Features of Using Automated Control Systems at the Enterprises of the Hotel Business

Características del uso de sistemas de control automatizados en las empresas del sector hotelero

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Abstract

The development of information technologies today implies opportunities for the development and implementation of automated systems in various applied areas, implying the need for information processing, the formation of various data representations. The modern economy operating in a competitive market, makes demands on the timeliness of information processing, the improvement of production organization technologies, the efficiency and long-term planning, forecasting and analysis of economic activities. This creates additional competitive advantages for organizations which use information systems. Each organization strives, within the framework of its activities, to minimize the time spent on performing the basic technological operations, to efficiently use the available material and labour resources and to simplify the information processing procedures. These tasks can be solved using automated information systems. Thus, the use of information systems within the framework of solving applied problems is currently becoming an integral part of the operation technology in modern enterprises and organizations. In this regard, the tasks of developing and introducing information technologies are becoming more relevant within the framework of modernizing existing business processes for various profiles of activities.

Keywords: Information Technology; Business Processes; Joint Ventures; Market Competition; Labour Resources

Resumen

El desarrollo de las tecnologías de la información hoy en día implica oportunidades para el desarrollo e implementación de sistemas automatizados en diversas áreas aplicadas, lo que implica la necesidad de procesamiento de información, la formación de diversas representaciones de datos. La economía moderna que opera en un mercado competitivo exige la puntualidad del procesamiento de la información, la mejora de las tecnologías de organización de la producción, la eficiencia y la planificación a largo plazo, la previsión y el análisis de las actividades económicas. Esto crea ventajas competitivas adicionales para las organizaciones que utilizan sistemas de información. Cada organización se esfuerza, en el marco de sus actividades, por minimizar el tiempo dedicado a realizar las operaciones tecnológicas básicas, por utilizar eficientemente los recursos materiales y laborales disponibles y por simplificar los procedimientos de procesamiento de la información. Estas tareas se pueden resolver utilizando sistemas de información automatizados. Por lo tanto, el uso de sistemas de información en el marco de la resolución de problemas aplicados se está convirtiendo actualmente en una parte integral de la tecnología de operación en las empresas y organizaciones modernas. En este sentido, las tareas de desarrollo e introducción de tecnologías de la información cobran mayor relevancia en el marco de la modernización de los procesos de negocio existentes para diversos perfiles de actividades.

Palabras clave: Tecnologías de la información; Procesos de negocios; Empresas conjuntas; Competencia en el mercado; Recursos laborales.

Introduction

Automated control systems (ACS) are an interconnected set of tools, techniques and personnel involved in the process of storing, processing and issuing data in the course of achieving the set goals.

Consider the currently accepted ACS classification. Information systems are classified according to various criteria. Let's describe the most commonly used classification methods.
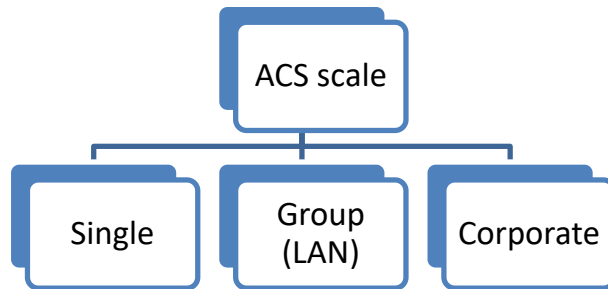
Figure 1: Scheme for classifying ACS by scale

The requirements for the reliability of operation and data protection are significantly increasing in group and corporate systems. These properties are ensured by maintaining the integrity of data, links and transactions in the DBMS.

As a rule, the implementation of single information systems is carried out on autonomous personal computers without the use of network technologies. This system can include simple applications connected by a common information collection, and assumes the work of one user or a group of users dividing one workplace in time. Applications of this type are created using desktop or local database management systems (DBMS). The most common local DBMSs are Clarion, Clipper, FoxPro, Paradox, dBase, and Microsoft Access.

Multi-user information systems imply the sharing of data by users belonging to work groups and are often based on local area networks. Specialized database servers (SQL servers) are used in the process of development of these applications. At present, a fairly large number of SQL servers have been developed on various platforms suggesting both commercial use and free distribution. The most famous database servers on local networks are: Oracle, DB2, Microsoft SQL Server, InterBase, Sybase, Inforqix.

Corporate information systems are used in organizations with a complex branch structure, which implies the presence of mechanisms for supporting geographically distributed nodes or networks.

These information systems, as a rule, have a hierarchical structure that includes several levels. These systems are characterized by the availability

1. Classification by scale

In terms of scale, information systems are divided into the following types:
- Single ACS;
- Group ACS;
- Corporate ACS.

