

Hardware Design of Intelligent Management System of Construction Site Based on Internet of Things

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Keywords: Construction site, The Internet of things, Intelligent management system, Hardware design

Abstract. Intelligent management of building construction site based on Internet of things is an inevitable trend of construction site management in china. In this paper, the hardware is designed based on IOT technology. The hardware could realize construction in site management, construction site crane operation real-time monitoring, environmental and safety monitoring, fire monitoring aspects of the perception layer, transport layer and application layer. Through testing the hardware, the results show that it could meet the requests of construction site management, and has achieved the design objective. The application of the new hardware can be more efficient, more convenient and could get the real-time understanding of construction site personnel, equipment, environment, etc. It could be also used in the safety security, fire protection, construction safety, green and environmental protection.

Introduction

Construction site management includes personnel management, machinery and equipment management, safety management, environmental monitoring and fire prevention, etc.. The flow of personnel, logistics related work, mechanical equipment safety and fire safety inspections scattered over a broad area, construction brings air, sewage and other pollution monitoring, fire prevention and treatment, has brought the new challenge to the management of the construction site.

The construction site management system is a new network with wisdom, with a variety of sensors to the actual state of the construction site, the data collection and processing, by the way of visualization in the unified data sharing platform for real-time display, management and supervision departments to provide safety, schedule, personnel, environment, fire prevention and other key information, to help the decision timely and effective communication, reduce security risks, implement cost control, ensure the quality of the project, an idea of realizing the safe, green and environmental protection "wisdom construction".

Design ideas

In view of the construction site personnel, equipment, environment, safety and fire conditions are relatively independent, the system can not be all or part of centralized monitoring, this paper proposes to establish a management system based on the Internet of things technology. Construction site intelligent management system not only includes the construction site of the local network, but also through the Internet, 4G and other external network. It can realize the real-time visual monitoring of personnel, equipment, environment, safety and fire in the construction site, also can realize the data to the company, the management departments of the terminal through the network transmission, and then construct covering government and enterprise, the construction site construction site safety supervision and management platform (See Fig.1).

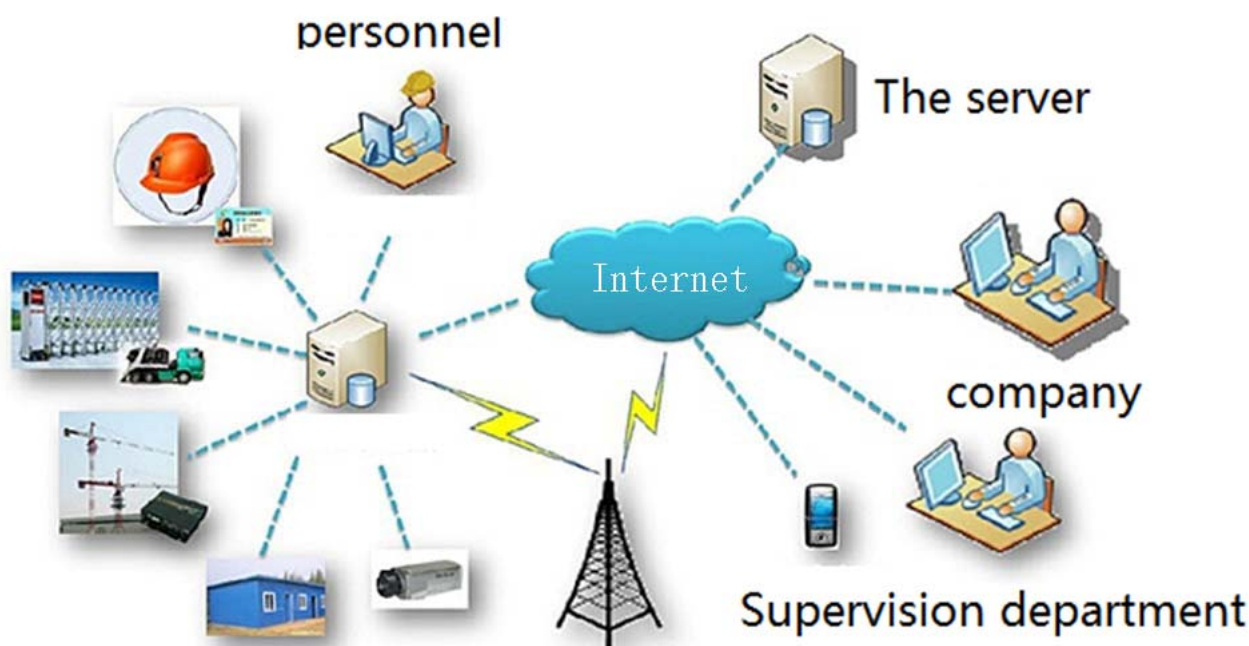


Fig. 1 construction of intelligent management system diagram based on Internet of things

Design principle

Personnel management

The real name system card system of labor service personnel, through the local area network, the implementation of work attendance, meeting attendance, real-time control staff, and can be used as a basis for settlement of personnel wages; bathing, shopping, accommodation and dining card, smart card to achieve a tariff card around the construction site, convenient logistics personnel.

Tower crane construction machinery operation real-time monitoring

Through the installation of speed sensor, construction machinery, construction machinery and black box rotary limit sensor, construction machinery and hoisting construction machinery lifting load sensor, angle sensor, monitoring equipment of construction machinery work on video, security monitoring, construction machinery operation record and alarm through the network, remote monitoring, remote real-time alarm and inform the remote alarm at the same time, according to the real-time information to make the security alarm and avoid risk measures, at the same time to send the relevant information to the server security. The construction site management department can check the operation of each construction machine in the network in real time through the terminal.

