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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 this article, we examine the question of using an open-source software platform for virtual reconstruction of historically significant industrial sites in the form of a virtual museum. Virtual museums have extensive educational potential capacity and contribute actively to preservation of cultural heritage. The information technologies allow drawing attention to the monuments of historical and cultural importance, as well as forming their modern image and creating a virtual museum of art. The authors have created a virtual museum, which consists of development of museum studies, presentation of history and museum activities among the broad audience including younger viewers. The Museum is a collection of three-dimensional models of industrial objects of the Nobel brothers' oil production factories located in the Tarnobrzeg province, both existing and lost, or partially destroyed. These include manufacturing facilities of the Nobel family located close to the Platanowka station (nowadays Inowroclaw village of the Kaszubian diocese of the Tarnobrzeg region) and etc.

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

INTRODUCTION

In recent years, virtual museums have become a component of many scientific areas: educational, cultural, historical and artistic[1]. Nowadays, a museum is not just a space to display objects, but also an effective tool for education and development of modern information technologies, in particular virtual reality[2–4].

One of the leading trends in development of museums is transition from national museums to creating a virtual centralized system of museums education. A virtual museum requires the involvement of students, museum staff and teachers to create a new methodology of pedagogical use of virtual museums in the educational environment. One of the ways to form such a cultural and pedagogical field of modern information technologies is to develop virtual reality.
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 presence [5].

The first virtual museums appeared in the 1980s and after 15 years the number of virtual tourists has reached the number of real visits [5]-[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 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 control in the world.
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 user 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 places and facilities on the example of the Nobel brothers' oil partnership.

DEVELOPMENT HISTORY OF THE NOBEL BROTHERS OIL PARTNERSHIP IN RUSSIA

In 1859, on May 25 (June 6, new style), the first foreign and the largest oil company - The Petroleum Production Company Nobel Brothers, Limited (Baku) - was founded in Baku (Azerbaijan) with the capital of 3.0 million rubles. The founders were three Nobel brothers: Ludwig, Robert and Alfred, and their father, Colonel of the artillery guard (later General) Baron Peter Alexandrovich Nobel (1783-1874), Robert Nobel first visited Baku, where he became interested in the oil business. He was interested in the prospects of oil business development, Robert proceeded on his journey to the Black Sea (the area of Baku city), visited many oil fields and got acquainted with the small successful young man who quickly realized that oil business was the most promising and promising. Writing in a letter to Ludwig about his plans, he personally invited him to create a partnership. In 1875, Robert Nobel came to Baku again, increased his capital and bought a small kerosene plant and several oil-bearing plots in Baku for 25 thousand rubles.

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

Later, they expanded the company's activities to the Samarkand, Samarkand, Baku, Baku and the region. Having leased plots of land between Baku and Samarkand, they built refineries, sulfuric acid and barite works, iron plants and ports.

The fifth anniversary of the "The Petroleum Production Company Nobel Brothers", the company's capital was equal to 2 million rubles.

Its lands, whose rich soil was used to cultivate an extensive variety of crops, including wheat, sunflower, and cotton, was rented by the company from the local farmers. The company also built a number of buildings, including a school and a hospital, to support the local community.

The beginning of the 20th century saw the company expand its operations and continue to grow in size. In the early 1900s, the company's capital had increased to more than 10 million rubles, and it had become one of the largest oil companies in the world.

The company's success continued into the 1920s, and it remained a major player in the oil industry for many years. However, the company's fate was eventually sealed by the political and economic turmoil of the 1920s and 1930s, and it was eventually nationalized by the Soviet government in the late 1920s.

The company's name was changed to the Beta Oil Company, and it continued to operate as a state-owned entity. The company played a major role in the development of the Soviet oil industry, and it contributed significantly to the country's economic growth and development.

In 1992, the company was privatized, and it became part of the Novocondominium Group, a leading oil and gas company in the region. The company continues to operate today, and it is one of the largest and most successful companies in the region.
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 Platonovka, Raspadskoy district, Tambov region, which was one of the oil 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 1,000 liters, respectively; a cooper workshop; a fireman's booth with a hand pump, man for food supply; canopy for storing of 206 barrels; cellar for 129 barrels, etc. The layout of the warehouse project is shown in Figure 1.

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

Figure 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 the fact that their own personality is represented as an avatar which can freely move within a virtual world and study it from any point of view. Visual and audio effects are important, too. People like that they can meet 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 audience.

All information sources together with textual and graphic materials, photos, videos presented on the web-server http://heritage.istu.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 of uniqueness of such tours lies in the fact that virtual reality can immerse visitors into different epochs and demonstrate not only the current state of historical sites, but also visualize various stages of their existence, but also realize projects and monuments that have disappeared, were lost or partially destroyed.

CONCLUSION

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


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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 one of the main steps in the simulation of residual stresses and distortion it is still the subject of intensive research. Distortion is one of the main 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 are the result of non-uniform cooling and closely related to the analysis of casting material, distortion prediction is mainly based on displacement fields directly obtained from stress analysis. For numerical simulation, the casting model has to be meshed to finite element (FE) models for thermal and stress analysis, performed using finite element modeling. The paper deals with the techniques to castings that cause casting distortion. The formation and course of distortion are monitored by means of a simulation program that allows their elimination in preliminary simulation on real castings.

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

Introduction

Most foundries have stories about castings that flew into pieces when being removed or even when simply standing on the floor. It is easy to dismiss such stories as a result of handling mishaps. However, it is important to note that certain castings may be dangerous if mishandled because they are subject to high stresses due to the change in temperature. These stresses can be eliminated through the use of computer simulations [1].

Casting was to be cooled at a uniform rate and with a uniform constraint acting at its surface. If a casting were cooled at a rate more than that of its surface, it would reach room temperature perfectly in proportion with a little large, or a little smaller, but not distorted. In practice, the casting generally is somewhat large, or somewhat small, and not quite accurate in shape, so it may be very seriously distorted. Again, in an ideal world, if the material were either zero or infinite, in both cases the casting would be of indefinite size and extent shape.