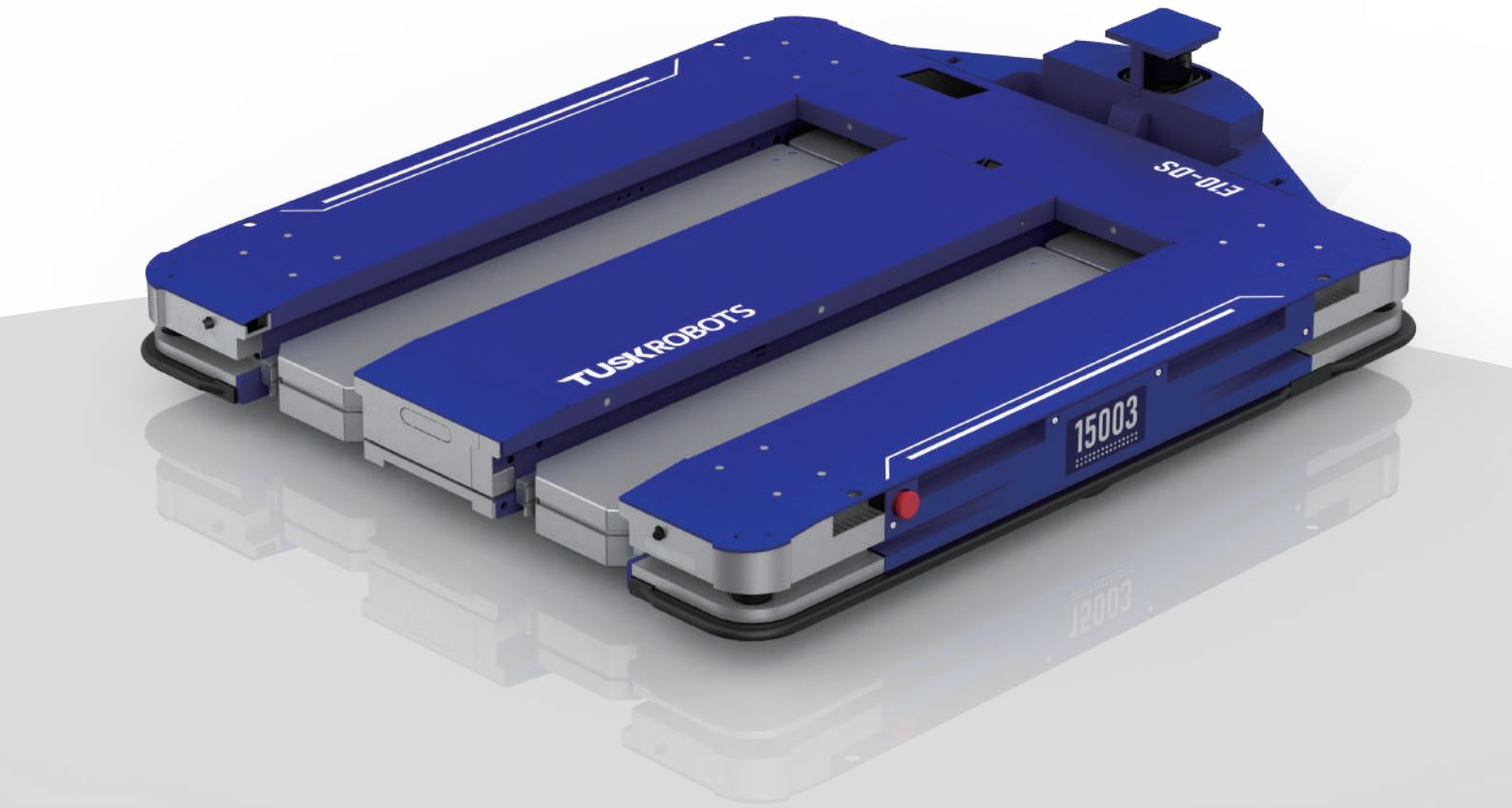
www.tuskrobots.com

TUSKROBOTS

Automated Pallet-Handling Robot



The intelligent transporter that never slacks off

Company Profile

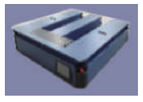
Tuskrobots devote ourselves to empowering factory and logistics to become intelligent, making handling easier and more efficient. We take the lead in launching this conveying and picking intelligent robot product with global unique innovation which can highly fit in the international standard pallets. The team members which come from famous universities at home and abroad have extensive experience in robot development and operation. The launching product has hundreds of patents and software copyright.

Tuskrobots Production Base locates in Foshan, Guangdong, and it sets R&D Centre in Beijing and Foshan. Local customer service/support staff are provided in Foshan, Shanghai, Beijing, Xi'an, Zhengzhou, Chengdu, Chongqing and other places.Our products are widely applied in automobile, medicine, tobacco, chemical industry, electronics, commerce and other fields to provide enterprises with much safer and more efficient transporting automation solutions.

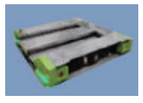
Design for the Pallet Handling

Basic Prototype Stage
V1.0
2018
First Generation
Product

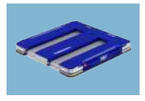
Product Application Stage
V2.0
2019
Second Generation
Product



Product Iteration Stage
V3.0
2020
Third Generation
Product



Project Solution Stage
V4.0
2021
Fourth Generation
Product



Tuskrobots Advantages

Focus on pallet transportation as the core all the time, consummating product functions ceaselessly, abundant peripheral connection to coping with all possible intelligent pallet transporting application scenario, enable enterprises to carry out digital and intelligent transformation.

