MIXED REALITY AS NEW OPPORTUNITY IN THE PRESERVATION AND PROMOTION OF THE CULTURAL AND HISTORICAL HERITAGE

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Abstract

This paper presents the main conceptual framework of the first stage of realization of the scientific project “Application of the mixed reality in the training and promotion of the cultural heritage in university information environment”. The aim of the project is to show the possibilities of the virtual and added reality through the so defined mixed reality in training and promotion of cultural and historical heritage for the benefits of the users. The presentation of the cultural and historical heritage based on the Augmented Reality (AR) technology will enable visitors to interact with the content in an intuitive and exciting way. It is a technology that expands the perceived reality at the expense of complementing the visible and tangible world with digital information in real-time.

In the context of modern trends for socialization of cultural heritage, the role of information and communication technologies is emphasized because it creates new opportunities for access to cultural values in regards of national policy and the very point that is a priority for the European Union. This policy is part of the global doctrine of sustainable development, which is based on the three basic principles: economic development, social justice and environmental protection, including cultural heritage. As a result of the investments made for the socialization of the cultural heritage, the development of the regions is stimulated through economic activities related to the exploitation of cultural resources for cultural tourism, the development of the regions and the human resources. In this sense, the cultural heritage plays an increasingly important role in the regional development of Bulgaria. The process of socialization is also a consequence of the increased educational level of travellers. The data given by the European Commission, quoted by some experts from the European Commission, show that nearly 60% of Europeans are interested in the cultural aspect of tourism and especially in issues related to cultural heritage. This is what makes tourism a powerful tool of cultural exchange worldwide. By using cultural and natural assets of the environment, cultural tourism promotes and “maintains the collective memory of society”.

Keywords: mixed reality, education, cultural and historical heritage.

1 INTRODUCTION AND THEORETICAL FRAMEWORK

The promotion of the cultural and historical heritage through information technology is an extremely efficient formula for the proper use of technology in the process of perception and study of human cultural heritage. The opportunities offered by modern technologies allow a more attractive and correct way to enrich the access options to the elements of cultural-historical heritage.

3D modeling is an opportunity for a more efficient documentation and socialization in modern concepts for the preservation of cultural heritage, where modern technologies are applied, and the highest possible preservation mode is achieved, as well as their studying and promotion are done [1], [2], [5] [7].

Today, researchers possess an increasing amount of available data so they need properly to adapt to the scientific methodologies. The use of 3D digital technology helps archaeological reconstruction in many ways [3], [4], [6]. The essential issue is that digital tools provide a means of standardizing and comparing individual data sets that match visual material together with geographic, textual, qualitative architectural and quantitative information. As a result, the three-dimensional models allow the researcher to holistically explore the city as a complex phenomenon, including spatial, its material and cultural determinants [8], [9].

Preservation of cultural heritage is a systematic process of search, study, identification, documentation, registration, conservation, restoration and socialization. Hence, protection of cultural heritage presents a system of measures ensuring its preservation in the Interest of Society. Opportunities for digitization of cultural heritage contribute to the “sustainable development of culture

as a guarantee for the establishment of our shared value system and is an indicator for the achievement of a higher quality of life". In this sense, cultural heritage can serve successfully to overcome a number of regional problems by stimulating cultural tourism and by achieving educational goals in a university environment [10], [11], [13]. More over, free access to cultural assets is provided, digitized with modern methods and providing high quality output. When choosing between the values foreseen for digitalization it is important to take these values, which are particularly significant and representative for the Bulgarian culture. Thus, any new investment made for digital cultural contents and their free access places our country in a more advantageous position than our competitors from abroad.

2 METHODOLOGY

As to the development of 3D technology, it should be noted that virtual walks have become an important factor to learn about history and culture of one's own country. The 3D technologies provide a realistic way for more complete representation of architectural sites, museums and galleries in the digital space [12], [14], [15], [16]. For this reason, 3D model presentation should include the necessary information so that the users get the same knowledge as if they would have actually visited the site. Two basic technologies for generating 3D information - photopanormas and three-dimensional virtual models will be used in the project. The first approach can be fulfilled only on real objects, while the second one allows the application of nonexisting ones.

Our intention and approach are to create an ancient city and includes a repository of procedural rules that generate the basic typologies of buildings for modeling Greek and Roman cities.

During the implementation of this project, a workflow will be generated on the bases of the Roman graphic schedule. The main challenge of this workflow is to integrate empirical data with procedural methods. The application of a generic description of the Roman temple will of the actually excavated temple site points at the Roman Forum, and shows some trends in which such generalizations are insufficient. Therefore, procedural rules, which rarely exist for a long time in a static state and become rewritten continuously when new parameters arise. This process of writing and rewriting of procedural rules is likely to lead the research to the discovery of elements that could be unexpectedly linked and therefore could be further systematized [17], [18].

