CV Engineer Technical Assignment

The following task consists of two parts that the candidate needs to complete to pass the assignment.

Part 1:

This part contains the topics of features extraction and coordinates transformation by using the given 3D model of an object.

Specification:

You are given a .stl model and image of its surface containing the holes.

Develop the **Python** application that addresses the following problems:

1. Provide an algorithm that extracts the holes' centre points and radiuses from the provided image. Visualize these holes' centroids with radiuses on an image and store this image in the repository.

2. Provide an algorithm that extracts the holes' centre points and radiuses from the provided .stl model. Centre points must be taken from the hole's bottom, similarly as on image below:
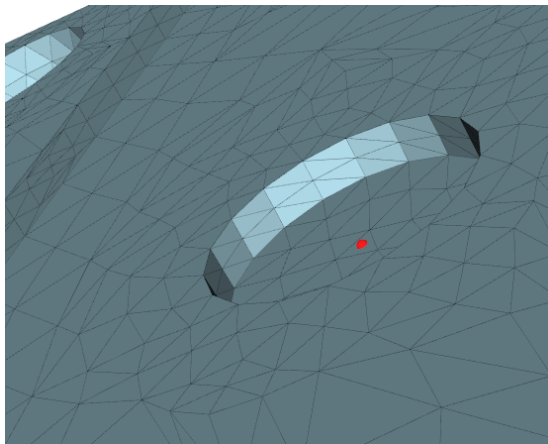
   Determined centroids with radiuses should be printed to the application output.

3. **Optional**. Assume that image has been taken from the camera. Based on the results from previous problems, find the model pose in the camera frame. Camera intrinsics are defined as follows:

$$cameraMatrix = \begin{matrix} 790 & 0 & 395 \\ 0 & 622 & 311 \\ 0 & 0 & 1 \end{matrix}$$

Camera distortions can be ignored.

Resulting translational and rotational components of transformation should be printed to the application output.

4. **Optional.** Execute the application in container. Image, which is being asked in a first problem, must still be accessible from the source repository.

Minimal requirements:

- Python version >= **3.6**
- The solution must be stored and shared as a .git repository
- Repository must contain README file describing how to launch an application.

Important notes:

- Optional tasks are not required to complete the assignment

Part 2:

This part contains the description of a specific problem. You are expected to provide an analysis on what can be a proof of concept, that solves this specific problem.

Specification:

We have a 6-axis robot manipulator arm that can move programmatically in the robot's base coordinate frame. Imagine, there is a .stl model that represents a product, on which it is required to perform a production process

Along with the model you are receiving metadata containing specific points located on a model in the model's coordinate frame. These points are the positions to which the robot is expected to move its tool central point (TCP).

The same product, which is represented by the .stl model, is always located under the robot's TCP and there are no major translational/rotational deviations between different products.

How would you convert the coordinates of the needed position from the model's frame to the robot's frame, so that the robot's TCP moves to the expected points? You are not constrained with the choice of vision for this task, and you are not constrained with the choice of sensorics for this task.

Important notes:

You can provide the solution to this part of assignment in any textual format, answer can be also stored in the repository with the first assignment. There are no constraints towards the solution length, describe it as much as you think it is needed to get an overall understanding of how to solve a problem. Consider not diving too deep into the technical implementation.