INTELLIGENT FACTORY

AI Identification and Feedback Module for Appearance Quality of Metal Products

Traditional visual inspection are easily affected by metal surface reflections and uneven light source. It leads to misjudgment issues, especially inspects on irregularly shaped 3D metal parts. Factors like low detection rate, unstable effects, and limited applications cause difficulty to achieve the goals of intelligent inspection. Using AI for detection helps overcome problems related to metal surface reflections and uneven lighting, and interference from the shadowing.

Technical Advantages and Features

AI Image Recognition Technology

Dynamic Optimal Lighting Layout Imaging

3D Helical Gear Inspection

- AI deep learning module trains on complex defect features, such as random wood grains and helical gear teeth. The AI module adapts to various environments and production lines.
- The scope is to broaden to varies industries, such as food and textile inspection.

- Combining image filtering transformations with blur analysis enables light and shadow detection, overcoming issues like reflections and uneven illumination in dynamic imaging.
- Based on light and shadow detection, dynamic adjustment reduces reflections in multi–angle imaging by light source placement and detection angles.

- A specialized detection model for 3D helical gears achieves a defect detection rate of 98% (industry average 80%).
- Breaking through technological bottlenecks by automatically detects challenging defects such as tooth surface black spots, tip collisions, and broken teeth, identifying flaws as small as $\geq$ 0.1 mm.

Industrial Benefits and Business Opportunities

- **Industry Applications:**

  Metal Product Processing Industry (e.g., Plumbing Supplies, Gear Manufacturing, Powder Metallurgy).

- **Application Examples:**

  The technology, integrated into specialized gear inspection equipment, has been successfully implemented by electric vehicle gear production line. It reduces inspection time by 50%, tripling daily production capacity, and cutting annual quality control costs by about 50%.

A Conventional Imaging Setup Often Leads to Reflection

AI Deep Learning Image Recognition
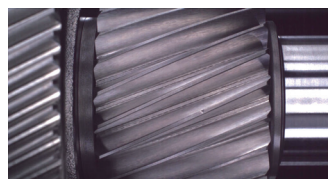
Optimal Light Source Arrangement for Imaging Reflective Surfaces

3D Helical Gear Inspection Mode

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Injection Molding Full Inspection and Process Parameter Optimization Technology

Traditional injection molding industries rely on manual quality assessments, which results in unstable quality and decreased the production efficiency. The parameter adjustment is based on production experience. It leads to challenges in knowledge management and production parameters optimization. Intelligent quality control can be achieved by using AI could establish relationships between process parameters and defects in injection products, such as short shots and deformations.

Technical Advantages and Features

Big Data and AI Deep Learning Analysis and Feedback

- Big data collects from product design parameters, process parameters, and quality control inspection.
- AI deep learning models provides real-time feedback and predicts upcoming manufacturing issues.
- Saving the manual inspection labor cost in 90% potentially.

Visualization of Key Feature Information

- The visualization interface displays key features of the machinery and molds, including mold internal pressure, integral pressure, and the slope of the pressure curve.
- Real-time monitoring and control enable the setting of machinery standards to ensure the quality.

Quality Prediction through Monitoring & Simulation

- Analysis and detect the planar geometric features of the finished product by monitoring machine status.
- Workpiece quality can be predicted with 96% accuracy (industry standard often involves manual spot checks) by simulating machine status and parameters.

Industrial Benefits and Business Opportunities

- **Industry Applications:**

  Electronics component industry (plastic casings), transportation tools (car bumpers, interior trim panels), and other plastic products.

