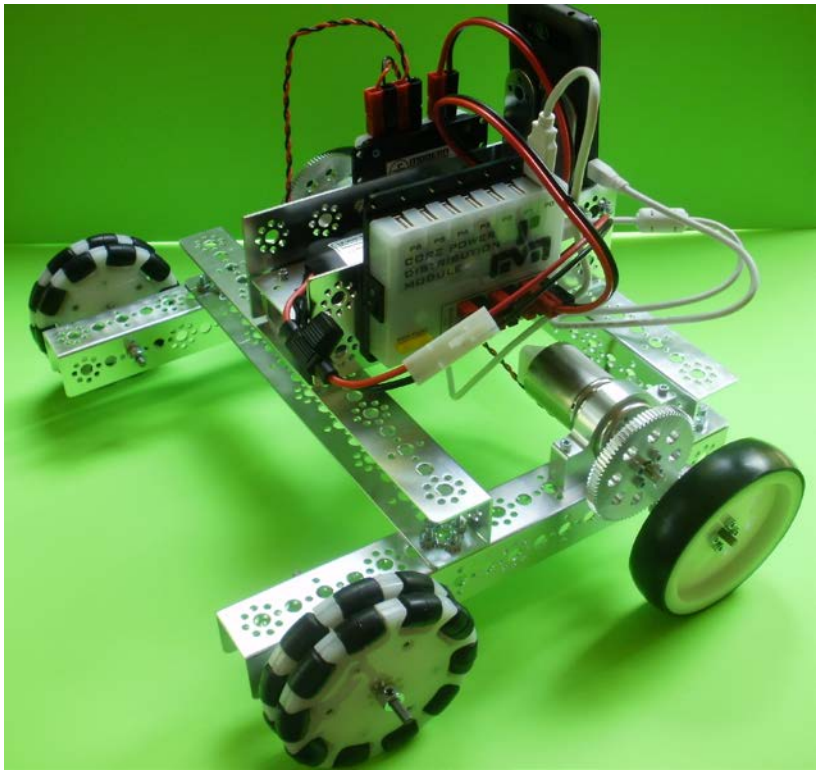
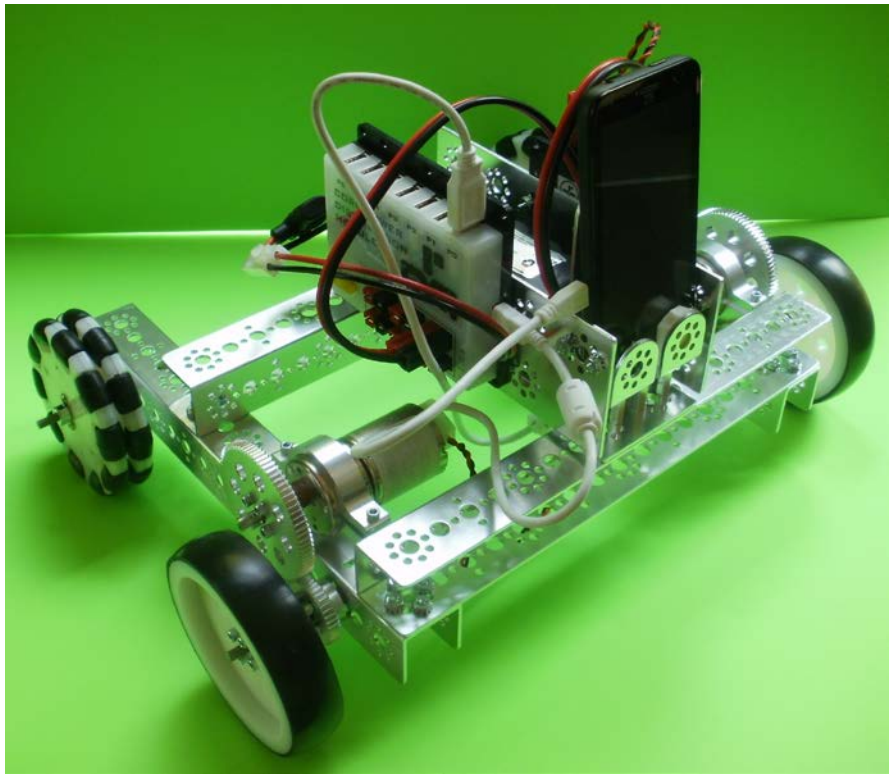
How to Build YetiBot – a Basic FTC Chassis

Using the 2015-16 Control System





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Photos by Chris Doig

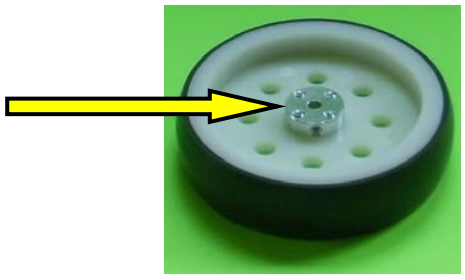
Text & Layout by Melody Doig

Revision History		
Revision	**Release Date**	**Description**
2015.1	September 12, 2015	Initial Release

- Chassis built using only parts contained in the standard *FIRST* FTC Tetrix Max kit [41329].
- Quantities are shown in ( ). Part numbers in [ ].
- Robot right & robot left are as viewed from the back of the robot (looking at the phone)
- Only extra large piece not used will be (1) 64x192nn Flat Building Plate [39073].

1. Drive Wheel Assembly and Attaching to Side Rail
    a. Get (1) 4” Tire/Wheel [39055], (1) Axle hub [39172] and (4) 6-32 socket head cap screws ½” long [39097].

i. Insert hub protrusion into center hole of wheel aligning the surrounding holes.
ii. Insert screws through holes on opposite side and tighten.

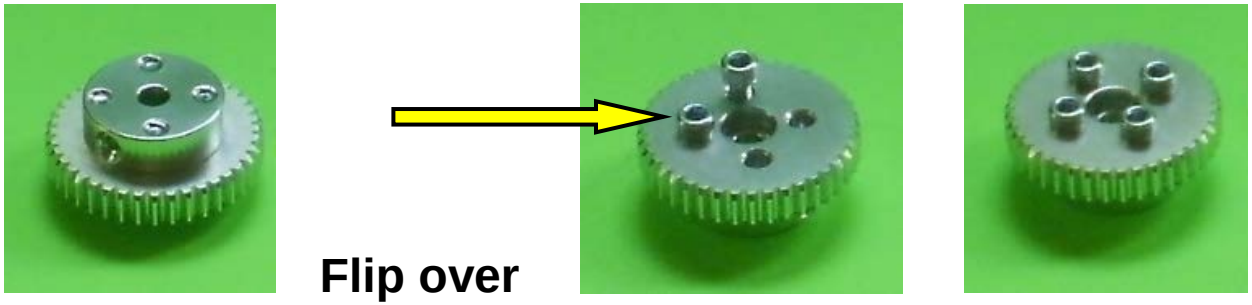


Flipped over

b. Get (1) Axle hub [39172] and (1) 40 tooth gear [39028] and (4) 6-32 socket head cap screws ½" long [39097].

i. Insert hub protrusion into center hole of gear aligning the surrounding holes.

ii. Insert screws through holes on opposite side and tighten.



