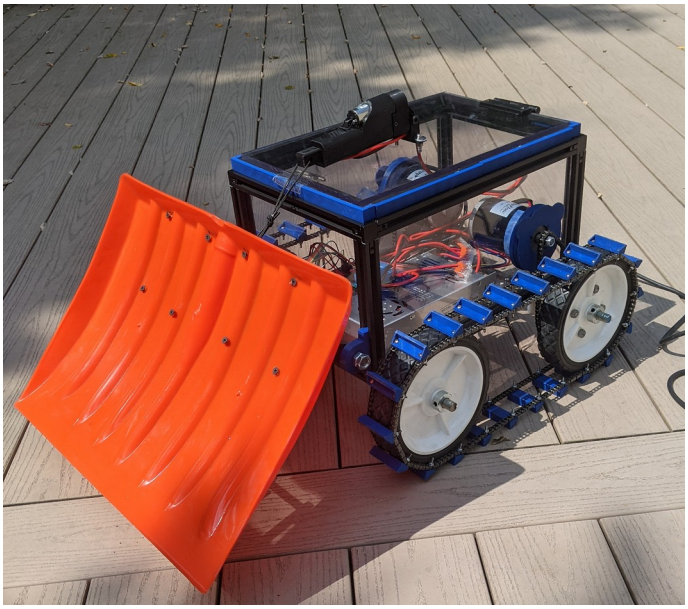
SNOWBYTE

Open-Source Remote Controlled Snowplow

Gerardo Cruz



Project Last Updated: August 9, 2023

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Contents

1. Overview

The SnowByte is an Open-Source Remote Controlled (RC) Snowplow that can help in clearing or removing snow from your driveway. Its a bare-bones RC vehicle that can be modified or customized using its code and supporting documentation. My goal was to put together a simple open-source Snowplow machine that people could build upon. I included 3D-printed files for easily converting the SnowByte into an RC platform for anything else, like for example an RC Lawnmower.

This project is my attempt at an RC snowplow that is not as expensive or as bulky as the other commercial RC snowplows on the market today. The frame was made using aluminum linear rails and 1/4" polycarbonate panels. Even though I aimed for this project to use an outlet for power, it can also be converted into a battery power RC snowplow.

This project came up as a necessity for myself, due to not being able to shovel snow myself for medical reasons. I needed to keep the size and weight of the snowplow down. All the solutions I could find were too expensive or too big for storing in a corner of my single-car garage. Another requirement of mine was that I didn’t want to use batteries, because I didn’t want to have to worry about charging them or battery life. Once I made my RC Snowplow, winter ended and I had no more snow for the rest of the year. So I then decided to extend the capability of the SnowByte by also making the lawnmower attachment parts.

I would love to see your own creations of this project and maybe feature them here as well. Please email me at cele9999@gmail.com with any videos/pics of your project. -Gerardo Cruz

2. Hardware Requirements

Most of the electronics and mechanical parts are off-the-shelf, but it does require some 3D-printed parts and a few other components to complete the project. If you have worked with any hobby electronics for RC toys, and have access to some basic power tools, then you should have no problem building this project. The code runs on an Arduino Nano and can be converted or ported easily to other microcontrollers or even into a Raspberry Pi.

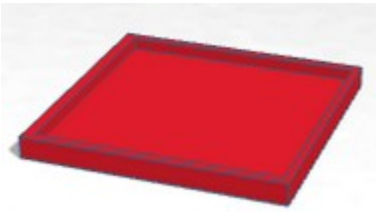
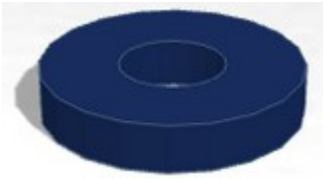
As mentioned before, the lawnmower attachment was an addition to the project so I have listed this as optional steps in the tutorial section of this guide. The frame was made using aluminum linear rails and 1/4" polycarbonate panels. Most of the electronics and mechanical parts are off-the-shelf, but it does require some 3D-printed parts and a few electronics components that need to be soldered to complete the project. If you have worked with any hobby electronics for RC toys, and have access to some basic power tools, then you should have no problem building this project.

2.1 Parts:

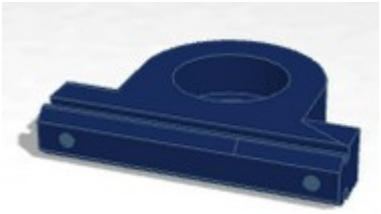
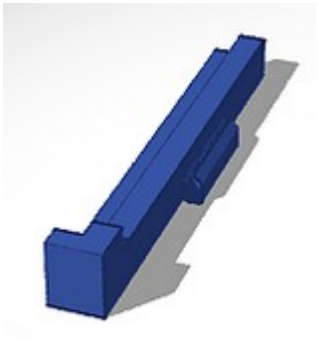
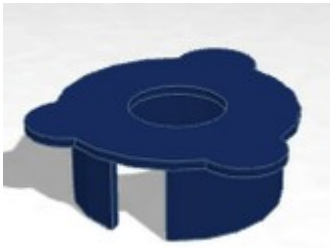
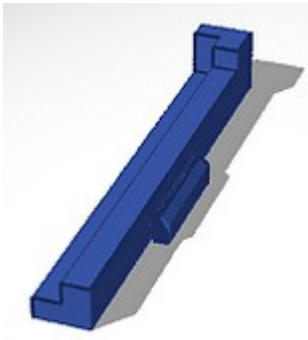
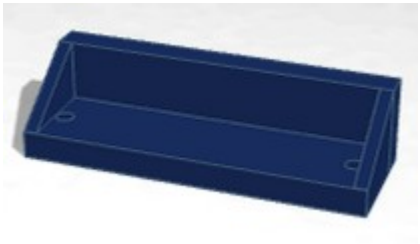
Part Name	Link
Power Supply	www.amazon.com/dp/B0146IAXYO
Linear Rails	www.amazon.com/dp/B09DYL4KK4
Linear Actuator	www.amazon.com/dp/B093ZP8JP6
Bracket Connectors	www.amazon.com/dp/B09ZPGTX38
Motor Driver	www.amazon.com/dp/B06XGD5SCB
Fuse Holder	www.amazon.com/dp/B07426WCLM
15A Car Fuse	www.amazon.com/dp/B08NSF2WXW
Power Socket	www.amazon.com/dp/B07RRY5MYZ
DC Motors (with sprocket)	www.amazon.com/dp/B00D3OROGI
#25 Bicycle Chain	www.amazon.com/dp/B018WFTE8I
Roller Chain Detacher	www.amazon.com/dp/B092PWDZH1
Gauge 14 Wire	www.amazon.com/dp/B0796KD4YF
#25 Chain Sprocket	www.amazon.com/dp/B06WWD95YX
Polycarbonate 1/4"x24"x36" Sheet	www.amazon.com/dp/B09254M5WB
6 Channel RC Transmitter and Receiver	www.amazon.com/dp/B097XXVF8R
1/2" Bore Shaft Collars	www.amazon.com/dp/B07GSW5LQZ
#25 Roller Chain Connector Link	www.amazon.com/dp/B01E6AZ55Y
#4-40 Hex Nut	www.amazon.com/dp/B000N2YSU8
#4-40 x 3/4" Phillips Screws	www.amazon.com/dp/B0B5GJZCKS
Snow shovel	www.amazon.com/dp/B00295R2AK

