Smart Buildings

"the Belt and Road" Zhejiang University Digital Twin Campus Operation and Maintenance Application

2025/8

Jiangsu BAS Technology Co.,Ltd

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Data-Driven New-Quality Productivity

01

Project Overview

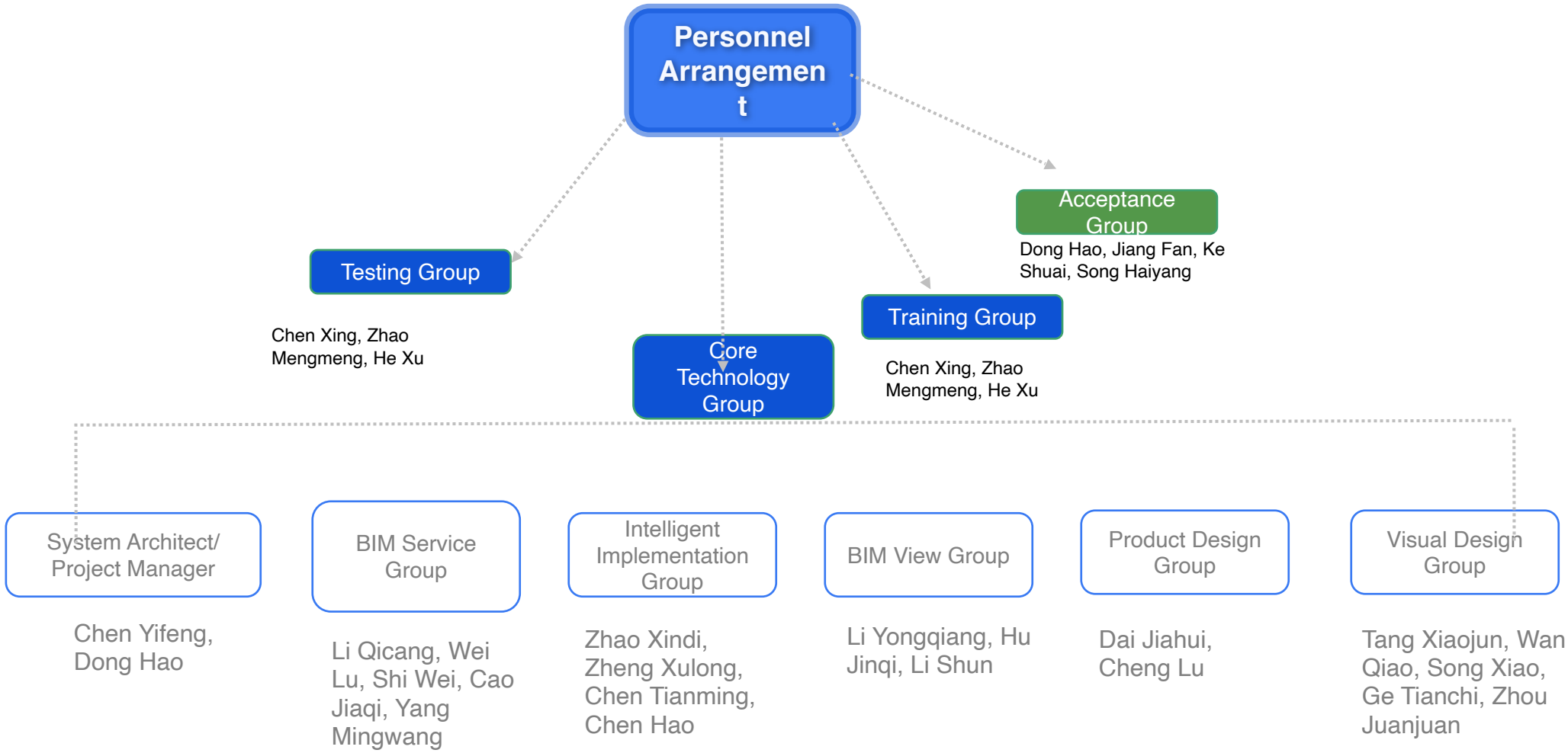
Overview of the International Medical College

New Benchmark of Digital Twin Campus

University "Belt and Road" International Medical College (hereinafter referred to as "International Medical College") was planned at the end of 2019 and approved by the Ministry of Education in 2020. It is operated and managed by Zhejiang University, and Huang Hefeng, an academician of the Chinese Academy of Sciences and a famous reproductive medicine expert, serves as the dean.Relying on the "three-in-one" development model with the International Institute of Health Medicine of Zhejiang University and the Fourth Affiliated Hospital of Zhejiang University School of Medicine, the International Medical College aims to serve the national "Belt and Road" initiative and is committed to building an international, high-level, and research-oriented higher medical education institution.

Organizational Structure of Project BIM Operation and Maintenance Team

To ensure the effective implementation of the project, the company has established a management system centered on the Testing Group, Core Technology Group, Training Group, and Acceptance Group according to the project characteristics, clarifying goals and responsibilities to ensure the project is carried out with high quality and quantity.



02

Construction Highlights

Construction Highlights

Traditional management relies on "human-based defense", ensuring the safety of areas and equipment through inspections and patrols, but the efficiency of problem handling is relatively low. This project transforms from the traditional "human managing human defense" to "machine managing machine defense", constructing a "Digital Campus Smart Operation and Maintenance Platform" supported by BIM + AI + IoT, and integrating various electromechanical equipment and monitoring systems with different functions. This enables buildings to proactively respond in advance based on prediction and self-learning functions, rather than passively handling issues through alarms, which is a new mode of operation and maintenance management. Its purposes are, on the one hand, to reduce on-site fixed maintenance personnel; on the other hand, to achieve optimized management of equipment operation with the help of building control and lighting systems.

Virtual Inspection + Regular Maintenance Reminder

AI Work Order Assignment

AI Operation and Maintenance (Machine-based Defense)

Descriptive Data Analysis + Predictive Data Analysis + Diagnostic Data Analysis + Interactive Behavior Data Analysis

Artificial Intelligence Algorithm + Building Operation and Maintenance Model Simulation

Improve Energy Utilization Efficiency

Improve Operation and Maintenance Management Efficiency

Reduce Operating Cost Expenditure

Comparison of Conventional Integrated Platforms

Conventional System Integration Platform

(Intelligent Management System
IBMS Intelligent Management System)

Vs

Zhejiang University "Belt and Road" International Medical College Digital Twin Campus Platform

In terms of digital monitoring, management and display of the system

① Traditional pure planar display

② Traditional pure planar display system topology diagram

③ Equipment management is simple form management

④ Data cannot be linked between various subsystems

① Three-dimensional spatial display method, based on 3D space, what you see is what you get, realizing a new management concept and management mode
② Various facilities and equipment that operate and are operated independently in traditional buildings are collected through the IoT edge gateway to a unified building intelligent property and facility management platform based on BIM 3D visualized graphics, realizing unified facility management and equipment monitoring. The spatial positioning and spatial position information of various monitoring system equipment and monitoring points such as building facilities, electromechanical, fire protection, security, cameras, and access control in the building are collected, analyzed, applied, and displayed through BIM 3D visualized graphics

In terms of the concept of platform construction and management

① Based on computer networks and with software as the core, through information exchange and sharing, integrate various independent weak electronic systems with complete functions in the building into an organic body, realize information sharing of the system, reduce the operating cost of the system, improve the automation level of system maintenance and management, and provide personalized services

