Acoustic firearm detection and location detection systems use sensors to detect sound waves while also informing security forces. The location of the shooter and the number of shots fired are both analyzed and reported to the police force headquarters in this system.

Smart Security

REPUBLIC OF TURKEY
MINISTRY OF ENVIRONMENT,
URBANIZATION AND CLIMATE CHANGE

DIRECTORATE GENERAL OF GEOGRAPHIC INFORMATION SYSTEMS

Smart Cities Capacity Building and Guidance Project

Training Manual

REPUBLIC OF TURKEY
MINISTRY OF ENVIRONMENT,
URBANIZATION AND CLIMATE CHANGE

SMART
SECURITY

Smart Cities Capacity Building and Guidance Project

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DECEMBER **2020**

"We will broaden new horizons in urbanism with smart cities. We will support all Smart City applications that will expedite the daily life of our people, from access to municipal services to the management of transportation, energy, buildings and devices."

"We are pursuing for constructing smart cities."
"We are setting out the principles to meet the future needs of our cities, not the past or present needs."

"We will leave cities which have identities, to be proud of, to find traces of our civilization for our future generations."

"What is the main thing? The main thing is the human. We will provide opportunities for the human."

Recep Tayyip ERDOĞAN

President of the Republic of Turkey

REPUBLIC OF TURKEY
MINISTRY OF ENVIRONMENT,
URBANIZATION AND CLIMATE CHANGE

"The yields of technological developments are reflected in urban life with the concept of smart cities. One of the elements that makes up the city is culture and the other is happiness of the human. What needs to be considered is to build cities that preserve the cultural fabric and reflect their own identity. I believe that both history and culture should be strictly preserved while making cities smart."

Murat KURUM

Minister of Environment, Urbanization and Climate Change of the Republic of Turkey

SMART SECURITY
Smart Cities Capacity Building and Guidance Project

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Preface

Urban populations are increasing day by day in our country and in the world, and as a result of this mobility, cities have to cope with new needs in many areas such as infrastructure, affordable housing, water, environmental cleaning, health services, transportation and security.

The concept of "smart city" comes to the fore in responding to these needs and even creating opportunities for urban development.

With its ability to transform the information it offers into social benefit, the smart city will create gains in the titles of sustainable development, competitiveness and environmental sustainability, increase the quality of life, contribute to economic development, and serve to prepare our cities in a way that reflects the perspective of history and civilization. However, the implementation of smart cities will contribute to the realization of many goals such as "Sustainable Cities and Communities", "Accessible and Clean Energy", "Industry, Innovation and Infrastructure" and "Climate Action" specified in the United Nations Sustainable Development Goals.

In our country, parallel to the whole world, smart city applications are becoming widespread day by day. Therefore, it is important that all public institutions, local administrations, universities, the private sector and non-governmental organizations act in a collective action in order to plan and direct smart city studies on a national scale.

With this motivation, it is to gain the ability to work together by bringing a holistic view at the national level to smart city policies in our country. At the same time, it is necessary to ensure that the investments are implemented with the right projects and activities by prioritizing the investments that are compatible with the determined policies. For this purpose, the 2020-2023 National Smart Cities Strategy and Action Plan, which was built with the common mind of ecosystem stakeholders, which considers national needs and priorities holistically, has been prepared. With the 2020-2023 National Smart Cities Strategy and Action Plan Circular No. 2019/29, it was published in the Official Gazette dated 24 December 2019 and numbered 30988 and entered into force.

The "Smart Cities Capacity Building and Guidance Project" was implemented by our Ministry in order to contribute to the realization of the actions, duties and responsibilities defined within the scope of the 2020-2023 National Smart Cities Strategy and Action Plan on a national scale and to increase the capacity of all stakeholders, especially our local governments.

This document you are reading is one of the guidance documents prepared within the scope of the aforementioned project, and all guidance documents can be accessed at www.akillisehirler.gov.tr.

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INTRODUCTION: SMART SECURITY CONCEPT AND SAFE, DURABLE CITIES

Our age is an "age of metropolitan cities, metropolitan cities and urban regions". As of 2007, more than half of the human population has come to live in cities. It is expected that 3 billion more people will be added to the urban population by the year 250 and the population living in cities will reach 69% (UN, 2010). At the same time, cities are places that play the main role in economic activities today. The fact that half of the global production of goods and services is realized in only 300 metropolitan cities today (Brookings Institution, 2012) shows that the focal point of our age is metropolitan cities. These developments create significant pressures on urban infrastructure, ecosystem and social structures and bring along important security problems.

The safety of cities as a whole, as well as specific issues such as the management of public spaces, infrastructure development and operation processes, the safety of the public, the security of economic enterprises and assets, has become the subject of considerable effort. The increase in the world population and denser population in narrower areas caused the number of people affected by disasters to increase rapidly. Floods and storms, especially starting in the 1950s and accelerating after the 1960s, have come to the fore as the highest number of disaster types. On the other hand, epidemics and disasters based on earthquakes have also increased considerably (Kundak et al., 2016). As a matter of fact, the Covid 19 Pandemic we are in has clearly demonstrated that epidemics are still a significant threat despite technological developments in terms of the rate of spread and the population it affects. Despite the increase in the number of disasters, while the loss of life was much lower than before 1950, it is seen that these losses tend to increase rapidly after 1970. Kundak et al. (2016) showed that economic losses due to disasters also increased rapidly after 1980.

The transformation to smart cities has become very important due to concerns over such problems. Many smart city solutions are expected to transform into safer, more resilient cities. Wireless communication systems based on open industry standards, which connect different elements such as buildings, infrastructure, management and planning, are the basic elements for smart cities (Al-Hader et al. 2009). As we will mention below, they can make the urban space safer and can be the source of new urban security problems that concern large masses.

Smart cities can be called truly smart cities if they are cities where their social, economic and environmental systems work in integrity, where natural resources are protected, and they are safe and capable of coping with disasters and crises. As a matter of fact, it is the duty of every city administration to move a city to this level without creating new security problems.

Under this first title of the guide, the concept of security and its capacity to withstand and cope with disasters and crises is explained, the security problems in cities with complex socio-technical systems are summarized, and the two sister concepts, Smart City and Safe City, are examined.

Smart city technologies and security problems are discussed under the second heading. Smart infrastructures, structures, places etc. The security issues it is subject to are examined here.

Under the third heading, environmental safety is briefly discussed with its various dimensions.

Under the fourth heading, the need for individual and social security, the perception of security and the role of public spaces, urban services and physical security, public security and smart applications, safe city applications in terms of various social groups are examined.

Under the fifth heading, urban food security, which is another important issue today, is examined.

Finally, a general assessment is presented.

1.1. SMART SECURITY DEFINITION AND ACTIONS WITHIN THE SCOPE OF 2020-2023 NATIONAL SMART CITIES STRATEGY AND ACTION PLAN

With the definition adopted within the scope of 2020-2023 National Smart Cities Strategy and Action Plan (T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı, 2019);

Smart Security is the whole of the functions of measuring and ensuring the efficiency of city security, designed to protect citizens and ensure crisis management against the threats that may arise against the existing security situation in cities by using technology.

The responsible persons within the Smart Cities Strategy and Action Plan are defined under the following action title, namely the Department of Internal Security Strategies of the Ministry of Interior and the General Directorate of Local Administrations of the Ministry of Environment, Urbanization and Climate Change:

(15.10) THE MATURITY OF THE SMART SECURITY COMPONENT WILL BE INCREASED.

In order to increase the Smart Security component maturity determined by Smart City Maturity Assessment applications in the transformation of cities by benefiting from the Smart City Technology Portfolio and 2020-2023 National Smart City Solution Portfolio; Security management will be carried out by protecting citizens against crime with physical security technologies and providing emergency management, collecting, monitoring, analyzing security data with sensors, and predictively evaluating potential asymmetric and hybrid threats.

Although these actions are not related to the issues that are among the powers and duties of the central government, local governments have an important role in the establishment of the relevant infrastructure. Smart Security is an important field of action that will increase the resilience of cities against natural and technological disasters and terrorist incidents, as it creates a security layer against situations that exceed local capacity in extraordinary situations.

A local government that wants to move towards becoming a safe smart city should be able to intervene in many areas that are not included in the above definition and develop its capacity. As a matter of fact, the Plan also includes the following explanation and related activities:

By utilizing the Smart City Technology Portfolio and the National Smart City Solution Portfolio in the governance activities of local governments, the maturity of the Smart Security component will be increased with the implementation of Smart City Solutions that can be used in the following scope and the Smart City Technology Portfolio, National Smart City Solution Portfolio and the new technologies developed and used in these solutions. Entry to the Local Smart City Solution Portfolio will be provided. Smart City Solutions can be implemented by all Smart City Ecosystem stakeholders at national and local levels. The activities to be carried out in this context will be carried out under the policy ownership of the institutions and organizations responsible for the action. The necessary coordination between the national and local Smart City Ecosystem stakeholders and the responsible and relevant institutions and organizations will be carried out by the General Directorate of Local Governments of the Ministry of Environment, Urbanization and Climate Change.

1. A Physical Security Information Management System will be created, in which Smart Security applications and devices are integrated and can be controlled over the user interface.

2. Security software needed in the field of physical security, innovative solutions and models that bring solutions will be developed.

3. Image processing and data analysis will be done with new generation and smart video cameras.

4. 4Recognition, detection and location detection will be provided by the use of sensors to detect incidents and transmit them to central systems.

5. Secure communication infrastructures with fast communication will be established.

6. At national, regional and local levels; Organization, resource management, planning and implementation, operational maintenance, monitoring and evaluation, sustainability, interoperability, service management, inter-stakeholder coordination and emergency safety and Safety Governance will be ensured.

7. Safe areas will be established on the beaches and at the air, road and railway borders with underwater and above water sensor networks.

The expected benefits from these activities are also described:

- City security will be increased with Smart City Solutions.
- Quality of life will be improved.
- Security perception of citizens will be increased with Smart City Solutions.
- Contribution will be made to the national economy with the use of local technologies developed with national capabilities.
- The use of Smart City Solutions in border security and immigrant control will be increased.

As can be seen from the expected benefits, it is important to make cities safe, healthy, peaceful and happy places, not just for security and monitoring purposes. Therefore, themes specific to the city such as earthquake and flood risks, security of residential areas, and infrastructure security may come to the fore locally. It is also clear that additional measures should be taken in places such as border cities. While doing all this, it will be possible to create new job opportunities by choosing local technologies, and it will be possible to increase the resilience of our cities against disasters and crises as explained above.

1.2. CONCEPTS OF SECURITY, CAPACITY TO WITHSTAND AND COPE WITH DISASTERS AND CRISES

In order to better understand the concept of Smart Security, it is not only the concept of security, but also the concept of "resilience", which refers to the capacity to withstand and cope with disasters and crises. Indeed, many of the United Nations Sustainable Development Goals and purposes that guide the way towards becoming Smart Cities are about making human settlements more resilient.

1.2.1. The concept of Security

The concept of security is expressed in two words in the international literature. It is the concept, one of which is known as "safety" and its name, which can be translated as "the state of being safe against injury, damage or loss". It can be used as security or safety in Turkish. The verb form of this "to safety" can be translated as protecting something against accident, demolition or error.

The definition presented in return of the adjective "Safe" concept can be translated as being harm or risk-free, being protected against danger, harm or loss, being able to provide assurance against a risk or danger. It can be translated into Turkish as "in safe", "safe" "secure". However, in some cases, it is also used to mean "safe" when one thing does not pose a threat to another. Another meaning is person, machine, etc. that are worth trusting. It is passed as.

Again, the word "secure", which is frequently used in the international literature, is used as an adjective to mean away from danger, safe, secured and ensured. As a verb, it refers to actions such as removing something from danger, taking it under protection, eliminating and securing the loss or inability of something. In addition to these, by physically connecting something, locking, etc. It also means making it protected. Finally, it is also used in situations such as staying at work and retaining control.

In this context, public safety, public health and physical assets (for example smart infrastructures) damage, theft, vandalism, systems overloading or hacking, disasters, etc. We can say that a wide range of topics such as securing and protecting against security concerns the Smart Security theme.

From the perspective of "safety management", which we can call

Safety Management, Assurance appears in different areas as a process that must be managed, subject to various safety performance parameters. For example, there may be areas such as construction site safety management, infrastructure security management, transportation safety management. As well as security management, the formation of a certain security climate and security perception are also important issues. We can express the services of police, gendarmerie and private security companies that provide life and property security and protect public peace as public security and security services.

Security System is a concept that covers all aspects of an organization's security-safety management. Security policies, procedures and protocols, security committees, etc. within a security system. decision bodies (Rafiq et al. 2007). This system provides the execution and realization of systemic planning, implementation, monitoring and review processes regarding security performance (Flin et al. 2000).

1.2.2. Capacity to Withstand and Cope with Disasters and Crises - Resilience

Expressed by the English word "resilience", it has found its place in Turkish in recent years as the capacity to withstand and cope with disasters and crises. It is a concept that can be used for a specific city, region, specific industrial sector, an industrial cluster, a production system or an infrastructure network. Although it is briefly expressed as "durability" for the sake of convenience in this text, it has a very complex conceptual framework as can be seen below. “Durability” is a capability unique to systems. This system feature is defined under three main approaches in the literature.

In the engineering resilience approach, durability is handled in a

narrow framework. It is expressed as the ability of a physical system to return to an assumed stable equilibrium state after a shock (Martin, 2012). The disturbing effect is temporary. With the disappearance of this effect, the system can always return to its own peak output values (Simmie, 2014). In this respect, a single infrastructure system is a suitable framework when examining simpler structures such as a single firm.

