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ENERGY EFFICIENCY OF MULTI-HOP SENSOR NETWORK ON THE SURFACE OF SOLAR SYSTEM PLANET

Abstract

Space exploration plays an important role to understand the behavior of our planet and universe. Engineers are developing different scientific equipment and devices, which are used in the space research and space exploration. There are several solutions to discover and continuously investigate a selected area on a surface of a Solar System body, which are based on expensive devices and sometimes on human monitoring. Instead of complex and expensive robots, we propose to deploy high number of cheap mobile sensor devices on the orbital planet surface to make the exploration more effective. These sensors form a multi-hop network and communicate with each other and offers many challenges from communications point of view. Our aim was to examine how to model, follow and control the movement of the sensor network in this special environment without losing the radio connection with any sensor. Moreover, we analyzed the effects of variant aboveground events (e.g., dust storm) on the communication in this network. The supposed sensors can make different measurements and take photos. In order to extend the examined surface, it is necessary to make the sensors movement possible. The knowledge of measurements' position is necessary for the data processing, in order to get accurate image for the surface of planet. Due to the lack of a global navigation satellite system, the sensors have to follow the movements and estimate the position of the other devices. We proposed extended positioning algorithms based on the triangulation method using simulation methods. However, the positioning ability of the algorithm is not effective if it includes unrealistic large energy consumption. This is why the examination of energy efficiency was in focus in our current work. Our aim was to get valid image about the performance and energy consumption of the developed algorithms. In the developed simulation program, we were able to define the main parameters of the sensor network in order to make the surface exploration more effective.