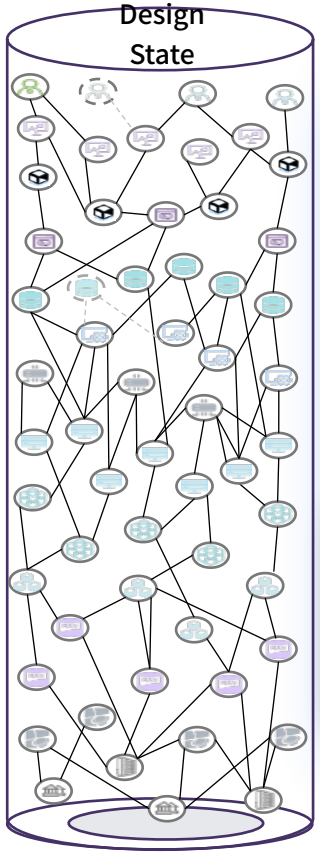
① Based on BIM technology, integrate various intelligent systems in the building operation and maintenance process with the BIM model as the carrier, realize the interconnection between people, equipment, and buildings, and provide a comprehensive control platform for building operation and maintenance, thereby better exerting the function and role of the building.
② Based on the data information carried by the BIM building model, through information means and Internet thinking mode, assist the logistics department to better realize logistics services and operation and maintenance management services for equipment and facilities, ensure the normal operation of the building interior, and realize a new logistics and operation and maintenance management mode

03

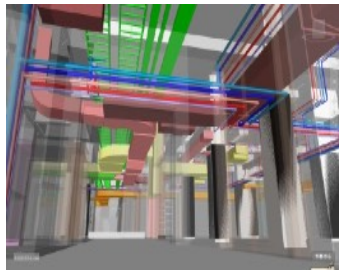
Innovative Scenarios

Rongguang BIM Lightweight Engine

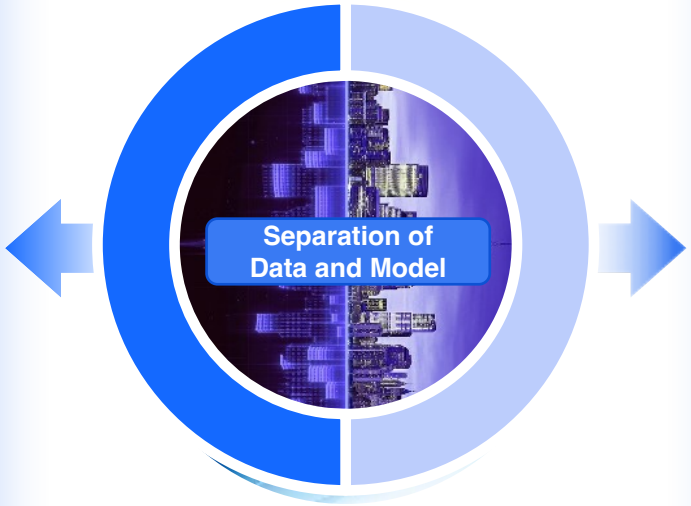
Maximize the value of BIM digital assets from project design and construction in the operation and maintenance phase. Utilize the lightweight engine to achieve second-level loading through LOD hierarchical management, mesh optimization algorithms, and attribute data optimization processing technologies.



BIM Collaborative Model

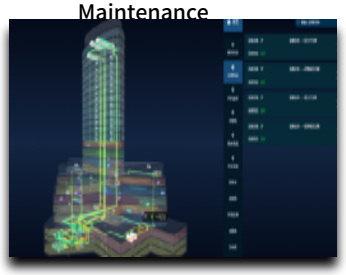


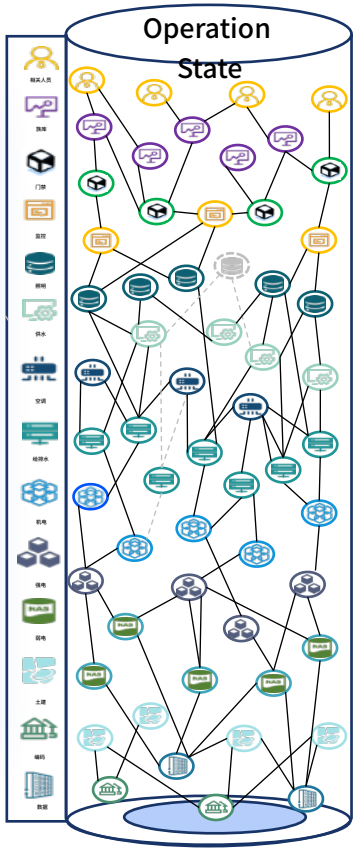
BIM Design Data



BIM Lightweight

Data Fusion Operation and Maintenance





AI Algorithm Capabilities

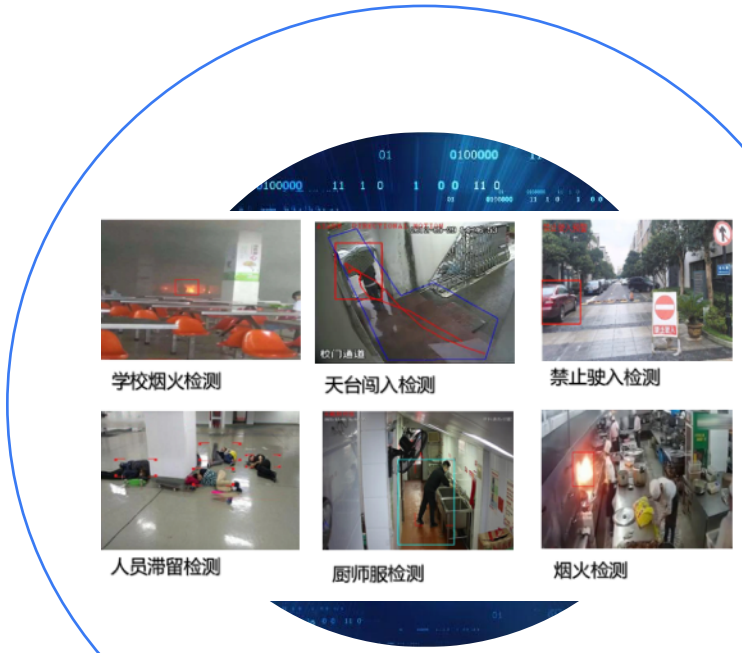
Supports deployment on NVIDIA GPU, Intel OpenVINO, Huawei Ascend, Rockchip, and Hisilicon.

Supports mainstream protocols: RTSP, ONVIF, GB28181…

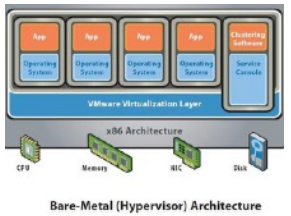
Supports mainstream manufacturers: Hikvision, Dahua, Uniview, Tiandy, Huawei…

Personnel Gathering Monitoring

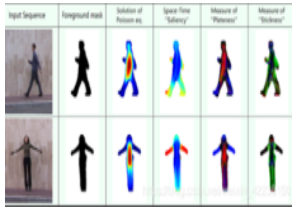
Unidentified Object Monitoring



Docker Container Deployment



RNN and CNN networks for action sequence image recognition



Internet of Everything Perception

Facing the extensive campus IoT construction and management needs, based on intelligent IOT connection, it easily realizes the connection and data collection of various systems in the park, and solves the problems of difficult access and difficult management such as multiple equipment manufacturers and inconsistent interfaces.

