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.
Location Map Of Alpha

- Cayman, England
- Chengdu, China
- Kitway, Zambia
- Manila, Philippines
- Sydney, Australia

Headquarters
Subsidiaries
Agency
Intelligent PdM System
Intelligent PdM System-Background

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

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

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 reflection of inner part wear; so the real-time monitoring of the vibration and temperature parameters is the main reliable and useful shortcut to solve this problem.

The intelligent PDM system monitors the mine equipment in real time through the wireless 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.
**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℃

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.
Intelligent PdM System-Main Framework

Cloud Processing

Data Analysis
Feedback

Ethernet/4G/5G

Group Cloud Server

User computer terminal 1

User mobile terminal 1

User computer terminal 2

User mobile terminal 2

User computer terminal 3

User mobile terminal 3

User computer terminal 4

User mobile terminal 4

Pilot 1

Pilot 2

Pilot 3

Pilot 4

Monitor
Intelligent PdM System-Item Distribution

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

**Alpha's first PDM in the coal preparation plant.**

- **Shiyaodian coal preparation plant**
- PdM successfully predict mechanical failure within 2 months

- **Xuyong coal preparation plant**

- **Large overseas PdM projects**
- Vale, Brazil.
- Material transport equipment

- **Guizhou Panjiang Coal Electricity Group**

- **Large PdM Project Based on 5G**
  - +Intelligent coal mining and processing
  - +Regional mining big data center

Apr. 2018

Nov. 2019

Otc. Future
Asset Life Cycle Intelligent Management
Asset Life Cycle Intelligent Management-Framework

Intelligent Asset Management

- Predictive maintenance monitoring of equipment (Intelligent Monitoring)
  - Multi dimensional real-time monitoring and viewing
  - Intelligent AI analysis and early warning push
  - Customized consultation and endorsement by industry experts

- Intelligent management of equipment spare parts (Intelligent supply chain)
  - Spare parts inventory management
  - Spare parts intelligent purchase plan
  - AI analysis of spare parts life cycle

- Equipment QR code intelligent management platform (Intelligent operation & maintenance)
  - Equipment information QR code display management
  - Problem solution intelligent analysis management
  - PDA code scanning input maintenance data

Intelligent Asset Management - Framework
Asset Life Cycle Intelligent Management - Data Center

1. Local Data Center
2. Group Data Center
3. Industry Data Center
Asset Life Cycle Intelligent Management - Advantage

- Equipment intelligent information management;
- Spare parts purchase plan forecast;
- Reduce spare parts inventory;
- Saving production cost;
Intelligent Technologies of CHPP Operations
01. Dense Medium Hydrocyclone
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.
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

01
Realtime monitoring equipment status

02
Forecast equipment maintenance plan

03
Avoid abnormal shutdown during production

04
Improve production efficiency
02. Teetered Bed Separator Intelligence
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.
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 the 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

- **Discharge device**
- **Sensor**
- **Feeding port**
- **Main body**
- **Gangue discharge port**
- **Control cabinet**
TBS Intelligence - Cases

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
02. Flotation Intelligence
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.
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.
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
04. Coarse Coal Slurry Centrifuge Intelligence
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.

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.
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

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

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.
05. Filter Press Intelligence
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.
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;
Robotic Management of Distribution Room
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

Architecture Composition

Control and Monitoring Layer

Communication Ring Network

Network Server

Network server

Field Partition Layer

Terminal

Terminal

Terminal

Terminal
Robotic Management of Distribution Room-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.
06

AI Vital Signs Monitoring and Location
AI Vital Signs Monitoring and Location-Introduction

- 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

Plant personnel safety management system

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

- Real time personnel distribution overview
- Personnel classification statistics
- Real time view of video picture
- Warning of over / missing personnel in workshop
- Real time tracking of visitor location
- Intelligent registration and identity verification
- Employee patrol automatic record
- Personnel vital signs monitoring

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

Transforming the Way Mining Industry Works!

E-mail: kyle.lee@alpha-technology.com.au
Lynette@alpha-technology.com.au
benjamin.yang@alpha-technology.com.au

Web: www.alpha-technology.com.au (English) www.pdmalpha.ru (Русский)