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Dam Safety Monitoring Solutions



System Overview

Water conservancy and hydropower dams require significant investment and yield substantial benefits upon completion. However, their complex structures and operating environments, coupled with uncertainties in design, construction, and maintenance, mean that any unexpected deformation could lead to severe disasters. Continuous real-time monitoring of these dams is essential. It provides crucial safety assessments, ensures the safe operation of dams, and gathers valuable technical data to inform the design and construction of future projects.

Key Features

The system provides intelligent analysis of deformation monitoring data, including process analysis and alarm/early warning features.

The system offers high-precision, all-weather real-time monitoring and can predict dangerous situations in advance. It also supports automatic collection, processing, and storage of monitoring data.



Company Overview Why us?



ComNav Technology is a global provider in high-precision GNSS technologies and applications, dedicated to innovation and excellence. We develop and manufacture GNSS OEM modules, GNSS receivers, data link modules, GNSS antennas and provide high precision solutions for various industries such as land survey, machine control, UAV, UGV, deformation monitoring, IoT, precision agriculture, and marine.

The company's success is driven by R&D efforts and a team of experienced employees with extensive knowledge in high-precision GNSS and engineering. We're committed to provide the best-in-class positioning solutions for high precision applications, meeting the high-precision requirements of engineers and users.

10+ vears innovation



800.000+GNSS modules delivered



technology industrial park



The system supports network management, remote system management, and automatic report generation.

The system offers an open interface development protocol to facilitate data integration with other monitoring methods, such as internal displacement, stress, temperature, and water level.

System Component

Rainfall Monitoring **GNSS** Monitoring Inclinometer Osmometer Wire Displacement Meter Anchor Cable Meter **Pressure Gauge**

Data acquisition subsystem:

It is composed of GNSS receiver and antenna, which can effectively ensure the monitoring accuracy and reliability

Data transmission and communication subsystem:

Depending on the site conditions, you can choose LoRa, 4G and other communication methods for data transmission

Data processing and analysis subsystem:

Use ComNav CDMonitor software for automatic data processing and analysis

Auxiliary support subsystem:

The system has a complete lightning protection system (including power line lightning protection and direct lightning protection) and a stable power supply system (solar power supply and city power supply are used together)

System Features

The dedicated monitoring software CDMonitor has a built-in GNSS high-precision anti-error filtering algorithm to output reliable results that meet the monitoring requirements of different scenarios.

GNSS monitoring systems can operate normally in all weather conditions and provide reliable monitoring data.

Solution Schematic Diagram



Back-end calculation solution



Monitoring Content	Monitoring Device	Distribution Requirements
Dam surface deformation	GNSS	Observation cross sections are typically set at the maximum dam height, original riverbed, closing section, areas with geological mutations, complex geological conditions, buried pipes within the dam, and regions showing abnormal reactions during operation.
Internal deformation of the dam	Fixed inclinometer	Observation sections should be arranged at the largest cross section and other characteristic sections (original riverbed, joint section, sections with complex geology and terrain, weak structural and construction areas). Generally, three sections are set, with one to three observation vertical lines per section.
Linstream and downstream	Radar water level gauge	The measuring point should be set at a place with a calm water surface, which is less affected by wind and waves and discharge,
water level monitoring Submersible level gauge basically re		and is convenient for installing equipment and observation; at a stable bank slope or on a permanent building; at a place that can basically represent the stable water level in front of the dam.
Rainfall in dam area	Rain gauge	The rain gauge is placed in a relatively open area around the dam to collect rainfall, easy to install and compact size.
Cracks at potential danger points in the dam	Crack Meter	Crack meters are placed preferentially at locations where stress concentration may occur, such as the junction between the dam body and the dam foundation, dam shoulders, spillways, corridors, etc., in areas with existing cracks or potential cracks to ensure accurate monitoring of crack expansion. The spacing between crack meters should be set according to the length and expansion trend of the cracks, generally between 0.5 meters and 2 meters, to ensure that subtle changes in the cracks can be monitored.
Internal deformation of the dam	Strain gauge	For the observation of concrete strain of the panel, the observation instruments at each measuring point should be arranged in groups and located in the same plane parallel to the panel plane. Generally, two instrument groups are arranged, one in the slope direction and one in the horizontal direction, with an angle of 90° between the two.
Wetting line monitoring	Osmometer	Observation cross-sections should be selected at the maximum dam height, joint sections, and dam sections with complex terrain or geological conditions. Generally, there should be at least 3 cross-sections, integrated with deformation and stress observation sections.

Related Products

A300 **GNSS** Receiver



Features



Millimeter Accuracy

Capable of tracking all running constellations, A300 receiver can reach millimeter-level positioning accuracy for precise monitoring.



Remote Monitoring

Benefit from flexible 4G/UHF transmission, users can check the positioning data and warning information anywhere and anytime.



Flexible Transmission

Supporting serial port/USB/UHF/ Bluetooth/4G communication media and TCP/IP, MQTT, Ntrip communication protocols.



24/7 Operation

Through strict quality control procedures, the MTBF of the A300 receiver can reach more than 50,000 hours for long-term trouble-free operation.

