# Project description:

The target of the project is to achieve the registration of a large number (>5000) of 2D point clouds into one single point cloud that minimizes the error among all of them.

The points clouds are obtained by consecutive LIDAR scans and they are composed of around 200 points each one. All the scans are obtained by the movement of the LIDAR so the distance between two consecutive scans will not be higher than a few centimeters and an initial approach to the origin of all of them is known. All the scans will contain some outliers that the registration process will have to deal with, they can be removed if necessary. The following picture shows an overlapping of the entire set of point clouds (in blue) and the initial estimation to the positions of the LIDAR (in orange):
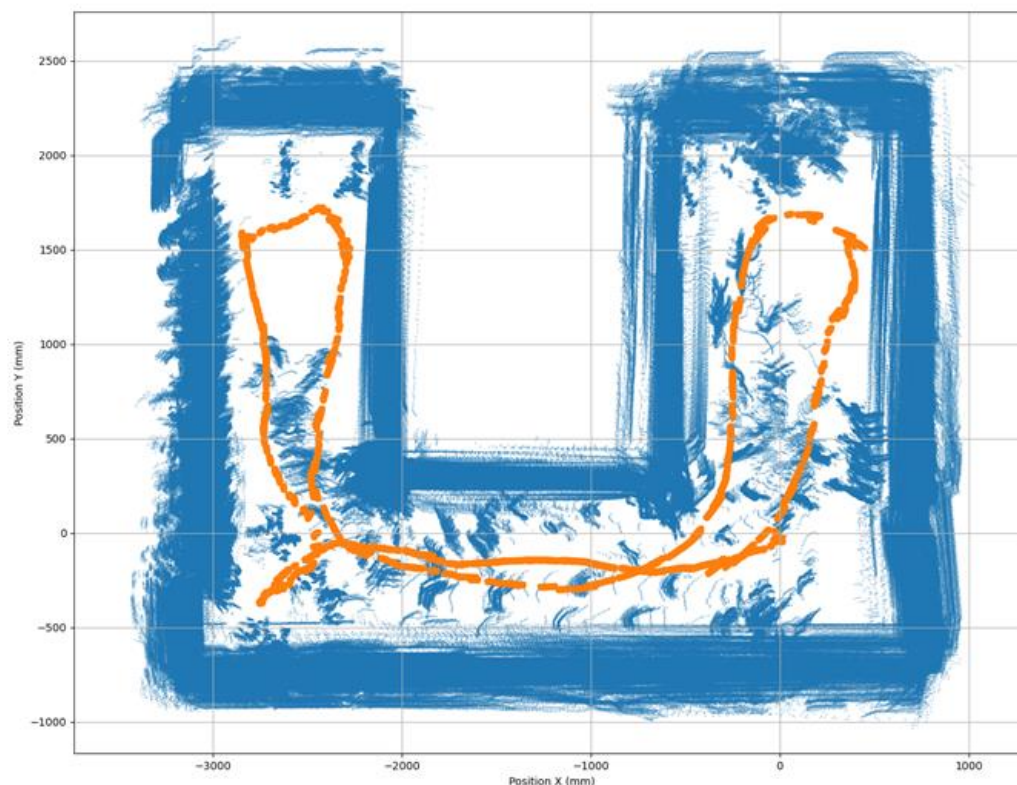
And the following picture shows two consecutive scans, note that the correlation is clear for most of the points but there are some outliers that have no correlation:
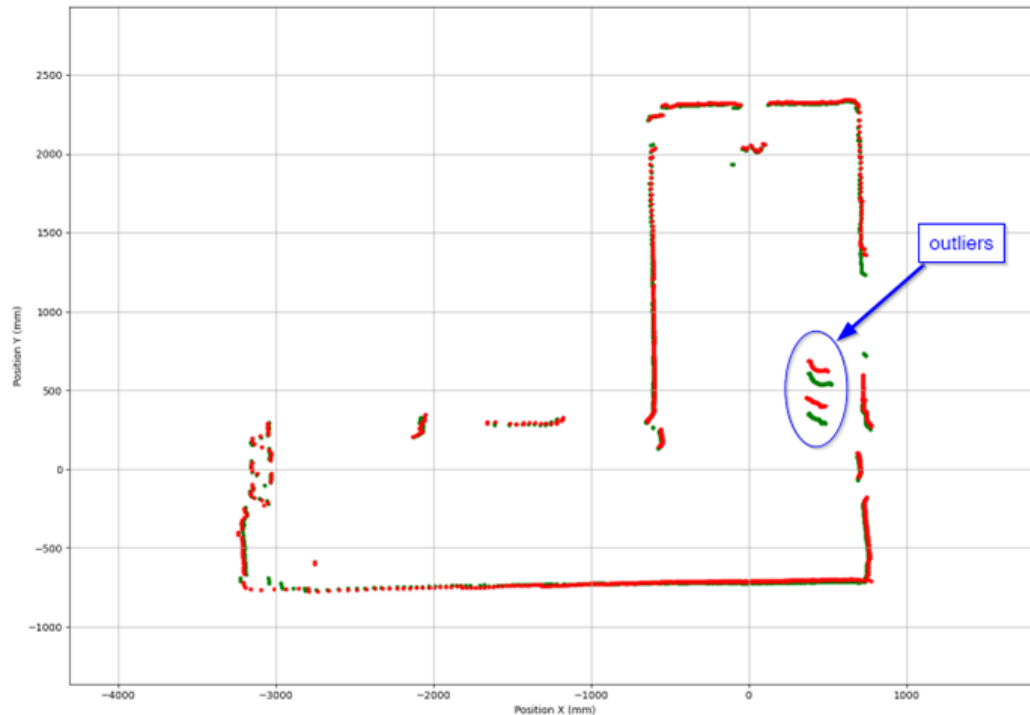
The deliverable code shall be able to merge all the scans in one single point cloud with the boundaries clearly defined. Due to the inherent uncertainties of the LIDAR a wall thickness of 10mm is allowed (exceptionally 20mm). At least three sample sets of different sizes will be provided for testing and development.

The following two approaches are suggested, but any other ideas will be well appreciated:

-To use the Open3D library to register the scans via iterative closest point alignment (point to plane is preferred)

-To use the OpenCV library to register the scans via feature detection.

In any case, downsampling the clouds is allowed during the intermediate process but the final solution must contain all the points with a resolution of at least 1mm

All the development needs to be done in Python 3 and making use of open-source libraries exclusively.