

# Algorithms Coding Challenge

## Kinexon

This challenge is part of the job interview process for vacancies that include tasks concerning position estimation at KINEXON.

It gives you the opportunity to show us how you approach programming problems and what we can expect from your code in terms of structure, efficiency and style.

You might use either Matlab or Python to solve the challenge, because these are the two languages we heavily use at the moment. However, if you prefer to use a different language just ask.

### Tasks

We'd like you to build a small program that performs trilateration (cf. [1]) to derive the 2-D position of a sensor on a playing field. It shall consist of two components for simulating and estimating the state of an object.

1. Implement a ranging generator that is responsible for generating more or less random ranging data.

It should fulfill the following requirements:

- The system consists of one sensor which periodically sends out wireless signals and four receivers at the corners of a rectangle (the playing field) which receive these signals. Assume that the receivers can measure the distance from the sensor to the receiver.

The playing field should have a length of 100m and a width of 60m and the update rate of the sensor should be 20Hz.

- The sensor should have random positions resembling movement on a playing field, i.e., they should not exceed speeds possible for human players and remain on the playing field.
  - From these positions, the distance to all receivers should be calculated.
  - After these distances have been calculated, noise of  $\pm 30\text{cm}$  shall be added before the data leaves the ranging generator.
2. Implement a position processor that receives the rangings from the ranging generator and derives the current position and speed.  
The challenge in this component is to derive a position from the rangings and to compensate the noise that has been added in the ranging generator.
  3. Present the estimation results in meaningful plots that demonstrate the performance of your estimation algorithm.

If you have any questions about the challenge, don't hesitate to contact

Torsten Knüppel

e-mail: [torsten.knueppel@kinexon.com](mailto:torsten.knueppel@kinexon.com)

[1] <https://en.wikipedia.org/wiki/Trilateration>