Course Title: Robotics using Niryo Ned2

Team:

PES1UG21CS045 – Aditya Rao
PES1UG21CS108 – Arnav Srinivas Atrey
PES1UG21CS168 – Darshan V
PES1UG21CS357 – Namita Hansraj Patil

Title: Boxbot

Abstract:

This abstract presents the implementation of a Niryo NED2 robot equipped with a vision system, programmed in Python, for autonomously picking items based on specific colour and size without needing any workspace. The robot then places these items in a convenient location for billing.

Shopkeepers often spend considerable time manually picking specific items from shelves for customers. To optimise this process, a robotic system can be employed to handle the task efficiently. The primary objective of this robotic system is to demonstrate advanced object recognition capabilities using computer vision techniques.The software is developed in Python and utilises various libraries, such as OpenCV for image processing and NumPy for data manipulation. To communicate with the robot (NED2), a ROS wrapper is used to create a ROS interface.

.

The overall workflow of the system is as follows:

- Robot Initialization: The Niryo NED2 robot is powered up and initialised, and is calibrated and its tool is updated as a standard gripper.The Robot is first brought to the object detection pose.

- Object Detection: The robot uses the camera module to capture real-time images of the objects. The images are then processed using OpenCV to identify specific objects based on their colour, contour and area. After the required object is identified, its mid-point is located with respect to the centre of the camera.
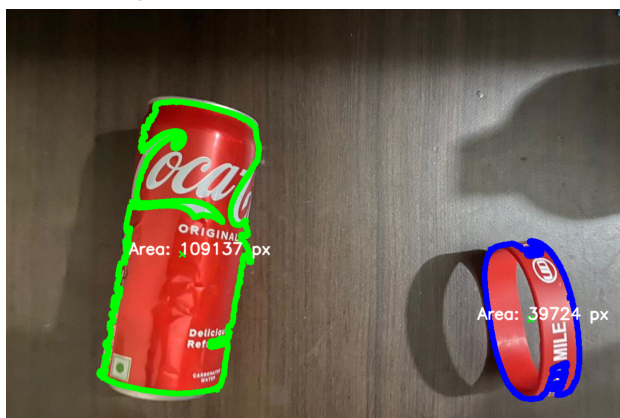 Sample object detection examples:
  Based on colour:
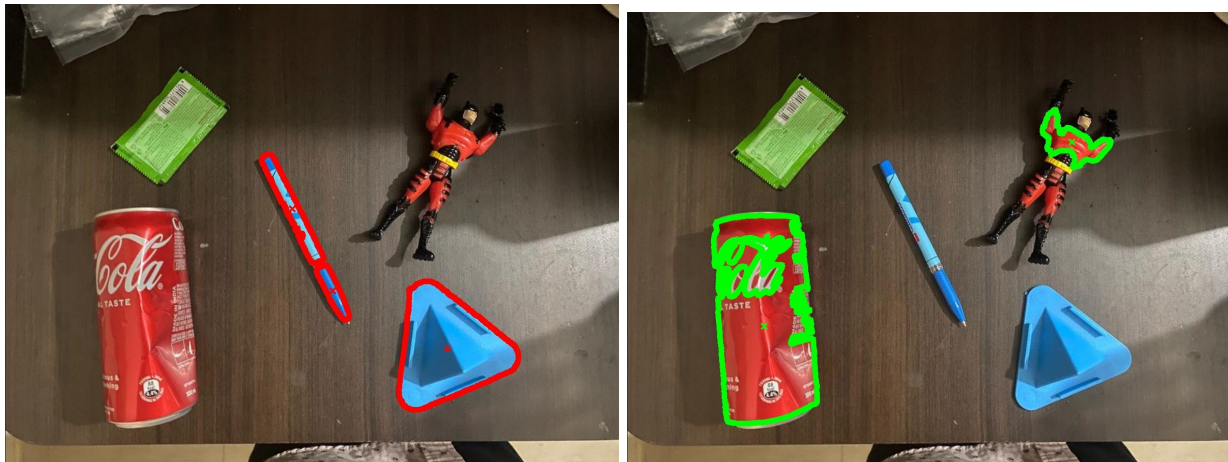
Based on area of pixels:
  objects of the same colour can be distinguished by their size.

- Robot Arm Movement: Once the object location is known, the robot arm positions itself towards the object. First, it centres the object in the y-axis, followed by centering it in the x-axis to ensure the required object's midpoint is precisely in the centre of the camera frame. Subsequently, the gripper is moved to the position of the object within the camera frame.

- Object Pick and Place: With the gripper in the correct position, it is opened and lowered to the required offset to pick up the object, followed by closing the gripper. The object is then transported to the designated location for dropping (e.g., the billing counter)

- Completion: Upon successfully dropping items in the required place, the arm is reset to the object detection pose for the next item and the robotic system signals the end of the task.

This implementation showcases the potential of using Python for object recognition and manipulation in a robotic application. The combination of advanced computer vision algorithms and robot control allows the Niryo NED2 robot to autonomously identify and grasp items .This technology has the potential to revolutionise the retail industry, enhancing customer experiences and optimising operational workflows.

Github repo link:
https://github.com/adityarao1612/BoxBot