- **Application Examples:**

  The software module, implemented at pump manufacturer, enhances intelligent injection molding of plastic casings and sets up a quality monitoring system. This has increased the yield by 12% (from 84% to 96%) and reduced annual carbon emissions by 25.33 tons.
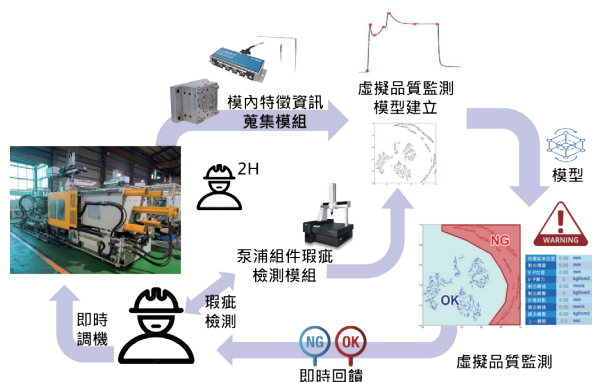
Process Parameter Collection and Feedback System
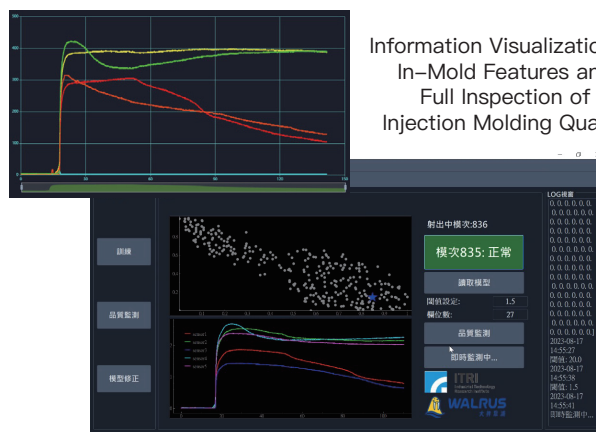
Information Visualization of In-Mold Features and Full Inspection of Injection Molding Quality

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AI Smart Magnetic Particle Inspection Module for Magnetically Conductive Materials

Surface and subsurface cracks inspection is crucial in steel manufacturing. Fluorescent magnetic particle inspection (MT) techniques are typically the method for inspection. Uneven powder residue can lead to misinterpretations and result in error rates exceeding 20%. Additionally, exposure to black light (UV) poses risks to human eyes and skin, potentially causing conditions such as cataracts. AI is necessary to accurately identify defects, given the challenge of defining uneven residues in images.

Technical Advantages and Features

AI Defect Inspection Module

- AI deep learning–based defect detection technology distinguish true and false defects with over 90% accuracy, compared to 80% with manual detection.
- Reducing reliance on personnel and increasing equipment competitiveness.

Fluorescent Imaging and Multi–Axis Synchronized Imaging System

- Fluorescent imaging highlights the features of shallow subsurface crack defects.
- Multiple synchronized mobile imaging modules expand the imaging range from 0.2 to 12 meters at the same resolution.
- Reducing the time required for manual inspection by 55%.

Defect Distribution Visualization and Real–Time Feedback

- Defect distribution is presented through a visual interface that includes information on defect size and location.
- Based on defect distribution, the system provides immediate feedback to the grinding process.

Industrial Benefits and Business Opportunities

- **Industry Applications:**

  Metal Processing (Casting, Forging, Steel Bars), and Steel (Steel Billets, H–beam Steel) Industries.
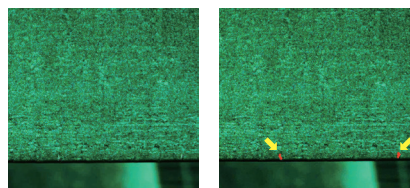
- **Application Examples:**

  The module, implemented in steel industry, established the first domestic AI inspection process for surface defect detection and removal, reducing inspection times by 50% and boosting accuracy from 80% to 90%.
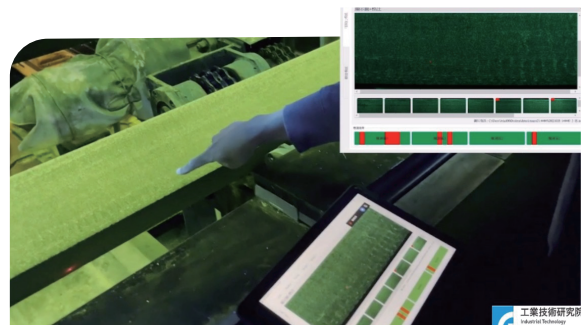
Fluorescent Magnetic Inspection Imaging Module
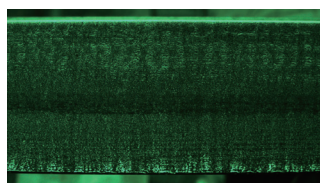
Residual Fluorescent Magnetic Particles

