PRODUCT USER MANUAL



Online Visual Tracking System | DIC Tracker-ONS

Sub-Millimeter Accuracy at 100 m | 80 × 50 m Field of View | Automated Structural Safety Monitoring for Civil Engineering















1. Product Overview

The Online Visual Tracking System is a visual displacement measurement system based on oblique-axis Digital Image Correlation (DIC) technology. It provides high-precision, non-contact, real-time measurement for various civil engineering structures. Using an IoT cloud platform, the system uploads deformation data to the cloud in real time, enabling around-the-clock monitoring of structural health. The system consists of a visual tracking device, passive targets, and a structural safety monitoring cloud platform.



Online Visual Tracking System

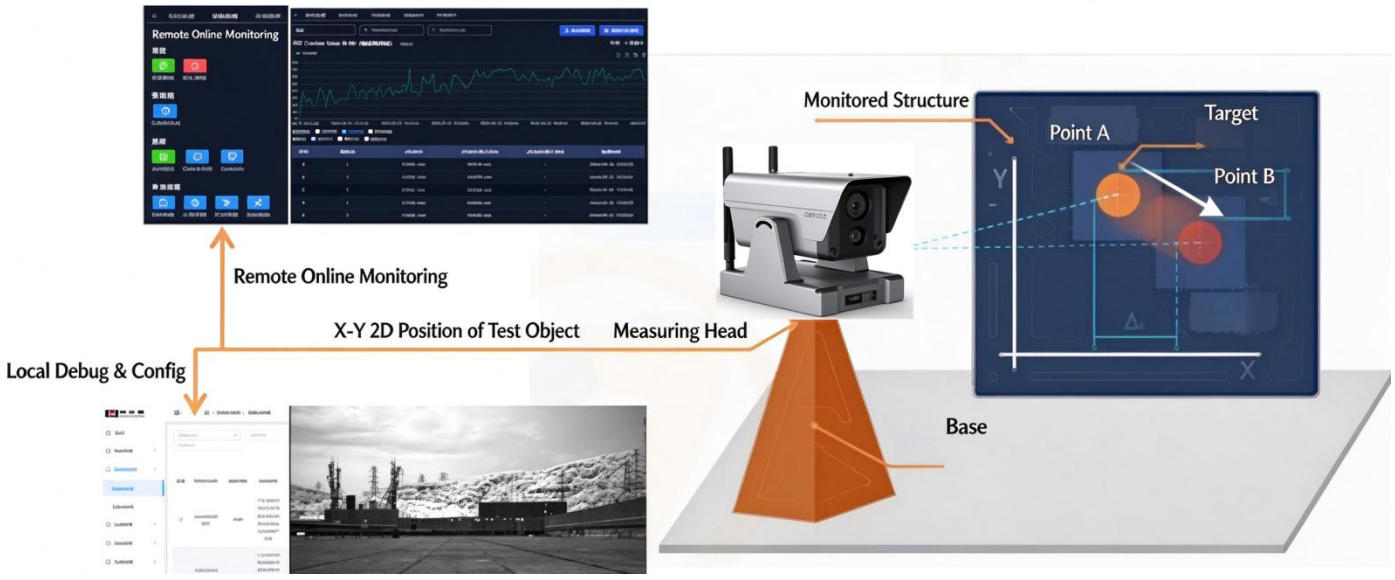


Passive Target



Cloud Platform

Measurement Principle: The visual tracking system is installed at a relatively stable location (such as a bridge pier), while multiple measurement points (targets) are placed on the structure being monitored (such as the underside of a bridge). When the monitored structure deforms, the image coordinates of the measurement points change accordingly. By continuously tracking these points and applying core technologies such as DIC and sub-pixel positioning, the system obtains horizontal and vertical displacement data. The data is uploaded to the cloud in real time via 4G communication. Users can access the data through the cloud platform or WeChat Mini Program, enabling 24-hour-a-day, 365-day-a-year displacement monitoring.



