



URBAN INFORMATION SYSTEMS

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SMART CITIES



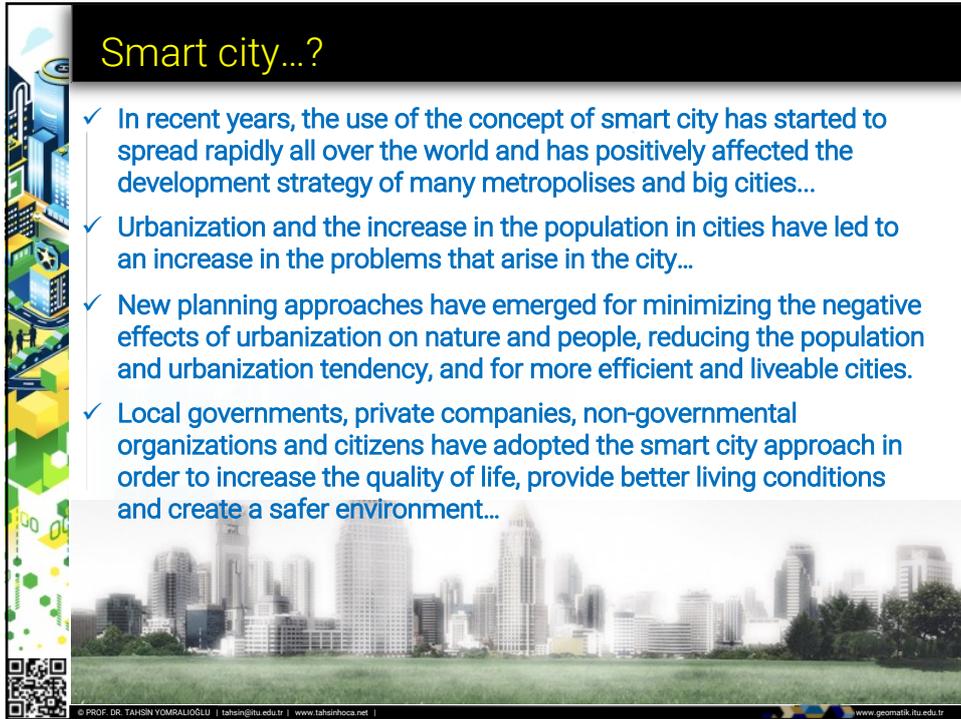
a smart city is an urban area that uses different types of electronic internet of things sensors to collect data and then uses information from that data to efficiently manage assets, resources, and services...



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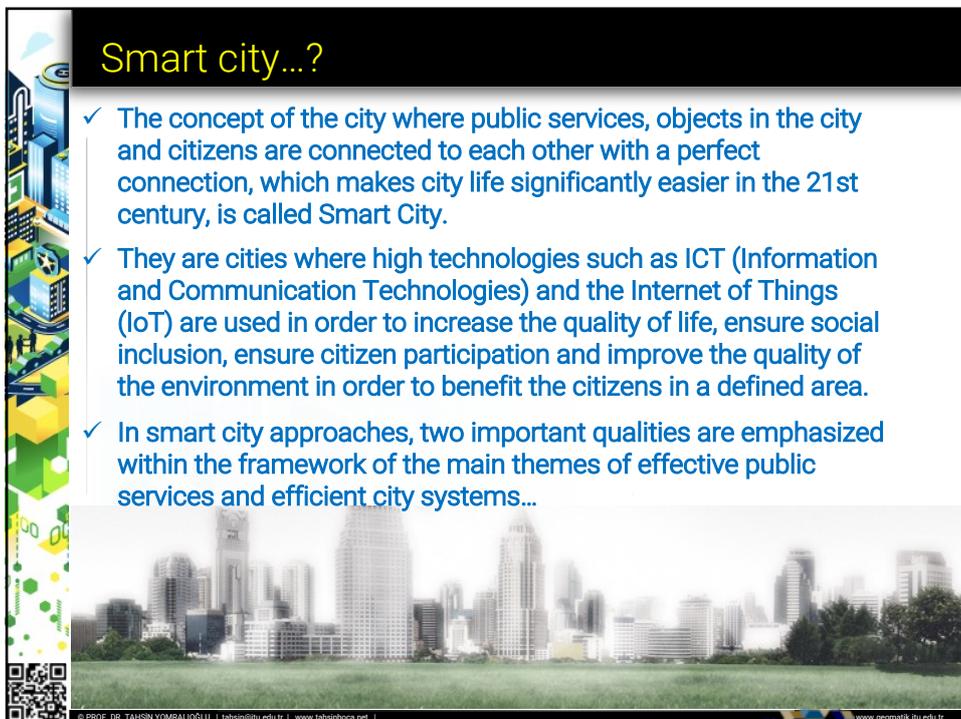


Smart city...?

- ✓ In recent years, the use of the concept of smart city has started to spread rapidly all over the world and has positively affected the development strategy of many metropolises and big cities...
- ✓ Urbanization and the increase in the population in cities have led to an increase in the problems that arise in the city...
- ✓ New planning approaches have emerged for minimizing the negative effects of urbanization on nature and people, reducing the population and urbanization tendency, and for more efficient and liveable cities.
- ✓ Local governments, private companies, non-governmental organizations and citizens have adopted the smart city approach in order to increase the quality of life, provide better living conditions and create a safer environment...

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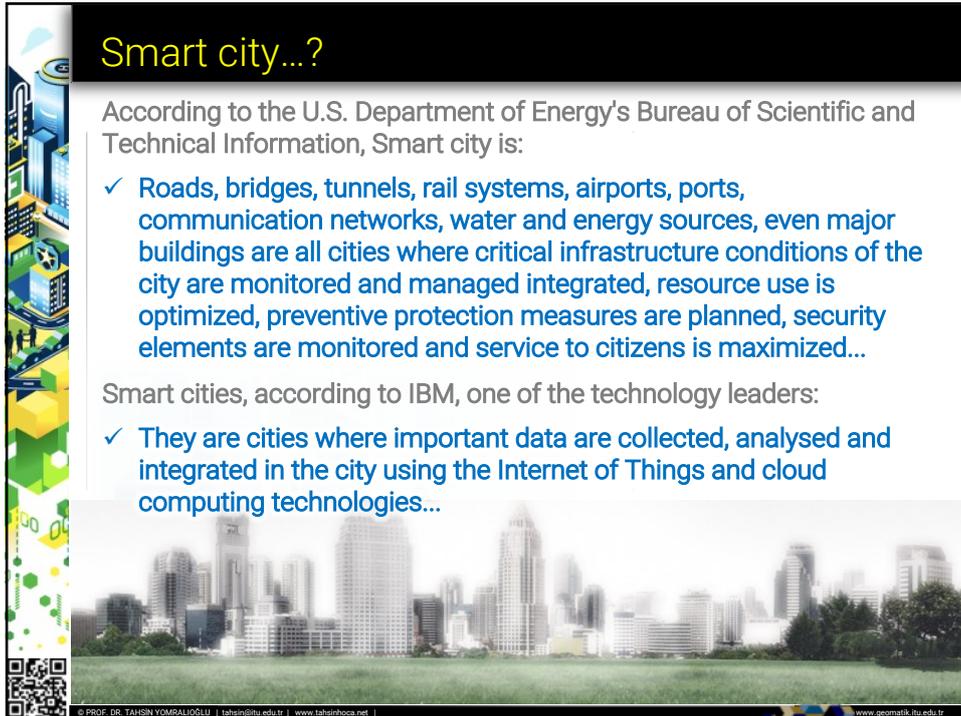
Smart city...?

