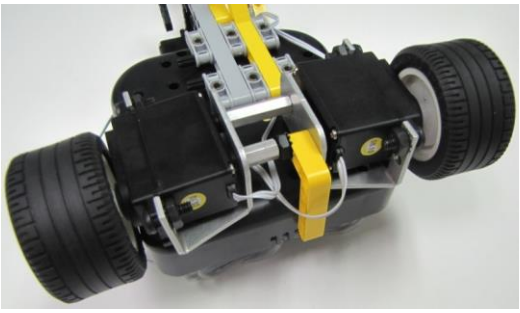
This document would score 96 points out of 96.

Mechanical Design Period 2



Drivetrain:

To the left is a picture of our drivetrain. We are using a direct drive between the wheels and the motors. The motors are mounted directly to the CBC. We considered using a gear system mounted on a frame to drive the motors. A gear system has the advantage over a direct drive in that it allows us to adjust the amount of torque the motors apply to the wheels. However, we chose a direct drive because we want a compact robot that uses as few parts from our kit as possible.

Commented [A1]: The section is titled Drivetrain, and it is clearly separated from the text. Meets requirement #2.

Commented [A2]: Picture: The picture is centered on the drivetrain and it is in focus. The background is a contrasting solid color and the photo was taken in good light. Meets requirement #3.

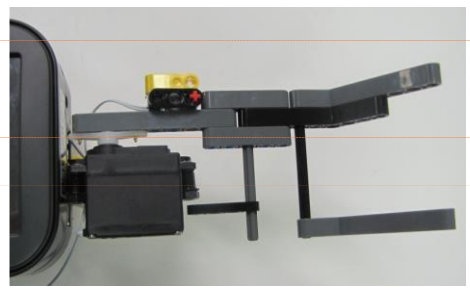
Commented [A3]: Describes the drivetrain. Meets requirement #4.

Commented [A4]: Makes a comparison to a different drivetrain design. Meets requirement #5.

Commented [A5]: Gives a reason for using this drivetrain. Meets requirement #6.

Effector:

The only effector that we are using is our forklift shown in the picture on the right. It is two tines tied to a short arm. The lifting motor for the arm is at the back of the robot to help distribute the weight. We were still going for a compact robot, so everything is as close to the robot body as we can make it. A lot of teams like to use arms and claws, but the forks can be just as effective as a claw without the extra weight of a motor or servo to open and close the claw. We do not need the extra capability of a motorized claw, so we chose an arm like this for its simplicity and lightweight.



Commented [A6]: The section is titled Effector, and it is clearly separated from the text. Meets requirement #7.

Commented [A7]: Picture: The effector is the center of attention, and is in good focus. The picture was taken in good light against a contrasting solid color background. Meets requirement #8.

Commented [A8]: Describes the effector Meets requirement #9.

Commented [A9]: Gives a reason for using this effector. Meets requirement #11.

Commented [A10]: Makes a comparison to a different effector design, and further justifies the effector used. Meets requirement #10 and provides more content for requirement #11.

Sensor Mount:

The picture to the left shows how we mounted a small touch sensor to our arm. We secured it using pins and captured it with the long yellow connector. We added the black three-long piece to make the sensor longer and to hold it in from the top. Another mounting method we considered was attaching the touch sensor to the beam with UGlu. Even though using UGlu would have been extremely simple we chose this mount because we believe that the LEGO pieces hold better than the UGlu for most applications.

Commented [A11]: The section is titled Sensor Mount, and it is clearly separated from the text. Meets requirement #12.

Commented [A12]: Picture: Careful attention was taken to get the sensor mount in focus rather than the surrounding areas. The background is a solid contrasting color, and the picture was taken in good light. Meets requirement #13.

Commented [A13]: Describes the sensor mount. Meets requirement #14.

Commented [A14]: Compares the featured sensor mount to a different design. Meets requirement #15.

Commented [A15]: Justification as to why the featured sensor mount was chosen. Meets requirement #16.