2. Product Features and Specifications

2.1 Product Features

- Multi-Sensor Integration: Temperature, humidity, attitude, and other sensors can measure environmental conditions and the device's own settlement.
- Multiple Targets / High Measurement Frequency: One device can monitor up to 15 targets simultaneously at up to 20 Hz, reducing the cost of monitoring each point.
- Integrated Algorithms: Temperature compensation, rain/fog penetration, and resistance to illumination changes and atmospheric turbulence help reduce the impact of environmental factors on measurement accuracy.
- Abnormal Image Capture and Storage: The integrated dual-camera function allows the device to save on-site images when abnormal conditions occur during displacement monitoring.
- Wired / Wireless Communication: 4G with latency of less than 100 ms, Wi-Fi, and 1000 Mbps wired Ethernet are supported for real-time data uploading.
- Energy-Efficient Operation: Power consumption is as low as 6 W in low-power mode. In areas with limited sunlight, lithium-battery power can support longer operation.
- Real-Time Alerts: Alerts can be issued when conditions such as low battery, target obstruction, or abnormal data are detected, notifying the site owner for timely action.

2.2 Technical Specifications

Product Model	**ONSN**	**ONDN**
Product Type	Low-Frequency	High-Frequency
Resolution (pixels)	12 Megapixels	12 Megapixels
Maximum Measurement Frequency (Hz)	10 Hz	22 Hz
Number of Measurement Points	30	15
Computing Configuration	i5 + 8 GB RAM	i7 + 8 GB RAM
Typical Applications	Slopes, Foundation Pits, Tunnels	Expressway Bridges, Viaducts, Small and Medium-Sized Bridges
Installation Method	Pole-Mounted / Wall-Mounted	Wall-Mounted
Power Consumption	18 W (with one built-in illuminator)	28 W (with one built-in illuminator)
Field of View (m × m)	1.4 × 1.1 m to 61 × 46 m	
Measurement Accuracy	±0.2 mm at 0–50 m; ±0.5 mm at 50–100 m; ±1 mm at 100–200 m; ±2.0 mm at 200–300 m	
Measurement Distance	1–300 m	
Measurement Head Dimensions (mm)	L 270 × W 200 × H 150 (including base)	

Measurement Head Weight	5 kg
Power Supply	220 V AC / 12 V DC photovoltaic power
Operating Temperature	−20°C to 60°C
Ingress Protection Rating	IP66
Weather Interference Resistance	✓
Exposure Interference Resistance	✓
Occlusion Interference Resistance	✓
Vibration Interference Resistance	✓
Built-In Temperature and Humidity Measurement	✓
Built-In Attitude Measurement	✓
Laser / Infrared Light Source	✓
Infrared Passive Targets	✓
Optional Features	Multi-System Coordination
	Video-Linked Snapshot Capture
	Battery Monitoring and Automatic Shutdown on Power Failure
	Solar / Battery Power Supply System
	Network Expansion
	Mobile Emergency Monitoring: Ride-On Mobile Cart / Mobile Tripod / Remote-Controlled Robot
	Alarm System: Linked Audible and Visual Alarm / Smart Safety Helmet / Smartwatch / Gas Leak Detection System / Intrusion Alarm

3. Main Applications

- Automated Bridge Monitoring (Dynamic Deflection, Static Deflection, and Horizontal Displacement)
- Automated Slope Monitoring (Settlement, Cracks, and Horizontal Displacement)
- Automated Tunnel Monitoring (Settlement, Cracks, and Horizontal Displacement)
- Automated Mine Monitoring (Settlement, Cracks, and Horizontal Displacement)
- Reservoir and Dam Safety Monitoring (Settlement, Cracks, and Horizontal Displacement)
- Railway Tunnel Monitoring (Settlement and Horizontal Displacement)
- High-Rise Building Monitoring (Settlement, Tilt, and Horizontal Displacement)
- Automated Foundation Pit Monitoring (Horizontal and Vertical Displacement)

3.1 Automated Bridge Monitoring

Deflection monitoring is one of the most important measurements in bridge monitoring. The

Online Visual Tracking System can monitor both static and dynamic bridge deflection. Static deflection indicates the overall deformation trend of a bridge, while dynamic deflection can indirectly indicate the extent of structural damage.

The online tracking system can be installed on bridge piers, towers, or cap beams. The number of targets is determined by the bridge span and scale. Typical target layouts are as follows: for small bridges, targets are placed beneath the deck at mid-span; for medium-sized bridges, targets are placed beneath the deck at mid-span and quarter-span locations; for large bridges, targets are placed beneath the deck at mid-span, quarter-span, and eighth-span locations.

The online tracking system can be powered by mains electricity or solar energy. Measurement data is uploaded to the cloud-based data management platform through the built-in 4G module. Management personnel can view deformation data in real time.

