

# Design of Intelligent Comprehensive Security System for Existing Office Building

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**Abstract:** This project is an overall renovation of the existing government administrative office buildings. In order to realize the overall management of office and security, the owner requires that the security monitoring center and the intelligent management center should be placed in one center, and there should be related interfaces. In addition, cooperation between different brands is often encountered in the project operation, and a set of intelligent weak current systems need to be built, which leads to the integration and integration of management platforms becoming a difficult problem. The owner hopes to obtain a very smooth resource interaction environment. Each access subsystem is regarded as the management module of the platform. Only by realizing the unified management of the platform, the coordinated operation of each access subsystem and the organic combination of the whole system can the real expectations of the owner be met.

## 1. Introduction

Based on the above reasons, the project has designed an intelligent integrated security management platform. The platform integrates the application of various security subsystems, realizes intelligent linkage, information and resource sharing among subsystems, thus realizing centralized management of the system, optimizing management efficiency, reducing management cost, improving the response speed of police situations, and giving full play to the overall application value of the system.

## 2. The sub-functions of the intelligent integrated security management system include:

Visitors management subsystem, video monitoring subsystem, parking management subsystem, all-in-one card subsystem (access control, attendance check, consumption, ladder control), and basic network subsystem.

## 3. Guest Management Subsystem

With the "Regulations on Supervision and Inspection of Public Security Work in Enterprises and Institutions by Public Security Organs" promulgated by the Ministry of Public Security officially implemented on October 1, 2007, the safety management of visiting guests has become a top priority for government agencies and enterprises and institutions at all levels. In particular, the rapid development and integration of social economy and the increasingly frequent mobility of various foreign personnel have increased the potential safety hazard. For this reason, the project has specially designed a visitor management system to strengthen visitor management and prevent safety accidents.



*3.1 The visitor management subsystem is mainly composed of three parts: front-end equipment, transmission network and management center.*

### *3.2 Front-end Equipment*

The main entrance on the first floor is equipped with a people's passage gate. The blocking body of the pedestrian passage gate is driven by the control system. After passing the personnel identity verification, the blocking body automatically opens and closes after delay. The gate is supplemented by a camera, an ID card reader, a CPU card reader, a two-dimensional code reader and a fingerprint reader. At the same time, the gate is equipped with a high-definition network camera, which is mainly used for video monitoring and image capture when a person enters or leaves the gate. When the cardholder swipes the card through the channel, the system will automatically capture the incoming/outgoing image of the person and automatically archive it for later inspection and verification. At the same time, it can also deter other external personnel from entering at will. The personnel passage gate is also equipped with a person-to-person card comparison component, which can ensure real-name demonstration, real-time comparison, one person, one card, and verification. The person-to-person card comparison equipment captures face photos, compares people in real time, and releases them after the comparison passes. The system can also associate the identity authentication records of personnel passage gates with attendance records to automatically complete attendance tasks. It is required to interface with the fire alarm system. In case of an emergency such as a fire, the personnel passageway can be automatically opened and released without hindering the emergency evacuation of personnel.

### *3.3 Transmission Network*

The face channel component is connected with the personnel channel controller through RS232. The face channel controller is accessed through a multi-core signal line in the downlink, and outputs an opening switch control signal, an alarm linkage signal and the like; The main control server of the management computer room is connected to the Ethernet of the computer room through a standard network line, and the personnel channel controller is connected to the Ethernet of the management center through a TCP/IP communication converter.

### *3.4 Management Center*

The workstation is mainly used to record the entrance and exit control operations for the entrance and exit control management personnel to query and manage data. The card issuer is a tool for reading and writing cards. It can read cards, write cards, authorize and format cards.

## **4. Video Monitoring Subsystem**

As this project is a government administrative office building, besides the office staff of this building, there are many foreign office workers and visitors, and the staff is complicated. In order to facilitate the management and maintenance of the safety of the office environment, video surveillance cameras are installed in the main entrances and exits, elevator rooms and stairwells of each floor. The video monitoring subsystem realizes integrated and centralized management of video image data, business application data and system information data sharing requirements. Using the combination of B/S architecture configuration and C/S architecture control, the functions of video security equipment access management, real-time monitoring, video storage, retrieval and playback, intelligent analysis, decoding and wall control are realized. The video monitoring subsystem consists of front end, transmission network and monitoring center.

