

Railway Inspection Robot



杭 州 申 昊 科 技 股 份 有 限 公 司
Hangzhou Shenhao Technology Co., Ltd

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01

Corporate Profile



Company Introduction

Provide comprehensive solutions for safe operation and intelligent O&M of industrial equipment

Shenhao Technology was founded in 2002. It has been engaged in the research and development and industrialization of pan-industrial system health monitoring technology, system and application for a long time. It is a leading enterprise in the fields of smart power grid, intelligent inspection robot and industrial health monitoring in China, and its business involves power, rail transit, petrochemical and other fields.



20+ years

Fault detection
experience

10+

Lead and
participate in the
formulation of
national standards
and industry
standards

2000+

Successful
application
cases of
products

Development History



Started the research and development of electric vehicle testing platform



2002

Established

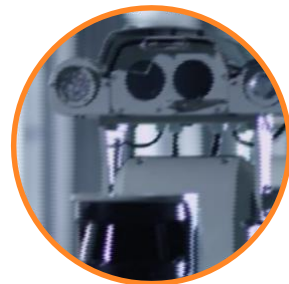
Transformed to do fixed-end online monitoring of power equipment



2007

First Transformation

Entered a new stage of unattended substations



2012

Product Extension

Expanded the business of rail transit, petrochemical and other industrial sectors



2017

Expanded Business Line

Set the strategic targets for comprehensive inspection of sea, land, air and tunnel



2022

Strategic expansion

Future

Strategic goals

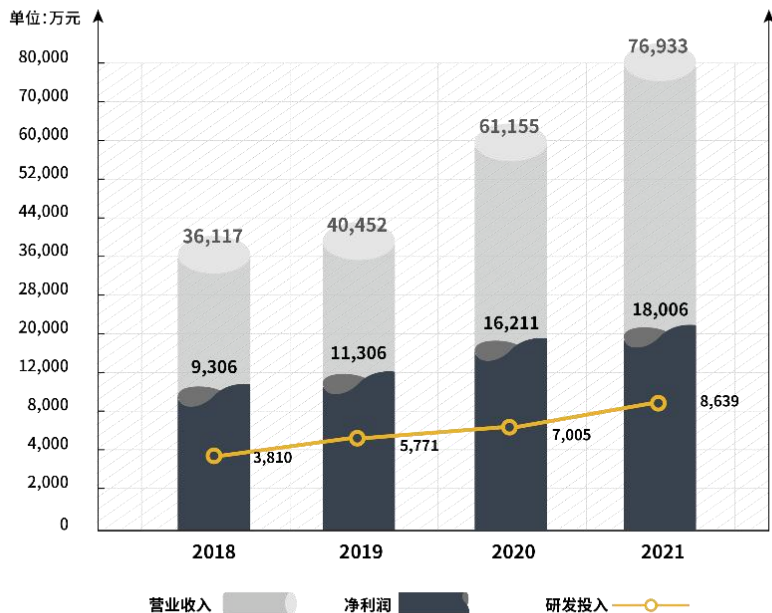
Establish a big data platform for monitoring the industrial fields of sea, land, air and tunnel to realize the corporate vision of "SHENHAO enables industrial health without any difficulties"



R&D Team

Shenhao Technology has more than **80%** of professional and technical personnel, covering all aspects of products, committed to the research and development and innovation in the field of artificial intelligence and robotics, and established a scientific and complete technical system.

Company R&D investment over the years



American Silicon Valley Shenhao Research Center

Led by Professor Ossama Khatib Stanford University, he has been engaged in intelligent control research for more than 40 years and is well-known in the international academic community in this field. The main research is the application of multi-degree-of-freedom manipulators in electric work robots.



Zhejiang University—Shenhao Technology Special Robot Joint Research Center

In collaboration with Professor Yang Keji of Zhejiang University, he is engaged in the research on the innovative design of robot mechanical ontology, robot theoretical modeling and simulation analysis, robot high-performance measurement and control and intelligence, and robot system integration and its application.



Beijing Institute of Technology—Shenhao Technology and Artificial Intelligence Joint Research Institute


Professor Zhang Longfei is the subject leader, carrying out research and development of cutting-edge technologies such as computer vision, deep learning, and artificial intelligence.



Zhejiang University of Technology-Shenhao Technology Robot Industrial Design Center


Cooperate with Professor Lu Chunfu, Dean of Zhejiang Industrial Art Design Institute, to define the commercial design of special robot series and lead the industry trend.

Gradually expanded from transmission and distribution inspection robots to aerial Uav inspections, submarine cable inspections, and automatic inspections of railway and petrochemical storage and transportation. The service customers have covered State Grid, China Southern Power Grid, the four major power generation groups, and China Railway Construction, Railway Corporation and Sinopec and other enterprises.



