

# “宁电” 电力数据 创新应用生态服务平台

"NINGDIAN" ECOLOGICAL SERVICE PLATFORM FOR ELECTRIC POWER DATA INNOVATION APPLICATION

- 国网宁夏电力有限公司电力科学研究院
- ELECTRIC POWER RESEARCH INSTITUTE OF STATE GRID NINGXIA ELECTRIC POWER CO.,LTD.



## 项目简介:

为贯彻国家大数据战略，加快落实建设数字中国要求，充分发挥电力数据时效性高、覆盖面广、准确性强的独特优势，国网宁夏电科院紧密结合政府、企业、电网关于电力大数据的应用需求，倾力打造“宁电+”电力数据创新应用生态服务平台。“宁电+”是一个以电力数据为核心生产要素，并融入多源数据，以贯通大数据全链条技术工具为抓手，为用户提供电力数据增值产品、大数据技术服务、数据分析场景应用、敏捷易用的在线数据分析工具和数字化供需匹配对接窗口的增值赋能平台。

项目累计投资175万元，实现数据资产化管理、数据深度挖掘与分析、数据场景化应用赋能的一体化贯通融合，形成了数据、平台、场景的三大发展引擎，完成近500万元营收。

项目已出版专著2部，发表EI论文4篇，受理发明专利17项，登记软件著作权25项。成功解决新能源发电调度难、经济发展趋势预测手段少、企业偷排监管难和金融信贷风险评估方式单一等问题，辅助自治区生态环境厅实现区内90%以上的污染企业监管，节省环保监测设备费用1.98亿元。获得政府批示、书面感谢10次，被新华社、人民日报等多家媒体宣传报道20次，产生了显著的经济效益和社会效益。

## PROJECT INTRODUCTION:

Aiming at upholding the national big data strategy and speeding up the realization of digital China as well as fully utilizing the unique advantages of electric data that boasts high effectiveness, wide coverage and immense accuracy, Electric Power Research Institute of State Grid Ningxia Electric Power Co.,Ltd. centers on the application demand from government, enterprises and the power grid in terms of electric big data to construct the "Ningdian +" ecological service platform of electric power data innovation application. "Ningdian +", as the value-adding and empowering platform, takes electric power as its core production element with the integration of multi-source data, and utilizes the technological tool of big data full chain to provide customers with value-added products of power data, big data technology services, data analysis scene application, customer-friendly online data analysis tools and digital connection between supply and demand.

With an accumulated total investment of 1.75 million yuan, this project has presented an integration of data asset management, data in-depth mining and analysis, and data scene-enabled application empowering, with the formation of three development drives, namely the data, platform and scene, and the revenue of this project is nearly 5 million.

This project has generated 2 monographs, 4 papers of EI, 17 received patents of invention and 25 registered software copyrights. It has successfully tackled the problems such as tough distribution of new energy power generation, monitoring difficulty over stealthy discharge of pollutants, limited financial credit risk assessment, and assisted the department of ecological environment of Ningxia in monitoring more than 90% of the pollution enterprises in this region, thus saving 198 million yuan in term of environmental monitoring equipment. This project has been bestowed 10 times of approval and written affirmation from government and has been reported 20 times by Xinhua News Agency, People's Daily and other media, which demonstrates tremendous economic and social benefits.

# AIoT智能蔗业装备

AIOT INTELLIGENT SUGARCANE EQUIPMENT

- 广西民族大学
- GUANGXI UNIVERSITY FOR NATIONALITIES

自主设计的深度卷积神经网络

自主设计的有序多边形偏移量识别方法

$$R_{CSMQ\_DIOU\_LOSS} = 1 - \sum_{i=0}^n \sum_{j=0}^n \frac{\rho_{ij}^2(\mathbf{b}, \mathbf{b}^{gt})}{c_{ij}^2}$$

自主设计的  
CSMQ\_DIOU\_LOSS损失函数

## 项目简介:

本项目采用AIoT技术(人工智能物联网)，由一系列甘蔗种植、加工智能化设备等组成。我们的核心技术是基于人工智能、物联网、大数据的甘蔗种植加工装备的智能识别、智能控制、智能监测以及大数据分析。AIoT智能蔗业装备的核心产品是甘蔗种植装备智能系统,以该核心产品为基础研发应用产品包括甘蔗种加工设备、智能灌溉设备、智能甘蔗抓取和转运设备等一系列装备。甘蔗种加工设备采用基于深度神经网络的进行蔗节、蔗芽、虫害的识别，并能高效率精确切割甘蔗。智能灌溉设备实现了传统灌溉无法做到的智能调节灌溉的功能。AIoT智能蔗业装备为广西的甘蔗业实现智慧化起到一个重要的促进作用。

## PROJECT INTRODUCTION:

The project adopts AIoT Technology (artificial intelligence internet of things), which is composed of a series of sugarcane planting and processing intelligent equipment. Our core technology is the intelligent identification, intelligent control, intelligent monitoring and big data analysis of sugarcane planting and processing equipment based on artificial intelligence, Internet of things and big data. The core product of AIoT intelligent sugarcane industry equipment is the intelligent system of sugarcane planting equipment. Based on this core product, R & D and application products include a series of equipment such as sugarcane seed processing equipment, intelligent irrigation equipment, intelligent sugarcane grasping and transportation equipment, etc. Sugarcane seed processing equipment is based on deep neural network to identify sugarcane nodes, sugarcane buds and pests, and can cut sugarcane efficiently and accurately. Intelligent irrigation equipment realizes the function of intelligent regulation of irrigation that cannot be achieved by traditional irrigation. AIoT intelligent sugarcane industry equipment plays an important role in promoting the intellectualization of sugarcane industry in Guangxi.

# DATAEXA-INSIGHT人工智能中台

DATAEXA-INSIGHT

- 厦门渊亭信息科技有限公司
- XIAMEN YUANTING INFORMATION TECHNOLOGY CO.,LTD.



## 项目简介:

本产品是一个面向企业级赋能的人工智能中台产品，平台以AUTOML、跨AI平台协议等技术为基础，提供人工智能应用构建全生命周期支持，支持科学家、工程师、算法研究员、分析师等全角色协同工作，输出包含机器学习和深度学习的算法级、组件级、引擎级、应用级全栈能力，涵盖了图像识别、自然语言处理、预测分析等数百种AI应用算子，并对计算资源（大数据集群、GPU集群等）进行统筹优化调度。实现人工智能应用构建的平民化、自动化、标准化、安全化，帮助客户快速实现人工智能应用落地，达到可持续性“业务智能化、智能业务化”的目标。



## PROJECT INTRODUCTION:

This product is an artificial intelligence middle-stage product for enterprise-level empowerment. The platform is based on technologies such as AutoML and cross-AI platform protocols. It provides full life cycle support for artificial intelligence application construction and supports scientists, engineers, algorithm researchers, analysts, etc. Full-role collaborative work, the output includes algorithm-level, component-level, engine-level, application-level full-stack capabilities including machine learning and deep learning, covering hundreds of AI application operators such as image recognition, natural language processing, and predictive analysis. Computing resources (big data clusters, GPU clusters, etc.) are coordinated and optimized for scheduling. This product can help realize the civilianization, automation, standardization, and security of artificial intelligence application construction, help customers quickly realize artificial intelligence application landing, and achieve the goal of sustainable "business intelligence and intelligent business".

# 城市轨道交通供电智能运维平台

URBAN TRANSIT POWER SUPPLY INTELLIGENT MAINTENANCE PLATFORM

- 天津凯发电气股份有限公司
- TIANJIN KEYVIA ELECTRIC CO., LTD.

## 项目简介:

城市轨道交通供电智能运维平台通过采用先进的传感器、视觉识别、泛在物联、数字孪生、大数据、人工智能等技术，以供电设备的参量数字化和信息化为基础创建城轨供电运维平台。该平台将与城轨供电运维相关的接触网监测、三工位可视化接地、智能巡检、能源管理、环境监控、安全防护、以及基于RFID的资产设备管理、PSCADA、OMC等各系统的数据进行动态感知、深度融合，通过基于数据驱动的数字孪生平台，从各个维度对监控数据进行有效地互联与共享，实现供电系统相关信息的全息实景监控和管理；通过对现场采集的海量数据进行大数据分析，形成运维知识库，利用专家系统和数字孪生仿真算法，对关键设备进行智能故障诊断和寿命预测，从故障修、计划修转向状态修，提供对应的运维策略，实现供电设备的全生命周期管理、增强安全及应急管理、运维流程自动管控能力；平台积累并数字化了运维经验，形成无形资产并促进了人员向技术复合型人才转变的结构优化过程。该平台创新地铁供电运维的一体化、网络化管理模式，不但提高了供电运维效率，提升了应急响应能力、处理能力，同时也实现运营管理减人增效，优化资产利用率、支撑供电系统安全运行。



## PROJECT INTRODUCTION:

Urban Transit Power Supply Intelligent Maintenance Platform(UTIM) is a maintenance platform for urban transit based on technologies of sensor, VIS, the internet of things, digital twin, big data and artificial intelligence. UTIM deeply merges the data of the urban railway maintenance systems, such as OCS inspection system, three-positions visual grounding system, intelligent patrol system, energy management system, environment monitoring system, security system, RFID equipment management system, PSCADA and OMC, which can share and transfer monitor data of different systems based on digital twin platform, to realize power supply information virtual reality monitoring and management.

UTIM makes big data analytics for data collected from local to form a maintenance knowledge base to detects fault and implements troubleshooting and life predicting for key devices based on expert system and digital data simulation, which can improve the urban devices maintenance mode from breakdown maintenance to condition based maintenance. UTIM, which proposes maintenance strategy and realizes lifecycle management for urban power supply devices, improves the automatic management capability. Also, UTIM digitalizes maintenance information and accumulates maintenance experience and improves the skill structure of the operation staff.

UTIM creatively improves the integrated management mode for urban transit power supply maintenance. And with the advantage of increasing maintenance efficiency and emergency response capability, it can reduce employees and improve efficiency for urban railway.

# 德龙钢铁有限公司5G智慧冶金应用

5G INTELLIGENT METALLURGY APPLICATION OF DELONG STEEL CO., LTD.

- 中国移动通信集团河北有限公司CHINA MOBILE COMMUNICATIONS GROUP HEBEI CO. LTD.
- 德龙钢铁有限公司DELONG STEEL CO., LTD.
- 华为技术有限公司HUAWEI TECHNOLOGIES CO., LTD



## 项目简介:

河北移动深入践行河北省政府办公厅印发《关于加快5G发展的意见》，与本地龙头企业德龙钢铁有限公司展开深入合作，德龙钢铁是中国企业500强，中国钢铁企业竞争力特强级别，中国首批绿色工厂，中国钢铁企业AAAA级旅游景区。当前已经在德龙园区内完成9个宏站、3个室分建设，以此为契机，不断挖掘探索5G+X创新应用，通过5G UPF下沉到园区内，打造一套完整的5G专网运营平台，充分发挥5G专网优势。当前在轧钢厂、成品库房等多个车间内分别实现“5G+质检、5G+高清视频回传”等5G应用能力；在园区内，实现“5G+智慧安防、5G+无人驾驶送样车、5G+远距离业务点备线、B+C双域融合”等5G创新应用；利用5G大带宽、广连接、低时延特性，解决钢铁领域特定环境下的高危、高人工成本、高施工成本、高维护成本等痛点，加速企业实现绿色、智能化转型。同时，5G+制造业试点项目的落地，也对本地数字经济发展具有重要推进作用。



## PROJECT INTRODUCTION:

Hebei mobile in-depth practice of hebei provincial government issued by the general office of the opinion on accelerating the development of 5g, with the local leading enterprises delong steel co., LTD., in-depth cooperation, calderon steel is China top 500 enterprises, China's iron and steel enterprise competitiveness strong level, China's first green plant, iron and steel enterprises in China AAAA level scenic spots. At present, the construction of 9 macro stations and 3 rooms has been completed in Delong Park. Taking this as an opportunity, the company will continue to explore 5G+X innovative applications and sink into the park through 5G UPF to create a complete 5G private network operation platform and give full play to the advantages of 5G private network. At present, 5G application capabilities such as "5G+ quality inspection, 5G+ HD video transmission" are realized in several workshops such as rolling mill and finished product warehouse. In the park, 5G innovative applications such as "5G+ smart security, 5G+ unmanned sample delivery, 5G+ remote business point standby line, B+C dual-domain integration" will be realized. By utilizing the features of 5G with large bandwidth, wide connection and low delay, it can solve the pain points such as high risk, high labor cost, high construction cost and high maintenance cost in the specific environment of the iron and steel field, and accelerate the realization of green and intelligent transformation of enterprises. At the same time, the implementation of 5G+ manufacturing pilot projects will also play an important role in promoting the development of local digital economy.

# 伏锂码云平台

FULIMA CLOUD PLATFORM

- 山东捷瑞数字科技股份有限公司
- SHANDONG JEREI DIGITAL TECHNOLOGY CO.,LTD

## 项目简介:

伏锂码云平台是一个以数字孪生驱动的工业互联网云平台。平台以海量三维模型组件库和拥有自主算法的影视级孪生设计器J3D为依托，从数字化营销、数字化生产与数字化管控三个维度，为智能制造业客户提供精准数字化创新性解决方案，引领带动企业实现数字化转型。

业务范围涵盖了工业数据采集和分析应用、工业APP和产业生态建设，平台拥有开放的工业互联网服务体系，支撑资源弹性供给和高效配置，打造资源富集、信息共享、合作共赢的产业生态。平台独有的数字孪生应用开发工具J3D，支持开发者和用户自主构建3D数字孪生和虚拟仿真应用场景，通过与平台的数据采集、分析预测和仿真服务集成，实现在线交互式数字孪生应用。

平台整体架构分为边缘计算、基础设施（IAAS）、平台支撑（PAAS）和应用服务四个层级，分别提供面向边缘设备的数据接入和边缘计算处理、面向开发者的云计算资源、基础工业微服务和应用开发服务、面向企业和客户的工业APP和资源市场，构建服务于整个产业的开放式跨行业、跨领域的工业互联网平台。除此之外，平台对全链路提供工业级安全防护服务，支持数据通讯动态加密、数据加密和账户安全认证，对异常访问行为进行实时检测和安全预警，有效保障用户数据和应用的安全和稳定。

## PROJECT INTRODUCTION:

Fulima cloud platform is driven to a digital twin industrial Internet cloud platform with enormous component library and 3D model with independent algorithms based on twin designer J3D level, film and television, digital production from digital marketing and digital control three dimensions, provide accurate digital innovative solutions for intelligent manufacturing customers, leading the drive the enterprise to realize the digital transformation.

The business scope covers industrial data collection and analysis application industrial APP and industrial ecological construction. The platform has an open industrial Internet service system, which supports elastic supply and efficient allocation of resources and creates an industrial ecology featuring resource enrichment, information sharing and win-win cooperation The platform's unique digital twin application development tool J3D supports developers and users to independently build 3D digital twin and virtual simulation application scenarios, and realizes online interactive digital twin applications by integrating with the platform's data acquisition, analysis, prediction and simulation services.

The overall architecture of the platform is divided into four levels: Edge computing infrastructure (IaaS) platform support (PaaS) and application service, which respectively provide data access for edge devices and edge computing processing, cloud computing resource basic industrial microservices and application development services for developers In addition, the platform provides industrial-level security protection services for the whole link and supports dynamic encryption of data communication Data encryption and account security authentication detect abnormal access behaviors in real time and provide security warnings, effectively ensuring the security and stability of user data and applications.

# 伏锂码云平台

以数字孪生驱动的  
工业互联网云平台

平台以海量三维模型组件库和自主研发的影视级孪生设计器J3D为依托，  
从数字化营销、数字化生产、数字化管控三个维度，  
为制造业企业提供数字化创新性解决方案，推动企业数字化转型。

云营销 云展厅 全渠道电商 数字中心 精益服务 员工培训 客户关系管理 经营决策 生产管理·MES

# 福建厦门远海集装箱码头基于5G的自动化码头业务场景应用

RICH APPLICATIONSCENARIO OF AUTOMATED TERMINAL BUSINESS BASED ON 5G IN XIAMEN OCEAN GATE CONTAINER TERMINAL

- 中国移动通信集团福建有限公司 CHINA MOBILE COMMUNICATIONS CORPORATION FUJIAN CO., LTD
- 厦门远海集装箱码头有限公司 XIAMEN OCEAN GATE CONTAINER TERMINAL CO., LTD

## 项目简介:

厦门远海码头是全国首个自动化码头，多年来积极探索港口创新。2019年与中国移动达成战略合作协议，以厦门远海码头为试点，积极开展港口5G自动化应用示范改造，依托于双方成立的5G企业联合实验室，顺利完成了传统码头5G自动化改造的设计与港口5G专网、高精度定位网和车路协同网基础设施建设及相关应用场景落地，给港区原有的作业模式带来改进，提升港区作业效率、保障作业安全。

当前，中国移动为码头规划建设5G专网，共建成14个5G基站，采用2.6G+4.9G双频段，解决港口桥吊高出网络覆盖及满足并发上行大带宽需求，同时结合新型技术，深入港口打造5G轮胎吊远程控制、5G岸桥远程控制、5GAGV集群管理、无人驾驶集卡、5G智能理货、5GVR智能安防等核心业务场景。创新研发了传统码头自动化改造及混合作业调度设计方案、基于5G在自动化码头通讯网络应用的技术方案和基于“5G+V2X（车路协同）”的港口无人水平运输技术方案，首创网络双发选收技术方案，在港机远程控制场景应用提升系统时延稳定性。解决了“传统码头自动化改造成本高难度大、缺乏低延时及大传输码头通讯专网、无人水平运输与港机设备作业远程操控缺乏成套系统技术”的关键核心技术、共性技术难点，为全国港口提供样板。

## PROJECT INTRODUCTION:

Xiamen Ocean Gate Container Terminal is the first automated terminal in China. Over the years, it has actively explored port innovation. In 2019, it reached a strategic cooperation agreement with China Mobile to actively carry out the 5G automation application demonstration transformation of the port with Xiamen Ocean Gate Container Terminal as the pilot. Relying on the 5G enterprise joint laboratory established by both sides, it successfully completed the design of 5G automation transformation of the traditional terminal and the infrastructure construction and related application scenarios of 5G private network, high-precision positioning network and vehicle road coordination network of the port, Improve the original operation mode of the port area, improve the operation efficiency of the port area and ensure the operation safety.

At present, China Mobile plans to build a 5G private network for the terminal, with a total of 14 5G base stations, using 2.6G + 4.9G dual frequency band to solve the problem that the port bridge crane is higher than the network coverage and meet the requirements of concurrent uplink large bandwidth. At the same time, combined with new technologies, China Mobile goes deep into the port to build 5G tire crane remote control, 5G shore bridge remote control, 5G Agv cluster management, driverless truck collection, 5G intelligent tally 5G VR intelligent security and other core business scenarios. It innovated and developed the design scheme of traditional terminal automation transformation and mixed operation scheduling, the technical scheme based on 5G application in automatic terminal communication network and the technical scheme of port unmanned horizontal transportation based on "5G + v2x (vehicle road coordination)", and pioneered the technical scheme of network dual transmitter and receiver, which was applied in the remote control scenario of port machinery to improve the time delay stability of the system. It solves the key core technology and common technical difficulties of "high cost and difficulty of traditional wharf automation transformation, lack of low delay and large transmission wharf communication network, unmanned horizontal transportation and remote control of port machinery equipment operation, and lack of complete system technology", and provides sample boards for ports all over the country.

# 福建省龙岩市紫金矿业金铜矿5G+智慧矿山项目

5G+ SMART MINE PROJECT OF ZIJIN MINING GOLD AND COPPER MINE, LONGYAN CITY FUJIAN PROVINCE

- 中国移动通信集团福建有限公司
- CHINA MOBILE COMMUNICATIONS GROUP FUJIAN CO. LTD



## 项目简介:

中国移动通信集团福建有限公司在龙岩上杭紫金山金铜矿搭建5G网络，主要在330洞外建设1个5G宏站，一期洞内选取2KM段落采用泄漏电缆建设室分系统，确保井下矿洞5G信号覆盖，并成功验证有轨机车可在5G网络下运行，2021年6月份完成330洞剩余段落5G网络覆盖，MEC部署在移动侧机房，项目整体投资约300万，通过5G和MEC边缘计算能力为龙岩上杭紫金山金铜矿打造虚拟无线专网，从井下的终端到网络接入、本地矿山应用等可以实现端到端的安全和高可靠性，构建和开发矿区机车5G无人驾驶的典型应用场景，有效解决工厂生产的痛点。基于5G+UWB定位技术的优势，并综合利用计算机、云计算、互联网和物联网等高科技技术，将矿井作业人员、设备设施等创新性地集系统，极大提升井下人员，设备定位精度，提升矿山本质安全。

## PROJECT INTRODUCTION:

China Mobile Communication Group Fujian Co., Ltd. has built a 5G network in Zijinshan Gold and Copper Mine, Shanghang, Longyan, mainly building a 5G macro station outside cave 330. A 2KM section in the first cave is selected to adopt the leakage cable construction sub-system to ensure 5G signal coverage in the underground mine and successfully verify that the rail locomotive can run under the 5G network. Completed in June 2021, 330 mine remaining paragraphs 5 g network coverage, MEC deployment in the mobile side of the room, the project total investment of about 3 million, with 5 g and MEC edge computing capacity of longyan shanghang purple mountain gold mine to build virtual private network, wireless from downhole terminal to Internet access, and local mining applications can achieve end-to-end security and high reliability, Build and develop typical application scenarios of 5G driverless locomotive in mining area to effectively solve the pain points of factory production. Based on the advantages of 5G+UWB positioning technology and the comprehensive use of computer, cloud computing, Internet and Internet of Things and other high-tech technologies, the mine operators, equipment and facilities are innovatively integrated into the system, which greatly improves the positioning accuracy of underground personnel and equipment and improves the essential safety of the mine.



# 福建信泰5G绿色智联智造项目

FUJIAN SINCETECH 5G GREEN INTELLIGENT MANUFACTURING PROJECT

- 福建省万物智联科技有限公司
- FUJIAN WORLDBLINKING TECHNOLOGY CO.,LTD



### 项目简介:

福建信泰5G绿色智联智造项目体系架构，利用5G无线专网是智联智造基础，为人、机、物、数据全面智联提供基础设施，促进各种工业数据与企业生产、管理、决策流程“点线面体流”无缝联接。针对纺织行业特点，构建面向工业互联网的行业专网，增强行业专网对应用场景的支撑能力，满足行业业务差异化SLA需求；在此基础上，基于MEC的机器视觉质检、数据归集分析、产线灵活调度等，实现业务的改造升级；进一步探索数字孪生，以实现工业制造的数字化、智能化转型，推动纺织行业鞋面材料领域智造的高质量、可持续发展。



### PROJECT INTRODUCTION:

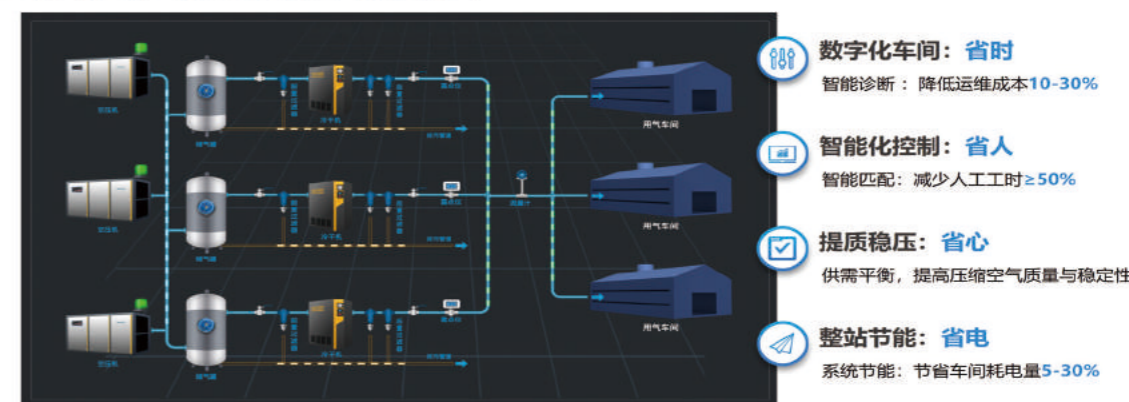
The system architecture of Fujian SinceTech 5G green intelligent manufacturing project, using 5G wireless private network is the foundation of intelligent manufacturing, providing infrastructure for the comprehensive intelligent connection of people, machines, things, and data, and promoting various industrial data and enterprise production, management, and decision-making processes" Point, line, surface flow" are seamlessly connected. According to the characteristics of the textile industry, build an industry private network for the industrial Internet, enhance the industry private network's support for application scenarios, and meet the differentiated SLA requirements of industry businesses; on this basis, MEC-based machine vision quality inspection and data collection analysis, Flexible scheduling of production lines, etc., to achieve business transformation and upgrading; to further explore digital twins to realize the digital and intelligent transformation of industrial manufacturing, and to promote the high-quality and sustainable development of the intelligent manufacturing of upper materials in the textile industry.

# 工厂动力车间云智控管理系统

CLOUD INTELLIGENT CONTROL SYSTEM OF FACTORY POWER WORKSHOP

- 蘑菇物联技术（深圳）有限公司
- MOGULINKER TECHNOLOGY (SHENZHEN) CO., LTD.

## 云智控四大功能与价值



### 项目简介:

工厂动力车间云智控管理系统是一套利用工业互联网技术对工厂动力车间实现数字化和智能化升级改造的解决方案。云智控管理系统采用典型的“数据采集层+边缘层+平台层+应用层”设计，系统由数据采集网关、无线传感器节点、通讯基站、边缘服务器、蘑菇云平台、PC端软件和移动端软件组成。云智控系统具有数字化车间、智能化管理和节能化控制三大功能。目前云智控管理系统主要应用在工厂的气动空间，即空压站房。数字化车间是通过将收集到的设备运行状态数据以可视化的方式呈现在PC或移动设备的APP上实现，展示空压站的整体或某一设备的运行状况，让设备时刻处于在线的状态，可以实现远程监控和调参。智能化管理功能可实现自动记录报表和点检、预测性维护，保养提醒和故障预警等功能，降低空压站的运维难度和成本，真正做到省心省力。节能化控制是云智控系统最具特色的亮点功能，云智控采用云边双控的方式，根据空压站的实时供气产出和生产车间的实时用气需求，利用先进大数据和AI算法技术，结合自主开发的窄带恒压和多参数、多约束控制算法，对设备实行精准的控制，实现供需动态平衡，从而达到节能降耗的目的，节能率可达10%-30%。

### PROJECT INTRODUCTION:

Cloud intelligent control system of factory power workshop is a set of solutions to realize digitalization and intelligent upgrading of factory power plant by using industrial Internet technology. The system consists of data collection gateway, wireless sensor nodes, communication base station, edge server, mogu cloud platform, PC software and mobile software. The cloud intelligent control system has three major functions: digital workshop, intelligent management and energy-saving control. At present, the cloud intelligent control management system is mainly applied in the pneumatic space of the factory, i.e. the air compressor station room. The digital workshop is realized by presenting the collected equipment operation status data in a visual way on the APP of PC or mobile devices, showing the overall or a certain equipment operation status of the air compressor station room, so that the equipment is always online and can realize remote monitoring and tuning. Intelligent management function can realize automatic record report and point inspection, predictive maintenance, maintenance in advance to remind and fault warning, etc., reduce the difficulty and cost of operation and maintenance of air pressure station, and really save heart and effort. Energy-saving control is the most characteristic highlight function of cloud intelligent control system. Cloud intelligent control adopts the way of cloud-side dual control, according to the real-time gas supply output of the air compressor station room and the real-time gas demand of the production workshop, using advanced greatly data and AI algorithm technology, combined with independently developed narrow-band constant pressure and multi-parameter, multi-constraint control algorithm, to implement accurate control of the equipment to achieve dynamic balance between supply and demand, so as to achieve the purpose of energy saving and consumption reduction. The energy saving rate can reach 10%-30%.

# 工业控制安全态势感知平台

INDUSTRIAL CONTROL SECURITY SITUATION AWARENESS PLATFORM

- 武汉卓尔信息科技有限公司
- WUHAN ZALL INFORMATION TECHNOLOGY CO.,LTD



## 项目简介:

“工业控制安全态势感知平台”由武汉卓尔信息科技有限公司自主研发，具有核心知识产权的网络空间安全产品。本产品以大数据、机器学习、深度学习等新一代新兴技术，在大规模骨干网络节点、用户网络和用户终端三个层面，开展了大规模网络数据高效采集、网络异常检测与未知威胁发现关键技术研究。利用人工智能算法对用户、事件、日志、流量、应用运行等多维数据进行关联检测分析，能够在无样本或少样本条件下训练机器学习算法模型，实现对高级持续威胁的准确分析和行为预测。通过对大层次网络、海量异构数据的深度挖掘和智能分析，能够预测潜在安全风险，测绘网络空间的安全态势。

本产品适用于SCADA、DCS、PCS、PLC等工业控制系统，有利于解决我国工业企业安全防范能力参差不齐，安全技改措施薄弱的现状问题，通过大规模工控网络的安全威胁智能诊断将减少企业投入，从“弱”防范转向智能化预测，可整体提升工控网络的安全防御能力与技术水平，可以被广泛应用到石油石化、天然气、电力、智能制造、水利、铁路、轨道交通、城市市政以及其他与国计民生紧密相关领域，降低运营成本，保障生产能力，具有重大经济和社会效益。

## PROJECT INTRODUCTION:

"Industrial Control Security Situation Awareness Platform" is a cyberspace security product with core intellectual property rights independently developed by Wuhan Zall Information Technology Co., LTD. With the new generation of emerging technologies such as big data, machine learning and deep learning, this product has carried out research on the key technologies of efficient collection of large-scale network data, network anomaly detection and unknown threat discovery at the three levels of large-scale backbone network nodes, user networks and user terminals. The association detection and analysis of multidimensional data such as users, events, logs, traffic and application operation is carried out by using artificial intelligence algorithm, which can train the machine learning algorithm model under the condition of no or few samples, so as to realize the accurate analysis and behavior prediction of advanced persistent threats. Through deep mining and intelligent analysis of large-level networks and massive heterogeneous data, we can predict potential security risks and map the security situation of cyberspace.

