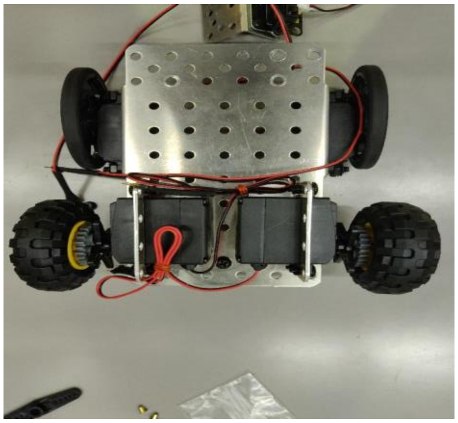
PERIOD TWO – MECHANICAL DESIGN

DRIVETRAIN



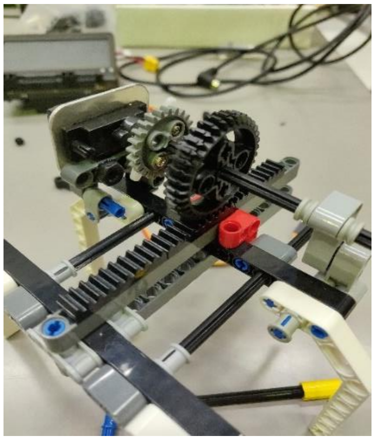
The image that is attached on the left is the drivetrain of our robot. In total the drive train consists of two wheels and one caster. The whole bot is run using two motors. The motors are attached using the chassis similar to the sample LEGO bot design. The motors are attached via screws, so the assembly is strong. The motors are directly attached to the wheels thus, forming a direct drive system. We used this system to be resource efficient, reduce friction between gears and allow coding to be easier.

The drive train consists of two motors so that max velocity can be reached. In order to counteract the shift in center of gravity, we attached these motors on the back end of the bot to move the center of gravity behind the bot thus, the drive train may also be called the rear-wheel drive. The center of gravity needs to be behind the bot b

because we will be adding a forklift design with a claw on the front. The motors will act as a counter weight to provide stability.

The caster is used to allow the robot to make rotations and thus change in directions. As the caster may provide friction, this may be swapped with wheels which can rotate freely.

EFFECTOR

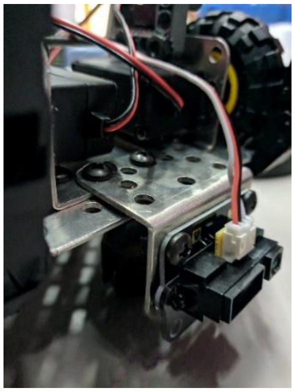


The effector of our robot mainly comprises of a sliding mechanism and a hoist that lift the mechanism itself. This sliding mechanism allows for versatility and efficient multi-tasking. The effector used here is a claw, as stated before the clay will do many tasks which include lifting supplies and people (also may be used to move other scoring items).

The effector works using a micro servo which moves the claw back and forth thus, allowing it to grab the supply, the claw will clamp onto the supply. The back end stays stationary whilst the front moves back and forth (the movement is controlled by the micro servo).

Initially the gear caused too much friction thus, a smaller more suitable sized gear was used

SENSOR MOUNT



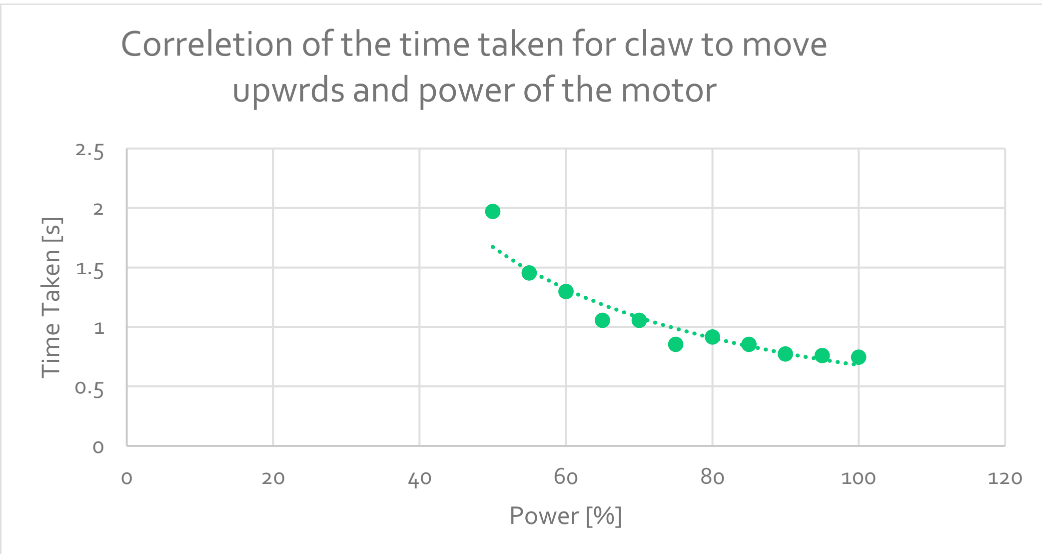
This is how we are able to mount the sensor onto the chassis. The mount as seen on the photo is secured firmly with two nuts and two bolts which would allow for increased stability and overall balance. The sensor will be used to aid in the bot movement.

