A VIRTUAL PROJECT OF THE HRANICKO MICROREGION

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Abstract. The aim of this project was to create a virtual project of the Hranicko Microregion and to analyze all virtual reality-enabled software capable of creating a virtual project. The bulk of the project consisted of summarization of Leica Virtual Explorer (LVE) capabilities for a generating of thematic virtual project/virtual GIS/3D GIS. The work is focused on utilization of three dimensional (3D) GIS for promoting tourism in the Hranicko Microregion. In the project were presented LVE capabilities for creating 3D maps, its strengths and weaknesses for current virtual cartography, LVE utilisation, and ways to further develop 3D GIS. All the data was obtained from project STRA.S.S.E (Strategic Spatial Planning and Sustainable Environment), most of them are thematic. This thesis resulted in a CD with a virtual project of the Hranicko Microregion, a user manual and a user-friendly installation pack. The results of this work have been used to make dozens of video sequences and printscreens which will be used for an upcoming atlas of the Hranicko Microregion. The project was part of the bachelor thesis of the author.

Keywords: Virtual GIS, Leica Virtual Explorer, thematic virtual cartography

1 Introduction

The 21st century is characterized by a tremendous increase in access to information and knowledge, due in large part to rapid developments in digital information technology, cartography faces double call – modern technologies and impact of the market. Traditional cartography has been impacted by these changes and market demand. One result of this has been the evolution of traditional cartography to digital maps and atlases which have unbelievable potential for the future. [5]

At the present time, 3D visualization in virtual reality is often utilized in conjunction with computer and web cartography. Virtual reality is frequently the first step in creating 3D maps. These maps tend to be user-friendly. The premise is that users (people) living in a natural 3D environment can work without difficulty in a 3D applications environment. Thus, these applications are easily understandable for all users, not just for those with cartographic or geographic technical knowledge. [2]

Three dimensional real-time visualization applications have reached global dimensions with solutions like Google Earth and NASA Worldwind. Users around the world can navigate from space to street-level for virtually any desired point on the planet. This development has significantly accelerated the next step into the third dimension of the GIS world. ArcGlobe and ArcGIS Explorer from ESRI (Environmental Systems Research Institute), TerrainView Globe from ViewTec and Leica Virtual Explorer from Leica Geosystems represent some of the programs that are currently on the market. They are able to visualize large amounts of data from local or remote resources. The data can be 2D, such as vector data or image data, but also digital terrain models and actual 3D such as 3D models. [1]

2 Aims of thesis

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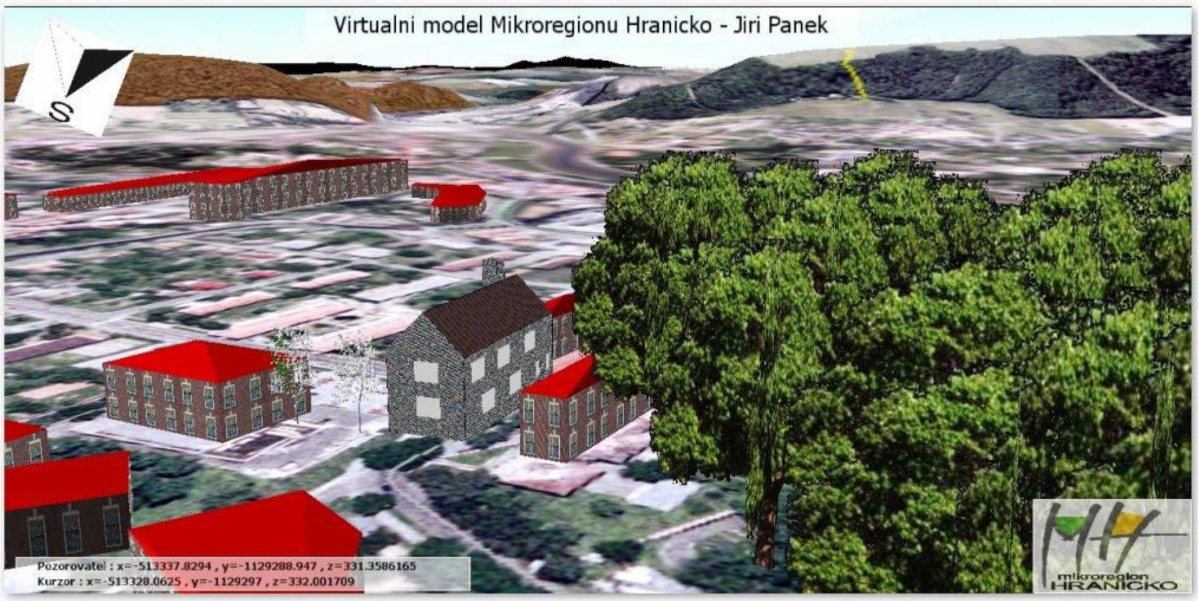


