ROBOTIC ARM: SHAPE-BASED OBJECT RECOGNITION AND MANIPULATION

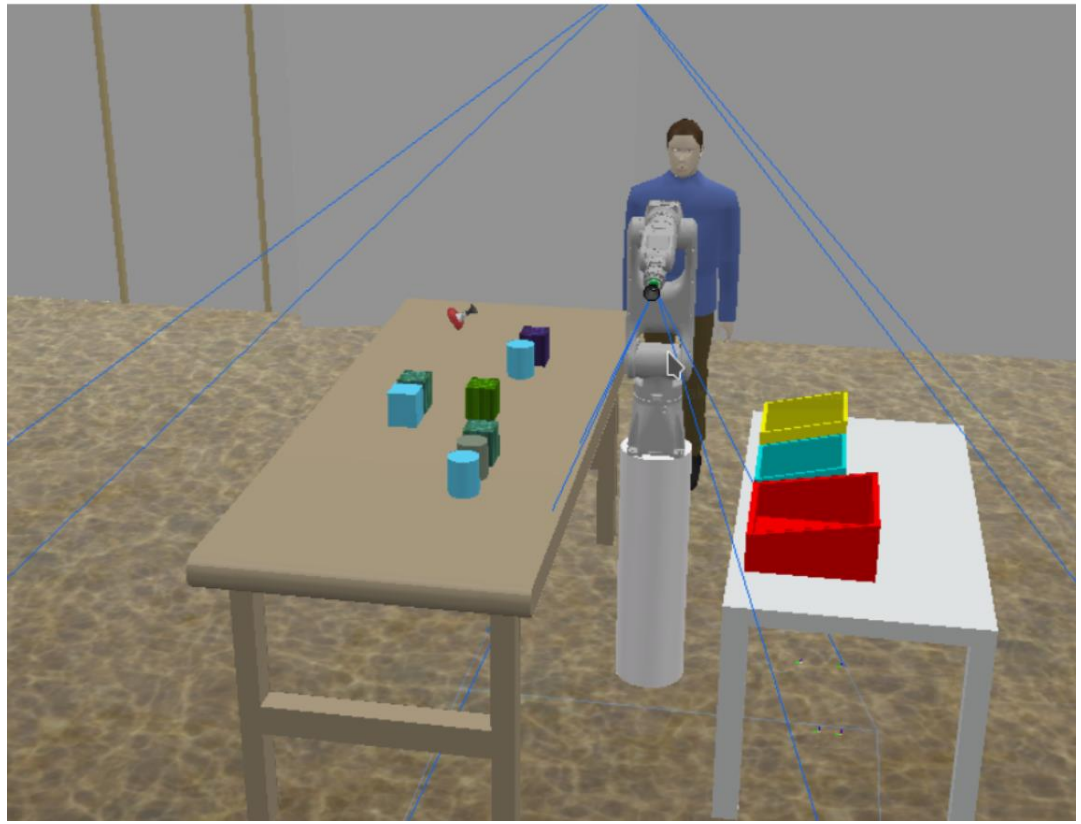
INTRODUCTION

- The objective of this project is to Identify the object and classify the object using the robotic arm.
- Addressing the challenges posed by dynamic environments. Through the fusion of machine learning, advanced object detection algorithms like YOLOv3, and the intricate integration of inverse kinematics, our project showcases a robotic arm's exceptional ability to identify, and manipulate objects.
- Sensors:-

  2D Vision Sensor – Intel real sense – 480 x 360 resolution

  Pressure Sensors in Suction Gripper

IMPLEMENTATION



- Simulation Environment: CoppeliaSim
- Robot: GP7 Robot with an arm and Suction Gripper
- Perception: YOLO v3 (based on Darknet ROS)

PROJECT STRUCTURE

```
poojaminna2203@Pooja:~/catkin_ws$ ls
build  devel  logs  src
poojaminna2203@Pooja:~/catkin_ws$ cd src
poojaminna2203@Pooja:~/catkin_ws/src$ ls
CMakeLists.txt  darknet_ros  gp7_visualization  my-robotic-arm  simExtROS
poojaminna2203@Pooja:~/catkin_ws/src$
```

- darknet-ROS :- This package integrates the Darknet neural network framework with ROS.
- gp7-visualization :- This is a MoveIt! configuration package for the GP7 robot model. MoveIt! is a middleware for robotic motion planning
- my-robotic-arm :- This is main folder of our project which will contain main functionalities and features tailored for our robot arm
- simExtROS :- This serves as bridge between ROS and the CoppeliaSim simulation environment.

