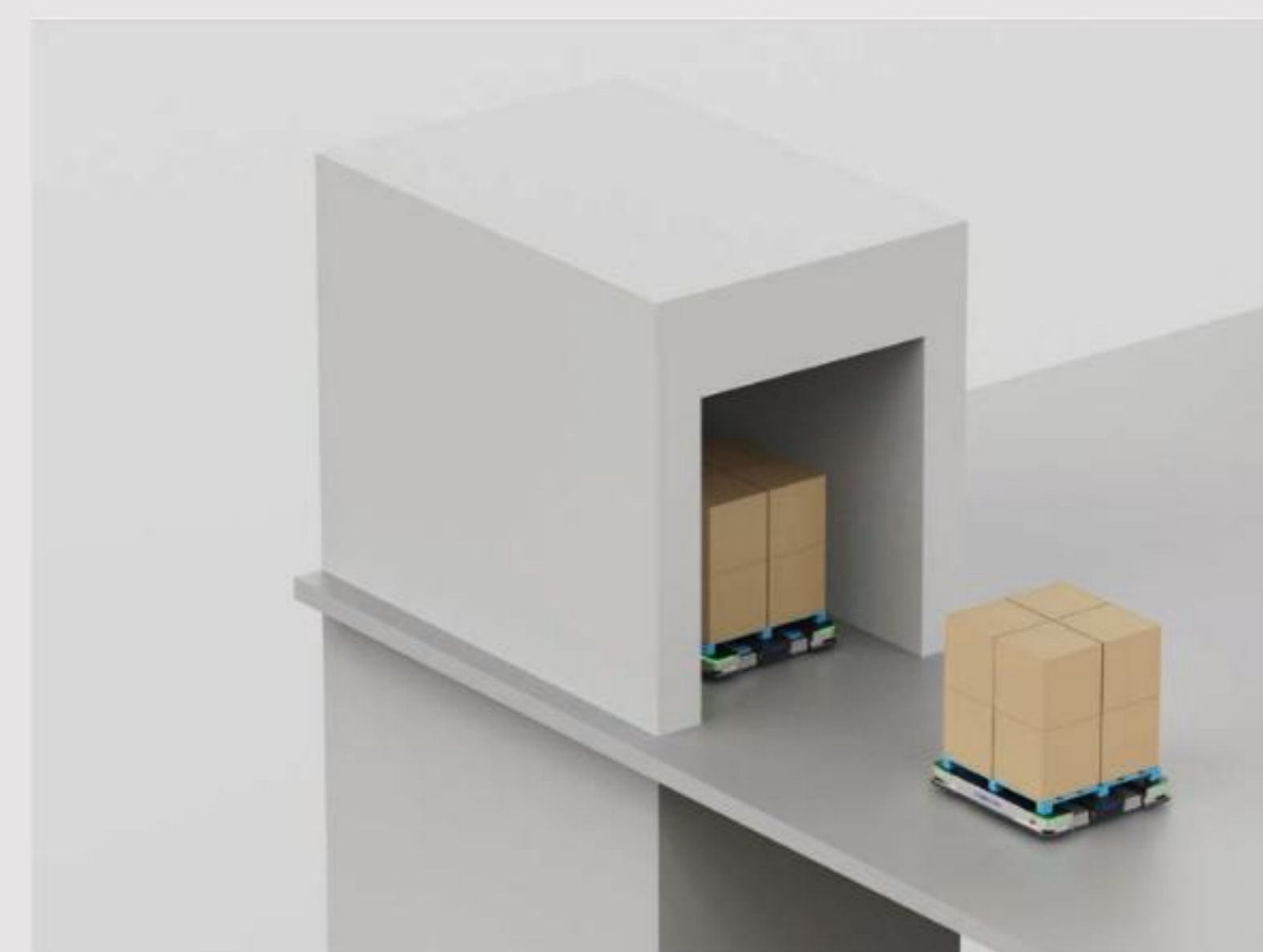


Smart Factory & Warehouse Solutions

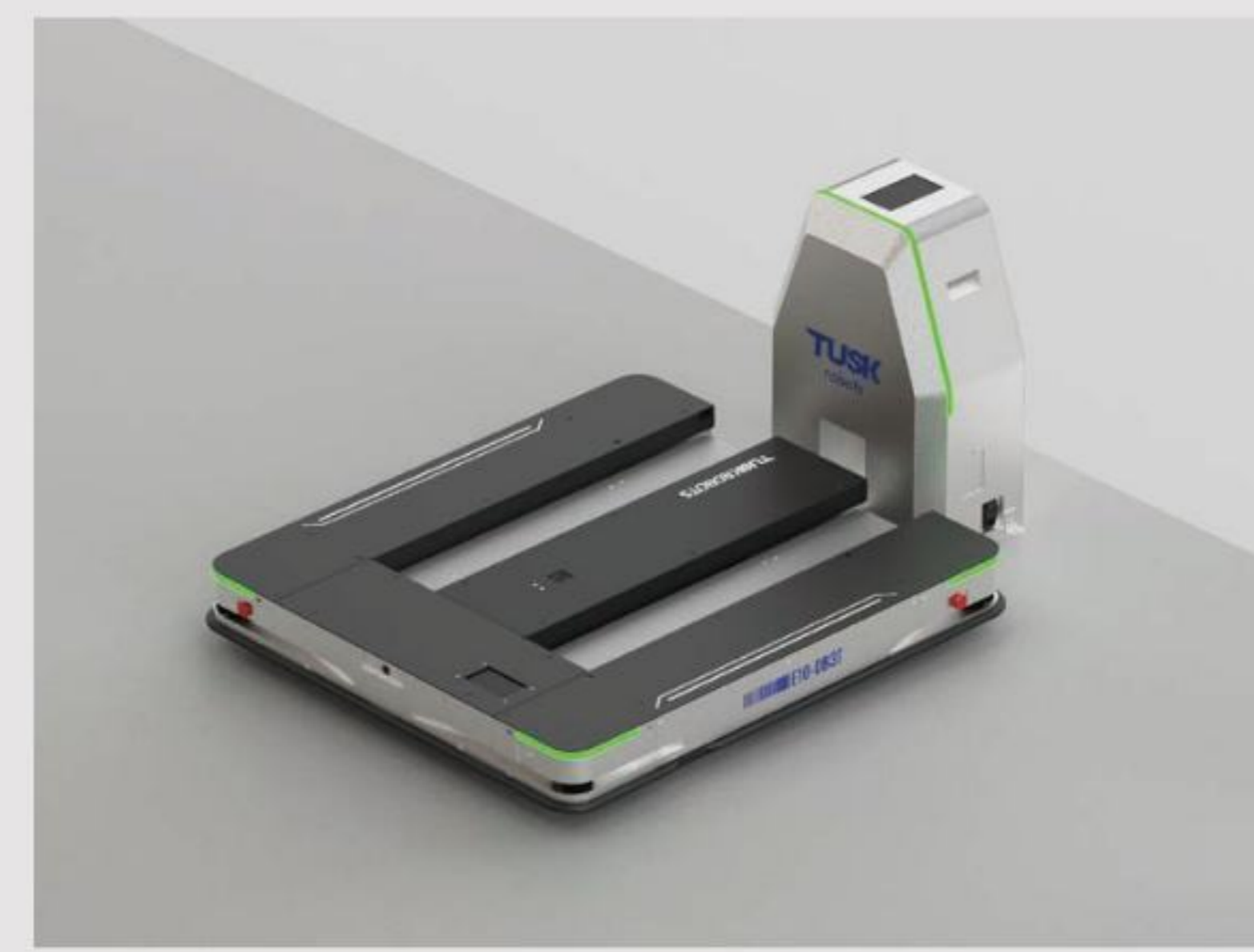
Autonomous pallet-handling robot and robot management system integrates with factory automation production lines, MES, and WMS. The material flow through paths of inbound and outbound docks, staging areas, production line areas, and semi-finished, finished goods storage areas seamlessly.



