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DEPLOYING A SMALL SATELLITE-BASED NETWORK OF GROUND SENSOR TERMINALS
(GSTS) IN DEVELOPING NATIONS FOR ENABLING REMOTE INTERNET OF THINGS (IOT)**Abstract**

Compared to conventional satellites, small satellites are more attractive to develop and demonstrate new technologies at a lower cost and shorter development time. These small satellites in the low earth orbit (LEO) have relatively low propagation delay and provide global coverage, suitable for IoT based applications in remote areas with no access to terrestrial networks. In addition, the use of these satellite communications is desirable as it is resilient to terrestrial disasters. This paper describes the overall mission architecture and implementation of remote IoT using a small satellite platform named KITSUNE. It is a 6U lean satellite developed at Kyushu Institute of Technology. One of the missions on board is to leverage IoT for building a network of remote ground sensor terminals (GST) in 10 developing countries. The involvement in this network has enabled the emerging nations' access to space technologies using a cost-effective low-power GST for their preferred application. The collaboration has also promoted capacity building and upskilled the participants as they built their own GST for terrestrial measurements, mostly meteorological that could be uplinked to the satellite. Although commercial solutions are booming in this field, they often involve huge subscription costs and offer limited capacity building opportunities for developing countries. This paper also describes the receiver payload design capable of simultaneously receiving multiple data from 8 channels. To meet the satellite's constraint in overall size and power budget, LoRa modulation has been employed for communication between the GST and the onboard payload. Compared to the wide applications of LoRa modulation for various wireless sensor network applications, there are limited research and on-orbit results for the satellite IoT service. Conclusively, the paper presents a feasibility study of the mission with communication tests performed on the ground between the payload and GST. KITSUNE is expected to be launched in the mid of 2021. The data collected by the satellite, specific for each country will be archived and analyzed for generating prediction profiles and monitoring variables as a basis to address local issues faced in these countries.