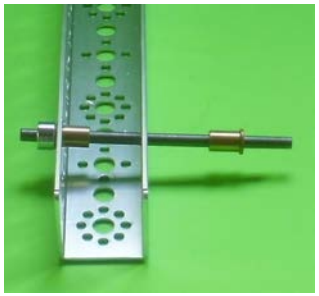
c. Get (1) Axle [39088], (1) Axle Set Collar [39092], (2) Bronze Bushing [39091] and (1) Hub Gear Spacer [39090] and (1) 288mm Channel [39068]. Note the 4 bolts included in with the Hub Gear Spacers are not used.

i. Slide Axle Set Collar onto Axle about ¼" from one end and tighten set screw over flat face of axle.

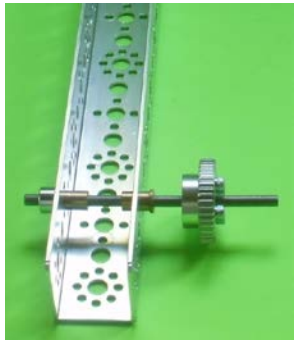
ii. Add Bronze Bushing onto axle so flange abuts set collar.

iii. Slide bare end of axle assembly into large center hole of Channel.

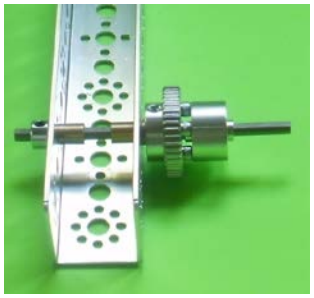

iv. Slide 2nd bushing over axle leading with non-flange end so that bushings are mirror images on axle.



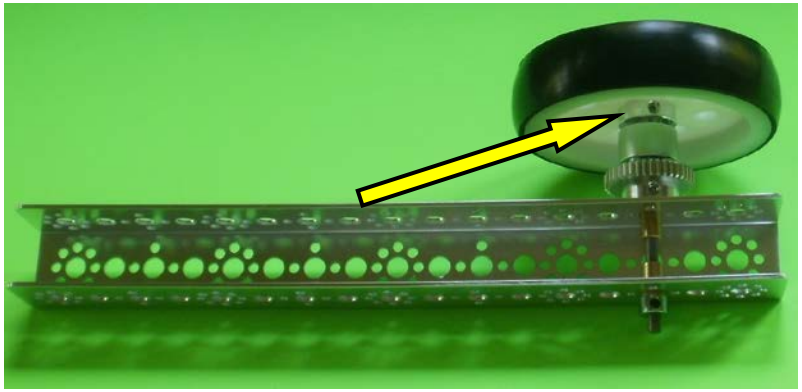
v. Slide Gear Assembly from step 1b over axle flange side leading and screws away from channel then tighten set screw over flat face of axle.




vi. Slide Hub Gear Spacer over Axle,



vii. Add Wheel Assembly with hub towards channel and tighten set screw over flat face of axle.



2. Motor Mounting and Gear Attachment
   - Motor & Axle Hub set screws are loose in the bags so insert set screws into socket side out so you don't lose them.
   - If game dictates more power swap the 40 & 80 tooth gears – ¼ speed & 4 times torque.
     a. Get (1) Motor [39530 and (1) Motor Mount bag [39089] including (2) screw and (2) nuts which will be used.

i. Push Motor Mount onto the axle side of the Motor which is a tight fit, requiring two people, one to spread open the mounting bracket while the other pushes the motor into place. The mounting bracket will set itself into a depression in the motor casing. The screw opposite the motor axle should be slightly above the bracket gap. BE CAREFUL NOT TO BREAK PINS ON OTHER END OF MOTOR.




b. Get Motor Shaft Hub [39079], 80-Tooth Gear [39086] and (4) 6-32 socket head cap screws ½" long [39097].

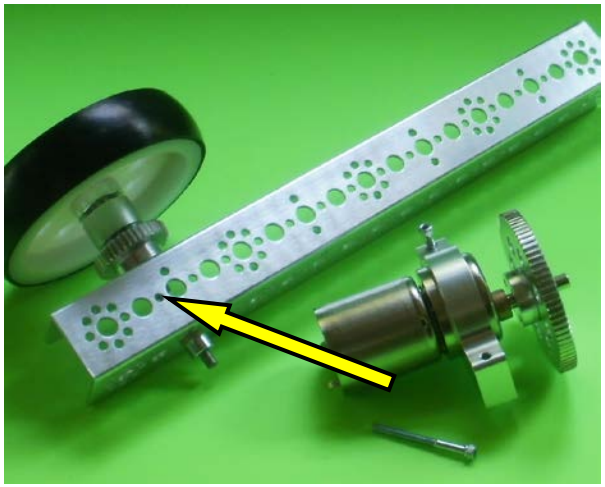
i. Insert hub protrusion into center hole of gear aligning the surrounding holes.

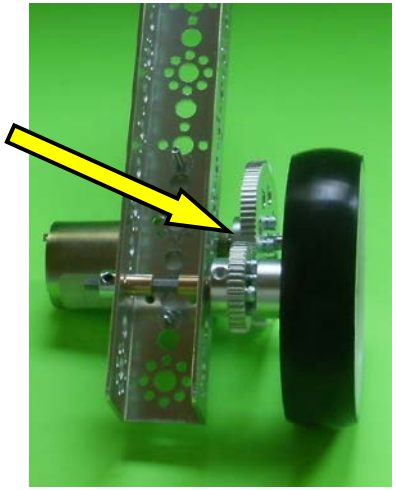
ii. Insert screws through holes on opposite side and tighten.

Flip over

iii. Place gear assembly onto motor output shaft hub towards motor, tighten set screw over flat face of axle. There will be a slight gap between the hub and the bronze bushing.

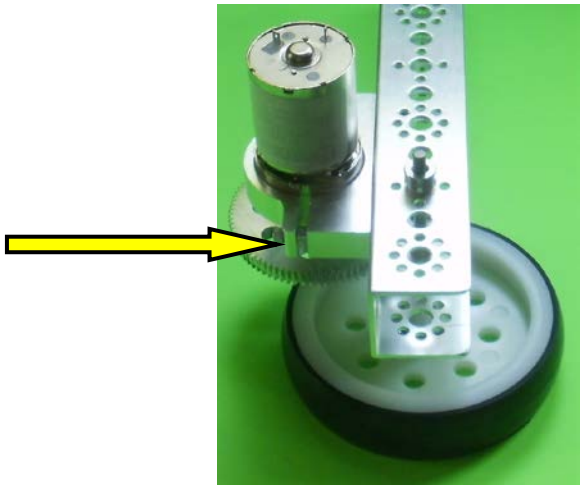
c. Attach motor and gear assembly to side rail with drive wheel already attached. Place screws in motor mounting bag through motor mount and top surface of Channel adding the 2 motor mounting nuts to end of screws but only tighten the front nut.





d. If 40 tooth and 80 tooth gears do not perfectly mesh – grab motor in one hand and side rail in other hand and rotate motor towards long end of side rail. If this does not correct the gear mesh try rotating motor the opposite direction.

