**Intelligent Robotics Project Proposal (Revised)**

**Yangqi Su 800957989**

**Outline:**

The goal of this project is to implement 2 **simulated** robots that receives a ball thrown from the user before throwing the ball between each other and finally back to the user. More specifically, the user can throw the ball arbitrarily to either of the robots, so the robots must first decide which one them should catch the ball, after catching the ball, the robot with the ball will throw the ball to the other robot and the other robot will throw the ball back to the user. The implementation will be **virtual only**, in 3D space with gravity and energy minimization constraints.

**Robot Type and Kinematic Assumptions:**

Both robots will be 6R robots. Based upon the outline for the project, there will be an extensive use of inverse kinematics in order for the robot to position the end effector on the trajectory of the ball in order to catch it. Furthermore, it will make use of trajectory generation such that the 6R arms know how to move into place to catch the ball. It will also make use of velocity kinematics to make sure the end effector can throw the ball back to the user and between each other. Gravity will be only be assumed for the ball’s trajectory as it travels between the robots and the user, while throwing and catching the ball will not require calculation of wrench and forces needed. To make the assumptions simpler, the ball will be ‘caught’ immediately as it touches the end effector, which means that to catch the ball the end-effector will not need to first match the speed of the ball and then slow to stationary, as long as the ball passes through the end effector, it will be count as ‘caught’.

**Milestones:**

1. Set up a 1 6R arm that can catch an arbitrarily thrown ball and return it to a stationary user.
2. Set up a 2 6R arms in the simulation that can throw and receive the ball between each other.
3. Set up the 2 6R robots to catch an arbitrarily thrown ball (to either robot), pass it between each other and then pass back to a stationary user.

**Goals:**

For the goals of the project, the first mile stones will be achieved by the deadline while it remains hopeful that the last 2 milestones can also be completed by the deadline. In the best-case scenario, the end product will be a simulation in which the user can throw a ball from anywhere in the 3D space into the workspace of the robot arms, before catching the ball back at an arbitrary point in the 3D space.

**Methods:**

* **Programming Language: C++/Python**
* **Robotics Framework: ROS**
* **Packages (Possible):** 
  + **URDF**
  + **Gazebo**
  + **Moveit**
  + **Rviz**