Autonomous Kitchen Assistant: A Prototype for Model based Grasping

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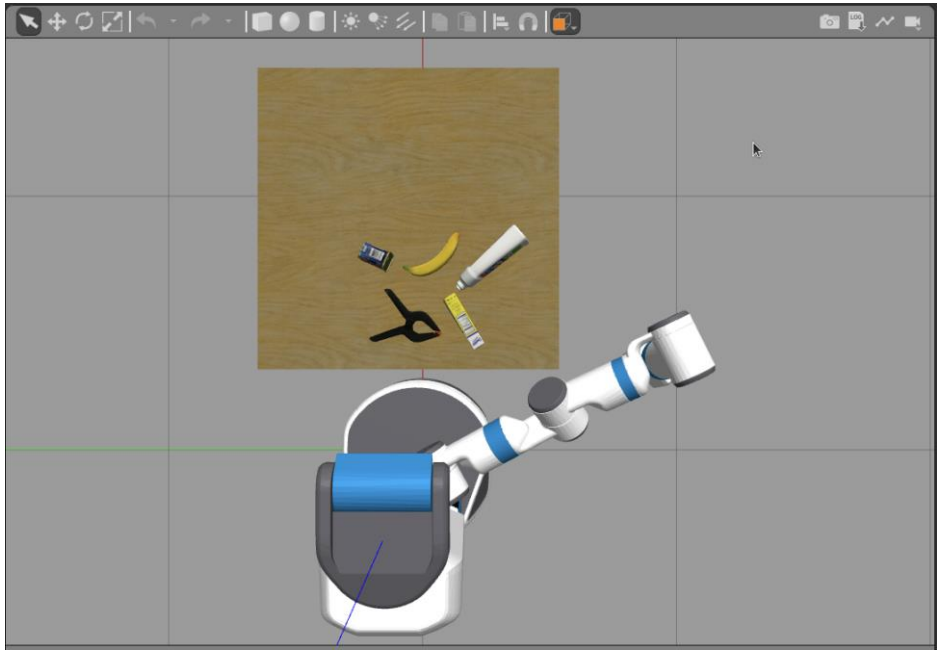
Introduction

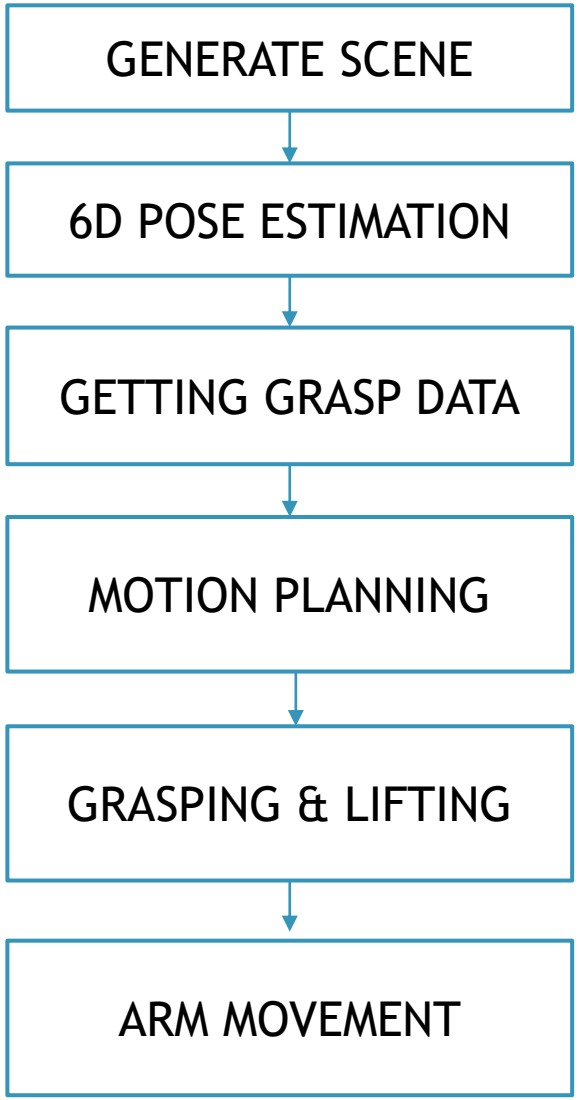
- Aim: To build robot that grasps kitchen objects using a different pose estimation algorithm
- We tried to implement the Model Based Grasping from SceneReplica, using different algorithm and try grasping

