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SECURE CUBESAT-TO-CUBESAT COMMUNICATION USING QUANTUM KEY DISTRIBUTION FOR INFORMATION UPDATES AND RISK ALERTS

Abstract

With the growing use of CubeSats for various applications, such as remote sensing, communication, and scientific research, the need for secure communication between them has become crucial. CubeSat-to-CubeSat communication is becoming increasingly important for maintaining the security and reliability of CubeSat missions in modern day. CubeSats often carry sensitive information that must be protected from unauthorized access or interception and hence vulnerable to physical and cyber-attacks that could compromise their security. In this paper, we propose a system for secure CubeSat-to-CubeSat communication using Quantum Key Distribution (QKD). It consists of a photon source, polarization manipulation device for quantum state preparation and photon detectors with the capability of quantum state measurement. This system could enable CubeSats to update each other in real-time on conditions and status, allowing for rapid response to potential risks. Apart from this, it also allows CubeSats to operate independently in space without relying on ground stations or other infrastructure for communication. In the method, the information to be shared is first encoded into binary signals, and then the sender CubeSat (Alice) generates a stream of single photons with binary codes represented by randomly chosen polarization states of photons and sends them to the receiver CubeSat (Bob). The receiver CubeSat measures the polarization of each photon and communicates its measurements back to Alice. Alice and Bob can then use the measurement results to establish a shared secret key. As the polarization state of a photon is inherently random, any attempt to eavesdrop on the communication will inevitably alter the state of the photons, which can be detected by Alice and Bob. By using this method, CubeSats in a network can exchange information securely and effectively, ensuring the reliability and stability of the CubeSat network.