

Use of augmented reality information and communication technologies in urban historical environment

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Abstract. In Samara, in the historical center of the city, the fragments of two wooden fortresses were found (the years of construction were: 1586 and 1706). The task is to find a way to demonstrate these architectural objects to a full extent against the background of the landscape of their historical location. The reconstruction of lost objects on the site where they were located is difficult because such areas are densely built up with newer houses. One of the solutions may be to use augmented reality technologies that allow combining, by means of superimposition, visual information (textual, graphic and three-dimensional), including the graphic reconstruction of the historical object, and the modern urban landscape as it looks.

1. Introduction

Year after year, information technologies are having an increasing impact both on economy and on people's everyday life. The competitiveness index of state economy has got a high level of correlation with the index of information and communication technologies development in the country. Thus, in the section "Development of individual segments of information technologies industry" of the document "Strategy for the development of information technologies industry in the Russian Federation during the years 2014-2020, and for the long term - until 2025", the conclusion is made that due to the wide use of new mobile, intelligence and other kinds of systems, as well as of related hardware, the demand for information and communication technologies in social and cultural life is increasing, due to the wide range of possibilities offered by visual technologies, first of all by interactive ones [1].

The promising formats of using information and communication technologies in social and cultural life may be seen as a way to solve the problem of demonstrating lost unique historical and architectural objects. Augmented reality (AR) technology is a demonstrative format used to connect the real and the virtual. In other words, this is a combination of the image of the real world with additional information (text, graphic and three-dimensional). The idea of this technology was first tested by the military - back in the middle of the 20th century, they started making helmets for military pilots with a built-in additional display. With its help, the pilot received important information: he saw, for example, how much fuel was left in the tank, or where the airplane was heading [2]. Currently augmented reality technologies from the military sphere are rapidly moving into the market of mass high-tech services. Augmented reality technology, for example, is widely implemented in the spheres of tourism, information services and advertising business.



In the field of augmented reality technologies, technological solutions are currently being developed and implemented in the spheres of education, scientific research, culture and history:

1. education - lifelong learning mode (which is associated with the rapid pace of development of information technologies and software, the change of technological patterns and the difference in the level of different generations representatives' communication skills);
 2. scientific research - the field of visual and information technologies, including interactive ones;
 3. culture and history
- interdisciplinary research based on the integration of engineering, IT, architectural and design skills;
 - marketing - the field of social media marketing and mobile applications.

2. Research

Let us consider the format of using augmented reality technologies in social and cultural sphere. A person in an unfamiliar city points his smartphone at the street view that opens up, and additional useful information appears on the screen of the gadget: "The building on your right is an architectural monument, it was built in this and that century; that's what this building looked like two hundred years ago," or "in the building on your left there is a cafe, and now it offers a discount for tea and delicious bagels". This is approximately how the augmented reality solutions work, that are already being actively implemented, by Russian companies too, and that are increasingly penetrating into various services.

One of the most notable examples of the emergence of such services in Russia is the historical and cultural innovative project "Virtual History", which the telecom operator MTS began to implement in October 2012. The project started in Irkutsk, where any user of a smartphone or tab computer (with iOS or Android operating system) is invited to download a special application. After that, the gadget, having automatically determined the part of the city in which the person is, will inform him/her of the nearby historical objects, and will also offer to look at the old photographs that give an idea of what this or that building looked like many years ago. It is possible to see the past of a particular architectural monument by pointing a camera at the object: the mobile computer recognizes the building and superimposes a historical photo over it on the screen. The application provides for adjusting the transparency of the historical photo - at the request of the user, the photo may show itself more or less weakly against the background of the real building. At the same time, a brief piece of information about the historical object appears at the side. Archival photos for the service have been provided by the Museum of the History of the City. In Irkutsk this project is being implemented in cooperation with the city authorities [3].

MTS has managed to implement the new service in cooperation with the world-famous Historypin web service. The work of the latter is based on anyone having a chance to "pin up" or "attach" a historical photo from his/her personal photo archive to the virtual map (therefore, Historypin can literally be translated as "attach history"). Thanks to such volunteers, a user walking past some particular urban sights can see archive photos. MTS, using the Historypin web service, plans to invite the citizens, who are ready to share their photos, to take part in the project.

The project in Irkutsk is not the first experience of MTS Company using augmented reality technologies. During the European Football Championship in Ukraine in the summer of 2012, similar services were offered in Lviv, Kiev, Kharkov, Donetsk: people could download an application on their phones and then, according to the above described scenario, get additional photos and other information about the sights. During past several years, MTS has covered Nizhny Novgorod, Kaliningrad, Kazan, Tomsk, Krasnodar, Samara and Moscow with the "Virtual History" project.