01

Core Functions-Real Pallet Intelligent Transporting

No Assistance: Pallets can be directly transported without any auxiliary equipment;

Tiny body with massive power: easily transport goods over 4 times its own weight;

Pass through narrow-channel: it can rotate in place without turning radius, as low as 1.7m channel width;

02

Ultimate Performance-High Efficiency and Security

Flexible Positioning: Be compatible with QR code and SLAM these two kinds of navigation, high positioning accuracy, can switch without the sense and adapt to the needs of multiple sites;

High Safety: 360 ° laser obstacle avoidance, Stereo vision detection is as low as 4cm obstacle, Stereo perception can eliminate all potential safety hazards all the part;

Cluster Scheduling: Large scale intelligent cluster scheduling, Real-time online planning of optimal path, Traffic management refresh 5 times per second, intelligent prediction prevent the occurrence of congestion;

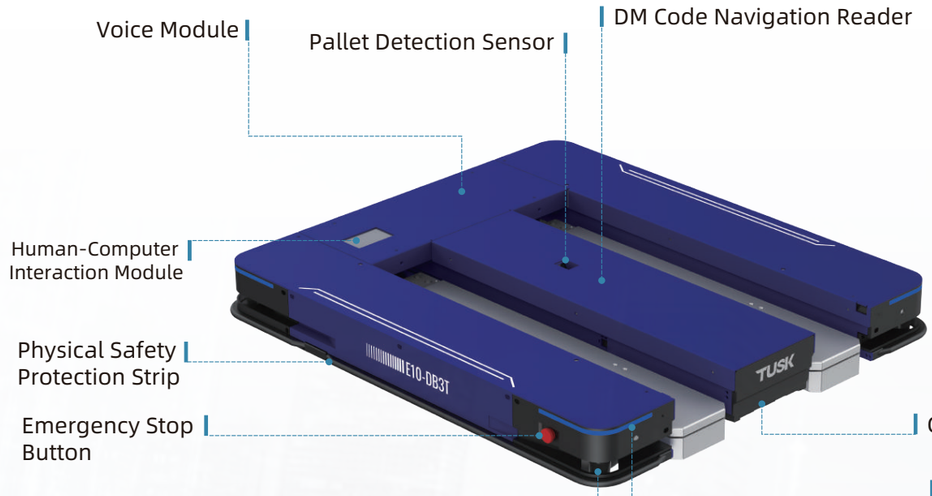
03

Rich Scenarios-Suitable for Various Requirements

Diversified Docking: Can directly connect with third-party equipment, including manipulator, elevator, conveyor line, elevator, ground roller, traffic light, disinfection light, etc.;

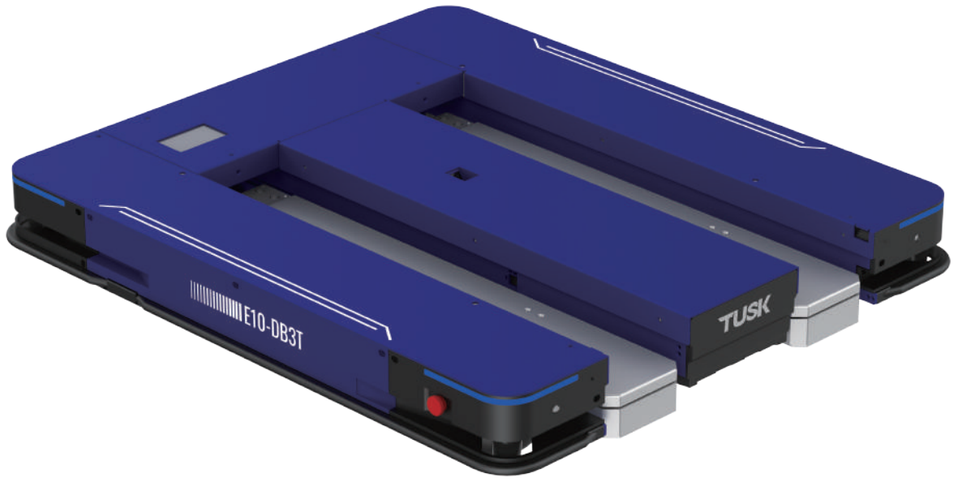
Wireless communication: support WiFi dual band or 5G mobile network communication;

Pallet Robot Function Configuration Diagram



Easy Transporting	Intelligent Operation	Flexibility	Improve Logistics	Security Assurance	Special working condition
Directly Transport Pallets Perfectly Replace	Cloud Big Data Intelligent Operation	Intelligent Positioning Flexible Operation	Optimize Storage Promote Efficiency	360° Protection Safe and Reliable	Special Working Condition Rich Peripherals
Maximum Loaded: 1T	Flexible Modification of Map Model	Visual Navigation	Faster Speed 1.5m/s	Support visual, laser	Special vehicle
Adapt to Multi Size Pallets	Large Scale Swarm Intelligence	Laser SLAM navigation	More Stable Dispatching System	Infrared, TOF, etc. distance	Ground Adaptability
Automatic Pallet Calibration-Identification	Dynamic Traffic Management	Online Map Real-time Update	Higher Storage Capacity	detection, additionally collision bar	Enrich peripheral docking
No Modification Required	Multitasking and Multipathing	24-hour Continuous Operation	Lower Channel Space	and emergency stop button, .etc	hoist, mechanical arm,
One Touch Call	Flexible Interface Mode		Better Activity Cost		automatic door, elevator,
			Perfect Report Statistics		traffic lights, .etc

E10（DM Code Version）



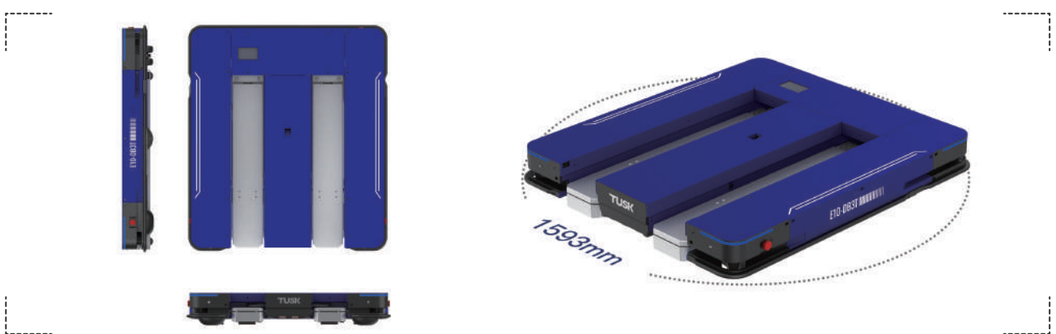
Dense Storage
High Utilization
of Warehouse