Power Grid

- Power generation Substation
- Power transmission power distribution




Rail Transportation

- HSR
- Urban Rail Transit
- Freight Railway



Oil, gas and chemical industry

- Oil, Gas, Chemical



Public Health

- Station, airport, school, bank, shopping mall, hospital

SHIR-3000 M
室外轮式巡检机器人

电力电网



SHIR-3002
室内轮式巡检机器人

电力电网



极寒适应型
变电站巡检机器人

电力电网



IR-SQ400A
开关室操作机器人

电力电网



IR-TH1530D
室内挂轨巡检机器人

电力电网



朱澜
自主式空中数据感知平台

电力电网



变压器油中气体
光谱光谱在线监测系统

电力电网



输电线路

康卫士1号
测温机器人

公共卫生



室内智能
喷雾消杀机器人

公共卫生



SHIR-3000EX
防爆型轮式巡检机器人

石油化工



工业罐体高宽
壁厚测量无人机

石油化工



刚性接触网
智能巡检机器人

轨道交通



RIIS1005
线路巡检机器人

轨道交通



TVIS1000
列车车底检测机器人

轨道交通



RSS-UT1015
双轨式钢轨超声波探伤仪

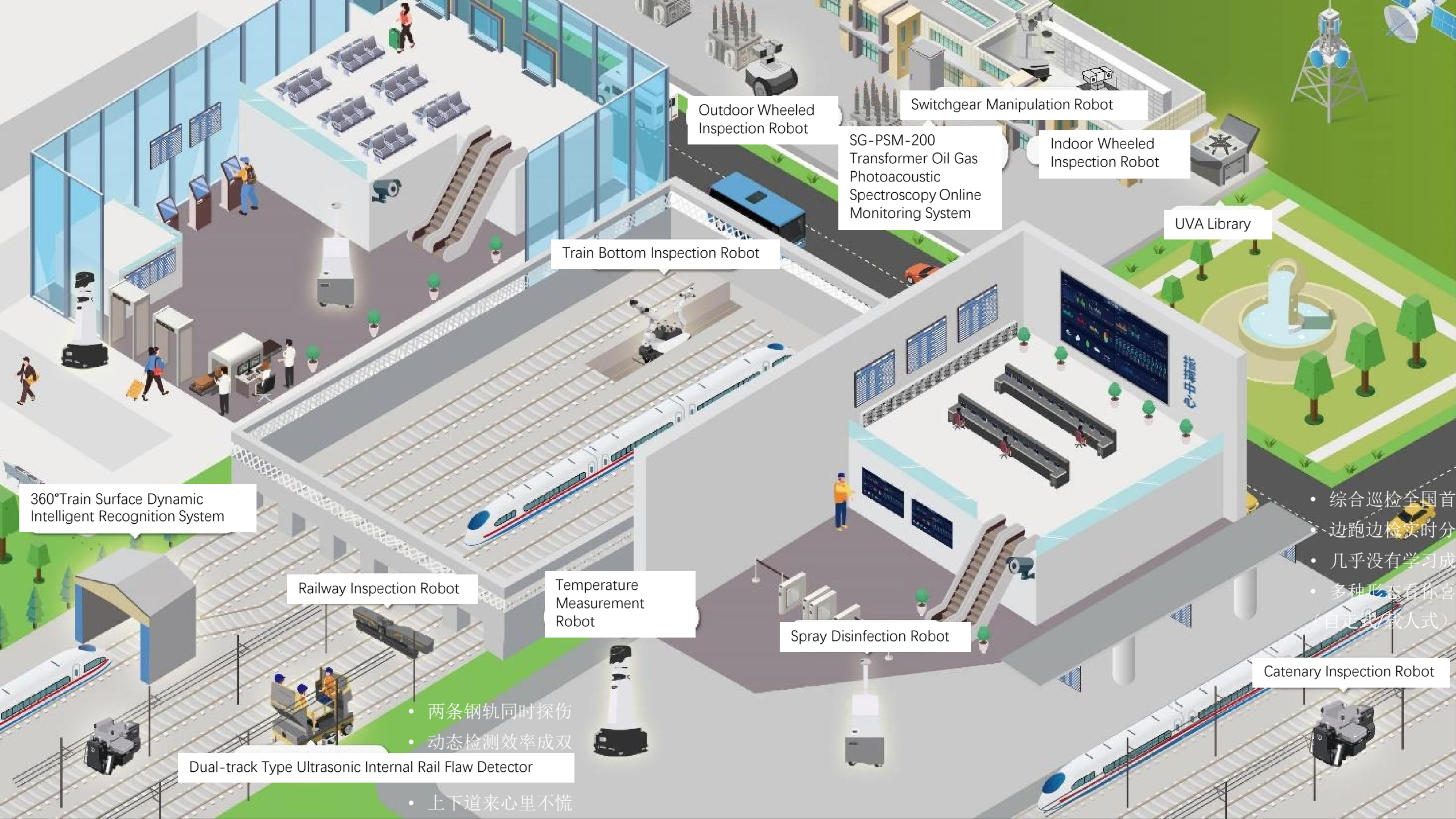
轨道交通



02

Solutions for Railway





Outdoor Wheeled Inspection Robot

Switchgear Manipulation Robot

Indoor Wheeled Inspection Robot

SG-PSM-200 Transformer Oil Gas Photoacoustic Spectroscopy Online Monitoring System

UVA Library

Train Bottom Inspection Robot

360° Train Surface Dynamic Intelligent Recognition System

Railway Inspection Robot

Temperature Measurement Robot

Spray Disinfection Robot

Catenary Inspection Robot

Dual-track Type Ultrasonic Internal Rail Flaw Detector







- 两条钢轨同时探伤
- 动态检测效率成双
- 上下道来心里不慌

- 综合巡检全国首
- 边跑边检实时分
- 几乎没有学习成
- 多种形态看你喜
- (自主式/载人式)



Railway Inspection Robot RIIS1005



-  Fastener defect detection
-  Rail surface damage detection
-  Clearance intrusion detection
-  Rail Profile/Wear Detection
-  Track geometry parameter detection
-  Track bed foreign body detection



