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A NOVEL ALGORITHM FOR LUNAR ROVER PATH PLANNING WITH CONSIDERATION OF FACTITIOUS INTERVENTION AND STEERING COST

Abstract

Path planning which plays an important role in rover navigation for lunar surface exploration guarantees a successful mission and symbolizes the technical intelligence degree. Path planning comprises two parts, environment modeling and path searching. Rover's every activity on the lunar surface including moving steering and so on can be abstracted into a cost. Environment modeling is to generate such a cost graph which reflects the effect of the environment on rover's activity. Based on the cost graph mentioned above, path searching is to find a collision-free path for rover to achieve the target. However two main problems are still to be solved: the searched path based on the model is usually hard to satisfy the controller's expectations and to be implemented because of frequent steering. This paper presents a path planning algorithm which generates a synthetic cost graph reflecting both the controller's expectations and terrain information and then presents an advanced path searching strategy reducing rover steering times. Firstly, high dimensional functions are used to describe the factitious cost, so the functions' characteristics can be varied to satisfy the controller's expectation by changing the functions' parameters, such as zero point, inflection point, derivable point and extreme point; the new factitious cost graph is weighted stacked with the traditional terrain cost graph to compose a synthetic cost graph that shows path planning strategy. Secondly, the heuristic evaluation function in Bi-directional A-star searching algorithm is improved in this paper so that steering cost, which can reflect the costs of power, time and moving distance and so on, is considered in each course deviation. This algorithm is validated by simulation in this paper and the path planning results can reflect the controller's expectation and has obviously less steering times. It is beneficial to the future lunar rover path planning.