Ecological resilience is used for more complex situations (Martin 2012). For example, a smart city ecosystem can be thought of as an ecosystem where many companies, public institutions, non-governmental organizations and citizens manage various infrastructures together, produce goods and services related to them, innovations continue and become dependent on each other. Or, smart infrastructures associated with each other can also be considered within this scope. Here, the main focus is on the continuity of these relations and the ability of this entire ecosystem to stretch its relations against shocks at different scales, that is, the strength of flexibility. Flexibility is based on the possibility of multiple stable configurations thanks to alternative technological systems. In this way, if the system loses its stability, it can switch to another stable state and the system can continue its existence (Modica & Reggiani, 2015). In this respect, industrial clusters are more suitable for the evaluation of smart city ecosystems or smart city infrastructures and services as a whole. Alternative technological systems can enable the same components to be organized differently and to share existing resources differently without requiring radical changes. Ecological resilience is based on high variation and learning, unlike a resilience understanding based on low variation and constant bearing capacity (Folke, 2006). This can actually create a higher stamina.

The third approach is "adaptive resilience", similar to the ecosystem approach. It refers to the ability of a complex system to change

its form, structural qualities and functions when it anticipates or reacts to a crisis (Martin, 2012). Holling (2001) states that the ability of a system to create, test and retain adaptive abilities are factors that determine its own sustainability. In this respect, a system should be able to have some information that can predict its own possible future situations. For example, simulations such as real-time hydraulic modeling in current water networks can generate information within this framework. In order for a system to survive and fulfill its functions in the future, it is based on complex qualities such as having a certain technological richness and being able to control its own processes. This technological richness, the ability to make various experiments without disturbing the determination of its own existence, the ability to combine the obtained information with the information produced elsewhere that is considered meaningless today but can gain meaning in crises, etc. depends. In this respect, we can say that there is also the ability to protect itself against conscious actions.

Shocks or crises are considered as important concepts in all three definitions. In fact, although economic shocks are seen by most as instantaneous, temporary, point events that occur for a single reason, they are actually things that emerge as a result of wider, longer-lasting and gradual dynamics (Pike et al., 2010). These events, which are described as burning something inside, can create opportunities for some actors and they may attempt to achieve different technological, economic, social changes than others to obtain these opportunities. Some of the natural disasters are actually related to the fragility that occurs over time. An urban area that develops by producing economic solutions under certain natural conditions also accumulates vulnerabilities against rare earthquakes and floods. Institutions and infrastructure systems may become too dependent on the investments they have made to change their decisions, and may find it difficult to abandon the existing structure despite their fragility due to various conflicts of

interest and sunk costs (sunk costs). Such situations can create rigidities such as being locked in the existing configuration and not being able to switch to another stable configuration (Martin and Sunley, 2006). In this case, shock can have devastating effects.

Although large technical systems such as urban infrastructure tend to gain strength and dominate the space over time, and to maintain their existence, they collapse and leave their places to other systems when they cannot solve a certain problem with existing technological facilities (Hughes, 1987). Today, it has become difficult to provide complex urban services with purely mechanical and electromechanical systems and quality of life problems have become necessary for cities to survive successfully. It is anticipated that in the coming years, revolutionary steps will be taken in the urban infrastructure services value chain by managing the demand side around the world and developing the relationship between service producer and consumer in a holistic manner (Stimmel, 2014). The level of complexity reached by cities, developments such as industry 4.0, climate change and large populations settled in risky areas are already extremely straining the existing systems.

Geographers, who view them from an evolutionary perspective, state that an economic unit should be able to incorporate successful and innovative business processes (routines) in other places, like DNA. Although these are not very important on that day, they provide some kind of immunity against possible shocks and gain the ability to adapt more quickly (Holling, 2001). City governments and infrastructure management also need to learn the best experiences from other cities so that they can adapt to the new environment and risks. In this way, they can ensure their own safety. As a matter of fact, living laboratories are actually smart city units that serve this purpose. In this way, cities can successfully and safely continue their functions in many areas such as quality of life, economic competitiveness, environmental sustainability, without experiencing major collapses.

The above definitions show that capacities such as continuous learning and experimentation, adapting to new situations, transferring good experiences from the outside world are important, rather than focusing on building a capacity that is thought to be stable and strong to actually be safe from events such as disasters, terrorist incidents or economic crises. Therefore, in a smart city, it is necessary to improve the carrying-bearing capacity of physical assets, the systems (primary and secondary infrastructures) formed by these assets, and the carrying-bearing capacities and especially the flexibility of the social and economic systems based on these systems. Of course this is quite complex and difficult. Today, however, technological possibilities offer significant opportunities.

A smart city should nevertheless be aware of some basic strategic approaches, by which it can evaluate how it can move back to a stable state when faced with a shock.

Nevertheless, when a smart city encounters a shock, it should be aware of some basic strategic approaches in which it can evaluate how it can return to a stable state. For example, economic sectors adapt to the new situation by changing their market orientation, optimizing the value chain according to new conditions, establishing strategic partnerships or closing their idle units and focusing on specific issues, innovating or updating, changing the location of production or changing the dynamics of firm populations altogether (Fromhold- Eisebith, 2015). Cities, on the other hand, cannot move, so they can always have conflicts of interest that do not match the resilience of economic sectors. Developing various scenarios against such possible situations and accumulating knowledge by testing them with simulations, and establishing partnerships by thinking in advance with which cities it can be in solidarity will ensure that a smart city can walk safely into the future.

1.3. SECURITY ISSUES IN COMPLEX URBAN SYSTEMS

Before dealing with the issue of smart security in more detail, it is necessary to talk about security issues that generally concern cities and general trends in them. Today, a significant portion of the population lives in cities. To ensure the quality of life in rapidly growing cities, to protect the urban infrastructure and to ensure the continuity of urban services, to ensure the safety of life and property at the most basic, security problems faced day by day and recurrent criminal events, social events with less frequent but powerful effects, It becomes very difficult in the face of natural and technological disasters and terrorist incidents (Hessel, 2018).

In addition to these, the threats posed by infrastructure deficiencies are also important. For example, around the world, 20 million children die every year due to insufficient infrastructure. Air pollution, malnutrition, accidents and mobility-access problems play

the biggest roles in these losses, and disasters occur relatively less (Ramaswami et al.2016).

Many complex trends such as climate change, economic imbalances, ideological differences and pollution at the global level cause cities to face new dangers. Increased non-contagious chronic disease due to problems such as the spread of disease-causing vectors to new geographies (Benedict et al. 2007), deadly heat (Mora et al.2017), sudden floods and floods (Kundzewics, 2017), pandemic risks (Flahault et al. 2006), obesity. disturbances (Fleischer, 2011) are some of them.

In addition to all these, fragility peculiar to various regions and losses based on them can reach significant dimensions. For example, in the USA, there are also studies on the emergence of neuro-behavioral disorders and crime rates based on exposure to lead poisoning in the womb or at young ages due to lead pipes and fossil fuels used in old drinking water infrastructures (Nevin, 2007). In Europe,

where a large number of immigrants and poverty emerged with the collapse of the Eastern Bloc, drug-related crime rates have increased continuously in the 1990-2000 period. In the same period, attacks on property first increased and then decreased (Aebi, 2004). Therefore, some negative social trends may be long-lasting and structural, while others may be more temporary and acute.

Looking at this picture, perhaps it is not an exaggeration to say that world settlements are faced with numerous global, regional and local security problems. Achieving the most appropriate and strongest effect on security, which is important in terms of maintaining economic and cultural functions and ecosystem functions as well as the quality of life and happiness, is the basic condition of qualifying a city as "smart".

Metropolitan cities in particular face a number of other security problems as they host many different activities. For example, big events are separate security issues. Such events are events that require special evaluation and planning in the face of risks such as natural and technological disasters, food poisoning or terrorist incidents, and may require interventions months in advance (Hessel, 2018).

On top of all these, there are also security problems arising from smart city applications themselves. In the ecosystem consisting of new users, private sector and public institutions that emerged with the digitalization of infrastructure, a wider area may become vulnerable as a result of combining and associating data. While systems such as SCADA provide the opportunity to monitor the infrastructure, they can also make it vulnerable to attacks due to old hardware (Igure et al. 2006). Therefore, the needs of smart cities for various information security models and technologies are increasing.

1.4. SMART CITY AND SAFE CITY: TWO SIBLING APPROACHES

Today, there are many approaches and applications under the name of Safe City as well as smart city strategies and applications. In fact, it sometimes appears as a component of the smart city approach (Ristvej et al.2020) (Figure 1).

Smart technologies that support field surveillance, research, warning and identification in the safe city approach, centrally managed technologies for police and integrated rescue systems, information and cybernetic security, decision making on emergency and environmental problems in crisis management, early warning, monitoring and prediction systems, design and other topics, data and data processing centers, and urban cloud and health issues.

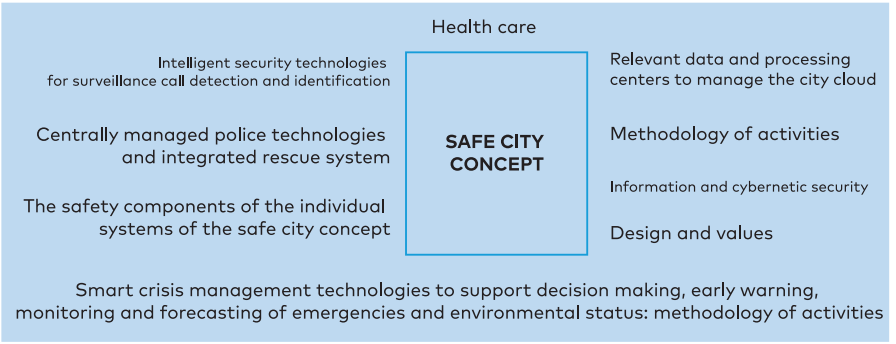


Fig.1 Safe City Concept Ristvej et al. (2020)

On the other hand, issues such as public space arrangement made with the desire to create a safe city, restriction of access, positioning of surveillance systems and deployment of law enforcement in public spaces can create fear and security concerns. For this reason, it should not be forgotten that while developing measures to understand security threats well and develop measures to eliminate them, it should not be forgotten that it is necessary to approach the security perception and concerns of the city people

carefully. Otherwise, security may become a problem that is built, not solved (Frois, 2011).

In fact, security in smart city approaches is both an element that should be handled in general and it is an element that is included in all sub-components. Especially in the environment or infrastructure components, both ensuring the security of the environment and ensuring the physical security of the infrastructure come to the fore. Building security and theft etc. in smart buildings. Issues such as security against crimes, fire, flood, and earthquake safety come to the fore. Even recently, applications for the in-house security of the elderly have been observed. Security is also addressed in smart transportation systems. For this reason, in this guide, all these issues are not dealt with one by one, but rather in terms of the internal components of the city.

Since smart cities are systems where many network systems are digitalized and combined, the advantages and disadvantages of network structures and different network topologies are also briefly examined.

2

SECURITY AND TECHNOLOGY IN SMART CITIES

Urban systems generally have a network structure. Networks such as water networks, transportation networks, electricity networks have topological characteristics specific to that location. While moving to smart systems, they also have a digital network. These networks are developing in a way that they can communicate with each other. However, there are vulnerabilities due to both physical networks and the structures of digital networks. Understanding the basic security aspects of network structures can result in significant savings in developing and implementing smart city strategies.

Most of the security systems used in a smart city are used to track links (roads or pipes) or foci (elements such as pumps, train stations) of a network. Even these devices themselves are being replaced by smart devices. Beyond these, different infrastructures are also beginning to connect with each other. These developments raise the question of whether the sustainability of cities stands out or is an unmanageable complexity (Colding, Colding, & Barthel).

In order to ensure security in complex smart cities, it is essential to ensure the security of both physical networks such as water and transportation networks, as well as digital networks. Network structures are briefly reviewed below in terms of security in order to provide a basis for those who contribute to these efforts.

2.1. NETWORK STRUCTURES AND DIFFERENT SECURITY PROBLEMS

Networks are simply structures made up of focus and links. The focus and their interconnection form different network topologies. For example, when a city is shown as a focus and a point, it may be connecting cities with transportation, communication, energy networks.

In the industrial revolution and afterwards, the train-railroad, plane and airline systems first emerged as providing point-to-point connection, but these have been replaced by centralized transportation systems in the form of hub-finger or horse cart wheels, as they create high transportation costs over time. Hub-finger-type networks work quite efficiently compared to other networks, they create logistical advantages, and point-to-point access advantages (Rodrigue et al.2013).

At the same time, the properties of networks such as their capacities, flow directions of the bonds, whether they are bidirectional currents, whether they form hierarchical structures with smaller networks in the networks are also used in the examination of networks by classifying them into typological classes.

When the connection between the two cities is broken in point-to-point transportation systems, it is very difficult to reach this city. In hub finger-type networks, when the connection with the center is broken, that city cannot be reached (Figure 2). In hub finger-type structures, if the central focus is, for example, a transfer airport, threats to this airport are the threats that concern the entire network, because all relationships are realized through this focus and there is no alternative. Central metro stations, bus stations, etc. therefore, they create security weaknesses. However, they are difficult to give up because of the scale and scope economies they create.

Structures such as the Bosphorus bridges that connect the two transportation networks are also critical. Here, too, if this critical link is damaged or in repair and there is no other link, the two networks are disconnected from each other. In this case, these two networks lose their combination of chain and relay systems, losing many economic and technical advantages. Therefore, the security of such critical infrastructures affects the entire system.

In tree branch networks, there is an intense flow in the main artery and all other subnets are connected to this artery in a hierarchical manner. When a problem related to the main artery occurs at a point that we can call the root of the network, the currents in the whole system may stop. For example, if the connection between an important port where grain is imported and the roads to the inner regions is broken, hunger threat may arise. In such networks, it is necessary to increase the connectivity of the network by developing alternative connections. However, as the number of links and foci increases, the operating costs of the network also increase. A network that effectively covers a geography or an area should have the appropriate number of links. Higher number of links can result in costs that eliminate the network's reasons for existence.

