The “smart city” model: the concept, technology, key tasks and the prospects for the modern urbanism development

E Alpatova¹, J Markaryan¹, A Udalov², J Denisenko ¹

¹Don State Technical University, 1, Gagarin sq., Rostov-on-Don, 344002, Russia
²All-Russian Research Institute of Economics and Standards - a branch of the Federal State Budgetary Institution of Economics, 1, Institutskaya Street, Rostov-on-Don, 344000, Russia

E-mail: katrin.alpatova@mail.ru

Abstract. “Smart City” is a key urban trend of our time. The principle of applying the “smart city” model in modern socio-economic systems management in the form of cities, districts, regions and even countries is based on the fact that the urban space is equipped with a digitalization function to increase the urban space comfort for the residents and the guests of this territory.

In Russia, this concept introduction founder for objective reasons - the territory size, cargo and passenger flows, a huge tourist and recreational cluster – has become the capital - the city of Moscow [1]. At present, at the state level, the question about the need to develop and implement projects in the “smart city” sphere in small cities, and especially in single-industry towns [2, 3], in the view of solving the able-bodied population outflow key problem from the cities of this type has been raised.

Introduction

Smart city (“transcript” from the English translation “Smart city”) is a complex of interconnected communication and information technologies with the “Internet of Things” (IoT), with which the city-object internal environment management becomes more optimal and simple, in connection with this, the living standards of the population and the quality of the urban environment are also improving.

The simulated “smart city” implements two promising tasks:

1. Formation of a database for the city top management by collecting and transmitting the data obtained with analytics on the city functioning.

2. Forms a qualitatively new process for the urban environment improvement management on the basis of obtaining mandatory feedback between the urban environment administration and residents.

Main part

Currently, futurologists predict the smart cities growth in a year (i.e. 2020) will increase to the size of six hundred across the planet. As the main smart cities’ emergence positive aspects, it should be noted the residents’ life quality improvement of such an urban environment, as well as a decrease in the total number of costs in business processes, in connection with the activities’ automation and digitalization use. The concept of a “smart city” is based on the basic premise that there are data on the inhabitants of the urban environment: demography, quantity, needs, occupations, lifestyle, etc. as a basis for the
making management decisions database to modify the urban environment. Thus, there is a constant urban environment modification and improvement on the basis of the constant processing of the information received and its updating about the main element of the city - its residents and their needs in the urban environment. With the help of active digitalization (various integrated sensors, various electronic devices), the city residents’ activity collects a large amount of data centrally and forms a database for analytics, then optimization in various areas of the city’s life, but in general, always aimed at solving problems of low efficiency in various fields.

The following global directions are distinguished as the main components of the modern smart cities’ system:
1. Centralized video surveillance and photographic fixation, which forms a global security system for the urban environment, including reducing the level of crime and the potential for terrorist actions directed against residents of smart city.
2. The “smart transport” system, which allows a global review of public transport logistics, the introduction of “intelligent traffic lights” for these purposes (the problem of the city “transport arteries” optimal functioning is especially acute for large million-plus cities, where there is a serious problem of transport collapses during peak).
3. Creation of a unified emergency call system - an analogue of the American 911 as a system of permanent protection for each resident of the intellectual urban environment from various force majeure circumstances.
4. Creation of unified dispatching services, situational centers, which also allow coordinating the work of many enterprises of one sphere for the convenience of both users (residents of smart cities) and service providers, ensuring a healthy level of competition and allowing the development of a smart economy in such a city;
5. The Internet of Things (IoT), that is, the creation of an environment where various devices communicate with each other without the direct participation of a person, using special sensors, a signal is transmitted to remote the control systems; the utilities counters report an array of readings to the companies’ servers providing the resources for housing and communal services or management companies; road safety is supported by special monitoring devices for transport logistics (fleet monitoring technology (fleet management)), notifying the location, interval (for public transport) and the speed of a specific unit of a public or personal smart city vehicle. The use of the Internet of things has an applied character not only in the management of housing and communal services, but also in logistics, agriculture, medicine, etc. For a particular resident of a “smart” city, this technology will provide the possibility of interacting with each other household appliances, as well as increasing management capabilities and optimal spending resources in the communal environment and optimize their payment, which will also improve the life quality and a conscious attitude to the ecology of the “smart” urban space citizens.
6. The fifth generation of mobile communications (5G), as an indispensable component of the innovative “smart” communication policy providing comfort to the urban environment residents.

The abovementioned tools of 6 key enlarged components are used in various spheres of the “smart” city citizens’ life: as a means to improve the transport functioning (regulating problems with transport collapses and optimal congestion of the city’s roads at different time intervals, as well as related to road safety), medicine (especially related to emergency counseling of patients from remote settlements to the specialized medical institutions with a complex course or chronic diseases), industry (to improve the logistics system) and other areas that form the model of innovative digital city.

