Advances in Engineering Research (AER), volume 61
International Conference on Mechanical, Electronic, Control and Automation Engineering (MECAE 2017)

Study and Design of Intelligent Building Management System

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Keywords: Internet of Things, Intelligent Building, Information Management.

Abstract. To meet the need of intelligent building construction, from the five subsystems of the intelligent building, the modern intelligent building management system has been designed by using the RFID radio frequency identification and wireless sensor network technology, and the overall system architecture has also been designed and analyzed. The Internet of Things has promoted the goal of building management information level. The management system has been applied in the intelligent building, which has good effect and meets the needs of modern building management.

1. Introduction

The Internet of Things technology is called the third wave following the computer and the internet. The Internet of Things has been promoted the industry upgrade in all areas. The Internet of Things is a multidisciplinary specialty, whose core technology includes mainly sensor, wireless sensor network and radio frequency identification [1]. At present, the Internet of Things has been applied widely in the modern logistics, intelligent transportation and agriculture, and has been produced enormous benefits.

The intelligent building is building that it combines computer technology, communication technology, information technology and building technology by using integration method [2, 3]. And it will realize the optimization of resource information management, information service and building by auto-monitoring. With the overcoming of the Internet of Things, it has permeated through each field of all trade already, and promoted the upgrade and reform of the traditional technology. Therefore, it is inevitable tendency to promote the intelligent building construction by the Internet of Things technology [4].

2. The Overall System Architecture and Main Functions

2.1 The Main Functions.

The intelligent building management system based on the Internet of Things mainly includes five parts, such as the building manager tracing and location system, building equipment intelligent control system, building environment intelligent control system, the wireless video control system and intelligent building stop location system.

(1) Indoor environment monitor. Main task of it is to monitor environment indexes, such as the concentration of toxic gases, the concentration of carbon dioxide, temperature, humidity and light intensity. In addition, it can show really to everybody with visual way in real time.

(2) Data collecting and storage. All kinds of data,

(3) Intelligent User Control. It will collect the data from sensors and intelligent equipment, and upload them to background center database.

(4) Intelligent Perception Control. Main task of it is to control all kinds of intelligent equipment by using the mobile equipment and network remote control method, such as the air-condition temperature, curtains and lights, etc.

(5) Intelligent Parking System. The intelligent building provides automatic grading installing modules. It provides different levels of security services, so as to meet the need of safety and comfort.

(6) Intelligent Parking System. There are many wireless sensors nodes, which can provide high-quality parking service.

2.2 The Overall System Architecture.

The intelligent building based on the internet of Things mainly includes five levels: awareness layer, accessing layer, network layer, supports layer and application layer.

(1) Awareness layer. It can provide the basic functionality of data-aware, so as to make the intelligent building perceive indoor things.

(2) Accessing layer. It can implement the data connection of terminal set-top-box (STB) to terminal equipments of all users by using the different protocols. It implement the inter-connection of network layer to intelligent building gateway.

(3) Network layer. It can provide interconnection for the intelligent building, data center and third party, and permit interconnection of each parties.

(4) Supports layer. It can provide the united data storage for the intelligent building, and provide real-time and historical data for the data share and application.

(5) Application layer. It can provide the simple and comfortable user application of for users. In addition, it can also provide the comfortable, healthy and safe life for users.

3. The Personnel Management and Location System

The intelligent building management system includes the following function modules: the access management system of the personnel office, personnel location system and visitor management system.

3.1 The Access Management System of the Personnel Office.

An open passageway need be setted at the entrance of building. Everyone can enter the intelligent building only if he must wear name tags. There is some users‘ information in the name tags. The displays can display some indentity information of the cardholder when cardholder enter the building. If the unauthorized personnel enter the building, the intelligent building management system will automatically make calls for timely. It will effectively prevent the unauthorized personnel entrance and improve the safety of the building.

The intelligent building management system is mainly composed primarily of RF reader, antenna, Sound & light indicator module, infrared module and the subscriber Identity module, ect. The subscriber Identity module implements identification of cardholder, and judge the access situation. It can make calls for timely if the unauthorized personnel enter the building.

3.2 The Visitor Management System.

The visitor management system can replace the traditional handwritten registration, and it can implement the integration of the visitor registration and management, so as to achieve the effect of digital registration, web office and safe management. If the visitor hold the temporary identity card, and he/she will can enter relevant buliding. If the visitor doesn‘t hold the temporary identity card or enter non-designated district, the system will make calls for timely. This will make security personnel understand the visitor situation timely so as to ensure the building and property security.

3.3 The Personnel Location System.

The location technology is a complex technology. The RFID technology has some capacity for object location, but it has also some defects. The active RFID location technology is well-positioned location technology. The personnel location system implements location function by using the active RFID label and “signal fingerprint” method.

The location method based on signal fingerprint mainly includes three parts: the active RFID label, antenna RFID reader and the relevant software.

