



光伏电站智能运维解决方案

Intelligent Maintenance and Operation Solutions for Photovoltaic Power Stations

基于“机器人+AI”的光伏运维解决方案

Based on "Robotics + AI"

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汇博机器人公众号



汇博机器人视频号

HUIBO ROBOTICS

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关于我们

ABOUT US

► 公司介绍

广东汇博机器人技术有限公司是汇博机器人集团工业板块全资子公司，是中国若干细分行业领先的智能制造技术和装备供应商。建有国家级博士后科研工作站，在全国设有一个研究院、两个制造基地、多家子公司及服务中心，形成了覆盖全国的营销、技术与服务网络。

公司专注于智能制造领域，以技术创新为引领，以场景应用为驱动，为客户量身打造智能仓储物流、智能产线、光伏电站智能运维、火车车厢余料清扫、数字孪生等整体解决方案，提供方案规划、系统集成、装备研发生产、软件开发、电气控制、安装调试、培训及售后的一站式全流程服务，赋能机械制造、仓储物流、半导体、新能源、通信光缆等行业的数字化转型与智能化升级。

► COMPANY PROFILE

Guangdong Huibo Robotics Technology Co., Ltd., a wholly-owned subsidiary of Huibo Robotics Group, is a leading supplier of intelligent manufacturing technology and equipment in China. With a national-level postdoctoral research station and a comprehensive network of research, manufacturing, and service centers, the company specializes in providing customized solutions for intelligent warehousing, photovoltaics, robotics, train residential cleaning, and digital twins. Its one-stop service covers planning, integration, R&D of equipment, software development, electrical control, installation, training, and after-sales support, empowering industries' digital transformation and intelligent upgrading.



· 光伏智能清洁机器人张北生产基地

► 生产基地

汇博机器人集团光伏智能清洁机器人张北生产基地位于张家口市张北县电子信息科创园，总面积7000平方米，主要从事新能源领域智能化高端机器人装备的研发、生产、销售，是中国北方唯一一个光伏清洁机器人规模化生产的智能制造工厂，自动化程度处于国内领先地位，可年生产光伏清洁机器人3万台套，预计可实现年产值8—12亿元。

► PRODUCTION BASE

The Zhangbei Production Base for Photovoltaic Robots of Huibo Robotics, situated in the Zhangbei Electronic Information Science and Innovation Park in Zhangjiakou, Hebei province, spans a total area of 7,000 square meters. Its primary focus is on the research, production, and sales of intelligent high-end robotic equipment in the field of new energy. As the sole large-scale manufacturing factory for photovoltaic cleaning robots in Northern China, it leads the country in automation, with the capacity to produce 30,000 sets of photovoltaic cleaning robots per year. This is expected to generate an annual output value ranging from 800 million to 1.2 billion yuan.

主营业务
MAIN BUSINESS

智能工厂解决方案

Smart Factory Solutions

光伏电站智能运维解决方案

Intelligent Maintenance and Operation
Solutions for Photovoltaic Power Stations

火车车厢余料清扫解决方案

Residual Material Cleaning Solutions for
Train Carriages

公司共荣获 106 项企业荣誉资质

The company has received a total of 106 corporate honors and qualifications

荣获国家级发明专利 43 项

43 national-level invention patents

实用新型专利 193 项

193 utility model patents

荣获 30 余项政府及社会单位荣誉称号

over 30 government and social organization honor titles

荣誉资质

HONORARY QUALIFICATION

国家级高新技术企业

国家专精特新“小巨人”企业

国家创新人才推进计划“先进机器人技术”重点领域创新团队(全国唯一)

National High-Tech Enterprise

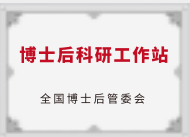
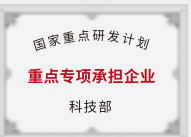
National Specialized and Innovative "Little Giant" Enterprise Honor

National Innovation Talent Promotion Plan's "Advanced Robotics Technology"
Key Area Innovation Team (The only one nationwide)

连续入围工信部

“中国机器人 TOP10”标杆企业

Consistently listed among the
Ministry of Industry and Informa-
tion Technology's "China's Top
10 Robotics" benchmark enter-
prises



发展历史
DEVELOPMENT HISTORY

启程初创

2001 - 2008

STARTUP

2001

汇博前身哈尔滨工业大学博实精密测控有限责任公司成立，致力于运动控制、精密定位和精密测量领域产品的开发

2009 - 2010

ESTABLISHMENT OF HUIBO

2009

汇博成立
初创团队南迁苏州
苏州博实机器人技术有限公司在苏州成立
重点布局高等院校教学仪器集成开发

2010

荣获“江苏省创新团队”称号

2011 - 2014

ADVANCING INTO INDUSTRY

2011

重点布局工业制造领域，深耕陶瓷卫浴等细分领域智能制造升级

2013

广东汇博机器人技术有限公司在佛山正式成立

2014

荣获“国家重点领域创新团队”称号

2015 - 2017

INITIAL INTEGRATION OF INDUSTRY AND EDUCATION
EXPANDING INTO THE INTERNATIONAL INDUSTRIAL LANDSCAPE

2015

初步产教融合
布局国际工业版图
正式更名为“汇博机器人”
开始承办国家职业教育技能大赛

2016

被工信部授予“中国机器人综合实力 TOP10”
“江苏省研究生工作站”
获评“中国专利优秀奖”
获评“智能制造综合标准化与新模式应用示范项目”

Huibo Robotics, formerly known as Harbin Institute of Technology Bo Shi Precision Measurement and Control Co., Ltd., is dedicated to the development of products in the fields of motion control, precision positioning, and precision measurement.

The startup team relocated to Suzhou and established Suzhou Bo Shi Robot Technology Co., Ltd., with a primary focus on the integration and development of teaching instruments for higher education institutions.

Honored with the title of "Innovation Team of Jiangsu Province."

Focusing on industrial manufacturing, with a special emphasis on the intelligent upgrade of subsectors such as ceramic sanitary ware.

Guangdong Huibo Robot Technology Co., Ltd. is officially established in Foshan.

Holds the title of "National Key Area Innovation Team."

Officially renamed as "Huibo Robotics,"the company started hosting the National Vocational Education Skills Competition.

Honored by the Ministry of Industry and Information Technology with "China Robot Comprehensive Strength TOP 10" and recognized as a "Graduate Workstation of Jiangsu Province."

"China Patent Excellence Award"

"Comprehensive Standardization and New Model Application Demonstration Project for Smart Manufacturing."

Tianjin Innovation Base established, marked an expansion into advanced manufacturing applications such as intelligent service robots.

In the industrial sector, the company expanded its presence to countries including Vietnam, Malaysia, Bangladesh, Indonesia, Thailand, Madagascar, Niger, and the Democratic Republic of the Congo.

