A low cost IoT wearable for localisation and communication in mines operating on existing network infrastructure.

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ABSTRACT

Tracking the location of personnel in underground mines is essential to support the increasing demands of a modernising mining sector as it can greatly enhance the effectiveness of safety procedures, provide the key data necessary for analysing and eliminating productivity inhibitors and record evidence often absent during incident investigations. The isolated environment of underground mines makes GPS technologies unsuitable for underground usage, creating a need for alternative means of positioning. Previous studies have indicated a clear innovation opportunity for low cost, battery powered IoT localisation technologies, particularly in hard rock underground mines. Key drawbacks of previously proposed localisation systems are the need for high cost and high maintenance infrastructure to provide Bluetooth Low Energy or Wi-Fi network coverage required by IoT devices.

A promising solution can employ both multilateration and fingerprinting techniques that utilise Wi-Fi signal strength data to provide a position estimate of each client device that are located within scan range of mine Wi-Fi networks. Data fusion techniques allow for more accurate localisation estimates for mining environments with sparse and inconsistent network coverage, using acceleration and gyroscopic data collected by an Inertial Measurement Unit (IMU) within each wrist tag. A partial mesh network composed of the proposed wearable devices can allow mine workers outside static network range to receive emergency alerts and relay IMU data to and from the central server.

This paper will succinctly introduce a novel, battery powered localisation and emergency communication wearable device that is being developed through a partnership between the University of New South Wales and Roobuck Pty Limited for operation with existing network infrastructure in underground mining environments.