Site Security System with 3D Imaging

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Abstract

This article presents research on site security systems with 3D imaging tools and geoinformation systems. This technology is built upon the integration of video surveillance systems, pattern recognition and cartographic platform to precisely locate events on a map or a plan. Such systems are used to quickly detect emergencies and make emergency actions. The technology is proposed for securing city-owned premises such as hospitals, schools, kindergartens, educational institutions, etc.Adoption of the technology will substantially secure these sites from intrusion and terrorist attacks. This article analyzes shareware programs for building a security system with 3D modeling. Based on the software chosen, we gained a high-quality imaging of the security system using the medical unit No. 154 in Krasnoarmeysk as an example. The key benefit of a security system with 3D imaging is that it allows for an active part in viewing, which is much more interesting than passive surveillance. It provides a vivid experience and a much clearer idea of what you are dealing with.

Keywords

3D modeling, security system, geoinformation technologies, geoinformation systems, video surveillance system, technical means, checkpoints

1. Introduction

As society evolves, city-owned premises face new security challenges. Potential intruders become more technical, illegal acts are being refined [1, 2, 3, 4]. City-owned premises such as hospitals, clinics, educational institutions, kindergartens, etc. are the most vulnerable.

In conventional access control systems, dispatcher at the checkpoint sees information from cameras and analyzes the current situation, so there is no processing or highlighting sites at risk [5, 6, 7, 8, 9]. An intelligent access control system established based on 3D geographic information system allows to approach site security at a different quality level. Such systems will not only monitor the current situation, but also predict possible deviations from the standard situation, assess the degree of emergency and offer the best solution to prevent a dangerous situation. Intelligent access control systems will make it possible to move the point of decision-making on access to a remote site, thus securing private security officers [10, 11, 12, 13, 14].

2. Materials and Methods

The article explores the application of spatial geoinformation analysis [15, 16, 17, 18, 19] to creation of a site security system [20, 21, 22, 23]. Geoinformation data analysis is based on mathematical and statistical methods, artificial intelligence methods (pattern recognition, neural network methods) [24, 25, 26, 27], cartographic and spatial analysis [28, 29, 30, 31, 32].

To ensure that security program is effective, it is necessary to identify and assess vulnerabilities to all types of hazards and threats. This involves developing capacity to prevent, protect, respond and

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recover from catastrophic incidents. Nowadays, maintaining continuous situation awareness is generally accepted as the basis for a successful outcome while ensuring national security. It is quite difficult to gain the ability to collaborate with different stakeholders; assess vulnerabilities; and prioritize resource allocation.

The Geographic Information System (GIS) platform allows government agencies to [33, 34, 35, 36, 37]:

- Assess threats and vulnerabilities to critical infrastructure and the public.
- Develop mitigation and protection options to protect critical infrastructure.
- Maintain general situation awareness across multiple teams for daily operations.
- Maintain response and incident management processes.
- Support damage assessment using all types of mobile devices.

GIS technology has long been used by government agencies, including those supporting national security missions. Traditionally, GIS has been used by a small group of highly skilled analysts and GIS specialists to identify threats, plan resource deployment, and map potential actions and develop contingency plans.

Desktop applications were created for creating information products and printing paper maps. Today's GIS platforms enable staff to access easy-to-use maps and applications supporting the mission on any device anywhere anytime, on any network.

GIS technology is much more prevalent and available online, in the cloud, and serves as a complete geospatial software platform for geographic understanding, user process support, collaboration, dynamic situation awareness and monitoring, and measurement. Technology provides access to information for planning, response, concern, mitigation and recovery. Applications are highly customizable and can provide quick access, understanding, and distribution to support coordinated action.

GIS platforms also integrate geographic information with business intelligence systems. Tabular data comes to life on a dynamic map, so the information is easy to understand, resulting in faster and better national security solutions. Enterprise business intelligence agency can now be geographically enriched with geospatial data and maps.

The GIS platform is designed to deliver relevant content via simple applications and web maps that fit everybody's needs in the organization.

The platform allows users to create, manage and access data from other systems both within organization and externally. The platform supports desktop, browser and mobile environments. It works in any environment, from the office to the field. Mobile applications can immediately sync with office systems and continue operation when disconnected from the network.

The GIS platform can be easily configured to securely exchange data with specific users or communities.

Inter-agency collaboration and intelligence sharing are critical to national security. For example, planning security for a special event, such as a major sporting event, or for an important tourist attraction involves collaboration. Special events attract many people including tourists, officials and celebrities.

