

Smart cities Cybersecurity - Challenges and Prospects

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Abstract

Through this research, we aim to identify smart cities, their characteristics and objectives, and the role of cybersecurity in protecting and sustaining them. We will also present some of the experiences of smart cities worldwide.

Cybersecurity has been found to protect smart cities from various cyber threats, protect personal and government information and data, and address gaps within smart city systems.

Keywords: Smart cities, cybersecurity, Cybercrime, information technology.

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Introduction

A few years ago, the world witnessed an information technology revolution shaping the twenty-first century's features. This impact was reflected in people's lifestyles, education, and work.

This technological development was also accompanied by a development in the concept and terminology of the city, so different names appeared for it. It was called intelligent and digital cities, virtual and electronic cities, and other labels. These cities are distinguished from other cities in terms of being modern. They have a sophisticated digital system that is employed to improve the quality of services and the quality of life for citizens through very advanced devices and intelligent technologies.

Smart cities use information and communications technology to transfer and receive data and analyze it to help citizens, institutions, and governments make better decisions to improve their quality. However, with this massive amount of collected information, there is an increase in the range of risks that begins from individuals who commit various methods of fraud and penetration, which end with some physical and electronic risks such as disruption of traffic signals, which may cause traffic accidents inside intelligent cities, in addition to some cyber-attacks that target institutions by stealing some of their information. These cyber-attacks and others are not limited to exposing individuals and institutions to danger but go beyond exposing several governments and countries to the line of fire, which makes the task of those responsible for the subject more difficult. This is what necessitated states and institutions to find mechanisms and solutions at the local and international levels. These solutions are in cybersecurity, which aims to protect networks, computer systems, and digital data. If leaked, cybersecurity can restore them as soon as possible in order to maintain the confidence of cyberspace users and stakeholders within smart cities. Based on the above, the problem of our research was as follows: How can smart cities achieve cybersecurity in light of the challenges of cyberattacks?

Hypotheses of the study:

To answer the research problem, we formulated the following hypotheses:

Smart cities rely on an infrastructure made up of various technologies.

Cybersecurity is the true guarantor of the continuity of smart cities in development.

Objectives of the study: This study aims to shed light on smart cities and cybersecurity, clarify their most essential elements and their importance, and then show the extent to which it is necessary to include cybersecurity in smart cities through some Arab and global models.

Research Methodology: This study employed a descriptive approach, through which the theoretical background of smart cities is identified, the importance of cybersecurity is also identified, and the nature of the relationship and impact between smart cities and cybersecurity is analyzed by highlighting various leading Arab and global experiences of smart cities.

First: The Conceptual Framework for Smart Cities

1- Historic Background of Smart Cities

Digital or smart cities first appeared at the European Digital City Conference in 1994. In 1996, Europeans started the European Digital City project in several European cities, which met with modest success. The European authorities then built Amsterdam as a digital city, followed by Helsinki. Several attempts were made to declare it a smart city in the United States of America, but most took a commercial rather than a comprehensive civil character. (صفحة 2022 زهرة، 147)

The term has been used as a synonym for digital city, information city, fiber city, and knowledge-based city for electronic communities associated with digital spaces. Digital networks and software applications are a dominant form of collective spaces, where digital networks cover and facilitate various dimensions of cities' economic and social life. (صفحة 2020 موسى، 11)

2- Smart Cities

There are many and varied definitions of smart cities, and it was unanimously agreed that there needs to be a unified definition. The definition of a smart city in the third world differs from that of Europe. Some see it as a modern urban area that depends on the infrastructure of the information and communication society, and some see it as an urban cluster based on several pillars, including the social, technical, and environmental pillars. Each researcher knows it according to his specialization and environment.

(couples) defined the **smart city** as "a comprehensive simulation based on web technology to carry out the normal functions of city dwellers in an

electronic manner and carried out by natural persons in an ordinary city. It is praiseworthy (بإدريس، 71، صفحة 2017) for this definition that it mentioned the link between smart cities and the geographical aspect, while it is taken to mean that it did not give great importance to those specialized in the technical field, computers, and networks and that ordinary people run this type of city.

