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Automated Event Registration System in Corporation

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Abstract - Modern security systems of corporations are urged to solve very complex and multidimensional challenge of ensuring the maximum safety on object at all stages of its functioning at the organization of optimum response to arising situations.

Creation of universal mathematical model which will consider all features of security object and generate the optimum decision on elimination of emergency situations of any type and in any place, is the relevant task demanding deep study of questions not only detection, but also optimum response to arising situations.

Keywords - Security Object, Vector Analysis, Decision-Making Support, Event Registration

INTRODUCTION

For ensuring protection and a security it is necessary to solve a complex problem of a choice, installation and operation of security hardware.

The object security system is intended for use in the banking, credit and financial and other large institutions having branched infrastructure and difficult management. The developed system has to easily and with the smallest changes in the existing software (SW) to be integrated into an automated control system for security object [1]. The system has to keep surely the objective journal of the events which have occurred during watch, which the persons who are keeping watch can't correct. It has to provide connection of sensors of different types and video cameras, to cope from a workplace of the operator by means of the computer or remotely [2].

Necessary condition of creation of object security systems is implementation of the following general requirements:

a) integration into an automated control system for establishment;

b) ensuring diagnosing of emergency situations and rapid response to their emergence. Thus probably two cases:

1) the general signs of a situation can be described by means of existing model, however development of a situation can happen in the various directions, to forecast which it is unambiguously impossible;

2) the general signs of a situation don't fit into existing model of functioning of the security object;

c) possibility of configuring and self-configuring of object security system;

d) the automated registration of events on security object and operational management of work of that, in particular his employees, information security from unauthorized access [3].

TASK DEFINITION

In conditions when emergency situations can arise in various parts of organization and bring various degree of damage, it is necessary to consider that factor at design of system that the security object represents large organization in which separate elements of system (departments, services, etc.) are distributed in space.

Besides, it is necessary to consider that object security systems can be developed in two aspects:

a) organization already exists and its spatial organization shouldn't change. In this case a task of the developer - modernization (re-engineering) of existing system of safety of object;

b) establishment isn't constructed yet or its architectural reconstruction or movement of separate elements of system within security object is possible. In this case the problem of creation of security system extends on synthesis of spatial and organizational structure of security object.

Taking into account stated, within the real work the problem of creation of system of registration of events is formulated as follows [4].

It is set: set of divisions and their spatial arrangement in the territory of security object; working hours of divisions; levels of access to rooms; requirements to indicators of quality of system (safety of people and ensuring safety of property of security object); economic indicators of development new or modernizations of existing system.

It is necessary to develop: model and algorithm of functioning of a subsystem of automatic registration of events in security system of corporation at various modes of its functioning.

In such general statement the solution of a task difficult for the following reasons:

a) lack of initial information: some characteristics of system can be defined only in the course of its operation;

b) evolution in development of the system, in particular not stable character of system functioning modes.

The specified difficulties can be overcome within methodology of the system analysis by means of decomposition of an initial problem on a little conditionally independent sub problems which are in turn divided into complexes of tasks, tasks, subtasks, etc.

Considering the above, in the real work the following hierarchy of problems of synthesis of event registration system is accepted at creation of security system of corporation) (see Fig. 1):

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a) mathematical modeling of spatial and organizational structure of organization;

b) development of model and algorithms of work of system at specification and registration of the arisen situation.

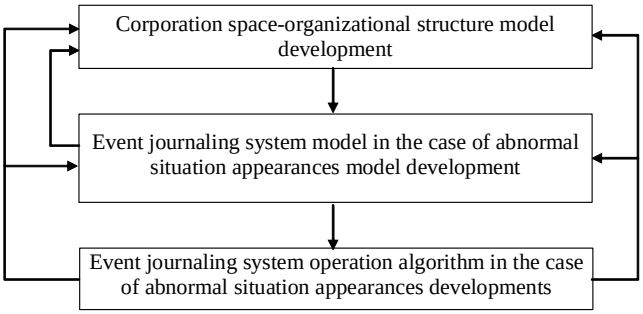

Fig 1 : Research structure

III. Development of models of event registration system

III.1 Modeling of spatial and organizational structure of corporation

When modeling spatial and organizational structure the security object can be presented in the form of a vector [5]

$$A(x) = A(x_1, x_2, ..., x_n), \qquad \text{(III.1)}$$

where $A = \{x_1, x_2, ..., x_n\}$ - elements of the set formed of a set of premises of corporation.