Picture 1: Environment of virtual project in LVE

3 Locality

Hranicko region is situated between Moravská brána (Moravian Gate), Podbeskydská pahorkatina highlands and the foot of the Oderské vrchy hills. The altitude ranges from 250 meters above sea level in Hranice to 502 meters in the Potštát area. The Bečva River forms the east-west axis of the region. Its most important tributaries are the Velička and Ludina. The Ludina flows into the Bečva, which continues into the Morava to the Danube into the Black Sea. The Velička with the Bradelný, Koutecký potok streams and Mraznice tributaries flow into the Bečva. The Luha with the Hradečný, Bělotínský and Lučický potok streams and Doubrava tributaries flow into the řeka Odra River and to the Baltic Sea. The Velička originates in a spring near Potštát, the Ludina between Partutovice and Jindřichov, and the Luha near Jindřichov. The entire area of the Hranice microregion is part of a mildly temperate climatic zone with average annual precipitation between 700 and 800 millimeters. There are 24 villages and cities in this microregion [4].

4 Methods

The most important aspect of this project was not creation of the virtual project, but an analysis of all capabilities that give us Leica Virtual Explorer for future development and creation of 3D maps and virtual projects. First, it was necessary to explore all the functions of LVE. This part was especially challenging since there are no Czech or English user manuals in existence. The bulk of the project could be conducted once the functions were revealed. During the creation of the virtual project, was attempted to test as many functions as possible and produce a short user manual. The aim of this presentation is to display LVE capabilities for 3D visualization.

4.1 Software

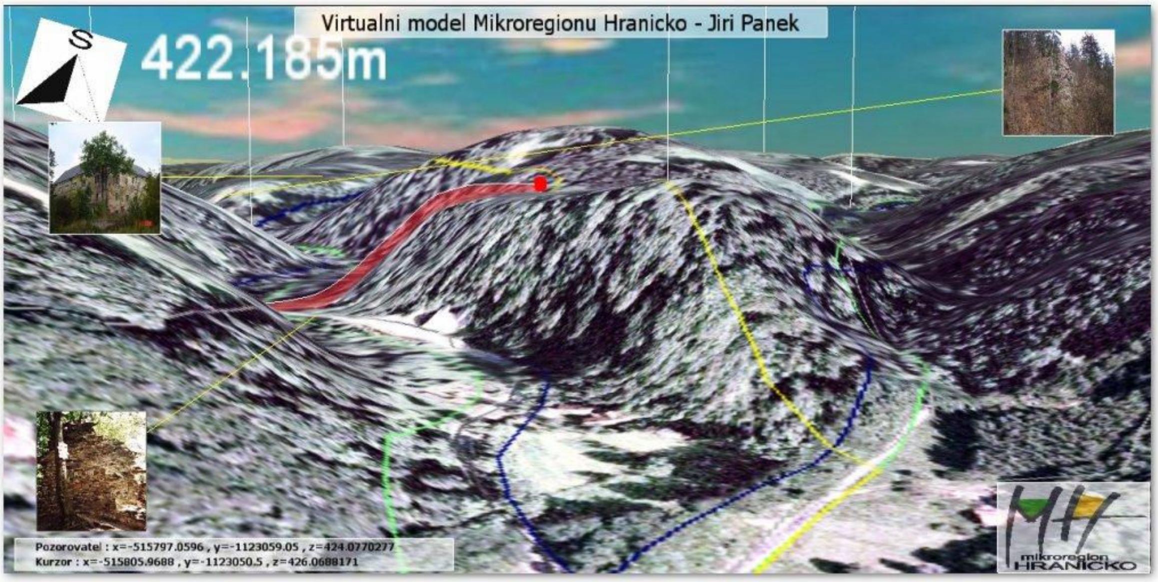
At the outset, it was necessary to ascertain the best software solution for this particular project. It was reviewed/utilized five basic software packages in the survey. The results can be found in Table 1. One may also utilize Microsoft NotePad using open language GeoVRML 2.0. This language is not dependent on any platform and it is possible to open it in Internet Explorer/Mozila Firefox/Netscape Browser with additional use of some of the add-ons, such as Cortona VRML client. One of the disadvantages of this language is its inability to effectively display large amounts of data expediently (in numbers of gigabytes). Leica Virtual Explorer was chosen because it was the most updated software on the market at the time and its capabilities had not been explored yet. The entire project employed this software (with the exception of DEM (digital elevation model), 3D buildings, modification of shapefiles and basic graphic work).