Dataset and Simulation Setup (Gazebo)

- We used YCB dataset
- Simulated kitchen objects scene in Gazebo and implemented python file to get required scene into gazebo



Project Workflow



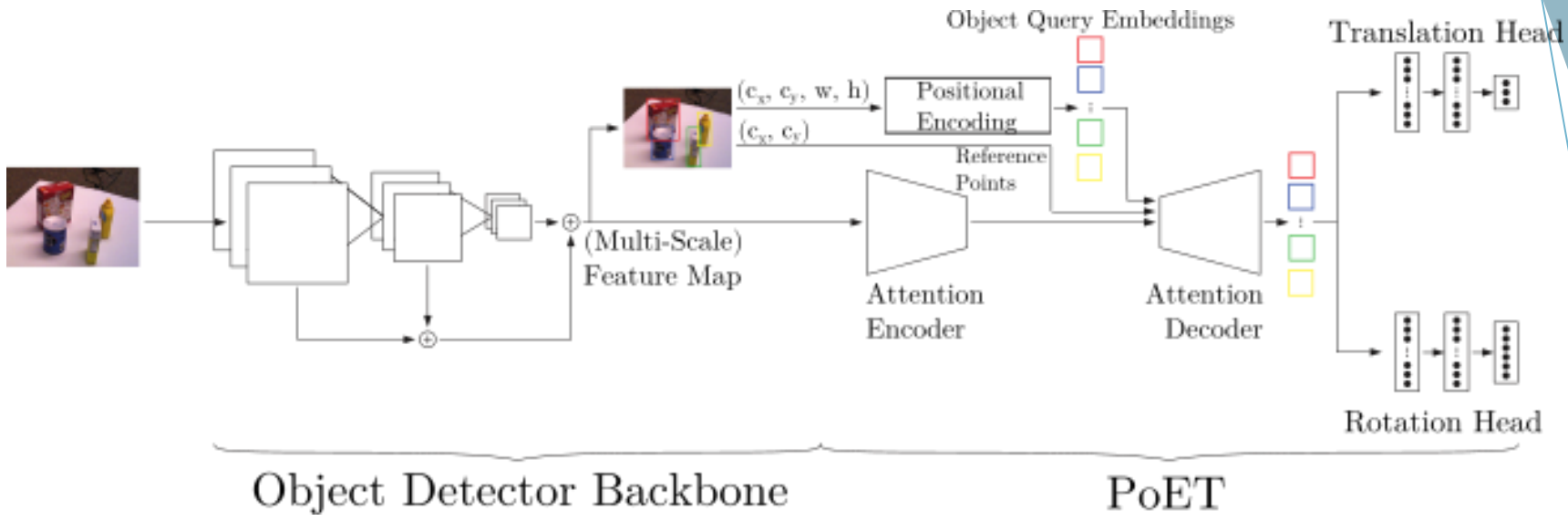
- Simulation in Gazebo
- PoseCNN, PoseRBPF, PoET, Gazebo
- 3D Object Model Dataset from SceneReplica
- MoveIt
- GraspIt
- Fetch Robot with parallel gripper

6D Pose Estimation

- Previously used pose estimation models
  - **PoseCnn:** PoseCNN estimates the 3D translation of an object by localizing its center in the image and predicting its distance from the camera. The 3D rotation of the object is estimated by regressing to a quaternion representation. Rotation regression in PoseCNN cannot handle symmetric objects very well.
  - **PoseRBPF:** This model handles both symmetric and asymmetric objects without manual labelling.

