

## Security and Safety Processes in Czech Republic Universities

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**Abstract— This paper focuses on security and safety requirements and processes to help universities in developing more effective security and safety risks management system. The proposal is based on management techniques and on understanding primary processes in university buildings. The solution proposes a system which is integrated as a management system in the commercial sector. However, this proposal only takes in account special conditions, such as requirements for students, which are present in the university buildings. The proposed system helps enforce more effective security and safety measures in school facilities and in universities.**

**Keywords- Law Requirements; Risk Management; Safety; Security; Soft Targets.**

### I. INTRODUCTION

The aim of this paper is the proposal of a security and safety management system in universities with software support. Safety and security in academic institutions is a common topic, especially with school buildings being the target of different attacks [10] [11] [12]. The objects, that need to be under the security and safety management system, include structures or facilities that are visited daily by hundreds or thousands of students. The paper is focused on understanding the processes and also on the specification of security and safety risks.

This research concentrates on the system integration which has been applied into school facilities and universities. The current situation could be different in other countries. In the Czech Republic, the current state could be presented as a system without any special security requirements. The school facilities have problems with financial resources that could be used towards security techniques and with knowledges about efficient measures. These statements are based on studies which have been done in school facilities such as kindergartens, primary schools and secondary schools [1] [2] [3].

University management faces to a different problem. Universities want to be more open towards their surroundings for students and potential students. This is the reason why security attacks have happened at Czech Republic Universities [10] [12]. This statement resulted from interviews with management at Czech Universities.

Universities could apply basic principles of management to manage processes because the structure is similar as a commercial organization aiming to gain/earn a profit. Risk is

a subjective concept that needs to be viewed and quantified on an individual basis [4].

This research defines processes which could be implemented into software. The level of security and safety situation at universities depends on the correct setting of measures. The software has to know the processes that occur at the university on daily basis and also the ideal situation. The ideal situation is represented by the values that are used for the fuzzy statements. The fuzzy statements are used for the decision making process [3].

The reminder of this paper is organized as follows. In Section 2, we defined the elementary law requirements which have to be integrated into the software. This had been done in order to simplify requirements for the management of school facilities and universities. In Section 3, we defined the categorization of the physical structure of a university building. The categorization could have an impact on security and safety incidents. In Section 4, we described the classification of each building or part of the building by the impact to emergency incidents. The aims of access are classified in section 5. According to the aim of access, the system should define the typical behavior and then identify NOK (Non-conformity) of process. In section 6, the impact of risk sources is defined. In section 7, special events are identified. Software solution must identify special events by values that represents it; for example, planning in calendar (user define special event in application). After that, the software will propose special conditions that have to be fulfilled before action. In the section 8, the proposal of security and safety solution is explained. This part describes system realization (the processes have been already specified in the previous section 2-8). The real life case study is expressed in section 9. The last section concludes this research paper.

The paper proposes one system solution that could effectively manage security and safety situation in the school facilities and the universities. The software could supply missing knowledges to management of the school facilities and universities. The research relates to the smart home security and intelligent management system that could support school facilities. The fuzzy logic is the modern theory which belongs to artificial intelligence field [5].

## II. LAWS REQUIREMENTS WAS INTEGRATED TO SCHOOL FACILITIES IN CZECH REPUBLIC

Law requirements are aimed to security and safety requirement that are integrated into school facilities and also universities, but it is not limited to this kind of facilities. In Czech Republic, two groups of universities are defined. Institution, which belongs to the first level of university, can perform role of a researcher (development and innovation). Each student must respect internal directives at university and at other buildings that are part of the campus. It is the first requirement that should be followed. In the proposal, it could be utilized as implementation support [3].

The internal directives are defined for appropriate behavior in object and also there is applied in educational system. If these directives have special security and safety option, it could be called as security and safety directives; however, it must be applied into other processes and also into related directives.

