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BepiVR: Virtual Reality for BepiColombo outreach

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Abstract

We present the project for an application for Android to introduce the public to the ESA BepiColombo mission, by using the Virtual Reality (VR) technology. VR technology demonstrated its versatility and power in graphic or industrial ambient in the last years and it earned the consideration of science community, in particular in geospatial and astronomic field. We will describe the contents that will be disseminated by the application, some technical and scientific concepts and a demo of the videos that can potentially be produced to demonstrate the high level of involvement that the VR technology can provide.

1. Introduction

The ESA cornerstone mission BepiColombo - to be launched in October 2018 to Mercury - is one of first ESA mission that will benefit of immersive experience for visualization of the data analysis. Some instruments, like the stereo camera of the instrument suite SIMBIO-SYS [1] , are already devoted to produce data that fit perfectly with this kind of approach. In addition, the synergy of different instruments onboard BepiColombo can also benefit of this tool (i.e. by visualizing the ionized and neutral particles around Mercury together with the planetary magnetic field, or dual measurements of the magnetic field itself as observed simultaneously from the two spacecraft MPO and MMO) This new technology could be used also as a valid support to the public outreach associated to the BepiColombo mission, by offering an appealing experience and giving the opportunity to transmit to the public a wide variety of information on the mission, on Mercury characteristics and different environments, and on the many scientific questions still open about the planet Mercury. Here we present the concept of the novel application, with a focus on the contents that we want to transmit to the user, a conceptual scheme of the information offered, and a demo of the video to be considered as a teaser for our application.

2. The Contents

We can organize the information into four different categories: the mission; the Mercury planet, the cruise and the scientists work.

2.1. The Mission

We display a 3D model of the spacecraft, the Mercury Composite Spacecraft (MCS), with the possibility to explode it in its three main modules: Mercury Magnetospheric Orbiter (MMO), Mercury Planetary Orbiter (MPO) and Mercury Transfer Module (MTM). From the modules hosting the payload it will be possible to extract each single instrument, open it and see a simple functional scheme, with an introduction at the phenomena measured (at different difficulty levels as defined by the user), and the technology used for the measure.
A special dashboard will help the user to understand the scientific objectives of the mission and how the answers can contribute to increase our knowledge. A special section will be devoted to the technology challenges faced. It will be possible to explore, also, the information about the launch vehicle.

2.2. The Mercury Planet

Data acquired from the previous missions will be implemented to create a VR reconstruction of some of the many different environments of Mercury (i.e. exosphere, magnetosphere, surface and interior) in order to describe the heritage of the previous explorations and explain the open issues to which BepiColombo aims to provide an answer.
We are discussing about the possibility to use a virtual assistant that can drive the user on a standard path through the information, with the possibility to personalize the experience by the interaction with it.

2.3. The Cruise

A 3D diagram of the BepiColombo route to Mercury will be shown and accompanied by some sheets to describe the various phases and explain the details of some special maneuvers (like the gravity assists or the electric thrusted arcs) and the physics behind them. During the swing-bys at the Earth and at Venus, windows could be opened to give additional information on the Earth-Moon system, and on a reconstruction of Venus as derived from the ESA mission Venus Express.

2.4. The Scientists Work

We will be planning a "Who's Who" section with the personal card of the scientists involved in the mission, starting from Giuseppe (Bepi) Colombo, the Italian engineer and mathematician inspirer of the mission. We are also exploring the possibility of an interview with some protagonists using 3D videos, especially the Principal Investigators of the instruments on board the spacecraft.
A section will be dedicated also to describe the genesis of a space instrumentation starting from the first idea of a scientist, through the engineering development of prototypes and up to the final flight model and its integration on the satellite.

We are starting to develop the application for smartphones that will use the Android SDK technology. This approach, in our opinion, can maximize the audience. The possibility to host the information on a mobile device give the opportunity to have a high dissemination rate. The developing of the application without the requirement of an active viewer, that mean very low costs for the viewer i.e. using a Google Cardboard™, could be an added value for the application. We are evaluating also the possibility to create an option for a multi-user experience. In this case the computation load will be really high, and it could not be delegate to a smartphone, but to a little computation farm, using the smartphone as a simple display. It is clear that this option could be used only in controlled environment.

3. The Teaser

The teaser of the application is a stereogrammetric 3D video, created by Blender application [2]. It can be downloaded from the page [3]. Figure 1 gives an idea of the high level of immersion that can be achieved.

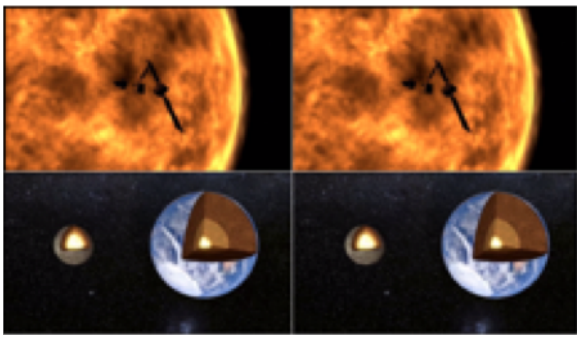

Figure 1: Frames Side by Side of the teaser showing the separation of the BepiColombo modules after the cruise phase (upper part) and the comparison between Earth and Mercury interior structure (bottom).

4. Conclusions

The application proposed has a high involvement of the audience, as well shown by the demo. The navigation interface (the first step in the application development) is presently under design, and a first version will be available for the meeting. With the present poster, we are also asking the support of the instrument teams to obtain all the information about their instruments and the related science to be included in the application. Presently, this work is supported by the BepiColombo Italian team for public outreach Bep-it

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References

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[2] Kent, B.R., 2015. 3D Scientific Visualization with Blender®. Morgan & Claypool Publishers,San Rafael, CA, 105 p.

[3] https://youtu.be/wX5pMHCKeT0