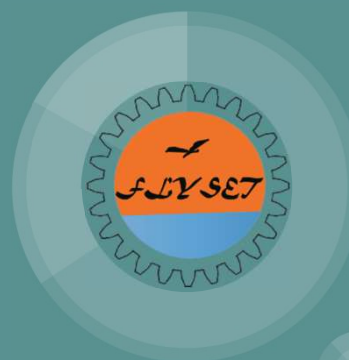


# 2018 FLYSET FTC Workshop - 3 Wheel Geared Drive

(9/3/2018)



## Derek He

I started out in Jr.FLL and worked my way up to FLL and now FTC. I got into the FIRST program about 7 years ago and I am still competing. I was mainly a builder throughout my years with Lego Storm, MinionBots, QuantumX, and now Technibots. Currently, I am in 8th grade and attending Rice Middle School.

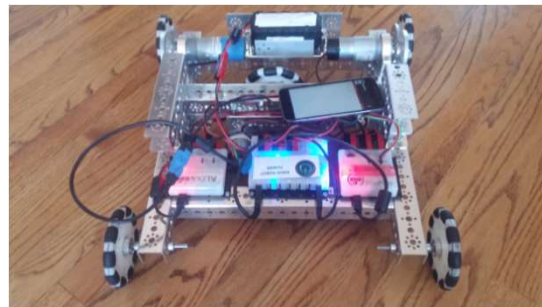
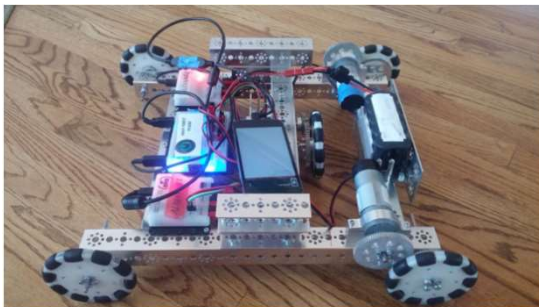


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# Chassis Specification

## 3 Wheel Geared Drive



Base Weight: 10.1 lbs



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## 3 Wheel Geared Drive



15.1 lbs



45.1 lbs



30.1 lbs

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## 3 Wheel Geared Drive

- Tetrix based chassis
- Two NeveRest 40 motors for left and right wheels
- One NeveRest 60 motor for middle wheel
- 3 wheel geared drive
- Gear ratio for left and right 1:1
- Gear ratio for middle 2:1
- Consists of 5 4 inch omni wheels
- Modern robotics motor controllers are horizontally mounted on the front of robot chassis
- Base chassis weight: 10.1 lbs

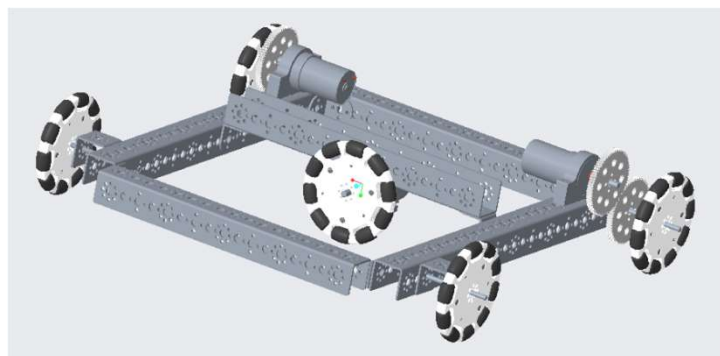


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# Chassis CAD Design

## 3 Wheel Geared Drive in Design Phase



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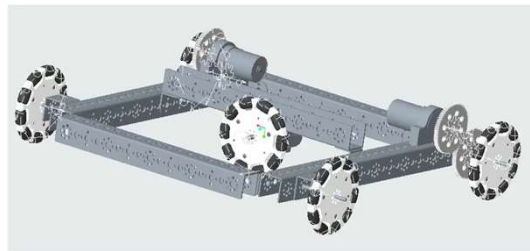
## 3 Wheel Geared Drive CAD Notes

- When I tried to edit a piece, every other model would disappear
  - Looking at the model tree is crucial
  - When constraining a piece, it will only be able to constraint to pieces above it on the model tree - Parts that were added to assembly after that particular piece will not appear when editing the piece
  - In order to fix - Drag the piece that you want to constraint to the bottom of the model tree
    - This may require you to unconstraint all piece underneath it



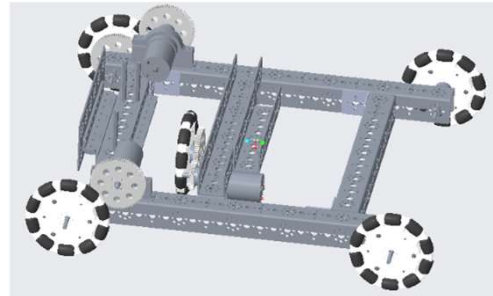
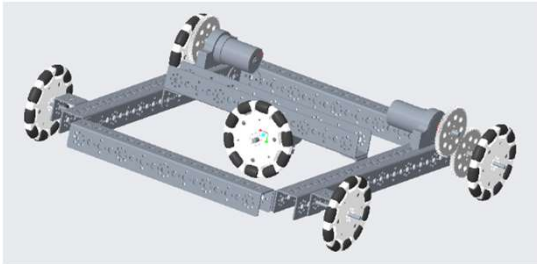
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## 3 Wheel Geared Drive CAD Model Simulation



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## 3 Wheel Geared Drive CAD Model Comparison



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## Chassis Test Results



## 3 Wheel Geared Drive Build Notes

- Parts came off easily even when tightened all the way (wheels)
  - Tetrix set screw is not holding securely, needs to keep tightening
  