The classification scheme for ACS by their scale is shown in Figure 1.

of client-server architecture implying specialization of servers or a multitier architecture. The development of such systems can use the same database servers as in the development of network software solutions. At the same time, large information systems most often use Oracle, DB2 and Qicrosoft SQL Server DBMSs.

Consider the classification of IS by scope

According to the scope of use, information systems, as a rule, are usually divided into the following categories [Lubyanskaya, Lukash, 2017]:
- IS for processing transactions;
- IS for decision making;
- Information and reference systems;
- Systems based on office software.

Transaction processing systems, in turn, are subdivided into batch information systems and operating information systems in terms of the time spent on information processing. Organizational management information systems use the OLTP (OnLine Transaction Processing) mode for on-line data processing, which is necessary to meet the requirements of the relevant of the subject area at any time, and the batch data processing takes up a very limited part. OLTP systems operate with a regular (possibly intensive) flow of fairly simple transactions that can correspond to work with orders, payments, requests, etc. The necessary requirements for the functioning of systems of this type are:
- Availability of high performance when processing transactions;
- The possibility of guaranteed delivery of information with remote access to the database via telecommunication channels.

Decision support systems - DSS (Decision Support System) - are a specific type of IS, in which, the tasks of selecting and analysing data in various

aspects (time, location, etc.) are implemented using a number of queries.

Hypertext documents and multimedia belong to an extensive class of information and reference systems. The greatest development of such information systems is realized by means of the global network.

Office information systems are used in the transfer of paper documents into electronic form, automation of office work and document management technology.

Consider the classification of information systems by the way of their organization (figure 2).
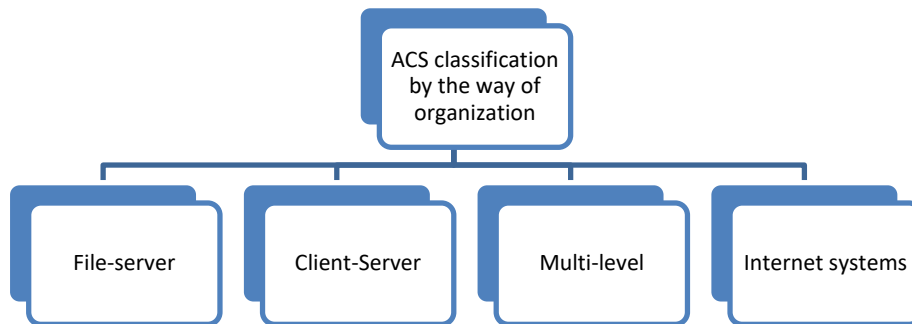
Figure 2: ACS classification by the way of organization

By the way of their organization, group and corporate information systems are divided into the following types [Vendeleva, & Vertakova, 2013]:
- ACS based on file-server architecture;
- ACS based on client-server architecture;
- ACS based on multitier architecture;
- ACS based on Internet / intranet technologies.

The file-server architecture is used to extract data from files in such a way that additional users and applications load the central processor to a small extent. The input of each new client increase consumption of computing power to the network.

The class of applied ACSs in the field of hotel business automation refers to CRM systems. A CRM system is a customer relationship management system. This is an IT strategy that organizations use to benefit their business by collecting data about their customers. CRM class systems are corporate information systems designed for the joint functioning of all divisions of the company within the framework of their interaction with the company's clients.

CRM systems are used to improve the efficiency of business processes aimed at working with a client base, which allows not only attracting and retaining customers, but also tracking and coordinating the development of relationships with them, as well as managing the process of sales and transactions, and also working with accounts as well as the customer service specialists themselves.

CRM systems significantly increase the performance parameters of organizational units that directly interact with customers (for example, sales departments, websites, online stores, marketing departments, service departments, subscriber departments, call-centres). The introduction of CRM technologies in organizations has a positive effect on the functioning of not only sales departments, but also on almost all divisions of those organizations. Thus, CRM systems should be the centre, the core of the client-oriented strategy of the entire organization. Consequently, when implementing the system, it is necessary to integrate it with the existing information systems of an enterprise.

The main areas of use of CRM systems include the following issues [Vendeleva, & Vertakova, 2013]:
• Contact management issues;
• Using Calendars and Reminders
• Sales management technologies
• Marketing management issues
• Mailing technologies
• Conducting questionnaires and surveys
• Using Knowledge Bases
• Technologies for modelling and automation of business processes
• Sales funnels
• Conducting advanced analytics for marketing companies
• Project management technologies (including resources)
• Possibilities of integration with call-centres and telephone conversation recording systems
• Maintaining a history of relationships with Contacts (including with client organizations)
• Contact Hierarchy
• Technologies for ordering; order history
• Issues of drafting contracts / agreements
• Technologies for managing discounts in the process of drawing up commercial offers
• Potential deal management issues
• Issues of managing the sales process
• Evaluation of the transaction success probability
• Technologies for attaching clients to sales managers
• Issues of work activity management (calls, meetings, cases)
• Technologies to support mobile agents

• Issues of individual and collective planning of work activities.