DEEP INTEGRATION OF INDUSTRY AND EDUCATION
LAYOUT IN THE FIELD OF INTERNATIONALIZED INDUSTRY-EDUCATION INTEGRATION

Huibo Institute was established

Foshan training base established

Awarded as "the first batch of industry-education integration pilot enterprises in Jiangsu Province", "National High-skilled Talent Training Base", "Jiangsu Province High-skilled Talent Public Training Base", "National Key R&D Plan Undertaker" and "Vocational Education School-Enterprise Cooperation Project Undertaker" "Industry-university cooperation collaborative education project support company"

Awarded as "Guangdong Province Industry-Education Integration Pilot Enterprise" and "'Little Giant' Enterprise"

Awarded as "National Innovation Award" and "Jiangsu Province Science and Technology Progress Award"

Awarded as "China's Top Ten Scientific and Technological Progress in Intelligent Manufacturing" and "National Hidden Champion of Nanhai Manufacturing Industry"

Awarded as "National Postdoctoral Research Workstation"

Awarded as "First Prize of Guangdong Machinery Industry Science and Technology Award"

Taking the lead in establishing the "National Robot and Intelligent Equipment Industry Industry-Education Integration Community"

Taking the lead in establishing the "National 'Robot +' International Industry-Education Integration Community"

Huibo Robot Thailand Institute of Technology "Digital Workshop" intelligent manufacturing training base was launched

2017

天津创新基地成立，向智能服务机器人等先进制造应用领域拓展

2018

工业板块布局越南、马来西亚、孟加拉、印尼、泰国、马达加斯加、尼日尔、刚果（金）等国

2018 - 2023

深度产教融合
布局国际化产教融合领域

2018

汇博学院在苏州工业园区正式成立

2019

佛山培训基地建立
被授予“江苏省首批产教融合试点企业”
“国家高技能人才培训基地”
“江苏省高技能人才公共实训基地”
“国家重点研发计划承担单位”
“职业教育校企合作项目承担单位”
“产学研协同育人项目支持单位”

2020

被授予“广东省产教融合型试点企业”
“专精特新‘小巨人’企业”
获评“全国创新争先奖”“江苏省科技进步奖”

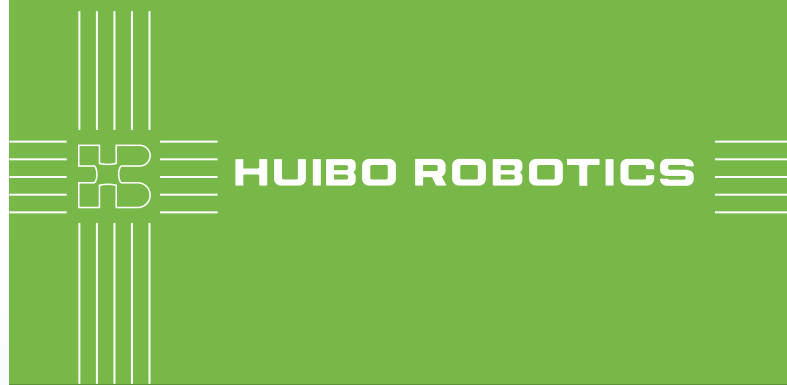
2022

获评“中国智能制造十大科技进展”
“南海制造业全国隐形冠军”

2023

被授予“国家博士后科研工作站”
获评“广东省机械工业科学技术一等奖”
牵头成立“全国机器人与智能装备行业产教融合共同体”
牵头成立“全国‘机器人+’国际化产教融合共同体”
汇博机器人泰国理工大学“数智工坊”智能制造实训基地挂牌启动

