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DESIGN AND DEVELOPMENT OF AN EXPLORATION ROVER TO ANALYZE THE ELEMENTS AND COMPOUNDS ON TERRESTRIAL BODIES

Abstract

Modern-day technology has several limitations when sample acquisition and analysis are taken into consideration. Collection of samples and bringing it back on earth to analyze it makes the mission longer, and also the cost of the overall mission increases. For example, the sample return mission to the moons of Jupiter and Saturn can take more than a decade. So to eliminate time and save resources we are developing an autonomous robot that collects and analyzes the sample and sends the results to the Earth. The exploration rover will collect samples and perform qualitative and quantitative analyses. The experiments will be focused on finding the compounds that cater to life and those which may help in colonizing extraterrestrial bodies. This new design of rovers with an in-house experimentation capability will allow researchers to analyze the sample's constituents. The Ganymede is the largest moon in the solar system and is suspected to harbor subsurface oceans and massive cave systems which our onboard system can map and sample. Using this data we can determine the best location to establish human civilization and study the origin of life. The rover will determine the geo-mechanics using a penetrometer or Geovane shear strength tester which will help us to determine the shear strength of cohesive soils, penetration resistance, bulk density, soil compaction, etc. It will also perform experiments to determine factors like the age of soil, the effect of changing space radiation, porosity, R-value testing, and temperature of the soil. The rover, using artificial intelligence, will perform experiments on the soil to determine the presence of different chemical elements of our interest like methane, amino acids, stromatolites, nitrogen, carbon

dioxide, phosphorus, oxygen, iron, etc and also to find pH, corrosivity, salinity, using radio waves and spectroscopy. The components like spectrometers will collect and analyze the data from the collected samples. The data will be sent through a high-speed communication system which will be attached to the rover. This paper will outline all the technical and operational parameters that include the subsystems, functionality, and communication system of the rover.