

## "Surveillance Cameras Technologies at Imam Abdul Rahman Bin Faisal University"

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#### Abstract:

This study aims to shed light on Imam Abdul Rahman bin Faisal University (IAU) and its pioneering role in field of surveillance cameras, as well as it provides a brief about security surveillance camera systems and their types along with various technologies used in surveillance systems, especially cameras.

Whereas universities and educational institutions are among the most important facilities in the country, the competent government agencies have taken care to prepare the conditions, standards, and specifications for their security situation. This why the current study reviews the relevant document of the technical specifications for security systems as issued by Saudi Ministry of Interior for 1442H year.

#### Introduction:

The technologies of Security CCTV Cameras have developed to be of high-quality images while their prices have decreased in the last two decades, which opened new horizons for applications were not available before. This coincided with the emergence of digital video recording devices, and the evolution of storage media and the massive increase in capacity.

However, real breakthroughs in surveillance camera systems have begun to appear in the last five years, as a result for the development of telecommunications networks and the emergence of new revolutionary technologies such as cloud storage & computing, artificial intelligence, and the processing of very big data, and others. This enabled modern surveillance camera systems to perform tasks that were impossible to perform - five years ago - without the intense intervention of human. For example, it has become possible to identify people's faces and clothes and locate their appearance in the thousands of hours that were recorded by hundreds of cameras only in few seconds, or may track cars by their shape or through their number plate completely automatically, and the cameras are now able to identify traffic congestion places and even count the cars in order to give decision makers an integrated picture that enables them to move in a timely manner, which made camera systems plays a vital role in promising applications such as Smart Cities and others.

### Objectives of the study:

The research objectives can be listed in the following points:

- To review types and systems of surveillance cameras.
- To identify various technologies used in the field.
- To throw light on IAU and its role in activating security systems.

### Surveillance Cameras:

Camera is an electronic device through which still or moving photography, i.e., photos and videos, and it is made up of main parts which are the lens, the processor, and the sensor. These are cameras in general, but when we talk about surveillance cameras, we refer to those cameras that aim to photograph for the purpose of monitoring, recording, and observing the security situation.

“CCTV (closed-circuit television) is a TV system in which signals are not publicly distributed but are monitored, primarily for surveillance and security purposes.” (CCTV (closed circuit television), 2023)

Surveillance cameras have become a necessity and a major requirement in every possible way, as "many companies, institutions and commercial markets are currently installing surveillance cameras as a security mean to check on the progress of work and monitor employees in carrying out their work tasks on the one hand, and on the other hand, the use of these cameras as a monitoring tool has raised the employee's complaint about the violation of their privacy because of the presence of these cameras" (Hassouni and Kaab).

Also, the rapid development in the field of technology has led to an increase of interest in surveillance cameras for their prominent role in our daily lives. Technology brings convenience and well-being to users because of the effort, time, and money it saves. It also increases knowledge and education and contributes to the transfer and reception of information and data double-more than traditional methods.

"Nowadays, the majority of public opinion still conceives video surveillance systems as synonymous of CCTV systems." (Cucchiara, 2005)

This is true as the two terms have overlapping and synonymous where one of the two terms replaces the other, but perhaps the connotation of the term (VSS) is broader and more comprehensive and it refers to the goal and purpose of the system, while the term (CCTV) refers greatly to the machine, devices, and technology.

The viewer of our reality and our lives today has no doubt that technology has become an integral part and an urgent need, and not something additional or a luxury. Technology and what we are talking about here in terms of surveillance camera technologies have become an effective role and a tangible number in achieving the desired goals, such as reducing the crime rate as affirmed by many studies and reseraches. In the United States of America, the use of surveillance cameras has reduced the crime rate by (16%). In some places, such as parking lots, crime has decreased by (51%), and in transportation and public transportation to (23%). And this percentage increases or decreases according to time and place. (Welsh, 2009)

### Types of surveillance cameras

When talking about the types of surveillance cameras, surveillance cameras can be classified and divided based on several criteria and basics. On the one hand, they are divided according to the location and place into internal and external cameras, or you can divide them according to the connection and wire technology into digital and analog cameras, or according to the structure, and here the cameras are in several forms, such as circular cameras and rectangular cameras, on the other hand, surveillance cameras are divided according to their function, such as face recognition cameras, general surveillance cameras, vehicles plate recognition cameras, speed monitoring cameras, night vision cameras, thermal measurement, and others. Accordingly, when talking about the types of surveillance cameras, it is necessary to define the basics and standards considered for their use.

#### Surveillance Cameras Technologies:

Technology can be defined as changes or modifications that a man makes to things exist in nature, in addition to the various tools he/she manufactured to facilitate the work he/she performs, as technology includes many applied aspects of life such as: food, medicine, housing, dress, communication, transportation, sports, science and many more.