- After moving around for a while, channels became loose
  - Added extra screws



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## Test 1: Forward Speed Test

- Went further (i.e., faster) with less load

	No load	15 lb load	30 lb load
Distance traveled	4.27 m	3.99 m	3.41 m



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## Test 2: Three Second Turn Test

- Load affects a lot on turn, make it harder to turn

	No load	15 lb load	30 lb load
Degree turned	599	423	290



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## Test 3: Driving up/down a ramp

- Could get onto ramp on slope but was quite difficult since omnis kept sliding
- Couldn't get past slope and onto flat surface due to the middle wheel (chassis design limit)

	No load	15 lb load	30 lb load
Up ramp	NA	NA	NA
Down ramp	NA	NA	NA



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## Test 4: Balance Stone Balancing Ability

- Same as Test 3, couldn't get on due to middle wheel

	No load	15 lb load	30 lb load
Go on the stone?	NA	NA	NA
How long on the stone? (forever is settled on the stone)	NA	NA	NA



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## Test 5: Pull Strength Test

- Chassis was weak due to the use of omnis and only a 2 wheel drive forwards and back

	No load	15 lb load	30 lb load
10 lb pull weight	4.56 sec	5.095 sec	5.44 sec
20 lb pull weight	NA	NA	NA
30 lb pull weight	NA	NA	NA



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## Test 6: Autonomous Straight Line Drift Test (Optional)

- Extremely more drift with more load

	No load	15 lb load	30 lb load
Horizontal drift	0.7 cm	20.3 cm	31.3 cm



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## 3 Wheel Geared Drive Summary

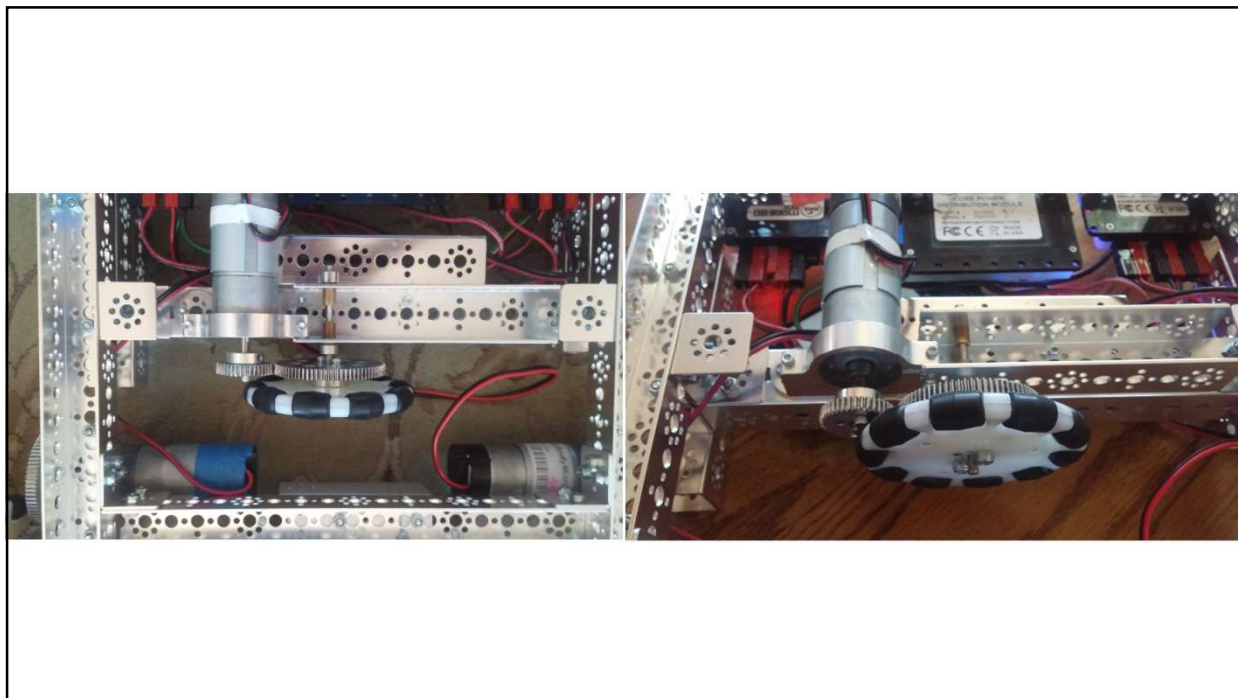
- 3 wheel drive behaves like a chassis with mecanum wheels to move sideways (but not diagonally)
- Middle motor allows sideways movement but limits the chassis for uneven surface such as balancing stone and ramp
- Chassis can be very effective in last year's challenge by only moving horizontally when right in front of cryptobox
- Drifts a lot since it is all omni wheels



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## Sideways Tests





## Making the Sideway Movement

- My chassis had a middle motor which enabled it to go sideways without moving anything else
- I conducted some extra tests
- Had to do some build changes to the middle wheel design in order to make it work
  - Changed to the newer wheel
  - Changed from direct drive to gearing down with 2:1
  - Lowered middle wheel by adding a plate underneath motor mount
  - Finally, switched to a stronger motor while gearing down.
    - NeveRest 40 -> NeveRest 60



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## Test 8.1: Sideways Speed Test

- Surface affects performance extremely. Mats had to have friction.
- Went through many variations and experiments of the middle motor to make it work
- Could only do 5lbs because of only a single motor
- The distance traveled in 5 seconds

	No load	5 lb load
Horizontal drift	1.3 m	1.04 m



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## Test 8.2: Sideways Drift Test

- More load weight has more drift
- Only went 4 feet for test because it was very inconsistent for longer distances and the chassis is meant for short distance movement

	No load	5 lb load
Horizontal drift	0.08 m	1.2 m



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