### *4.1 Front-End*

In this project, 1.3 million high-definition infrared hemispherical network cameras are set up in corridors, stairwells, elevator rooms and other places where personnel stay to support 3D noise reduction, digital width dynamics, corridor mode and backlight compensation. Support audio detection,

virtual focus detection, face recognition; 2 million infrared high-definition intelligent high-speed ball machines are set up at the main entrance and exit of the hall to support intelligent behavior analysis and intelligent tracking. The outdoor public activity space is equipped with 2 million high-definition infrared waterproof gun type network cameras to support audio detection, virtual focus detection and face recognition. Support ICR filter switching function, realize day and night monitoring, infrared monitoring distance of 85 meters; Panoramic monitoring will be carried out around the commanding heights of the building, and video coverage without blind areas will be carried out for the park. 16 million 360°eagle-eye cameras will be used as equipment.

#### *4.2 Transmission Network Part*

The front-end network camera is directly connected to the access switch through the network cable for short-distance transmission (within 100m); For long-distance transmission, the optical fiber transceiver or ONU equipment is first connected through the network cable. When lightning protection equipment is used, it is necessary to connect the lightning protection equipment first, and then connect the transmission or exchange equipment.

#### *4.3 Monitoring Center*

The design of the monitoring center mainly includes video storage, video display and platform software for unified management.

The project monitoring center adopts video cloud storage mode to store high-definition video images. The video integration platform is used to complete the video decoding, splicing, wall mounting and other applications. Through the unified management of video monitoring equipment and users through the management platform, applications such as video preview, playback and rights control are realized.

### **5. Parking Management Subsystem**

The system takes the entrance and exit as the main information collection place, obtains the basic information of the vehicle through the front-end collection system, uses the network to send the vehicle information data to the back-end monitoring management center, uses the license plate recognition technology to realize the license plate data comparison, ensures that the vehicle enters and exits are documented, ensures that the vehicle enters and exits are controllable, ensures the reasonable utilization of parking spaces, ensures that the fixed vehicle passes through the gate quickly, and strengthens the efficient and safe management of the entrance and exit.

#### *5.1 Vehicle access*

This project adopts a compound management mode of non-contact IC card and license plate recognition for vehicles entering and leaving, and temporary cards can be used for visiting vehicles. At the same time, IC card can share one card with entrance guard, consumption and other systems to realize "one card line".

The system detects parking status and collects parking vehicle information through IC card reader and parking camera arranged on the vehicle card swiping channel at the main entrance. And compare parked vehicles in the management center. In case of occupying a fixed parking space, a fixed car occupying a temporary parking space, a charging parking space, etc., the alarm will be given in time.

The property can manage all vehicles entering and leaving the garage according to the license plate in the parking lot management system. At the same time, through the parking lot management system, the whole parking lot traffic flow, parking space usage, charging, etc. can be monitored in real time.

#### *5.2 Parking Space Guidance*

For the parking space guidance system of underground parking lot, image processing technology is adopted, and a video parking space detection terminal and a parking space status indicator lamp are installed in each parking space, which are front-end acquisition and detection equipment. Every 12

parking spaces are collected into an equipment box, which is provided with 3 on-site image recognition controllers and shares a regional switch. The regional switch uploads the collected parking space information and vehicle information to the node switch, and then uploads the relevant information to the core network switch through optical fibers; The core network switch is connected with the integrated management and control platform, and the parking space status and license plate recognition are completed on the management platform. A guide screen is arranged at the passage to prompt the number of empty cars for drivers to find empty parking spaces.

## 6. One-Card Subsystem

The one-card system is based on IC card as the core and IC non-contact technology as the foundation, providing intelligent management including entrance guard, attendance check, consumption, elevator control, water control and other different functions. With the same IC card, users can realize the functions of entrance guard, attendance check, consumption, etc. and become a real one-card bank.

