YOUNG PROFESSIONALS VIRTUAL FORUM (V)
Space Communications and Navigation Young Professionals Virtual Forum (3-B2.8)

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A TAXONOMY OF ENERGY EFFICIENCY STRATEGIES FOR CUBESAT CLUSTER FORMATION NETWORKS

Abstract

CubeSats, featured as magnificent scientific and educational advantages, win great popularities in universities and institutes. CubeSat provides an open standard for young students and professionals to design small size, low cost but functional satellites responsively. Recently, European Union is promoting a project, QB50, a network of almost 50 CubeSat formation flight for low atmospheric research and space technology demonstrations. However, in contrast to the big satellites, CubeSats also face some drawbacks such as small area for solar cells and limited power to dedicate high speed downlinks. Hence a robust and efficient network is required to facilitate communication between the CubeSats in the cluster. Energy efficiency is an important issue for this network. Thereafter, a strategy of using a number of multi-hop radio relaying was proposed maintaining and facilitating the network connectivity. Energy awareness thus needs to be adopted by the protocols at all the layers in the protocol stack, and has to be considered one of the important design objectives for all the protocols in this network. The paper also investigated energy balance mechanisms, such as selection of optimal transmission ranges for the nodes and exploiting wireless multicast advantage. The variation in transmission power greatly influences the accessibility of a node. Increasing the transmission range not only increases the coverage, but also the power consumption rate at the transmitter. This paper discussed how to find a trade-off between some contradictory issues such as increasing the coverage of a node, decreasing its transmission range and data rates. Moreover the paper discussed the feasibilities using current protocols like WIFI, Zigbee and Blueteeth in this network with simulations. Finally simulation results demonstrated the validity of the proposed approaches for CubeSat formation networks.