SinoGNSS A300 integrated GNSS module, GNSS antenna and communication module in one compact receiver. Reliable and convenient user experience is ensured via compact design, high-precision positioning and flexible transmission of A300. As a universal GNSS receiver, A300 is compatible with multiple sensors in facing of different kinds of monitoring tasks, which is one of the best choices for your monitoring solutions.



Multi-sensors

Supporting versatile external sensors for multi-sensor integrated monitoring, A300 can flexibly match different sensors according to different monitoring applications.



Easy Configuration

Partnered with Android-based SinoGNSS Navigate Master software, it is easy to configure A300 via Bluetooth connection.



Rugged Housing

Featuring IP68 proof level, anti-vibration and anti-lightning, the A300 receiver is not afraid of harsh working environments.



8GB Large Memory

Equipped with 8GB internal memory and loop recording function, the A300 can meet your data logging requirement for monitoring.

Technology Parameter

Signal Tracking

GPS	L1C/A, L2P, L2C, L5, L1C
GLONASS	L1, L2
BDS	B1I, B2I, B3I, B1C, B2a, B2b
Galileo	E1, E5b, E5a
QZSS	L1C, L2, L5
IRNSS	Upgradeable
SBAS	L1, L5

Performance Specification

Cold start	<60 s
Hot start	<15 s
Initialization time	<10 s
Signal re-acquisition	<1 s
Initialization reliability	>99.9%
Overload	15 g
Time accuracy	20 ns

Positioning Specifications

Post Processing	2.5 mm + 1 ppm Horizontal 5 mm + 1 ppm Vertical
Single Baseline RTK	8 mm + 1 ppm Horizontal 15 mm + 1 ppm Vertical
DGPS	<0.4 m RMS
SBAS	1 m 3D RMS
Standalone	1.5m 3D RMS
Interfaces	
1 14-pin Lemo port	Serial ports, USB port, power,

	switching value Support external sensors input
1 TNC connector	UHF modem
2 SIM card slots	4G modem, dual SIM dual standby

Typical Application

Multi-sensor integrated monitoring station.



Communication

Serial port	RS232, RS485
USB	USB 2.0
UHF modem	Frequency range: 410MHz-470MHz Transmit power: 0.5-2 W adjustable Range: 8-15 km, varies in different environments
Bluetooth	4.1/2.1+EDR, 2.4GHz
Network	TCP/IP, MQTT, Ntrip
Indicator LEDs	4 LEDs, indicating power, satellite searching, correction data and GSM status
Data Format	

Correction data I/O	RTCM 2.X, 3.X, CMR (GPS only),
Position data output	NMEA-0183, ComNav Binary, RTCM2.X, RTCM3.X
Data update rate	60s, 30s, 15s, 10s, 5s, 1Hz, 2Hz, 5Hz, 10Hz

Physical

Size (L × W × H)	φ205mm*126.5mm
Weight	≤2kg
Housing	FRP cover & aluminum alloy base

Environmental

Operating Temperature	-40°C to +70°C
Storage Temperature	-55°C to +85°C
Humidity	100% No-condensing
Waterproof and Dustproof	IP68
MTBF	≥50000h

Electrical

iput voltage	6-36 VDC, overvoltage protection
ower consumption	<2 W

Software

CDMonitor



Features

Strong Data Processing

Capable of receiving and processing plenty of GNSS data from multiple base stations and monitoring stations synchronously, CDMonitor is a powerful data processing center.



Millimeter Level Accuracy

Featuring with advanced Kalman filter algorithm, full-constellation & full-frequency GNSS data processing capability, CDMonitor can easily realize millimeter-level monitoring.



Real-time Monitoring

CDMonitor supports both static and dynamic processing modes, offering real-time data and graphic display of baseline and coordinate changes, which is convenient for status monitoring and analysis.

HOURS OPERATION

24/7 Operation

CDMonitor supports long-term trouble-free operation and system integrity monitoring for monitor the health of the entire system, providing a reliable and accurate 24/7 monitoring solution for users. CDMonitor is a professional real-time GNSS data processing and monitoring software. Adopted with Kalman filter algorithm, the monitoring accuracy of CDMonitor is up to millimeter level. With the capability of real-time monitoring, remote management, strong data processing, early alerting, the CDMonitor can be widely used in monitoring applications such as mining monitoring, construction monitoring, dams & hydropower monitoring and geodetical disaster monitoring.



Early-alerting Function

Based on the real-time data monitoring, once the data exceed the threshold range, the system can perform sound & light alarms, SMS alarms and email alarms to remind relevant personnel to take measures.



Status Recording

Equipped with the ability of recording both monitoring data status and system working status, CDMonitor makes it more convenient for users to troubleshoot.



Remote Control

CDMonitor can realize remote configuration for the onsite monitoring devices, remote query and management for the monitoring GNSS data.

Sensors

NaviCloud Platform



SinoGNSS NaviCloud Platform is an online analyzing monitoring platform, which includes real-time monitoring system, online analyzing & alerting system, device management system and database management system.