Technology also defined as “the application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation of the human environment.” (Augustyn, 2023)

#### Light Catcher Technology:

Which provide clear details of more color from a low-light scene by increasing the amount of light and details captured by the camera along with reducing noise in the image. This combination results in the ability to identify objects of interest more effectively.

#### Infrared Technology:

Many cameras include Content Adaptive IR technology, which is an efficient and flexible way to capture visual detail without an optical light source. Cameras with zoom lenses offer adaptive infrared zoom technology to help ensure uniform illumination across the entire shooting area at a wide range of zoom distances.

“One important characteristic of IR LEDs is that when they operate, they are often invisible.” (Costin, 2016)

#### HDSM Technology:

HD Streaming Technology reduces bandwidth sent from a server to a client by maximizing image details and minimizing bandwidth usage, helping to lower communication costs.

#### PTZ Pan Tilt & Zoom Technology:

It is the rotation technique, meaning that the camera can rotate horizontally and vertically. This rotation is done mechanically without affecting the field of vision or image quality, and this differs from the process of zooming in and out, part of which is digital only.

“The benefits of having a pan-tilt-zoom camera in a security application are obvious. Having a camera which can be controlled from a remote location enables a user to cover a much larger area with a single camera.” (Greg, 2023)

#### **Thermal Image Technology:**

The visible light spectrum is only a small part of the large collection of detectable signals or waves, that travel through the material. The electromagnetic spectrum contains radiation of different types of invisible waves, each with a unique wavelength. Theromo-rays are one type of radiation that has longer wavelengths than visible light radiation. Hence, they are generally invisible to the nkaed eye. Any object with a temperature above absolute-zero emits a detectable amount of radiation. The higher the object-temperature, the greater the amount of radiation emitted. By taking advantage of differences in temperature between objects, thermal cameras convert invisible theromo-rays into "visible" images of heat regions.

#### **Varifocal Technology:**

It is a technology that describes the camera lens as a lens with a variable focal length, which is slightly higher, and its focal length can be changed manually as needed to control the range of vision and zoom. Changing the focal length affects the field of view inversely where the greater the focal length, the smaller the field of view will be, and vice versa. If the focal length is changed automatically and not manually, we call this technology (Motorized).

#### **Facial Recognition Technology:**

It is a technology capable to automatically identifying or verifying a person in a digital image or video frame taken from a video clip. There are many ways in which facial recognition systems work, but in general they work by comparing the facial features of selected photo with the faces stored in a database.

#### **LPR Technology:**

(License Plate Recognition) technology relies on computer, image processing technology, fuzzy recognition, to build the characteristics of the car model, and identify the characteristics of the vehicles, such as nameplate, model, color, etc., so that the plate image can be automatically extracted from an image by using advanced image processing technology, pattern recognition and artificial intelligence of image information and processing collected images, along with identifying plate numbers, characters and Chinese letters can be identified, directly as a result of recognition, makes the system a reality.

#### **WDR Technology:**

“It is natural, and by now rather common, to use multiple photographs to reconstruct an image with higher spatial resolution, a process known as super-resolution or dynamic range” (Lecouat, Jean , & Mairal, 2022).

Wide Dynamic Range technology is used in the event that there is a difference or contrast in the lighting levels in the scene or the place to take a picture of, so that there are places in the scene with high lighting and other dark areas that produce a blurred and distorted image, and thus this problem is addressed using cameras Equipped with the WDR feature, where a high-purity image is produced in different lighting levels by making compensation or balancing the lighting levels in the image. (WDR) is measured using the decibel (db) unit, and whwnever this value is higher, the image quality will be better, where its highest value is 120db.

There are two types of WDR technology, the first is known as (Digital WDR), in which the high and dark image lighting is processed programmatically using Software, while the second type is known as (True WDR), in which the high and dark image lighting is mechanically processed using (Shutter) where the Shutter speed to allow a smaller amount of light to reach the sensor in high-light places of the scene and produce a first image, and the shutter speed is reduced to allow a larger amount of light to reach the sensor in dark places of the scene and produce a second image. The two images are merged in a third image of high quality and clarity. And since (True WDR) technology is a physical-mechanical technology it gives better quality results and images than (Digital WDR) technology.

### **IRIS Technology:**

The (IRIS) technology determines the amount of light reaching the image sensor, just as it happens in the iris of the human eye, where in the case of bright light, the iris narrows to reduce the amount of light entering the eye, and vice versa, in the case of complete darkness, the iris expands to deliver the largest possible amount of light into the eye. The iris is an aperture called (aperture or lens aperture) that controls the amount of light falling on the image sensor. (Focal Length) over the aperture diameter.