In safety solution, Czech Republic has two groups of requirements. The first is an Occupational Health and Safety (OHS). These requirements do not affect only employees and also students [8]. On the other hand, Czech Republic has specified requirements for Fire Protection (FP). This second group is based on primary firefighting building technical solution which is designed in project plan by authorized engineer. This solution is implemented to project in the preparatory development phase. Other fire requirements are derived from this solution which is implemented in operation of facilities. The special safety conditions for primary, secondary, and high school are specified in Czech law; however, these conditions are not established for universities. It could be utilized for definition of primary requirements for this type of objects. That means, it could be specified for schools, universities, theatres, shopping centers and other objects which fall into soft targets category.

## III. PHYSICAL STRUCTURE OF UNIVERSITY BUILDINGS

This section considers the division of parts of university. University buildings are used to educational process or to other supported processes. This categorization is important for the proposal of software solving. The proposal of software has implemented this structure into the main program.

### A. Size and Separation University Building

The university consists of educational buildings, individual faculties, and other buildings. The number of visitors is closely related to the location and territorial jurisdiction. There is a relevant assessment of objects whose activities are closely related to the processes in the university. The building or premises separation should be evaluated mainly from two perspectives, namely the distribution of individual objects and their connectivity with a university.

### B. Distribution of Relevant Faculties and Buildings

The dislocation of individual objects should be addressed by linking effectiveness ties and with location of the object.

This aspect should be examined in the relation to the transport or access of individuals into the object, and also due to the timetable of the teaching process and other aspects. A parts of the university are defined as the basic building block.

The map of dislocation helps visitors to familiarize with the localization of individual rooms or increase the degree of orientation of the building. The software support will define requirements for the parts of university, and it could help to solve incidents quickly and effectively. An expert who will make decisions could see the structure of building and the number of persons in object. It could be useful for emergency. The main reason is to use the plans for solving incidents and security and safety situations. The proposal of the system security and safety integration implements plans for support into decision making process. Experts can offer effective and smart solutions if they are informed about the dislocations and security devices layout [2].

In individual building complex, where the systematic solution is implemented, the efficiency of safety and security is lower than in the whole area. In the second case, the distance between university buildings is different in each educational institution. Therefore, this is the one of many inputs that is supplied to the decision making process.

While the student is moving between buildings, there is higher probability of safety and security emergency incidents. In the software solution, this could be represented by numerical value. Due to this value, the expert is aware about the current situation.

This is important fact, especially, if we are talking about the possibility of the injury risks and also repeated controls on re-entry to another parts of the university [4].

## IV. DEFINITION OF UNIVERSITY BUILDINGS

This section deals with specifications for each kind of university building (see Figure 1). This definition considers three parts:

- Complex structure,
- the main and supported aim of the object,
- the primary visitors aim.

In this section, primary options are presented. These options can improve security and safety situations at universities.

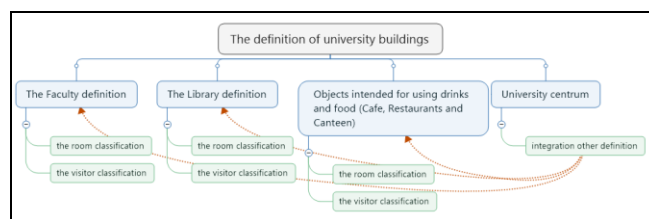


Figure 1. Definition of university buildings.

The definition of university buildings is the first part of object categorization. According to the building categorization, the software can identify input requirements.

If several objects are located in one central place, there is a need to consider their purposes. Individual components should be analysed as an individual unit.

This part of paper has been reflected physical structure of university buildings. After this analytical process, the analyses of visitors are followed. The next process examines the ties between visitor aim and operation requirements. This process will be applied in software. When the evaluation is negative, then the visitor aim is different than university aim. The management should implement security and safety rules into this process. These rules have to be implemented into process, have to be documented and also controlled. The main aim of the University building is education. Another object aims are supporting and the object have to be adapted to these requirements. In this situation, there are reciprocity ties. It could be utilized to achieve greater safety and security situation.

### V. EVALUATION OF USER ACCESS

Each category of the school facility is specified by the aim and function rules which are closely related to the person who sets the access to the facilities. For the effective security and safety options, the study and evaluation of these ties and its attributes is important. The intersection of the attributes should be used for effective decision-making in the crisis situations; for example: public course and common classes.