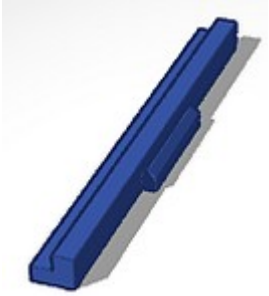
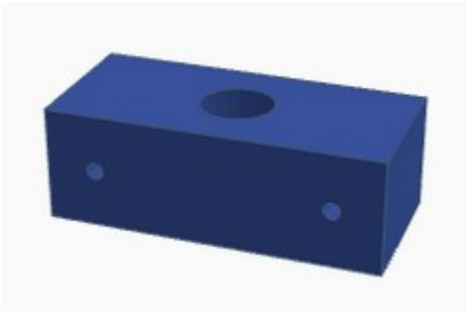
Perf board	www.amazon.com/dp/B07RC68D5C
+12V regulator	www.amazon.com/dp/B07XTDB7LJ
1/2" All threaded rod	www.amazon.com/dp/B002YLT50O
1/4" All threaded rod	www.amazon.com/dp/B083R6BNKP
1/2" Hex nut	www.amazon.com/dp/B0767LJXPV
1/4" Hex nut	www.amazon.com/dp/B07WHKRLWN
Lawnmower wheels	www.amazon.com/dp/B0C2TXPNTZ
Arduino Nano	www.amazon.com/dp/B07R9VWD39
Jumper wires female-female	www.amazon.com/dp/B01EV70C78
Male header pins	www.amazon.com/dp/B07R5QDL8D
Insulation tape	www.amazon.com/dp/B0BVMF2FYH
Assortment kit	www.amazon.com/dp/B01N5FWUCR
Loctite	www.amazon.com/dp/B018IW732E

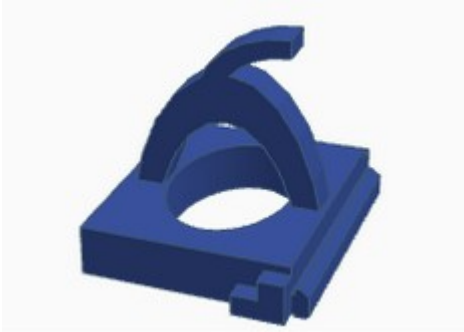
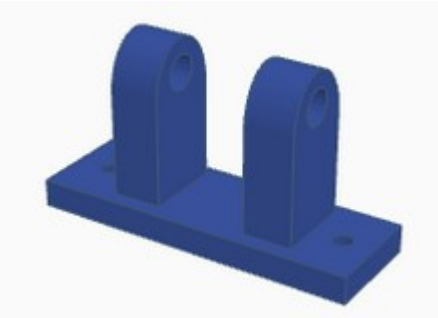
2.2 3D-Printed Parts:

#	Filename	3D Part
3	driver-holder.stl	
8	rail-anchor-short.stl	
1	gear-guide.stl	

4	motor-sleeve-spacer.stl	

2	rail-holder.stl	
2	lid-cover-frontface-half-l.stl	
2	motor-sleeve-v2.stl	
2	lid-cover-frontface-half-r.stl	
44	tank-thread.stl	

2	lid-cover-side.stl	
1	plow-arm-l.stl	
1	plow-arm-r.stl	
1	lid-hinge-spacer.stl	
4	axel-holder.stl	

1	cable-holder.stl	
1	actuator-holder.stl	

2.3 Circuit Schematics:

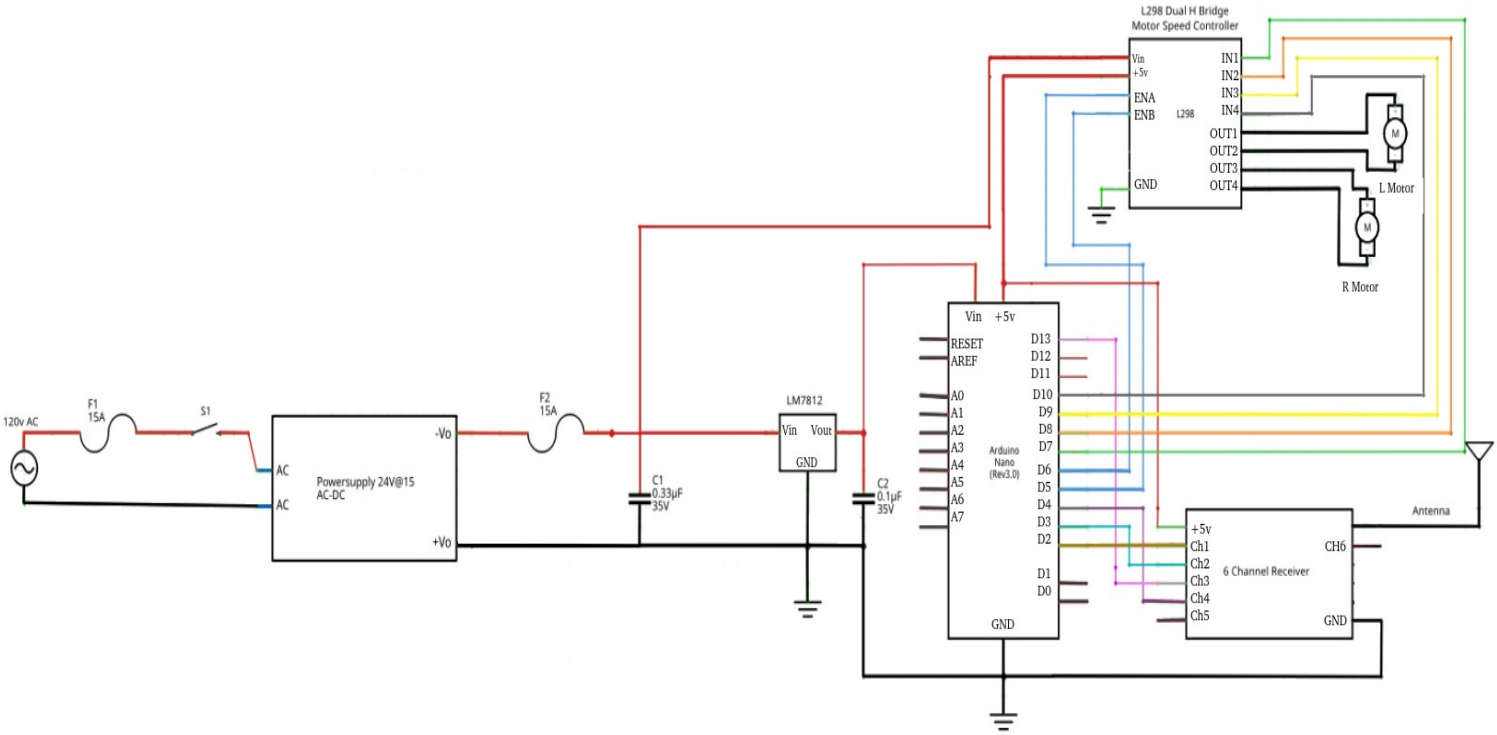


Figure 1: RC Snowplow Schematic

Note: In figure 1, pins D11 and D12 are reserved for the linear actuator to be raised or lowered via a couple of relay modules. Which would drive a linear actuator to raise or lower the snowplow or lawnmower attachment. The figure below shows the circuit diagram for connecting pins D11 and D12 to the relay modules and into the linear actuator.