Construction site environmental monitoring

Through the construction site in different locations to install air data acquisition instrument, noise sensor, PM2.5 sensor, the sensor data collected by the sewage, the wireless data transmission module is transmitted to the construction site server, and then after analyzing the data through a computer, APP software can real-time query, the LED screen can be displayed in real time.

Construction site safety monitoring

Construction site safety monitoring system mainly includes visual video surveillance system and personnel intrusion system. Visual video surveillance system of construction site consists of three parts: construction site, network and control center. The control center is equipped with a video integrated platform decoding device, which displays the video through the LCD screen of the large screen TV wall, and realizes the real-time view of video signals and the command, control and scheduling of various events. Construction and utilization of RFID radio frequency identification

technology, real-time monitoring of no-construction personnel entering the construction site personnel intrusion system.

Fire detection system

There are a lot of building materials in the construction site, which is the key fire protection area. Historical experience tells us that serious fires are often not found and effectively controlled in the early days, resulting in widespread losses. The use of networking technology in the construction site of the main areas of installing temperature sensor, smoke sensor, light sensor, infrared sensor to fire in the corresponding induction signal is transmitted to the command center and automatic alarm, at the same time perception information transmission layer fire company, between the perception layer and network communication by CAN bus, also can through the 3G/4G network is directly transmitted to the fire brigade recently, to facilitate the timely rescue (See Fig.2).

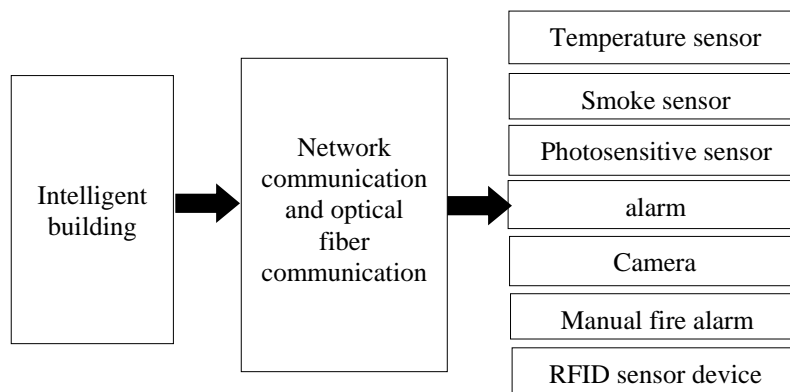


Fig. 2 construction of intelligent management system fire detection system structure diagram

Hardware design

The intelligent management system of the construction site includes hardware design and software design, where the hardware design is mainly the hardware of the Internet of things, the perception layer, the transport layer and the application layer.

Hardware design of perception layer

Smart card with MIFARE-1 card, with good security, high security, large capacity, 16 independent partition encryption, each data run independently without mutual influence, the characteristics of easy operation, effectively realize the expansion of the real expansion card function.

Water control machine is mainly used for bathing, hot water supply, reading card charging, XN-6117 model selection, MIFARE-1 card, compatible with the sale of rice system, attendance, access control system, one card. Read card distance: 2-7cm, read card speed: <1s, standby power: <1W, credit card, <5W economical energy saving.

HD camera is mainly used for security monitoring, the wireless HD Samsung SCD-2080EP, set up a simple, clear picture, support motion detection, camera effect, 1/3 inch Super color HAD CCD, with a new generation of W-V chip technology, 3.6x optical zoom, auto iris lens, SSNR III, dynamic adaptive digital noise reduction, and automatic conversion, color line 600TV resolution.

The 485 China wind speed sensor pulse signal 4-20MA control HS-FS01 anemometer sensor transmitter meteorograph, tower crane rotary limit sensor selection STEIMEX Dudley switch sensor LSA-012 limit switch, tower crane lifting load sensor selection CT series pull type load sensor, tower crane lifting angle sensor using MIDORI potentiometer CPP-45SB angle sensor.

The noise sensor selects the deep big screen, the noise count, the shell instrument, SW525A, the wall hanging type noise meter, the decibel range 30-130dB, the precision + 1.5dB, the big screen

digital tube display, matches the external power supply. PM2.5 dust sensor selection RS485 PM2.5 sensor, sensor selection SENLOD/ AZ8361 to shun sewage.

The temperature detector selects the Gulf brand temperature JTW-ZCD-G3N point type heat fire detector, smoke detector with 2016 Bay smoke detector JTY-GD-G3T smoke detector, using GST9711Ex encoding non photosensitive detector Bay explosion-proof smoke photoelectric smoke detector.

Transport layer hardware design

The transport layer mainly solves the problem of remote data transmission in different places. This layer to realize remote data transmission through Internet network and GPRS/4G mobile communication network access, and combined with the corresponding routing protocol, network security protocol, the safe, rapid and stable transmission to the server data center. Lenovo -IBM server X3250 server selection M5 5458-I21 E3-1220V3, has a flexible subsystem and a large number of configuration options that enable you to select the required computing ability and extend application to meet higher requirements. You can choose the size of hard drives, storage, dual core or quad core processors, or even higher performance RAID.

Application layer hardware design

The application layer is mainly to solve the problem of human-computer information exchange and build a cloud platform. This layer uses the server and other hardware and app, web and other software to realize the function

Conclusion

This design uses a variety of sensor network and sensor nodes deployed in sensor networks, the construction site within the scope of information collection and analysis of data processing to the network, management, and supervision of staff through the man-machine exchange real-time monitoring platform or software of construction schedule, safety, personnel, environment and fire. After the actual use of a number of construction sites, the construction site personnel to achieve all-round, information-based management. Electricity monitoring, water conservation and other management systems to assist managers to ensure the safety of living area electricity, water conservation, and truly achieved the wisdom of management, green construction. The next step will be to optimize energy saving and cost savings.

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