- ✓ The concept of the city where public services, objects in the city and citizens are connected to each other with a perfect connection, which makes city life significantly easier in the 21st century, is called Smart City.
- ✓ They are cities where high technologies such as ICT (Information and Communication Technologies) and the Internet of Things (IoT) are used in order to increase the quality of life, ensure social inclusion, ensure citizen participation and improve the quality of the environment in order to benefit the citizens in a defined area.
- ✓ In smart city approaches, two important qualities are emphasized within the framework of the main themes of effective public services and efficient city systems...

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Smart city...?

According to the U.S. Department of Energy's Bureau of Scientific and Technical Information, Smart city is:

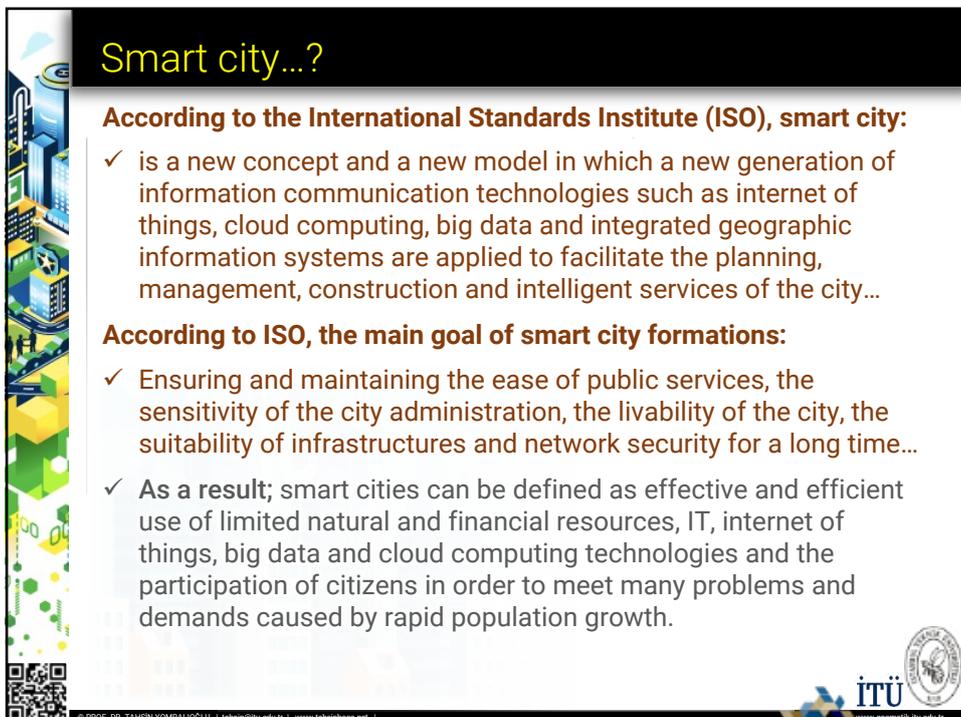
- ✓ Roads, bridges, tunnels, rail systems, airports, ports, communication networks, water and energy sources, even major buildings are all cities where critical infrastructure conditions of the city are monitored and managed integrated, resource use is optimized, preventive protection measures are planned, security elements are monitored and service to citizens is maximized...

Smart cities, according to IBM, one of the technology leaders:

- ✓ They are cities where important data are collected, analysed and integrated in the city using the Internet of Things and cloud computing technologies...

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Smart city...?

According to the International Standards Institute (ISO), smart city:

- ✓ is a new concept and a new model in which a new generation of information communication technologies such as internet of things, cloud computing, big data and integrated geographic information systems are applied to facilitate the planning, management, construction and intelligent services of the city...

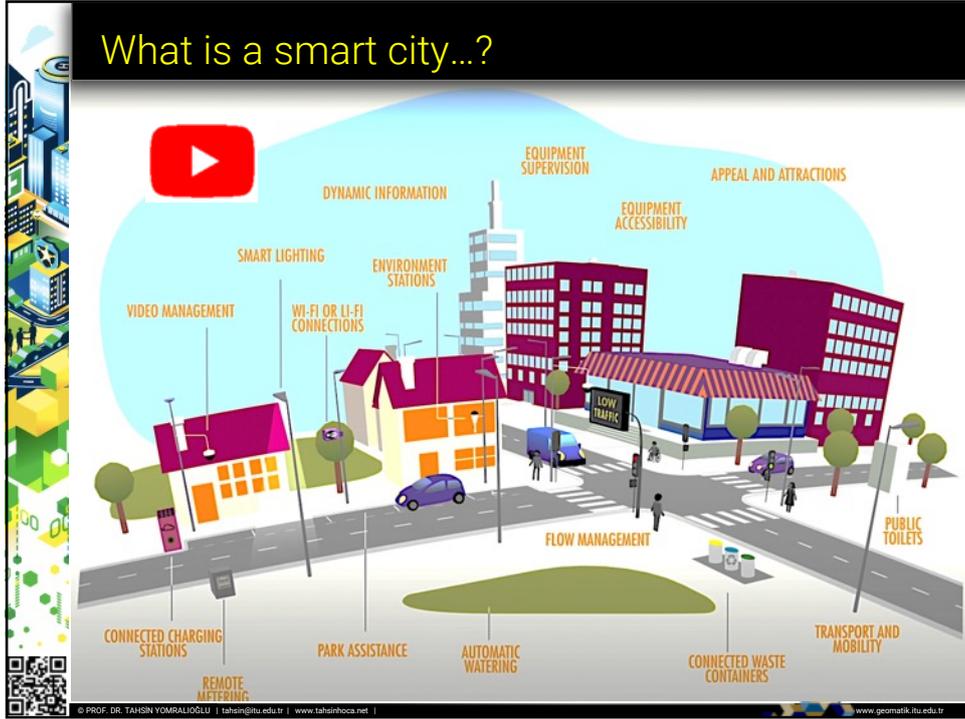
According to ISO, the main goal of smart city formations:

- ✓ Ensuring and maintaining the ease of public services, the sensitivity of the city administration, the livability of the city, the suitability of infrastructures and network security for a long time...
- ✓ As a result; smart cities can be defined as effective and efficient use of limited natural and financial resources, IT, internet of things, big data and cloud computing technologies and the participation of citizens in order to meet many problems and demands caused by rapid population growth.

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Actions for smart cities in Türkiye...?

