Vibration energy harvesting for self-powered sensors at mine sites

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# ABSTRACT

With the prevalence of Mine Internet of Things (MIoT), various types of sensors have been widely deployed in mine sites for environmental monitoring and personnel/asset management. Currently, sensors in mine sites are mainly powered by cables or batteries. However, the deployment and maintenance of a power supply network can be difficult and expensive, and batteries have a limited lifespan. The vibration energy harvesting (VEH) technology can be used to provide power for low-power sensors in mine sites. This presentation briefly introduces three widely used VEH methods (i.e., piezoelectric, electromagnetic, and electrostatic). The performance of a commercial electromagnetic energy harvester (ReVibe model D) is evaluated based on the vibration of a lab vibrator (3 g, 50 Hz) and an idling SUV automobile (0.3 g, 25 Hz). Experimental results indicate that a ReVibe energy harvester can generate adequate electricity to power a sensor, and its power output depends on the load resistance as well as the vibration frequency and amplitude of vibration sources. To apply VEH to mining applications, this study also analyses the characteristics of vibration sources at the mine site based on the vibration data collected from various operating machines in a coal handling and preparation plant (CHPP). The vibration analysis results indicate that all the measured vibration sources in the CHPP can generate stable and abundant vibrations, characterized by substantial amplitudes (up to 5.55 g) and low dominant frequencies (ranging from 14 Hz to 25 Hz), which are sufficient for VEH.