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Author: Mr. Osama Asghar

National University of Science and Technology (Zimbabwe), Pakistan, ossamaasghar69@gmail.com

Ms. Nabila Chaudhry

University of Calgary, Canada, nabila.chaudhry@outlook.com

IDENTIFYING A SUITABLE LOCATION FOR A PERMANENT SOLAR POWER GRID ON MARS

Abstract

This study covers the aspects of Remote Sensing capabilities used to identify the most feasible locations on the Martian surface for a solar power grid. Site suitability analysis tools are used in ArcGIS Pro to identify the high priority zones where sunlight is significant enough to power a Martian colony. Several habitation zones have been identified by various researchers, in light of that, our research focuses on the identification of a suitable site for a permanent solar power grid. High-resolution satellite image data was retrieved from High-Resolution Imaging Science Experiment (HiRISE), Mars Reconnaissance Orbiter (MRO), Compact Reconnaissance Imaging Spectrometer for Mars (CRISM), THEMIS, and CTX which is used in this research. We used temporal data to identify the patterns emerging in the atmospheric conditions, solar reflectance, sand storms, and sand avalanches, as these are pivotal factors influencing the sustainability, efficiency, suitability, and safety of our solar power grid, respectively. Furthermore, we generated Digital Surface Models (DSM), Digital Elevation Models (DEM), and Digital Terrain Models (DTM) to identify the surface, elevation, and terrain of the Martian surface. Different map layers were created and graded based on the criteria for site suitability. This criterion was designed on parameters like slope, slope aspect, distance from the nearest colony site, elevation, and solar reflectance. The results indicated that areas lying between the latitudes of +20 to -20 around the equator are the most suitable zones to place a solar power grid. For future and practical analysis, an analog environment can be designed on any arid region on Earth lying near the equator to check the feasibility of our results.