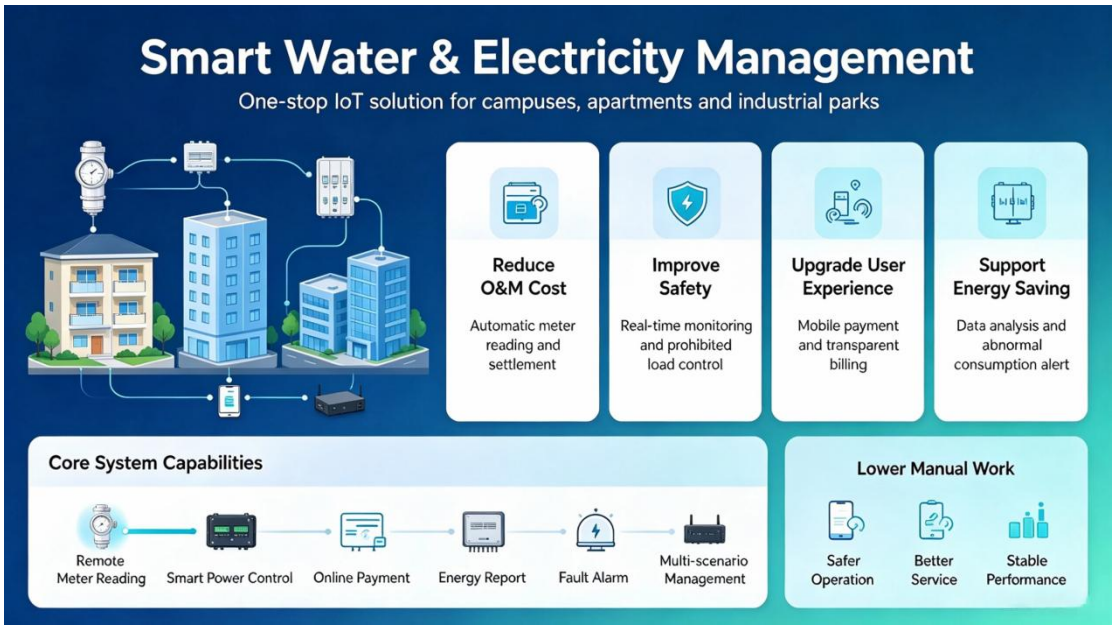
Smart Water and Electricity Management System Solution

1. Solution Overview

The Smart Water and Electricity Management System is an integrated IoT solution combining hardware and software. Designed for university dormitories, talent apartments, industrial parks, commercial communities, and other scenarios, it integrates smart metering devices, a centralized management platform, and mobile services to address key challenges in traditional water and electricity management, including inefficient manual meter reading, difficulties in electricity safety management, inconvenient payment processes, and excessive energy consumption.



2. Customer Challenges

Traditional water and electricity management is facing increasing challenges across a wide range of applications. Whether in campus dormitories, residential apartment complexes, or enterprise parks, facility managers must address the following common issues:

⚠ Challenge 1: Inefficient Manual Management

Manual meter reading is prone to errors, data updates are delayed, and fault identification and emergency response are inefficient. Large-scale facilities require significant manpower for routine inspections and meter reading, resulting in high management costs.

⚠ Challenge 2: Inconvenient Payments and Frequent Complaints

Limited payment options lead to long queues during peak periods, while top-ups may be unavailable during holidays. Users cannot check their utility consumption in real time, and unclear billing information can lead to disputes and complaints, negatively affecting user satisfaction.

⚠ Challenge 3: Difficulties in Managing Safety Risks

Inadequate control over high-power electrical appliances makes it difficult to detect and prevent unauthorized electricity use in real time, creating significant fire hazards. Traditional management relies on manual spot checks, which offer limited coverage and cannot ensure continuous, comprehensive safety monitoring.

