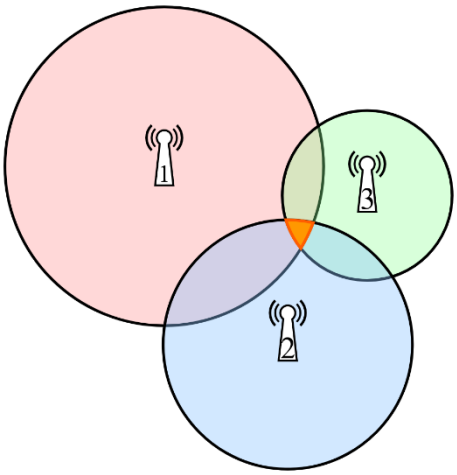
becker MINING EUROPE

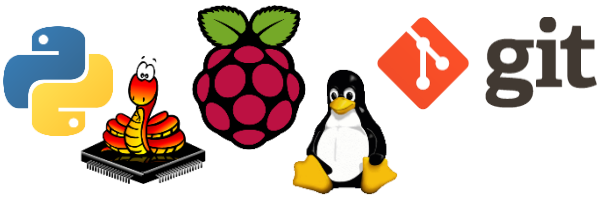
PosSys4.0

Validation system for PDS4.0



The Project:

- 2D Position detection system
- Easy to use verification system for existing product
- Data collection via API from industrial sensor modules
- Mathematical analysis
- Graphical User Interface
- The rest is up to you…



Project background:

A new Becker product is about to reach production phase - PDS4.0

About PDS4.0:

A collision awareness and proximity detection system.

The goal of the system is to prevent accidents in mining operations between vehicles and between vehicles and mining personnel. For this purpose it will be mounted on mining vehicles and feature Tags for mining personnel. The system will constantly measure the distance between all detectable participants and be able to interact with the vehicles and be able to engage breaks or slow down the vehicle in dangerous situations, which otherwise could end deadly.

For the purpose of evaluating the reliability and accuracy of the PDS4.0 a way of measuring needs to be established. The position of a vehicle, a target and the distance between these two, must be determined. An easy to use system with known uncertainty is therefore required.

PosSys4.0 Overview

The same ranging technology being utilized in the PDS4.0 should be used in PosSys4.0.
An API for interacting with the distance measuring chip (Nanotron Swarmbee) is provided.
Trilateration as mathematical foundation turns the distances to positions.

Requirements about deployment

The goal is to be able to set up the system anywhere and configure it quickly.

- Deployment of the system must be fast
- Autonomous Anchor points
- Coordinate System setup simple usage
- Possibly custom design (3D print) of housings

Requirements about Precision Requirements Specification

Which precision can be achieved / is required..

Minimum requirement: +/- 10cm -> 95%

- Evaluate current precision with minimum amount of anchors
- Evaluate precision gain when adding more anchors (find optimal amount)
- Ensure that system evaluates/displays info close to real-time

Requirements about Coordinate System Setup

Before the system can be used, a coordinate system in which to operate will have to be defined.

- Anchors that can be ranged will be the base of building a coordinate system
- Anchors can be told apart by their unique ID (mac address)
- Graphical user interface for the coordinate system building

Requirements about Graphical User Interface

Display the position of the vehicle to be tracked inside of a coordinate system

- Display calculated measurement uncertainty graphically as circle (fixed radius)
- Data Display (X/Y Coordinate and Distance/Uncertainty)
- Display the position of PosSys4.0 and give an indication about the PDS4.0 zone
- Reload previously recorded measurement runs
- Dynamically scale the coordinate system

Bonus: Dynamical Target Evaluation

PosSys4.0 assumes the target (which is ranged by the actual PDS) to be position static. ("virtual POI"). Adding dynamic targets ("real POI") would be the next step.
Hint:

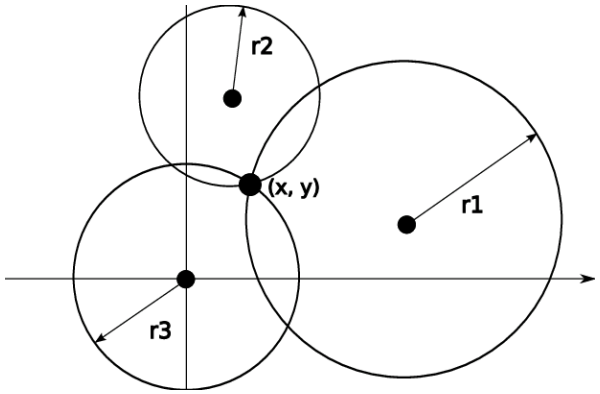
- Target uses same technique as measuring system
  (get current x/y in same coordinate system as PDS)
- Target then sends current position (via Uhf, BT, Wifi, RfToF BC, …) to main measuring system
- Both PDS and Target will be displayed in GUI

About Trilateration

The PosSys4.0 measurement system will be based on the concept of Trilateration.

Anchors will be placed around a target measuring area. The target vehicle to be measured will receive the distance from each anchor. These distances can be seen as radiuses of circles around the individual anchors. The PosSys4.0 knows the coordinates of each anchor. By using linear regression a point where all these anchor circles intersect (or reach a minimum deviation) can be found. This point will be the location of the target vehicle. The location will be returned as a coordinate point.

- Find optimal/efficient amount of anchors needed
- Minimize the uncertainty



About MSA - Measurement System Analysis

In order to establish the achieved precision of the measuring system, a way of verification needs to be decided

- Deploy the measuring system in a fixed grid (previously measured manually)
- Set know markers (manually measured Points) in fixed coordinate system
- Record measurements at marker positions (for fixed time)
- Evaluate difference (IS-Position <-> measured Position) for all recorded measurements
- Evaluate precision distribution according to precision requirements

Hint:

Possible Dataflow