Many agencies and stakeholders use their own systems to plan and operate a special event. These systems are often disabled, which makes them more reliable. Information exchange is near-impossible. GIS platforms are designed to access data from existing systems and integrate them into a common geographic system, a web map. This platform provides data interaction, better performance and understanding by adding location.

The GIS platform can be configured with applications, viewers, and group permissions that are consistent with the organization's workflows.

3. Results

3.1. 3D Spatial Data Modeling and Visualization System

The 3D spatial data modeling and visualization system is designed to visualize territories and sites in space, carry out a comprehensive analysis of the territory and display geoinformation resources [38, 39, 40]. The program enables users to freely move in 3D space, provides a 3D visual representation of

cities, settlements, terrain, critical sites, and simulation of possible natural and man-made situations. The program allows you to load vector layers and space images, Earth remote sensing data, 3D models with an option to edit model location.

3.2.Building a Security System

The site should have a checkpoint for access control (Fig. 1).

Figure 1. Checkpoint

Checkpoint equipment should provide the necessary throughput and a possibility to thoroughly check passes and documents, inspect all types of transport, transported goods and meet the following requirements. The checkpoint must be equipped with the necessary communication and alarm systems to call the guard reserve. Various turnstiles can be used as access control. There will be video cameras installed on site (Fig. 2).

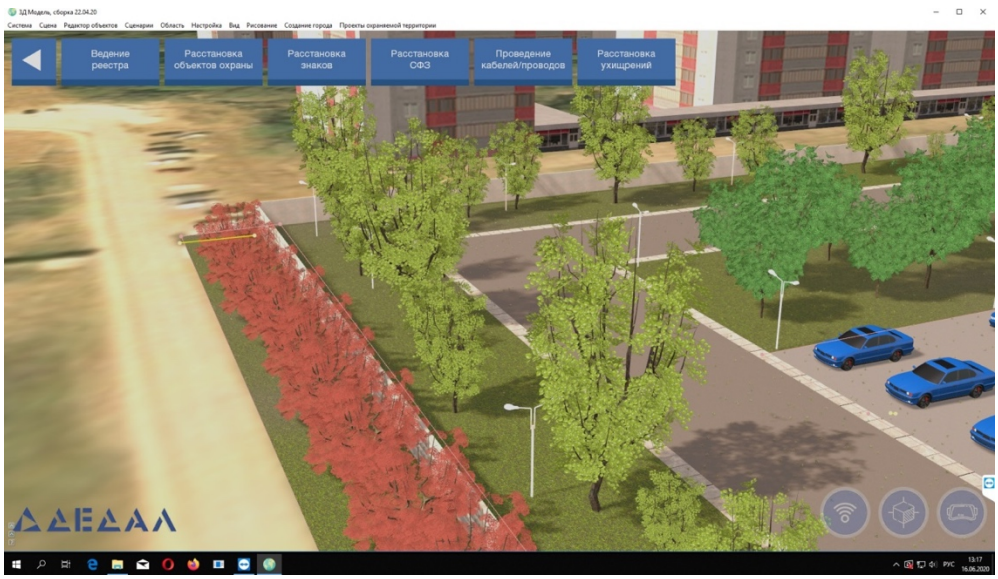

Figure 2. Perimeter camera display

A 3D site model will be created based on 3D modeling programs (Fig. 3).

Figure 3. 3D Site Model

The current situation will be determined by comparing the data received from the video camera with the site model.

4. Discussion of Results

Geographic information system in the modern sense is a technology for collecting, organizing, exchanging and analyzing information. It allows to see what is happening and where, how different events are interrelated and affected by location, what geographic, social and economic factors determine the organization's operation, and how to best use local features and spatial patterns. By combining spatial and business information, GIS allows to simulate the real world and gives an idea of the spatial patterns, dependencies, processes and situations that occur therein.

GIS has become a conventional technology for solving a great number of tasks, particularly in monitoring, security and emergency management systems [41, 42]. GIS is a necessary component in building situation and analytical centers. In these cases, GIS is used both for addressing strategic planning, forecasting and modelling tasks and for day-to-day monitoring and operational management. With situation and analytical centers (SAC) built upon GIS, you can see process dynamics with precise spatial and temporal localization of each event.

5. Conclusion

All-source data integration and broad options for a comprehensive analysis (including real-time), visualization and publication of information allow decision-makers to act within the cartographic system model. Moreover, pattern recognition systems can be used for a fast response in emergency situations.

Cartographic video monitoring is built upon the integration of video surveillance systems, pattern recognition and cartographic platform to precisely locate events on a map or a plan. Such systems are used to quickly detect emergencies and make emergency actions.

The system combines data streams from various sources (including video), they can be accessed via various services on the cartographic portal and mobile devices.

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