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THE ROLE OF CCTV IN INSTITUTIONAL ARTWORK PROTECTION AS A SUBSYSTEM OF SMART CITY

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ABSTRACT

When planning the institutional artwork protection of a temporary or permanent exhibition, it is not enough to adopt a template property protection plan or security protocol. In order to develop complex protection plans it is essential to consider professional specialities, since it is necessary to prepare for entirely different risk factors, hazards, and environmental conditions depending on the special characteristics of the protected work of art. In line with the smart city concept, research is also being carried out to examine the needs of smart public service infrastructure, the innovative implementation of which contributes to sustainable development and also provides security functions. In addition to describing the essential functions of closed-circuit television, the authors also highlight the possibilities of further particular parts of closed-circuit television systems installed in smart city environments in the field of the structure of institutional artwork protection.

KEYWORDS

smart city, institutional artwork protection, CCTV, safety

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INTRODUCTION

Artwork Protection, as a concept, covers two large basic areas: the property protection for works of art (complex protection: exhibition, storage, warehousing, packaging, transportation), and the value protection of works of art, as a stock protection (maintaining value and conditions: storage, restoration, conservation), in relation to which a number of research studies, publications and legal regulations have already been presented.

The use of closed-circuit television (CCTV) systems in Institutional Artwork Protection, both for temporary and permanent exhibitions, is supported by the fact that it is not enough to ensure that the buildings or premises hosting the exhibitions comply with basic security requirements. It is very important that they cannot be moved inside or outside the building without inspection or supervision, neither by the institution's employees nor by other persons. Furthermore, the condition of works of art must also be protected, as it plays an important role in Artwork Protection.

Therefore, the planning of Artwork Protection for a temporary or permanent exhibition is not the same as developing a typical property protection plan or security protocol, in fact, much more than that, as it is necessary to prepare for completely different risk factors, imminence and environmental conditions. When temporary exhibitions are organized, the frequency of possible risks and the extent of potential damage also changes from the beginning to the end of the project, and accordingly, the structure of the built-in protection system must be appropriately flexible, and its elements must be determined in consideration of the threats.

With the development of various autonomous intelligent city systems and their expansion, innovative solutions that improve our everyday lives are being applied one after the other, and they have a direct and indirect effect on other systems and processes. Among others, this also necessitated their coordination and the development of the Smart City concept.

In terms of the operation of these autonomous systems, the sensors of the IoT system play an important role, which, connected through different networks, provide various information about the environment [1].

The technology that ensures data transfer between individual system elements plays an important role in these systems' Smart City environments. The adequate technology may be difficult to choose due to the variety of technologies applicable in the given environment and the difference in their technological characteristics [2].

CCTV SYSTEMS IN INSTITUTIONAL ARTWORK PROTECTION

In terms of its basic functions, CCTV is an essential security technical tool for institutions that provide space for exhibitions. Through the design of the CCTV system it can be ensured that the circle of people accessing the images of the cameras can be well defined, and only specific people can reach these images [3]. The CCTV system is a closed video surveillance system in which the data transmission between the camera, the image recorder and the image display device takes place on a closed or open channel in such a way that the transmitted images can only be viewed by a predetermined target group. The basic purpose of a CCTV system is to observe and document the actions in such a way that it can be used later as proof in the course of a trial [4].

The views formed in professional circles must be broadened with such an approach and with a proactive way of thinking that theoretical and practical research are not only visible to one or another protection areas, or only a part of the areas, should be visible should not only be visible for one protection area or a part of these areas. The role of security cameras is not limited to

monitoring the entrance to buildings or rooms that provide space for exhibitions. The cameras provide versatile and continuously expanding capabilities to significantly expand the above-mentioned role. The importance of CCTV system(s) is present from the preparation stage, in the object and room protection, through the processes of transportation, loading and unloading, to temporary storage, or even when highlighting an international example of "profiling", and, last but not least, it has an indisputable role in the creation of "masked" area protection alarm systems.

The CCTV system also plays a very important role in the protection of temporary exhibitions. Only a small circle within the group of those watching the camera images has the opportunity to control the fixed cameras of the CCTV system, as well as to review any recorded images. CCTV systems are used in outdoor surveillance systems, to monitor the environment of buildings (such as the space and environment of the Van Gogh Museum in the Netherlands for "profiling"), interior spaces and/or rooms, but even inside the transport device, container or box into which the artifact was packed. CCTV systems can be installed even to simply monitor visitor behavior and movement in an area where there is no alarm, signaling or artefact protection function paired with the CCTV system.

