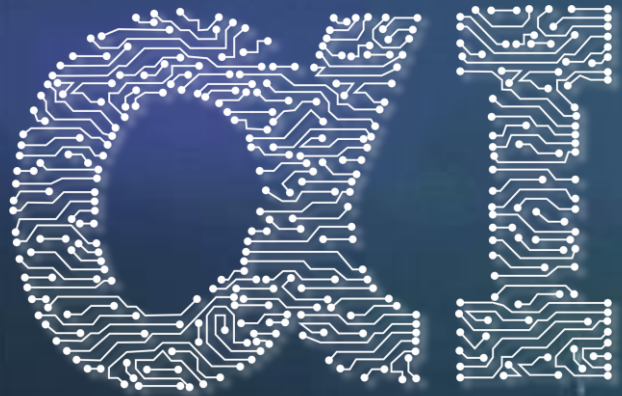

Intelligence For Coal Preparation

Alpha Industrial Intelligence Holding Co.,Ltd

ALPHA INTELLIGENCE

CONTENTS

ALPHA INTELLIGENCE

01

About Alpha

About Alpha

- Alpha Industrial Intelligence Holding Co Ltd, we focus on providing IoT intelligent solutions for resource industry.
- With Headquartered in Cayman, UK, Alpha has wholly owned subsidiaries in Sydney, Australia and Chengdu, China.
- Chengdu Alpha Industrial Intelligence Co Ltd is a wholly-owned subsidiary company established in China. Alpha Chengdu is mainly responsible for R&D, outsourcing of core hardware and sensor manufacturing, and some international technical support.
- Alpha focuses on intelligent mining, from underground mining to open-pit mining, from exploration to mining, mineral processing, and CHPP operation. Alpha can provide different intelligent customized equipment and solutions.
- The safety and efficiency of the mine overall management and operation is the area where the company is committed to and good at.

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Location Map Of Alpha

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02 Intelligent PdM System

Intelligent PdM System-Backgroud

Now: 22000 + PDM sensors have been implemented, and machine learning time has exceeded 190 million hours / year.

Future: it will be connected to tens of millions of core equipment in mining industry, n billion level edge computing, and machine learning time will exceed trillion level hours / year.

Intelligent PdM System-Backgroud

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With the arrival of **Industry 4.0 era**, the intelligent industrial Internet of things began to break through to a higher level. In the field of industrial equipment maintenance, **Predictive Maintenance** has become a key technology innovation point. **Predictive maintenance** is developed from the concept of **"condition monitoring",** which means that collects real-time data on the condition of the monitored parts; **However, condition monitoring fails to predict the interruption of machine operation and wear consumption prospectively.**

Therefore, the emergence of predictive maintenance is a turning point: **More sophisticated sensors, More efficient communication network**, **The powerful computing platform capable of processing large-scale data,** adopting the random algorithm to compare the data with the data mode when the machine has problems. Compared with the traditional time equipment maintenance, preventive work is done. By analogy, predictive maintenance has become a new highlight.

Preventive maintenance: Preventive maintenance is to carry out planned maintenance work according to the scheduled maintenance interval or equipment working time, regardless of the current operation and health status of system equipment.

Predictive maintenance: It is a method to analyze and evaluate the health status of equipment based on **machine learning algorithm and failure model** through periodic or continuous monitoring of equipment status, so as to predict the time of next failure and the specific time of maintenance.

Intelligent PdM System-Technical Principle

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In mine equipment accidents, mechanical failure is the main cause. But, before the equipment failure, the vibration and temperature parameters of the equipment will be abnormal, which is the core replectction of inner part wear, so the real-time monitoring of the **vibration and temperature** parameters is the main realiable and useful shortcut to solve this problem.

The intelligent PDM system monitors the mine equipment in real time through the wirelss IoT sensors installed on the equipment, and uploads the vibration temperature parameters to the alpha cloud server through the repeater, processes and feeds back through the Cloud AI machine learning algorithm, and the feedback information is pushed to the mobile APP and the computer terminal of the relative employees, so as to achieve the function of early warning, prevention and maintenance.

Intelligent PdM System-Main Components

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IOT Sensor

Condition monitoring is the basis of predictive maintenance. Through the IoT sensors installed on the equipment, real-time monitoring and collecting operation data. All kinds of sensors include temperature, vibration, pressure, current and other sensors.

Wireless Vibration Temperature Sensor

Wireless transmission, tri-axial vibration
Power：0.1W
Acceleration measurement range:：±16g
Frequency range：0.5~1600Hz（Optional）
Temperature measurement range:：-55～+125℃
Temperature measurement accuracy：0.1℃
Protection grade：IP65

Wireless Repeater

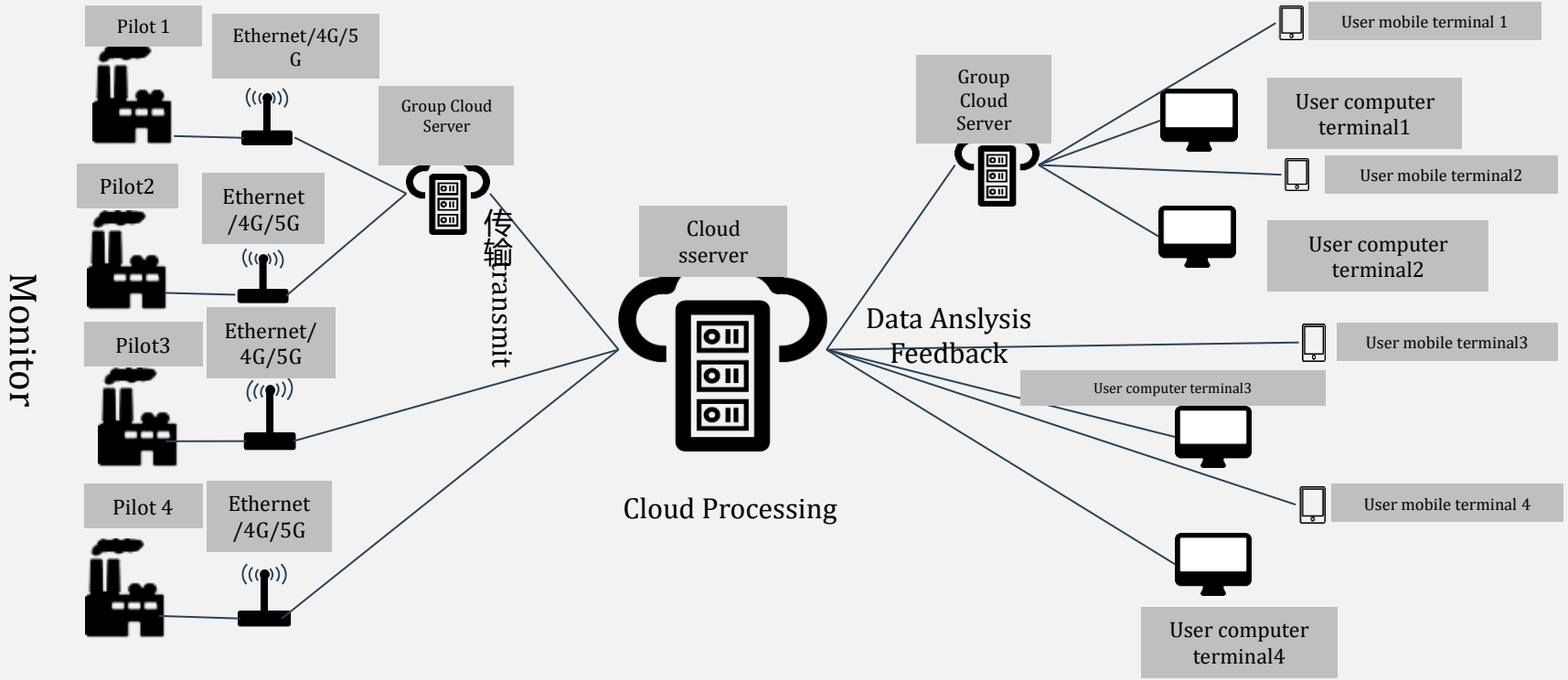
Power：0.6W
Transmitting power：22dBm
Transmission frequency：2.4GHz
Transmission rate：1Mbps
Transmission distance：2500M(barrier free)
Wireless protocol：Zigbee
Network transmission:：10/100M Adaptive
Power supply：AC220V
Working temperature：-40℃～+85℃