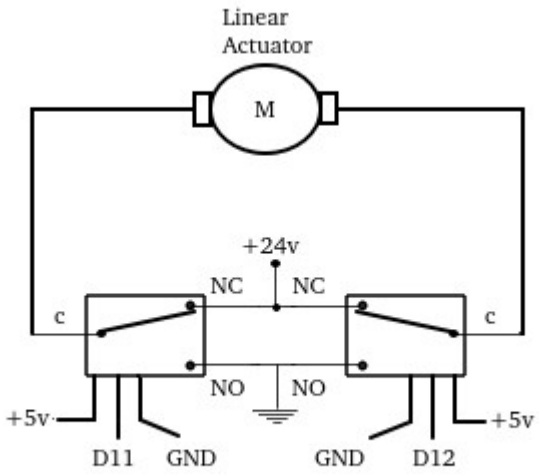


Figure 2

3. Software Requirements

The code was written for the Arduino Nano, but it can be ported to other platforms or microcontrollers. Code is uploaded to the board using the Arduino IDE; download the latest version here:

https://www.arduino.cc/en/main/software

4. The Code

The code is located in https://github.com/cele9999/RCSnowplow under the ‘./arduino-code/snowbyte/’ folder. Open the ‘snowbyte.ino’ file using the Arduino IDE. For the purposes of this guide I will be using an Arduino Nano, but this code can be or used on other Arduino microcontrollers. After this you should be ready to upload the code by clicking on the upload button.

If you wish to use other microcontrollers or another device like a Raspberry Pi, then the code will need to be converted and will be up to the user. Hopefully in the future, with revisions and updates to the project I could create a Python version of the code for other devices that can run MicroPython and be able to serve as another alternative for the Arduino. Still this doesn’t solve the issue that the logic levels are mainly at 5v. So a stock Raspberry Pi might not be the best alternative for this.

5. Build Instructions:

5.1-Making the Frame

Get the linear rails and cut them to make the frame with the following dimensions:

Frame Dimensions	In Centimeters	In Inches
Length	35cm	13.78”
Width	25cm	9.84”
Weight	15cm	5.91”

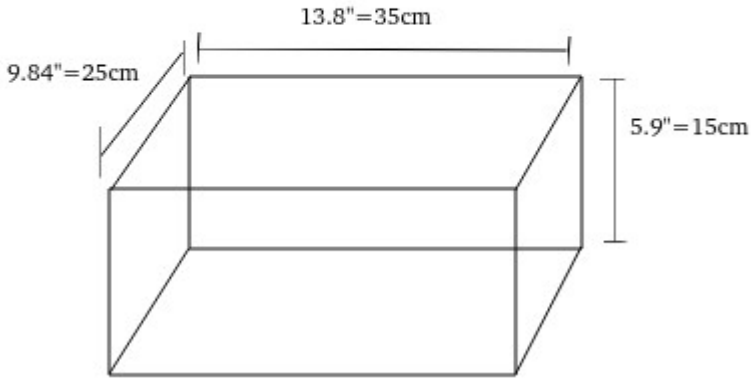


Figure 3 Frame Dimensions

Connect the frame with the bracket connectors and you should end up with a frame like this:

Figure 4 Assembled Frame

5.2-Making the Panels

Take the polycarbonate panel and cut it into the following pieces:

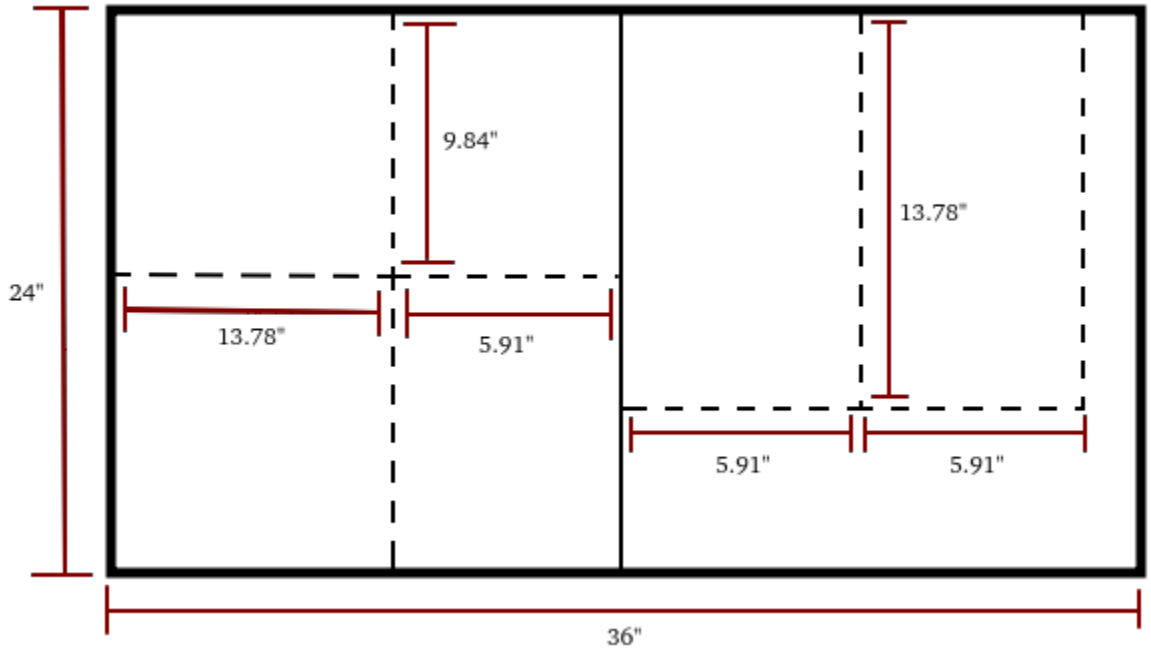


Figure 5

The dimensions are written very specifically, but you can round them and then sand them or cut them down to fit into frame as the panels for the frame.

