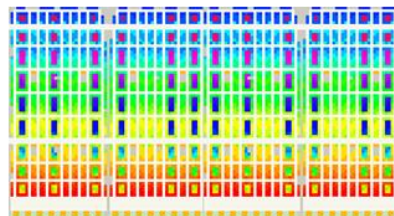
# Interface With Customer's System



# Main WMS docked



## Learning based strategy



Dynamic Storage Location Optimization

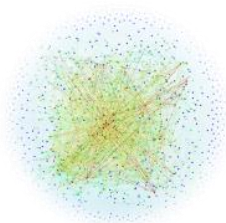


Order Forecast

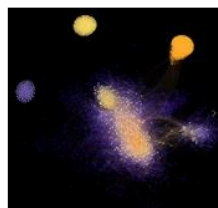


Inventory Optimization

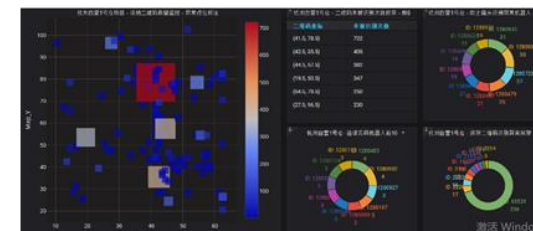
## Data analysis



SKU Cluster Co-location



Order Cluster Partitioned Storage



The analysis of QR code in warehouse

## The device/robotics



Navigation & Perception



Device Monitoring



Fault Diagnosis



# Picking Workstation

- Modular design. A workstation is composed of basic operation module, sorting wall module, safety module, identification module, etc.
- Compare with the traditional style, computer is not fixed at the sorting wall, so we can change sorting wall conveniently
- Fence and door separate the robots area from manual area, to ensure operators' safe
- Laser guider is optional, which could point out the picking location by laser, to guide operator pick goods. It can improve the efficiency and reduce the error rate.



# Safety Solution

## Meet EU safety standard

- Minimizes the security risks caused by Human-Robots interaction by means of isolation, speed control and system emergency stop control and etc.
- It can not only prevent the safety risk caused by the wrong operation of personnel, but also prevent the hidden safety danger caused by human deliberately.
- Safety solution includes: Picking Station Safety, Access Control, Maintenance Area Physical Safety, Speed Control, Fire Safety and System Emergency Stop Control.

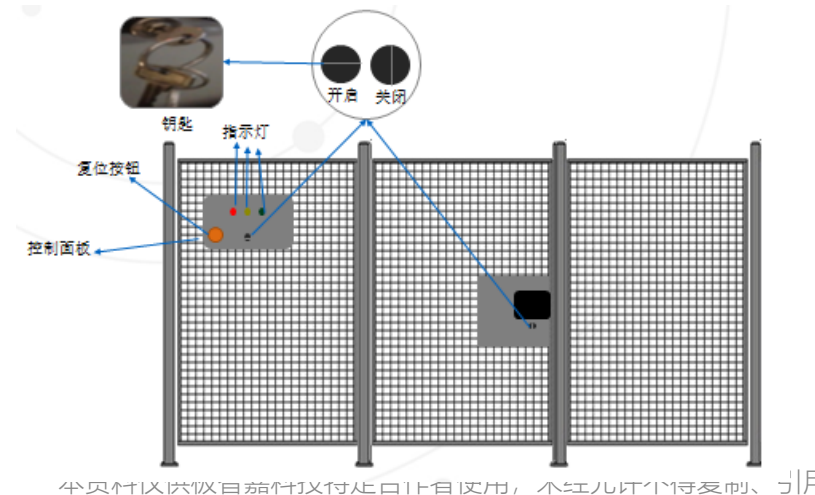
### Picking Station Safety

The combination of detector and grating is used to detect whether the operator is probing into the unmanned area under the circumstance which it is not allowed. If any abnormality is detected, the emergency stop function of the system will be activated to protect the safety of personnel