This in itself represent a self-actualized exercise that provides information and which contains information of the research process that helps us to create structural hypotheses to fill the gaps left by incomplete remnants, while allowing us to distinguish between peculiarities and contexts, on the one hand, and plausible alternatives, on the other. Therefore, this process of work is an "integrated" approach to the procedural modeling, as it aimed at a complete depiction of architectural data including geographic databases, published documentation, 3D models, semantic descriptive rules, and interactive displays [5], [7], [19].

The intended approach is a method for clarifying the logical problem of architecture as well as it is an effective means of creating fully realized data models for ancient cities. The sections that follow will describe the steps that make up this workflow and which explain how the procedural rules are written.

The workflow starts with an area map that summarizes the geo-reference of all relevant published plans and of the survey data. The object's terrain model is constructed with contour lines and/or dots. Then it creates a geographic database that will be the repository for all model metadata. Construction steps are called a polygon in the geographic database, and some fields are added that match the attributes and will be displayed on the final model. In addition, the geographic database fields can be created [16] so to allow the recording of the link to the source of each attribute, indicating whether the value is a guess or if it is an estimated value, or if it provides additional comments on the decision-making process associated with the model of the ancient city [20].

The creation of virtual objects from the cultural and historical heritage passes through two stages - elaboration of a maximum detailed three-dimensional model and generation of variants of visualization of the model.

A three-dimensional model of a building can be designed in many ways. The easiest and fastest way to do this is through any of the specialized architectural design products such as Maya, REVIT Architecture, Autodesk Architecture, ALLPLAN etc. Because they handle the standard elements for construction of modern buildings, it will be necessary to develop additional components or repositories related to the specificity of the respective monument. These may be special openings for windows and

doors where the arched shapes and special layout, embrasures for closing walls, grids, etc [2], [3], [13].

The used modeling program should have richer opportunities for the creation of random geometric shapes and their combination in view of the modeling needs of the construction of dome-shaped forms; arches supported by different forms of cupolas, arched bridges) and so on. In these cases, it may be more convenient to apply the three-dimensional model with general purpose programs such as Autocad or even Google Sketchup. In the most common cases, the work on generating the model is realised by combining the products' advantages listed above [3], [5], [9].

By generating a three-dimensional model, a virtual description of the geometry and the material construction of the surfaces of different objects is practically created. From it, it is possible to subsequently generate different visual and spatial visualizations of 3D space.

The interdisciplinary scientific team is a serious prerequisite for applying modern approaches and research techniques that will favor the generation of new knowledge, skills and hypotheses.

A bibliographic study of traditional and electronic sources related to proposed approach is envisaged. As a result, a comprehensive picture of the degree of scientific and societal interpretation for conservation and socialization of cultural heritage through modern information technologies will be achieved [7], [8].

A survey among students and lecturers from all accredited universities in specialties related to cultural heritage will be conducted. The aim will be to get information about the level of knowledge and awareness of the capabilities of modern technologies in the training process.

The "traditional" modeling model is based on polygon or on NURBS modeling. Multi-angle mesh modeling is perhaps the most common form of 3D software and it is represented by popular software systems such as 3ds Max and SketchUp. Polygon modeling retrieves a 3D shape from primitive geometric shapes that scale, rotate, and transform. This is similar to procedural modeling, except that the polygonal modeling element manipulates objects directly into the visual interface, pointing and clicking to change the geometry. This type of GUI is intuitive, fast and easy to learn. However, unlike procedural modeling, it does not require the moderator to "write" in textual form the solutions that are offered so that the record of the modeling process, along with the ability to provide scientific evidence of the interpretative model, is more likely to get lost unless the model maker takes care of way for documenting his choice [8], [9].

NURBS modeling uses flexible spline devices rather than polygons in order to create geometry, allowing realistic representation of organic shapes and curved surfaces. Similar to sculpture, NURBS modeling is even more intuitive than polygon modeling and therefore carries the risk when used for research patterns to lose scientific rigidity in the process. NURBS modeling software Rhino and Maya include more and more "parametric" features into their packages. The terms "parametric" and "procedural" are sometimes used substitutable, but in practice they are quite different concepts. In principle, "parametric" means any technique that works by using parameters. But "parametricity" has a specific meaning in the context of 3D modeling for architectural design. In the field of architectural reconstruction, the parametric components of the building can be mapped in Maya as they are a 3D model of the Suleymanie mosque in Istanbul [13], [16].

