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CUBESAT CONTROL CENTRE: A DEVELOPMENT OF AN EDUCATIONAL CONTROL CENTRE TO SUPPORT CUBESAT SPACE OPERATIONS

Abstract

CubeSats are becoming an important reality in space exploration both in academia and industry. The increasing capabilities of this type of system enables new kind of missions able to fulfill more diverse mission goals. Nonetheless their reduced complexity, spacecraft operations does not scale down with the size. Hence, training future spacecraft operators via CubeSat operations would be an important method to increase the effectiveness of future operations with already trained experts. To tackle these issues, the paper presents the Cubesat Control Centre (C3), an innovative ground segment that supports Cubesat Operations from Politecnico di Torino. It is composed by a ground station and a control centre operated by students and non-professional operators. The Control Centre's software for the telemetry data unpacking and scheduling of operations are implemented by Python. Its aim is to provide an interface that can automatically read telemetry data and using scheduled protocols for sending telecommands. The process is monitored by several consistency checks which identify the correct packet acquisition and classification, extract the data and convert them into an engineering language. The main component of this process is a database that helps software and consistency checks to perform their tasks. The operator can access an interface where the following are displayed: type of arriving packet, check of correct acquisition and validation of packets, binary code from satellite, engineering value of arriving data. From the interface, the operator can choose the mission protocols to be used, can simulate and send commands directly to satellite when it is in visibility. C3 is one of the first academic control centres in Italy using the ESA's CCSDS standards and it is a useful facility for educational and research purposes. Control Centre is divided into three areas: Flight Operation: Where CubeSats receive telecommands, sends telemetries and where the team evaluates follow up operations; Payload Data Ground Segment: where the management of payload data happens; User Segment: where a consumer could request a series of products by means of a formal request. By assisting primary mission through fast delivery of high-quality information and data, sending scheduled commands and assisting in managing requests from stakeholders, C3's control centre

is a valid resource and cheap support for operation, enabling great learning opportunities and effacement operations with an open source vison to support CubeSat community.