This product is applicable to SCADA, DCS, PCS, PLC and other industrial control systems, which is conducive to solving the current problems of uneven safety prevention ability and weak safety technical transformation measures of China's industrial enterprises. Through the security threat intelligent diagnosis of large-scale industrial control network, the enterprise investment will be reduced, from "weak" prevention to intelligent prediction, It can improve the security defense capability and technical level of industrial control network as a whole, and can be widely used in petroleum and petrochemical, natural gas, electric power, intelligent manufacturing, water conservancy, railway, rail transit, urban municipal administration and other fields closely related to the national economy and the people's livelihood, reduce operating costs and ensure production capacity, which has significant economic and social benefits.

# 基于 5G 开放系统 的小批量多品种柔性生产线

FLEXIBLE LINE ENABLED BY 5G

- 中国移动通信集团江苏有限公司 CHINA MOBILE COMMUNICATIONS GROUP JIANGSU CO., LTD,
- 无锡普洛菲斯电子有限公司 WUXI PRO-FACE ELECTRONICS CO. LTD.



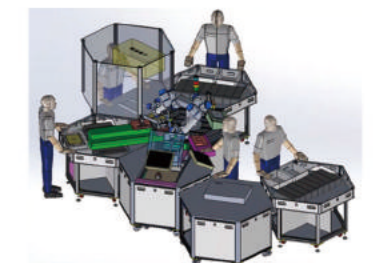
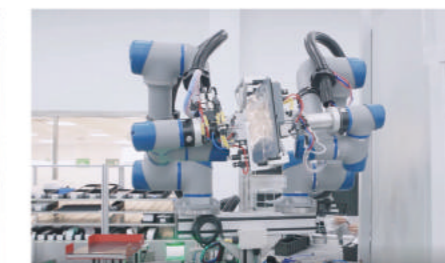
## 项目简介:

### 项目解决以下问题:

- 1、产能不平衡的矛盾，40%的产线年生产负荷率低于50%，但同时又有部份产线产量不足，资产综合有效利用不高。
- 2、低自动化投资回报率与提高质量的矛盾，因为批量小造成无法有合适的投资回报率来支持自动化提高质量。
- 3、专线专用模式下的高空间占用和扩产的矛盾。

### 项目包含以下部分:

- 1、5G支持的可移动多种生产流程的生产线，可以针对不同产品快速组装换型。
- 2、“积木式”理念设计的通用功能工作台和可重用模组。
- 3、配方式MES系统可用于不同产品的工艺流程控制。



## PROJECT INTRODUCTION:

### The project addresses the following issues:

- 1、Unbalanced production loading, The loading ratio of 40% production line is less than 50%
- 2、Low ROI of automation for high mix low volume, and repeat investment
- 3、Limited space for new projects due to fixed and dedicated production lines

### The project consists of the following parts:

- 1、5G supported moveable and multi-combination model production line with rapid setup and change over for different products
- 2、“LEGO bricks” concept designed workstations base on functionalities
- 3、Recipe based MES system for different process control

# 基于5G专网的一体化无人矿山

AN INTEGRATED UNMANNED MINE BASED ON 5G PRIVATE NETWORK

- 中国移动通信集团江苏有限公司镇江分公司 ZHENJIANG BRANCH OF CHINA MOBILE COMMUNICATIONS GROUP JIANGSU CO., LTD.,
- 句容台泥水泥有限公司 JURONG TAI CEMENT CO., LTD.,
- 中国移动上海产业研究院 HINA MOBILE SHANGHAI INDUSTRIAL RESEARCH INSTITUTE,
- 长沙智能驾驶研究院有限公司 CHANGSHA INTELLIGENT DRIVING RESEARCH INSTITUTE CO., LTD

## 项目简介:

结合国家相关政策要求，立足疫情普遍化社会环境，加快矿山智能化升级，解决矿山生产作业危险度高、招工难等问题，全面提升矿山的生产、经营的科学性。以5G专网为基础，站式集成矿山边缘集装箱机房、网络/计算资源和各类无人矿山应用，统一存储矿山生产数据，实现极简部署和运维。项目一期投资约1650万。其中硬件投资600万，软件平台投资400万，前端集成投资300万，网络投资350万。项目主要采用自研模式，以物联网、三维GIS、VR技术为核心，构建虚拟矿山模型，实现可视化管控。未来将进一步对运输皮带廊进行实时监控，基于AI技术，自动识别隐患，确保运输系统长期有效的运行，实现生产与安全的综合集中管控。利用5G低延时和大带宽特性，基于车载5G视频回传和毫米波雷达，完成对现有矿卡车辆的改造，实现无人驾驶；同时建设指挥中心，部署指挥中心平台以及远程驾驶舱环境，正常情况下进行无人驾驶，紧急情况可进行远程接管。通过5G高精度定位功能，实现毫米级定位。利用车载定位和安全帽定位系统，在矿山进行爆破作业期间，划分精确电子围栏，确保爆破区无人化，提升爆破的安全性。



## PROJECT INTRODUCTION:

In accordance with the relevant national policies and requirements, and based on the prevailing social environment of the epidemic, we will speed up the intelligent upgrading of mines, solve the problems of high risk in mining operations and difficulty in recruiting workers, and comprehensively improve the scientific production and operation of mines. Based on THE 5G private network, the station integrates the container room at the edge of the mine, network/computing resources and all kinds of unmanned mine applications, and stores the mine production data in a unified manner to achieve minimal deployment, operation and maintenance. The first-phase investment of the project is about 16.5 million yuan. Among them, hardware investment is 6 million, software platform investment is 4 million, front-end integration investment is 3 million, network investment is 3.5 million. The project mainly adopts self-research mode, with the Internet of Things, 3D GIS and VR technology as the core, to build a virtual mine model and realize visual management and control. In the future, the transportation belt corridor will be further monitored in real time. Based on AI technology, hidden dangers will be automatically identified to ensure the long-term effective operation of the transportation system and realize the comprehensive centralized control of production and safety. By using the characteristics of 5G with low delay and large bandwidth, and based on on-board 5G video transmission and millimeter wave radar, the existing mining truck is transformed to realize unmanned driving; At the same time, the command center will be built, and the platform of the command center and the remote cockpit environment will be deployed. Under normal circumstances, unmanned driving can be carried out, and remote takeover can be carried out in emergencies. Millimeter level positioning is achieved through 5G high-precision positioning function. Using vehicle-mounted positioning system and safety helmet positioning system, accurate electronic fence is divided during blasting operation to ensure unmanned blasting area and improve the safety of blasting.

# 基于EIS管道监控系统技术应用

BASE ON ENGINEERING INFORMATION SYSTEM PIPELINE MONITORING SYSTEM REALIZE

- 吉林化工学院
- JILIN INSTITUTE OF CHEMICAL TECHNOLOGY

## 项目简介:

该项目通过客户提出的具体需求，通过由工程建设图纸、工艺生产资料、竣工验收资料等所组成的EIS (ENGINEERING、INFORMATION、SYSTEM) 管道安全数据库对其进行模拟搭建，并进一步整合管道的工程信息、地理信息、物理信息，将录入数据进行有效地分析整合，充分应用现代信息技术及大数据理论，根据搭建模型建立合理的整体监控系统，以及检测设备安装方案。通过安装于工作管线附近的伴检管线中的监控设备对管线工况进行实时监控。监控数据一方面上传至PC端及移动端，另一方面反馈至EIS管道安全数据库中，进一步完善EIS数字化管道安全数据库。产品具有实时监控效果，同时可对微小泄漏点进行检测，具有超高的准确性与稳定性。

产品的监控系统采用复合式监控模式，即通过其他多种检测设备与“眼、耳”两大系统共同作用于管线上，从而达到高效准确的监控效果，最大限度的降低泄漏所带来的不利影响。产品的信息处理系统采用PC端与移动端共同作用的双项模式，既满足了工厂级别的监控效果，又满足移动化监控的趋势，实时采集数据将汇总于工作站，一方面数据将被存储至PC终端后台，以完善EIS管道安全数据库，为后期管线安全预测做准备；另一方面，泄漏情况将以APP推送的方式，推送至移动端，使得客户在第一时间得到泄漏信息，并且根据推送的泄漏等级，系统将提出合理的维修方案以供客户选择，将泄漏所带来的不利影响降至最低。



## PROJECT INTRODUCTION:

The project simulates and builds the EIS (Engineering, information and system) pipeline safety database composed of engineering construction drawings, process production data and completion acceptance data according to the specific needs put forward by customers, further integrates the engineering information, geographic information and physical information of the pipeline, and effectively analyzes and integrates the input data, Make full use of modern information network technology and big data theory, establish a reasonable overall monitoring system and detection equipment installation scheme according to the construction model. The monitoring equipment installed in the accompanying inspection pipeline near the working pipeline can monitor the pipeline working conditions in real time. On the one hand, the monitoring data is uploaded to the PC and mobile terminals, on the other hand, it is fed back to the EIS pipeline safety database to further improve the EIS digital pipeline safety database. The product has real-time monitoring effect, and can detect small leakage points, with ultra-high accuracy and stability. The monitoring system of the product adopts the compound monitoring mode, that is, it acts on the pipeline through a variety of other detection equipment and the two systems of "eyes and ears", so as to achieve efficient and accurate monitoring effect and minimize the adverse impact caused by leakage. The product information processing system adopts the dual mode of the joint action of PC end and mobile end, which not only meets the monitoring effect at the factory level, but also meets the trend of mobile monitoring. The real-time collected data will be summarized in the workstation. On the one hand, the data will be stored in the background of PC terminal to improve the EIS pipeline safety database and prepare for the later pipeline safety prediction; On the other hand, the leakage will be pushed to the mobile terminal by app push, so that the customer can get the leakage information at the first time. According to the pushed leakage level, the system will put forward a reasonable maintenance scheme for the customer to choose, so as to minimize the adverse impact caused by the leakage.

# 基于RED-MOS®的智慧矿山工业物联网平台

INTELLIGENT MINE INDUSTRIAL INTERNET OF THINGS PLATFORM BASED ON RED-MOS®

- 华夏天信智能物联（大连）有限公司
- CHINA TIANXIN IIOT (DALIAN) CO., LTD.



## 项目简介:

基于RED-MOS®的智慧矿山工业物联网平台，是通过煤矿安全监控系统（KJ66X）、矿用人员精确定位系统（KJ323D（A））、RID-GIS多网融合等子系统实现井下安全监控、人员管理、紧急救援等数字化应用，即是开放和可扩展的操作系统平台，也是实现各种感知数据的接入，为智能应用子系统开发提供组态化开发工具及协同设计服务等，全面实现各大矿山的工业物联网智能化建设，促进金砖各国智慧矿山数字化应用落地。RED-MOS® 是智慧矿山建设的核心，采用虚拟化和云计算技术，构建矿山云数据中心，实现计算资源、存储资源和网络资源的统一规划与集约建设，并通过内置的平台和工具，为智慧矿山应用子系统提供数据综合服务、时空服务、可视化服务、协同设计服务、业务流程服务和大数据分析服务等服务和工具，实现信息世界和物理世界的实时信息融合和控制迭代优化，最终实现矿山万物互联、平台融合、系统联动与智慧运营。基于RED-MOS®的智慧矿山工业物联网平台经中国煤炭工业协会鉴定认为其填补了国内矿山操作系统平台的空白，研究成果在智慧矿山物联网领域达到了国际领先水平。

## PROJECT INTRODUCTION:

Intelligent Mine Industrial Internet of things platform based on RED-MOS®, KJ66X, KJ323D (A), RID-GIS and other sub-systems are used to realize the digital application of underground safety monitoring, personnel management and emergency rescue, which is an open and extensible operating system platform, and also to realize the access of all kinds of perceptive data. KJ323D (A) and RID-GIS are used to provide configuration development tools and collaborative design services for the development of intelligent application sub-systems, to fully realize the intelligent construction of industrial internet of things in major mines and to promote the digital application of intelligent mines in the brics countries. The platform of Intelligent Mine Industrial Internet of things based on RED-MOS® has been appraised by China Coal Industry Association, which has filled the gap of domestic mine operating system platform and reached the international leading level in the field of intelligent mine Internet of things.

# 基于云端大数据的工业互联网智慧液压系统

INTELLIGENT HYDRAULIC SYSTEM BASED ON CLOUD BIG DATA OF INDUSTRIAL INTERNET

- 国机智能（苏州）有限公司 SINOMACH INTELLIGENCE (SUZHOU) CO., LTD.,
- 广州宝力特液压技术有限公司 GUANGZHOU BLT HYDRAULIC TECHNOLOGY CO., LTD.

## 项目简介:

“基于云端大数据的工业互联网智慧液压系统”围绕工厂液压系统、自动化线、机器人等设备的智能化监测与运维，以“大数据获取融合及动态分析—设备故障识别与健康健康管理—移动端远程运维—设备效率可视化”为服务链条，开发了一套基于云边协同的具有信号处理、故障诊断及云平台运维的硬件及软件系统。软件平台具有早期故障预警、智能故障诊断、故障趋势预测、维修决策支持、动态备件管理、在线数据管理等功能。

产品分为三大模块，分别为边缘端数据获取模块、边云协同大数据管理模块和云平台运维模块。其中基础边缘端通过各种传感器监测液压系统运行状态数据、液压介质老化与污染数据并进行数据融合。边云协同大数据管理模块对液压系统、自动化线、机器人等设备各项数据进行管理、清洗、挖掘与利用。为云运维软件提供数据支撑与决策支持，在云端打通人员智能化维保与设备智能化监测两个孤岛。

通过该套智慧液压系统智能监测和信息管理系统可有效提高液压系统的可靠性，有效降低液压系统的维修维护成本。智慧液压系统已经成功投入区域试点及产线应用。



## PROJECT INTRODUCTION:

"Intelligent Hydraulic System based on Cloud Big Data of Industrial Internet" focuses on intelligent monitoring, operation and maintenance of factory hydraulic system, automation line, robot and other equipment. Following the service chain "Big data acquisition, fusion and dynamic analysis -- Equipment fault identification and health management -- Remote operation and maintenance on mobile terminal -- Equipment efficiency visualization", a set of hardware and software system with signal processing, fault diagnosis, operation and maintenance management based on Cloud-Edge collaboration is developed. The software platform has the functions of early fault warning, intelligent fault diagnosis, fault trend prediction, maintenance decision support, dynamic spare parts management, online data management and so on.

The product is divided into three modules, Edge data acquisition module, Cloud-Edge collaborative big data management module and cloud platform operation and maintenance management module. The Edge end monitors the operating condition of hydraulic system, aging and pollution data of hydraulic media through various sensors and carries out data fusion. The Cloud-Edge collaborative module is designed to manage, clean, mine and utilize the data of hydraulic system, automation line, robot and other equipment. It provides data support and decision support for cloud platform operation and maintenance management module, which fix the gap between intelligent maintenance and intelligent equipment monitoring in the cloud.

This system can effectively improve the reliability, reduce the maintenance cost of hydraulic system by intelligent monitoring and information management. The system has been successfully put into application.



# 开创 5G 无人机多机协同新时代

CREATE A NEW ERA OF 5G UAV MULTI MACHINE COOPERATION

- 西北工业大学
- NORTHWESTERN POLYTECHNICAL UNIVERSITY

## 项目简介:

当今时代数据爆炸，集中式云计算却捉襟见肘，边缘计算刚需场景涌现，预计到2030年中国边缘云计算市场规模将接近2500亿元。与此同时，随着应用领域的扩大，无人机市场需求迅速提升。然而现有无人设备有传不出，算不了，高时延迟的三大痛点问题，发展受到掣肘。

“志合者，不以山海为远。”

开创5G无人机多机协同新时代项目致力于以前沿科技资源实现无人机网联化、微型化、集群化、智能化，联合国际伙伴共助力工业级无人机系统提质增效节能降价，最终推动金砖国家乃至全球城市安防、交通检测、航空测绘等领域无人机应用发展。

项目团队NIUVS利用5G移动通信网络进行无人机中近程、可靠通讯链路的搭建及集群控制；结合边缘计算与云系统，解决了现有无人设备三大问题；突破了网联5G无人机微型化，控制、定位关键算法，大场景多目三维重建和集群无人机边缘计算等难点，推出面向无人机集群的云边协同系统。

团队注重前瞻性技术开发与储备，积极同学术界、产业界展开合作，共发表专利5篇，软件著作权2篇（含在审）。自立项以来，团队共获得国际级奖励1次，国家级5次……

NIUVS团队愿——让无人系统技术普惠更多人！



## PROJECT INTRODUCTION:

Today is a day of data explosion--centralized cloud computing can't match the demand and edge computing is emerging. It is estimated that the market size of China's edge cloud computing will approach 250 billion yuan by 2030. Meanwhile, with the development of applications, the UAV market demand is rising rapidly. However, the existing unmanned equipment is hampered by three pain points--can not be transmitted, can not calculate, high time delay.

"Mountains and seas are not far away from those who share their aspirations."

Create an era of multiple cooperating 5G UAV project is dedicated to realize the miniaturization, clustering, intelligence of UAV with frontier science and technology resources, engage international partners to help industrial-grade UAV system improve quality, mass efficiency, save energy and reduce emission, ultimately promote the application development of UAV in areas, such as city security, traffic detection, aerial mapping, in the bricks and even global.

The team--NIUVS of the project uses 5G mobile communication network to build reliable medium and short range communication links and control the UAV cluster, combines edge computing and cloud system, solves three key problems of existing unmanned equipment, makes breakthroughs in the miniaturization of internet-connected 5G UAVs, key algorithms of control and positioning, 3d reconstruction of large scenes, multi-view and edge calculation of cluster UAVs. The cloud-side collaborative system for UAV clusters has been launched.

The team focuses on cutting edge technology development and reserve, and actively coopts with academia and industry. We has published 5 patents and 2 software Copyrights (including those under review). Since the project started, our team has won a total of 1 international award, 5 national award……

NIUVS team is willing to make unmanned system technology benefit more people!

# 雷盾网络异常行为分析管控平台

RAYDUN NETWORK ABNORMAL BEHAVIOR ANALYSIS AND CONTROL PLATFORM

- 福建雷盾信息安全有限公司
- FUJIAN RAYDUN INFORMATION SECURITY CO., LTD



## 项目简介:

在不影响网络拓扑、不需要流量分光镜像、不需要部署流量探针、不需要在终端设备安装代理程序、不依赖于其它安全设备的日志的情况下，一站式地解决了大型及复杂环境下东西向攻击难管控、虚拟化设备内部行为难管控、新型攻击行为难监测、脆弱性端口难全天候排查、通信日志存在盲区、威胁源头无法区分轻重缓急等诸多问题与难题，并可对所有威胁事件进行溯源取证。项目核心技术填补了大型网络场景下网络威胁检测技术的空白。



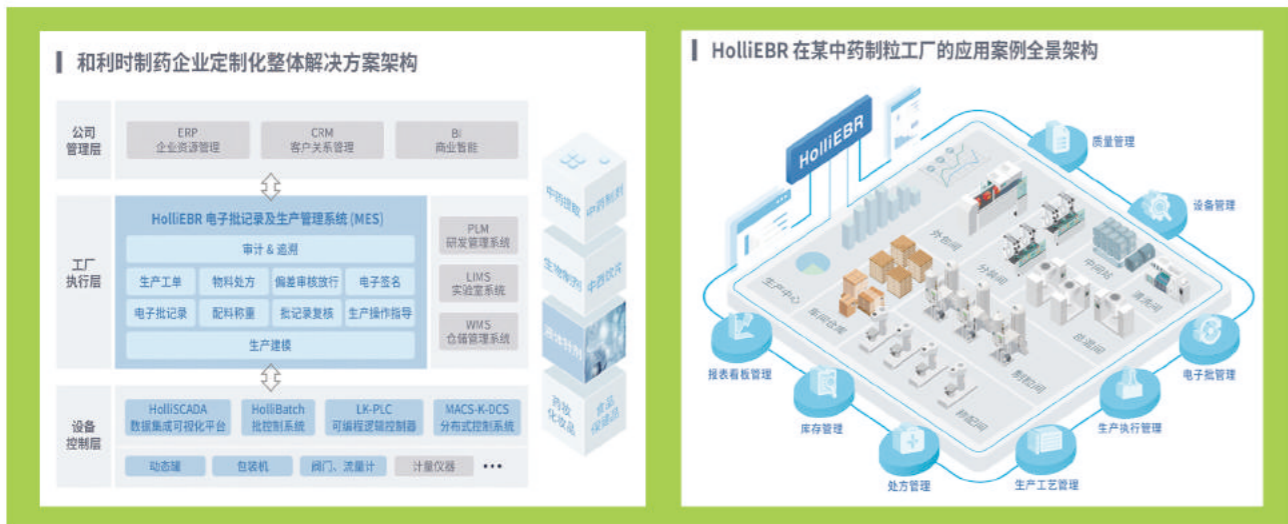
## PROJECT INTRODUCTION:

Without affecting the network topology, requiring no traffic splitting image, without deploying traffic probes, without installing agents on terminal devices, and no relying on the logs of other security devices, it solves the problems of difficult control of East-West attacks in large and complex environments, difficult control of internal behaviors of virtualization devices, and difficult monitoring of new attacks the vulnerability port is difficult to check in real time, there are blind areas in the communication log, and the threat source cannot be prioritized. It can trace the source of all threat events. The core technology of the project fills the gap of network threat detection technology in large-scale network scenarios.

# 面向混合制造行业的生产管理系统

MANUFACTURING EXECUTION SYSTEM FOR MIXED PRODUCTION INDUSTRY

- 宁波和利时智能科技有限公司
- NINGBO HOLLYSYS INTELLIGENT TECHNOLOGY CO., LTD



## 项目简介:

面向混合制造业的生产管理系统（HOL-LIEBR）是基于和利时工业互联网平台HOL-LICUBE的行业生态应用，适用于制药、食品饮料、特种化学品、快消品等行业，借助批次生产过程中的全流程中的全流程质量监控，可有效满足企业生产合规性和数据完整性要求，既降低合规成本又能提升生产效率。实现了生产全过程标签控制、设备数据实时采集、生产操作按工艺流程控制、电子标签和操作系统审计追踪等功能，解决了企业的生产批记录管理的痛点和难点问题。HOLLIEBR能有效满足各行业对生产批次的管理要求，特别是满足制药行业GMP的要求。不同于传统的套装软件，面向混合制造行业的生产管理系统是基于HOLLICUBE的云原生工业APP；同时，为了兼顾当前企业实际非云IT环境，面向混合制造行业的生产管理系统也支持本地部署。

## PROJECT INTRODUCTION:

Holliebr (production management system for hybrid manufacturing industry) is an industrial ecological application based on hollicube, Hollysys industrial Internet platform. It is suitable for pharmaceutical, food and beverage, special chemicals, FMCG and other industries. With the help of the whole process quality monitoring in the whole process of batch production, it can effectively meet the requirements of enterprise production compliance and data integrity, Reduce compliance costs and improve productivity. The functions of label control in the whole production process, real-time collection of equipment data, control of production operation according to process flow, electronic label and audit tracking of operating system are realized, and the pain points and difficult problems of production batch record management are solved. Holliebr can effectively meet the management requirements of various industries for production batches, especially the GMP requirements of the pharmaceutical industry. Different from the traditional suite software, the production management system for hybrid manufacturing industry is a cloud based industrial app based on hollicube; At the same time, in order to take into account the actual non cloud IT environment of the current enterprise, the production management system for hybrid manufacturing industry also supports local deployment.

# 南通海上风电5G智能化项目

INTELLIGENT PROJECT OF OFFSHORE WIND POWER WITH 5TH GENERATION COMMUNICATION TECHNOLOGIES IN NANTONG

- 中国移动通信集团江苏有限公司南通分公司 CHINA MOBILE GROUP JIANGSU CO., LTD. NANTONG BRANCH,
- 中移（上海）信息通信科技有限公司 CHINA MOBILE(SHANG HAI) ICT CO. LTD,
- 中国华能集团清洁能源技术研究院有限公司 HUANENG CLEAN ENERGY RESEARCH INSTITUTE,
- 中国移动通信集团有限公司 CHINA MOBILE GROUP JIANGSU CO. LTD,
- 华能国际电力江苏能源开发有限公司清洁能源分公司 HUANENG POWER INTERNATIONAL JIANGSU ENERGY DEVELOPMENT CO., LTD. CLEAN ENERGY BRANCH,
- 南通先进通信技术研究院有限公司 NANTONG RESEARCH INSTITUTE FOR ADVANCED COMMUNICATION TECHNOLOGIES.



## 项目简介:

海上风电是我国实现“双碳”目标的重要保障措施之一，为解决传统PLC控制机组智能化不够、通用性不高、互联化较弱的弊病，项目提出智能风电机组理念，并开发智能感知与主动监测系统，运用先进的5G通讯与切片技术，解决风电机组的通信问题，提升海上风电项目整体的信息化、数字化水平，实现对于风电机组外部环境、结构安全以及其他等现有层级无力关注的的数据采集，为海上风电安全平稳地运行打下坚实技术基础。通过部署5G微蜂窝基站，承载5G+机器人巡检、5G+AR辅助智能运维工作，满足附近海域海上检修人员及无人机、水下机器人等巡检设备的通信需求，5G网络全覆盖同时也解决了沿海区域网络信号不足的历史性难题。

## PROJECT INTRODUCTION:

Offshore wind power is one of the important guarantee measures to realize the objective of "double carbon". In order to solve the problems such as traditional PLC intelligent control unit is not intelligent, not general, not International enough. This project put forward the concept of intelligent wind turbines, and develop intelligense and active monitoring system. With 5th Generation Communication Technologies and advanced slicing technique, it has solved the problem of communication of wind turbines. To improve the overall informatization and digitization level of offshore wind power projects, realize data collection that the existing levels do not pay attention to the external environment, structural safety and other aspects of wind power units, and lay a solid technical foundation for the safe and stable operation of offshore wind power. Through the deployment of 5G microcellular base stations, 5G+ robot inspection and 5G+AR auxiliary intelligent operation and maintenance work, the communication needs of offshore maintenance personnel, unmanned aerial vehicles, underwater robots and other inspection equipment in the nearby sea can be met. The full coverage of 5G network also solves the historic problem of insufficient network signals in coastal areas.



# 湃道AI工业智慧安全管理解决方案

AI PRIME INDUSTRIAL INTELLIGENT SAFETY MANAGEMENT SOLUTION

- 上海湃道智能科技有限公司
- SHANGHAI AI PRIME CO.,LTD

## 项目简介:

湃道AI工业智慧安全管理解决方案是由上海湃道智能科技有限公司开发研制，专注于高危生产场景的研究，利用AI视觉、行业知识图谱、小样本算法、异常检测、连续动作识别等人工智能算法来主动监测、提前预警安全隐患及风险违规，解决行业智慧安全监管等问题，广泛应用在化工、矿业、石油、核能、钢铁、冶金、设备制造、建筑等领域。

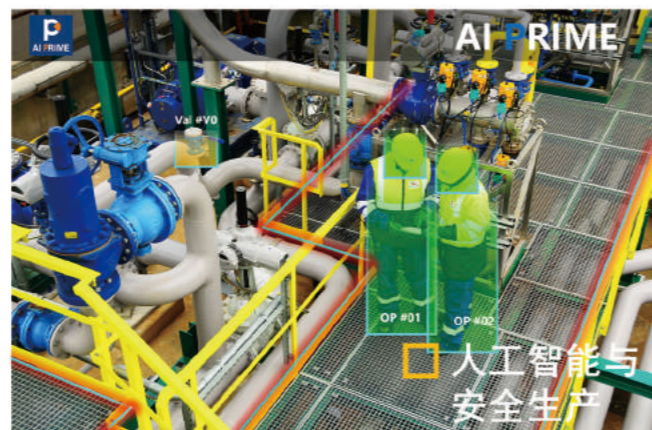
“湃道AI智慧安全监管解决方案”的建设是旨在响应国家、地方政府、企业等对人工智能等新技术、安全生产信息化建设的号召，充分利用计算机视觉技术，深入高危安全生产场景，与安全生产管理深度融合。围绕人、物、环境等安全要素，利用AI全面感知，主动发现，全天候对企业安全生产中的人员行为、设备异常状态、环境缺陷、违规作业流程主动监测安全隐患并实时预警；有效的提高了监控设备的利用效率和监管质量，全面提升企业风险感知及隐患排查能力，帮助企业和监管部门解决监管问题，高效推动质量变革、效率变革、动力变革。



## PROJECT INTRODUCTION:

AI Prime Industrial Intelligent Safety Management Solution is developed by SHANGHAI AI PRIME CO.,LTD, focuses on the research of high-risk production scenarios. This scheme takes advantage of AI vision, industry knowledge map, small sample algorithm, anomaly detection, continuous action recognition and other artificial intelligence algorithms to actively monitor potential safety hazards and risk violations. In the meantime, the problems of industry intelligent supervision are solved. The scheme is widely used in chemical industry, mining, petroleum, nuclear energy, iron and steel, metallurgy, equipment manufacturing, construction and other fields.