Narrow Aisle
Small Rotation
Diamete

Intelligent Pallet
Recognition
Automatic
Adjustment

DM Code
Navigation
High Accuracy

Product 3D Perspectives



E10（DM Code）Technical Specifications

Project	Specifications	E10 (DM Code)
Basic parameters	Size(mm)	1233×1102×170（Include the protection strip）
	Maximum Lifting Weight (kg)	1000
	Self-Weight (kg)	316.6kg
	Rotation Diameter (mm)	1593
	Fork Height (mm)	90（7mm downward floating height with loading）
	Maximum Lifting Height (mm)	⩽329
	Pallet Opening Height(mm)	95-130
	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, 360° Obstacle avoidance detection
	Detection Distance of Front Laser	⩽3m
	Mechanical Protection	Emergency stop button、Reset button、A protection strip around the whole vehicle body
	Caution Function	With voice and photoelectric alarm functions
Movement Capability	Navigation Mode	DM Code
	The Speed with Zero Load	0-1.5m/s
	The Speed with Fully Loaded	0-1.2m/s
	Rated Acceleration	1m/s²
	Stop Accuracy	±5mm /±1°
	Movement Mode	two-wheel differential
	Maximum Clearance	40mm
	Maximum Slope	3.3°
	Maximum Step	15mm
	Maximum Slope when the Fork Extension reach to the Maximum	1.9°
Lithium Battery Performance	Rated Voltage	51.2V
	Capacity	28AH
	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	⩾8H
	Charging Time	⩽2H
	Battery Type	LFP

E10-SLAM（SLAM+DM Code Dual Navigation Version）

Loading by Vehicle Body High Stability

SLAM + DM Code Dual Navigation Automatic Switching

Audible and Visual Alarm Automatic Control

E10-SLAM （SLAM+DM Code Dual Navigation Version）

Project	Standard	E10 SLAM Dual Navigation
Basic parameter	Size(mm)	1384.8×1102×170（include the protection strip）the height of the SLAM component is adjustable
	Maximum Lifting weight (kg)	1000
	Self-weight (kg)	330kg
	Rotation Diameter (mm)	1606.7
	Fork Height (mm)	90（7mm downward floating height with loading）
	Maximum Lifting Height (mm)	⩽329
	Pallet Opening Height (mm)	95-130
	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, 360° Obstacle avoidance detection
	Detection Distance	⩽3m
	Mechanical Protection	Emergency stop button、Reset button、A protection strip around the whole vehicle body
	Caution Function	With voice and photoelectric alarm functions
Movement Capability	Navigation Mode	SLAM + DM code Dual Navigation
	The Speed with Zero Load	0-1.5m/s
	The Speed with Fully Loaded	0-1.2m/s
	Rated Acceleration	1m/s²
	Stop Accuracy	±20mm /±2°
	Movement Mode	Two-wheel differential
	Maximum Clearance	40mm
	Maximum Slope	3.3°
	Maximum Step	15mm
	Maximum Slope when the Fork Extension reach to the Maximum	1.9°
Lithium Battery performance	Rated Voltage	51.2V
	Capacity	28AH
	Battery Life	1500 times (The battery capacity is guaranteed to be more than 70% of the new battery)
	Battery Endurance	⩾8H
	Charging Time	⩽2H
	Battery Type	LFP

E-series Charging Station

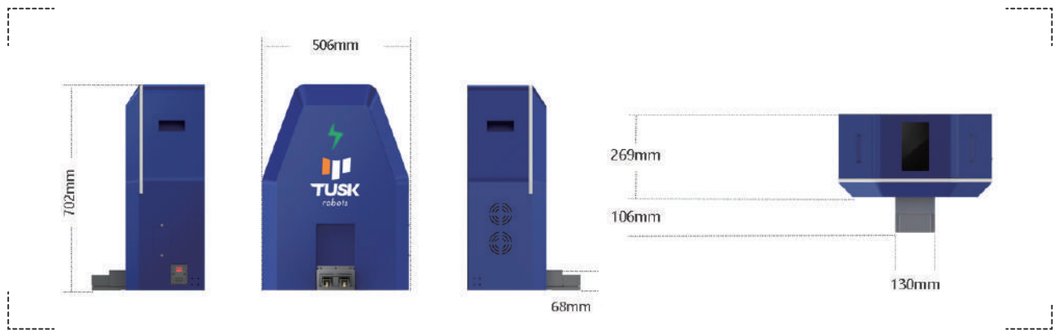
Fast Charging by High Current Dynamic Current Charging

Telecommun-ications System Control

Real-time Status Display Human-computer Interaction

Charging Identification Intelligent ID

Product 3D Perspectives

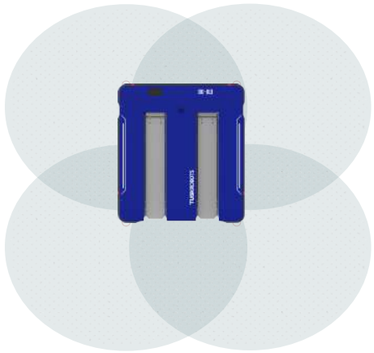


Charging Station Technical Specifications

Project	Technical Specifications
Specification	CSE（International special version）
Input AC voltage	China：220V±10%50HZ Japan：100/200V%50Hz Some EU countries：230V%50Hz America 110V%60Hz
Input Rate	<2KW
Output DC voltage	12V~58.4V
Maximum output current	20A
Output voltage error	±0.5V
Output current error	±0.5A
Output Voltage	Dynamic adjustment of output voltage
Output Current	Dynamic adjustment of output current
Overcurrent Protection	Support
Over Temperature Protection	Support
Wireless Communication	Dual-band 02.4G/5G，IEEE802.11b/g/n
Human-computer Interaction	Touch LCD
Status Indication	Three color LED indicator
Charging Plug	Support anti reverse connection and good contact detection
Short Circuit Protection	2P 20A Leakage protector
Working Temperature	-5℃~+50℃
Weight	23kg