Original Images

AI Detection Results

Fluorescent Magnetic Particle AI Detection that Overcomes Misjudgment due to Residual Particles

Real–Time Feedback on Visualized Defect Status

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Non-Symmetrical 3D Composite Braiding System

In response to the demand for energy conservation and carbon reduction, components must maintain structural strength while reducing weight. Traditional composite braiding and stacking methods require customized molds and depend on manual lamination for forming, which is particularly challenging for tubular structures and irregular shapes, material utilization rate achieves only 60%-70%. This technology introduces a 160-spindle radial composite braiding device that tightly fits outer fibers to core surfaces via weaving and axial expansion; dual-arm propulsion aids in swiftly producing complex three-dimensional parts, thereby improving material utilization.

Technical Advantages and Features

Radial Composite Braiding Equipment

- The first domestic radial composite braiding equipment, featuring 160 circular motion of the spools.
- Fiber utilization has increased to 80%, up from 60-70% with traditional equipment."

Dual-Arm Propulsion Control
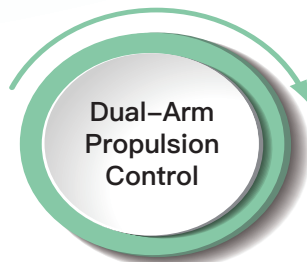
- Combines dual-arm synchronized control for high stability.
- Suitable for manufacturing slender workpieces up to 3 meters in length.

Optional Expandable Axial Fiber
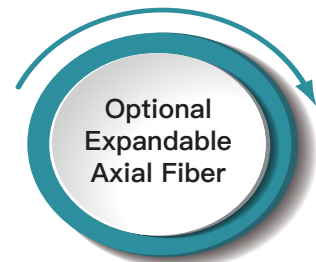
- The expandable 40-strand axis enhances the product's tensile and bending strength, broadening its application range.

## Industrial Benefits and Business Opportunities

- **Industry Applications:**

  Aerospace Industry, Transportation Industry, Green Energy Industry.

- **Application Examples:**
  - Established the first domestic 'Composite Component Verification and Trial Production Laboratory,' which develops lightweight composite components and leads Taiwanese manufacturers into the international composite component market.
  - In the aerospace industry, the development of carbon fiber engine blade weaving technology is currently in the phase of small-scale production testing.
  - In the defense industry, lightweight personal protective equipment is being developed to provide the national military with high-strength protective gear.
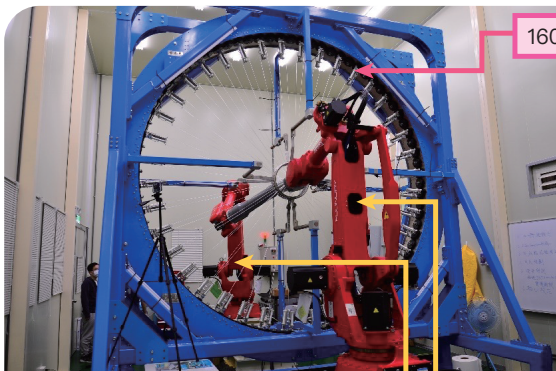
160-Strand Circular Weaving

Radial Composite Braiding Equipment

Dual-Arm Synchronized Control

Irregular Structures and Slender Composite Braided Products

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Prognosis Monitoring System, PMS

Traditional manufacturing often faces interruptions in operations due to equipment inspection and maintenance cycles. These gaps can result in issues or shutdowns, requiring expert intervention and impacting production capacity. Moreover, inefficient maintenance scheduling can lead to higher costs. AI–based prognosis monitoring systems, learning from expert analysis techniques, streamline complex sensor data to provide intuitive equipment status information. This system acts as a 24–hour monitoring AI engineer, accurately predicting machine conditions, diagnosing anomalies, and offering immediate feedback.

Technical Advantages and Features

Customizable Equipment Health Monitoring

Equipment Health Trend Forecasting & Optimal Maintenance Scheduling

Automatic Fault Diagnosis for Rotary Machine

- Monitor the health of equipment according to ISO vibration standards, such as air compressors and mechanical vibrations.
- Customize specific health indicators to accurately predict equipment lifespan.

