

3D MODELLING. VIRTUAL CAMPUS FOR THE UNIVERSITY OF AGRONOMIC SCIENCES AND VETERINARY MEDICINE OF BUCHAREST

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Abstract

This paper presents the workflow for creating a virtual campus for the University of Agronomic Sciences and Veterinary Medicine of Bucharest from 2D GIS data. Basically, it follows the data integration based on ESRI templates and software specialised in 3D modelling. Over the years, GIS has evolved from a complex system for maintaining and analysing spatial and thematic information on spatial objects to digital representations of the Earth's surface and related objects belonging to urban areas. Thus, the most common use of 3D geovisualisation today, is within public planning, architecture, environmental monitoring and landscape planning.

Key words: GIS, 3D modelling, 2D data, virtual campus.

INTRODUCTION

The University of Agronomic Sciences and Veterinary Medicine of Bucharest is a modern educational institution that hosts all forms of high education. The quality of education provided in the lecture rooms, laboratories and faculty practice centres, is a certificate for the fact that USAMVB is the most representative and prestigious institution in agronomic and veterinary education in Romania. Many of its graduates become outstanding personalities in the fields of agricultural practice and in the teaching, research and administration fields. With a material base and an exceptional heritage which comprises two campuses – “Agronomy - Herăstrău” Campus and “Veterinary Medicine - Cotroceni” Campus, USAMV is a modern educational institution, in line with the European requirements. USAMVB has three subsidiaries acting as genuine research centres, production and practice - The Research and Development

Wine-growing "Pietroasa", Farm Fruit Growing "Istrița" and teaching farm "Moara Domneasca".

This paper focuses on campus “Agronomie-Herastrau” (fig.1).

In the campus “Agronomie-Herăstrău” of an area of 38 hectares, located near the famous park in Bucharest, are six of the seven faculties of Veterinary Medicine Bucharest. In new dorms, live over 4,000 students who applied for accommodation at the beginning of the academic year. In the complex are also a cafeteria, two restaurants, three conference rooms and a summer terrace. Inside the campus students can also access a campus library with an impressive collection of books, including works of heritage. The studying conditions are great. In the campus can also be found a student church where religious services are performed as well as educational activities regarding young people. The sports area is composed of a multi-purpose olympic size gym, a grass football field, a synthetic football field, a tennis court. On campus are organised

sports competitions, cultural and artistic performances.

In this context, a smart campus provides an interactive map, as well as services that allow visualization, allow people to search, locate and access information about campus street network, buildings, classrooms, departments, study programs, offices, cafeterias, residence, green space, etc. Basically, it is a smart solution to provide bases for students' life improvement and better management of the resources related to the campus.



Figure 1. The study area-Agronomie-Herastrau Campus

MATERIALS AND METHODS

Nowadays, everyone is familiar with 3D visualization. A revealing example to support this idea is browsing or using Google Maps or Google Earth to identify the location of an object or event. It goes without saying that we better understand information when it is presented to us in a realistic, intuitive 3D form. Therefore I think it is a good approach for presenting the campus in terms of communicating ideas and fresh vision. The improve of aerial and close range photogrammetry, are important factors for the development of 3d modelling as well as the development of hardware components: processors, memory and disk space devices are now built to support and process large data sets, especially graphics cards that were previously used priory in the gaming industry. (S.C. Antules, 2013). Following this direction applications were developed and the most popular, comprehensive and intuitive are those developed by ESRI-ArcGIS 3D Analyst that includes ArcGlobe, ArcScene, and the complex CityEngine along with specific tools for 3D processing data. As mentioned in the abstract, this paper focuses on the integration of information using multiple applications, showing the interoperability of methods in

order to obtain realistic 3D visualization of Agronomie-Herastrau Campus.

In this sense I started from the Esri campus template in Redlands California that I downloaded from www.arcgis.com and wich I used as database support for the next actions (fig.2). In the first phase of the project I used a campus aerial image using the ANCPi portal to which I logged directly through the ArcMap GIS Server service in ArcCatalog menu.

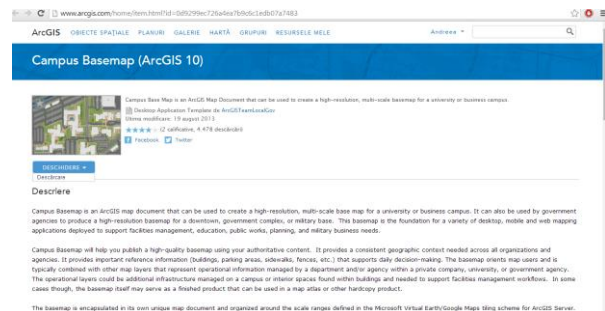


Figure 2. ESRI Campus Basemap

Having the support for the digitization I populated the geodatabase with the street network, buildings footprints, green spaces and other detail elements such as street furniture using the editing tools that are provided by the application. Regarding the tree layer, I populated it using "Collector" app available in AppStore for mobile devices using an organization account (Figure 3).