The location method based on signal fingerprint mainly includes three parts: venue implementation planning, signal fingerprint gathering and signal fingerprint match. In the location method of signal fingerprint, the venue implementation is firstly implemented. That is to say, the location of each receiver should be recorded. After the receiver implementation, the signal fingerprint

need be gathered. After finishing gathering of the signal fingerprint, the system can gain the signal fingerprint of the area positions. The location server mainly implements the location of person in the stage of signal fingerprint match.

4. The Intelligent Building Control System

4.1 The Building Equipment Control System

The building equipment control system can intelligently control the some equipment by the online control technology of the Internet of Things. It can control some operations of all kinds of equipment with the mobile phone or other mobile smart equipment, such as lighting, air-condition and curtain.

The whole system includes some units: intelligent curtain, lighting control unit, intelligent switches and air-condition. These control units implement control and monitor common electrical appliance, and implement interconnection with indoor main control unit by wireless sensor nodes.

The intelligent building based on the Internet of Things adopts layered architecture. It can be divided into awareness layer, network transport layer and fusing service layer.

The awareness layer of the building includes all kinds of equipment, such as sensors, controller, executor and identification equipment, etc. In addition, the layer also includes MAC sub-layer and link control sub-layer, which can provide untied interface and shield the difference between the two kinds of heterogeneous networks [5]. It can support the interconnection with different networks, and support dynamic and intelligent wire and wireless network connection.

The core module of system is intelligent sensor nodes. The wireless sensor network node is comprised of ZigBee wireless radio frequency, RISC instruction sets and all kinds of sensors.

4.2 The Building Environment Control System.

The indoor environment monitor system mainly implements monitors of the indoor environment. The monitor parameters mainly include temperature, humidity, sunlight intensity and radiation, etc.

The environment perception system mainly includes four parts: information gathering nodes, gateway nodes, data center and mobile intelligent equipment interface. The information gathering nodes are mainly used to perceive data acquisition and transmission. The gateway nodes is intended for regional data collection, internet access and system configuration. The data center is used to data processing and storage. The mobile intelligent equipment interface is mainly used in query users' information. The system frame diagram is shown in Figure 1.

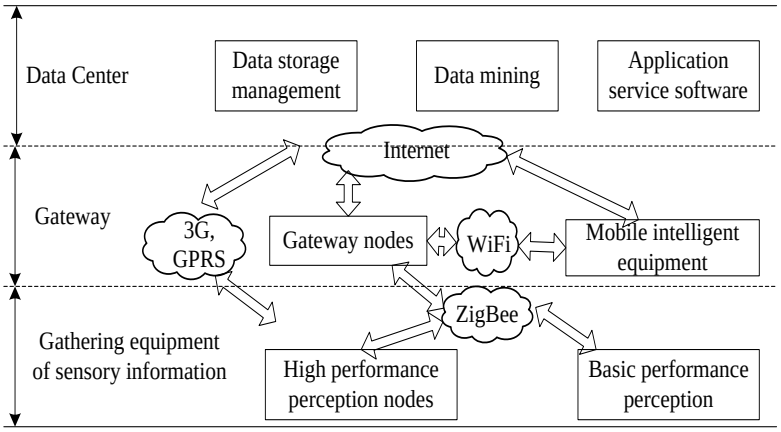

Fig.1 The system frame diagram

4.3 The Real Time Control System of Intelligent Wireless Video.

The real time control system of intelligent wireless video can implement video monitor, event surveillance and calling by using the wireless intelligent video, the intelligent data analysis technology and the intelligent terminals information system. In addition, it enables all kinds of terminals to acquire the video data and event notice. Its function module is composed of overnight video monitor and intelligent video data center.

The wireless video monitor equipment can implement the monitor operation without interruption. All the perception equipment and monitor data are gathered with building management center. The information center can provide the data display, intelligent analysis, event record for all kinds of terminals in real time. The intelligent mobile equipment and the wires terminal can gain access to intelligent video data, and view the sensor data.

4.4 The Parking Location and Environment Control System.

With the increasing of cars ownership, it will intensify the contradiction and confliction between car numbers and parking planning. The effective management of parking location is relevant to people' life. The traditional manual administration is not only high cost, but the management is low efficiency. The intelligent parking system based on wireless sensor technology can improve the utilization and management quality of parking location [6].

The parking location and environment control system is composed of HMC5883L sensor, the lowest-power chips and RISC instruction sets. The monitor equipment not only detects the parking information of the present status, but also shares the data of parking location. It can monitor the driving route path of parking location by using the wireless sensor location technology, so as to meet the need of parking space choice.

5. Summary

The Internet of Things in the recent years in the great efforts of state and government are under way to enter a rapid development period. In addition, the intelligent building also enjoys fast development. The combination of intelligent building and the Internet of Things are the development direction of the intelligent building. And it also can push for the internet of Things progress. The system has been applied in the intelligent building for operation, and the results shows that it is rational in design and good effect.

Acknowledgments

This research was financially supported by the financial aid of the Nanchang Key Laboratory for Intelligent Buildings Network Engineering, Particular Major of Jiangxi Province, under Grant no. NGTSZY201001 and Science & Technology of Nanchang Institute of science & Technology, and under Grant no. GJKJ-15-47.

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