

# Realization of smart city concept through media technology in architecture and urban space: from utopia to reality

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**Abstract.** This article describes the realization of smart city concept in architectural and urban media spaces. Considerable attention is paid to studying the influence of some parameters of the "smart city", such as adaptability, mobility, intellectualization, sustainability, security and some others. The article also analyses the elements of utopianism and realism in the application of high technologies in urban reality. The connection is studied between utopian models of ideal city and realized strategy of smart urban development, in which the integration of digital technologies leads to the formation of high-hume communicative space that serves as the locomotive of global changes. The study also identifies four theoretical models of media space and classification of urban screens according to compositional-planning implementation methods. As a result of the research, a hypothesis is suggested that there are some key factors and conditions furthering the implementation of the "smart city" concept, as exemplified by the creation of media spaces in urban environment. In addition, a conclusion is made about the prospects of using media technologies in the city on the example of Samara.

## 1 Introduction

"Smart City" is a strategy of resource management based on information and communication technologies in order to improve the efficiency of urban management and the quality of life in city. The concept of "smart city" is aimed at creating a safe, viable and sustainable urban development equipped with intelligent technologies and networks for provide the impetus for economic growth.

Digital technologies are realized in the urban environment in the form of media objects that create a virtual space, becoming a form of realization of the techno-utopia.

Information and communication technologies already today become a reality and improve the quality of life of citizens - these are public services, urban transport network management, rational energy use, healthcare, rational water use, innovative agriculture and waste management. Therefore, the future of cities belongs to smart urban electronic services [1].

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The basis of the "smart city" concept in the late XX - early XXI century was the digital utopia of the global pluralistic world. Twenty years later, the implementation of digital technologies has become a priority in the development of urban environment and the driving force behind the transformation of such metropolitan cities as New York, London, Hong Kong, Beijing and Moscow. The basis of the "smart city" is the six basic ideas with the prefix "smart": economy, management, citizens, mobility, environment and lifestyle [2, 3].

One of the main characteristics of the "smart city" is the intellectualization of space. The implementation of digital technologies ensures the transformation of space and contributes to the successful integration of the city into the global network of metropolitan cities. More and more cities of the world find themselves included into the common communications system via information and telecommunication means. The inclusion of the city into the world context leads to new opportunities for economic growth, the development of technologies, the creation of new jobs, the maximization of efficiency and productivity, the development of international tourism. However, depending on the level of the area's development, the scale of its adaptation and integration into the sphere of digital technologies may vary [4, 5].

Accelerated development and high quality of living in the "smart city" manifest themselves through efficient operation and satisfaction of the population's needs, through better allocation of resources and quick response to changes in living conditions. Elements of the "smart city" strategy are implemented on a first-priority basis in the following sectors: civil services, public transport management, land use planning, public health service and innovative agriculture [6, 7].

## 2 Materials and methods

The foundation of the high-tech city is the combination of the following basic elements: the efficiency of management; economic development; the prestige of the state.

The word utopia is traditionally translated from the Greek as an imaginary perfect place - οὐ ("not") and τόπος ("place"). But utopia is also ability of human consciousness to create a new concepts that guides for progress of surrounding reality. In 1516 English humanist and statesman, Sir Thomas More used the term utopia to describe an ideal island, citizens of which lived in harmony and in peace. Since then, the term utopia has been used to describe an imaginary project alternative to the existing reality [8].

The first description of utopia in the sense of a practicable model was offered by Plato in the Republic. Utopia is connected with reality, it is not fantasy, utopian model has a revolutionary power.

In recent years, the concept of techno-utopia has been used to define the smart city strategy. The advocates of this paradigm describe the smart city as a new technological utopia realized in an urban space.