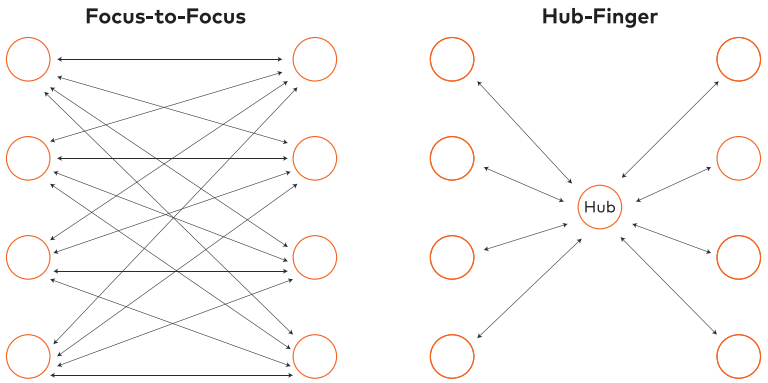


Figure 2. Focus-to-focus meshes and hub-finger meshes

As the connectivity of a network increases, a prominent center disappears. For example, in a distributed network, even if a link is broken, it becomes possible to reach that place with many alternative links (Figure 3). However, running all these links is very costly. For example, if this is a transportation network, many roads will be used below their capacity, thus high maintenance costs will arise.

In communication networks, both the system can consume a lot of energy, and information that is not wanted by other users can be seen by others. When running a network, these different factors must be taken into account in order to operate safely, economically and efficiently.

With the help of simulations, how a network structure will be affected by various disaster, attack or accident scenarios can be examined and measures can be developed.

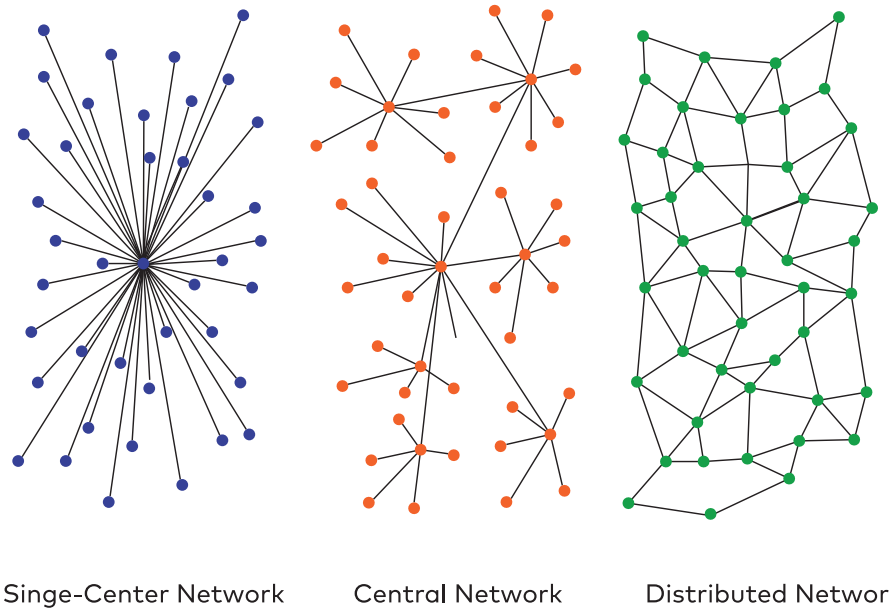


Figure 3. Hub finger (single-center) networks, central-decentralized networks and distributed networks

2.2. DISTRIBUTED NETWORK IMPLEMENTATION: BLOCKCHAINS

Blockchain is defined as the dissemination of central trust in the internet environment by enabling the removal of a central serv-

er or trusted authority. Blockchain technology is a distributed database that enables us to transfer assets to which we value as well as data (Saberi et al. 2019). They use technologies that use open or private distributed ledger (public or private digital ledger). They offer both privacy and transparency, showing a record of all transfers. Malicious manipulation of data is never easy. Especially in cases where there are actors that are difficult to establish trust with each other, they offer significant advantages in fragmented supply systems (Ølnes et al.2017) (Figure 4).

As we mentioned above, distributed systems are systems that consume more energy in the entire network. However, if the costs due to safety are higher, then it can be said that they are more efficient than a centralized (hub-finger) system. This feature of blockchains offers summary algorithms, and because summary information about the transferred record and summary information of previous transfers are kept in a block, very durable systems emerge. However, scalability and efficiency are still controversial systems.

Blockchains offer significant advantages especially in terms of payment systems and transactions requiring high trust such as title deed registration. It is thought that they offer significant potential in reducing the security problems caused by the interconnection of systems in smart cities. In terms of local governments, blockchain ownership is also important when considering situations such as smart infrastructures developed in public-private partnerships.

Public (open) Blockchain network

- Unrestricted access and writing,
- Equal access rights for all,
- Higher security,
- Ability to appeal to large populations,

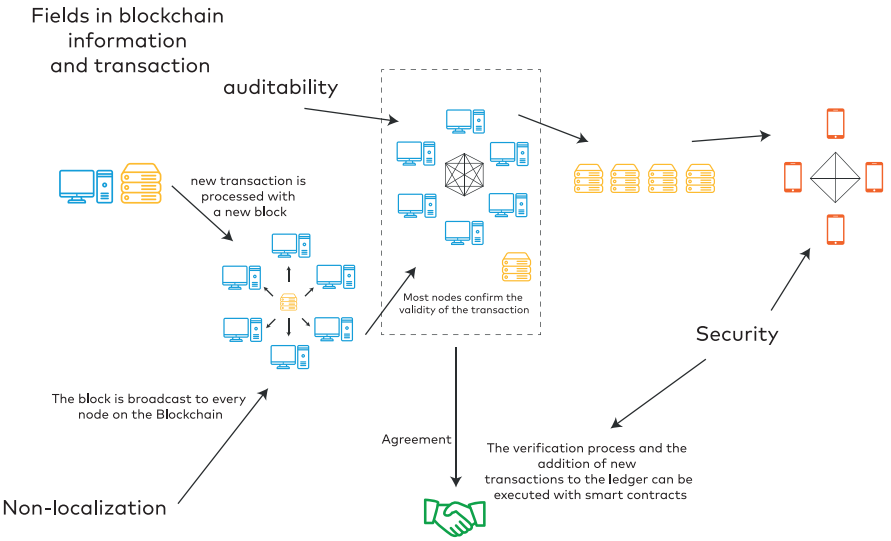


Figure 4. Blockchain networks functioning

- Need for advanced technology,

High operating cost

- May not be suitable for private jobs due to the diversity of participants.

Proprietary Blockchain Network

• Network access is granted by the owner of the network, that is, the central authority. This is a public institution or private sector institution, a person, etc. may be.

- Protected behind fire / firewall.
- The central authority can change the structure of the network.
- Back office of financial institutions, payment, customs clear-

ance, etc. suitable for operations.

- In networks created by the blockchain, participation must be approved by a federation.
- It is not transparent.
- Network manager is powerful.

Blockchain Consortium Network

- Hybrid, that is, it contains the features of public and private networks together.
- Creates a predefined group of blockchain networks.
- Access, write and read rights are given to a certain number of people / institutions.
- Participants are co-owners of the blockchain.

Systems based on blockchains can open new pages for smart cities:

- It can provide a more resilient information infrastructure and urban economy in the face of disasters and technological risks.
- It can enable the creation of new technological collaborations with confidence.
- It can reduce costs and increase service quality in public services such as education and health.
- Correct blockchain topologies must be constructed in terms of safe city applications.
- Blockchain can establish trust in applications that require transparency in city management.
- Energy and infrastructure demand arising from blockchain applications should be seriously evaluated on the axis of sustainability and solutions should be produced.

2.3. SECURITY TECHNOLOGIES IN SMART CITIES

The main technologies used to create safe public spaces in smart cities are presented below.

- **Physical Security Information Management (PSIM)**

Physical security information management (PSIM) is a software platform where many associated security applications and devices are integrated and controlled over a single comprehensive user interface. Data from different security devices and information systems (such as video, access control, sensors, analytics, networks, building systems) are collected and correlated to identify and proactively resolve security incidents. This system collects data from security devices; Analyzes alarms, alerts and events; confirms; solutions in accordance with the standards; creates a suitable environment for reports and audits.

- **IP Based Video Surveillance Systems**

Thanks to the new generation video camera systems and software and hardware integrated into these systems; Processes from image detection to instant and fast transmission to analysis are possible. After capturing images with sensors integrated into IP video systems and converting these images to digital data, the process is accelerated by converting long-lasting camera images into minute records with artificial intelligence-based analysis solutions that can be reviewed quickly with smart compression. The acceleration also makes it easier to scan large areas.

- **Video Analytics Based Suspicious Behavior Detection**

In video analysis, with the use of technologies such as artificial intelligence, video content analysis is the ability to automatically detect and identify temporary and spatial events. With this system, features such as dynamic masking, motion detection, shape and object identification, tracking can be fulfilled.

- **Video Monitoring Systems as a Service**

It defines users' video streaming services, solutions to receive from a common platform or cloud. Video Surveillance as a Service is a web-based wireless security system that allows user images to be stored, managed, saved and monitored in the cloud. Cameras are not kept local and users do not need to use related software or install IP camera systems. Efficiency and efficiency can be achieved while ensuring the security of infrastructure facilities and public spaces with shareable monitoring systems.

- **Detecting Human Behavior from Images**

It includes features such as labeling human movements in images (such as related action classes) and behavior detection and recording. Analyzing video broadcasts in certain algorithms and action classes created is an application example.

- **Biometric Based Video Systems**

It is automatic detection of guilty or wanted persons from video recordings taken against excessive light or at distances up to 50 meters. The integrated use of biometric solutions such as fingerprint, face and iris in video systems is an example.

- **• Watching the Crowds with Video**

It includes elements such as monitoring areas with intense human floods with smart video monitoring systems and fast and instant detection of possible dangers. Monitoring mass movement behavior in concerts or stadiums, temporary events, is an example.

- **Physical Identity and Access Control System (PIAM)**

The physical identity and access control system provides a holistic approach to standards to manage the entire lifecycle, physical access and their relationship to physical security incidents and compliance requirements of any physical identity.

- **Acoustic Firearm Detection and Position Detection**

The acoustic firearm detection system detects the location of the gunfire using a series of acoustic sensors and transmits it to the central system. Government buildings, military facilities, museums etc. It can be used to direct security forces to neutralize threats, under the supervision of high-security facilities.

- **Automatic License Plate Recognition**

Automatic license plate recognition is the process of reading the characters on the license plate by separating the plate area on the vehicle image obtained from the camera (s) for certain purposes. Dubai police use license plate recognition cameras to track vehicles in front of and on either side of the patrol car.

- **Vehicle Detection System**

Vehicle detection system can be used in threats such as detecting intruders in forbidden areas, road violations, speed limit exceeds on the highway, and suspicious vehicles in critical areas. The image taken with real-time alert can be automatically mapped to the watch list. Vehicles can be tracked with more than one camera or at a location. In addition, it can be ensured that the plates at the scene are recorded and used as evidence for forensic investigation.

- **LTE Wireless Communication System**

Instant and fast communication is provided safely and efficiently with LTE-based radio systems in emergency situations. Voice, data and video reach the desired areas in the same way. It is an example of instant transmission of HD video broadcasts used by law enforcement at the scene to the central operation system.

- **Real Time Intelligence Systems**

Supporting law enforcement's live operations, day-to-day operations or investigative work by consolidating data compiled from social media, surveillance cameras and other sources, including streamlining internal systems and databases. For example; they are software solutions that can transfer real-time field information, alarm and KPI values to operators, engineers and other employees via mobile devices.

- **Crime Scene Monitoring**

Crime scene investigation is a process aimed at shedding light on the physical reality of the crime and obtaining physical evidence to identify the criminal. Capturing images and videos of the crime scene enables a deeper analysis of digital evidence of possible clues. The images taken from the scene are modeled in 3D with computer software and realistic reconstructions are obtained.

- **Drones**

Drones; It automatically flies on the desired routes and identifies anomalies with artificial intelligence and informs all stakeholders. The transparency of security operations can be increased by routine flight recordings and quality video footage in large areas (especially uneven terrain).

- **Port monitoring system**

With the underwater sensor network, the security of important facilities on the beaches can be ensured. The port monitoring system shares underwater / surface risks information to the person under surveillance who uses the underwater sensor network. It is used in areas such as terrorists' trespassing, poachers' fishing, nuclear facilities, etc.

2.4. SMART CITY ECOSYSTEM AND SECURITY SERVICES

Security services outsourced or produced by smart city administrations against many special problems specific to smart cities are generally presented below. In smart cities, security problems arising from the operation of different systems in silos that are disconnected from each other, as well as security problems caused by their combination with each other, may arise (Andersen, 2020). In addition to digital problems, ensuring the security of physical assets has also gained importance. Theft of high-cost smart infrastructure components, Vandalism etc. for them. actions can create serious costs.

- **Physical Security Consultancy**

Physical Security Consultancy services are consultancy services that Smart Cities receive from the private sector in order to solve their physical security problems.

- **Public Safety Response Point (PSAP)**

These are systems in which emergency calls are routed to a common platform and terminated through all national networks. Thanks to this system, activities assigned (operation control center) are managed, information is received, evaluated and connected services are coordinated. System assets; It may include fire fighting, protection or salvage of important assets, medical and technical rescue services for civil protection, public safety and order issues.

- **Safe City as a Service Software (SaaS)**

Systems loaded with firmware have their own vulnerabilities. Software as a Service (SaaS) solutions are an alternative to fixed systems. In cloud architecture, software, application, hardware and

storage services are performed. Data can be accessed from anywhere and shared seamlessly on multiple devices at scale. SaaS is the fastest growing cloud computing market. Customers can use special software without having to install special software on their computers, thus without incurring high software and hardware costs (Apprenda, 2016).

- **Platform as a Service (PaaS)**

PaaS is a cloud service used by software. Software developers can meet rapid demand increases by producing easily scalable solutions. It has a strategic role in overcoming scaling problems for smart cities (Apprenda, 2016).

- **Service Infrastructure (IaaS)**

IaaS eliminates the need for users to set up their own systems, providing access, monitoring, and management opportunities to a remote data center infrastructure (Apprenda, 2016).

2.5. SECURITY OF SYSTEMS

All these technological solutions and services should still be evaluated and their use decided, keeping the following question in mind:

How do we ensure the security of personal data and privacy of the person in a smart city based on fast data sharing and data mining with many actors?

Applications (applications) offered by data integration and combining data will expand the digital surface to make security breaches easier. How can we deal with this problem?

