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CONCEPTUAL ROVER DESIGN FOR TURKISH LUNAR MISSION

Abstract

Moon missions are gaining popularity, with numerous nations, and commercial enterprises aiming to explore the lunar surface. Turkiye is also taking a step to become one of the pioneers in space exploration, with the "National Space Program", introduced in 2021 by the Turkish Space Agency (TUA). One of the main pillars of the National Space Program is the Moon Research Program, where two missions are planned with targets of reaching the Lunar orbit and then the surface through a hard landing within a few years (AYAP-1) and delivering a rover to the surface through soft landing (AYAP-2). In this manner, a group of AYAP-1 scholarship students of TUBITAK UZAY - Space Technologies Research Institute and Space Exploration Society (UKET) members has performed a conceptual design for a small Lunar rover considering AYAP-2 (soft landing mission). The main goal of the designed rover is to carry out scientific research during a lunar day focusing on the physical properties of the landing site, detection and analysis of the concentrations of different minerals and elements, as well as performing a biomining experiment. From the perspective of the biomining experiment, the landing site is considered as the southeast of the Copernicus Crater based on the abundance of iron (Fe), uranium (U), and thorium (Th) elements. A miniature biomining reactor design is studied with an aim of obtaining the maximum elemental mining throughout a lunar day. The investigation of the effects of the lunar conditions on the mining capacity of the microorganisms and performing sustainable space resource mining for in situ resource utilization (ISRU) are considered. Finally, the design factors of the rover platform as well as instruments and payloads are discussed while introducing the technical budgets and concept of operations. Design analyses are introduced via the outcomes of computer simulations which are performed to validate the interaction between the rover and the lunar surface as well as the operational environment.