Lift Docking



Elevator Docking



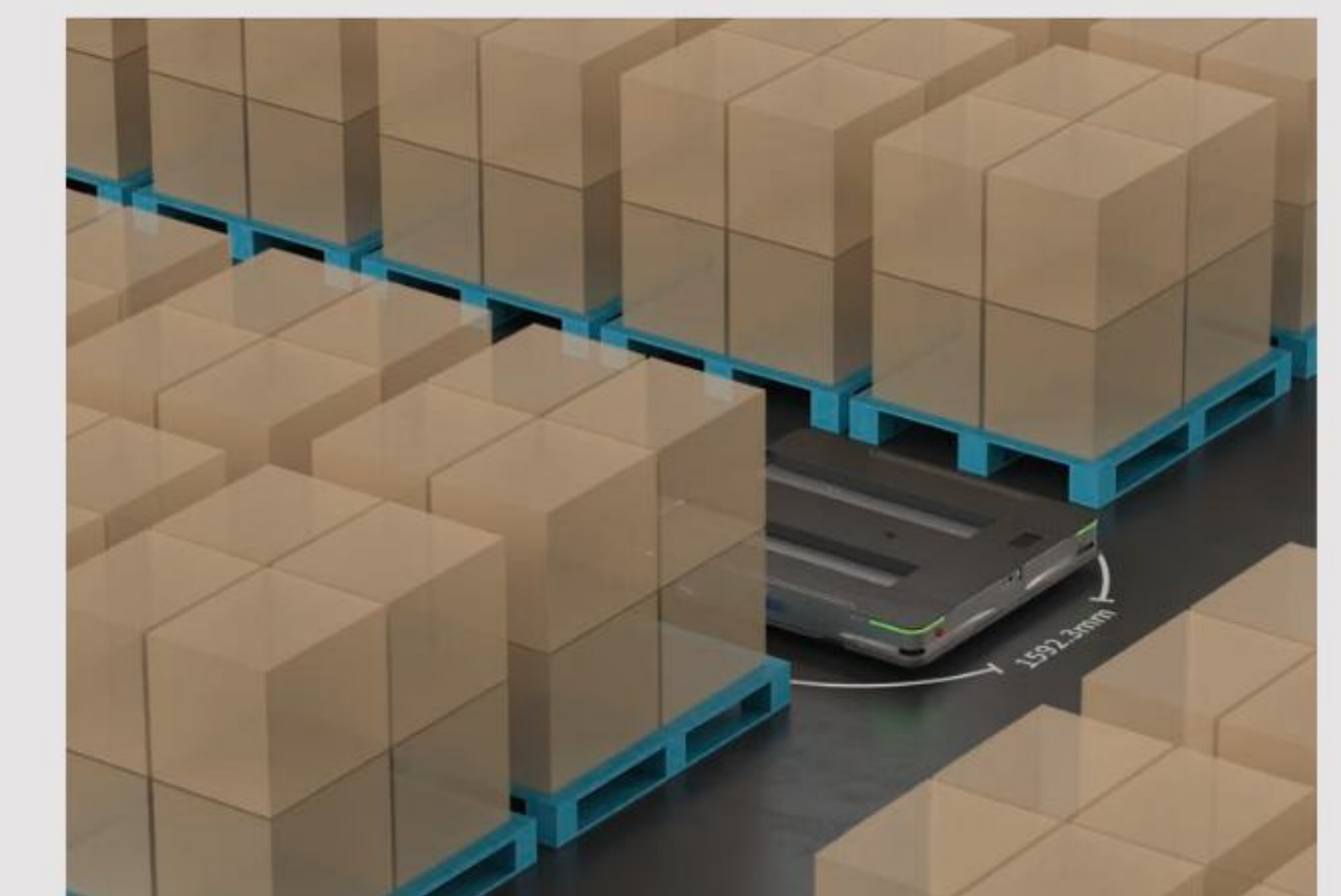
Automatic Charging



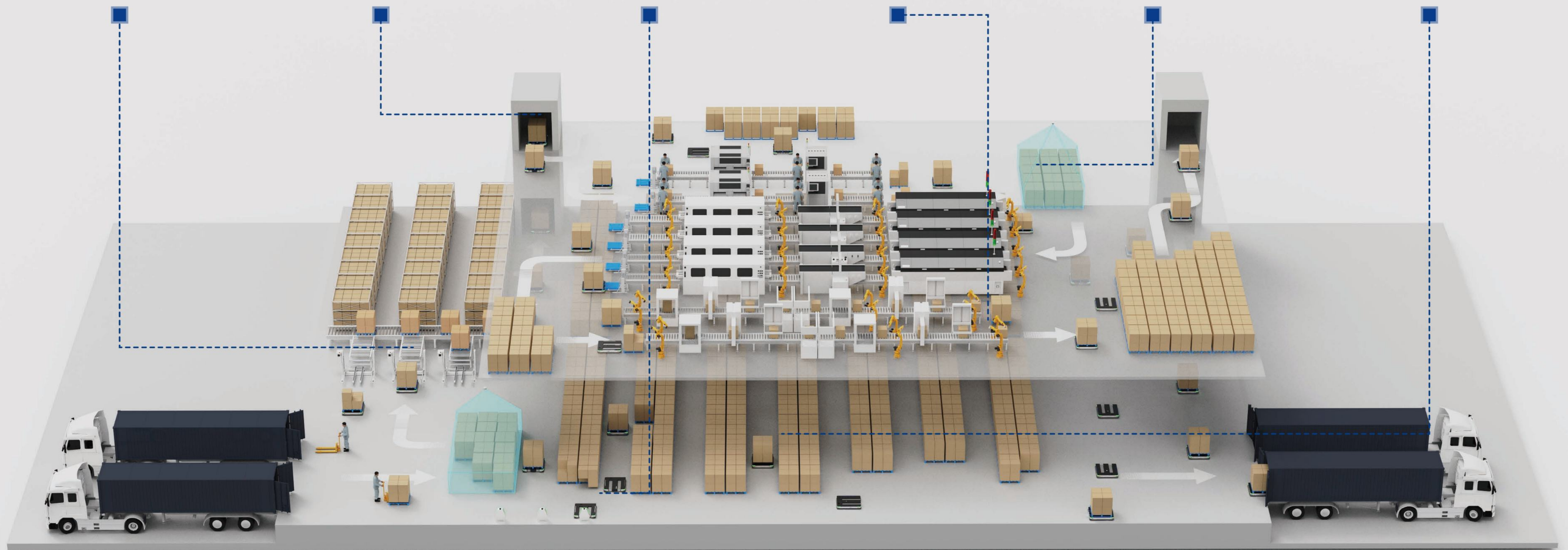
Line-side Transportation



Farseer Bin Location Detection



High-Density Storage



E10

Standard Pallet

Available for 1000*1200mm plastic pallet handling

Narrow Aisle

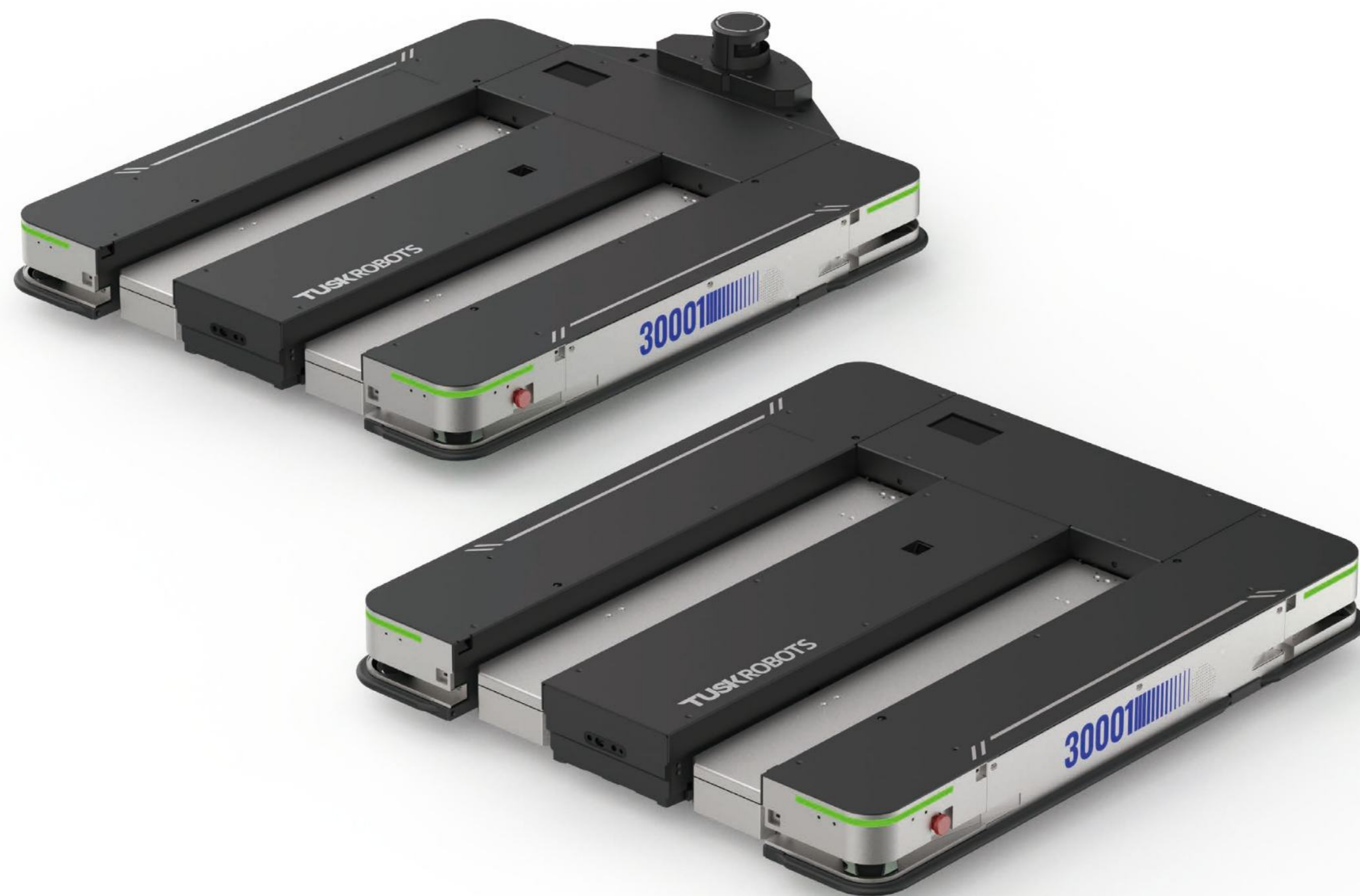
The minimum width of pallet handling aisle is 1800mm

High-level Safety

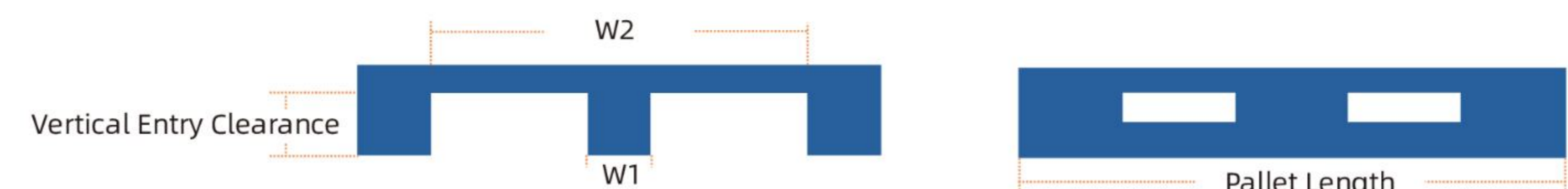
360° laser obstacle avoidance detection, cargo detection, etc.

Equipment Docking

Multi-equipment types docking support, - such as lift, elevator, mechanical arm, etc.