让科技学以“智”用



光伏电站智能运维解决方案

Smart Operation and Maintenance Solution for photovoltaic power stations

适用场景 Applicable Scenarios



屋顶分布式电站
Rooftop Distributed Power Station



渔光互补电站
Rooftop Distributed Power Station



山地电站
Rooftop Distributed Power Station



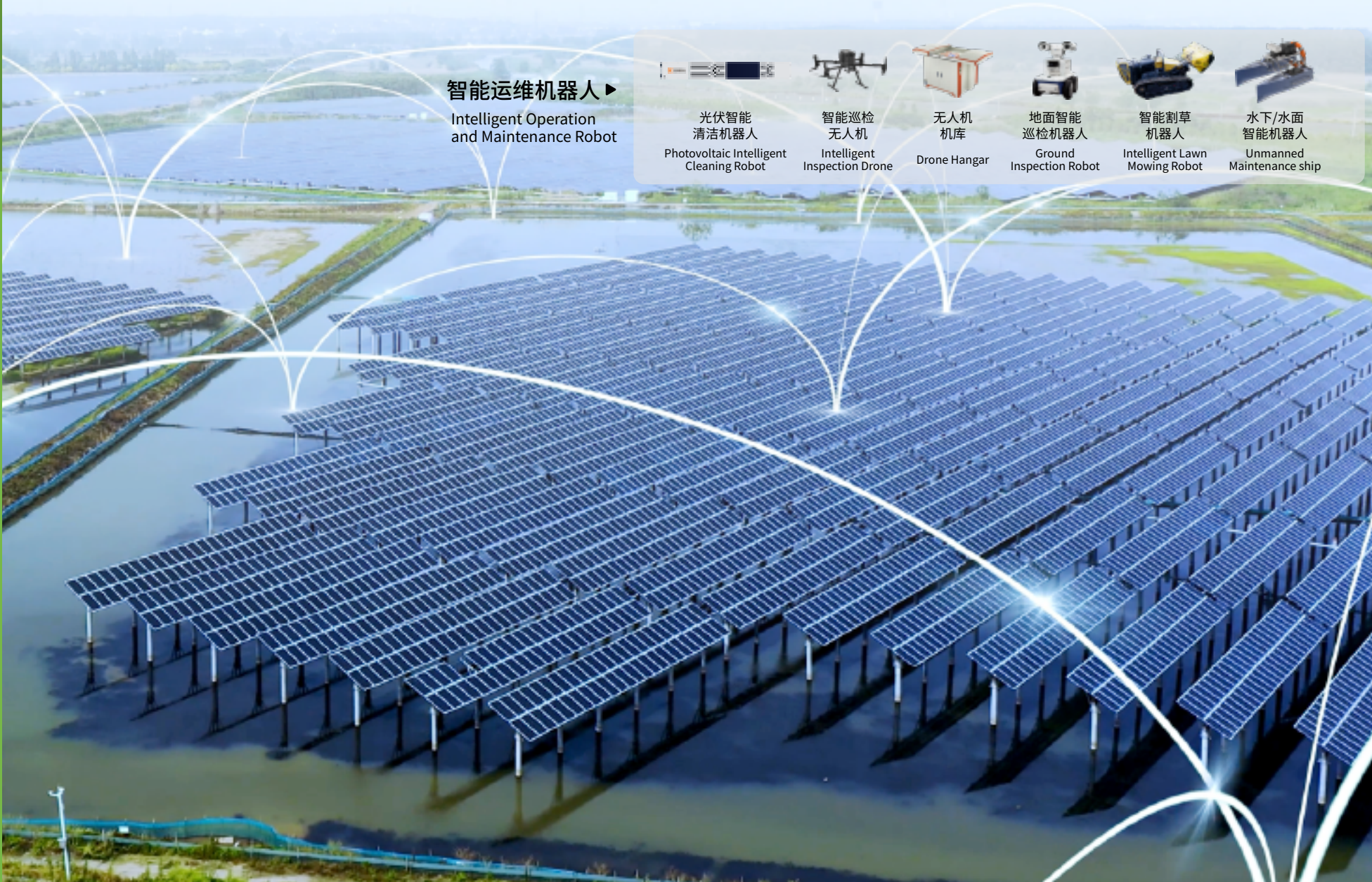
地面电站
Rooftop Distributed Power Station



农光互补电站
Rooftop Distributed Power Station



沙漠电站
Rooftop Distributed Power Station



系统管理平台
System Platform

一体化智能运维管理平台
Smart Integrated Management Platform

电站监测系统
Business Application Service System



智能运维系统
Intelligent Operation and Maintenance System



智能无人机巡检系统
Intelligent Drone Inspection System



智能清洁机器人管理系统
Intelligent Cleaning Robot Management System



智能割草系统
Intelligent Lawn Mowing System



智能安防系统
Intelligent Security System

通信控制通道
Communication Control Channel



采集棒
Stick Logger



采集器
Data Collector



规约转换器
Protocol Converter



通讯管理机
Communication Management Unit



箱变测控装置
Transformer Box Monitoring and Control Unit

智能运维机器人
Intelligent Operation and Maintenance Robot



光伏智能清洁机器人
Photovoltaic Intelligent Cleaning Robot



智能巡检无人机
Intelligent Inspection Drone



无人机机库
Drone Hangar



地面智能巡检机器人
Ground Inspection Robot



智能割草机器人
Intelligent Lawn Mowing Robot



水下/水面智能机器人
Unmanned Maintenance ship

方案介绍

SOLUTION INTRODUCTION

汇博机器人光伏电站智能运维解决方案采用典型的物联网架构，基于模块化多构型机器人本体、自主机器人操作系统、群体智能管控技术，依托“一体化智能运维管理平台、全方位电站监测系统、集群化运维机器人”等产品，覆盖“水-陆-空”多维度不同场景，实现光伏电站数字化、智能化管理及运维。

The Huibo Robotics' Smart Photovoltaic Maintenance Solution adopts a typical Internet of Things architecture, leveraging modular and multi-configuration robotic platforms, autonomous robot operating systems, and swarm intelligence management and control technologies. Relying on products such as the "Integrated Smart Maintenance Management Platform," "Comprehensive Power Station Monitoring System," and "Clustered Maintenance Robots," it covers a multidimensional range of scenarios including water, land, and air, enabling digitalization and intelligent management and maintenance of photovoltaic power stations.

行业现状及痛点 INDUSTRY STATUS AND PAIN POINTS

- **安全隐患大**
巡检、消缺严重依赖人工经验，存在运维死角和安全隐患
 - **智能化水平低**
电站巡检、监控运维信息化、智能化水平低
 - **运维效率低**
巡检运维效率低，导致电站发电收益损失
 - **严重依赖人工**
人工运维劳动强度大，运维成本高
-
- **High Safety Risks**
Inspection and defect elimination rely on manual experience, resulting in operational blind spots and safety hazards.
 - **Low Level of Intelligence**
Low informatization and intelligence in the inspection, monitoring, and maintenance of power stations.
 - **Inefficient Operation and Maintenance**
Low efficiency in inspection and maintenance operations, leading to losses in power generation revenue for the power stations.
 - **Heavy Reliance on Manual Labor**
Manual operation and maintenance involves high labor intensity and results in high maintenance costs.

方案价值
SOLUTION VALUE

提升电站安全性、效益、管理规范性

Build a power station more safe, better benefit, more standardized

保障资产和数据安全 Secure assets and data



增加电站收益 Increasing Power Station Revenue

少人化或无人化的智能运维, 有效缓解人工费逐年增长对电站运营成本的压力

定期规范巡检, 及时消缺故障, 降低设备故障率及安全隐患, 减少发电量损失, 增加电站收益

Intelligent operation and maintenance with fewer or no personnel alleviates the pressure of increasing labor costs on power station operating expenses over time;

Regular and standardized inspection, timely elimination of faults, reduce equipment failure rate and safety risks, reduce power generation loss, increase power station income.

机器人解决运维痛点 Robots Address Operation and Maintenance Challenges

机器人运维有效降低人工作业工伤概率

机器人解决人工无法实现的组件高频清洁, 以及按需割草的运维需求

Reduce the Probability of Work-Related Injuries for Manual Workers;

Address high-frequency cleaning of components and mowing needs on demand that are unachievable through manual labor.

规范管理 Standardized Management

集团/区域中心集中管理, 加强电站运行情况监控和管理的透明性

光伏电站智能采集, 主动分析, 挖掘数据价值, 提高效率

整合无人机巡检、光伏板清洁、割草等子系统, 提升运营效率, 降低度电成本

Centralized management by the group/regional center to enhance transparency in monitoring and managing power station operations;

Intelligent collection, proactive analysis, and data mining for photovoltaic power stations to improve efficiency;

Integration of subsystems such as drone inspections, photovoltaic panel cleaning, and grass cutting to enhance operational efficiency and reduce the cost per unit of electricity.

优化业务转型

Optimizing Business Transformation

传统运维模式
Traditional Operation and Maintenance Model

初步实现电站数据采集, 无人化比例低
未打通系统间的数据链, 各系统相互孤立
智能化诊断和运维功能差, 无法实现预测性运维

Preliminary achievement of data collection in power stations with a low proportion of unmanned operations;

Lack of connection between systems, resulting in isolated systems;

Poor intelligent diagnosis and maintenance capabilities, unable to achieve predictive maintenance.

智能化运维
Intelligent Operation and Maintenance

全面智能设备数据采集, 形成数字底座, 无人化比例高
广泛应用AI+大数据技术, 实现智能监测、智能预测等各类智能化应用
3D数据展示、专题分析功能

Fully intelligent equipment data collection to form a digital foundation with a high proportion of unmanned operations;

Use of AI + big data technology to achieve various intelligent applications such as intelligent monitoring and intelligent prediction;

3D data visualization and thematic analysis capabilities.

机器人集群运维
Robotic Fleet Operation and Maintenance

设备全面感知多维信息要素, 智能机器人技术实现无人化运维
基于“数据驱动+模型驱动”的混合建模技术和仿真技术
无人机、清洁、割草、巡检等机器人实现集群运维作业

Comprehensive perception of multi-dimensional information elements for equipment, utilizing intelligent robotic technology to achieve unmanned operation and maintenance;

Hybrid modeling and simulation technology based on "data-driven + model-driven" approach;

Realization of clustered operational and maintenance tasks through a fleet of robots including drones, cleaning robots, lawnmowing robots, inspection robots, and more.

