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Interactive Presentations - 20th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (IP)

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A STRATEGIC APPROACH TO TACKLE INTERPLANETARY COMMUNICATION DELAY: EXPLOITING ARTIFICIAL INTELLIGENCE SOLUTIONS FOR FUTURE SPACE EXPLORATION

Abstract

Despite the extreme measures in any interplanetary mission, a probe is inevitably prone to a handful of unexpected errors. Concerning this, an exceptional challenge in every interplanetary endeavor is the inescapable communication gap (delay) resulting from the relative positions of the earth and the target planet or moon. Although the gap is in the range of few minutes to seconds, the actions performed by the probe during critical events such as Entry Descent and Landing (EDL), among others, creates the necessary to establish a continuous and real time communication with the mission control. Thinking long term on manned missions to Mars and beyond, escalates the concern substantially. The current paper proposes an alternate strategy to tackle this subject. With recent advancements in the development of Artificial Intelligence (AI) and state-of-the art algorithms, it can be so optimized for applications suitable to meet the needs of interplanetary missions. In the light of which, the paper investigates the design of

a monitoring satellite orbiting the target planet or moon, that is made to connect with the probe during its mission. This monitoring satellite is fed with the mission details prior to the mission and a developed deep learning algorithm is employed by the satellite to understand the dynamic probe status during its mission and assist the probe in its actions. The motivation behind the idea is to create an immediate communication channel for multiple probes and spacecrafts during their missions to planetary bodies and exploit the AI-based solutions for satellites. The paper describes the strategy of such an implementation in detail with reference to several case studies.