Cohen also defined the **smart city** as «the metropolis with communication links and network engineering that is governed by the IT sector to carry out information exchange operations (صفحة 2011-2012 لبال، 46)." This definition is praiseworthy for its focus on the aspect of grid engineering, which is a fundamental pillar for the establishment of smart cities, and it is taken that this definition does not address the other aspects that make up smart cities, such as the social and environmental aspects.

Smart cities are also defined as: "An urban cluster that includes three basic elements: technical, social and environmental basis. It is three cities in one: virtual or information, cognitive and environmental, and the place where the virtual and real world meet." (صفحة 2021 لطرش، 190) This definition is praiseworthy as it is more comprehensive because it mentions the various aspects of smart cities the, the technical aspect that provides various technologies to run the city, and the social and environmental aspects.

Finally, there needs to be a universally unified definition of a smart city. Therefore, the term smart city has different interpretations from one city to another and from one country to another. For example, smart cities in our Arab world differ from those in the developed world.

3- Smart Cities

The characteristics of smart cities were identified in the following points:

Innovative economy (competition): global productivity, brand, creativity, and marketing flexibility so that there is integration into local and international markets and the ability to transform.

Innovative society (human and social capital): percentage of education, social ethics, level of qualification, quality of social interaction given to integration and participation in public life and openness to the outside world, creativity. (صفحة 2018 نصر الدين، 122)

E-government: Smart government means enabling new forms of e-government that adopt new methods of governance and advanced models of

virtual simulation of reality with a technical administration capable of dealing with the variables of the city informally. This government is more transparent, participatory, and subject to criticism and accountability.

Competent user: It is intended that the urban user will be more aware, empowered, and inclusive of all smart city technology and infrastructure to achieve the principle of empowerment, active participation, and maximum utilization of the available city services and ensure his right to participate in decision-making. (صفحة 19، 2019 الجميلي،)

4- Smart city targets

Preparing the city's infrastructure to achieve the population's expectations and needs through planning and organization regarding the services provided in all areas of individual life.

- Ensuring the population's quality of life by following technological strategies and accurate scientific data.
- Providing intelligent solutions that serve the city and residents in all fields.
- Transforming the city into a “human-friendly city.”
- Provide a clean and sustainable environment for the city. (صفحة 284، فاطمة وبنلباد، 2019)

Second: What is cybersecurity?

1- Cybersecurity

cybersecurity is a combination of processes and techniques practiced. It aims to protect programs, applications, networks, computers, and data from attack and immaterial or moral security related to data and information from any attack, deliberate damage, theft of information, and control of correct access to devices, applications, and networks to protect them from damage that may occur through networks in Cyberspace. (كلا، 2022، صفحة 298)

This definition is considered more comprehensive than it mentions the material and non-material aspects that cybersecurity protects, and it is considered that it does not mention the cause of this attack and damage, as it may be an individual or some enemy countries or institutions.

We conclude that cybersecurity is all organizational procedures aimed at protecting software, computers, and various forms of information, in

addition to the human capabilities that work to confront Cybercrime and various espionage operations...etc.)?

2- Concepts Associated with Cybersecurity

The Internet is linked to the construction of a new **space**, virtual Cyberspace, as this concept first appeared in the eighties of the last century in one of the science fiction novels by the American-Canadian writer (William Gibson), who wrote several that included this concept to take with the Internet meaning of the new space of communication (صفحة 66، 2016)

2.1 Definition of Cyberspace

The French Agency for Information Systems (ANSSI) defined it as: "The space of communication formed through the global environmental linkage of automated processing equipment for digital data." (صفحة 1017، 2018 زرفة). The technical aspect of processing equipment and digital data is praiseworthy for this definition. At the same time, it is taken for not mentioning the human aspect, which is essential in the continuation and development of Cyberspace.