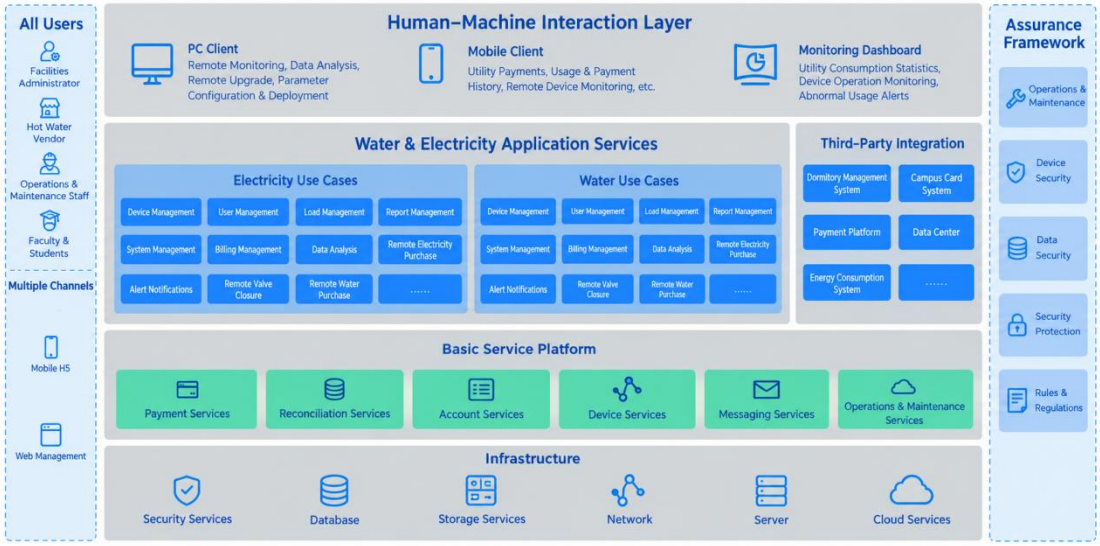
⚠ Challenge 4: Widespread Energy Waste

The lack of intelligent management tools prevents the implementation of flexible strategies such as scheduled control and holiday modes. Water leaks and electrical faults may go undetected, while lights and water supplies are often left running unnecessarily, resulting in significant energy waste and financial losses.

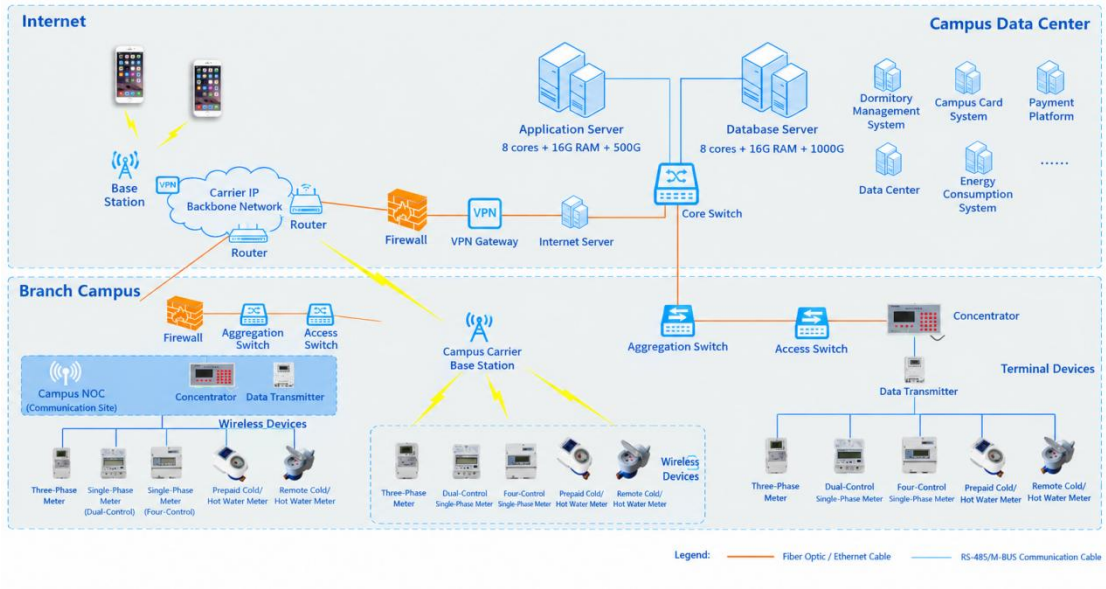
3. Smart Water and Electricity Management System Solution

The Smart Water and Electricity Management System is built on a Browser/Server (B/S) architecture and Internet of Things (IoT) technologies to provide comprehensive intelligent management capabilities. Integrating utility metering, billing management, and real-time consumption monitoring, the system enables accurate metering, convenient payment, and centralized management of water and electricity usage across multiple scenarios, including dormitories, commercial premises, and industrial parks.

3.1. System Architecture Diagram



3.2. Network Topology



3.3. Hardware Product Portfolio

3.3.1. Smart Water Meter Series

Smart Prepaid Water Meter



- **Prepaid Control:** Motorized ball valve enables prepaid water management, supporting a **"pay before use"** model.
- **Remote Monitoring:** Remotely control water supply and monitor device operating parameters, including battery level, valve status, device status, and signal strength.
- **LCD Display:** Displays operating status, cumulative water consumption, remaining water balance, and other information.
- **Self-Maintaining Valve:** Automatically performs periodic valve maintenance to prevent the valve from seizing due to prolonged inactivity.
- **Communication:** LoRaWAN / NB-IoT / 4G Cat 1 / M-Bus optional.

