ABSTRACT

Stable and efficient data communication is essential for supporting soldier ergonomics monitoring systems within military vehicles, particularly in suboptimal operational environments. This study proposes a LoRaWAN-based communication system with integrated local data redundancy via microSD to overcome the limitations of conventional LoRa architectures. The system was designed using RFM95W and SX1276 modules, configured with fixed parameters (SF7, BW 125 kHz, CR 4/5). All nodes were connected to a RAK7268V2 gateway linked to a local ChirpStack server for centralized network management and data monitoring.

Field testing was conducted on two types of military vehicles, namely the Open-Body Military Vehicle (OBMV) and the Armored Military Vehicle (AMV), in two different environments: a military vehicle testing facility and the hilly terrain of Sukawana. The results show that vehicle structural design and terrain characteristics significantly influence communication performance, as indicated by variations in RSSI, SNR, PDR, path loss, and link budget. The local data logging mechanism proved effective in maintaining data continuity during connectivity interruptions. This study presents technical configuration recommendations to improve wireless communication performance in mobile vehicle scenarios operating under harsh environmental conditions.

Keywords: LoRaWAN, Military Communications, Vehicular Networks, Field Testing, Wireless Sensor Networks, Path Loss Analysis.