专利认证
CERTIFICATIONS&PATENT

CE认证
CE Certification

TUV光伏组件清洗智能机器人测试报告
TUV Test Report of Intelligent Photovoltaic Module Cleaning Robot

开普检验报告
Kaipu Inspection Report

汇博光伏清洗机器人控制系统软著证书
Software Copyright Certificate for Huibo Photovoltaic Cleaning Robot Control System



服务保障

Customer-service

我们深度了解客户的需求, 竭力为客户提供全面且完善的售前、售中、售后服务
In-depth understanding of customer needs, and strive to provide customers with comprehensive and perfect pre-sale, sale and after-sales service.

项目咨询
Project consultation

巡检及升级
Patrol inspection and upgrodng

云平台服务
Cloud platform services

安装调试
Installation and commissioning

技术支持
Technicol support

系统在线检测
System online detection

维护保养
Maintenance

培训辅导
Training and guidance

电站体验
Power stotionexperience

智能服务
Intelligent service

一体化智能运维管理平台集成智能运维系统、智能无人机巡检系统、智能清洁机器人管理系统、智能割草系统、智能安防系统,可对光伏电站日常运营、巡检、面板清洁、场站割草及安防进行全面智能化管理,能提升效率、保障安全并降低成本。



HUIBO ROBOTICS

电站监测系统

Power Station Monitoring System

- 智能运维系统
- 智能无人机巡检系统
- 智能清洁机器人管理系统

智能运维系统

智能光伏运维系统涵盖智能数据监测、工单系统、场站巡检、组件清洁、割草作业、场站安防等模块。

通过线上线下协同运作,实现光伏电站运维的全面、高效、智能化管理,保障电站运维安全的同时,有效提升运维效率和质量。



INTELLIGENT OPERATION AND MAINTENANCE SYSTEM

The intelligent operation and maintenance system includes modules such as intelligent data monitoring, work order system, site inspection, module cleaning, grass cutting, site security, and more.

Through online and offline collaborative operations, it achieves comprehensive, efficient, and intelligent management of photovoltaic power station operation and maintenance, ensuring the safety of power station operations while effectively improving the efficiency and quality of maintenance.



功能特点

Functional Characteristics

智能监测

智能监测系统能够实时监测汇流箱、逆变器、箱变、升压站、气象站和电表等关键设备的数据, 为电站提供精准的运行信息。

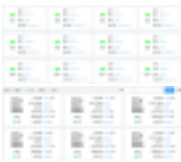
电表监测

精确记录光伏电站的发电量和电能消耗, 实时监测电表数据, 及时发现问题, 优化能源管理, 降低运营成本。



逆变器监测

实时监控逆变器的各项参数, 包括输入输出电压、电流、功率、温度等, 一旦发现异常情况, 系统会立即发出警报, 避免因逆变器故障而导致的发电量损失。



防雷汇流箱监测

实时监测汇流箱的电流、电压、温度等参数, 确保汇流箱的正常运行, 同时对汇流箱的故障进行诊断。



箱式变压器监测

对箱变的运行状态进行全面监测, 包括遥测量和遥信量, 遥测量包括进出的电压电流以及温度, 遥信量包括开关状态、设备告警信号、保护跳闸信号。



气象数据监测

实时采集气象站的数据, 包括光照强度、温度、湿度、风速等, 通过结合气象数据和电站运行数据, 可以更好地了解电站的发电效率, 优化电站的运行策略, 提高发电量。



Intelligent Monitoring

The intelligent monitoring system is capable of real-time monitoring of data from critical equipment such as combiner boxes, inverters, transformer boxes, booster stations, weather stations, and electricity meters, providing accurate operational information for the power station.

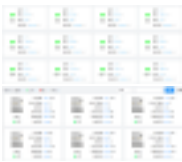
Electricity Meter Monitoring

Accurately record the electricity generation and consumption of photovoltaic power stations, monitor electricity meter data in real-time, promptly identify issues, optimize energy management, and reduce operational costs.



Inverter Monitoring

Real-time monitoring of various parameters of the inverter, including input and output voltage, current, power, temperature, etc. In case of any abnormalities, the system will immediately issue an alert to avoid loss of power generation due to inverter failure.



Combiner Box Monitoring

Real-time monitoring of parameters such as current, voltage, and temperature of the combiner box to ensure its normal operation, as well as diagnosing any faults in the combiner box.



Transformer Box Monitoring

Comprehensive monitoring of the operating status of the transformer box, including telemetry and telecontrol parameters. Telemetry includes incoming and outgoing voltage and current, as well as temperature. Telecontrol includes switch status, equipment alarm signals, and protective trip signals.



Meteorological data monitoring

Real-time collection of data from the weather station, including light intensity, temperature, humidity, and wind speed. By combining meteorological data with power station operational data, it is possible to better understand the power generation efficiency of the power station, optimize operational strategies, and increase electricity production.



智能工单

智能工单系统结合移动端的便捷操作、全面的运维管理、智能的工单分配、实时的进度跟踪、详细的记录报表、无人机巡检及地图导航等功能, 为光伏电站提供高效、智能的运维管理服务, 降低成本、保障安全。

► 高效便捷的移动端应用

随时随地通过手机管理工单, 实时掌握电站运维情况, 快速响应和处理问题。



► 实时进度跟踪

随时了解工单的处理进度, 及时掌握电站运维情况, 确保问题得到及时解决。



► 全面运维管理

实现对光伏电站的全方位监测和管理, 包括设备巡检、故障处理、维护计划等, 确保电站的稳定运行。

► 详细记录和报表

系统自动记录工单的处理过程和结果, 生成详细报表, 提供数据分析和决策支持。

► 智能化工单分配

根据故障类型和优先级, 分配工单给相应的运维人员, 提高工作效率, 减少人工干预。



Intelligent Work Order System

The intelligent work order system integrates convenient mobile operations, comprehensive operation and maintenance management, intelligent work order allocation, real-time progress tracking, detailed report recording, drone inspection, map navigation, and other functions to provide efficient and intelligent operation and maintenance management services for photovoltaic power stations. This system helps to reduce costs and ensure safety.

► Efficient and Convenient Mobile Application

Manage work orders anytime, anywhere through your mobile phone, grasp the operational and maintenance status of the power station in real-time, and respond and address issues quickly.



► Real-time Progress Tracking

Manage work orders anytime, anywhere through your mobile phone, grasp the operational and maintenance status of the power station in real-time, and respond and address issues quickly.

► Comprehensive Operation and Maintenance Management

Achieve comprehensive monitoring and management of photovoltaic power stations, including equipment inspection, fault handling, maintenance plans, and more, to ensure the stable operation of the power station.



► Detailed Records and Reports

The system automatically records the processing procedures and outcomes of work orders, generates detailed reports, and provides data analysis and decision support.



► Intelligent Work Order Allocation

Allocate work orders to corresponding operation and maintenance personnel based on fault types and priority levels, improve work efficiency, and reduce manual intervention.