Smart Remote Water Meter 	• **Accurate Metering:** Proven rotary vane wet-type metering mechanism delivers accurate and stable measurement for reliable billing. • **Remote Monitoring & Alerts:** Automatically reports device status and proactively alerts users when water levels are low, enabling efficient maintenance. • **Battery Compartment:** Independent waterproof battery compartment. • **Low Power Consumption:** Standby power consumption below **15 µA**. • **Communication:** LoRaWAN / NB-IoT / 4G Cat 1 / M-Bus optional.
Photoelectric Direct-Reading Water Meter 	• **Synchronized Reading:** Directly reads the mechanical register, eliminating cumulative reading errors and ensuring reliable metering. • **Zero Standby Power at the Meter:** Passive operation with power drawn from the bus only during meter reading, eliminating the need for a built-in battery. • **Accurate Metering:** Uses a proven rotary vane dry-type metering mechanism to deliver accurate and stable measurement, ensuring reliable billing. • **Communication:** M-Bus.
Smart Ultrasonic Water Meter 	• **Accurate Metering:** Based on ultrasonic transit-time measurement and electronic sensing technology, the meter features a low starting flow rate and an ultra-wide measurement range, enabling accurate measurement even at very low flow rates, including dripping water. • **Prepaid Control:** A motorized ball valve enables prepaid water management. • **Remote Monitoring:** Remotely control water supply and monitor device operating parameters, including battery level, valve status, device status, and signal strength. • **Communication:** LoRaWAN / NB-IoT / 4G Cat 1 / M-Bus optional.

3.3.2. Smart Electricity Meter Series

Centralized Electrical Control Cabinet 	• **Supports 12–96 Circuits:** Adaptable to different dormitory sizes and floor configurations. • **Abnormal Load Detection:** Accurately identifies and distinguishes resistive, capacitive, and inductive loads. • **Three-Level Temperature Control:** Automatically disconnects the power supply for over-temperature protection. • **Flexible Power Management:** Supports scheduled power-off, holiday mode, and time-based power limit settings.
Single-Phase DIN-Rail Energy Meter 	• **Standard Configuration:** 1–4 independent metering and load control channels. • **LCD Display:** Displays operating status, cumulative electricity consumption, remaining balance, and other information. • **Load Type Identification:** Supports enabling or blocking specific types of loads. • **Multiple Communication Options:** Supports NB-IoT, 4G, RS485, and other communication methods.
Three-Phase Four-Wire Energy Meter 	• **Wide Operating Temperature Range:** Ensures high reliability and stable long-term operation without frequent calibration. • **Real-Time Monitoring:** Provides real-time access to phase voltage, current, power, power factor, and other electrical parameters. • **Remote Prepaid Management:** Supports encrypted transmission of purchased electricity data with automatic balance accumulation. • **Wide Range of Applications:** Suitable for electricity management in common areas, commercial premises, factories, and other scenarios.

4. Core Features

Real-Time Monitoring & Automatic Alerts

- **24/7 Real-Time Monitoring:** Continuously monitors device status around the clock for clear visibility into system operations.
- **Real-Time Data Access:** Provides real-time status and key parameters of electricity meters, water meters, and data concentrators.
- **Automatic Alerts:** Immediately triggers alarms for equipment faults, unauthorized electricity usage, and threshold violations.
- **Dual-Channel Notifications:** Sends alerts through both the management platform and mobile devices, enabling precise identification of affected equipment.
- **Reduced Manual Inspections:** Minimizes routine inspection workload, allowing maintenance personnel to focus on resolving abnormalities

Shared Accounts for Convenient Consolidated Payments

- **Shared Balances Across Multiple Rooms & Devices:** A single account balance can be shared across multiple rooms and devices, enabling one payment for multiple locations.
- **Flexible Meter Binding:** Water and electricity meters can be linked to the same account for flexible account management.
- **Flexible Meter Management:** Meters can be freely added to or removed from an account to accommodate room changes.
- **Multiple Payment Channels:** Supports convenient self-service payments via mobile devices, self-service kiosks, and other channels.
- **Unified Payment & Usage Inquiry:** Provides a clear overview of payment records and detailed consumption data for all linked meters.

