

Smart Campus

Integrated Solution

Campus Safety | Campus Management | Smart Classroom | Network & Platform

1. Background

As digital transformation accelerates globally, the education sector faces both significant opportunities and growing challenges. Governments worldwide are increasing investment in smart campus infrastructure, while issues such as campus violence, inefficient administration, and unequal access to quality education remain persistent concerns.

This solution leverages IoT, artificial intelligence, and big data to deliver an integrated smart campus platform spanning safety, administration, teaching, and networking. It is designed for K-12 schools, higher education institutions, and vocational training centers.

2. Industry Challenges

Educational institutions commonly face three categories of core challenges:

Safety & Security	Administration & Operations
Difficulty controlling access for unauthorized persons and vehicles	Manual and time-consuming attendance processes
Lack of effective tools to prevent and respond to violent incidents	Inefficient use of classrooms, venues, and facilities
Inadequate emergency response processes	Complexity of managing multi-campus environments
Insufficient security personnel for campus-wide surveillance	Fragmented data with no unified management platform

Teaching & Digital Infrastructure Challenges
Limited effective tools for hybrid and online teaching
Low classroom interactivity; teaching quality difficult to measure
Siloed systems with poor integration between platforms

3. Solution Architecture

The solution adopts a four-layer architecture — Perception, Transmission, Platform, and Application — with a unified management platform at its core, connecting front-end devices below and supporting diverse business applications above.

Layer	Key Components	Primary Function
Perception	Cameras, access control, sensors, terminals	Real-time data capture and sensing
Transmission	PoE switches, core/aggregation/access switches	Reliable, high-performance networking
Platform	Unified video management platform (DSS)	Device management, event handling, storage
Application	Safety, management, teaching, signage	Business scenario delivery

4. Campus Safety Solution

4.1 Access Control

Smart access control with face recognition turnstiles forms the first line of campus defense, ensuring only authorized individuals enter the premises.

- Multi-factor authentication: face recognition, IC card, QR code, and password
- Automatic License Plate Recognition (ANPR) for smooth vehicle entry/exit management
- Real-time blocklist alerts with instant push notifications to security personnel

4.2 AI Event Detection & Emergency Response

AI-powered video analytics proactively detect risk events across the campus. Integrated with emergency call systems, alerts trigger immediate response workflows.

Detection Type	Applicable Areas	Response Action
Violent Behavior	Playgrounds, corridors, outdoor areas	Audio-visual alarm + security dispatch
Perimeter Intrusion	Fences, restricted zones	Alarm linkage + video recording
Fall Detection	Lakesides, staircases, hazard zones	Auto alert + video pop-up
Crowd Overcrowding	Auditoriums, entrances/exits	Congestion warning + guidance broadcast
Blocklist Face Match	All access points	Real-time alert + access denial

4.3 Internal Roads & Parking Management

- Radar speed signs on internal roads alert drivers and enforce speed limits
- Visual parking guidance with real-time space availability and illegal parking detection
- PTZ cameras with auto-tracking for continuous monitoring of suspicious persons or vehicles

4.4 Student Pick-Up Management

An intelligent pick-up system streamlines the dismissal process, ensuring each student is collected by an authorized guardian. Parents verify identity via face recognition or QR code, the system matches the corresponding child, and security staff coordinate orderly departure.

5. Campus Management Solution

5.1 Attendance Management

AI-based face recognition automates attendance for students and staff, eliminating manual roll calls across all scenarios.

- Gate turnstiles: automatic entry/exit recording with real-time parent notifications
- Classroom attendance: AI cameras detect present students at class start, no manual input required
- Dormitory access: late return and absence alerts for residential management

5.2 Exam Supervision

AI-assisted invigilation reduces the burden on supervisors and upholds exam integrity.