The construction of 'AI Prime Industrial Intelligent Safety Management Solution' aims to respond to the call of the government and enterprises for the construction of new technologies such as artificial intelligence and safety production informatization. Focused on safety factors such as people, things and environment, AI is used to fully perceive, actively discover, actively monitor and give real-time early warning of potential safety hazards for personnel behavior, equipment abnormal status, environmental defects and illegal operation processes in enterprise safety production all day long. It effectively improves the utilization efficiency and supervision quality of monitoring equipment, comprehensively improves the enterprise's risk perception, helps enterprises solve supervision problems.



# 瑞动安全精灵——能源互联网安全风险主动预警平台

RUIDONG SECURITY ELF ENERGY INTERNET SECURITY RISK ACTIVE WARNING PLATFORM

- 南瑞集团有限公司
- NARI GROUP CORPORATION

## 项目简介:

近年来，电网安全运行事故频发，例如2021年自然灾害造成的美国大停电，2019年网架薄弱造成的阿根廷大停电、2015年网络攻击造成的乌克兰大停电等事故。通过对能源互联网安全风险数据的梳理分析，对智能电网和电力数字网络安全运行有一定影响的事件约1600起/年和6.5万起/年。目前几乎没有预警手段，造成的损失极为惨重。

为改变在事故发生后仓促应对的被动管理模式，实现在事故发生前就及时预警并辅助用户解决隐患的主动管理模式，产品“瑞动安全精灵—能源互联网安全风险主动预警平台”应运而生。

瑞动安全精灵定位于国内首创的能源互联网安全风险主动预警整体解决方案，包括主动预警体系、互动控制台和可视化大屏三个部分。其中，主动预警体系通过对能源互联网的建模和对相关大数据的分析研判，对灾害做出预警，避免事故造成巨大损失；互动控制台和可视化大屏能够以直观、友好的互动形式帮助用户参与到问题分析、方案验证和成果展示中，辅助用户决策。同时，依托瑞动安全精灵建立了面向事前威胁感知预警，事中智能主动防御，事后全面研判处置的主动防御体系（APDR），实现了对安全风险的闭环处理。



## PROJECT INTRODUCTION:

In recent years, security accidents have been frequent in the power system, such as a power outage in the United States caused by natural disasters in 2021, great power outage caused by the weak network architecture in Argentina in 2019, great power outage in Ukraine caused by cyber attacks in Ukraine in 2015 and so on. By combing and analyzing the security risk data of the energy Internet, we can conclude that there are about 1,600 events / year and 65,000 events / year with a certain impact on the safe operation of the smart grid and power digital networks. There are few warning means, and the losses are extremely heavy.

In order to change the passive management mode of hasty response after the accident, and realize the active management mode of timely warning and assisting users to solve hidden dangers before the accident, the product RuiDong Security Elf Energy Internet Security Risk Active Warning Platform emerged at the historic moment.

RuiDong Security Elf is positioned as the first active early warning for the security risk of the energy Internet in China. The system consists of active early warning system, interactive console and large visual screen. In the active early warning system, disasters can be warned by modeling the energy Internet and the analysis of big data to avoid the huge losses caused by accidents. Interactive console and large visual screen can help users to participate in problem analysis, scheme verification and results presentation in an intuitive and friendly interactive form, to assist users in decision-making. At the same time, relying on RuiDong Security Elf, an active defense system has been established for the perception and early warning of prior threats, intelligent active defense in the event, and comprehensive investigation and disposal after the event. The defense system realizes a closed-loop processing of security risks.

# 无人机一站式智能巡检系统

UAV INTELLIGENT INSPECTION SYSTEM

- 西北工业大学
- NORTHWESTERN POLYTECHNICAL UNIVERSITY



## 项目简介:

随着国民经济对电力能源的需求愈加旺盛，电网的维护成为一大问题。团队将巡检技术与图像识别技术相结合，提出了有效评估电力设备健康状况的新思路。

## 传统痛点:

传统无人机巡检行业普遍存在无人机飞行自主性不强、避障飞行与可靠性不足、数据处理自动化程度低、巡检成果数字化管理分析不足等痛点，却暂时无法有效解决。

## 解决方案:

本项目以全面状态感知、高效信息处理及数据应用多样化满足行业需求，通过开发自主化巡检系统，形成了一套从设备管理、数据采集、数据处理、数据分析，到成果管理应用的整体解决方案。

## 技术特点:

**数据处理系统。**系统将同一电塔不同视角的巡检图片信息进行自动分类，可以有效解决海量图片信息分拣难的痛点。

**图像识别系统。**创新的图标比较工具可快速比较、标注和查看相同坐标区域内2D正射影像随时间的变化，可用于通道及塔周围隐患的分析。

**数据分类存储系统**实现了巡检数据的自动分类和管理，有效降低了传统巡检数据的管理成本，使巡检工作快速、准确。

## 商业合作:

团队已同集成商北海天际航空科技有限公司、江西省菲客航空科技有限公司签订战略合作协议，为南方电网、赣北公路、中科遥感提供无人机巡检技术解决方案，共实现97万元的销售订单。

## PROJECT INTRODUCTION:

As the national economy's demand for electric energy becomes more and more vigorous, the maintenance of the power grid has become a major problem. The team combined inspection technology with image recognition technology, and put forward a new idea to effectively evaluate the health of power equipment.

## Traditional defect:

In the traditional UAV inspection industry, there are common defects such as insufficient flight autonomy of UAVs, insufficient obstacle avoidance flight and reliability, low degree of automation of data processing, and insufficient digital management and analysis of inspection results, but they cannot be effectively solved for the time being.

## Solutions:

This project meets the needs of the industry with comprehensive status awareness, efficient information processing and diversified data applications. Through the development of an autonomous inspection system, a set of equipment management, data collection, data processing, data analysis, and results management applications have been formed.

## Technical features:

**Data processing system.** The system automatically classifies the inspection picture information of the same electric tower from different perspectives, which can effectively overcome defects of the difficulty in sorting massive picture information.

**Image recognition system.** The innovative icon comparison tool can quickly compare, mark and view the changes of 2D orthophotos in the same coordinate area over time, which can be used for the analysis of hidden dangers around the channel and the tower.

**The data classification storage system** realizes the automatic classification and management of the inspection data, effectively reduces the management cost of the traditional inspection data, and makes the inspection work fast and accurate.

## Business cooperation:

The team has signed a strategic cooperation agreement with the integrator Beihai Tianji Aviation Technology Co., Ltd. and Jiangxi Philip Aviation Technology Co., Ltd. to provide drone inspection technology solutions for China Southern Power Grid, Ganbei Highway, and Zhongke Remote Sensing, achieving a total of 970,000 Yuan sales order.

# 智联电驱-智能网联全线控 底盘分布式驱动电动汽车协同驾驶

INTELLIGENT DRIVE-BY-WIRE ELECTRIC VEHICLE - CONNECTED AND COOPERATIVE CONTROL OF DISTRIBUTED DRIVE ELECTRIC VEHICLE WITH DRIVE-BY-WIRE CHASSIS

- 北京理工大学BEIJING INSTITUTE OF TECHNOLOGY
- 电动车辆国家工程实验室NATIONAL ENGINEERING LABORATORY FOR ELECTRIC VEHICLES

## 项目简介:

本项目基于团队在分布式驱动电动汽车整车控制领域的技术积累，以车辆动力性、操作稳定性、安全性、高效性等控制目标，建立了一套经充分验证的分布式驱动电动汽车全线控底盘架构，可为各大主机厂及主流零部件供应商提供技术解决方案。此外，本团队参与研发的基于EX3平台的全线控分布式驱动电动汽车具备高性能网联通信能力，能够为车-车、车-路信息交互与车辆协同控制提供平台支撑。在硬件层面具备有量产能力的线控转向、线控制动与轮毂电机系统，配备了智能化高性能底盘域控制器。所设计的底盘域控制器基于英飞凌AURIX TC芯片平台，可为算法执行提供算力基础。多输入多输出接口提升了可拓展性和兼容性，具备5G通信与以太网通讯功能。在软件层面，开发了多目标底盘协调控制策略融合总线信息收发和车辆状态估计，完成协同上下电及模式判断。在此基础上形成了控制策略与算法集群，面向不同行驶场景工况，分别实现了冰雪路面独立驱动防滑、紧急换道横摆矢量控制、紧急刹车电液复合制动、常规巡航自适应模式切换、非铺装路面复杂环境脱困以及异常故障驱动系统容错。此外还支持基于V2X通信的多车协同驾驶功能。在服务层面，将搭载OTA远程智能升级并提供个性化模块定制服务。



## PROJECT INTRODUCTION:

Based on the technology accumulation in the field of distributed drive electric vehicle, our team established a reliable drive-by-wire chassis architecture of distributed drive electric vehicle. The chassis architecture can achieve multi control targets, e.g. dynamics, stability, safety and efficiency, which is ready-made solutions for each automobile enterprises and OEMs. The drive-by-wire distributed drive electric vehicle based on EX3 platform developed by our team has high performance network communication capability, which can act as the verification platform for vehicle-to-vehicle and vehicle-to-infrastructure information interaction and vehicle cooperative control. In the hardware domain, it has wire steering, wire control motor and hub motor system with mass product capability, equipped with intelligent high-performance chassis domain controller. The chassis domain controller is based on the Infineon Aurix TC275 chip, which can provide sufficient computational ability for algorithm execution. The multi-input multi-output interfaces improve the scalability and compatibility, enabling 5G and Ethernet communication. In the software domain, a multi-objective chassis coordination control strategy was developed integrating bus information and vehicle state estimation, to realize collaborative power-on and power-off and mode judgment. Control strategies and algorithms for different driving scenarios are developed, respectively for the ice and snow road, yaw moment vector control under emergency lane changing maneuver, electro-hydraulic compound brake, conventional adaptive cruise mode switches, control under unpaved road and fault tolerant control. Besides, multi-vehicle cooperative control is also achievable under V2X communication. In the service domain, the product will carry OTA remote intelligent upgrade and provide personalized module customization services.

# 中铁装备5G+智慧盾构项目

CREG 5G+ SMART SHIELD PROJECT

- 中铁工程装备集团有限公司 CHINA RAILWAY ENGINEERING EQUIPMENT GROUP CO.,LTD. (CREG)
- 中国移动通信集团郑州分公司 ZHENGZHOU BRANCH OF CHINA MOBILE COMMUNICATIONS GROUP CO.,LTD.



## 项目简介:

盾构机相对于传统施工方法具有自动化程度高、地面沉降少、施工速度快等优点，是隧道与地下工程施工的重大装备。然而受制于隧道内的恶劣环境，常规组网模式存在通信网络覆盖窄、成本高、不稳定、延迟高等短板，导致盾构机施工信息化程度低，施工方仅能通过手抄纸录、后期人工统计进行施工分析，无法实现多区域实时数据采集、分析、诊断与智能决策。

针对上述难题，中铁装备联合中国移动搭建“1+1+N”5G盾构实验室，即依托1张5G专网，1个智能盾构决策中心，5G+振动数据传输、5G+UWB人机定位、5G+智能穿戴终端、5G+远程诊断、5G+渣土小车防撞、5G+远程控制、5G+无人巡检系统等创新应用，破解远程控制延迟高、安全事故频发、设备维检难度大等问题，保障盾构机核心机位5G网络通畅，使得中铁装备远程故障诊断、掘进数据无线传输、人员设备定位、风险预警与智能决策等创新技术得以实现。一期投资约250万元，其中5G网络投资约50万元，开展5G应用与盾构装备施工的全方位融合，为盾构装备施工项目提供智慧决策、智能运维等服务，保障了盾构施工安全生产。于2021年4月在郑州南曹地铁站成功贯通世界首条5G技术支持下地铁隧道施工段项目。

## PROJECT INTRODUCTION:

The shield machine is a major equipment for tunnel and underground construction projects because it has the advantages of ensuring high automation level, generating less ground subsidence and shortening construction duration compared with the conventional construction equipment. However, restricted by adverse environment in the tunnel, the conventional networking mode has the shortcomings of narrow communication network coverage, high cost, instability and high latency, which results in the low informatization level of the construction by shield machine. The contractor analysis the construction performance manually only by paper records. As a result, data acquisition in multiple areas, analysis, diagnosis and intelligent decision-making can not be achieved on time.

Aimed at the above problems, China Railway Engineering Equipment Group Co., Ltd. (CREG) and China Mobile Communications Group Co., Ltd. (CMCC) jointly built a laboratory incorporating 5G network technology and shield machine under the model of “1+1+N”, which integrates one 5G private network, one intelligent decision-making center and innovative applications including 5G+vibration data transmission, 5G+UWB man-machine positioning, 5G+intelligent wearable terminal, 5G+remote diagnosis, 5G+muck trolley anticollision, 5G+remote control, 5G+unmanned patrol inspection system. This solves the problems such as high latency of remote control, frequent occurrence of safety accidents and difficulty in equipment maintenance and inspection, and provides the core components of shield machine with unobstructed 5G network, ensuring successful application of CREG's innovative technologies including remote failure diagnosis, wireless transmission of tunneling data, personnel and equipment positioning, risk warning and intelligent decision-making. The first-stage investment about 2,500,000.00 RMB including 500,000.00 RMB for 5G network. All round integration of 5G technology and shield machine was conducted, which provides intelligent decision-making and smart operation and maintenance for projects, ensuring safe tunneling of shield machines. In April 2021, the world's first subway tunnel with the support of 5G technology was successfully completed at Nancao Station in Zhengzhou.

# “精益化 自动化 信息化”促铁路货车制造技术升级

"LEAN AUTOMATIZATION INFORMATIZATION" PROMOTE THE UPGRADING OF RAILWAY FREIGHT CAR MANUFACTURING TECHNOLOGY

- 中车株洲车辆有限公司 CRRC ZHUZHOU ROLLING STOCK CO.,LTD

## 项目简介:

在《中国制造2025》规划中，“先进轨道交通装备”被列入10大重点领域之一。中国铁路货车制造行业面临劳动密集型、制造离散型、产品附加值和人均产值较低等问题，中车株洲车辆有限公司在认真总结行业特点，对标国际先进制造技术、数字化生产应用案例基础上，提出了“精益化+自动化+信息化”促铁路货车制造技术升级的智能制造方案。

该方案以管理精益化为指导思想，以产线自动化为支柱，以生产信息化为基础，对铁路货车制造技术进行升级，并在“三化”的基础上进行数字化升级，最终实现具有铁路货车行业特色的智能制造方案。

公司结合该方案在铁路货车行业进行了积极实践，建成了铁路货车轮轴节拍化自动流水生产线、转向架节拍化自动流水生产线、中小部件生产线等，实现了铁路货车低成本、节拍化、柔性化、精益化、自动化、信息化的制造样板线，取得了突出的经营成效，并将创新方案进一步在车体、底架等自动生产线转化应用。



## PROJECT INTRODUCTION:

In the Made in China 2025 plan, "advanced rail transit equipment" is listed as one of the ten key areas. China's railway freight car manufacturing industry faces problems such as labor-intensive, discrete manufacturing, low product added value and low per capita output value. CRRC Zhuzhou Rolling Stock Co., Ltd. puts forward an intelligent manufacturing scheme of "Lean + automation + informatization" to promote the upgrading of railway freight car manufacturing technology on the basis of conscientiously summarizing the characteristics of the industry and benchmarking international advanced manufacturing technology and digital production application cases.

With lean management as the guiding ideology, production line automatization as the pillar and production informatization as the basis, the scheme upgrades the railway freight car manufacturing technology, and carries out digital upgrading on the basis of "three-lization", so as to finally realize the intelligent manufacturing scheme with the characteristics of the railway freight car industry.

Combined with this scheme, the company has actively practiced in the railway freight car industry and built the railway freight car axle beat automatization flow production line, bogie beat automatization flow production line, small and medium-sized parts production line and realized the manufacturing model line of railway freight car with low cost, beat, flexibility, refinement, automatization and informatization, and achieved outstanding business results. The company also further transformed and applied the innovative scheme in automatization production lines such as car body and underframe.

# DIY食品智能3D打印生产线

DIY INTELLIGENT 3D PRINTING PRODUCTION LINE FOR FOOD

- 厦门大学嘉庚学院
- XIAMEN UNIVERSITY TAN KAH KEE COLLEGE

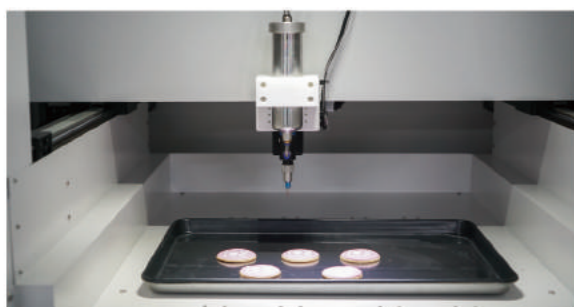
## 项目简介:

本团队致力于半流体食品生产线的研发，将食品3D打印技术应用在此研发上，运用图像处理和流体控制技术，以3D打印中的XYZ三轴运行的龙门架结构的堆积成型技术为基础形成DIY食品智能3D打印生产线。

操作者可使用团队自主研发的绘图软件（目前已获得软件受理通知书），可根据消费者或工厂的实际需求建模。启动机器后可将理想的DIY图案绘制在饼干表面上，后续通过新型挤出装置（此新型挤出装置已获得专利），便可在饼干上挤出配料以实现模型图案的生产加工。同时利用实时监控与检测，对产品的生产情况进行反馈和异常警告，实现智能化生产流水线。

绘图软件中产品图像识别功能的误差精度达到0.1毫米，精确的机器绘图显著提高了良品率。未来可通过团队研发的多工位生产线实现几乎零人工自动化流水生产。

如今这种即将面临升级转型，急需高新技术支持的产业，本产品能更好地替代人工生产力、减少人工成本、改善食品的加工工艺、减少了废品率。从根本上解决因人工技术带来的不确定性，保证加工质量，提高了生产效率。



## PROJECT INTRODUCTION:

The team is committed to developing semi-fluid food production lines, using image processing and fluid control technology, and using the stacking forming technology of the XYZ three-axis gantry structure in 3D printing. Build on these, creating a DIY Food Intelligent 3D printing line.

Operator can use team-developed graphics software (received Software Acceptance Notice) to model according to the actual needs of consumers or factories. The ideal DIY pattern can be drawn on biscuits surface after starting machines, by means of a patented device by the team, biscuits are extruded to realize of processing.

In the meantime, using real-time monitoring to generate feedback, to achieve intelligent production. The accuracy of the product image recognition function in the drawing software reaches 0.1 mm. The accuracy of the machine improves the rate of products. The team developed multi-station production lines to achieve almost zero manual automated flow production in the future.

Now this industry, which is about to be upgraded and transformed, is in urgent need of high-tech support. The product can better replace Labor productivity, reduce labor cost and reduce waste rate, improve food processing technology. Fundamentally solve the uncertainty caused by artificial technology, guaranteed the processing quality, and the production efficiency is improved.

# 大功率IGBT数字化驱动器

HIGH-POWER IGBT DIGITAL DRIVER

- 全球能源互联网研究院有限公司
- GLOBAL ENERGY INTERCONNECTION RESEARCH INSTITUTE CO., LTD



## 项目简介:

全球能源互联网研究院有限公司(简称联研院)是国家电网直属科研单位，中国船级社质量认证企业、北京市高新技术企业。围绕智能电网、清洁能源领域，构建了涵盖先进输电装备、大功率电力电子器件等6大创新方向。拥有国家级双创示范基地，建立了完备的技术成果转化平台，采用技术许可、作价投资等方式进行科技成果转化。

IGBT器件广泛应用于轨道交通、智能电网、新能源发电和各类家用电器等众多领域，其关键技术主要包括IGBT功率芯片和IGBT驱动器，一直被国外垄断。本项目研制出了拥有自主知识产权的IGBT智能驱动器DREAYER，该驱动器拥有门极电阻矩阵纳秒级动态切换、谐振软开关和恒定导通时间频率调制、动态有源钳位多级退饱和精准保护、多故障细化分类反馈编码四大核心技术。与国外同类产品相比，自主化驱动在安全裕度、开关损耗、抗电磁干扰能力和最快保护响应时间等多个技术指标上领先目前，该项目成果已应用于厦门、渝鄂和张北柔直、上海UPFC和舟山直流断路器等多个工程，数量达30000片。

## PROJECT INTRODUCTION:

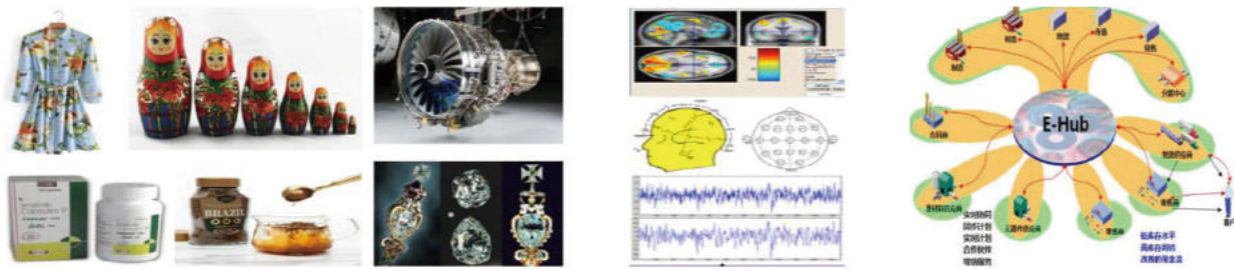
Global Energy Internet Research Institute Co., Ltd. is a scientific research unit directly under the State Grid, a quality certification enterprise of China Classification Society, and a high-tech enterprise in Beijing. Around the field of smart grid and clean energy, 6 major innovation directions including advanced power transmission equipment and high-power power electronic devices have been constructed, has a national-level entrepreneurial innovation practice base, and has established a complete platform for the transformation of technological achievements. It uses technology licensing and valuation investment to transform technological achievements.

IGBT devices are widely used in many fields such as rail transit, smart grid, new energy power generation and various household appliances. Its key technologies mainly include IGBT power chips and IGBT drivers, which have been monopolized by foreign countries. This project has developed the IGBT intelligent driver DREAYER with independent intellectual property rights. The driver has nanosecond dynamic switching of gate resistance matrix, resonant soft switching and constant on-time frequency modulation, dynamic active clamp multi-stage desaturation and precision protection, multi-fault detailed classification feedback coding. Compared with similar foreign products, the autonomous drive leads in multiple technical indicators such as safety margin, switching loss, anti-electromagnetic interference capability and fastest protection response time. At present, the project results have been applied to Xiamen, Yu'e and Zhangbei HVDC flexible system, Shanghai UPFC and Zhoushan DC circuit breaker and many other projects, the quantity reached 30,000 pieces.

# 大规模定制敏捷供应链的自主智能技术

AUTONOMOUS INTELLIGENT TECHNOLOGY FOR MASS CUSTOMIZATION OF AGILE SUPPLY CHAIN

- 复旦大学 FUDAN UNIVERSITY
- 上海对外经贸大学 SHANGHAI UNIVERSITY OF INTERNATIONAL BUSINESS AND ECONOMICS
- 上海长海医院 SHANGHAI CHANGHAI HOSPITAL
- 东华大学 DONGHUA UNIVERSITY
- 云南财经大学 YUNNAN UNIVERSITY OF FINANCE AND ECONOMICS
- 上海巨浪信息科技有限公司 SHANGHAI BILLOW INFORMATION AND TECHNOLOGY CO.,LTD



## 项目简介:

随着社会、经济的快速发展和消费者多样化需求的日益增长，大规模定制已成为众多生产制造领域发展的新模式。与此同时，产业链全球化分工与协作的不断深化，使得现代供应链的集成衔接、敏捷运行已成为迫切需求，对于作为全球重要制造基地的金砖国家提升其产品竞争能力、促进产业链的密切协同具有重大战略意义。在大规模定制敏捷供应链体系中，如何以终端客户为中心，实现供应链资源及相关服务的柔性整合、动态集成，并且低成本、高效能地处理大量个性化协商决策问题，已成为亟待解决的关键难题。

本项目研发了解决上述难题的自主智能技术：（1）设计了基于E-HUB平台的供应链体系新架构与网格模型，实现了供应链资源及服务的动态优化匹配与柔性集成；（2）采用移动智能AGENT技术，实现了从客户需求信息获取、订单处理、资源集成到个性化协商及决策的全程供应链敏捷运行；（3）研发了基于认知-情感神经机制的智能计算技术，实现了对客户心理与需求的自主计算和精准分析。本项目成果已取得了6项授权发明专利，获得了上海市科技进步二等奖、全国商业科技进步一等奖、吴文俊人工智能科技进步二等奖、中国产学研合作创新成果奖二等奖、中国国际高新技术成果交易会（高交会）优秀产品奖等多项科技成果奖励。

## PROJECT INTRODUCTION:

With the rapid development of social and economy as well as the increasing diversified demands of consumers, mass customization has become a new mode of developing trend in many manufacturing fields. At the same time, the deepening of global division and collaboration of industrial chains has also made the integrated and agile operation of modern supply chains an urgent need, which is of great strategic significance for BRICS countries, the important global manufacturing bases, to enhance their product competitiveness and promote the close collaboration of industrial chains. For a mass customization agile supply chain system, how to realize the flexible integration and dynamic integration of supply chain resources and related services focusing on the end customers, and deal with a large number of personalized negotiations and decision-making problems at low cost and high efficiency has become the key trouble to be solved urgently. Aiming at solving the above problems, this project developed following autonomous intelligent technologies: (1)Designed the new architecture and grid model of supply chain system based on E-HUB platform to realize the dynamic optimization matching and flexible integration of supply chain resources and services; (2)Adopted mobile intelligent agent technology to realize the agile operation of the whole supply chain, from customer demand information acquisition, order processing, resource integration to personalized negotiation and decision-making; (3)Developed the intelligent technology based on the neural mechanism of cognition and emotion to realize the autonomous computing and accurate analysis of customer psychology and demands. The achievements of this project have obtained 6 authorized invention patents, and won many prizes including Science and Technology Progress Prize of Shanghai Municipal Government(Second Prize), National Commercial Science and Technology Progress Prize(First Prize), Wu Wenjun Artificial Intelligence Science and Technology Progress Prize(Second Prize), Industry-University-Research Collaboration Innovation Achievement Prize(Second Prize), and the Excellent Product Prize of China International Hi-Tech Fair.

# 高端数控机床智能化热误差补偿系统

STUDIES ON THE SMART THERMAL ERROR COMPENSATION SYSTEM OF HIGH-LEVEL COMPUTER-NUMERICAL-CONTROL MACHINE TOOLS

- 三明学院机电工程学院 SCHOOL OF MECHANICAL AND ELECTRIC ENGINEERING, SAMING UNIVERSITY
- 机械科学研究总院海西（福建）分院有限公司 HAIXI (FUJIAN) INSTITUTE, CHINA ACADEMY OF MACHINERY SCIENCE & TECHNOLOGY, LTD.

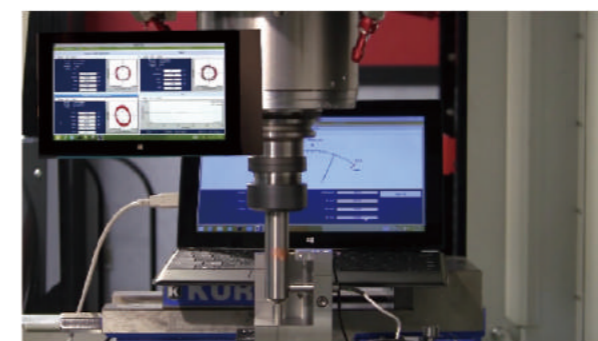


## PROJECT INTRODUCTION:

Due to the ever-increasing demands for the part-machining industries of cars and molds, it is urgent to develop high-level compound computer-numerical-control machine tools with high machining abilities (precision, effectiveness, and reliability). In the marketplace, the machining ability of our native-produced machine tools only rank about middle level in the world. Machine tools produced by Japan or European countries occupy most of marketplaces for high-precision parts manufacturing. This project develops a smart, digital, automatic, and adaptive thermal error compensation system as well as its key techniques. This innovative system can be combined with any native-produced five-axis or mill-turn machining centers, which may largely promote their machining precision and efficiency, reach the goal of high-level smart manufacture. Further, this invented system and its related techniques can be used as a platform to evolve more thermal compensation systems fitted for various machine tools and connect with other automation equipments, such as robots, or softwares, such as MEMS, to form a smart manufacturing factory. After applying our developed system to a machine tool, its machining accuracy may attain as high as within 10 micrometers.