Application Scenarios



Urban Rail
Railway



Hangzhou-Haining Intercity Railway



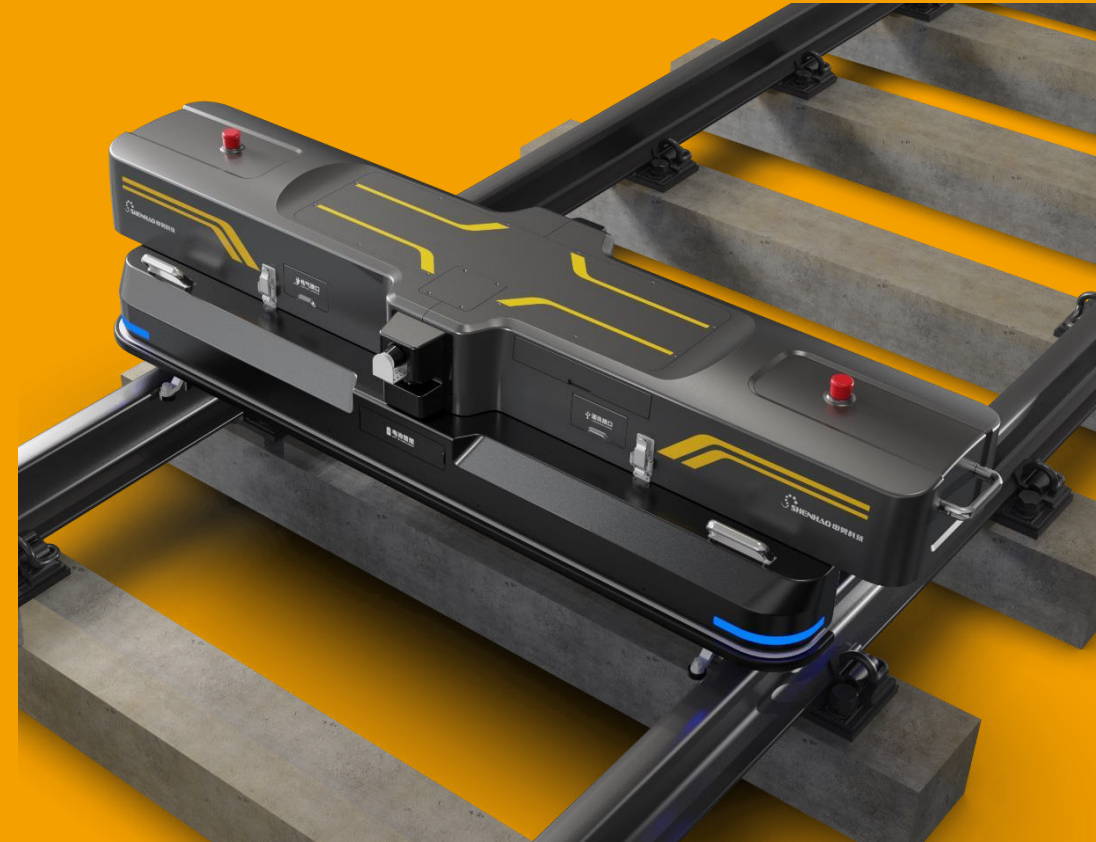
Guangzhou Metro



Hangzhou MTR

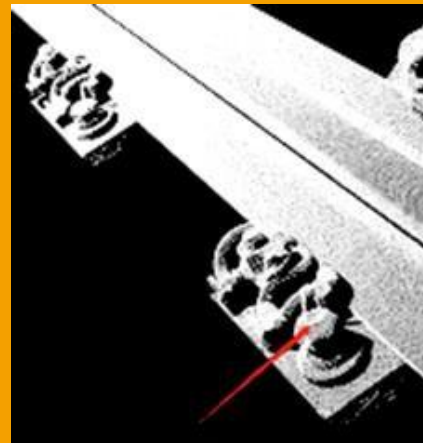
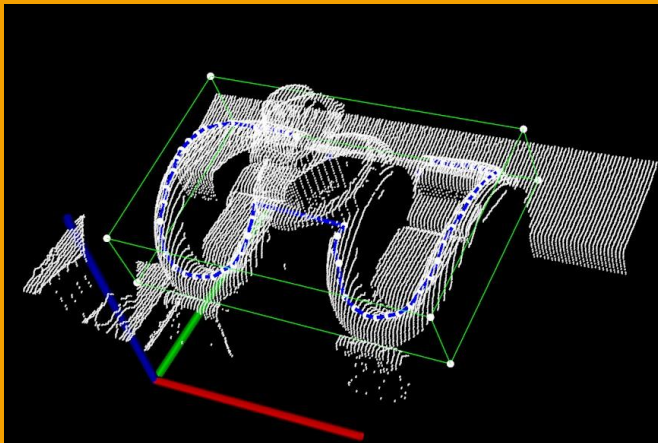
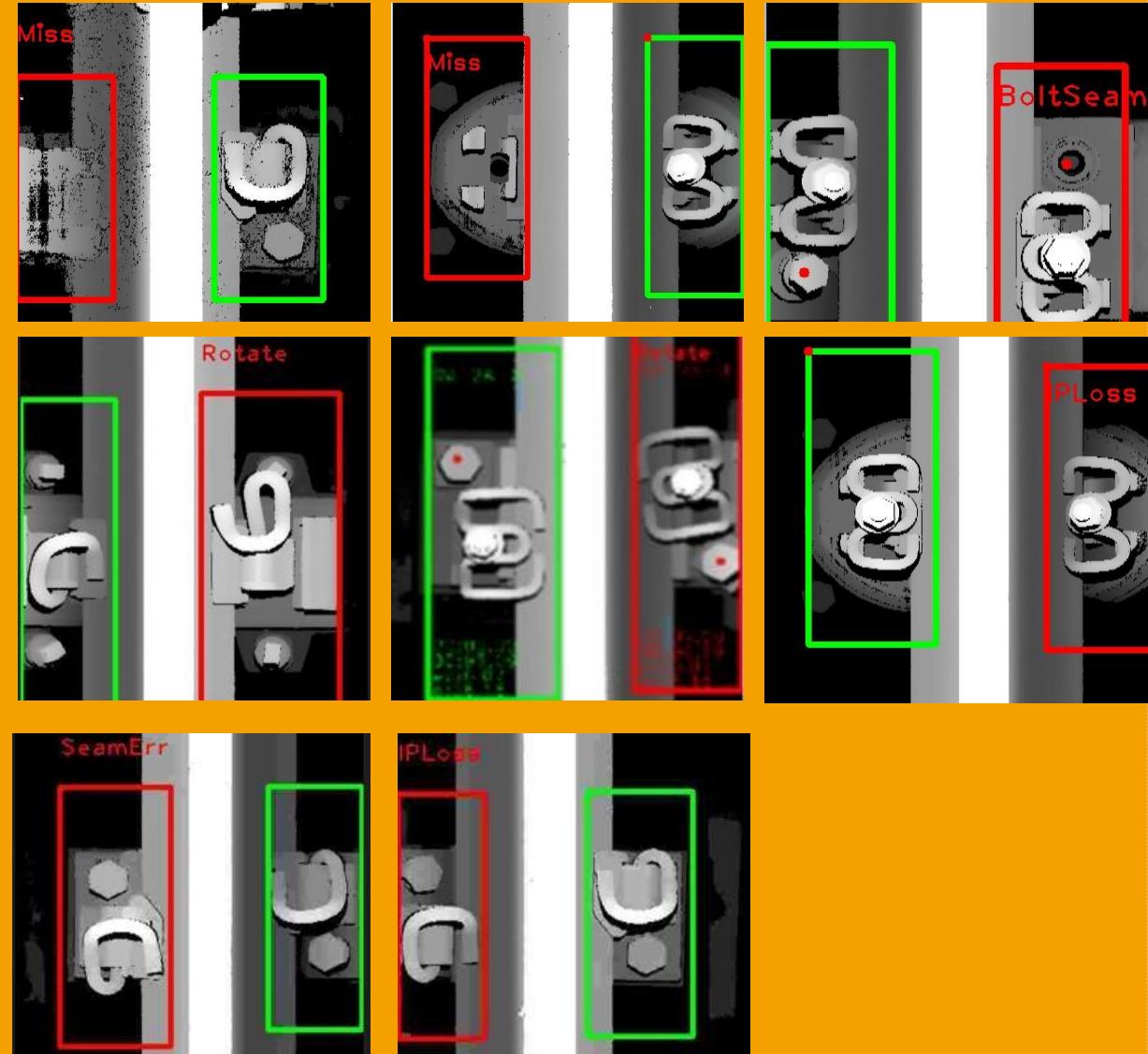
Technical Parameter

No.	Item	Description
1	Size	Length/Width/Height (mm) 2100*695*550
2	Weight	Overall body weight does not exceed 118kg, modular design, and a single module does not exceed 55kg
3	Rated inspection speed	Maximum inspection speed is 5km/h
4	Emergency braking distance	Under 5km/h speed, < 1.4m (obstacle avoidance, emergency stop, edge touch)
5	Drive mode	Motor driven
6	Climbing angle	Strongest climbing ability is not less than 40%
7	Positioning accuracy	Repeat positioning error ≤5%
8	Control method	Remote control inspection
9	Battery capacity	Robot battery power supply: 50AH Battery life: more than 4 hours Charging speed: less than 4 hours Power consumption of the whole machine is less than 500W
10	Charging Method	Manual Charging
11	Protection Level	IP55
12	Operating Temperature	-20°C~45°C
13	Security	Laser obstacle avoidance, collision emergency stop, emergency stop button
14	Communication Method	WiFi



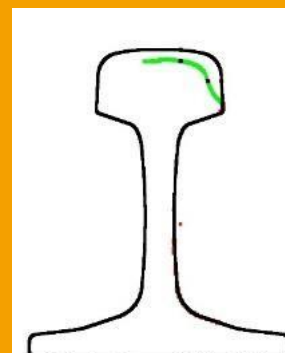
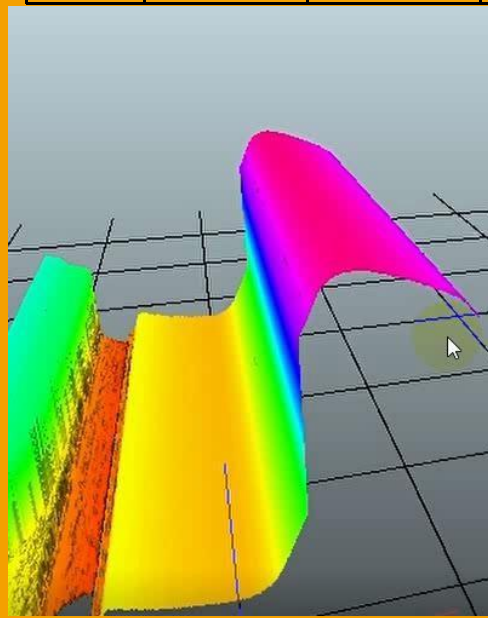
Detection Function - Fastener Defect Detection

Defect Parts	Defect Type	Equipment Category	Category	Priority	Defect Type
Fastener	Component defect	Line equipment	Fastener	High	Elastic-rod Break
		Line equipment	Fastener	High	Missing elastic-rod
		Line equipment	Fastener	High	Broken T-bolt
		Line equipment	Fastener	High	Missing T-bolts
		Line equipment	Fastener	High	Broken anchor bolt
		Line equipment	Fastener	High	Missing anchor bolts
		Line equipment	Fastener	High	Loose anchor bolts
		Line equipment	Fastener	High	Missing track block
		Line equipment	Fastener	High	Loose T-bolts
		Line equipment	Fastener	High	Elastic-rod off-seam value
		Line equipment	Fastener	Medium	Fastener quantity statistics
		Line equipment	Fastener	Medium	Missing spring washer
	Non-standard size	Line equipment	Fastener	High	T-bolts not standard
		Line equipment	Fastener	High	Reverse installation of elastic-rod
		Line equipment	Fastener	High	Elastic-rod is skewed

