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A ROBOT ARM POSITIONING METHOD BASED ON HAZARD CAMERA FOR CHANG'E-3 LUNAR ROVER

Abstract

Chinese Lunar Exploration Program includes three phases, which are "orbiting, landing and sample returning". In the second phase of the lunar exploration program, Chang'e-3 lunar probe is used to achieve the mission objective of China's first soft-landing and rover exploration on celestial body beyond Earth, which is a new milestone in the development of our space technology. In this paper, a robot arm positioning method based on hazard camera is proposed for the science and engineering applications of a lunar rover in Chang'E-3 project, which include three procedures. Firstly, the spherical projection model for hazard camera is transformed to a perspective projection model, based on which the epilpolar images are generated by resampling digital imagery to epipolar geometry. Secondly, correlation matching and least-square matching methods are applied to get homogeneous points at sub-pixel level. Thirdly, the target-point coordinates are calculated by forward intersection, and the surface normal at the target point is obtained by fitting a plane with surrounding points. This method has been successfully applied to robot arm probing of Chang'e-3 lunar rover. The results showed that the final position error of the robot arm probing is better than 1mm, and the angle error is less than 0.5, which are both superior to the position error index of 4mm and the angle error criterion of 0.3. On January 14, 2014, the first robot arm probing test is completed successfully, and we applied this method to detect target point and operated positioning manipulator, finally scientific data of target derived.