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TALOS: DEVELOPING THE FIRST GREEK ROVER FOR THE EUROPEAN ROVER CHALLENGE - DESIGN, IMPLEMENTATION, AND LESSONS LEARNED FROM A MARS SIMULANT MISSION.

Abstract

In 2023, Beyond Robotics - the 1st Greek student team to develop a space rover (planetary exploration vehicle) for Mars simulation environments, marked a significant milestone for space robotics in the country. The team clinched the 1st prize in the Science Task and ranked 7th out of 54 teams overall in their debut appearance at the international competition "European Rover Challenge" (ERC), with their rover, Talos 1. Expanding upon this accomplishment, this paper is devoted to the development of Talos 2, the evolution of Talos 1.

Besides the inherent risks of a complex system as a rover, our team also has to manage risks during the operations within the Mars Yard. Competition tasks include but are not limited to: navigation, maintenance, scientific analysis, drone piloting, sample collection and more. The challenge is to ensure that our system complies with ERC requirements, operates as a robust and low risk platform, developed and tested within a short time frame and with limited budget resources. This constitutes a complicated task for project management and systems engineering teams.

Talos 2 represents a culmination of lessons learned and feedback gathered from the previous iteration of Talos 1. Noteworthy improvements include advancements in subsystem integration with emphasis on modularity, the introduction of a new drilling system, enhanced mobility features with the design of new wheels and lightweight structural approaches. Further, to tackle contingency scenarios, the team upgraded the software for enhanced autonomous navigation, increased redundancy in all subsystems and refined telecommunications to ensure operational efficiency.

The detailed design of Talos 2 subsystems (mechanical, power, computer, telecom, payloads, science) utilizes a 4 wheel configuration with lightweight bogie suspension made out of composites and differential bar. It houses everything in an aluminum frame chassis that includes two Li-ion battery packs, a 6-axis 3d printed robotic arm, carousel sample collection system, detachable drill, wireless telecommunications, 360 cameras etc. The peripherals were integrated through software built on the Robotic Operating System (ROS), with additional autonomy functionalities subsequently implemented. Overall, the system weighs about 55 kg and measures an approximate size of 1.2 x 1 x 0.8 m^3.

Talos 2 aims to act as an inspiration for the Greek space ecosystem, fostering implementation of innovative technologies and promoting relevant educational opportunities to students and young professionals. ur team is committed to pushing the technological boundaries and promoting international collaboration in the pursuit of advancing space exploration activities.