Senior Design Group 301
4/8/22

Scholarship In Practice

Kelvin:

The arm that I designed for collection was modeled off of a humanoid arm. Surface level, this was a good decision because it is easy to design since we are familiar with our own arms and understand the points of movement. However, for the functions necessary for the robot to perform, the design was not optimal. Since servos were used, which only have 180 degrees of movement, this limited the rotations severely. For example, once the arm is fully extended to reach for the beads, it cannot move up or down, or rotate to make up for the inaccuracy of the bead locations. If the robot is just a little rotated or off the ideal pickup location, the hand will not successfully grab the beads. A better solution is to add more axes of rotation with more degrees of freedom, and more limbs to more accurately retrieve the beads from the trees. Most of the top performing bots at the competition were arms with unlimited degrees of rotation, as they used stepper motors instead of servos. Additionally, detailed kinematic equations for the movement of the arm as discussed in various robotics courses were not incorporated well. The degree at which each servo had to move was found by testing various values and finding the values in which the arm was closest to our target area. If the arm was more physically and mathematically advanced, the robot could have collected the beads in a much more smooth and reliable manner.

Melissa:

The decision of using fixed cup/net and tree locations was short-sighted as it resulted in some accuracy issues. The basis of our navigation algorithm was inspired by the methods taught in the Autonomous Robotics and Advanced Microprocessors courses, but hard-coding the locations of cups/nets and trees was a last minute adaptation due to another change on the robot involving the image recognition. I would have liked to improve the position tracking of the robot, since the accuracy of the launching and collecting solely depended on the position and orientation of the robot in relation to the target nets or trees. When the robot veered off of the line, and was in the process of correcting its path, the distance flags for the trees/cups/nets would halt the robot in whatever orientation it was. This was problematic because the launcher wasn't always directly lined up with the net or similarly, the arm wasn't always lined up with the trees. By design, the robot needed to be in the exact location with precise orientation to correctly execute the collecting and launching protocols. By adding an element of rotation when stopping at the different locations, to realign itself on the center of the line, the navigation problem could have been solved and the accuracy of collecting and launching the beads would be improved.

Raymond:

The decision I made early on was to use the motors that we removed from another robot to move the driving base. While the decision seemed logical per the specifications learned in the Autonomous Robotics course, the use of those motors incurred issues we did not anticipate. The main issue was how much current would be needed to start turning while under load. This would cause the robot to stall at lower speeds and then cause too much acceleration when the motors would make up for the lack of current. Another issue that came along with using the motors was that the mounts used to attach them were very easy to bend, so whenever we would assemble a different stage of the robot, the wheels would bend out of their ideal position, which would cause the robot to turn more towards one way and would also cause friction between the wheel and the base. I think that a good solution for the issues caused by the motors would have been ordering a new, smaller pair of motors with encoders. It would have saved the team some time in testing and might have made the robot's movement less abrupt and much straighter.

Allison:

A decision we made early on was to incorporate a two-tier circular base in order to have enough surface area for all the components we needed and to be able to rotate. While the circular base made it easy to turn in place to continue on the course, we realized that if the robot didn't land directly back on the line it would get lost and end up hitting a barrier or getting stuck trying to center itself again. I think that to mitigate these issues, we could have incorporated sensors learned about in various courses, such as IR or sonar sensors, close to the ground so the robot could detect how far it was from the roadway walls, and in turn prevent it from hitting the barriers.

Destiny:

As we learned about in our artificial intelligence courses, we decided to use the Raspberry Pi for image recognition, which was a good decision at the beginning of the project, but we soon realized it would not be an easy feat. We ran into multiple issues regarding the process of creating the image recognition from scratch due to conflicting resources. After realizing how complicated and time-consuming the process is without consistent resources, it would have been easier to use the PixyCam from the beginning of the project instead of the Raspberry Pi.