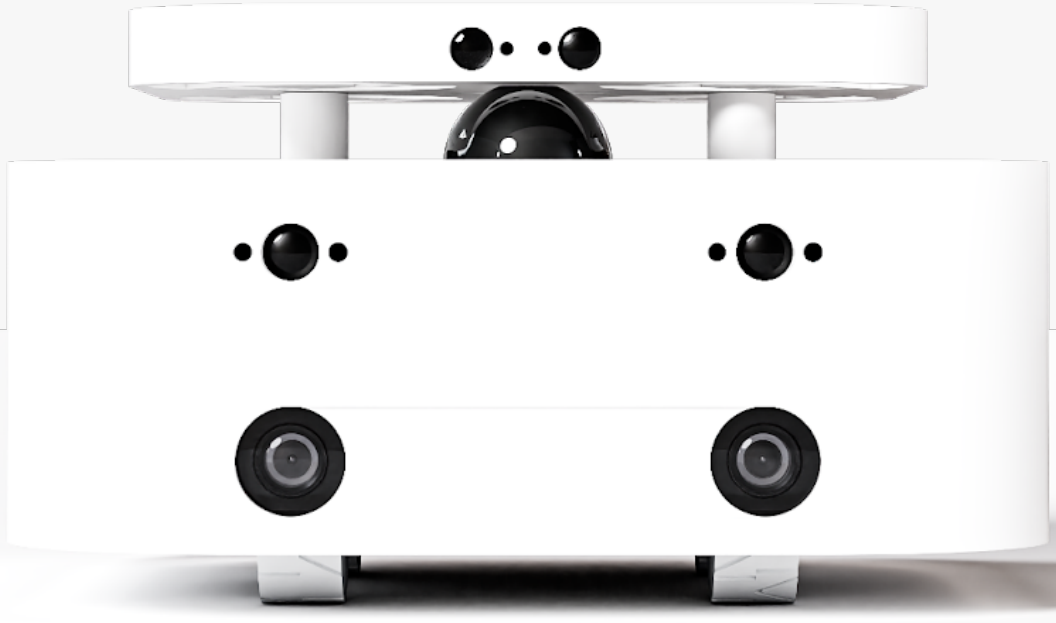
AICI

Challenge:
Computer Vision | Software Developer
(Working Student | Internship)



About Us

AICI is an architectural technology startup with the objective of streamlining the process of designing and creating architecture. One of our main projects is MESA, a robot developed to fully automate architectural surveying and floor plan sketching. As part of the perception|post-processing team, you will process raw or preprocessed measurements from MESA to provide highly accurate environmental insights to end-users.

Challenges

As a dynamic startup, we are always identifying new ways to improve our pipeline to make it more efficient, robust, and accurate. This means that you need to understand different computer vision and robotics concepts and be familiar with various sensor modalities. We present not one but three challenges through which you can demonstrate your skills to us. Note that you do not need to complete all challenges—just choose the one that interests you most and that you believe will best highlight your skills. Nevertheless, you are welcome to tackle more than one.

1. *Projecting object detections into an occupancy grid map:* Given continuous images and point clouds of an environment, it is important to correctly detect objects and their poses to accurately represent them in a floor plan. For this task, you have to generate your own 2D/3D object detections using the provided raw data (images, depth maps, point clouds, and TF transforms stored in rosbags). Please ensure that at least 2 of the classes listed below are detected:
    a. Bathtub
    b. Chair
    c. Couch
    d. Shelf
    e. Table
    f. WC

    Based on the detections you have to draw oriented bounding boxes that represent the objects in the occupancy grid map.
2. *Point cloud concatenation and colorization:* Given a continuous feed from a camera and a LiDAR, it is important to be able to accurately combine the data from both sources. In other words, for this task you should project images into the clouds as well as to concatenate the clouds into a single point cloud to in the end get a fully colorized cloud that represents an environment.
3. *Point cloud registration/matching:* In some cases, we might not be able to completely scan an environment in one pass, but we can collect data in separate sections (rooms/floors). Since these sections correspond to the same environment, they should be merged. Therefore, it is important to find a transform that enables an aligned merge of both scans. In this task, you need to compute a transform (from the origin of one map to the other) that will align both occupancy grid maps.

Provided Data

You'll be given data of 2 environments, which are subdivided into 2 surveys each. For each survey you can find the following data:

1. Occupancy grid map of the survey (PGM format) and corresponding configuration file (YAML) containing key information of the map, such as its origin and resolution of the map.
2. Rosbags containing the following topics (among others):
    a. Depth maps
    b. Point clouds
    c. RGB images
    d. TF transforms
    e. Camera info

Expected Outputs

- *Challenge 1:* For each survey, generate a PNG image with the bounding boxes of the detections superimposed on the occupancy grid map, as well as a file (any format, preferably JSON or YAML) containing all detections with their respective dimensions, pose, and class. It is important to note that there should ideally be no overlapping bounding boxes.
- *Challenge 2:* For each survey, return a single point cloud (in PLY format) that represents the environment seen during the survey (including color information).
- *Challenge 3:* For each environment, provide a file containing the transform to align the 2 surveys of the environment, as well as an image displaying the aligned occupancy grid maps.

Submission Guidelines

- Submit your code as a GitHub repository or a ZIP file.
- Include a README file explaining your approach, dependencies, and how to run your code.
- Include a folder called "results" where you provide the results for each survey.
- Send your submission to raul.dominguez@aici.de.

Feel free to contact us if you have any doubts/comments. Good luck coding! We look forward to seeing your solutions.