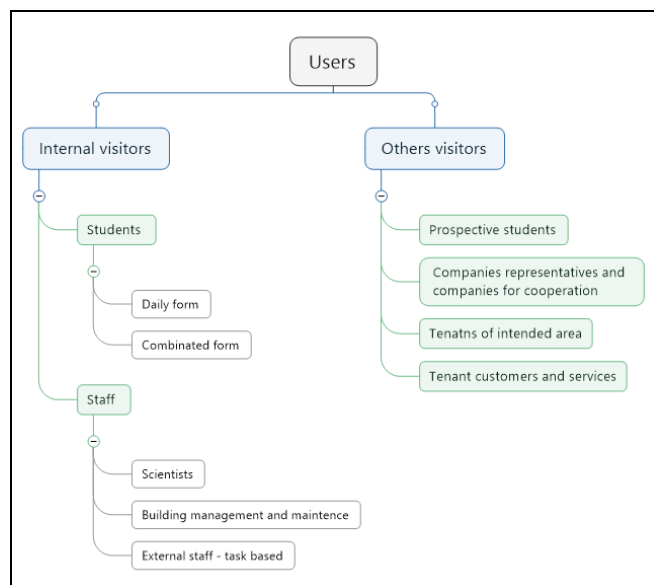


Figure 2. The definition of users.

According to the specification (primary building, second visitors), the management should define the security and safety requirements and furthermore system options. The effective measures should set up rules for visitors in building and manage their movement. The measures have an impact on incident probability. The software will monitor visitors by the effective measures. The visitor has to apply for access by an assigned card. The assigned card has given rules that correspond with the visitor aim. The categorization of visitor with assigned card is depicted in Figure 2. This solution

could be implemented into a program and transferred into the soft targets net. The management of solution could be faster and more effective. The software will replace expert knowledges and then the manager of the object can specify the internal object knowledges.

### VI. IMPACT OF RISK SOURCES

This part of the paper will describe causes of the incidents that could happen in university buildings. In case, that the management of university will know root cause of incident, then the setting of permanent measures will be more effective, because the measures will be implemented for specific event. In the paper, two primary groups of risk sources are defined (human factors, technical factors). These two factors are represented in software by numerical value. In each category, whole range of the values that represents status of these factors is defined.

#### A. Impact and context with measures - Human factors

The factors, which are described in this section, are resulted of survey in educational buildings. This factor also occurs in commercial building; however, the management coordinates it with ISO standard. The human factors are important for definition of typical human behavior and it could be implemented to software solving. In the next part, the main points of human factors are defined.

- Cause of security incident by inappropriate behaviour (unwanted conduct).
- Occurrence of human error negligence, ignorance - without the presence of variations in operational practices.
- Lack of definition and application of security measures in operation.
- Establishment of internal procedures and rules with the help of guidelines that define the desired conditions and the required visitor behaviour.
- The implementation of measures and procedures of the directives in the actual operation of the facilities.
- Monitoring compliance with the security measures binding to the desired level.

It is only the first part of risks. The second part is connected to the technical factors.

#### B. Impact and context with measures - Technical factors

The technical components are used to security measures and also for other use. The technical components, which are used to other use, could have impact to security and safety situation in object. Security technical components are used to achieve more effective monitoring and permanent controlling in object [4]. The security components are designed to support managers and experts. The causes of technical difficulties are defined:

- Improper installation of equipment - technical failure of the device or other parts.

- The failure of the technical component caused by its use.
- Short circuit was caused by other activities.
- Closely related to the definition of procedures for the installation of technical equipment and functional tests and more.
- Closely related to the defined intervals to check the technical component devices.
- Specification of the possible effects of the above mentioned equipment.

The risk sources are implemented to the proposal as inputs for the analytical processes. The proposal of software solving is based on the object characteristics and the sources of risks.

### VII. SPECIAL EVENTS IN UNIVERSITIES

In the research, each process is implemented into a flowchart. It should be integrated to security and safety solution. For integration, primary Deming’s cycle (PDCA model) is chosen. Table I. defines events that can occur at the University and educational objects. The next part of the proposal will define the preventive actions in event planning.