Photogrammetry, the latest 3D modeling technique, can reproduce every historical element with photorealistic precision and is increasingly common in 3D archaeological documentation and cultural heritage. Using different processes, an individual object such as a sculpture, a column, or even a whole building can be photographed using laser scanners, photographs, or a motion structure to achieve an incredibly precise, accurate photographic pattern. The software that creates these models happens with both an open source and a commercial code, and also includes popular packages such as Photoscan and 123D Catch. Similarly, the equipment they require ranges from a simple camera phone to an expensive laser scanner. Photogrammetry is suitable for documenting artifacts as it can be used on the site as a basis for extremely precise measurements and linear drawings. However, for the reconstruction of models that rely on restricted archeological remains, this method is less useful.

3 RESULTS

The development of science in Bulgaria both in the short and long term perspectives is related to the state of art in the European Union, its main policies and trends. These policies are defined by the Lisbon Strategy and the adopted Europe 2020 strategy and are linked both to actions targeting

intensive funding for research and new research infrastructures as well as to the establishment of networks in the scope of national and joint research programs by strengthening of European cooperation with Third countries [14], [15], [20].

This project envisages building a scientific network that will promote the results of the project and will further support the development of an international project related to the creation of 3D models of ancient cities.

The project envisages serious publishing activity in indexed by worldwide databases such as Scopus, Web of Science, Elsevier, etc.

It is a fact, that science in Bulgaria has a significant potential in the most major areas of modern scientific research. Bulgarian publications, which bridge the citation barrier, are registered in all 21 main scientific areas monitored by the Essential Science Indicators according to the National Strategy for the Development of Research. We will contribute to the increase in the qualifications and skills of the project research team-members [16].

The main focus of the scientific infrastructure priority is information and communication technologies. We will use the latest technologies in the field of Virtual Reality and Added Reality. Our project will involve experts from different institutions who will contribute to create a virtual model of an ancient city (for example the ancient city near Blagoevgrad, Bulgaria – Skaptopara).

We can summarize that the search for opportunities to expand access to cultural content through digitization and the creation of 3D models also helps to overcome the problems of poverty, social exclusion, digital division, as well as helps to facilitate the access to the cultural heritage of the whole territory of the country. This case also has a direct application in all educational levels, particularly in a university environment. The concrete trend will be studied through a truck survey, where some predefined indicators will be specified and the change in the number of users interested in digitized cultural values will be followed. The introduction of these new forms of presentation of cultural heritage will contribute to promote it among a wider audience, which in turn can be conceived as a prerequisite to stimulating cultural tourism [12], [13].

These actions will further help to potentially accelerate economic development; restoration and preservation of important cultural values; the local economy will become more entrepreneurial and stable; as a result the traditional culture will be strengthened; a greater tolerance towards cultural differences will be achieved mainly for the multicultural societies; the perspective will be open to attract investments in by conservation and management of cultural heritage thus supporting and improving the local infrastructure. One of the great advantages of 3D models is the possibility of realistic, dynamic and accurate representation of the ancient world, referring to the modeling and simulation methods [4], [5], [16].

The main results of the project will be:

- Preparing the classification scheme for the comparison of software products for 3D modeling;
- Elaborating of three-dimensional modeling based methodology and three-dimensional modeling based on panoramic images;
- Performance of the basic technological processes necessary for three-dimensional modeling;
- Drawing up of a virtual model of an ancient city from South-Western Bulgaria;
- Methodology for the publishing of 3D models on the Internet through Virtual and Added reality;

Another aspect of this project is the use of new 3D technologies in the training of students and PhD students as a virtual reality. Virtual halls will be set up in which students will be able to distance themselves from lectures and "touch" the ancient cities. This virtual world enables people to take activities that include virtual meetings, training sessions, and virtual school or university training. Many universities around the world have built an online version of their campus and use this to lecture, teach new skills, or enable students to work together on projects.

This type of system assists in full-time education but is also crucial for students and PhD students in distance and distance learning. They enable them to interact actively with remote collaborative projects.

The goal is to build a community in which students can participate and collaborate in a learning process based on teamwork and solving specific practical tasks. The apprenticeship of "learning by doing" by American scientist John Dewey enables students to design and build new places, perform

different tasks - assigned to them by the lecturer, and acquire knowledge in new and exciting ways. This ensures an experience that is unlikely to forget and acquire the necessary skills and qualifications to work in a real work environment [3], [4], [20].

4 CONCLUSIONS

This article aims to present the short description of the project, its objectives and methodology. Towards the end of the project, we will try to present the revival of an ancient city and opportunity to be seen by modern people.

ACKNOWLEDGEMENTS

This research would not have been possible without the financial assistance of the following project: "Application of the mixed reality in the training and promotion of the cultural heritage in university information environment" financed by National Science Fund of the Ministry of Education and Science of the republic of Bulgaria with Contract № KP – 06 – OPR 05/14 from 17.12.2018, led by Prof. DSc Irena Peteva.

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