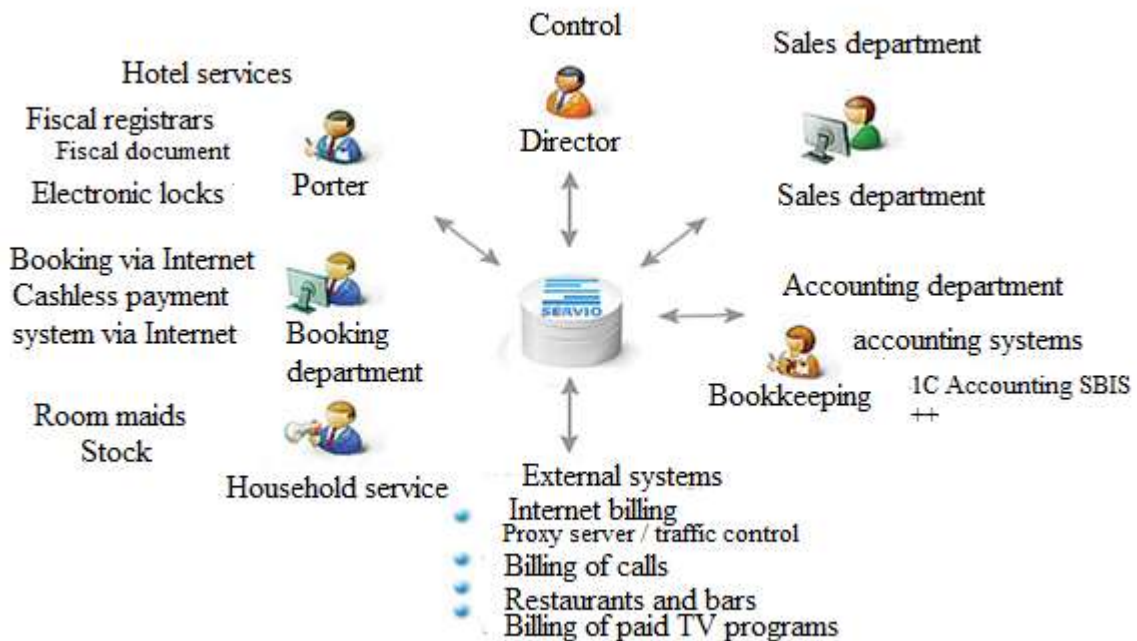The architecture of a hotel business ACS is shown in Figure 3.

Figure 3: Hotel business ACS architecture

ACS intended for the hotel business can be used through the implementation of universal solutions, as well as industry-specific software systems.

The most common universal CRM systems are BPMonline CRM, Microsoft Dynamics CRM, Oracle CRM OnDemand.

BPMonline CRM is an applied SaaS CRM solution using the BPMonline platform. The system developer is Terrasoft company. The capabilities of the BPMonline system include: technologies for managing business processes, their design, automation, and analytics; customer base management; sales planning and management; marketing campaign management; automation of office work and workflow; working time management; control over the execution of orders; tracking work results and analytics. Working with BPMonline CRM data in offline mode is provided by the capabilities of the "BPMonline Outlook Connector" extension.

Another widely-distributed CRM system, Microsoft Dynamics CRM, is a powerful tool used to manage the customer relationship process. This software solution allows us to increase the productivity of employees inside and outside the organization and increases the efficiency of interaction between sales departments, marketing teams and also departments serving customers with the use of modern technologies integrated into a single work environment. The key results of using Microsoft Dynamics CRM are: the ability to reduce the cost characteristics of products, to attract new customers, increase quality characteristics of marketing data and the ability to analyse returns associated with marketing investments; to reduce the cycle and cost of sales; to manage sales funnels; to increase the number of closed deals and the level of sales for the existing customer base, with reducing the cost of customer service, increasing their level of satisfaction and loyalty. Often, organizations are faced with the issues of automating business processes that are not reflected in standard IT solutions, such as ERP, CRM or industry information systems. Examples of these processes are technologies for managing a dealer network, working with citizens and organizations in government agencies, managing a corporate educational process, relationships between companies and applicants in the process of recruiting and selecting personnel, managing supplier relationships, and other issues. Microsoft Dynamics CRM software allows us to customize such advanced relationship management scenarios, or xRM, due to a large number of standard features, advanced options for configuring system objects and connecting business technologies.