Project	Specifications	E10	E10-SLAM
Basic Parameters	Size(mm)	1233×1102×170	1399×1102×170 (SLAM component can be elevated)
	Rated Load (kg)	1000	
	Self-Weight (kg)	310	320
	Fork Height (mm)	90(7mm downward floating height with loading)	
	Fork Stretch Out Max Limit (mm)	1400	
	Fork Max Lifting Height (mm)	≤330	
	Display Screen	5 inches	
	Telecommunication Modes	Default WIFI version: Support dual-band 2.4G/5G, IEEE802.11b/g/n (-5G version support 5G communication)	
Safety Protection	Obstacle Avoidance Protection	Front laser sensors + Rear laser sensors, 360° obstacle avoidance detection	
	Detection Distance of Front Laser(m)	0-3	
	Mechanical Protection	Emergency stop button, Reset button, A protection strip around the whole vehicle body	
	Caution Function	With voice and photoelectric alarm functions	
	Fork tip protection	collision switch	
Movement Capability	Navigation Mode	DM code	SLAM + DM code Dual Navigation
	Maximum Speed (Empty Load/Full Load)(m/s)	2.0 / 1.5	
	Rated Acceleration(m/s ²)	1	
	Stop Accuracy	±5mm / ±1°	±20mm / ±2°
	Movement Mode	two-wheel differential	
	Ground Adaptation Gap Slope Step	40mm(Gap)/4°(7%)(Slope)/15mm(Step)	
	Maximum Slope when the Fork Extension reach to the Maximum	2°	
Lithium Battery Performance	Rated Voltage/Capacity	51.2V/30AH	
	Battery Life	The times of fully charging: 1500 times (The battery capacity is guaranteed to be more than 70% of the new battery)	
	Battery Endurance/Charging Time	≥8H/≤2H	
	Battery Type	LFP	
Environment	Operating temperature(°C)	0~45	
Pallet Requirement	The Width of W1 and W2 (mm)	W1≤190, 700≤W2≤970	
	Pallet Length (mm)	≤1400	≤1300
	Vertical Entry Clearance(mm)	95-130	



E10(Titan)

■ Heavy Load Handling

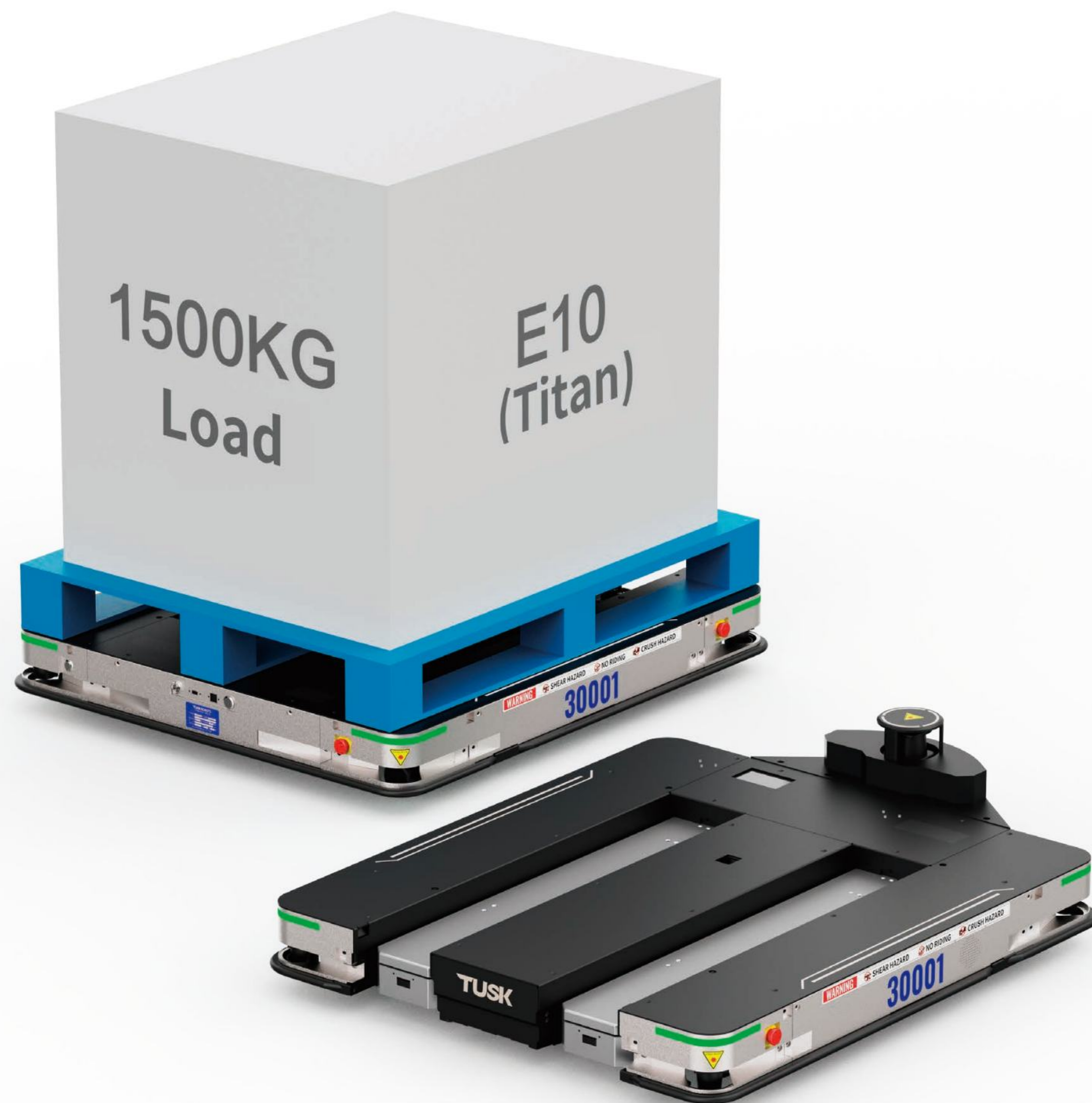
Capable of handling loads up to 1.5 tons

■ Narrow Aisle Passable

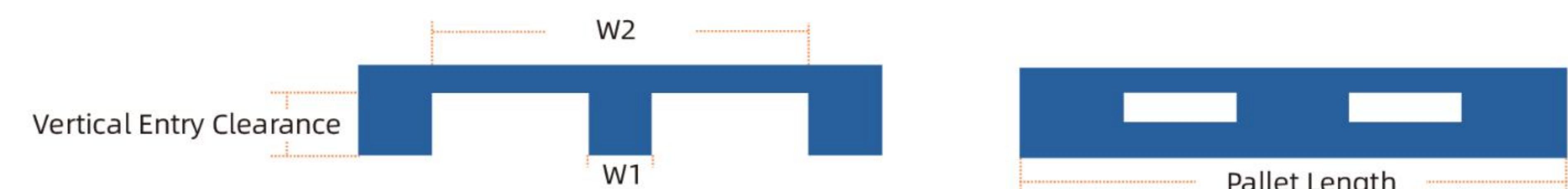
APR can spin around

■ High-level Safety

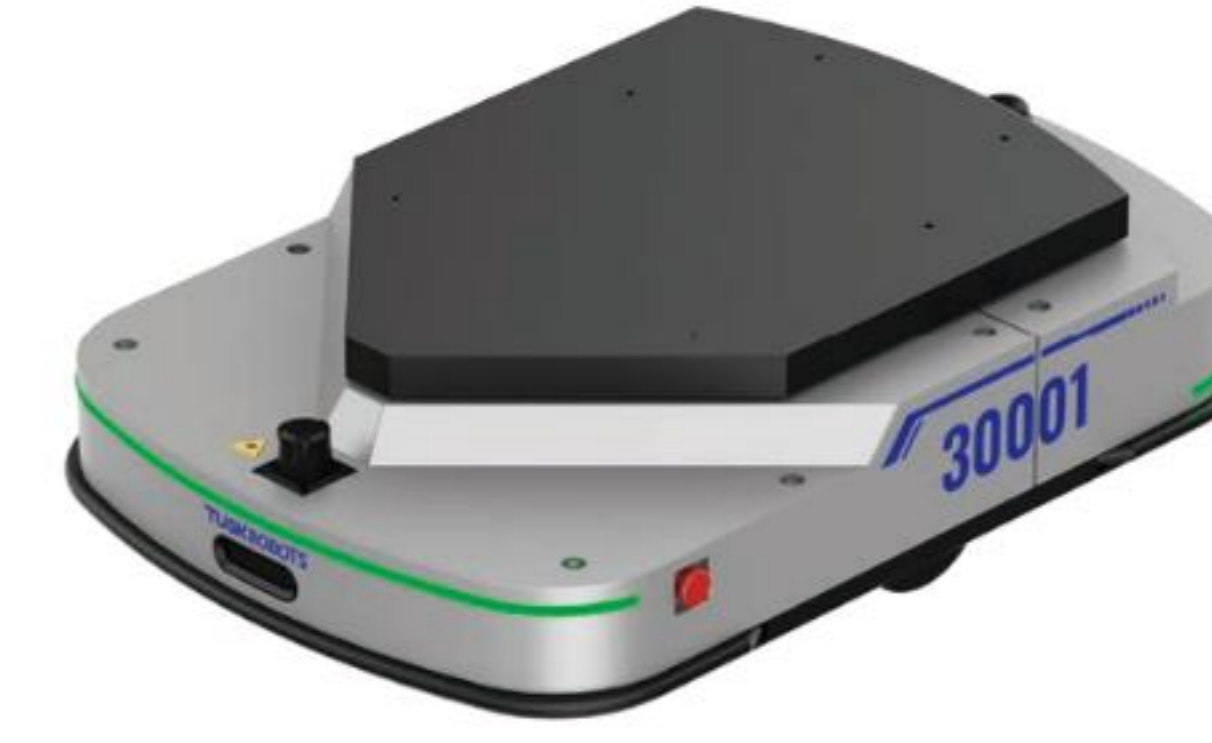
360° obstacle avoidance detection, cargo detection, etc.