## 项目简介:

因应汽车和模具等产业零件加工需求，具高端加工能力（精度、效能、可靠度）的复合数控机床，日益迫切；我国产制机床的加工能力仅达中端水平，市场均被欧日占据。本项目研发智能化且具三化（数字化、自动化、自适应化）的热误差补偿技术及系统，可结合应用于各式五轴复合国产数控机床，大幅提升性能，达智能化高端精密制造目标。技术成果可为一平台，衍生用于各型数控机床提高加工精度的热补系统，亦可互联多机、机器人与后台而成智能制造系统。应用本热误差补偿控制系统于数控机床，其位移修正可达耐久高精度10微米以内。



热误差补偿技术基本原理结构图

# 高空强磁爬壁清洁机器人

HIGH-ALTITUDE HIGH-INTENSITY MAGNETIC WALL-CLIMBING CLEANING ROBOT

- 福建工程学院FUJIAN UNIVERSITY OF TECHNOLOGY
- 福建福清核电有限公司FUJIAN FUQING NUCLEAR POWER CO. LTD

## 项目简介:

高空强磁爬壁机器人解决了高空、高温的复杂环境下清洁采用脚手架搭建平台模式，有效解决施工的安全问题，同时避开主线施工，显著的优化施工周期。项目组与福清核电有限公司合作开发，已成功研制出强磁爬壁机器人，它采用磁吸附式，履带式攀爬在“华龙一号”核电站的金属壁上，带有自动清扫、吸尘和远程无线控制功能。爬壁机器人还带有可配置吸尘器、前后左右四驱灵活转向，后台现场视频监控的能力。使用爬壁机器人代替人力完成核清洁工作，仅需考虑机器人坠落风险，完全避开工业安全风险，大大缩短了施工周期。本技术已申请了发明专利1项，实用新型专利2项，技术较为成熟，将该装置已经应用于福清核电厂核清洁工作，替代常规岛搭建脚手架+人工清洁的方式，实现缩减核清洁工期、优化主线工期，降低管理成本，项目组正积极在工业其他领域，如风电塔筒运维、光伏面板清洁、船舶侧壁除锈、飞机机翼检测、管道无损探伤、楼宇外墙清洗等功能服务。



## PROJECT INTRODUCTION:

The high-altitude high-intensity magnetic wall-climbing robot solves the mode of using scaffolding to build a platform for cleaning in the complex environment of high altitude and high temperature, effectively solves the safety problem of construction, avoids the main line construction, and significantly optimizes the construction period. In cooperation with Fuqing Nuclear Power Co., LTD., the project team has successfully developed a high-intensity magnetic wall-climbing robot, which uses magnetic adsorption type and crawler type to climb on the metal wall of "Hualong No.1" nuclear power plant, with automatic cleaning, vacuuming and remote wireless control functions. The wall-climbing robot is also equipped with a vacuum cleaner, front, rear, left and right four-wheel steering, and background live video surveillance capabilities. The use of wall-climbing robot to complete nuclear cleaning work instead of human, only need to consider the robot fall risk, completely avoid industrial safety risk, greatly shorten the construction period. One item of this technology has been applied for a patent for invention, two utility model patents, the device has been used in Fujian Fuqing Nuclear Power Co. LTD, replace erection of scaffolding and artificial clean way, implement clean cut nuclear period, optimization of the main line period, reduce the management cost and the project team is actively in other industrial areas, such as wind power tower cylinder operation and maintenance, photovoltaic panel cleaning, ship side wall rust removal, aircraft wing testing, pipe nondestructive testing, building external wall cleaning and other functional services.

# 国际海事组织EEXI和CII框架下，综合利用新一代信息技术的智能船舶建造、碳排放核算、监控与交易系统

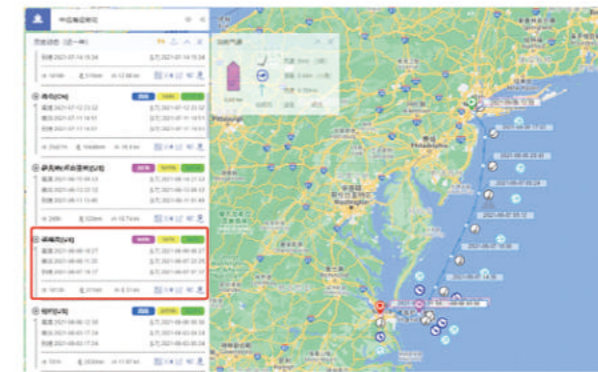
UNDER THE EEXI AND CII STANDARDS OF THE IMO, INTELLIGENT SHIP CONSTRUCTION, CARBON EMISSION ACCOUNTING & MONITORING AND TRADING SYSTEM WITH NEW GENERATION INFORMATION TECHNOLOGY

- 中远海运科技股份有限公司COSCO SHIPPING TECHNOLOGY CO.,LTD

## 项目简介:

“碳达峰、碳中和”已成为国家战略，IMO（国际海事组织）即将针对船舶行业低碳化能效实施船舶能效指数（EEXI）及碳排放强度指数（CII）考核。这项措施将对现有远洋航行船舶降低排放，提升管理水平产生重大影响。

中远海运科技作为中远海运集团下属的唯一科技与信息化平台，专门设立研发创新中心负责新一代信息技术在行业内的应用。中心核心产品包括：智能船舶建造及数据中心，航运数据中台，航运供应链区块链存证平台等。本作品以上述三个核心产品为核心子系统，综合运用物联网、大数据、云计算和区块链等新一代信息技术，按照IMO的管理和考核要求，实现船舶碳排放核算、监控功能，并对交易功能进行展望。



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## PROJECT INTRODUCTION:

"Emission peak and Carbon neutrality" have become Chinese national strategy, IMO (International Maritime Organization) proposed the Energy Efficiency Existing Ship Index (EEXI) and carbon intensity indicator (CII) by for low-carbon energy efficiency of the shipping and shipbuilding industry.

COSCO Shipping Technology is the only technology and information platform subordinate to COSCO Shipping Group, a special R & D and innovation center is set up to be responsible for the application with the new generation of information technology in shipping industry, core products include intelligent ship construction and data center, shipping data center, shipping supply chain blockchain platform, etc.

The three core products mentioned above are the core subsystems of this work, which combine the new generation of information technologies such as Internet of things(IoT), big data, IaaS and blockchain, aiming to realize ship carbon emission accounting and monitoring based on IMO's EEXI & CII standards, and laying the foundation for future carbon emissions trading.



# 红狮水泥5G智慧水泥项目

HONGSI 5G+ SMART CEMENT PROJECT

- 中国移动通信集团浙江有限公司
- CHINA MOBILE COMMUNICATIONS GROUP ZHEJIANG CO., LTD.



## 项目简介:

作为新型基础设施的重要组成部分，5G和工业互联网的融合创新发展，将赋能工业行业数字化转型，促进经济高质量发展。我国是水泥生产和消费大国，水泥产量占世界水泥总产量的60%左右。当前水泥行业正处于新旧动能更迭的关键阶段，自动化、智能化和信息化水平参差不齐，亟需提高生产制造水平和效能，实现水泥行业“调结构、降成本、补短板、增效益”高质量发展。“5G 工业互联网”融合了云计算、大数据、人工智能等技术，将构建满足水泥行业业务需求的大带宽、低时延、大连接的无线网络基础设施，催生融合创新应用，为水泥行业高质量发展增添新动能，带来发展新机遇。利用“5G 工业互联网”技术赋能水泥行业各大业务场景，提质增效显著，为业界树立一批内网改造建设、融合应用创新的标杆样板工程。

## PROJECT INTRODUCTION:

As an important part of new infrastructure, the convergence and innovation of 5G and industrial Internet will enable digital transformation of industrial industries and promote high-quality economic development. China is a big country producing and consuming cement, and the cement output accounts for about 60% of the total cement output in the world. At present, the cement industry is in the key stage of changing the old and new momentum, and the level of automation, intelligence and informationization is uneven. Therefore, it is urgent to improve the production and manufacturing level and efficiency to realize the high-quality development of the cement industry, such as adjusting the structure, reducing the cost, making up the weaknesses, and increasing the benefits.

The "5G+Industrial Internet" integrates technologies such as cloud computing, big data, and artificial intelligence. It will build a wireless network infrastructure that features large bandwidth, low latency, and large connections to meet the service development requirements of the cement industry, promote convergent innovative applications, and add new impetus to the high-quality development of the cement industry. Bringing new opportunities for development. The "5G + Industrial Internet" technology is used to enable major service scenarios in the cement industry, significantly improving quality and efficiency, and setting up a number of benchmark projects for intranet reconstruction and integrated application innovation in the industry.



# 基于5G技术的铜精矿仓配料系统智能化改造研究项目

CLOUD INTELLIGENT CONTROL SYSTEM OF FACTORY POWER WORKSHOP

- 中国移动通信集团甘肃有限公司CHINA MOBILE GROUP GANSU CO., LTD
- 金川集团股份有限公司JINCHUAN GROUP CO., LTD

## 项目简介:

本项目是一个集5G、光、机、电等现代技术的综合性工程，采用SA独立组网模式建设，通过在精矿仓周边及车间内部部署5G基站，实现了车间内天车及卸料小车作业路线5G无线信号无缝覆盖；通过5G工业CPE将采集到的视频、三维扫描结果、位移等信息，由5G网络回传至集控室服务器进行数据分析，服务器根据现场数据、来料信息、配料信息综合进行判断，制定天车及卸料小车运行规划，下达运行操控指令，传回至天车及卸料小车，由5G工业CPE连接的PLC控制器负责执行响应作业动作。同时在精矿仓配置了2台10吨智能化桥式起重机和其他配套设施及配套专用软件，通过搭建无人桥式起重机智能配料作业系统，实现了铜精矿配料仓的全无人化的物料入库、混料、上料、散料的高效智能作业，既可通过智能控制软件和智能识别系统进行全自动智能化作业，也可由操作人员通过集控室操作台手柄按钮等对桥式起重机进行远程操控及现场人员手动操控，而且系统能自动生成库存管理的日报、月报。项目建成后，在实现作业现场无人化、智能化的同时，也将员工从恶劣的环境中解放出来，实现了传统工业企业通过数字化手段转型升级，工作效率提高20%，总体成本降低15%，提高了企业自动化程度，实现由机器代替人工。本项目在国内同行业具有极强推广复制意义。

## PROJECT INTRODUCTION:

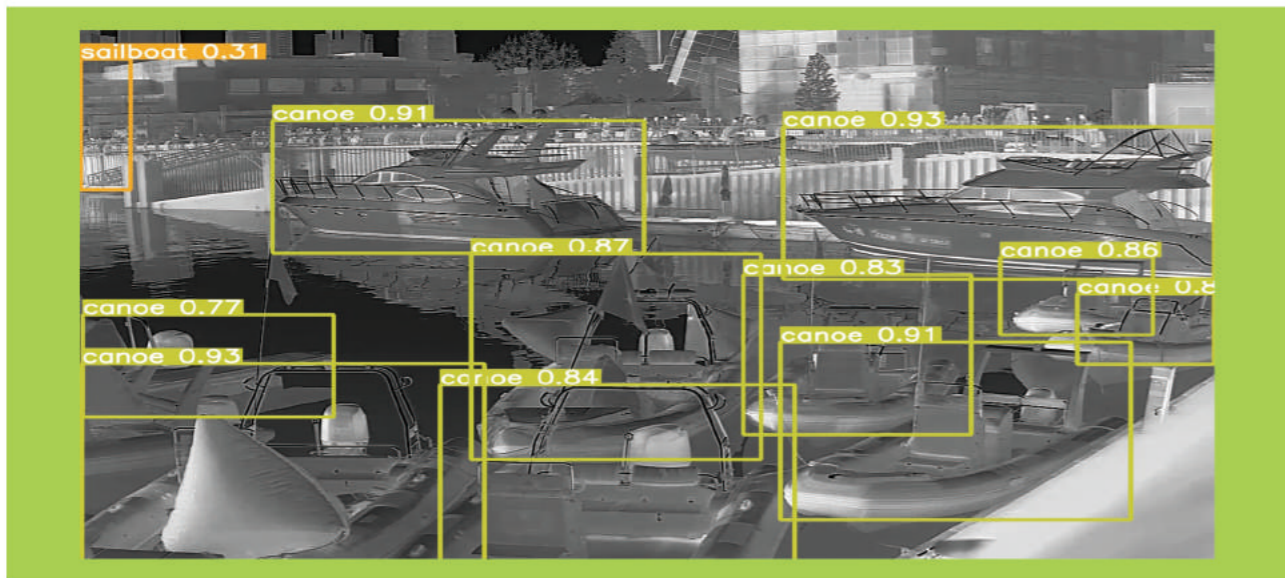
This project is a comprehensive project with modern technology such as 5G, light, machine and electricity. It is built with SA independent network mode. By deploying 5G base station around the ore concentrate warehouse and inside the workshop, the seamless coverage of 5G wireless signal on the working route of overhead crane and unloading trolley in the workshop is realized, and the video, 3d scanning results, displacement and other information collected by 5G industrial CPE are obtained, the 5g network is sent back to the server in the central control room for data analysis. The server makes judgments based on the field data, incoming material information and ingredient information, makes the operation plan for the overhead crane and the unloading trolley, and issues the operation and Control Command, back to the crane and discharge car, 5g industrial CPE connected to the PLC controller is responsible for the response operation. At the same time, two 10-ton intelligent overhead traveling cranes and other supporting facilities and supporting special software have been installed in the concentrate bin, and by setting up an intelligent batching operation system for unmanned overhead traveling cranes, the fully unmanned intelligent operation of material warehousing, mixing, feeding and spreading materials in copper concentrate batching bin has been realized. The full automatic intelligent operation can be carried out through intelligent control software and intelligent identification system, it can also be remotely operated by operator and manually operated by on-the-spot personnel through the control room operating console handle button, and the system can automatically generate daily and monthly inventory management reports. After the completion of the project, while realizing the unmanned and intelligent job site, it also liberated the employees from the harsh environment, realizing the transformation and upgrading of traditional industrial enterprises through digital means, and increasing the work efficiency by 20%, overall cost reduction of 15%, increased enterprise automation degree, to achieve the machine instead of manual. This project has the extremely strong promotion and replication significance in the domestic same profession.



# 基于深度学习的红外舰船图像目标感知技术与应用

TECHNOLOGY AND APPLICATION OF INFRARED SHIP IMAGE TARGET PERCEPTION BASED ON DEEP LEARNING

- 哈尔滨工程大学
- HARBIN ENGINEERING UNIVERSITY



## 项目简介:

本作品主要针对海洋舰船红外图像进行目标检测。在创新方面，主要表现在数据以及模型上。在数据方面，针对数据大小不一、目标分布各异以及各类数据量偏差较大，我们对数据做了增强以及扩充处理。在模型方面，针对图像特征难以抓取以及模型训练缓慢，我们采取将模型融合注意力机制和采用先验知识训练模型的措施。模型具有较强的普适性，将模型迁移到陆上红外图片，模型不需经过大的修改，在保证实时性的前提下检测效果非常理想。该模型不仅可以用在船舶的智能航行和船舶的辅助驾驶上，还可以利用到汽车的夜间辅助驾驶，联合海上救援，甚至在其他无人操作的设备上都可应用，具有广泛的市场前景。最重要的是在保证实时性的前提下，该模型的识别效果非常理想。

## PROJECT INTRODUCTION:

This work mainly aims at object detection of infrared images of marine ships. In terms of innovation, it is mainly reflected in data and models. In terms of data, we have enhanced and expanded the data for different data sizes, different target distributions and large deviations in the amount of data of various categories. In the aspect of model, in view of the difficulty in capturing image features and the slow speed of model training, we take the measures of integrating the model with attention mechanism and training the model with a priori knowledge. The model has strong universality. We migrate the model to land infrared images. The model does not need to be greatly modified. On the premise of ensuring real-time performance, the detection effect is very ideal. The model can be used not only in the intelligent navigation and auxiliary driving of ships, but also in the night auxiliary driving of cars, joint maritime rescue, and even in other unmanned equipment. It has a wide market prospect. The most important thing is that on the premise of ensuring real-time performance, the recognition effect of our model is very ideal. without major modification, and the model has real-time performance.

# 面向复杂结构零部件的增减材复合制造工艺及其装备研发

RESEARCH ON THE ADDITIVE-SUBTRACTIVE HYBRID MANUFACTURING PROCESS AND EQUIPMENT FOR THE COMPLEX STRUCTURE PARTS.

- 浙江大学高端装备研究院 INSTITUTE OF ADVANCED MACHINES ZHEJIANG UNIVERSITY
- 浙江大学机械工程学院 SCHOOL OF MECHANICAL ENGINEERING, ZHEJIANG UNIVERSITY

## 项目简介:

增材制造技术在实现内部复杂结构制造方面具有传统切削加工技术无法比拟的优势。然而，当前几种成熟的增材制造技术在成形精度和表面粗糙度上都存在先天性缺陷，短期内无法达到与减材制造技术相当的加工精度。本项目研制的基于变姿态平台的增减材复合制造技术，能通过独有的复杂曲面轨迹规划技术解决现阶段国内悬臂类构件的成形难题，无需支撑结构搭建，避免材料浪费，在悬臂类构件的一体化成形方面具有独特的优势。

本项目成果为基于堆焊/铣削的变姿态增减材复合制造技术及装备，主要用于复杂几何结构零件无毛坯一体化成形制造，可满足大中型复杂定制零件的快速低成本成形，以及对内部复杂结构零件的快速精确一体化制造。

增减材复合制造装备的研发和产业化可解决航空航天、军工、医疗等关键领域对特殊零部件的制造瓶颈，提升核心技术自主化率。同时，缓解科研机构和研发型企业在制造环节的工艺技术和装备束缚，解放科研和设计的创造性并带动传统机床企业开辟复合制造装备生产路径。

本项目初期用户以科研机构及大型研发企业为主，预计成果转化升级后5-10年内，可对定制化复杂零件的需求越来越大的航空航天、骨科医疗、能源电力等行业提供50-100台套增减材复合制造装备和配套技术支持。



## PROJECT INTRODUCTION:

Additive manufacturing has advantages on realizing the machining of the parts which have complex inner structures, especially compared to the traditional subtractive process. However, several mature AM technologies all have drawbacks on machining precision and surface roughness, which can't reach the same level as the subtractive process. Therefore, this project proposes an additive-subtractive hybrid process based on the posture-changing platform. The hybrid process aims to solve the problem of the cantilever structure parts forming by using the proposed toolpath planning method without the support structure, which can save the material.

This project develops a set of equipment to realize complex structure parts manufacturing directly without stock generation, which is appropriate to the parts with complex inner structure. This equipment puts a low cost and high efficiency and precision strategy to generate these parts.

The research and development of hybrid equipment provides a way to break through bottleneck of the special parts used in the aerospace, military, and healthcare industry, especially improving these parts' ratio of localization. Meanwhile, it also plays an important role in promoting the creation in design and scientific research and making the traditional machine tool companies take part in hybrid manufacturing equipment development.

The early users of the hybrid equipment are mainly large research institutes of enterprises or universities. We predict that our project can offer 50 to 100 sets of equipment to market in five to ten years.

# 面向全球绿色智能制造的自进化式工艺参数数据库

SELF-EVOLVING PROCESS PARAMETER DATABASE FOR GLOBAL GREEN INTELLIGENT MANUFACTURING

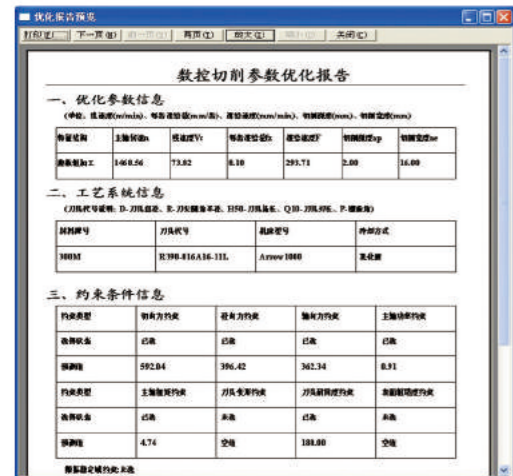
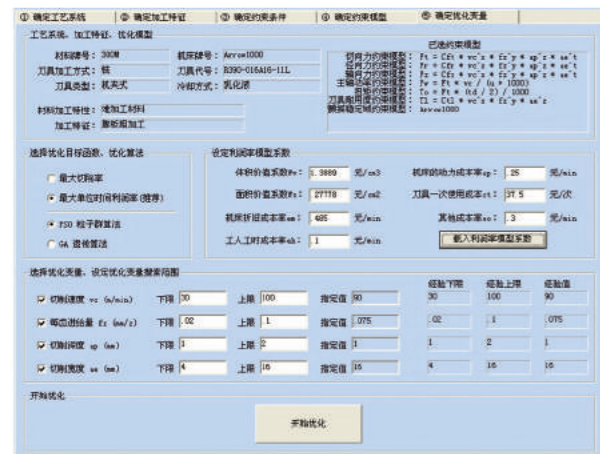
●北京航空航天大学BEIHANG UNIVERSITY

## 项目简介:

本项目拟建立一个工艺数据服务平台和工艺数据测试采集平台(两套软件),前者用于对企业提供工艺数据咨询、优化服务,后者用于从高校、企业、研究所获得基础工艺数据和自行生成工艺基础数据(优化模型中的各种底层数据、中间数据)。

本项目拟建立独立的制造工艺数据储存与服务计算机系统,接入互联网,实现与企业互联网连接。建立3-5个示范应用点和30-50数据采集点,实现工艺数据的大量收集和整理。前期招聘30-50人开展工艺实验和数据收集、收据咨询服务。总投资2亿元人民币。

本项目目前由北航和昌飞合作开展第一期自进化式工艺参数数据库应用系统建设,拟实现8000条工艺数据的收集和10种零件加工中获得初步应用。



## PROJECT INTRODUCTION:

This project intends to establish a process data service platform and a process data test collection platform (two sets of software). The former is used to provide process data consulting and optimization services to enterprises, and the latter is used to obtain basic process data and data from universities, enterprises, and research institutes. Generate process basic data (optimize the various underlying data and intermediate data in the model) by itself.

This project intends to establish an independent manufacturing process data storage and service computer system, which is connected to the Internet to realize the connection with the corporate Internet. Establish 3-5 demonstration application points and 30-50 data collection points to realize the massive collection and sorting of process data. Recruit 30-50 people in the early stage to carry out process experiments, data collection, and receipt consulting services. The total investment is about 200 million yuan.

In this project, Beihang and Changfei are currently cooperating to carry out the first phase of self-evolving process parameter database application system construction. It is planned to realize the collection of 8,000 process data and obtain preliminary applications in the processing of 10 parts.



# 年产1500吨高档羊绒纱线制造智能工厂

INTELLIGENT FACTORY WITH AN ANNUAL OUTPUT OF 1500 TONS OF HIGH-GRADE CASHMERE YARN

●康赛妮集团有限公司  
●CONSINEE GROUP



## 项目简介:

康赛妮集团有限公司与浙江理工大学合作投资设备和软件系统约2.6亿,建设“年产1500吨高档羊绒纱线制造智能工厂”,共同开发研制了羊绒粗纺纱线生产设备间的物流系统,建立了首条高端羊绒粗纺纱线全流程连续化智能生产线;研究了基于OPC UA规范的毛纺设备信息化模型构建技术,设计了信息模型,开发了羊绒粗纺生产设备的信息互联互通系统;研制了智能化毛纺生产线,完成了毛纺智能生产线的建设。研发了智能物流系统,可实现实时按需自动配送,成品自动运输。研发了智能仓储系统,实现了毛纺产品的自动入库、自动发货。开发了信息软件系统,建立了PLM、ERP、MES、SCADA、WMS等软件系统。设计了信息互联互通及工业互联网系统,实现设计、工艺、生产、和资源管理各环节的信息共享与传递,实现设计与生产协同作业管理。建设了看板及集控中心,通过对采集数据的处理,采用不同的展示形式,对关注的数据类型和各类统计图表进行大屏展示。“高端羊绒纱线制造智能工厂”颠覆了传统毛纺企业自动化和信息化技术落后的面貌,创立“纺纱单元化、工厂黑灯化、物流全自动,数据互联互通,排产高智能、质量可追溯”的创新生产模式,实现了羊绒纱线的高端制造。

## PROJECT INTRODUCTION:

CONSINEE GROUP with Zhejiang Sci-Tech University to invest about 260 million in equipment and software system to build an "intelligent factory for manufacturing high-grade cashmere yarn with an annual output of 1500 tons", jointly developed the logistics system between cashmere woolen yarn production equipment, and established the first full process continuous intelligent production line of high-end cashmere woolen yarn; The information model construction technology of wool spinning equipment based on OPC UA specification is studied, the information model is designed, and the information interconnection system of cashmere woolen production equipment is developed; The MES system and ERP system suitable for cashmere woolen yarn production are developed, and the intelligent production and management of cashmere yarn manufacturing are realized. The intelligent wool spinning production line has been developed and the construction of wool spinning intelligent production line has been completed. Developed an intelligent logistics system, which can realize real-time on-demand automatic distribution and automatic transportation of finished products. The intelligent storage system is developed to realize the automatic warehousing and automatic delivery of wool products. The information software system is developed, and PLM, ERP, MES, SCADA, WMS and other software systems are established. The information interconnection and industrial Internet system is designed to realize the information sharing and transmission of design, process, production and resource management, and realize the collaborative operation management of design and production. Kanban and centralized control center are built. Through the processing of collected data, different display forms are adopted to display the concerned data types and various statistical charts on a large screen. "Intelligent factory for high-end cashmere yarn manufacturing" subverts the backward appearance of automation and information technology of traditional wool spinning enterprises, and establishes an innovative production mode of "spinning unit, factory black light, fully automatic logistics, interconnected data, high intelligence in production scheduling and traceable quality", realizing the high-end manufacturing of cashmere yarn.

# 全流程智能化棉纺成套装备及系统

WHOLE PROCESS INTELLIGENT COTTON SPINNING EQUIPMENT AND SYSTEM

- 经纬纺织机械股份有限公司
- JINGWEI TEXTILE MACHINERY CO., LTD



## 项目简介:

本项目是纺织工业“十三五”规划六大智能示范线之一，是经纬纺织机械股份有限公司建设的10万锭智能化纺织新模式应用项目，曾获2019年中国纺织工业联合会科学技术奖二等奖、2020年国有企业数字化转型百大典型案例等荣誉。

本项目以层次化、模块化、平台化的规划思路为指导，按照设备层、传感层、网络层、物流层、信息层5个建设层次并行协同实施。重点推动智能装备、智能物流、智能管理系统等能力建设，形成了具有“纱线产品实时在线智能检测与分析、智能仓储与服务化调度协同运行”等特征的纺纱智能制造系统。

本项目共获得知识产权56项，其中发明专利21项、实用新型专利18项、软著13项、论文3篇。经院士专家鉴定评价认为项目成果具有自主创新性，多项技术填补了国内空白，整体技术达到国际领先水平。近三年，累计为国内广大纺纱企业提供了约70万锭智能化棉纺成套示范线建设服务，直接经济效益14.67亿元，社会效益显著。

## PROJECT INTRODUCTION:

The project is one of the six intelligent demonstration lines planned in the 13th five year plan of the textile industry. It is a 100000 spindles intelligent textile new mode application project constructed by Jingwei Textile Machinery Co., Ltd. The project has won the second prize of the science and technology award of China National Textile And Apparel Council in 2019 and the top 100 typical cases of digital transformation of state-owned enterprises in 2020.

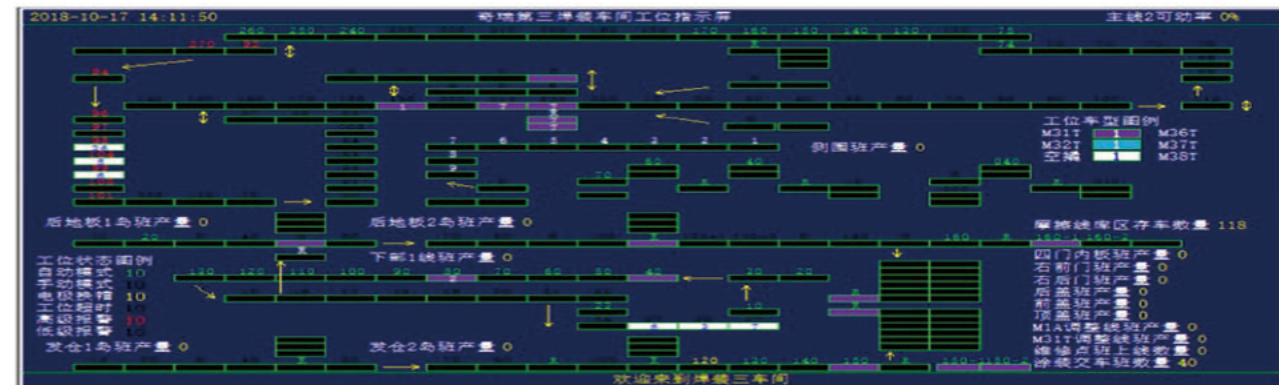
This project is guided by the hierarchical, modular, and platform-based planning ideas, and is implemented in parallel and coordinated according to the five construction levels of equipment layer, sensor layer, network layer, logistics layer and information layer. Focus on promoting the capacity building of intelligent equipment, intelligent logistics, intelligent management system, etc., forming a spinning intelligent manufacturing system with the characteristics of "real-time online intelligent detection and analysis of yarn products, intelligent warehousing and service-based scheduling" and other characteristics.

This project has obtained 56 intellectual property rights, including 21 invention patents, 18 utility model patents, 13 soft papers, and 3 papers. Appraisal and evaluation by academicians and experts Identified that the project results have independent innovation, a number of technologies have filled the domestic gap, and the overall technology has reached the international leading level. In the past three years, it has provided a total of about 700,000 spindles of intelligent cotton spinning demonstration line construction services for the majority of domestic spinning enterprises, with direct economic benefits of 1.467 billion yuan and significant social benefits.