EXPERIMENTS

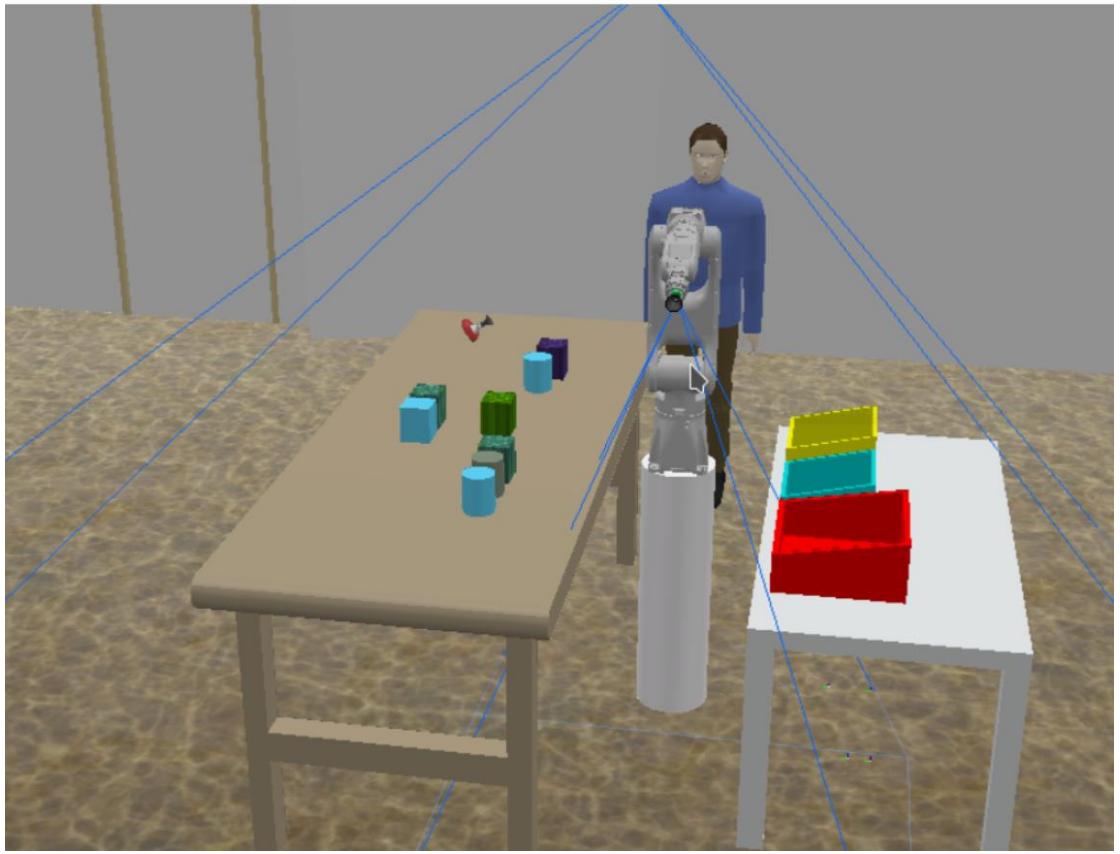
Tests

- Single Object Detection vs Multiple Object Detection
- Correct Classifications vs Incorrect Classification

Observations

- Detection accuracy depends on the distance of the object
- Accuracy is not affected by having multiple objects in the frame

DEMO



FUTURE SCOPE

- **Error Recovery Mechanisms:**

  Implement error recovery strategies to enhance the system's robustness. Explore methods such as sensor fusion, redundant manipulation, or predictive algorithms to handle errors that may occur during object manipulation tasks.

- **Real-Time Object Tracking:**

  Develop real-time object tracking algorithms to monitor object movement on the table dynamically. Implement techniques such as visual odometry or sensor fusion to track objects' positions and velocities accurately.

THANK YOU