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LUNAR POSITIONING SYSTEM USING HIGH FREQUENCY IMAGERY AND CHIP-SCALE ATOMIC CLOCKS

Abstract

Lunar navigation has historically relied upon correlating features from lunar orbital imagery. This is an unsophisticated method with low reliability. Earth based navigation systems on the other hand have relied upon expensive, intricate atomic clocks that cannot be justified for lunar applications. As either method does not scale well for future lunar positioning systems, it provides the opportunity for a meshed approach. This paper proposes a lunar positioning system architecture that will utilise high frequency lunar imagery supplemented with onboard chip-scale atomic clocks to provide high fidelity surface positioning. A constellation of spacecraft equipped with these systems will take real time images of the lunar surface. Onboard computing systems will process the request signal from the target body using the MEMS derived chip-scale atomic clock. Autonomous analysis of the imagery from the spacecraft constellation will track and determine coordinates of the target body and verify it using the positioning from the chip-scale atomic clock. The spacecraft will then return coordinates to the requesting system. This system is expected to assist autonomous operations of landed equipment and rovers, as well as future crewed missions.