Frederick May defines **Cyberspace** as a new human and technological environment for expressing opinions and ideas. It mainly consists of people from all countries, cultures, languages, ages, and professions through the digital communication infrastructure that allows the digital exchange and transfer of information. This definition (2020 خيرة) is more comprehensive because it mentions the two fundamental aspects of Cyberspace: the technical aspect and the human aspect.

Cyberspace is a technical environment for information that consists of physical and non-physical elements, such as various devices, technologies, network systems, etc., and the human element represented by users and workers.

2.2 Definition of Cybercrime

Marco Rossini also defines it as: that is, the adaptation of military electronic capabilities in order to influence, disrupt, and destroy other sites, whether civil or military services (صفحة 379، 2021 مسلم). This definition is praiseworthy for its focus on the political and military aspects, so it can be considered a political-military definition. It is taken that he did not focus on the other aspects of Cybercrime, the "economic, legal, and social" aspect.

Cybercrime is "any illegal, unethical, or unauthorized behavior related to the automated processing or transfer of data. A group of experts developed this definition referred to for discussion at the Paris meeting held in 1983 within the circle of crime related to information technology (المایل، 2019، صفحة 246). This definition is praised for mentioning the moral and legal aspects of Cybercrime, while it is taken for not mentioning the Internet networks and websites that represent a pot

From the above, it can be said that Cybercrime is a group of illegal acts and actions that are carried out through electronic devices or using information and communication technology to target websites, systems, and data

2-3-Definition of Information Security

Information security is definedas: "Those visions, policies, and procedures that are designed and implemented at different levels, individual, institutional and societal, and aim to achieve the various elements of protection and maintenance that ensure that confidential or reliable information is achieved (صفحة 2021 حميدة، 348) any guarantee that an unauthorized person will not enter the information system. According to this definition, the levels of information security are individual, institutional, and societal.

Information security can be defined as a set of preventive measures that are used, whether in the technical or preventive aspect, to preserve information, hardware, and software, in addition to procedures related to the preservation of workers in this field (صفحة 164 امينة، صفحة). This definition is praiseworthy as it is more comprehensive, as it touches on the technical aspect of information security (hardware, software) and mentions the personal aspect (workers).

2-4- Definition of Cyber Deterrence

The most common definition of the term cyber deterrence is the definition of General André Buffer, which he presented as preventing an enemy state from deciding to use its weapons (or more generally) to prevent it from acting or responding to a particular situation by taking a set of measures and actions that pose a sufficient threat to it. The result to be obtained by the threat is a psychological result.(صفحة 2022 جمال، 416)

Cyber deterrencecanbedefined as a set of measuresthatcountervarious cyber-attacks and protect the security of countries and institutions.

2-5- Definition of Cyber Terrorism

Cyberterrorism has traditionally been defined as the unlawful use of force and violence against persons or property to intimidate or force governments, ordinary people, or any part of them to achieve social or political goals. This definition is praiseworthy (صفحة 532، 2021 لحر،) for its political and social aspects, but it is considered that it does not address the technical aspect.

The United Nations also defined cyberterrorism in October 2012 as the use of the Internet to spread terrorist acts (صفحة 303، 2022 جدو). This definition is praised for mentioning terrorist and hostile acts and neglect of other aspects, such as the threat of force.

Cyberterrorism can be defined as "physical or moral threat and intimidation through the digital media of states, institutions, or even individuals, and poses a threat to the security of states and individuals."