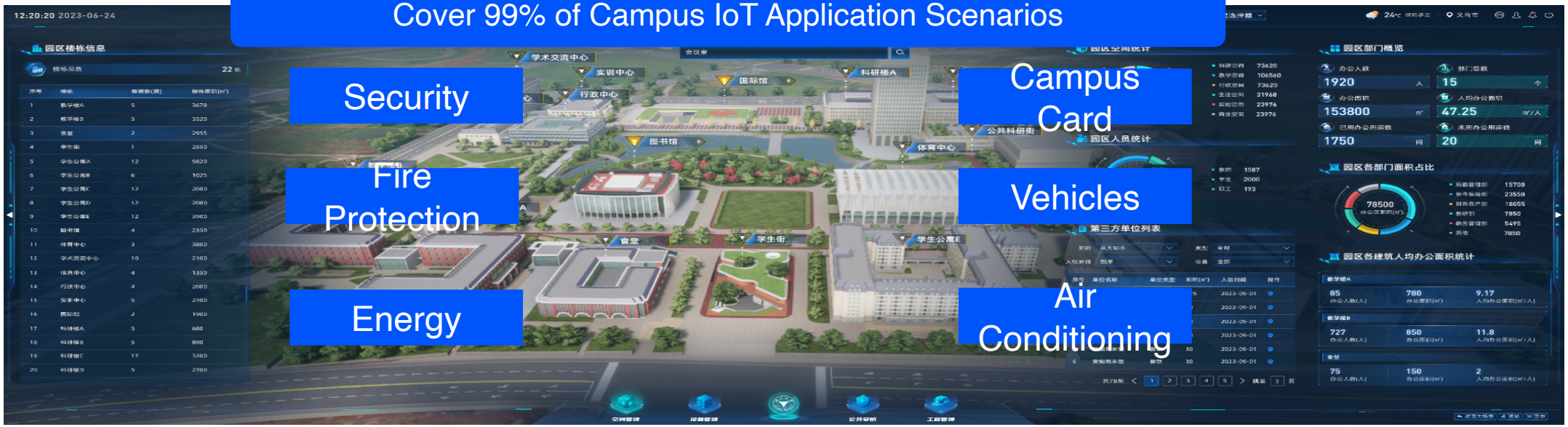
Mainstream Interface Protocols

- TCP
- MQTT
- Kafka
- http
- OPC-DA
- CoAP
- Extended Interfaces
- OPC-UA

Access Process Configuration

- Listening/Polling Collection
- Protocol Interface Configuration
- Field Path Acquisition Configuration
- Output Field Configuration
- Data Output Configuration
- Linkage Rule Configuration

Cover 99% of Campus IoT Application Scenarios



AI Automated Operation and Maintenance Report

浙 江 大 学 “ 一 带 一 路 ” 院 国 际 医 学 院

体检报告

（第一期 2025.08.18-2025.08.18）

一、整体概览

浙江大学一带一路国际医学院占地面积 40.2 万平方米，共有员工 163 人。2025 年 08 月 18 日 - 2025 年 08 月 18 日，学校总用电量 25975.82 kW·h，总用水 219.00 m3，全校共接收报警 781 次，报修工单 35 件。

二、用水用电分析

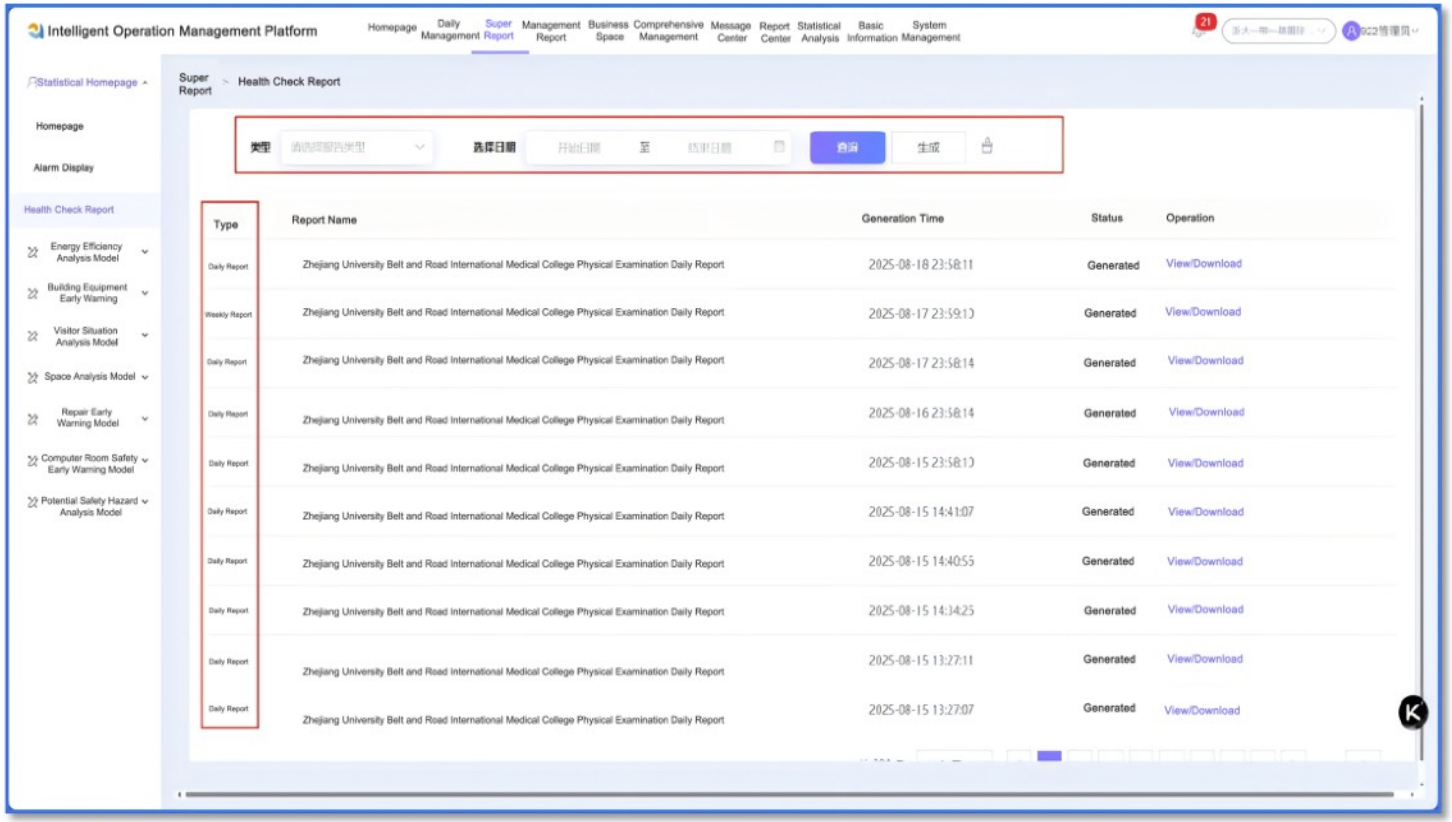
2025 年 08 月 18 日- 2025 年 08 月 18 日，学校总用电量 25975.82 kW·h，昨日用电量 27466.10 kW·h，环比下降 5.00%，其中图书馆 学生公寓 A 学生公寓 B 学生公寓 D 学生公寓 E 学生街 教学楼 B 教学组团地下 生活组团地下 食堂 用电量下降。

2025 年 08 月 18 日- 2025 年 08 月 18 日，学校总用水量 219.00 m3，昨日用水量 211.00 m3，环比上升 4.00%，其中体育中心 学生公寓 A 学生公寓 E 教学楼 A 用水量下降。

序号	楼栋	今日用电量	昨日用电量	今日用水量	昨日用水量
0	体育中心	952.40	630.90	0.00	23.00
1	公共区域地下	0.00	0.00	0.00	0.00
2	公共区域室外	0.00	0.00	0.00	0.00
3	公共科研街	0.00	0.00	0.00	0.00
4	动物中心	0.00	0.00	0.00	0.00
5	国际馆	0.00	0.00	0.00	0.00
6	图书馆	1645.06	3857.05	0.00	0.00
7	学术交流中心	0.00	0.00	0.00	0.00
8	学生公寓 A	707.20	743.20	6.00	7.00
9	学生公寓 B	535.30	566.50	2.00	1.00
10	学生公寓 C	352.80	324.80	16.00	15.00
11	学生公寓 D	597.39	618.60	3.00	2.00

Comprehensive Building Operation and Maintenance Inspection Report

- Supports automatic generation of daily, weekly, and monthly operation and maintenance statistical analysis reports by type and time, which can be directly viewed and downloaded as PDF files.
- The automatically generated reports include comprehensive water, electricity, and gas data analysis reports, equipment work order reports, inspection reports, etc., improving management efficiency, fully grasping the overall operation status, and facilitating timely detection and resolution of issues for convenient management.