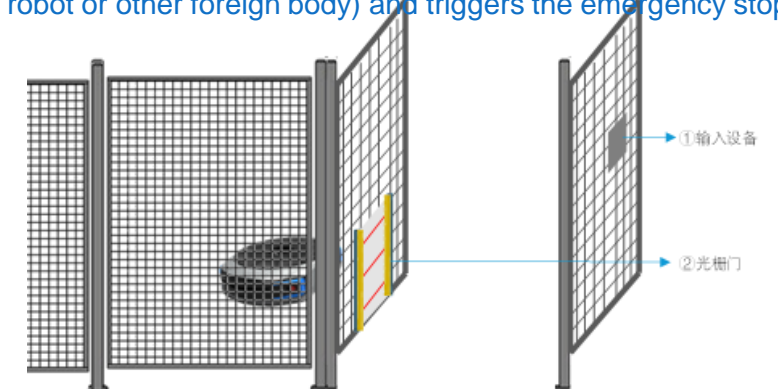
### Access Control Safety

The control combination of two control switches and two keys are used to ensure that the system is in a suspended state when personnel enter the robot area, the system can not be reset until personnel reach a safe position



### Maintenance Area Physical Safety

- The maintenance area adopts the scheme of physical partition + robot control button + grating; When the robot is about to leave the unmanned area, the personnel can control the robot to step out of the grating on the other side of the physical partition and stop at the safe area. At this point, the personnel can push the robot and start to repair and maintain.
- The grating is used to detect whether someone deliberately enters the unmanned area (the grating can be judged to be a robot or other foreign body) and triggers the emergency stop





# Efficiency Monitoring System (EMS)

## Warehouse status

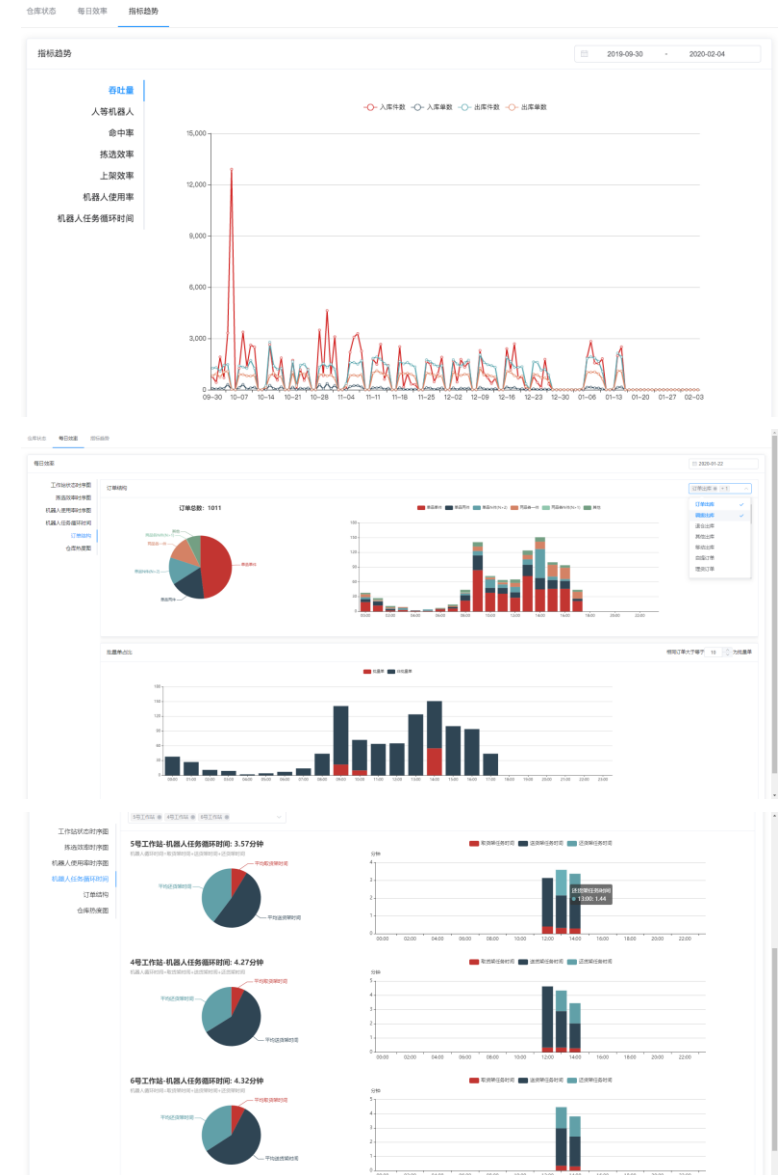
- Warehouse utilization rate calculated by shelf and shelf bin, usage capacity
- Dispersion of goods on the shelf, too centralized inventory will affect picking efficiency
- Visual display of shelf heat, shelves in wrong position should be adjusted
- Visual display of utilization rate of robots, and operation information, such as who are operating at which workstation, how many and which workstation are do which business