The assembly is all strong several bumps or drops will not break it furthermore, it is joined using a servo mount thus for such a small component the servo bracket provides enough strength.

Our previous idea was to attach it using LEGO pieces but that was resource inefficient and looked weak, so we swapped it out for a much stronger servo mount. The design looks much cleaned and sturdier.

DATA

To gather data our bot was programmed so that the forklift would move the claw downwards at different powers. The time taken for the claw to move downwards was measured using a stop watch. The data will be presented in a graph furthermore to increase accuracy we will do repeats. The y – axis represents the time taken whilst the x – axis represents the power applied (%)

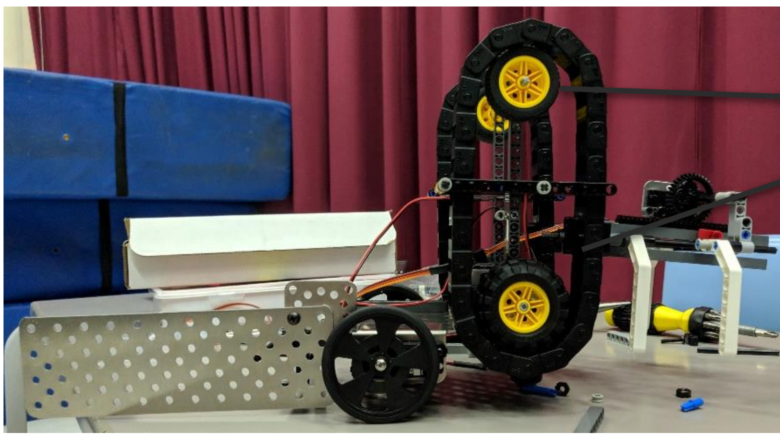


Power [%]	Average [s]	Test 1 [s]	Test 2 [s]	Test 3 [s]	Test 4 [s]	Test 5 [s]
50	1.97	1.95	1.98	1.87	2.12	1.93
55	1.45	1.36	1.47	1.56	1.46	1.42
60	1.30	1.42	1.1	1.27	1.38	1.32
65	1.05	0.98	1.01	1.23	0.99	1.06
70	1.05	0.83	1.2	0.88	0.96	1.4
75	0.85	0.87	0.93	0.96	0.68	0.83
80	0.92	0.93	0.75	1.02	1.06	0.82
85	0.85	0.75	0.87	0.78	0.95	0.92
90	0.77	0.86	0.81	0.75	0.72	0.72
95	0.76	0.79	0.76	0.64	0.92	0.68
100	0.75	0.68	0.75	0.89	0.82	0.59

DATA EVALUATION

Our data tells us that at a lower motor power the time taken for the claw to reach the floor is longer, whilst at a higher motor power the time taken reduces, however the reduction in time isn't linear which may be caused because of human error or the motor maximum torque being reached. More likely the motor reached maximum torque thus, using a motor power of 95% or above is inefficient and not required this is because the difference between 90% motor power and 100% power is a mere 0.02 seconds (which is also variable). Furthermore, using higher power sometimes caused the forklift to get stuck as the rubber tires would snag on the claw. After a long discussion we decided to reduce the drag on the bot's forklift thus, be more efficient and may have faster times. We removed the rubber tires and shortened our forklift chain. (Design better explained in next section)

MODIFIED SYSTEM



Rubber tracks were placed here these snagged on the claws screws (the claw is attached via screws on the IGUS chain)

The change made was removing the LEGO rubber tracks and making the IGUS chain a little shorter. We tested the bot using the same code and the chain had run more efficiently and the claw moved up and down successfully. (This was tested 100 times and out of those 100 tries, it didn't stop at all).
As of that moment we had a functioning forklift, testing the downward motion however introduced a new problem – it was rather slow and inconsistent in speed.

In spite of our predicament, our modification was a success as now we had a 100% chance for the claw to move up and down respectively.