智能分析

增发电量分析

精确记录光伏电站的发电量和电能消耗,实时监测电表数据,及时发现问题,优化能源管理,降低运营成本。



发电能力分析

系统结合电站理论发电量、实际发电量和上网电量,分析电站能效PR值和等效小时数,辅助分析光伏电站的发电能力。



损耗分析

系统能够智能分析能量转换过程中,光伏组件、汇流箱、逆变器、箱变等设备所产生的能量损耗,提供精准的数据支持,助力优化系统性能,提升发电效率。



故障分析

基于大数据分析光伏系统性能,实现故障检测与定位,提升诊断准确性及效率,便于设备维护及更换,保障系统最佳运行。



组件积尘分析

依托深度学习算法,系统能够快速分析出设备灰尘累积程度,并结合未来天气情况制定清扫计划。

Intelligent Analysis

Increased Electricity Generation Analysis

Accurately record the power generation and energy consumption of photovoltaic power stations, perform real-time electricity meter data monitoring, identify issues promptly, enhance energy management, and reduce operating costs.



Electricity Generation Capacity Analysis

The system combines the theoretical electricity generation, actual electricity generation, and grid-connected electricity of the power station to analyze the energy efficiency PR value and equivalent hours, assisting in the analysis of the electricity generation capacity of the photovoltaic power station.



Loss Analysis

The system is capable of intelligently analyzing the energy losses generated by equipment such as photovoltaic modules, combiner boxes, inverters, and transformer boxes during the energy conversion process. It provides precise data support to assist in optimizing system performance and improving electricity generation efficiency.



Fault Analysis

Based on big data, the system analyzes the performance of the photovoltaic system to achieve fault detection and localization, enhancing diagnostic accuracy and efficiency. This facilitates equipment maintenance and replacement, ensuring optimal system operation.



Component Dust Accumulation Analysis

Utilizing deep learning algorithms, our system efficiently analyzes the degree of dust accumulation on equipment. It further integrates future weather conditions to formulate tailored cleaning plans. The implementation will be phased, starting with simpler tasks and gradually progressing to more complex ones.

智能报表



系统能够针对日总辐射量、日照时长、理论发电量、上网电量、发电收益等数据展开实时剖析，并且会自动生成日报和月报，以辅助电站的运营工作。

智能预警

预警类别

涵盖了各设备在运行进程中可能出现的通信异常、故障告警、数据异常告警以及设备告警等各类告警信息。

智能预警分级

根据告警的性质和紧急程度，将其科学划分为不同等级，极大地提高了工作效率和应对的准确性。

Intelligent Reporting

The system is capable of conducting real-time analysis on data such as daily total radiation, sunshine duration, theoretical power generation, grid-connected power, and power revenue. It automatically generates daily and monthly reports to assist in the operation of power stations.



Intelligent Warning System

The categories of warnings cover various alarm messages such as communication anomalies, fault alarms, data anomaly alarms, and equipment alarms that may arise during the operational process of various devices.

Intelligent warning classification divides these alarms into different levels based on their nature and urgency, greatly improving work efficiency and the accuracy of responses.

智能无人机巡检系统

INTELLIGENT DRONE INSPECTION SYSTEM



智能化的无人机巡检系统,能够自主进行巡检、智能图像处理,自动识别并检测组件表面的灰尘、污垢、裂痕、遮挡以及异常发热等情况。系统会及时报告异常情况的详细信息以及准确位置,为设备运维人员提供运维的依据和导航。

An intelligent drone inspection system is capable of conducting inspections autonomously, performing intelligent image processing, and automatically identifying and detecting dust, dirt, cracks, obstructions, and abnormal heating on the surface of equipment. The system promptly reports detailed information and accurate locations of abnormalities, providing equipment operation and maintenance personnel with the basis and navigation for repairs.

功能特点

Functional Characteristics

三维建模

3D Modeling

运用 3D 建模技术对光伏电站场景进行建模,能够在 3D 模型上直观地展现电站的详实信息

The 3D modeling technology is used to model the photovoltaic power station scene, and the detailed information of the power station can be intuitively displayed on the 3D model.



自动化巡检

Automated Inspection

依据实际的业务需求,拟定与之相对应的巡检任务,无人机将会按照既定的规则来开展自动化巡检

Based on actual business needs, corresponding inspection tasks are developed, and the drone will carry out automated inspections according to established rules.



实时流媒体巡检

Real-time Streaming Inspection

依托流媒体视频技术,能够在平台端实时地观看到无人机巡检过程中的即时画面

Relying on streaming video technology, it is possible to view real-time footage of the drone inspection process on the platform side in real-time.



AI算法

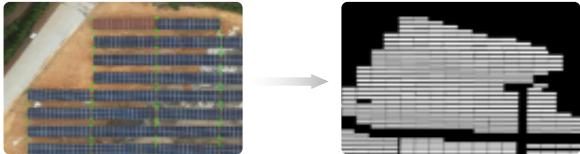
AI Algorithm

结合深度学习算法,能够精准地识别出光伏组串的位置以及与面板相关的异常状况

Combined with deep learning algorithms, it is able to accurately identify the location of photovoltaic strings and anomalies related to panels.

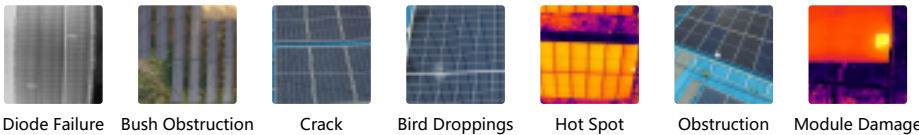
组串识别

String Recognition



异常识别

Anomaly Recognition



自动化报告生成

Automated Report Generation

无人机在完成巡检工作之后,通过先进的 AI 算法来进行全面深入地分析,自动且快速地生成与之相对应的详细巡检报告

After the UAV completes the inspection work, the system carries out comprehensive and in-depth analysis through advanced AI algorithm, and automatically and quickly generates the corresponding detailed inspection report.



智能清洁机器人管理系统
INTELLIGENT CLEANING ROBOT MANAGEMENT SYSTEM

智能清洁机器人管理系统能监控各机器人的电压、温度、功率等参数及运行状态,还可监控其任务与异常报警状态。除此之外,系统还能同时监控多个光伏电站的清扫机器人,用户可通过手机应用程序或云平台实时查看各电站清扫情况,实现高效便捷智能化管理。

The intelligent cleaning robot management system can monitor various parameters and operating statuses of the robots, such as voltage, temperature, power, as well as task progress and abnormal alarm status. Additionally, the system can simultaneously monitor the cleaning robots of multiple photovoltaic power stations. Users can view the cleaning status of each power station in real-time through a mobile application or cloud platform, enabling efficient, convenient, and intelligent management.



功能特点
Functional Characteristics



定时清扫 Scheduled Cleaning

允许用户设定清扫任务的时间表,使清洁机器人能够在最佳时段执行清扫操作,提高清扫效率。
Scheduled Cleaning: Allows users to set a schedule for cleaning tasks, enabling the cleaning robots to perform cleaning operations at the optimal times, thus improving cleaning efficiency.

远程监控与控制 Remote Monitoring and Control

用户可以通过云平台远程监控和控制清洁机器人,包括启动、停止等操作,提高了操作的便利性和灵活性。
Users can remotely monitor and control the cleaning robots through a cloud platform, including starting, stopping, and other operations, which improves operational convenience and flexibility.