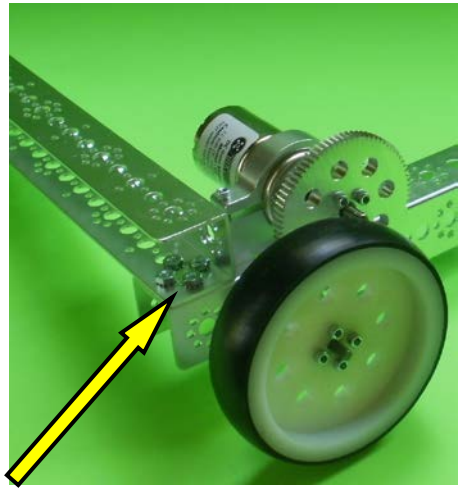
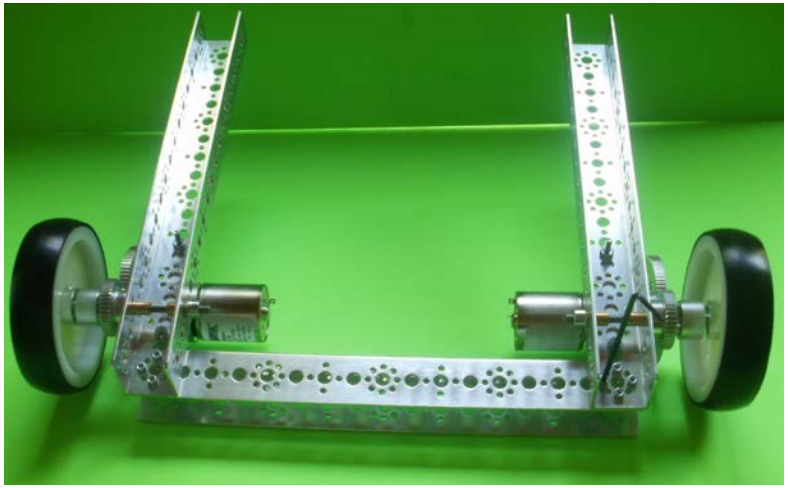
e. Tighten screw on open end of motor mount bracket.



f. Repeat steps 2a through 2e for other side, mirroring the assembly as shown.

3. Connecting Left & Right Side Rails:

   a. Using (4) 5/16” socket head cap screws [39098] & (4) keep nuts [39094] attach each end of 288mm Channel [39068] going through side of cross channel into top of side rail channel. Screws are points up so nuts are in interior of channel.

   b. Repeat for other end and side.

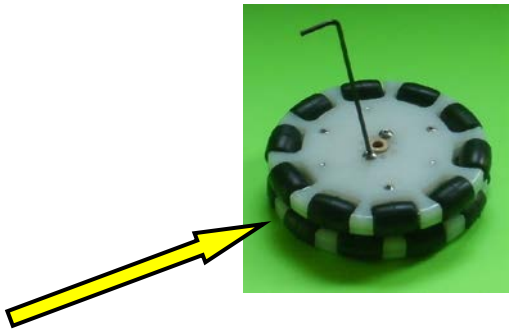
4. To Construct a Dually Omni Wheel [36466] assembly

a. Using contents of Omni wheel bag plus (2) Bronze Bushings [39091] press bushing into center of each wheel hub – this is a tight fit & will need very strong fingers or a rubber mallet.

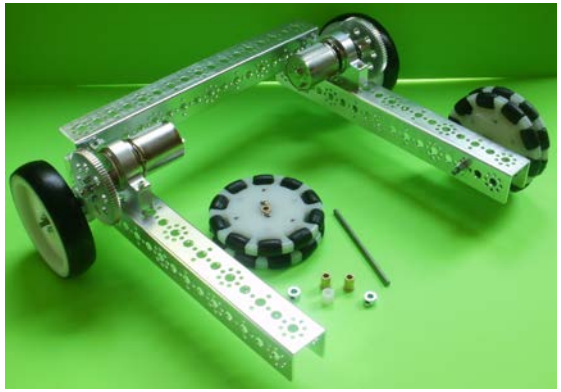
b. Bushing will protrude through one side attach Omni wheel hub over bushing.

c. From bushing flat side - opposite side - insert (2) Omni bolts lining up hub holes and tighten.

d. Place 2nd Omni wheel protruding hub over 1st wheel hub with rollers offset lining up 4 of the center holes. You will see light through 2 of the holes as 2 already have bolts installed – insert Omni bolts into these holes.

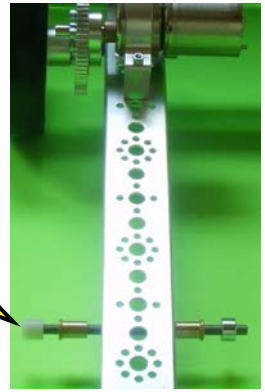


5. Axle Assembly
    a. Get (2)100 mm Axles [39088], (4] Bronze Bushings [39091], (2) 3/8" Nylon Axle Shaft Spacers [39101] and (4) Axle Set Collars [39092].

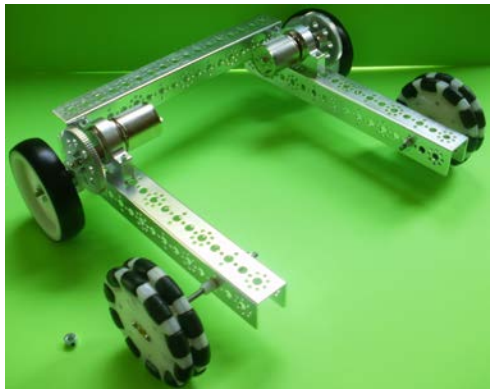


    b. Slide set collar onto axle about ¼" from one end and tighten set screw over flat face of axle.
    c. Slide Bushing onto axle so flange abuts set collar.
    d. Slide bare end of axle assembly into large center hole of Channel from centerline of robot
    e. Slide 2nd bushing over axle leading with non-flange end so that bushings are mirror images on axle.
    f. Slide (1) Nylon Axle Shaft Spacer over axle.

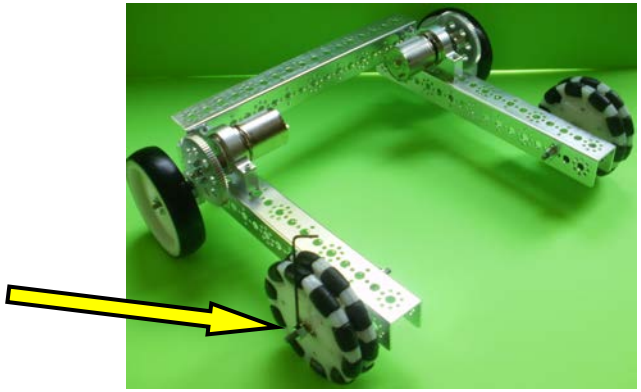
Steps b through e



g. Slide Dually Assembly over axle.

