Portal Crane Automated Solutions

Advantages：

1.High Operational Flexibility

Equipped with interchangeable load-handling attachments (hooks, grabs, electromagnets, spreaders) for rapid switching, enabling efficient handling of diverse cargo types (bulk, breakbulk, containers).

2、 Wide Operating Range

3、Cost-Effective Procurement

Challenges in Portal Crane Operations & Automated Solutions

wuxin

Development Trend of Portal Slewing Cranes

Evolution of Portal Crane Operation Modes

01

Manual Operation

One operator per crane, local cab control

All functions (hoisting, slewing, traveling) performed manually by the operator

02

Semi-Automatic with Anti-Sway & Positioning (Local)

One operator per crane, local cab control

Manual grab operation with automated sway control and position assistance

03

Remote Semi-Automatic

One operator per crane, remote control station

Manual grab operation with remote monitoring capability

04

Fully Automated

Single operator monitors multiple cranes

Complete autonomous operation including automatic grabbing

What is an Automated Portal Crane?

An automated portal crane integrates advanced sensing technologies, automatic control systems, and communication technologies. It enables:

Autonomous cargo/environment recognition

Fixed-route cruising

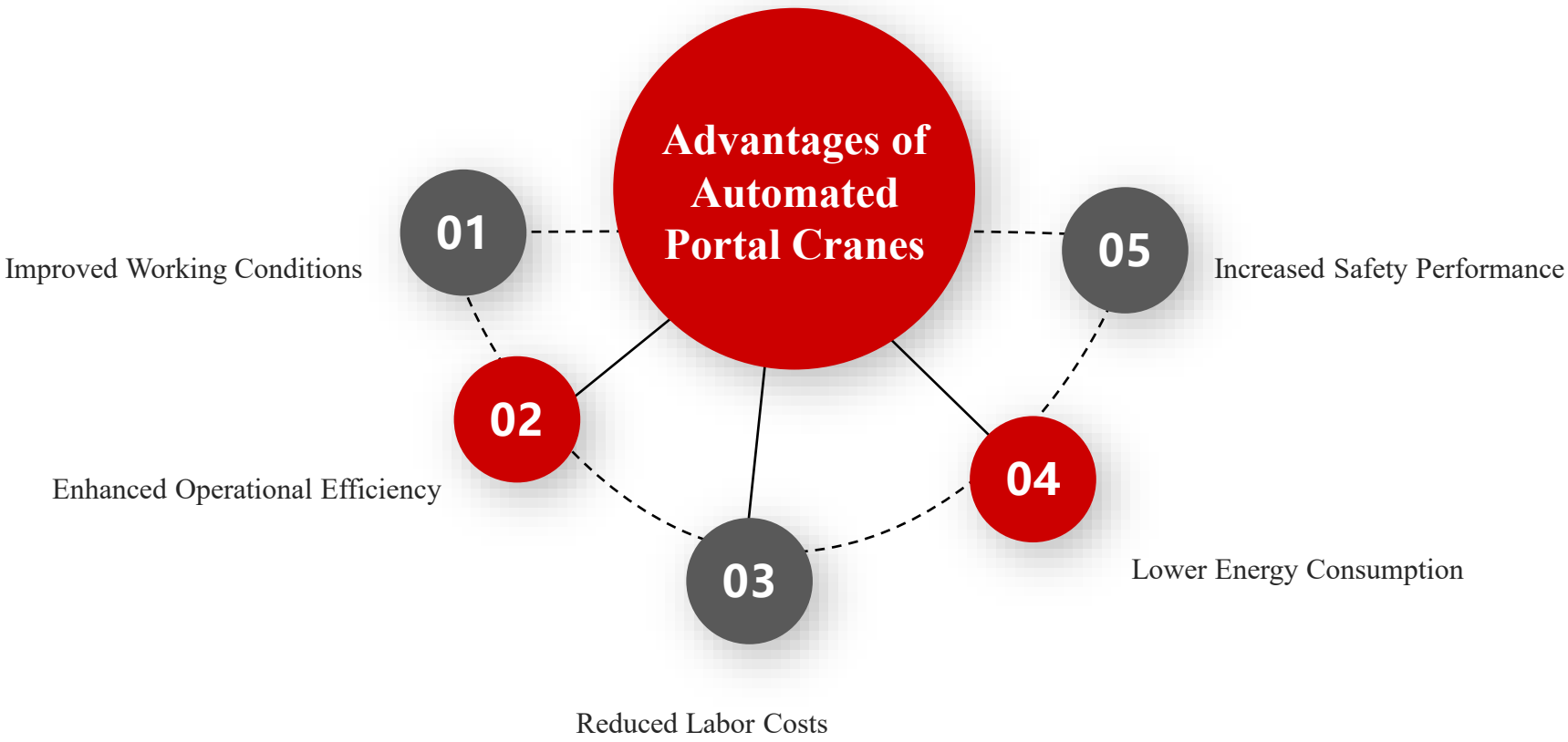
Automated grabbing and unloading

All operations are completed automatically except for hold-clearing phases requiring manual intervention, significantly reducing reliance on human operators.

