WSN for Planetary Surface Probing: Design of a Laboratory Prototype

K. Durga Prasad and S.V.S. Murty
PLANEX, Physical Research Laboratory, Ahmedabad 380009, India

The in-situ measurements of planetary regoliths are key for understanding the various planetary surface processes Here we propose an upcoming technique of Wireless Sensor Network (WSN) for long-term probing of planetary surface in a large geographical area. Such a network would contain a large number of tiny battery powered devices, called NODES, with surface properties sensors, deployed in a particular region of scientific interest. The deployed nodes would then form an adhoc network with self-organising capability, probe the surface for various sensor specific properties and transmit the data to the lander/rover/orbiter. A Laboratory Prototype of such a sensor network using CoTS(Common Of The Shelf) components is being designed at Physical Research Laboratory, Ahmedabad. Simultaneous efforts are also being made to make it a space worthy architecture. This is the first step towards designing a large scale planetary surface probing sensor network targeted for future missions.

The sensor nodes and the base station of the prototype are custom-designed using an SoC(System on Chip) comprising of a 16-bit microcontroller and radio operating in 2.4 GHz ISM band and follow a modular architecture with small foot-print. Each node is integrated with a CoTS electrical properties sensor and an RTD as our parameters of immediate scientific interest are electrical properties and temperature of the regolith. These nodes are separately deployed in areas representing various analogue topographic and environmental conditions. On activation, all these nodes form a multi-hop mesh network and the distributed surface properties are logged into a remote computer using a base station. Some of these nodes are even deployed in simulated planetary conditions to infer the behavior of the surface properties and sensor network together.

Critical analysis and testing of the node and network design, power sources, node lifetime, communication range and topographic effect on the sensor network is carried out. Efforts for ruggedisation of the node are also being carried out and tested to prove its readiness for withstanding harsh and extreme environments. Some of the initial results of these tests and planetary analogue remote deployment experiments will be presented.