Overview

For the final project, the class had to construct a soccer playing robot! Each robot had to stay to a standard size constraint, that is, the robot must be able to fit in the goal zone in both width and length; height did not matter. The teams would position their robots on the opposite sides of the table at the beginning of the competition. At the same time, each team would execute the competition code, which was supposed to locate the IR ball in the middle of the table in conjunction with the Compass sensor. Once the ball was located, the robot must be able to orient itself on the table to kick the ball in the correct goal.

If a tie would occur during the competition, the teams must have a goal keeper and penalty kick code ready to execute penalty kicks. The penalty kick code was supposed to locate the ball and kick it at a random angle towards the goal, and the goal keeper code was supposed to locate the ball in motion and stop it before it reaches its goal.

The competition was hosted in a double elimination bracket style which resulted in two teams in getting a buy. The competition was extremely exciting due to the fact that the atmosphere of the lab was lively and cohesive. However, even though the class was lively and worked well, there were several problems in the code and design that made some people jaded towards the competition.

Problems/Solutions

With more code and functionality, comes more problems and mechanical flaws. There were several deficiencies with our robot that was mostly fixed throughout the development process.

The main issue we faces as a team was the physical build of the robot. Our robot went through several phases, which resulted in several failed prototypes. Our first generation of our robot had double gear reduced wheels. The robot was amazingly fast and was able to get to the ball faster than any other robot. The flaw though is that the robot had zero torque, which meant that the robot would flip over as soon as it hit the ball. It would be the first to get to the ball and get it moving, but it would not be able to follow up with anything since it would be turtled.

We decided to keep the same design but take away a layer of gear reduction to give it a little more torque, but retain its speed. This plan seemed great since the robot had more control and was able to compete with the other robots in head to head combat for the ball. Unfortunately though, there was no creativity with the robot. It would be a cookie cutter design like everyone else. Even through it would be a good design for the competition, we decided to attack the problem from a different approach.

The approach we decided to use was no gear reduction at all. Every other robot in the competition was sacrificing power for speed, we did not want to be on the same level as them. We decided to sacrifice the matched speed with surplus torque. The reason for the increased torque is so when the robots clash head on head, we will be able to move the ball and their robot at the same time. With their little torque, they will have no choice but to go where we tell them to go.

After solving our mechanical problems we then had to face our coding problems. Like our mechanical design, our software went through several different iterations to match our current design. We went with the simplicity approach by having minimal sensors on the robot. The only sensors we had on our robot were touch sensors, compass sensor, and IR sensor. The Bump sensor was there to tell us if we hit a wall, the Compass was for table orientation so we know what goal we are facing, and the IR sensor was to detect the ball and maneuver towards it. The code itself was extremely simple. The robot would advance towards the ball if it was in the field of 5, which is the reading of the IR sensor that meant it was right in front of the robot. Any other readings would tell the robot to shift its position until it read 5 again.

Below are a couple pictures of our robot on competition day. Figure 1 and 2 show the robot in two different angles. The robot had two bump sensors on the front of the robot which gave it frontal avoidance, but had a hard time with side and rear avoidance. On the far top of the robot was the compass which told the robot which way it was facing so it knew what goal to kick towards, and below that is the IR sensor which is in sense its eyes. Figure 3 demonstrate the size constraint the robot had to stay in during the competition, which was the width and length had to stay in the black.

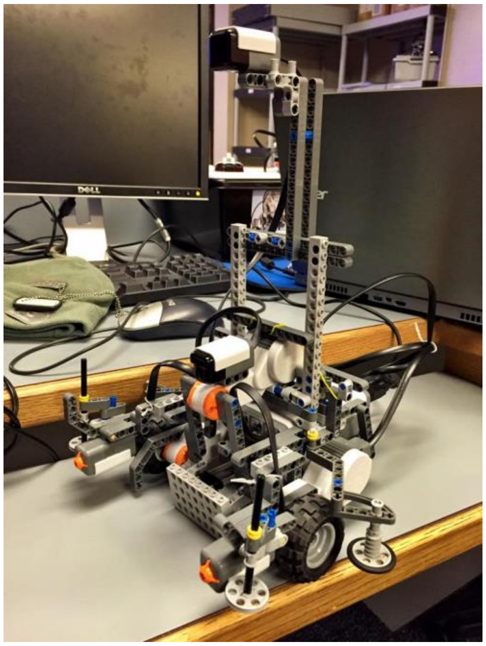

Fig 1: Final iteration of robot. This picture shows the overall layout of the robot from a 45 degree isometric viewpoint, showing all components of the robot. The far top sensor is the compass, the sensor below that that looks similar to the compass sensor is the IR sensor. The two sensors on the bottom right and bottom left are the bump sensors.

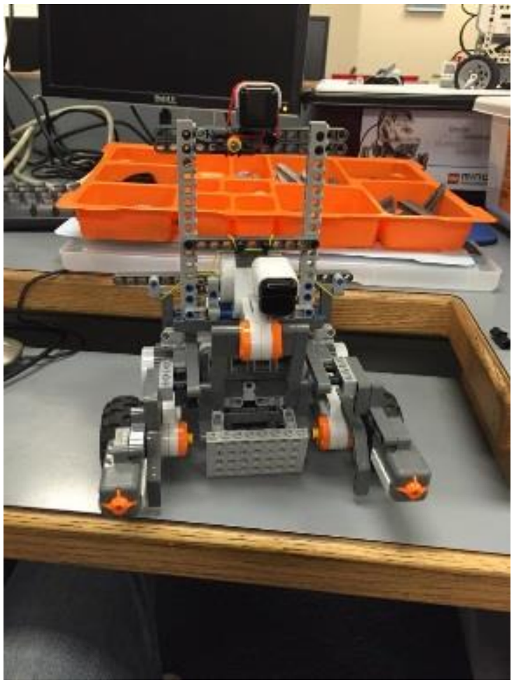

Fig 2. This is the same picture of the final robot but a frontal view.

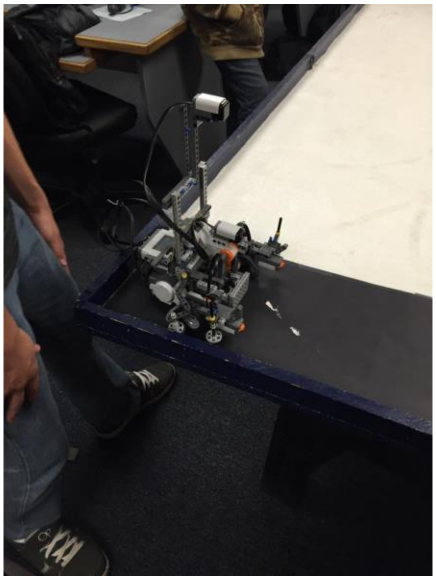

Fig 3. This pictures demonstrates the size constraints of the robot. As shows in the picture, the robot must be able to fit in the black space on either side of the table.

Conclusion

Overall the robot competition was a blast! Our robot was able to make it all the way to the semifinals, which then we were knocked out by the robot called Gadnuk, Destroyer of Worlds. Our robot did have some emergent behaviors when the compass and IR sensor conflicted with each other. The robot would somehow avoid the other robot and maneuver around the robot to get to the ball and angle itself accordingly to the compass, which was a great surprise. The robot was able to complete its task with all three different segments of code. It was able to compete against another robot for the IR ball, perform penalty kicks when needed, and defend the goal when needed.