Automated Portal Crane Demonstration

External Views & Remote Control Center of Shaoguan Portal Crane

Advantages of Automated Portal Cranes



Automated Operation Process for Portal Slewing Crane

Semi-Automated Process

Operator one-click sets discharge point

Manually selects grab point & positions grab on material

Activates semi-auto mode

Grab bucket automatically grabs material then automatically ascends.

Grab bucket automatically transfers above hopper

Automatic discharge

Grab auto-returns to loading point

Grab auto-returns to loading point

Automated Process

Operator one-click sets discharge point Operator one-click sets discharge point

Operator manually selects grabbing point and controls grab bucket to descend onto material.

Activate laser scanning system to obtain hatch position, bulwark height, material pile profile, etc.

Activate Full Automatic mode.

Grab bucket automatically grabs material and ascends.

Grab bucket automatically moves to next grabbing point.

Grab bucket automatically transfers above hopper.
Automatic discharge.

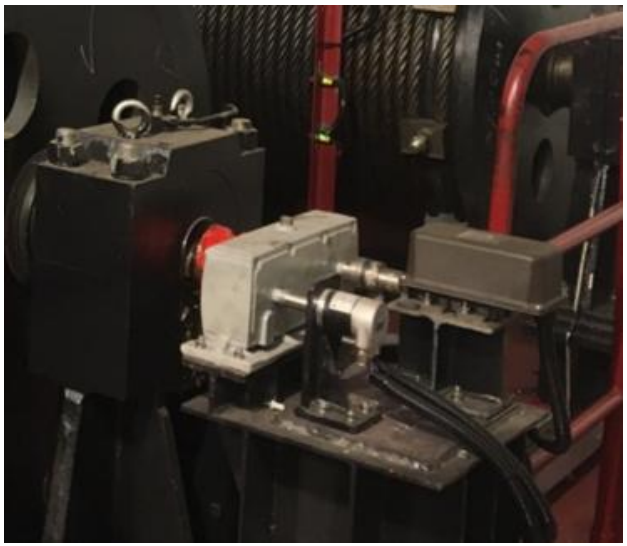
Composition of Portal Slewing Crane Automation System

- Positioning System

  (Hoisting/Luffing/Slewing/Traveling)
- Grab Sway Prevention & Positioning System
- Hull Scanning System
- Active Anti-Collision System
- Multi-Crane Coordination System
- Video Monitoring System
- Voice Communication System

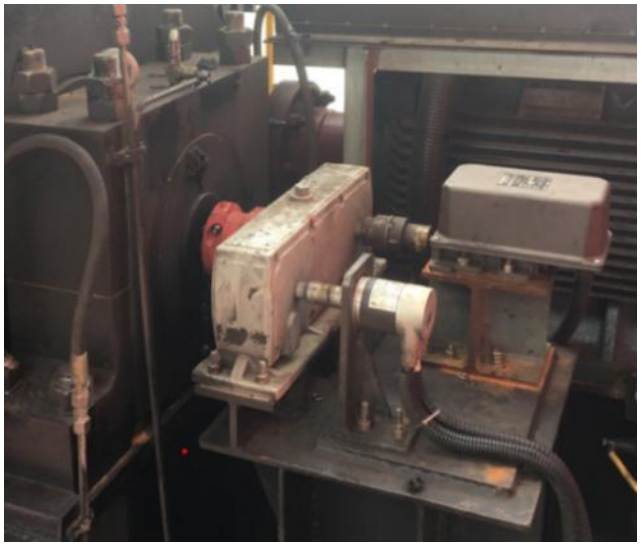
Hoisting Mechanism Positioning System

The hoisting mechanism employs an absolute encoder for position detection. The encoder calculates travel distance to determine real-time load height, with position data verified by cam limit switches at predefined calibration points.



Luffing Mechanism Positioning System

An absolute encoder installed on the luffing mechanism precisely measures boom angle amplitude, with periodic verification performed via luffing travel limit switches.



Slewing Mechanism Positioning System

A small driven gear is installed on the main gear ring, rotating in mesh with the primary gear. A multi-turn absolute encoder mounted on the driven gear's shaft calculates slewing angles through encoder readings, while calibration limit switches provide position verification.

