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USE OF THE OPEN SOURCE SOFTWARE PLATFORM OPENSIMULATOR FOR THE VIRTUAL RECONSTRUCTION OF HISTORICALLY SIGNIFICANT INDUSTRIAL SITES

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ABSTRACT

In the article, we examine the questions of using an open-source software platform Open Simulator 0.9.0 for virtual reconstruction of historically significant industrial sites in the form of a virtual museum. Virtual museums have extensive educational and research capacity and contribute actively to preservation of cultural heritage. The use of modern information technologies allows drawing attention to the monuments of historical and cultural importance, as well as forming their modern image, and causing a desire to visit a real museum and see original works of art. The authors have created a virtual Museum, which contributes to development of museum studies, promotion of regional history and museum activities among the broad audience including younger generation. The Museum is a collection of three-dimensional models of industrial facilities of The Nobel brothers oil production facilities located in the Tambov province territory, both existing and lost, or partially destroyed. These include manufacturing facilities of the Nobel family located close to the Platonovka station (nowadays Platonovka village of the Rasslazovskii district of the Tambov region) and etc.

Keywords: information system, virtual museum, software platform Open Simulator, preservation of historic and cultural heritage, Nobel family.

INTRODUCTION

Museum studies represent a combination of many scientific areas: educational, historical, cultural, historical and artistic[1]. Nowadays, a museum is not just a collection of exhibits, but also an effective tool for education and development of personality.

Currently one of the leading trends in development of museums is transition from non-systematic visits to museums to creating a centralized system of museum education. A constructive dialogue between students, museum staff and teachers should become a theoretical and methodological basis of pedagogical influence of museums in the educational environment. One of the ways to form such a cultural and pedagogical space is the use of modern information technologies, in particular *virtual reality* [2]–[4].

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VIRTUAL REALITY AS A TOOL FOR CREATING OF A VIRTUAL MUSEUM

By virtual reality, we mean a new concept of using modern computer systems and human-machine interface in order to obtain an effect of a three-dimensional environment where user interactively contact with virtual objects, thereby creating a sense of three-dimensional presence [5].

The first virtual museums appeared in the 1990s and after 15 years the number of virtual tourists has reached the number of real visits to [6]–[8]. In a broad sense, by a virtual museum we mean an information resource created by the means of modern computer technologies and representing digital versions of objects of tangible and intangible cultural heritage in a virtual space [9], [10].

At present, there are many different virtual worlds, all of which have 6 attributes that are inherent in all worlds [11]:

1. Common space: many people can simultaneously participate in the life of a world.

2. Graphic interface: world's space is reflected virtually and varies from 2D "animated" images to more impressive 3D images.

3. Efficiency: communication takes place in real time.

4. Interactivity: participants are allowed to modify, develop, build, or accept content that is tailored for them.

5. Consistency: a world exists regardless of whether there are individual users in the system.

6. Communication: a world provides an opportunity and facilitates formation of social groups within a world, such as teams, guilds, clubs, cliques, neighborhoods, communities and so on.

This paper deals with the virtual reconstruction of historically important industrial facilities on the example of the Nobel brothers' oil partnership.

DEVELOPMENT HISTORY OF THE NOBEL BROTHERS OIL PARTNERSHIP IN RUSSIA

In 1879, on may 25 (June 6, new style), the first foreign and the largest oil company "The Petroleum Production Company Nobel Brothers, Limited (Branobel)" was founded in Russia (Baku) with the capital of 3.0 million rubles. The founders of the partnership were three Nobel brothers Ludwig, Robert and Alfred and their friend Colonel of the artillery guards (later General) Baron Peter Alexandrovich Bilderling. In 1874, Robert Nobel first visited Baku, where he became interested in the oil business. Interested in the prospects of oil business development, Robert proceeded up and down the Black city (the area of Baku city), visited many oil fields and factories. Entrepreneurial young man quickly realized that oil business was the most promising and promising. Telling in a letter to Ludwig about his plan, he persistently persuaded him to create a partnership. In 1875, Robert Nobel came to Baku again with a small capital and bought a small kerosene plant and several oil-bearing plots in Sabunchi from the Tiflis society for 25 thousand rubles.

Initially, the Partnership focused its activities in the village of Sabunchi, where 8 acres 114 square yards of oil-rich lands were purchased just for 15,500 rubles.