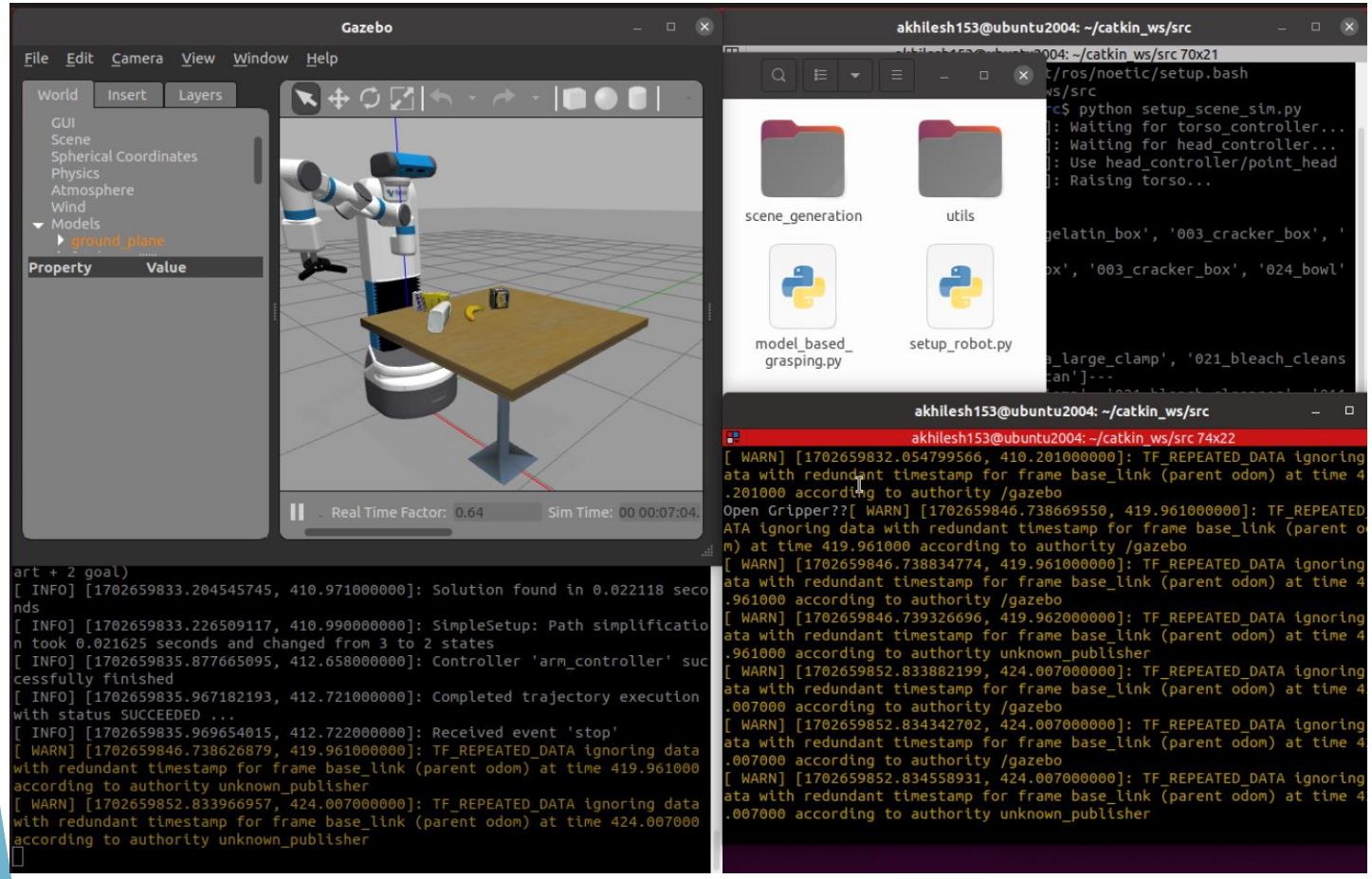
PoET: Pose Estimation Transformer for 6D Pose Estimation