## Efficiency data

- Query efficiency information by date
- Visual display of
  - working status of each workstation
  - picking efficiency of each workstation
  - robots utilization rate & robot travel cycle time, summed up by robot distribute time, take shelf time, return time
  - proportion of different order structure
  - in every hour of the day and averages or summary
- Heat of each grid

## Visual display of index trend in a period of time

- Quantity of Inbound and outbound statistic by orders or pieces
- Proportion of operator waiting time relative to working time
- Picking & putaway efficiency
- robots utilization rate & robot travel cycle time



# System Monitoring Platform (SMP)

## Geek+ System Fault Alarm & Robots Scoring

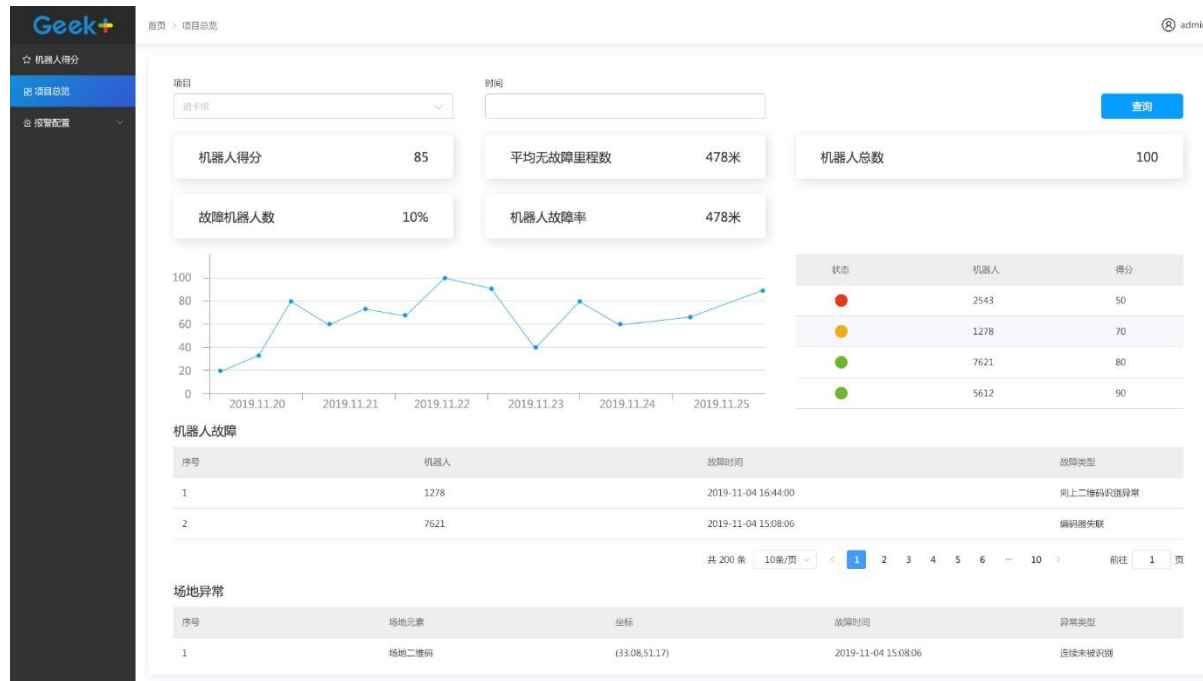
- System & Robot fault collection and Alarm in real time
- Different alarm channels for different rank fault, supporting email, SMS, Dingding and alarm light to different handler
- Provide the customized display based on different role
- Score the health status of each robot base on sensor data and history record
- Score the health status of key components, such as battery, controller, servo motor, etc.
- Robot fault, QR code damage, charge station fail, network, etc.