Product Features

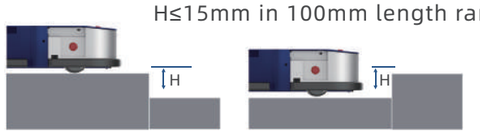
- Direct fork type, convenient and flexible;
- Whole vehicle body bearing, more reliable and stable operation;
- 360 ° laser protection;
- DM code and SLAM can be dual and switched;
- Spin in place, no rotation radius;
- Manual/Automatic random switching;
- WIFI, 5G wireless communication;
- Safer design of the invisible fork arm;



Ground Adaptability

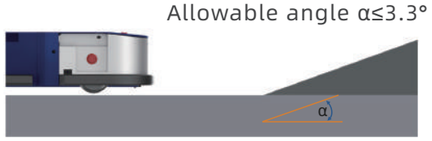
step

Allowable height of step
H≤15mm in 100mm length range



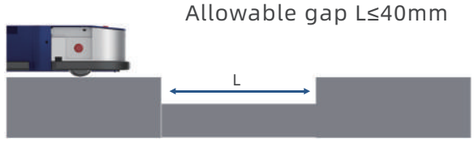
angle

Allowable angle α≤3.3°



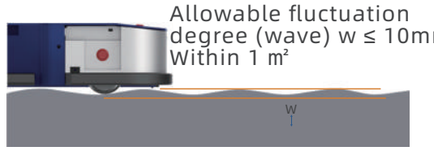
gap width

Allowable gap L≤40mm

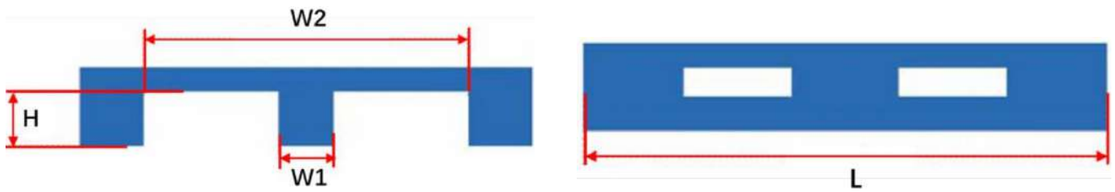


fluctuation degree

Allowable fluctuation degree (wave) w ≤ 10mm
Within 1 ㎡



Pallet Size Adaptation



Description of Pallet Size Parameters

Serial No	Parameter label	Description（unit：mm）
1	W1	⩽190
2	W2	700⩽W2⩽970
3	L	⩽1200
4	H	Under the condition of 95~105: the maximum load is 800kg
		Under the condition of 105~130: the maximum load is 1000kg

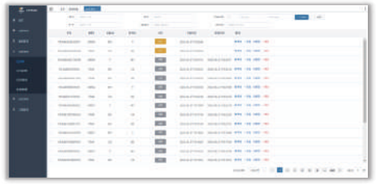
Software System - Functional Characteristics

Data Board

Provide real-time and historical visual data to help data analysis and business decision-making

Map Management

Independent and flexible to perform the configuration task, adapt to different business scenarios and job processes

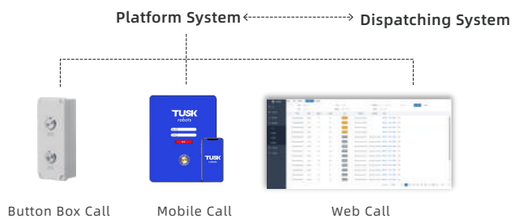


Task Management

Independent and flexible to perform the configuration task, adapt to different business scenarios and job processes

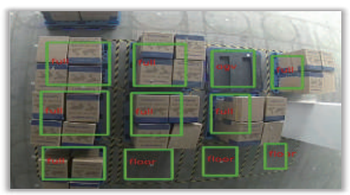
Simulation

Assist in business process design and problem analysis, help business optimize the logic to make site implementation and operation schemes efficient and reasonable



Intelligent Dispatching

Intelligent coordination of multi device operation, optimal planning of multi-objective in multi-path scheduling, providing the shortest path form, avoidance control, path replanning control and other processing mechanisms to dynamically manage traffic, supporting a variety of call modes



Storage Location Monitoring System

ROI (focus area) photographed by the camera can be intelligently recognized by using the deep learning technology of visual recognition, and different storage positions (open space, empty pallet, loaded pallet) can be efficiently and accurately identified. With the mechanism of automatically triggering scheduled tasks, the requirements of various business scenarios such as production line replenishment, goods input, picking, goods output and production can be satisfied

Tuskrobots System

Tablet Pager

> Support the control of direct task scheduling and task initiation;

> Support free configuration, simple operation and One-button call;

> Support the display of location information and task status;

> Support the locking, unlocking and dynamic modification of the storage location;

> Real time monitoring of equipment status;

> Intelligent fault location and quick solution;

Wireless Control Box

> Support third-party equipment to access the robot system;

> Support switching and mutual exclusion logic of automatic doors;

> Support hoist, elevator, pallet stacking machine, etc.;

