Human trained robots - training a CRS robotic arm using human arm imitation through kinect

Ayush Varshney *Ritesh Gautam*

Introduction

Robotic arms are mechanically controlled devices designed to replicate the movement of a human arm. The devices are used for lifting heavy objects and carrying out tasks that require extreme concentration and expert accuracy. The robotic arm most often is used for industrial and nonindustrial purposes.

The imitation of the human arm by the robot arm can help remove the physical limitations of our working capability. We would just have to do as we want our robot to do and it would imitate our motion.

Imitation is useful when the robot has various different types of tasks which it has no prior experience with. Then we could make it learn by imitating our arm.

For example if we have to relocate a heavy object then we just need to imitate picking up the object in the air the arm would do the same. In this case when we only had to move one object making the robot imitate would be better than coding the arm to identify the object and then pick it up which would be preferred in multiple same type of tasks.

So if we have a variety of task at our hands then we could use imitation which would complete our task with less overhead with a little loss in accuracy which would be due to human error.

The objective of our project is to make the Robot arm imitate the human arm which is been processed through the kinect. Our model can be further evolved to imitation learning.

Implementation

One of the main tasks of industrial robots is to do repetitive tasks - such as picking up a heavy block and placing it somewhere else. The general notion to build such a robot is to make some sensory system to recognize the position of the object and the destination and run some path-planning algorithm to perform the task. Here, we are using a completely different approach where in our robot is made to learn how to perform a particular task by making it imitate a human arm.

The Microsoft Kinect Sensor gives us data of four coordinates on the human arm - the shoulder joint, the elbow joint, the beginning of the palm, and the approximate center of it. Using the known D-H Parameters of a human arm, we calculate the joint angles and transfer the angles through serial communication to the 6 DOF CRS Robot which then causes each of it's motors to rotate to the same angle. Thus the human controls the robotic arm and uses it to perform the particular task. We store all moves made by the arm from it’s initial position up to the completion and can now use it to perform the task again any number of times. Thus we enable our robot to perform the repetitive task without using any actual sensory or path-planning system and the errors involved with it. Also when the task changes - we don't have to change the system but only train the robot once again.

References

- Real-Time Human Pose Recognition in Parts from Single Depth Images

http://research.microsoft.com/pubs/145347/BodyPartRecognition.pdf