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A CONCEPT OF THE LUNAR NAVIGATION MOBILE NETWORK

Abstract

Based on the theory that future Lunar colonies will likely be settled in craters, communication and navigation systems have to be properly established to satisfy needs of users. This paper will provide the theoretical concept of a navigation system which will be based on the pseudolite methodology and/or terrestrial-like distance and angle measurements. The concept proposes the high accuracy positioning system which will be based on developing the crater control network. Such network consists of two sets of the control points (the external frame and the internal network) around and within the crater, assuring mutual visibility. Precise positioning, within the scope of this research, means the capability to locate a tool, an object or a facility inside a crater with accuracy of few centimetres and even better (below cm). This accuracy is needed for positioning and precise navigating of construction machines and the principal points of the facilities that are to be built in the crater. Counting on the fact that construction works in the craters will have a local character, meaning that just certain parts of the crater will be exploited in a single period, the internal network points will be constructed as mobile facilities. That will allow high precision on micro-locations, without the need of maintaining the network around the not used areas. The internal network is connected to the external frame, providing the consistency of the coordinate system. Each internal control network point is equipped with a robotized total station, supported by an attached 360 degrees reflective prism and a camera. The total stations are operated remotely, from a monitoring station. Determination of the internal control network points is performed by the trilateration/triangulation measurements between them and the external frame points. The coordinates of the internal network points are adjusted in the sense of the constrained network, within the external frame coordinate system. The external reference frame is determined as the free network, created by the mutual measurements between the external frame points. There are two possible measurement models: (1) the same principle of distance and angle measurements as applied in the internal network or (2) pseudolite (GNSS-like) measurements. Such model of Lunar local navigation system increases the landing accuracy of human or autonomous vehicles as well. Nevertheless, the proposed methods give a broad spectrum of ideas, how common surveying methods, applied on Earth, could be transposed and rearranged to be applicable on the Moon.