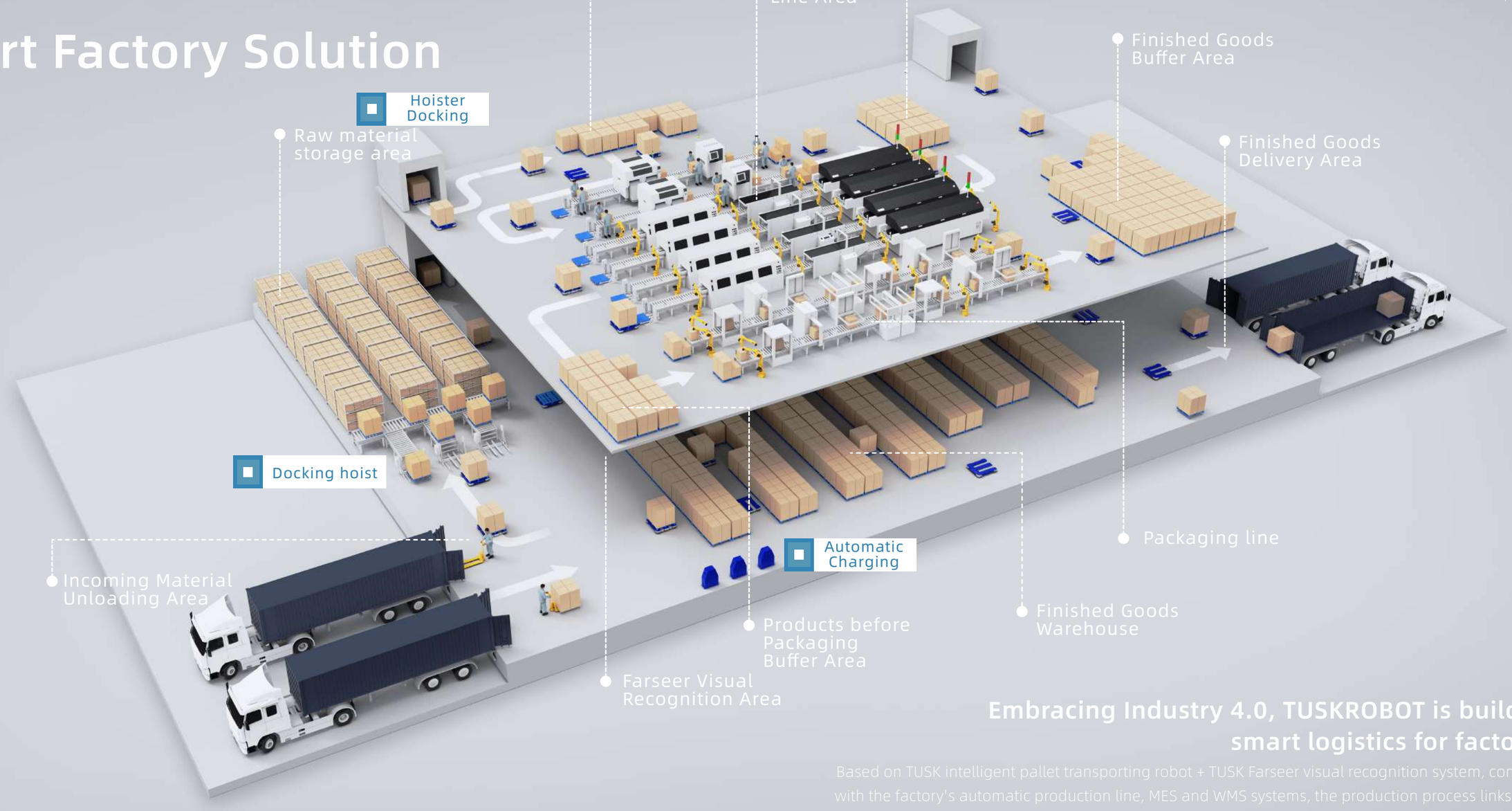
> Support wind shower room, traffic light, disinfection light, etc.;

> Support real-time status display of third-party equipment;

> Provide switching IO, RS232, RS485 (ModBus) and other protocol interfaces;

> Support customized control logic;

Smart Factory Solution



Embracing Industry 4.0, TUSKROBOT is building smart logistics for factories

Based on TUSK intelligent pallet transporting robot + TUSK Farseer visual recognition system, combined with the factory's automatic production line, MES and WMS systems, the production process links of raw material area, buffer area, production line area, semi-finished goods area and finished goods area are breaking through. TUSK can realize the whole link of materials to be checked, controlled and visualized, and fully implement the intelligent logistics solution in the 4.0 factories.

Human-machine Cooperation High Efficiency

Realize an efficient collaborative work scenario of "human-machine-goods-area"

Workflow Smooth

Optimizing the input, output and intermediate goods transporting process, implementing the best scheme, achieving smooth operation

Manufacturing Flexibility

Customized production, flexible manufacturing and intelligent logistics help the factory to achieve producing flexibly

Multi Device Cocking Flexible

Flexible docking with third-party equipment such as hoister, elevator, roller shutter door and ground roller

Production Management Visualization

Break up the whole link and whole process data, realize the integration of logistics and information flow to achieve the visualization of production management

Operation Cost Declined

Eliminate production bottlenecks and reduce unnecessary losses, thus reducing operating cost