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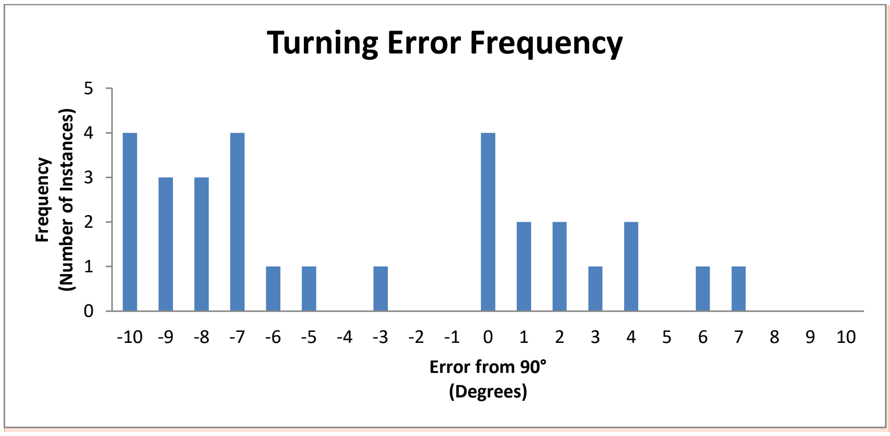
Data:



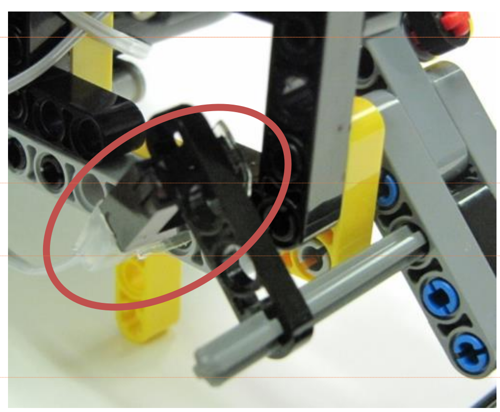
We wrote a program to turn the robot to what should be 90 degrees. We put an arrow on the front of the robot and set it on a surface marked with degree angles. We would run the program and see how much the robot turned. In the graph a positive error represents an overturn to the right, and a negative error represents an overturn to the left.

Data Evaluation:

The data represents the accuracy in the steering system of our robot. Factors such as motor alignment, weight distribution, and tire traction all have influence on the data. The data shows that our robot is generally accurate within a couple of degrees when making turns. However, upon seeing the data and calculating the mean of the values, we realized our robot is often over turning in the negative direction (left)! This caused much concern among our team as such an error would cause severe problems when trying to score points. Upon examining the robot while it executed several turns we realized that it is sometimes tipping causing one wheel to lift from the game table. This occasional tipping is the cause of the large overturns to the left that we observed in the data. To prevent the robot from tipping, and to enable it to turn more accurately we need to distribute the weight better on the robot. Our plan is to lower the arm that is mounted to the back of our robot so its mass is centered closer to the table. With a lower center of gravity our robot should keep all of its wheels on the ground, and therefore it will turn much more accurately.

Modified System:

A change that we made to the robot was adding a slot sensor (circled in red) to act as a limit switch. The sensor is just UGlued in place. We prefer LEGO, but this is a quick fix that has not given us any trouble yet. If the beam passes into the sensor, the robot knows that the arm is on the ground. The main reason we had to do this is that the robot was over rotating the arm. The arm would hit the game table, and would end up tipping our robot over. We tested the sensor and the new code by telling the servo to move the arm as low as it could. We did this multiple times, and the arm stopped once it hit the sensor every time. We will continue testing the new sensor by running the robot in our practice rounds and making sure the arm never over rotates.



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Commented [A16]: The section is titled Data, and it is clearly separated from the text. Meets requirement #17.

Commented [A17]: Chart: The chart has a descriptive title, axis labels with units, and 30 data points. Meets requirements #18 and #19.

Commented [A18]: Explains how the data was gathered, and explains what the data represents. Meets requirement #20.

Commented [A19]: The section is titled Data Evaluation, and it is clearly separated from the text. Meets requirement #21.

Commented [A20]: Clarifies how the data is related to the robot. Meets requirement #22.

Commented [A21]: Explains the trends in the graph using descriptive data analysis. Meets requirement #23.

Commented [A22]: Draws a conclusion from the data. Meets requirement #24.

Commented [A23]: Gives a general idea of how the robot will be modified on account of the conclusions drawn from the data. Meets requirement #25.

Commented [A24]: The section is titled Modified System, and it is clearly separated from the text. Meets requirement #26.

Commented [A25]: Picture: The modified item is the center of attention, is circled in red, and is against a contrasting solid color background. The photo was taken in good light, and the modified item is in good focus. Meets requirement #27.

Commented [A26]: Describes the changes that were made. Meets requirement #28.

Commented [A27]: Explains why changes needed to be made. Meets requirement #29.

Commented [A28]: Outlines how the modified system was and will continue to be tested. Meets requirement #30.