You should end up with the following polycarbonate panels:

Number of panels	Length	Width
2	13.78”	9.84”
2	13.78”	5.91”
2	9.84”	5.91”

Drill a 3" circle for the motors in each of the 13.78” * 5.91” panels. The circle should be placed in the following location:

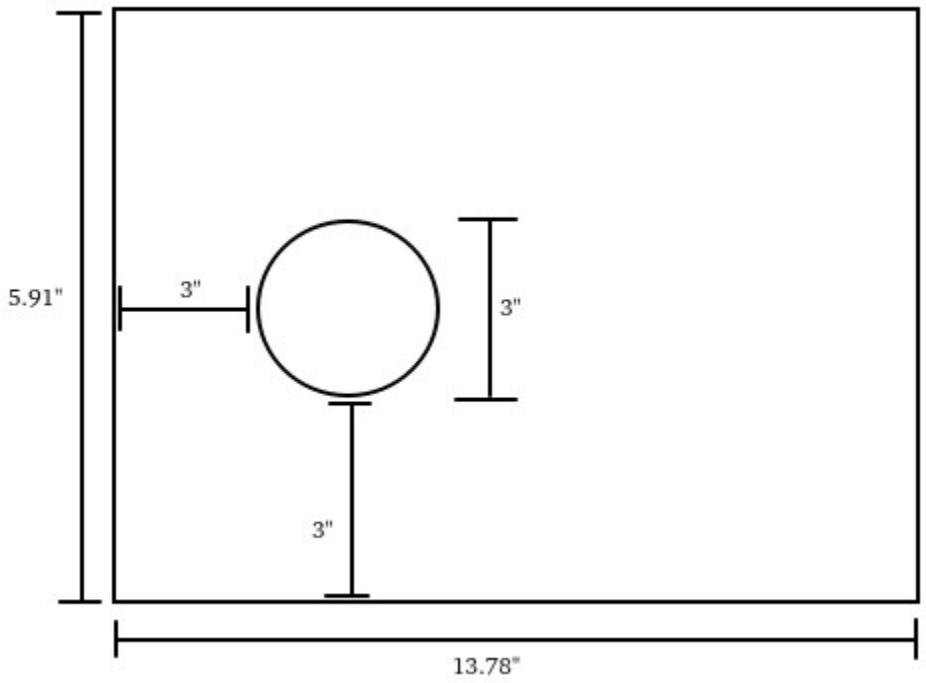


Figure 6

Cut a ~2"*1" rectangle in one of the 15cm*25cm polycarbonate panels for the outlet connector. Shown in the figures below.

Figure 7

The outlet connect should be centered at about 2" from the bottom of the panel. I used a drill and then filed the outline of the outlet until if fit.

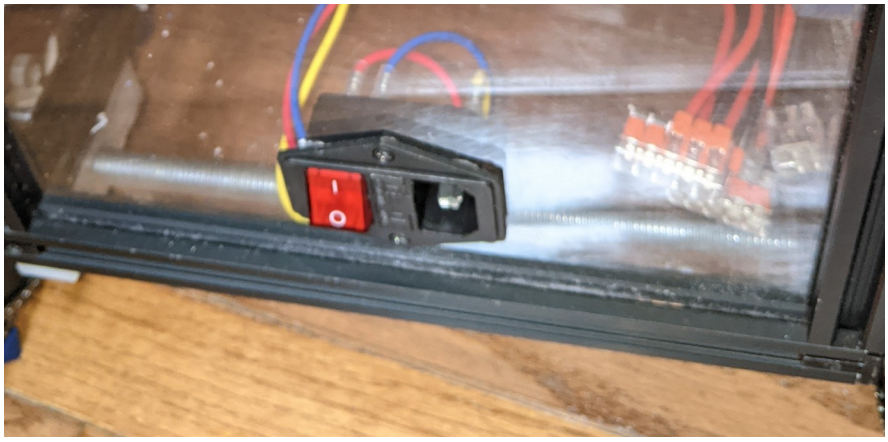


Figure 8

5.3-Wheels and Axles

Cut the 1/2" all threaded rod into 2x 11.25".

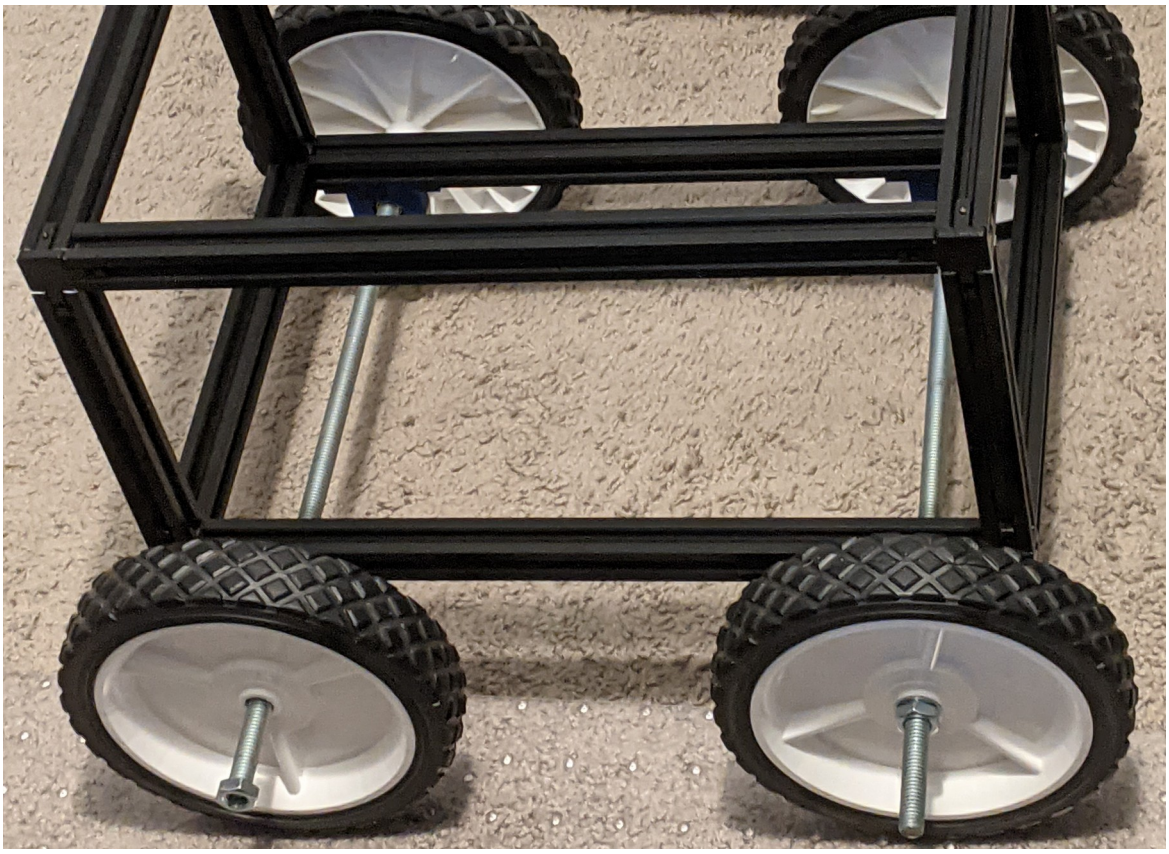


Figure 9

Place the cut polycarbonate panels in all the sides of the frame and the bottom panel. Cut any extra polycarbonate if you need to make the panels fit along the corners of the frame. The top panel should not be placed into the frame yet. Later we will install the top panel on a hinge and use it as a lid, but for now we still need to work on the internal components of the SnowByte.

