1. being able to move away from the active table space to not interfere with the balls

Post-shot Ball Interference

In order to adequately strike a ball anywhere on the table the end-effector or striker will be required to enter the active ball area (the theoretical volume at which object inside it may interfere with a rolling ball). As a result the end-effector must enter this volume to initiate contact with the ball but must not stay inside it much longer to allow the balls to roam freely. Whether it’s a linear or rotational actuator the active motion of exiting the volume must occur.

Our team will address this issue by creating a mechanism that will raise the end-effector soon after the shot. This will be done as quickly as possible without damaging the instruments or requiring human intervention to reset it to its striking position. According to current discussions the team is considering a raising motion although we have yet to finalize any designs so the outcome may change if other (and better) solutions arise.

1. Counting steps to know the current location and orientation of the end-effector

Counting Steps

When the system is required to move from one location to another it will be required to account for the number of steps it needs to move to get there. This is why being able to count the number of steps of all motion motors (linear motor systems for translational motion and rotational motor systems for system orientation) is essential to the success of the project. A difficulty which we may encounter during this project is both the real time tracking of steps and the loss of steps due to disturbances or system error.

We will address this issue in several ways. Firstly, the system must be well built in order to not allow slack for the motors to slip or skip steps. Second, we are estimating that most if not all motors will be stepper motors which have a definite mechanical step rather than servos which rely on other tracking methods. We will have a dedicated system within the microcontroller software that will track each step carefully in order to avoid inaccuracies. If the system detects a potential miscalculation there will be known checkpoints that the system will use to calibrate the stepping sequence. These checkpoints are not necessarily often since they are not meant to replace the stepping mechanism of the motor but they should be frequent enough to the program to reset often. The actual number of checkpoints is based on the accuracy of the motor and structure of the system (i.e. an inaccurate system will require lots more checkpoints rather than a very exact solution). I predict somewhere between 2 and 10 checkpoints depending on the integrity of the motion.

9. Rigid structure to avoid bending or unwanted motion

Rigid Structure

A large portion of the system will include rails which will provide support for translational motion for the end-effector. As a result there must be non-bending bars that will be able to span the long distances of the table. Furthermore all jitter, shaking or unnecessary motion must be reduced in order to provide stability for the system and avoid inaccuracies in the motion.

This is will be addressed through the selection of non-flexing materials. These materials will be sturdy and straight at the length required by the design. Additionally, it is planned to apply support points along the way which will ensure straightness if the bar is deemed too long. Finally, the system must be designed to include very little jitter space within connections. All mechanical connections must be tight and be able to withstand disturbances from the environment.