Globe Based 3D GIS solutions for Virtual Heritage

Andrea Scianna, Marcello La Guardia
Recent development of Virtual Reality (VR) applications allowed to explore environments that, otherwise, would be inaccessible.

The application and development of VR technologies for the creation of 3D Cultural Heritage (CH) representations and virtual reconstructions is a fundamental research field.

From the merger of VR and CH comes the term Virtual Heritage (VH) (Roussou, 2002).
In recent times, advances in Information and Communication Technology (ICT), in particular on VR, allowed the creation of 3D CH environments for interactive navigation on Web (Guarnieri et al., 2010).

The development of WebGL (Web-based opensource graphics library for Web-browsers) allows users to navigate on Web, inside 3D environments, in an interactive way, without the requirement of any additional app or plugin.

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Recent advances in ICT technologies allowed the development of new **Globe applications**, which are real human-centred **WebGIS solutions**.

Globe application examples on web. In recent times these Globe models can be integrated with the insertion of 3D city models (with buildings, roads, bridges etc..) and layers, accessible through **WMS services**, draped over the **DTM** surface.

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Experimented solutions for a case study

Gaming technologies

Web 5.0 technologies

GIS Globe applications

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The case study of the virtual navigation model of the Manfredonic Castle of Mussomeli. This monumental complex was built in 1374 in Sicily on a massive rock that dominates the surrounding territory for many kilometres.
The reconstruction of the model

Preliminary operations: UAV and GNSS survey, photogrammetric restitution and 3D modelling of the external and internal environments of the castle.

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Experimented solutions

- Commercial proprietary application (Terra explorer)
- Free and open-source solution (Cesium)

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The 3D model of the castle into the Cesium 3D Globe

Tested solutions – The free and open-source solution

WebGL visualization with Cesium.js library

WebGL visualization with Three.js library

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Tested solutions – The free and open-source solution

The workflow

1. Uploading of Cesium.js libraries into the server folder
2. Implementation of the 3D model on the main georeferred .html template
3. Creation of queryable elements containing semantic description and links to internal environment visualizations

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# The experimentation - Comparison between the two solutions

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<th>FEATURES (Highlights and Issues)</th>
<th>OPEN SOURCE (WebGL)</th>
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<td>Free navigation around the model</td>
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<td>Rigid limitations on 3D model format files</td>
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Conclusions

- The construction of the 3D GIS virtual environment is simpler using the commercial software because it uses a graphic interface for structuring the system;
- considering the user needs, probably the open-source solution is more direct because no installation of any app is required;
- Both of the solutions represent some limitations about the dimensions of 3D models because the possibilities of visualization crashes or loading issues are strongly linked to the increment of the number of polygons.
- These experimentation represent different solutions in the perspective of the creation of a standard model for the virtual fruition of CH

The studied solutions of this work are available and navigable online connecting to GISLab Website at the address: http://gislab.dirap.unipa.it/mussomeli/
Thank you for your attention!!!