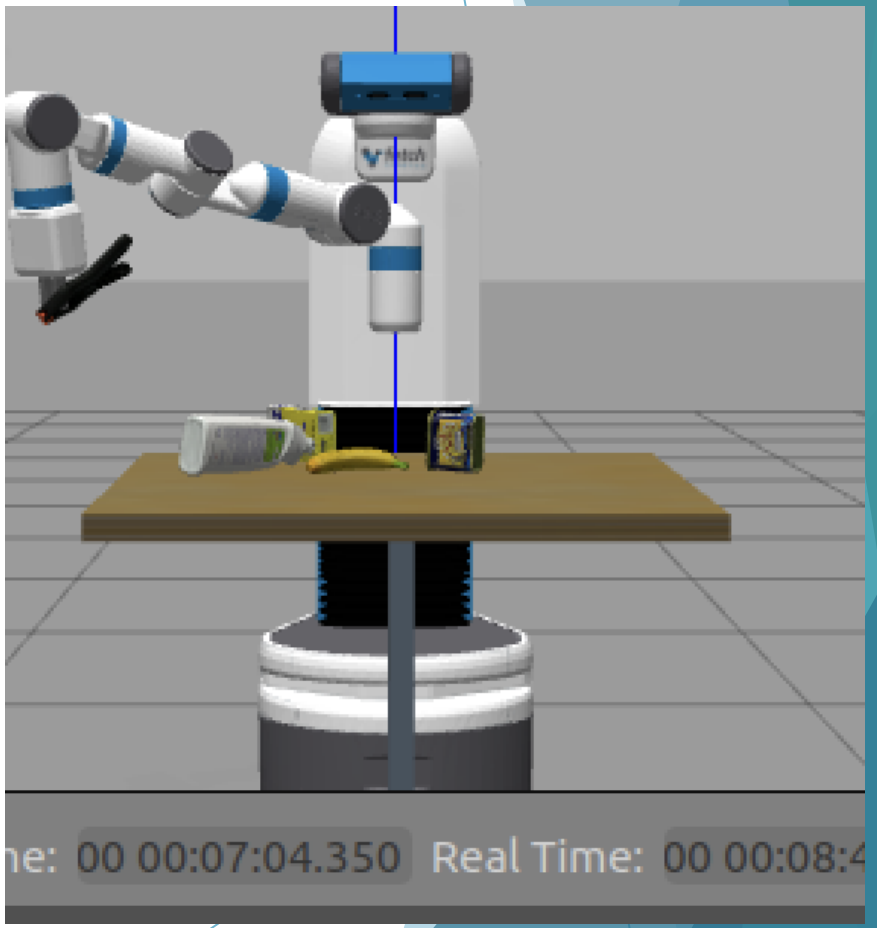
- It is a transformer-based approach that takes an RGB image as input and predicts a 6D pose for each object in the image.
- It takes the detections and feature maps of an object detector backbone and feeds this additional information into an attention-based transformer.



- First, the image is passed through an object detector to generate feature maps and to detect objects.
- Second, these feature maps are fed into a transformer while the detected bounding boxes are provided as additional information.
- Afterwards, the output object queries are processed by a separate translation and rotation head. Hence, achieving state-of-the-art results for approaches on the challenging YCB-V dataset. It illustrate the suitability of the resulting model as pose sensor for a 6-DoF state estimation task.

Output Screenshots





Future Works

- We would like to add navigation and build robot in an industrial environment.
- Build a model to grasp irregularly shaped and soft objects.
- We like to list the pros and cons by comparing with previous models

THANK YOU!