## Information maintenance and process

- Maintenance and repair information summary
- Maintenance notes process, including report, distribute, handle, record, etc.
- Data analysis and export

## Intelligent maintenance & repair

- Maintenance plan auto-generation and management
- Maintenance record and workflow
- Report





# Simulation Platform

The Geek+ Simulation Platform provides **real simulation** by running a real RMS in the background. By inputting the parameters of customer's actual scenarios, driving virtual robots to move shelf and pick at a set rate, then obtaining result by statistics. The platform can find the best solution and configuration basing on the customer's data before the implementation of the project, to help customer to quickly verify the project plan and get a reasonable return on investment.

## Function Module

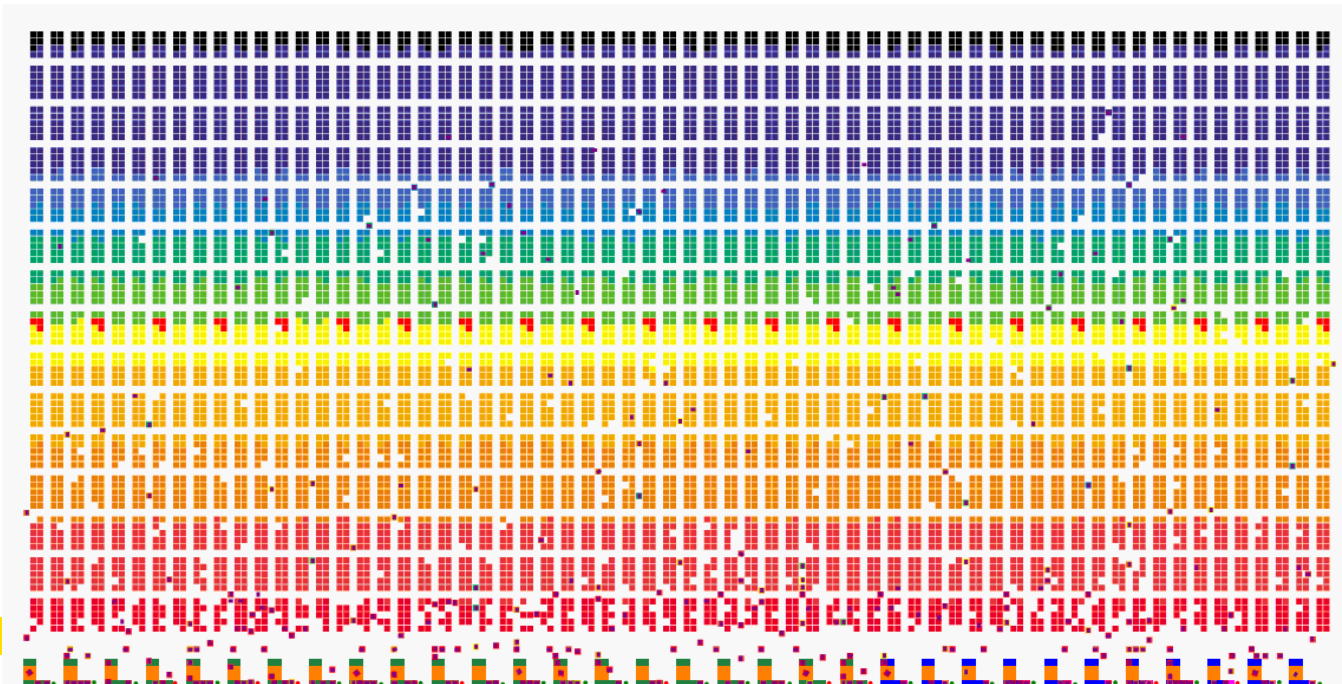
Planning tool

Map editing tool

Simulation tool

Robot simulation models

Algorithm library



## 4. Geek+ Advantages



# Advantages Overview

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## Short term ROI

- Within 3 years payback period
- The investment is much lower than that of heavy automation equipment