Thus, a set of key clusters that defines the key areas in the smart city development is determined.
1. Smart economy, which is expressed in:
   - the creation of a certain ecosphere, an enabling environment for the further innovative and entrepreneurial activities based on the development of information and communication technologies development;
2. Smart management based on the principles of:
- an effective system for building communications between the citizens and the city government, which should ensure the information flows information transparency level and the city administration activities;
- various initiatives and activity of citizens in the smart city management;
- the current section of the urban unit development strategy;
- interest of the citizens in the city administration official website, (expressed in its high attendance).

3. Smart finance, expressed in the categories such as:
- quantity, convenience and safety of using ATMs for the citizens;
- open public tenders to ensure the transparency of their work for the citizens;
- introduction of a payment system for travel in public transport using the means of payment by bank transfer.

4. Smart infrastructure, expressed in the following factors:
- “fast” Internet for efficient work with the consumers of the “smart” city taxi fleet (call efficiency, call forwarding to the taxi fleet free units, the online payment possibility of the order and taxi class choice);
- the existence of effective monitoring for the citizens on the change in road traffic of public transport online;
- the construction of a new type gas stations network for various types of alternative vehicles (electric vehicles, etc.);
- providing the “smart” city residents with car sharing services, also using Internet technologies.

5. The smart residents are represented by the following characteristics:
- active global Internet users and their growing number;
- introduction of electronic cards for the students at all levels of education into the educational process;
- using labor market data for employment in an online form.

6. A smart environment characterized by categories such as:
- implementation of a system that allows monitoring the residents’ environmental safety of a smart city;
- management and organization of measures to clean up the unauthorized waste in the city and suburban areas by the city active residents on the same team as the administration of the “smart” city.

7. Smart technologies are revealed in such forms as:
- providing the city residents with free Wi-Fi Internet connection points, in particular in public transport;
- providing the “smart” city citizens with mobile broadband access networks.

Results
The complexity of smart city technologies introducing into existing megalopolises is obvious, especially if these cities have historical centers that are not subjected to architectural changes and, in connection with this, there are difficulties in actively introducing the intelligent technologies into the existing megalopolis structure. In this regard, there is another approach to the urban environment intellectualization, namely, the urban facility creation from scratch. There are interesting projects examples for creating completely new cities using the “smart city” concept, which are essentially a single mega-project with strict structural constraints, subordinate to a single architectural solution, approaches to building an intelligent infrastructure, introducing “smart” technologies in all the smart city urban space areas. One of the striking examples of such megaprojects is the project to create the city of Masdar (United Arab Emirates), the end of this megaproject to create a “smart” city - Masdar is planned in 2030, but the city already exists and the city population has already reached 7 thousand people, it is planned to live in total number of inhabitants up to 100 thousand people. This urban space is already planned for construction using the key smart city technologies, namely, all the energy in this city will be based on the using renewable sources principles (Sun, wind, water). The urban space design takes into account the position of the Sun and the “rose” of the winds, as well as the introduction of a
special system that maintains a comfortable temperature for a person (that is, in general, it is the organization of victory over the climatic components of the new “smart” city territory and the construction of a comfortable urban space for future potential residents). The environmental problems solution is planned with the widespread introduction of electric autopilot vehicles. To avoid the environmental pollution by vehicles equipped with internal combustion engines, they will be banned from crossing the forbidden corridor around the city, which is about 10 km, which will reduce the carbon emissions from the conventional vehicles into the urban space atmosphere. Also, the project is based on smart housing and communal services technologies related to water consumption, which allow using its special meters to reduce its consumption, as well as using the technology for processing used water into water for vegetation irrigation in the city territory. For the benefit of the “smart” city and its ecology urban environment, the “smart” residents, who will sort the waste into containers specially delimited by type of waste will also work, which will allow further organizing the production of recycled materials at a waste processing plant (which will be built in the future).

Summary
Thus, as an example, the project for the construction and, at present, partial functioning, of the futuristic city of Masdar, even when viewed with its “wide” strokes, demonstrates how difficult it is to build a full-fledged “smart city”, since its construction should cover all the urban infrastructure areas. And also, the fact that the creation of such new “smart” cities, in fact, anticipates the well-known problems of building a typical urban space in relation to the construction site climatic features, thereby demonstrating a customer-oriented approach based on marketing analysis in modern conditions [4] to the creation of “smart” cities, as a key economic center in the future.

References
[1] Erokhina O V 2018 Prospects for the “smart cities” creation in Russia (T-Comm: Telecommunications and transport) 12 (4) 17-22.
[2] Markaryan Yu A, Kurbatova A N 2018 Modern problems and development prospects of Russian single-industry towns (Kant.) 1 199-204.
[3] Alpatova E A, Markaryan Yu A 2018 The vector of strategic development of a small single-industry town based on the diagnosis of its environment (Accounting and Statistics) 3 (51) 116-123.
[4] Udalov A A 2015 Marketing analysis in modern conditions (Collection of materials of the IV Intern. scientific-practical conf., Actual directions of development of accounting, taxation and statistics in an innovation-oriented economy, AzovPrint LLC, Rostov on Don).