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MULTI-FUNCTIONAL RECTENNA FOR A LUNAR ROVER

Abstract

Current and previous lunar rovers are powered solely by batteries. These batteries are charged up during the lunar day and the rover is powered down during the lunar night to conserve energy. The rover can be made operational at all times by powering the rover wirelessly using a microwave beam. This microwave beam being transmitted to the rover can also be used to navigate the rover. The theory of a multi-functional rectenna array is presented in this article. Eight symmetrical nodes on the circumference of the rectenna and one node in the center of the rectenna are fitted with sensors which calculate the power density constantly. The central node communicates with the other 8 nodes calculating the relative power density. The central node is assigned to send movement commands such as faster speed in the direction of movement, slower speed in the direction of movement, forward, reverse, left turn, right turn, start and stop to the rover. These commands are triggered when the microwave beam is moved to focus one of the 8 nodes. For example, when the microwave beam is focused towards node 1 which is programmed to trigger the 'stop' command, the central node detects that node 1 has the highest relative power density and send the 'stop' command to the rover. Similarly, the microwave beam can be focused on other nodes to trigger the respective movement commands. While the beam is required to be returned back to the center before a new command is used, a return to center policy is employed, that sends data signals back to the transmitter so that the beam is moved back to the center of the rectenna after a movement has been triggered. The data signal contains the delta x and delta y of the beam position from the center of the rectenna. This data signal can also be used to relay other information collected by the rover to the ground station. Thus, the proposed multi-functional rectenna can power the rover at all times increasing its operational time, can be used to navigate the rover and also relay information collected by the rover to the ground station, all at once.