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Application of image identification technology in security systems for intelligent buildings

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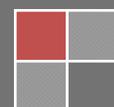
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ABSTRACT

This paper analyzes the role of the image identification technology in the security systems for intelligent buildings, and proposes that incorporating the image identification technology and technical support can enhance the intelligence and automation of security systems and thus provide users of intelligent buildings with more secure, convenient, and comfortable living and workplace environments.

KEYWORDS

Security system; Image identification technology; Access control; Vehicle management.



INTRODUCTION

The intelligent building technology was developed by combining traditional architecture and modern information technology. It usually consists of five subsystems, namely building automation system (BAS), communication Automation system (CAS), office automation system (OAS), fire automation system (FAS), and security automation system (SAS)^[1]. SAS is one of the main subsystems of an intelligent building, designed to maintain public security. It is a distributed control system constructed by integrating modern electronic technology, video capture technology, sensor technology, computer technology, and network technology.

Security is one of our primary demands on our living and workplace environments. The intelligent building security system is the part of the infrastructure that safeguards people's life and properties. For an intelligent residential area, a well-established intelligent building security system mainly comprises a video monitoring system, an intercom system, and a home security alarm system, which constitute a three-layer complex security for the intelligent building area. The intelligent video monitoring system is the first layer of the security system; based on digital, online video monitoring, this high-end system can identify various objects, locate anomalies in the monitor screen and issue alarms and display useful information in the fastest and optimal manner, thus effectively assisting the security staff in the handling of crises and minimizing false and missed alarms^[2]. The core of the intelligent video monitoring system is the realization of the intelligent video monitoring algorithm. The emergence of video monitoring systems capable of image identification is an important milestone in the development of intelligent video monitoring systems.

The image identification system is designed to process, using mathematical methods and on a computer, images captured on the front end of a system; it is an important field of artificial intelligence. With the advancement of computer technology and information technology, image identification technology has been widely applied in various fields, such as satellite image identification, satellite cloud image identification in weather forecast, analysis and identification of various medical images in clinical medicine, bio-identification, criminal investigations, positioning in automatic industrial production, and image identification in intelligent building systems. In developed countries like EU, USA, and Japan, this is already a mature technology. In recent years, in order to further tap the advantages of the video monitoring system, researchers have incorporated image identification technology into the video monitoring system, and used image identification technology to realize intelligent monitoring, thus constructing an effective warning mechanism^[3].

In light of the important role and applicability of image identification technology in the security system, this paper will focus on the technical application and trend of development of image identification technology in security systems.

APPLICATION OF IMAGE IDENTIFICATION TECHNOLOGY

Overview of image identification technology

Image identification is a computer-based technology that processes, analyzes, and comprehends images in order to identify targets and subjects of various modes. This technology mainly involves digital signal processing and mode identification. Digital signal processing is the prerequisite and preparation for mode identification, while mode identification is the essential stage of image identification^[4]. An image identification process basically consists of data acquisition, data processing, and categorization decision or mode matching. Specifically, for any image identification method, the physical variables of the subject of interest have to be converted by sensors into numerals or symbol (string) sets that can be recognized by computer. The acquisition of image information means capturing video image information from the video stream received. In image data processing, all kinds of interference, noise, and variation are first removed and the original image is converted into a form suitable for characteristic extraction on computer. This include transformation, amplification, and filtering, which are meant to sort, analyze, and categorize video image information, extract the characteristics that reflect the essences of the images, and derive vectors that help the judgment. Judgment, or categorization, means calculating, comparing, and analyzing the characteristic quantities, parameters, and thresholds in order to judge the status or nature of the image and thus derive the ultimate output.

Application of image identification technology

The application of image identification technology in intrusion alarming involves using image identification technology to extract and analyze the subject's activities within the monitored range and then acquiring the characteristics of the subject's movements. This application is commonly known as behavior identification. This technology is usually used in two ways. One is to study the subject of interest as a whole, analyze its loci of movement, and there judge if the subject deviates from a predetermined route. For example, this technology can be used to judge if the subject entered an area to which the subject has no right of access, if the subject is lingering in a dangerous area, if the subject stays in a certain area longer than permitted, or if the subject is turning to a certain direction. The other way is to study the local movements of the subject's limbs. For example, this technology can be used to judge if the subject is making a phone call, pilfering, or vandalizing.

DESIGN OF IMAGE IDENTIFICATION TECHNOLOGY IN INTELLIGENT BUILDING SECURITY SYSTEMS

As an artificial intelligence technology, image identification has had advanced and well-established applications in security systems. Using the access control system and car park management system as examples, this paper will analyze the prospect of image identification technology in its future application^[5].

Application of image identification system in access control systems

Besides fingerprints, facial appearance, iris, handwriting, and veins are also bio-characteristics of the human body that can be introduced into the identification process of the access control system. Each of these bio-characteristics has its pros and cons and scope of application in terms of identification. For example, veins may change due to disease, and iris may change due to cataract. As a result, multiple bio-characteristics often need to be combined for a high precision identification system in applications with strict security requirements. Combination of multiple bio-characteristics is a more accurate and secure identification method. With the advancing image identification technology and intelligent building technology and the burgeoning demand on the security market, this identification method will become an inevitable trend in the field of security systems.

Application of image identification technology in vehicle management systems

The carpark management system is an important part of the security system of intelligent buildings and intelligent residential areas. With the increasing number of intelligent buildings and building clusters, the image identification technology has been widely used in the carpark management systems in China. The vehicle management system is a network system that handles the entry and exit authentication of vehicles, diversion of traffic within the carpark, and collection of parking fees on a platform based on computers, video cameras, networks, and lane management equipment. Highly efficiency, security, and scientific management are the goals of a vehicle management system.

The mainstream technology currently applied on the carpark management system uses a radio-frequency card as the vehicle identifier to identify incoming and outgoing vehicles. However, this card reading method is inconvenient in that the driver has to stop the car to swipe the card, and the resulting slow passage easily causes congestion during rush hours.

The non-stop carpark tolling management system solves all the problems mentioned above. This system realizes non-stop passage in two ways: by using a powered RF card for long-distance identification, and by using image identification technology to identify the license plate number. From the perspective of fuel economy, environmental protection, convenience, and technological development, the latter will definitely be the future trend of the application of vehicle identification. The license plate number can be extracted by installing license plate image identification software on the existing hardware of the carpark system, thus avoiding redundancy.

In the future, the license plate image identification technology, combined with network-based tolling system and other advanced technology, may be widely used in urban vehicle management and freeway transport, putting an end to the low efficiency of manual tolling and the low throughput of freeway tolling stations.

CONCLUSION

As an important part of the security system, the video monitoring system includes lots of video cameras and video image processing equipment. This system has already provided a platform for the application of image identification technology. Therefore, the image identification technology can totally be realized on the existing hardware platform of intelligent buildings by incorporating image identification software and auxiliary equipment without having to make major additions or modifications to the equipment and the cabling system. This kind of technical upgrading and transformation both conforms to the trend of application on the security market and meets the users' demand for high quality and low cost.

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