Travel Mechanism Positioning System

Absolute encoders mounted on auxiliary wheels calculate travel distance via constant-radius passive wheel rotation, while integrated RFID devices read pre-embedded tag data along the wharf to perform real-time encoder calibration.

Absolute Encoder for Travel Mechanism

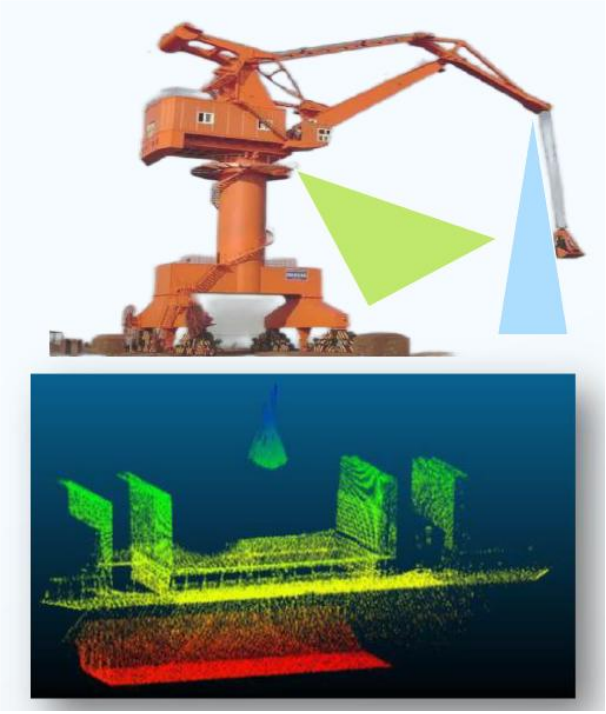
RFID for Travel Mechanism

Anti-Sway Control System

- The system employs real-time velocity control algorithms for the luffing and slewing mechanisms to eliminate wire rope swing angles, ensuring smooth grab movement without oscillation.
- When the grab reaches its target position, integrated anti-sway technology enables stable positioning with zero residual swing.

Hull Scanning System

- Utilizing 3D laser scanning technology to perform real-time vessel contour scanning, the system generates a three-dimensional vessel profile model through point cloud processing algorithms, accurately identifying key features including hatch positions, freeboard height, and stockpile contours.
- The automated control system leverages this hull data to optimize spreader paths, enhance positioning accuracy, and enable automatic collision avoidance, thereby improving loading/unloading efficiency and operational safety compliance.