Oracle CRM OnDemand is a customer relationship management system that is accessed through software as a service model (SaaS). Oracle CRM OnDemand provides capabilities for sales management, service process, marketing campaigns, virtual call centre functionality and data warehouse with its own built-in analytical tools. As

part of the system, more than 50 report templates have been implemented, which allow obtaining data in various analytical aspects. Also, various specialized technologies are used to integrate data obtained from the Internet and corporate networks based on Web 2.0 technology. The main advantage of Oracle CRM OnDemand is the absence of costs associated with the need to install, update and maintain the functionality of the hardware and software running on it. In this case, there is no need for preliminary investments in IT; the system is easily deployable; there are automatic update services, which provide a high degree of profitability; this allows organizations to optimize performance in accordance with their own specifics. The product includes a set of ready-to-use modules and business processes for corporate sales, use in car dealerships, finance and insurance, pharmaceuticals, high-tech and distribution. The software also includes business intelligence modules, which allows management and employees to gain a comprehensive understanding of customer needs and ways to increase their level of loyalty.

Next, we will analyse the specifics of using CRM systems in the hotel business. The specificity of this type of activity implies ample opportunities for the use of systems of this class.

So, the main areas of application of CRM systems in the hotel business are:
- Keeping records of arriving clients;
- Formation of customer classification by categories;
- Formation of marketing policy in terms of calculating discounts and discount cards;
- Providing customers with additional hotel services and analysing the need for them;
- Formation of corporate programs for interaction between the hotel and large organizations in terms of organizing business trips and conducting seminars.

Next, we will analyse the specifics of the hotel "Ampir Belorusskaya", analyse the business processes of customer service and define the tasks of automating the process of relationships with customers.

In this section, we will consider the functionality of existing solutions in the field of hotel business automation.

1. PO "Kors-Hotel"
The main functions of the program [Fidelio. Hotel business automation system. [Electronic source]. Access mode: https]:
- Automation of the technology of hospitality enterprises in terms of registration of settlements, the formation of accompanying documents, recording the time of residence;
- Accounting of payments made;
- Food accounting;
- Accounting for additional services;
- Printing checks, receipts, and contracts;

- Formation of price lists;
- Calculation of the total cost of living, taking into account the range of services and discounts provided;
- Availability of an access control system;
- Formation of statistical reporting.

2. Software package "Gostinitsa"
The software for the hotel performs the automation of the administrator's work in terms of accounting and payment for accommodation; accommodation of clients, **booking rooms** in the hotel, sanatorium, and boarding house. Hotel room stock and guest profiles are displayed in a check register Rooms / Calendar.

There is a separate set of services for each room, the division of the cost of services by date, and discounts depending on the occupancy of the rooms (bed capacity).

The history of check-in is saved for each visitor and the invoice is printed for payment in the form 3-G (Approved by order of the Ministry of Finance of the Russian Federation dated 13.12.1993 No. 121, can be changed at the request of the customer).

3. 1C: Enterprise 8. Hotel
The software product "1C: Enterprise 8. Hotel" is designed to automate hotels, boarding houses and rest homes.

The program automates workplaces for [Akperov, Smetanin, Konopleva. 2013]:
- Receptionist (administrator),
- Manager of the booking department,
- Supervisor of the hotel room stock service,
- Manager of the conference-room reservation service,
- Employees of the planning and economic service.

The possibility of integrating "1C: Enterprise 8. Hotel" with "1C: Accounting", restaurant management systems, billing systems integrated with automatic telephone exchanges installed in hotels has been implemented, there is the possibility of accounting for Internet traffic, pay TV, thus, an integrated accounting system for services provided is implemented.

1C: Hotel 8 includes interfaces with the following equipment [Akperov, Smetanin, Konopleva. 2013]:
- Cash register machines (CRMs),
- Electronic locks,
- Payment systems for authorizing credit cards.

The program implements the ability to generate operational, analytical and regulated reports.

The main functionality of the program includes [Akperov, Smetanin, Konopleva. 2013]:
- Accounting for the occupancy of the room stock;
- Individual and group booking system;
- Accounting for mutual settlements with counterparties;
- Accounting for settlements with guests;
- Working with groups;
- Reservation of resources: conference rooms, saunas;

- Planning events and banquets;
- Accounting for guests' accommodation;
- Keeping a register of foreign citizens;
- Tariff management by days of the week, by seasons;
- Management of discounts. Cumulative discounts;
- Room quotas management;
- Management of the room stock service. Formation of tasks for cleaning, planning and control over the performance of work in the rooms;
- Online booking module via Internet;
- Working with credit cards through bank terminals;

