

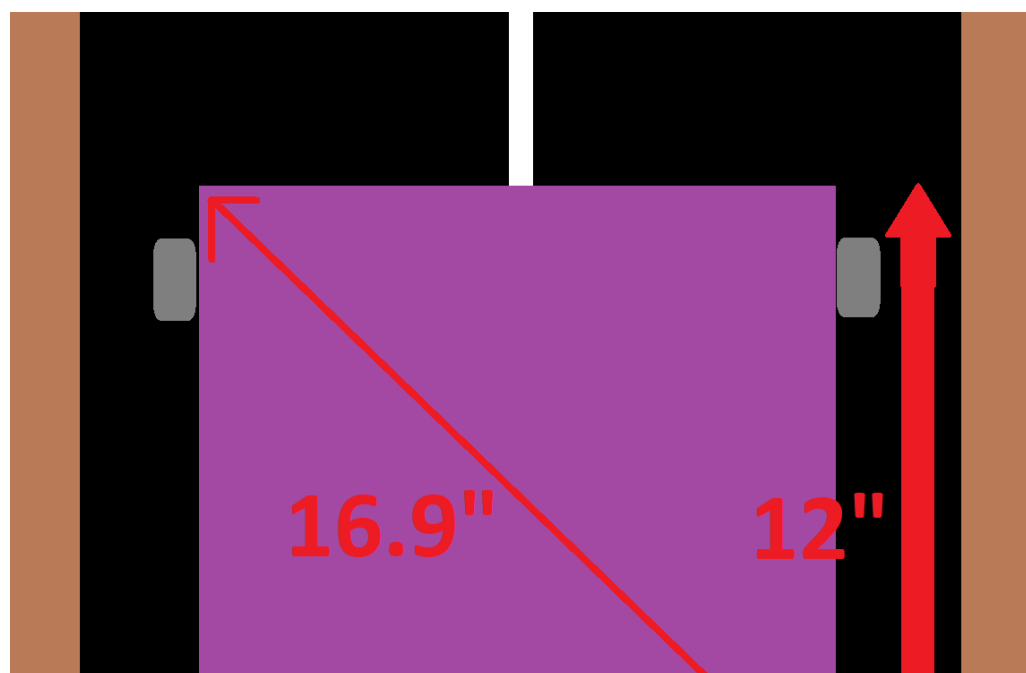
Signoff – 1/24/2022 - Chassis

Monday, January 24, 2022

10:57 AM

Chassis Specifications

The main purpose of the chassis is to house the other subsystems of the robot. Additionally, the combination of the chassis' structure and any external subsystems must conform to fit into a 1 cubic foot form factor at the beginning of the competition. Once a competition run has begun, the robot is allowed to extend beyond this form factor. Another constraint on the chassis is the limited turn radius of the game track. If the chassis' footprint measures 12" x 12", the robot will not be able to turn around on the narrow portions of the track. The figure below illustrates the necessity of conforming to this specification. The track itself measures 16" across, and the robot's width and length are each specified at 12" or less. This allows the robot to traverse the track in its initial direction. However, if the robot attempts to turn, its diagonal length of 16.9" will exceed the track width. Designing around this constraint involved dividing the chassis into a stationary lower compartment, which is used to house the electronic components (microcontrollers, drivetrain, power supply system), and an upper platform attached to a turntable. This turntable must rotate 180 degrees to allow the robot to fire beads horizontally in either direction perpendicular to the track. Lastly, the chassis was designed in order to maximize the reach of the robotic arm. In order to do so, a tiered design was incorporated onto the upper platform.

