Grasp Objects in Pybullet Environment

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I. INTRODUCTION

A. Background

Due to the rapid development of automation and intelligence, robot technology is making great progress and is widely used. An intelligent robot can recognize and make decisions automatically. Robots are required to work in environments which are human centric and should have a knowledge of the kind of objects that exist and how to grasp various objects in different situations. Robot arm involves in process of interacting continuously with the environment and it will perform specified tasks in order to complete the transfer of the object from one location to other specified location.

B. Procedure

The main aim of the project is to grasp an object and transfer it to a location where tray is placed. Here for the process input is considered as the object assigned in the folder(database). Inverse kinematics algorithm needs to be used for determining the path to pick the object up. For picking the object the robot arm receives the object in 3D which is obtained by tuning and using it in the functions. Grasp strategy is decided depending on the shape of the object. Depending on the object location the arm is controlled towards the target. Once the object is picked it will hold it and drops in the desired tray location.

C. Summary

Using Inverse kinematics algorithm object which is placed in a random position is dropped into a tray by the intelligent sawyer robotic arm which is created in a virtual environment using python and pybullet.

II. PROJECT DESCRIPTIONS

A. Procedure

In this project we need to grasp an object and transfer it to a location where tray is placed. For the process input is considered as the object assigned from the database. Robot's degree of freedom considered is 7 and as it is high, Inverse kinematics algorithm needs to be used in order to determine the path to pick the object. For picking the object the robot arm receives the object in 3D which is obtained by tuning and using it in the functions. Grasp strategy is decided depending on the shape of the object. Hand fingers are controlled using the functions like **thumb, indexF, ringF, midF, pinkyF.** Control parameters like Lower, mid are used to control the joints of the fingers.

We need to use the function palmp() in order to move the palm to desired position. Orientation of the palm is obtained by using **p.getQuaternionFromEuler([roll,yaw,pitch]).** Location where the object needs to be dropped is target and it is a vector with x, y, z coordinates. Depending on the object location the arm is controlled towards the target. Once the object is picked it will hold it and drops in the desired tray location.

B. Algorithms

Inverse Kinematics Algorithm

For calculating the positions of joints used for placing a robot in a particular orientation or position, the Inverse kinematics algorithm is used. Robots need to be programmed using Inverse kinematics to perform tasks. We usually cannot instruct a robot to go to specified coordinates like x, y, z so we used inverse kinematics to give instructions specific to coordinates.

The process of computing reversal of joint parameters to obtain a position which is fixed is known as inverse kinematics. The robot arm selects specific spatial coordinates of targeted position coordinates using inverse kinematics solution to get reverse solution values for each degree of freedom for picking posture and coordinates can have multiple values sets. Kinematic equations are usually used to calculate the position of end effector for corresponding values of joint parameters.

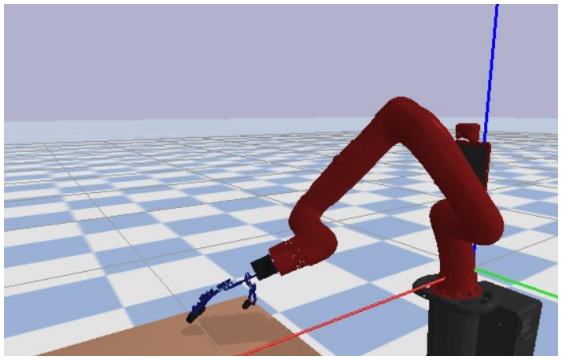
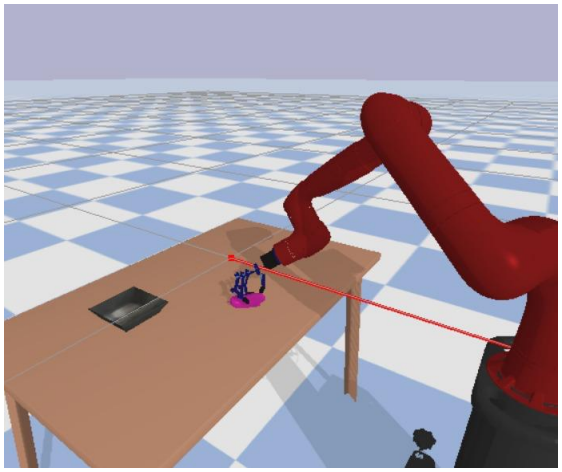
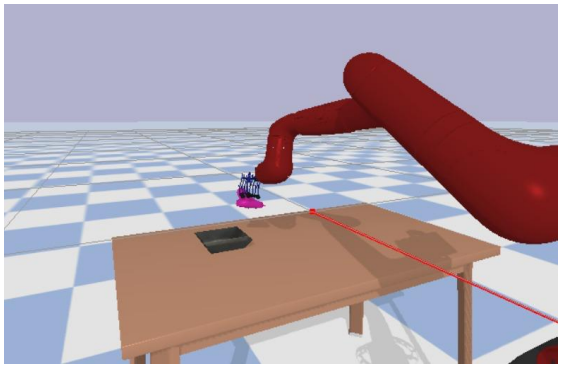