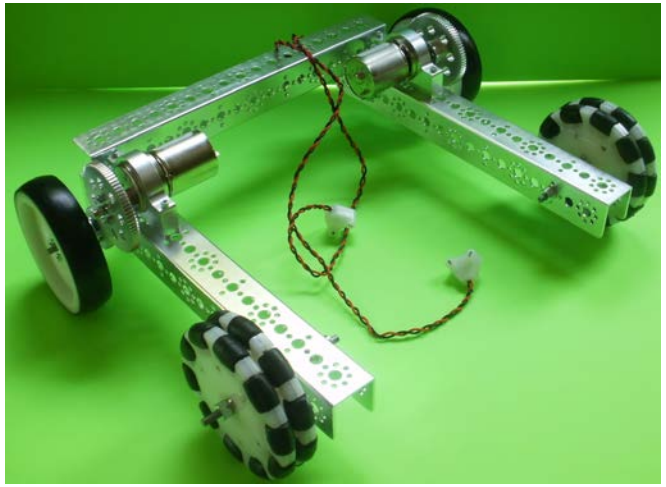


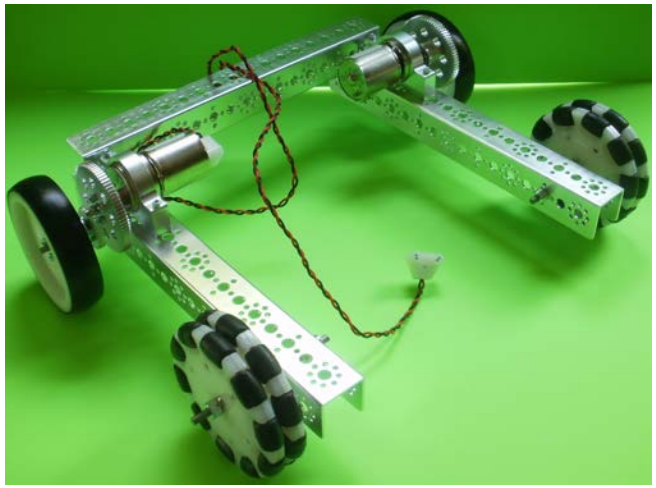
h. Slide 2nd set collar over axle and tighten set screw over flat face of axle. Make sure all pieces are pushed together with no slack and Dually Assembly is on outside of frame.

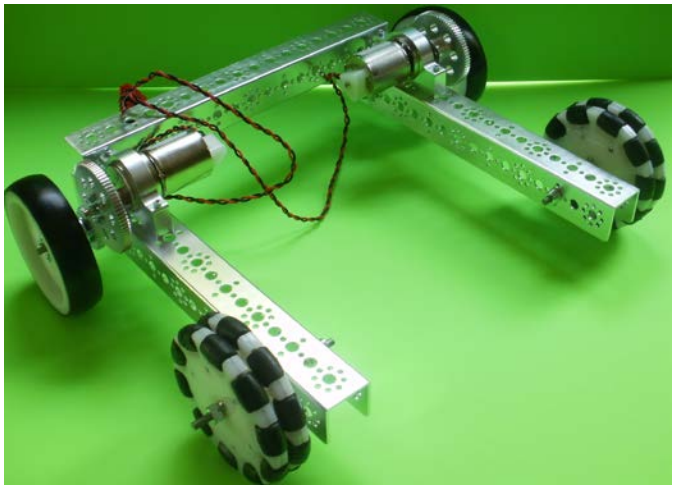


i. Repeat steps b through i for other side.

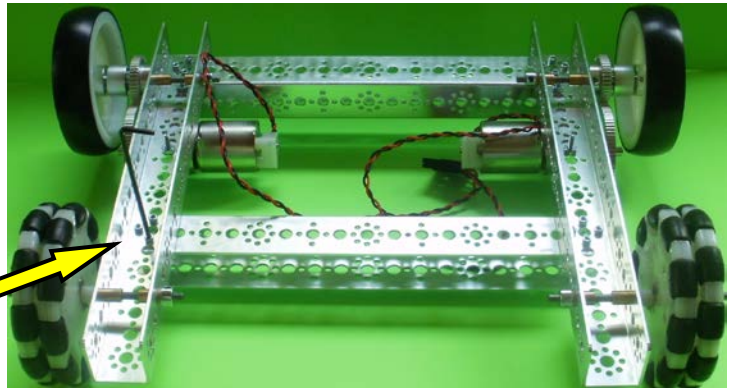
6. Attach white connector of (1) Motor Power Cable [41352] to pin end on each motor with a press fit. Be careful to not damage the pins.

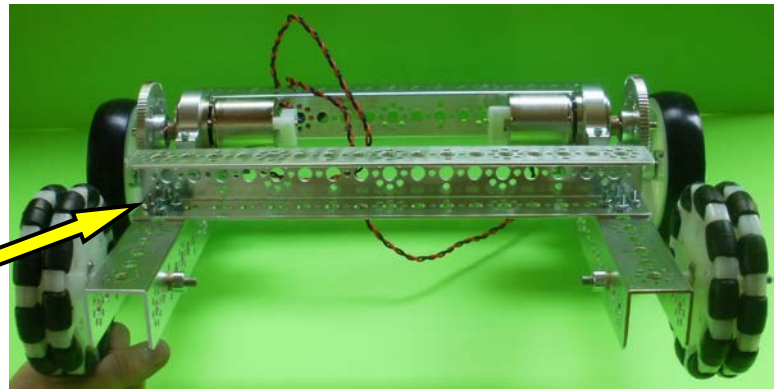


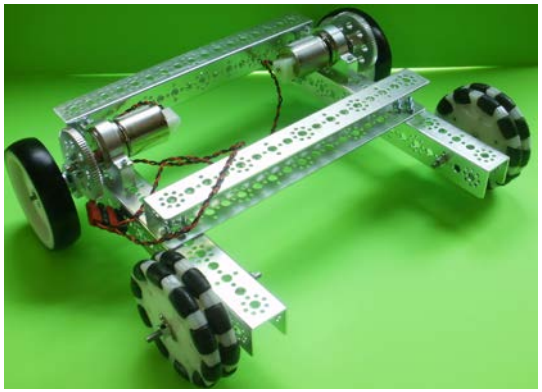




7. Front Cross Bar – with opening of Channel [39068] forward attach each end of front cross bar [39068] using (4) 6-32 socket head cap screws ½" long [39097] with keep nuts [39094] through top surface of side rail [39068]