Wireless transmission

Sensor data acquisition is completed, wireless transmission is used, and data is transmitted to the repeater.The repeater then transmits the data stably to the local server for storage through optical fiber and cable or stractly to Cloud AI Platform.

IOT Repeater

Intelligent PdM System-Main Framework



Intelligent PdM System-Item Distribution

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22000 + sensors have been put into use.

Machine learning time increased by 192,720,000 hours per year

Alpha is about to increase pilot projects in Russia, Mongolia, Vietnam, Philippines and other countries.

Intelligent PdM System-Case

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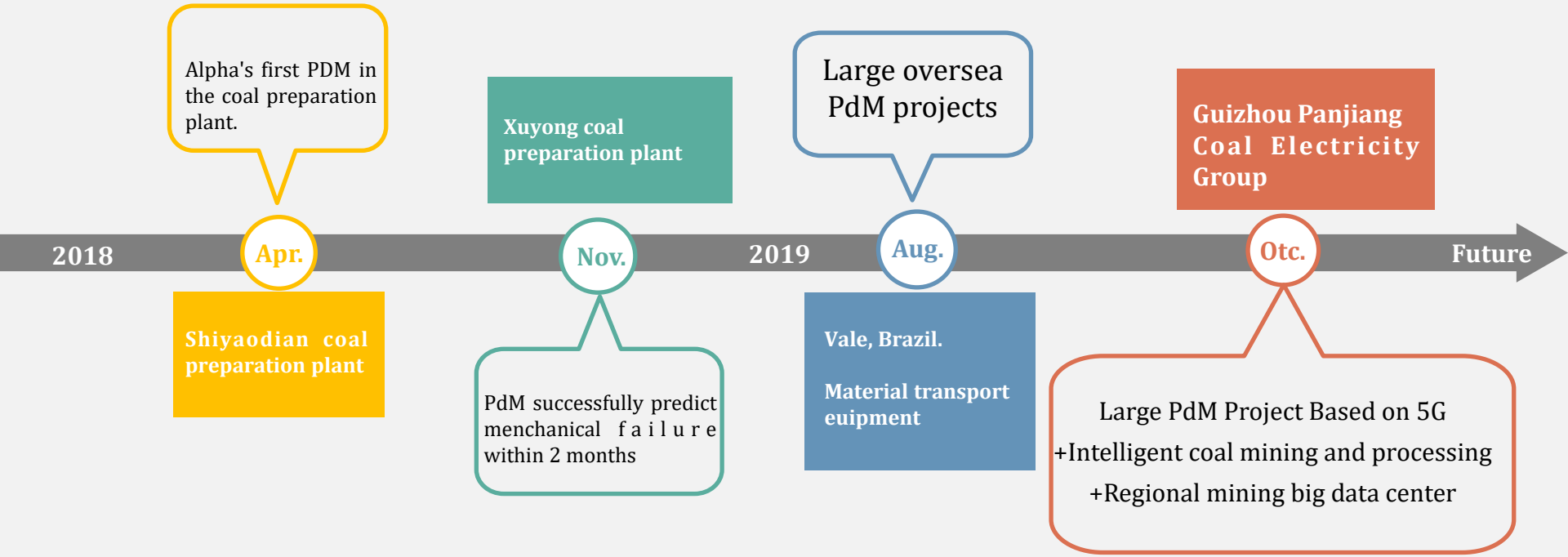

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03 Asset Life Cycle Intelligent Management