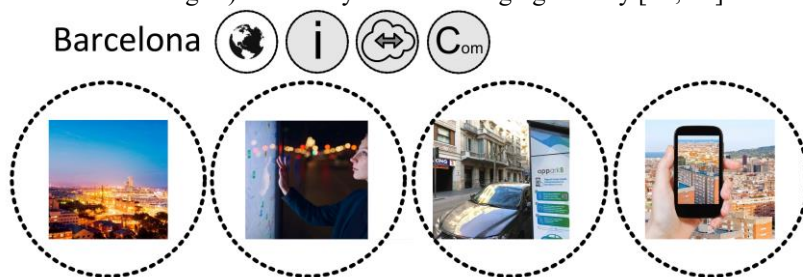
Often the idea of creating ambitious "smart cities" comes from IT companies, that have information about network technologies, but have no idea about the real functioning of the city. One of the most difficult question is how to create cities that are both smart and soulful. Cities are products of history and happenings, cultures colliding and communities evolving over time. Thus, there is a risk of the shift to creating new technological worlds (such as Masdar in the United Arab Emirates, Songdo International Business District in South Korea, PlanIT Valley in Portugal), which are far from real needs and don't solve any problems of already existing cities [9]. Modern realities are characterized by the creation of the key elements of the "smart city". These elements should develop as transitional ones, just like "aerials" [10] are created in a natural way.

The concept of smart city will not be the answer to all our problems but it will be instrument for transformations our environment through creating infrastructure underpinned by data sharing. For example, using a contactless card on the London Underground is a fragment of Smart City strategy. The right funding and support can provide such possibilities as intelligent lighting and waste management systems.

### 3 Results

The modern "smart city" is a realization of the future digital city. Despite the fact that the concept looks innovative, initially it was based on the traditional idea of centralized coordination. The integration of this intellectual infrastructure required significant capital investment. Therefore, on the city scale such a program could be implemented only within a vertical management system. However, the Internet has provided an infrastructure that allows creating independent communities. Thus, the "smart city" strategy is gradually changing - technological and social innovations are combined, in order to realize its separate elements.

An important example of the implementation of such an approach is Barcelona, which took the first place in the world ranking of intellectual cities in 2015 (Figure 1). The capital of Catalonia is an example of area branding and of the integration of ICT (information and communication technologies) into the system of managing the city [11, 12].



**Fig. 1.** Integration of ICT in Barcelona

As far as architecture and town planning are concerned, one of the most innovative characteristics of the "smart city" is the symbiosis of various digital technologies in the city. The modern city consists of a variety of digital media that give an impetus to the development of open visual information in communication field. Filling urban environment with digital technologies, such as media facades, LED screens, navigation objects, will make the city more open, informative and attractive, forming its mediature (media + architecture) [13]. The artificial light environment is a part of human habitat that provides optimal comfortable conditions for work and rest, for recreation and improving people's health.

To create a comfortable modern urban environment, architects should work in cooperation with other scientists. In his book "Places of the heart. The psychogeography of everyday life" the neurophysiologist Colin Ellard is trying to understand how our environment shapes our behavior and emotions, and what kind of world we should strive for creating. He concludes that people are much more obsessed with the virtual world than with the physical world. Technologies lay hands on the most valuable thing - our attention [14].

The merging of the virtual and the material, the utopian and the real in architecture has become possible due to the creation of media spaces, where certain processes of the dissemination and transmission of electronic information are taking place [15]. Today the architectural object is a media communicating information into the visual space of the city.

Therefore, the media space is a product of the historical evolution of the city's visual information and communication field [16].

Virtual space is essentially a bridge between utopia and reality. If utopia is generally known as a place that does not exist, then virtuality offers an alternative form of embodiment to this non-existent place. So there is a new kind of space - no longer material, but not yet real, a kind of quasi-environment that goes beyond the physical reality.

Today the media space, which penetrates into urban environment, is a fusion of traditions and innovations that reveals itself through a number of integrations of architecture and society, architecture and information, text, shape, sound and color. The informative function of the architectural object, which reflects the society's social, ideological, navigational, commercial aims, takes an active part in changing both the architectural object as such and the appearance of the city as a whole, forming a new architectural and spatial phenomenon - the city's visual information and communication field [17].

Modern media spaces are diverse and are located in central squares, in streets, in parks. The pioneers of the integration of media spaces into urban environment are Piccadilly Circus in London, Times Square in New York, Ginza in Tokyo and Las Vegas. The implementation of modern technologies in the architectural and spatial environment of the world's largest cities is a necessity for the formation of the newest complex urban spaces [18].