Place the 3d printed parts (motor sleeves, axle holder, cable holder and the top lid siding) and tighten the screws and t-nuts in the bottom of the frame. The axle holders should be at each end of the frame for the wheels to be installed.

Figure 10

5.4-Installing the Motors

Place the motors in the sleeves and 2 spacers for each motor. You might have to sand the sleeves a bit for the motors to fit in. The motor sleeves and spacers should be placed first from outside of the polycarbonate panel. Then the motors can be installed from the inside and everything should be held in place.

Figure 11

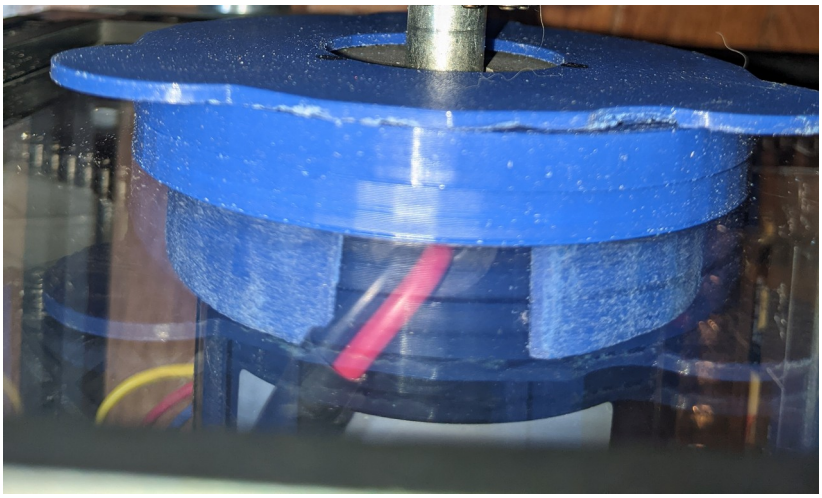


Figure 12

Notice that the 2 spacers in the figure above are on the outside of the polycarbonate panel. This is so the motor sprocket and chain ring have enough space to move with the chain and not hit the frame.

5.5-Installing the Chain ring and the Wheels

Drill 4x 1/4" holes into 2 of the lawnmower wheels by using the 3d-printed wheel drill alignment part or gear guide. This took a little bit of time because at the time I didn't have a 3D printed guide to line up the holes of the chain ring with the wheel. Now you simply put the wheel face down, place the 3D printed gear-guide and then pace the chain ring on it and mark where you will be drilling. Should end up with the 2 wheels looking like the following:

Figure 13

Figure 14

Cut the 1/4" threaded rods into 2.5" pieces and placed thru the 1/4 holes in the wheels. Tighten with nuts the 1/4" threaded rods thru the 2 lawnmower back wheels with the drill holes and place the #25 chain sprockets thru the threaded rods.

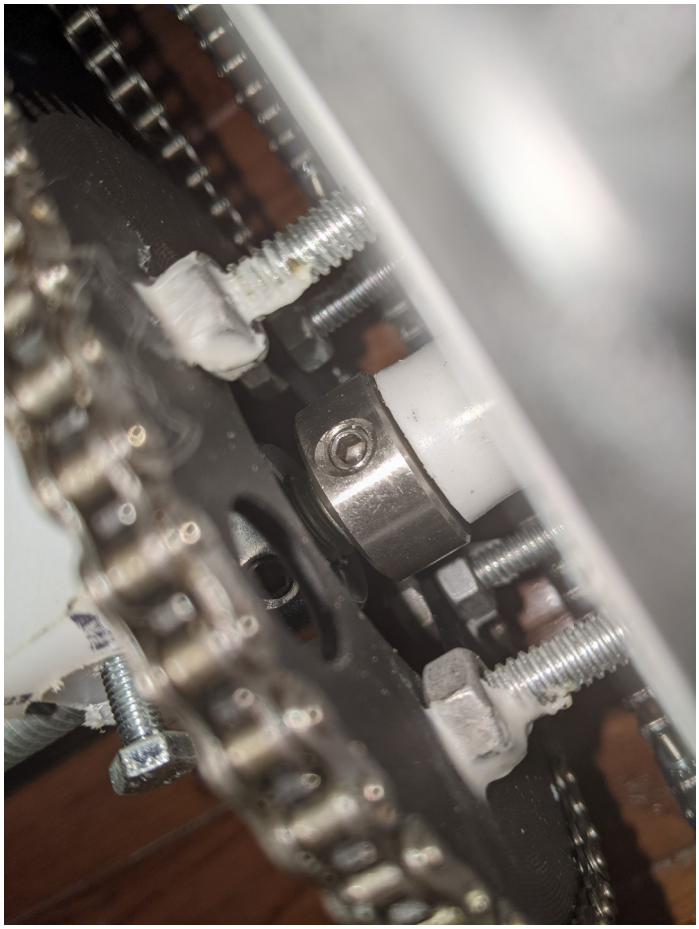


Figure 15

Secure the sprockets and the threaded rods with 1/4" nuts and tighten as needed. I also applied Loctite once everything was lined up to prevent the chain ring from moving out of alignment.

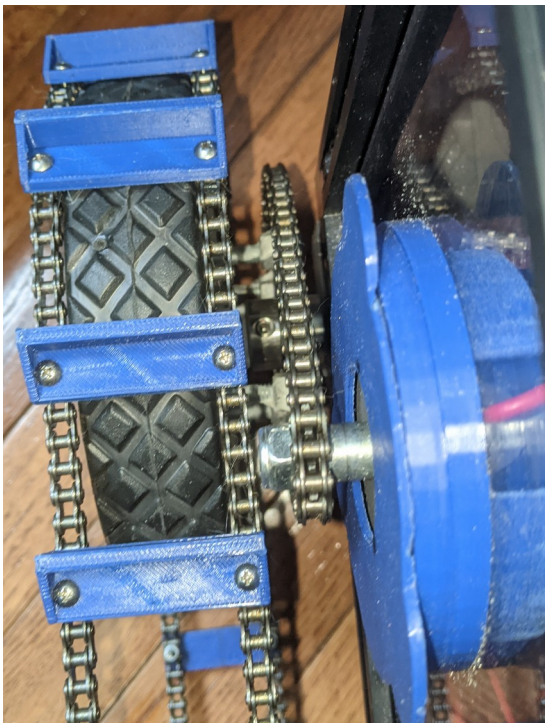


Figure 14

5.6-Securing the sprockets and the Wheels

Measure the #25 chain required to connect the motor sprocket to the back wheel chain ring.

