



# CPS: Synergy: Collaborative Research: Enabling Smart Underground Mining with an Integrated Context-Aware Wireless Cyber-Physical Framework

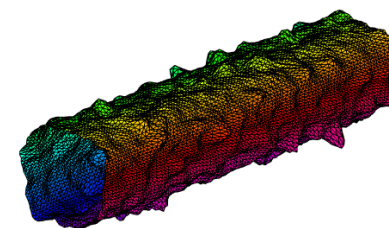
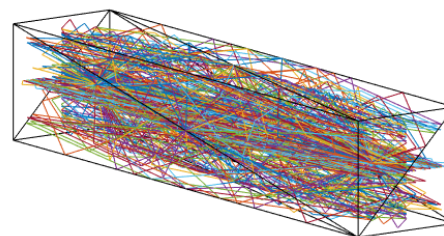
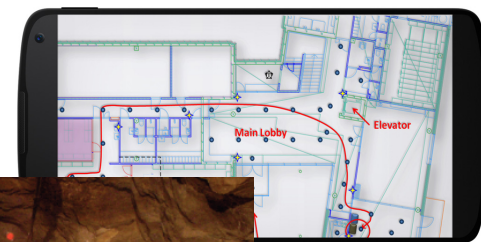
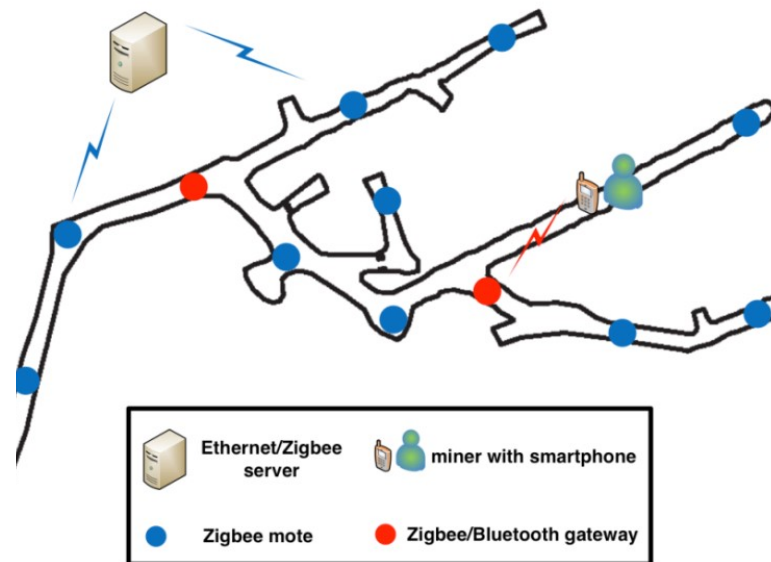
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# Description

Underground mining is dangerous, with many open challenges for environmental sensing, wireless communication, and localization

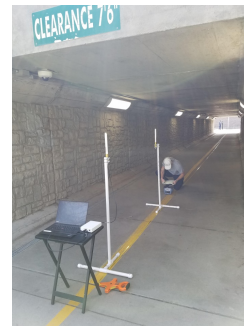
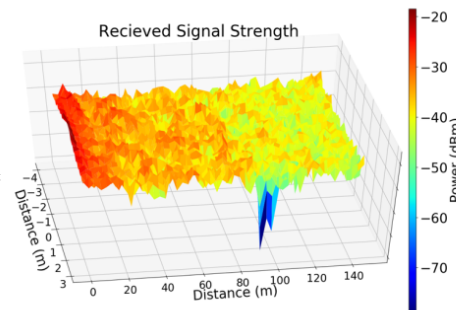
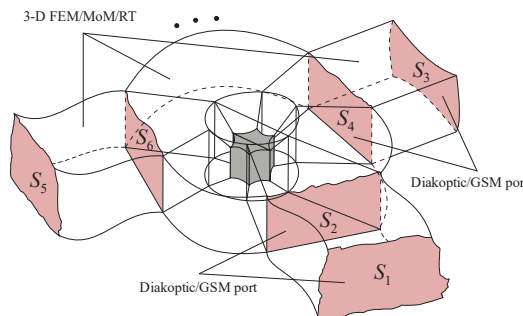
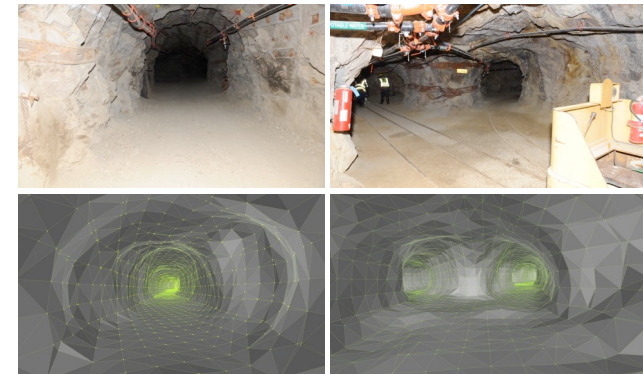
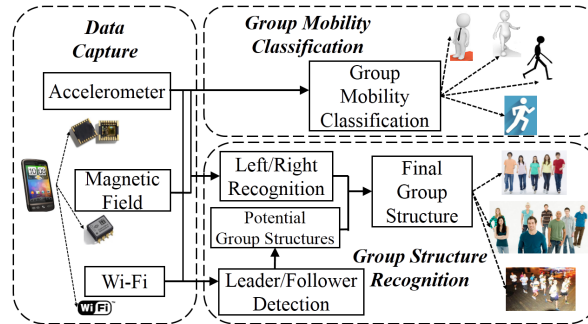
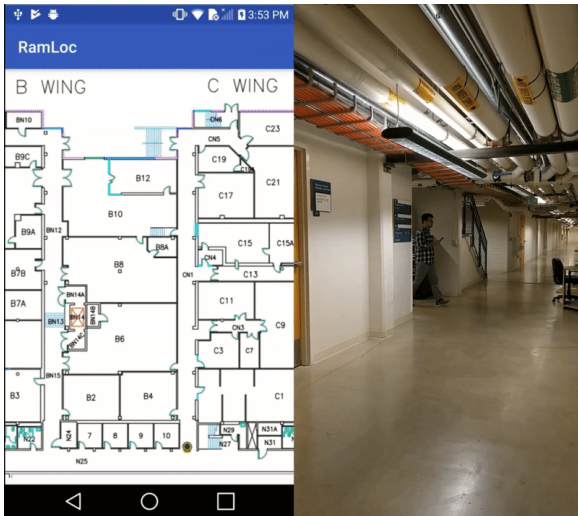
## Goals of This Project:

- develop energy-efficient and error-tolerant indoor (underground) localization to locate individual miners and groups of miners
- enable co-existence of high quality voice streams with environmental sensor data in low-power wireless mesh networks
- characterize wireless signal behavior with EM modeling in real underground mines, to guide placement of wireless nodes in mine tunnels



# Findings

- Designed new deep learning based framework for heterogeneity-resilient, real-time, high-accuracy, and secure localization in indoor environments
- Devised miner mobility classification and voice convergecast and multicast techniques with datacasts on low-power wireless sensor deployments
- Performed EM propagation modeling and fast ray tracing for wireless signal characterization in Edgar underground mine (Idaho Spring, Colorado)
- Integrating CPS framework for deployment testing in underground mine



Poster Time and Location