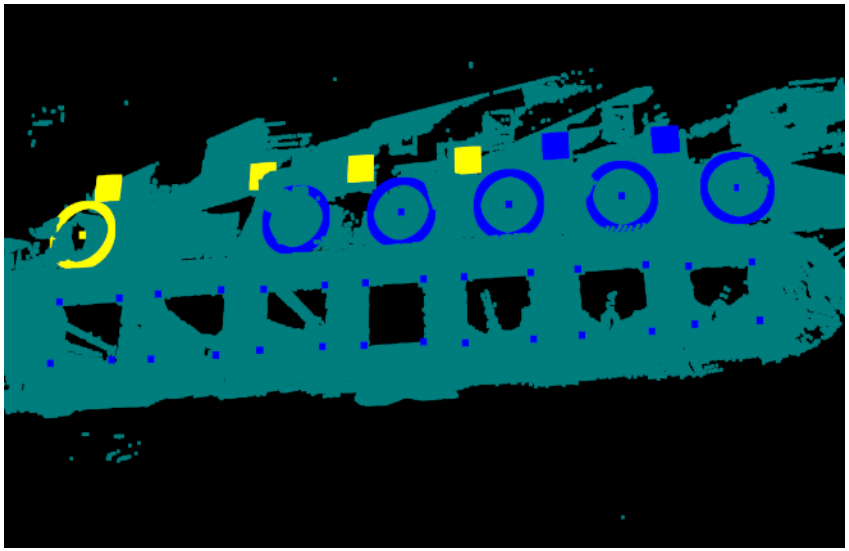


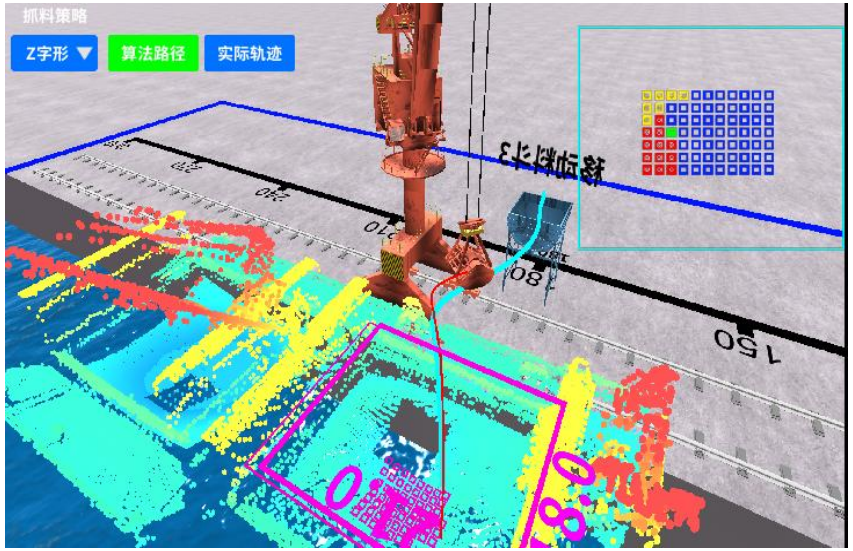
Active Anti-Collision System

Three multi-line laser scanners are installed at optimal positions on the crane to enable real-time detection and protection against obstacles during boom telescoping and slewing operations, covering both the front and lateral areas of the boom. The system employs active collision avoidance algorithm software to ensure effective protection without compromising the operational efficiency of the portal crane.

Multi-Crane Coordination System

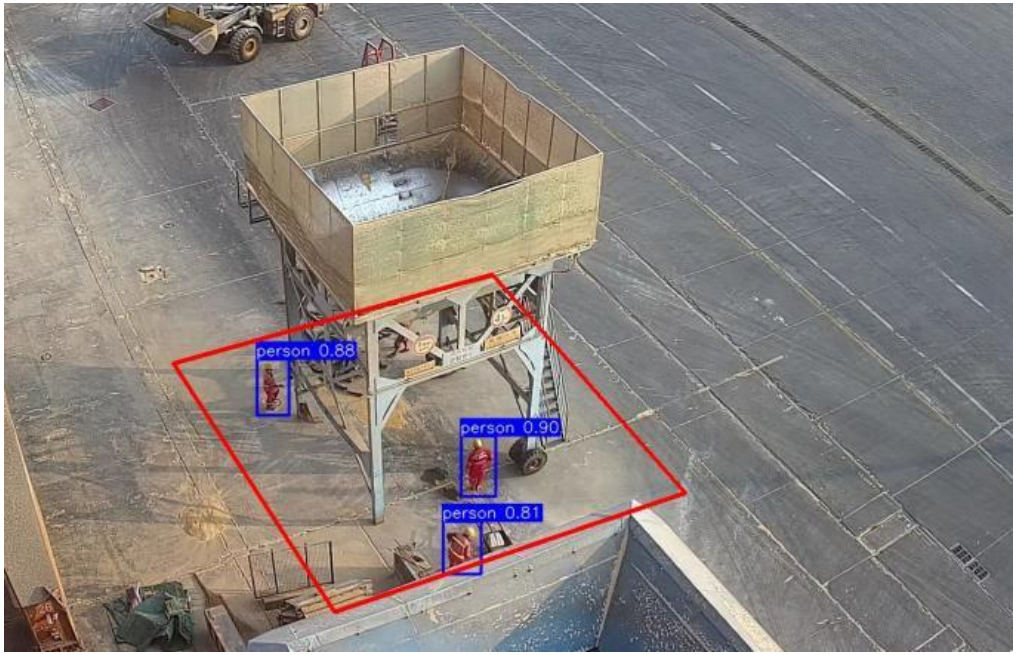
- Utilizing ship modeling data, equipment deployment plans, and operational modes to determine optimal positioning for portal cranes and material hoppers.
- During operations, the system dynamically plans coordinated movement paths by analyzing adjacent crane activities, enabling fully automated synchronized operations across multiple portal cranes.





Anti-Intrusion System

A surveillance camera shall be installed at appropriate locations on the crane to utilize AI-based intelligent recognition technology for detecting personnel presence within designated warning zones. When personnel are detected in restricted areas, all crane operations are automatically prohibited while alarm signals (including voice alerts and graphical/text notifications) are simultaneously transmitted to the central control console.



Video Monitoring System

The video monitoring system serves as the remote operator's "eyes," providing real-time visual feedback during manual operations. Operators rely on live video feeds to monitor onsite conditions.

The system must display the following continuous video streams on the central control console:

Cab View (Operator's perspective)

Trolley Travel Direction

Grab Operation

Machinery Room

Luffing Mechanism

Remote Control Platform

Operators can perform remote operations via a remote control console, which is equipped with:

Control levers for operational commands
Switch buttons for system functions
Displays showing real-time monitoring data
Touchscreens for status visualization and control inputs
Voice communication devices for coordinated operations

Thank you !