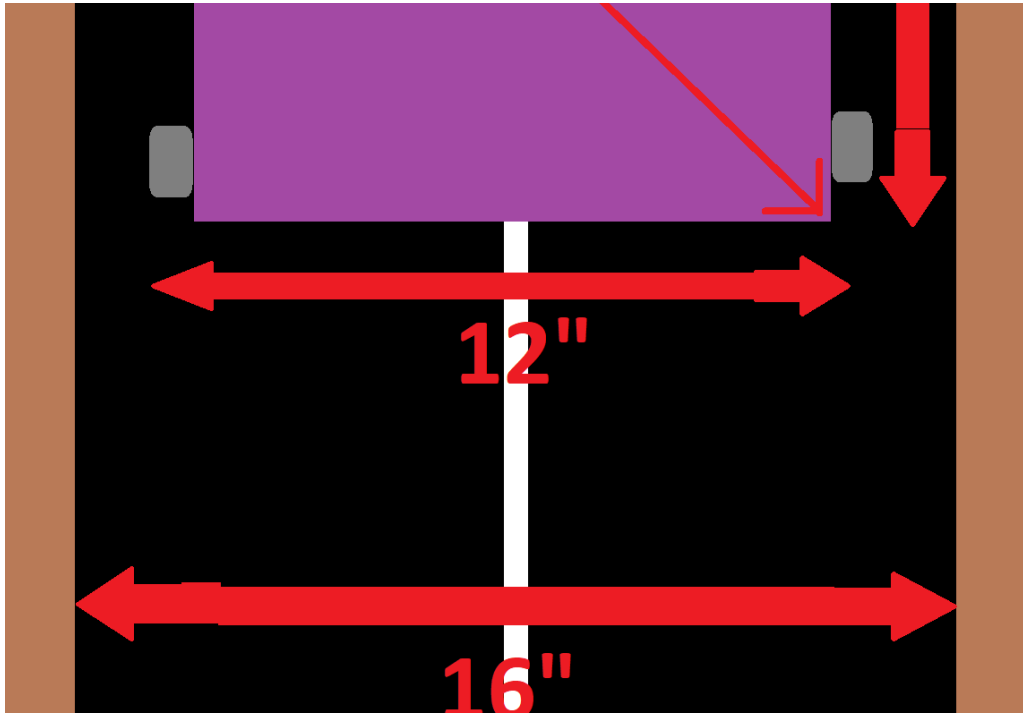


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