SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
"Hands-On" Space Education (1)

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DESIGN AND MANUFACTURE OF A NANOSATELLITE FOR SPACE TECHNOLOGY EDUCATION AND POTENTIAL APPLICATION

Abstract

Space is the next frontier for mankind and utilization of space is human's ultimate quest. Although we have been in the Space Age for more than half a century, the cost associated with developing a space system is still very high. First proposed by California Polytechnic State University almost 10 years ago, the idea of cubesat has caught the attention of many organizations around the world because of low development cost and short project schedule. Inspired by the idea, FSpace lab of FPT corporation and FPT University have joined force in a project to design and manufacture a nanosatellite measuring 10x10x20cm, weighing 2kg (2U cubesat) to give students and young engineers a chance to study about space technology and its application. The satellite itself is an Earth observation and technology demonstration satellite as we hope to demonstrate the use of many Commercial Off The Shelf (COTS) components to reduce development cost. We have analyzed 38 cubesat missions launched in the past and learned from both success and failure cases to our satellite design. All critical subsystems are double-redundant such as onboard computer using flight-proven PIC 16F877A microcontroller together with the newly released high performance Helios Single Board Computer (PC/104 standard) or triple-redundant as in the case of the communication subsystem which includes the handheld transceiver Yeasu VX-3R for VHF band, data radio Tekk SDU-2000 for UHF band and the advanced MHX2420-SL transceiver for ISM 2.4Ghz band. The nanosatellite also carries 02 low-resolution cameras with an option for a third digital compact camera to take pictures of the Earth from space. These COTS components are tens time less expensive than their space-rated counterparts. As we are finalizing the design of our nanosatellite, preliminary experiment with the mentioned hardware yielded quite good result: programming with the Helios board is straight forward since it shares the same x86 architecture with ordinary personal computers; all the transceivers are working as expected and we've been testing communication between the prototype satellite and the ground station at increasing distance, the latest test went successfully at 10km range. Our nanosatellite project is moving on track for the next phases: breadboard model, engineering model, flight model manufacture and finally we hope to put our satellite into Low Earth Orbit by the end of 2010. Over the project's 18-month course, the total development cost of the nanosatellite is expected to be less than 100,000USD (launching cost is not included as it varies by different launch providers). If succeed, we believe that it will help to foster the idea of cubesat and open a new possibility for universities and start-up companies to join the new trend of space development via small satellites. Perhaps it will become the most launched satellite platform in history.