## Promote automation

- GTP Picking System reduce labor by 50% to 70%, Aisle Picking System reduce labor by 30% to 50%
- Reduce labor intensity

## High efficiency

- GTP Picking System increase picking capability by 3 times compared with manual operation
- Aisle Picking System increase picking capability by 2 times compared with manual operation
- Operation accuracy 99.997%

## Flexible

- Increase or decrease the robots at any time based on business development
- Standard solution, covering different industries
- High failure tolerance

## Fast implementation

- Less than 2 months to deploy on site
- GTP system can be deployed in 2 weeks, AislePick system can be deployed in 1 week, at fastest



# Advantages of Robot

## Geek+

### Product Performance

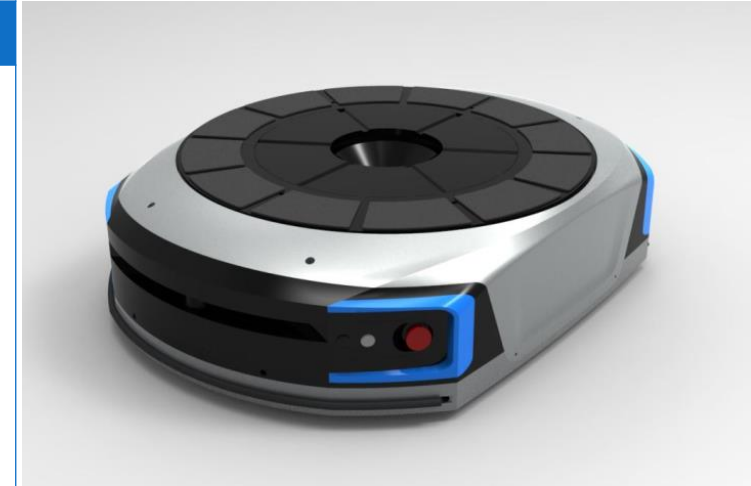
- ✓ V5.1 P800 and P500, unload speed 2m/s, payload speed 1.5m/s~2.0m/s, lifting time 3s;
- ✓ 1000kg lift payload for P800, rack height 2.8m; 600 kg for P500
- ✓ All aluminum forming chassis, flexible multi-link suspension design, shelf stability during acceleration and deceleration
- ✓ Design life 10 years, CE certification
- ✓ Battery, capacity 38.5Ah, 30A efficient charging, comprehensive protection mechanism
- ✓ The charging station supports 2kW high power charging and can be equipped with 12 robots

### Technological Level

- ✓ Working temperature range, supporting low temperature environment (-30 ° C)
- ✓ All the core modules are independently developed with high integration and IP67 protection level, which can adapt to bad working conditions, integrated wiring and high reliability

### Back-office Support

- ✓ Data center, capable of big data analysis, remote monitoring of robot data
- ✓ Failure warning, operation and maintenance guidance



# Advantages of System

Geek+ system has obvious advantages in function completeness, efficiency and industrial solutions.

Geek+	
<b>System</b>	➤ The RMS has the highest scheduling capacity, supporting 400+ robots, and 1000 robots of simulation.
	➤ The efficiency of picking system is 20-40% higher than that of competitors
	➤ With the operation capacity of the whole warehouse WMS, high availability of the system, 8.0 million orders will be processed during November 11, 2019
	➤ The system architecture is highly modular, supporting white box interface. WMS, GPS, RMS standard interface,
	➤ Data and algorithms platform to support production monitoring, data mining and analysis
<b>Solution</b>	➤ Multi-zone Picking, Cluster order picking and rebin, Flow picking
	➤ Intensive storage solutions
	➤ Having many cases: E-commerce /3PL/shoes & clothes/medicine/ manufacturing /3C/ books/retail/postal
<b>Cases</b>	➤ Coverage area: mainland China, Hong Kong, Taiwan, Japan, Europe, Australia, Southeast Asia, North & South America