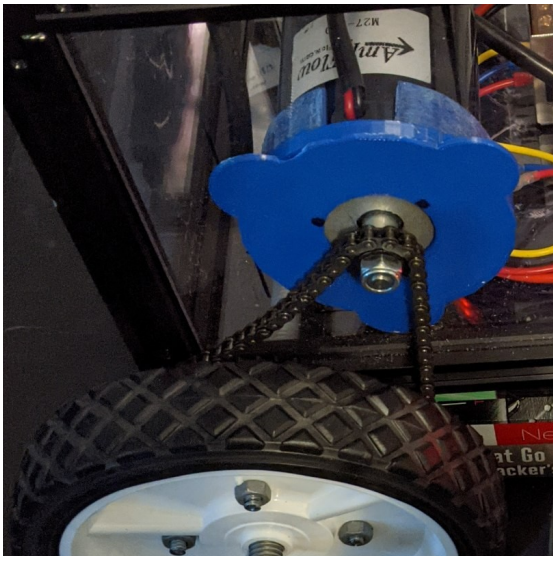


Figure 15

Place the 1/2" threaded rods thru the axle holders and place 2 shaft collars in each side, followed by the lawnmower wheels. And each axle end will have another shaft collar to hold the wheels in place. So each wheel should have 2x shaft collars on the inside and 1x shaft collar outside the wheel.

Figure 16

5.7-Testing all the Electronic Components

Test all the electronics components with the RC control and adjust the wiring as needed before installing inside the frame. I suspended the frame with books on a table in order to test the components and to check the proper wiring before installing inside the frame. This also made it easier to measure and connect the chains for the motors and wheels plus the tank threads later on.

5.8-Installing the Electronics

Start connecting and placing the electronic components inside the frame and connecting to the motors. Follow the schematics in section 2.3 of this document.

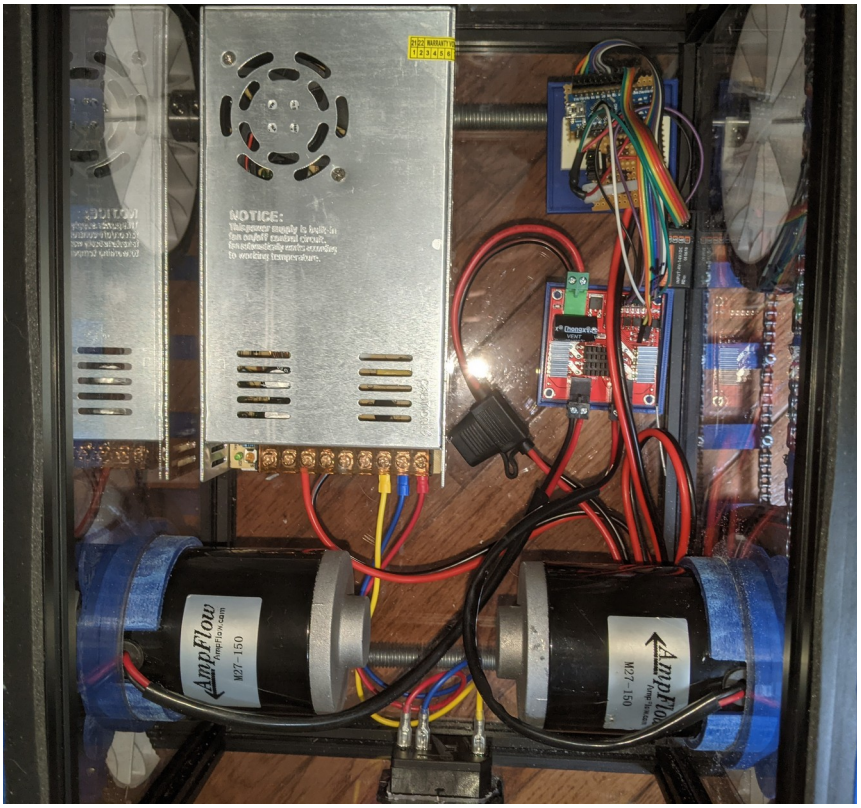


Figure 17

5.9-Installing the Tank Treads, Trims and Lid

Place the 3D-Printed tank treads into the #25 chain as you wrap them around the wheels on each side. Put a little more tension on the treads by separating the front and back wheel as far as the chain allows you and lock them in with the axle-holders. As you see in the figure below I had not done this before the picture.

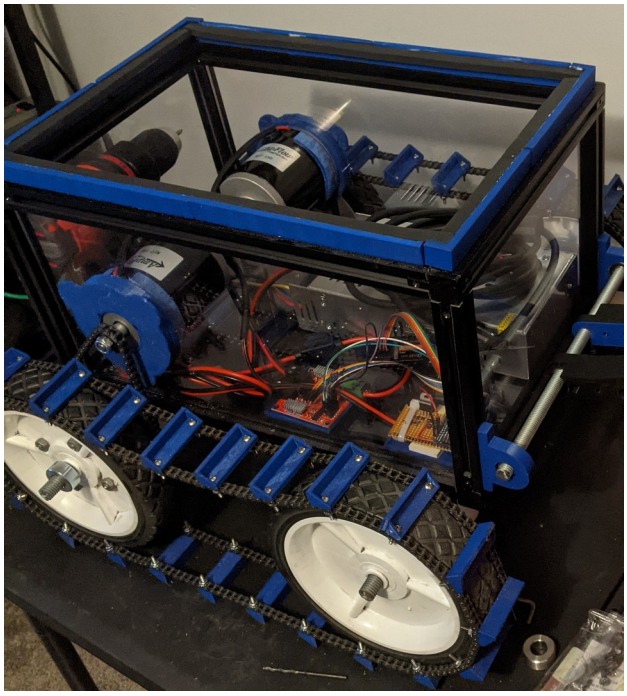


Figure 18

Measure the top lid hinge placement and drill into the top polycarbonate panel and secure with screws.

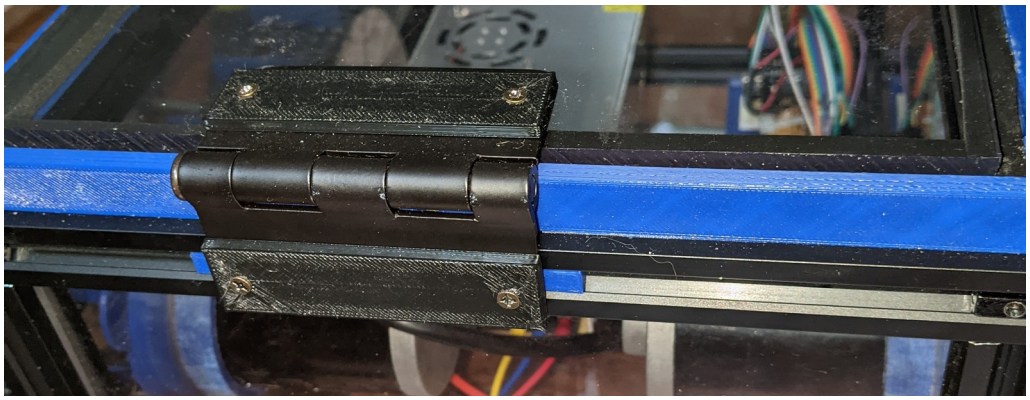


Figure 19

Install the 3d-printed parts for the lid and the plow holder attachment. I placed rubber insulation adhesive around the top border of the frame to seal the top lid. A folded piece of tape was used on the front of the top lid to use for lifting the lid.