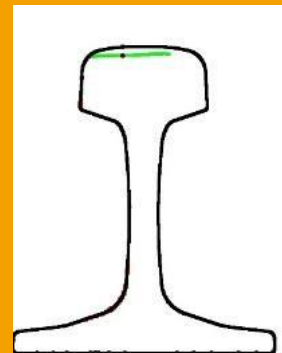


Detection Function - Rail Defect Detection

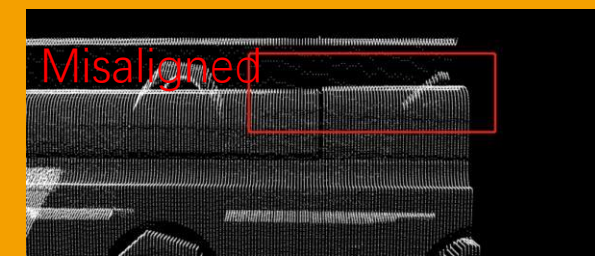
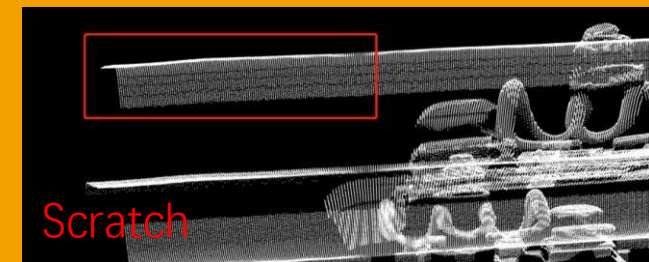
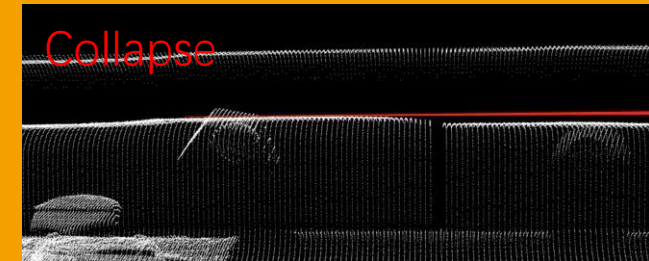
Defect Parts	Defect Type	Equipment Category	Category	Priority	Defect Type	Note
Rail	Rail damage	Line equipment	Rail	High	Abnormal wear (side wear)	±0.5mm
		Line equipment	Rail	High	Abnormal wear (vertical wear)	±0.5mm
		Line equipment	Rail	High	Abnormal wear (total wear)	±0.5mm
		Line equipment	Rail	High	Rail head fat edge	
		Line equipment	Rail	High	Top scratch	
		Line equipment	Rail	High	Drop blocks	
		Line equipment	Rail	High	Seam joints misaligned	
		Line equipment	Rail	Medium	Rail collapse	



Vertical wear: 5.5mm
Side wear: 6.3mm

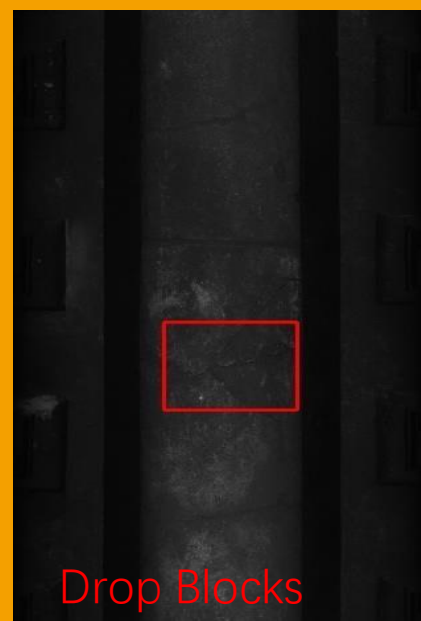
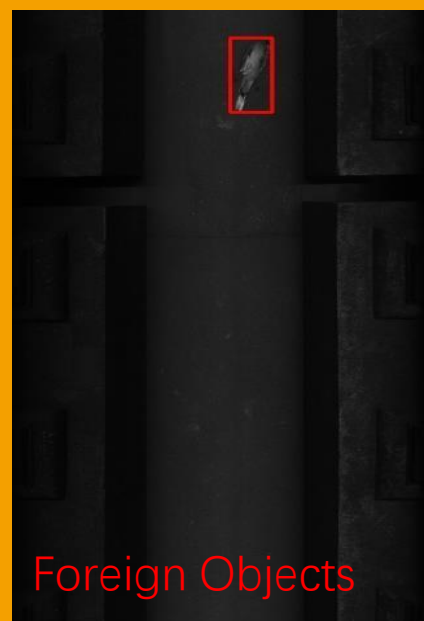


Vertical wear: 2.9mm
Side wear: 0mm



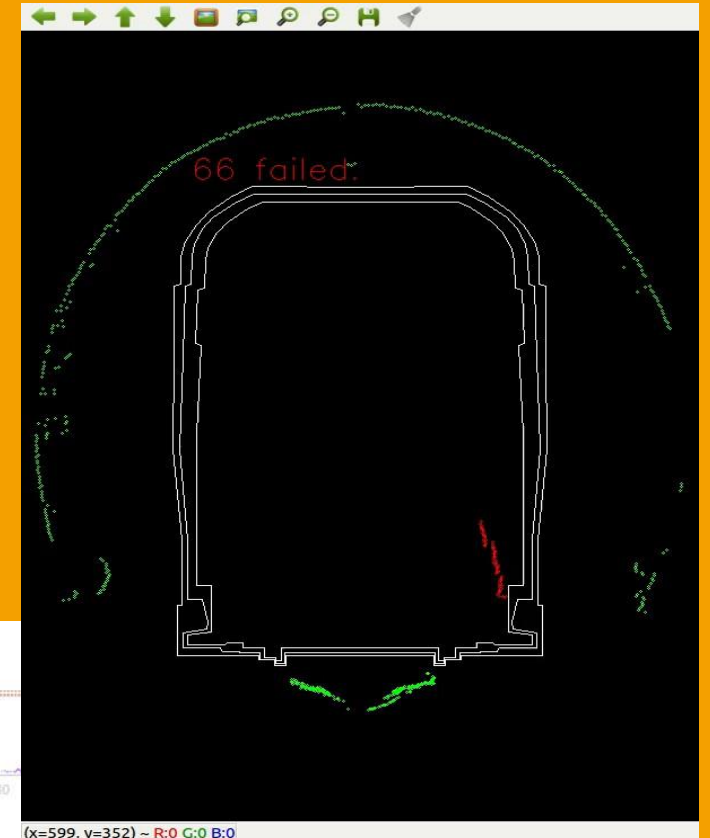
Detection Function - Track Bed / Sleeper Defects

Defect Parts	Defect Type	Equipment Category	Category	Priority	Defect Type	State
Fastener	Component defect	Line equipment	Fastener	High	Elastic-rod break	Completed
Sleeper	Structural defect	Line equipment	Sleeper	High	Muddy whitening	Detection rate verification optimization
		Line equipment	Sleeper	High	Drop blocks	Second stage
		Line equipment	Sleeper	High	Foreign object in the sleeper	Completed
		Line equipment	Sleeper	Medium	Count the number of sleepers	Completed
		Line equipment	Sleeper	Low	Break off	Completed
		Line equipment	Sleeper	Low	longitudinal fissure	Completed
		Line equipment	Sleeper	Low	Transverse crack	Completed
	Structure location is not standard	Line equipment	Sleeper	Medium	Skewed sleeper	Second stage
Track bed	Structural defect	Line equipment	Sleeper	High	Foreign object on track	Completed
		Line equipment	Sleeper	Medium	Crack track bed	Completed
		Line equipment	Sleeper	Medium	Seepage, mud	Second stage



Detection Function

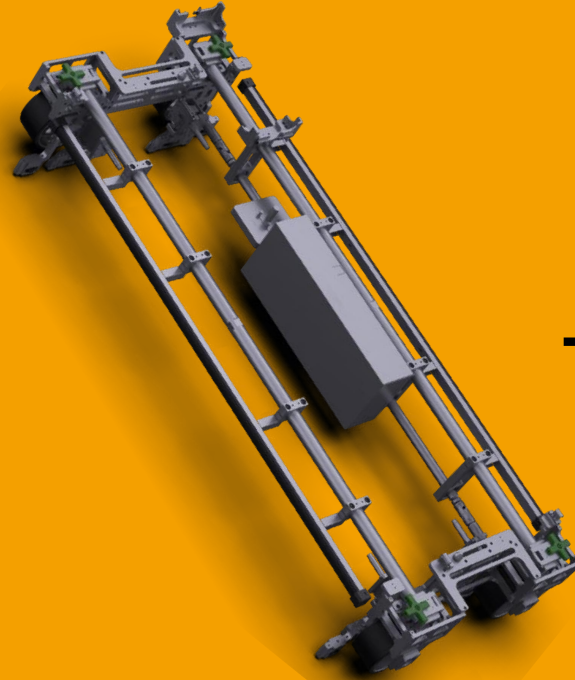
Defect Parts	Defect Type	Equipment Category	Category	Priority	Defect Type	State
Others	Others	Clearance	Train clearance	Medium	Train clearance	
		Clearance	Equipment clearance	Medium	Equipment clearance	
		Rail	Geometry parameter detection	Low	Gauge	±0.5mm
		Rail	Geometry parameter detection	Low	Level	±0.5mm
		Rail	Geometry parameter detection	Low	Triangle Pit	±0.5mm
		Rail	Geometry parameter detection	Low	Gauge change rate	



