State of the art of consumer video surveillance standards in Russia and abroad

A A Stupina\textsuperscript{1,2,3}, S V Tynchenko\textsuperscript{1,2}, A V Kukartsev\textsuperscript{1,2}, K Yu Lobkov\textsuperscript{1,2,3}, N V Fedorova\textsuperscript{1,2}, and Y V Danilchenko\textsuperscript{1,2}

\textsuperscript{1}Reshetnev Siberian State University of Science and Technology, 31 Krasnoyarsky Rabochy Av., Krasnoyarsk, 660037, Russian Federation
\textsuperscript{2}Siberian Federal University, 79 Svobodny pr., Krasnoyarsk, 660041, Russian Federation
\textsuperscript{3}Krasnoyarsk State Agrarian University, 90, Mira Avenue, 660049, Krasnoyarsk, Russia

E-mail: vadimond@mail.ru

Abstract. In recent years, video surveillance technology has been developing. The use of video surveillance has spread from national and social welfare to everyday life, and a number of consumer-grade video surveillance products have been created. However, there is a problem where the domestic market is still in a non-standard stage. Consumer-grade video surveillance system does not have specific standards, which seriously affect the consumer awareness of the consumer-grade video surveillance products. This article presents a video surveillance system and reveals the standards of an existing video surveillance system.

1. Introduction

Video surveillance is part of our daily lives, even if we do not understand it. They can watch us on the street, on the highway, in ATMs, in public transport, in private and public buildings, in elevators, in front of our television screens and anywhere, where the camera can be installed.

The main direction in security and video surveillance is the development of software that allows target systems to work faster, smarter and more stable. One of the leading trends in the field of video surveillance is to make a camera with all the possible features: 4K resolution, observation in the thermal range, analytics on board. Some of the existing design trends also include miniaturization (the size of cameras becomes small, and the quality of shooting is higher). Thus, the product goes into a high-level price range [1].

The video surveillance system is an electronic network system in which video surveillance technology is used for monitoring protected areas. As a rule, professional video surveillance products are widely distributed in industrial conditions and are especially suitable for work in places with a small number of people. Unlike professional video surveillance products, consumer monitoring products should be easier to install, more practical and more confidential. In recent years, due to changes in consumer demand for video surveillance, companies have increased their investment in studies in the field of video surveillance systems. They are constantly introducing some consumer-oriented surveillance products to the market [2]. This process has resonated across all industry sectors and has become a topic of discussion among ongoing technical studies and standardization.
The implementation of video analytics, the increase in the installation of video surveillance systems, the use of cloud services for centralized data, the use of high-definition cameras, as well as the need for physical security are the main factors in the growth of the video surveillance market.

At the moment, the general price level continues to decline. Many solutions, which used to be premium, are now available in a more budget price range. This lead, first of all, to the growth of IP-systems and their use for small and medium-sized businesses [3].

The appearance of new equipment configurations entails a change in market conditions, giving entry points for new players.

In general, the focus on integration should serve to provide the user with integrated solutions that maximally satisfy all his needs and functional purpose.

Increasing the cybersecurity level of equipment has been the main trend in the video surveillance market in recent years. The increased attention to network security is associated with the active use of IP devices in botnets for hacker DDoS attacks[4].

2. Standards and structure of a video surveillance system

As a rule, a video surveillance system consists of five parts: a camera, a transference, a controller, a storage device and a display [5]. For receiving the external image signal, cameras are installed with some auxiliary equipment, such as lenses, screens, stages and platforms. As for consumer-grade video surveillance products, their structure was not able to satisfy demand in terms of appearance, structure and functions. The video signal captured by the cameras must be transmitted to the server hardware. A traditional video transmission medium includes a coaxial cable, twisted pair cable and optical fibre. With the development of technology, the method of transmitting video information has changed dramatically. Today, consumer-grade video surveillance systems mainly use network video surveillance or IP video surveillance, and digital video information is transmitted over wired or wireless IP networks [6].