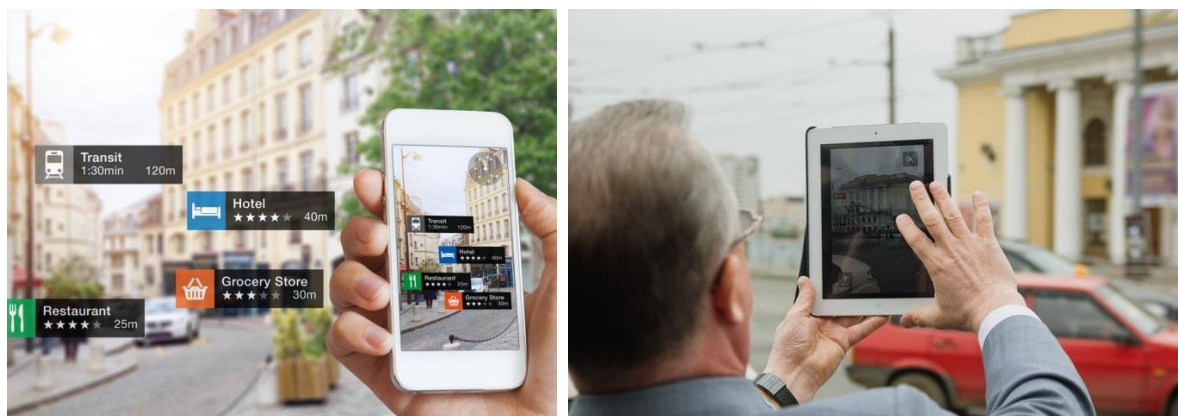


Figure 1. Example of using AR technology: real objects amended with information or historical photos superimposed over them.

Gorki Park in Moscow has got interactive tables called Historama. The aim of the project is to reconstruct the historical panoramas of this place with AR and VR components. The project was developed by the Russian company PlayDisplay. In fact, they wrote an application for mobile devices on iOS and Android. Anyone can point the camera of his/her gadget at a marker, and he/she will be surrounded by photographs of the mid-20th century, it is just needed to rotate the device. Also, along with this, the application provides a map of the park, and in future PlayDisplay specialists plan to add more new panoramas and audio tours [4].

AR technology offers other possibilities of use in the sphere of virtual history - demonstrating a graphic reconstruction of the three-dimensional models of lost historical architecture, and superimposing it over the visible space of modern urban landscape. Such use of augmented reality technologies makes it possible to perceive long-lost architecture on the spot, in 3 D and life size, which helps to create comfortable conditions for the development of educational tourism and to involve older people and active young people in the study of the history and architecture of the city.

In Samara this technology could be adapted for one more project. “Samara fortresses in augmented reality format” is creating the virtual models of two lost wooden fortresses [5]. In urban environment this method of demonstrating models of fortresses can be implemented via joining together the real and the virtual, when additional information is superimposed over the image of real urban environment, in the form of a virtual three-dimensional model of one of the two Samara fortresses.

3. Expected Results

It will be possible to see the past of a particular architectural monument by pointing the camera of a smart phone or tab computer at a special information module with a QR code: the mobile computer will recognize the code, and a historical photo or a virtual three-dimensional model of the reconstructed historical-architectural object in different historic periods will be superimposed on the screen over visible urban space. The demonstration of lost architectural objects on the sites where they existed before will contribute to the increase of tourist flow into the area.

The users of the results of this project will be the citizens and numerous guests of the city. The interested parties to this work may be the Department of Culture, Samara City Administration and telecom operators. The benefit that the municipal authorities will get from this project is drawing attention to the history of the city; a telecom operator may use it for stimulating mobile Internet traffic consumption.

The sequence of project implementation stages:

1. Researching and determining the architectural planning characteristics and dimensions of Samara wooden fortresses, based on engravings, plans, descriptions and analogues.

2. Virtual 3D reconstruction of the objects – the two Samara fortresses at the time when they existed. The creation of the three-dimensional models of the two fortresses, and the models' activation in augmented reality system.

3. Information support of the project. The development a presentation platform with virtual interactive models of historical-architectural objects.

The implementation of the way to demonstrate in urban environment the fortress models in augmented reality format. The fabrication of information signs and their installation on the site of the cultural layer of the two fortresses.



Figure 2. Graphic reconstructions of the first and second Samara wooden fortresses.

4. Conclusion

In specific town-planning situations, with numerous spatial transformations, the problem of demonstrating lost architectural objects can be solved by means of reproducing the virtual model of

the object, which will draw public attention to the problem of irretrievable loss of historical and cultural heritage;

The development and subsequent implementation of a comprehensive historical and cultural urban development strategy should be based on the creation of unique public space models, which will combine the past and present in a new spatial paradigm.

References

- [1] Russian Government 2013 *Strategy for the development of information technologies industry in the Russian Federation during the years 2014-2020, and for the long term - until 2025*, available at: https://digital.gov.ru/common/upload/Strategiya_razvitiya_otrasli_IT_2014-2020_2025.pdf
- [2] Hi-News 2019 *New pilot helmet allows you to see through the plane*, available at: <https://hi-news.ru/technology/video-novyj-shlem-letchika-pozvolyaet-videt-skvoz-samolet.html>
- [3] Russian Expert 2012 *At the borders of reality*, available at: <https://expert.ru/expert/2012/46/u-granits-realnosti/>
- [4] Moscow Administration 2013 *Historama/Historama - new mobile app Gorki Park*, available at: <https://cao.mos.ru/presscenter/news/detail/842087.html>
- [5] Malysheva S G and Shlienikova E V 2016 Wooden fortresses of the 16th-18th centuries. The concept of historical renovation of the center of Samara and its media mythology *World heritage and degradation. Smart Design, Planning and Technologies Le Vie dei Mercanti. XIV Forum Internazionale di Studi* pp 1574-1581