Contiguity of rooms is described by double sets

$$x_i \wedge x_j = \begin{cases} 1, if: \blacksquare A(x_i) \to A(x_j) \\ 0, if: \square \quad A(x_i) \to A(x_j) \end{cases}; \qquad \text{(III.2)}$$

$$i, j = \overline{1, n},$$

where $\blacksquare$ - statement is true,

$\square$ - statement is false;

i, j - conditional numbers of the rooms entering into security object.

From expression (III.2) follows that conjunction of any double set of a vector $A^I(x_i, x_j)$ is equal to "1" if transition from the placement of x_i to x_j room is possible. Otherwise, this conjunction is equal to zero. The vector $A^I(x_i, x_j)$ looks like a two-dimensional matrix in which conditional numbers of rooms - sources (rooms from which transition is supposed) are columns, and across there are conditional numbers of target rooms of security object (rooms where transition is carried out). On crossing of the corresponding column and a line of a matrix settles down "1" if transition is possible, and "0" if transition is impossible that is if rooms aren't adjacent (see a formula (III.2)).

The main lack of this representation is that it doesn't provide division of access rights to various rooms of various categories of people that at the emergency situation can reduce security of object essentially. For elimination of this shortcoming the vector $F(u) = F(u_1, u_2, ..., u_i, ..., u_n)$ in which each member of a set represents "1" if this room belongs to category of rooms to which access for all people is allowed, and "0" - otherwise is entered.

The following factor having impact on work of security object, is the mode of its work. It consists that all the time of functioning of object security system can be divided into two main modes:

a) protection mode;

b) supervision mode.

At the first mode all protective functions of security system have to be activated.

In the second case part of functions of security system can be passive or be ignored. The reason of it consists that, for example, presence of people indoors during the working day can't be considered as invasion as it there can be workers or visitors. At the same time part of functions can be still active (for example, the detector of a smoke, glass breaking, etc.).

From here follows:

a) the state of all sensors of object security system has to be active irrespective of, whether this sensor in the corresponding time-point is used, or not;

b) it is necessary to define, in what mode there is the appropriate room:

1) in a protection mode in a time off or in not working (festive) days;

2) in a supervision mode in working time for this room.

Thus, the operating mode of the room is described by a vector

$$B(x) = B(b_1(x), b_2(x), ..., b_n(x)), \qquad \text{(III.3)}$$

where $B = \{b_1, b_2, ..., b_n\}$ - elements of the set formed of a set of rooms, and each of elements it is equal "1" if the appropriate room is in a mode of protection and "0" if this room is in a supervision mode.

Using vectors *A*, A^I, *B*, и *F*, we can define next:

a) the room in which there was a possible event (the emergency situation which is subject to registration in information system of corporation);

b) category of the room, from the point of view of division of access rights (the general access, limited access);

c) operating mode of this room (protection mode, supervision mode);

d) what rooms are adjacent to this room (from the point of view of definition of ways of evacuation or possible distribution of an emergency situation).

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Data of a vector describe the general spatial and organizational structure of corporation and can be used for management of event registration system.

MODELING OF WORK OF EVENT REGISTRATION SYSTEM AT EMERGENCY SITUATION

In this subsection it is necessary to consider how it is possible to use the offered vector representation of spatial and organizational structure of corporation for modeling of work of system of automatic event detecting at possible emergency situation.

Thus it is necessary to consider that within corporation possibly appearance of several emergency situations at the same time.

Therefore the purpose of automatic event detecting in corporation is situation ranging from the point of view of its possible importance for the general safety of object.

For implementation of such ranging it is necessary to take the following steps:

a) to detect a possible emergency situation and to define its arrangement;

b) to define category of an emergency situation;

c) to define level of access to this room, in particular, to define, there are there only employees or there can be ordinary visitors;

d) to define the possible directions of distribution of an emergency situation and an evacuation way;

e) to define a rank of the arisen situation and a priority of registration of this event.

The event is considered arisen if at least one of members of a vector (III.1) became nonzero.

Number of the member of this vector *i*, corresponds to room number in the architectural plan in which there was a possible emergency situation.

Emergency (conflict) situations can be generally presented in the form of a vector

$$C(z) = C(z_1, z_2, z_3, z_4, z_5, z_6). \qquad \text{(III.4)}$$

and set of vector *C(z)* can be formatted as in table 1.