3- Cybersecurity

On a networked day, everyone benefits from the CyberDefense programs. The importance of cybersecurity is as follows:

- Safeguarding the information, its safety, and homogeneity by stopping hands from tampering with it.
- Checking the availability and readiness of the data at the time of need.
- Exploring weaknesses and gaps in systems and addressing them.
- Using grand-source tools to achieve cybersecurity principles.
- Providing a very safe work environment through online work. (السرطان، 2022، صفحة 12)

From the above, the issue of security and protection is one of the most critical issues of this area, as it works to protect personal and government information and data. It also works to address the gaps within the systems of smart cities. It also works in the service of official bodies, countries, and organizations by protecting information and data related to their national security. As for cybersecurity protecting individuals, it does so by preventing extortion attempts that occur within the digital space that harm the reputation of the individual (especially girls in Arab societies), in addition to protecting personal data such as those on social media sites

and also protecting information about the intellectual property of individuals.

4. The relationship between smart cities and cybersecurity

The relationship between smart cities and cybersecurity is interdependent and complementary, meaning that smart cities can only be created with the presence of cybersecurity that ensures the protection of the smart city from various penetrations. However, the smart city remains vulnerable to many threats or risks resulting from breaches (piracy, whether individual or collective) in its cybersecurity. In this case, smart cities must develop a robust security strategy to maintain their cybersecurity(بوضياف، 2022، صفحة 512).

This is done by empowering municipalities with tools, systems, and individuals who can effectively defend the electronic borders of the smart city. Proper planning is needed to deal with such cases, and business continuity plans and related disaster plans must be fully prepared and tested to ensure that the smart city continues as systems have become unavailable due to malicious piracy. Careful selection of connected institutions through smart systems and services is necessary to ensure their efficiency in applying cybersecurity standards.(غزالة، 2021)

In order for smart cities to thrive and continue, they must be protected by cyberdefense systems

5- Global realistic models in the field of smart cities

5-1- Dubai Experience

Dubai is one of the most essential smart cities in the Arab world. The Dubai Government's strategy is based on six pillars: transport, communications, architecture, infrastructure, financial services, and electricity. The Internet of Things also represents a largely tangible reality in Dubai under the leadership of the Dubai Electricity and Water Authority (DEWA) for one of the first initiatives, which represents the deployment of 200,000 smart meters that allow citizens to monitor their consumption of electricity and water through the Internet or their mobile phones. In addition, Dubai Police has developed innovative services that allow citizens to locate the densest traffic areas, report accidents, and deploy about 650 television surveillance cameras to monitor commercial sites. (فلاق، 2020، صفحة 176)

5-2- The New York Experience

Some believe that New York is one of the most polluted cities in the world due to its status as a center of finance and business. Because it is characterized by high population density, this is what made those in charge of it decide to build the "Hudson" project, which is a small city next to the city of Manhattan to be one of the largest smart cities in the world, the city sits on an area of twenty-eight acres, everything will be tracked digitally to (صفحة 171، 2019 بلفيدوم) help reduce pollution. In addition to supporting the role of cybersecurity by giving it and empowering it with various modern technical devices to track and address various technical problems and protect this smart city from various cyber attacks

5-3- The experience of the city of Mecca

Mecca is considered one of the most important religious cities in the world. It is a city sacred to Muslims and receives millions of pilgrims annually, so it is considered one of the most tourist cities in the world. Those responsible for it have taken the initiative to transform it from an ordinary city to a smart city. This initiative aims to renew the existing infrastructure and expand its scope through the municipality and the Ministry of Hajj to integrate services so that visitors to Mecca and pilgrims can obtain electronic services. The municipality relies on geographical information systems to help track the movement of Hajj and provide information. The municipality of Mecca has also used an intelligent transport system to monitor traffic, reduce traffic congestion, reduce accidents, and raise public safety. (07 القاضي، صفحة)

In addition, the city of Makkah studied the various weaknesses in information security and the technologies on which this city is based to guide cybersecurity in securing and protecting data and addressing various cyber intrusions and attacks.