Robot Weight Reduction and Transfer



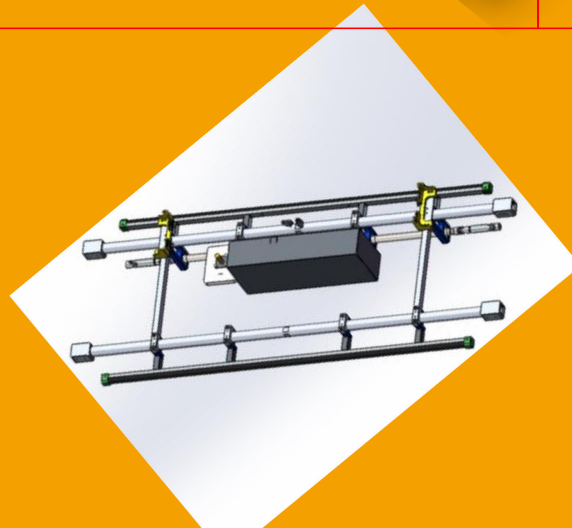
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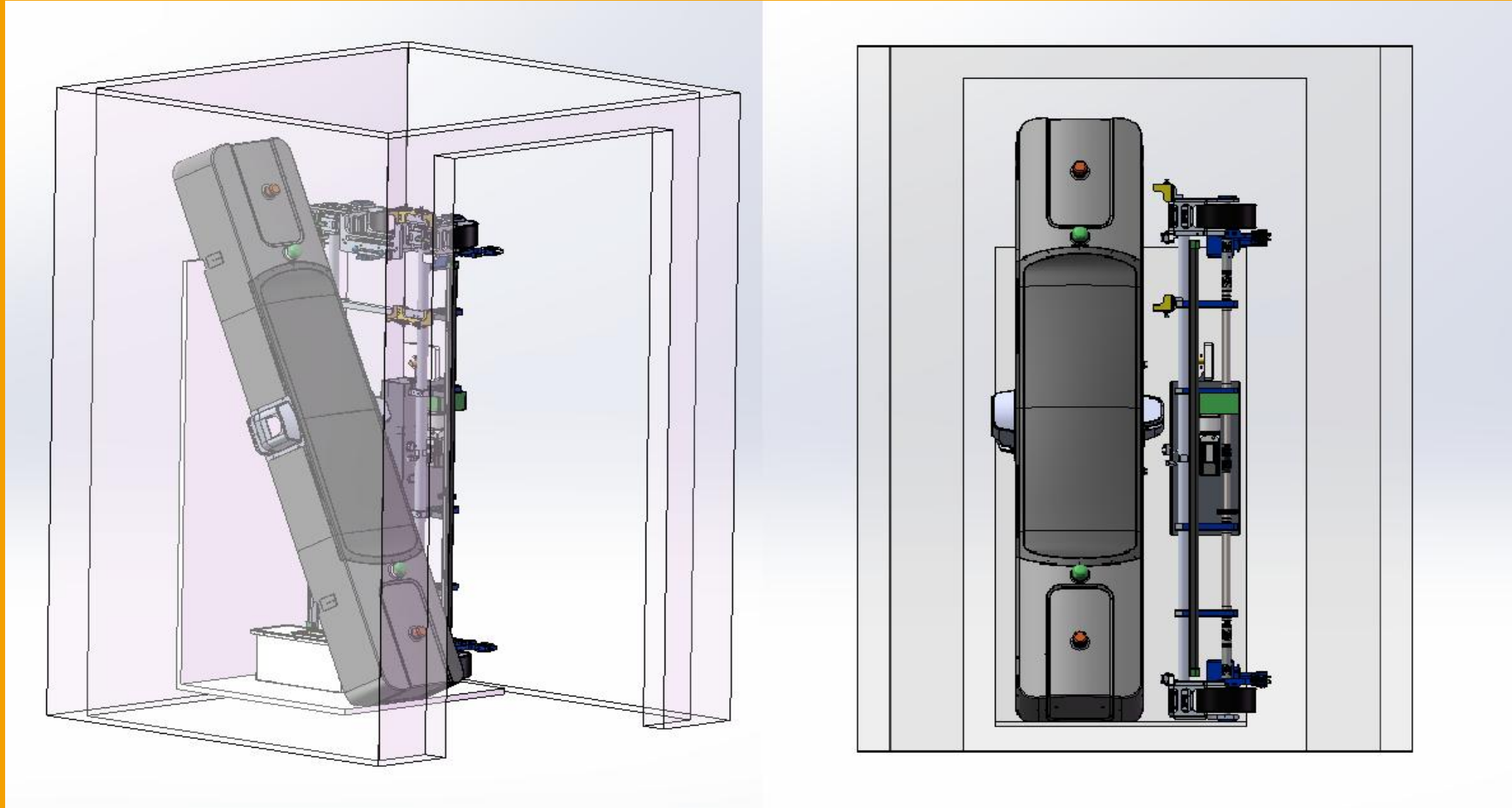
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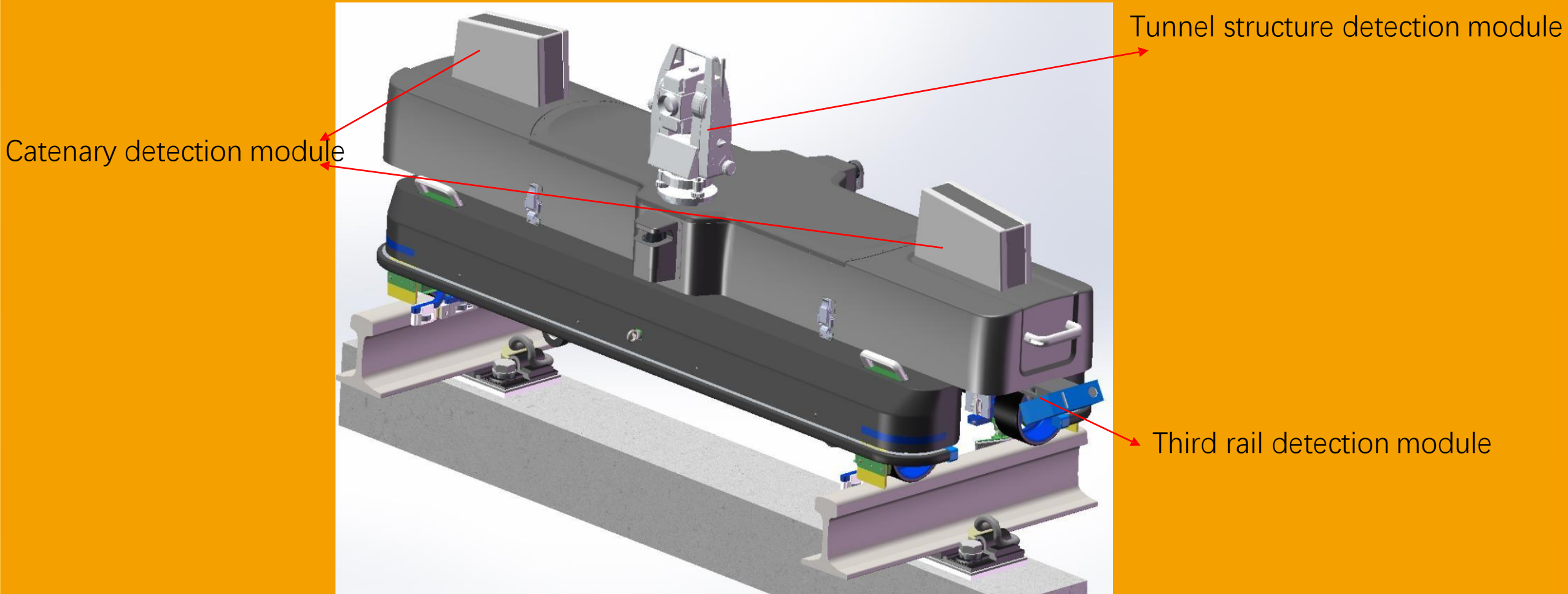
Robot Weight Reduction and Transfer