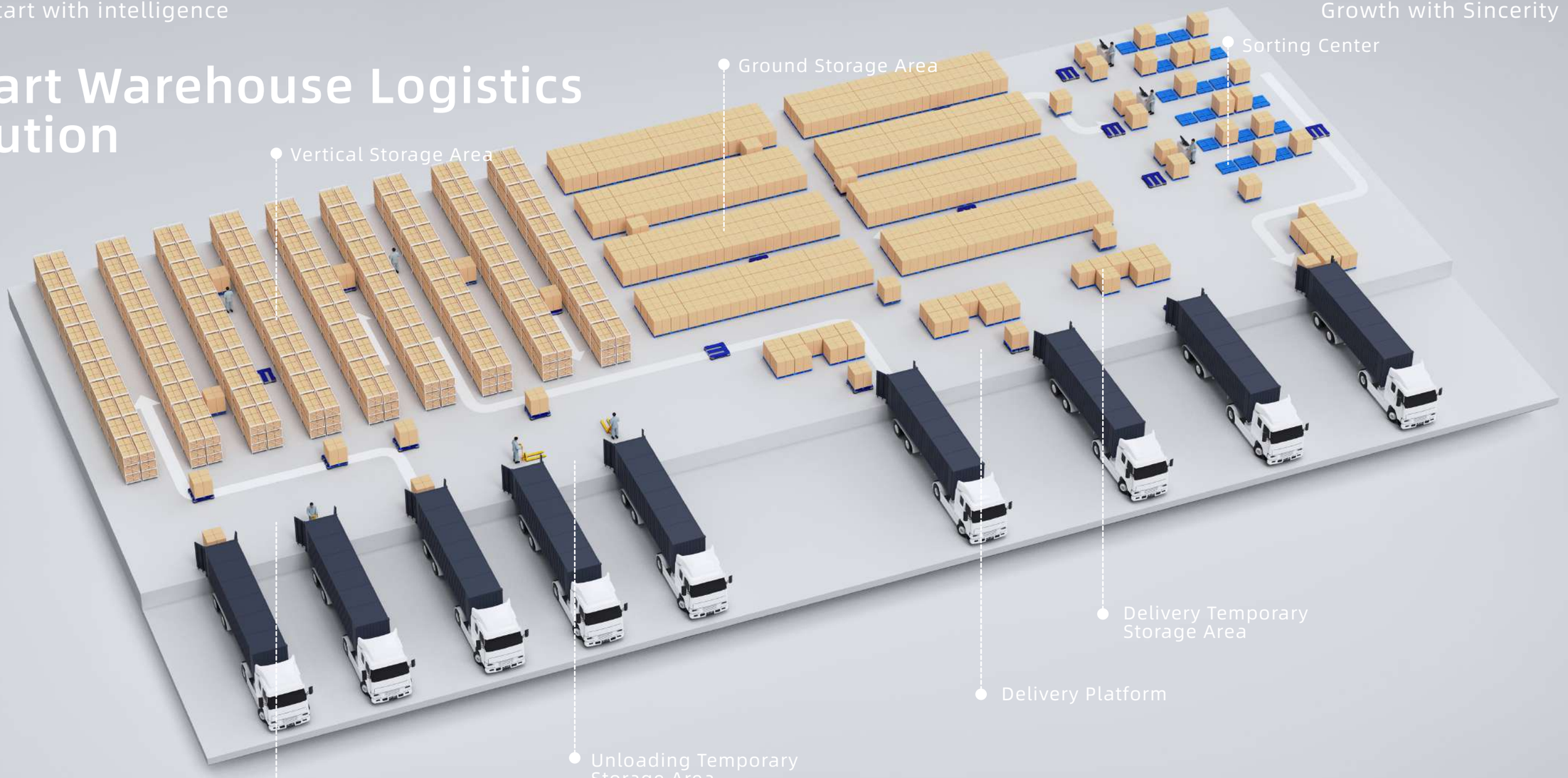
Production Efficiency Improve

Optimize operation to realize flexible production and improve production efficiency

Application Range Extensive

Satisfied diversified production and adapt to the requirements of multiple industries

Smart Warehouse Logistics Solution



Based on TUSK intelligent pallet transporting robot + Lothar task scheduling system platform, it provides warehouse personnel with human-machine cooperation through terminal PDA, PAD pager, etc., flexible configuration and task distribution mechanism can easily cope with various warehouse picking scenarios. The whole process of material flow automation from platform, warehousing, temporary storage, picking, packaging and ex-warehousing is completed in combination with the WMS system

Operation Environment Safety

The warehouse area is clearly divided and the moving line is reasonably planned to reduce the mixing of people and vehicles. The high-level forklift is fixed in the vertical storage area to reduce the possibility of safety accidents

Workflow smooth

Optimize the whole pallet warehousing, whole pallet loading, whole pallet ex-warehousing, bulk sorting, empty pallet recovery, empty pallet replenishment and other operation processes to achieve efficient and smooth whole process

Location Management Optimization

Optimize the layout of the storage area and the moving line, intelligently manage the global storage location to achieve intensive storage and inventory improvement

Multi Equipment Docking Flexible

Flexible docking with third-party equipment such as elevator, roller shutter door, elevator, mechanical arm and ground roller

Operation Management Visual

Break up the whole link and whole process of data, realize the integration of logistics and information flow, and achieve the visualization of warehousing and logistics operation

Operation Cost Declined

Optimize area division and workflow, reduce manual walking, operation and workload to reduce operation cost

Logistics Efficiency Improved

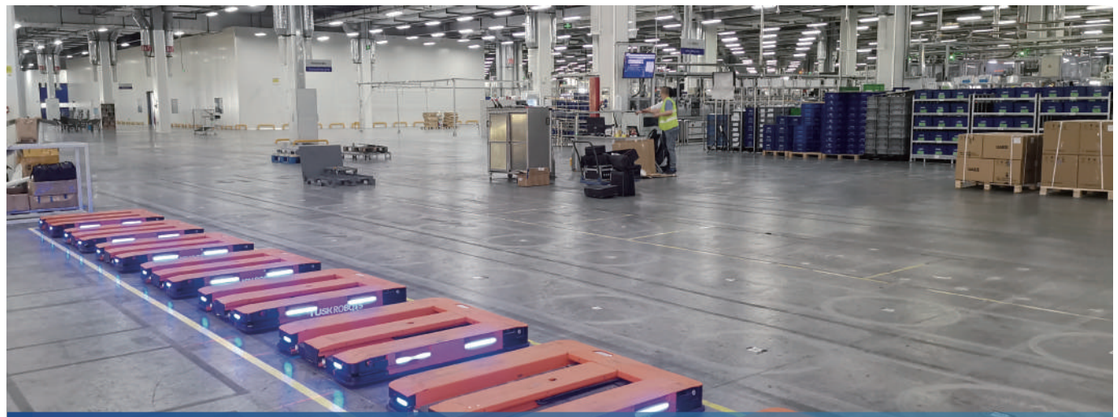
Workflow optimization, intelligent scheduling global multi equipment, optimal path planning, efficient processing of high concurrency of multi tasks, logistics efficiency improvement