Asset Life Cycle Intelligent Management-Framework

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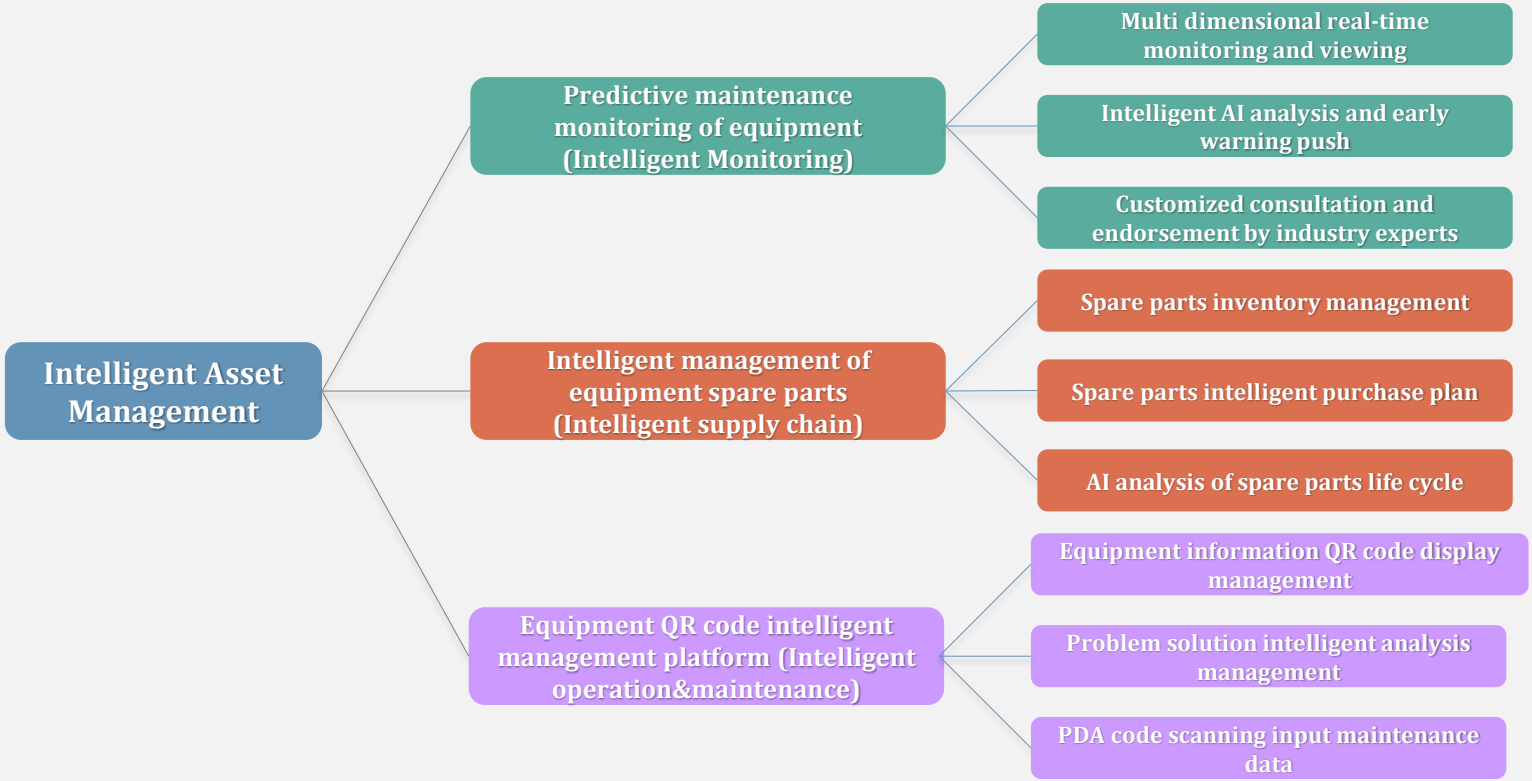

Asset Life Cycle Intelligent Management-Data Center

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1

2

3

Local Data Center

Group Data Center

Industry Data Center

Asset Life Cycle Intelligent Management-Advantage

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- Equipment intelligent information management;
- Spare parts purchase plan forecast;
- Reduce spare parts inventory;
- Saving production cost;

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04 Intelligent Technologies of CHPP Operations

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01.Dense Medium Hydrocyclone

Dense Medium Hydrocyclone Intelligence - Background

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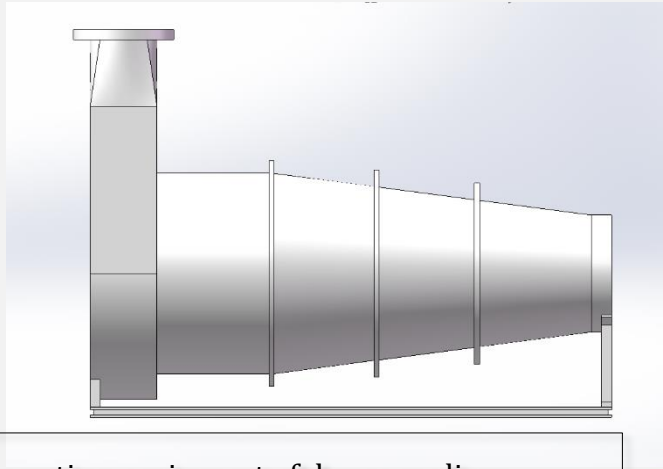
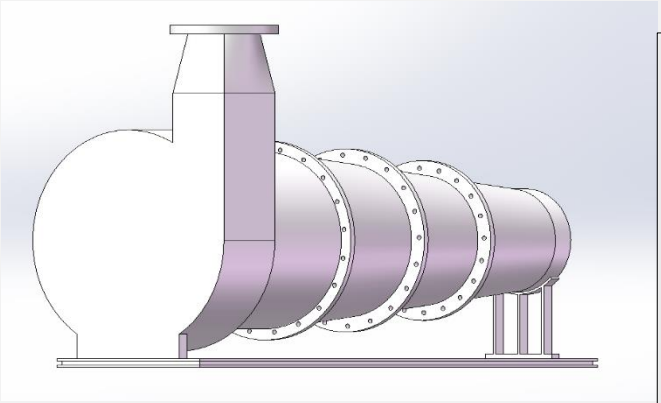
With the further improvement of national requirements for environmental protection, energy conservation and consumption reduction, now the coal preparation plant mainly based on dense medium technology is more and more favored by industry, and the supporting production automation and intelligent system is also developing rapidly.





For coal preparation equipment of dense medium process, such as shallow dense medium tank, dense medium hydrocyclone, etc, it is an inevitable trend for the equipment to be upgraded automatically and intelligently. Through intelligent transformation to achieve the improvement of production efficiency, reduce production costs and improve product quality.

Dense Medium Hydrocyclone Intelligence - Principle

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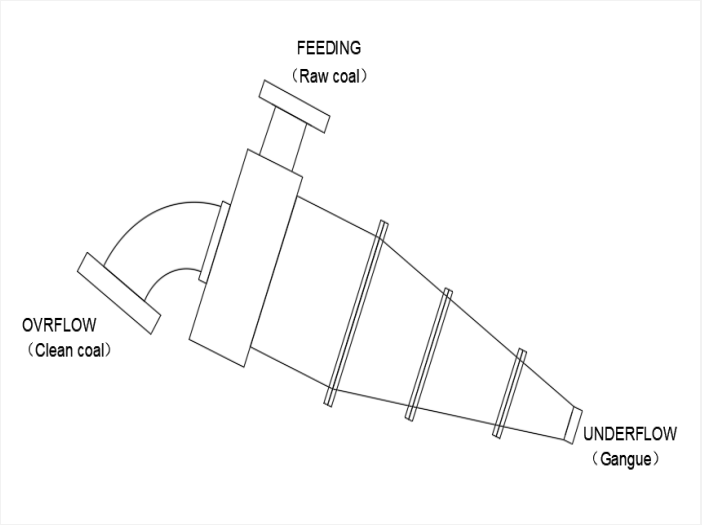

All kinds of sensors built in the dense medium hydrocyclone can monitor the hydrocyclone in real time, including hydrocyclone **wear detection, cluster phenomenon monitoring** and **process control status monitoring.** And through wireless transmission, the monitoring data is imported into the computer for big data analysis. It can reduce the process interference related to the hydrocyclone, improve the overflow particle size distribution of the hydrocyclone, and help to optimize the process. It can also predict and control the maintenance plan of the dense medium hydrocyclone.