This coefficient is written in the camera data in an image ( $f / 2.8$ , for example), and therefore there is an inverse relationship between this coefficient and the amount of light arriving at the image sensor.

The (iris) can be divided into three types, the first is known as (fixed iris) where it is not possible to control the width or narrowness of the aperture, and therefore it does not allow controlling the amount of light falling on the image sensor, and it is cheap and used in places where the lighting is fixed throughout the day, such as schools and offices. The second type is known as (Manual Iris), in which the amount of light falling on the image sensor is controlled using a (Ring) that is moved manually to widen or narrow aperture, and thus increase or decrease the amount of light reaching the sensor, often this type is used in indoor places where slight changes in lighting occur. As for the third and last type, it is known as (Auto Iris), and in this type, the amount of light falling on the image sensor is controlled automatically by a motor that controls the diameter of the aperture responsible for increasing or decreasing the amount of light reaching the sensor, and it is divided into two types: (DC Iris) and (Video Iris) where both of them use a motor that controls the diameter of the aperture, but the difference between them is in the location of the motor control circuit, where in the type (DC Iris) the control circuit is in the camera itself, while in the (Video Iris) the control circuit is in the same lens.

The third type, i.e. (Auto Iris), is used in outdoor areas where there is a clear and significant change in the lighting ratio.

### **PoC & PoE Technology:**

The first stands for (Power Over Ethernet) and the second stands for (Power Over Coaxial), and they are among the wonderful features and technologies provided by some cameras, which allow both the feature of merging the electrical power supply with the signal in one cable, which saves a lot of the cost of cable extension and the time required to determine and install its paths. PoE technology is available in cameras connected to the network (IP Cameras) and allows the transmission of feed through (UTP) cables, and the second is available in analog cameras or (HD over coax) cameras and allows the transfer of feed through coaxial cables.

Surveillance cameras at Imam Abdul Rahman Bin Faisal University (IAU):

During the past years, the Kingdom witnessed a major development renaissance in all urban, economic, and social fields, and IAU, like other universities in the Kingdom, has become one of the universities that is witnessing development in various fields, and it has occupied a prominent place among Saudi, Arab and international universities.

In light of the accelerating pace of life, and the rapid growth in various fields, new types of criminal behavior, violence, and other manifestations have emerged that threaten the educational process and the students and employees of the university, and there has become an increasing importance for the use of security systems at the university, and in particular the use of surveillance cameras to protect property and provide security and safety as well in the university, and to provide the necessary evidence in detecting crimes where security studies have proven -in many major universities- that the expansion of the installation of security systems had a major role in decreasing the percentage of crimes of all kinds, as the work of these cameras with continuous monitoring and continuous recording of all events was one of the most important factors to prevent criminal incidents, as one of the main means provide forensic evidence in case of crime occurrence.

Over the past few years, the university has made tremendous efforts in installing different types of security cameras with multiple specifications, to provide the necessary protection for property, some of which have proven good efficiency in operation and documentation, while others have not met the minimum-security monitoring requirements.

The major objectives of IAU surveillance camera systems:

- **To achieve security security control.**
- **To prevent crime occurrence.**
- To build an integrated audio-visual database.
- To provide forensic evidence for security sector competent of crime fighting.
- To raise IAU ability to detect crime and trace wanted or suspected individuals.
- To achieve a qualitative leap in field of security protection systems of IAU buildings and vital facilities can be used as a rapid response to security sectors in case of emergencies in an organized manner.
- To provide other advantages such as controlling cases of ethical and behavioral violation, monitoring the behavior of workers, dealing with students, speedy completion of work, and others.

Hundreds, even thousands of cameras have been installed at the university in buildings, fences, halls, etc. These cameras are managed through a central monitoring room affiliated with the General Administration of Security and Safety at the university. There are also sub-monitoring rooms in each building that are under the responsibility of the entity, whether this entity is a college, a deanship or any. (Safety, 2023)

The university is keen to adhere to all the conditions and standards issued by the Saudi Ministry of Interior represented in the security conditions and requirements document for installation of surveillance system and the general technical specifications for the surveillance systems devices through dealing with many leading companies in the field such as (Pelco), (Hikvision), (Honeywell), (Samsung), (Avigilon), (sony) and others.

#### Conclusion:

Surveillance cameras are used permanently in all places, including universities, with the aim of reducing thefts and combating crimes in general, through recording and imaging that the cameras do when installed in the specified place and give clear results, high-quality pictures and videos, as they can detect the face of the thief or the perpetrator easily -if the crime or theft occurred- as the surveillance cameras can intimidate the thief, so when he/she sees that the place he/she wants to steal, for example, is full of surveillance cameras, he/she will not complete the theft process because he/she is well aware that the competent authorities will reach him/her easily through these cameras.



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