Project	Specifications	E10(Titan)	E10-SLAM(Titan)
Basic Parameters	Size(mm)	1233×1102×170 (Include the protection strip)	1399×1102×170 (SLAM component can be elevated)
	Maximum Lifting Weight (kg)	Rated 1200KG, Max 1500KG	
	Self-Weight (kg)	310	320
	Fork Height (mm)	90(7mm downward floating height with loading)	
	Fork Stretch Out Max Limit (mm)	1400	
	Maximum Lifting Height (mm)	≤330	
	Display Screen	5 inches	
	Telecommunication Modes	Default WIFI version: Support dual-band 2.4G/5G, IEEE802.11b/g/n (-5G version support 5G communication)	
Safety Protection	Obstacle Avoidance Protection	Front double laser sensors + Rear double laser sensors	
	Detection Distance of Front Laser(m)	0-3	
	Mechanical Protection	Emergency stop button, Reset button, A protection strip around the whole vehicle body	
	Caution Function	With voice and photoelectric alarm functions	
	Fork tip protection	Photoelectric sensor detection distances≤100mm, collision switch	
Movement Capability	Navigation Mode	DM code	SLAM + DM code Dual Navigation
	Maximum Speed (Empty Load/Full Load)(m/s)	1.5 / 1.2	
	Rated Acceleration(m/s ²)	1	
	Stop Accuracy	±5mm / ±1°	±20mm / ±2°
	Movement Mode	Dual-wheel differential	
	Ground Adaptation Gap Slope Step	40mm(Gap)/4°(7%)(Slope)/15mm(Step)	
	Maximum Slope when the Fork Extension reach to the Maximum	2°	
Lithium Battery Performance	Rated Voltage/Capacity	51.2V/30AH	
	Battery Life	The times of fully charging: 1500 times (The battery capacity is guaranteed to be more than 70% of the new battery)	
	Battery Endurance/Charging Time	≥6H/≤1.5H	
	Battery Type	LFP	
Environment	Operating temperature(°C)	0~45	
Pallet Requirement	The Width of W1 and W2 (mm)	W1≤190, 700≤W2≤950	
	Pallet Length (mm)	≤1400	≤1300
	Pallet Opening Height (mm)	120-130	



■ C-series Robot



Project	Specifications	C06		C06C		C10		C10C		CR10		CR10C		CR10-BG		CR10C-BG			
Basic Parameters	Rated Load(kg)	600				1000				1000				1000					
	Overall Size(mm)	950×650×250				1150×820×260				950×650×195				950*750*1470 (without warning lights)					
	Rotation Diameter(mm)	965				1201				1000				1000					
	Lifting Height(mm)	60				60				\				\					
	Ground Clearance(mm)	25				25				25				25					
	Lifting Plate Size(mm)	850×600				1030×770				\				\					
	Lifting method	Electric lifting				Electric lifting				\				\					
	Self-weight(kg)	130				180				100				100					
	Communication method	Default WIFI dual-band, 5G optional				Default WIFI dual-band, 5G optional				Default WIFI dual-band, 5G optional				Default WIFI dual-band, 5G optional					
	Navigation Mode	DM Code	DM Code + Laser SLAM				DM Code	DM Code + Laser SLAM				DM Code	DM Code + Laser SLAM				DM Code	DM Code + Laser SLAM	
LCD Display	Equipped				Equipped				Equipped				Equipped						
Safety Protection	Front Protection	270° Laser				250° Laser				270° Laser				270° Laser					
	Rear Protection	180° Laser				180° Laser				210° Laser				210° Laser					
	Collision Strip Detection	360° Detection				360° Detection				360° Detection				360° Detection					
	Emergency Stop Button	One at the front and one at the rear				One at the front and one at the rear				Two sides & rear, a total of three				Two sides & rear, a total of three					
	Lighting Alerts	Equipped				Equipped				Equipped				Equipped					
	Voice Prompts	Equipped				Equipped				Equipped				Equipped					
	3D Obstacle Avoidance	Optional				Optional				Optional				Optional					
Movement Capability	Maximum Operation Speed (Empty Load/Full Load)(m/s)	2.0 / 1.5				1.8 / 1.5				2.0 / 1.5				2.0 / 1.5					
	Rated Acceleration (Unloaded)(m/s ²)	1				1				1				1					
	Stop Angle Accuracy	±5mm / ±1°	±20mm / ±2°				±5mm / ±1°	±20mm / ±2°				±5mm / ±1°	±20mm / ±2°				±5mm / ±1°	±20mm / ±2°	
	Stop Position Accuracy	30mm(Gap) / 3°(5%)(Slope) / 10mm(Step)				30mm(Gap) / 3°(5%)(Slope) / 10mm(Step)				30mm(Gap) / 3°(5%)(Slope) / 10mm(Step)				30mm(Gap) / 3°(5%)(Slope) / 10mm(Step)					
Lithium Battery Performance	Rated Voltage/Capacity	51.2V / 24AH				51.2V / 40AH				51.2V / 30AH				51.2V / 30AH					
	Number of Charge Cycles	Full charge and discharge: 2000 cycles (Battery capacity remains above 70% of new battery)				Full charge and discharge: 2000 cycles (Battery capacity remains above 70% of new battery)				Full charge and discharge: 2000 cycles (Battery capacity remains above 70% of new battery)				Full charge and discharge: 2000 cycles (Battery capacity remains above 70% of new battery)					
	Endurance/Charging Time	≥8H / ≤2H				≥8H / ≤2H				≥8H / ≤2H				≥8H / ≤2H					
	Battery Type	LFP				LFP				LFP				LFP					
Environment	Operating Temperature(°C)	0~45				0~45				0~45				0~45					

Accessories



Calling Device

One-Click Call

Call tasks directly with a single button press.

Fault Location

Achieve fault location through an intelligent system.

Live Monitoring

Real-time display of task status, location information, and equipment status.

User-Friendly Operation

Visualized operational logic for easy and intuitive operation and equipment status.



Charging Station



4096

System Control

Wireless Communication and Centralized System Control

Intelligent Control

Real-time monitoring of temperature and current
Overcurrent, Overvoltage, and Overheat Protection, Intelligent Cooling

Intelligent Identification

Charging Identity Recognition and Access Inspection

Protection

Electric Shock Protection, Protection against Motor Exposures and Foreign Object Detection

Dual-Charging Mode

Supports Manual and Automatic Mode Switching

Communication Module

Supports Dual-band WiFi and Mobile 5G Communication

Wireless Control Box



IO Interface

Provides Multiple Digital Input and Output Interface and equipment status

Communication Interface

Provides RS232 and RS485 Communication Interfaces

Network Connectivity

Support dual-frequency WIFI and 5G communication

Customization

Supports Customizable and Multiple Protocols.

Various Devices

Supports integration with automatic doors, elevators, signal lights, and other devices

Third Party

Supports Third-party Device Integration into the System

Instanders for forklifts

Fingerprint login

Log in through fingerprints, identify, control driving permissions;

Safety belt detection

Whether to wear a seat belt detection to ensure the driver's safety

Intelligent speed measurement

In real-time detection of forklift operation speed, providing reference and overspeed alarm for the driver