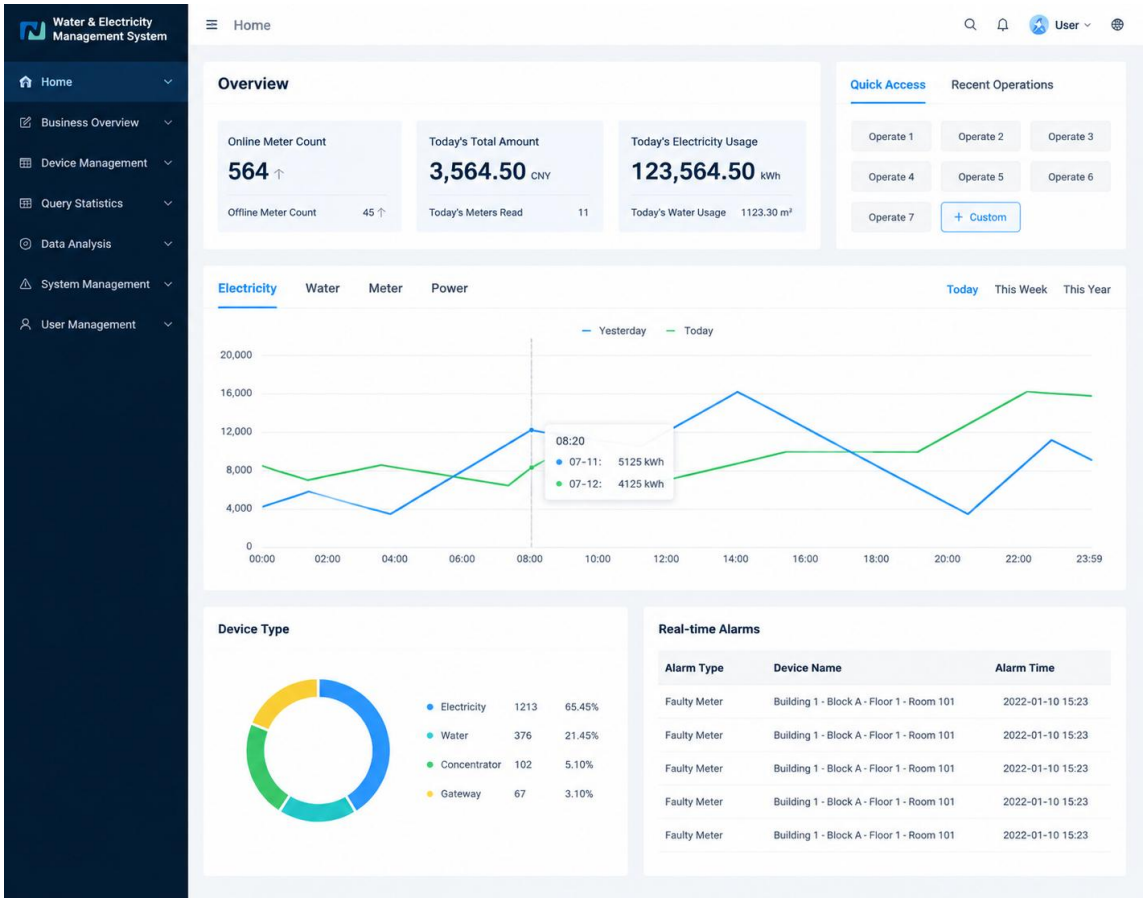
Multi-Scenario Integration for Unified Water & Electricity Management

- **Unified Management Platform:** Enables integrated smart management across multiple application scenarios.
- **Lower Platform Deployment Costs:** Reduces system implementation costs while improving management efficiency.
- **Versatile Applications:** Suitable for campuses, apartments, industrial parks, and other scenarios.

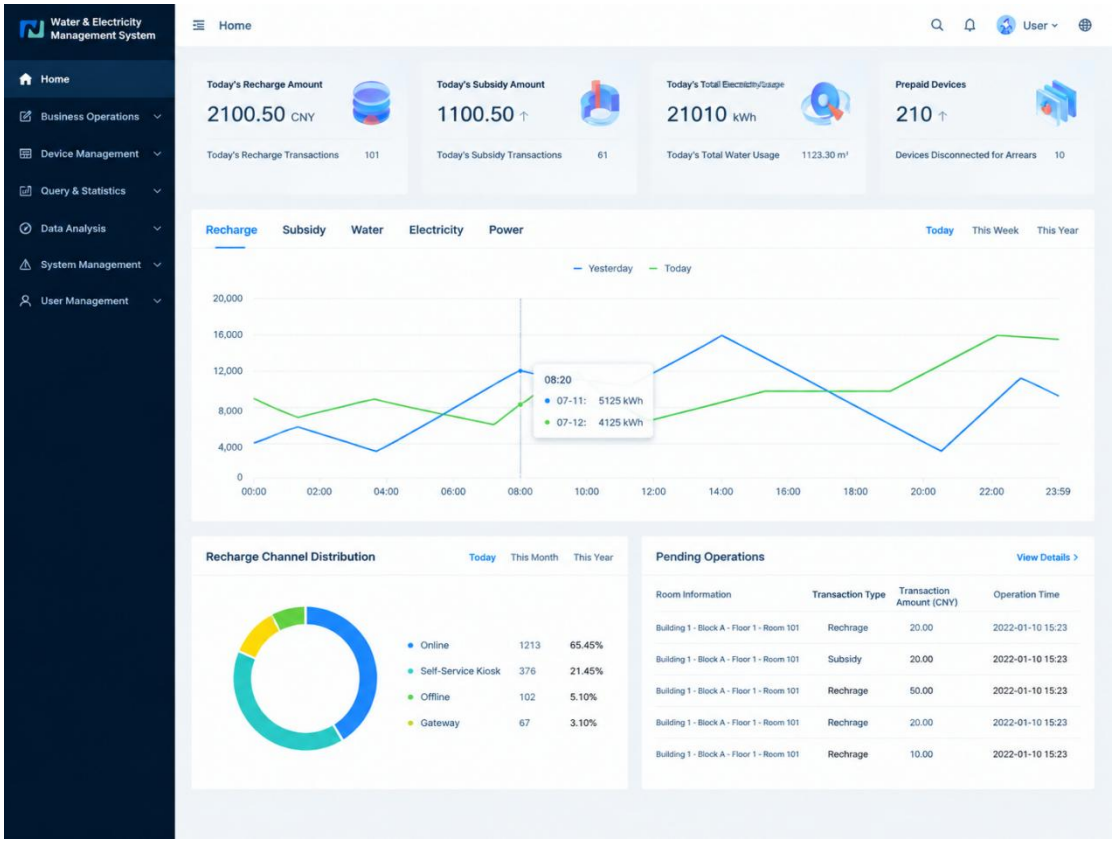
  Flexible Billing Models: Supports tiered rates, multi-tariff rates, shared-cost allocation, and other billing methods.

