

Using Ultra Wide Band for Underground Positioning and Collision Avoidance

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ABSTRACT

For surface mines, Global Navigation Satellite Systems are normally the best option. For underground mines, However, satellite signal cannot penetrate the rocks, alternative positioning methods have to be used. WiFi, RFID and Bluetooth low energy are popular technologies. In recent years, as the chipset price decreases rapidly, Ultra Wide band (UWB) for underground positioning has attracted much attention.

UWB transmits ultra-low power radio signals with very short electrical pulses, often in the picosecond range to minimise multipath and interference. Hence, precise distance measurement (about 10cm) can be obtained. The distance measurement can be directly used for positioning based on trilateration. It also implies that UWB can be used for collision avoidance.

In this paper, we introduce the principle of UWB based underground positioning. The 1D scenario and the 2D scenario are discussed in detail. The factors affecting the positioning accuracy are investigated.

Furthermore, location based solution requires the connection to the server for every UWB anchor, which cannot be guaranteed in many underground mine sites. To eliminate the limitation, we propose a method using range and angle measurement to estimate the target's relative position. Based on the relative position, collision avoidance can also be achieved.