



## Master thesis project: Wireless communication systems for underground mines

**Description:** This thesis work is defined in the scope of the SafePos II (Safety positioning for first responders and remote controlled fire and rescue vehicles in mines) project ([www.sics.se/projects/safe-pos-ii](http://www.sics.se/projects/safe-pos-ii)). The main scope of the SafePos II-project is to increase the possibility for positioning and connectivity for use in manual or remote controlled fire and rescue operations in complex underground structures. The increased possibilities for positioning and connectivity ensures safer and more efficient fire and rescue operations in mines. Proper and reliable communication systems not only decrease machine break down time, but more importantly provide immediate transmission of messages from the underground working area to the surface for normal mining operations as well as necessary rescue operations in case of disaster. Therefore, a reliable and effective communication system is an essential requisite for safe working, and maintaining the requisite production and productivity of underground mines. Pre-installed communication systems are ineffective in many disaster situations. Wireless ad hoc systems can be used for backing up existing systems. Based on the results from SafePos I, the following approach emerged. Wireless devices, called anchors, are dropped by the firefighters as they progress into the mine. The anchors connect to each other in a multi-hop ad-hoc network and the first anchors, closest to the entrance, establish connections to the command center outside the mine. The anchors close to the firefighter connect to a device attached to him/her. The anchors can then be used to convey data between the firefighter and the command center bidirectionally. The anchors are also used for positioning of the firefighter by using UWB technology. This is accomplished by recursively determining the position of the anchor nodes as they are deployed, by performing measurements, such as angular or distance measurements between neighboring devices, including the one attached to the firefighter. These one-hop position data are then transferred to the command center where it is fused, possibly together with additional information, to compute the locations of anchors and firefighters.

This thesis work involves setting up and testing in a mine-like environment, and meeting with potential users, such as Mobilaris and Boliden to discuss requirements and usage.

This thesis is suitable for 2-4 students.

**Qualifications:** To be successful in this thesis work the candidate(s) would need the following:

- MSc studies in Computer Science or similar area.
- Excellent programming skills in C/C++
- Other preferable programming languages Python or Java
- Good knowledge of wireless communication systems
- Like to build end to end prototypes and concepts
- Be fluent in English.

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**Application:** To apply please send your CV along with the list of courses you have taken and their grades to [ali.balador@ri.se](mailto:ali.balador@ri.se). In your CV provide a short description of previous projects that you have done.

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