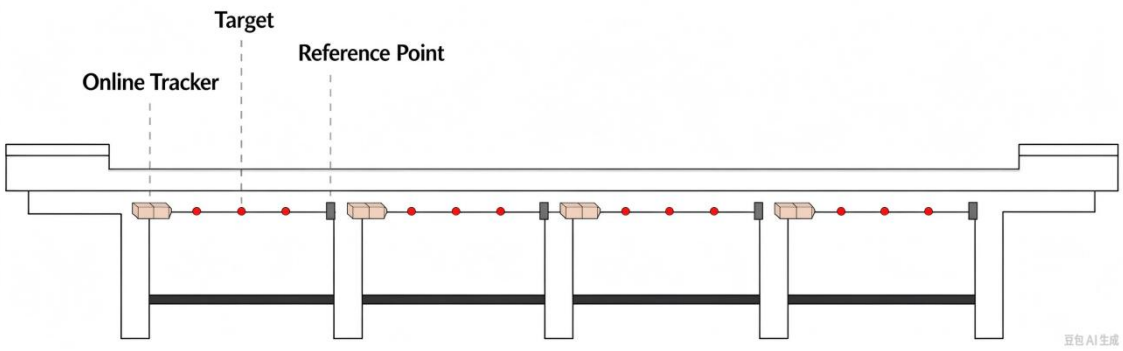


Illustration of Bridge Monitoring Point Layout

3.2 Automated Tunnel Monitoring

The online tracking system can be used for tunnel settlement and convergence monitoring. Targets are evenly distributed across each tunnel monitoring section. Each section generally has at least seven monitoring points, arranged symmetrically at the crown, haunches, and springlines. The online tracking device and reference points are installed in a relatively stable area outside the monitoring zone. One tracking device can monitor multiple sections simultaneously. Displacement analysis of multiple points within a section provides tunnel convergence data; analysis of crown targets across multiple sections provides crown settlement data for each section.

The online tracking system can be powered by mains electricity or solar energy. Measurement data is uploaded to the cloud-based data management platform through the built-in 4G module, allowing management personnel to view deformation data in real time.

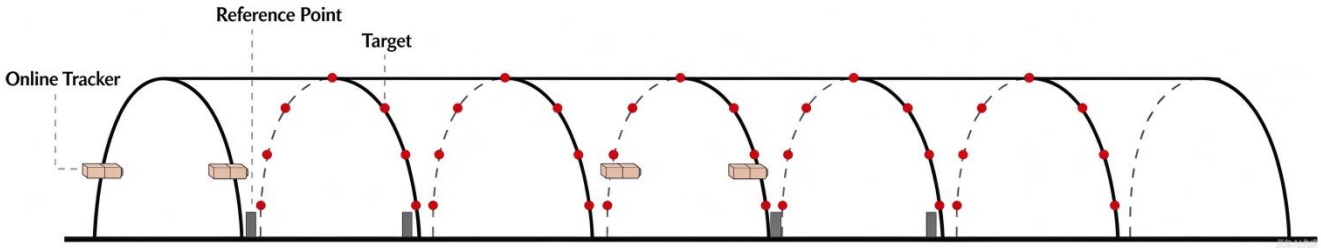


Illustration of Tunnel Monitoring Point Layout

3.3 Automated Slope Monitoring

Before a large-scale slope failure, various forms of deformation may occur. Regardless of the deformation mode, movement of the slope surface is generally involved; the most noticeable movements are horizontal and vertical displacement of the surface. The Online Visual Tracking System can monitor the horizontal and vertical displacement of slope monitoring points in real time and retrieve saved live images, providing a visual reference for understanding actual on-site slope failure conditions.

Targets are installed at intervals of 10 – 20 m on each slope bench or wall. The online tracking system is positioned on one side of the slope, facing the targets. A clear line of sight between the tracking system and targets is required, with no obstruction. The displacement of monitoring points is obtained by tracking the targets.

The online tracking system can be powered by mains electricity or solar energy. Measurement data is uploaded to the cloud-based data management platform through the built-in 4G module, allowing management personnel to view deformation data in real time.