多电站管理 Multi-Station Management

支持管理多个光伏电站的清洁机器人,用户可以在同一界面上查看和管理不同电站的清扫情况,简化了管理流程。
Supports the management of cleaning robots across multiple photovoltaic power stations. Users can view and manage the cleaning status of different stations on the same interface, simplifying the management process.

故障记录与诊断 Fault Recording and Diagnosis

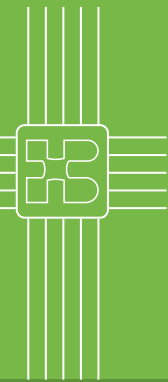
系统能够实时监测清洁机器人的状态和性能,及时发现可能的故障或异常情况,并进行故障记录和诊断。
The system can monitor the status and performance of cleaning robots in real-time, promptly detect possible faults or abnormalities, and perform fault diagnosis and recording.

移动管理 Mobile Management

通过手机应用程序,用户可以随时随地对清洁机器人进行管理和监控,大大提高了管理的高效性和便捷性。
Through a mobile application, users can manage and monitor cleaning robots anytime and anywhere, significantly improving the convenience and flexibility of management.

任务执行记录 Task Execution Records

系统可以记录每次清扫任务的执行情况,包括任务开始时间、任务结束时间、清扫时长等信息,为用户提供清晰的任务执行记录。
The system can record the execution details of each cleaning task, including the start time, end time, cleaning duration, and other relevant information, providing users with clear task execution records.



HUIBO ROBOTICS

智能运维机器人

Intelligent Operation and Maintenance Robot

- 光伏智能清洁机器人
PHOTOVOLTAIC INTELLIGENT CLEANING ROBOT
- 智能巡检无人机
INTELLIGENT INSPECTION DRONE
- 智能割草机器人
INTELLIGENT LAWN MOWING ROBOT
- 地面巡检机器人
GROUND INSPECTION ROBOT
- 水下/水面机器人
UNDERWATER/SURFACE ROBOTS

光伏智能清洁机器人
PHOTOVOLTAIC INTELLIGENT CLEANING ROBOT

产品介绍

该产品是一款专为太阳能光伏组件设计的自动清洁机器人，具备运动控制、航向角检测、姿态控制、无线通讯、大数据、气象联动和灰尘预警系统等功能。采用LORA物联网通信技术，可通过互联网传输数据和远程管理机器人操作系统。同时，采用无水清洗方式，节约水资源。该机器人能够高效地清洗太阳能光伏组件，提高能源利用效率。

产品优势

- 环境和地形适应能力强，可实现光伏面板前后、上下错位50mm的跨越；
- 具有跨行清扫、自供电、轻量化、模块化、智能跨障、自主操作系统等6大核心关键技术；
- 具有自我检测和诊断功能，保障机器人长期稳定运行；
- 全自动化量产技术，保障清洁机器人制造一致性及可靠性。

Product Presentation

This product is an automatic cleaning robot specifically designed for solar photovoltaic modules. It features functions such as motion control, heading angle detection, attitude control, wireless communication, big data processing, weather linkage, and dust warning system. Utilizing LORA IoT communication technology, it can transmit data over the internet and remotely manage the robot's operating system. Additionally, it adopts a waterless cleaning method, saving water resources. This robot can efficiently clean solar photovoltaic modules, thereby improving energy utilization efficiency.

Product Advantages

- (1) Strong adaptability to various environments and terrains, capable of crossing 50mm misalignments in the front, back, up, and down directions of photovoltaic panels.
- (2) Six core technologies including cross-row cleaning, self-powering, lightweight design, modularization, intelligent obstacle crossing, and an autonomous operating system.
- (3) Features self-detection and diagnostic functions to ensure long-term stable operation of the robot.
- (4) Fully automated mass production techniques guarantee the consistency and reliability of the cleaning robot manufacturing process.

光伏智能清洁机器人——技术参数

| 名称 | | 单位 | 参数值 |
|-------------|--|-------|--------------------------------|
| 清洁机器人型号 | Cleaning Robot Model | mm | 1000-8000 |
| 连续爬坡能力 | Continuous Hill-climbing Capability | ° | 20 |
| 越障能力-支架高低落差 | Obstacle Crossing Capability - Height Difference of Supports | mm | 50 |
| 越障能力-支架前后落差 | Obstacle Crossing Capability - Front-back Difference of Supports | mm | 50 |
| 行走功率 | Walking Power | W | 120~200 |
| 行走速度 | Walking Speed | m/min | 8~13 |
| 单次充电行走距离 | Single Charge Walking Distance | m | 1200-3000 |
| 自充电光伏板功率 | Self-charging Photovoltaic Panel Power | W | 60 |
| 充电器类型 | Charger Type | MPPT | MPPT |
| 电池类型 | Battery Type | / | 三元锂电池 Ternary lithium battery |
| 标称电压 | Nominal Voltage | V | 24 |
| 标称容量 | Nominal Capacity | AH | 15~60AH(Optional) |
| 机器自重 | Machine Weight | kg | 35~100KG |
| 机器宽度 | Machine Width | mm | 395 |
| 机器高度 | Machine Height | mm | 300 |
| 机器长度 | Machine Length | mm | 1000-8000(依基板尺寸而定) |
| 运行温度 | Operating Temperature | °C | -30~70 |
| 防护等级 | Protection Level | / | IP65 |
| 物联网通信技术 | IoT Communication Technology | / | GPRS/LORA可选LORA通信距离4-5km |
| 电机类型 | Motor Type | / | 无刷电机brushless electric machine |
| 电机使用寿命 | Motor Lifespan | H | >10000 |
| 自动报警 | Automatic Alarm | / | 有 |
| 自动校准归位功能 | Automatic Calibration and Home Positioning Function | S | 30 |

智能巡检无人机
INTELLIGENT INSPECTION DRONE

产品介绍
Product Introduction

该巡检无人机系统利用无人机、智能机库、红外传感器和AI识别算法技术,实现对光伏板高效、全面地检测和维护。系统能够自动识别热斑并标注位置,监测光伏组件的温度异常行为,有效检测到光伏组件的故障。同时,系统结合了无人机、智能机库和移动APP技术,实现了一键查看故障点位信息和自动导出巡检报告。无人机具备全自动飞行、多模型异常检测、可见光/红外双光检测等特点,能够实现高效地电站巡检。

This inspection drone system utilizes drones, intelligent hangars, infrared sensors, and AI recognition algorithms to achieve efficient and comprehensive detection and maintenance of photovoltaic panels. The system is capable of automatically identifying hotspots and marking their locations, monitoring temperature abnormalities in photovoltaic components, and effectively detecting faults in photovoltaic modules. Furthermore, the system integrates drone, intelligent hangar, and mobile APP technologies to enable one-click access to fault location information and automatic export of inspection reports. The drone features fully automatic flight, multi-model anomaly detection, and dual-band visible/infrared detection, enabling efficient power station inspection.

安全性 Safety

避免人员暴露在危险环境中,减少人身伤害的风险。
It avoids exposing personnel to dangerous environments, reducing the risk of personal injury.

