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PLANETARY SURFACE MODELLING AND VISUALISATION FOR ASSISTING ROVER NAVIGATION SYSTEM

Abstract

Planetary surface models are fetching concern due to recent planetary exploration missions by various space agencies. High resolution surface model assists in path guidance and provides valuable information to scientists and geologists to study planetary morphology. Three Dimensional (3D) surface reconstruction techniques are prominent in creating surface model. These models are obtained by processing orbital stereo images to model and visualise using computer assisted system to provide photo-realistic visualisation. Virtual 3D environment also empowers to generate path traversal procedure with maximum covertness, which leverages research for computer graphics and vision. Hitherto, merely few attempts exist to utilise digital surface model in assisting navigation systems, which unwraps potentials of more research. The current work employs analytical research for analysis and simulation. The major thrust of the works includes modeling, analysis and simulation for autonomous navigation system. The method of 3D surface model representation utilises digital elevation model (DEM).The method- ologies includes photogrammetric triangulation methods to generate digital elevation models (DEM) for various applications at varying scales and accuracy. The procedure of planetary surface modeling and visualisation for assisting rover navigation system includes surface modeling, visualisation, and simula- tion procedure along with terrain elevation map. The current work assists rover navigation system with the help of surface models along with analytical simulation. Navigation path evaluation are performed through varying threshold values of terrain inclinations, weighting factors, motion profiles, time profiles ,vehicle orientations (roll and pitch angles), slip ratios, and slip angles of each wheel. The candidate paths are shown and traced in a plot and characteristics values such as total length, inclinations and other parameters are summarized in tabular format. Evaluated candidate path using constraints values assists to resolve safer, optimal and hazardless path. The work presents techniques and algorithms to provide experimental results for navigation system. The major output includes digital surface model (DSM), color coded slope and aspect map, contour map, terrain profile map, color coded painted relief map, shaded relief map, simulated generated path and raster profile map. The quest of exact surface model and complexity of surface model brings a lot of challenges and tasks for future researchers. A lot of research lacks in surface modeling, visualisation, analysis and simulation for assisting navigation system, where one can reconnoitre novel approaches for getting higher accuracies in 3D object. Also active research hides behind integration of spatial information with spectrally rich datasets.