## 4 Discussion

As a part of the analysis of media objects internationally, of the study of their design datum, their functional profiles, the peculiar features of their translation into the visual communication field of urban environment, in the course of the research it's possible to single out four theoretical models of media space formation:

- Mechanical model (the structural shell of the facade is designed using a hydraulic or pneumatic engine of mechanisms, the shell is connected via a system of cables to the media façade's control unit; and basing on the parameters of the preset program, the system sets the option of the media façade's movement);

- Illumination model (includes the design of the media facade, sensors, a system cable, the building's electrical control unit and active content. A mobile phone, an Internet guide or a special unit for the interactive control of the building by the public may serve as active content.

- Projection model (video-mapping, it may be adapted only to an already existing building, its orientation implies the use of just the main facade, the structure of the model is a projector installed at a certain distance from the projected facade, internationally this model is often temporary, used during media festivals, when graphic expositions are projected on architectural sights);

- Display model (principally its design is similar to the illumination model, except the active content).

Each of these models is a structural basis for the functioning of the object, into which the media facade is integrated or for which it has been specially designed. While designing, it is necessary to allot room in the building's electrical control unit for the media façade's controls, which include:

- Software computer;
- Display generator;
- Motion or temperature sensor generator, etc.

Some companies use motion, temperature or sound sensors that increase the interactivity of the object, and with the help of their generators the received data is

processed and transmitted to the PC for further digitization. Thus, for example, depending on environmental temperature, the building may change the color of the façade's graphic illumination (Dexia Tower, Belgium) [19, 20]. Besides, urban screens may be classified according to the used compositional-planning implementation methods, basing on artistic language:

1. Abstract-dynamic (technologies: frontal and reverse projection, LED technology, LED cluster "ProPixel", "Mediamesh", "Illumesh")

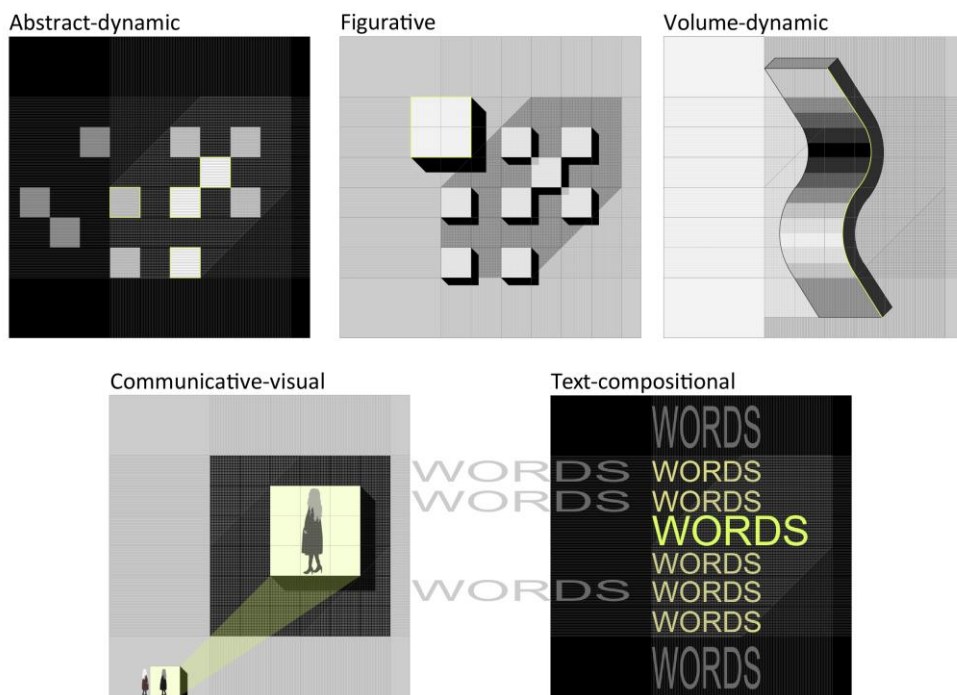
2. Figurative (technologies: frontal and reverse projection, LED technology, LED cluster "ProPixel", "Mediamesh", "Illumesh")

3. Text-compositional (technologies: frontal and reverse projection, LED technology, "Mediamesh", "Illumesh")

4. Volume-dynamic (technologies: "Aegis Hyposurface" solution, Nova Technology)

5. Communicative-visual (technologies: LED technology, "Mediamesh", "Illumesh", Stealth™ material, Interactive LED-tiles)

The availability of the resources included into this classification in the city becomes an important system for the formation of new space for social networking (Figure 2).