全面性 Comprehensiveness

无人机配备高分辨率的摄像头、红外传感器等设备,可以对光伏板进行全面检查。
The drone is equipped with high-resolution cameras, infrared sensors, and other devices, enabling comprehensive inspection of photovoltaic panels.

高效性 Efficiency

能够快速覆盖大面积的光伏板区域,完成巡检任务所需时间较短。
It can quickly cover large areas of photovoltaic panel regions, completing inspection tasks in a relatively short amount of time.

经济性 Cost-effectiveness

无人机巡检减少了人力投入,节约了时间,降低了维护成本,提高工作效率。
Drone inspections reduce manpower requirements, save time, lower maintenance costs, and enhance work efficiency.

主要路径



智能割草机器人
INTELLIGENT LAWN MOWING ROBOT

产品介绍 Product Introduction

履带式割草机器人具备超强越障能力, 斜面作业主动纠偏、无极调速, 支持不同属具快换切替, 提高了割草机在野外的适应性。其履带式设计使机器人能够在复杂地形中轻松穿行, 如草地、滩涂、坡地等地形, 有效应对各种障碍, 确保机器人在光伏电站等野外环境中的稳定运行和高效作业。

The tracked lawn mowing robot possesses excellent obstacle-crossing capabilities, active deviation correction for slope operation, stepless speed regulation, and quick interchangeability of different attachments. These features greatly enhance the robot's adaptability in outdoor environments. Its tracked design allows the robot to traverse complex terrains easily, such as grasslands, beaches, slopes, and other terrains, effectively dealing with various obstacles. This ensures stable operation and efficient work of the robot in outdoor environments like photovoltaic power stations.



割草能力强 | 杂草、灌木、树桩等



灵活配件组合 Flexible attachment combinations

基于履带机器人平台以及配套割草作业工具, 完成光伏电站杂草、灌木、藤蔓植物清除作业。
Based on the tracked robot platform, it is equipped with lawn mowing tools to complete the removal of weeds, shrubs, and vines in photovoltaic power stations.

割草、割灌作业机器人系列

Series of lawn mowing and shrub cutting robots



割草属具
Lawn Mowing Mttachment



割灌属具
Shrub Cutting Attachment



集草器
Grass Collector



剪草机
Grass Cutter



割草机
Lawn Mower

技术参数

发动机 Engine

| | |
|---|---|
| 制造商 Manufacturer | 洋马3缸 Yanmar 3 cylinder |
| 型号 Model number | 四冲程直列水冷柴油机 Four-stroke in-line water-cooled diesel engine |
| 扭矩 torque | 1077 Nm |
| 燃油 Fuel oil | 柴油 Diesel oil |
| 燃油箱容积 Fuel tank capacity | 28L |
| 喷油方式 Fuel injection mode | 直喷 Direct injection |
| 额定功率 Rated power | 28.2Kw (38.3Hp)@3000rpm |
| 传动方式 Mode of transmission | 静液压精细控制 Fine control of hydrostatic pressure |
| 冷却方式 Mode of cooling | 油冷混合 Cold oil mixing |
| 冷却器自清洁(选配) Cooler self-cleaning (optional) | 自动控制+手动控制(选配) Automatic control + manual control (optional) |
| 冷启动装置 Cold start device | 选配 Fit and match |
| 允许适用倾角 Permissible tilt angle | 60°任意方向(发动机优化后) 60° in any direction (after engine optimization) |

液压系统 Hydraulic System

| | |
|---|--|
| 液压泵 Hydraulic pressure pump | 柱塞泵+齿轮泵 (B&P) Piston pump + Gear pump (B&P) |
| 驱动马达 Drive motor | 大扭矩马达 (Poclain) High torque motor (Poclain) |
| 割草台马达 Lawn mower motor | 高转速马达 (Danfoss) High Speed motor (Danfoss) |
| 割草台独立油路 Mowing platform independent oil path | 是 is |
| 驱动独立油路 Drive independent oil circuit | 是 is |
| 动作独立油路 Action independent oil circuit | 是 is |
| 液压油箱容积 Hydraulic tank capacity | 26升(系统内40升) 26 L (40 L in system) |
| 前臂抬升 Lift the forearm | 750Kg 750Kg |
| 系统允许适用倾角 The system permits applicable tilt angles | 80°任意方向(液压系统优化后) 80° any direction (hydraulic system optimized) |

履带 Track

| | |
|-------------------------------------|---|
| | 加高齿橡胶履带(支持55度斜面工况)齿牙比市场普通或常见履带高出2倍，达到抓地力，摩擦力应付各种地形能力。 |
| 橡胶履带(标配) Rubber track (standard) | The teeth of the rubber track with high teeth (support 55 degrees incline) are 2 times higher than that of the common track in the market, achieving the ability of grip and friction to cope with various terrain. |

| 尺寸 Size | 重量 Weight |
|--|--|
| 外形宽度(+割草台) Profile width (+ mowing platform) | 1500mm 主机 Host computer |
| 外形长度(+割草台) Shape length (+ mowing platform) | 2900mm 开荒台 Land opening platform |
| 外形高度(+割草台) Contour height (+ mowing platform) | 1300mm 380Kg |

遥控系统 engine

| | |
|--------------------------------|--|
| 工作距离 Distance of work | >150m >150m |
| 频率 Frequency | 2.4G 2.4 G |
| 电池 Battery | 内置充电锂电池2块电池每台, 支持设备自身充电 Built-in rechargeable lithium battery 2 batteries per unit, support self-charging equipment |
| 比例摇杆 Proportional rocker | 是(支持摇杆方向切换, 满足车头在前行驶及车尾 Yes (Support rocker direction switch, meet the front of the car and the rear of the car |
| | 在前行驶便捷操控操控.通过旋钮开关, 可实现前 Drive in front for easy control. Through the knob switch, can achieve before |
| | 进后退方向切换, 更加快捷, 无须掉头) Faster forward/backward switching without turning around) |
| 发动机启停 Engine start and stop | 遥控 Remote control |
| 发动机转速 Speed of engine | 遥控 Remote control |
| 大灯、喇叭 Headlight, horn | 遥控 Remote control |
| 动作控制 Motion control | 遥控 Remote control |