Table 1. Commercial software capable of working with virtual reality.

Software	Producer	Country
ArcGlobe and ArcGIS Explorer	ESRI	USA
GeoShow 3D	GradualMap	Spain
Leica Virtual Explorer	Leica Geosystems	USA
Terra Suite	Skyline Software Systems	USA
TerrainView Globe	ViewTec	Switzerland

4.2 Layers

Leica Virtual Explorer is more compatible with raster formats then with vectors. If vectors are used, they are not fully integrated to the DEM. Vector layers store huge amounts of spatial and non-spatial data; since vectors are not integrated into the DEM, lower quality ensues. Vectors are "floating" above DEM and when points of view are changed from orthographic to anything else, they are not compatible with the DEM. Vectors remain in orthographic view. For instance, a vector road is not above a road on an aerial photo in contrast to raster data format. Using raster data you lose a great deal of additional information, but raster is fully integrated with the DEM; that means that whatever point of view one chooses, all lines and polygons are on the same place with the same shape and size. Personal testing has shown that raster data are superior input for LVE, if accuracy is the goal.

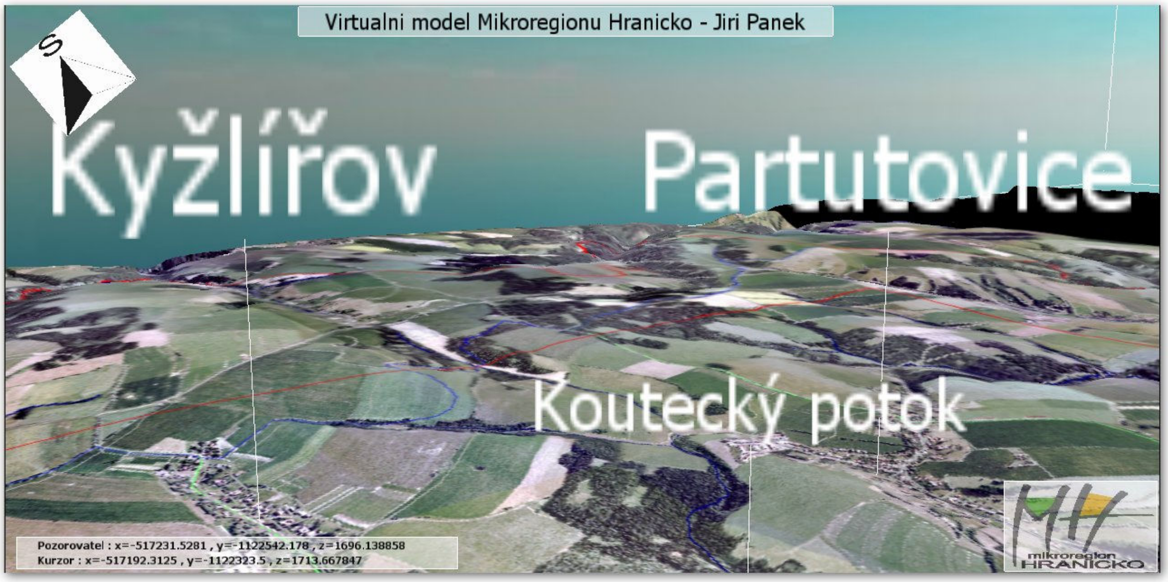


Picture 2: DEM and layers on it

4.3 Work above data

