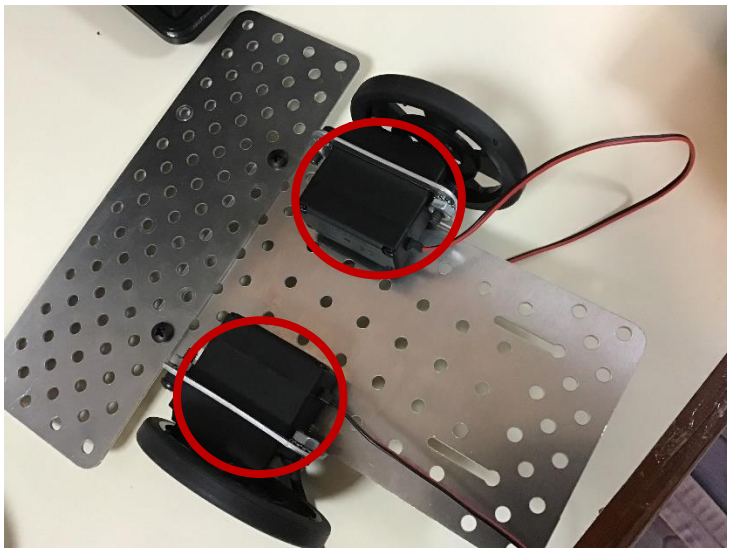
Team Name – DC Team 2 Region – Qatar Team Number - 0726

Period 2 – Mechanical Design



Drivetrain:

To the left is our drivetrain (red circles). Given the structure of the base metal plate, we found it perfect as a foundation, and the two hollow rectangular sides an ideal fit for our drivetrain. A direct drive between the wheels and the motors was made, which will connect with the wallaby that will be attached on the back. The motors are attached to the plate with screws, tightly wound to avoid shaking/coming loose. We also tried to add another drive train to the front for steering. However, decided against it as this used one extra motor. Also, you could turn by stopping one wheel, and letting the other move. Hence, we removed the extra parts and stuck with the original design,

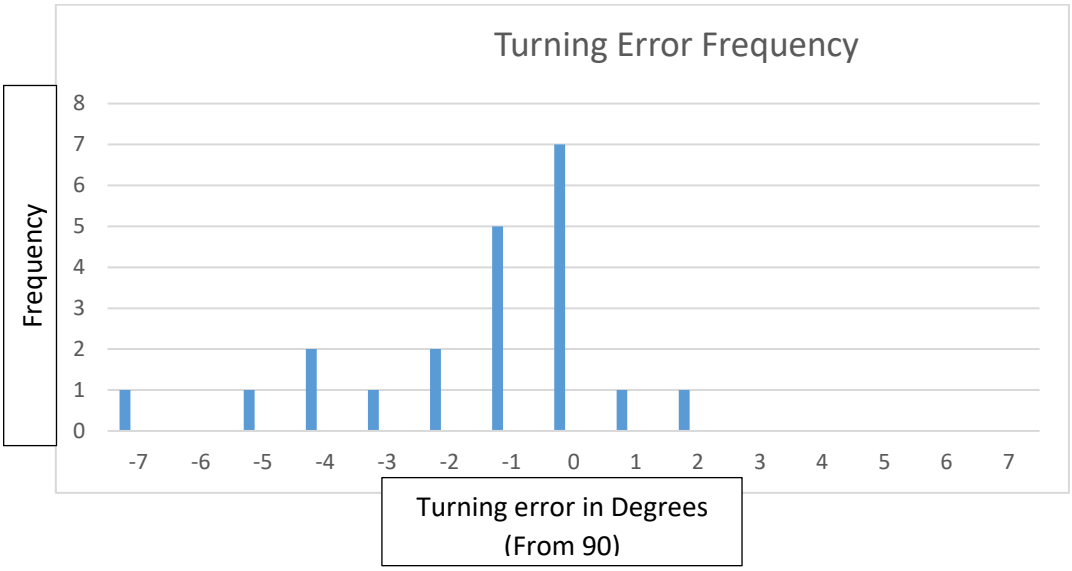
Effector:

There are two effectors we plan to use. The one on the left will go on our small robot. The build is like that of a diggers arm. Two gears (peach coloured and one at the back) will be rotated by their servo to control the length and height of the effector. The servos will be attached to the sides of the robot. The effector will be attached to the middle of the robot which is possible due to the thin but long base which can fit between the drive trains and provide stability. The sturdy build allows a motor and claw to be attached to the top for grabbing purposes. The reason we used this effector is because it has the stability needed to house a motor on the top without tipping over from the weight, a problem we had from a previous, lighter version.

Sensor Mount:

To the left is a sensor mount we added to the effector. We added two long three-part connectors shown which were fastened to the arm with two pins on both sides. The mount would hold a touch sensor. We considered using one three - part piece in the centre and pushing the claw branch back. However, this would put stress on the piece as the branch would push against it, so we removed the piece, and added them to the sides as shown allowing the branch to move freely.

Data:

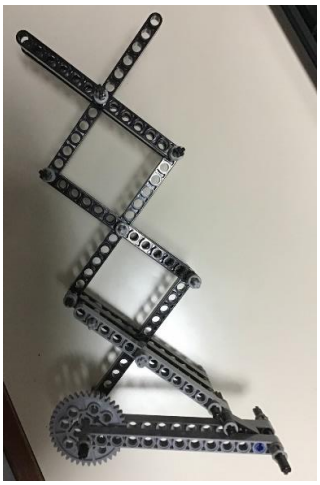


The data above represents the result of a program we made for our small bot. The goal was to see the turning error when the robot got to a set position (marked on the ground in red, ground also had angle markings) and had to turn by 90 degrees. A black sharpie was attached to the back, so we could see the trail left behind by the robot, making it easier to measure angles. We ran the program a total of 30 times. In the graph a positive error shows an overturn to right by that many degrees, and a negative error shows an overturn to the left by that many degrees.

Data Evaluation:

The data shows how accurately our robot would turn after arriving at the set point. Elements such as the speed at which the robot arrived at the spot (affected sensors) and weight distribution all affect the results. According to the results, we have an overall accurate turning system, with a 0 turning error being most common. However, this isn't reliable enough as there is a tendency of our robot turning to the left (as shown by the numerous negative data points). This was evident when looking at the robot during the run, as it would have the effector arm swing and trail behind the robot. This caused a small tilt which would cause the robot to turn a bit to the left. The problem was easily fixed when we realised (after many runs) that this tipping effect was almost directly linked to the extension of the arm. This would also explain why there were nearly no overturns to the right as the robot was turning left to begin with. As such, starting off the run with no extension would minimise the effect of the tilt as the robot's centre of gravity would be closer to the ground providing more stability. The arm also had a slight tilt forward due to a large gear being attached to it making it difficult to lie flat on the base. To further minimise the chance of overturning, we would need new effector arm which had a wider base, more sturdy build and capable of lie flat on base.

Older Design



New Design

Modified System:

To the far left is our older version of the effector we used during the run. The improved version of the effector shown to the left in red outline. As you can see the new design is much more stable due to the extension mechanism being sandwiched between two supporting columns. When resting, the arm has its centre of mass closer to the ground. Also, by using smaller gears, the arm is almost flat on the base, further ensuring the stability of the robot when it rotates. This has completely removed the problem so far. There have been 10 test runs so far, if and when more pieces are added to the design, further tests will continue to eliminate any chance of error.