The answer to these questions is to strengthen system security,

not trying to circumvent attacks on smart networks with patches or other palliative solutions. Often approaches are adopted, called the stratified, onion model.

The Onion Model describes a system where all smart network devices have a unique identification number and operate in three layers of security (Figure 5). These layers are:

- Data protection application for the server: They compare data exchanged between servers and the rest of the network to detect malicious software that could damage the server. It's kind of like a smart net cop.
- Data scrutiny layer: they prevent direct communication with servers within the smart network and act as a kind of firewall, protecting the servers from malicious operations.
- Secure smart software for devices: they prevent network leaks by providing protection at the device level directly (Sen et al. 2013).

The Onion Model can also be considered in layers such as the local government control domain for smart cities, smart city residents and infrastructure domain and service providers jurisdiction. The local government jurisdiction is the regulatory body and ensures the smart network's functionality in accordance with laws and regulations. The smart city dwellers and the infrastructure layer authorize users within the smart network and protect these users from malicious attempts. The service layer securely enables data sharing between trusted and untrusted jurisdictions. In this way, it is possible for a smart city to increase the quality of life and productivity without personal security violations (Khan et al.2014).

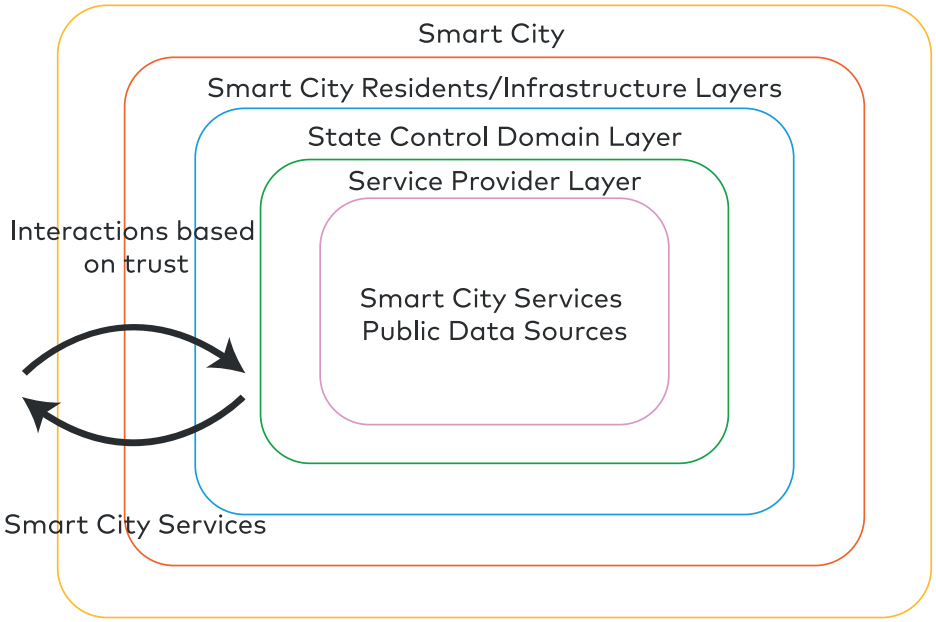


Fig. 5 Three Layered Onion Model, Khan et al. (2014)

3

ENVIRONMENTAL SAFETY

Today, in many parts of the world, there are problems and crises based on events such as natural disasters, climate change, loss of biological diversity, and ecosystem destruction. Most of these are based on rapid population growth, industrialization, urbanization, destruction of ecosystem areas, lifestyle based on excessive consumption and depletion and inefficient use of natural resources (Yiğitcanlar, T., et al., 2019). According to the data of the United Nations, although cities cover less than 2% of the earth's surface; responsible for 70% of greenhouse gases in the world (UNDP, 2020). In other words; Human activities have significant impacts on the environment, climate and ecology such as pollution, loss of biological diversity and resource scarcity.

Environmental aspect among the environmental, economic and social dimensions considered within the framework of the concept of sustainability; It is aimed at ecological values. Concepts such as protection of natural environment (fauna and flora) and natural resources, energy efficiency, combating climate change are related to environmental sustainability. Environmental safety can be evaluated with three criteria based on sustainability:

1. 1Factors affecting the quality of daily life such as water quality, air pollution and green spaces

2. Shaping infrastructure and energy consumption to reduce greenhouse gas emissions (transportation, water treatment and distribution, sewerage, etc.)

3. Resilience to natural disasters and climate change (Kahn, M., 2014).

Therefore, like every city strategy, smart city strategies should aim at sustainable development. A city that does not aim for sustainable development cannot be said to be truly smart (Ahvenniemi, H. et al., 2017).

With Habitat III, smart city solutions have begun to be seen as a promising development for both urban resilience and urban sustainability from global to local scale to solve environmental crises, to reach climate change goals, to increase energy efficiency and to reduce greenhouse gas emissions (Colding, J. & Barthel, S., 2017). Current smart city solutions can reduce greenhouse gas emissions by 10-15%, water consumption by 20-30% and solid waste volume by 10-20% in the urban area (MGI, 2018).

Smart infrastructure and smart energy; It offers sustainable, sensitive, energy-efficient and carbon neutral building and infrastructure facilities in environmental security with its smart environmental monitoring systems (Ristvej, J. and others, 2020). Thanks to these possibilities, environmental safety can be provided in a smart city.

3.1. SECURITY OF NATURAL RESOURCES AND BIODIVERSITY

The population of cities is increasing rapidly. Urban land use is increasing even faster and destroying sensitive ecological and agricultural areas. Rapid population growth and urban fringing delay the transition to advanced infrastructure systems, waste recycling, etc. solutions can cause delay. Urban wastes and air pollution, carbon emissions, the effect of urban heat islands, consumption and pollution of natural resources, climate change, sea level rise, extreme air temperatures, air pollution; It causes the loss of natural species and biodiversity, and may cause the deterioration or extinction of the ecosystem's resource supply, food supply and cultural functions. This harms not only nature but also people. Problems such as the destruction of local income sources, damage to cultural functions, and dangerous exposure of certain social groups to pollution lead to many social problems.

In general, it is desired that smart city applications be of a nature that supports and protects, not disrupts the ecosystem's resource provision, food provision and cultural functions. In this respect, green and blue infrastructures are also increasingly being adopted in smart infrastructure approaches.

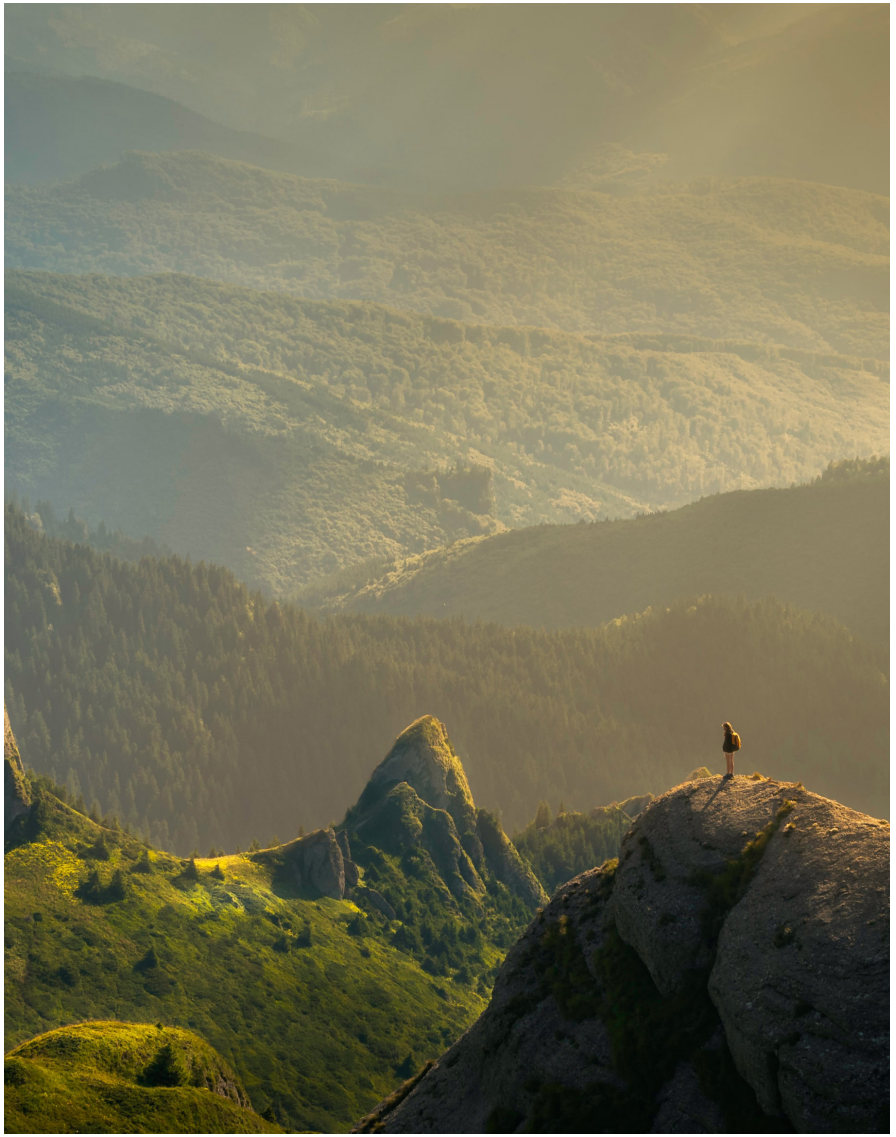
3.1.1. Water and Air Quality

Water is the most important natural resource for the continuity of life for both human beings and other living creatures. With global warming, the importance of water resources has once again come to the fore. While water scarcity threatens living conditions and ecosystem continuity, it also affects countries economically. On the other hand; Air pollution results from incomplete policies and estimates in industries, transport, energy use and waste generation, and more than seven million people die each year from air pollution around the world (WHO, 2016).

water quality; chemical, physical, biological and radiological character of water, and air quality expresses the rate of purification of air from pollution (Risdiana, D. M., & Susanto, T. D., 2019). Looking at the smart city indicators, it is seen that there are measures related to environmental safety such as water quality and air quality; air quality and water quality are addressed within the health and safety layer of smart cities (IMD, 2020).

In addition to being a dimension in the evaluation of smart cities, air pollution is also included in the priority rankings of city administrations and citizens. In the table below, the cities that are in the top five among the top fifty smart cities are listed in the 15 priority ranking of air pollution for the city. In these cities, smart technologies are used to improve air quality. However, for example, a significant portion of air pollution in Seoul originates from

Beijing. Air quality is also seen as an important urban problem in Asian cities such as Beijing and Guangzhou, which are important industrial foci.



Smart City Ranking	City	Air Pollution Priority Order	Smart City Ranking	City	Air Pollution Priority Order
2	Helsinki	3	26	Los Angeles	3
3	Zürih	3	29	Rotterdam	4
6	Kopenhag	5	32	Hong Kong	4
7	Cenevre	4	35	Denver	3
9	Amsterdam	3	38	Berlin	5
10	New York	4	39	Phoenix	4
11	Münih	3	43	Dubai	5
13	Düsseldorf	4	44	Prag	4
15	Londra	2	46	Busan	4
17	Manchester	3	47	Seul	1
22	Hamburg	4	49	Barcelona	4
25	Viyana	5	26	Los Angeles	3

Table.1 Among the Top 50 Smart Cities, Cities Where Air Pollution is Among Top Five Priorities (Kaynak: IMD, 2020)

Big data sources created with smart city technologies have played an important role in monitoring air pollution in China, Serbia and Switzerland (Cheng, Y., et al., 2014; Hasenfratz, D., et al., 2012; Brkovi´c, M. and Sretovi´c, V., 2012). In addition to measuring and monitoring air quality with smart environmental monitoring systems, energy consumption in cities can be controlled (NEC, 2020).

3.1.2. Energy Resources

According to the United Nations, urban areas consume 78% of the energy in the world (UNDP, 2020). In addition to increasing energy efficiency, reducing energy consumption is important for the sustainability of energy resources. Use of renewable energy sources and reduction of energy consumption energy; resources and balancing areas with high average temperatures known as urban heat islands. As regards environmental safety, smart cities focus especially on efficient water and energy technologies and particulate matter pollution control. Smart city technologies (smart energy, smart building, smart grid, detection and monitoring methods, etc.) play an important role in increasing the energy efficiency of cities and decreasing greenhouse gas emissions (Ahvenniemi, H. et al., 2017).

3.2. SECURITY OF ECOSYSTEM FUNCTIONS

Cities play an important role again in the fight against the climate change they cause. Ecology-based solutions together with smart city technologies enable the development of urban sustainability and the city to become a more durable living space. ICT is seen as an important tool in bringing together many disciplines and following an integrated approach, from landscape ecology to the study of animal behavior, in order to integrate biodiversity in smart cities (Bakaar, M., 2019).

The urban ecosystem includes the management of the ecosystem inside and outside the city, reconnecting with the biosphere

(Colding, J. & Barthel, S., 2017). Smart technologies, on the other hand, allow the generation of real-time data; Thus, a database of structures such as wetlands, which are important and natural resources for urban ecology, can be created. Changes in important natural resources and ecological values can be recorded in the database and problems can be detected thanks to these changing measurements. Thus, by monitoring the green infrastructure of the city, the ecological system (natural resources, biological diversity, etc.) is protected.

In addition to its traditional approach, smart cities include vertical and roof solutions that will prevent heat islands and strengthen green infrastructure in urban areas with the technologies they provide (Yiğitcanlar, T., et al., 2019). With these solutions, in addition to strengthening the green infrastructure of the city, continuity in the city ecosystem can also be achieved.

3.3. DISASTER MANAGEMENT

Is the most frequently appearing landslide disasters in Turkey with 32.7%. Climatic factors, geological structure and altitude are involved in the frequent occurrence of landslides. Afterwards, the second most common disaster was floods with 12.2%. Extreme weather conditions have a rate of 1.7% (Öcal, A., 2019). Climate change can cause extraordinary weather changes. Extraordinary weather changes can lead to situations such as drought, excessive rainfall and sea level rise, and may cause natural disasters such as floods and landslides as a result of the inadequacy of urban drainage systems. This situation requires rethinking the drainage systems in the urban area. In this context, it is important for the sustainability of urban areas to be ready for risky situations such as disasters, to defeat themselves quickly and to have a durable environment.