### 6.1 Access Control Management System

1) Due to the large number of foreign office workers and visitors in this building, in order to effectively ensure the safety of the office environment and facilitate the guidance and management of visitors, entrance guard management systems are set up at entrances and exits on the first floor, elevator rooms on each floor, stairwells and entrances and exits of important machine rooms in this project.

2) One-way access control of swipe card+door lock is adopted at each entrance on the first floor. Users swipe card and enter password at Mifare card reader, which is compared with the legal card information stored in the access control host and released after passing. The entrance guard controller is accessed downward through multi-core signal lines: door state information, door opening button signals, alarm input signals, etc., and outputs door lock switch control signals and alarm linkage signals, etc. A plurality of controllers are connected through RS-485 bus, connected to the management center and connected to the management computer through RS232 communication converter, or connected to Ethernet of the management center through TCP/IP communication converter, and the access control host can be connected to the management center through EHOME protocol; The main control server of the management computer room (shared with the fire control room) is connected to the Ethernet of the computer room through a standard network line; Workstation (Property Management Center) is connected to card issuer through USB interface.

3) Face recognition and access control integrated machine is used in elevator rooms, stairwells and important machine rooms of each floor, which integrates the functions of identity information collection and judgment and access control. Through face+swipe card+password authentication. The access control integrated machine accesses the management center through TCP/IP (customizable 4G/3G/GPRS); External connection of secondary card reader via RS485 or Wiegand communication mode; Downlink access via multi-core signal line: output door lock switch control signal and alarm linkage signal etc.

4) Visitor Management: ①Entry: The visitor integrated machine or management center completes the distribution of authority, and the user arrives at the front-end identification equipment for identification. The front-end identification device transmits the acquired identity information to the integrated machine or the controller for data analysis and comparison, and at the same time the integrated machine or the controller automatically judges whether the user is allowed to enter or leave at the current time. If the relay allowed to enter the access control controller will operate the electronic lock to open the door. At the same time, after the comparison is successful, the interface text will be displayed, and the personnel identity information and on-site snapshot pictures will be uploaded to the background for complete recording.

②Go out: push the button to go out; When a user goes out, the user can access the integrated machine or the controller through the go-out button to go out.

5) Fire alarm function

This system can be linked with the automatic fire alarm system. In case of fire, the entrance and exit control of the passageway in the relevant area shall be automatically released, so that internal personnel can escape in time and firefighters can smoothly enter to implement fire fighting and rescue.

### *6.2 ladder control system*

This building is equipped with three elevators, of which two are public elevators and one is for internal use only. Therefore, there is a need to distinguish the usage rights and time of elevators. The elevator control system is used to control the floor authority of the elevator and ensure the safety of the elevator. It mainly includes: access control of specific floors, setting of normal opening hours of floors, setting of public floors, holiday configuration, alarm upload and display, and inquiry of swipe card records.

The setting of the ladder control system can not only prevent foreign personnel from entering the internal area through the elevator at will, avoid unnecessary troubles in various places, but also further protect the safety of personnel and property in these areas. At the same time, the elevator control system can save energy and prolong the service life of the elevator, reduce misoperation and idling, effectively reduce loss, reduce the elevator maintenance burden, save maintenance costs, and further improve the overall comprehensive security intelligent security management level.

The elevator is controlled by means of a ladder control linkage module (relay), i.e. the ladder control linkage module is connected to the elevator interface board (the elevator manufacturer is required to support this docking mode), and the elevator judges according to the input signal and then converts the corresponding floor key into an input state. By default, the elevator does not have any authority judgment. At this time, the elevator control linkage module (relay) is not enabled, and the floor keys of the elevator cannot be effectively input except the public floor keys. When a user swipes a card for authorization authentication, after the ladder control system judges the authorization, the ladder control main board sends the floor information needing to be opened to the ladder control linkage module, and the relay corresponding to the ladder control linkage module is enabled. At this time, the elevator converts the corresponding floor key into an input state through the judgment of the output signal of the ladder control system, and the ladder control system completes the management function of the floor authorization. Support the linkage of the elevator maintenance switch and the fire alarm signal. When the elevator maintenance switch is on or the fire alarm signal is triggered, the system will automatically cancel the floor control function.