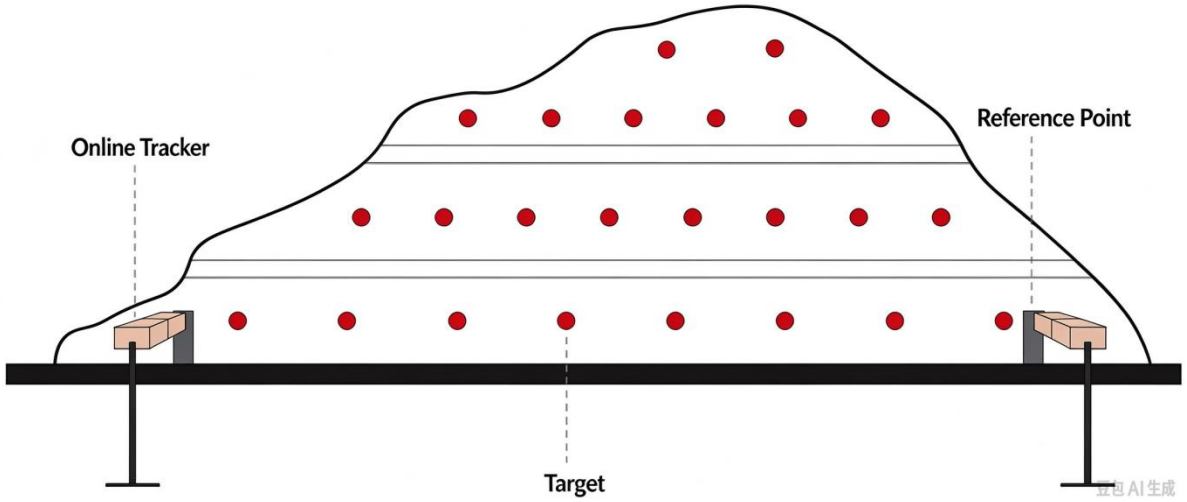


Illustration of Slope Monitoring Point Layout

3.4 Automated Foundation Pit Monitoring

Horizontal and vertical displacement of foundation pit retaining structures are essential monitoring items. Traditional methods use total stations or hydrostatic leveling systems to monitor displacement. These methods can have low monitoring efficiency and visual-reading errors, and may not meet requirements for measurement accuracy, continuity, and timeliness. The Online Tracking System can be used for automated foundation pit monitoring, offering high measurement accuracy and real-time performance, as well as timely alerts to address the limitations of traditional methods.

The online tracking system is installed at a relatively stable location around the foundation pit, while targets are mounted on the retaining structure (such as diaphragm walls or bored piles). By identifying the two-dimensional displacement of the targets, the system determines deformation of the retaining structure. The system can be powered by mains electricity or solar energy. Measurement data is uploaded to the cloud-based data management platform through the built-in 4G module, allowing management personnel to view deformation data in real time.

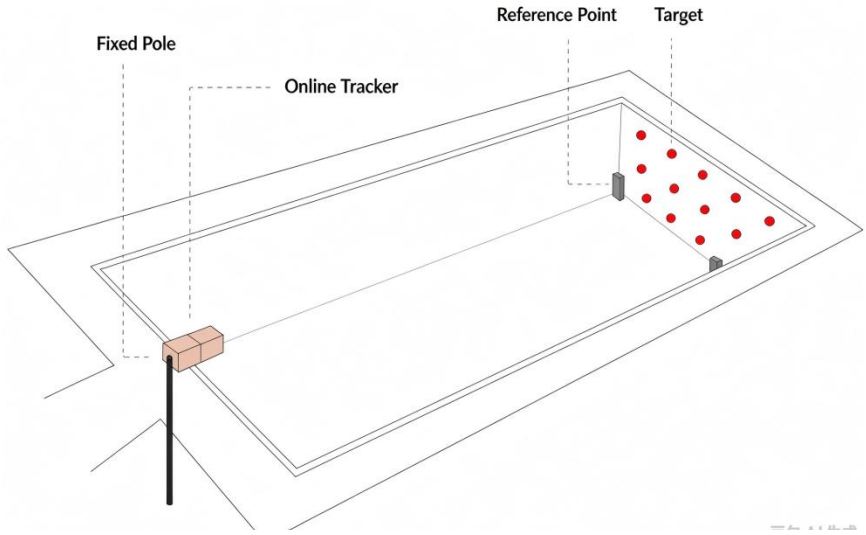


Illustration of Foundation Pit Monitoring Point Layout

3.5 Automated Reservoir and Dam Monitoring

For displacement monitoring of reservoirs, dams, and embankments, targets are installed at intervals of approximately 20 m. Each online tracking system monitors a distance of 100 m. The tracking system is installed at a stable location on the shore, while targets are placed at specified intervals along the dam crest or dam body. The system monitors settlement and horizontal displacement at each target. It can be powered by mains electricity or solar energy, and measurement data is uploaded to the cloud-based data management platform through the built-in 4G module, allowing management personnel to view deformation data in real time.