On the other hand, smart city technologies, sensing and monitoring devices such as sensors and drones allow to simulate possible disaster moments by collecting data from the submarine level to global scale simultaneously (NEC, 2020). Thus; smart environmental systems provide support in decision making in response to the crisis phenomenon within the scope of the security of the smart environment (Ristvej, J. and others, 2020). On the other hand, factors such as disaster management and death rates in natural disasters are associated with the security of infrastructure in smart cities. In this situation, environmental safety; In addition to its relationship with smart security, it shows its close relationship with smart environment and smart health.

3.4. PEST CONTROL AND COMBAT

Cities emit more and more waste and pollutants every day. It is predicted that the amount of urban solid waste will increase from 1.3 million tons to 2.2 million tons in 2025 (Hoornweg, D., & Bhada-Tata, P., 2012). Problems such as the collection and storage of wastes not only reduce energy efficiency, but also cause damage to natural resources and urban ecology with the harmful substances secreted.

Waste management, realized with the help of smart sensors, allows the waste process to be carried out in the city with more efficient and ecologically sustainable methods. Sensors can also detect the types of waste as organic or inorganic, and measure the harmful substances they may secrete. Smart flow management creates a wide range of domains from energy efficiency to pest control with the Internet of Things. In addition to this, smart sensors enable to measure the pollutant level towards water resources especially in cities; It prevents water pollution that may occur in cities with real-time data. Thus, not only the protection of water resources and water efficiency; At the same time, the health of the people living in the cities is secured with waste and harmful substance controls.

3.5. ENVIRONMENTAL SAFETY AND GOVERNANCE

Environmental sustainability provided by smart city technologies not only on the basis of ecology, but also has a positive effect on social and economic sustainability by increasing the welfare of citizens (Ahvenniemi, H. et al.).

In environmental safety practices, city and municipality administrations are required to inform citizens about the quality of the environment they live in, as well as collecting and processing data and producing integrated plans in line with these data (Bakaar, M., 2019). Citizens' participation in environmental sustainability is a frequently mentioned issue in smart city criteria. The availability of the opportunity to monitor the environmental quality of the city residents from various applications and online databases is taken as a criterion in evaluating the presence of smart city technologies (IMD, 2020).

3.6. APPLICATION EXAMPLES

3.6.1. Copenhagen Urban Drainage System

Together with Copenhagen Carbon Neutral by 2025, Copenhagen aims to become a carbon neutral city by 2025 and combat climate change. One of the ways followed in Copenhagen's fight against climate change is smart city solutions (Copenhagen Carbon Neutral). Smart monitoring systems used in sewer and drainage systems ensure that Copenhagen is prepared for disasters such as possible floods. Smart sensors are placed in drainage systems and inform the authorized institution of any blockages that occur in the system. Thus, thanks to smart systems, it provides the possibility to prevent situations such as congestion, which may be detected before, and flooding that may occur in excessive precipitation.

3.6.2. Air Quality Control

China has very high air pollution due to intense industry and urbanization. As a result, mortality rates are quite high. As a precaution to this situation, air quality was started to be monitored in real time with smart systems, and it was implemented for the industries to publish air quality values and drainage values every two hours (Cooke, 2014). On the other hand, citizens can access air quality data through applications. Thus, they can organize travel assistants, track urban heat islands, and keep personal health records (Cheng, et al., 2014).

3.6.3. Pest Control

With the help of drones, one of the smart city technologies, pest movements in agricultural areas and ecological areas can be detected without the need for people. With the help of the sent detection drone, a digital map is created and the areas to be intervened can be determined. With a second drone, necessary interventions in these areas are carried out unmanned (Filho, F., et al., 2020). Thus, sustainability in agricultural areas can be achieved largely by means of technologies and these technologies provide opportunities for monitoring not only agricultural areas but also natural areas.

4

SAFE URBAN SERVICES AND SOCIAL AND INDIVIDUAL SECURITY PERCEPTION

The most visible and noticeable of smart city applications in public are those related to public safety. In this section, individual and social security need, security perception and urban services and physical security, urban risks in terms of vulnerable social groups and security issues regarding social networks are examined. Then, the main technological solutions used in providing public safety are summarized.

4.1. INDIVIDUAL AND SOCIAL SECURITY NEED

Security need of the individual in Maslow's pyramid of needs; It comes after physiological and biological needs such as eating, drinking and sheltering. The individual who thinks that his life and assets are in danger, is inclined to defend himself against these dangers. Another dimension of the individual's need for security leads him to live in a community.

In the Turkish Language Institution, security in the literal sense is defined as "the execution of the legal order in community life without interruption, the state of people living without fear". Security concept today; It includes many dimensions such as national security, social security, human security, environmental security, and gender security (Brauch, H., 2008). This shows the wide and flexible use of the security concept (Table 2).

In terms of city administration, security is considered mainly as urban security and environmental security; When it comes to security in the public sphere, a multi-faceted approach that includes many security definitions is followed. Avoiding threats and dangers and minimizing the situation that may pose a danger is the common point of all security dimensions.

Security Concepts	Shown (whose security)	Value At Risk (what's safety)	Sources of Threat (from whom / why to fear)
National Security (Political and Military dimension)	State	Sovereignty, Territorial Integrity	Other States and Terrorism
Social Security	Nations, Social Groups	National unity, identity	Nations, Immigrants, Foreign Cultures
Human Safety	Individuals, Humanity	Survival, Quality of Life	State, Globalization, Global Environmental Problems, Nature, Terrorism
Environmental Security	Ecosystem	Sustainability	Humanity
Gender Safety	Gender Relations, Indigenous People, Minorities	Equality, Identity, Solidarity	Patriarchy, Totalitarian / Imperial Institutions, Intolerance

Table 2. Extended Security Concept Source: Brauch, H. (2008)

4.2. PERCEPTION OF SECURITY AND THE ROLE OF PUBLIC SPACES

Public security or assurance is mostly related to people feeling safe psychologically (Shahdadi, A., 2016). Feeling safe can vary according to the degree of threat. The degree of threat felt by the person, as well as internal factors; It also includes the influence of external

factors. It depends on both external and internal factors; indicates that the perception of security fluctuates according to the situation, event, place and many different factors.

As an objective concept, security consists of reflections of environmental and social behaviors (Brauch, H., 2008). In the public sphere, facts such as uncertain borders, different users, unlimited ownership, crime rate cause a feeling of insecurity. Individuals and society who feel themselves in danger may resort to behavioral restrictions; It can affect the use of the area by avoiding the situation and area where it feels threatened (Ferraro, 1987).

Avoiding the use of the public space causes the space to become empty. There is a suitable ground for crime and unwanted events in these places where auto-control is eliminated. In addition to the increase in the crime rate, this situation can have negative effects in many directions from economy to city health, from public life to sustainability in the long term.

Feeling safe in the public sphere is an indication that the society and the city have a safe, peaceful and healthy environment. This sense of security includes minimizing risk factors such as crime and making sure that the individual will be protected in case of any threat.

In addition, one of the most important factors determining the quality of the space is the safety of the space and the security perception it provides (Machielse, W., 2015). Because the feeling of trust causes the user to continue to use the space or to leave (Figure 6). In this context, designs that create the perception of safe support the increase of the quality of the space by contributing to the use of the space by the user. The less fear of security in the public space contributes to more use of the space. More social ties can develop in the more used public sphere.

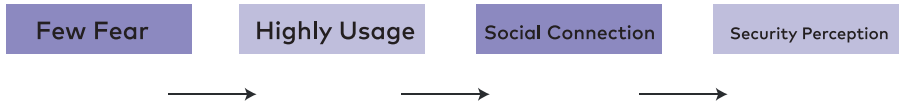


Figure 6: Security Perception - Domain Usage Relationship

There are two main issues to increase the security of the city. The first of these is the construction of a public space that will make the individual and society feel safe; the other is to reduce the factors that create insecurity. Smart cities have a very important potential in terms of developing these two approaches and gaining different dimensions. Advanced technologies such as ICT, Internet of Things (IoT), artificial intelligence (AI), big data and block chain enable the creation of smart security systems by connecting different systems in the city. Smart security systems, on the other hand, provide the opportunity to detect different security problems and crimes from corporate crime to violence, from social crime to damage to the physical environment.

With smart surveillance systems, data on events and situations that may threaten public security can be collected, analyzed and predicted in advance. Thus, smart security technologies allow intervention at the time of the event and before it.

In smart safe cities, surveilance systems are seen as an important tool to keep citizens safe. A multi-dimensional smart security system that includes many state-of-the-art security equipment such as closed circuit television systems, command and control centers, level III data centers, patrol cars, aerial surveillance forms the basis of smart security (Yekkirala, S., 2017).

Looking at the scope of the Safe City Index, it is seen that besides health and infrastructure security, public security is addressed through personal and digital security (The Economist Intelligence Unit, 2017). These are summarized in table 3.

Individual and Social Security	Digital Security
Community oriented policing	Privacy policy
Street level crime data	Citizens' awareness of digital threats
Use of data-based techniques for crime	Public private partnership
Special security measures	Cyber security teams
Weapon use regulation	Fraudulent reporting rate
Political power risk	Frequency of identity theft
Prevalence of minor crimes	Percentage of infected computers
Organized crime	Technology level used
Illegal drug use	Copyright abuse
Terrorist attack frequency	
Gender security	
Security perception	
Terrorism was a threat	
Military conflict was a threat	
Civilian threat	

Table.3 Safe City: Personal and Social Security and Digital Security Components (Source: The Economist Intelligence Unit, 2017; Ristiana, D.and Susanto, T., 2019

Thanks to smart technologies such as smart sensors and cameras, the necessary data can be collected in real time to increase the security of the city and to control the insecurity environment. Collected data can be analyzed and potential security risks can be identified. In addition, the data collected in real time allows different institutions and stakeholders to access data and act jointly in an urban system connected with smart technologies (Allam, Z.,

2019). Providing 24/7 monitoring of human behavior with a wide angle of real-time data analysis; enables smart security systems to act as virtual security guards (Chui, K., et al., 2019).

4.3. URBAN SERVICES AND PHYSICAL SECURITY

Physical security; It covers the measures taken to prevent any damage to the system, facility or resource. Among these measures, closed circuit television surveillance system, private security service, use of barriers and locks, access control protocols, etc. There are many applications. In particular, the remote monitoring facility offered by surveillance cameras is frequently used to ensure the security of the urban system, especially public safety, employee safety and traffic safety.

Physical security measures are frequently preferred, especially in closed areas belonging to heavy users. Airports can be given as an example of these closed areas. Increasing domestic and international mobility brings the security issue to the fore in airports, which are the entrance to the country and the city. According to the International Air Transport Association (IATA), the number of air passengers, which was 4.3 billion in 2018, will increase to 8.2 billion in 2037 (IATA, 2018).

The increasing density at airports requires many factors such as passenger control and customs control to ensure safety. The One ID system proposed by IATA is a smart security method that addresses passengers' biometric identification and identity control (NEC, 2020). According to this method, biometric identity verification enables more fluid and problem-free travel, as well as migrant control and border security, especially at airports (NEC, 2020). Artificial intelligence supported video recognition technologies reduce the pauses at checkpoints by recognizing the faces

of passengers. Thus, in addition to a more efficient security control, a more comfortable travel opportunity is provided for passengers.

4.4. TECHNOLOGICAL SOLUTIONS FOR PUBLIC SAFETY

Especially after the 1980s, besides national security, the concepts of public security and consequently urban security were included in the policy agenda (Köseoğlu, Ö., 2019). Urban security together with terrorism, crime and violence; It includes many different dimensions of crime such as violence against women, organized crime, drug use and smuggling. Smart security technologies provide rapid intervention in case of threat. It can contribute to anticipating the possible crisis and risk and responding accordingly.

Image recognition systems are the basis of smart security technologies. Image identification technologies, on the other hand, rely on individual analysis to identify the criminal, from terrorism to street-level crimes.

Also; Smart secure systems enable the identification of epidemics and infections that may threaten public health and national security with different criminal dimensions and thus enable rapid response.

4.4.1. Video Surveillance Systems

Surveillance tools such as closed circuit television (CCTV), camera and smart phone can monitor human behavior and movements and convert these images into information. In other words, surveillance devices are used as detection devices for monitoring (Chui, K., et al., 2019). Among surveillance tools, the most common use is video surveillance systems.

It is estimated that around 600 petabytes of video data are collected each year around the world (Chui, K., et al., 2019). Due to the efficiency of smart surveillance systems, the transition from traditional surveillance systems to smart surveillance systems is increasing; hence the global surveillance cameras market is growing. The global video surveillance market, which was 42.94 billion dollars in 2019, is expected to be 144.84 billion dollars in 2027 (Tewari, D., 2020).

With video analysis technologies, behaviors in the crowd can be analyzed. Observing the behavior in the crowd is based on the tracking of the movements of the objects (NEC, 2020). Unusual behaviors that are not suitable for the general flow in the crowd can be analyzed with crowd movement analysis, and a possible crime and insecurity situation can be prevented by warning the necessary departments.

In addition, crowd behavior analysis method; It can prevent pedestrian congestion by taking into account intensively used environments, especially when there may be an increase in use such as event days. Observing the flow of people requires directing the movement of the community rather than individual recognition. The perception of insecurity may increase in heavily used areas and may contain many risks from terrorism to minor crime. Community movement surveillance has the potential to provide a perception of security by balancing heavy use in the field, especially at times of events.

Big events can create the necessary environment for terrorism and crime in the city. Participants in the event, users of the area or

tourists are at individual risk as well as collective risk. However, smart security technologies offer crisis management opportunity for these situations (NEC, 2020). Smart security methods; The control of the entrance and exit of the area allows for anticipation of possible dangers in advance and rapid intervention with counter-flow analysis within the area. Thus, smart security methods become part of a crisis management system that is prepared and responds quickly to possible crises.

