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GROUND STATION NETWORK FOR THE TIM NANOSATELLITE EARTH OBSERVATION CONSTELLATION

Abstract

The Telematics International Mission (TIM) is a multinational effort to combine multiple nanosatellite missions in a larger formation aiming at different remote sensing applications. In TIM institutes from around the world join by contributing their own satellite formations as well as ground infrastructure. Germany contributes to TIM with the Telematics Earth Observation Mission (TOM). The formation of cooperating satellites enables observation of target areas on the Earth's surface from different viewing angles. In this fashion three-dimensional surface maps are generated by photogrammetric methods as well as sensor data fusion. This offers interesting application potential to characterize ash clouds from volcano eruptions, damages after Earthquakes, growth of city limits, ships on sea among other applications. The challenges of optimization of resources for formation and constellation operation and data management in TIM necessitates the development of a worldwide Ground Station Network (GSN). This contribution focuses on the GSN aspects of the TIM. It presents a novel GSN concept driven by existing web and internet of things technologies. We introduce a central planning and scheduling server, that operators can access for issuing requests and receiving schedules. The coordination of the communication within the satellite formation and with a GSN leads to a complex planning problem. Additionally the various interests of the different satellite mission's operators must be taken into account. Therefore, the proposed GSN concept employs sophisticated scheduling algorithms and provides a simple but secure software integration for receiving schedules. This paper starts with an overview of the TIM/TOM project. Next the basic architecture of the GSN and its design and implementation is briefly sketched. Its operation is demonstrated by several use-cases. A comparison to existing GSN concepts is added to show the benefits for TIM. Finally the performance of various scheduling algorithms in different mission scenarios for TIM is presented.