Sound and light alarm

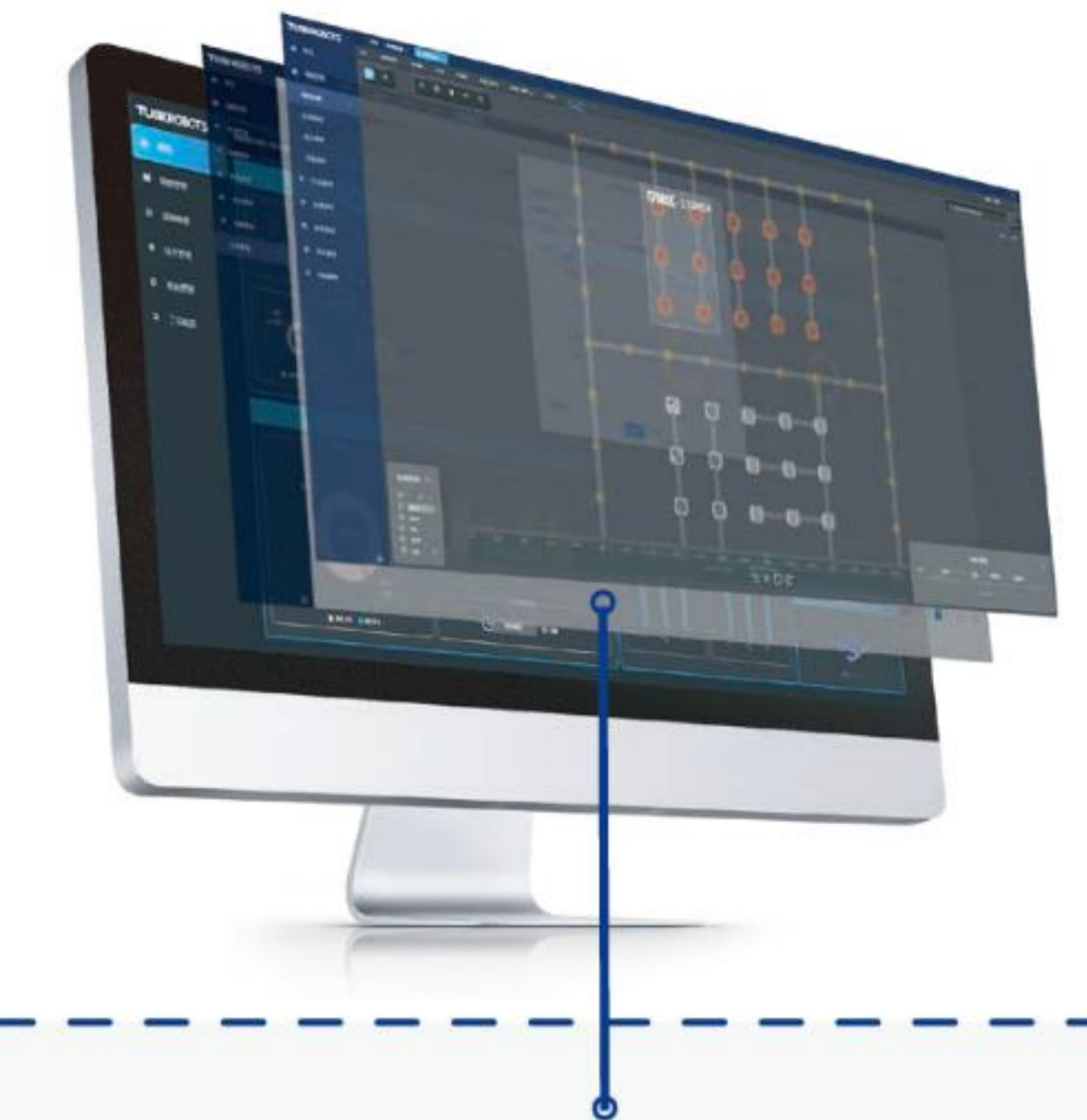
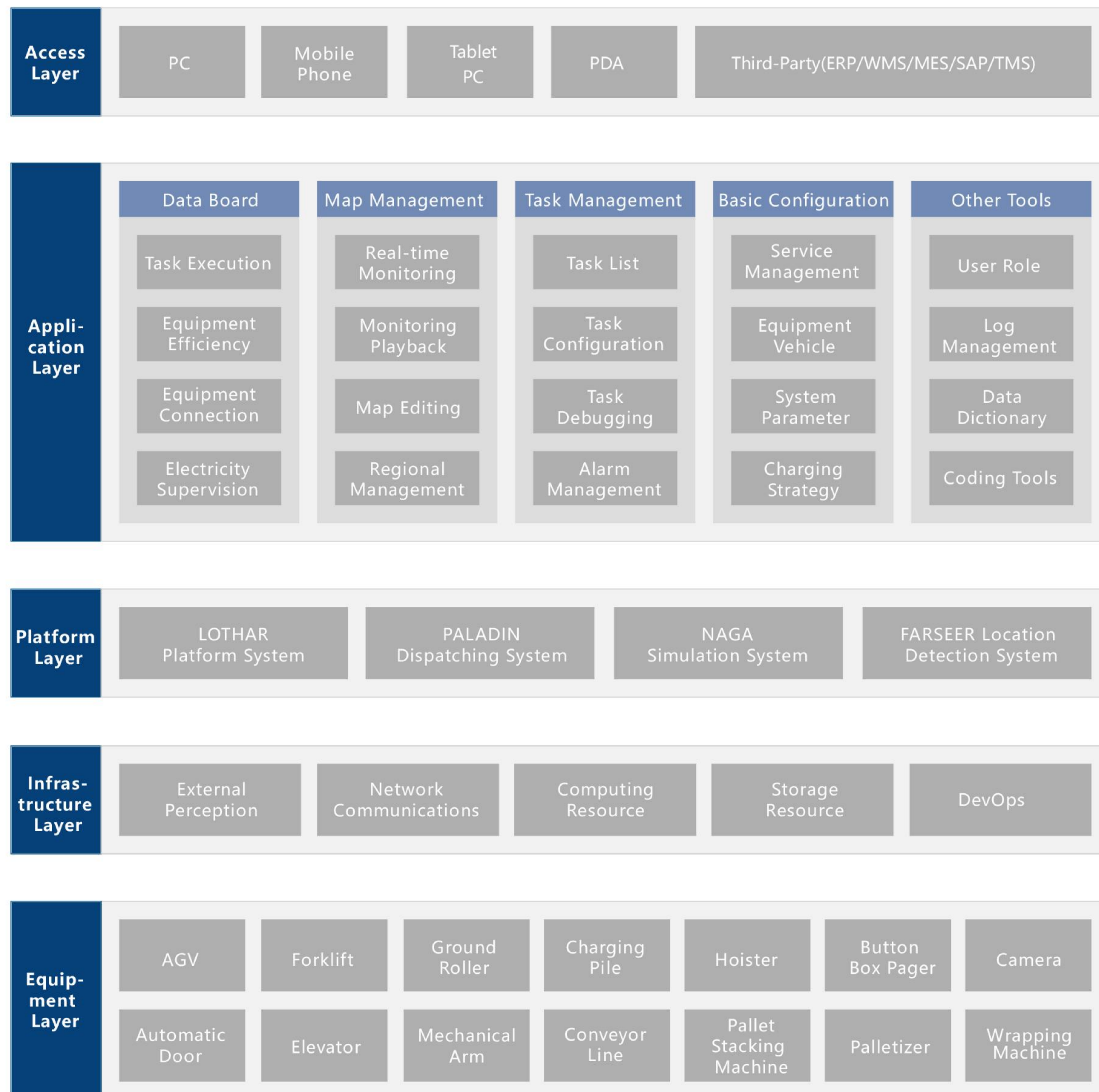
Equipped with sound and light alarms, providing multiple sensory prompts



Software System Introduction



Tusk Intelligent Management Platform

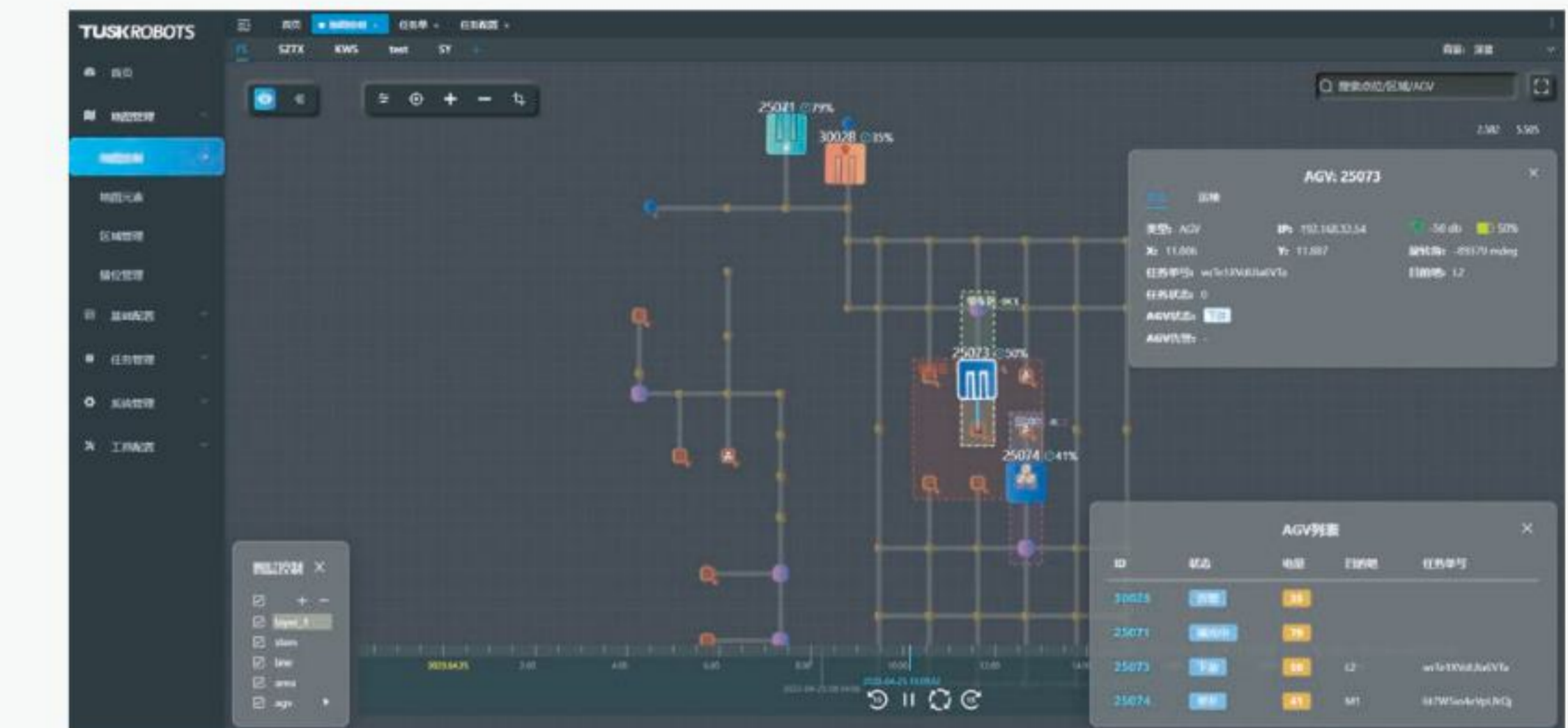


Real-Time Display



Homepage Data Dashboard

Offering real-time and historical visualized data to empower data analysis and aid in business decision-making.