İstanbul'un Akıllı Şehir Yolculuğu

The timeline shows the following actions for each year:

- 2016:**
 - Akıllı Şehir Müdürlüğü kuruldu.
 - Literatür Taraması (Faz-1)
 - World Smart Cities Congress İstanbul'16 (Haziran)
- 2017:**
 - Mevcut Durum Analizi (Faz-2)
 - World Smart Cities Congress İstanbul'17 (Mayıs)
- 2018:**
 - Akıllı Şehir Master Planı tamamlandı (Mayıs)
 - Akıllı Şehir Master Planı Sürdürülebilirlik Faaliyetleri (Ekim)
- 2019:**
 - World Smart Cities Congress İstanbul'19 (Mart)
 - Akıllı Şehir Endeks Çalışması
 - Akıllı Şehir Olgunluk Çalışması
 - Akıllı Şehir Mevzuat Çalışması
 - Akıllı Şehir Sözlüğü
 - Akıllı Şehir Web Sayfası
- 2020:**
 - Projelere başlandı.
 - İBB Büyük Veri Platformu'nun kurulması
 - Zemin İstanbul
 - İBB Açık Veri Portalı
 - Deprem Hackathonu
 - Tech İstanbul Platformu
- 2021:**
 - Veri Laboratuvarı
 - İBB Büyük Veri ve Açık Veri platformlarının zenginleştirilmesi
 - İBB Akıllı Şehir Platformu'nun kurulması
 - EIT CO-APS (Covid)
 - OASC Türkiye koordinatörlüğü

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Actions for smart cities in Türkiye...?

Smart City concept within the scope of 2020-2023 National Smart Cities Strategy and Action Plan:

- ✓ «More liveable and sustainable cities that are implemented through collaboration between stakeholders, that use new technologies and innovative approaches, that are justified based on data and expertise, and that produce solutions that add value to life by anticipating future problems and needs»

is defined as.

The cover of the National Smart Cities Strategy and Action Plan (2020-2023) features the logo of the Ministry of Environment, Urbanization and Climate Change (T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı) and the website <https://www.akillisehirler.gov.tr>. The title is '2020 - 2023 ULUSAL AKILLI ŞEHİRLER STRATEJİSİ VE EYLEM PLANI' and the date is '24 ARALIK 2019'.

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Actions for smart cities in Türkiye...?

Within the scope of 2020-2023 National Smart Cities Strategy and Action Plan

PURPOSE;

- Preparing a city-specific smart city strategy and roadmap in line with the needs of each city,
- Creating a smart city index by using the smart city maturity assessment model prepared by the Ministry of Environment and Urbanization,
- Developing and effectively planning, realizing and disseminating smart city projects with high public value,
- A holistic and planned investment environment will be provided for the effective and efficient use of resources in smart city investments, and a financially encouraging and facilitating environment will be created...

 T.C. ÇEVRE VE ŞEHİRCİLİK BAKANLIĞI
<https://www.akillisehirler.gov.tr>

 2020-2023
ULUSAL AKILLI ŞEHİRLER
STRATEJİSİ VE EYLEM PLANI

 İTÜ

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Smart city components...

- ❑ The basis of the smart city approach is the creation of human, social capital and **Information and Communication Technologies (ICT)** infrastructure and linking these elements with each other.
- ❑ With the smart city approach, it is aimed to provide sustainable economic development and better quality of life.
- ❑ **smart city**; It can be examined in 6 basic components: **Smart Economy, Smart Society, Smart Mobility, Smart Governance, Smart Environment and Smart Life ...**
- ❑ Considering these basic components, cities that include citizens who are determined for the future, independent and with high awareness in the ideal of being a smart city are defined as Smart Cities.



- Smart Economy
- Smart Society
- Smart Mobility
- Smart Governance
- Smart Environment
- Smart Life

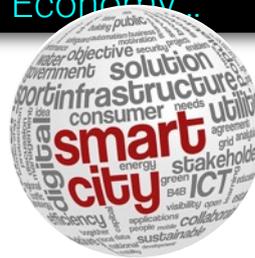
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Smart city components: (1) Smart Economy...

- ❑ With the Smart Economy component, it is expressed that online commerce and online businesses develop, productivity increases, production is made and services are provided using ICT and advanced technologies, and innovative products, services and business models are developed based on ICT.
- ❑ Along with the smart economy, smart ecosystems (Digital businesses and entrepreneurship) are being established.
- ❑ Smart Economy also requires the provision of physical and virtual product, service and information flow, together with the interconnectedness of the parties in the national and global sense.

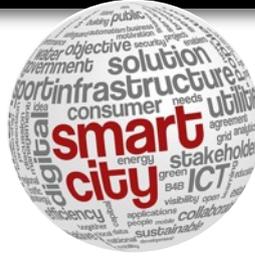


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Smart city components: (2) Smart Society...

- ❑ In the smart city approach, individuals who are aware of ICT technologies, can use these technologies and have access to education, training, human resources and capacity management are characterized with the Smart Society component.
- ❑ It is aimed to create an inclusive society with the encouragement of innovation and the development of creativity.
- ❑ In this component, at the same time, people and communities are considered as individuals who can enter data with participatory systems, use data, can be personalized, and can play an active role in the creation of products and services that contribute to the decision-making process.



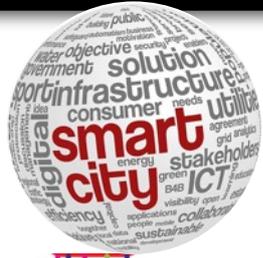
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Smart city components: (5) Smart Environment...

- ❑ The environment where sustainable energy sources are used, ICT technologies integrated, grid systems, pollution control and inspection, buildings and facilities are restored, green buildings, green city planning and energy is used efficiently are described as Smart Environment.
- ❑ In addition, it is necessary to monitor and evaluate the street lighting system, solid waste management facility, drainage system and water supply systems in the city and to minimize the use of resources.
- ❑ Improving water quality and reducing pollution can be shared as good examples.



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Smart city components: (6) Smart Living...

- ❑ Smart life is the way of life, behavior and consumption in which ICT technologies are used effectively.
- ❑ At the same time, smart life is to live in a healthy and safe city in a city that is culturally dynamic, has various cultural opportunities, and has quality housing opportunities.
- ❑ It is aimed to have a high level of social cohesion and social capital.



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Performance measurement of smart cities ..?

the performance of smart cities are evaluated using the basic components of smart cities and evaluation factors for each component.



Smart Economy performance indicators; innovative spirit, entrepreneurship, productivity, flexibility of the labour market, international compatibility, economic image and brands.

Smart Society indicators; qualification level, propensity for lifelong learning, social and ethnic diversity, flexibility/creativity, public participation, cosmopolitanism and open-mindedness.

