OPTIMIZATION OF 3D MODELS IN GOOGLE EARTH FOR VIRTUAL TOUR IN THE FACULTY OF AERONAUTICS

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The work describes the development, updating and optimizing virtual tour in the area of Faculty of Aeronautics (LF). To creation of virtual tour we used technology as Google Earth and Google Sketchup. The important part of the work is optimization process, finding the most appropriate method to create complex 3D objects LF and the development and playback of the virtual tour. The output of work is a database of 3D objects(warehouses) of LF and virtual Tour of Google Earth. The technology is designed for both professional and laymen.

K e y w o r d s: virtual tour , 3D model, 3D warehouse, Faculty of Aeronautics

1 INTRODUCTION

The main objective of this work is to create, update and optimize a Google Earth complex *3D model* of the Faculty of Aeronautics as a continuation of last year's air of students of the faculty. The work is divided into two parts, practical and the theoretical one.

The practical part will try to process the task of the present assignment. The first step of this phase of the project is to select the appropriate 3D objects (also called as *3D warehouses*) to be used in a virtual tour through the area of aviation faculty in Kosice.

The output of the theoretical part will be slightly wider and will include a detailed description and procedure of the practical part of the solution. Our goal in this stage is to describe the procedure for updating, creation and optimization of 3D model of the Aeronautics faculty. At individual chapters it will disassemble, describe and analyze selected buildings, the whole process of creating a 3D model dormitory buildings and canteen, the whole process of *virtual walk* over the area, brief instructions for created virtual walk and also we will say a little about the individual application Google - Earth, Sketchup.

2 AIM OF WORK

The aim was to create and update the *3D model of area at Faculty of Aeronautics*. The work is the sequel students work of last year at this faculty, see [1],[2],[3]. At first stage it was needed to add 3D models of missing dormitory buildings and dining building.

Another important objective of this assignment was to create a virtual walking around the campus of the Faculty of Aeronautics, with marked trails and paths. Our task was to create a single path from the entrance to the premises of Aeronautics faculty to individual buildings. Next we had to visualize the route between the airport, station square and the area of Aviation faculty.

3 SOURCES OF WORK

The work have been developed on the basis of already existing works of former colleagues and students of the Aeronautics faculty. These former students gradually developed and upgraded the content of *3D model of Aeronautics faculty in Kosice*, [5]. They used the same information technology, to create it as I used. The mentioned information technologies are Google products. This is the Google Earth and Google Sketchup, see [4].

4 CREATING A 3D MODELS OF COLLEGE AND DISHES

In this chapter we have analyzed the process of 3D object dormitory buildings and dining. Models of these buildings, unlike other building complex aviation faculty have not yet been created. Before we started the realization of 3D models, we have viewed the building in a real form and took a picture. We had such a better idea about how the building looks like, what the dimensions, characteristics and other properties. This helped us to minimize the differences between the final

model and the actual display of the building. The implementation of the 3D model were performed using Google Sketchup, which is freely available on the Internet.

The location of the building: The first step, which we did after finding all the necessary information and after inspecting the real display dormitory building was enter the locating of object into Google Sketchup. This step ensures that we have placed the location of model in the real world so then Google Earth will appear location to the right place. If we did not specify its location and we would like to see created model in Google Earth, it would automatically set the location where they are all temporary display 3D objects. Thus, when we entered the real position of the generated 3D objects, we can begin to create the 3D models.

Developing the basic shapes of 3D model: First, we outlined a 3D model. To create a base dormitory and dining, we used the *rectangle* tool, because their base is a regular quadrilateral shape. From these bases, we developed a 3D modeling and further course of the dormitory and dining.

To realize next step we needed a tool *pull / push.* As the name itself is whispering, this tool is used for pushing and pulling of selected areas and a limited part of the model. It use to change the dimensions of a 3D deformation of different parts of objects. Given the (entity), this tool can be used to expand, narrow at the case to deepen and continuously improve. The different sections must be bounded. It is for this reason that this tool can recognize which area we want to form the and change its shape. Therefore plays a key role proper separation of areas that we want to edit. The 3D modeling of objects is quite frequently used tool. Also, at this work, we have not use it just at this stage of the project, but also later in the modeling of building dormitories and canteens.