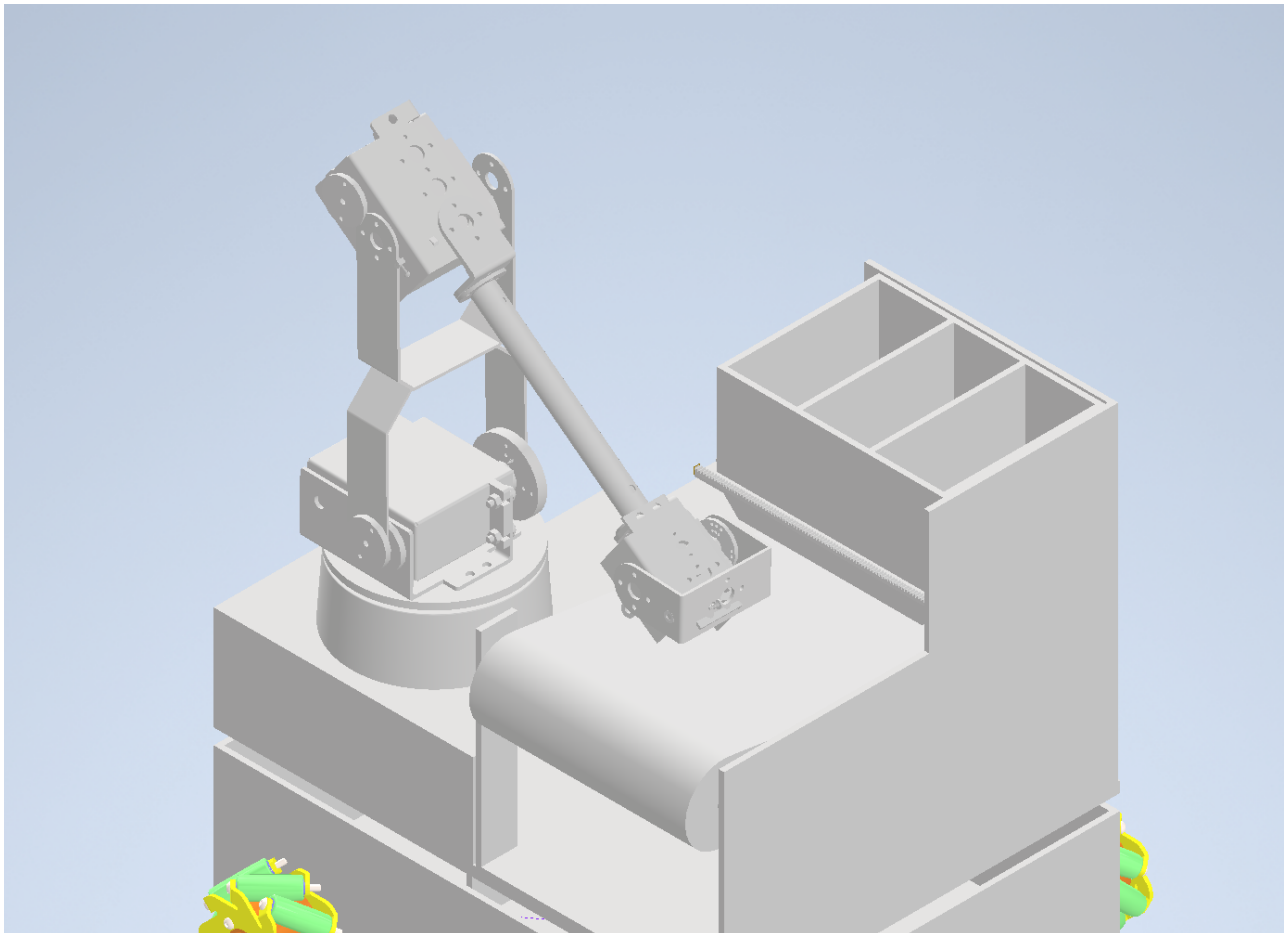
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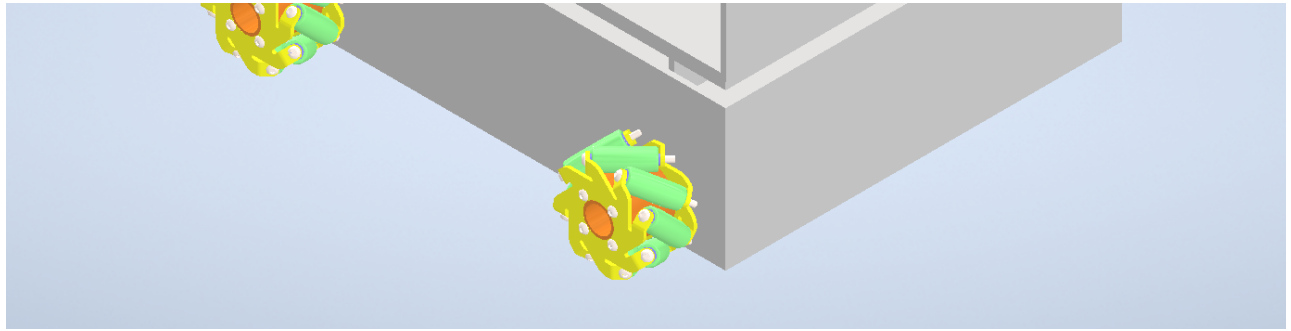