Features



Real-time Monitoring

Provide real-time data and graphic display of monitoring data changes to facilitate status monitoring and analysis.



Online Management

Providing online device management and database management service for remote control.

Emergency Rescue Support Function

Provide technical support for emergency rescue command through basic data, emergency plans, and on-site videos.



Early-alerting Function

Support online alarm threshold setting and early-alerting via sound & light alarms, SMS alarms and email alarms.



Online Analyzing Function

Support basic data management, data analysis, comprehensive early warning, etc. Data analysis includes trend analysis of various monitoring contents, comprehensive process line analysis, etc.

Mud And Water Level Monitor



Technical parameters (optional)

- Range: 0-30m/0-70m, blind area: <1.0cm
- Accuracy: ±3mm

Power supply: 6~24V DC

- Signal output: RS485
- Communication protocol: Modbus

Working temperature: -40°C~+80°C

- Protection level: IP67
- Application: water level, mud and rock flow monitoring

Warning Broadcast



Technical parameters (optional)

Audio response: (20-20000 Hz) ±3.2Support TCP/IP protocolSupport HTTP/MQTT protocolDistortion (at rated power): ≤1%Alarm sound pressure: 120dBOutput impedance: 4/8ΩStandby power consumption: <1W</td>

Alarm light: LED strobe alarm light

Piezoelectric Rain Gauge



Technical parameters (optional)

Power supply voltage: DC12V

Humidity range: 0~100%RH

Collection time: 10~100s (settable)

Resolution: ±0.1mm

Accuracy: ±5%

Cumulative rainfall: 2000mm~6000mm (settable)

Anti-noise time: more than 8s

Auto-zero time: 30~3600s (settable)

Video Surveillance



Technical parameters (optional)

Pixels: 4 million pixels 4 inches

Image output: up to 1440P/30fps HD

Network output: 100M RJ45

Supports 23x optical zoom, 26x digital zoom

Infrared irradiation distance: up to 100m

Supports Hikvision SDK, ONVIF, ISAPI, GB/T28181, E-home

protocol and EZVIZ access

Case Study

Jiangxi Reservoir Dam Safety Monitoring System

Project Background

The scope of construction of the safety monitoring project is to build monitoring stations at the Huangnibu Reservoir Dam, Fengxi Reservoir Dam, Ziyunshan Reservoir Dam, and Xijiang Reservoir Dam (as shown in the figure), install GNSS monitoring receivers and their ancillary facilities according to the designed points, and send data to the data center through the 4G network, ensure smooth data communication, and realize data processing, data analysis, data display, abnormal warning and other functions in the provincial data center.





Project Description

A total of 95 observation stations are designed for this project. The Huangnibu Reservoir Dam has 15 monitoring stations and 1 base station, all of which are cast in concrete; the Fengxi Reservoir Dam has 12 monitoring stations and 1 base station , all of which are cast in concrete; the Ziyunshan Reservoir Dam has 15 monitoring stations and 1 base station, all of which are cast in concrete; the landslide monitoring on both sides of the Xiajiang Reservoir Dam has 18 monitoring stations and 1 base station, all of which are cast in concrete, and 31 monitoring stations on the dam surface and retaining wall use steel column observation piers.

Xiaoheba Dam Monitoring System

Project Background

The unstable slope of Xiaoheba (hereinafter referred to as Xiaoheba) is located on the opposite bank of the Datang International Living Area of Changheba Hydropower Station, and across the river from the living area. Rockfalls occurred on the unstable slope, which seriously affected and threatened the work and life of the people in the living area, and there were great safety hazards. In order to be able to predict the geological status of the unstable slope in time, after analysis, 5 characteristic points on the unstable slope and fixed points on the roadside of S211 Highway were selected to conduct all-weather automatic monitoring of the entire unstable slope.

Project Description

The Xiaoheba Dam monitoring system has been operating normally and stably since 2014, ensuring the safety and normal life of the living area of the hydropower station. The monitoring system installed 1+5 GNSS surface displacement monitoring stations, solar power supply and wireless bridge communication transmission system; monitoring data is transmitted to the monitoring center in real time, and the stability of the dam can be analyzed through real-time data.

Wuling Hydropower Dam Safety Monitoring System

Project Background

Wuqiangxi Hydropower Plant is located in the middle and lower reaches of the main stream of Yuanshui River in Yuanling County, 73km upstream from Yuanling County and 130km downstream from Changde City. The project is mainly for power generation, with comprehensive benefits such as flood control and shipping. The designed average power generation capacity for many years is 5.37 billion KW·h. There are many creep bodies and landslides on the slope of the reservoir area near the dam on the left bank





Monitoring deployment

The SinoGNSS safety monitoring system is deployed at the flood discharge and air raid shelter entrance of Wuqiangxi Hydropower Station, with a total of 18 deformation monitoring points. It adopts a monitoring method based on GNSS high-precision positioning, which can achieve 7×24 hours of continuous monitoring to provide protection for dam safety. GNSS surface displacement monitoring system point installation diagram is as shown in the figure:

Other Cases









