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## COMMUNICATION SYSTEM OF LEO CUBESAT CONSTELLATION FOR DISASTER RESPONSE

**Abstract**

The applications of CubeSats are now transitioning from being solely educational and technology demonstrations tools to fulfilling missions that can meet complex user needs. The purpose of this paper is to study the feasibility and propose a CubeSat constellation system for providing text messaging communications for disaster responders. A developing country, Bhutan, has been selected as a case study for this paper as Bhutan launched its first satellite in 2018 and it may be able to undertake the proposed mission. The system is designed to provide communication links to connect local affected areas and Emergency Operations Centre (EOC) at districts and national level in the event of disasters. In the worst case scenario, a total of 225 active users is considered to be present in the system. The accommodation of all ground users by a CubeSat payload is achieved by engaging the Time Division Multiple Access Technique (TDMA). A mission requirement of satellite revisit over Bhutan every 30 minutes or less is set so that responders can have regular communication. The analysis shows that a Walker Delta constellation of 6 CubeSats, 3 CubeSats per 2 orbital planes, at an altitude of 550 km with an inclination of  $45^\circ$  is found to meet the mission revisit requirement with an average communication widow of 10.94 minutes for each satellite pass over Bhutan. While a 2U and 3U CubeSats can easily carry out the mission, 1U CubeSat is also found to be feasible by implementing power management techniques. A communication link analysis shows that a 1U CubeSat and portable handheld terminals of responders in the field can close a communication link. The cost of the proposed system and its comparison with the commercial communication services are also presented along with the system trade-offs that can be carried out among important mission parameters.