Smart Governance performance indicators; public participation in decision-making, public and social services, transparency, political strategies & perspectives

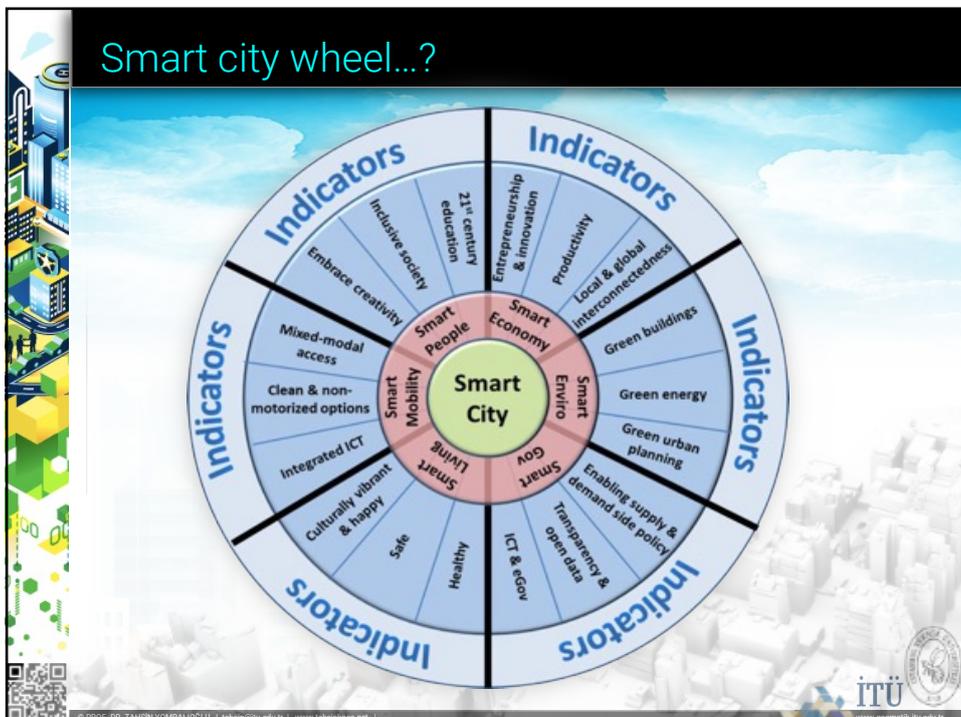
Smart Mobility performance indicators; national and international accessibility, availability of ICT infrastructure, sustainable, innovative and safe transportation systems

Smart Environment (Natural resources) performance indicators; attractiveness of natural conditions, pollution, environmental protection and sustainable resource management

Smart Living (Quality of Life) indicators; cultural services, health conditions, safety of the individual, quality of accommodation, educational opportunities, tourist attraction and social cohesion

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ICT technologies and infrastructure used in smart cities

Akıllı Şehirlerde Yükselen Eğilimler

The infographic displays 12 trends in smart cities, arranged in two rows of six. Each trend is represented by a circular icon with a corresponding label. The top row includes: Açık Veri ve Vatandaş Katılımı (Open Data and Citizen Participation), Akıllı Şebekeler (Smart Grids), Blockchain, Riskler ve Siber Güvenlik (Risks and Cyber Security), Hibrit Bulut (Hybrid Cloud), and Akıllı Ulaşım (Smart Transportation). The bottom row includes: Akıllı Sağlık Sistemleri (Smart Health Systems), Güvenlik Teknolojileri (Security Technologies), Akıllı Bağlı Teknolojiler (Smart Connected Technologies), Yapay Zeka (Artificial Intelligence), Büyük Veri (Big Data), and Nesnelerin İnterneti (Internet of Things). The ITÜ logo is visible in the bottom right corner.

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ICT technologies and infrastructure used in smart cities

OPEN DATA

Data that can be accessed and used freely (without legal, financial, technical barriers) by anyone without being subject to any copyright, patent or other control mechanisms is defined as open data.

- Basically, open data means data that can be freely accessed, processed, used, modified and shared again by third parties.
- Basic conditions of open data; It should be free and unrestricted, accessible anytime and anywhere, ensure global participation, be human-understandable and machine-readable, and comply with open data standards.
- Open data is data that can be accessed, used and shared free of charge by anyone. Instant traffic data, instant public transport time data, training data and all other statistics can be given as examples of open data.

The infographic features a vertical column of colorful icons on the right side, including a lightbulb, a magnifying glass, a gear, a network diagram, a smartphone, a hand holding a tablet, and various data-related symbols. The ITÜ logo is visible in the bottom right corner.

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ICT technologies and infrastructure used in smart cities

OPEN DATA

Accessibility of open data is one of the most fundamental pillars for the development and improvement of smart cities.

The types of open data that must be shared in the open government structure are as follows;

- Data about companies
- Crime and justice statistics
- observation data
- Training data
- Finance and contract data
- Location/location data
- Global development data
- Health data
- Science and research data
- Statistics
- Social mobility and development data
- Data on accountability and democracy
- Transportation and infrastructure data















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Urban Data Platform Plus

UDPplus is a joint initiative of the Joint Research Centre and the Directorate General for Regional and Urban Policy of the European Commission.

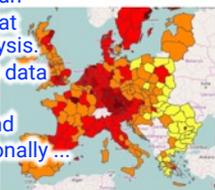
<https://urban.jrc.ec.europa.eu/#/en> As a key component of the Knowledge Centre for Cities, it provides information on the status and trends of cities⁽¹⁾ and regions and to EU supported urban and territorial development strategies.



Localising the Sustainable Development Goals



Urban Data Platform, developed by the European Commission, is an open data sharing platform that enables comparison and analysis. Thanks to this platform, many data belonging to European Union countries can be visualized and compared regionally and nationally ...



My Place

Thanks to our Territorial Dashboard, you can visit any place (city, metropolitan area, region) and discover how it performs in different



Trends

Get an overview of trends at various territorial scales for a wealth of indicators⁽²⁾ grouped by thematic or SDG domains, allowing



Strategies

STRAT-Board offers a unique knowledge base on the integrated approach to urban and territorial development as supported by EU

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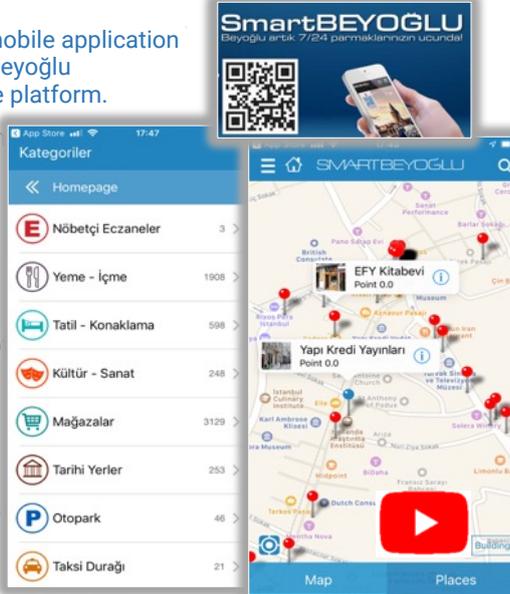
ICT technologies and infrastructure used in smart cities

EXAMPLE: Smart Beyoğlu
Smart Beyoğlu application is a mobile application that collects all transactions in Beyoğlu Municipality's system on a single platform.