In addition, through the analysis of the history and real-time data of raw coal quality by on-line ash analyzer, the mathematical model of dense medium can be established. According to the density composition and particle size composition of raw coal, the **Washability Curve** can be automatically generated, the separation density can be predicted, and the density of circulating suspension can be automatically set with the change of raw coal quality. Finally, the expected separation effect is achieved.

Dense Medium Hydrocyclone Intelligence - Advantages

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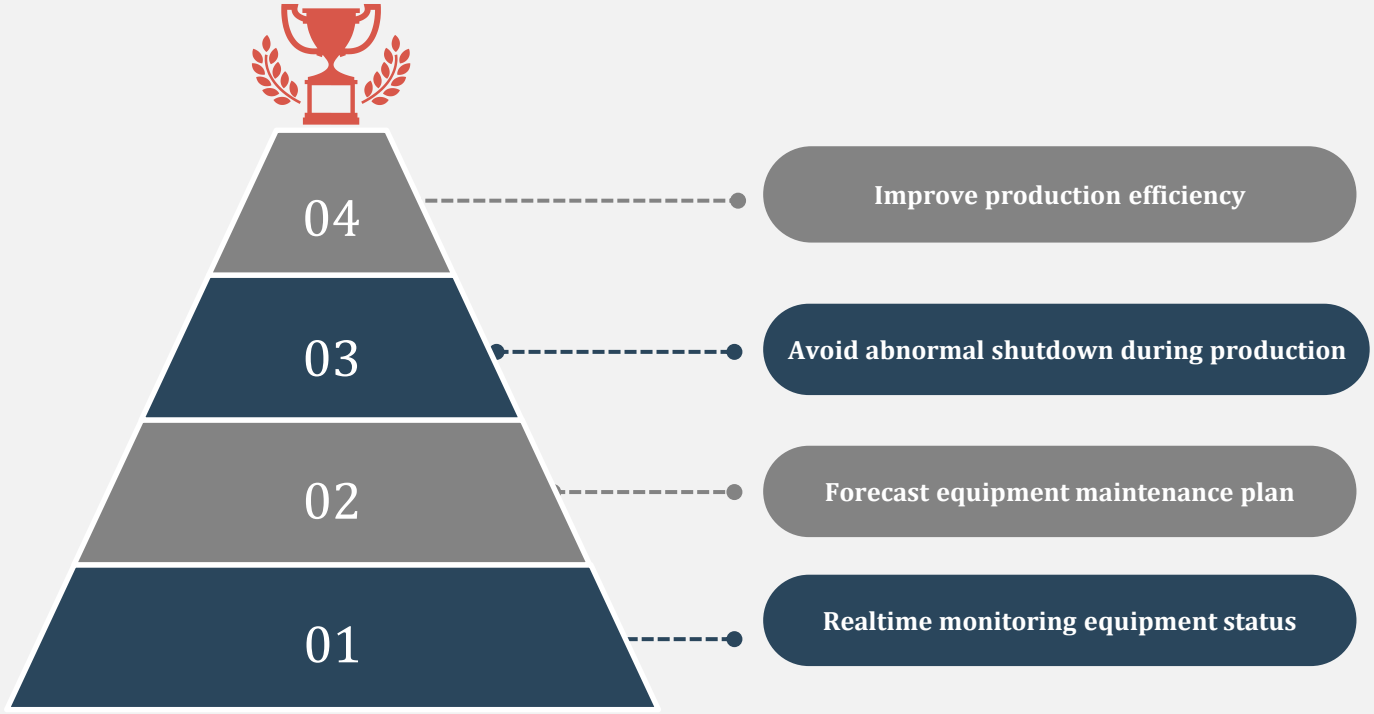

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02.Teetered Bed Separator Intelligence

TBS Intelligence - Principle

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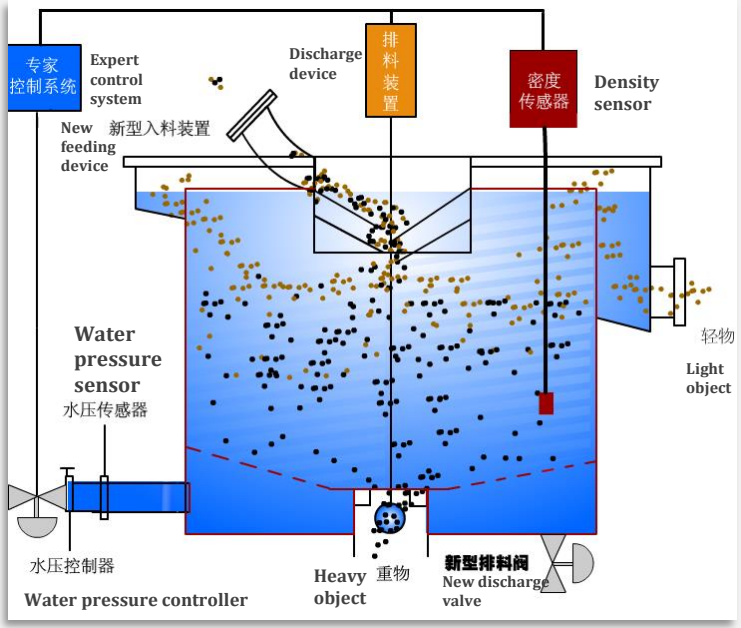
Separating Principle

For 0.25-1mm coarse coal slurry separation, TBS intelligent coal slurry separation equipment scheme is adopted. It is a kind of equipment which can realize intelligent separation under the joint action of upward water flow and intelligent jammer according to the density difference of materials.

During the normal operation of the equipment, materials enter the separation tank through the central feeding barrel. Under the action of upward water flow, materials and top water flow mix in the equipment, forming a stable "teetered bed". In this bed, materials (clean coal) with lower density move upward, while materials (gangue) with higher density move downward. Then, the clean coal overflows from the top of the separation tank, and the gangue is discharged by the discharge pump through the gangue discharge tank.