Ludwig enlisted the help of friends, financiers P. A. Bilderling, A. F. Blumberg, A. S. Gadgeren, B. F. Wunderling, I.Ya. Vabelskiy, M.J. Beliamin and in 1879 "The Petroleum Production Company Nobel Brothers" was founded. Soon the companions became owners of oil-fields in Surakhany, Balakhany, Bibi-Heybat. Having leased large plots of land between Black and White cities, they built refineries, sulfuric acid, copper smelters, iron plants and berths.

To the fifth anniversary of the "The Petroleum Production Company Nobel Brothers", its total capital was equal to 3 million rubles.

The lands, where presence of oil resources was detected were immediately rented: plots in Kura or Caspian lowland, on Kobylanski pastures or in the aquatic area of the Caspian Sea. Part of them was kept in reserve, while the remaining was used for drilling wells, conducting research and borehole exploring.

In the beginning of the 20th century, the Absheron Islands attracted attention of millionaires and owners of fishing business. The Nobel brothers immediately rented the island of Saint ("Pirallahi"), and in 1904 they found a rich oil field there and started its operation. In a short time, a small fishing village turned into an industrial town. On the Nobel Island, people scooped oil with buckets from small manually dug wells since ancient times.

Within a short period of time, the Branobel Company turned into a giant oil tycoon, monopolized oil trade and occupied the most important markets of Russia.

By the beginning of its activity, with the permission of the Russian government, the partnership issued shares in the amount of 5 million rubles in order to gain access to the world oil market, and thus significantly expanded its capabilities.

Ludwig Nobel died in 1888. When he died, the partnership had a capital of 35,000,000 rubles in gold, which was one fifth of the total capital of foreign companies in the Russian oil industry. Robert Nobel died in 1896. From 1888 to 1917, Russian properties of the Nobel family were headed by Ludwig's son Emmanuel. In 1918 he moved to Sweden.

Throughout Russia, the partnership has built a network of warehouses for storage and sale of petroleum products. Two of 140 warehouses were built on the territory of the Baku province.

In this paper, a virtual reconstruction of petroleum products warehouse, located at the Platonovka station of Rasskazovsky district, was performed.

VIRTUAL RECONSTRUCTION OF AN OIL PRODUCTS WAREHOUSE IN THE VILLAGE OF PLATONOVKA, RASSKAZOVSKII DISTRICT, TAMBOV REGION

The three-dimensional virtual museum is implemented using an open source software platform OpenSimulator 0.8.2, which is a server platform for creating three-dimensional virtual worlds [12], [13].

At the initial stage of reconstruction, all available information about the objects of cultural heritage was studied, including historical materials and archival information.

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Then, based on known parameters (dimensions, material) and using 3D-modeling programs (Google SketchUp, Blender) we have developed 3D models of production facilities, which are parts of the oil products warehouse built near the village of Platonovka, Rasskazovskii district, Tambov region, which was one of the first warehouses belonging to the oil production partnership of the Nobel brothers.

The warehouse consists of: tanks for gasoline and fuel oil with a capacity of 25,000 and 3,000 liters, respectively; cooper workshop, firefighter's booth for a hand pump, [illegible] for food supply; canopy for storing of 200 barrels; cellar for 120 barrels, etc. The layout of the warehouse project is shown in Figure 1.

Using landscape design programs (L3DT, Terragen) based on available topographic information (maps, plans, schemes, images from space), a 3D landscape model was designed. Based on 3D models of objects and landscape, a total virtual space was formed in the software system for creating multi-user 3D worlds - OpenSimulator. A visitor of the museum connects to the server via the Internet using a special software client (Cool VL Viewer, Singularity) and manages movements of an avatar (virtual character) inside a simulated virtual world.

Figures 2 through 4 present individual fragments of the virtual museum.

Using a three-dimensional environment for development of a virtual museum is attractive to users of the system. They like that their own personality is represented by an avatar, which can freely move within a virtual world and study it from any point. In addition, social aspect plays an important role. Users like that they can meet other people inside a virtual world, watch their movements and actions and communicate with them in real time. Resemblance to a game is undoubtedly attractive for the young audience.

All information sources together with textual and graphic materials, photos, video [illegible] presented on the web-server http://heritage.tstu.ru in two languages: Russian and English, which increases the amount of potential visitors of the virtual museum.