With the Smart Beyoğlu application this information is made available to the citizens, together with the barcode application in thirty thousand buildings and nineteen thousand workplaces in Beyoğlu.

Each business can be inspected with the barcode it owns, and the citizen can query the information of the business with this barcode.

At the same time, citizens can use the application to inquire about cleaning, eating and drinking, municipal services, accommodation and other options through the application and get information.



The image shows the SmartBEYOĞLU mobile application interface. On the left, there is a 'Kategoriler' (Categories) list with icons and counts: Nöbetçi Eczaneler (3), Yeme - İçme (1908), Tatil - Konaklama (598), Kültür - Sanat (248), Mağazalar (3129), Tarihi Yerler (253), Otopark (46), and Taksi Durağı (21). On the right, there is a map of Beyoğlu with various points of interest marked, including 'EFY Kitabevi Point 0.0' and 'Yapı Kredi Yayınları Point 0.0'. A QR code and a smartphone displaying the app are also visible at the top right.

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ICT technologies and infrastructure used in

BIG DATA

Today, data, like human and financial resources, has become an important resource that affects the economy and our society. **Data mining** has gained great importance...

- According to IBM's calculations, 2.5 quintillion bytes of data are produced every day.
- 90% of the data available today has been produced in the last two years. We can include spatial, statistical, weather, transportation, energy consumption, health data and social media posts in this generated data.
- Trying to make sense of this high volume of data produced has led to the development of innovative technologies and analysis tools.

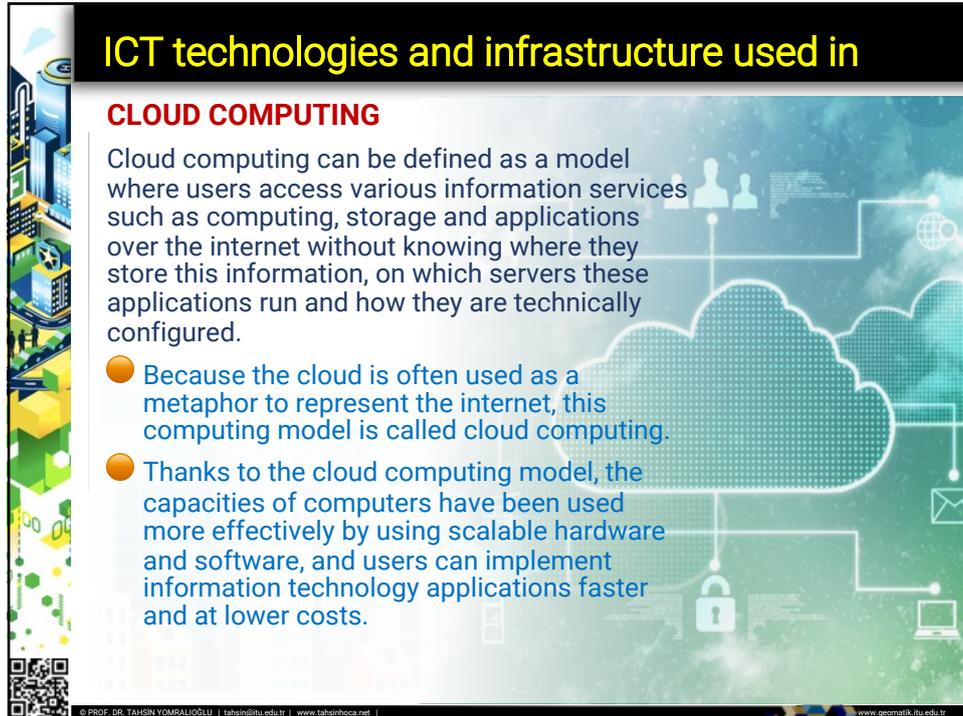


The image shows a night view of a city skyline with a security camera in the foreground. The city lights are visible, and the camera is mounted on a structure, pointing towards the city.

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ICT technologies and infrastructure used in

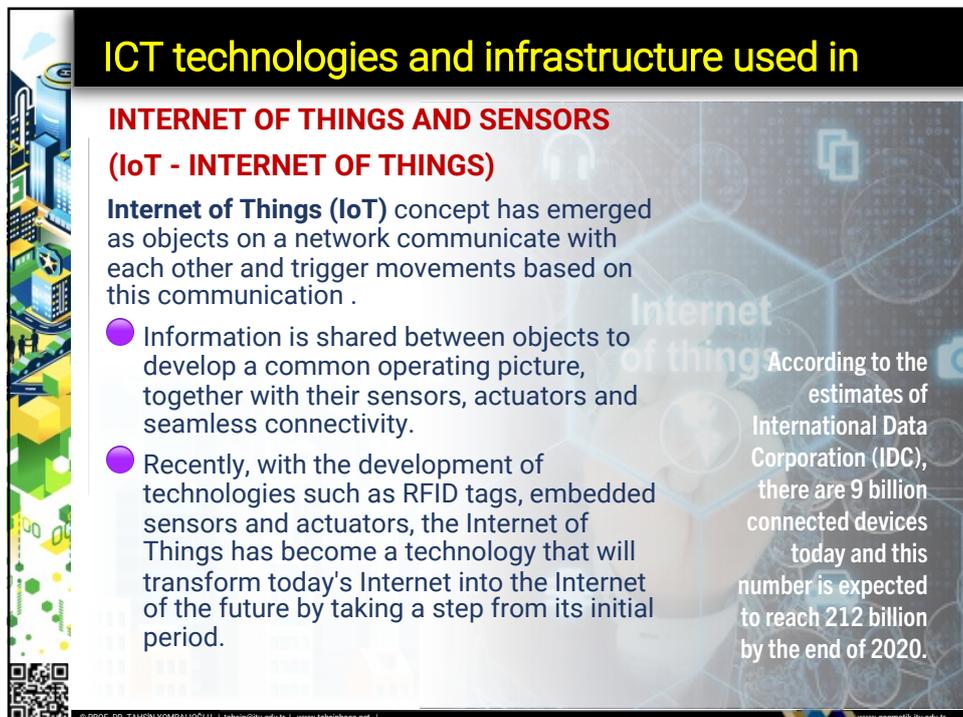
CLOUD COMPUTING

Cloud computing can be defined as a model where users access various information services such as computing, storage and applications over the internet without knowing where they store this information, on which servers these applications run and how they are technically configured.

- Because the cloud is often used as a metaphor to represent the internet, this computing model is called cloud computing.
- Thanks to the cloud computing model, the capacities of computers have been used more effectively by using scalable hardware and software, and users can implement information technology applications faster and at lower costs.

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ICT technologies and infrastructure used in

INTERNET OF THINGS AND SENSORS (IoT - INTERNET OF THINGS)

Internet of Things (IoT) concept has emerged as objects on a network communicate with each other and trigger movements based on this communication .

