IAF SPACE SYSTEMS SYMPOSIUM (D1)
Technologies to Enable Space Systems (3)

Author: Mr. Mohammed Khoory
Mohammed Bin Rashid Space Centre (MBRSC), United Arab Emirates, mohammed.khoory@mbrsc.ae

Dr. Mohammed Alzaabi
Mohammed Bin Rashid Space Centre (MBRSC), United Arab Emirates, mohammed.alzaabi@mbrsc.ae
Dr. Hamad Almarzooqi
Mohammed Bin Rashid Space Centre (MBRSC), United Arab Emirates, hamad.almarzooqi@mbrsc.ae
Mr. Ahmed Salem
Mohammed Bin Rashid Space Centre (MBRSC), United Arab Emirates, ahmed.salem@mbrsc.ae

ON-BOARD SOFTWARE DESIGN FOR THE EMIRATES LUNAR MISSION USING OFF THE SHELF HARDWARE

Abstract

Recent trends in off-the-shelf hardware designs for space missions have allowed missions to be designed quicker and cheaper, but not without implications on its software design. In this paper, an embedded software design based on FreeRTOS and Linux is proposed for the Rashid rover, the main system of the Emirates Lunar Mission, that almost entirely uses off-the-shelf Cubesat-based boards for command and data handling, electrical power, and communication. The software runs on two computers, with the critical portions running on a reliable space heritage low-power computer with EDAC memory, while the less critical but more demanding imaging portion runs on a more powerful computer with substantial processing capabilities and memory. Existing software frameworks and hardware technologies are reused for the rover mission, while maintaining health and safety requirements, to allow for rapid development and prototyping. The software uses the Cubesat Space Protocol over CAN 2.0B for communication between subsystems and the ground system, while also allowing a basic CAN framework to be used for simpler on-board subsystems utilizing a simpler protocol on the same bus, without any clashes in compatibility. The design of different tasks allows for communication between hardware modules with different protocols, while gathering housekeeping data in a unified way for downlink. The telemetry table is split into groups, with each group assigned to an owner task to allow direct writes to it, and a separate task can collect this telemetry in an abstract manner for other purposes. Synchronization is achieved through an API to control access to telemetry groups with mutual exclusion. This paper also describes on-board software methods employed to monitor the status of rover mobility and assist the operator in safely controlling the rover's position and orientation.