Archaeological field survey automation: concurrent multisensor site mapping and automated analysis

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ABM SE develops mobile robots (rovers) used for analog research of Mars exploration missions. The rovers are all-terrain exploration platforms, carrying third-party payloads: scientific instrumentation. "Wisdom" ground penetrating radar for Exomars mission has been tested onboard, as well as electrical resistivity module and other devices. Robot has operated in various environments, such as Central European countryside, Dachstein ice caves or Sahara, Morocco (controlled remotely via satellite from Toruń, Poland. Currently ABM SE works on local and global positioning system for a Mars rover basing on image and IMU data. This is performed under a project from ESA. In the next Mars rover missions a Mars GIS model will be build, including an acquired GPR profile, DEM and regular image data, integrated into a concurrent 3D terrain model.

It is proposed to use similar approach in surveys of archaeological sites, especially those, where solid architecture remains can be expected at shallow depths or being partially exposed. It is possible to deploy a rover that will concurrently map a selected site with GPR, 2D and 3D cameras to create a site model. The rover image processing algorithms are capable of automatic tracing of distinctive features (such as exposed structure remains on a desert ground, differences in color of the ground, etc.) and to mark regularities on a created map. It is also possible to correlate the 3D map with an aerial photo taken under any angle to achieve interpretation synergy. Currently the algorithms are an interpretation aid and their results must be confirmed by a human.

The advantages of a rover over traditional approaches, such as a manual cart or a drone include: a) long hours of continuous work or work in unfavorable environment, such as high desert, frozen water pools or large areas, b) concurrent multisensory data acquisition, c) working from the ground level enables capturing of sites obstructed from the air (trees), d) it is possible to control the platform from a remote location via satellite, with only servicing person on the site and the survey team operating from their office, globally.

The method is under development. The team contributing to the project includes also: Oleksii Sokolov, Michał Koepke, Krzysztof Rydel, Michał Stypczyński, Maciej Ślęk, Łukasz Zapała, Michał Dąbrowski.