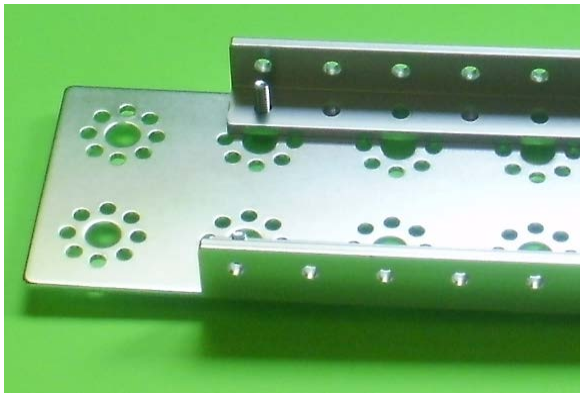


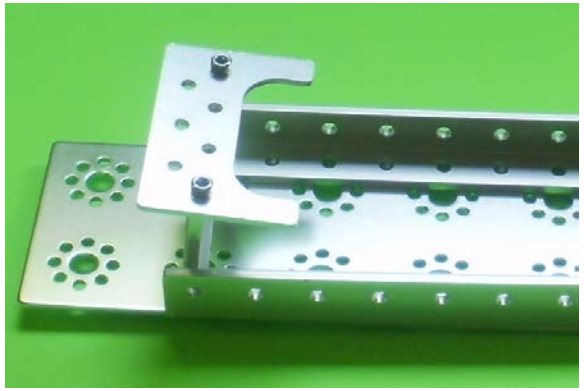




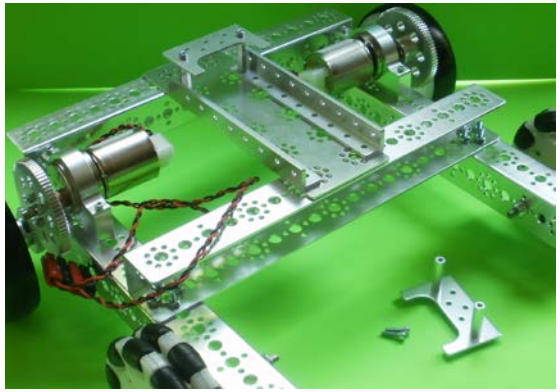
8. Build & Attach Battery holder:
    a. To build (2) Battery Clip Assemblies attach (2) 1” Stand-off Posts [39107] to Battery Clip [38009] using 6-32 socket head cap screws ½” long [39097]

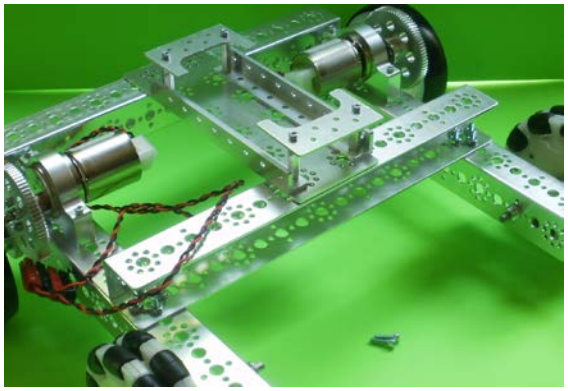
    b. Attach (1) Battery Clip assembly using (2) 6-32 socket head cap screws ½” long [39097] through 64x192 Flat Building Plate [39073] then through (2) 144 mm Angle [39072].

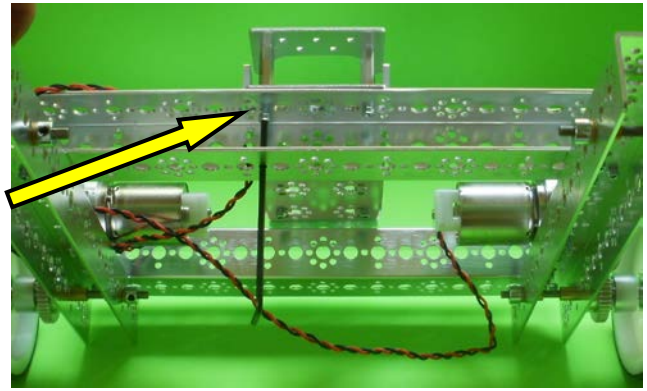


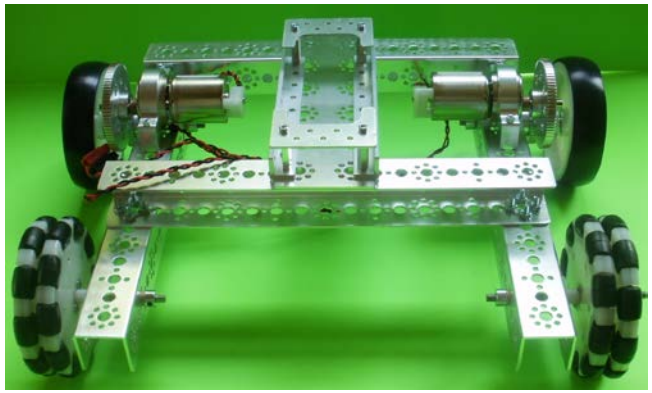


c. Attach partially assembled Battery Holder to the top of the front cross bar using (2) 6-32 socket head cap screws ½" long [39097] going through the 288mm Channel [39068] & 64x192 mm Flat Building Plate [39073] & 144mm Angle [39072] into 1" Stand-off Post [39107] on the battery clip. The flat plate should be flush with the front of the cross channel.



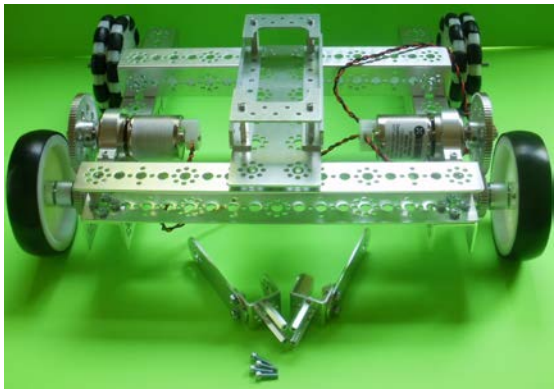


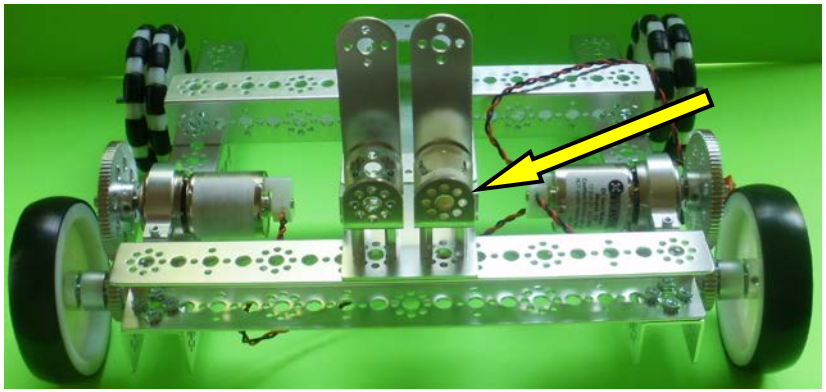




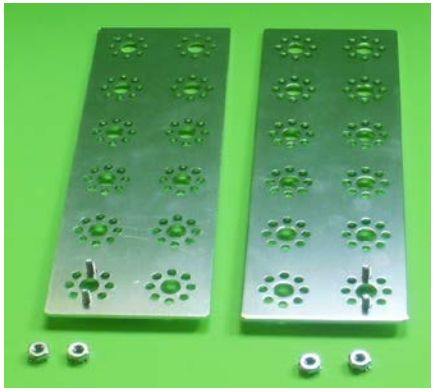
9. Build phone holder:
    a. Attach (2) 1” Stand-off Post [39102] to bottom of C Connector [39270] using (2) 5/16” socket head cap screws [39098]. Repeat for 2nd assembly.
    b. Attach Flat Bracket [39061] to Inside C Connector [39270] using (2) 5/16” socket head cap screws [39098] & (2) keep nuts [39094].

    c. Attach phone holder assemblies with (4) 6-32 socket head cap screws ½” long [39098] to back of robot through 64 x 192mm Flat Building Plate [39073] & top of 288mm Channel [39068]. Line phone holder brackets with adhesive backed foam to cushion phone.