Railway inspection robot is transferred vertically by cart (the elevator door is 2.1m high and 0.98m wide)

Extensible Module

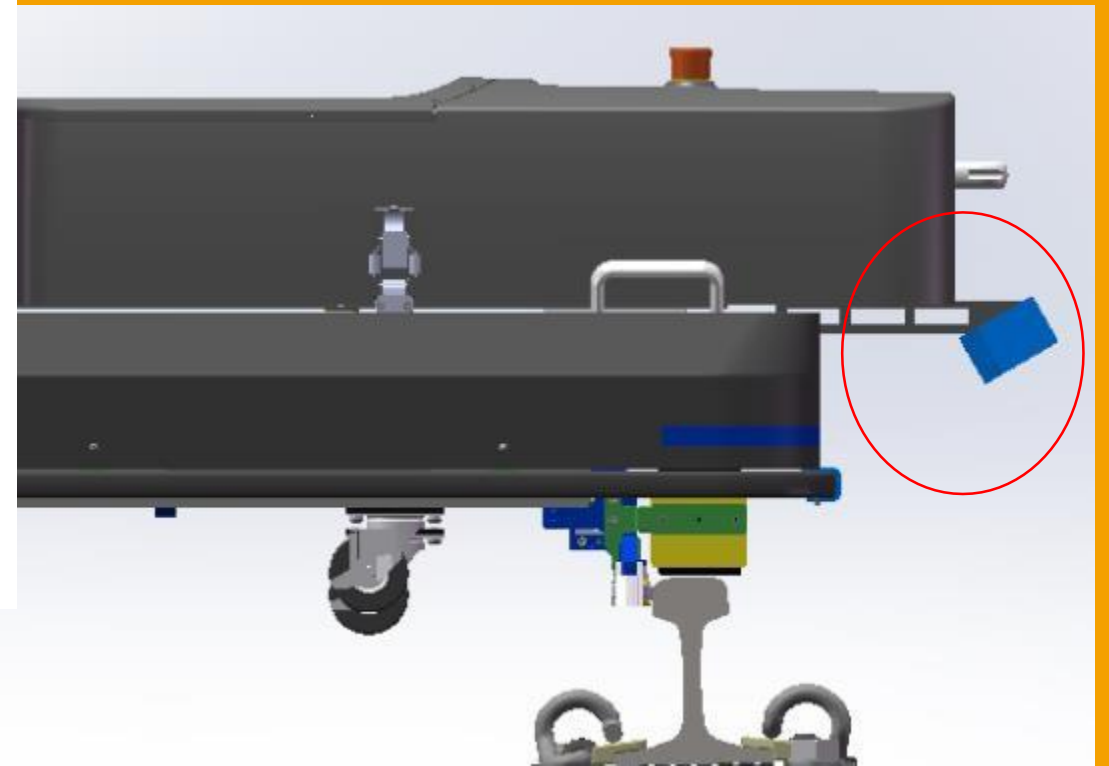
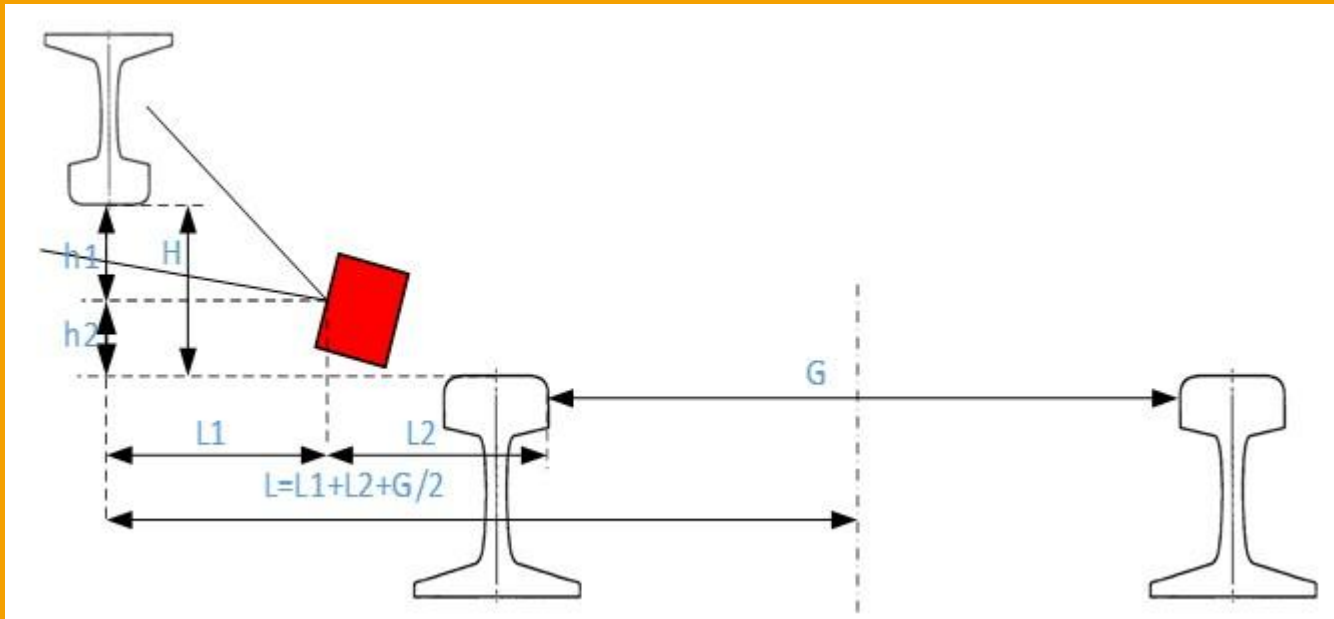
- On the basis of the original detection module, the detection module of catenary, tunnel structure and third rail can be expanded



Extensible Module

✓ Third Rail Inspection

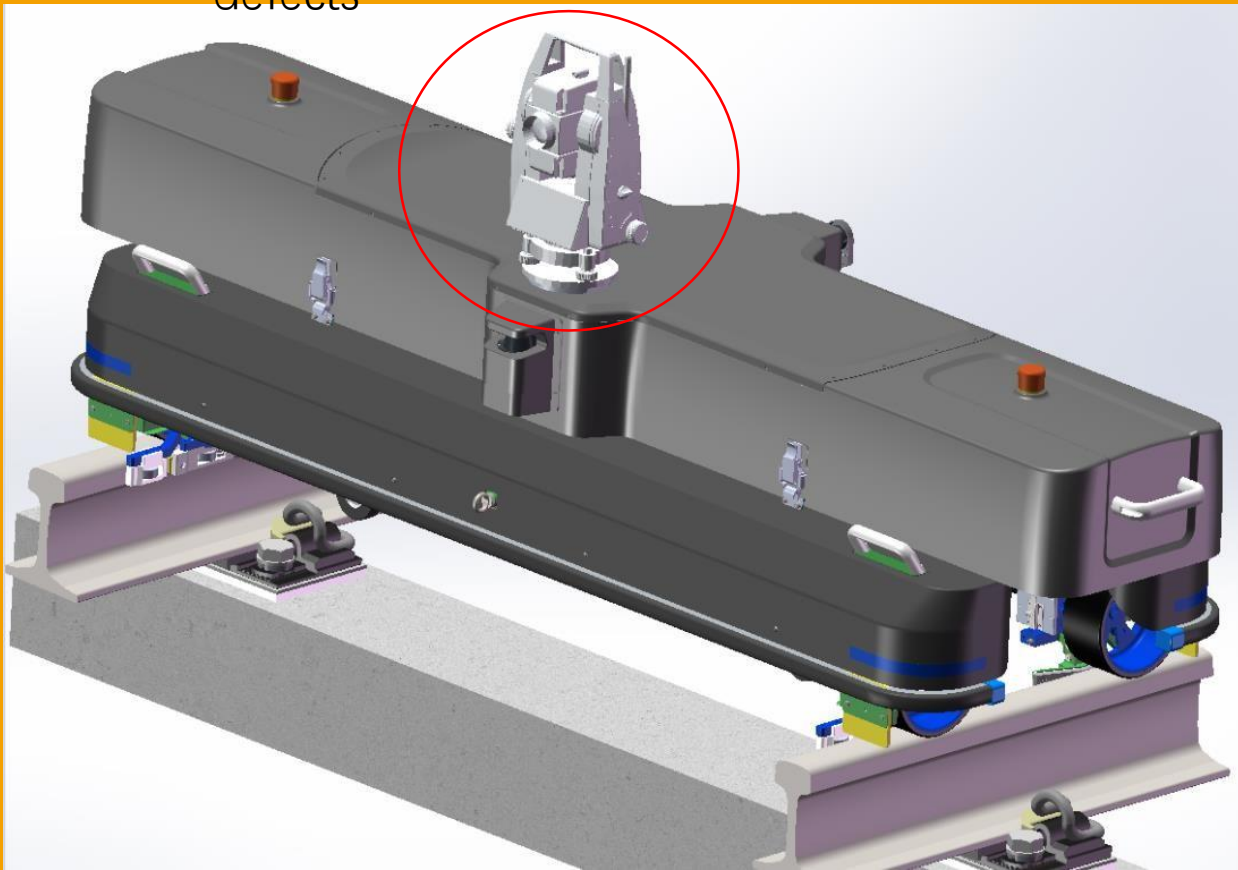
- ① Using the non-contact laser measurement method, the depth map of the third track is clearly and completely captured by the 3D camera, and the third track is detected by the 2D image processing algorithm and the 3D point cloud processing algorithm;
- ② Able to support the detection of third rail pull-out value, lead-up value, rail surface angle and wear



