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MARSWEB: A GIS based web 2.0 mapping application to measure impact craters on the surface of Mars.

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Abstract

A open source web-based mapping application has been developed to allow both professional and amateur geologists to participate in a large-scale project to map craters on extra-terrestrial bodies, starting with the planet Mars. The context is the dating of the surface of Mars which can be retrieved using crater size frequency distributions (Kim et al., 2005) or crater 3D shape (Kim and Muller, 2009) using Web 2.0. This is based on sharing information dynamically and interactively over the Internet, and has a huge potential in the search for the best answer.

We describe the development of a GIS-based Web 2.0 rich internet mapping application, MarsWeb (http://marsweb.net) to identify and measure the shape of impact craters of Mars interactively. The system provides a generic framework for users, both professional and amateur, to engage actively in mapping Mars by creating, sharing, aggregating and using crater information in a variety of formats that work in traditional GIS and planetary software.

1. Introduction

Due to the increasing use of web technologies and the availability of OGC compliant web mapping services, web based mapping applications are becoming popular tools to generate knowledge in online communities. Internet users can contribute cartographic content and easily create, modify, and share geographic information.

This opportunity offers the scientific community new ways to collaborate with each other and share their research results, opening up the possibility as well as for amateur users to be engaged in planetary mapping efforts.

We first describe the general Mars Web multi-layered architecture used to provide the foundation to develop MarsWeb. The second section presents the key features of the application. In the final section we present an analysis of the results obtained and summarise the key conclusions of this work.

2. MarsWeb Architecture

The open source MarsWeb architecture follows a generic interactive web mapping application. Underlying the application is a relational database for metadata and pointers to data, some application logic in the middle, and a user interface layer at the top.

The database is implemented in PostgreSQL/PostGIS with a file-based storage system (MSSL Image Group Server) at the bottom, a logic application written in J2EE for Enterprise Applications in the middle, and a user interface layer implemented using ExtJS plus Openlayers at the top. Figure 1 shows the MarsWeb system architecture, which makes use of a set of open source components, each fulfilling a particular functional role. Measurements can be exported into shapefiles, readable by most standalone GIS systems as well as the Freie Universität Berlin isochron crater Size Frequency Distribution plotting system (Michael & Neukum, 2009). The University of Minnesota Map Server (UMMS) provides the map serving for WMS (Web Map Service PNG files) and WCS (geotiff raster data).

3. MarsWeb Application

Taking advantage of OGC standards-oriented architecture, the system is able to access layers from distributed map services, including cascaded WMS services from colleagues such as the onmars server at JPL (JPL onmars), the PIGWAD system at USGS (Hare & Tanaka, 2001) or the J-MARS system at ASU (Viviano and Moersch, 2010).

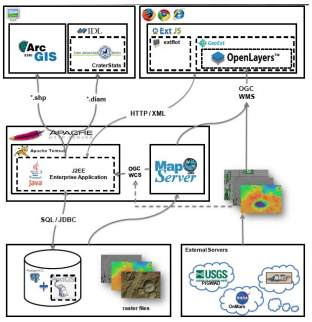

Figure 1: MarsWeb Architecture

MarsWeb allows the creation of fused views from in-house and cascaded WMS services in order to be able to create new views of the maps by using WMS layer transparency. Users can draw simple impact crater boundaries with minimal manual input or can import previously measured craters from shapefile or text files; they also can indicate characteristics of each crater via the generation of tags. After creating their own crater catalogues, users can share these crater measurements with colleagues or the entire online community. Finally the system provides two basic crater analysis functionalities: Plot Crater Profiles and Plot Crater Count Size-Frequency Distribution. Several screenshots are presented in Figure 2.

4. Conclusions

There is an increasing need to communicate both to scientistific colleagues who are involved in Mars science, or others who would like to get involved, regarding mapping results. The Mars science community needs to increase its multi-disciplinary approach to Mars science, by increasing the ability to pull in scientists who are not Mars specialists.

In this context, Mars, MarsWeb has been developed as a Rich Internet Mapping Application to allow both professional and amateur geologists to participate in a large-scale web-GIS project to map craters on extra-terrestrial bodies, starting with the planet Mars.

This combination of tools and frameworks enables the integration of sophisticated cartography, robust map services, and new geographic information visualization techniques in the continuously changing Internet environment, for the purpose of mapping craters of Mars.

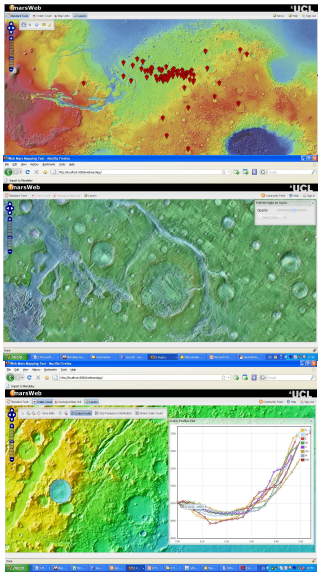

Figure 2: Upper Panel: measured craters in red superimposed on a hill-shaded and colourised MOLA DTM. Middle panel: layers can be cascaded and combined using transparency (opacity) alpha layer. Lower Panel: Crater height Profiles.

Acknowledgements

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References

Hare, T., Tanaka, K.L., 2001. Planetary interactive GIS-on-the-web analyzable database (PIGWAD). The 20th International Cartographic Conference, Beijing, China. http://webgis.wr.usgs.gov/

JPL Onmars WMS server at http://onmars.jpl.nasa.gov/

Kim, J. R., Muller, J-P., Morley, J.G. et al. (2005). "Automated crater detection, a new tool for Mars cartography and chronology." Photogrammetric Engineering And Remote Sensing 71(10): 1205-1217

Kim, J.-R. and J.-P. Muller, 2009: Multi-resolution topographic data extraction from Martian stereo imagery. *Planetary and Space Science*, **57,** 2095-2112.

Viviano, C. and J. Moersch, 2010: Using JMARS as a Teaching Tool in Undergraduate Planetary Courses. *41st Lunar and Planetary Science Conference*. see http://jmars.asu.edu/