**Fig. 2.** Classification of urban screens according to compositional-planning implementation methods

## 5 Conclusions

The primary elements of the concept of smart city can be found even in the social utopias of Francis Bacon and Tommaso Campanella. But thanks to the development of technology this utopian model becomes realistic strategy of urban development. The idea of a smart city gradually ceases to seem like an ephemeral fantasy and begins to materialize in the urban environment, becoming a program of future in many metropolitan areas of Europe, America, Asia, and even Africa [21, 22].

The development of interactive technologies promises to make the city a comfortable and reasonable place for living. At the moment, thanks to the implementation of high technologies, new approaches to design are appearing, when architecture is an interface responding to the user (economic, political and physical reaction).



**Fig. 3.** Layout of existing and promising media spaces on an example of Samara

More and more projects are aimed at involving citizens in the "co-management" of the city: from solving transportation problems - to improving their own yards. Thus various levels of the implementation of media technologies in urban environment are formed – to be implemented in distant or near future, depending on the potential of the city and on the concern of citizens about its development (Figure 3). For example, in Russia the leaders in the sphere of creating the "smart city" are Moscow, St. Petersburg, Kazan and Yekaterinburg. Separate elements for creating a comfortable and safe, multifunctional and diverse environment have been implemented in such cities as Samara and Volgograd within the framework of the "smart city" program. To sum up, it can be said that at present media spaces are part and parcel of the "smart city", the model of which is pre-determined by the benchmark data of the city, its weaknesses and strengths.

## References

1. URL: <http://www.greaterkashmir.com/news/opinion/smart-city-mission-utopian-idea-or-a-reality/253593.html>
2. G.V. Esaulov, L.G. Esaulova, *Urban construction*, **4**, 27 (2013).
3. M. Batty, *European Journal of Physics ST* **214**, 66 (2012).
4. E. Moir, T. Moonen, C. Clark, *What are future cities – origins, meaning and uses* (2014).
5. A.V. Adonina, E.A. Akhmedova, *Innovative project*, **4**, 30 (2016).
6. G.V. Esaulov, *Architecture and modern information technologies*, 1 (2015).
7. M. Husár, V. Ondrejčka, S.C. Variş, *Materials Science and Engineering* **245** (2017)
8. S. Mohanty, *IEEE Consumer Electronics Magazine*, **6** (2016)
9. URL: <http://www.information-age.com/smart-city-concept-vs-reality-123468465/>
10. G. Grossi, D. Pianezzi, *Cities* **69**, 79 (2017)
11. A.L. Gelfond, *Architecture and building construction*, **3**, 44 (2016)
12. A. Townsend, *Smart cities: big data, civic hackers and a quest for a new utopia* (2013)
13. URL: <http://status-media.com/lyudy/ekspertnoe-mnenie/umnyj-gorod>
14. L.S. Akhmedova, *Vestnik of Orenburg State University*, **2**, 165 (2009)
15. C. Ellard, *Places of the Heart : The Psychogeography of Everyday Life* (2015)
16. S. McQuire, *The Media City: Media, Architecture and Urban Space* (2008)
17. M.V. Dutsev, *The concept of artistic integration in the latest architecture* (2013)
18. L.S. Akhmedova, *Privolzhsky Scientific Journal*, **1**, 109 (2009)
19. E.A. Akhmedova, A.D. Kandalova, *Urban construction and architecture*, **3**, 44 (2016)
20. URL: <http://www.online812.ru/2017/06/05/009>
21. S. McQuire, *Urban screens: history, technology, politics*, **5**, 45 (2009)
22. URL: <https://www.theguardian.com/global-development-professionals-network/2014/oct/06/smart-slums-smart-city-kenya-mapping>