Operation Mode Diversity

Realize multiple picking and transporting modes such as " Pick-it-Easy Shop ", "relay picking" and "relay seeding", which can be flexibly applied according to the actual situation of the project

Application Range Extensive

Satisfy diversified warehousing and logistics scenarios and adapt to the requirements of multiple industries



Automotive Electronics Industry – Solutions

TUSK
Project Case

Driven by the trend of automobile lightweight, miniaturization, intelligence and electrification, the overall market scale of automotive electronics has grown rapidly. Due to the market's demand for customization and delivery efficiency, component manufacturers are forced to join the ranks of automation transformation and upgrading. Digitalization of logistics in the factory has become an important part of transformation and upgrading, and pallet robots have naturally become everyone's first choice.

Customer Profile

An automotive electronics leading enterprise established in 1995, a production base of a joint venture company established between China and Top 500 German funded enterprises.

Customer Difficulty

The construction specifications and the degree of automation of the joint venture factory are relatively high. However, the auxiliary materials, raw materials and finished products can only be transported manually due to the limited working space.

Solve Manpower Gap: Numerous porters, high training costs, relatively high labor intensity, repetitive work, boring, and easy loss of workers.

Improve Work Efficiency:manual transporting relies on manual work order task assignment, resulting in low efficiency of transporting.

Embracing Industry 4.0:traditional manual transporting, poor information transparency, and scattered data cause logistics and information flow to be out of sync which may result in errors. A certain gap with the requirements of Industry 4.0.

Solutions

Replenishment of Raw Materials: The production line station calls for materials through clicking the pager, and the system automatically transports the auxiliary materials to the specified position through intelligent scheduling.

Finished Product Transporting: After the production of finished products is completed, the workers will automatically assign the pallet robot to the finished product station through the pager instructions to transport the finished products to the inspection area or packaging area. After the packaging is completed, the pallet robot will automatically transport the products to the area to be shipped.

Digital System: The transportation instructions and logistics information can be obtained through real-time connection with WMS and JIS systems. Combined with the system's own map, real-time online control of the logistics process can realize and the intuitiveness, accuracy and efficiency of warehousing, EX-warehousing and material operation can be guaranteed.

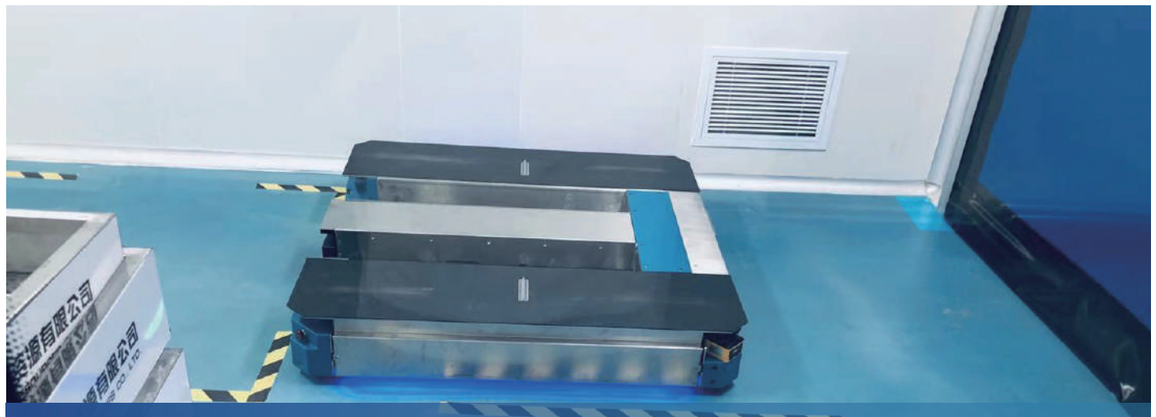
360° Safety Protection:360° laser obstacle avoidance, audible and visual alarm, collision bar protection and other multiple safety protection functions are able to ensure the safety of manual mixed operation to the greatest extent and reduce the high risk of normal forklift operation.

Achievement

99%
Timely Transporting Rate up to

25%
Efficiency Improve

- ROI:1.5 year
- Average Daily Task: 18 hours / Pallet Robot
- Average Daily Driving: 20 km / Pallet Robot
- Robot Single Shift 1:1 Replacement of Manual and Forklift



Pharmaceutical Industry – Solutions

TUSK
Project Case

The pharmaceutical industry is an important part of China's national economy. This industry combines traditional industry with modern industry and integrates the primary, secondary and tertiary industries. It mainly includes chemical active pharmaceutical ingredients and preparations, Chinese medicinal materials, Chinese medicine decoction pieces, Chinese patent medicine, antibiotics, biological products, biochemical drugs, radioactive drugs, medical instruments, sanitary materials, pharmaceutical machinery, pharmaceutical packaging materials and pharmaceutical commerce. Due to the special requirements of GMP in that industry, in order to avoid more pollution from external environmental factors, the investment in automation is also relatively pressing.

Customer Profile

The Listed Pharmaceutical Group has more than 20 scientific research capability centers around the world and 11 production bases all over the country. Focus on major treatment fields such as cardiovascular and cerebrovascular, digestion and metabolism, tumor immunity and neuroscience which can maintain human healthy life experience to carry out precise innovation.