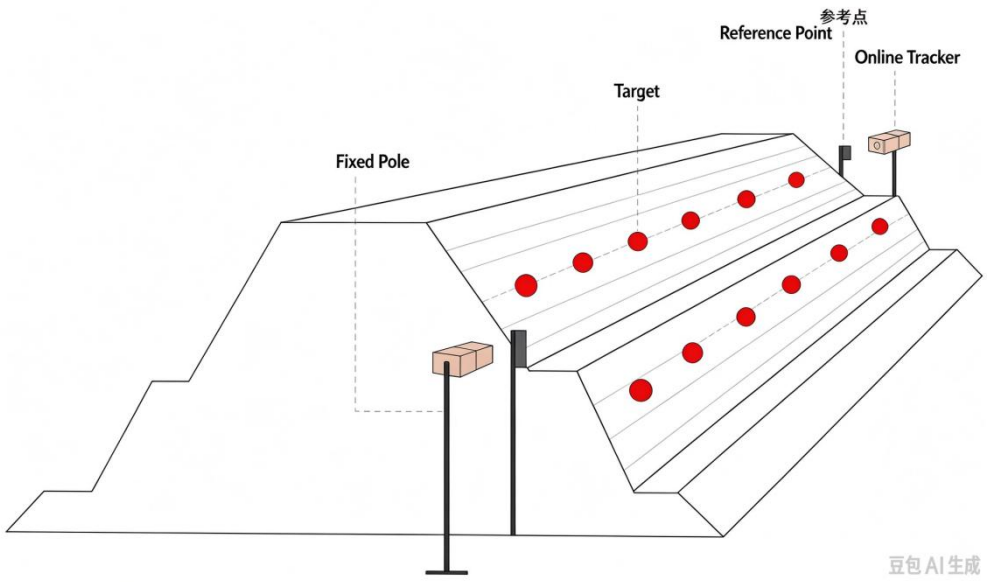


Illustration of Dam Monitoring Point Layout

3.6 Automated High-Rise Building Monitoring

Insufficient preliminary site investigation, inappropriate initial design or construction, nearby construction activities, poor foundation soil, or excessive structural loading may cause uneven foundation deformation or vibration. This can result in building tilt or differential settlement in the superstructure. The Online Visual Tracking System can be used to monitor building deformation. Targets are evenly distributed on the walls, while the online tracking system and reference points are

installed at relatively stable locations outside the building.

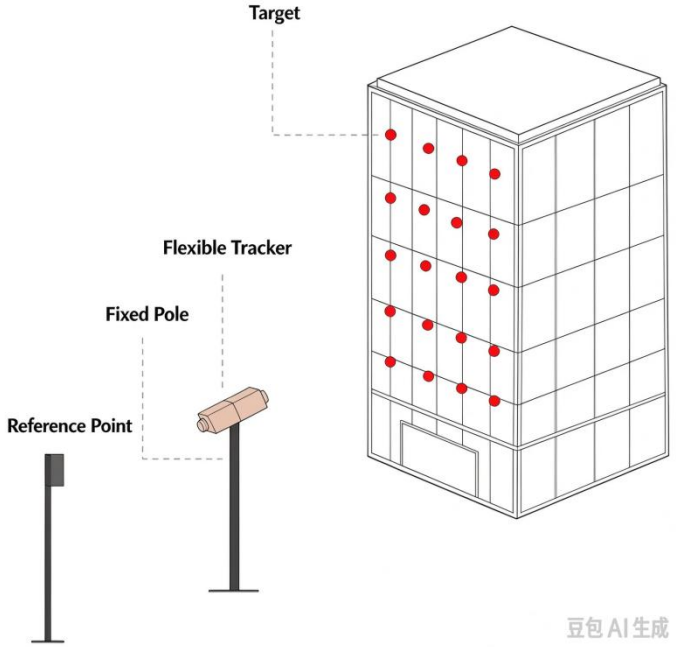


Illustration of High-Rise Building Monitoring Point Layout

3.7 Automated Railway Tunnel Monitoring

The online tracking system can be used for settlement and convergence monitoring in metro tunnels. Targets are evenly distributed across each tunnel monitoring section. Each section generally has at least seven monitoring points, arranged symmetrically at the crown and on both sides. The online tracking device and reference points are installed in a relatively stable area outside the monitoring zone. One tracking device can monitor multiple sections simultaneously. Displacement analysis of multiple points within a section provides tunnel convergence data; analysis of crown targets across multiple sections provides crown settlement data for each section.