Super Business Reports Enable Comprehensive Logistics Operation and Maintenance Management

- Based on all equipment and environmental data, the super report function of the business model using big data analysis and machine learning algorithms can provide multi-dimensional intelligent decision support.Provide decision support tools to help managers make decisions on resource allocation, scheduling, equipment maintenance, etc.

Value：

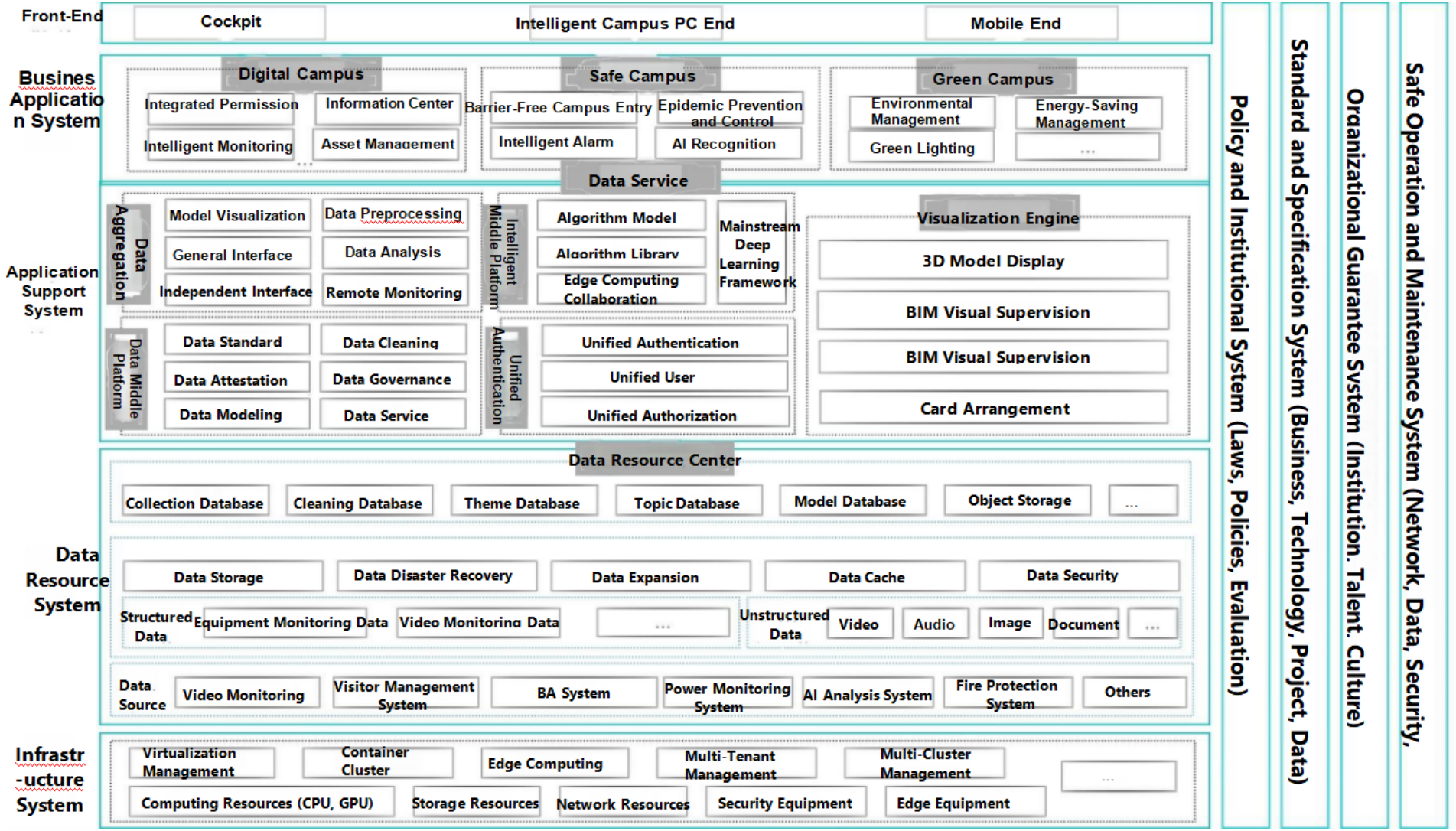
- Enhance the scientificity of management decisions: With data analysis support, help managers make more accurate decisions and optimize resource allocation.

04

Construction Contents

Top-Level Design

Build the "1133" Architecture System, including "1" Data Resource Center, "1" Campus Platform, "3" Major Application Scenarios, and "3" Types of Interactive Experiences



Digital Twin IOC Cockpit

Quickly Reach Every Corner of the Campus and Accurately Perceive Every Pulse of the

View

BIM-based IoT Perception
Campus Situation, Event Situation
Equipment Dynamics, Pedestrian Dynamics
Operation Situation, Space Situation

Mangement

Management and Control of People, Affairs, and Objects in the Park
Security Operations, Monitoring Operations
Inspection Operations, Patrol Operations
Repair Operations, Work Order Operations

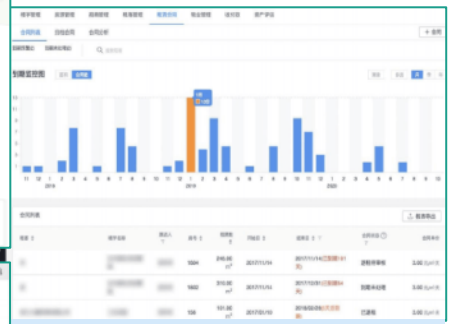
Contral

Trend Prediction, Risk Controllable
Comprehensive Management,
Emergency Plan
Security Operation, Operation and Maintenance Service
Asset Operation,
Energy Consumption Operation

Spatial Asset Application

Space Management

Quickly view on-campus leasing/sales information on the BIM side, intuitively display the current leasing situation, with different colors for different expiration dates and specific information of the lessee.