Customer Difficulty

There are many problems in the preparation, extract and other processes, such as intermittence, repeated disinfection, abnormal vehicles, and manual material flow. No interconnection between equipment and the ubiquitous information isolated island problem makes industrial upgrading face more complex challenges.

Solutions

Disinfection Room Solution: According to its high cleanliness requirements, TUSK can directly break through the connection between the automatic door and disinfection equipment through the providing wireless control module, and fully automatically complete the whole process of opening the door, entering, opening the disinfection equipment, timing, stopping and mutually exclusive of opening and closing the door.

One Click Whole Process: TUSKROBOT is equipped with terminal operation for each process. Workers can call for materials with one click and transport temporary storage on the operation screen. Meanwhile, they can enter the materials information and query, lock and modify the status of inventory locations. For the cooling process of traditional Chinese medicine preparation production, the robot can automatically complete the whole process of material temporary storage, cooling timing, transfer and warehousing.

Special Shaped Carriers: For the diversity of categories in the pharmaceutical industry, the forms of carriers are also diverse. The special-shaped pallet recognition algorithm developed by TUSKROBOT can well complete the recognition and adjustment functions of different types of pallets. It has good adaptability to special-shaped carriers and can be used for multiple purposes, perfectly replacing the operation form of hand hydraulic carrier.

Achievement

100%
Production Cooling Timing Accuracy

41%
Efficiency Improve

Guaranteed Aseptic Production
Robot Operation, More Thorough Disinfection

Logistics Industry – Solutions

TUSK
Project Case

With the continuous development of the e-commerce industry, the characteristics of high frequency, short time limit, numerous types of products, large quantities and fast updates make logistics distribution have natural requirements for convenience diversity and timeliness of turnover. However, relying solely on huge-crowd strategy to solve the efficiency problems of various promotion will lead to waste of human resources and increase in management costs. However, it is imperative to reduce costs and increase efficiency in the logistics industry. In the logistics cycle, the plane transportation with the pallet as the carrier is the main component, so the pallet robot has unique advantages.

Customer Profile

This customer is one of the distribution warehouses of domestic e-commerce giants, mainly covering Guangzhou's e-commerce logistics distribution services to other major cities.

Customer Difficulty

Hundreds of pallets of goods need to be transported manually by hand hydraulic carriers every day. Plenty of tasks, high labor intensity, high potential safety hazards due to mixed traffic.

Reduce Labor Intensity: Hand hydraulic carriers are transported on a long-distance plane, with high labor intensity and easy fatigue.

Solve the Manpower Gap: A great amount of goods, many transporting personnel, high training costs, high labor intensity, repetitive operations, boring, difficult to recruit workers, and easy to lose workers.

Reduce safety risks: Complex environment, large workload, confusing working scene, numerous people are shuttling around in mixed traffic. Collisions will occur in the blind area of vision, and the potential safety hazards cannot be ignored.

Solutions

Tusk E-Series QR code version of transporting robots was used on the site to replace the plane transporting of hand hydraulic carriers. The pallet robot's millimeter level positioning accuracy effectively solved the work scene of intensive storage and improved the inventory rate; Meanwhile, the 360° laser obstacle avoidance, audible and visual alarm, collision bar protection and other multiple safety protection functions of the robot ensure the safety protection in the case of manual mixed operation to the greatest extent.

In view of the difficulty of high timeliness of logistics turnover, TUSK selects Farseer intelligent visual recognition system to intelligently identify and update the status of the warehouse in real time. When the status of the warehouse changes, it automatically triggers the corresponding transporting task, so that the pallet transporting flow is faster and more efficient.

Achievement

After adding the pallet robot, the cross regional movement of personnel is greatly reduced and the operation efficiency is greatly improved by combining with the visual recognition system to assist the scheduling. It makes the whole site more intelligent and efficient, and the transporting operation is orderly. It not only reduces the labor cost, but also reduces the labor intensity of the collaborative process. The whole logistics production process is intuitive and reliable, which also reduces the complexity of management and successfully achieves the goal of cost reduction and efficiency increase.

3C Industry – Solutions

TUSK
Project Case

In the production of 3C industry, there are many accessories, complex models and high requirements for classification. Electronic parts are updated quickly, avoiding long-term inventory, so the timeliness requirement is higher. Electronic products are small in size, high in product value, light in weight and easy to be damaged, so they require high safety in loading, unloading, transportation, storage and other operations.

Customer Profile

This customer is a famous 3C brand manufacturer in China, whose products cover notebook, desktop, monitor and other computer accessories.

Customer Difficulty

The docking between warehousing and ex-warehousing depends on experience, which easily leads to overstock of materials and untimely docking;
The manual perception of the actual material status is not clear, and it is hard to reasonably judge whether to issue materials in time;
The route cannot be reasonably planned manually, and opposite congestion is easy to occur under the effect of blind area of vision;
The correct rate of material distribution depends on personnel management, which is easy to cause incorrect distribution;

Solutions

Tusk E-Series QR code version of transporting robots was used on the site to replace hand hydraulic carriers for plane transportation. Data binding is performed manually through terminal PDA scanning, and WMS system automatically sends corresponding task instructions to pallet robot scheduling system on demand. The pallet robot automatically transports to the designated handover position and is responsible for the automatic recycle of empty pallets. Based on the work task list and self-generated map system, the robot scheduling system plans the optimal path and sequence of work in real time, which not only solves the problem of timeliness of material delivery, but also avoids congestion.

The combination of the robot scheduling system and WMS system achieves full data link traceability, from warehousing to inventory and then to ex-warehousing, ensuring that the whole process of material flow can be located and traced, and minimizing the error probability.

Achievement

99%	28%	16 pallets / vehicle/hour
Timely Rate of Material Issuance	Efficiency Improve	Robot Transporting

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Pallet Robot

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