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A 3D immersive application for real-time flythrough of planetary surfaces : The VR2Planets project

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1. Introduction

During the last two decades, a fleet of planetary probes has acquired several hundred gigabytes of images of planetary surfaces. Mars has been particularly well covered thanks to the Mars Global Surveyor, Mars Express and Mars Reconnaissance Orbiter spacecrafts. HRSC [1], CTX, HiRISE [2] instruments allowed the computation of Digital Elevation Models with a resolution from hundreds of meters up to 1 meter per pixel, and corresponding orthoimages with a resolution from few hundred of meters up to 25 centimeters per pixel. The integration of such huge data sets into a system allowing a user-friendly manipulation either for scientific use or for public outreach can represent a real challenge, which we are investigating in this study.

2. Scientific Rationale

The interpretation of geomorphologic features on planetary surfaces often relies on the quality of the acquired data, i. e. high resolution images (eventually at different wavelengths) and topographic models derived most often by laser altimetry, stereoscopic imaging, or radar interferometry. The data handling itself also plays a role in our capacity to apprehend accurately the environment which has been imaged. For example, it might be difficult to analyze a layered outcrop on a full 360° panorama rendered on a flat screen only, due to the distortions induced by the projections. On the contrary, when such a panorama is integrated into a virtual reality headset, the user can look freely by himself in any direction and apprehend the landscape as if he were simply standing in the middle of the scene, and see the nearby rocks, layered outcrops, and geological features without any distortion. Similarly, flying in real time over a 3D reconstructed landscape allows a better understanding of the stratigraphic and structural relationships between several geological units.

3. The VR2Planets project

We are investigating how innovative tools can be used to freely fly over reconstructed landscapes in real time. For this purpose, we have developed an application to immerse users in real martian landscapes reconstructed from planetary satellite data. The user can freely navigate at full spatial resolution using a game controller. The actual rendering is compatible with several visualization devices such as 3D active screen, virtual reality headsets, and a prototype of a low-cost cave system (Fig. 1), which will be shown at a public exhibit taking place in Nantes' city hall in parallel of this EPSC scientific meeting.

Figure 2: Prototype of a low-cost 3D cave environment to freely fly over martian landscapes.

References

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[2] McEwen, A. S., et al., J. Geophys. Res., vol 112, issue E5, 2007.