The first step was to import DEM to Leica Virtual Explorer. The DEM was created out of contour lines of dataset DMÚ 25 in environment of ArcGIS 9.1. Later on the DEM was exported to *.img, which is native importing format for DEM in LVE. On this particular model, aerial photographs were overlaid in order to create a realistic 3D landscape model. Once this segment was completed, the importing of thematic layers could commence.

In the thematic part of virtual projects, one may discover many layers, such as rivers, roads, tourist pathways, and cycling pathways. 3D buildings made in Google SketchUp Pro 6 were imported as well, in order to produce a more realistic scene. The purpose of this project was to promote tourism and, in that vein, more interactive layers had to be added. These layers consisted of: photos of POI (points of interest) in areas linked to particular places, 3D bushes with sounds of song birds when users fly through, heraldry of villages hanging above each village, labels of villages, rivers, tourist pathways, and POIs.

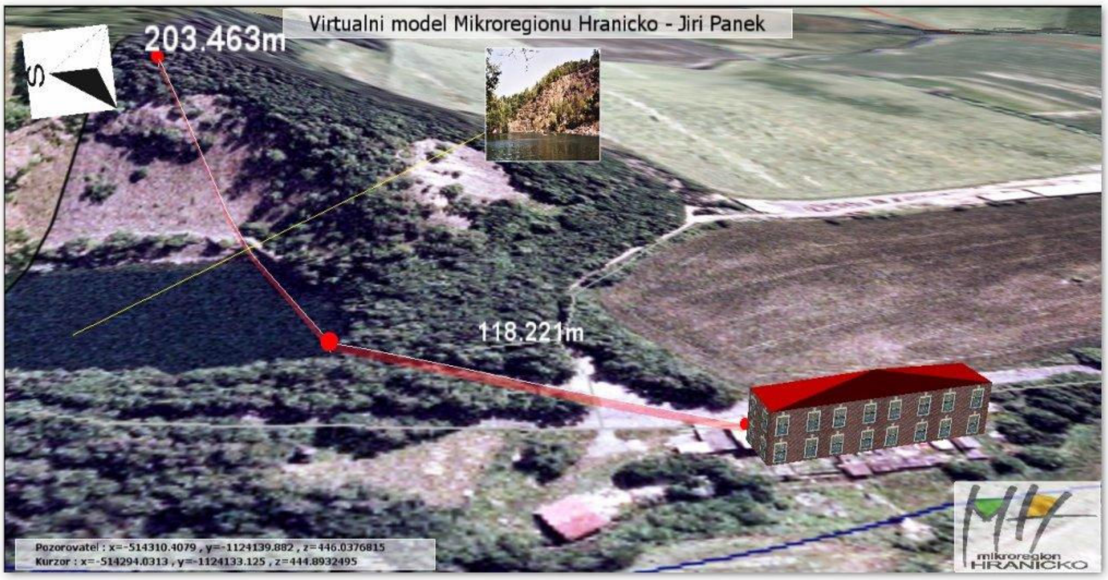


Picture 3: Labels cannot be made by computer!

Once all the line layers were imported, polygon layers could be added as well. The following polygon layers were used in this project: forests, natural reservations, buildings, borders of the microregion and areas where all analyses were practiced. LVE gives users two possibilities to import polygon layers, *drape* and *overlay*. *Drape* has been used for importing natural reservations, *overlay* for forests.