Table 1 : Set of *C(z)* vector

Designation	Denomination
z_1	Force majeure
z_2	Intrusion at the security mode
z_3	Intrusion in the supervision mode
z_4	Violation by means of intrusion to the computer network
z_5	Attack
z_6	Input-output violation

Then for event detecting in any premises of corporation it is necessary to present each element of a vector *A* as a vector describing possible emergency situations. Then we will get

$$A(C(z)) = A\big(C_1(z), C_2(z), ..., C_n(z)\big). \qquad \text{(III.5)}$$

According to a formula (III.5), the state of each room of corporation is described by a vector (III.4) in which the corresponding element is equal "1" if this category of an event takes place and "0", otherwise.

Presence in the *j* room of people represents a variable described by logical function

$$\delta(j) = \begin{cases} 1, & when\ H_j \geq 1 \\ 0, & when\ H_j = 0 \end{cases}; \qquad \text{(III.6)}$$

where H_j - number of peoples in the *j* premise.

Then the fact of presence of people in the appropriate rooms of security object (corporations), it is possible to present in the form of a vector similar to the previous vectors

$$D(x) = D(d_1(x), d_2(x), ..., d_n(x)). \qquad \text{(III.7)}$$

Each element of a set of a vector *D* accepts value "1" if indoors there are people and "0" if people indoors aren't present.

Thus, for this purpose, carrying out conjunction of vectors $A(C(z))$ and $D(x)$ step-by-step, we can define not only number of the room in which there was an event which is subject to registration, but also and, whether there are in this room people.

The combination of category of an emergency situation and presence at the room of people allows to define more precisely degree of danger of a situation and to establish its rank according to which it is possible to define a priority of transfer of the image transfer in the case when simultaneous high-quality transfer of images on all arisen events is impossible.

The criterion of degree of event importance is for this purpose entered. This criterion looks like

$$K = k_1 \cdot C_i^1(z) + k_2 \cdot C_i^2(z) + k_3 \cdot C_i^3(z) + \\ + k_4 \cdot C_i^4(z) + k_5 \cdot C_i^5(z) + k_6 \cdot C_i^6(z), \qquad \text{(III.8)}$$

where $k_1, k_2, ..., k_6$ - coefficients of degree of importance of a situation (event) which are defined on the basis of estimates of experts and representatives of top management of corporation;

i - number of the room in which there was an event interesting us.

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DEVELOPMENT OF ALGORITHM OF EVENT REGISTRATION AT EMERGENCY SITUATION IN CORPORATION

This algorithm provides performance of the following stages:

a) automatic detecting of an event by means of the corresponding hardware-software complex;

b) definition of degree of importance of the occurred event on the basis of models developed in section III;

c) definition of the rooms adjacent to the room in which there was an emergency situation (event);

d) transfer of images from video cameras on the central server of object security system.

The analysis algorithm of a one room state is given in figure 2.

Automatic detecting of an event is made by means of the corresponding hardware-software complex. Information that the emergency situation of a certain category is detected by the automated system, is formed in the form of a vector (III.5). This vector has a form of a matrix in which columns correspond to room number, and lines - categories of a possible emergency situation (event). The problem of system of registration consists in scanning this matrix formed automatically by event detecting system.