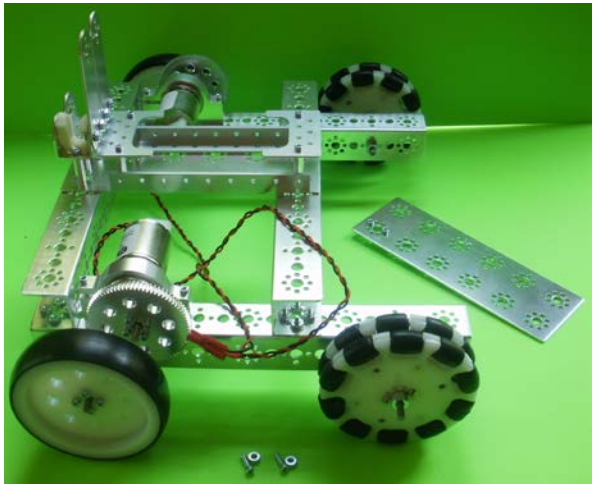
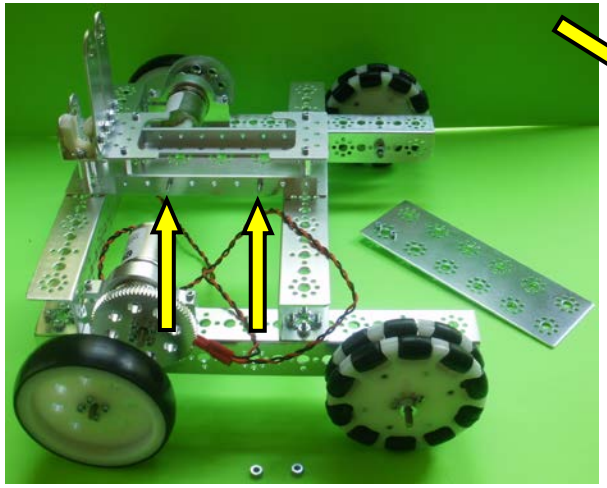
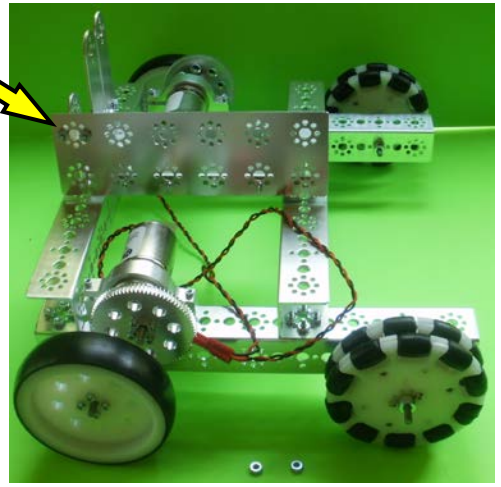




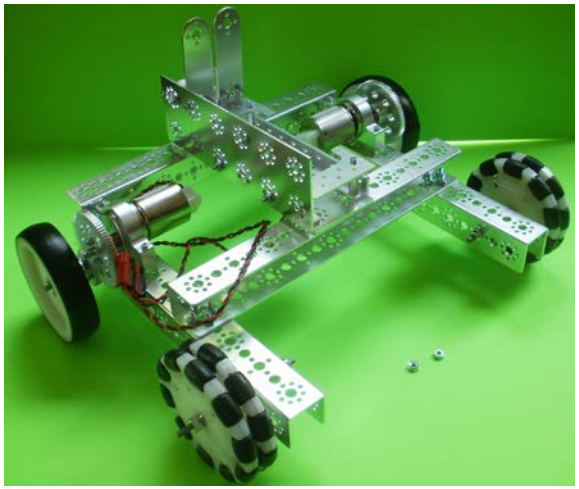
10. Phone Guides – Install (2) 5/16” socket head cap screws [39098] & (2) keep nuts [39094] to (2) 64 x 192mm Flat Building Plates [39073]. The plates will be mirror images of each other.

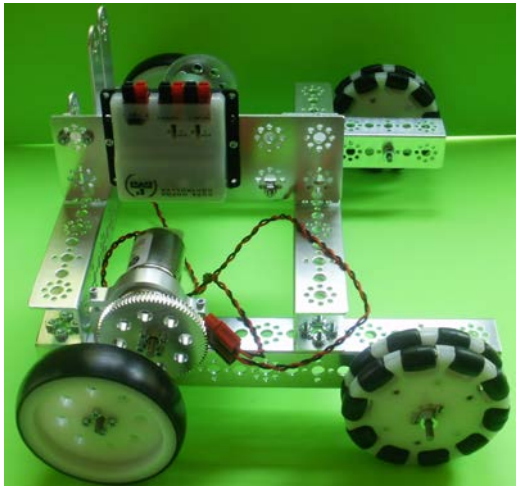



11. Attach right side panel to angle on bottom of battery holder using (2) 6-32 socket head cap screws ½” long [39097] & (2) keep nuts [39094]. Make sure the phone guides are at the back of the chassis in line with the phone holder with the screw heads on the inside. The rearmost keep nut needs to be rotated horizontal (like this ⬣, not this ⬢).

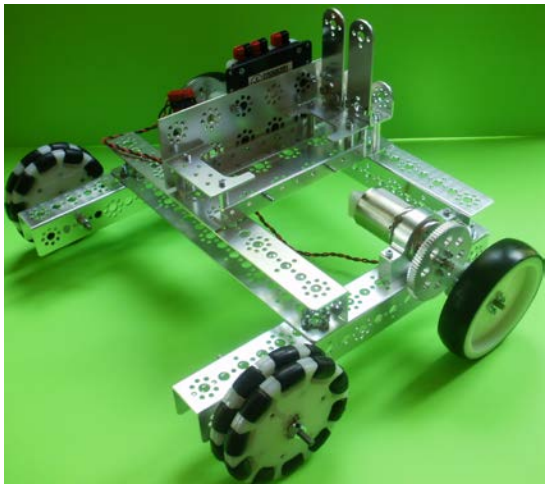




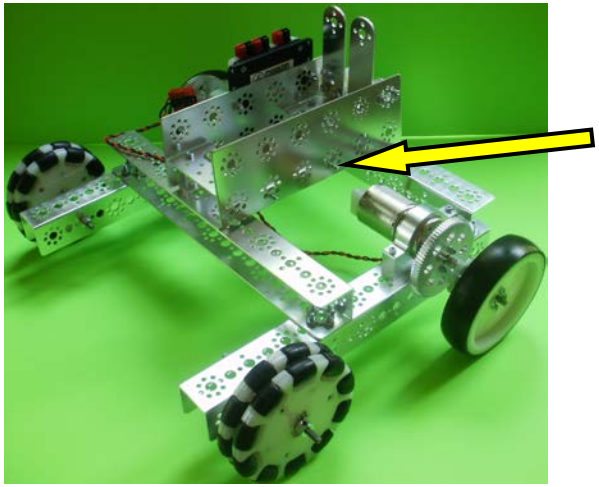
12. Attach the Motor Controller to the already installed right side panel using (2) 6-32 socket head cap screws ½" long [39097] & (2) keep nuts [39094]. The screws will go through the holes in the mounting flanges and the side panel.