Video surveillance allows for the prevention and rapid response of possible accident as well as crime in the urban area (NEC, 2020). The system, which is connected to each other, allows the related units to be informed simultaneously by considering possible accidents and crimes.

4.4.2. Traffic Surveillance

More than 1 million people die in traffic accidents each year, and more than 50 million people are injured (Chui, K., et al., 2019). With the widespread use of video surveillance systems on traffic monitoring, traffic accidents and crimes are tried to be controlled. Video surveillance systems, automatic license plate detection, vehicle detection systems placed in areas such as heavily used areas, intersections and crossings provide the opportunity for safe driving by detecting excessive speed, identifying dangerous and violating drivers. Alternative routes can be offered to drivers by measuring traffic density with cabins, smart phones and sensors placed on

the road or vehicle; In addition, data can be created for experts for transportation planning.

4.4.3. Smart Street Lighting

Smart street lighting is not only for energy saving in public space; At the same time, it offers many opportunities from crime detection to vehicle parking area, from weather conditions to increased security perception. Today, most of the roads in the world are still illuminated with a lighting system based on old technologies. Old-style street lighting covers approximately 40% of city electricity consumption (IoTUK, 2017).

Smart street lights provide energy efficiency with LED-based lighting in the first place; It is then connected to the central management system by connecting the lamps to each other via a communication network. Later, with the addition of equipment such as sound recording sensors, cameras, particle counters, it can serve many layers of the smart city such as security, health, energy and environment in addition to lighting (IoTUK, 2017).

Smart street lights; Besides internet service, environmental monitoring, transportation / park optimization, digital signage, electric vehicle charging; It can offer safe walking and public spaces for citizens with its smart video cameras and sound sensors. In addition, some companies ensure that in case of witnessing a traffic accident or crime, citizens can reach the security forces quickly and correctly with emergency call buttons.

4.4.4. Crime and Location Detection

Acoustic firearm detection and position detection systems include the detection of sound waves by sensors and simultaneously noti-

fying the security forces. In this system, the location of the shooter and the number of shots fired are analyzed simultaneously and reported to the police forces headquarters.

New York, Washigton D.C. Firearm detection applications are used in more than 90 cities, including San Francisco and San Francisco. As a result of the implementation, a 25% decrease in crime rates in Las Vegas, 56% decrease in gunshot victims in Omaha and a 29% decrease in gunshot injury in the first year in Greenville (Shotspotter, 2020).

Another location detection application is drones. Examination of the area in times of crisis or before, and identification of positions within the area and control in the intervention are provided with the help of airborne drones (NEC, 2020).

Also, emergency buttons added to pay phones in public places such as LinkNYC; In addition to many public services such as internet, phone charging, video calls, it enables citizens to simultaneously notify the security forces in case of emergency.

4.4.5. Privacy and Ethics

The data collected with smart security technologies, the possibility of the digital system being used maliciously by "hackers" or uncontrolled people can create fear on citizens (Allam, Z., 2019). A safe city needs to reduce the sense of fear of citizens and ensure that they are in a safe environment and platform. Accordingly, the protection of digital systems from attacks is also within the scope of smart security.

In smart urban systems, individuals' data are tried to be secured through the use of encryption, anonymity and biometrics (Allam, Z., 2019; Zhang, K. et al., 2017). However, digital security systems

public-private partnership and protocol may raise concerns that data may be misused, especially by the public (Allam, Z., 2019). A smart safe city should ensure the security of its citizens as well as ensuring that the personal data of its citizens are safe. Among the safe city criteria, digital security also includes privacy (The Economist Intelligence Unit, 2017). In addition to the technological measures taken in this context, privacy and personal rights should be protected by laws and regulations.

Digitalization of security; issues such as digital privacy, human rights and ethics have been brought to the agenda in international platforms and countries have started to make relevant regulations to protect the rights of their citizens. In this direction, the European Union has accepted the General Data Protection Regulation and published the Code of Ethics for Reliable Artificial Intelligence (NEC, 2020).

4.4.6. Data Security

Increasing urbanization, globalization and technological developments digitize the concept of security. In the concept of digitalized security, not only urban or corporate systems are under cyber attack, but also countries are becoming open to these threats. For this reason, digital security, cyber security, data security are constantly on the agenda for countries.

Access of data belonging to individuals, countries and institutions by unwanted users is the main issue of data security. Access to personal data by unauthorized persons, hackers, malicious people or viruses is a security breach and cyber attack. Although data encryption and access control are methods developed for data security, there is still a risk in the cloud system (Chui, K., et al., 2019).

International standards have been established to prevent attacks

and to ensure data security. ISO / IEC 27001: 2013 is the international standards for corporate data security and ISO / IEC 27002: 2013 for the management and standards of information security (Chui, K., et al., 2019).

One aspect of data security is hardware-based security. Systemically protected software must also be protected against dangers such as hardware shutdown (Chui, K., et al., 2019).

4.5. FRAGILE SOCIAL GROUPS AND RISKS OF URBAN LIFE FOR INDIVIDUALS

Individuals and groups with many vulnerabilities, vulnerabilities and vulnerabilities such as children, the elderly, those with physical disabilities, pregnant women, low-income earners, marginalized identities and refugees are defined as vulnerable or disadvantaged social groups and individuals.

It is also vulnerable social groups and individuals who are most affected by urban risks and crises and whose urban rights are most abused. The protection of the human rights of these vulnerable groups and individuals in the urban space has been brought to the city's agenda with Habitat III and New Urban Agenda. In parallel with this, supporting the security of vulnerable groups and individuals in urban life is closely related with the "Sustainable Cities and Communities" number 11 in the framework of the 2030 Sustainable Development Goals.

The need for the help of others in meeting the basic functions of an individual is defined as "addiction" (Tezel, n.d.); Vulnerable groups with high addiction rates such as children, the elderly, the disabled and the sick are highly affected by the risks based on urban systems. In addition, the overall addiction rate, which was 47.5% in

2019, is expected to reach 70.3% by 2080 (Ministry of Family, Labor and Social Services (MoFLSS), 2020a).

In particular, the tendency of the age dependency ratio to increase indicates that the fragility of disadvantaged groups in cities and accordingly urban systems may increase. In this context, a branch of smart city security should be the development of urban systems that include vulnerable groups and individuals and meet their needs.

4.5.1. User Focused Cities

Definitions such as user-oriented or user-friendly mean that the user's focus is on the entire system (Melis et al., 2015); It indicates that the needs of the user are determined specifically, the system is shaped to meet these needs, and thus the quality of life of the user is tried to be increased.

4.5.1.1. Age Friendly Cities

In Europe, where the population aged 65 and over is more than the population of the child and adolescent group, it is estimated that the ratio of the elderly in the population will be 27% from 2040 (van Staalduinen et al., 2018). In Turkey, the proportion of elderly people in the general population is 9.1% in 2019; It is predicted that it will be 16.3% in 2040 and 25.6% in 2080. The other hand, the old age dependency ratio in Turkey in the year 2019 reached 13.4% and 43.6%, this rate is estimated to be in the year 2080 (AÇSHB, 2020).

Increasing age dependency or aging tendency in cities; it shows that urban systems need to be rethinked and restructured in a way to meet the demands and needs of the aging population. The

aging workforce requires an increase in the demand for health and social care, as well as changes in income balances, and the solution of needs such as transportation, housing, health and social services for different segments of the society with alternative and sustainable methods. Age Friendly Cities aims to create a healthier urban environment for everyone, especially the elderly, regardless of gender, culture, ethnic origin, economic status and health status. (van Staalduinen et al., 2018).

Table.4 Age Friendly Cities Checklist

Outdoors And Buildings	Environment	Security	Roads
	Green Areas Walking Paths	Services	Traffic
	Sitting Element	Bicycle Paths	Public Toilet
	Sidewalks	Buildings	
Transportation	Availability	Stops And Stations	Priority Seating
	Reliability And Frequency	Information	Transport Drivers
	Travel Destinations	Community Transport	Safety And Comfort
	Age-Friendly Vehicles	Taxis	Driving Proficiency
	Special Services	Roads	Car Park
Housing	Availability	In Situ Aging	Modifications
	Basic Services	Community Integration	Maintenance
	Design	Housing Options	Living Environment
Social Participation	Accessibility Of Events And Activities	Promotion And Awareness Of Activities	Facilities And Settings
	Availability	Addressing Insulation	
	Effectiveness And Range Of Activities	Promoting Community Integration	
Respect And Social Inclusion	Respectful And Inclusive Services	Public Education	Intergenerational And Family Interactions
	Public Images Of Aging	Community Involvement	Economic Participation
Civic Participation And Employment	Volunteering	With The Participation Of The Public	Accessibility
	Employment	Valuable Contributions	Pay
Communication And Information	Information Offer	Correct Language	Printed Information
	Oral Communication	Automated Communications And Equipment	Computers And The Internet
Community Support And Healthcare	Service Availability	Volunteer Support	Presentation Of Service
	Emergency Planning And Maintenance		

Source: World Health Organization (WHO), 2007

"Smart Age-Friendly Cities" include integrated city systems supported by smart technologies to meet the increasing demand and need for health and social services, accessible transportation and participation in social life, especially by the elderly. In these cities; health services, affordable housing, accessible public space, transportation, participation of the elderly in social life are the main issues (van Staalduinen et al., 2018; Klimczuk, 2016).

Integrated Smart Age-Friendly cities where smart technologies and traditional methods are used together, increasing the safety and protection of the elderly in the society, preparing for the cities of the future with the aging population; It also ensures the security of the natural and built environment and thus the development of sustainable and resilient cities (Table 4).

4.5.1.2. Child Friendly Cities

While the ratio of the child population in the general population in Europe is 18.6% on average, this rate is 16% in Italy, 16.4% in Germany, 19.4% in the Netherlands and 21.1% in the United Kingdom. In Ireland, which has the highest rate among the European Union countries, this rate is 24.5%. When we look at the rate of the general population in Turkey was 27.5% of the child population in 2019 to 23.3% in 2040 and this proportion is expected to be 19% in 2080 (AÇSHB, 2020b). On the other hand, when the causes of child deaths are examined, external injuries and poisoning come first. The vast majority of child deaths are caused by external factors and unsafe health conditions. Children constitute 10% of those who lost their lives as a result of traffic accidents (MoFLSS, 2020b).

Although children constitute a significant part of the population in cities, one of the vulnerable groups most affected by risks such as climate change, natural disasters, and unsafe urban environment; they are often overlooked in urban planning. Child-friendly cities have been brought to the international urban planning agenda in order to protect the rights of children over the city and to ensure urban security for children.

UNICEF defines child-friendly cities as local government approaches that aim to increase child safety by protecting children's rights at its own level (UNICEF, n.d.). These cities try to ensure that children can grow actively in a safe and social life (City of Rotterdam, 2010); In this context, they develop various local practices. According to local dynamics, this approach can be shaped at different scales such as country, city, town and neighborhood. However, in addition to the fact that not only the physical structure of child-friendly cities makes it suitable and safe for children; socio-economic needs should also be met.

Rotterdam (Gill, 2018), previously seen as one of the worst cities in the Netherlands for raising children, offers a successful practice among child-friendly cities (National Institute of Urban Affairs (NIUA, 2017). The Child in the City program, launched in 2007, aims to develop city centers as residential areas, encourage families with children to stay in city centers, strengthen the economy and improve the quality of life of children aged 0-18. (City of Rotterdam, 2010) (Table 5). Today, Rotterdam is a child-friendly city, ranking 36th in 2019 and 29th in 2020, ranking 1st in the smart city rankings, with the application areas being handled as building blocks and each building block is designed according to its own dynamics. entered the group (IMD, 2020).

The National Institute of Urban Relations of India aims to bring the needs of children to its current agenda by including the

Child-friendly housing	Family-friendly apartments
Public Space	Outdoor playgrounds
	Green Playgrounds
	Thresholds
	Existing buildings
Services	Local services
Safe traffic routes	Improving safety

Table.5 Child Building Islands Approaches in the City of Rotterdam
Source: (City of Rotterdam, 2010)

child-friendly city approach to the agenda of smart cities with the "Child Friendly Smart Cities" program developed in cooperation with the Netherlands-based Bernard van Leer Foundation. Accordingly, public health, safety, living conditions, transportation and mobility are seen as the intersection of smart cities and child-friendly cities (NIUA, 2017).

Solution possibilities offered by smart technologies create a potential for child-friendly cities. In addition to solving the problems and demands of children, a potentially fragile group, in the city with the help of technology; It provides the adults of the future to be smart people who are used to the technologies of the future.

4.5.1.3. Disabled Friendly Cities

Rather than medical approach such as disability, organ loss, dysfunction; It is based on limitations in physical and mental functions and disability (WHO, 2011). Generally, functional restrictions in the senses of individuals with vision, hearing, speech and mobility difficulties are included in the disability situation. It is estimated that approximately 15% of the world population, including children, live with disabilities (WHO, 2011). In Turkey, this rate is 5.9% men, 7.9% in women, and 6.9% in the general population (AÇSHB, 2020c).

Disability may be congenital or may occur as a result of previous illnesses or accidents. These individuals, as well as health settlements in cities; existing urban systems face constraints, obstacles and difficulties due to social and administrative attitudes. Disabled movements, as well as physical barriers; It also includes social barriers. This situation enabled the models developed on disability to leave the medical model and turn into a social model.

Disabled-friendly cities are a social model developed on the disabled, aiming to create a safe urban environment in order to solve the problems that disabled people face in cities and increase their participation in daily life. In this context; Disabled-friendly cities are accessible and inclusive cities that promote participation in social life, as well as making the urban environment suitable for the disabled.

Smart city solutions, on the other hand, can help disabled people to participate in community life, access health and social services faster, and create safer public spaces by increasing urban accessibility. Disable Friendly Smart Cities, which is formed by the combination of smart cities and disability friendly cities and sees technology as a solution partner, is an important model for the comprehensive and sustainable cities of the future. This model is an important opportunity for disabled people to be included and participate in urban systems (Table 6).