Overlay vector layer is imported as a vector with all data and topology included. The user can make queries on the layer and get valuable information out of it. On the other hand, using *drape* to import data converts vector layers to raster. Hence, when vectors become integrated into aerial photos, they lose much of the information that is stored but are more accurate topologically. Therefore, this importing function was chosen for all line layers.

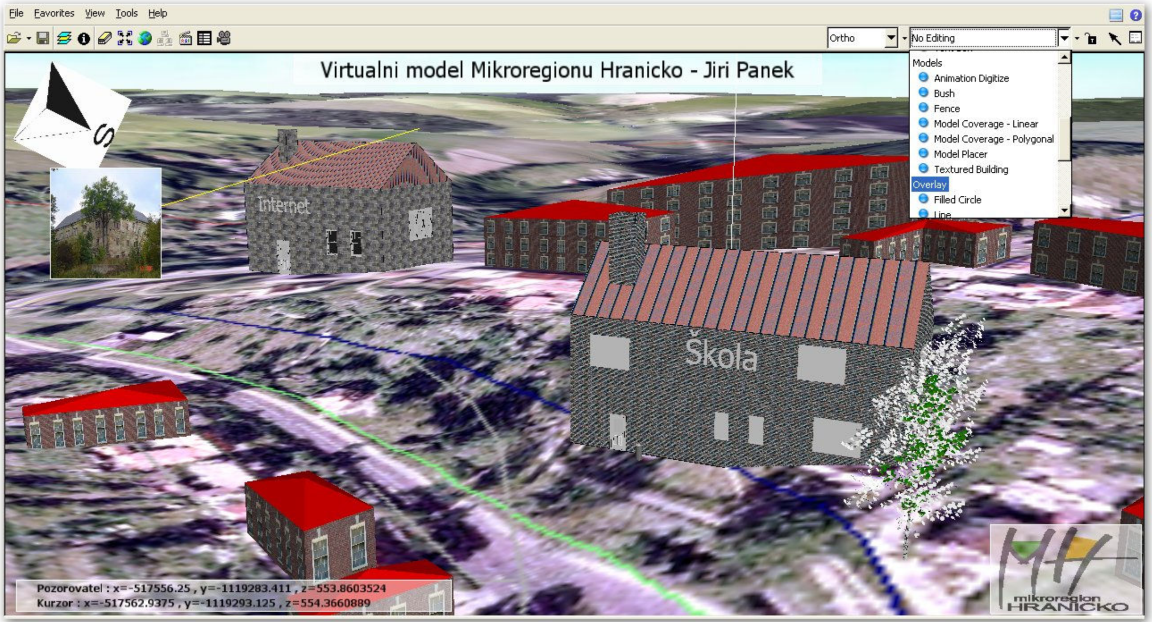
The layer of buildings was imported via *extrude 2D* that enables the user to raise polygon layers and give rise to a third dimension. The only thing a user needs is a polygon shapefile and LVE can automatically create a layer of 3D buildings out of it. The user has one default type of building and chance to give it random or given height (LVE can take it from the attribute table). The user can also choose the shape, roof and colour of wall and roof for the buildings.



Picture 4: 2D pointer and measuring distance

Picture 5: 3D forest and default buildings

In order to enhance some of the thematic buildings, such as schools and libraries with public internet, distinct 3D buildings were created in Google SketchUp Pro 6, designed by Google Inc. This software is a very useful and easy tool for creating realistic 3D buildings. Users can export results in a *.3ds file, which is also an importing file type for LVE. In addition to houses, users can also fabricate trees, benches, and trays among other things. These files can be imported by function *model placer*.