- Accounting in one database of any number of hotels and buildings;
- Multilingual user interface (Russian / English);
- Printing documents from the program in different languages;
- Accounting on behalf of several legal entities;
- Ability to work with different currencies;
- Detailed audit of system users' actions.
It is possible to build a distributed multi-hotel database by means of managing distributed information bases included in the 1C: Enterprise 8 platform

Functionality	"Kors-Hotel" Software	"Gostinitsa" Software	1C: Hotel 8
Occupation accounting	+	+	+
Customer filing	+	+	+
Room booking	+	+	+
Data transmission to the accounting system	-	-	+
Integration with catering services accounting	-	-	+
Accounting for additional services	+	+	+
Time system	+	-	+
Forming the history of occupying rooms	-	+	+
Integration with the billing system	-	-	+
Formation of analytical financial statements	+	-	+
Integration with cash register	+	-	+
Documents with legal entities	+	-	+
Accounting for discounts	+	+	+

Table 1: Comparative characteristics of hotel software products

Having considered the functionality of the software for the automation of the hotel business, we can draw the following conclusions:
1. Software "Kors-Hotel" allows us to automate the workflow used in the hotel business technology, while there is no integration with the accounting system; there is no possibility of configuring the output information for a specific user.
2. Software "Gostinitsa" has a partially implemented functionality of the hotel business operation (there is no document flow with legal entities and integration with cash register machines). There is also no integration with the bookkeeping system and accounting of the catering services provided.
3. In "1C: Enterprise 8. Hotel", all the necessary functionality for the work of a hotel manager is implemented: the possibilities of document flow from the step of booking a hotel room and checking into it by the client and up to the formation of analytical reports are implemented. The disadvantages of using "1C: Enterprise 8. Hotel" include the availability of unnecessary functionality that is not used in the technology of the hotel. Also, this configuration covers the ability to customize financial reporting for the specifics of the organization, which implies the need to contact with the developers of this software and additional costs for configuring.

Protection of the information system of hospitality organizations is necessary to fight against the following threats:
- Viral activity
- Loss of data due to technological failures
- Data loss as a result of violation of user rights
- Compromise of EDS and passwords
- Personal data leaks
- Unauthorized copying of data
- Misuse of Internet traffic
In order to preserve the data in the information system, it is necessary to take technical and organizational measures. Information technology specialists oversee the work of protecting information in the information system of hospitality organizations.
Technical measures to protect information include:
- Availability of a database backup system using external media
- Determination of the level of user access to information resources
- Centralized administration
- Antivirus software
- Availability of a system for differentiating access to the Internet, as well as to a firewall (it is also necessary to differentiate up to the physical separation of media for their Internet access concerning hotel employees and clients connecting via a wireless network)
- Using cryptographic tools to encrypt highly valuable information

Organizational measures to protect information include:
- Prohibition of the use of unaccounted media
- Sealing of servers and workstations with crypto tools installed
- Regulation of Internet use
- Availability of instructions for the on-site regime and restriction of access to information processing centres (server rooms, as well as offices where backup copies of databases are stored)
- Determination of personnel responsibility for violation of information protection rules by order

It is necessary to develop the following regulatory documents in the field of ensuring the protection of information in the hotel business organizations:
- "Instruction on the procedure for handling machine-readable media (regulates the accounting, storage and use of media within the organization, and also prohibits the use of unaccounted media)
- "Instructions for the cryptographic protection of information (regulates the use of cryptographic tools used in work. These include electronic document management tools)
- "Instruction on access and intra-site regime (determines the access regime, as well as the rules for the use of premises where information of a confidential nature is processed)

- "Instructions for using external network resources"
- "Instructions on password protection" (regulates the use of password protection, defines the rules for the use of passwords and documentation).

The ACS (automatic control system) also includes the management of video surveillance systems and fire and security alarms.

Specialized means are used to control the access of persons to the premises of the organization (access control systems, ACS) to ensure the physical protection of information.