TBS Intelligence - Principle

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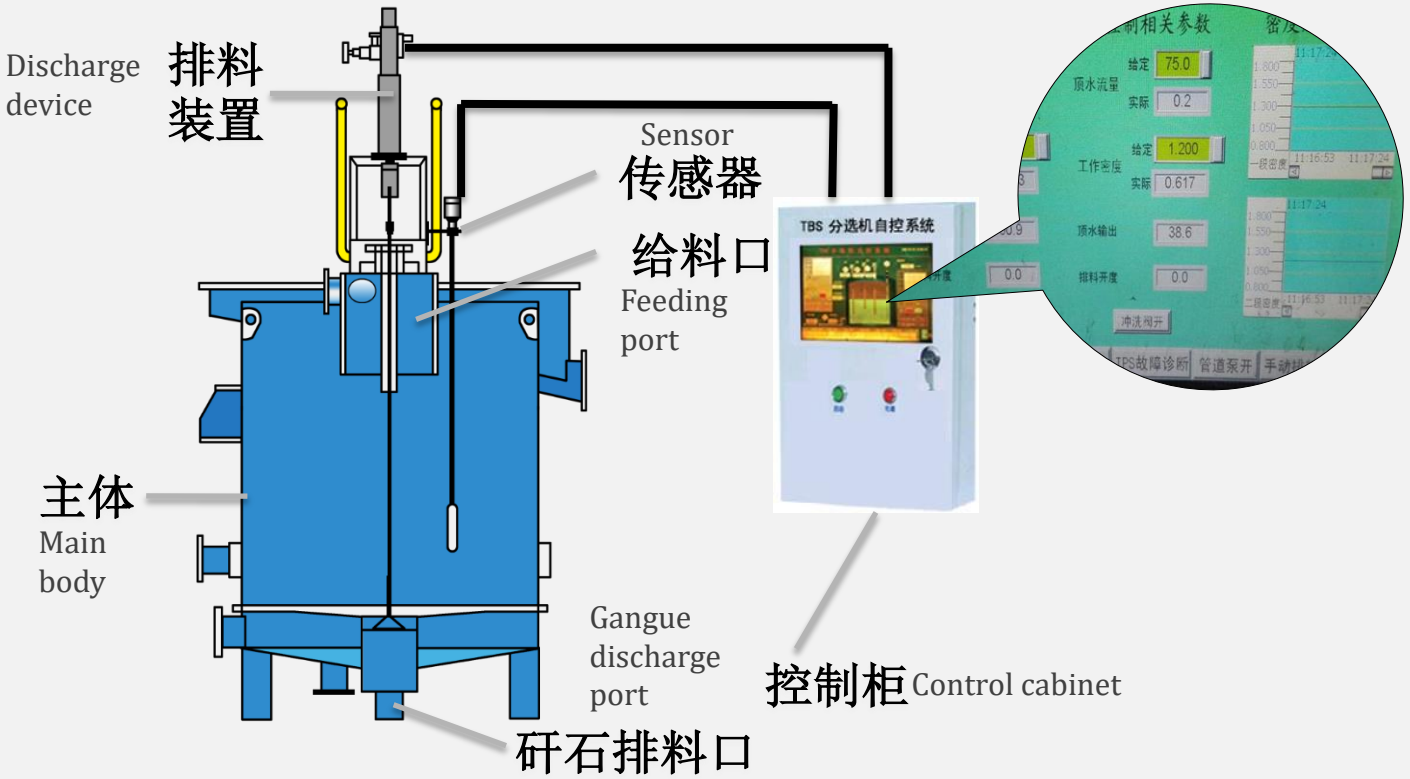
Intelligent

In the separation process, various sensors collect data at the front end, and the intelligent control system analyzes these parameters in real time, so as to monitor teetered bed conditions in the separation tank. When its density changes, the system will carry out intelligent control on the equipment to achieve stable separation quality.

At the same time, it also combines the functions of edge computing, cloud computing and AI machine learning. In the practical application of production, through the analysis of the real-time production data of the coal preparation plant, in-depth learning, self optimization, and ultimately achieve the optimal separation efficiency, to maximize the efficiency of the coal preparation plant.

The equipment itself is also equipped with PdM predictive maintenance system. Through real-time monitoring of various parameters of the equipment, combined with AI machine learning system, it can accurately predict equipment failure, reduce equipment downtime and effectively guarantee production continuity.

TBS Intelligence - Main Components



TBS Intelligence - Cases

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1

Ningxia Shenhua coal industry Renjiazhuang coal preparation plant

Site operation condition

2

Uhg coal preparation plant of MMC company in Mongolia

Site installation condition

3

Anhui Huaibei Liudong coal preparation plant

Site operation condition

ALPHA INTELLIGENCE

02.Flotation Intelligence

Flotation Process Intelligence - Principle

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At present, in flotation process, flotation is mainly controlled by experienced workers or engineers. The flotation process is in a stable state by observing the bubble state on the surface of the slurry and adjusting the liquid level of the flotation pulp, manually control the dosage of medicament and the air volume. In most cases, this work is very complex, mainly reflected in the following aspects:

- It is difficult for operators to monitor and obtain changes in the characteristics of flotation froth in real time.
- The accurate flotation froth feature information can not be obtained by naked eye observation.
- Flotation environment will cause health damage to workers.
- Only qualitative estimation can be carried out, and the results cannot be quantified in terms of continuity and systematization
- The observation results vary from person to person, and the control strategies of each person are different, which leads to extremely unstable production.
- With the improvement of the automation level of flotation process, it gradually provides a good development space for optimization control, expert system and other research.

Background

Flotation Process Intelligence - Principle

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In recent years, with the rapid development of computer and electronic technology, the application of computer vision technology in the industrial field has become a trend. It is further introduced into the control of froth flotation process. The image analysis system of flotation froth is using computer vision technology to analyze froth images in real time, so as to get the characteristic data of froth in the flotation cell. At the same time, it can provide reliable data for optimizing control system.

Combined monitoring of flotation reagent dosage, flotation concentration, flow rate, thickness of froth layer and feeding ash, a mathematical model of flotation automatic dosing is established through large data platform. According to the feeding materail quality and product index, the parameters of flotation process, such as charge ratio, aeration volume and thickness of foam layer, are automatically predicted. The product line is equipped with online ash analyzer, according to the online flotation concentrate or tail coal ash content, floating concentration, flow rate and froth thickness, real time adjustment of dosage, dosing ratio, aeration volume and liquid level is achieved, so as to realize intelligent control of flotation, stabilize the ash content of clean coal, increase the yield of cleaned coal, and improve the quality and yield of flotation.