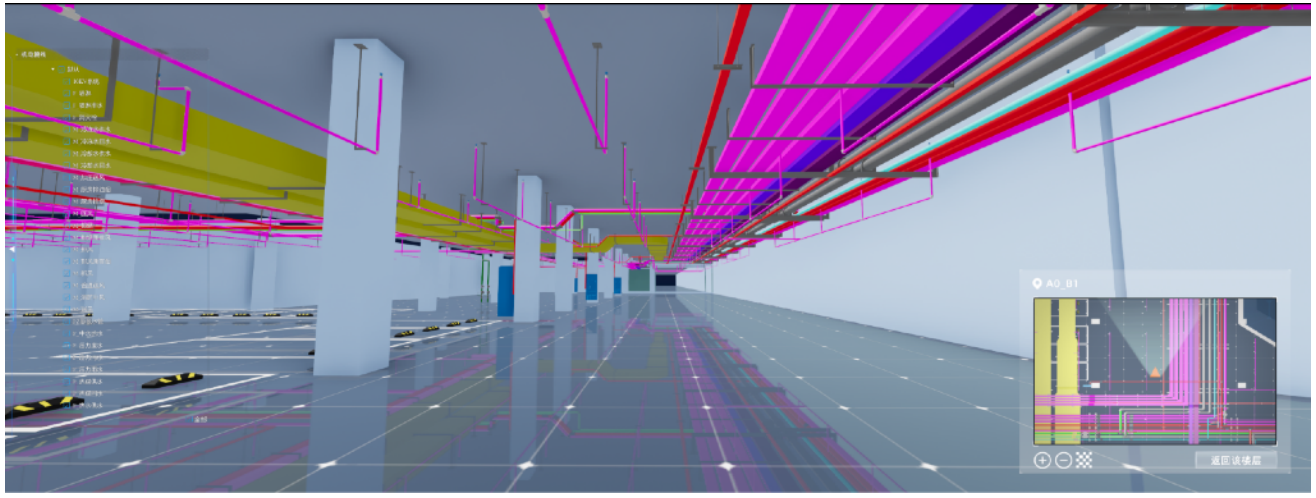
The web terminal displays tenant information and provides bidirectional reminders for the lease term, ensuring neither party makes mistakes or overlooks details. This allows for advance preparation for rent collection, lease renewal, or investment promotion.

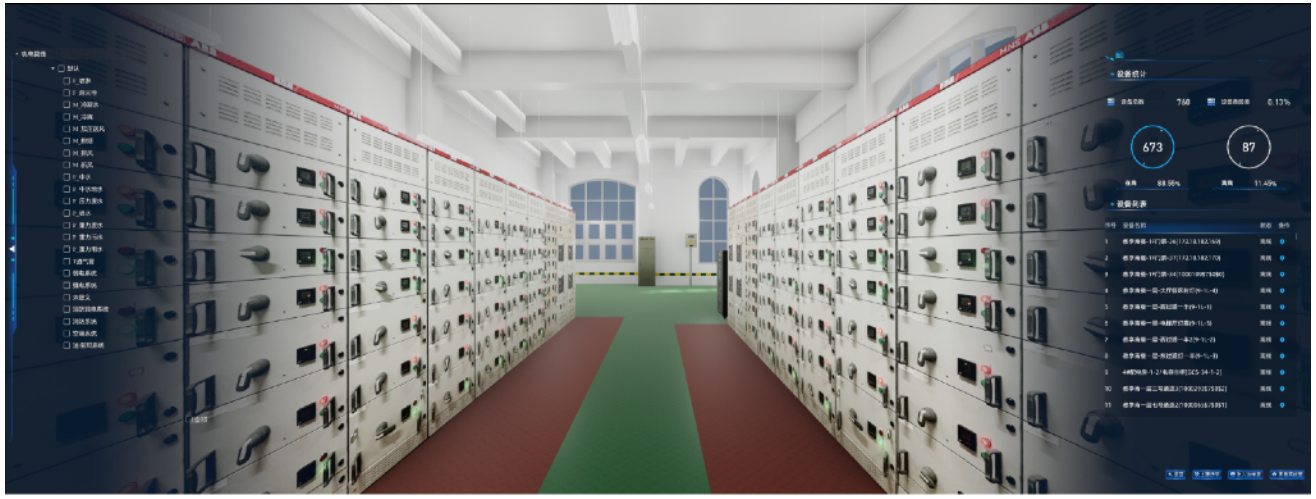
Spatial Analysis Indicators

- Optimize space allocation and improve utilization rate.
- Traceable information enables analysis of utilization rate.
- Quick search and positioning of spatial information.

- Space Vacancy Rate
- Space Efficiency - Per Capita Space
- Departmental Space Management
- Personnel Space Management

Maintenance of Concealed Engineering





Concealed Faults, Faster Repairs

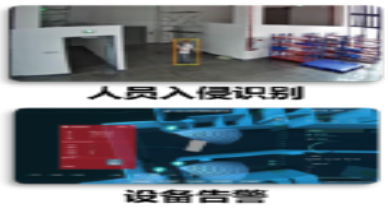
Through the BIM system, equipment inside ceilings and walls or concealed equipment/ pipelines can be viewed in real time. Compared with traditional drawing consultation, time efficiency is greatly improved.

Clicking on the equipment allows viewing of relevant basic information, real-time operation data, and maintenance history records.

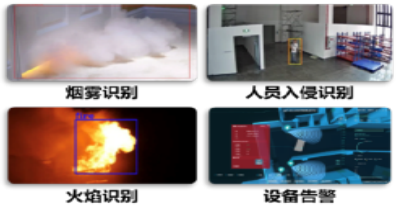
Safe Campus Application - AI Alarm Linkage

Alarm Generation → *Alarm Confirmation* → *Alarm Handling*

Smoke Recognition



Abnormal Intrusion Recognition in Important



Flame Recognition

Student Fight Recognition

Automatic Location of Alarm Space and Video Linkage Processing

Mobile Work Order Reception and Processing

Accurately and quickly identify hazards, automatically alarm, and link with videos; link with public security to timely detect blacklisted personnel

Safe Campus - Fire Fighting Linkage

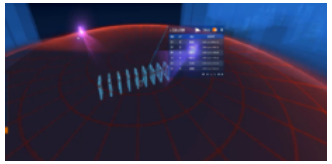
Front-end Scenario

Hazard Identification

Fire Lane Occupation

...

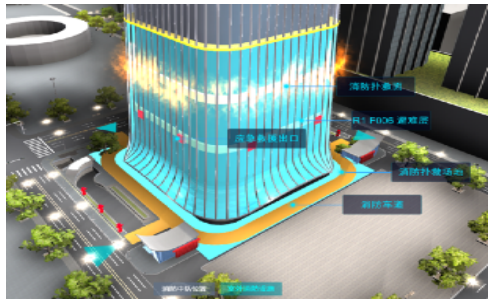
Fire Situation Monitoring



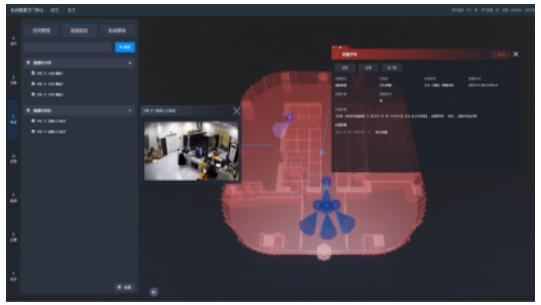
Fire Equipment Alarm

...

Fire Equipment Monitoring



Floor Display of Fire/Abnormal Equipment
Distribution Display of Fire Resources (Fire Equipment)
Display of Emergency Evacuation Exits, Escape Routes, and Elevation Surfaces



Alarm Video
Alarm Details

Early Warning ***Confirmation*** ***Disposal and Response***

Back-end Support

- Integrate algorithms such as illegal parking detection and hazard identification to identify, monitor, and alarm fire hazards.
- Access fire equipment data, utilize the capabilities of Rongguang IoT Middle Platform to conduct operational analysis on equipment, and realize alarms for operational failures, abnormalities, and other conditions of fire equipment.
- Based on the three-dimensional spatialized scene, it realizes fire alarm positioning, security linkage, fire situation confirmation, retrieves corresponding emergency plans, and assists managers in making scientific decisions.