The entire camera control system includes decoding, a screen splitter and a video matrix. However, in family use, the function request is uniform, and the professional ability of the device is different. Therefore, equipment should be easier to use. The traditional method of control could not satisfy demand. For the current market of consumer-grade video surveillance, video storage mainly includes an SD card, cloud storage, and NVR storage. Common display devices are monitors and displays. Image signals of all cameras will be displayed on the monitor [7]. Currently, consumer video surveillance products put forward new requirements for display devices. Due to the rapid development of technology, consumers prefer to control the real-time video surveillance system on mobile phones.

Due to the sustainable development of the video surveillance industry worldwide, the following international standards have become widespread [8]:

- **ONVIF (open network video interface forum)** - it is an open industry standard jointly developed by companies such as AXIS, BOSCH, SONY, which describes the network video model, interface, data type and data interaction model, and also uses some existing standards, such as the WS series.
- **Interface Protocol PSIA**, developed by the Physical Security Alliance, which can standardize the relationship between video management systems and various networked media devices. PSIA standard adopts REST architecture. Implementation of the PSIA protocol allows network cameras to meet common standards, which improves the compatibility of network cameras between different manufacturers in the same system. It can recognize the equipment without installing a driver to identify the device.
HDCCTV is a new standard proposed by several manufacturers of microchips and systems in 2009 for the development of high-resolution video surveillance systems. It is the standard of physical, electrical interface for transmitting uncompressed lossless HD video through coaxial cable and is the only electrical standard for the world's most comprehensive HD video surveillance.

In China, for example, with the development of the video surveillance industry, many video surveillance standards have been formed, and the typical standard is GB/T 28181-2016, technical requirements for information transport, switch and management in a network video surveillance system for public safety. The standard defines the structure of interconnects, the structure of communication protocols, security requirements and interface protocols for the transfer, exchange and management of information in the city's alarm system. This International Standard is applicable to circuit design, system testing, acceptance and related research of equipment and development, manufacturing and other information systems that may be used [9].

Today, the consumer video surveillance market is in chaos. For solving this problem, they establish the video surveillance standard 2017-0288T-SJ with the technical requirements of a cloud video storage for video surveillance with large domestic manufacturers [10]. This International Standard defines the general requirements for cloud storage technology for video surveillance and is also applicable to a cloud storage system. Currently, work is underway to develop standards.

With the advance of urbanization and improvement in the security needs of the residents, the market share of consumer video surveillance products is increasing year by year. Figure 1 shows the use of video surveillance systems in various fields.

In consumer applications, video surveillance, is mainly used in these two aspects:

- For family applications: such applications are usually used in residential areas, ranging from tens of square meters to several hundred square meters. They mainly play the role of remote video surveillance, remote alarm and night burglar alarm.
- For small enterprises: such applications are generally used for small commercial enterprises. The main objective is focused on anti-theft, anti-robbery, remote control and surveillance of workers [11].

3. “Security ring”
Currently, most developed countries in the world use video surveillance as the main tool for monitoring population movements and preventing crimes. Video surveillance is, first and foremost, control over the situation and assistance in the protection and capture of criminals. Specialists in law
enforcement and security management in the leading world countries rely heavily on video surveillance as a tool to combat crime and prevent terrorism. Today, video surveillance is an integral part of our lives, as this system guarantees us safety, as well as timely assistance in various dangerous and unforeseen situations[12].

Figure 2 shows the “security ring” - a video surveillance system that covers the entire city and includes video surveillance points for streets and roads, squares and parks, emergency contact points with the police and rescue services.

Figure 2. “Security ring”.

Also, this "Ring" has a sound and light warning system for the population, reference and information terminals, access control and management systems in office buildings and institutions.