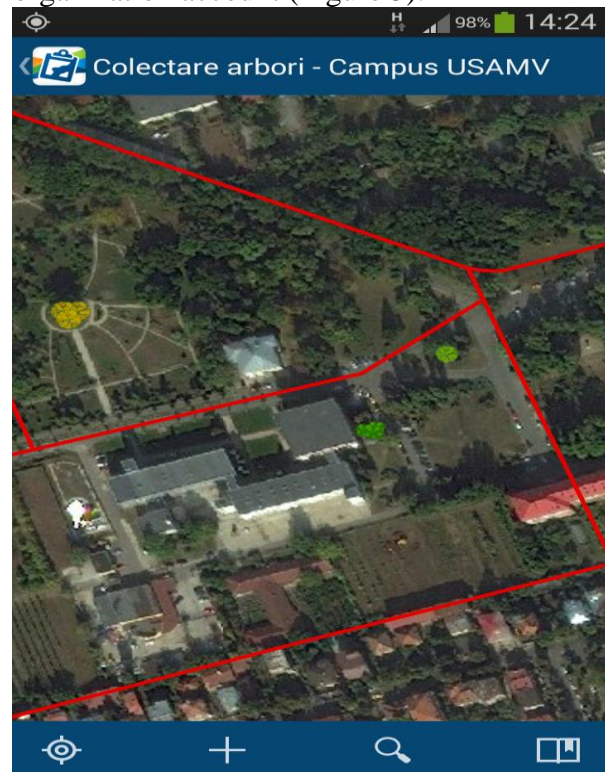


Figure 3. Collector App

After collecting the trees in the field, information about the type of trees and their location can be downloaded directly in ArcMap after logging into the same account as mentioned above. Apart from issues related to the campus as a whole, I rebuilt a part of the building FIFIM C body, by using building plans for the ground and the 2 floors. Also, I populated the attribute table with information about rooms, offices, classrooms, etc. especially those related to size - wall height-an important attribute when making transitions to 3D. For instance, in CityEngine, on the basis of a programming language, the walls can be extruded on the height attribute.

The described operations are the steps through which I created the data in the classic 2D GIS format (fig.6). After this stage we can discuss about 3D integration. Next are several available options. At first I chose ArcScene because I was familiar with the application. I loaded the data reported previously as being created and the digital elevation model of the terrain (fig.7). For the extrusion of the buildings are also several possibilities. They can be extruded considering height, depending on the number of floors or created in dedicated programs and then imported back into ArcScene. I chose the second option and used the trial version of Sketchup8. Before I started creating the actual buildings, I needed the textures. It reminded me of the open source Google Buildings app which unfortunately has been removed from the market in June past year. However, buildings that were constructed by using Google Buildings are still available for download at <https://3dwarehouse.sketchup.com>.



Figure 4. 3D model of the Horticulture Building from <https://3dwarehouse.sketchup.com>

After searching, I found several campus buildings in 3D format that I could download along with textures (Figures 4, 5).

Before I could use them in ArcScene, I had to convert them into a file that could be read by the software. In order to exchange data between 3D software the files must be converted to Collada (.dae). COLLADA™ defines XML - based schema year to make it easy to transport 3D assets between applications - Enabling diverse 3D authoring and content processing tools to be combined into a production pipeline. The intermediate language provides comprehensive encoding of visual scenes including: geometry, shades and effects, physics, animation, kinematics, making and even multiple version representations of the same asset (www.collada.com).

However, if no buildings are available for download, they can be easily created in Sketchup using the building footprint or the buildings' plan together with pictures of them that can be used as textures.

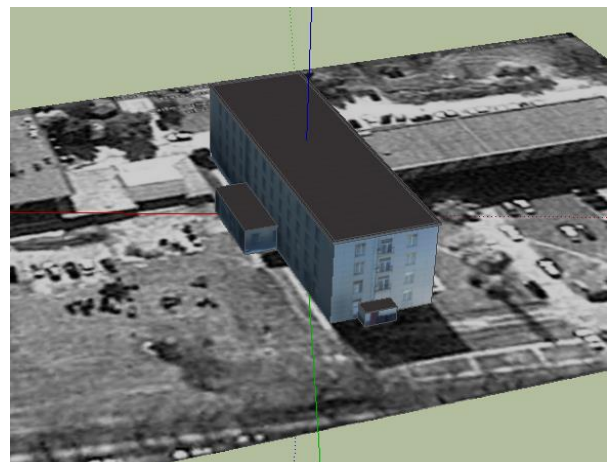


Figure 5. 3D model of the A4 Dorm from <https://3dwarehouse.sketchup.com>

A second method to transform 2D data that we created in 3D is to import the data in Esri CityEngine. In this case, the best way to import them is the form of .gdb basically import all data at once. The data is viewed sin eparate layers and can be approached individual to make changes and implement rules. In fact, the data is converted into 3D based on the processing rules (fig.8). CityEngine is complex by allowing mapping, compilation, analysis, geodatabase management and geographic information sharing. The software allows the

user to create high quality 3D content on 2D base data, attributes, and procedurally defined rules.