### *6.3 Attendance Management System*

Attendance management system can realize the automation of attendance data collection, data statistics and information inquiry process. It can count attendance, lateness, early departure, absenteeism, leave, overtime, business trip and other situations, customize statistical reports such as week, month and year, and further realize the automation of personnel and administration management. The attendance machine is networked with the integrated management and control platform through a router or a switch in a TCP/IP mode, attendance data is sent to the integrated management and control platform through a local area network, the attendance management module performs unified processing and analysis on the attendance data, and finally obtains attendance data of each person.

Considering from the cost point of view, the attendance points of this project reuse the front end of equipment such as entrance guard card reader or personnel channel, and use the card reader to collect the attendance authentication information of personnel. Only one set of attendance software needs to be added to realize attendance management. The management center is mainly composed of integrated security management platform (including software platform and hardware server), B/S client and card issuer.

The hardware equipment of the management center is mainly installed in the property management center. As the rear platform software, the integrated security management platform needs to support all functions included in the whole system, including attendance equipment management, staff information management, authority management, attendance data management, attendance rules management, etc. In addition, the integrated security management platform also supports system

management functions such as parameter setting, equipment monitoring, fault location, etc. to reduce maintenance costs and improve reliability.

The B/S client is the entrance for administrators to log on to the integrated security management platform. Its main functions are management and configuration. Administrators can operate through this portal to realize the functions of the integrated security management platform.

#### *6.4 Consumption Management System*

Consumer management system is one of the subsystems of one-card system. It is a brand-new intelligent charging management system with integrated management and control platform as the core, contactless IC card as the information carrier and consumer machine as the consumer terminal. In this project, a desktop consumption machine is set up in the dining hall to be used in the dining consumption system of the dining hall to realize electronic transactions and to query and count various consumption data according to conditions.

### **7. Basic Network**

The main function of the transmission network system is to access various monitoring resources, to provide basic guarantee for various applications of the central management platform, and to better serve various users.

The basic network of this project consists of optical fiber network and PLC network, which are integrated and have unified network management. It can realize on-line network on-off monitoring and real-time alarm, and the network operation is intelligent.

In this project, three computer rooms are set up on the first floor, namely, the core computer room, the government internal and external network computer room, and the classified computer room. Each layer of weak current room is equipped with an access layer, which adopts a gigabit switch with 10,000 gigabytes of uplink, and the government intranet, extranet and internet are physically separated.

Each station in the office area is provided with a four-port information panel (i.e. an internet data point, an extranet data point, an intranet data point and a voice point); Wireless AP point: each office and conference room is equipped with a coverage radius of 15m.

The main data lines of each floor are connected by 12-core indoor multimode optical fibers. The large conference room and classified network interface adopt PLC network and optical fiber to the desktop. In the design of the horizontal area of the office area, 6 types of twisted-pair copper cables are arranged to the work area units as transmission lines for data, voice, equipment and other units.

### **8. Conclusion**

To sum up, the integrated security system uses the integrated security management platform to uniformly configure and manage numerous systems, and multiple systems use the same login entrance, which is convenient to use and maintain. Unified database, internal information interconnected, is conducive to information transmission. It brings unprecedented operation experience and business value to the owner.

### **Reference**

- [1] Fangyi Zhang. (2018) Brief analysis of the comprehensive security system in Colleges and universities . Intelligent building and intelligent city,11 : 55-56.
- [2] Xu Du, Gaowei Zhong. (2018)Brief discussion on the application and development of intelligent building and security system . Modern information technology, 2(03): 173-175.
- [3] Kaicheng Zhao. (2010)Brief discussion on security system of intelligent enterprise . Science and technology information,30: 267.
- [4] Yuhui Zhang.(2014) Exploration of Building Intelligent Integrated Security Monitoring System . Science and Technology Style, 17: 150-151.
- [5] Siyuan Tian,(2010) Research on Intelligent Building Security Automatic Monitoring and Alarm

System . Agricultural Network Information, 7: 24-26.

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