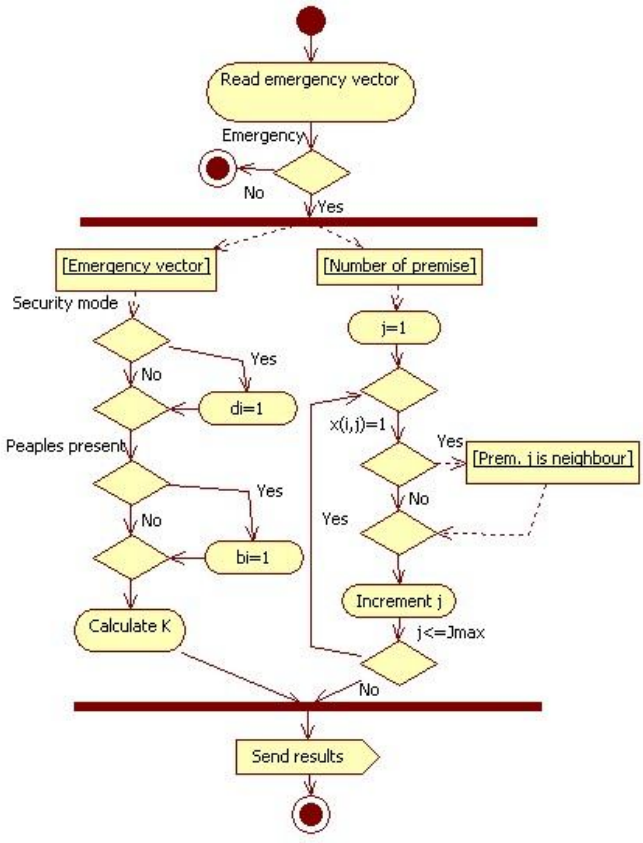

Fig 2 - Analysis algorithm of a room state

At first the first room gets out. In our model it corresponds to the first column of a matrix (III.5). Then reading of this column of a matrix for the purpose of receiving a code of an event is made.

The task of the program of detecting in that case consists in defining, whether equally in the received 6-bit number to zero or not. If isn't present, the system passes to reading of a condition of the following room of corporation. If the code isn't equal to zero, the system carries out sending the message on emergency situation and transfers control to the following module of the program - to definition of degree of event importance.

Irrespective of result of condition control of the appropriate room the system continues to scan a matrix (III.5) till the end (when rooms any more didn't remain).

This scanning allows to find any quantity of emergency situations which could arise in corporation (security object).

For definition of degree of importance of an event the result of operation of the event detecting program module and earlier developed elements of model used in system of registration of events is used.

After the event in the appropriate premise of corporation is detected, we get a number of the room and an event code. The operating mode of the room is a 1 bit of information. For definition of degree of importance of an event from the point of view of a room operating mode, it is enough to supervise bit of an operating mode of the room and to use it for definition of degree of importance of a situation.

We accept that in case the room is in a protection mode, importance of a situation doubles, that is the final criterion has to be multiplied by 2.

Presence at the room of people is used in the same way, as well as a room operating mode: if indoors there are people, the criterion of importance doubles.

Thus, to define degree of importance of an event, it is necessary in a formula (III.8) to add two additional coefficients, described earlier. Then for i room degree of importance of an event is determined by a formula

$$K = \left(1 + d_i(x) + b_i(x)\right) \cdot \left(k_1 \cdot C_i^1(z) + k_2 \cdot C_i^2(z) + \right.$$
$$\left. + k_3 \cdot C_i^3(z) + k_4 \cdot C_i^4(z) + k_5 \cdot C_i^5(z) + k_6 \cdot C_i^6(z)\right), \quad \text{(IV.1)}$$

where $d_i(x)$ and $b_i(x)$ are specified earlier.

When developing algorithm of definition of the rooms adjacent to the room in which there was an event which is subject to registration on the central corporation security server, we use earlier developed formulas (III.1) and (III.2).

Using these formulas (III.1) and (III.2), it is possible to define, to what rooms transition from the room where there was an event is possible. It is necessary to define ways of possible distribution of an emergency situation.

In order that to make it, the matrix in which numbers of lines and columns correspond to numbers of placements to corporations is formed.

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On crossing of numbers of lines and columns are "1" if transition from one room in another and back is possible, and "0" if such transition is impossible.

Here in case the room is adjacent, information about it goes to the main program and is used for definition of what cameras have to be activated.

CONCLUSIONS

The main advantages of developed model and algorithm are their universality.

The using of all operating modes of security object and the differentiated approach to definition of degree of importance and danger of the corresponding event allow providing optimum work of object security system and most effectively to use technical resources of corporation at registration of arising events.

These model and algorithm can be used when scheduling security system of any object by determination of the basic parameters offered in the real work.

REFERENCES

[1] Access Rights Administration in Role-Based Security Systems. M.Nyanchama, S.Osborn// University of Western Ontario.- 23 p.

[2] System and method for Monitoring Security Systems by Using Video Images. M.J.Saylor, A.Slavin, J.P. Hugues Martin. US Patent No US 6,400,265, 2002 - 14 p.

[3] Creating Proxies for Distributed Beans and Event Objects. V.Shih-Chuan Chan, P.Kwong-Hung Yu. US Patent No 6,230.160 B1, 2001 - 11 p.

[4] G.Muller. System Modeling and Analysis: a Practical Approach. Baskerud University College, 2013 - 127 p.

[5] M. Hutton. Vector Analysis Notes. Autumn 2006 Lectures.