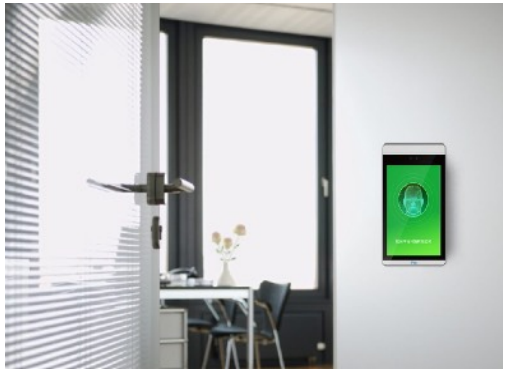
Campus Visitor Application Scenarios

Front-end Scenarios

Reservatio → ***Arriva*** → ***Access Control*** → ***Arriva***

Seamless Passage

Face Recognition, Abnormal Alarm, Video Linkage



Shared Space Entry

Back-end Support

- Online reservation application, confirmation, and approval via mobile terminals;
- QR code/face recognition;
- License plate recognition authorization;
- Integration with intelligent access control and other systems.

- Back-end VIP visitor management
- Back-end third-party visitor authorization
- Visitor access analysis
- Visitor blacklist and whitelist
- .....

- Visitor data display
- Abnormal intrusion alarm
- Access control equipment monitoring
- Access control entry and exit record monitoring
- .....

- Shared space management
- Shared space monitoring
- Shared operation analysis
- .....

Campus Vehicle Application Scenarios

Front-end Scenario

Reservation Application → ***Entry*** → ***Parking*** → ***Departure***

Back-end Support

- Online reservation application, review, and SMS notification;
- Integration with intelligent vehicle systems.

- Traffic situation monitoring, integrating data from the data middle platform for analysis, and establishing a vehicle congestion model analysis;
- Conduct parking space guidance based on vehicle distribution, remaining parking spaces, and other information;
- Automatically record entry time and a series of vehicle information;

- Integrate AI recognition and other algorithms to monitor the parking lot in real time, prevent electrical fire hazards, collisions, and other accidents, and automatically alarm and locate abnormal situations;
- Integrate vehicle data for multi-dimensional vehicle analysis (time period, vehicle type, etc.) to identify and handle zombie cars.

- Vehicle departure situation monitoring;
- Parking fee statistics;
- Remote control of barriers.

Campus Environment Regulation

Outdoor Environmen

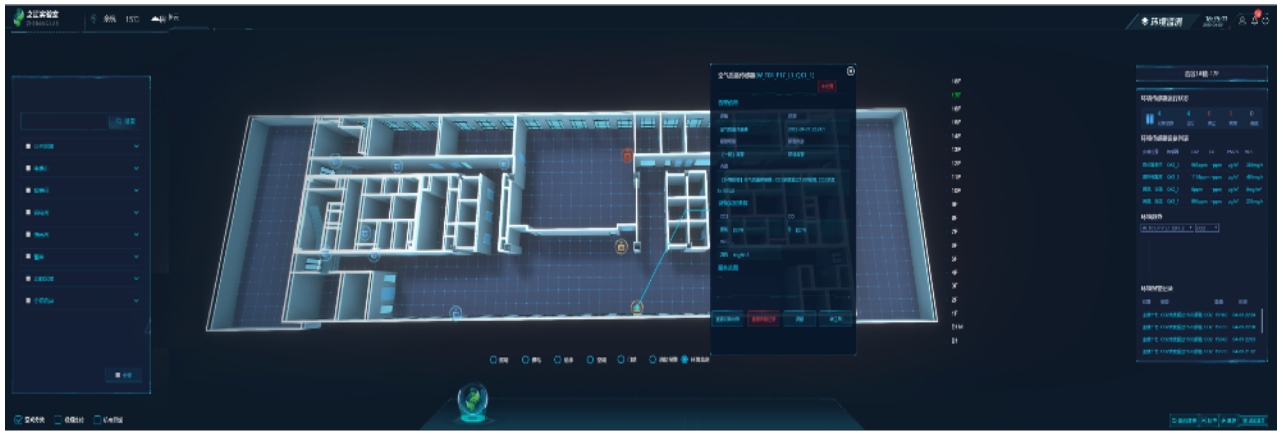
Implemented Functions:

- Street lamp monitoring and control;
- Outdoor temperature and humidity environment monitoring;
- Outdoor carbon emission monitoring;

Back-end Support:

- Integrate Baisheng's IoT data analysis capabilities and conduct comprehensive regulation in combination with infrastructure data;

Indoor Environment



Implemented Functions:

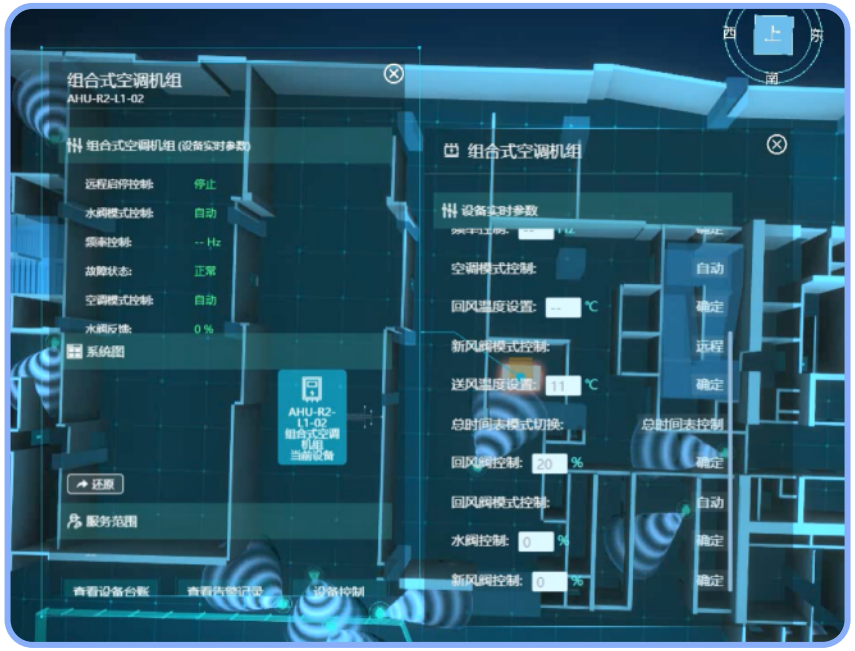
- Real-time monitoring of indoor environment
- (Temperature and humidity, PM2.5/ PM10, TVOC, formaldehyde, CO_2);
- Real-time evaluation of teaching environment;
- Dynamic optimization of teaching environment;

Back-end Support:

- Integrate the data analysis capabilities of Baisheng IoT Middle Platform and conduct comprehensive regulation in combination with the office environment

Intelligent Device Control

- ✓ Air conditioning control: Supports single-point device control and multi-point centralized control, with parameters such as device temperature and wind speed adjustable.
- ✓ Lighting equipment control support: Multi-mode intelligent control, including full on, energy-saving, night, full off, etc.



