Below is a summary of the work completed so far in the Image Generator project.

1. Scene Creation

Task:

Develop 3D models for various objects, including robotic end effectors (e.g., Screw bit head, Drilling Head), a workpiece, a worktable, a robotic arm, and a human worker.

Implementation:

Utilized Blender to create and texture 3D models. These models were integrated into a single scene to simulate the work environment. Note: Robotic Arm and Human Worker models were bought from online store. You can find these models in the below path:

Path: BlenderProc/code/resources/Dataset  
Online store link: <https://www.turbosquid.com/de/>

Credentials: Berit’s user account

2. Python Code Interface

Task:

Develop a Python script that automates the scene setup, manipulation, and rendering processes using BlenderProc and Blender python API.

Implementation:

a. Load 3D models and render images with COCO annotations:

Developed a base script to load the 3D models and render images with COCO annotations.

b. Randomize positions of the workpiece and robot arm on the worktable:

Implemented randomization of workpiece and robotic arm positions, while adhering to defined constraints (on the table or workplace).

c. Robotic Arm Manipulation:

Two approaches were tested—using a URDF file and a .blend file—to manipulate the robotic arm movement and positioning.

d. Link and animate robotic arm end-effector motions:

Successfully linked different end effectors to the robotic arm and animated the arm's motion.

e. Define a safety zone:

Created a spherical safety zone around the end-effector, ensuring its movement along with robotic arm head.

f. Randomize camera and lighting settings:

Implemented randomized camera positions and lighting setups to enhance the rendered images.

g. Manipulate Human worker position and arm movement:

Implemented basic functionality to manipulate the human worker’s position within the scene, including preliminary arm movements.

h. Adjustable rendering settings (textures and materials):

Initial rendering settings for textures and materials have been set up for the scene.

You can find the rendered images and annotations in the following path:

BlenderProc/code/output

To be implemented:

* Refine Human Worker Constraints: Apply constraints to human worker and arm movements.
* Implement collision avoidance logic based on the requirement
* Refine annotations for worker and robot.
* Complete Texture and Material Adjustments: Adjust the textures and materials for all objects in the scene based on the requirement