Figure 4 shows a diagram of the interaction between the components of the access control system for rooms with limited access. As shown in Figure 4, the system includes the following components:
- Operator's workplace;
- Administrator's workplace;
- Central access control system server;
- Accountant workstation (within the framework of working hour accounting);
- Reader interfaces;
- Employee identifiers;
- Room entry controllers;
- Modules for accounting entries and exits of employees.
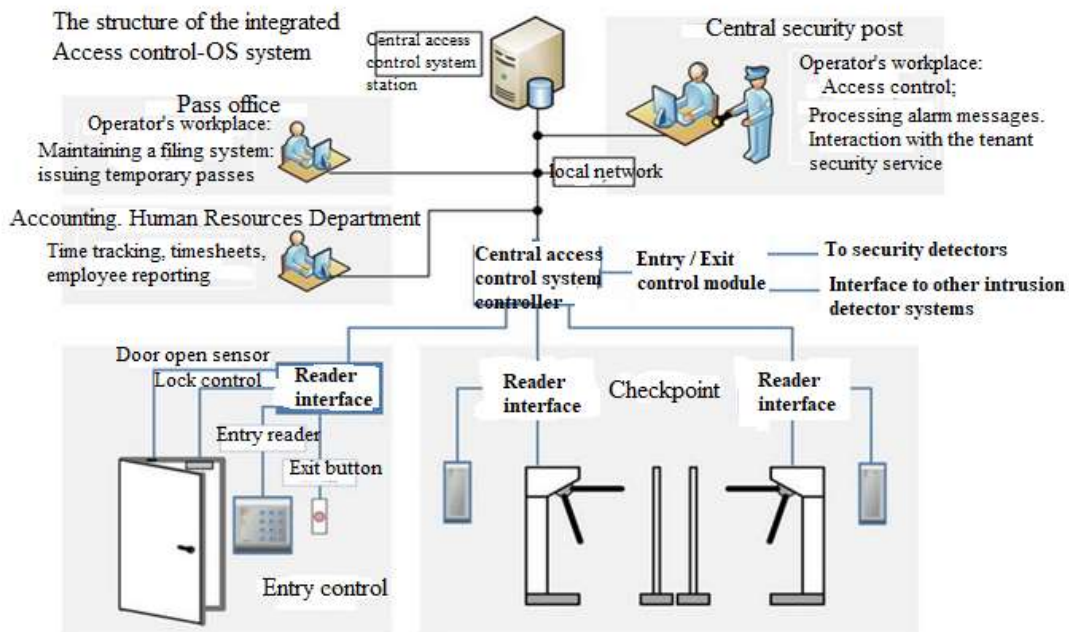
Figure 4: Diagram of interaction between Access control system components

Table 2 contains a list of functions and assignments of the access control system components.

| Component name	Assignment of the component
Administrator workplace	Managing readers, setting access rights, blocking identifiers, issuing new identifiers, managing the accounts of the access control system operators, managing access to protected premises
Operator's workplace	Accounting for employees' access to premises, monitoring the access control system status

Access control system central server	Storing the access control system database, managing access to the database at the DBMS level, installing and configuring the server software for the access control system
Accountant's workplace	Formation of reporting information about the presence of employees at the facilities of the enterprise, the actual hours worked
Room entry controllers	Reading employee's ID, determining accessibility
Employee IDs	Use for access to the protected premises of the organization
Accounting modules for employee entrances and exits	Programmatic accounting of employee entrances and exits to premises

Table 2: List of functions and purposes of assignments of the access control system

The degree of vulnerability from the actions of violators associated with physical access to the system is determined by the functioning of the engineering and technical protection of information built in accordance with the existing threat model, and the cost of the protected information resources. Access controllers of the KOM-SKD-01 series are designed to provide access control at facilities of various scales. The hardware part of the access control and management system is based on the KOM-SKD-01 access controllers.