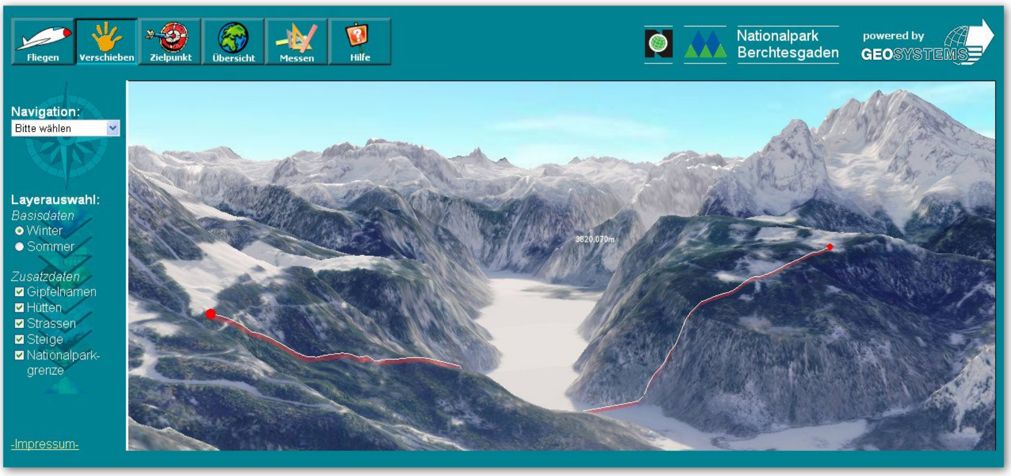


Picture 6: Buildings from Google SketchUp Pro 6

5 Current worldwide work in Leica Virtual Explorer

5.1 On-line works

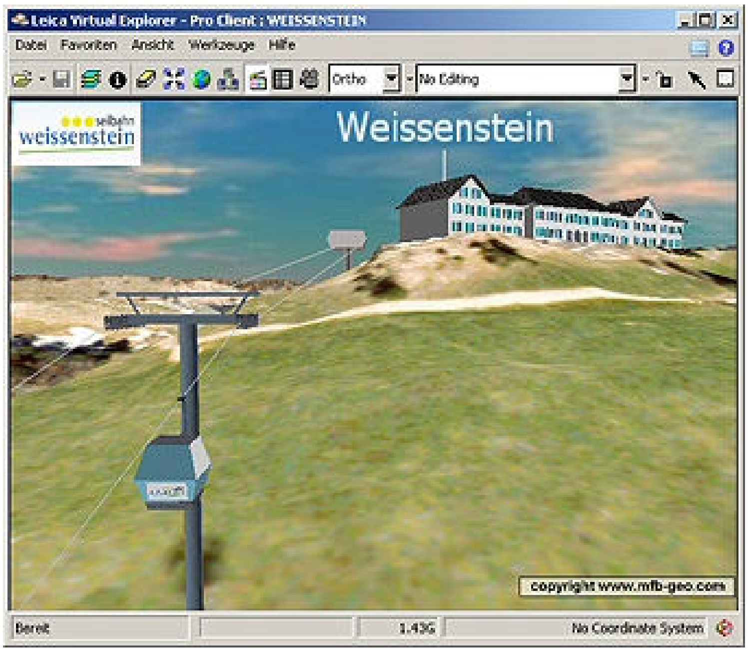
One of the most impressive, on-line works nowadays is the information portal of the German national park Berchtesgaden [3], where the whole project made in LVE was integrated. The navigation and application environment is altered, but is still LVE.