Figure 20

5.10-Installing the SnowPlow Attachment

Cut a piece of the 1/2" all threaded rod to 18.5" for holding the 3d-printed arms and the snow shovel. This is the step where you can decide to replace the snowplow attachment with whatever you desire. But for the purposes of this guide I’m simply attaching a snow shovel.

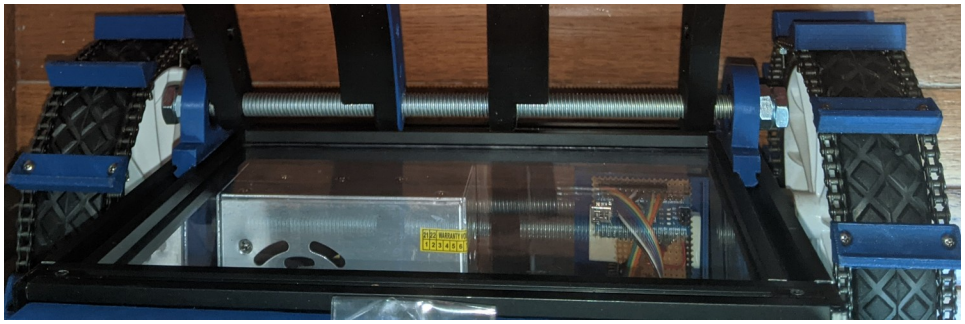


Figure 21

Remove the handle from the snow shovel and drill into the 3d-printed attachment holder arms.

Figure 22

Place snowplow attachment thru the all threaded rod and secured with a couple of 1/2" hex nuts and Loctite. You can also lock the 3D-Printed rail-holders with a screw and a t-nut onto the bottom of the linear rail in order to prevent the snowplow attachment from sliding up.

Figure 23

5.11-(Optional) Installing a Linear Actuator

I decided to install a linear actuator for raising and lowering the snowplow after finishing this project and wasn't really necessary for the use of the RC Snowplow. But I can see how someone else might needed for adjusting height or for some other attachment ideas. Using the 3D-Printed actuator-holder, mark and drill with a ¼" drill bit the holes for the linear actuator holder. I also drill another hole for the cable to pass from the top lid to the inside of the frame. Installed the 4" linear actuator with its base in the middle of the polycarbonate top lid and secured it using screws and nuts. I used a DYI linear actuator designed by Michael Rechtin (link in the References section). Also included a ready to order linear actuator in the part's list if you don't want to build your own.

Figure 24

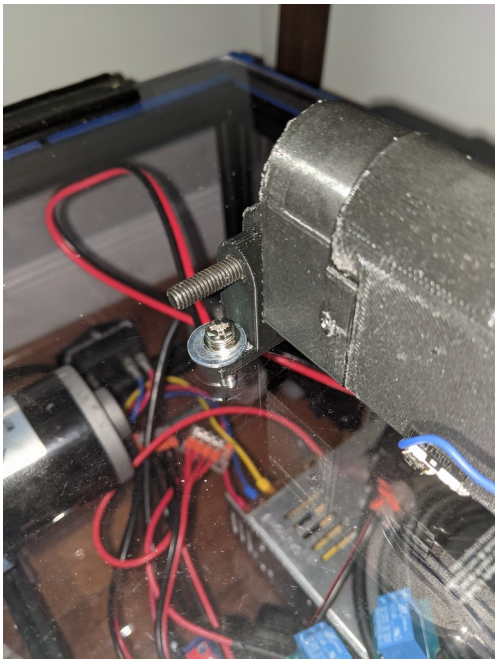


Figure 25

Utilized a metal wire to tie the snow shovel to the linear actuator in the following picture.

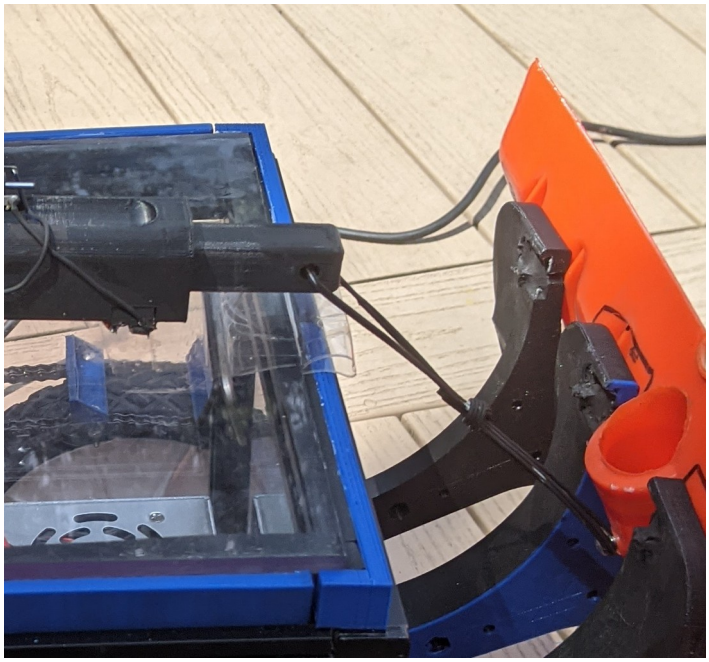


Figure 26

The SnowByte:

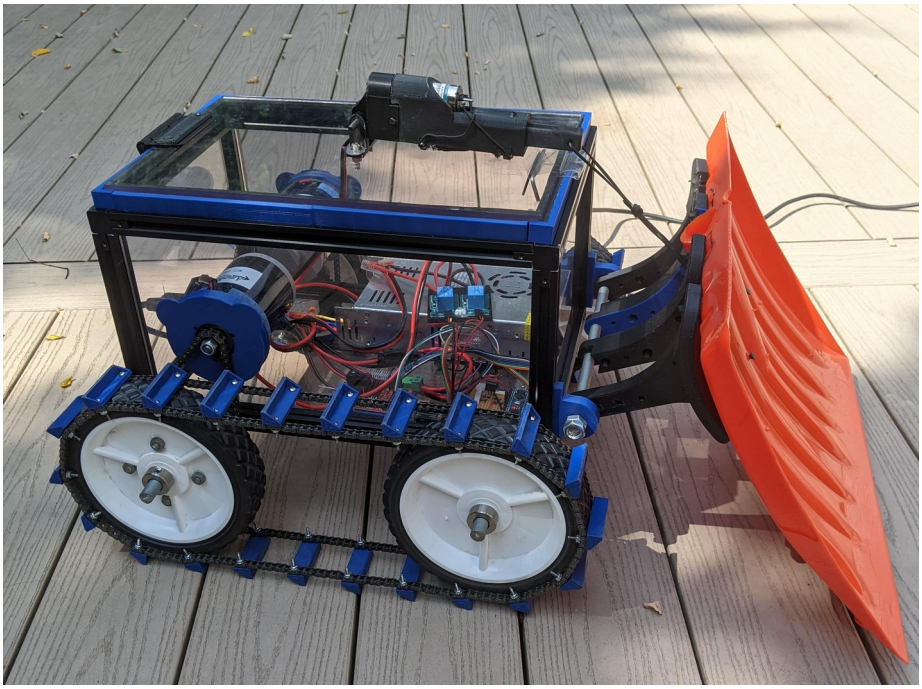


Figure 27

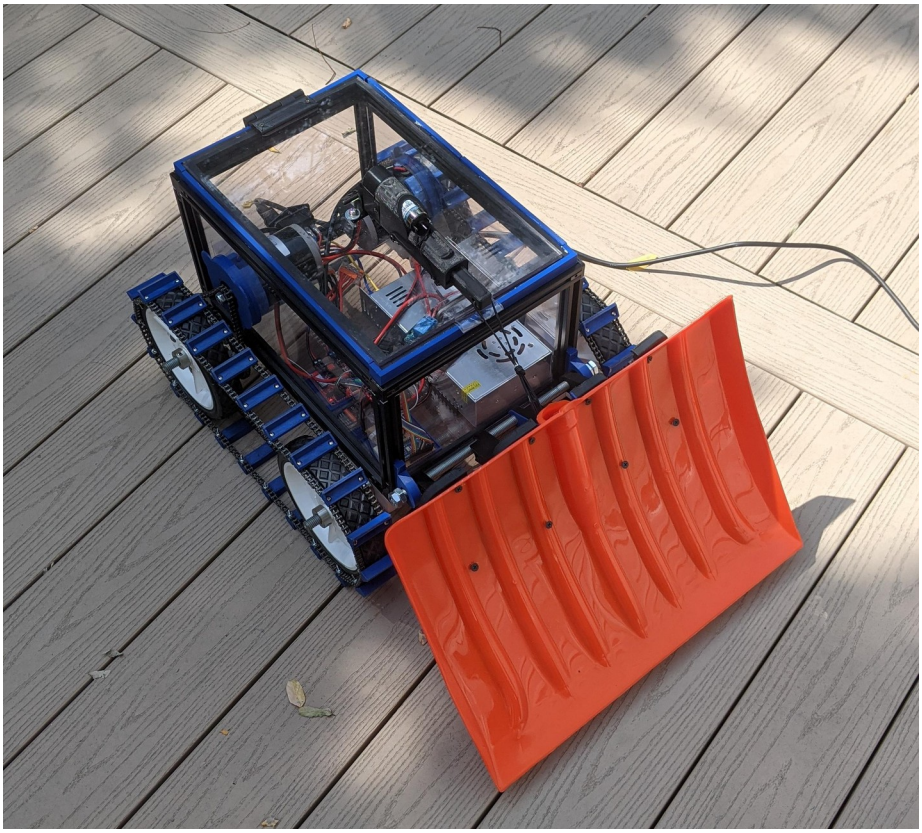


Figure 28

6. Frequently Asked Questions

- Can you use this RC robot for other things like cutting the grass or dragging a cart full of heavy equipment?

  Sure, as long as job doesn’t require more than .4 horsepower and/or more than 15A. I also included a 3D-Print part for holding a weed wacker attachment, just in case.

- Can this project work with other microcontrollers or a RPI?

  Yes, you can customize the code to work with any other microcontrollers and a even RPI. For the RPI you would just need to convert the logic from 3.3v to 5v. Because most parts detect a digital 1 with 5v and not 3.3v.

- What is the difference from the RC Lawnmower and the RC Snowplow?

  Just the attachment and using an extra GPIO pin in the microcontroller and another relay module to turn on the trimmer motor.

7. License Information

8. Disclaimer

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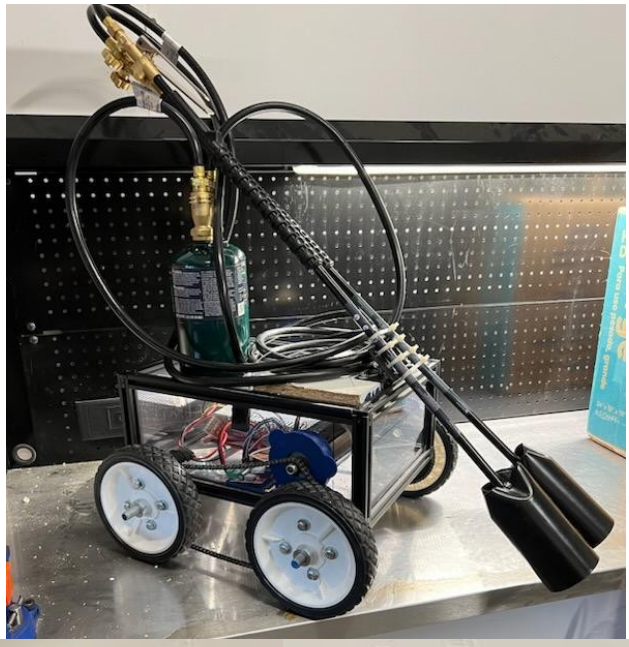
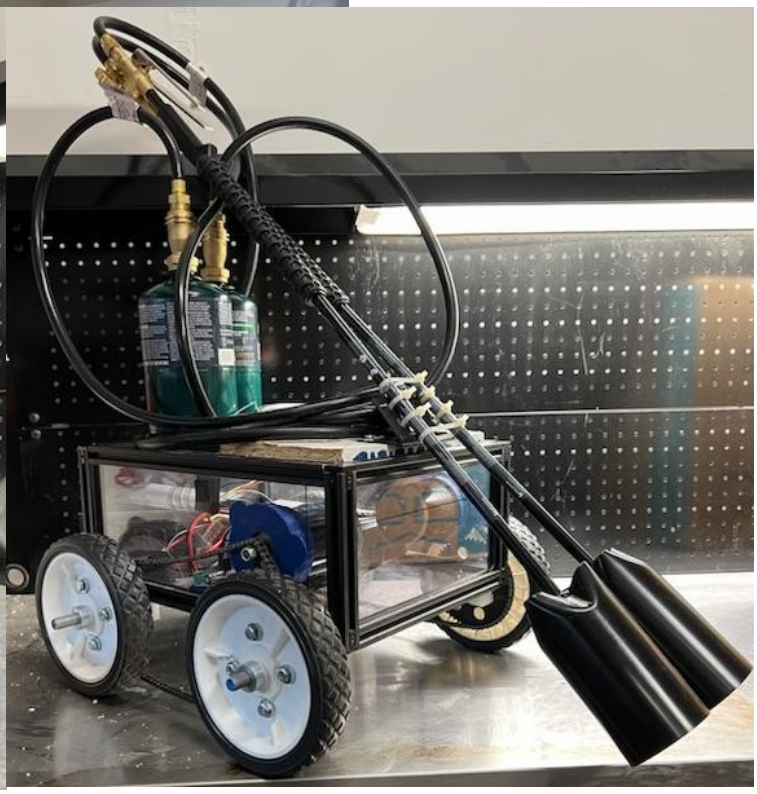
9. Special Thanks

- Shout out to my good friend Scott P, who help me by letting me use his power tools that allowed me to complete this project. He also build his own version of the SnowByte, with a few customizations and here are some pictures of his RC SnowMelter.





10. References

- Open-Source Snow Plow-Link
- Michael Rechtin’s DIY Linear Actuator-Link
- Creative Commons License-Link