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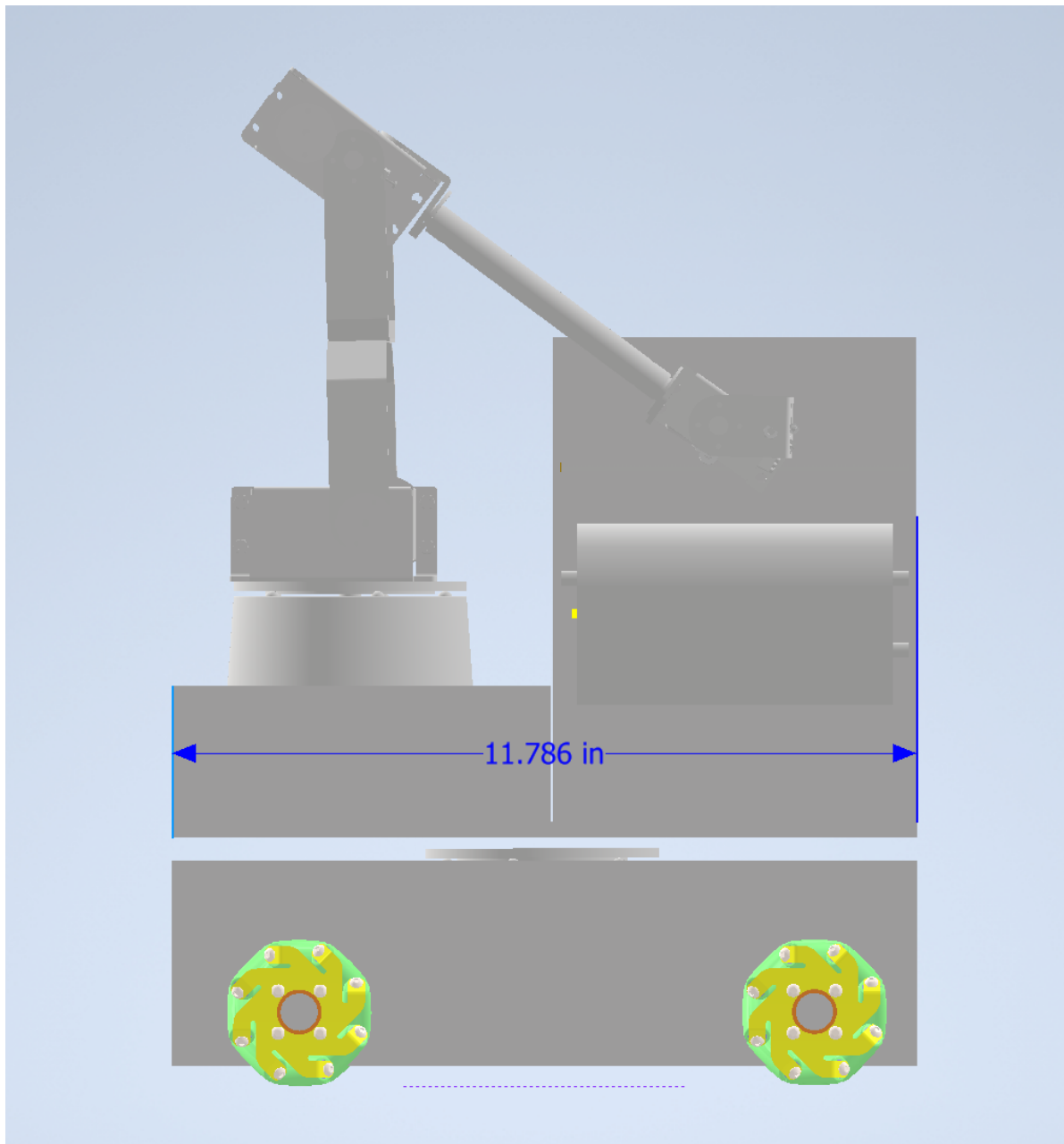