Remotely view dynamic and static data of the air conditioning system and remotely control key measuring points

Energy Conservation Application

Energy Management System

① Campus Energy Data Monitoring:
② Sub-item electric meter measurement
③ Water meter measurement
④ Energy meter measurement
⑤ Power monitoring (Level 1 electric meter measurement)

Energy monitoring data collection
Operating status
Data indicators
Operating parameters

Digital Twin Campus Platform

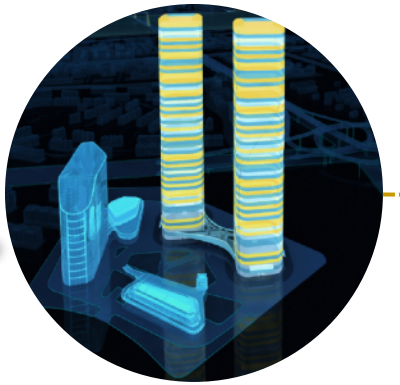
BIM 3D Model Display

Real-time Monitoring Data Display Big Data + AI

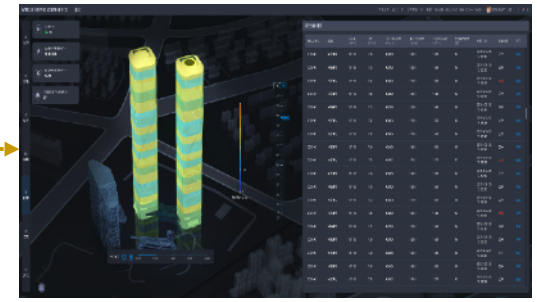
Built-in

Integration

- Data Monitoring, Statistical Analysis
- Sub-item energy consumptionGeneral data model
- Energy consumption indicator systemEnergy-saving diagnosis indicator system
- Sub-item energy consumption splitting algorithmEquipment energy-saving diagnosis algorithm
- Energy-saving diagnosis method systemEnergy-saving transformation method system



Dynamic Evolution Display of Building Energy Consumption Thermal Model



BIM 3D Visualization Model for Spatial Positioning Substation-Transformer/Low-Voltage Distribution Cabinet Power Monitoring Visual Energy Consumption Management

CS/BS端

Energy consumption monitoring sub-itemsMeasurement summary display

Statistical Analysis of Sub-item Energy Consumption Measurement Data

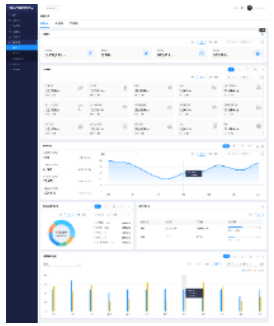
① Chiller room
② Boiler room
③ Elevator
④ Water pump
⑤ Above-ground tenant trunk line
⑥ Above-ground air conditioning trunk line
⑦ Above-ground public lighting
⑧ Underground mechanical parking space
⑨ Underground garage lighting
⑩ Underground garage charging pile
⑪ Weak current equipment room
⑫ Building floodlighting
⑬ Outdoor landscape
⑭ Building E
⑮ Others

Abnormal energy-consuming equipmentMonitoring and alarm display

Energy-consuming equipment dataComparison and demand forecasting

Energy-consuming equipmentEnergy-saving diagnosis

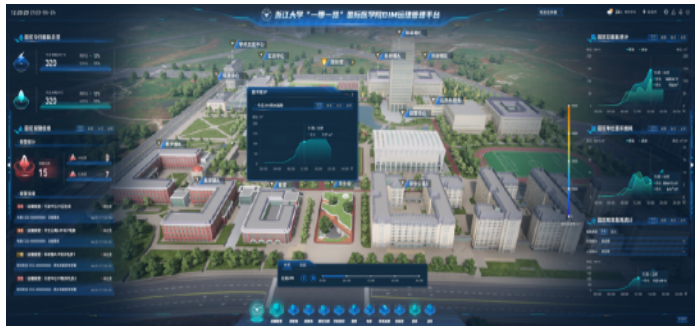
Energy-consuming equipmentEnergy-saving transformation



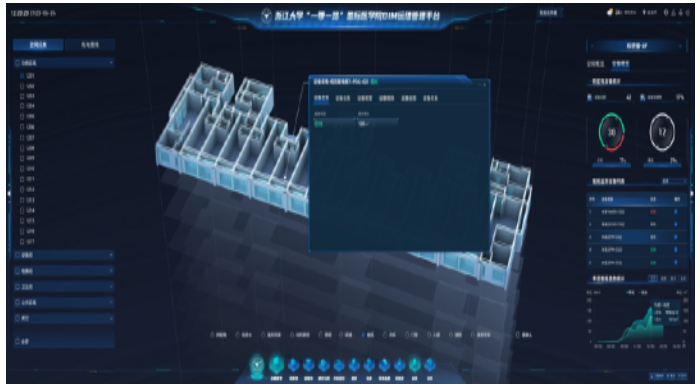
Value:Improving energy efficiency: Based on big data and AI, intelligent diagnosis, transformation, and optimization of energy-consuming equipment control and operation are carried out for the operation and maintenance data of energy-consuming equipment in buildings, so as to improve the overall energy efficiency ratio of buildings.Reducing costs: The improvement of building energy efficiency ratio continuously reduces building energy consumption and lowers the comprehensive operation and maintenance expenditure o buildings.

Energy-saving Application

Featured Functions



Energy Itemized Analysis



Energy Abnormal Alarm

Pain Points Solved

- ➢ Solve the problem of difficult energy security guarantee;
- ➢ Solve the problems of difficult energy data report analysis and extensive energy management methods;
- ➢ Solve the problem of energy waste;

Construction Value

- Energy-saving and Consumption Reduction: Precise energy use scenarios to increase benefits;
- Energy Use Optimization: Peak shaving and valley filling of energy use, and improvement of energy use quality;
- Decision Support: Tap the value of energy efficiency data services and quickly respond to the needs of energy business changes;

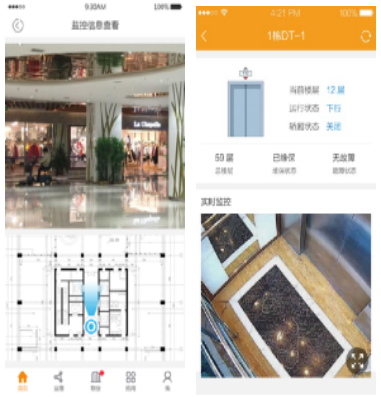
User Entity

Mainly used by the logistics management department.

Elevator Early Warning and Linkage Application

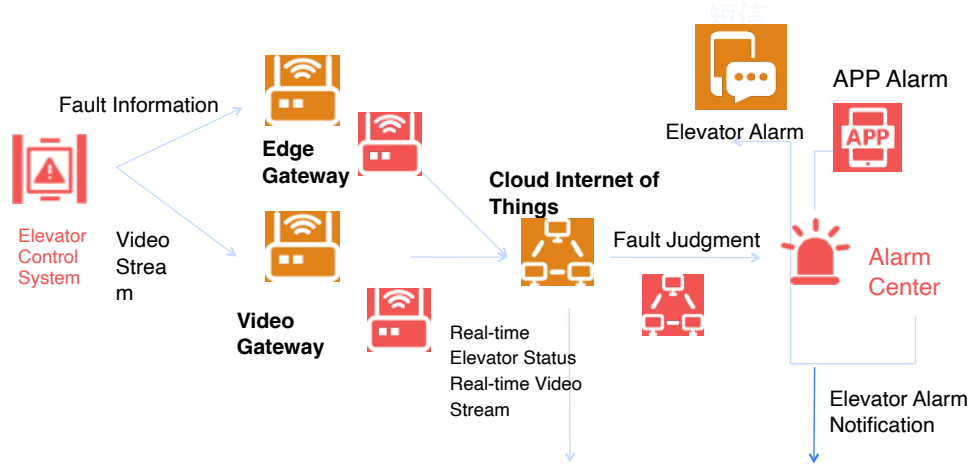
Linkage of BIM Model and Elevator System

Security Personnel in the General Duty Hall: View the spatial position of the elevator system in the 3D digital twin space and display the operation status of the elevator system
Logistics Management Personnel: Real-time monitoring via mobile app