TABLE I. THE CHARACTERISTIC OF SEPARATION IN PROCESSES [2]

Num.	The separation in university processes		
	The Process	The Separation	Groups of person
1.	Educational	Admission process	Prospective students
		Enrolment to studies	Acceptance of candidates
		The beginning of the semester – full-time study	Enrolled students
		The beginning of the semester – correspondence course	Enrolled students
		Exam period	Students who have been granted credits (full-time and correspondent).
		Final exam	Students who graduated and fulfil student’s requirements.
2.	Public events	Conference, workshops and other regulate actions.	Invited guests, acceptable reservations, payments.
		Open door day and other actions.	Public actions.
3.	Commercial sector	Operation of commercial sector.	Clients and business partners.
		Meetings and workshops organized by the commercial sector.	Clients and business partners (it could be public action).

This part of paper defines primary events in educational processes; however, behavior and interest of students in free time period is not presented in these analyses. Free time

period is period between two teaching units or two groups of activities.

### VIII. THE PROPOSAL OF SECURITY AND SAFETY SOLUTION

The proposal has been implemented to two groups of university buildings. In the new buildings or facilities, the proposal should be included in plan documentation for construction. In existing buildings, the application of this proposal is more demanding because of the processes must not be suspended. Both categories are based on similar principle. For the proposed application, fuzzy logic was chosen. The processes definitions are demonstrated in Figure 3.

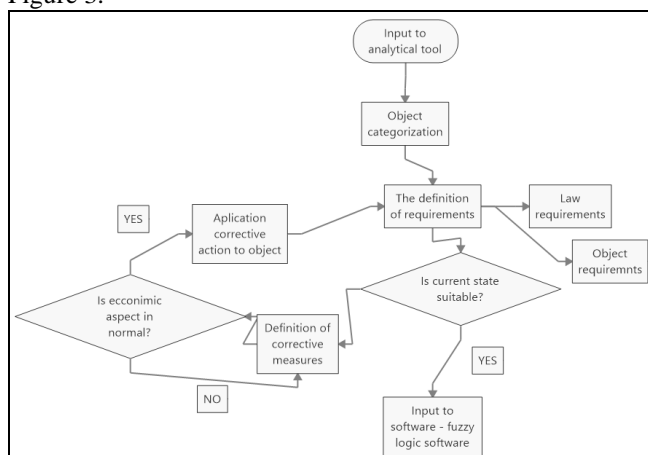


Figure 3. Analytical process and software integration.

Fuzzy logic is based on analysis of real numbers between 0 and 1. Fuzzy logic works with fuzzy statements that are constructed from expert experiences and knowledges.

The first analytical part is based on the object categorization. The software inputs are objects that have defined characteristic properties and measures. The software analyzes the current state in the object and also the control statements. If the current state does not correspond with the required state, the software defines immediate actions or decision making actions [3].

#### A. The proposal for educational object integration

- Analysis the current state (definition of buildings aim, visitors aim, events, categorization of teaching units and processes and definition of acceptable and unacceptable risks).
- The definition of root causes (safety and security solution and suggestibility of other processes in the objects).
- The definition of permanent corrective actions (PDCA model).
- The repeated security and safety analysis (law requirements and management requirements).

Figure 4. shows designed ties between measures in educational objects. The measures are defined in planning

process and also in operator process. Users should define input attributes and this attributes could be set by experts or by building documentations.

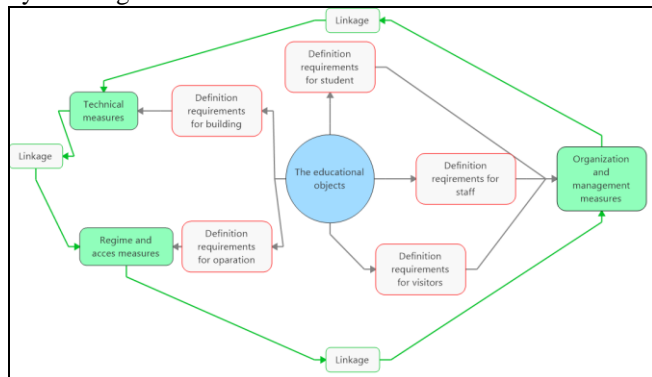


Figure 4. Integration into educational objects.

The next part defines proposal for the division of educational rooms.