Chassis Design

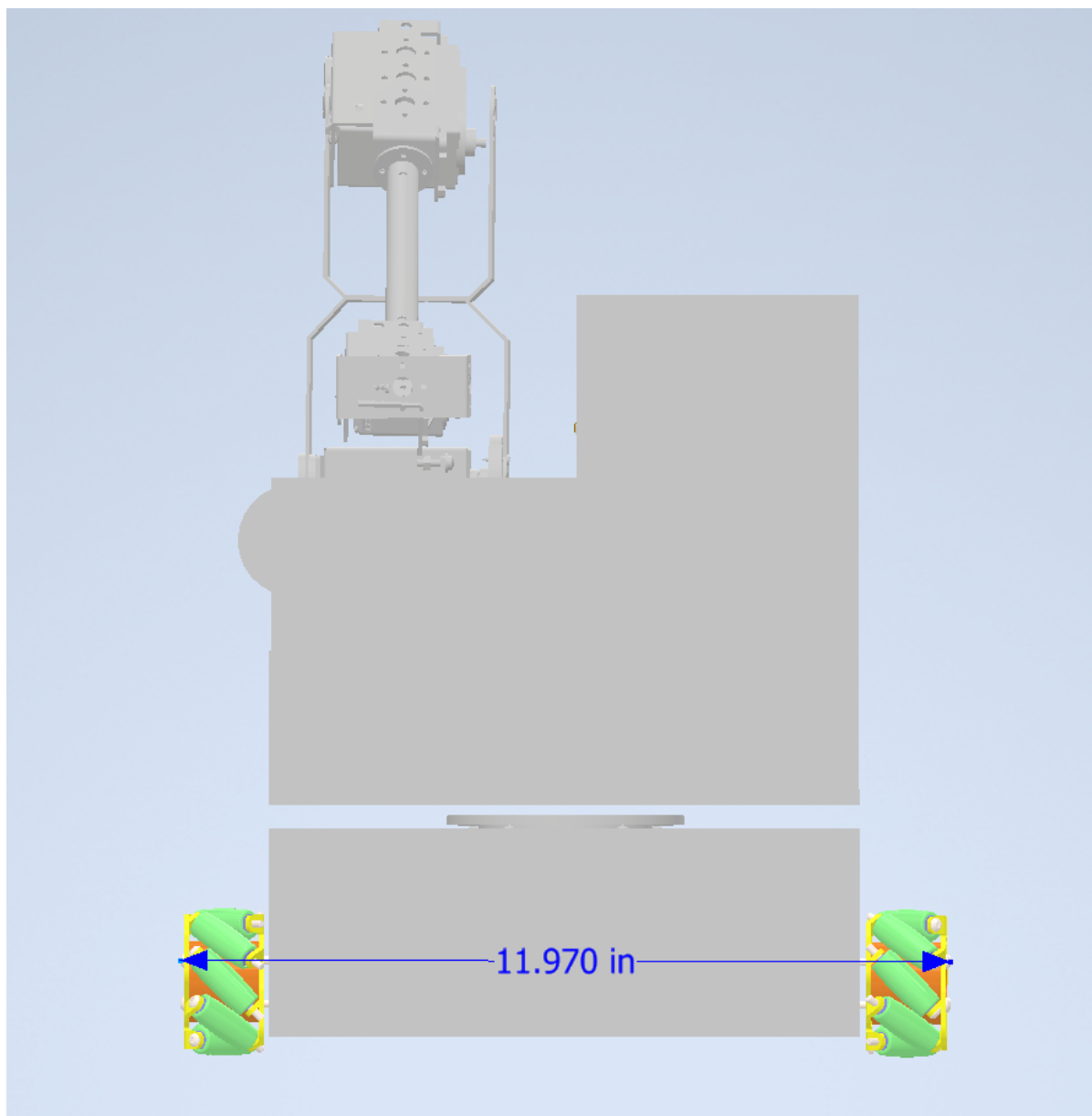




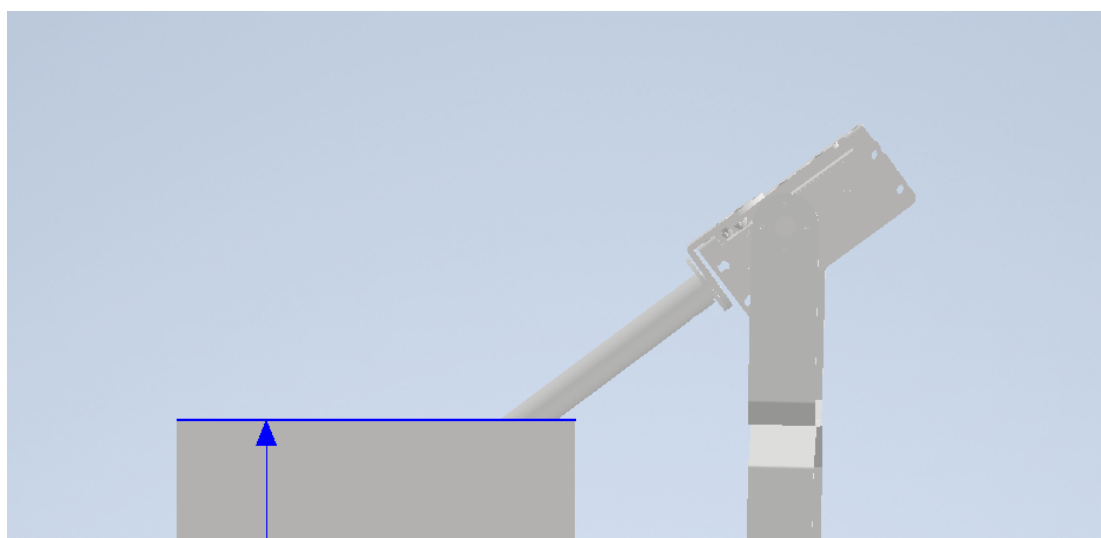
Overview of the Chassis