Flotation Process Intelligence - Image Recognition Technology

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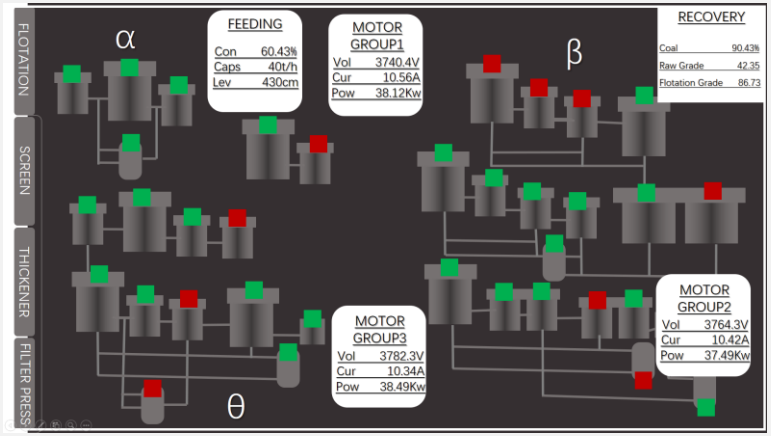

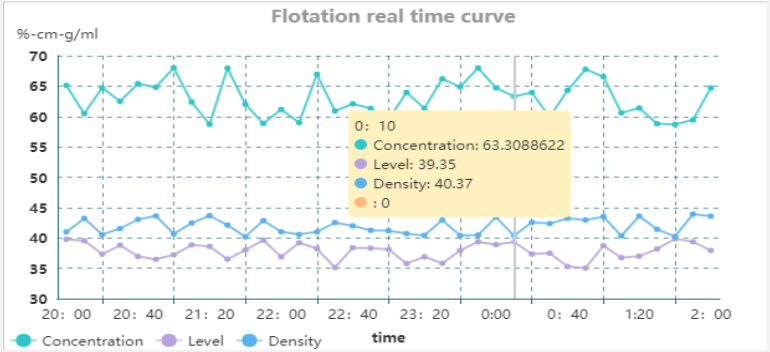

The image recognition system of computer vision technology has the following monitoring functions:

- Froth real size
- Number of froth of different sizes
- Percentage of froth of different sizes
- Average moving velocity of froth
- Average life cycle of froth
- RGB color feature vectors of froth

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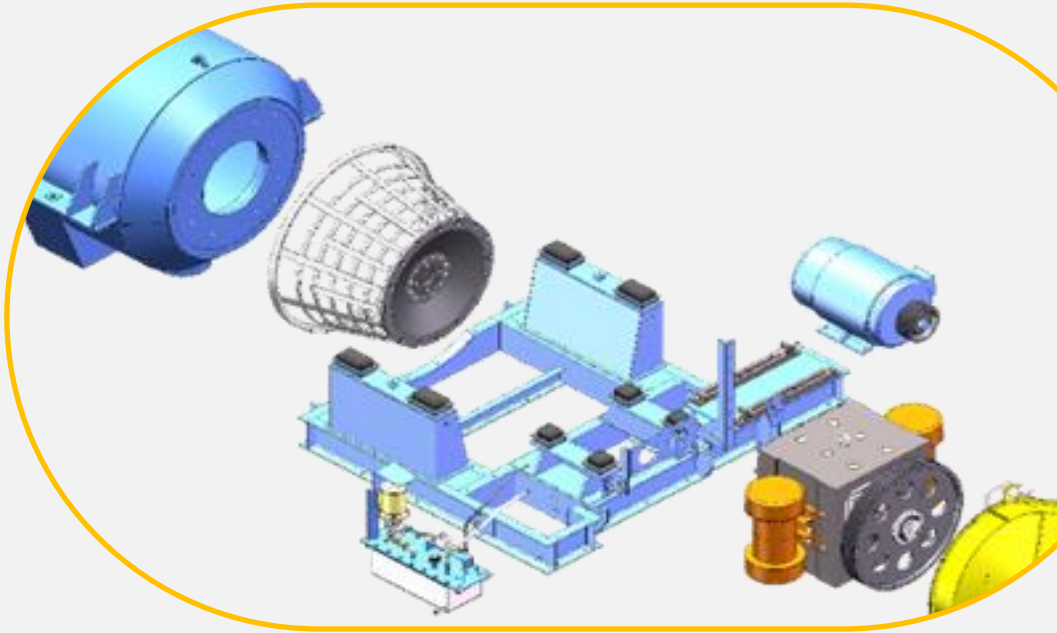
04.Coarse Coal Slurry Centrifuge Intelligence



Coarse Coal Slurry Centrifuge Intelligence - Principle

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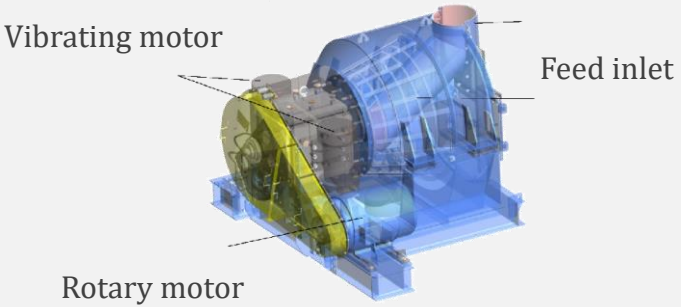
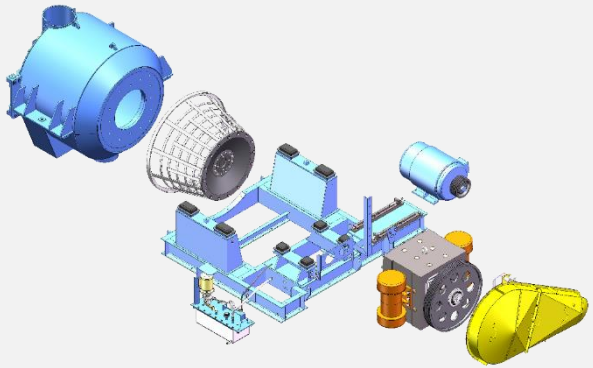
Working principle

The screen basket vibration is realized by two vibration motors installed on the main body, which transmit the vibration power to the main shaft to drive the screen basket vibration. At the same time, the main shaft drives the screen basket rotation by the drive motor through the belt, and finally the feed is centrifugally dehydrated in the screen basket and vibrated for unloading.





Application area

Horizontal vibrating centrifuge is mainly used to separate suspended solid particles and liquids, and widely used in coal preparation, mineral processing, water treatment and other industries.