The described system is interactive, at any time the dispatchers of the monitoring centres monitor the situation in the city and, depending on the situation, can quickly transmit information to the control desk of the police, fire or ambulance, which in turn will send specialists to the scene to eliminate the consequences of the incident.

The efficiency of data exchange is due to the use of modern wired and wireless means of communication – fibre optic communication channels, Wi-Fi devices and wireless broadband access systems (Motorola), satellite equipment (VSAT), switching equipment (Cisco), radio communications (Motorola, Vertex, ICOM), DECT telephony (Panasonic, Ericsson-LG) and, of course, surveillance cameras (Pelco, Axis, Dallmaer, Sony, Arecont Vision, Hikvision). These systems are used both jointly and separately, depending on the specific task, and are based on professional solutions of leading world manufacturers.

Although the pace of development of the domestic market is not the same as in other developed countries, the study of the video surveillance market abroad still has some background value for domestic experts in this field. To promote the internationalization of internal standards, we can
proceed from the following aspects. In developing their standards, groups and enterprises should not only actively adopt international but also advanced national standards, standards of associations and enterprises in developed countries. Follow development trends and collect, compare, analyze and transmit standardization information in our country and abroad. Actively participate in international standardization events, monitor the latest developments in this field and strive to bring closer and turn domestic standards into international standards.

In general, the video surveillance system in the international market has achieved significant results in a very short period. However, due to the late start in Russia and the lack of research and development, there is still a big gap between domestic and foreign manufacturers.

4. Conclusion
This article presents study the market and standardization of consumer-grade video surveillance products and found that the corresponding market is in chaos, and the product quality is uneven. Hence, it is necessary to establish standards and regulate the market. For analyzing the demand for consumer-grade video surveillance products and related standards, it is necessary to establish specific standards for consumer-grade video surveillance products.

References
[1] Dufaux F and Ebrahimi T 2008 Scrambling for privacy protection in video surveillance systems IEEE Transactions on Circuits and Systems for Video Technology 18(8) 1168-74
[2] Sivaram GV, Kankanhalli M S and Ramakrishnan K R 2009 Design of multimedia surveillance systems ACM Trans Multimedia Comput. Commun. Appl. 5(3) 1-23
[3] Fehr D, Fiore L and Papanikolopoulos N 2009 Issues and solutions in surveillance camera placement In: Proc. of the IEEE RSJ Int. Conf. on intelligent robots and systems pp. 3780–5
[4] Lavee G, Khan L and Thuraisingham BM 2007 A framework for a video analysis tool for suspicious event detection Multimed. Tools Appl. 35(1) 109–23
[5] Nazare Jr A C and Schwartz W R 2016 A scalable and flexible framework for smart video surveillance Computer vision image understanding 144 258–75
[6] Bodor R, Drenner A, Schrater P R and Papanikolopoulos N 2007 Optimal camera placement for automated surveillance tasks J. Intell robot syst. 50 257–95
[7] Blitz M J (2003) Video surveillance and the constitution of public space: Fitting the fourth amendment to a world that tracks image and identity Tex. L. Rev. 82 1349
[8] Huang J and Hong L 2013 Analysis on standards of IP base video surveillance - ONVIF and PSIA Video Engineering 37(1) 175–7
[9] Yabuta K and Kitazawa H 2008 Optimum camera placement considering camera specification for security monitoring In: Proc. of the IEEE international symposium on circuits and systems pp. 2114–7
[10] Foresti G L, Mahonen P and Regazzoni C S 2012 Multimedia video-based surveillance systems: Requirements, Issues and Solutions (Springer Science & Business Media)
[11] Yao Y, Chen C H, Abidi B, Page D, Koschan A and Abidi M 2010 Can you see me now? Sensor positioning for automated and persistent surveillance IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics) 40(1) 101-15
[12] Williams J and Lee W S 2006 Interactive virtual simulation for multiple camera placement In: Proc. of the IEEE international workshop on haptic audio-visual environments and their applications pp. 124–9