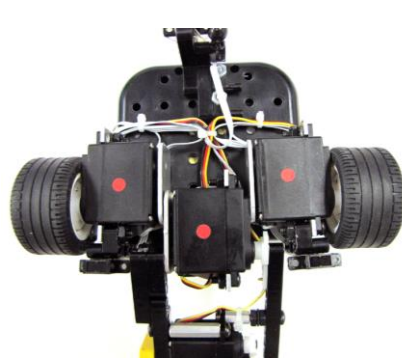This document would score 70 points out of 96.

Mechanical Design Period 2

Drivetrain

The picture to the left shows the drivetrain of our robot. On each side of the robot a LEGO wheel is connected directly to a black gear motor with screws making this drivetrain a direct drive system. A direct drive system simplifies the construction, and will make programming the robot a straightforward process. We decided mounting the motors directly to the CBC case would give the robot the lowest center of gravity and simplify the structure.

Effector

The effector on our robot (see picture on the left) is composed of a grabbing claw mounted to a lifting arm. The claw features a servo that moves two angled LEGO beams that are coupled together with two gears. When the servo moves one beam the gears force the other LEGO beam to close at the same time. The first claw we built used one stationary LEGO beam and one moving beam. Our current claw design closes around both sides of the object, which lets the robot pick it straight up.

Sensor Mount

The picture to the left is a close-up of the mount for one of the top-hat sensors on the front of our robot. We built a small "platform" out of an L-shaped LEGO and a three-hole beam, and screwed it to the servo bracket. The platform created a smooth flat surface that we then attached the top-hat sensor to using Uglu. We tried to design a mount for the sensor that didn't require Uglu by using flat LEGO beams, axles, and connectors. However, every design we came up with was too bulky, and would get in the way of the arm. The Uglu is low profile allowing the sensor to sit right up against the servo bracket. The platform allowed us to use a long strip of Uglu, which makes the bond very sturdy. Since the sensor is tucked back between the wheel and the rest of the robot where it won't get hit we are confident the Uglu will continue to hold.
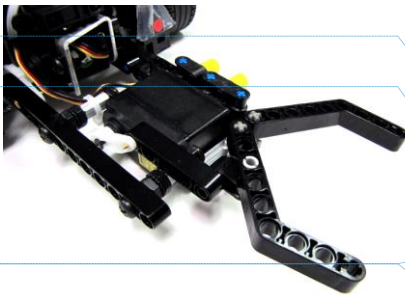
Commented [A1]: Picture: The effector is the center of attention, and is in good focus. The picture was taken in good light against a contrasting solid color background. Meets requirement #3.

Commented [A2]: The section is titled Drivetrain, and it is clearly separated from the text. Meets requirement #2.

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

Commented [A4]: Gives a reason for using this drivetrain. Meets requirement #6.

Commented [A5]: There is no comparison to a different drivetrain design. Does not meet requirement #5.

Commented [A6]: 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 [A7]: The section is titled Effector, and it is clearly separated from the text. Meets requirement #7.

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

Commented [A9]: Makes a comparison to a different effector design. Meets requirement #10.

Commented [A10]: No reason given for using this effector. Does not meet requirement #11.
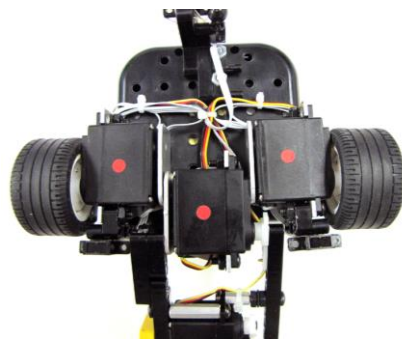
Commented [A11]: Picture: Reused picture from the drivetrain section. Even though the picture is in focus and well lit, it does not clearly show a sensor mount. The sensor mounts are visible, but they are not the center of attention. Does not meet requirement #13.

Commented [A12]: The section is titled Sensor Mount, and it is clearly separated from the text. Meets requirement #12.

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.

This document would score 70 points out of 96.

Data

To gather data we coded our robot to drive straight towards a scoring object. By using the ET sensor we coded the robot to stop when the center of the object was between the tips of its claw. When the robot stopped we measured how far the centerline from claw tip to claw tip was from the center of the object. A positive number represents the distance from the claw tips in the direction away from the CBC (i.e. object too far away to grab). A negative number represents the distance from the claw tips in the direction towards the CBC (i.e. too close to grab).

Object Distance from Claw Ends Histogram
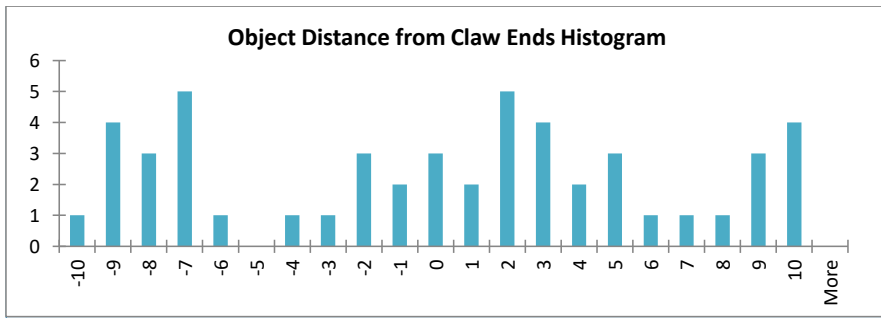
Data Evaluation

We need as close to 100% accuracy as possible from our claw if we want to score the most points. We plan to modify our claw in order to improve its ability to grasp an object when grabbed off-center. When designing we will keep in mind that the claw needs to be able to grab and hold an object when it is positioned ±10mm from the center of the claw ends.
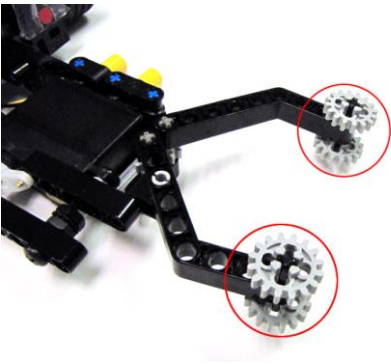
Modified System

After a lot of testing we decided our robot picked up the scoring objects very well with the geared claw design, but it would often drop the objects on the table when driving it to the scoring area. We had to do something to help the robot get a better grip. When approaching the problem we knew the goal we had to design for based on the data from our testing trials: the claw needs to able to hold onto an object when it is grabbed a maximum of ±10mm from the center. After a lot of trial and error with designs we found a surprisingly simple solution that meets our goal. We attached two 16-tooth gears with a short axle to each end of the claw (see the picture above and to the left). The teeth on the gears hook into the object allowing the claw to hold it tightly instead of slipping off.

This document would score 70 points out of 96.