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AUTONOMOUS SMALLSAT NETWORKS FOR EVA SUIT MONITORING AND DEEP-SPACE ASTRONAUT SAFETY

Abstract

Future deep-space missions require innovative solutions to enhance astronaut safety and mission efficiency. This paper proposes a novel network of autonomous SmallSats designed to provide real-time monitoring of extravehicular activity (EVA) suits in lunar and Martian environments. By leveraging miniaturized sensors, AI-driven telemetry processing, and inter-satellite communication, these SmallSats offer continuous health diagnostics, environmental hazard detection, and navigation support for astronauts operating in extreme conditions. The study explores the integration of COTS-based miniaturized propulsion, GNC systems, and resilient deep-space communication architectures to ensure seamless data relay. Simulation results demonstrate the feasibility of this approach for reducing astronaut risk, enhancing situational awareness, and enabling autonomous operations in lunar and planetary exploration.