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LUNAR LAUNCHPAD TO COSMIC FRONTIERS: NAVIGATING INTERPLANETARY EXPLORATION FROM THE MOON

Abstract

As the frontier of interplanetary travel unfolds, innovative solutions become paramount. This research sets a course toward new horizons by exploring the integration of advanced technologies into the operational framework of lunar missions. The objective is to empower spacecraft originating from the Moon with autonomous navigation capabilities, thereby reducing dependence on Earth-based commands and propelling us into deeper realms of exploration beyond our lunar neighbour. Interplanetary travel presents inherent challenges, such as communication delays and the need for real-time decision-making. This research advocates for spacecraft equipped with the ability to analyse data onboard and autonomously make informed decisions. The goal is to redefine the efficiency and adaptability of interplanetary exploration, beginning with missions launched from the Moon. The primary aim is to maximize the scientific potential of interplanetary missions by leveraging autonomous systems onboard spacecraft. These systems are designed to adapt trajectories dynamically, responding to unexpected phenomena and optimizing resource utilization to enhance the overall scientific yield. The research methodology involves the development and rigorous testing of navigation algorithms tailored specifically for interplanetary missions originating from the Moon. These algorithms undergo training using simulated mission scenarios and historical data, ensuring robust performance in navigating the vastness of space. The study addresses challenges associated with autonomous navigation in deep space, including trajectory planning, course corrections, and optimized resource allocation. Anticipated outcomes include a demonstration of the feasibility and effectiveness of autonomous navigation for interplanetary exploration. The research aims to provide insights into the transformative potential of this technology for the future of interplanetary travel, showcasing how autonomous systems proactively contribute to mission objectives. The findings emphasize the role of autonomous navigation in shaping the future of interplanetary exploration, unlocking the full scientific potential as humanity ventures beyond the Moon into the cosmic unknown. This research signifies a critical contribution to the evolution of interplanetary travel methodologies, highlighting the pivotal role of autonomous navigation in unlocking the full scientific potential of exploration as we extend our reach into deep space from the Moon.