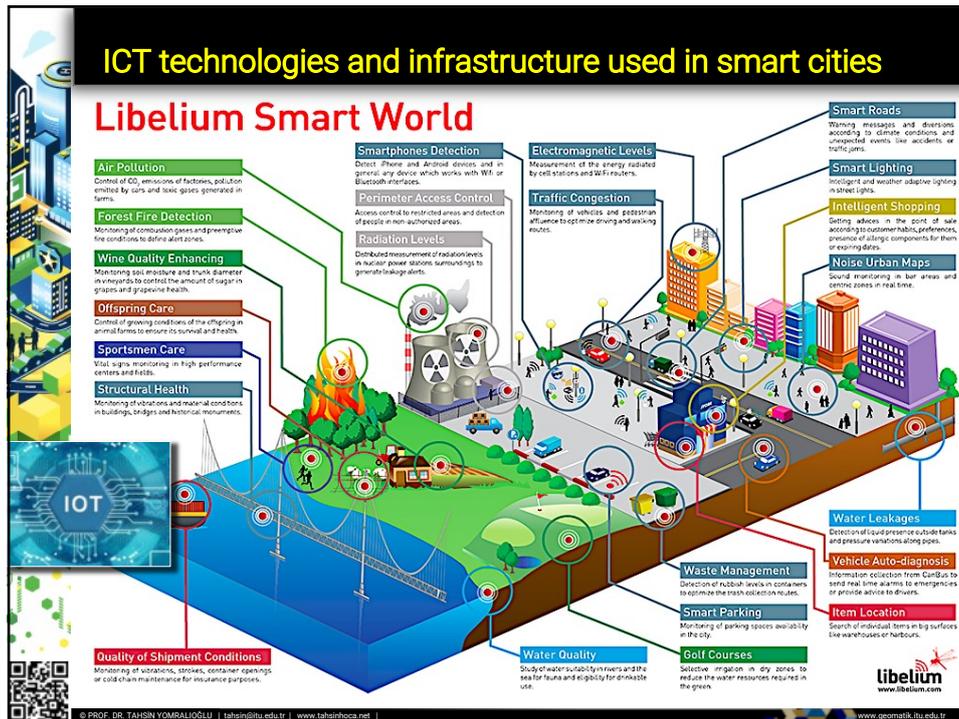
- Information is shared between objects to develop a common operating picture, together with their sensors, actuators and seamless connectivity.
- Recently, with the development of technologies such as RFID tags, embedded sensors and actuators, the Internet of Things has become a technology that will transform today's Internet into the Internet of the future by taking a step from its initial period.

According to the estimates of International Data Corporation (IDC), there are 9 billion connected devices today and this number is expected to reach 212 billion by the end of 2020.

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ICT technologies and infrastructure used in

NETWORK AND CONNECTION TECHNOLOGIES

Radio Frequency Identification (RFID) is the technology that allows microchips to communicate over a wireless network. Objects can be identified automatically with RFID tags attached to the objects.

Wireless Sensor Network (WSN) Today, it is possible to use remote sensing applications in low voltage integrated circuit and wireless network technologies. Thus, their networks, which contain a large number of smart sensors together, collect data in various environments, process this data, analyze it and share meaningful information.

WiFi - Wireless Networking; Although it is a rapidly developing technology, it enables flexibility and mobility in communication. WiFi is a technology in which broadband and high-speed internet connection is offered in accordance with the wireless network protocol, provided that the users connect to the access points.

4G LTE -5G; It is a technology used to describe the 4G-5G wireless network connection. 4G offers all kinds of network services at any time, anywhere, at a single point, with completely IP-based, wired or wireless computer, communication technologies and service quality and high security in indoor and outdoor environments. 5G is the technology that can accommodate 100 billion devices and makes it possible to transfer 10 Gigabits per second data transfer with low latency.

RFID
reader/writer
IC tags

Sensor Node
Gateway Sensor Node

5G

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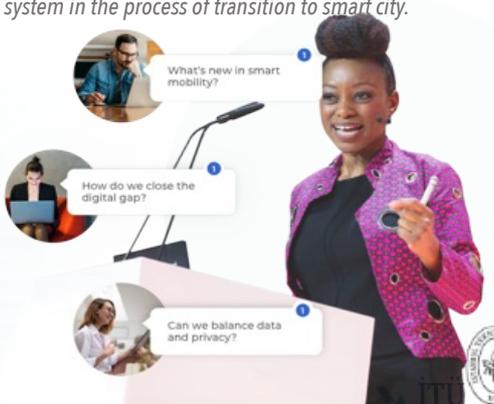
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Problems and expectations...

- ◆ How will decision makers set goals for sustainable Smart Cities and measure progress?
- ◆ How can cities provide shared understanding to create a Smart City vision?
- ◆ How will data be collected and how will this data be shared by different infrastructures and services?
- ◆ National and international standards for sustainable smart cities?

*The ecosystem in which public services are offered to citizens, information is shared between different systems in the city, and this information is analyzed and resources are used effectively is called a **smart city ecosystem**. Smart city ecosystems primarily need different standards at various levels, and these standards are priority for the system in the process of transition to smart city.*



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Problems and expectations...

- ◆ **Institutional and collaboration challenges:** Relevant departments of public institutions work in isolation or out of coordination with each other. It is difficult to combine different institutions and to implement common standards, protocols and procedures. Adding to this challenge, IT systems used in various management departments lack interoperability.
- ◆ **Spatial Data Sharing:** Lack of standards and legislative barriers play a critical role in the sharing of spatial data produced by public institutions, private sector actors and universities.
- ◆ **Systems Interoperability:** After the completion of the planning work for the smart city technology categories, it is necessary to make plans for the development of the internet of things (IoT), fiber optic and wireless networks and data centers throughout the region.
- ◆ **Insufficient Financial Resources:** Technology development companies generally make their investments project-oriented, not R&D-oriented. In addition, since these investments are profit-oriented, the benefit of the city cannot be the primary factor.



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Relationship between GIS and Smart Cities ...