RESULTS AND DISCUSSIONS

I shown how the data originally created in 2D can be converted into 3D and can be combined with other data acquired from other sources using the different software mentioned. ArcScene is a more simplistic approach in

comparison with Esri CityEngine but the results obtained in the last mentioned are more sophisticated, given the complexity of the program and knowledge needed to work with it.

In the end, what matters is the result and the impact a 3D model of the campus has, a realistic approach that can help decision makers in terms organizing, resource management, monitoring, and security.



Figure 6. 2D Agronomie-Herastrau Campus

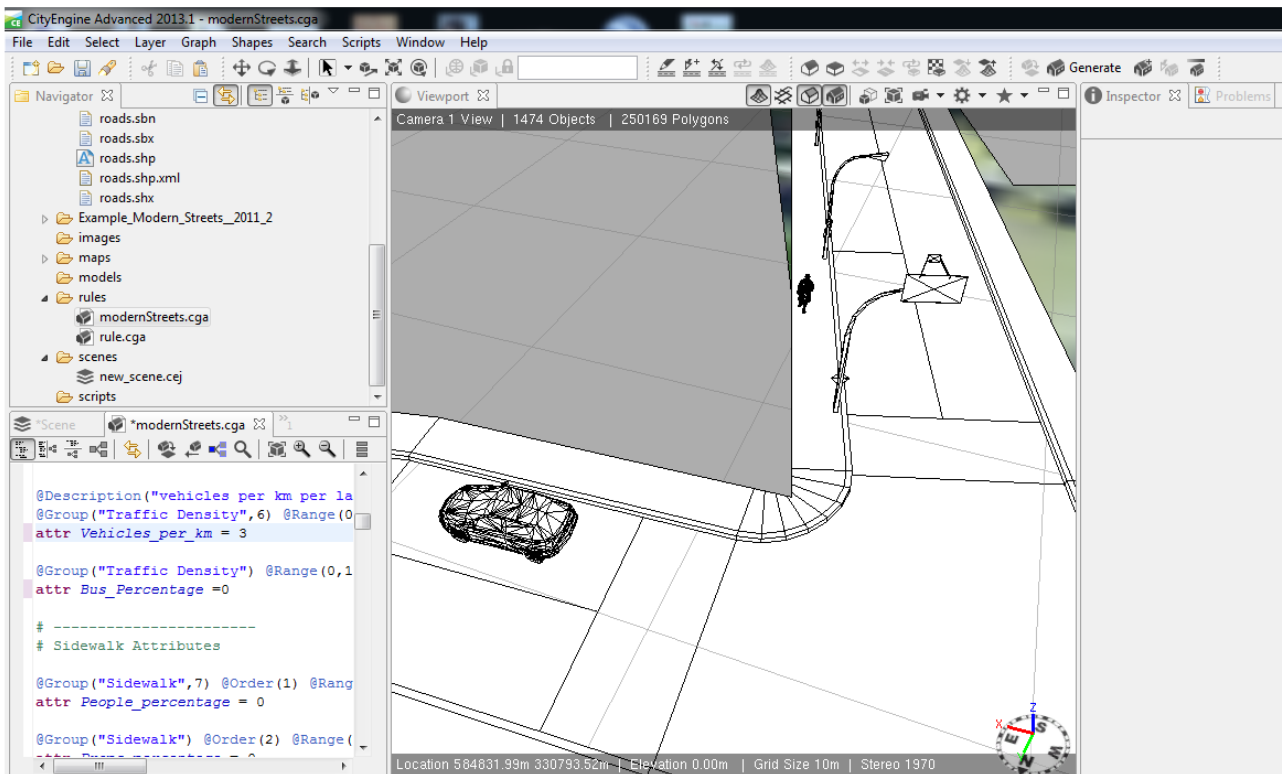


Figure 7. CityEngine modelling



Figure 8. ArcScene 3D Model of the USAMVB Campus

CONCLUSIONS

Why 3D? Because we live in a three dimensional world. Geographical Information Systems are a concept tool for capturing, storing, manipulating and analysing geographic data (D. Mihai, 2012), but manipulating and representing the world in 2D is no longer adequate because new applications demand

higher complex hierarchical spatial data than previously supported by the relational model. In geomatics or geoinformatics, it is considered that real world objects exist in three-dimensional, thus it is desirable to have a system which is able to store, handle and analyse objects in a 3D environment. The paper focuses on that few systems available on the market which can be categorized as solutions

for 3D representations and analysis. The 3D USAMVB Campus is an example of how this systems can work together in obtaining a realistic visualization (A. Abdul-Rahman, 2007).

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