CSE462/562 – Augmented Reality (Fall 2023)

Homework #2

In this assignment, you will build a simple Unity application to align two point-cloud data. The program will load two files in the following format (all floating-point numbers):

```
num_pts
x1 y1 z1
…
xn yn zn
```

Your program should:

- Read from two such files two sets of 3D points $P = \{P_1, \dots, P_i, \dots, P_n\}$ and $Q = \{Q_1, \dots, Q_i, \dots, Q_m\}$ with n and m points respectively (n and m can be different).
- Calculate the transformation (registering the second point set to the first one) between these two sets of points using the following algorithms:
  - Rigid transformation: Assume that there are different number of points (not ordered) in the files but at least half of the points are exact matches. The rigid transformation is given by: $Q_i = RP_i + T$.
  - Rigid transformation up to a global scale: Assume that there are different number of points (not ordered) in the file with at least half of the points are exact matches. The transformation is given by: $Q_i = \begin{bmatrix} s_x & 0 & 0 \\ 0 & s_y & 0 \\ 0 & 0 & s_z \end{bmatrix} RP_i + T$.
  - Hint: use RANSAC along with three-point alignment method discussed in class.
- Have a button to choose among the two registration methods.
- Show the results in the following two different ways (again selected with another button):
  - Show the original and aligned points (with three different colors).
  - Show the transformed points (second sets) with its movement as a line.
- Also show the reconstructed transformation and scale (if any) parameters in text.

Grading:

- 100 points for the correctly working Unity program (should be shown to the instructor) with all the above features.

Submission:

- Submit a short video showing your application in use with all the above features demonstrated (studentnumber_lastname_yourfirstname_hw2.avi.zip).
- Submit the link to the code (preferably GitHub) with proper access (you can add the instructor to your project using the GitHub handle yakup.genc@gtu.edu.tr).