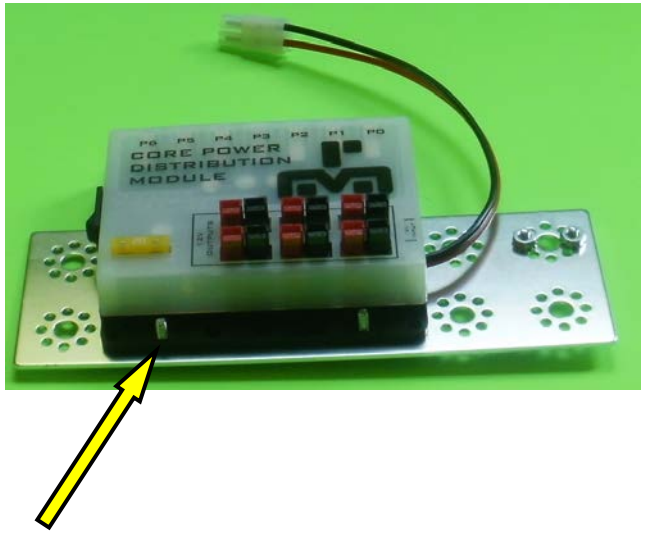


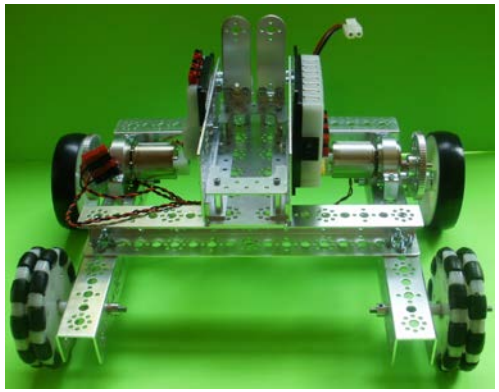
13. Attach CPM & left side panel to the angle on the bottom of the battery holder, using (2) 6-32 socket head cap screws ½" long [39097] & (2) keep nuts [39094], with the screw heads on the inside.



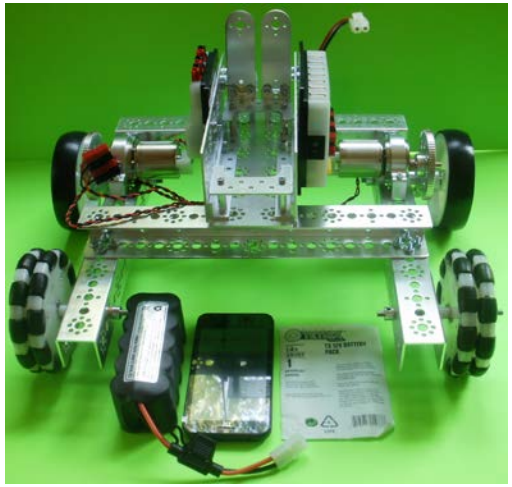
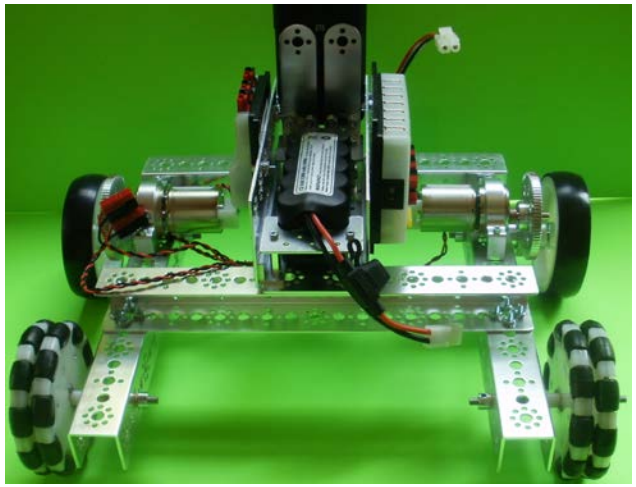
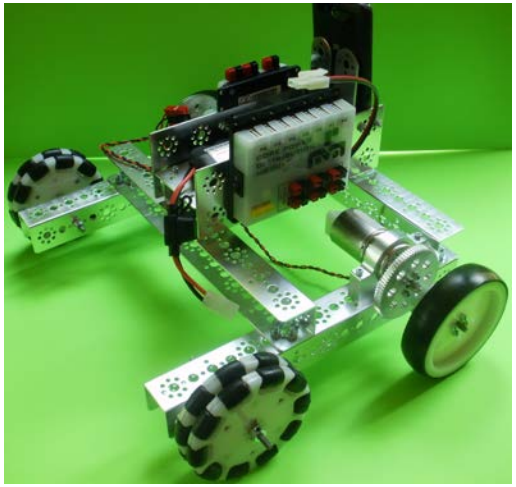


a. Line up side panel along angle piece with phone guide towards rear of chassis, put the (2) screws through both pieces, then power module before finishing with keep nuts on the outside.



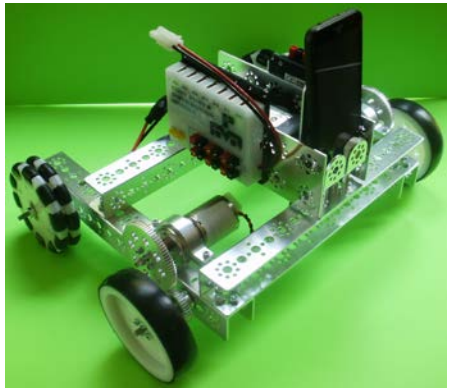


14. Slide battery into bracket in center of robot. Secure with Velcro strap or zip tie. The battery can be charged without removing it from the robot so it doesn't need to be easy to remove.

