Virtual Reality at Regional Scale: Exploring Terrestrial Bodies in Immersive 3D Environments

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November 22, 2022

Abstract

Virtual reality (VR) is an important tool for several applications in science, industry, and education. Previous studies have already shown how the use of VR at full scale is an effective tool for outcrops characterization even at centimetre scale [1]. We aim to extend the use of this approach in various fields of planetary exploration, from outcrop to regional scale. This regional approach may provide an effective support for the planning and management of future missions, but also for geological and geomorphological studies and mapping. Among the most obvious advantages of the use of virtual reality are the lack of optical deformations and approximate dimensions of the two-dimensional display (such as display, projections and printed cartography) and the opportunity to layer various levels of information through a new concept of superposition. The VR environment is derived from several multi-scale elements: medium to high-resolution elevation data, photogrammetric 3D models, orthophotos, multispectral data, thematic maps and vector data transformed into three-dimensional digital representations placed in the study context. The first tests are based on stereogrammetry (using USGS ISIS [2] and NASA ASP [3]) of the lunar LRO (LROC-NAC) [4] and Martian MRO (CTX and HiRISE) [5] and MEX (HRSC) [6] missions and on data and cartography realized through external open-source GIS tools (GDAL libraries, QGIS, GRASS) and virtual tools developed to be used within the VR environment. In our tests, for example, the Rock Abundance analysis results have been shown not only as thematic maps but also as digital representations of floating boulders on the surface. This has been achieved by placing major rock elements (>1m) in the position detected from satellite imagery and smaller elements, estimated from size-frequency distributions studies, with a preliminary semi-random distribution. References [1] Mouélic S. L. et al. (2019), Geophys. Res. Abstr, Vol. 21. [2] Becker K. J. et al. (2013), LPSC, Vol. 44. [3] Moratto Z. M. et al. (2010), LPSC, No. 1533, p. 2364. [4] Robinson M. S. et al. (2010), Space Sci. Rev., 150: 81-124. [5] McEwen A. S. et al. (2007), J. Geophys. Res. Planets, 112.E5 [6] Neukum G. & Jaumann R. (2004). Mars Express: The Scientific Payload, Vol. 1240, pp. 17-35.

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References

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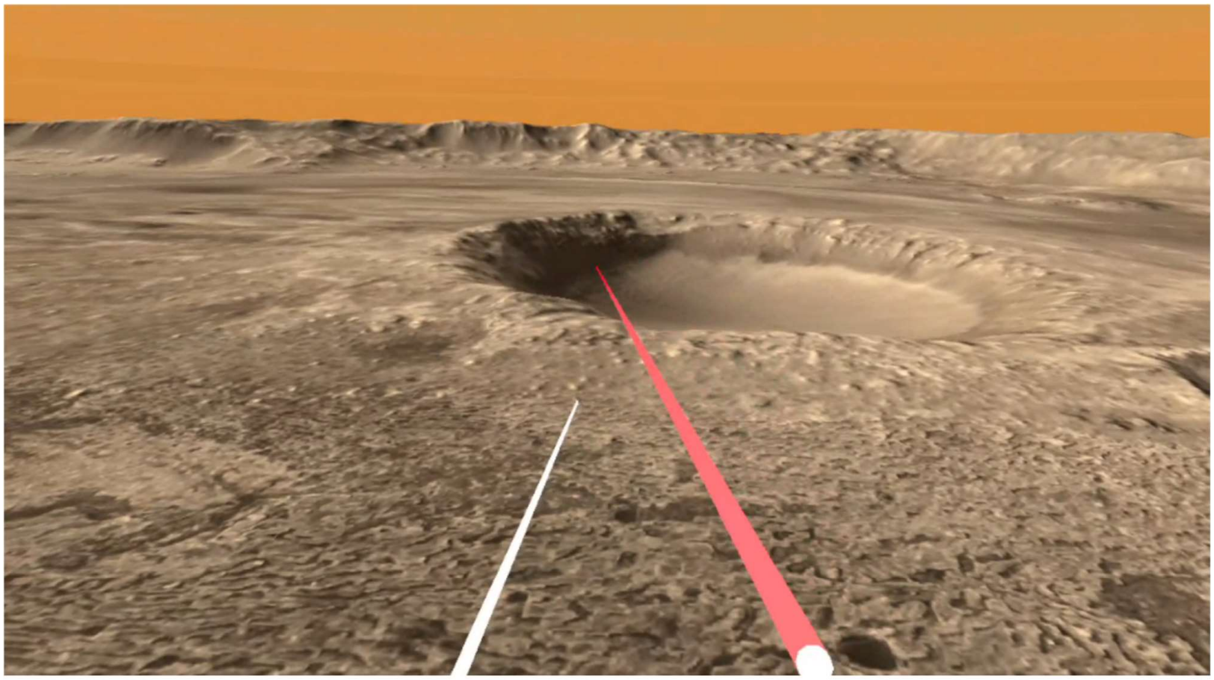

Figure 1: Virtual Reality visualization inside a crater with diameter more than 50 km in Arabia Terra region (Mars); the user is free to move in the environment through the white and red controllers and their rays for the teleportation system. For reference, the crater in the centre has a diameter of 8 km and the view is at 1:1000 scale.