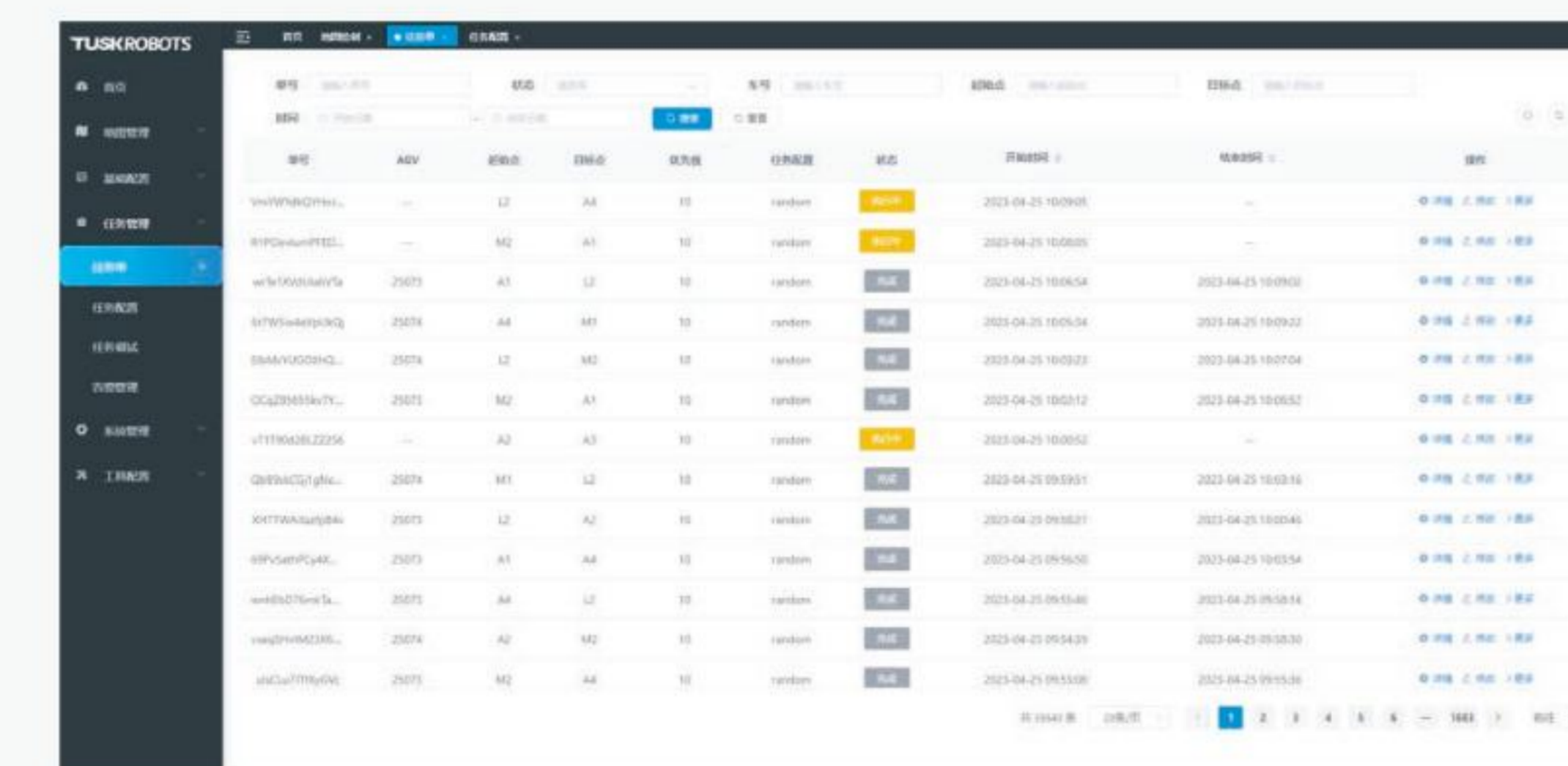


Real-time Map Tracking

Quick and easy visualization of map construction enables real-time monitoring of on-site conditions at project location.



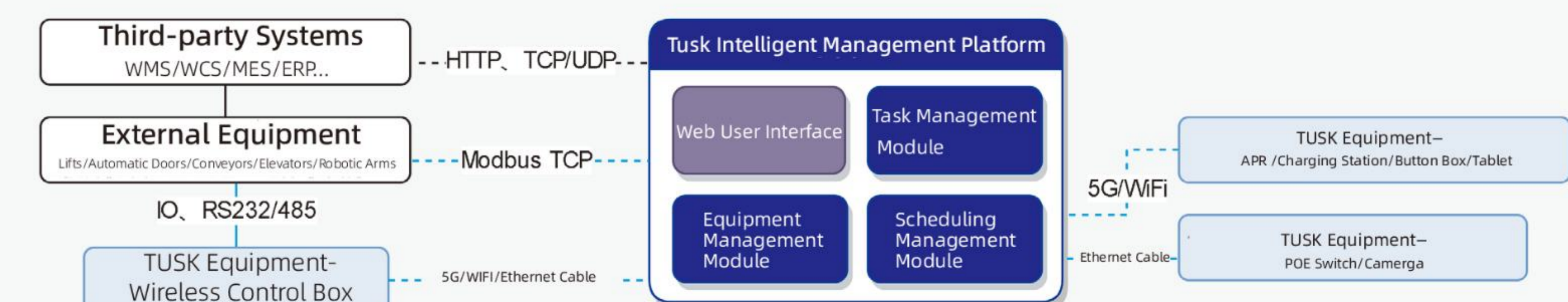
Task Management



- Transportation Mode: Combination of Point and Area Handling
- Picking Mode: Call from Operation Station
- Fixed Mode: Initialization, Clearing, and Organizing
- Collaborative Mode: Multi-vehicle Collaborative Box Picking
- Manual Mode: Manual Task Assignment, Cancellation, and Designated Charging



External Interface



Mobile Application

TUSKROBOTS self-developed mobile app for Android devices offers real-time management of storage locations, zones, and device status. It facilitates quick task initiation, simple inventory management, and device anomaly alerts. With an intuitive UI design, it ensures low learning curve and easy usage for operators.

- Supports All Android Devices
- Real-time Query of Devices
- Swift Initiation of Tasks
- Exception Diagnosis
- Easy Inventory Management
- DM Code Scanning Input