5. Platform

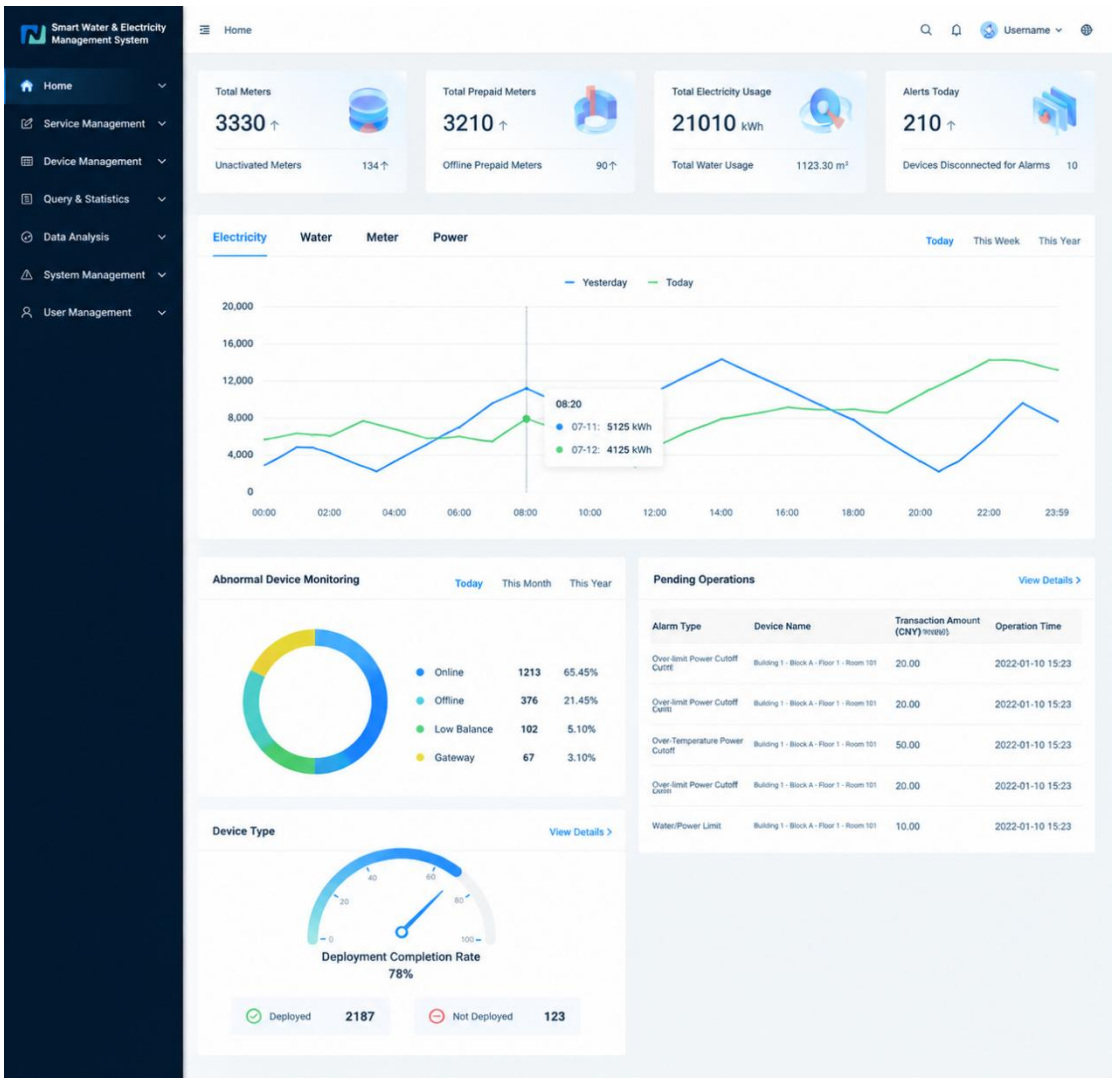
5.1. Dashboard Overview



System Administrator Dashboard



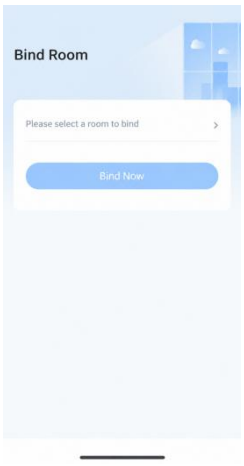
Water & Electricity Operator Dashboard

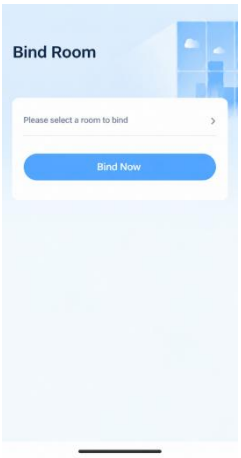


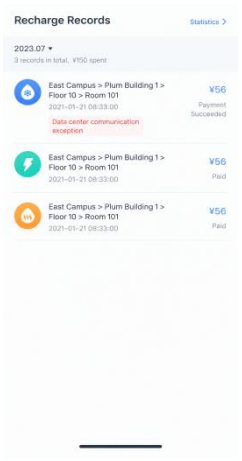
Operations & Maintenance Administrator Dashboard

5.2. Mobile Mini Program

5.2.1. User-Side Workflow



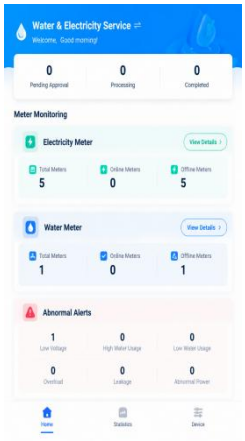






Bind Room
Water & Electricity Recharge
Record Inquiry
Energy Usage Statistics

5.2.2. Administrator Workflow









Admin Login
Water & Electricity Device Monitoring
Room Power Control
Room Power Control

6. Application Scenarios

6.1. Campus Scenario



Dormitory Electricity Management

- **Usage Quota & Tiered Billing:** Set electricity quotas and apply additional charges for excess consumption to encourage energy conservation.
- **High-Power Appliance Detection:** Automatically detects high-power appliances and triggers power cut-off and alerts.
- **Scheduled Power Control:** Supports scheduled power-off based on daily routines and flexible holiday modes.

  Occupancy-Based Power Control: Automatically links power supply with room occupancy to prevent unnecessary electricity use and improve safety.



Dormitory Water Management

- **Subsidized Water Usage:** Provide water subsidies within the allocated quota, with excess consumption charged based on actual usage.
- **Real-Time Flow Monitoring:** Monitor water flow in real time to prevent unnecessary continuous water usage.
- **Automatic Leak Alerts:** Automatically detect and report water leaks, enabling timely maintenance.

  Common-Area Water Monitoring: Monitor water consumption in common areas and encourage water conservation.