Good preparation, prior orientation, necessary information and data collection, analysis, evaluation and planning can significantly determine the effectiveness of Artwork Protection and the effectiveness of the CCTV system. This process is similar to a survey before the installation of a general security system, with the addition that all possible events and "negative activities" must be assessed in advance in such a way that they are always "in front of the camera", or become visible, even if the perpetrator (thief, vandal) has an advantage over those providing art protection.

The complexity of Institutional Artwork Protection including the CCTV system always depends on the particularities of the given temporary (or permanent) exhibition, its degree of difficulty and the expected level of danger.

There is no pre-determined date or interval for when, by whom and how to start the preparatory Artwork Protection, but based on experience, it is recommended that in the first phases of the initial period, the persons responsible for the exhibition and the organization (artist, curators, institutional managers) consult with the expert of Artwork Protection during the planning period of the temporary exhibition. In general, it can be said that the institutional Artwork Protection and related preparations should begin days before, but even weeks or months before the temporary exhibition.

The usefulness and applicability of the CCTV system(s) resulting from their basic function is well known in the field of temporary Artwork Protection. At the same time, its role in complex protection is multifaceted, given that in integrated physical protection, the elements of the CCTV system, or the cameras, can typically be installed in almost the entire vertical of the protection structure. During the protection of the institutional artefacts the main functions of the CCTV system can be divided into the following groups based on the nature of the monitored area:

- monitoring the area outside the object and fence (access road, square, park),
- observation of the building's surroundings outside the object, but inside the fence or directly the surroundings,
- monitoring of the spaces within the building,
- monitoring rooms, security center watch,
- special CCTV functions.

Of course, additional groups can be formed according to demand and necessity, but care must be taken to ensure that the Artwork protection is not compromised due to possible lack of transparency.

The grouping also shows that the increasingly specific observation areas represent different risk factors. In the Artwork Protection of Institutions, special attention must always be paid to

the weakest and most vulnerable points of the areas and zones, such as the gates and other points providing access and exit.

OBSERVATION OF OBJECTS AND AREAS OUTSIDE THE FENCE

According to an international approach, 'everyone and everything outside the protected area can be a risk factor, even our friends and family'. Therefore, when designing Institutional Artwork Protection, attention must be paid to being able to access information outside the fence (preferably as soon as possible and at the same time as far away from the protected area as possible), in order to be able to prepare for a possible "event" and at the same time to keep away a poorly prepared "perpetrator". The cameras are built in a clearly visible, strikingly marked (demonstrative) camera housing, which are evenly equipped with lighting, have a distancing effect, which can be enhanced with two property warning signs. Hidden (conspiratorial) cameras, which can even play an important role in preventing possible sabotage against other cameras, can be installed with a different purpose than the ones above.

Day-night cameras must be placed outside the fence that can withstand extreme weather or other possible events (vandalism). Furthermore, it is important to equip them with lenses that ensure, even in minimal light, that the fence and everything else within a few meters is clearly visible. Despite their great advantage, hidden cameras can also be a weakness of the systems, from installation difficulties, protection and power supply, to good image quality, so in such cases it is advisable to install them only with a control role or for security purposes. The increase in temperature causes the cameras to produce more and more noise in the absence of adequate cooling or ventilation. This noise can result in distorted images, which makes the recognition of small details increasingly difficult [5]. A similar problem occurs with low ambient light. The detail and contrast of the image can even be halved compared to normal lighting. In the case of small-format but high-resolution security cameras (e.g. 4K) extremely high lighting (e.g. daylight outdoor lighting conditions) can also cause a decrease in resolution [6].

However, the information transmitted by the cameras deployed to monitor the areas outside the object does not only carry valuable content from a security point of view at the moment of the crime. The new Institutional Artwork Protection involves "profiling", which is carried out by the security specialists of the Van Gogh Museum in the Netherlands as a preventive approach in the field and environment of the institution. If a loud person is detected in the monitor room through the CCTV system, the civilian and security personnel outside the building are notified, and they personally collect additional information to decide whether the person carries a risk or not. For example, if in sunny weather, someone in a big coat, perhaps a hat covering his face, with an umbrella stick or with a strange package approaches the institution, a civil security guard will politely initiate communication about where this person came from, where he is going, etc. With this method, it has already been possible to stop and prevent a damaging act outside the building several times.

In addition to the direct information transmitted by the cameras, there is also a lot of additional information that is useful only in specific circumstances, but which is particularly important in certain cases, for which human power is not enough to analyze, and therefore, artificial intelligence is of particular importance. Additional information can be defined as information that appears in addition to the content of intentionally conveyed information, which represents added value based on specific criteria [7].

