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SPACE ENGINEERING EDUCATION IN NEPAL USING PICO-SATELLITE TRAINING KIT

Abstract

This paper presents the development of Pico-Satellite Training Kit in Nepal and the training activities performed at different colleges and universities in Nepal as well as outside Nepal. The kit is based on PocketQube form factor with a dimension of 5 cm x 5 cm x 5 cm and weighs less than 250 grams. The training kit consists of four subsystems On-Board Computer [OBC], Electrical Power Subsystem [EPS], Communication Subsystem and Payload Subsystem. The kit is derived from the engineering model of the 'Nepal-PQ1' PocketQube which is being built at ORION Space. Each subsystem is stackable, which can be used independently or integrate them by stacking to make a complete PocketQube kit. The OBC is based on ATMEGA328 microcontroller which can be programmed separately via micro-USB. It also consists of FRAM as a storage device, a watchdog for Single-Event Upset (SEU) protection, and few test LEDs. The EPS contains three embedded Maximum Power Point Tracking (MPPT) devices, current protection for Single-Event Latch-up (SEL) protection, a power monitoring unit, connectors for solar cells, a rechargeable battery, and two deployment switches. The Communication board consists of RFM98 which is a LoRa board and RFM26W which works in GFSK Modulation. The Payload board has an accelerometer, gyroscope, LDR, pressure, humidity sensor and Camera. The kit is being used as a training kit in and outside Nepal to provide space education. The training kit is used to teach students about different subsystems by giving the students to assemble, program, test and integrate the satellite. The workshop is divided into theory sessions and hands-on sessions. During the hands-on session, each student is provided with a kit and the students are taught about the concepts and are asked to solve a real problem with programming during each exercise. The Kit is based on Arduino Platform so it is easy for the students to learn and program the PocketQube who are familiar with the Arduino Platform. The participants of the workshop are undergraduate students from background in Electrical, Electronics, Mechanical, Computer and Aerospace Engineering. The students also learn different modulation technique during data transmission like GFSK and OOK along with LoRa.