Location Management

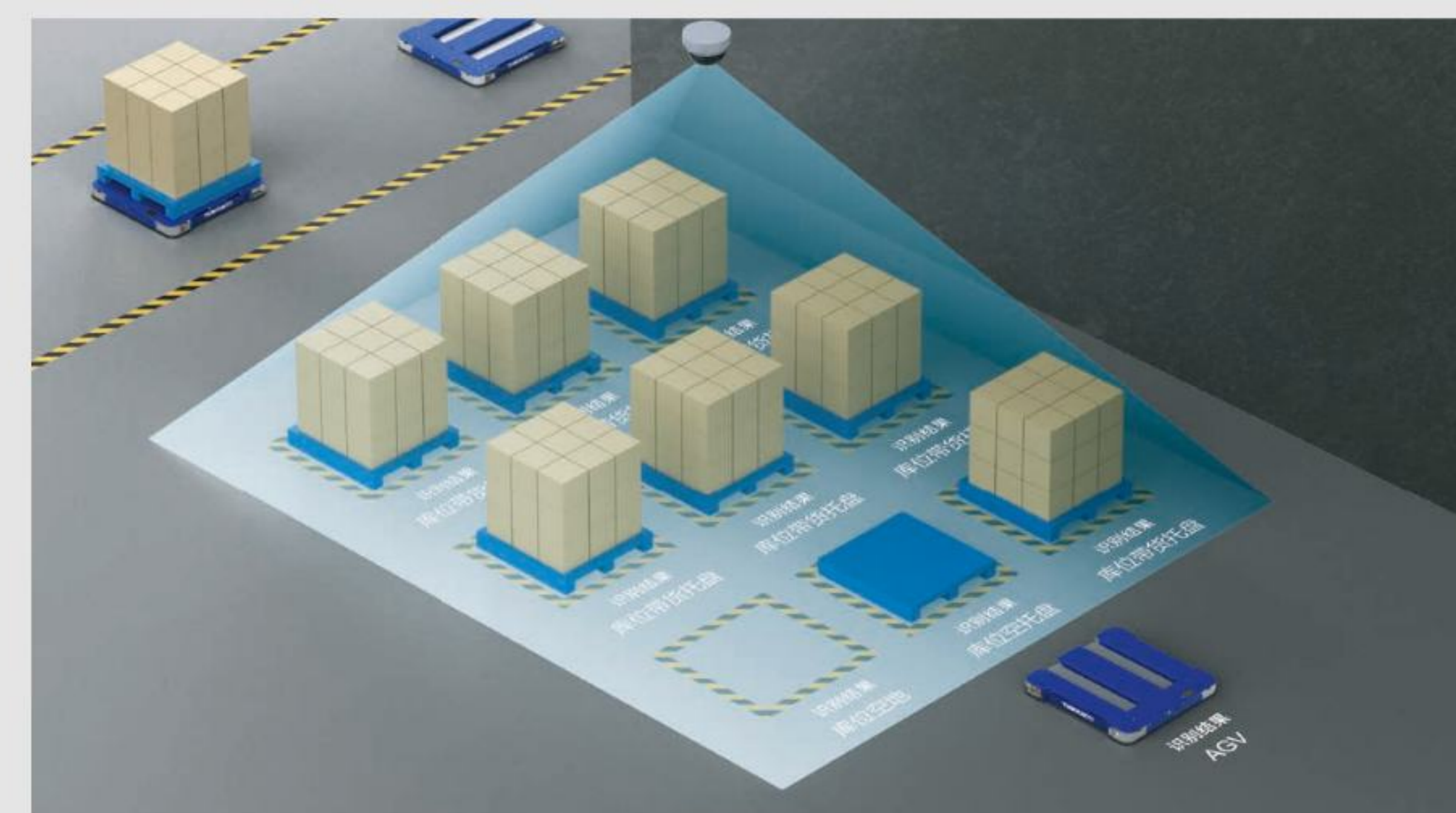
Point/Area Operation

Performing inbound and outbound operations in designated location

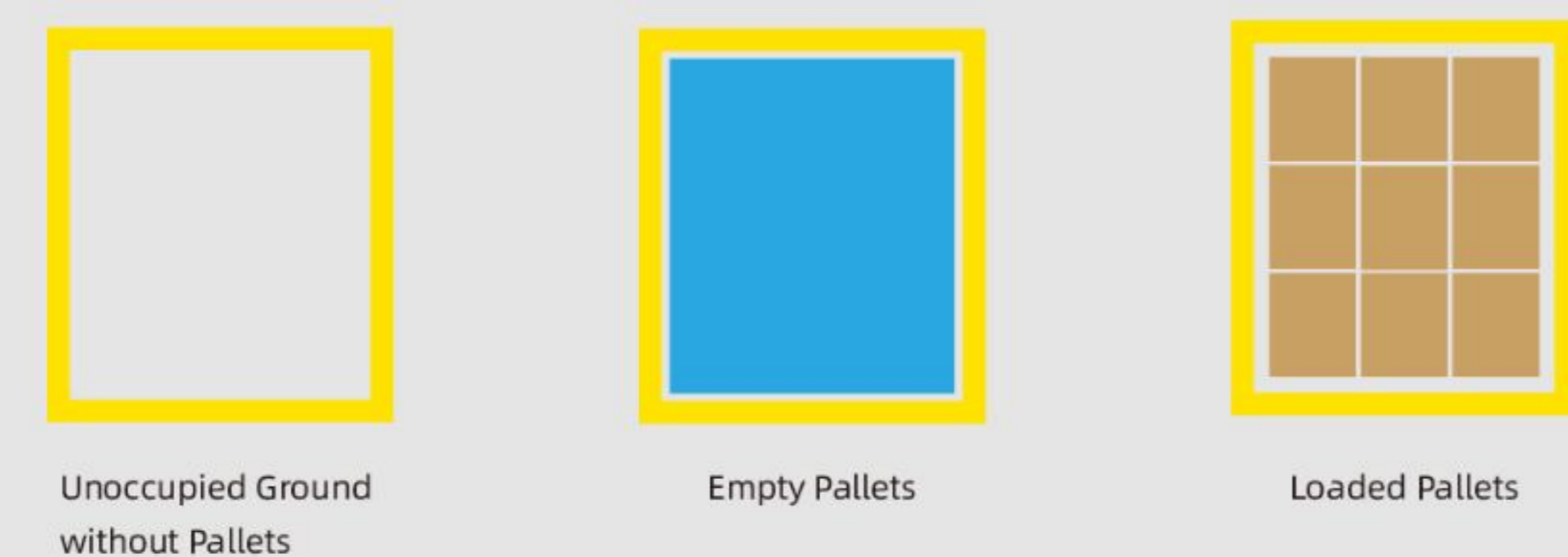
Device Management

Storage Location Visual Inspection System

The Storage Location Visual Inspection System uses deep learning image recognition to monitor storage locations in real-time. It updates information to the Tusk Intelligent Management Platform and optimizes robot deployment for factory operations accordingly.



Recognizable Storage Location States



The Storage Location Visual Inspection System paired with the LEGO Task Configuration Module, offers flexible application for various business scenarios and task workflows. It enables automated triggering of pre-configured transport tasks like semi-finished product offloading, finished product offloading, raw material replenishment, empty pallet recycling, and empty pallet replenishment based on storage location status changes.

Automotive Parts Industry

Advancing Automated Multi-Vehicle Collaboration in the Logistics of an Automotive Parts Enterprise

Industry Case Studies

Client Profile

- Established in 1972, a world-leading automotive technology manufacturer with a global sales presence
- Significant safety hazards exist due to **the coexistence of numerous manual material handling equipment** in the workshop
- Dependence on manual operations for goods in/out and transfers, leading to delayed response to demands
- Complex working conditions, **diverse carriers**, and high difficulty in task allocation and vehicle scheduling

Solution

- APR seamlessly **integrates with third-party equipment** for efficient transfers and automated outbound processes
- Combining with the **C-series Submersible Lifting Robot** can ensure precise material distribution and automatic retrieval of empty carts
- TUSK Visual Inspection System autonomously updates inventory statuses, enabling **human-machine collaboration** and one-click deliveries

Project Value

- 30% Efficiency Improvement
- RReduction of 30 Personnel
- Precise and Efficient Human-Machine Interaction
- Collaborative Operation of Different Types of Equipment



Automotive Electronics Industry

APR Handling Project for XAP (Electronic Group) Raw Materials and Finished Products.

Industry Case Studies



Pharmaceutical Industry

Intelligent APR Handling Project for Logistics in the Clean Area of a Pharmaceutical Limited Company

Industry Case Studies



Client Profile

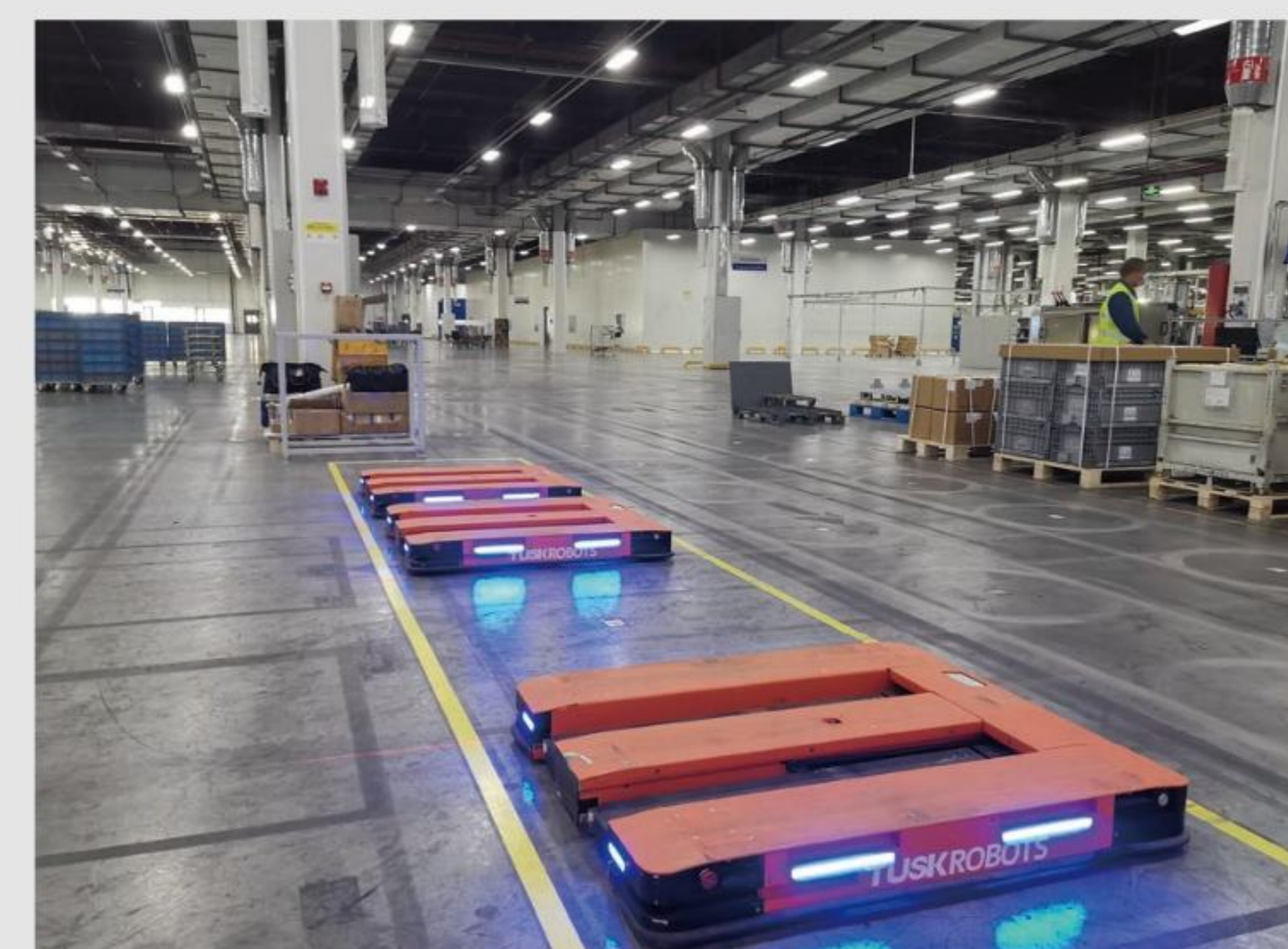
- **Leading global** automotive electronics company, a **Fortune Global 500** German corporation
- Three-shift operation with strong workforce, but delayed manual material replenishment
- Diverse carrier categories lacking process monitoring, resulting in high management costs.

Solution

- **Button call system** for seamless raw material replenishment and finished product transfer
- **360° laser safety protection** with intelligent human-machine interaction for collision avoidance
- Real-time integration with WMS/JIS digital systems for online monitoring through data fusion
- Standardization of 16 pallet types down to **4**, reducing management costs;

Project Value

Average daily operation 18 hours	More than 25% Efficiency Increase	ROI 1.5 years	Cost reduction and efficiency enhancement	Stable Operation with 2 Repurchases in 2 years



Client Profile

- A nationally recognized innovative enterprise engaged in the research, production, and global distribution of novel pharmaceuticals
- Challenges include low manual labor efficiency in multi-floor, multi-zone warehouse transfers
- Varied sterilization requirements across zones make manual aseptic handling **difficult to control**

Solution

- Automatic distribution and transfer of packaging materials, raw materials, and finished products in **multiple zones**
- Full automation with **elevator integration** for efficient multi-floor operations
- SLAM + DM code **hybrid navigation** for adapting to various environmental requirements in different areas
- Zone-based door control switching and **automatic disinfection and sterilization**

Project Value

20 Units of APRs Utilization	Cost Reduction and Efficiency Enhancement	Inter-Floor Transportation	Hybrid Navigation Operations



Home Appliance Industry

NB Packaging Line and Warehouse Material Distribution Project in Hefei

Industry Case Studies



Electrical Vehicle

APR Project for Line-side Delivery of Aluminum Shells and Top Covers in a New Energy Company

Industry Case Studies



Client Profile

- A famous enterprise in the home appliance manufacturing industry looking to establish an intelligent, lean **benchmark factory**
- Operates 24/7 with high labor intensity, leading to fatigue issues;
- Facing high labor cost and recruitment challenges
- Current inventory management lacks **material information integration**;

Solution

- Achieved automated material transfer within the workshop and at the production line side by integrating APR.
- APR automatically docks with **the hoister**, enabling cross-floor material transfer for production
- **Customized business processes** integrated deeply with the customer's MES, enabling end-to-end automation and flexibility in production

Project Value

			
More than 30% Efficiency Increase	Reduction of 15 Personnel	Cost reduction and increased efficiency	Flexible, efficient, and safe production