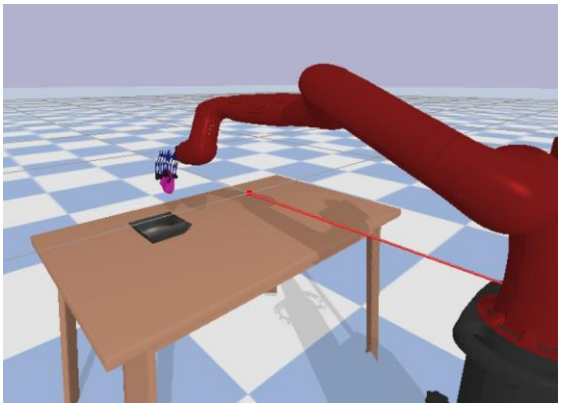
Fig 1 *Hand* Gesture

III. RESULTS

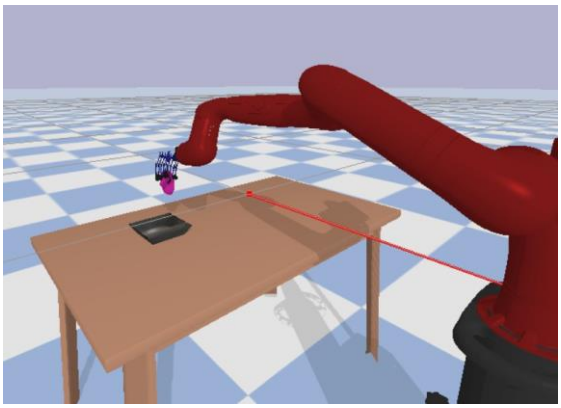
A. Trajectory of the object in grasping

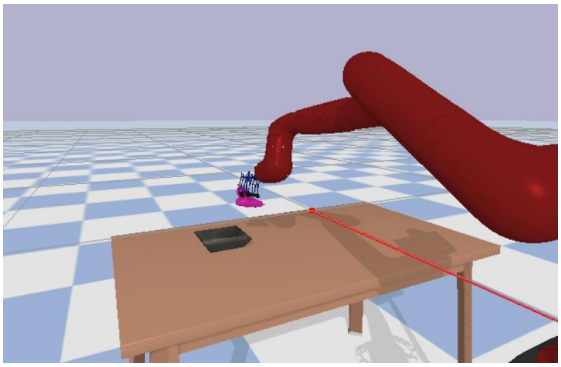






B. Snapshots of Successful Grasps





C. Video one drive Link

T736D656.mp4

IV. DISCUSSION OF RESULTS

A. Advantages/Disadvantages

The foremost advantage is the object we have is big enough to hold and the hand gesture we used is a general hand hold gesture so that we can hold the object firmly and carry it to the tray without any issues.

The only disadvantage we have in this gesture is if the object is in a slant position the robot fingers may not be hold the object firmly and that results in slipping of the object.

B. *Designed Trajectory of Hand Movement and Set of parameters*

The trajectory of the hand movement is decided by the key parameter that we used i.e wristpos it is the important parameter which decides the hand movement trajectory by hold the object in place controlling all the fingers such as pinky, ring, index, mid and thumb of the robot with the inbuilt function that drives the hand control. The trajectory of the hand is designed to hold the object with a finalpalmpostion till the it reaches the tray and then we open the hand to place the object in tray

V. CONCLUSION

Applications of robots in industries have been increased and in order to improve the automation the pick and place robots are widely used. Because having an ability to perform tasks in any environment irrespective of structured or unstructured is essential. Advances are being made in robotics which help in detection, position and grasping strategies development.

The assigned object will be grasped by the robotic arm based on the selected control parameters which can be obtained by tuning. Once the grasping of an object is done the robotic arm transfers the object into the tray. Depending on the object size the robot arm needs to be placed, which is we need to change the parameters accordingly by placing the robot in a position to grasp the object and place it in the tray.

VI. REFERENCES

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