Public-Area Electricity Management

- **Sub-Area Metering:** Meter electricity consumption separately for classrooms, laboratories, offices, and other areas.
- **Time-Based Control:** Automatically switch power on or off according to predefined schedules and operating hours.
- **Centralized Management:** Manage electricity usage across public areas through a unified platform.

  Energy Consumption Analysis: Analyze energy consumption data to support energy-saving decisions.

6.1.1. Zhengzhou University

Zhengzhou University, located in Zhengzhou, Henan Province, was founded in 1956. It is a comprehensive university established by the People's Government of Henan Province and jointly administered by the Ministry of Education and the People's Government of Henan Province. The university is also a key institution under the national "Project 211", a Double First-Class University, and a university participating in the Ministry-Province Joint Development Program.

Project Requirements

- **Scenario-Based Power Control:** Develop differentiated power control solutions based on the electricity usage characteristics of dormitories across different campus areas, accommodating diverse usage scenarios.
- **Cost Reduction & Reuse of Existing Infrastructure:** Reuse existing control cabinets and wiring wherever possible to minimize project investment and reduce renovation costs.
- **System Integration:** Support seamless integration with the campus One-Card System, enabling unified electricity payment and One-Card services.
- **Unified Supervision:** Establish a unified electricity management platform covering multiple campus areas to enable centralized monitoring and management of dormitory electricity usage at the university level.