Coarse Coal Slurry Centrifuge Intelligence - Characteristics

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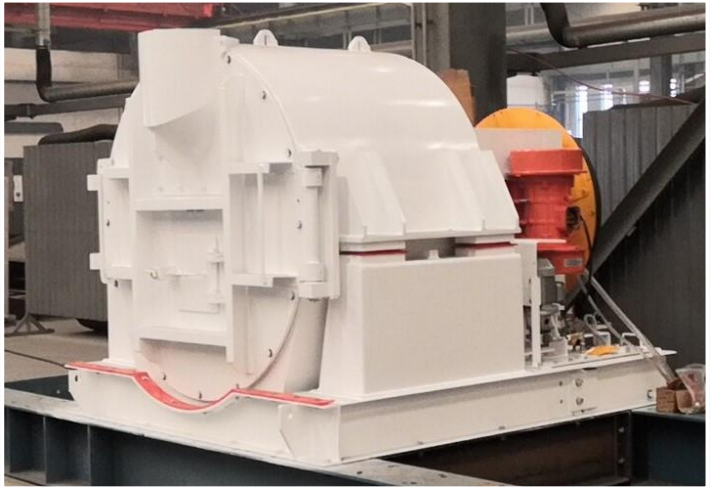
Equipment characteristics

- High efficiency, low moisture content and low coal loss rate
- Wide range of feed particle size and strong processing capacity
- Low energy consumption and low production cost of coal preparation plant
- Less wearing parts
- Simple and flexible structure, firm and durable, easy to maintain
- Reduce plant height and investment cost
- Vibration balance, low noise
- Optimization design suitable for the actual demand of coal industry



Coarse Coal Slurry Centrifuge Intelligence - Advantages

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Product Advantage

- All key components are of international famous brands, with excellent equipment performance and component wear-resistance.
- Using two independent vibration motors, the vibration force is large, the vibration effect is good, the amplitude is 2-6mm, and it is convenient to adjust.
- The use of polyurethane buffer block and damping rubber plate reduces the noise and foundation vibration.
- Integrated design, when the material passes through the chute, it also participates in the vibration to ensure the uniformity and looseness of the incoming material.
- Intelligent predictive maintenance and monitoring of core components to ensure the working status of equipment.

Coarse Coal Slurry Centrifuge Intelligence - Unique Technology

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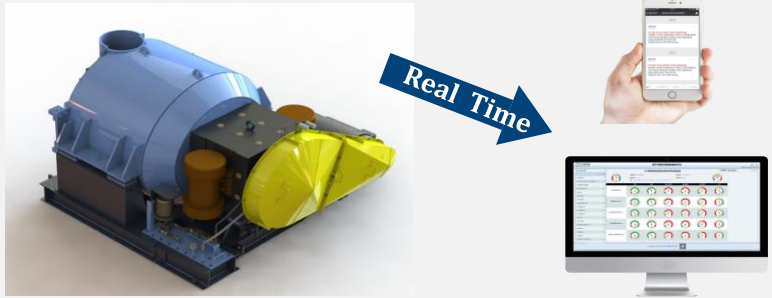
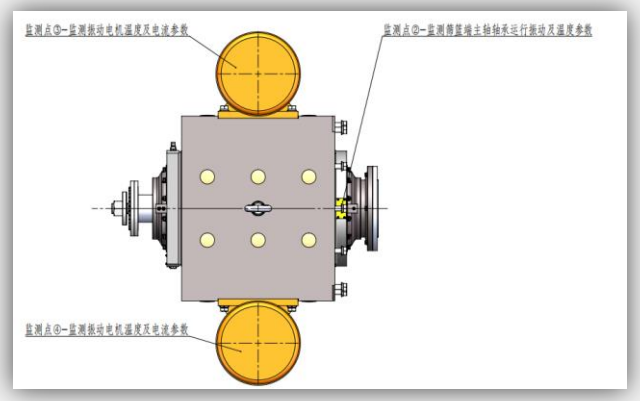
① Intelligent Predictive Maintenance

The built-in wireless sensor is specially customized for the centrifuge, which can monitor the operation status of the core components of the centrifuge in real time.The operation data is uploaded to the cloud wirelessly. Through intelligent analysis, the intelligent algorithm is embedded to predict the operation failure of the whole centrifuge to achieve predictive maintenance of the centrifuge.Predict the failure in advance to avoid failure shutdown. The operation data can be viewed in real time on the computer and the wechat end of the mobile phone, and the warning and alarm information can be pushed in real time. Extend the service life of the equipment.





② Real Time Monitoring of Solid Particles

The content of solid particles in the centrifugal liquid is monitored in real time, and the abrasion of the screen basket is known in real time through analysis. It is convenient to replace the wearing parts in time and reduce the abnormal shutdown in production. The early warning information is pushed in real time, and the production personnel can understand and process the information in the first time.

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05. Filter Press Intelligence

Filter Press Intelligence - Principle

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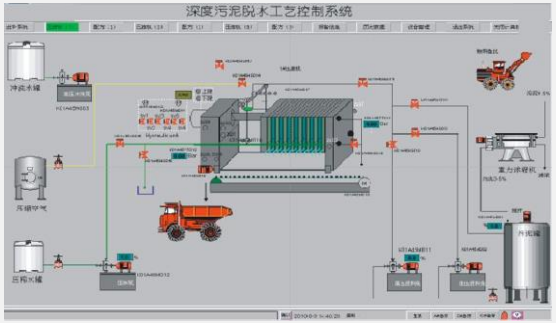
Working Principle

The recovery and utilization of coal slurry can not only improve the utilization rate of resources, but also improve the utilization efficiency of circulating water. Usually, the way of filter press is used to recover coal slurry. Intelligent technology of filter press is a kind of intelligent technology which can monitor the state of filter press in real time through various sensors and monitoring systems, and realize all PLC control of filter press by mobile devices such as flat plate.

Not only that, a tablet PC can also control multiple filter presses at the same time. Completely avoid the back and forth operation of operators between several filter presses, resulting in the status that caused errors, which is time-saving, safe and efficient.



Filter Press Intelligence - Intelligent Characteristics

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Intelligent Characteristics

- The built-in pressure sensor monitors the pressure of the filter plate in real time;
- The solid particle monitoring system monitors the solid particle content of filtrate in real time;
- The main body of the equipment is connected with the main control system, and the PLC control of the filter press is completed remotely by the mobile equipment such as the tablet PC ;
- The built-in PDM intelligent predictive maintenance system can predict equipment failure;

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05 Robotic Management of Distribution Room

Robotic Management of Distribution Room-Introduction

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System Introduction

Unattended distribution room refers to the distribution room without personnel on duty during operation. The operation state of the room is uploaded to the centralized control room after being summarized and processed by the intermediate signal acquisition and conversion unit for monitoring, query and processing by the central control personnel, and cooperate with the abnormal state early warning system to achieve unmanned power distribution management.

The system composition of unattended distribution room mainly includes: field partition layer, communication network layer and centralized control layer.