Extensible Module

✓ Tunnel Structure Detection

- ① The non-contact 3D structured light measurement integrated imaging component is used to detect the boundary of the tunnel structure, and high-precision 3D point cloud data can be collected at high speed;
- ② Able to support tunnel boundary detection, including tunnel cracks, dropped blocks and other defects



Extensible Module

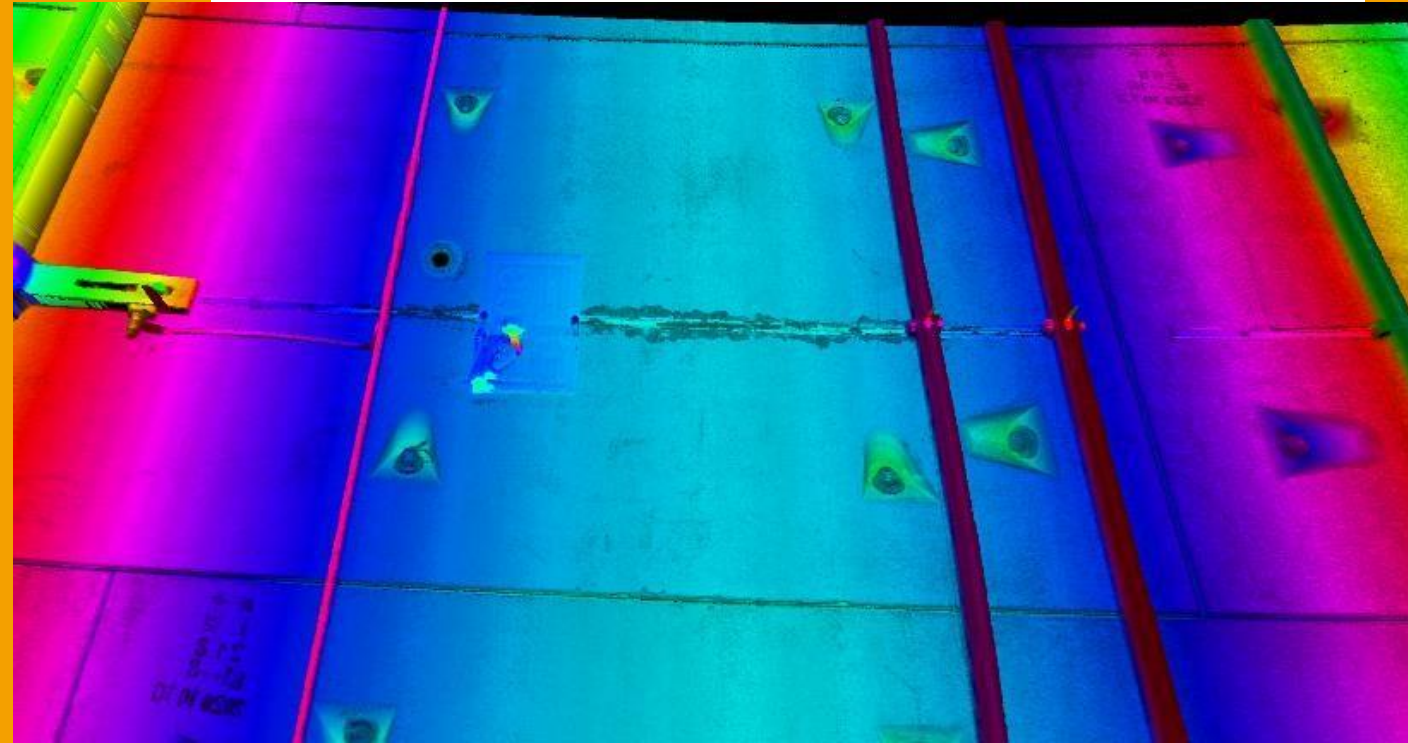
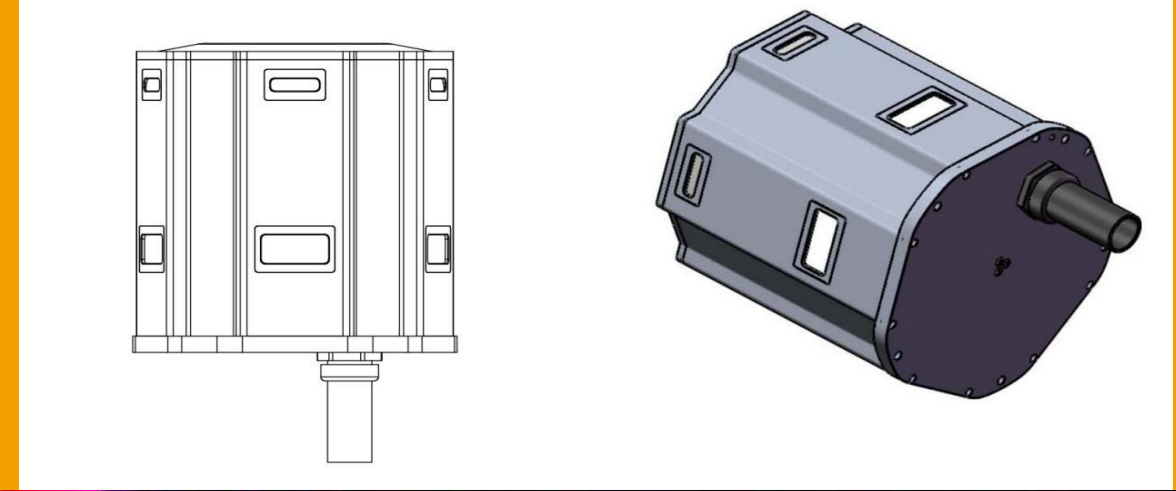
✓ Catenary Defect Detection

- ① The design scheme of high-speed camera and line laser light source is adopted, and the sampling interval is 1.5mm;
- ② Support non-contact, continuous dynamic detection of catenary geometry parameters, wear and pillar side clearance



On-vehicle Tunnel Detection Module

- ① Installed on construction vehicles or electric buses
- ② Real-time detection of tunnel apparent defects



Professional inspection solution

Professional intelligent inspection solutions from power supply, public works, vehicles, station services, etc.