Project Outcomes

By continuously improving the system, upgrading functions, and optimizing operation and maintenance based on the needs of students, faculty, and campus logistics management, the project has provided **18 years of stable and reliable dormitory electricity management services** for Zhengzhou University. It has achieved unified supervision across multiple campus areas, customized solutions for different electricity usage scenarios, and seamless One-Card System integration, significantly improving the overall efficiency of campus electricity management.

- **Scenario-Based Customization to Meet Campus Needs:** Conducted in-depth analysis of electricity usage structures and management challenges across different campus areas, and developed targeted power control solutions to meet differentiated management requirements.
- **University-Level Unified Supervision Across Multiple Campus Areas:** Established a university-level centralized electricity management platform integrating dormitory electricity data from **eight major campus areas** into a unified management system, enabling real-time monitoring of electricity usage and timely alerts for abnormal conditions.
- **Long-Term O&M Support for Electrical Safety:** Continuous technical support and operation and maintenance services have enabled the university to meet long-term electricity safety management requirements. Over the past **18 years**, the solution has helped prevent potential dormitory electricity safety risks and provide a safe and stable electricity environment for faculty and students.
- **Seamless Integration for an Improved User Experience:** Through deep integration with the campus One-Card System, the solution provides unified electricity services. Faculty and students can conveniently complete recharge and payment operations, improving the overall campus living experience.



6.1.2. Jimei University

Located in Xiamen, Fujian Province, Jimei University is a **Double First-Class University in Fujian Province**. It is jointly established by the Ministry of Transport and Fujian Province, the Ministry of Natural Resources and Fujian Province, and Fujian Province and Xiamen City. The university is authorized to confer doctoral and master's degrees, is a pilot institution for the development of a strong transportation sector, and is the only university in mainland China approved by the Maritime Safety Administration of the Ministry of Transport to provide competency training for Taiwanese seafarers.

Project Requirements

- **Unified Management:** Establish a management system covering dormitory areas to enable intelligent monitoring, control, metering, and data management of water and electricity usage in campus dormitories and laboratories, replacing traditional manual meter reading and management.

- **Convenient Payment:** Support online payment services, allowing students to check water and electricity consumption and make payments via mobile devices. The system should also support remote payment reminders and remote power/water supply control by administrators.

- **Data-Driven Management:** Enable real-time monitoring of electricity usage status and cold-water consumption across all dormitory rooms through the management platform, and generate energy consumption reports to support data-driven decision-making for campus water and electricity management.

Project Outcomes

The project established an IoT-based water and electricity management platform, with power control equipment deployed across 75 buildings and 7,800 campus rooms. Cold water meters were installed in 22 buildings covering 2,200 rooms, including 700 water meters for laboratory applications.

- **Unified Management & Significantly Improved Efficiency:** The system provides real-time monitoring of water and electricity usage in every dormitory and laboratory, enabling precise electricity load control and accurate water and electricity metering. It eliminates errors, missed readings, and incorrect readings associated with manual meter reading, while reducing the manpower required for routine inspections and meter reading. This significantly improves the efficiency and refined management of campus utilities, achieving the goal of **"unified platform, centralized management, and precise control."**

- **Convenient Payment & Improved User Experience:** Students can check real-time water and electricity consumption and detailed charges for their dormitory rooms and laboratories anytime via mobile devices and complete payments online without queuing. Administrators can remotely issue payment reminders and control power and water supply for the corresponding rooms through the platform. Flexible control measures can be applied to overdue accounts, ensuring timely payment collection while reducing the inefficiency and inconvenience of manual collection.

- **Data-Driven Insights & More Scientific Decision-Making:** The system automatically generates energy consumption reports and usage analysis, clearly presenting water and electricity consumption by building, room, and time period, while identifying high-consumption areas and periods. Comprehensive and accurate data provides a reliable basis for policy development, energy optimization, tariff adjustments, and facility maintenance, supporting more efficient resource allocation and energy conservation.

- **Comprehensive Scenario Coverage & Targeted Management:** Through a scenario-based and comprehensive management approach, the solution ensures convenient daily water and electricity use in dormitories while strengthening the standardization and safety of utility usage in laboratories. This helps mitigate potential safety risks caused by improper water and electricity use and enhances the effectiveness of campus utility management.