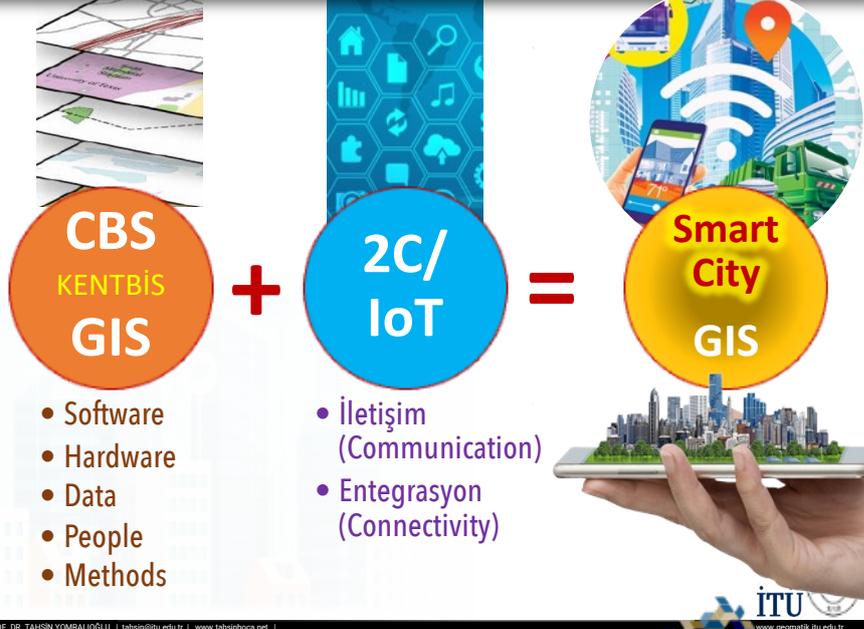
- Smart cities from a GIS perspective; It is defined as the complete integration of the digital city, the internet of things and cloud computing technologies.
- Together with the internet of things and the ubiquitous sensor network, they form a 3D spatial framework (geospatial framework) for real-time detection, measurement and data sharing.
- With cloud computing technology, patterns are discovered by making data mining and analysis from high and complex calculations. Thanks to these patterns, it is possible to monitor, control and feedback the city administration and public services with the data received from the physical city.
- Spatial data and other spatial information must be accessible and usable by local governments, citizens and businesses. In the context of the city, spatial-temporal data needs to be collected, kept up to date, analysed, presented and communicated. At the same time, the data obtained from all these data should be processed and used in the management of the city and in the decision-making process.



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Relationship between GIS and Smart Cities ...



CBS KENTBİS GIS

- Software
- Hardware
- Data
- People
- Methods

2C/IoT

- İletişim (Communication)
- Entegrasyon (Connectivity)

Smart City GIS



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Relationship between GIS and Smart Cities ...

A smart city is first and foremost a spatially efficient city. Spatial and GIS constitute an important frame of reference in transferring the physical city to the virtual environment.

In terms of geomatics, the main issues to be addressed in the transition to Smart Cities are:

- Georeferencing,
- 3D spatial-temporal modeling,
- GPS integration,
- Mobile, Remote Sensing and GIS platforms,
- Sensors that spread everywhere and the communication infrastructure that these sensors can communicate with,
- Availability of map services (WFS, WCS) to the end user on the cloud platform...

Must be examined...



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The Base of Smart Cities: Spatial data

- Spatial data forms the basis of every smart city project.
- There is a place where the objects in the city and all the actions that take place take place, and only when one knows where the objects in the city and where the actions take place can connections be created that make cities smart.
- It constitutes the source of the spatial data, mainly the zip code of the city dwellers, the GPS coordinates of the mobile devices, the data of the urban furniture and the data provided by the sensors placed in the smart cities.
- Space-based data and information in Smart City projects come from various sources. Basic geographic data is obtained from the country's national map provider (HGM, TUCBS..). Data pertaining to immovables are obtained from TKGM . Cities can easily add their data from sources such as election or property tax records. Aerial photographs can also often be added as an additional level of detail.
- How all this data can be brought together on a single platform is the most important challenge of smart cities.



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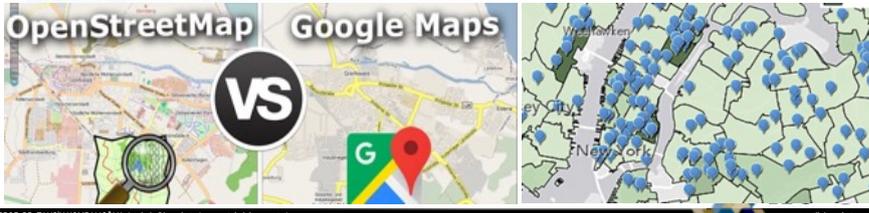
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The Base of Smart Cities: Spatial data

Data Quality and Sharing

- Evaluation, processing and updating of spatial data is one of the basic principles for smart city projects.
- Since Smart Cities collect and share spatial data from transportation systems, electricity networks and emergency services on a common platform, the accuracy and reliability of the data is of great importance.
- Since Smart City projects are a concept involving many stakeholders, transportation services, healthcare services, private companies and citizens should have access to the same dataset.



The image shows a comparison between OpenStreetMap and Google Maps. On the left is a snippet of OpenStreetMap showing a street view. In the center is a large 'VS' logo. On the right is a snippet of Google Maps showing a street view with a red location pin. Below the maps are small text attributions: '© PROF. DR. TAHSİN YOMRALIOĞLU | tahsin@itu.edu.tr | www.tahsinhoca.net' and 'www.geomatik.itu.edu.tr'.

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The Base of Smart Cities: Smart BUILDINGS...

SMART BUILDINGS: Buildings, which are indispensable for cities, play an important role in the concept of Sustainable Smart City in terms of improving the quality of life of city residents and providing a safe living space for city residents.

- ❑ Buildings are one of the most important factors that cause the release of greenhouse gases in cities to nature. Buildings account for 36% of total energy use and 65% of total electricity consumption in the United States. 30% of the total greenhouse gas released to nature is emitted from buildings.
- ❑ Smart building solutions increase energy efficiency in buildings and contribute to the efficient use of resources by using real-time information to ensure the efficient and controlled use of energy used in buildings.
- ❑ Smart building solutions can be applied not only to newly constructed buildings, but also to previously constructed buildings. With smart building solutions, energy efficiency in buildings can be achieved by 50%.
- ❑ Smart building solutions are mostly focused on controlling the energy and lighting systems of previously built or new buildings. Key technologies used in smart building solutions are smart sockets, light sensors and power automation software.



The image shows the ITÜ logo in the bottom right corner. Below the text are small text attributions: '© PROF. DR. TAHSİN YOMRALIOĞLU | tahsin@itu.edu.tr | www.tahsinhoca.net' and 'www.geomatik.itu.edu.tr'.

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The Base of Smart Cities: Smart BUILDINGS...

Intelligent building systems are a set of technological structures, generally based on automation, in which various technological systems are used together, providing many advantages to home and business owners, helping to reduce costs with low energy use as well as functional benefits.



The diagram illustrates the components of a Smart Building. At the center is a circular hub labeled 'Smart Building'. Surrounding it are five main categories: 'Sensors and Actuators' (top left), 'Networking and Communication' (top right), 'Software Platform' (right), 'HVAC System' (bottom), and 'Smart Control Devices' (bottom left). Each category is represented by a colored segment containing various icons of smart building technologies. To the left of the central hub is a vertical energy efficiency scale with levels A+++ (green), A++ (light green), A+ (yellow-green), A (yellow), B (orange), C (red-orange), and D (red). Below the scale is an image of a person holding a yellow handheld device. The ITU logo is in the bottom right corner.

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The Base of Smart Cities: Smart BUILDINGS...



The image shows a construction site with a worker in a hard hat and safety vest in the foreground. In the background, a building is under construction with a crane and a drone flying. A large computer monitor displays a 3D BIM model of a building structure. A purple banner at the bottom of the monitor reads 'REVIT for Structural Engineering & Design | Autodesk'. To the right, a smaller inset image shows a building's steel framework with the text 'Building Information Systems in the Construction Industry'. The ITU logo is in the bottom right corner.

