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NEPAL'S HIGH SCHOOL 1U CUBESAT MUNAL INTEGRATED BUS SYSTEM: MODIFICATION OF
THE BIRDS OPEN-SOURCE STANDARDIZED BUS

Abstract

BUS systems are the crucial parts of any satellite that plays an important role in successful operation of a satellite's mission. The CubeSat mission and purpose may vary but a standard CubeSat bus system can be used in different CubeSat. The use of a standard CubeSat bus system can reduce the time, effort and resources required for designing CubeSat from scratch. With the volume of 1U CubeSat, there can only be few number of missions. Multiple boards of the Bus system consumes volume and power which can be used for other missions. MUNAL, a continuation of NepaliSat-1, is a 1U Cubesat currently being designed by a group of nine High School Students. The MUNAL BUS system is the modification of BIRDS open-source standardized bus which was designed by Kyushu Institute of Technology, Japan. With an aim to make the bus systems a single stackable board and for the use in satellite constellation, MUNAL system is designed with Front Access Board (FAB), Electrical Power System (EPS) and On-Board Computer(OBC) integrated on a single PCB. Hence, the two boards used in BIRDS BUS system are merged to a single board providing about 17% more space in MUNAL. Unlike BIRDS BUS, MUNAL BUS system boards are interconnected to mission boards through the 60 pin connectors through Backplane Board, providing all the necessary power lines and interface to the corresponding missions. The MUNAL BUS system comprises only two microcontrollers which are flight-proven STM32 MCU series. The tasks assigned by the BIRDS bus system for FAB, MAIN and COM MCU are all assigned to a single Main MCU. The reduced number of MCUs results in a reduced number of components resulting in 28% reduced Bill of Materials and about 15% less power consumption. This also minimizes the software development time, and hardware manufacturing and assembly cost. With the decrease in number of components and boards, MUNAL integrated bus system is a more compact and simplified version of open-source BIRDS standard bus system used for the 1U CubeSat constellation.