With the help of the developed system it is possible to conduct virtual tours. The uniqueness of such tours lies in the fact that virtual reality can immerse visitors in different epochs and demonstrate not only the current state of historical objects in various stages of their existence, but also unrealized projects and architectural monuments that have disappeared, were lost or partially destroyed.

CONCLUSION

Virtual museums possess significant cognitive and research potential and [illegible] contribute to preservation of cultural heritage. The use of modern information technologies makes it possible to draw attention to historical and cultural monuments as well as to form their modern image and desire to visit this museum in reality and look at original works of art. The virtual museum developed by the authors [illegible] development of museum studies, popularization of local history and museum [illegible] especially among the younger generation.

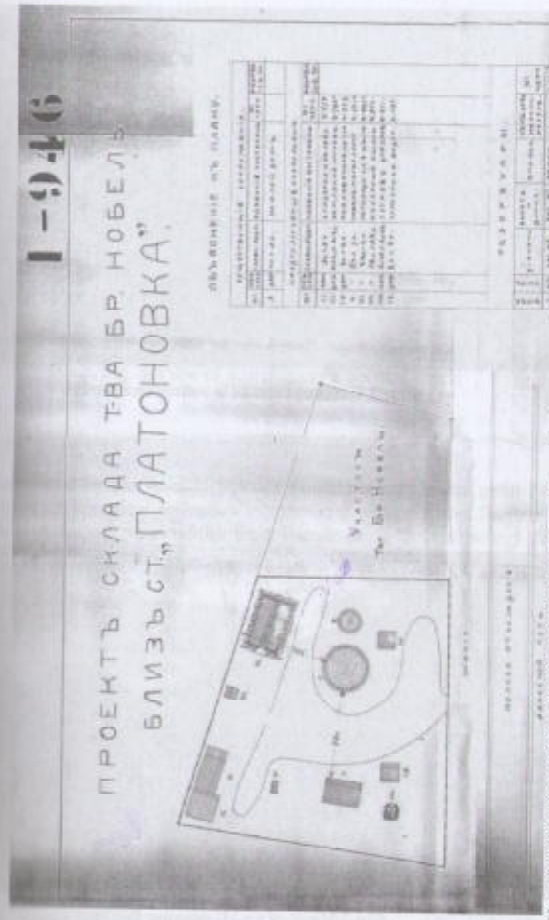

Fig 1 Project of a warehouse of the Nobel brothers oil production partnership near the "Platonovka" station

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Fig. 2 General view of a warehouse model

Fig.3 View of an oil pouring facility

Fig. 4 View of a firefighter's booth

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USING A SIMULATION PROGRAMME TO PREDICT DISTORTION OF CAST IRON CASTINGS

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ABSTRACT

The increasing computing power of modern hardware systems opens new possibilities for simulating complex solidification phenomena as well as the overall simulation of the casting process. Although the simulation of filling and solidification can be considered to be state of the art, the simulation of residual stresses and distortion is still the object of intensive research. Distortion is one of often found problems of castings, especially large castings with thin sections such as frame shape or those with curved surfaces. To predict distortion, it is necessary to perform thermal and stress analysis of castings because distortions is the result of non-uniform cooling and closely related to the behavior of casting material. Distortion prediction is usually designated by displacement results directly obtained from stress analysis. For numerical simulation, the casting design has to be enmeshed to finite difference (FD) or finite element (FE) models for thermal and stress analysis, erformed using finite element modeling. The paper deals with the stresses in castings that cause casting distortion. The formation and course of distortion is monitored by means of a simulation program that allows their elimination or minimization on real castings.

Keywords: distortion, simulation programme, casting, stress, crack

INTRODUCTION

Most foundries have stories about castings that flew into pieces with a bang when being machined, or even when simply standing on the floor. It is easy to dismiss such stories, but they should be viewed as warning. They warn that, in certain conditions, castings can have such high stresses locked inside that they are dangerous and unfit for service – even though they look perfect. Castings defects can be essentially eliminated through the application of computer predictions [1].

If a casting were to be cooled at a uniform rate and with a uniform constraint acting at all points over its surface, then it would reach room temperature perfectly in proportion – perhaps a little large, or a little small, but not distorted. In practice, of course, the casting generally is somewhat large, or somewhat small, and not quite accurate in shape. Occasionally, it may be very seriously distorted. Again, in an ideal world, if the constraint by the mold were either zero or infinite, in both cases the casting would be of predictable size and correct shape.

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