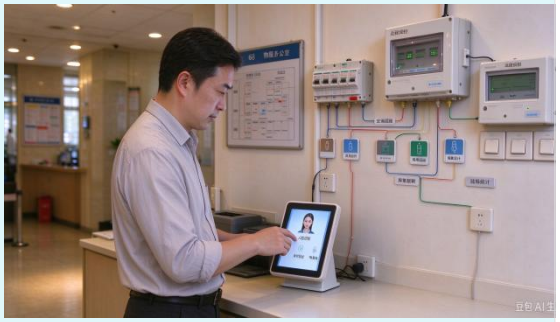


6.2. Apartment Scenario



Smart Prepaid Solution

- One Meter per Apartment for Accurate Measurement and Usage-Based Billing
- Prepaid Mode: Pay Before Use with Automatic Power Disconnection
- Online Top-Up with Real-Time Credit
- Anti-Tampering Chip to Prevent Electricity Theft and Unauthorized Connections



Remote Energy Management Solution

- Remote Meter Reading, Eliminating the Need for On-Site Visits
- Online Payment Records for Transparency and Accountability
- Remote Power On/Off Control for Efficient Management
- Mobile Access for Residents to Check Usage and Manage Services Independently

6.2.1. Zhengzhou “Meiyu” Talent Apartments

Zhengzhou Talent Apartments are a key initiative under Zhengzhou's 14th Five-Year Plan and the "One Million University Graduates in Henan" program, designed to support young professionals and new residents who come to Zhengzhou for employment and entrepreneurship. Zhengzhou Chengfa Anju has established the "Meiyu" talent apartment brand by acquiring existing residential properties. As of the end of October 2024, approximately 44,000 apartment units were in operation, covering a total area of nearly 1.82 million m².

Project Scope

- **44,000 Smart Water Meters:** Enable remote water meter reading and data collection for each apartment, replacing manual meter reading.
- **IoT Water and Electricity Management Platform:** Integrate meter data from all residential communities to enable centralized monitoring, analysis, and management.

Project Outcomes

1. **Unified Management:** Centralized collection, control, and analysis of water consumption data across all talent apartments have eliminated management barriers between individual projects and improved operational efficiency.

2. **Cost Reduction and Efficiency Improvement:** Before implementation, water meter readings, billing calculations, and fee collection relied on manual processes, resulting in complex workflows, low efficiency, potential meter reading errors, and lengthy collection cycles. After implementation, fully automated remote meter reading has fundamentally transformed the traditional manual operation and maintenance model.

3. **Improved Resident Satisfaction:** Residents can check their water consumption in real time and pay bills online via a mobile app. The system also sends automatic notifications and reminders about water usage and payments.





6.3. Enterprise Campus Scenario



Integrated Water and Electricity Management Solution for Industrial Parks

- **Centralized Management of Public Electricity:** Integrate road lighting, landscape lighting, access control, and surveillance systems into a unified platform.
- **Independent Metering for Commercial Tenants:** Apply commercial electricity tariffs, with remote meter reading and low-credit alerts.
- **Abnormal Usage Monitoring and Alerts:** Automatically detect and alert on unusual fluctuations in electricity consumption to prevent electricity theft and waste.
- **Safety Inspection and Maintenance:** Automatically report equipment faults and identify potential hazards such as equipment aging and electrical leakage through data analysis.
- **Multi-Level Metering System:** Meter public areas, commercial tenants, and office areas separately for accurate cost accounting.

6.3.1. Tesla

Yijia Jiangshan Road Apartments is a dormitory-style affordable rental housing project located in the Lingang New Area of Pudong, Shanghai, China. Developed by Lingang Group and delivered in June 2025, the project covers 130,000 m² and

comprises 11 dormitory buildings with 5,713 apartment units. Three room types are available: double, quadruple, and six-person rooms, each measuring approximately 47 m². The apartments are equipped with high-standard furnishings and smart amenities, including IoT-enabled air conditioners, smart water and electricity management systems, and night lights. The project can accommodate approximately 15,000 residents and primarily serves industrial professionals working for companies such as Tesla.

Project Requirements

- **470 Smart Water Meters:** Enable remote, automatic, and high-precision collection of household water consumption data, replacing manual meter reading.
- **5,713 Shower Water Controllers and Hot Water Management Systems:** Enable usage-based or time-based billing and control for shared facilities or designated water outlets, ensuring precise control and metering.
- **IoT Water and Electricity Management Platform:** Integrate data from all meters and devices to enable centralized monitoring, analysis, and management.

Project Outcomes

- **Improved Management Efficiency:** Automate remote meter reading, bill generation, and data reporting, reducing labor costs for meter reading and billing calculations by over 90%. Real-time fault alerts enable rapid response.
- **Reduced Energy and Utility Costs:** Precise metering and intelligent control of water outlets help eliminate waste caused by continuously running taps and water leaks. Overall water and energy consumption across the apartments has decreased by approximately 25%, with an estimated monthly water bill saving of RMB 5 per room.
- **Transparent and Fair Billing, Higher Resident Satisfaction:** Tenants can check their water and electricity consumption and detailed charges in real time through a dedicated mobile application, and top up their accounts and pay bills online. Transparent billing helps reduce payment disputes.