4.5.1.4. Human Friendly Smart Cities

When we look at the theoretical and applications of the people-oriented city approaches mentioned earlier (age-friendly, child-friendly and disabled-friendly cities), even though it is seen that different groups are focused on, the solution proposals include all segments of the society and everyone's participation is

Urban Infrastructure	Universal design or barrier-free design
Transportation	Accessibility and road safety
Health	Availability, awareness and access to medical facilities
ICT LED Solutions	Accessible digital technology
Education	Digital learning, inclusion in education
Citizen-Friendly Governance	Accessible apps, government platforms, and participating communities

Table.6 Components of Disabled Friendly Smart Cities Source: National Center for Promotion of Employment for Disabled People, n.d.

emphasized (Klimczuk, 2016; Melis et al., 2015) . The solutions and public policies adopted are inclusive and capable of serving all ages and segments; It is spawning human-friendly cities that bring together the previously mentioned concepts.

Human friendly cities; age, gender, ethnicity, culture, economic status etc. they are healthier, more accessible, inclusive and safer cities for all segments of society, regardless of whether they are. Meeting the real needs of people in these cities; It is based on communication, social interaction, and participation of each group (van Staalduinen et al., 2018; Melis et al., 2015).

Smart cities are not just software possibilities of smart systems; It creates solutions to security problems of different dimensions by increasing the quality of life of citizens in many ways, from the smart design of the public space to the faster provision of social services. It is smart to respond to the needs of the individual such as health, individual security, transportation, housing quality, access to education and cultural services, harmony with society

(Köseoğlu, 2019). "People Friendly Smart Cities" (Melis et al., 2015) It is a dynamic concept where many of the smart city components come together.

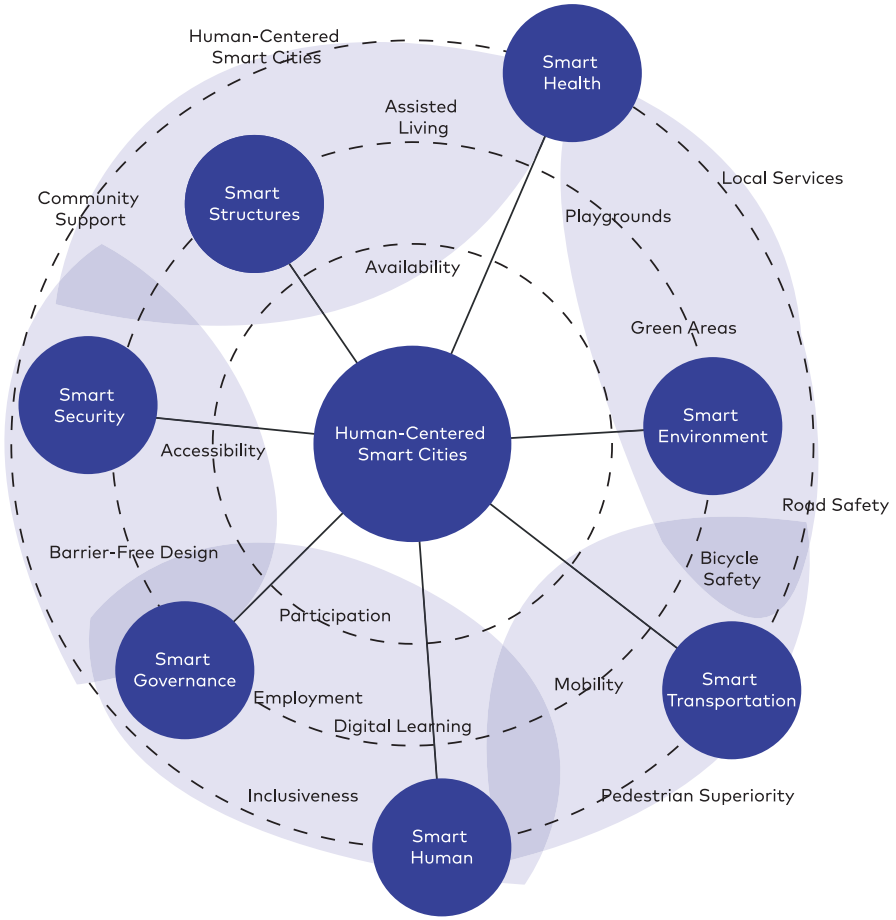


Figure.7 Human Oriented Smart Cities Diagram

Even if the creation process of smart cities is technocratic due to the high technology involved (Tokody & Mezei, 2017); The aim of creating a sustainable and resilient city environment that underlies smart cities makes it important to include the needs and preferences of city residents in the urban management process (Tokody & Mezei 2017; Melis et al., 2015). In this context; Bringing together smart city technologies and people-oriented city systems, "Human Friendly Smart Cities" shows the place of local governments in the smart city process, especially with their applicability and participation.

People Focused Smart Cities, one of the 5 programs within the framework of social inclusion specified in the 2020-2023 Strategic Plan by UN Habitat; It aims at sustainability, inclusiveness, quality of life and the inclusion of human rights in the transformation process of cities. Within the scope of this program, it aims to benefit everyone with smart city technologies and supports national and local governments in this direction (UN Habitat, 2019).

4.5.2. Application Examples

4.5.2.1 Health Services

With smart technologies, wearable devices and medical sensors, remote health monitoring and timely diagnosis can be made. The health data collected thanks to the sensors are transmitted to the doctors, enabling the patient to reach the health services more quickly and comfortably. These methods especially increase the quality of life and health safety of individuals who have difficulties in society such as the elderly and the disabled. In addition to remote health services, smart health services provide home care, emergency control, smart sports tracking and diet tracking.

In addition, smart health services can provide comprehensive retrospective health information by collecting the data collected with biomedical sensors in the cloud. It offers the chance to diagnose chronic or infectious diseases at an early stage by storing real-time health data (Zhang, K. et al., 2017). Early diagnosis of infectious

diseases, especially with smart health technologies; It provides the opportunity to identify serious health and safety problems that may occur in the city in advance.

4.5.2.2. Assisted Living

Catapult Future Cities; It is the innovation hub that brought together businesses, city governments and academics to develop innovative city services and the smart city economy in 2013 by the UK's Innovate Agency (Innovate UK). "The Housing Innovation Map"; offers comprehensive and innovative solution concepts to future housing problems in nine different categories: connected homes, low carbon homes, shared living, supported living, modern construction methods, property management tools, immersive applications, location information and innovative financing (Catapult Future Cities, n.d.). When these nine headings are examined, it is seen that assisted living and connected homes are related to smart security.

Assisted living includes supporting the elderly and people with disabilities to live an independent and sustainable life in their own homes with health and care services. With smart assisted living technologies, elderly and disabled individuals can be followed in their own homes. Sensors that detect environmental changes such as smoke and temperature, and a fall detector enable faster response to risky moments by remotely monitoring the safety and well-being of elderly and disabled individuals with assisted living, which provides tele-maintenance (remote care) with the use of personal sensors such as occupancy sensors, drug reminders that detect indoor movements such as light, temperature and ventilation in the home. Providing clinical services by remote monitoring of vital signs such as heart rate, blood pressure, and sugar, and tele-health (remote

health) services that support the long-term self-management of the elderly and disabled are an alternative to the traditional healthcare demand that will be created by the increasing elderly population. In addition to remote health and care, assisted living includes services that will encourage a healthy life such as the diet of the person, the nutritional content of the food he takes, and following sports. In addition to physical wellness, social interaction and mental health, digital participation services, including online shopping, banking, e-public services, constitute other components of assisted life (Catapult Future Cities, n.d). Assisted living applications are the intersection area of smart health component of smart cities and smart security.

4.5.2.3. Connected Houses

Connected Homes, on the other hand, on the Catapult Future Cities Residential innovation map, connects the devices and sensors used in the daily home with the help of the Internet of Things (IoT) and defines the houses where autonomous actions take place, where data transfer between objects takes place. Connected homes; It contributes to improving the quality of life in many areas from indoor energy control to health, from health to indoor safety, and has the potential to be an important tool in responding to demands, needs, crisis moments that may occur, and designing urban systems with the big data it provides (Catapult Future Cities, n.d). Even though connected houses are frequently considered under smart structures within the components of smart cities; It is an innovation that shows that smart city components should intersect with each other and act together with the opportunities it provides.

4.5.2.4. Social Networking and Health - WeChat

Not only do social network data enable communication and social solidarity. Additionally, it facilitates the study of social interactions made during social engagement (Zhang, K. et al., 2017). Combining social network data with real-time health data enables the creation of several applications. Apart from being a platform for social friend finding and engagement built by the Chinese company Tencent, WeChat debuted WeChat health services in 2014. Within the realm of healthcare services, this application enables users to connect with healthcare providers, schedule appointments, pay medical bills, monitor patients online, and conduct online consultations (several physicians diagnosing a disease together). (Tan et al., 2020; Zhang, K. and others, 2017; Zhang, X. et al., 2017).

4.5.2.5. Non-Disturbance Energy Monitoring (Non-intervention load monitoring) (NILM)

Non-invasive energy marking systems can analyze the power, voltage and current letters entering the house. This analysis can now create a household energy consumption model. This allows NILM to be identified as another type of surveillance (Chui, K., et al., 2019). An anonymous due diligence in the analyzed energy trend allows the energy entering the house to be cut and the messages to be notified. Thus, an early warning system against home accidents and health problems is established and the health safety of the household is protected.

4.5.2.6. Transportation Security

Although terrorism garners more attention than other urban threats, the high number of injuries and fatalities in traffic accidents has elevated transportation safety to one of the smart

safety's key areas. (2019, Közeolu). Additionally, security is a consideration in determining the quality of transportation networks (Sosik & Iwan, 2020).

Around 1.24 million people worldwide are killed in automobile accidents each year. This number is expected to grow as the number of motor vehicles rises, and the fifth message will be the leading cause of mortality in traffic accidents in 2030. (Welle et al., 2015). In Turkey, 1,883 individuals died at the scene of road accidents between January and October 2020. Pedestrian collisions accounted for 14.6 percent of incidents between January and October 2020. (Turkish National Police, 2020).

This requires an updating of the hazards in order to provide a safe and secure transportation system. Smart transportation technology have the ability to penalize traffic collisions and accidents, therefore making transportation safer for everyone.

Mobility

At the conclusion of this era, it is hoped that everyone, including the old, disabled, and humans, would be able to travel wherever they like in a healthy and safe manner. In these places, it is vital to construct a compact city that demonstrates a city that is more than ecological while also improving the quality of life for city people. Within the compact city concept, mixed mobility networks are implemented; preference is given to walkers and bicycles, while public transportation users are encouraged.

Smart transportation systems facilitate the integration of various types of travel by monitoring the security of transportation lines via cameras and sensors. Throughout the transportation system, sensors and cameras assist users' cellphones in collecting real-time road information. By controlling traffic information, shared trains,

and cycling pathways, this collected data helps to the safety of the urban transportation system.

Road Safety

Road safety is concerned with reducing traffic accidents and enhancing road safety. By concentrating on people, it assures the safety of pedestrians, bikers, and riders. The transportation system's safety and accessibility offer an urban system and enhance the life purpose of city people. Applications developed using smart city technology; It intends to improve the safety of all road users, particularly pedestrians (Sosik & Iwan, 2020). In this context, apps are often made available to us using a combination of smart technology and traditional design methodologies.

Automotive Telematics

Automotive telematics is the transmission and monitoring of real-time data regarding communication devices and cars. This technology may simply be used to monitor the vehicle's target information, the driver's awareness, and compliance with the restrictions. This technology is compatible with vehicle tracking and fleet tracking systems. This technology enables increased fleet efficiency via the creation and modification of programs and the prevention of traffic violations through the tracking of the driver. What matters is its capacity to adapt to a variety of alternative solutions. It is the ideal location for senior couples and has the capacity to alert them of dangerous situations by simply regulating their health to make teaching and learning hard for an extended period of time (Catapult Future Cities, 2017). Automotive telematics is the process of transmitting and monitoring real-time data concerning telecommunications tools and cars. This technology may simply be used to track the vehicle's target information, the driver's understanding, and compliance with the laws. This technology is compatible

with vehicle and fleet tracking systems. This technology enables increased fleet efficiency via the creation and modification of programs and the prevention of traffic offences through the tracking of the driver. What matters is its capacity to adapt to a variety of solutions. It is the ideal location for older couples and has the ability to alert them in dangerous situations by simply regulating their health to make teaching and learning hard for an extended period of time (Catapult Future Cities, 2017).

Stigmergic Adaptive Responsive Learning

Stigmergic Adaptive Responsive Learning (Stigmergic Adaptive Responsive Learning) (Figure 2), also known as Starling Crossing or Starling CV, was founded by Umbrellium in 2017, with the first fully functional prototype in a UK television studio. Cameras set on street lamps characterize the movements of pedestrians, bicycles, and automobiles in the vicinity. By describing the position of concealed pedestrians and bicycles, this system determines their trajectories. Computer-controlled LED lights integrated into the floor covering govern traffic by emitting different signals depending on the ground condition. It detects, predicts, and responds correctly to conditions that differ across junctions, roadways, and sidewalks by assessing the speed of objects. For instance, if a pedestrian attempts to cross the road without looking, a customized warning signal illuminates. If one exists between parked cars, the vehicle in question is alerted to the presence of a red zone. Additionally to the pedestrian crossing disappearing when there are no pedestrians in the vicinity, when pedestrian density is high and it is raining, the vehicle stop line recedes. Signs are designed specifically for bikers (Sosik &Iwan, 2020; Bradley, 2017).

4.6. SOCIAL NETWORKS AND SECURITY

In today's digitalizing environment, social networks have become crucial. Individuals engage and exchange their personal data on these networks. It enables behavioral analysis through the sharing and entry of information on social media, gives chances for harmful individuals, and jeopardizes the security of personal information. Numerous hazards such as identity theft, fraud, phony security software fraud, profile cloning, selling counterfeit items, and unwanted messaging are among the social network's security threats.

Fig.8 Starling Crossing (Stigmergic Adaptive Responsive Learning) Bradley, (2017)

Citizens should be educated about their privacy and security, as well as which data will be shared on social media platforms and which will not. The public's awareness of hazards lurking in social media platforms should be heightened.