- Specific places in object – define the requirements to the access, the requirements for the manipulation with the materials and the machines, definition of the safety procedures for working process, the definition of room aim and definition of risk attributes.
- Non-public space object - these spaces belong to group premises accessible to the public; however, the access control does not require a high level of management. The management defines the same attributes as previous. In these places, specific objects (machine and materials) should not be placed.
- The public space at university – it is not public for everyone (only on Open day door or other specific events); however, the management defines public space as a space, where every person who has aim to be in university can move.

Access to university facilities should be managed and monitored. In case, that the part of the building is used for commercial purposes, the rules for the minimization of possible creation of security incidents should be defined. These rules cannot influence the main activities of the university and supported processes.

*B. The categorization of system layout*

- University areal - defined territory forms a single unit. The university areal consists of several buildings with undeveloped land between them. The complex should be bordered.
- The simple structure of the university buildings – the university is formed by one or more connected buildings (mostly faculties).
- The complex structure of the university buildings - multiple buildings with different distance between them that are in competence of university (located

at the site of one city or the structure also affects flights to another city) [2].

Those types of structures guaranties safety and security procedures which are specified especially in their dislocation. In the case of the complex there is a possibility of managing the entry and exit of the building. The categorization will be set in software. It means, we must use description that is written above for the implementation in a school facilities and a university.

Other approaches are defined separately and it causes that measures are not as effective as can be. The software support will economize financial support and reduces requirements for security operators. These are the main two reasons why the managers and directors do not want to invest money to security solutions.

IX. REAL-LIFE CASE STUDY

The software could help the academic objects. If a university campus is included into the software, an expert can see where people are and what they are doing. If some incident threatens, the expert could have a number of people in the building immediately.

*A. The fire in the building*

In the software we can see, where the fire is, what cause it, who is threaten and what decision expert should do.

Without the software, we could lose time. We could see where the fire is; for example, fire control panel, but we cannot see other information as access, number of visitors, the position of the resources for extinguishing. Other information could be integrated to one system that could provide the expert decision making. Nowadays, the universities integrate more systems in an object; however, the management is different for each other. This proposal could integrate it together. The aim is to unite each output from central unit that manage these components. If the software knows the visitor aim, the expert also knows that visitors are not able to orient in the building.

The reasoning is based on fuzzy rule in the software. The fuzzy rules use the linguistic variables. The form of fuzzy rule is:

**If  $x \in A$  and  $y \in B$  then  $z \in C$ , where A, B, and C are fuzzy sets.**

*B. Example for fuzzy reasoning*

If (security coefficient of events 1 is medium) and (number of visitors is high) then (security measures are medium).

The degree of support for the variable “security measures” is defined by fuzzy set “medium”. The degree of support for the variable “security coefficient” is defined by fuzzy set “medium” and the degree of support for the variable “number of visitors” is defined by fuzzy set “high”. The underlying idea is with increasing number of checks of propositions in premise; the more suggestions could be

derivate. For the degree of support for the truth of the fuzzy proposition “security measures are medium”, the fuzzy implication must be defined. The fuzzy statement defines the degree of support for the fuzzy rule. The defuzzification is process in which the one shape value is determined from the interval [5].

### C. The software solution

The access for visitors is monitored by a card. They will obtain cards in registration process. Management rules are defined with an event plan. After the software are familiarized with the plans, the measures will be done.

This part of paper applies the application into processes in the universities and the school facilities. The measures will be supported by the expert groups. The expert groups are represented by fuzzy statements in software. That is the main reason why this solution could be effective and the management does not need to know any special knowledges about security and safety decision making. The research is aimed to software support; however, we still need the support of training for effective decision making; for example: employee training. The employee training is aimed on a crises situation. They will manage crises situations; for example: attack in a school.

## X. CONCLUSION

The main advantage is the system approach which should manage security and safety situation at universities. The system integration could increase effectivity of all processes. In this paper, the security and safety proposal was presented as a system solution which is used in World Corporation, and also companies and it is called management systems with software support. This paper describes primary processes and identifies possible weaknesses in processes which could be used as an opportunity for improve. These methods are certificated by authorized subject and the effectiveness is verified every day.

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