Instead of the operator, the video analytics software evaluates the image and gives an alarm when certain criteria are reached. These criteria can be predefined, but most of them can be changed or adapted to the given location. Simpler analytics are static, while more complex ones are self-learning or dynamic [5]. In the processing of the large amount of data generated during

the operation of such a system, the information created by transforming the data collected by various sensor networks plays a key role. Based on this information, serious predictions and important conclusions can be drawn. Therefore, the processing of such amount of data (data mining, data science) provides information that can be used for security [8].

Cameras in public areas serve security in countless cases, but their increasing number raises other questions. Research is also undergoing about the impact of CCTV systems installed in public areas on crime patterns. There are indications that, under certain circumstances, CCTV may also lead to an increase in crime. For example, it can give potential victims a false sense of security and make them more vulnerable as they let their guard down [9]. During today's urban development, various diverse digital, autonomous and physical systems are integrated into the built environment, and it is very important to determine the appropriate evaluation method for their effectiveness [10].

When planning the installation of expensive outdoor camera systems, other aspects must also be carefully considered, one of them being the optimization of the number and location of cameras. In order to effectively install CCTV's, the condition of the built environment and the density of personal traffic must be taken into consideration, while the spatial characteristics of the monitored environment affect the flow of pedestrians. Full monitoring of the latter is very difficult. Research is also being conducted on the placement model of public CCTV cameras using a genetic algorithm. After analyzing the monitoring conditions, the model is able to place the surveillance cameras into the optimal space. In practice, the installation of the cameras cannot always be done according to the instructions of the plan, so its subsequent inspection and analysis is absolutely necessary [11].

OBSERVATION OUTSIDE THE OBJECT, BUT INSIDE THE FENCE OR DIRECTLY THE BUILDINGS ENVIRONMENT

The aim of the installation here is to ensure that the outer part is well-covered, trying to keep the "blind" space as minimal as possible. Cameras connected to other security signals are also usually installed here, such as:

- the camera connected to the hydraulic step indicator,
- the camera connected to the magnetic field sensor,
- the camera connected to the infrared field sensor,
- the camera connected to the microwave field sensor;

which, while giving a signal to the security monitoring center (monitor room) automatically activates a camera and/or cameras in the alarmed area at the same time, and this can be used to collect information about the alarm even more easily. In today's fast paced development, there are of course many other alarm options that can be connected to the CCTV system, such as fence protection devices. At the same time, the CCTV system can effectively support the functions of outdoor protection elements by itself [12]. In the case of the installed cameras, choosing the right optics ensures the accurate monitoring of the activity and identification of the persons. It must be possible to track movement in open spaces without "blind" spots [13].

OBSERVATION OF SPACES INSIDE THE OBJECT

From the point of view of Institutional Artwork Protection, this is perhaps the most complex, complicated and at the same time the most dangerous area, since everything must be subject to Artwork Protection, and in such cases the privacy rights of the visitors and/or employees may be impaired, because cameras often have to be installed in places where otherwise it would not be necessary for general safety reasons. However, the necessity of these cameras must be

understood both by visitors, employees, artist and curators. According to the specific interpretation of the artist and curators, not only the displayed art is the object of the exhibition, but also the installation where the art object was placed, in most cases. Of course, within an object, in case of closed and/or highly important rooms, the special Artwork Protection security devices can control additional cameras in the event of an alarm, or even in the event of movement. According to some professional assumptions, these are theoretically not necessary, since the intruder has to overcome multiple zones, other special security technical devises and in some cases even the protection of manpower, which is almost impossible, but in practice it is used in many cases in rooms for the temporary storage of works of art.

SPECIAL CCTV FUNCTIONS

License plate recognition CCTV systems are well known and can be used as a part of the central CCTV system or as a stand-alone system which can send (provide) a signal to the central system, besides allowing or prohibiting entry, if a barrier/gate entry is connected with the security system. In addition to vehicles, the entry of people can be supported indirectly or even directly with CCTV systems or the central security system, so, for example, the entry of employees can be controlled completely automatically with a facial recognition CCTV system. In this case, it is possible to prohibit the entry of persons who are not authorized to enter at a specific time and in a given place by signaling the CCTV facial recognition system in the monitor room. Regardless whether they have the necessary authorization for the entry (code, proxy, card) or not, the security staff in the monitor room can manually block entry and notify the security service [14].