- Capable of predicting the deterioration of health status or even the Remaining Useful Life (RUL), with an error rate of less than 10%.
- Providing recommendations for optimized maintenance scheduling, with proven cases that have increased equipment lifespan by at least 50%.

- Capable of automatically diagnosing 17 common faults in rotary machines, including bearing and gear damage.
- The accuracy of fault diagnosis exceeds 85%.
- Proven cases have reduced maintenance operation time by up to 30%.

Industrial Benefits and Business Opportunities

- **Industry Applications:**

  Electronics, semiconductors, metals, petrochemicals, automation, and information services industries, among others, are all applicable as long as they can utilize vibration signal collection and AI analysis.
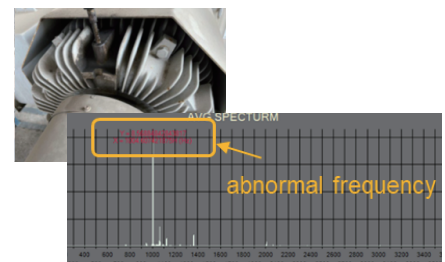
- **Application Examples:**

  This technology has been applied to over 500 pieces of machinery. Partnering with leading manufacturers, such as a domestic semiconductor vacuum equipment producer, has led to a 50% increase in equipment lifespans. Similarly, collaboration with a top domestic machining factory has improved tool lifespans by 10% through optimized drilling processes. In the green energy sector, we worked with a state–owned enterprise to diagnose gearbox anomalies in wind turbines a month in advance, effectively leveraging the benefits of predictive maintenance.
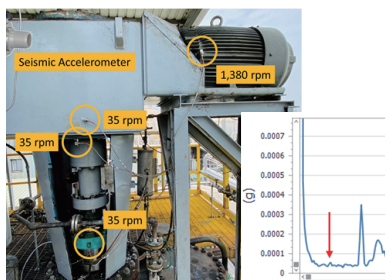
Continuous and High–Quality Signal Monitoring

Fast and Accurate Fault Diagnosis

Effective Forecasting of Trend States

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Flexi-Modeler for OPC UA

Industry 4.0 adopts OPC UA as the communication standard to help integrate Taiwan's industries with international norms. By establishing OPC UA servers, data is captured from various devices and systems and provided to clients in a unified format. However, building device information models is complex, involving software installation, data definition, and security configurations, which adds to development costs and time. This technology assists users in quickly completing OPC UA modeling and facilitates the transfer of data to cloud or on-site systems for display, analysis, or decision-making.

Technical Advantages and Features

Easily Modeling

- Support various OPC UA Companion Specifications.
- Automate hierarchies and inheritance for easy, fast programming.
- Reducing user development time by more than 80%.

HMI with Industry Knowledge

- HMI with Industry Knowledge, users can get started quickly.
- With three major industrial automation communication setting interfaces: Method, Event, and PubSub.

Cross-Platform Control Module

- Seamless International Communication (IEC 62541).
- Simplified Setup, Rapid OPC UA Server Control Module Deployment.
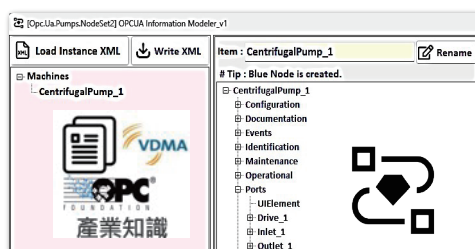- Cross-platform: Windows, Linux Ubuntu and ARM.