## 5. User Cases



# Case Study

## Blackwoods

### The Customer

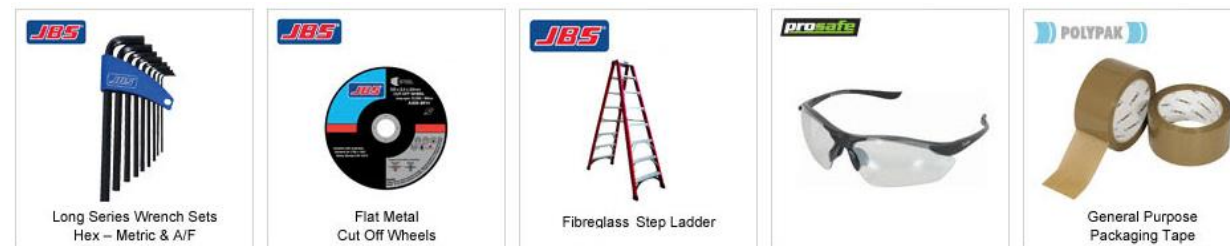
Australia's largest provider of industrial and safety supplies

### The Warehouse in Australia

4500  $m^2$  warehouse  
32 robots  
1360 racks

### The Geek+ Impact

Workforce from 16 pickers to 4 pickers  
No barcode solution help to improve accuracy  
Integrated in conveyor system







# Case Study

## DECATHLON

### The Customer

Sports goods retailer  
41 warehouses over the world

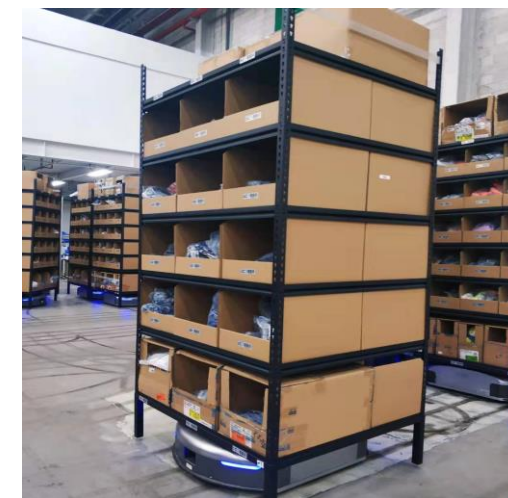
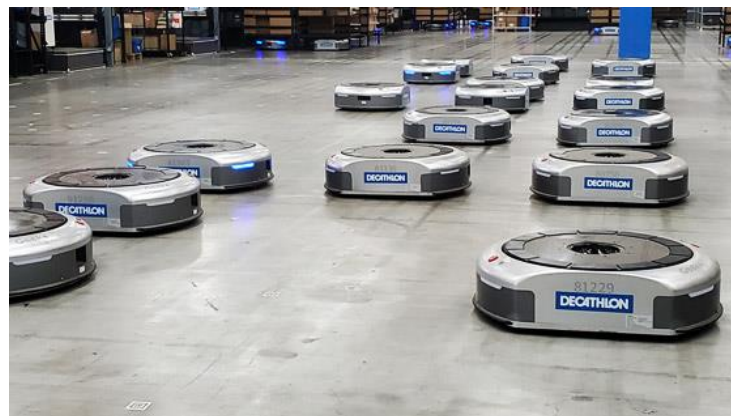
### The Warehouse in Shanghai

2000  $m^2$  warehouse  
300,000 pcs total inventory  
20,000+ different SKUs

### The Geek+ Impact

Out bound ability: 40,000 pcs/day  
Efficiency: 300 pcs/h, 3 times than manually

**Combined with RFID technology**



# Case Study



## The Customer

World's leading designer, marketer & distributor of apparel of sports and fitness activities

## The Warehouse in Chiba Japan

14000  $m^2$  warehouse  
200 robots, 6000 racks

## The Geek+ Impact

Helped realized same-day delivery in Tokyo area  
Decrease labor costs



Geek+

Moving the World Intelligently