Logistics Management Personnel: Real-time monitoring via mobile app

Alarm Process



Work Order Process Triggered by Elevator Alarm

- Generate alarm information immediately, force pop-up and generate work order, and send it to the corresponding person in charge (security department, engineering department, customer service department)
- BIM system administrator checks the location and floor of the faulty elevator
- Link the camera in the elevator on BIM to check if there is anyone, so as to judge the alarm level
- Maintenance personnel and elevator maintenance manufacturers carry out elevator maintenance
- Complete the alarm work order process and display the overall process in BIM

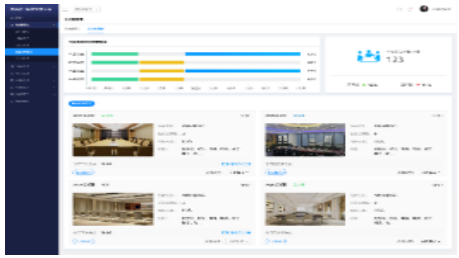
Smart Conference Application

BIM Model Positioning and Display of Conference Room Space

BIM 3D Visual Smart Conference Management

Visual End

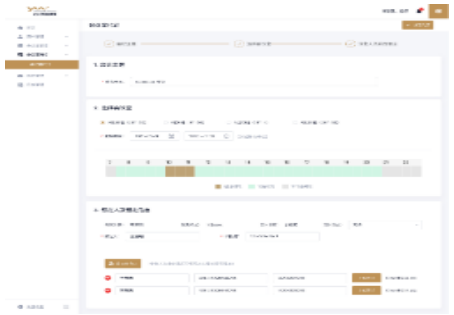
- Conference Room Reservation Display
- Conference Room Status Display
- Conference Room Statistical Analysis



Conference Reservation System

Mini Program End

- Conference Room Management
- Operation Management
- Message Center
- Conference Room Reservation

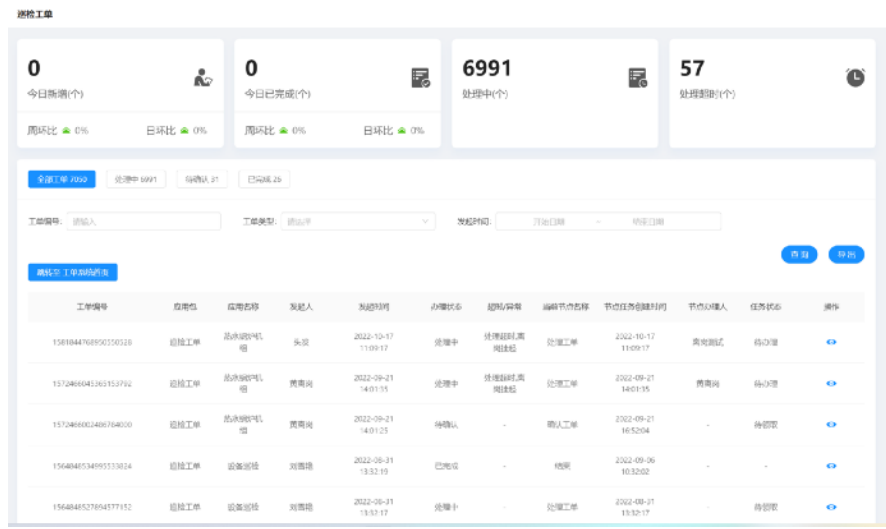


Smart Inspection Application

Unmanned Inspection

The system automatically collects data for unmanned inspection, reducing human input. According to the needs of different equipment types, it automatically generates inspection record forms. The inspection situation is proactively sent to logistics personnel via email.

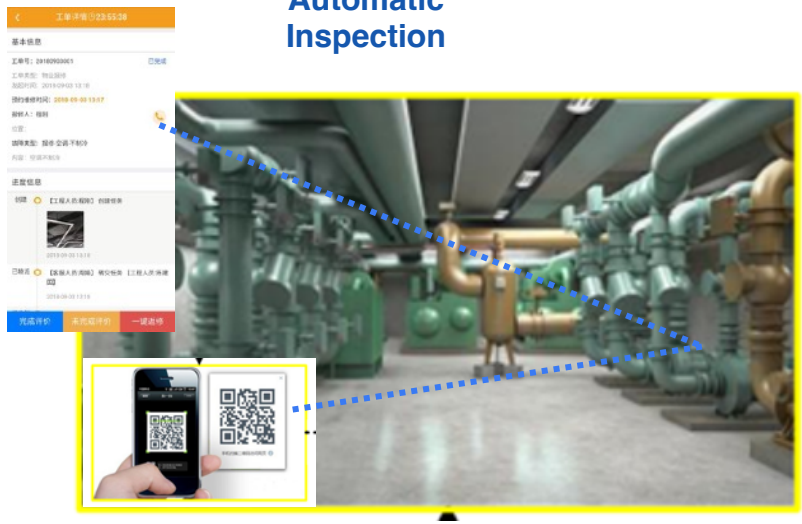
Automatic Inspection



WEB End Inspection Work Order Confirmation and Processing

Manual Inspection

On-site, inspectors scan the QR codes of equipment rooms and equipment to view inspection contents and requirements, confirm the information of inspection contents one by one, and describe the overall inspection situation by taking photos, writing texts, etc. The inspection function module provides an entrance for repair functions to support repair.



can the QR Code on the Equipment with Mobile App

Smart Work Order Application

Digital Twin Campus Platform
Property IOC, PC End
Property App and Teacher-Student
WeChat Mini Program End

Property Management Personnel
School Teachers and Students

Report Service Management

Repair Service Management

Maintenance Service Management

Inspection Service Management

Value:
Improve Efficiency: Based on BIM 3D visual repair and maintenance management, complete and detailed equipment information can be obtained, inspection and repair work can be completed quickly, making work efficient and convenient, and improving overall work efficiency.
Fine Management: Through the work order system, the implementation status of equipment, equipment repair and maintenance records, and the performance of repair and maintenance personnel are effectively managed, improving the level of refined management.

Super Report

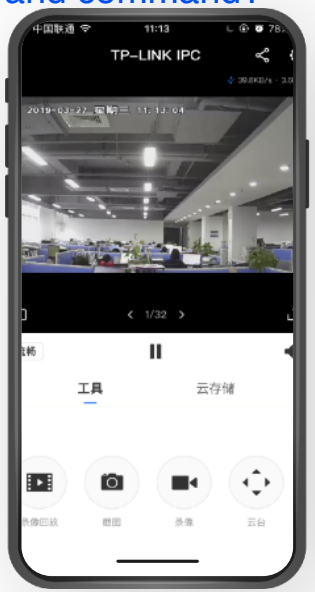
- Based on all equipment and environmental data, leverage big data analysis and the super report function to provide intelligent decision support for managers
- Automatically generate monthly building health check operation reports, offer an overall analysis view for managers, and support convenient viewing and management on mobile devices

Mobile End Operation and Maintenance Assistant

A convenient mobile application, a good helper for daily business application and management

A convenient mobile application, a good helper for daily business application and management

Is there a situation on site that requires handling and command?



Video Surveillance Viewing

Are you worried about the operation of important equipment?

Real-time Monitoring of Important Equipment

Do you have to be in the office to view work orders?

Work Order Inspection

Can't keep track of the parking lot situation in real time?

Parking Space Management Viewing

In case of an emergency, can you quickly view the plan manual?

Emergency Plan

How to reflect the patrol situation in real time?

Equipment Control


Thank you for watching
BAS
Digital Intelligent Campus,
Cloud Empowers the Future