- Automatic detection of suspicious behaviors such as looking around and passing objects
- Remote invigilation via PC or mobile — no need to physically visit each exam room
- Automatic video archiving for post-exam review and dispute resolution

5.3 Canteen & Kitchen Management

- Facial payment: contactless meal confirmation supporting both free and paid meal programs
- Queue length detection: real-time monitoring of service queues to guide student flow
- Kitchen compliance: AI detects violations such as no mask, improper uniform, and smoking

5.4 Library Management

- Face recognition turnstiles for precise people counting and access control
- Integration with library systems to enable face-based book borrowing and returning

5.5 Digital Signage & Information Publishing

A unified digital signage platform enables centralized content management and remote publishing across all campus venues — canteens, libraries, corridors, sports halls — reducing operational costs and improving communication efficiency.

6. Smart Classroom Solution

Built around interactive flat panel displays and supported by classroom cameras and microphone arrays, the smart classroom solution covers the full teaching cycle: lesson preparation, in-class delivery, and post-class review.

6.1 Four Teaching Scenarios

Scenario	Core Capabilities	Value Delivered
Lecture	Interactive whiteboard, AI teacher auto-tracking	More engaging and dynamic lessons
Seminar	Multi-screen collaboration, cross-campus shared canvas	Borderless teamwork and discussion
Hybrid	Synchronized online/offline interaction	Wider reach for quality education
Recording & Sharing	Auto-recording, RTMP streaming, resource library	Supports online learning platforms

6.2 Key Feature Highlights

- AI teacher tracking: the classroom camera automatically follows the teacher and adjusts the frame
- Cloud-based lesson preparation: PDF/PPT import with cloud storage and sync across devices
- Content sharing without software: students access whiteboard content via URL on any device
- Device management (MDM): remote app deployment, device status monitoring, usage reporting
- Interactive tools: game-based activities, random student selection, polls, and quizzes

7. Smart School Bus Solution

A comprehensive student safety system for school transport, covering on-board video monitoring, active safety alerts, GPS tracking, and student attendance, forming a complete safety management loop.

Vehicle Safety Features	Management Features
Indoor and outdoor cameras with continuous recording	Student face recognition check-in/check-out at stops
Driver fatigue and distraction detection	Real-time GPS route tracking
Forward collision warning (ADAS)	Route deviation alerts
Blind spot detection (BSD)	Left-behind child detection system

8. Network & Platform Management

8.1 Campus Network Architecture

A three-tier network (core — aggregation — access/PoE switches) supports PoE transmission up to 250m, up to 90W PoE output, and self-healing capability to ensure uninterrupted surveillance network operation.

8.2 Multi-Campus Networking

Schools connect to a Ministry of Education (MOE) management center via the education network, supporting three deployment scales:

- Small scale: single-server deployment for individual schools
- Medium scale: distributed primary/secondary server architecture for multi-campus institutions
- Large scale: multi-site architecture for city- or province-level unified management

8.3 Unified Management Platform (DSS)

- Live monitoring: video wall displays real-time feeds from all campus points
- Event management: alarm-triggered recording with map-based visual alerts for rapid response
- AI forensics (DeepXplore): image-based search for persons or vehicles in recorded footage
- Mobile access: security staff view live video and alarms anytime via mobile app

9. Solution Value Summary

Value Dimension	Key Benefits
Enhanced Safety	Proactive AI alerts and integrated emergency response significantly reduce incident response time
Operational Efficiency	Automated attendance, pick-up, venue, and canteen management reduces admin workload by over 60%
Teaching Quality	Hybrid tools and resource sharing break geographical barriers and improve student engagement
Cost Reduction	Digital signage, remote inspection, and automated processes lower overall operating costs
Data-Driven Decisions	Unified data dashboard gives management real-time visibility into campus operations
Scalability	Modular design supports phased implementation and seamless expansion from single to multi-campus

10. Target Segments

K-12 Schools (Kindergarten to High School)	Higher Education & Vocational Training
Closed campus — safety and access control are top priorities	Open, large campuses — emergency response is critical
Strong demand for intelligent student pick-up management	Multi-venue management for stadiums, libraries, canteens
Multi-school networking meets MOE regulatory requirements	Growing demand for hybrid and online teaching tools
Smart classrooms promote equitable digital education	AI-assisted exam supervision enhances academic integrity

This document is a solution overview. Specific configurations are customized based on project requirements.