20th SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Satellite Operations (3)

Author: Mr. Harald Wojtkowiak
University Wuerzburg, Germany, wojtkowiak@informatik.uni-wuerzburg.de

Mr. Oleksii Balagurin
University Wuerzburg, Germany, balagurin@informatik.uni-wuerzburg.de
Mr. Gerhard Fellinger
University of Würzburg, Germany, fellinger@informatik.uni-wuerzburg.de
Prof. Hakan Kayal
University Wuerzburg, Germany, hakan.kayal@uni-wuerzburg.de

ASAP: AUTONOMOUS DYNAMIC SCHEDULING FOR SMALL SATELLITES

Abstract

Usually planning of satellite missions is done on ground by an expert team. Activities have to be prioritized; telecommand lists have to be generated according to time-based procedures and sent to the satellite for execution. In consequence of this method expenses for operations are a major part of the overall satellite mission cost because of the usually intense involvement of humans in the planning and operations processes. Additionally, doing it this way makes it impossible to react on special short-time events such as volcanic eruptions or fires. To improve the process of mission planning, the development of a new autonomous imaging system with an integrated autonomous planning system has been started at the University of Wuerzburg which is funded through the German Aerospace Center (FKZ 50RM1208) by the Federal Ministry of Economics and Technology (BMWi). The aim is to use such a system on board of nano satellites in the future to enable autonomous fast time responses to short-lived optical phenomena. Furthermore the system can relieve the On-Board-Computer (OBC) of the satellite by providing scheduling capacities and mechanism. The main functionality of our new satellite system is twofold. On one hand, it uses its optical system to autonomously detect, classify and track (in the field of view) interesting objects or phenomena like meteors or lightning in the Earths atmosphere. In the context of our project, this is called "Autonomous Sensing (AS)". On the other hand, it provides the capability and means to schedule satellite operation procedures. This feature is called "Autonomous Planning (AP)". Combined, these acronyms form the project's name ASAP. The main feature is that both functionalities work autonomously. The focus of this paper lies on the scheduling system of ASAP. It has to manage activities and resources. One or several resources can be grouped to one hardware platform on which activities can be executed. Activities and resources can be distinguished in internal ones and external ones. Internal activities and resources are provided by ASAP and can be independently scheduled. For example the "Autonomous Sensing" functionality of ASAP is fully accomplished by internal activities and resources. External activities and resources can be registered in ASAP in order to be integrated into the scheduling process. This sort of operation requires some kind of communication. For this case ASAP offers a special interface to bind external components into the scheduling mechanism.