On the other side, social networks may also be used to maximize the efficiency of time and vehicle in smart technologies, including the Internet of Things (IoT), big data, blockchain, and crowd counting, as well as smart sensors.

5

FOOD SAFETY

Under this heading, food supply problems and food security and related smart city applications are presented. Food safety is also a member of a variety of cities in Turkey Healthy Cities Association that is also a major area of interest.

5.1. FOOD SUPPLY PROBLEMS IN CONTEMPORARY CITIES

Only around 25% of the fruit and vegetables produced in Turkey, including trash generated during eating, go to waste throughout production and delivery. Food that is discarded has an estimated economic worth of 20 billion TL. Fruit and vegetable losses range between 4 and 12 percent during harvest, 2 to 8 percent during product transit to and from the market, 5-15 percent during market preparation, 3-10 percent throughout the storage process, and 1-5 percent at the consumer stage. Tümenbatur and Tanyaş, 2018). This circumstance demonstrates the breadth of the challenges in cities' existing food supply chains.

Food supply chain; each stage of manufacturing, shipping, storage, distribution, and consumption has distinct risks and issues. These dangers and concerns begin with the import of GMO seeds for production, reliance on foreign sources, energy loss during irrigation, planting, and harvesting, climate change and drought, and settlement pressure on agricultural areas. Apart from the manufacturing phase, other risks and issues in the food supply chain include energy loss during transit, the danger of transportation interruption under extreme circumstances (Covid-19 Pandemic), and interruptions during storage.

On the other hand, the availability of adequate food to fulfill consumer expectations, the quality of food, and economic and physical accessibility to food all contribute to the city's goal for "food security and food security." Food security is a notion that necessitates a comprehensive public response to the public health, economical, and ecological crises that jeopardize human health (Maye, 2019). Food safety is defined in this article to include not just the nutritional content of food, but also the manufacturing process, food accessibility, and the fragility of the food supply chain.

According to the United Nations, the urban global population will expand from 3 to 8.5 million in the twenty-first century, and by 2050, urban regions would account for 70% of the world's population. Increased urbanization also raises cities' needs for water and food, transforming them into water and food hotspots (Drangert, 2020). Along with rising food demand, climate change, rising inequality, and hunger issues all pose the question, "How will cities satisfy food demand sustainably?" At the moment, the capabilities of smart technologies offer a solution to the world's current and future food problems.

5.2. FOOD SAFETY AND URBAN DESIGN PRACTICES

Smart food technology have the potential to play a critical role in resolving food challenges that may occur in the future and today. These technologies are already in use, and ICT plays a critical role in food movement communication through apps that connect farmers and consumers. These apps enable the expansion and sharing of knowledge. However, food safety and conceptions of smart cities are not well-aligned (Maye, 2019).

One of the most critical characteristics of smart cities is their resource efficiency. However, food is frequently mentioned in contexts other than this one. However, a considerable portion of food is produced and brought to the city from areas beyond the city and its hinterland. On the other side, food supply chains rely significantly on industrialized food production imported internationally,

which is frequently based on mass manufacturing (de Amorim, et al., 2019). The city's food supply chain incorporates not only local and regional dynamics, but also national and international dynamics (Maye, 2019).

Smart city plans are aimed at lowering the costs of different systems, enhancing their efficiency, and developing solutions that improve inhabitants' quality of life. In this regard, food safety may well be a critical area of intervention for smart city efforts.

The absence of urban-rural links can help alleviate the present urban food systems' external reliance. It is required to develop a hybrid system that incorporates urban agriculture, peri-urban link farming, and rural-urban connected agriculture in order to maintain food security by reducing the city's reliance on imported food (de Amorim, et al., 2019; Maye, 2019). Smart technologies can be used to regulate the hybrid system that has been installed. The hybrid food system encompasses both urban and rural regions; it emphasizes food waste reduction, agriculture quality improvement, and cost and energy efficiency.

Through the application of smart technologies in the urban food system, ICT and the fourth industrial revolution improve the performance of the food chain by enhancing supply, production, distribution, logistics, and waste management (de Amorim, et al., 2019; Maye, 2019). Food security in cities improves when food chain performance improves, and a smart, sustainable, and permanent urban food chain is developed.

Their approaches to Smart Food Cities fall into two categories. Urban agriculture is the first of them. Vertical agricultural areas in cities and tiny technology installed on building facades and rooftops urbanize food production (Maye, 2019). Roof farming, vertical farming, LED-based artificial farming, hydroponics, and aeroponics all contribute to urban food production in smart food cities. Another focus of smart food cities is the incorporation of tiny technologies into the food chain and smart agriculture. With smart applications in the food chain, energy consumption in the food distribution process may be reduced. Energy efficiency may also be accomplished by smart technology in my logistics system and food waste management.

5.2.1. Ecology

Apart from food production, urban agriculture is viewed as a strategy that promotes ecological balance and helps manage urban heat islands by integrating open space into urban areas. Urban agriculture and wetland ecosystems contribute to the protection of urban ecology from threats (Colding & Barthel, 2017). Urban agriculture is intrinsically linked to the smart environment component of smart cities in this regard.

Numerous challenges, such as urban agricultural fertilizer production, organic waste management, and waste water recycling, play a significant part in smart cities, as they all relate to energy efficiency. While smart agriculture technologies manage and utilize agricultural resources, they also monitor environmental implications and food security. Thus, it contributes to the city's ecological sustainability while also lowering labor costs and improving crop quality in smart agricultural systems.

By integrating the smart city and the urban food supply chain and

by merging smart city planning and the urban food system, it generates smart urban food systems. It has the potential to considerably contribute to raising food production and decreasing food waste through the Fourth Industrial Revolution (robotics and automation) (de Amorim, et al., 2019).

5.2.2. Social Innovation

In Smart Food Cities; Technology-oriented innovations play an important role in the management of food safety. Additionally, there is the social innovation component, which encompasses public adoption of smart food technology. Social isolations such as social practice and institutional change are required for technological advances to succeed in the real world (Maye, 2019).

"Smart Food Safety" or "Smart Food Cities" are used to study the relationship between smart cities and food safety. City administrations that are capable of controlling the city's food flow and implementing alternative smart solutions via the integration of Smart City technology and solutions with urban food movements, in collaboration with citizens, comprise the "Smart Food City" Governance (Maye, 2019).

Local solutions and reactions to food system challenges emerge at the neighborhood level. Local governments play a critical role in this transformation as "food system innovators" (Maye, 2019).

5.2.3. User Data

The purpose of smart city technology is to optimize city system control. The city's users and the "data source" produced in collaboration with them are at the heart of system optimization (Colding&Barthel, 2017).

Smart systems were used to establish the food chain; the technology may collect data for users. Thus, personalized diets may be produced, citizens can have a better understanding of the food they consume, and consumer preferences can be used to provide big data for businesses and local governments. Thus, it is possible to produce meals that consumers require or anticipate in the future (de Amorim, et al., 2019). This strategy exemplifies the connection between smart food security and smart health. The objective of smart city technology is to optimize city system control. The city's users and the "data source" produced in collaboration with them are at the heart of system optimization (Colding&Barthel, 2017).

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This strategy exemplifies the connection between smart food security and smart health.

5.2.4. Application Examples - New York

Over 200 smart cities (Smartcity.press, 2019) have joined the Milan Urban Food Policy since 2015, with the goal of establishing a sustainable urban food system centered on entrepreneurship. One of these smart cities is New York City.

In New York City, urban agriculture gives access to nutritious food, builds community networks, improves environmental conditions, and promotes educational and career possibilities. Outside in the

city, urban agriculture entails the utilization of private gardens for agricultural production, the establishment of communal gardens, and community-built farms. Along with outdoor regions, agricultural production is conducted indoors using hydroponic, aeroponic, and LED-based artificial agriculture techniques. Aeroponic agriculture is a technique of agriculture that consumes 95 percent less water and requires significantly less area, as it does not require sunlight or soil. As a result, it generates 390 times than much food as conventional agriculture.

The "NYC Urban Agriculture" website, created by the NYC Planning Department, NYC Parks Department, and Small Business Services Department, provides information on agriculture in the city to companies, property owners, and the general public. Again, the NYC Zoning Resolution defined where and how agriculture may be practiced in the city. In all residential and most commercial zones, agricultural activities classified as Group 4B are authorized. Furthermore, all industrial zones enable agricultural operations classified as category 17C. (NYC Urban Agriculture).

In 2017, New York City's percentage of food imports increased over the last two decades, reaching 15%. Over half of the fruit produced in the city is imported, and the city is attempting to improve food consumption from local and regional sources (Smartcity. press, 2019).

AeroFarms (New Jersey) and farm are two examples of such businesses. At each stage of the product's development, AeroFarms collects precise data. These data are then utilized to maximize the intended flavor, nutritional value, color, and yield of food using food technology.

5.2.5. Application Examples - United Kingdom

In the United Kingdom, by assisting the National Farmers Association (NFU) with research and development projects aimed at implementing technology in agricultural production and increasing productivity, it aims to assist producers in adopting technological advancements and thereby strengthening the agricultural industry. It works to offer smart food technology to farmers in this environment.

The sensor system (developed by Bosch's start-up business Deepfield Connect) is one of the smart food technologies that enables farmers to monitor their fields at any time and from any location using their smart phone. Smart sensors may be used to protect the product by detecting changes in humidity and temperature in the air or soil.

5.2.6. Application Examples - China

"Management of Food Safety" in smart urbanism in China; "Management of Public Security" is taken under the heading of Public Administration and Services together with Smart Traffic and Environmental Protection; Appeared under the components of Smart Cities (Liu & Peng, 2015). In this context, in 2011, a "traceability system" of meat and vegetables was established in 10 pilot cities, with applications where citizens could follow the origin, growing conditions and ingredients of food in detail (Liu & Peng, 2015).

6

GENERAL EVALUATION

Security is a multifaceted issue in smart cities, affecting all segments. While some of these dimensions address issues that now exist in existing cities, others address potential new issues that will occur as Smart City apps and smart infrastructures proliferate.

Numerous cities nowadays are cut off from rural areas and reliant on distant sources of energy and food. Cities become more vulnerable as a result.

A component of a smart city is smart security. Without a doubt, smart energy applications in areas such as energy security, drinking and utility water supply, as well as waste water and solid waste disposal, should be examined alongside smart infrastructure applications. In this context, smart energy and smart infrastructure applications have the potential to contribute to smart security methods based on concepts such as more effective use of local resources and less reliance on external resources. However, it should not be forgotten that interventions should take place at a scale that does not result in the destruction of rural regions around cities or the formation of socioeconomic inequities between rural and urban communities. Furthermore, these measures should not result in the emergence of new catastrophic risks. In this regard, both the function of green infrastructures and innovative technologies in terms of smart security should be thoroughly explored.

Within the context of smart city strategies, smart city applications present significant opportunities for meeting a variety of needs, including reinforcing the urban-rural relationship, protecting agricultural areas in the hinterlands of cities, safeguarding and effectively managing marine and coastal assets, and expanding urban agriculture practices. By detecting, monitoring, conserving, and enhancing ecosystem services, vulnerabilities associated with the acquisition of resources such as food, fiber, and energy can be decreased. Additionally, it is vital to preserve ecological services as

well as the quality of drinking water, air, and soil. Cities can achieve more resilience in this manner.

Social vulnerabilities can be mitigated to a certain extent by increasing the rural-urban interaction in this way and by establishing new social networks. Additionally, urban agriculture has a role to play in this context. Applications of smart city technology can bolster efforts to repurpose idle urban infrastructure for urban agriculture.

The expansion of smart infrastructure and management systems raises the possibility of shared risks affecting all segments. In this context, local smart city policies and action plans should pay specific attention to emerging technical hazards.

The problem of smart security should be prioritized in every local smart city strategy and action plan, as our nation is more vulnerable to calamities like as earthquakes and flooding. Smart city applications have tremendous prospects for determining what kind of catastrophes the building assets, infrastructure, public spaces, and sensitive natural assets can be safeguarded from, as well as identifying each settlement's vulnerabilities. For example, in an area prone to earthquakes, it is self-evident that the notion of a smart building should not be confined to information applications that enhance building comfort. Alternatively, it is obvious that in areas at danger of flooding, smart wastewater infrastructures should be designed as systems capable of dealing with these conditions. In this context, it should be emphasized once again that smart buildings, smart infrastructures, and smart energy systems should be approached holistically.

The issue of smart security is gaining even more importance due to the fact that our country is under strong international and internal migration pressure and the civil wars in the surrounding countries.

In this context, it is important for smart cities to be prepared for sudden population flows and to acquire the capacities and abilities to manage the social, medical, economic and environmental risks that these may create. In this context, such risks should not be ignored in smart city approaches, especially in metropolitan and border cities.

Especially in metropolitan cities, the abundance of public spaces and the need to use them 24 hours a day make it more difficult to maintain security in public spaces. The smart security approach, which can be considered together with smart space management and smart transportation approaches in strategy and action plan studies in metropolises, should include special solutions for the places and hours of use used by different groups such as children, the elderly, women, tourists and the disabled. In addition to these, they need to implement special security strategies and solutions for different places such as residential areas, central business areas, industrial areas in general.

In smart cities, approaches such as citizens' participation in management and taking proactive and solution-producing roles are important. In this context, the solidarity of the city dwellers, taking on roles for each other's safety, having civil defense skills, and developing solutions for various problems such as the environment, transportation and shelter are also important things that will enable a city to look to its future with confidence. Including practices that support such abilities and skills of citizens in smart city strategies and actions will be the most important contribution to the security of the city.

A smart city should be a safe city.

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Undoubtedly, one of the most basic criteria for a city to be livable is security. Both the city's residents benefiting more from the city and the development of the city's economy are directly related to the safety of that city. In this study, first of all, the concept of security and the capacity to withstand and cope with disasters and crises are explained, and then smart city technologies and security problems are discussed. Smart infrastructures, structures, spaces, etc. The security issues with the natural elements are also examined. In addition to these, special issues such as environmental safety and food safety were also evaluated in this study.

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