The next step in making the 3D model of the dormitory building was to create more detailed shapes that are part of the building. These forms were included balconies, partitions and chimney. We could also create a much more detail, but work with 3D models would then be slower and more difficult.

So we proceeded on creating a dividing wall between the balconies. First we had to draw a separate area on the walls of which are based on these walls. For this we used the above-mentioned *rectangle* tool, or we drew the outline of walls using the tool *line*. Because every dividing line between balconies had the same size, it was enough to draw one basis. We copied and reproduced it on the necessary number of additional base. Using the *select* tool, we only selected areas or contours, we want to copy. The actual copying had been done already by the usual keyboard shortcuts' ctrl + C "and" ctrl + V ". Similarly, we drew the outline of balconies. To create the base of the chimney, as it is a quadrangular shape, we used the *rectangle* tool. As we have outlined all the areas of contours, we could start with the 3D modeling of parts. For this we used the previously mentioned tool *push / pull.*

Colouring of 3D models: When the skeleton of a 3D model and its basic shapes done, it is time to enrich the model of the color page. For this, we used *paint bucket* tool. This stage usually decides how the 3D model will resemble the real-image of building. Google Sketchup offers several ways to recreate the object of their shape and color. It offers a wide range of the most common surfaces, which are divided into categories to make it as easy as possible for users to find the best coverage of the surface. These categories include: metal, wood, glass, water, stone, roofing, and various other categories of surfaces.

However, if the user program will not find the right form of coverage for your 3D model, can produce a given texture itself in any program. All you need is only to load the texture created in Google Sketchup and fill desired shapes and objects. Similarly, we proceed in our case when we solved the coloring of dormitory buildings mostly in a way where we created our own textures. For this we needed actual pictures of the surfaces of the dormitory. Then the graphics program edits photos into final shape, which could be used in the Google Sketchup for completion of various parts of the dormitory building. We created a texture of window, balcony, main entrance and the side walls of 3D models. Using these generated images we could begin to paint different surfaces dormitory. Because the individual windows and balconies are not different it was enough to create only one texture of a window and balcony. All of the walls where are windows, were then simply filled with this texture. For accuracy, we still have to set the

correct dimensions of texture. After selecting the tool, we automatically opens window with surface (materials) and click on the section *edit*, we can easily adjust the dimensions of a 3D model which we can fill with the desired texture and gain its final form. Created 3D models, we could apply to the creation of a virtual walk.

Sharing a created 3D model: Google Sketchup offers its users, and creators of 3D models sharing their 3D models in Google Earth, which is a very interesting feature of the program. Created 3D models can be visible to all Google Earth users worldwide. Publication of the model would require the approval of Google employees. From my experience, this approval process takes about two weeks. Our 3D models of dining room and college are currently approved and published in the global system of Google Earth and they are visible to all users of Google Earth.

5 DEVELOPING THE VIRTUAL TOUR

One of the main objectives of our work was to create a virtual tour option for building LF. To achieve this it was necessary to consider the 3D objects will figure in this survey. The responsible decision-making, we choose these buildings:

- college building,
- dining room,
- Building dean office,
- Building B-14 (KLI, KLTP),
- Building B-15 (KLTP, KAaS),
- Building B-16 (KA, KLI),
- Building B-19 (KLP, KMLP),
- Building B-25 (KAaS, library),
- Building B-43 (teaching block).

After selecting the appropriate objects that are on the premises of the Faculty of Aeronautics, we continued by creating a virtual tour of the Faculty of Aeronautics. The virtual tour we created in Google Earth. This is basically a process which consisted of certain inputs, outputs and activities. In our case we could consider for inputs a single 3D models of buildings, which are located in the area of aviation faculty. The following activities were for example: the creation of places, creation of routes between places and optimize output. The output of this stage has already done a virtual walk in the area of aviation faculty.