性能表现 engine

| | |
|---|--|
| 支持坡度 Slope of support | 满足工况斜面角度55° (50°设备报警, 喇叭+报警灯; 55度设备自动停车角度过大保护(大于55度), 防止翻车, 增加角度传感器, 在行驶过程中, 由于地形变化, 大于机器极限角度, 机器自动报警, 防止误操作, 造成翻车.) Meet the working condition of inclined plane Angle 55° (50° equipment alarm, horn + alarm light; 55 degree equipment automatic parking Angle is too large protection (greater than 55 degrees), to prevent rolloping, increase Angle sensor, in the driving process, due to terrain changes, greater than the machine limit Angle, the machine automatic alarm, to prevent misoperation, resulting in rolloping. |
| 无级变速控制(0到100%) CVT control (0 to 100%) | 工况速度前进后退0-4 Km/h转场速度前进后退0-10.2 Km/h Working speed forward and backward 0-4 Km/h transition speed forward and backward 0-10.2 Km/h |
| 驻车 Parking in car | 遥控驻车开关, 确保设备稳固停靠.通过驻车旋钮, 实现机器实地驻车, 实现电子手刹功能, 安全性能有效保障, 有效防止溜车.误操作造成的安全事故 Remote control parking switch to ensure stable docking equipment. Through the parking knob, the machine on-site parking is realized, the electronic handbrake function is realized, the safety performance is effectively guaranteed, and the sliding car is effectively prevented. Safety accidents caused by misoperation |
| 转向 Steering direction | 滑移转向, 支持原地转向 Slip steering supports in-place steering |
| 坡面行驶纠偏 Slope driving correction | 是(在斜坡工作中, 由于角度过大, 机器自身重量会出现倾斜状况, 增加倾斜角传感器, 程序设定制动纠偏) Yes (in slope work, due to the excessive Angle, the weight of the machine will tilt, increase the tilt Angle sensor, and set the braking correction program) |
| 定速巡航 Constant speed cruise | 是(一键解除) Yes (one click to release) |
| 急停 Emergency stop | 一键停止 One click to stop |
| 倾斜超角度 Tilt super Angle | 报警(喇叭+报警灯), 自动停车 Alarm (horn + alarm light), automatic stop |
| 大灯 Headlight | LED |
| 信号丢失 Loss of signal | 自动停车 Automatic parking |
| 其它 Other | 液压, 润滑油油压异常, 自动停车 Hydraulic, lubricating oil abnormal oil pressure, automatic stop |

地面智能巡检机器人

产品简介

四款巡检机器人, 适用于光伏电站、电力机房和山地电站的巡检需求。能够自动采集和分析设备外观、表计、红外、气体、噪声、环境等数据, 确保设备状态安全。同时, 具备自主导航、视觉检测和全地形运载能力, 提高巡检效率、降低人力成本, 并确保设备的正常运行。

产品类型

升压站移动巡检机器人

可在无人值守环境中为光伏电站提供全天候的设备外观、表计、红外、气体、噪声、环境等数据的自动采集、分析服务, 确保设备状态安全。



电力机房巡检机器人

针对电力机房研发的智能一体化巡检方案, 可代替人工进行电力机房设备与环境的大范围不间断巡检。



光伏区移动巡检机器人

光伏区移动巡检机器人搭载自主导航、视觉检测等设备, 可在电站的光伏区进行光伏组件、逆变器、汇流箱、箱变等设备区域进行巡检。



山地电站全地形运载机器人

轮足结构全地形运载机器人采用仿生轮足结构, 基于独立6X6驱动及转向结构适应山地电站全地形高越障需求, 实现光伏电站逆变器、组件、维保物资及人员运载。



GROUND INSPECTION ROBOT

PRODUCT INTRODUCTION

Four inspection robots, suitable for the inspection needs of photovoltaic power plants, power distribution rooms, and mountain power stations. They can automatically collect and analyze data on equipment appearance, meters, infrared, gas, noise, and environment to ensure equipment safety. Additionally, they possess autonomous navigation, visual detection, and all-terrain transportation capabilities, improving inspection efficiency, reducing labor costs, and ensuring the normal operation of equipment.

TYPE OF PRODUCT

Substation Mobile Inspection Robot

Provides around-the-clock data collection and analysis services for equipment appearance, meters, infrared, gas, noise, and environment in unmanned photovoltaic stations, ensuring equipment safety.



Power Room Inspection Robot

An intelligent integrated inspection solution for power rooms, replacing manual inspections of power room equipment and environment.



Photovoltaic Area Mobile Inspection Robot

Equipped with autonomous navigation and visual inspection devices, conducting inspections in the photovoltaic area of power stations, including photovoltaic modules, inverters, combiner boxes, and transformer substations.



Mountain Station All-Terrain Carrying Robot

The bionic wheel-leg structure robot uses independent 6X6 drive and steering structure for high obstacle-crossing needs in mountain stations, carrying inverters, modules, maintenance materials, and personnel.



水下/水面智能机器人

产品简介

为渔光互补电站提供全面的巡检和运维解决方案, 产品包括水下巡查机器人、无人运输船及水面巡检机器人, 可以执行多样化任务, 提高电站运维效率和管理水平。

水下巡查机器人

水下巡查机器人利用机器视觉和人工智能技术, 精确巡查光伏组件状态和水下设备运行情况。



无人运输船及水面巡检机器人

无人运输船及水面巡检机器人是一款多功能设备, 可运输物资、巡检光伏组件和水面浮游物。



功能特点

高效性: 自动化巡查和任务执行, 减少人工干预, 提高电站运维效率

安全性: 能够在复杂环境下进行各项作业, 有效规避安全风险

智能化: 精准识别光伏组件异常情况, 实时传输数据和画面, 帮助运维人员快速解决故障, 提高电站管理水平

UNDERWATER/SURFACE ROBOTS

PRODUCT INTRODUCTION

Providing comprehensive inspection and maintenance solutions for Yuguang Complementary Power Station, our products include underwater inspection robots, unmanned transport ships, and surface inspection robots, which can perform diverse tasks and improve the efficiency and management level of power station operation and maintenance.

Under Water Inspection Robot

Utilizing machine vision and artificial intelligence technology, the underwater inspection robot can precisely inspect the status of photovoltaic modules and the operation of underwater equipment.



Unmanned Transport Ships and Water Surface Inspection Robots

The unmanned transport ship and water surface inspection robot are multifunctional devices that can transport materials, inspect photovoltaic modules, and detect floating debris on the water surface.



PRODUCT FEATURES

Efficiency:

Automates inspections and task execution, reducing manual workload and improving station O&M efficiency.

Security:

Carrying out various operations in complex environments, effectively avoiding safety risks.

Intelligence:

Accurately identify abnormal situations in photovoltaic modules, transmit data and images in real-time, help operations quickly solve faults, and improve the level of power station management.

案例展示

CASES

· 江苏渔光互补电站机器人运维项目

· 河北渔光互补电站机器人运维项目

江苏沛县电站

150MW

150台机器人

河北十里海电站

100MW

130台机器人

· 广西智能运维示范电站机器人运维项目



· 广东山地电站机器人运维项目



· 广东屋顶分布式电站机器人运维项目

· 广东屋顶分布式电站机器人运维项目



合作企业

Partner enterprises

| | |
|---|---|
|  <p>中国华能集团有限公司 CHINA HUANENG GROUP CO., LTD.</p> |  <p>中国华电集团有限公司 CHINA HUADIAN CORPORATION LTD.</p> |
|  <p>中国核工业集团有限公司 China National Nuclear Corporation</p> |  <p>中国大唐集团有限公司 China Datang Corporation Ltd.</p> |
|  <p>中广核 CGN</p> |  <p>中国南方电网 CHINA SOUTHERN POWER GRID</p> |
|  <p>国家能源集团 CHN ENERGY</p> |  <p>中国能建 ENERGY CHINA</p> |
|  <p>中国中铁</p> |  <p>国家电投 SPIC</p> |