Industrial Benefits and Business Opportunities
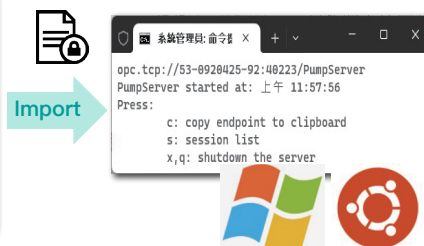
- **Industry Applications:**

  Plastics and Rubber, Machine Tool Industry, and Automation.
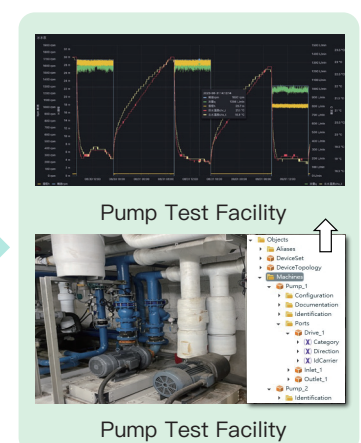
- **Application Examples:**

  This technology has been implemented in nationally renowned injection machine controllers and intelligent pumps, aiding manufacturers in rapidly establishing information models with companion specifications and constructing OPC UA servers, which has doubled production reporting efficiency and reduced development time by 30%.

Flexi-Modeler Easily Modeling

Import

Cross-Platform Control Module

Apply

Pump Test Facility

Pump Test Facility

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SECS/GEM Communication Technology

Electronic device controllers handle data collection, equipment monitoring, and production control in factories. However, diverse brands and models lead to non–standardized communication technologies, complicating integration and requiring extra manpower and time. The SECS/GEM standard can be quickly implemented through simple, automated settings, solving issues with complex processes, multiple devices, and challenging information integration.

Technical Advantages and Features

International Communication Standards

- SECS/GEM is the official communication standard in semiconductor industry.
- Equipment uses the standard (SECS/GEM) to communicate and process and data.

Efficient Core Driving to Fully Interconnect the Entire Factory's Information

- Efficient driving structure technology offers application on a broad product range, equipment and factories.
- Improving factory connection, increasing automation efficiency, and reducing labor costs.

One–Stop Professional Consulting Services

- With over 20 years experience in industry counseling, thousands cases service has facilitated collaboration users and makers.
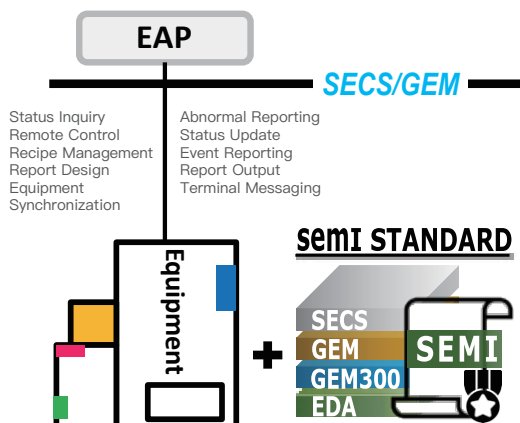- One–stop services including factory visits, specification negotiations, and validation.

Industrial Benefits and Business Opportunities

- **Industry Applications:**

  Semiconductors (including Wafer Foundries and Packaging/Testing Facilities), PCB Printed Circuit Boards, Panel Manufacturers, and Solar Energy.

- **Application Examples:**
  - Assisted the largest domestic photomask manufacturing company in SECS/GEM communication standard implement while facilitating the sale of their photomask cleaning equipment to major semiconductor companies in the United States, generating additional output value exceeding 30 million NT Dollars.
  - Guided a top domestic die–sorting equipment manufacturer to integrate advanced semiconductor communication systems into the LED machines and the solution was successfully sold to Toshiba Corporation and OSRAM GmbH , receiving high customer praise.

EAP

SECS/GEM

Status Inquiry
Remote Control
Recipe Management
Report Design
Equipment
Synchronization

Abnormal Reporting
Status Update
Event Reporting
Report Output
Terminal Messaging

Equipment

SEMI STANDARD

+

SECS
GEM
GEM300
EDA

SEMI

Users > 20

tsmc (intel) UMC
GLOBAL FOUNDRIES ASE GROUP winbond
Unimicron 欣興電子 GINTECH 昱能源科技
Eink NXP AUO
BPIL 碧陽精密 iNNOLUX 群創光電 嘉林科技
Himax 力成科技 PTI

6 大產業

ITRI

6 Major Industries
50 types of equipment

顧問服務
專案開發
企業輔導
量化生產

Comprehensive Professional Technical Services

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