The necessary additional equipment is connected to them, they are: readers, interface modules, sensors, relay modules, etc. Below is a brief overview of the operating modes of the GRIFON access control system in the conditions of the All-Russian State Television and Radio Broadcasting Company. Figure 5 shows the system pin-code input mode.
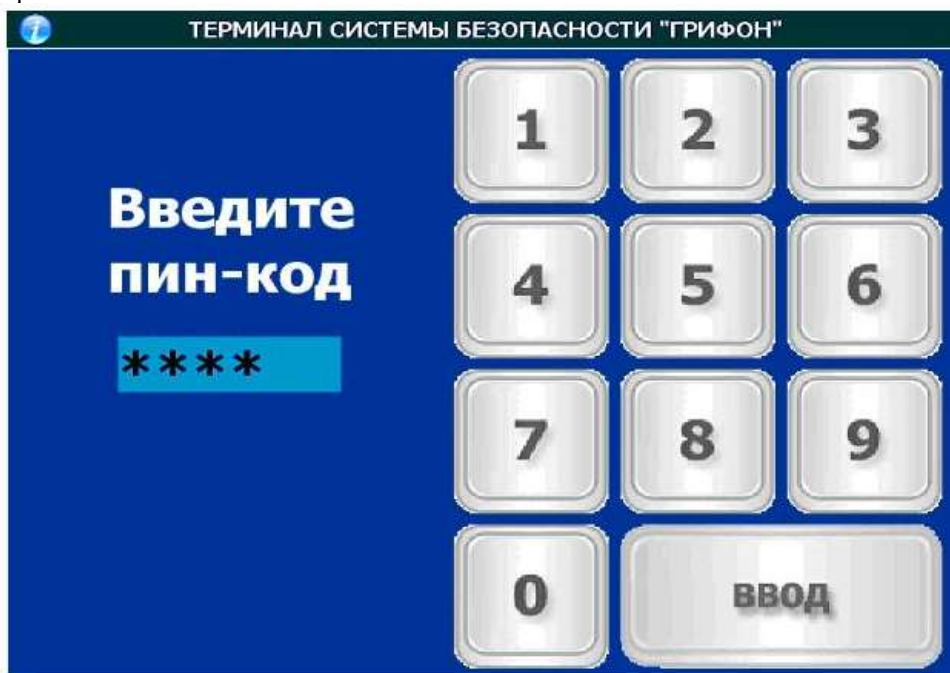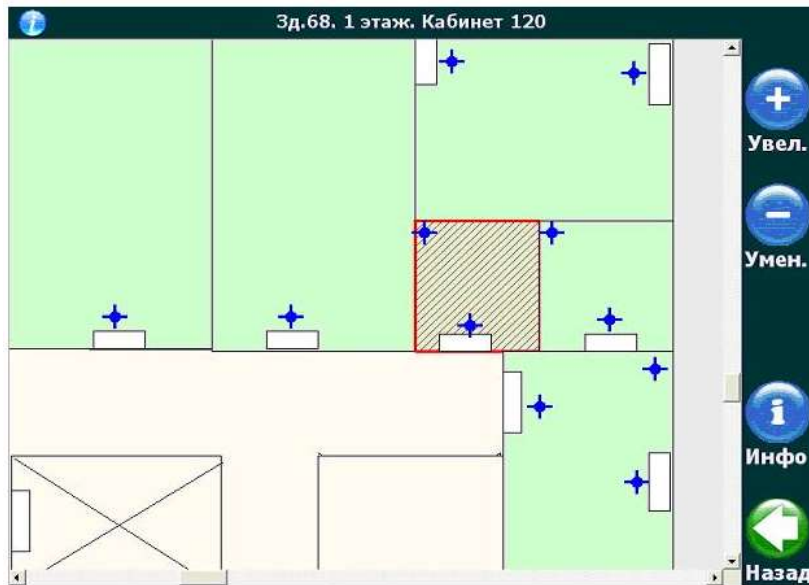

Figure 5: PIN code input mode

Figure 6 shows the custom arming mode for enterprise objects. Fig. 6 shows the mode of working with floor plans.
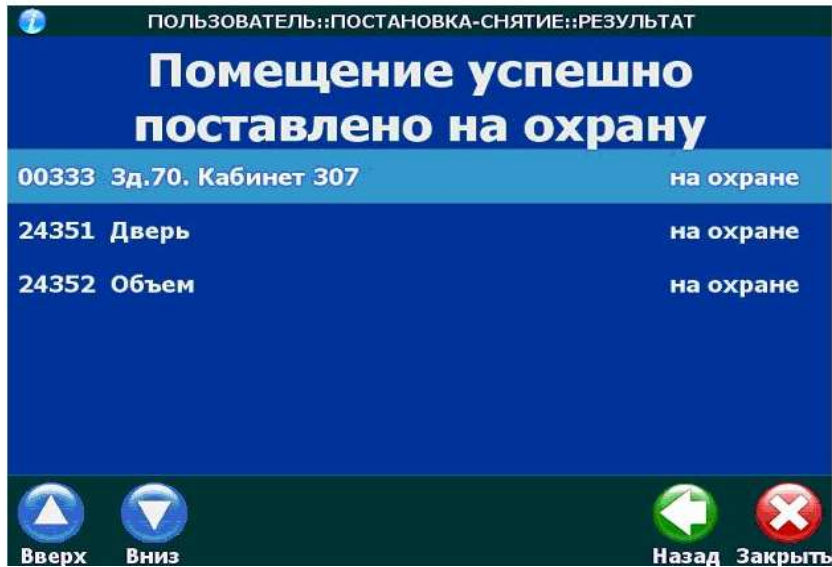
Figure 6: Custom Arming Mode

Figure 7: Working with plans of hotel premises

Fig. 7 shows the access control system protocol integrated into the hotel's ACS (automated control system). The software "GRIFON" installed on an IBM-compatible personal computer (PC) is required for initial programming, system control and information collection during the system operation. A special RS-232 / RS-485 converter can be used to interface with the PC system hardware.