Client Profile

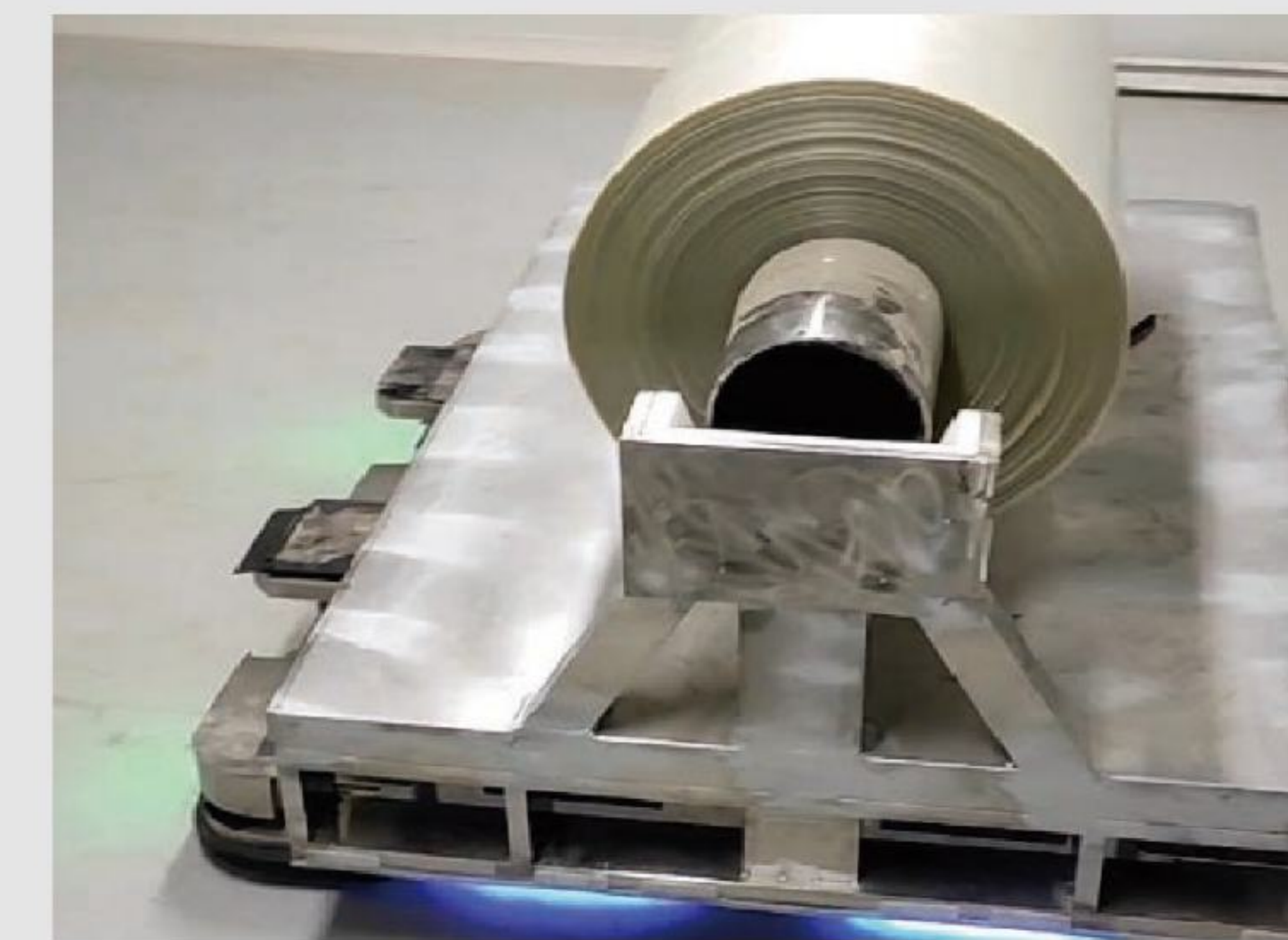
- A well-known domestic high-tech enterprise established in 1995, leading in multiple fields such as batteries, electronics, and automobiles;
- Working across multiple floors, long-distance transportation, resulting in high-intensity labor and **high safety risks**;
- **Low efficiency** in temporary storage management and material handling interactions;

Solution

- Pallet handling of foil and electrode materials for warehouse inventory, including cross-floor transportation, with **high-precision alignment** to elevators within $\pm 5\text{mm}$;
- Customized carriers equipped with automatic recognition capabilities, compatible with various equipment;
- Real-time integration with WMS for end-to-end visibility and control throughout the process;

Project Value

				
Over 80 Units of APRs Utilization	More than 35% Efficiency Increase	Multiple Project Launches Across Locations	Customized Carriers	Visualized Tracking



Food Industry

Cross-Floor Material Transfer Project for Raw Materials and Finished Products at a Food Company in Guizhou

Industry Case Studies



Tobacco Industry

Automation Project for Discrete Material Handling in the Semi-Finished Tobacco Production at a Cigarette Factory

Industry Case Studies



Client Profile

- Positioned as a high-quality chain bakery brand, occupying a modern industrial park of over 60,000m²;
- Chain-operated business with high production capacity and **stringent delivery schedule accuracy requirements**;
- Involves long-distance, cross-floor material handling, with a heavy reliance on manual labor that faces staffing instability;
- Complex passageways and transfer areas, with a high risk to personnel safety;

Solution

- PDA task instructions are issued promptly, ensuring seamless task execution;
- Efficient transportation with seamless transitions **across floors and diagonal warehouse** map locations;
- Utilizes 5G device communication for low latency and high stability;
- Employs SLAM+DM code **hybrid navigation** for highly adaptable environmental navigation;

Project Value



8 Units of APRs Utilization



Reduction of 6 Personnel



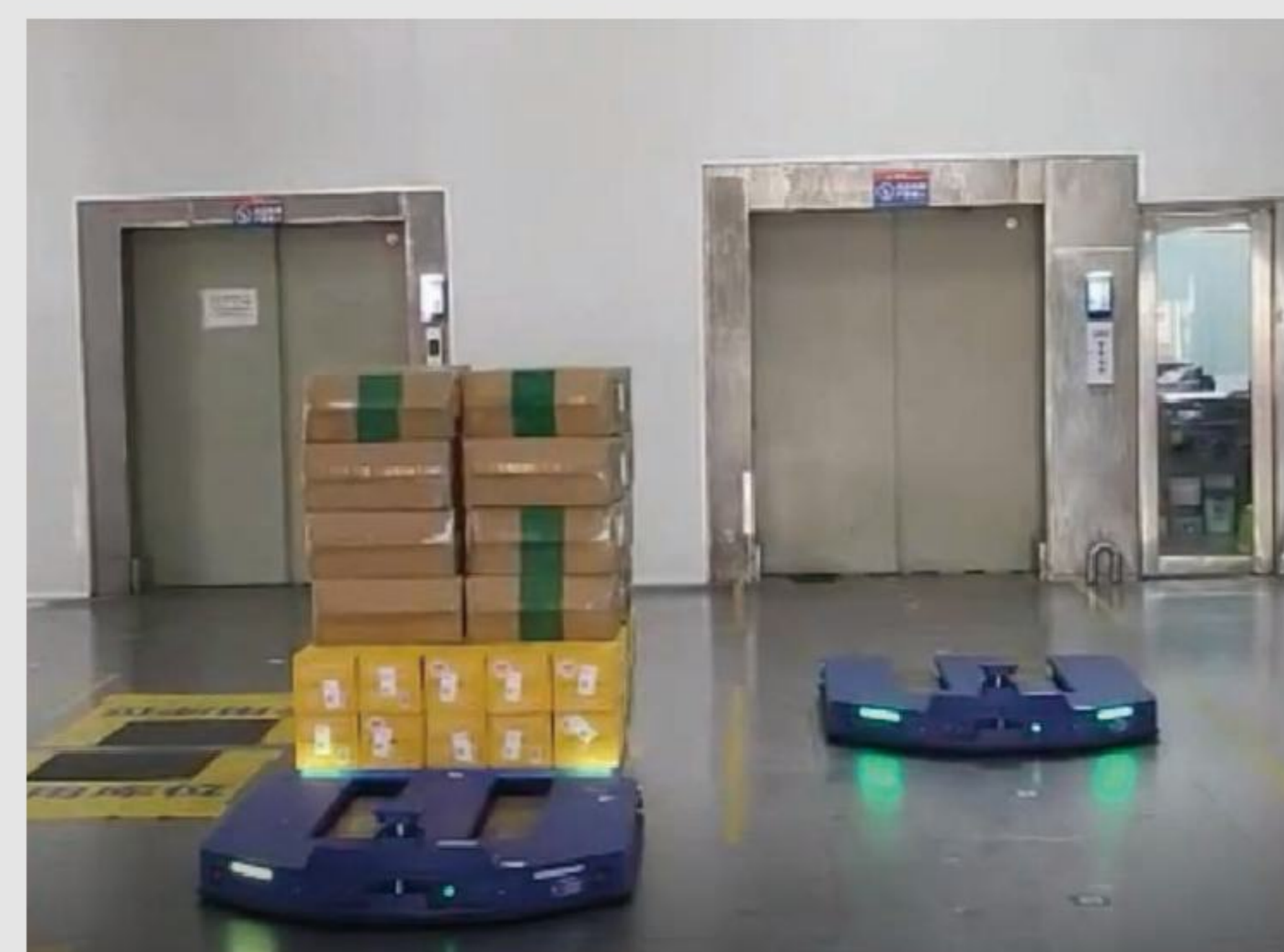
Increase in Inventory by Over 30%



Hybrid Navigation Operations



5G Communication



Client Profile

- Well-known tobacco industry corporation with 6 major cigarette production plants;
- Multiple on-site handling scenarios with long transportation distances, imposing significant manual labor;
- High-stacked goods pose substantial safety risks during handling;

Solution

- Automated Integration of **Robotic Arm** for Unpacking and Palletizing;
- **Double-Stacking** of Tobacco Bales in the Casing Box for **Enhanced Stability and Safety** during Transportation;
- **360° Laser** Safety Protection for Effective Hazard Elimination;
- Real-time Integration with WMS Digital System for Data Fusion and Online Monitoring;

Project Value



Over 20 Units of APRs Utilization



Reduction of 6 Personnel



Stable Operation for Over 1 Year



360° Laser Safety Protection



Precision Integration