Given that the buildings of the institution organizing the exhibition may have work areas in which specialized activities are subject to special authorizations or qualifications, the facial recognition function may prove particularly useful. This also effectively supports safety in work processes where the rules require the presence of at least two people. Biometric identification of people has become a rapidly developing area of security technology. The use of biometric identification tools may become an integral part of our lives in the future. Due to its advantages it provides an identification method in which it is difficult to find a security hole in modern devices. A big advantage over possession or knowledge-based identification methods, is that our biometric tickets are constantly available to us. The development of the modern technical background enables its use in areas of security risk where the proxy card or code-based systems cannot be used. Depending on the convenience and the appropriate level of security, biometric identification can be used in all areas of life, therefore it is expected to spread dynamically in the future [15]. The secure storage of data related to certain biometric characteristics of individuals is evident in this area as well, to which special attention must be paid. With the rise of biometric identification systems, more and more accurate data will be mapped on the daily habits of individuals, their routes and so on, while the sensitivity of these data will raise additional security questions. Note that the problem is not new, decades ago the spread of surveillance cameras raised similar problems.

The CCTV system supported by the appropriate analysis algorithm, in addition to its security role, can effectively serve the operation of a Smart Museum in the Smart City project, with its special function which analyzes the activities of the visitors. It is possible to study the on-site interactions and similarities of the visitors, and it is possible to explore new behavioral patterns, so visitor models can be of particular importance when furnishing the physical exhibition space [16].

MONITOR ROOM, SECURITY CENTER, SURVEILLANCE CENTER

The monitor room is the center of the CCTV system, which can also be called the monitoring center or security center. These are all concepts with different meanings, but in case of temporary Artwork Protection this fact can be disregarded, since there is no precise definition of what a security center is like, where the signals of the CCTV system and the information run into, as it always depends on many factors, such as the given temporary exhibition (Value, artefacts, needs). Therefore there are only recommendations, which are always advisable to consider. The central design of a CCTV system should be placed in a "protected" room, where even security personnel have limited access, and only specially authorized persons with adequate theoretical and practical knowledge should manage the system [17].

If required, with special privileges, the entire CCTV system, including the complete security technology and other alarms can be monitored or controlled by persons working in the security center or in other positions, which requires nothing more than a personal computer and a protected line ensuring a secure or an encrypted connection [18].

Data is playing an increasingly important role in order to ensure successful and secure operation, representing an ever increasing value. Because of this, in addition to security, creating an environment that supports information and data security is a fundamental requirement. Data and information of significant value must be protected not only by legislation, but also by the provisions of the organization's internal regulations. These must cover the prohibition of the transfer of confidential and secret company information, the use of the IT and other devices, the way that company data is stored and the access rights [19].

Experience shows that clearly defined and structured regulations create the conditions for the protection of sensitive data. The safety conscious behavior of employees effectively contributes to reducing the risk of the human factor as an error. Given that nowadays the collecting and storage of data is processed and transmitted by using IT tools, the protection of these IT systems is of utmost importance.

SECURITY POWER SUPPLY OF CCTV SYSTEMS

It is very important that the alternative or parallel power supply of the CCTV systems and other security centers must be ensured even in case of Artwork Protection, because even an innocent power outage can cause a very serious problem, as the entire system can collapse for a longer or shorter time. In order to ensure a continuous power supply, not only uninterruptible power supplies must be used, but also alternative power generation, which can be based on renewable, and environmentally friendly, natural sources, or on power generating aggregators.

SUMMARY

CCTV systems are nowadays an indispensable part of a complex protection system in Artwork Protection, both in relation to permanent and temporary exhibitions, and they play an increasingly important role not only in the protection of artefacts and in their stock, but in relation to the mapping of visitor statistics and habits.

During the preliminary assessment of the CCTV needs of the given exhibition, in addition to the asset and stock protection requirements, attention must be paid to the nature of the given exhibition and in many cases to the fact that the given room itself can be part of the installation. It is very important that not only the design and construction of the CCTV system must precede the installation of the exhibition, but that it must also be commissioned and tested before the installation of the artefacts, as well as integrated with other security systems, such as alarm systems, and in some cases with technical means, such as fire protection. The management of

installed and tested CCTV systems must also be taught to users and operators of the system before the installation of the artefacts, and this must be reviewed at intervals and the training must be repeated if necessary or the CCTV system must be modified.

An institution providing space for a permanent or even a temporary exhibition must have various emergency plans and related protocols in place in order to optimize Artwork Protection, since even with the support of CCTV systems, there is no one hundred percent protection.

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