Gradually, we have created in Google Earth database of folders, places, roads, and routes. This database is part of the created virtual tour and contains the following items:

- **Faculty of Aeronautics TUKE** is a folder that contains all the places and roads in this area. Double-click on this icon for our 3D viewer displays vertical display area of the Faculty of Aeronautics.
- **Object Faculty of Aeronautics** is a place that shows the LF area. In contrast to the previous screen, this screen is not vertical but is tilted so it is better to see 3D objects in this area.
- **College, building B-43** are places that are located at selected buildings. Double-click on the selected place are the 3D viewer displays the selected site, hence the selected building.
- **Roads** are the last item in the folder Faculty of Aeronautics TUKE and is also the subdirectory. It contains drawn roads, from entering of the area, to every place in the area of LF. After the opening of folder you will see a list of ways such as: Road to the college, Dean office, the B-19 etc. After clicking on the chosen road, we show the selected route and the bubble, which contains information on road distances to the nearest 10 meters. Double-click on that road, we in the 3D viewer displays a vertical view of the whole road. The roads are highlighted in blue. All roads are set opacity to 50%. View of roads is performed by checking and un-checking the boxes, which are located in every way in the Places panel. Ideally, you always see only one way.
- **Routes** are folder, which is not part of the folder of the Faculty of Aeronautics TUKE, because the data in this directory are not in the LF area. In this folder are routes from the two major cities of Kosice to the Faculty of Aeronautics. The folder containing the return routes, holds a total

of 4 items: Route Airport - LF, LF - airport or Station Square - LF, LF - Station Square. After clicking on the selected route, we show the selected route and the bubble in which there are data on the distances and approximate time to overcome this route by car. Double-click on that route, we are in the 3D viewer displays a vertical view of this entire route. Selected routes towards LF complex are highlighted in blue. Return paths are shown in red. All routes are set opacity to 50%. View of tracks is performed by checking and un-checking the boxes that are located on each route in the Places panel. Ideally, you can always see one route, only. .

6 OPTIMIZATION OF VIRTUAL TOUR

There are many ways to optimize the generated virtual tour for optimal performance. Generally speaking, when the greater demands on the quality of our output, the result will be more space on your hard drive, so it will work slower. It is therefore important that the designer has found an optimal balance between output quality and user-friendly software and computing.

Optimization in Google Sketchup: We can say that the optimization process we started in the fist step of the work, and in creating 3D models of dining and dormitory in Google Sketchup. The 3D models we have tried to make with regard to quality, but also the ease of software and computer technology. Certainly it could be any of the buildings to create much greater detail, but further work would then result was much slower and more difficult. Therefore, we must not go into all the details of the building, and we focused mainly on the final shape of a building with a 3D model. We selected the most suitable surfaces to cover various parts of the building. To optimize the output we certainly helped by the fact that we have 3D models of buildings, dormitories and dining stored in one file and so it made working with models a bit easier. We were able to achieve the final effect of the form of 3D models of real buildings, and even at the cost requirements of software and hardware. The resulting set of 3D models, canteens and dormitories occupied on your hard drive just less than 1 megabyte.

Optimization in Google Earth: As for the optimization in Google Earth, there are more options than in Google Sketchup. Condition applies here, the more *placemarks* in folder My Places is located, the slower the loading of the virtual tour contents. Therefore, we tried to create a limited number of placemarks, and those we place only in those places that have played in a virtual stroll through the role. Google Earth offers other ways to optimize the virtual tour. The possibilities offered by such optimization. showing and hiding points of interest, showing and hiding important 3D buildings and optimization tools are also displayed preferences that also affect the speed of work and view virtual tour in Google Earth.

7 CONCLUSION

The main contribution of this paper is in the virtual tour of the Faculty of Aeronautics´ campus. It might serve for all its employees, professors, students, and also the general public interested in virtual familiarization with the area of the Faculty. The work involved development and optimization of the 3D model of campus . Optimization of graphical objects was necessary owing to their number and complexity. Digital output of the work is a database "*letecka_fakulta_kosice_2012.kmz*".in the system of Google Earth. It contains separate graphical RD objects of the campus, virtual tours in the area and optimized virtual routes from the airports and the railway station leading to the campus of the Faculty of Aeronatuics Košice.

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