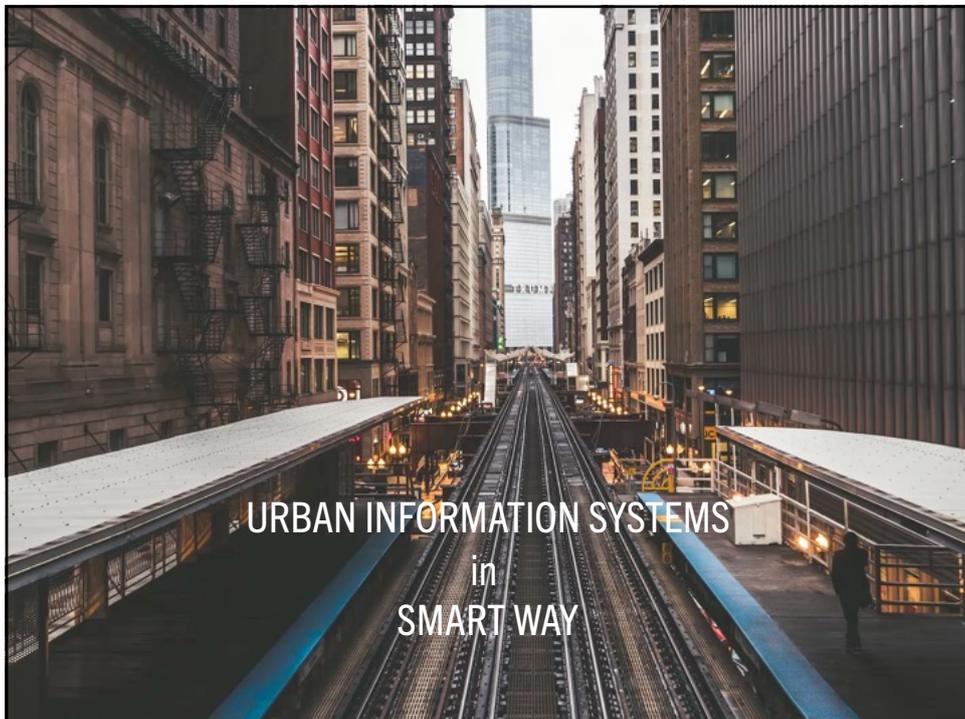
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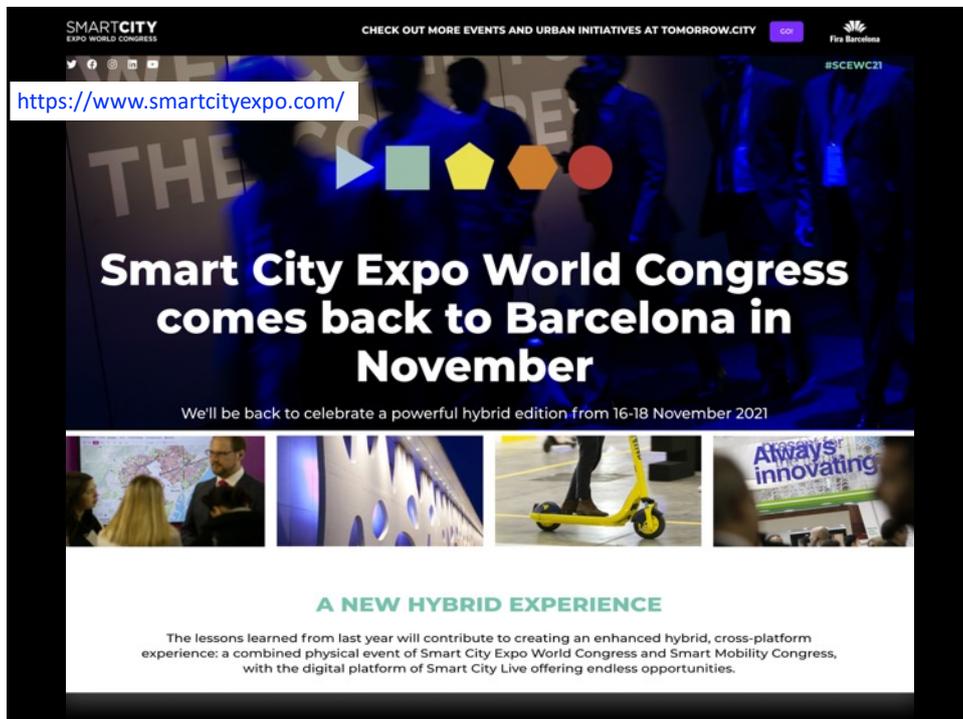


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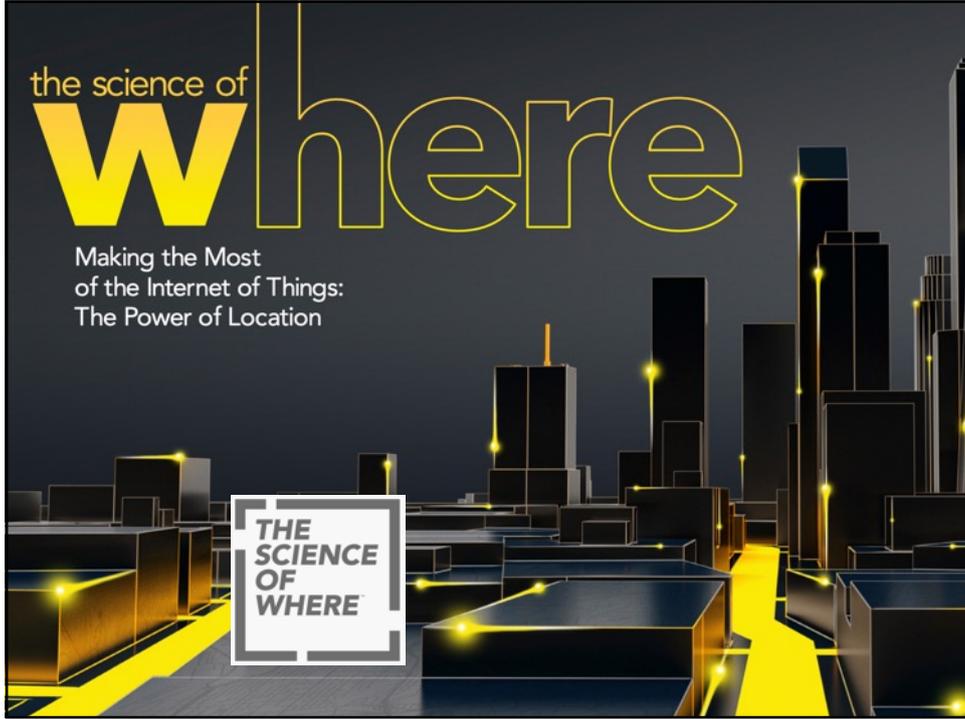


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