# 设备数据分析系统技术研究

RESEARCH ON EQUIPMENT DATA ANALYSIS SYSTEM

- 奇瑞汽车股份有限公司
- CHERY AUTOMOBILE CO.,LTD



## 项目简介:

该系统在整个生产周期中可以进行全面的设备数据管理分析，能够实现产线设备信息实时监控，提前处理问题，数据透明化，使生产维护获得更多有效的数据。系统的建立，在现有PLC调试同时，将标准底层数据库导入，无需额外增加调试工时。实现从设备故障、设备频次、TOP问题管理及故障分析上，实现数据管理的标准化和实时化，快速进行维修，提升设备开动率及管理效率。

设备数据系统智能终端的开发，实现了设备数据在网页端一站式查询获取，该智能终端在公司的首次应用，在行业内具有很好的示范作用，取得了显著的经济和社会效益。可以形成以下创新：

- (1) 标准化：形成标准设备基础信息收集表
- (2) 通用化：标准数据分析表
- (3) 信息化：形成无纸化信息记录
- (4) 智能化：TOP问题及瓶颈点故障提取及分析



## PROJECT INTRODUCTION:

The system can conduct comprehensive equipment data management and analysis throughout the production cycle. It can realize real-time monitoring of production line equipment information, deal with problems in advance, and make data transparent, so that more effective data can be obtained for production and maintenance. The establishment of the system, in the existing PLC debugging at the same time, the standard underlying database import, without additional debugging time. The standardization and real-time of data management are realized from the aspects of equipment failure, equipment frequency, TOP problem management and fault analysis, and rapid maintenance is carried out to improve the equipment start-up rate and management efficiency. The development of intelligent terminal of equipment data system realizes the one-stop query and acquisition of equipment data on the web page. The first application of the intelligent terminal in the company has a good demonstration effect in the industry, and has achieved remarkable economic and social benefits. The following innovations can be formed:

- (1) Standardization: forming the basic information collection table of standard equipment
- (2) Generalization: standard data analysis table
- (3) Informatization: forming paperless information record
- (4) Intelligent: TOP problem and bottleneck point fault extraction and analysis

# 时速160公里动力集中式智能化货运动车组

160 KM/H POWER-CONCENTRATED INTELLIGENT FREIGHT EMUS

- 中车山东机车车辆有限公司
- CRRC SHANDONG CO., LTD

## 项目简介:

为落实国家战略和市场客户需求，中车山东机车车辆有限公司采用既有双端牵引动力车和既有拖车的转向架、钩缓、制动、电气信号信息系统等，研发了2动16拖时速160公里动力集中式智能化货运动车组。车辆最高运行速度160KM/H，单车装载货物容积达200M3，载重达30T。

时速160公里动力集中式智能化货运动车组应用客运动车组管理模式；采用大开度侧墙，搭载可折叠模块化货箱，自带太阳能绿色能源，利用RFID技术实现列货智能配装，可装载普通快运及冷链类货物；配置智能监控系统，实时监测列货信息；通过模块化货箱，实现货物的快速转运；配套共享配货小车，实现货物的快速、准确配送。该动车组有安全可靠、技术成熟、管理成熟、先进领先、经济性好、检修成熟六大技术特点；高时效、多用途、智能化、机械化四大功能特点。

时速160公里动力集中式智能化货运动车组用于一、二级铁路货场之间白货的智能化运输，实现货物“快装、快运、快卸”，提升铁路货运产品在白货领域的市场竞争力。此项目的研发与应用必将带动铁路货运装备升级，优化铁路货运产品结构。



## PROJECT INTRODUCTION:

To implement the national strategy and meet the demands of market and customer, CRRC Shandong Co., Ltd. has developed a 2-traction-16-trailer, The 160 km/h power- concentrated intelligent freight EMUs. The wagon is composed of bogies, coupler and buffers, brake system and electrical signal information system. The freight EMUs adopt existing double-end traction power EMU bogies and existing trailer bogies. The maximum operation speed of the freight EMUs is 160km/h, the capacity of the single vehicle is 200m3 and the load capability is 30t.

The 160 km/h power-concentrated intelligent freight EMUs apply management mode of passenger EMUs, adopt wide opening side walls, carries foldable modular cargo boxes. The freight EMUs come with solar green energy, adopt RFID technology to achieve intelligent distribution of column goods, can be loaded with ordinary express and cold and fresh goods as well. By configuring the intelligent monitoring system, the information of the listed goods can be monitored in real time; by using the modular cargo box, the rapid transfer of goods can be realized; by supporting the shared distribution trolley, the rapid and accurate distribution of goods can be realized.

The freight EMUs has six technical features: safety and reliability, mature technology, mature management, advanced leadership, good economy and mature maintenance, and four functional features: high efficiency, multi-purpose, intelligence and mechanization.

The 160km/h power-concentrated intelligent freight EMUs is used for the intelligent transportation of white goods between first and second class railway yards to achieve "fast loading, fast transport and fast unloading" and to enhance the market competitiveness of railway freight transportation in the market of white goods. The development and application of this project will certainly drive the upgrading and optimize the structure of railway freight products.

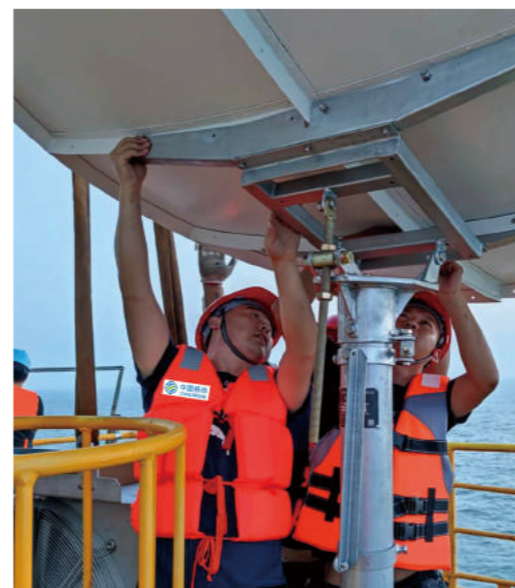
# 首台全国产化机组助力海上风电进入全国产化时代

SINICIZATION OF OFFSHORE WIND POWER ASSIST BY PRODUCING THE FIRST DOMESTICALLY UNITS

- 中国移动通信集团江苏有限公司南通分公司 CHINA MOBILE GROUP JIANGSU CO., LTD. NANTONG BRANCH
- 中移（上海）信息通信科技有限公司 CHINA MOBILE(SHANG HAI) ICT CO. LTD
- 中国华能集团清洁能源技术研究院有限公司 HUANENG CLEAN ENERGY RESEARCH INSTITUTE
- 中国移动通信集团有限公司 CHINA MOBILE GROUP JIANGSU CO. LTD
- 华能国际电力江苏能源开发有限公司清洁能源分公司 HUANENG POWER INTERNATIONAL JIANGSU ENERGY DEVELOPMENT CO.,LTD. CLEAN ENERGY BRANCH
- 南通先进通信技术研究院有限公司 NANTONG RESEARCH INSTITUTE FOR ADVANCED COMMUNICATION TECHNOLOGIES

## 项目简介:

项目首次采用海装集团的全国产机组，为国产电气系统设备在海上风电工程项目中的部署首开先河，以海上风电机组核心关键装备国产化的重大突破，为建党百年华诞献礼。核心设备的国产化将加速我国海上风电开发成本的下降，提升海上风电项目的经济性，形成产业良性循环的可持续发展。结合应用5G通讯技术，解决风电机组的通信问题，提升海上风电项目整体的信息化、数字化水平，为海上风电安全平稳地运行提供坚实的技术基础。通过部署5G微蜂窝基站，运用5G切片技术实现各类传感、测量设备的无线专网通信、5G+机器人巡检、5G+视频监控、5G+AR辅助智能运维，以及附近海域海上检修人员及无人机、水下机器人等巡检设备的通信需求。近海5G网络全覆盖同时也解决了沿海区域网络信号不足的历史性难题，发挥央企的先锋模范带头作用，助力从脱贫攻坚到乡村振兴的重要转型。



## PROJECT INTRODUCTION:

Adopting the first domestically units produced by Haizhuang Group, which is the first time for the deployment of domestic electrical system equipment in offshore wind power engineering projects. It's a great breakthrough for the localization of core and key equipment of offshore wind power units, and a gift for the centennial anniversary of the founding of the Party. Localization of core equipment will accelerate the reduction of the development cost of China's offshore wind power, improve the economy of offshore wind power projects, and form a virtuous cycle of sustainable development of the industry. Combined with the application of 5G communication technology, the communication problems of wind turbines will be solved, the overall informatization and digitization level of offshore wind power projects will be improved, and a solid technical foundation will be provided for the safe and stable operation of offshore wind power. Through the deployment of 5G microcellular base stations, 5G slice technology is used to realize wireless private network communication of all kinds of sensing and measuring equipment, 5G+ robot inspection, 5G+ video surveillance, 5G+AR auxiliary intelligent operation and maintenance, as well as the communication requirements of inspection equipment such as offshore maintenance personnel, UAV and underwater robot in the nearby sea. The full coverage of offshore 5G network has also solved the historic problem of insufficient network signal in coastal areas, and given play to the pioneering and exemplary role of central enterprises, helping to promote the important transition from poverty alleviation to rural revitalization.

# 探索智慧修船新模式

EXPLORE A NEW PATTERN OF SMART SHIPYARD

- 舟山中远海运重工有限公司
- COSCO SHIPPING HEAVY INDUSTRY (ZHOUZHAN) CO., LTD.

### 项目简介:

舟山中远海运重工有限公司结合自身修船业务实际情况，构建了以修船生产为中心，以修船生产综合指挥、5G+AR远程智能服务、5G+无人机船舶检验等应用为基础的5G+工业互联网融合服务应用平台。通过以上智能化应用和开放的数据开发平台不断完善智慧修船新模式应用，提升修船业务管理综合水平、提升生产效率，提升智能设备应用力度，降低修船成本，增强企业市场竞争力。



### PROJECT INTRODUCTION:

COSCO SHIPPING Heavy Industry (Zhoushan) Co., Ltd. combined with the actual situation of the ship repair business has constructed a 5G + industrial interconnection and integration service application platform, the platform is centered around ship repair production and based on comprehensive command of ship repair production, 5G + AR remote intelligent service and 5G + UAV ship inspection application. Through the above intelligent means and open data development platform, we will continue to improve the application of new modes of intelligent ship repair, improve the comprehensive level of ship repair business management, improve production efficiency, improve the application of intelligent equipment, reduce ship repair costs and enhance the market competitiveness of enterprises. improve the application of intelligent equipment, reduce ship repair costs and enhance the market competitiveness of enterprises.



# 天津空客5G智慧工厂应用

TIANJIN AIRBUS 5G SMART FACTORY APPLICATION

- 中国移动通信集团天津有限公司CHINA MOBILE GROUP TIANJIN CO., LTD
- 空客中国创新中心AIRBUS CHINA INNOVATION CENTER



### 项目简介:

空中客车（天津）总装公司，位于天津市空港经济区天津滨海国际机场东侧，属于高精尖智能制造行业，是空客在金砖国家建设的首条总装线。

该项目实施落地于空客天津工厂，并主要围绕基于空客产线业务中的物料管理、人员管理、生产管理、交付管理等四大场景需求，充分结合移动5G专网和AI视频等先进技术，打造了“5G+物品遗留管理”、“5G+周界入侵管理”、“5G智能工具柜”“5G+AR远程交付”等5G应用场景解决方案。空客5G智慧工厂项目主要以5G+MEC整体解决方案为基础，基于空客天津总装生产线的高端制造场景，结合其具体业务场景和需求痛点，整合AI智能视频相关产品方案，为空客工厂的人员管理、物料管理、生产管理和交付管理提供了数字化的创新手段，从而成功助力空客天津工厂实现了5G数字化智能作业升级改造。

通过现场5G专网部署和5G应用场景的验证，有效证明了5G+AI+视频解决方案在智能制造场景下有巨大的市场应用价值，同时空客项目中的四大5G应用场景具有通用性和大规模复制的价值空间，值得进一步加大投入，优化5G+AI视频的解决方案，推动促进产业链的成熟发展，并输出标准化的基线方案，为5G智能视频在制造行业的快速推广落地打造坚实的基础。

### PROJECT INTRODUCTION:

Airbus (Tianjin) Final Assembly Company is located at the east of Tianjin Binhai International Airport in the Tianjin Airport Economic Area. It is the first general assembly line built by Airbus in BRICs countries and is dedicated to high-grade, precision and advanced intelligent manufacturing.

The 5G Smart Factory of Airbus Tianjin project is based on the 5G+MEC solution. In view of the high-end manufacturing scenarios of the Airbus Tianjin Final Assembly Line as well as its specific requirements and challenges, the AI smart video and other related technology have been integrated to digitize and innovate personnel management, material management, production management and delivery management of the factory. These efforts have helped the Airbus Tianjin factory with its upgrading and transformation toward 5G-based digital intelligent operations.

The on-site 5G private network deployment and 5G application scenario verification have proven the huge value of the 5G+AI+video solution in smart manufacturing scenarios. Meanwhile, the four 5G application scenarios of the Airbus project are highly generic and can be promoted in scale, making the solution worth further investment. The improved 5G+AI+video solution can promote the maturation of related industrial chains and output of standardized baseline solutions, which can lay a solid foundation for fast promotion and implementation of 5G smart video solutions in the manufacturing industry.



# 威诺高档数控机床智能制造工厂

INTELLIGENT MANUFACTURING FACTORY FOR HIGH GRADE CNC MACHINE OF WEINO

- 福建省威诺数控有限公司
- FUJIAN WEINO CNC CO., LTD

## 项目简介:

福建省威诺数控有限公司成立于2004年，是一家专注于高端数控机床的研发制造与智能制造工厂整体解决方案输出的国家级高新技术企业。项目智能工厂属于“工信部智能制造新模式应用专项”，基于威诺五大系列立式加工中心产品的关键零件（含大型的立柱、床身、滑板零件，以及电机座、轴承座、主轴箱体等中小规格零件）自动化智能化加工，采用大量自主或国产核心智能装备和软件，通过整合联合单位技术与自主装备资源，开发集成了MES、PLM/PD-M、FMS、ERP等管理软件系统，研发建成了由5个加工单元的智能生产线、3条车间物流线、立体仓库等组成的智能工厂，解决了零件种类多、外形尺寸差异大、加工工序多、精度要求高、加工难度极大等问题，实现所有零件从毛坯输入、加工、成品输出等流程的全自动化高效加工，以及对生产过程、加工状态等数据的实时采集、交互、分析处理，将原来离散的、人工管理生产模式提升为信息数据化、管理可视化、制造智能化的生产模式。该项目在国内机床行业还没有先例，技术领先，为行业装备水平提升提供了借鉴模式。项目在本公司数控机床零件加工应用以及其他公司重点改造项目应用，取得了很好的应用效果，也获得了工程机械制造龙头企业的采购订单，创造了优异的经济和社会效益，具有很强的应用推广价值。



## PROJECT INTRODUCTION:

Fujian Weino CNC Co., Ltd. was established in 2004, It is a national high-tech enterprise focusing on the R&D and manufacturing of high-end CNC machine tools and the overall solution output of intelligent manufacturing factories. The intelligent factory project belongs to the "Special Project for the Application of New Intelligent Manufacturing Mode by the Ministry of industry and information technology". Based on key parts (including large parts of column, bed, sliding saddle, and small and medium-sized parts of motor seat, bearing seat, and spindle box) of WEINO's five series vertical machining center products, management software systems such as MES, PLM/PDM, FMS and ERP have been developed and integrated, an intelligent factory composed of 5 processing units, 3 workshop logistics lines and vertical warehouse have been developed and built by using a large number of independent or domestic core intelligent equipment and software, integrating joint unit technology and independent equipment resources. Thus the problems such as many kinds of parts, large differences in overall dimensions, many processing procedures, high precision requirements and great processing difficulty are solved, fully automatic and efficient processing of all parts from blank input, processing, finished product output and other processes, as well as the real-time collection, interaction, analysis and processing of data such as production process and processing state are all realized, the project upgraded the production mode from original discrete and manual management to the mode of information digitization, management visualization and manufacturing intelligence. The project has no precedent in the domestic machine tool industry and has advanced technology, which provides a reference model for the improvement of equipment level in the industry. The project has been applied in the processing and application of CNC machine tool parts of the company and key transformation projects of other companies, and has achieved good application results. It has also won the purchase order of leading construction machinery manufacturing enterprises, created excellent economic and social benefits, and has strong application and promotion value.

# 鞋业MES解决方案

MES SOLUTIONS FOR FOOTWEAR INDUSTRY

- 中电望辰科技有限公司
- CEC FREUNDSCHAFT TECH. CO., LTD

## 项目简介:

鞋业MES系统聚焦鞋业行业，以鞋企规模和生产需求出发，可采用私有化和云端部署两种方式，致力于鞋业企业信息化管理体系建设，加强企业生产制造过程管理，致力于管控企业生产进度、员工工资核算、产品质量统计和半成品配套管理等，提高企业生产管理水平。鞋业MES系统主要功能模块包括生产管理、件资管理、质量管理、设备管理、仓库管理、看板/报表管理、设备数据采集等，通过系统打通生产现场、生产管理、厂长、财务等部门的生产数据，使生产过程的数据呈现实时化、精确化，降低了企业10%的生产成本，降低企业10%的人力成本。

项目本身实现了较好的经济效益，而且通过降低用户单位的运营成本、提高运营管理效率，为行业整体带来的经济效益更加可观。鞋业MES解决方案应用推广拥有非常大的市场，针对制鞋行业的大、中、小企业不同需求都可以采用定制化的MES生产制造执行系统，拥有更高的普适性，本项目通过推广应用将产生一批标杆性企业，形成可复制可推广的标杆项目，带动产业内其他企业转型升级，引领行业发展。

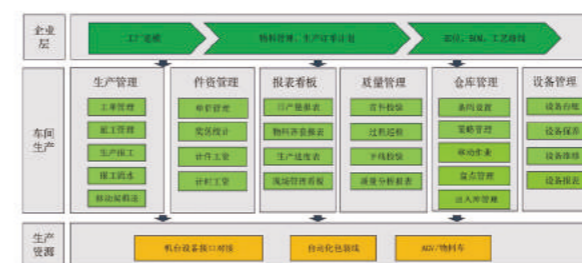
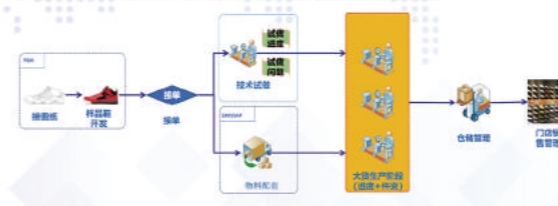
## PROJECT INTRODUCTION:

The shoe MES system focuses on the shoe industry. Based on the size and production needs of shoe enterprises, it can adopt two ways: privatization and cloud deployment. It is committed to the construction of information management system of shoe enterprises, strengthening the management of enterprise production and manufacturing process, and controlling enterprise production progress, employee salary accounting, product quality statistics and semi-finished product supporting management, improve the production management level of enterprises. The main functional modules of shoe MES system include production management, parts and materials management, quality management, equipment management, warehouse management, Kanban / report management, equipment data acquisition, etc. through the system, the production data of production site, production management, factory director, finance and other departments are connected, so that the data of production process is realistic, timely and accurate, and the production cost of the enterprise is reduced by 10%, Reduce the labor cost of enterprises by 10%.

The project itself has achieved good economic benefits, and by reducing the operation cost of user units and improving the operation and management efficiency, it has brought more considerable economic benefits to the industry as a whole. The application and promotion of MES solutions in the footwear industry has a very large market. Customized MES manufacturing execution system can be adopted according to the different needs of large, medium and small enterprises in the footwear industry, which has higher universality. Through the promotion and application of this project, a number of benchmark enterprises will be generated, which can be copied and popularized, so as to drive the transformation and upgrading of other enterprises in the industry, Lead the development of the industry.

## 中电鞋业MES解决方案

中电鞋业MES致力于中小鞋企信息化管理体系建设，加强企业生产制造过程管理，致力于管控企业生产进度、员工工资核算、产品质量统计和优化仓库管理等，提高企业生产管理水平。



# 优质浮法玻璃智能生产线冷端装备的研发与应用

RESEARCH AND APPLICATION OF COLD-END EQUIPMENT FOR INTELLIGENT PRODUCTION LINE OF FLOAT GLASS

- 中国建材国际工程集团有限公司
- CHINA TRIUMPH INTERNATIONAL ENGINEERING CO., LTD

## 项目简介:

本作品适用于优质浮法玻璃智能生产线冷端，并在玻璃生产企业中进行应用。本作品核心组件由优化系统、切割系统、线控系统三部分组成，通过智能生产优化算法、二维联动控制技术和立体输送技术，完成了优质浮法玻璃优化切割、输送、堆垛，提升了生产能力，促进企业数字化转型，实现了整个冷端的无人化操作和柔性化、智能化生产。

近3年，中国建材工程集团有限公司在此项目上直接新增利润2125万，税收358万，产值2个亿，此项目带动的其他辅助项目三年来共计约3个亿。金砖国家在玻璃生产领域相对落后，急需进行技术升级，此作品在金砖国家市场上将会有广泛的推广和应用前景。预计今后5年将会有20~30条生产线冷端技术提升改造，将新增15~20亿的产值，节约外汇近6亿美元，为我国玻璃行业智能制造提供有力支撑。

优质浮法玻璃冷端智能装备水平达到国际领先，此技术的研究及应用，引导行业、企业实现了创新发展新模式，引领了国际玻璃工业的新方向。



## PROJECT INTRODUCTION:

This project is suitable for the intelligent production line of high-quality float glass and has been applied in glass production enterprises. The key components of this project are composed of three parts, which are the optimization system, cutting system and control system. The intelligent production-optimized algorithm, 2D-coordinated control technology, and stereoscopic conveying technology are used in this application to finish the cutting, conveying and stacking processes of high-quality float glass on the production line. It improves the production capacity, promotes the digital transformation of enterprises, and realizes the unmanned operation, flexible and intelligent production of the whole cold end.

In the past three years, China Triumph International Engineering Co., Ltd (CTIEC) has gained revenue of about 200 million yuan with a profit of 21.25 million yuan from this project, and 3.58 million yuan in tax revenue has been delivered. The BRICS countries are relatively undeveloped in the field of glass production and are in urgent need of technological improvements. This project will have broad application prospects in the market of BRICS countries. One optimistic estimate is that technological upgrades might be needed by 20 to 30 production lines in the next 5 years, with about 1.5 billion yuan in income that could be increased. This may provide strong support for intelligent manufacturing in the field of the glass industry within China.

This project has reached the international leading level, which was evaluated by CBMF (China Building Materials Federation). The application of this project has led the float glass industry to realize a new model of innovative development, and leading the new direction of the international glass industry.

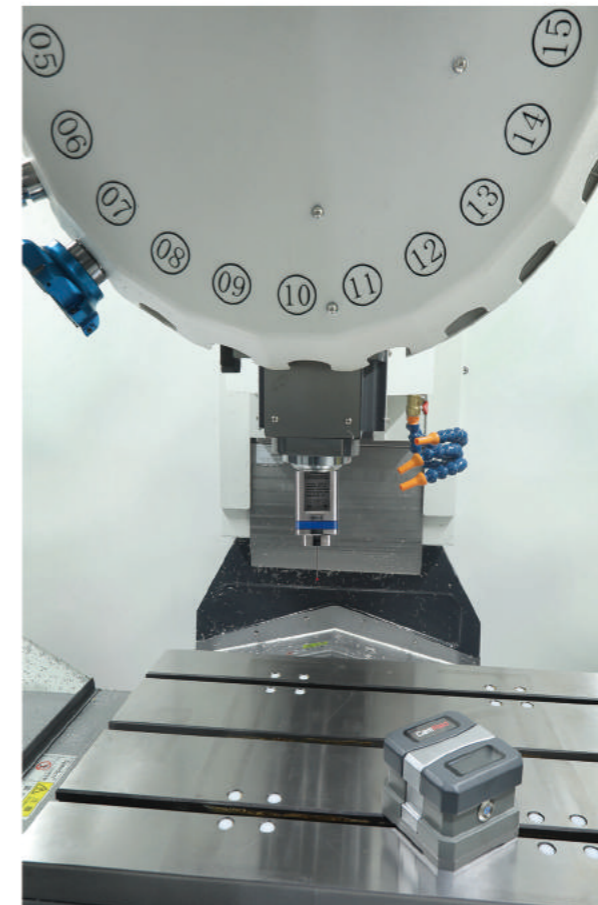
# 智能机床调测系统

SMART MACHINE ADJUSTMENT AND MEASUREMENT SYSTEM

- 桂林市晶瑞传感技术有限公司
- Guilin GemRed Sensor Technology Co., Ltd

## 项目简介:

传统机床制造业对生产效率和工件精度要求很高，而机床设备的工作状态及加工精度决定生产效率及工件精度。因此，对机床工作状态进行监控和对机床加工精度进行经常的测试是非常必要的。调平仪是检测数控机床工作状态的最常用工具，测头是整个在机检测系统的关键组成部分，其精度很大程度影响整个测量系统的精度。该方案推出的智能调平仪完全解决传统条式水平仪需要反复查看水泡的繁琐操作问题和空间阻碍。便捷自检调平机床，节省70%-80%的停机检修时间，提升生产效率，有效工具，延长机床寿命。测量式测头，在不需要提升机床精度的情况下，提升加工件的加工精度，同时取代三大量具实现在机检测，保障工件兼具高精度和高可靠性，节约机床加工生产成本，减少废品率；使普通机床拥有高端机床的性能，实现机床多元化应用。



## PROJECT INTRODUCTION:

The traditional machine manufacture requires high efficiency and high precision of workpiece, and high efficiency and precision are determined by the state of machines and machining accuracy. Therefore, it is very necessary to detect the working state of machines and measure the machining accuracy of machines frequently. Machine Leveling is the most common tool to detect state of CNC machines. Probe is the most critical parts of on machine inspection, which precision greatly affects the precision of the whole system. Smart Machine leveling in this project solves traditional spirit levels' problems in complicated operation and low efficiency. Smart Machine leveling is easily self-checking machine level, keeping machine health and shortening the machine down time over 70%, effectively extending the service life of machine tools. On Machine Inspection Measuring Probe improves machining accuracy without improving the accuracy of machine tools. Replacing the three measuring tools to achieve on machine inspection, On Machine Inspection Measuring probe ensures that the workpiece has both high precision and high reliability, saves processing production cost, reduces the reject rate. This system make ordinary machine tools performance like premium machine tools, achieving diversified applications of machine tools.





# 中汽研离散型智能制造运营管理系统

CATARC DISCRETE INTELLIGENT MANUFACTURING OPERATION MANAGEMENT SYSTEM

●中汽研汽车工业工程（天津）有限公司CATARC AUTOMOTIVE INDUSTRY ENGINEERING (TIANJIN) CO.,LTD.

## 项目简介:

中汽研离散型智能制造运营管理系统，是以支撑智能化生产、网络化协同、个性化定制和服务化延伸的智能制造新模式和新业态为目标，以离散型制造过程为研究对象，覆盖国内外汽车、船舶、电子等离散型制造企业生产计划、物流管理、质量管理、设备管理、生产运维等关键环节的信息化需求，采用微服务架构开发出的综合生产运营类工业软件，具有柔性化生产制造、物料管理协同模式创新、动态可视化生产运维管理等创新点，拥有完全自主知识产权。

该系统在福建奔驰、长安汽车、北汽福田等多家汽车主机厂或零部件厂部署使用，用户数量大约已增至6000多个，完成了TB数量级的生产制造、仓储管理与物料拉动等维度的数据加载与传输，管控车辆达到1000万辆级。2020年8月开始，本系统已在某些知名企业成功替代国外同类产品，实现关键工业软件国产化。



## PROJECT INTRODUCTION:

英文 CATARC Discrete Intelligent Manufacturing Operation Management System, the goal is to support the new intelligent manufacturing mode and new business format of intelligent production, networked collaboration, personalized customization and service extension. Taking discrete manufacturing process as the research object, the paper covers the informatization needs of key links such as production planning, logistics management, quality management, equipment management and production operation and maintenance of discrete manufacturing enterprises at home and abroad, such as automobile, ship and electronics. The comprehensive production and operation industrial software developed in microservices architecture has innovative points such as flexible production and manufacturing, material management collaboration mode innovation, micro service architecture technology and dynamic visual production operation and maintenance management, and has completely independent intellectual property rights.

The system has been deployed and used in Fujian Benz, Changan Auto, Beiqi Foton and other automobile main engine plants or parts factories. The number of users has increased to more than 6000. It has completed the data loading and transmission in the dimensions of TB production and manufacturing, warehouse management and material pulling, and managed and controlled 10 million vehicles. In August 2020, the system successfully replaces similar foreign products in an enterprise and realizes the localization of key industrial software.

# 5G绿色无人矿山直击行业痛点 引领转型升级

5G GREEN UNMANNED MINES DIRECTLY HIT THE PAIN POINTS OF THE INDUSTRY AND LEAD THE TRANSFORMATION AND UPGRADING

- 中国移动通信集团河南有限公司 CHINA MOBILE GROUP HENAN CO., LTD.
- 河南跃薪时代新能源科技有限公司 YUEXIN CONTEMPORARY AMPEREX TECHNOLOGY CO., LTD.