5-4- The experience of the Colombian city of Medellin

It is one of the largest Colombian cities that turned from a backward city to a tourist city and an example of the efficiency of urban planning. In 2005, the city exploited all its potential for developing poor areas and raised the slogan "Peace through education and community building." The city also focused on the field of security and transport. Thanks to this, the city of Medellín has become one of Colombia's most important cultural centers. The city has made significant progress in the field of

transformation into a smart city. The initiatives launched by the government have encouraged individuals' participation in social and economic issues. One of the projects included providing open data sources to help individuals make decisions that help improve and facilitate their lives. Intelligent technologies have also helped to enhance transparency in government departments. (صفحة 26، 2021 النوي) The government has also launched some initiatives to enhance cybersecurity. These initiatives have contributed to reducing the rate of Cybercrime and avoiding various risks related to the infrastructure of this brilliant city.

It is good to look at these global experiences and try to imitate them in some successful aspects, such as urban planning, organizing transportation, and providing cybersecurity, without copying them literally. Each country has its navigator and features that distinguish it from the rest of the countries, and each city and its economic potential, in addition to the quality of the society it develops for it. This is what makes each smart city somewhat different from other smart cities. Smart cities in the third world and brilliant cities in the Arab countries are not the same as in developed countries.

6- Cybersecurity Risks to Smart Cities

According to the IHS report, smart city devices will exceed one billion units by 2025. These Internet-connected devices transmit massive amounts of data that expose them to risks due to the charging stations of electric vehicles, data for surveillance cameras, parking lots, and GPS systems, which contain confidential information for citizens. They pose a cybersecurity threat. Users' data can be easily accessed and used for illegal purposes. Therefore, the government must strengthen the security borders of smart devices and supporting infrastructure. (بوعموشة، 187، صفحة 2022)

The linking of computers in smart cities to each other through a communication network leads to the rapid transfer and circulation of security information and data, which leads to the shortening of time, which is what the electronic dealer is looking for inside the smart city, and this facilitated the process of intruding on that information or data, which ultimately leads to piracy and theft, as these crimes target banking institutions, insurance companies, private companies or financial value institutions and e-commerce sites located inside smart cities (154 خضر اوي، صفحة)

In addition to the problem of interconnection between innovative systems within smart cities, another problem that is a concern is that attackers supported by enemy countries sabotage the operations of an entire smart city. Risks also include that attackers supported by enemy countries sabotage the operations of an entire smart city.

7. Increasing the level of safety in smart cities

Security and safety are among the necessities of daily life inside and outside the home, as these technologies used inside smart homes in smart cities contribute to raising the level of security because they provide advanced protection systems, such as surveillance cameras, tracking sensors, and linking them directly to the owner of the house either through his smartphone or directly linking them to his police station, as it is used in the resorts of the company (smart home) in the United States of America. In addition, traditional keys can be replaced with modern electronic cards to identify the identity of people entering the house with the time and door number, as each card has a different serial number than the other cards. (11، صفحة 2014 النفيسة).

All these technical measures help the safety of smart city residents. Information security and privacy must be addressed, and individuals' privacy must be protected. This can only be done by activating cybersecurity and enabling it with various digital technologies to protect the information of smart cities from any penetrations.

Conclusion

From the above, it has become clear that the era of technology based on information and digital media has become an indispensable reality in the daily lives of individuals. Various smart digital devices are no longer seen as dispensable whenever necessary, but knowledge of them has become imperative. It was also found that their use in the service of the city and the transformation of city spaces into intelligent spaces created many problems and risks, and this necessitated the emergence of cybersecurity in order to protect and secure data, networks, computers, and software, and protect the private lives of individuals from extortion and penetration of data and personal information. The existence of cybersecurity in smart cities is imperative in order to protect their infrastructure and ensure its continuity.

Recommendations

- ✓ Security for information technology systems is necessary to create the appropriate climate for the success of smart cities.
- ✓ To maintain security and user privacy, working to develop a digital structure in line with technological development.
- ✓ Users
- ✓ Strict laws are needed to protect customers and smart city institutions from spying operations on accounts.
- ✓ Governments should develop infrastructure projects and local governance systems to be compatible with smart cities' requirements.
- ✓ Benefiting from the experiences of developed countries in establishing smart cities.

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