Robotic Management of Distribution Room-Frameworks

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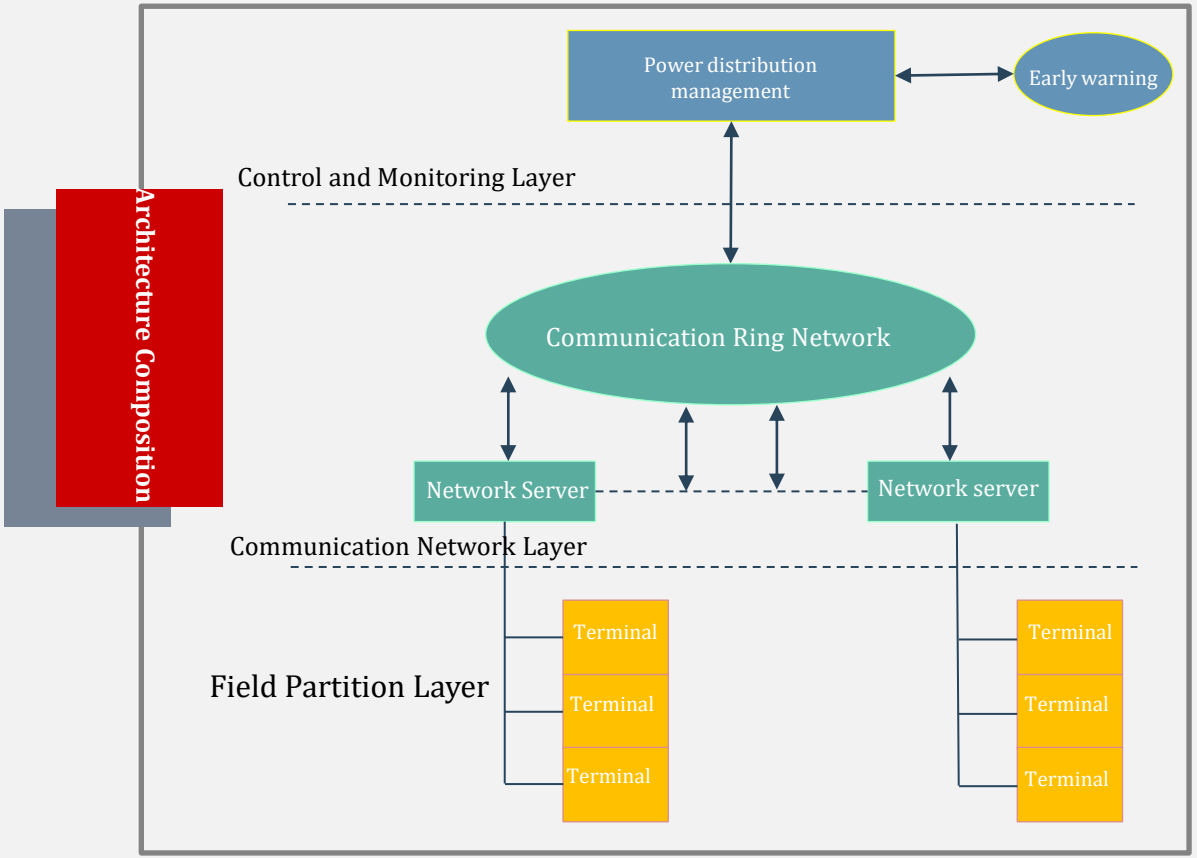

Robotic Management of Distribution Room-Characteristics

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Intelligent Characteristics

Intelligent distribution system

The temperature probe configured in the high-voltage distribution cabinet can monitor the contact temperature of the high-voltage distribution cabinet at any time. The communication function and control function are added in the low-voltage distribution cabinet to record, store and send the monitoring data in real time.

Video and audio monitoring system

The monitoring camera, monitoring and intercom system are added in the power distribution room to realize the linkage between the power distribution cabinet and the monitoring image, making the monitoring more intuitive and convenient.

Unattended distribution management system

It is a computer-based power supply control and dispatching automation system. Through the management and analysis of the monitored parameter information, it can realize the intelligent functions of remote operation, monitoring and self-processing of some conditions.

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06 AI Vital Signs Monitoring and Location

AI Vital Signs Monitoring and Location-Introduction

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Plant personnel safety management system

- Real time positioning of personnel
- Personnel tracking and behavior analysis
- Safety protection of electronic fence
- Personnel vital signs monitoring
- One touch emergency help
- Area personnel over / missing alarm
- Assessment management of inspectors
- Plant wide data analysis

Visitor location management system

- Real time location of visitors
- Trace of visitors' activities
- Electronic fence warning
- Destination voice navigation
- Statistics of visiting events
- Multiple authentication mechanism

AI Vital Signs Monitoring and Location-Visualization System

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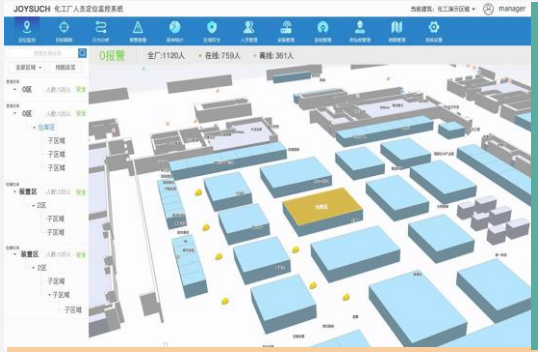
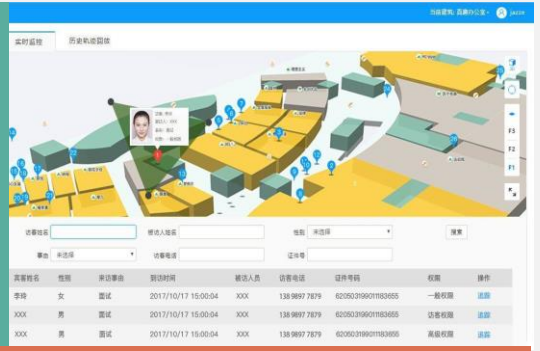


- Real time tracking of visitor location
- Intelligent registration and identity verification
- Employee patrol automatic record
- Personnel vital signs monitoring



- Real time personnel distribution overview
- Personnel classification statistics
- Real time view of video picture
- Warning of over / missing personnel in workshop

- Contractor man-hour statistics
- Personnel authority management
- Plant information visualization
- Manage and upgrade data support

Global Partner Opportunties

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Now, we are going to set up pilot intelligent factories in Vietnam, Russia, Mongolia and other countries, which will be a great progress in our intelligent technology.

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Thanks!

Transforming the Way Mining Industry Works!

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