## 项目简介:

5G绿色无人矿山项目，主要实现挖机远程操控和纯电动矿卡无人运行、自动编组等场景，可实现露天矿区铲、装、运的全程无人操作，使非煤矿山生产的安全性、开采效率、资源利用率得到大幅提升。该项目两期工程共建投入14个5G基站，2019年11月底完成一期5个5G基站的建设；2020年实现60台无人车的5G无人驾驶、13台挖机、10台钻机的5G远程控制等应用。该项目是全省第一个基于5G的绿色无人矿山项目。项目三大创新点：一是无人操控更高效。大大节省企业人工成本，仅人力成本一项就为企业每年节省1500万以上，整体效益提升4800万/年。二是绿色环保更安全。采用无人纯电动车代替传统柴油车运输，有效减少了二氧化碳排放量。三是5G技术更可靠。通过中国移动5G+工业网关将传输时延降低到30毫秒以内，定位精度达到20厘米以内，最大限度地提高生产安全性，实现安全生产“零事故、零伤亡”。



## PROJECT INTRODUCTION:

The 5G green unmanned mine project mainly realizes remote control of excavator, unmanned operation and automatic grouping of pure electric mine cards, and can realize the whole unmanned operation of shovel, loading and transportation in open-pit mining areas, so that the safety, mining efficiency and resource utilization rate of non-coal mine production have been greatly improved. 14 5G base stations will be invested in the two phases of the project, and the construction of five 5G base stations in the first phase will be completed by the end of November 2019. By 2020, 5G driverless driving of 60 unmanned vehicles, 5G remote control of 13 excavators and 10 drilling RIGS will be realized. The project is the first green unmanned mine project based on 5G in the province. The project has three innovations: first, unmanned control is more efficient. It greatly saves the labor cost of the enterprise. The labor cost alone saves more than 15 million yuan for the enterprise every year and improves the overall benefit by 48 million yuan per year. Second, it is safer to be green. Unmanned pure electric vehicle instead of traditional diesel vehicle transportation, effectively reduce carbon dioxide emissions. Third, 5G technology is more reliable. Through China Mobile 5G+ industrial gateway, the transmission delay is reduced to less than 30 ms and the positioning accuracy is less than 20 cm, maximizing production safety and realizing "zero accidents and zero casualties" in production safety.



## MAGIC智能平车研制

DEVELOPMENT OF THE INTELLIGENT FLAT WAGON PROJECT - MAGIC

- 中车山东机车车辆有限公司
- CRRC SHANDONG CO., LTD.

### 项目简介:

中车山东公司为探索下一代铁路货车发展方向，与瑞士国家铁路货运公司SBB CARGO联合研制了MAGIC智能平车。这是一款瞄准未来、填补了多项行业空白、集成了众多黑科技的45FT集装箱专用平车，各项技术指标相对传统铁路货车形成了代差优势。

车辆设计融合绿色理念，采用全铆接车体结构，完全消除了焊接污染，降低能耗、碳排放；底架采用模块化结构设计，可以快速调整车辆长度，实现柔性生产；车体只有18种冲压件，为车体自动化生产创造了条件。

转向架采用内置式焊接构架，轻量化效果显著，实现了低能耗、低磨损和低噪声。

车上装有智能监测系统，可以实时监测轴温、振动、磨损、超偏载等车辆信息，实现了车辆的智能控制、远程感知、健康预测、运维指导和智慧物流。

车辆自带动力，实现无机车牵引时自行走，提高货物周转率，降低调车成本。车辆装载冷藏集装箱时，蓄电池还可以为冷藏箱单独供电。

车辆采用模块化电空制动，提升制动性能的同时，并可实时监测及识别制动故障，降低维护成本。

采用密接式自动车钩，车钩的连接、解钩以及气路连接均可自动完成。

基于新功能、新技术、新工艺，智能平车实现了模块化、自动化、绿色、智能、便捷的五大代际特性，探索了下一代铁路货车发展方向。

### PROJECT INTRODUCTION:

CRRC Shandong, to explore the direction of next generation of railway wagons, joint developed the MAGIC Wagon with Switzerland national railway freight company SBB CARGO. MAGIC wagon is an intelligent 45ft container carriage flat wagon which is aiming at the future, filling a number of industry gaps, and integrating many black technologies. Compared with the traditional railway freight wagons, MAGIC wagon has formed the generation advantage in each technology characteristic.

The design of the wagon integrates green concept and adopts fully riveted structure, which completely eliminates welding pollution and reduces energy consumption and carbon emissions. The underframe adopts modular structure, which can adjust the length of the wagon quickly and achieve flexible manufacture. There are only 18 stamping parts for wagon body, which creates conditions for automatic production of car body.

The bogie is designed as a inner-welding frame, with remarkable lightweight effect and low energy consumption, low wear and low noise.

The wagon is equipped with intelligent monitoring system, which can monitor the vehicle information real-time such as axle temperature, vibration, wear condition, excessive and partial load, which also realize the intelligent control, remote perception, health prediction, operation and maintenance guidance and intelligent logistics of the wagon.

The wagon is designed with self-power supply, which can running by itself without traction of locomotive, so as to improve the turnover rate of goods and reduce the cost of shunting. When the wagon is loaded with Refrigerated container, the battery can also power the container separately.

Modular electro-pneumatic braking system is adopted, which improves braking performance and can monitor and identify any braking faults in real time to reduce maintenance costs.

Equipping with the close-coupled automatic coupler, can realize the automatic coupler, uncoupler and air pipe connection.

Based on the new functions, new technology and new process, we can achieve Modula, Automation, Green, Intelligent and Convenient five generation characteristics of the intelligent flat wagon MAGIC and explore the direction of next generation of railway freight wagon.



## 百川星空系列纺织面料 (再生无水着色)

BAICHUAN COSMOSTM TEXTILE FABRIC (RECYCLED DOPE DYED POLYESTER)

- 福建省百川资源再生科技股份有限公司FUJIAN BAICHUAN RESOURCES SCIENCE & TECHNOLOGY CO., LTD



### 项目简介:

百川星空系列纺织面料（再生无水着色）是基于工信部绿色制造系统集成之“基于互联网+的绿色化再生彩纱超市”项目所取得的下游应用创新成果，彩纱超市项目总投资1.68亿元，构建了绿色工厂、绿色供应链、绿色标准、绿色制造的典型模式，开发了1000余种颜色的再生彩纱。星空系列产品通过对不同规格、颜色互拼的个性化开发，现已成功开发5000多种颜色、规格的绿色纺织面料数据库。产品各项化性指标均能达到国际REACH、OEKO、ROSH等产品标准，并在干擦、湿擦、水洗、皂洗、日晒牢度等方面远优于标准要求。在节能减碳方面有优秀的表现，可减少63%左右的碳排放，减少89%左右的水消耗，节省60%左右的能源消耗（数据来源：全生命周期绿色管理专委会出具的LCA报告）。

目标：完成50000种颜色规格的再生无水着色纺织面料数据库，满足客户快反应、小批量的需求。

### PROJECT INTRODUCTION:

Baichuan COSMOSTM textile fabric (Recycled Dope Dyed Polyester) is a downstream application innovation achievement based on the "Internet+ green regeneration of colorful yarn supermarket" project of green manufacturing system of the Ministry of Industry and Information Technology. With a total investment of 168 million yuan, the project of colorful yarn supermarket has built a typical model of green factory, green supply chain, green standard and green manufacturing, and developed more than 1,000 colors of recycled colorful yarn. Through the personalized development of the interplay of colors and different specifications, COSMOSTM has now successfully developed a green textile fabric database including more than 5,000 colors and specifications. All the chemical indexes of the products can reach the international standard like REACH, OEKO and ROSH, moreover, they are far better than the standard requirements in colorfastness to dry rubbing, wet rubbing, washing, light, etc. It has superior performance in energy saving and carbon reduction, which can reduce carbon emission by about 63%, water consumption by about 89% and energy consumption by about 60% (Data source: LCA report issued by the Life Cycle Assessment & Management Committee). Goal: Complete a database of 50,000 color specifications of recycled dope dyed textile fabrics in order to meet customers' needs of fast response and small batch production.



# 超视觉垃圾分拣机器人

VISION-X GARBAGE SORTING ROBOT

- 上海交通大学中英国际低碳学院
- CHINA-UK LOW CARBON COLLEGE AT SHANGHAI JIAO TONG UNIVERSITY



## 项目简介:

垃圾分类是一项工程量巨大、过程重复且枯燥的工作，大量的人工参与对工人的体力和精神力都是一项较大的考验。生活垃圾来源广、组成复杂、性状不一，传统的分选技术具有一定的局限性，急需有效的新技术作为补充。机器人技术和人工智能是传统垃圾处理的好帮手。团队依托国家自然科学基金、国家863高科技计划等项目，数年来产学研联合攻关，相继突破混杂物料图像快速识别、高速精准面激光空间定位、近红外指纹材质识别、多维信息耦合联用、机器人快速轨迹跟踪等十余项关键技术，实现了垃圾精细分拣机器人的核心技术国产化，开发出与国外产品基本处于同一个水平的产品，打破了垃圾智能分拣技术的国际垄断。一个超视觉垃圾分拣机器人可以高精度分拣多种不同品类的垃圾，有效分拣率可达95%，最高分拣速度5400次/小时，工作时间24小时/天。生产线上每套设备布置2个机械手，相当于替代了54个分拣工人的工作量。



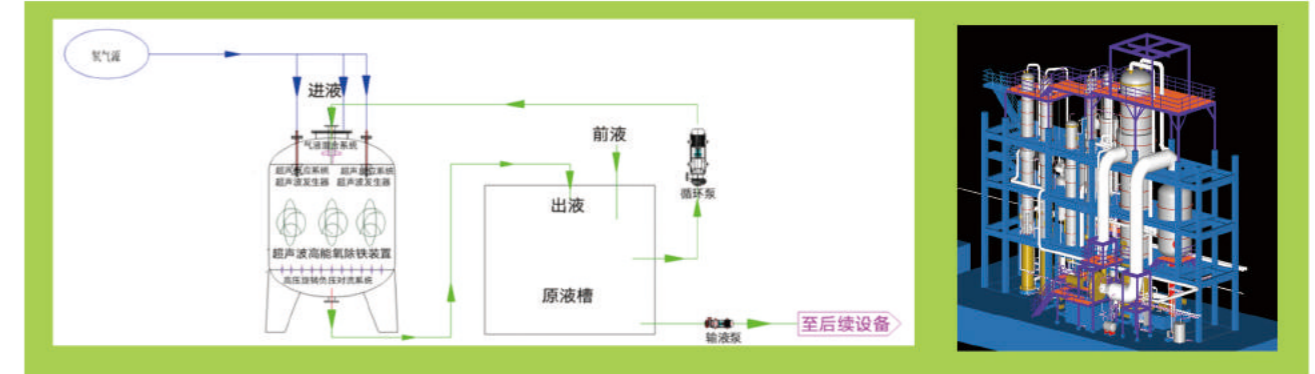
## PROJECT INTRODUCTION:

Workers involved in manual sorting of unseparated domestic waste are exposed to unhygienic environments. Furthermore, it's getting more difficult to hire such workers given the harsh working conditions. Robots would be useful for such repetitive and arduous tasks. Using robots will also improve the speed and quality of recycled waste re-entering the production process as valuable raw materials, thereby reducing the pollution associated with the manufacture of new materials. With more Chinese cities slated to implement compulsory garbage sorting regulations, teams from the China-UK Low Carbon College at Shanghai Jiao Tong University have been working to devise more efficient means of accomplishing this task through the use of high-end technology. Equipped with three kinds of cutting-edge sensors and other technologies like contour identification, the machine can identify the color, shape and texture of an object, as well as what it is made of. An algorithm also enables the robotic arm to determine the most efficient way to fetch items. According to the team behind this project, the machine can identify a piece of dry waste before placing it in its respective container. The device currently boasts a 90 percent accuracy rating and can sort up to 5,400 pieces of waste per hour. Two robots operating for 24 hours a day can handle the workload of 54 workers, and with a higher efficiency.

# 磁材废料综合利用生产废水绿色资源化关键技术开发与应用

DEVELOPMENT AND APPLICATION OF KEY TECHNOLOGIES FOR GREEN RECYCLING OF WASTE WATER FROM PRODUCTION OF MAGNETIC WASTE MATERIALS

- 中稀天马新材料科技股份有限公司
- ZHONGXI TIANMA NEW MATERIAL TECHNOLOGY CO., LTD



## 项目简介:

根据钕铁硼废料回收利用中产生的高盐废水的特性，低浓度废水经物理法预处理后，在超声波高能氧化后，去除乳化油、调节PH值后、去除COD及金属离子后，产生的较高浓度废水和萃取产生的高浓度皂化废水混合后，采用热源再利用，蒸汽压缩就大串小的工艺，不同浓度采用不同温度的压缩蒸汽。在经过MVR技术蒸发浓缩后，生产出铝镁冶金的保护剂、精炼剂、色淀颜料的沉淀剂。轻质产生的蒸馏水循环使用回用于生产。为稀土回收生产废水绿色资源化成套技术开发与应用、节能降耗及环境保护提供了坚实的基础。工艺过程完全密封，符合资源回收利用，符合循环经济模式。



## PROJECT INTRODUCTION:

Summary: According to the characteristics of high salt wastewater produced in NdFeB waste recycling, low concentration wastewater by physical method, after ultrasonic high energy oxidation, remove emulsion oil, adjust pH, remove COD and metal ions, the higher concentration of wastewater and extract high concentration of saponified wastewater mixed, using heat source, steam compression is small process, different concentrations of different temperatures. After evaporation and enrichment through MVR technology, protective agents of aluminum and magnesium metallurgy, refining agents and precipitates of adian pigments are produced. Light-produced distilled water is recycled back for production. It has provided a solid foundation for the development and application of complete sets of green recycling technologies for rare earth recycling and production waste water, energy conservation and consumption reduction and environmental protection. The process process is completely sealed, in line with the resource recycling and the circular economy model.

# 大功率机车高效低噪牵引风机

HIGH EFFICIENCY AND LOW NOISE TRACTION FAN FOR HIGH-POWER LOCOMOTIVE

- 湖南联诚轨道装备有限公司
- HUNAN LINCE ROLLING STOCK EQUIPMENT CO., LTD

## 项目简介:

为了全面提升牵引风机的性能，本项目重点开展了产品参数系统性分析、工程修正 CFD 计算方法、基于正交试验方法的优化设计方法、风机噪音预测和优化设计系统、智能制造产线设计与开发、风机健康管理系统等课题研究，搭建了下一代绿色智能轴向离心风机的设计、制造与试验集成开发平台。简况如下：

1. 该集成开发平台为轴向离心风机产品设计开发提供新的理论基础和方法，形成了产品样本手册、内部企业标准，而且研究成果可推广到其它风机，能够有效提高产品设计质量、缩短研发周期。

2. 该技术成果应用于太原铁路局湖东机务段牵引风机提效改造项目，在同样的工况下，相对于原风机能耗降低了25.97%，获得客户了的充分认可。本项目成果已运用于HXD1八轴机车、III型动车组、“复兴号”FXD1集中动力动车组、德国DB调车等车型，装车数量达上千台，随车服务于全国各地，目前运行状态良好。依托一带一路与金砖国家合作等发展契机，本产品出口至德国、塞尔维亚、匈牙利等国家，并取得了欧盟产品认证。

3. 该技术成果被湖南省机械工业协会评价认定整体技术达到国际领先水平，得到了以刘友梅院士为首的专家组高度评价，获得了湖南省百项重点项目、省重点研发计划项目资助，荣获2018年湖南省科学技术进步三等奖和中国科协第二届全国企业创新方法大赛全国二等奖。本成果获得5项发明、10项实用新型专利授权，发表科技论文4篇。

4. 和谐系列机车牵引风机再制造市场超过3万台，预计市场容量超15亿，采用本项目风机预计每年节约2.7亿度电，减少210万吨二氧化碳排放。

本项目中的系列技术成功实施，满足了轨道交通装备绿色低碳的技术发展要求，使大功率机车牵引风机产品向高效低噪、安全保障、装备轻量、保质保寿和节能环保等技术方向发展，提高了我国轨道交通装备关键零部件通风冷却系统技术领域的核心竞争力。

## PROJECT INTRODUCTION:

In order to comprehensively improve the performance of traction fan, the systematic analysis concerning the product parameters, engineering correction CFD calculation methods, optimization design methods based on orthogonal experimental methods, fan noise prediction and optimization design systems, and R&D for the intelligent manufacturing production line, fan health management system and other topics research have been proceeded. The design, manufacturing and testing integrated development platform for next generation of green intelligent axial centrifugal fan has been built. Below is the brief introduction:

1. The integrated development platform provides a new theoretical basis and method for the design and development of axial centrifugal fan products, forming a product sample manual and internal enterprise standards, and the research results can be extended to other fans, effectively improving product design quality and shortening the R&D cycle.

2. This technical achievement was applied to the efficiency improvement project of the traction fan of the Hudong Locomotive Depot of Taiyuan Railway Bureau. Under the same working conditions, compared to the original fan, the energy consumption was reduced by 25.97%, which was fully recognized by customers. The achievement of this project have been applied to HXD1 eight-axle locomotives, Type III EMUs, "Fuxing" FXD1 centralized power EMUs, German DB shunting locomotive and other vehicles for thousands of vehicle applications which are operated in all regions of the country with good operating condition. Relying on development opportunities such as cooperation between the Belt and Road and the BRICS, the product is exported to Germany, Serbia, Hungary and other countries, and has qualified by EU product certification.

3. The technical achievement was evaluated and recognized by Hunan Machinery Industry Association, and the overall technology reached the international leading level. It was highly praised by an expert group headed by Academician Liu Youmei. It was awarded with funding for one hundred key projects of Hunan Province and the provincial key research and development plan. It was awarded the third prize of Hunan Science and Technology Progress Award in 2018 and the second prize of the 2nd National Enterprise Innovation Method Contest of China Association for Science and Technology. This achievement has been granted 5 inventions, 10 utility model patents, and 4 scientific papers have been published.

4. The remanufacturing market of HXD1 series locomotive traction fans exceeds 30,000 units, and the market capacity is expected to exceed 1.5 billion. The application for the fans of this project is expected to save 270 million kilowatt-hours of electricity each year and reduce 2.1 million tons of carbon dioxide emissions.

The successful implementation for the series of technologies in the project meets the technical development requirements of green and low-carbon rail transit equipment, makes the development direction of high-power locomotive traction fan products transferring to high-efficiency, low-noise, safety, lightweight equipment, quality and longevity, energy conservation and environmental protection, enhances the core competitiveness in the technical field of ventilation and cooling systems for key components of rail transit equipment in China.

# 大线能量埋弧焊剂制备关键技术

CRITICAL TECHNOLOGIES GEARED TOWARDS SUBMERGED ARC FLUXES FOR HIGH HEAT INPUT APPLICATIONS

- 东北大学
- NORTHEASTERN UNIVERSITY



## 项目简介:

团队致力于厚板大线能量焊接。目前设计并开发了匹配大线能量埋弧焊系列焊剂，已完成基础试制、中试验证及工业应用。所研发焊剂能带来优良的电弧稳定性、焊渣脱渣性及焊缝成形性。焊后焊渣回收处理后进行化学性质与组织性能的检测，检测结果与设计原焊剂相当，践行了熔炼焊剂的绿色循环理念，为实现钢铁及相关制造业的“双碳”目标贡献具有原创性的关键技术。目前，团队承担区域创新发展联合基金、金砖国家科技和创新框架计划、英国皇家工程院“通过伙伴关系改造系统”计划、牛顿高级学者基金等关键项目。已授权发明专利3项；与主要产研企业--鞍钢集团、五矿营钢、营口瑞福来耐火材料、大连船舶重工集团--等多家展开密切的合作。

## PROJECT INTRODUCTION:

Our team is committed to high heat input welding of thick plates. At present, we have designed and developed a series of submerged arc fluxes suitable for high heat input welding applications. We have completed laboratory-scale proof validation, pilot production, and successfully conducted industrial application. We have demonstrated that, by employing appropriate fluxes, adequate arc stability, satisfactory slag detachability and excellent formability of the weld metal can be achieved. Most important, the developed fluxes possess superior recyclability. Chemical and microstructural analysis have dictated that recycled fluxes have essentially the same functionality as the original ones. By adopting such critical technologies, we are devoted to contributing to the "carbon peak and neutrality" goal for the steel industry, and, to a large extent, the entire manufacturing sector. Our team is engaged with several key projects such as Regional Innovation and Development Joint Fund, BRICS STI Framework Program, Royal Academy of Engineering "Transforming Systems through Partnership" Program, Newton Advanced Fellowship, etc. We have multiple patents granted pertinent to the research. Meanwhile, we have maintained a close cooperative relationship with several major corporations, including, AnSteel, Minmetals Yingkou Medium Plate, Yingkou Refly Refractories, Dalian Shipbuilding Industry Group, etc.



## 低聚半乳糖零碳智造示范工场

ZERO-CARBON AND INTELLIGENT GALACTOOLIGOSACCHARIDE MANUFACTURING PERFORMANCE PLANT

- 天津科技大学
- TIANJIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

### 项目简介:

本作品内容为“万吨级低聚半乳糖零碳智造示范工场”，以低聚半乳糖酶法制造技术为依托，开发全套智能制造技术与装备，搭建智能化生产管理体系，使用绿色能源，实现低聚半乳糖的绿色高效零碳智能化生产。

低聚半乳糖是具有天然属性的功能性低聚糖，存在于人母乳中，被称为“母乳益生元”。低聚半乳糖是婴儿体内的双歧杆菌菌群建立的关键因素，广泛用于婴幼儿配方奶粉。当前低聚半乳糖市场以欧、美、日等发达国家为主，生产与销售额皆大于全球份额的60%。而“金砖五国”中除我国外，低聚半乳糖生产及销售均严重依赖进口。

针对制约“金砖五国”低聚半乳糖产业健康发展的技术瓶颈，本作品团队在前期研究中获得了世界最高性能的低聚半乳糖生产专用酶制剂及其高效制备技术，以及低聚半乳糖的酶法制造新技术并实现工业化应用，在智能制造技术和智能化管理体系方面积累了丰富的技术和工程化实施经验。

本作品进一步开发针对低聚半乳糖的智能化无人工厂所需技术与装备，建成示范性低聚半乳糖高度智能化生产线，搭建智能化生产管理体系，充分利用风能、太阳能等绿色能源驱动工厂运行，实现低聚半乳糖的绿色高效零碳智能生产。



### PROJECT INTRODUCTION:

The content of this work is 'Ten thousand tons of galactooligosaccharide's zero-carbon and intelligent manufacturing demonstration factory'. Based on the enzymatic production of galactooligosaccharide (GOS), a full set of intelligent manufacturing technology and related equipment are developed, an intelligent management system is established, and also green energies are used for manufacturing operations. Therefore, resulting in green, high-efficiency, zero-carbon, and intelligent production of GOS.

GOS is naturally existing functional oligosaccharides and is especially abundant in human breast milk. GOS is widely used in infant formula milk powder due to it is a key factor for the establishment of bifidobacteria flora in infants. Currently, the GOS market is dominated by developed countries, such as Europe, the United States, and Japan, and holds over 60% market share. BRIC countries' GOS market is extremely reliant on imports, except China.

In order to unblock the technical bottleneck of the GOS industry's healthy development in BRIC, our team developed a special enzyme for GOS production, its efficient preparation technology, and related new enzymatic GOS production technology. And the technologies have been applied for industrialization. Moreover, the team has accumulated rich technical and engineering experience in intelligent manufacturing technology and intelligent management system implementation.

This work is further developing the technology and equipment required for the intelligent lights-off factory for GOS, building a demonstration COS intelligent production line and related intelligent management system, taking advantage of abundant wind, solar, and other green energy in BRIC countries to drive the factory operation, thereby realizing the green, efficient, zero-carbon intelligent production of GOS.

## 涤纶织物无废水排放连续浸轧染色新技术的工业化应用

NEW PROCESS INDUSTRIAL APPLICATION ABOUT NO WASTEWATER DISCHARGED CONTINUOUS PAD DYEING FOR POLYESTER FABRIC

- 福建溢佳仁科技有限公司 FUJIAN YIJIAREN TECHNOLOGY CO.,LTD.
- 西安工程大学 XI'AN POLYTECHNIC UNIVERSITY

### 项目简介:

“涤纶织物无废水排放连续浸轧染色新技术的工业化应用”项目，是福建溢佳仁科技有限公司与西安工程大学长期密切科研合作，进行了充分的实验室研究和工业化生产实践，从而在子项目-涤纶针织人造革基布免水洗连续染色技术工业化应用，形成了规模化工业生产的结晶。经过深入不断的试验，该项技术于2019年12月实现了稳定的规模化工业生产应用。目前该项目累计投资3000余万元，建成生产线四条，在建生产线二条（预计2021年9月初投产），计划再建生产线六条（预计2022年六月前投产）。2020年由于疫情等因素影响，产值6000余万元/年，目前月产1200吨，月产值1800余万元。在公司的研发与生产实践中，注重与西安工程大学的科研合作，目前公司与学校拥有与该项技术密切相关的授权发明专利三项，授权的实用新型专利五项，受理的发明专利一项，受理的实用新型专利十项。所有专利都在企业的生产实践中进行了转化应用。该项生产技术纳入“2019年工信部印染行业绿色发展技术指南目录”，纳入《纺织行业“十四五”绿色发展指导意见》中的印染行业绿色发展规划。项目的突出技术亮点在于理论创新，突破传统染色理论。将原有的染色理论，上染→固色→染色后处理（多次的水洗皂洗）。在涤纶纤维织物的染色中突破为上染→固色。免去了耗水、耗时的染色后处理工序，缩短了工艺流程和工艺时间，低成本的实现了涤纶织物染色生产的废水零排放。产品各项性能达到传统染色的各项性能指标，生产成本远低于传统技术，在市场销售中极具竞争力。

### PROJECT INTRODUCTION:

The project of "Industrial application of new technology of continuous dip rolling dyeing of polyester fabric without wastewater discharge" is a long-term close scientific research cooperation between Fujian Yijiaren Technology Co., Ltd. and Xi'an Polytechnic University. To apply the washing-free continuous dyeing technology of polyester fiber knitted artificial leather base cloth in the sub project, the project has carried out sufficient laboratory research and industrial production practice. It has formed the crystallization of large-scale industrial production. After in-depth and continuous tests, the technology has realized stable large-scale industrial production application in December 2019. At present, the project has invested a total of more than 30 million yuan, four production lines have been built, two production lines are under construction (expected to be put into operation in early September 2021), and six production lines are planned to be built (expected to be put into operation before June 2022). In 2020, due to the impact of epidemic situation and other factors, the original value was more than 60 million per year. At present, the monthly output was 1200 tons and the monthly output value was more than 18 million yuan. At present, the company and the school have three authorized invention patents closely related to this technology, five authorized utility model patents, one accepted invention patent, and ten utility model patents accepted. All patents have been transformed and applied in the production practice of the company. In the company's R&D and production practice, the company pays attention to scientific research cooperation with Xi'an Polytechnic University. At present, the company and Xi'an Polytechnic University jointly have three authorized invention patents closely related to the technology, five authorized utility model patents, one accepted invention patent and ten accepted utility model patents. All patents have been applied in the production practice of the enterprise. The production technology is included in the "2019 Ministry of Industry and Information Technology's Directory of Green Development Technology Guidelines for the Printing and Dyeing Industry" and The Green Development Plan for the Printing and Dyeing Industry in the 'The 14th Five-Year Plan' Green Development Guidance for the Textile Industry.

The Technical highlight of this project lies in the theoretical innovation, and breaks through the traditional dyeing process, dyeing→dye-fixing→dyeing post-processing(rinsing and soaping). In the dyeing of polyester fiber fabric, the dyeing process is simplified to dyeing → fixing. In this way, the water consuming and time-consuming post-treatment process is avoided, the process flow and process time are shortened, and the zero discharge of low-cost polyester fabric dyeing wastewater is realized. The performance of the product has reached the performance indexes of traditional dyeing, and the production cost is far lower than the cost consumed by traditional technology, so it is very competitive in the market.



## 碲化镉发电玻璃

CDTE SOLAR POWER GLASS

- 成都中建材光电材料有限公司
- CNBM (CHENGDU) OPTOELECTRONIC MATERIALS CO., LTD.



### 项目简介:

公司贯彻习近平总书记对玻璃行业的重要指示，努力建成世界一流的碲化镉发电玻璃企业。历经十余年探索，于2018年投产世界第一条大面积（1.92m<sup>2</sup>）碲化镉发电玻璃生产线，开创了我国碲化镉薄膜太阳能“发电玻璃”产业化先河。

碲化镉发电玻璃是国家首批认定的绿色建材产品，是在两块普通玻璃之间沉积一组先进的光电功能材料，使玻璃从绝缘体变成导体，并且具有发电功能。产品具有发电多、效能高、复杂环境条件下表现好、低能耗、无污染等属性，生命周期结束后可回收。碲化镉发电玻璃可广泛应用于大型太阳能地面电站、工商建筑、现代工厂、产业集团、摩天大楼等；目前已在雄安新区、成都双流机场、江西瑞昌电子商务楼等现代化地标建筑投入使用。

目前，成都中建材碲化镉发电玻璃转化效率达到15.8%，实验室转化效率已经达到20.2%，达到国际先进水平。成都中建材已布局国家发明专利177项，主持或参与制（修）定国际、国家、行业标准18项，并承担8项国家级、省部级科研课题。产品进入国家发改委《绿色技术推广目录（2020年版）》、工信部《重点新材料首批次应用示范指导目录（2019年版）》、第21届中国国际工业博览会新材料奖；获得北德TUV认证、CE认证、CQC认证、绿色低碳足迹认证。碲化镉发电玻璃具有绿色、创能、环保等优势属性，为中国早日实现碳达峰、碳中和贡献力量。

### PROJECT INTRODUCTION:

The Company has implemented the important instructions of General Secretary Xi Jinping to the glass industry and strove to build a world-class CdTe solar power glass enterprise. With more than ten years of exploration, the Company brought the world's first large-area CdTe solar power production line (1.92 m<sup>2</sup>) into production in 2018, pioneering a precedent for the industrialization of CdTe solar power glass in China.