It is possible to connect the controllers to the Ethernet network to operate via the TCP / IP protocol using the appropriate module (Ethernet - RS485 converter).
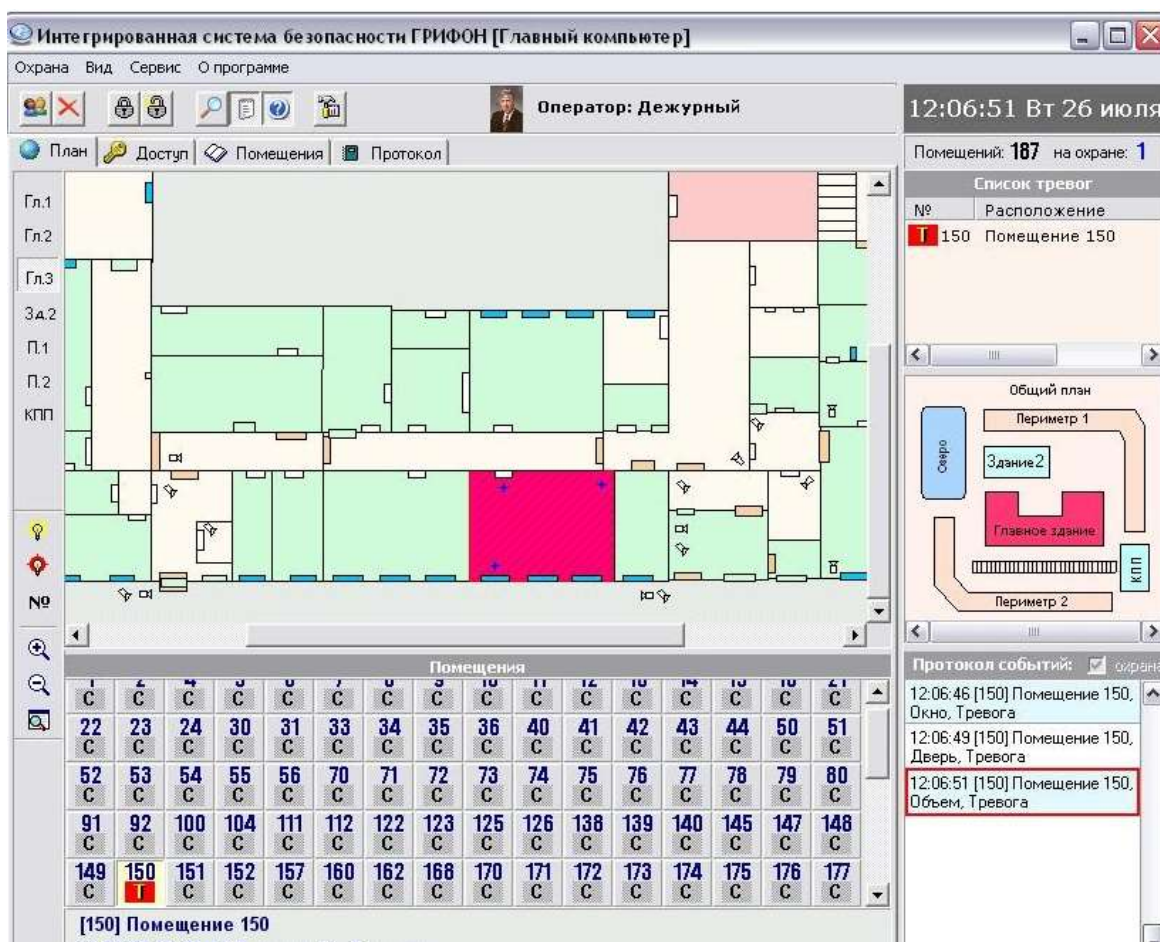
Figure 8: Protocol of the integrated access control system

The system can support control from one to several tens or even hundreds of access points. Each controller of the system is focused on the comprehensive protection of one area of the object (room, floor, or another closed area). The system is designed to use proximity cards such as StandProx or SlimProx as keys, and MiniTag key fobs, with which the own system readers work. The system can work with TouchMemory readers (keys of the I-Button type), or with any standard readers with Wiegand 26 bit or TouchMemory output interface.

Reed contacts, infrared or combined sensors or other "dry contact" sensors can be connected to the controllers in the capacity of sensors.

GRIFON software runs under Windows XP and higher versions, and supports many additional functions in addition to standard: graphic plans of alarm zones, video verification of hotel clients, time tracking, accounting of clients' passage into hotel premises, and so on.

Ergonomic support is associated with the development of recommendations and norms suggesting the correct organization of workplaces for system users; this includes the correct location of workplaces for users in the premises, compliance with the required level of illumination, and setting the standardization of users' work at the computer.

Conclusion

Today, the introduction of information systems can contribute to:
• Obtaining more rational options for solving management problems through the introduction of mathematical methods and intelligent systems, etc.
• Release of workers from routine work due to its automation;
• Ensuring the reliability of information;
• Replacement of paper data carriers with magnetic and optical ones, which leads to a more rational organization of computer information processing and a decrease in the volume of paper documents;
• Reducing the cost for production and services.

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