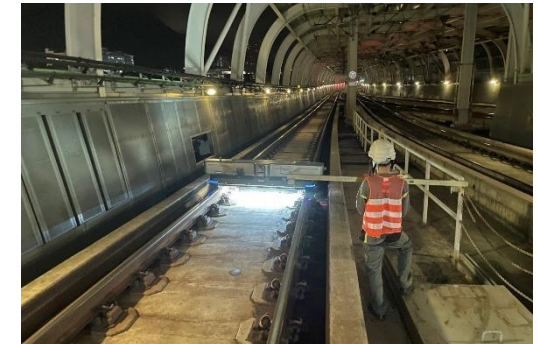


Pilot tests in many cities across the country, such as Hangzhou, Shanghai, Guangzhou, Tianjin, Hong Kong, Chengdu, Inner Mongolia and other cities

Successful projects



Hangzhou-Haining Intercity Railway



MTR Corporation



Tianjin Metro



Hohhot Wuhai Works Section

03

Economic Benefits



Economic Benefits Railway and Train bottom inspection robots



Check 1 train (6 cars)

Train Bottom Inspection Robot

Robot

1 Set
32min
14000+checking items

- Automatic recording
- Automatic Identification
- Auto-tagging
- Automatically generate ledger
- Autonomous transfer

Traditional

2 staffs
45min
2000+checking items

- Manual record
- Manual review

Overall efficiency ratio

7: 1



Nightly skylight period

Railway Inspection Robot

1 Set
20km
6 checking items

- Automatic recording
- Automatic Identification
- Auto-tagging
- Automatically generate ledger
- flexible transfer

2 staffs
5km
Random checking items

- Manual record
- Subjective

8: 1



Economic Benefits

Rail flaw detector and electric power inspection robots



Nightly skylight period

Rail flaw detector



Single substation

Electric power inspection robots

Robot

1 set
50km

- Automatic running
- Automatic recording
- Auto-tagging
- Automatically generate ledger

Traditional

2 staffs
1~5km
Manual push

- Personnel with certificates
- Manual record
- Manual calibration
- Manual review

Overall efficiency ratio

10: 1

1 set
On duty throughout the year
7*24

- Automatic recording
- Automatic Identification
- Auto-tagging
- Automatically generate ledger
- Flexible transfer

4 staffs
On duty throughout the year
Shift inspection

- Low frequency inspection
- Manual record
- Manual report
- Manual recheck

4: 1

04

Development Prospects





Sky



Oil and gas,
coal



Electric power



Rail



Ocean

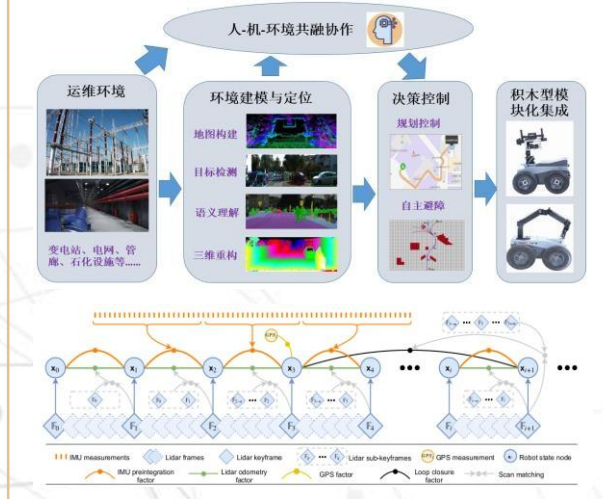


Tunnel



Intelligent robot technology

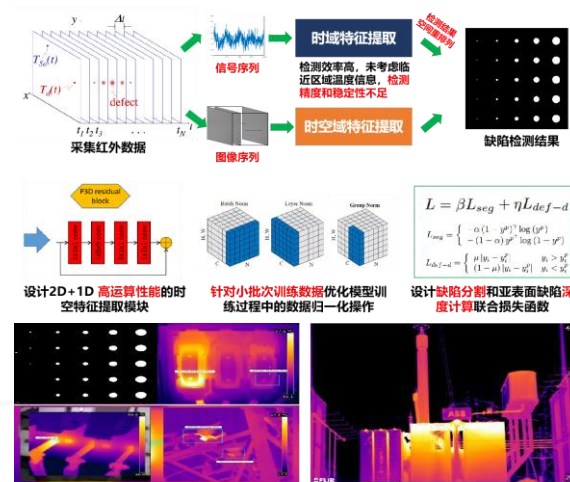
- Autonomous modeling and navigation positioning of robot operation and maintenance environment
- Decision control and obstacle avoidance in complex environment
- Building block modular robot integration
- Robot global perception and nature



Lay the technical foundation of the carrier platform and execution device for the intelligent operation and maintenance of robots

Autonomous monitoring and evaluation technology

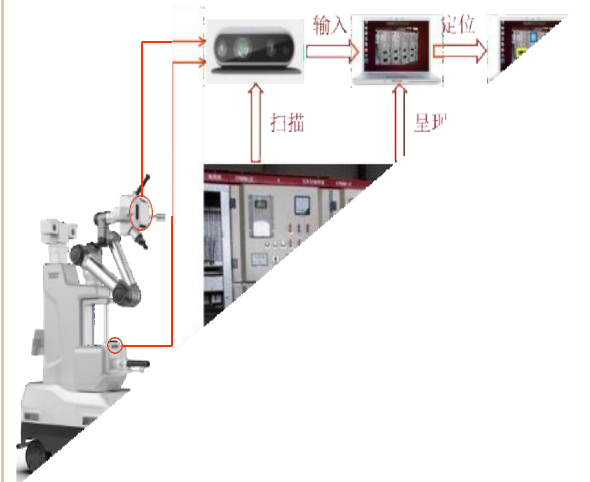
- High-performance dynamic acquisition and analysis of multimodal operation and maintenance data
- Robust health condition monitoring and service performance evaluation with incompleteness constraints of measured data



Lay the technical foundation for autonomous inspection of operation and maintenance robots

Human-machine collaboration work technology

- On-site control and human-machine integration collaborative operation and maintenance operation implementation
- Flexible and dexterous work equipment and multi-modal flexible sensing
- Remote evaluation of operation implementation effect



Lay a technical foundation for the operation and maintenance of human-machine integration

Solve the core pain points of customers, escort the safety of customers, reduce costs and increase efficiency

Safe operation

- The traditional electric power, rail transit, and petrochemical industries are highly dangerous and labor-intensive. Accidents occur from time to time. Safe operation has become a rigid demand for the industry.
- Shenhao's products realize full coverage monitoring of equipment status in various scenarios, and timely discover hidden dangers and failure symptoms of running equipment

Reduce cost

- Rising labor costs
- Automatic inspection improves inspection frequency, keeps device health, and reduces manual inspection costs

Promote efficiency

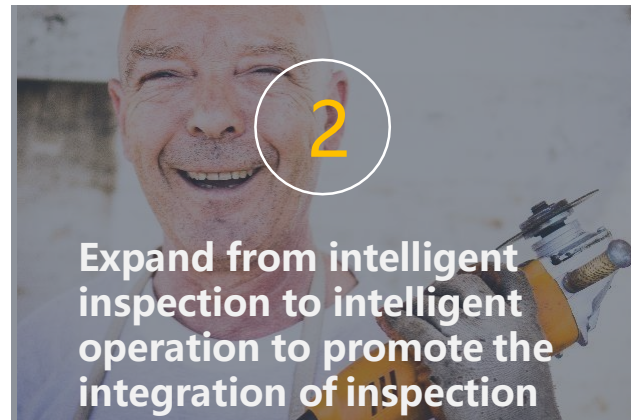
- Electric power, rail transit, petrochemical and other industries have operational "skylights" that require high efficiency
- Comprehensive detection technology, intelligent analysis and identification technology, timely analysis and alarm when defects are found, to achieve the goal of maximizing the efficiency of a single inspection within a limited time, and improve the inspection efficiency

Solve manpower shortage

- The population is aging and the labor force is in short supply. The electric power, rail transit and other industries have high workload and long training cycles. The industry is facing a labor shortage and a shortage of employees.

Future Plan

Continue to optimize product structure, improve product function and intelligence level, and take market demand as the guide to continuously promote the adaptability of products in rail transit, petrochemical and other industries, promote the healthy development of main business, and achieve "sea, land, air, "Tunnel" three-dimensional, all-round strategic layout





Thank you!

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