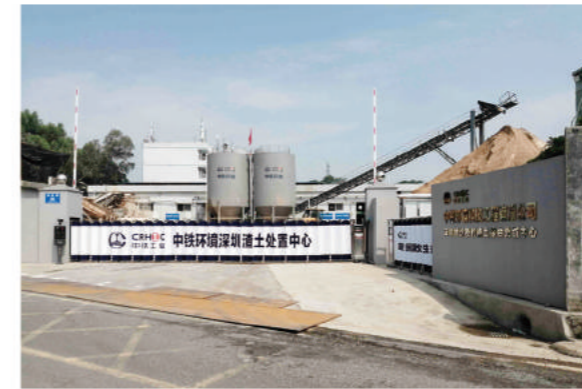
CdTe solar power glass is the first national certified Green Building Materials Product. And it is produced by setting a set of advanced optoelectronic functional materials between two pieces of ordinary glass, making the glass become a conductor from an insulator and have the function of power generation. The solar power glass is featured by high power generating capacity, high efficiency, sound performance under complex environmental conditions, low energy consumption, and no pollution. It can be recycled at the end of its life cycle. CdTe solar power glass can be widely applied to large-scale solar ground power plants, industrial and commercial buildings, modern factories, industrial groups, skyscrapers, etc. At present, it has been used in Xiong'an New Area, Chengdu Shuangliu International Airport, Jiangxi Ruichang E-commerce Building, and other modern landmark buildings.

At present, CNBM (Chengdu) Optoelectronic Materials Co., Ltd. has achieved 15.8% conversion efficiency of CdTe solar power glass and 20.2% laboratory conversion efficiency, coming up to the international advanced level. CNBM (Chengdu) Optoelectronic Materials Co., Ltd. has implemented 177 national invention patents, organized or participated in the formulation (revision) of 18 international, national and industry standards, and undertook 8 scientific research projects at national, provincial and ministerial levels. CdTe solar power glass was included in the Catalog for Promotion of Green Technologies (2020 Edition) issued by the National Development and Reform Commission and the Guidance List of the Application Demonstration of the First Batch of Key New Materials (2019 Edition) of the Ministry of Industry and Information Technology. It was granted the New Material Award at the 21st China International Industry Fair, and other honors. Moreover, it has passed the TUV certification, CE certification, CQC certification and certification of green and low carbon footprint. CdTe solar power glass is environmentally friendly, and favorable for energy generation and environmental protection, contributing to early realization of peak carbon dioxide emissions and carbon neutrality in China.

## 盾构渣土多相分级处理成套技术及装备

COMPLETE SET OF TECHNOLOGY AND EQUIPMENT FOR MULTIPHASE CLASSIFICATION TREATMENT OF SHIELD MUCK

- 中铁环境科技工程有限公司
- CHINA RAILWAY ENVIRONMENT AND TECHNOLOGY ENGINEERING CO.LTD.



### 项目简介:

该成套技术系统通过“盾构渣土多相分级无害化处理系统”、“盾构渣土多相分级减量化协同处理系统”与“盾构渣土多相资源化处理系统”的联合使用，对隧道施工盾构渣土进行全面控制，从源头控制盾构渣土的处理规模，将能资源化的盾构渣土进行分类筛分后，直接资源化利用，其余盾构渣土进行减量化、资源化和无害化处理，降低盾构渣土的处理规模和处理难度。

本成套技术系统在运行上有很大的灵活性和可调节性，能够适应土壤类型、温度和含水量的变化，能够有效去除盾构渣土中的泡沫剂、石油类和重金属等多种污染物，可处理盾构渣土废水中含有的SS、COD、氨氮、石油类、硬度等。可根据项目所在区域的盾构渣土特点和资源化需求，进行工艺单元的调整，实现工艺单元的灵活组合。

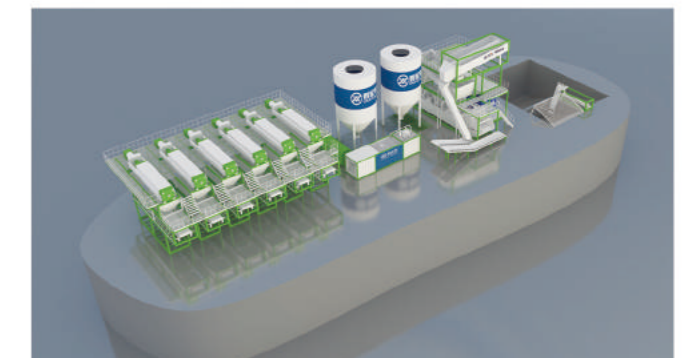
该成套装备采用移动式模块化一体化设计，根据需要可采用车载式、撬装式和集装箱式多种形式，占地面积小，设备安装维护方便。操作灵活，可根据现场盾构渣土的特点，灵活使用不同的处理工艺，配置不同的设备数量，而且方便运输，临近的工程场地之间可快速进行设备调度，节约项目的整体投资。

### PROJECT INTRODUCTION:

The complete set of technical system comprehensively controls the shield muck in tunnel construction through the joint use of "shield muck multiphase classification harmless treatment system", "shield muck multiphase classification reduction collaborative treatment system" and "shield muck multiphase resource treatment system", controls the treatment scale of shield muck from the source, and classifies and screens the resource shield muck, Direct resource utilization. The remaining shield muck shall be reduced, recycled and harmless to reduce the treatment scale and difficulty of shield muck.

The system has great flexibility and adjustment in operation, and can adapt to changes in soil type, temperature and water content. It can effectively remove foam, petroleum, heavy metals and other pollutants in shield residue, and deal with SS, COD, ammonia nitrogen, petroleum, hardness, etc. in shield waste water. The process unit can be adjusted according to the characteristics of shield slag and soil and resource demand in the project area to realize the flexible combination of process units.

The complete set of technology adopts mobile modular integrated design, and can adopt vehicle mounted, skid mounted and container mounted forms as required, with small floor area and convenient equipment installation and maintenance. The operation is flexible. Different treatment processes can be flexibly used and different equipment quantities can be configured according to the characteristics of shield residue on site. It is convenient for transportation, and equipment can be quickly dispatched between adjacent engineering sites, so as to save the overall investment of the project.



## 多领域烟气多污染物干式协同净化技术

MULTI-DOMAIN FLUE GAS MULTI-POLLUTANT DRY SYNERGISTIC PURIFICATION TECHNOLOGY

- 福建龙净环保股份有限公司
- FUJIAN LONGKING CO.,LTD

### 项目简介:

多领域烟气多污染物干式协同净化技术以高端动性能循环流化床反应器为核心,有机集成SNCR/SCR/COA多维梯级脱硝、流化床造粒+超滤布袋净化、吸收吸附双重净化等多项技术,并通过智能化检测与控制系统,高效协同脱除烟气中SO<sub>2</sub>、NO<sub>x</sub>、SO<sub>3</sub>、HCL、HF等酸性气体、As、Pb、Cd、Cr、Hg等重金属、二噁英及颗粒物(含PM2.5)等多组份污染物,系统运行过程无废水产生,相较传统解决方案可整体节能20%,节水30%,减少占地面积约50%。项目技术经三位院士领衔的专家委员会鉴定,达到国际领先水平,并获评2019年环境技术进步一等奖及2019年福建省科技进步奖一等奖。

项目成果广泛应用于钢铁、煤电、玻璃、煅烧、焙烧、焦化、炭黑、碱回收、催化裂化等不同行业领域,并出口印度、巴西、南非等“金砖”国家(10套),以及越南、土耳其、乌克兰、塞尔维亚等“一带一路”沿线国家(12套)。项目累计应用业绩超600台套,其中,满足超低排放要求应用业绩200多套,合同总额超过190亿元。



### PROJECT INTRODUCTION:

Multi-domain flue gas multi-pollutant dry synergistic purification technology is based on the high turbulence performance circulating fluidized bed reactor, integrating SNCR/SCR/COA DeNO<sub>x</sub>, fluidizing flocculation, fabric ultrafiltration, absorption and adsorption double purification, and through the intelligent detection and control system, which can efficiently and collaboratively remove SO<sub>2</sub>, NO<sub>x</sub>, SO<sub>3</sub>, HCL, HF and other acid gases, as well as As, Pb, Cd, Cr, Hg and other heavy metals, dioxins and particulate matter (including PM2.5), with no wastewater. Compared with traditional solutions, it can save energy by about 20%, save water by 30%, and reduce area by about 50%. The technology was appraised reaching the international leading level by an expert committee led by three academicians. It won the first prize of 2019 Environmental Technology Progress Award and 2019 Fujian Science and Technology Progress Award.

The technology is widely used in different industries such as steel, coal power, glass, calcination, roasting, coking, carbon black, alkali recovery, catalytic cracking, etc., and is exported to “BRICS” countries (10 sets), such as India, Brazil, and South Africa, as well as the “Belt and Road” countries (12 sets), such as Vietnam, Turkey, Ukraine, and Serbia. The number of references is nearly more than 600 sets, of which, more than 200 sets have met the requirements of ultra-low emission, and the total contract value exceeds 19 billion CNY.

## 工业产品全生命周期绿色低碳管理服务平台

SERVICE PLATFORM FOR LIFE CYCLE GREEN AND LOW-CARBON MANAGEMENT OF INDUSTRIAL PRODUCTS

- 北京生态设计与绿色制造促进会 BEIJING ASSOCIATION OF GREEN DESIGN AND GREEN MANUFACTURING PROMOTION
- 北京中创绿发科技有限责任公司 CIFOOTPRINT CO., LTD
- 工业大数据应用技术国家工程实验室(北京工业大学) NATIONAL ENGINEERING LABORATORY FOR INDUSTRIAL BIG-DATA APPLICATION TECHNOLOGY (BEIJING UNIVERSITY OF TECHNOLOGY)



### 项目简介:

工业产品全生命周期绿色低碳管理服务平台由北京生态设计与绿色制造促进会、北京中创绿发科技有限责任公司、工业大数据应用技术国家工程实验室(北京工业大学)联合开发。平台是以绿色大数据和产业应用为导向,运用云计算、大数据、区块链等技术,融合生命周期评价理论和方法,打造的一个基于互联网的共享、开放的“一站式”绿色低碳SAAS服务平台。平台采用的微服务化模块、组件式设计,拥有高稳定性、扩展性、可移植性的特点;平台拥有目前国内体系最完整、数据量最充分的工业产品全生命周期资源环境影响数据库,可以提供本土化工业绿色数据的采集、存储、处理、采购、应用开发等服务,并支持企业碳核查;同时平台率先引入了区块链技术,可以为数据和资产的共享、流转、分析、交易和监管提供安全保障。

平台的SAAS服务已广泛应用于钢铁、有色、机械、日化、电子等10个工业行业的近500家企业用户。同时,开发团队与联想、上海家化、浙江七星、上海昂丰、广东天元等代表性企业合作,共同构建重点行业的产品全生命周期绿色低碳管理平台,并进行行业标准规范的研究与推广。

### PROJECT INTRODUCTION:

The “Service platform for life cycle green and low-carbon management of industrial products” is jointly developed by Beijing Association of Green Design and Green Manufacturing Promotion, Cifootprint Co., Ltd and National Engineering Laboratory for Industrial Big-data Application Technology (Beijing University of Technology). The platform is an Internet-based shared and open “one-stop” green low-carbon SaaS service platform oriented to green big data and industrial applications, using cloud computing, big data, blockchain and other technologies, and integrating life-cycle evaluation theories and methods. It adopts microservice-based module and component design, which has the characteristics of high stability, scalability and portability. The platform has the most complete domestic system and the most sufficient data volume of industrial product life cycle resource and environmental impact database, which can provide services such as collection, storage, processing, procurement, application development and other services of localized industrial green data, and support enterprise carbon verification. It also takes the lead in introducing block chain technology, which can provide security for the sharing, circulation, analysis, transaction and supervision of data and assets.

The platform's SaaS service has been widely used by early 500 enterprise users in 10 industrial industries, including steel, non-ferrous metals, machinery, daily chemical and electronics. At the same time, the development team has cooperated with representative enterprises such as Lenovo, Jahwa, Zhejiang Qixing, Shanghai Angfeng, Guangdong Tianyuan and so on to jointly build a green and low-carbon management system for life cycle of products in key industries, and conduct research and promotion of industry standards and specifications.

# 轨道交通用大功率氢-电混动系统 关键技术研究及应用

RESEARCH AND APPLICATION OF KEY TECHNOLOGIES OF HIGH-POWER HYDROGEN-ELECTRIC HYBRID SYSTEM FOR RAIL TRANSIT

- 中车青岛四方机车车辆股份有限公司
- CRRC QINGDAO SIFANG CO.,LTD

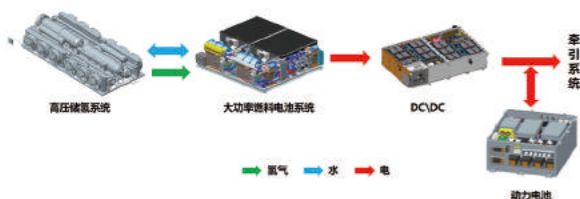


## 项目简介:

基于国家顶层产业政策、市场需求和客户定制化要求，氢能源在轨道交通上的应用将是大势所趋，采用氢能取代传统内燃机或牵引供电系统，可以在实现绿色环保、环境兼容的同时保证轨道车辆的载运和动力性能。

由此，中车四方股份开展氢能技术研究，开发了轨道交通用大功率氢-电混动系统，创新性开发了车用最大功率等级的燃料电池模块、耦合型储氢冷却模块，创建了轨道交通车辆氢-电混合动力系统能量控制策略，突破了大功率多源耦合能量调度及效率提升等关键问题，实现了氢-电混动系统与车辆线路匹配设计，搭建了轨道交通氢-电混合动力系统总成一体化设计体系、安全评估认证体系、混合动力系统控制体系以及轨道交通氢-电混动系统软件仿真及硬件测试平台。

依托大功率氢-电混动系统关键技术，中车青岛四方机车车辆股份有限公司开发了世界首列氢能源有轨电车，并在此基础上开发了新一代商业运营车辆，率先实现了氢能源轨道交通的商业化运营。



## PROJECT INTRODUCTION:

Based on the national top-level industrial policy, market demand and customization requirements, the application of hydrogen energy in rail transit will be the irresistible general trend. Using hydrogen energy to replace the traditional internal combustion engine or traction power supply system can ensure the carrying and dynamic performance of rail vehicles while realizing environmental protection and environmental compatibility.

Therefore, CRRC Sifang has carried out research on hydrogen energy technology, developed high-power hydrogen-electric hybrid system for rail transit, innovatively developed fuel cell module and coupled hydrogen storage cooling module with the highest power level for vehicles, and created energy management strategy for hydrogen-electric hybrid system of rail transit vehicles. It breaks through the key problems such as the control and efficiency improvement of high-power multi-source coupling energy, realizes the matching design of hydrogen-electric hybrid system and railway, and establishes the integrated design system, safety evaluation and certification system, hybrid system control system, software simulation and hardware test platform of rail transit hydrogen-electric hybrid system.

Relying on the key technology of high-power hydrogen-electric hybrid system, CRRC Sifang has developed the world's first hydrogen energy tram, and the new generation vehicles for commercial operation, and took the lead in realizing the commercial operation of hydrogen energy rail transit.

# 航空发动机内花键高可靠性薄膜 绿色再制造技术

GREEN REMANUFACTURING TECHNOLOGY OF HIGH-RELIABILITY THIN FILMS FOR AEROENGINE INTERNAL SPLINE

- 中国农业机械化科学研究院
- CHINESE ACADEMY OF AGRICULTURAL MECHANIZATION SCIENCES

## 项目简介:

为提航空发动机附件机匣传动内花键的耐磨性，传统方法是采用渗碳、渗氮以及碳氮共渗等热处理技术，虽然能在一定程度上提高硬度和耐磨性，但制备所需能耗较高，而且当内花键工作环境进一步恶化时，内花键仍存在寿命不足和可靠性低的问题。本项目利用空心阴极等离子体绿色制备技术，在大长径比航空发动机附件机匣内花键上制备出低摩擦系数、高耐磨性的Si/Si-DLC/DLC/

Si-DLC多层薄膜，并开发了国内首套针对复杂型腔结构内表面薄膜制备的专用装备，实现了传动内花键表面薄膜的低温 (< 150°C) 制备，设计了中心电极进气结构和外部辅助阳极，实现了传动内花键表面薄膜沉积的均匀性和稳定性，建立了薄膜去除与再制造工艺协同精准调控工艺机制，实现了内花键的绿色再制造。试验台架考核与苛刻服役飞行环境下验证，制备多层薄膜的内花键服役寿命提升25%。目前本项目成果已经在多个型号的内花键表面获得应用并形成批量化生产，产生了巨大的社会效益和经济效益。



## PROJECT INTRODUCTION:

In order to improve the wear resistance for driving internal spline of aeroengine accessory gearbox, conventional heat treatments include carburizing, nitriding and carbonitriding are carried out, although the hardness and wear resistance are enhanced, high energy consumption are required for above preparations, and when working environment deteriorates, internal splines still have problems of short service life and low reliability. Green manufacturing technology with hollow cathode discharge generated plasma was used in this work, multi-layer Si/Si-DLC/DLC/Si-DLC films with low friction coefficient and high wear resistance is prepared on internal spline with a high aspect ratio, which is used for aeroengine accessory gearbox, and the first domestic equipment which is used for film deposition on inner surface for complex cavity structure was set up. Film deposition at low temperature (<150°C) was achieved for driving internal splines. Precursor intake structure of central electrode and external auxiliary anode were designed, which realize the uniformity and stability of the film deposition on inner surface for driving internal spline, a coordinated and precise control process for film removal and remanufacturing process was established, which realizes the green remanufacturing technology for internal spline. Test bench assessment and verification under severe service flight environment show that multi-layer film coated internal spline has a service life with a 25% increase. At present, this work has been applied to the multiple models of internal splines which form mass production, resulting in a high social and economic benefits.



# 基于能源作物蓖麻的全产业链高值化利用技术

HIGH VALUE UTILIZATION TECHNOLOGY FOR THE WHOLE INDUSTRY CHAIN BASED ON ENERGY CROP CASTOR

- 南开大学NANKAI UNIVERSITY
- 天津南大蓖麻工程科技有限公司TIANJIN NKU CASTOR ENGINEERING S&T CO., LTD
- 内蒙古威宇生物科技有限公司INNER MONGOLIA WEIYU BIOTECH CO., LTD
- 天津蓖能科技有限公司TIANJIN CASTOR ENERGY S&T CO., LTD.
- 浙江丹弗中绿科技股份有限公司ZHEJIANG DANFER ZHONGLV TECHNOLOGY CO., LTD

## 项目简介:

非粮能源作物蓖麻，种植适应性广，油脂分子结构独特、高值化产品丰富，可应用到新能源、新材料、石油化工等若干产业领域，是助力这些产业绿色发展的很好供给。

本作品“基于能源作物蓖麻的全产业链高值化利用技术”是南开大学历经多年组织开发的，涵盖“绿色润滑油+生物燃料+生物基材料+良种育繁及种植”四大板块成果，被列入《国家重点推广的低碳技术》、《适宜向一带一路国家转移的可持续发展技术》等，获国家科技进步二等奖、军队三等奖、世界自然基金会气候创行者奖、保尔森基金会可持续发展奖。成果产业化有整体布局，在国内合作建有绿色润滑油、生物基材料等产品生产，和良种良法及“油+肥”加工示范，与巴西、俄罗斯、印度等开展种植和加工技术合作。

本作品、旨在提供一套完整的绿色产业链技术方案，体系健全、水平领先，通过示范引领、实现绿色产品“就地解决原料、就地加工、就近推广应用”，助力金砖国工业创新伙伴关系建立和发展。



## PROJECT INTRODUCTION:

Castor, a non-food energy crop, has widely planting adaptability, unique molecular structure of oil and numerous high-value products. It can be applied to several industrial fields such as new energy industry, new material industry, petrochemical industry, etc. It is a good supply to improve their green development.

This work "High Value Utilization Technology for the Whole Industry Chain Based on Energy Crop Castor", which mainly has four sector "Green Lubricating Oil & Grease + Bio-Fuel + Bio-Material + Fine Seeds Breeding & Planting", has been listed in <Low Carbon Technology of National Priority Promotion>, <Sustainable Development Technology suitable for One Belt, One Road Countries>, and has won several prizes such as the second prize of National Science & Technology Progress Award, the third prize of Military Science & Technology Progress Award, the Climate Solver Award of World Wide Fund for nature, and the Sustainable Development Award of the Paulson Foundation. The industrialization of the achievements has an overall layout. In China, we have cooperated in the production of green lubricants, bio-based materials and other products, improved seed and law and "oil + fertilizer" processing demonstration, and carried out planting and processing technical cooperation with Brazil, Russia and India.

This work aims to provide a set of technical solutions for the green industrial chain, which is a sound system and in leading level. Through demonstration, it leads and realizes the "local solution of raw materials, local processing, and nearby promotion and application" of green products, so as to help the establishment and development of the BRICs industrial innovation partnership.

# 胶结充填采矿协同资源化利用生活垃圾焚烧飞灰

RECYCLING UTILIZATION OF MUNICIPAL SOLID WASTE INCINERATION FLY ASH (MSWIFA) BY MEANS OF CEMENTED BACKFILL MINING

- 北科蕴宏环保科技(北京)有限公司
- BEIKE YUNHONG ENVIRONMENTAL TECHNOLOGY (BEIJING) CO., LTD.



## 项目简介:

胶结充填采矿协同资源化利用生活垃圾焚烧飞灰技术以垃圾焚烧飞灰资源化利用为核心，首先通过低温热解除去飞灰中的二噁英，再因地制宜地将热解后的垃圾焚烧飞灰与矿渣、炉渣、脱硫石膏等固废进行配比优化，充分利用硅的四配位同构化效应和复盐效应，制备出低成本、绿色矿山充填专用全固废胶凝材料。矿山企业利用该胶凝材料代替水泥，并配合煤矸石、尾矿或废石为骨料，加水拌和后制成充填料。充填料通过管道输送到地下采空区，在地下采空区凝结硬化，飞灰中的有害组分（重金属离子）进入难溶复盐矿物的晶格体系中，实现原子级微观尺度的重金属稳定化。充填硬化体永久储存在矿山地下采空区，远离人类生活区域，实现生活垃圾焚烧飞灰的低成本地下安全处理及多种工业固废的资源化利用。

该矿山充填专用胶凝材料各项指标满足矿山充填工艺技术指标要求，充填硬化体中有害组分的浸出浓度达到国家饮用水的限值要求，具备环境安全性；与同类矿山充填用胶凝材料（水泥）相比，生产该胶凝材料的CO2排放可减少50%，能耗可降低70%。经由中国环境科学学会的论证，本技术的先进性达到国际领先水平。

## PROJECT INTRODUCTION:

This technology focuses on the resource utilization of MSWIFA. First, the dioxin in the MSWIFA is removed by low-temperature pyrolysis, and then the pyrolyticMSWIFA is combined with solid wastes such as desulfurized gypsum, blast furnace, steel slag, coal slag according to local conditions to prepare a low-cost, green cementitious material specifically used for backfill mining. The proportion of the cementitious material is optimized through fully utilizing the four-coordinate isomorphism effect and the double salt effect of silicon. Mining enterprises use this cementitious material instead of cement, together with coal gangue, tailings or waste rock as aggregates and water to make backfill material. Such backfill material is transported to the underground goaf where it solidifies and hardens, and the harmful components (heavy metal ions) in the MSWIFA enter the lattice system of the insoluble double salt minerals to achieve the stability of heavy metals at the atomic scale. The hardened filling body is permanently stored in the underground goaf of the mine, far away from the living area of human beings, so as to realize the low-cost treatment of MSWIFA and the resource utilization of various industrial solid wastes.

This cementitious material can meet the technical requirements of mine filling technology, and the leaching concentration of harmful components in the hardened filling body can meet the national drinking water limit requirements, ensuring environmental safety. Compared with cement (traditional backfill mining cementitious material), the CO2 emission of this cementitious material can be reduced by 50%, and the energy consumption can be reduced by 70%. Through the demonstration of the Chinese Society of Environmental Sciences, this technology has reached the international leading level.

# 垃圾渗滤液膜浓缩液处理

THE TREATMENT OF LANDFILL MEMBRANE CONCENTRATED LEACHATE

- 湖南天为环保科技有限公司
- HUNAN TIANWEI ENVIRONMENTAL PROTECTION TECHNOLOGY CO., LTD



## 项目简介:

垃圾渗滤液是指来源于垃圾填埋场中垃圾本身含有的水分、进入填埋场的雨雪水及其他水分，扣除垃圾、覆土层的饱和持水量，并经历垃圾层和覆土层而形成的一种高浓度的有机废水，还有准备用于焚烧的垃圾堆积渗漏出的水分。

目前，我国大部分垃圾填埋场进入老龄化阶段，渗滤液可生化性差。各种组合处理工艺大多含膜处理单元，如纳滤、反渗透，随之产生的膜滤浓缩液难以处置。目前浓缩液回灌是常见的处理方式，由于回灌未从根本上去除污染物且影响膜处理的正常运行，因此，本参赛项目提了一种经济、环保、高效的垃圾渗滤液膜浓缩液处理技术。垃圾渗滤液的膜浓缩液的处理近年来已引起人们重视，行业内现有的主要工艺有蒸发、高级氧化、回喷焚烧等工艺，由于每个填埋场渗滤液的特殊性，采用单一的处理技术成本往往很高，且每一种技术均具有一定的局限性，因此选择合适的工艺组合十分重要。通过研发经济环保、适用性广的垃圾渗滤液膜浓缩液处理技术，解决现有垃圾填埋场存在的问题，并率先在湖南省内推行，具有重要的环保意义和推广价值。

## PROJECT INTRODUCTION:

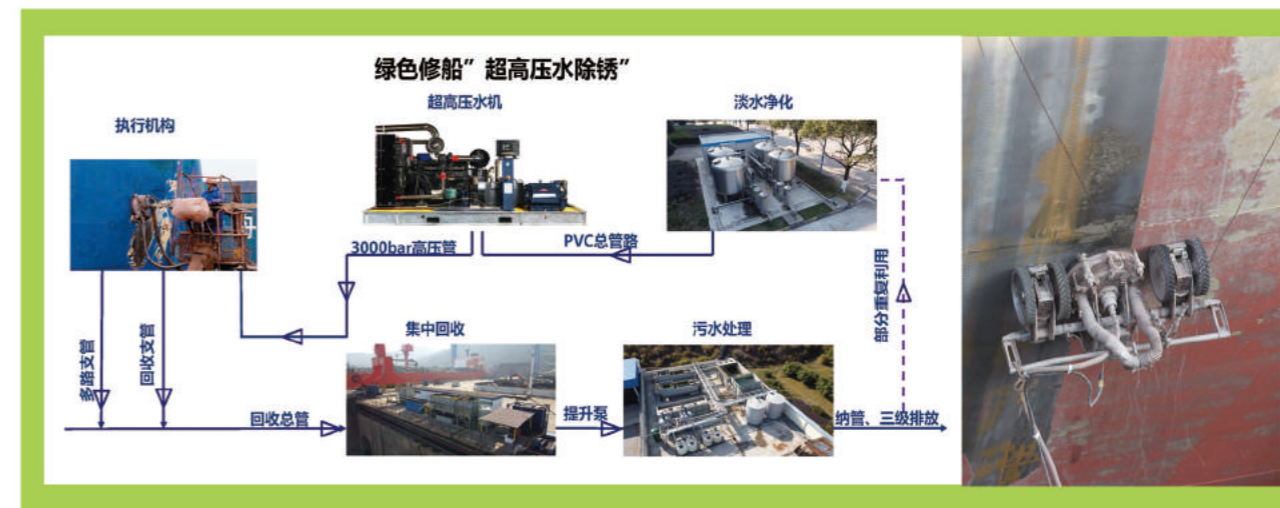
Landfill leachate refers to a kind of high-concentration organic wastewater derived from the water contained in the garbage in the landfill, the rain and snow water entering the landfill and other water, deducting the saturated water holding capacity of the garbage and the overlying soil, and experiencing the garbage layer and the overlying soil layer, as well as the water leakage from the garbage prepared for incineration.

At present, most landfill sites in China have entered the aging stage, and the biodegradability of leachate is poor. Most of the combined treatment processes contain membrane processing units, such as nanofiltration and reverse osmosis, and the resulting membrane filter concentrate is difficult to dispose. At present, concentrated liquid recirculation is a common treatment method. Since the recirculation does not fundamentally remove pollutants and affects the normal operation of membrane treatment, an economic, environmental protection and efficient treatment technology for landfill leachate membrane concentrated liquid is proposed in this competition. The treatment of landfill leachate membrane concentrate has attracted people's attention in recent years. The existing main processes in the industry include evaporation, advanced oxidation, and reinjection incineration. Due to the particularity of each landfill leachate, the cost of single treatment technology is often high, and each technology has certain limitations. Therefore, it is very important to select the appropriate process combination. It is of great environmental significance and promotional value to solve the problems existing in the existing landfill sites and take the lead in implementing it in Hunan Province by developing an economic, environmentally friendly and widely applicable landfill leachate membrane concentrate treatment technology.