Picture 7: National park Berchtesgaden

5.2 Off-line work

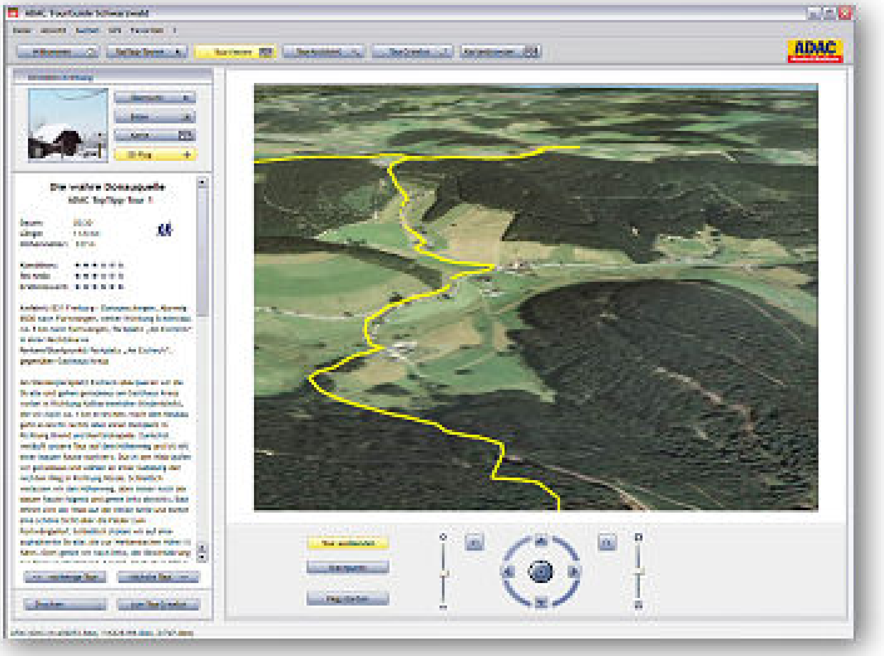
In a case study of the Weissenstein cable car in Switzerland, a 3D project made in LVE was developed. Authors made use of DEM and overlaid it with aerial photos, in addition to 3D models of the cable car.



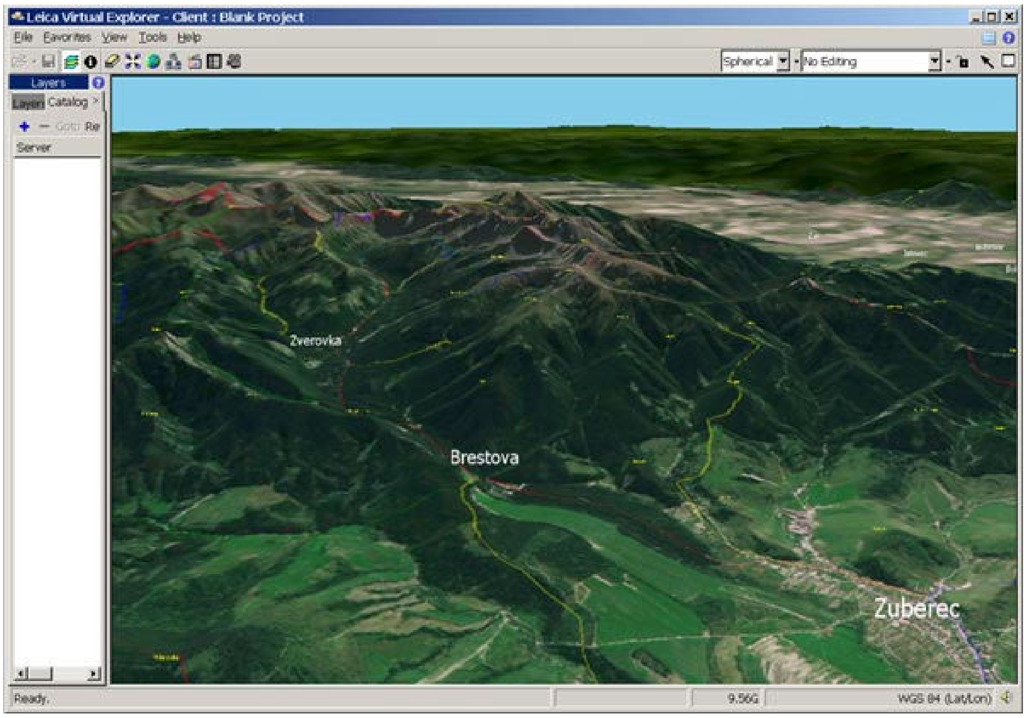
Picture 8: Swiss case study cable car in Weissenstein

5.3 Other works

Leica Virtual Explorer allows users to export scenes on CD/DVD by using *Publisher*, a special part of LVE. Two applications were a byproduct of this function. The first application is a tourist guide of the German part of Schwarzwald (pic. 9) made by ADAC – a German automobile club. The second application is an atlas of the Polish portion of the Tatra Mountains –distributed as a book with a DVD and 3D project on it (10).



Picture 9: ADAC tourist guide



Picture 10: Atlas of the Polish portion of the Tatra Mountains

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