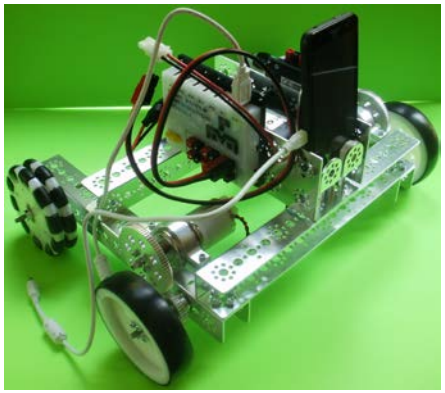




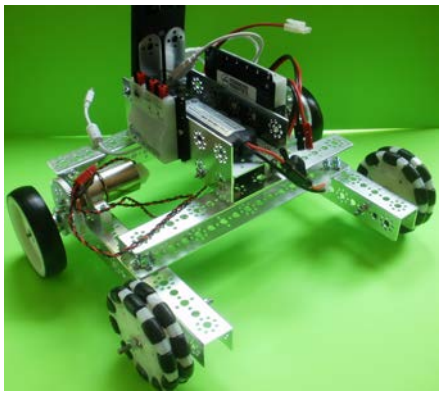
15. Slide phone into bracket on backside of robot – make sure phone is upright so power button is on top and screen points out. Secure with Velcro tie so the phone is secure but easy to remove.

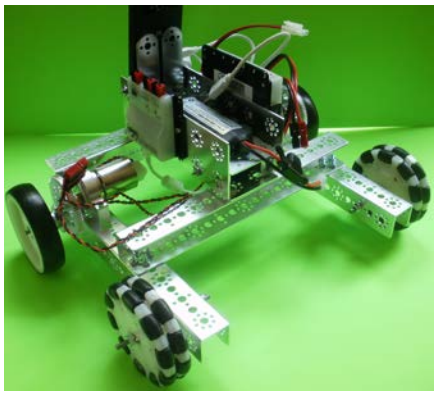
16. Make all remaining electrical connections

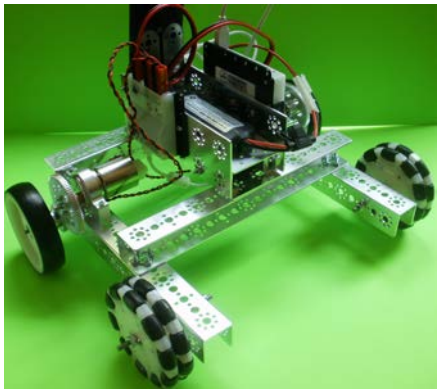


a. USB CPM to motor controller,
b. Power from CPM to motor controller,
c. Power from battery to CPM,
d. Power from motors to motor controller
e. Phone to CPM.



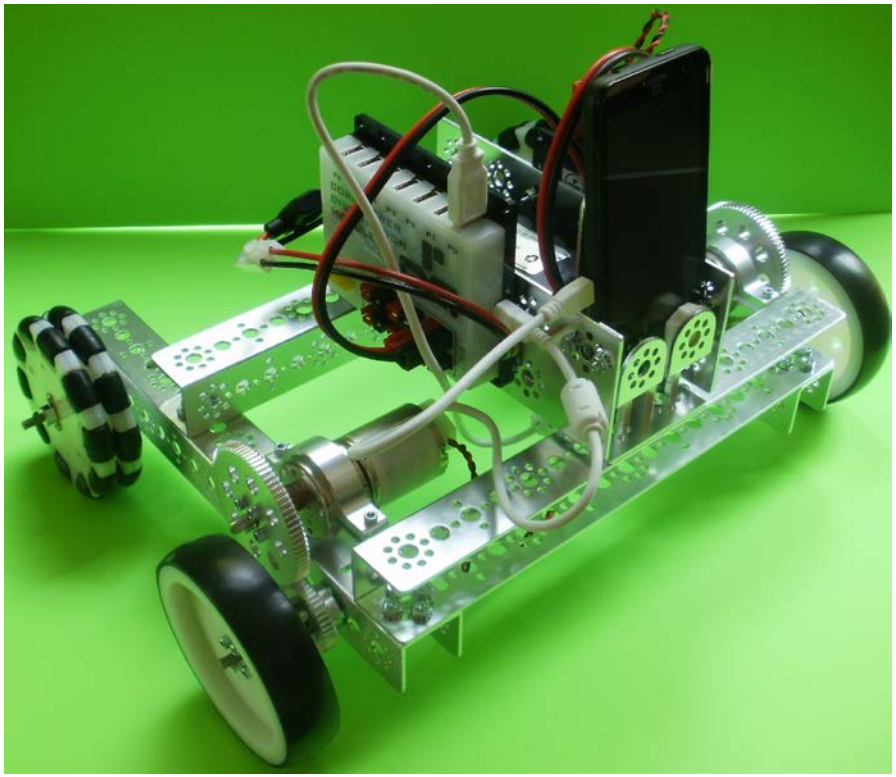


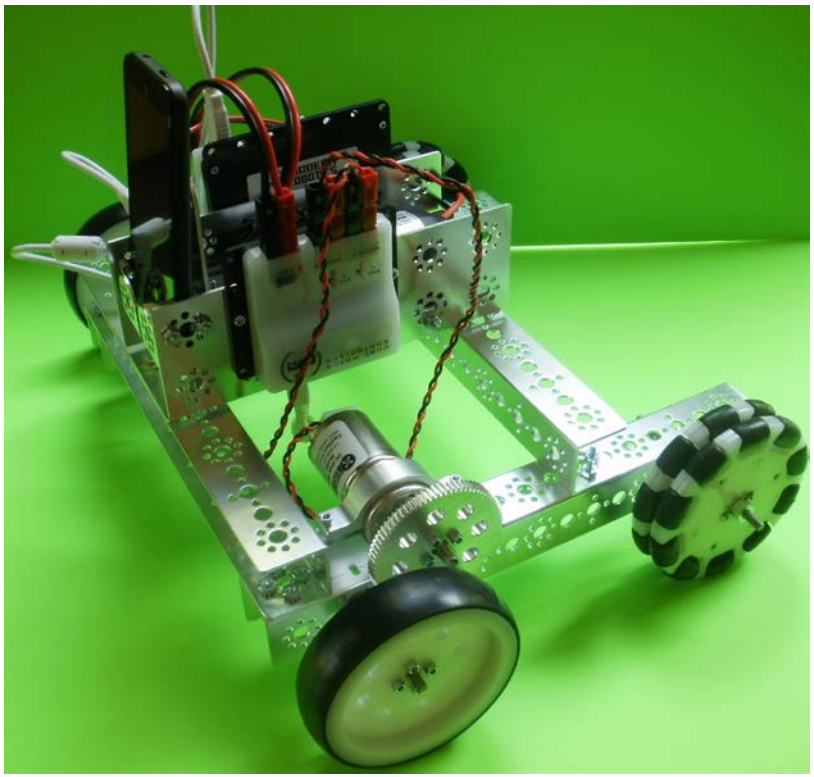




Note: Power connections are always red-to-red, black-to-black. DO NOT plug power from CPM into an output on the motor controller.

Your YetiBot chassis is now complete and ready for you to design tools to attach to it.





- The chassis can be manually pushed until the communication setup is complete. This will be covering in the second workshop.
- For a similar robot with a powered claw on a motorized arm, designed by FTC Team #2843, check out PushBot 2 on the FTC website.
- Check out facebook, Twitter, the official blog, the FTC Youtube channel and the FTC website.