# 绿色修船 “超高压水除锈”

ENVIRONMENTAL-FRIENDLY REPAIR SHIP "ULTRA HIGH PRESSURE WATER JET DERUSTING"

- 舟山中远海运重工有限公司
- COSCO SHIPPING HEAVY INDUSTRY (ZHOU SHAN) CO. LTD



## 项目简介:

新工艺利用淡水作为介质，淡水经过高压软管到达喷嘴把低压低速的水转换为高压高流速的射流，然后射流连续不断地作用在被清洗表面，从而使油漆、铁锈脱落达到清洗的目的。除锈产生的污水通过集成真空系统将除锈过程中产生的锈渣和废水回收到污水处理站，将污水达到回用或是排放标准。通过自主研发了一系列机械化产品及辅助设备提高了生产效率并达到绿色环保循环的要求。新工艺解决大气扬尘污染并达到全过程污染控制。



## PROJECT INTRODUCTION:

The new process uses fresh water as the medium. The fresh water reaches the nozzle through the high-pressure hose to convert the low-pressure and low-speed water into high-pressure and high-velocity jet, and then the jet continuously acts on the ship surface to be cleaned, so that the paint and rust fall off to achieve the purpose of cleaning. The waste water produced by derusting is recycled to the sewage treatment station through the integrated vacuum system. The waste water can meet the standards of reuse or discharge. The company through independent research and development has designed a series of mechanized products and auxiliary equipment to improve production efficiency and meet the requirements of green environmental protection cycle. The new process solve the air dust pollution and achieve the whole process of pollution control.

## 绿色再制造生产方案

PRODUCTION SCHEME OF GREEN REMANUFACTURING

- 广州市花都全球自动变速箱有限公司
- HUADU WORLDWIDE AUTOMATIC TRANSMISSION CO., LTD

### 项目简介:

广州市花都全球自动变速箱有限公司(以下简称“花都全球”)绿色再制造生产体系的主要再制造对象是自动变速箱。自动变速箱再制造工艺流程主要分为五个环节,分别为拆解、清洗、再制造、装配、测试,废旧变速箱经过前面四个工序的作业之后,最后经质量检验测试,对于合格品放在产品堆放区等候出货;对于不合格的产品,则找出具体原因并重新装配。项目方案总投资75,620,656.21元。其中国拨资金:5,200,000.00元,占地总面积:5032 m<sup>2</sup>,建成一条设备完善、工艺流程完整的自动变速箱再制造生产线,形成年再制造2.4万台自动变速箱的生产能力,并建成广东省自动变速箱再制造工程技术研究中心。方案启动前,项目方案承担单位拥有年再制造1万台次的自动变速箱产品的生产能力,由于本方案形成了每年2.4万台次的再制造能力,方案完成后共形成每年再制造3.4万台次的生产能力。方案启动前,装备水平自动化程度低,在清洗等生产环节仍然使用大量的手工操作的工人,方案实施以后清洗等已实现自动化,装备水平已到达国家先进水平。



### PROJECT INTRODUCTION:

The main remanufacturing object of the green remanufacturing production system of Huadu Worldwide Automatic Transmission Co., Ltd (hereinafter referred to as "WWT") is automatic transmission. The remanufacturing process of automatic transmission is mainly divided into five links, namely disassembly, cleaning, remanufacturing, assembly and testing. After the operation of the previous four processes, the waste transmission is finally tested by quality inspection. The qualified products are placed in the product stacking area for shipment; For unqualified products, find out the specific causes and reassemble. The total investment of the project scheme is 75620656.21 yuan. China has allocated 5.2 million yuan, covering a total area of 5032 m<sup>2</sup>. It was built a remanufacturing production line of automatic transmission with complete equipment and process flow, formed a production capacity of manufacturing 24000 automatic transmissions a year, and built Guangdong automatic transmission remanufacturing engineering Technology Research Center. Before the scheme is launched, the project scheme undertaking unit has the production capacity of remanufacturing 10000 sets of automatic transmission products per year. Since the scheme has formed the remanufacturing capacity of 24000 sets per year, a total of 34000 sets per year have formed after the scheme was completed. Before the scheme was launched, the automation level of equipment was low, and a large number of workers were still used in cleaning and other production links. After the implementation of the scheme, cleaning and other processes have been automated, and the equipment level has reached the national advanced level.

## 农用机器人

A ROBOT FOR AGRICULTURAL HOLDINGS

- SIBERIAN TIGER

### 项目简介:

精准农业是适应性景观农业的最高形式,以知识密集型农业技术为基础,具有高度可生产性。精准农业的科学理念基于单一领域内存在异质性的概念。为了评估和检测这些不规则行为,目前利用航空摄影或GPS传感器手工取样,并采集土壤样本进行进一步的化学分析。

该项调查成果形成了田间数字地图,附有有关水分、温度、酸度、碱度和照片的数据。基于这些资料训练的神经网络将能够:这些地图可帮助更好地控制和管理各个农业阶段。可帮助节省20%的资源(农药、燃料和润滑油、种子)。也可避免某些具有会导致减产元素的区域发生过度饱和。

然而,现在获得的地图不是很准确,而且由于能够执行这些任务的公司很少,获取地图的成本非常高。因为每年需要分析12-15次,获取1-2次这样的地图对企业的帮助不大。这些因素导致在俄罗斯仅有10%的企业使用精准农业,而在德国和法国——80%的精准农业在农场,在中国,这一比例为60%。农业专家缺口巨大。此外,考虑到我国的地理位置,大型企业的农学家通常致力于增加农田产量。

俄罗斯的解决方案之一是引入机器人系统用于土壤取样。类似解决方案已经在美国、德国和法国得到广泛应用。现有机器人解决方案可用于扫描农田。

机器人将提供有关农田状况更加全面的信息。与使用GNSS进行人工采样和在实验室对样品进行进一步分析相比,机器人能够更快地收集数据;与RS方法相比,我们的机器人准确率更高,而且能够提供更多不同的地图。此外,还提供了发展神经网络的机会;机器人会沿途拍摄作物,收集训练神经网络的数据集,以识别作物类型和疾病。

### PROJECT INTRODUCTION:

Precision farming is the highest form of adaptive-landscape farming, based on knowledge-intensive agro-technologies with a high degree of manufacturability. The scientific concept of precision farming is based on the notion of the existence of heterogeneities within a single field. To assess and detect these irregularities nowadays aerial photography or manual sampling with a GPS-sensor and by collecting soil samples for further chemical analysis are used.

The result of this survey work is a digital map of the field with attached data on moisture, temperature, acidity, alkalinity and photographs, from which trained neural networks will be able to. The maps will allow better control and management of all phases of farming. It will save 20% of resources (agrochemicals, fuels and lubricants, seeds). It will also be possible to avoid oversaturation of certain areas with elements due to which there is a decrease in yields.

Now the obtained maps are not very accurate, the cost of obtaining is extremely high due to the small number of companies that can perform these tasks. Obtaining such a map 1-2 times a year is not very helpful for companies since the analysis is required 12-15 times a year. These factors contribute to the fact that in Russia only 10% of enterprises use precision farming, while in Germany and France - 80% of farms, in China - 60%. The problem of lack of agricultural specialists in agriculture is extremely acute. Also, given the geography of our country, agronomists in large companies are often responsible for the yield of the fields

One of the solutions for Russia will be the introduction of robotic systems for soil sampling. Similar solutions are already widely available in the US, Germany and France. Existing robotic solutions can scan agricultural fields.

The robot will provide more comprehensive information about the condition of the fields. Compared to manual sampling using GNSS and further analysis of samples in the laboratory, the robot will be able to collect data more quickly; compared to RS methods, our robot will be much more accurate and provide more different maps. There will also be an opportunity for the development of neural networks; all along its path, the robot will photograph plants in order to form a dataset for training neural networks to recognize plant types and diseases.

There is a global need for devices that can scan both fields and hilly terrain, so the Siberian tiger is equipped with an active suspension and an omnidirectional stroke. The omnidirectional stroke allows us to reduce the area of technological passes, thereby increasing the yield of the field.

## 燃气分布式能源绿色集成化应用及推广

POPULARIZATION AND APPLICATION OF GREEN INTEGRATED GAS DISTRIBUTED ENERGY SYSTEM

- 远大空调有限公司
- BROAD AIR CONDITIONING CO., LTD.



### 项目简介:

远大空调有限公司，创于1988年，生产以天然气和废热为能源的“非电空调”及“冷热电联产系统”和磁悬浮“节电空调”，并生产99.9%过滤PM2.5的“洁净新风机”、“空气净化机”和检测PM2.5的“环境仪”。使命是“成倍提高空调能效，百倍降低室内空气污染”。

远大燃气分布式能源系统以绿色制造理论为基础，将原来离散的用能设备，通过模块化、工厂化、标准化的设计制造，开发了集成化成套产品；相较于传统模式，绿色集成化应用产品的初投资成本减少20%以上，安装调试时间缩短50%以上。开发了智慧能控系统，自动追踪各用能设备的能源产出以实现各用能设备之间的协同，并采用冷凝热回收技术、低温烟气高效制冷技术、烟气自驱自回收技术，夏季制冷系统综合效率较国家标准（70%）提升了15%，冬季制热综合效率提升36%。建立了全生命周期绿色供应链管理平台，整合从源头到废弃的供应链服务能力，实现全过程节能减排，并大幅降低了运营和运维费用；该技术开发及应用共计投入11000万元，实现产业化后，制造技术绿色化率达到93.25%，制造过程绿色化率达到93.53%，环境资源影响度下降至45.29%。燃气分布式能源绿色集成化应用及推广，将推动绿色智慧能源的快速落地，为实现“双碳”目标贡献力量。

### PROJECT INTRODUCTION:

Broad Air Conditioning Co., Ltd. set up in 1988 manufactures non-electric air conditioning system powered by natural gas and waste heat, the cooling, heating and power (CHP) system and energy-efficient magnetic bearing oil free chiller as well as fresh air machine & air purifier PM2.5 by 99.9%, and the air monitor detecting PM2.5. It is with the mission of “doubling the air conditioning efficiency and reducing indoor air pollution 100 times” .

Broad Green Integrated Gas Distributed Energy System, based on the environmentally conscious manufacturing principle, the traditional and discrete energy equipment will be developed to an integrated energy equipment system, by designing and manufacturing in a modular, factory-based, and standardized way.

Compared with the traditional way, the integrated system can reduce more than 20% initial investment cost, more 50% installation and commissioning time.

Intelligent control system is developed to automatically track the energy output of each energy equipment, and achieve the best performance of the integrated system.

The condensation heat recovery technology, low-temperature exhaust high-efficiency refrigeration technology, and exhaust self-drive and self-recovery technology is adopted, which increases 15% overall cooling efficiency than China national standard, 70%, in summer, and increases 36% overall heating efficiency in winter.

Established a full-life cycle green supply chain management platform, integrated supply chain service capabilities from the source to abandonment, realized energy conservation and emission reduction throughout the entire process, and significantly reduced operation and maintenance costs.

Totally, 110 million CNY was invested in the development and application of this technology. After the realization of industrialization, the greening rate of manufacturing technology reached 93.25%, the greening rate of manufacturing process reached 93.53%, and the degree of environmental resource impact dropped to 45.29%.

The green integrated application of gas distributed energy system will promote the rapid implementation of intelligent green energy, and contribute to the realization of the carbon peak and neutrality goals.

## 太钢区块化多链耦合减污降碳的创新与实践

INNOVATION AND PRACTICE OF TISCO'S BLOCK-BASED MULTI-CHAIN COUPLING FOR POLLUTION REDUCTION AND CARBON REDUCTION

- 太原钢铁（集团）有限公司
- TAIYUAN IRON AND STEEL (GROUP) CO., LTD.



### 项目简介:

实现碳达峰、碳中和是一场广泛而深刻的经济社会系统性变革，减污降碳是钢铁行业当前面临的最重要任务。

作为典型的城市钢厂，太钢坚持做绿色低碳可持续发展的积极推动者，创新发展理念和发展方式，强化顶层设计，破除惯性思维，积极融于城市。通过建立以铁前区域为代表的区块化多链耦合减污降碳发展模式，集成了国内外先进的节能环保技术，实施了大规模的绿色低碳、循环经济改造项目，推动全方位、全流程卓越环保，率先成为国家首批绿色工厂和钢铁行业全流程超低排放绩效A级企业，实现了碳排放、污染物排放协同下降，经济效益和环境效益双赢，走出了一条绿色高质量发展之路。

### PROJECT INTRODUCTION:

Achieving carbon peaks and carbon neutrality is a broad and profound economic and social systemic change. The reduction of pollution and carbon is the most important task currently facing the steel industry.

As a typical urban steel mill, TISCO insists on being an active promoter of green, low-carbon and sustainable development, innovating development concepts and development methods, strengthening top-level design, getting rid of inertial thinking, and actively integrating into the city. Through the establishment of a block-based multi-chain coupled pollution reduction and carbon reduction development model represented by the iron front area, it integrates advanced energy-saving and environmental protection technologies at home and abroad, and implements large-scale green, low-carbon, circular economy transformation projects, and promotes all-round, Excellent environmental protection in the whole process, taking the lead to become the first batch of national green factories and the whole-process ultra-low emission performance A-level enterprise in the iron and steel industry, achieving a coordinated reduction in carbon emissions and pollutant emissions, a win-win for economic and environmental benefits, and a green and high-quality development the road.



# 碳路先锋—数据引领低碳出行

CARBON ROAD PIONEER—DIGITAL LEADING LOW-CARBON TRAVEL

- 北京理工大学
- BEIJING INSTITUTE OF TECHNOLOGY



## 项目简介:

我国致力于可持续的绿色发展道路，节能减排刻不容缓，“碳达峰、碳中和”迫在眉睫。交通领域碳减排作为重要组成部分仍存在巨大的体系空白，政府缺乏系统性的数据支持，车企缺乏碳减排运营指导。

为此我们碳路先锋团队以大数据技术为基础，从政府、企业、个人三个角度出发，分别为各方提供政策建议、运营指导、个性化分析，直击行业痛点。

团队实力雄厚，我们拥有海量的大数据资源，合作平台接入新能源汽车车辆数超500万辆；我们拥有丰富的算法经验，已有算法模型超200个。

绿水青山就是金山银山，碳路先锋致力于服务中国汽车行业节能减排，助力守护美丽中国。碳达峰，我们在路上。



## PROJECT INTRODUCTION:

China is committed to sustainable green development, energy conservation and emission reduction urgently, "carbon peak, carbon neutrality" is imminent. As an important part of carbon emission reduction in the field of transportation, there is still a huge gap in the system. The government lacks systematic data support, and auto companies lack operational guidance on carbon emission reduction.

Therefore, based on big data technology, our Carbon Road Pioneer team provides policy suggestions, operation guidance and personalized analysis for all parties from the perspectives of the government, enterprises and individuals, and directly hits the pain points of the industry.

With strong team strength, we have massive big data resources, and the number of new energy vehicles connected to our cooperation platform exceeds 5 million. We have rich algorithm experience and have more than 200 algorithm models.

Clear water and green mountains are mountains of gold and silver. Carbon Road Pioneer is committed to serving China's auto industry in energy conservation and emission reduction, and helping protect a beautiful China. Carbon peak, we're on our way.

# 乡村振兴的心路——智慧农业与分布式光伏协调发展

MENTAL PROCESS OF RURAL REVITALIZATION-- COORDINATED DEVELOPMENT OF SMART AGRICULTURE AND DISTRIBUTED PHOTOVOLTAIC

- 国网甘肃省电力公司 STATE GRID GANSU ELECTRIC POWER COMPANY



## 项目简介:

甘肃是光伏扶贫大省，但扶贫光伏消纳难、设施运维难等问题凸显，据国家能源局统计，近三年扶贫光伏可用率不足80%。同时，由于甘肃农村配电网结构薄弱，改造能力有限，满足大规模分布式新能源并网面临巨大挑战。

甘肃公司本着“乡村振兴，电力先行”的理念，在国网公司科技项目支持下，联合中国农业大学等科研单位，从培育农村负荷、实现多能互补、力争就地消纳、建立商业模式等多角度综合施策，千方百计提高光伏扶贫整体效益，探索适宜于当地农业生产的光伏扶贫新路子。

## PROJECT INTRODUCTION:

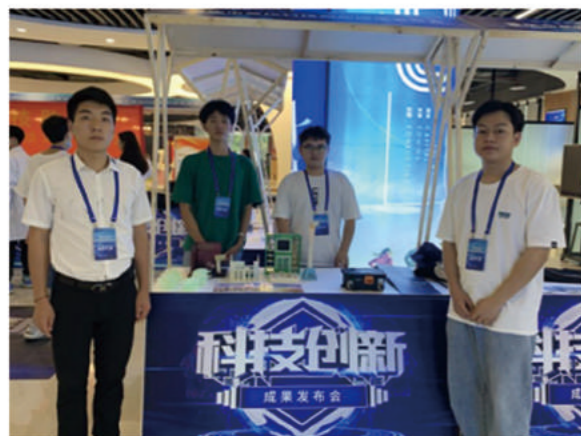
Gansu is a major photovoltaic poverty alleviation Province, but the poverty alleviation photovoltaic consumption and facility operation and maintenance are difficult. According to the statistics of the national energy administration, the poverty alleviation photovoltaic availability rate in recent three years is less than 80%. At the same time, due to the weak structure and limited transformation capacity of rural distribution network in Gansu, meeting the large-scale distributed new energy grid connection is facing great challenges.

Based on the concept of "Rural Revitalization and power first", Gansu company, with the support of the State Grid Corporation's science and technology projects, cooperates with China Agricultural University and other scientific research institutions to make comprehensive measures from multiple perspectives, such as cultivating rural load, realizing multi energy complementarity, striving for local consumption and establishing business model, so as to do everything possible to improve the overall benefits of photovoltaic poverty alleviation, Explore new ways of photovoltaic poverty alleviation suitable for local agricultural production.

# 小旋风-全球首创微动力小型 静音风力发电机

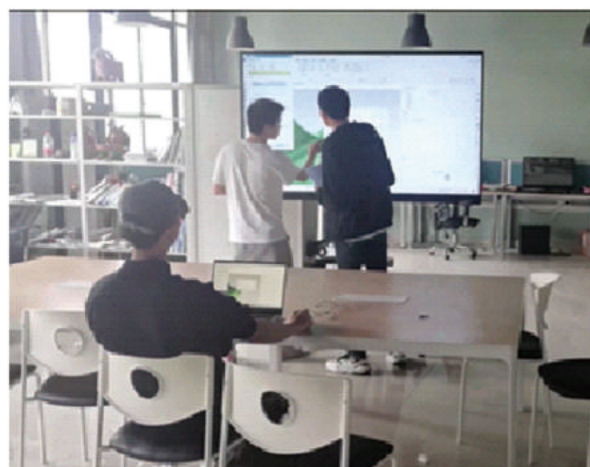
LITTLE TURBO-THE WORLD'S FIRST MICRO-POWERED SMALL SILENT WIND TURBINE

- 重庆工业职业技术学院
- CHONGQING INDUSTRY POLYTECHNIC COLLEGE



## 项目简介:

项目团队背靠重庆工业职业技术学院博士后科研工作站, 长期专研能源环保问题。风力能源是储量巨大的清洁能源, 其中低风力能源占风力能源的68% (能源价值达465万亿元), 该部分能源目前并未得到利用。项目摒弃了集中输电方式, 让用户借助本产品实现自给自足, 解决了传统风力发电不稳定、不可靠、并网难等致命技术问题。项目采用电磁感应原理、磁悬浮技术, 通过空气动力学设计、拓扑优化结构算法、增材制造加工工艺, 使得我们的产品体积小、更静音、更智能、更安全、可定制、且安装运输方便, 让我们的产品应用范围更广, 用户体验更佳, 在发电产品中占据绝对优势。项目属于创新项目, 也属于技术壁垒较高的项目, 乃全球首创。



## PROJECT INTRODUCTION:

The project team is backed by the postdoctoral research station of Chongqing Industry Polytechnic College and has been specializing in energy and environmental protection for a long time. Wind energy is a clean energy with huge reserves, of which low wind energy accounts for 68% of wind energy (the energy value is of 465 trillion RMB), and this part of energy is not currently utilized. The project abandoned the centralized transmission method and allows users to achieve self-sufficiency with the help of this product, solving the fatal technical problems such as unstable and unreliable traditional wind power generation and the difficulty of grid connection. The project adopts electromagnetic induction principle, magnetic levitation technology, through aerodynamic design, topology optimization structure algorithm and additive manufacturing processing technology, which makes our product smaller, quieter, smarter, safer, customizable and easy to install and transport, allowing our product to have a wider range of applications and better user experience, which occupy an absolute advantage among power generation products. The project is an innovative project and a project with high technical barriers and the first of its kind in the world.



# 液压混合动力挖掘机

HYDRAULIC HYBRID EXCAVATOR

- 山河智能装备股份有限公司
- SUNWARD INTELLIGENT EQUIPMENT CO.,LTD.

## 项目简介:

参赛作品为液压混合动力挖掘机, 应用山河智能自主研发的耦合式混合动力技术, 在动臂势能回收再利用技术、回转节能技术和节能核心元件开发等技术领域取得了大量原创性进展。目前已实现量产, 在相同作业工况下, 单作业循环耗油量降低15%以上, 节能效果明显, 对实现“碳中和、碳达峰”的节能减排目标具有重要意义。本产品的混合动力系统具有较强可移植性, 可推广应用。项目总投资21200万元, 其中研发经费2200万元, 固定资产投资19000万元。



## PROJECT INTRODUCTION:

The entry is a hydraulic hybrid excavator, using the coupled hybrid technology independently developed by SUNWARD INTELLIGENT EQUIPMENT CO.,LTD., and has made a lot of original progress in the technical fields of boom potential energy recovery and reuse technology, rotary energy-saving technology and energy-saving core component development. At present, mass production has been achieved. Under the same operating conditions, the fuel consumption of a single operation cycle is reduced by more than 15%, and the energy saving effect is obvious. The discharge target is of great significance. The hybrid power system of this product has strong portability and can be popularized and applied. The total investment of the project is 212 million yuan, including 22 million yuan for research and development and 190 million yuan for fixed assets investment.

# 重钙固废资源化利用

UTILIZATION OF SOLID WASTE OF HEAVY CALCIUM CARBONATE

- 华润电力（贺州）有限公司 CHINA RESOURCES POWER (HEZHOU) CO., LTD
- 华润水泥（富川）有限公司 CHINA RESOURCES CEMENT (FUCHUAN YAO AUTONOMOUS COUNTY) CO., LTD



## 项目简介:

碳酸钙是一种无机化合物，是石灰岩(简称石灰石)的主要成分，广泛用于造纸、塑料、橡胶、油墨、化学建材、密封材料、日化、食品、药品等诸多领域。

大理石废浆是天然大理石经切割、锯磨等生产工艺过程产生的废浆，后经汇集至沉淀池而形成的白色粘稠状石泥。大理石废浆随意排放曾造成水体污染，出现牛奶河现象。在风力作用下，石粉四处扬散，严重影响周边居民的正常生产生活。

岗石废渣是人造岗石经切割、锯磨和水淋降温产生岗石废浆，通过圆盘式压滤机压滤脱水而成。由于其中含有不饱和树脂和絮凝剂PAM等高分子残余物，导致其难降解、难回收利用，给环境造成沉重负担。

据悉，贺州市年产生大理石废浆、岗石污泥100万吨以上。大理石废浆和人造岗石废渣引起的环境问题日益凸显。

针对贺州市重钙固废资源化利用难问题，本作品提出以下解决方案：一是创造性将大理石废浆创新循环用于电厂湿法烟气脱硫系统；二是将岗石污泥按不同配比，进行烘干、粉磨、改性等工艺，实现岗石污泥回用制备为人造岗石；三是将岗石污泥用于制备水泥，实现重钙产业固废的无害化资源化处理。

## PROJECT INTRODUCTION:

Calcium carbonate is an inorganic compound, limestone (limestone for short) is the main component, widely used in paper, plastic, rubber, ink, chemical building materials, sealing materials, daily chemicals, food, medicine and many other fields. Marble waste slurry is a kind of white viscous stone mud, which is produced by cutting, sawing and grinding of natural marble and then collected into sedimentation tank. Random discharge of waste marble slurry has caused water pollution and milk river phenomenon. Under the action of the wind, the stone powder is scattered everywhere, which seriously affects the normal production and life of the surrounding residents. The waste slag of granite is produced by cutting, Sawing and water pouring to reduce the temperature of the artificial granite. It is difficult to degrade and recycle because of the unsaturated resin and Pam, which is a kind of polymer residue, and it is a heavy burden to the environment. It is reported that Hezhou produces more than 1 million tons of waste marble slurry and granite sludge every year. The environmental problems caused by the waste slurry of marble and the waste residue of artificial granite are becoming more and more serious. In view of the difficulty in recycling heavy calcium solid waste in Hezhou, the following solutions are proposed: First, the Marble waste slurry is creatively recycled into the wet flue gas desulfurization system of power plants; second, the granite sludge is mixed with different ratios, drying, grinding, modification and other processes to achieve the granite sludge reuse to prepare artificial granite, the third is to use the granite sludge to prepare cement, heavy calcium industrial solid waste harmless treatment.

# 综合利用废弃共沸剂及醇解废液 年产14万吨异丙醇

COMPREHENSIVE UTILIZATION OF WASTE AZEOTROPIC AGENT AND ALCOHOLYSIS WASTE LIQUID WITH AN ANNUAL PRODUCTION CAPACITY OF 140,000MT ISOPROPANOL

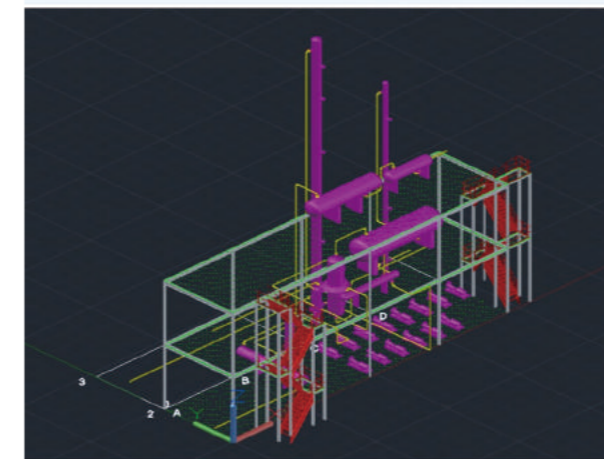
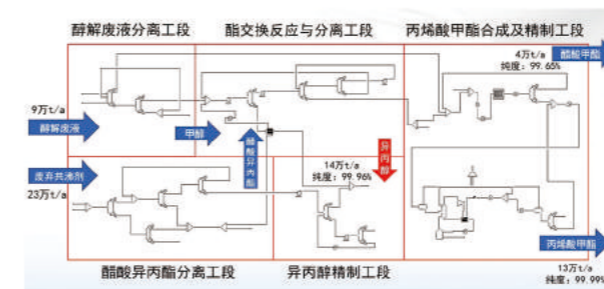
- 河北工业大学 HEBEI UNIVERSITY OF TECHNOLOGY

## 项目简介:

项目秉承废物利用、绿色循环理念，依托安徽皖维集团下属的内蒙古蒙维科技有限公司聚乙烯醇（PVA）产业，建立废液利用生产高附加值产品的分厂，减轻了环境负担，提高经济效益，为化工厂的废液处理提供了新的方案。

将PVA产业中难以处理的大量醇解废液与废弃共沸剂进行收集作为原料，对废液进行分离纯化，所得醋酸返回母厂作为PVA生产的原料，实现与母厂的物料循环；所得高纯度醋酸异丙酯和甲醇通过绿色反应精馏酯交换工艺生产异丙醇；所得醋酸甲酯与甲醛反应后生产高附加值产品—丙烯酸甲酯。

本项目工程总投资14亿5千万元，于内蒙古蒙维科技有限公司旁建设一座占地面积6.24万m<sup>2</sup>的现代化工厂。目前本项目正处于创立初期，相关工艺路线已基本完善，技术可行性较高。项目建成以后将具有年产14万吨异丙醇的能力，且综合利用化工厂产生的废液，对于改善生态环境具有重要意义，符合《中国制造2025》要求与“碳达峰、碳中和”的战略目标。



## PROJECT INTRODUCTION:

Adhering to the concept of waste utilization and green recycling, relying on the polyvinyl alcohol (PVA) industry of Inner Mongolia Mengwei Technology Co., Ltd. subordinate to Anhui Wanwei group, the project establishes a branch plant for waste liquid utilization and production of high value-added products, reduces the environmental burden, improves economic benefits, and provides a new strategy for liquid treatment of chemical plants.

A large amount of alcoholysis waste liquid and waste azeotropic agent, which are difficult to be treated in PVA industry, are collected as raw materials. The waste liquid is separated and purified, and the obtained acetic acid is returned to the parent plant as raw materials for PVA production, realizing material circulation with the parent plant. Isopropanol is produced from high purity isopropyl acetate and methanol by green reactive distillation transesterification process. The obtained methyl acetate is reacted with formaldehyde to produce high value-added products—methyl acrylate.

The total investment of the project is 1.45 billion yuan. The factory is located next to Inner Mongolia Mengwei Technology Co., Ltd., covering an area of 62,400 m<sup>2</sup>. The project is in the initial stage of establishment, the process route has been basically perfected, and the technical feasibility is high. After the completion of the project, it will have an annual production capacity of 140,000MT isopropanol. The comprehensive use of waste liquid is of great significance to improve the ecological environment, which is in line with the requirements of "Made in China 2025" and the strategic plan for achieving carbon emissions peak and carbon neutrality.