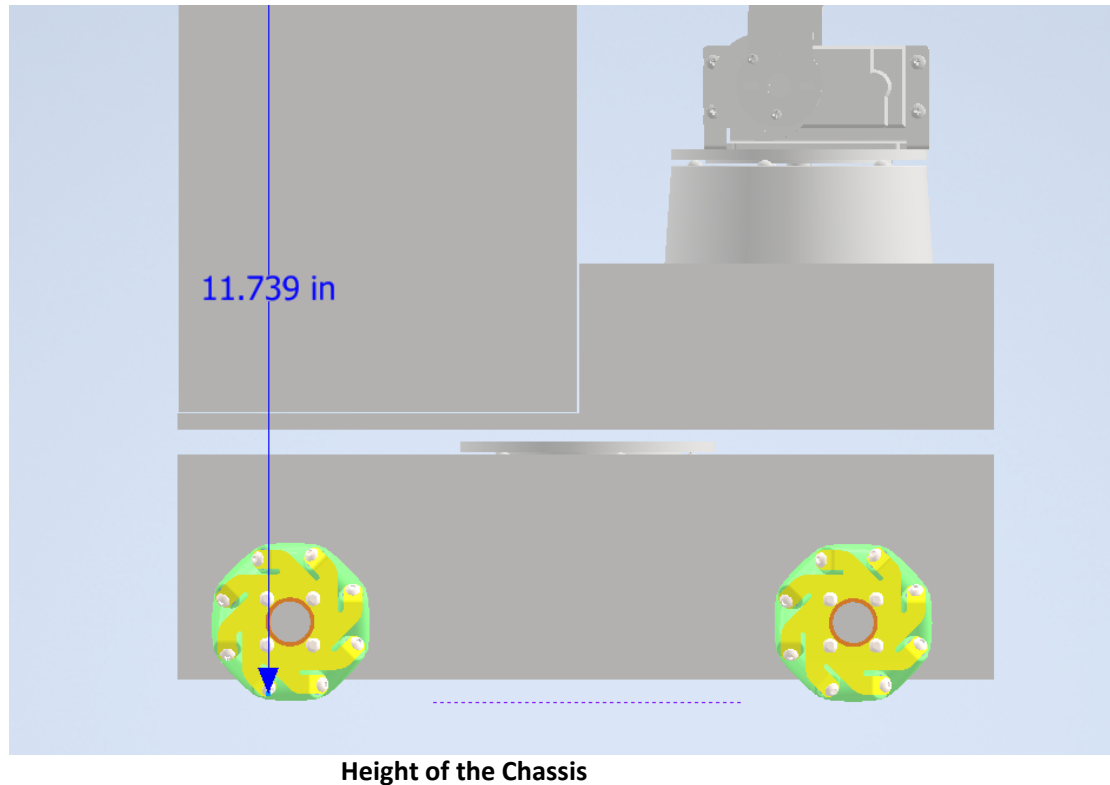


Length of the Chassis



Width of the Chassis



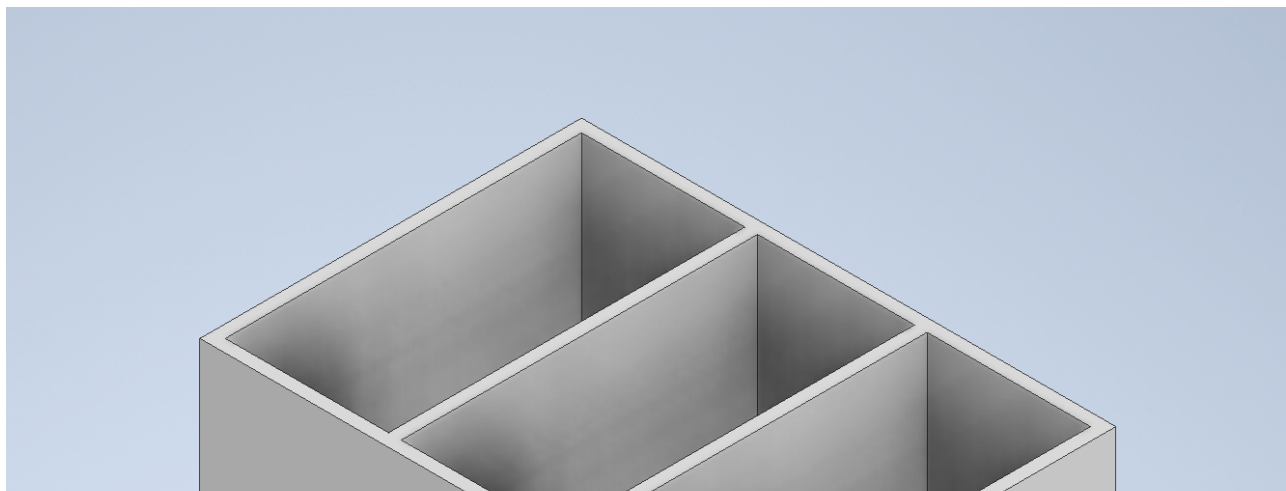


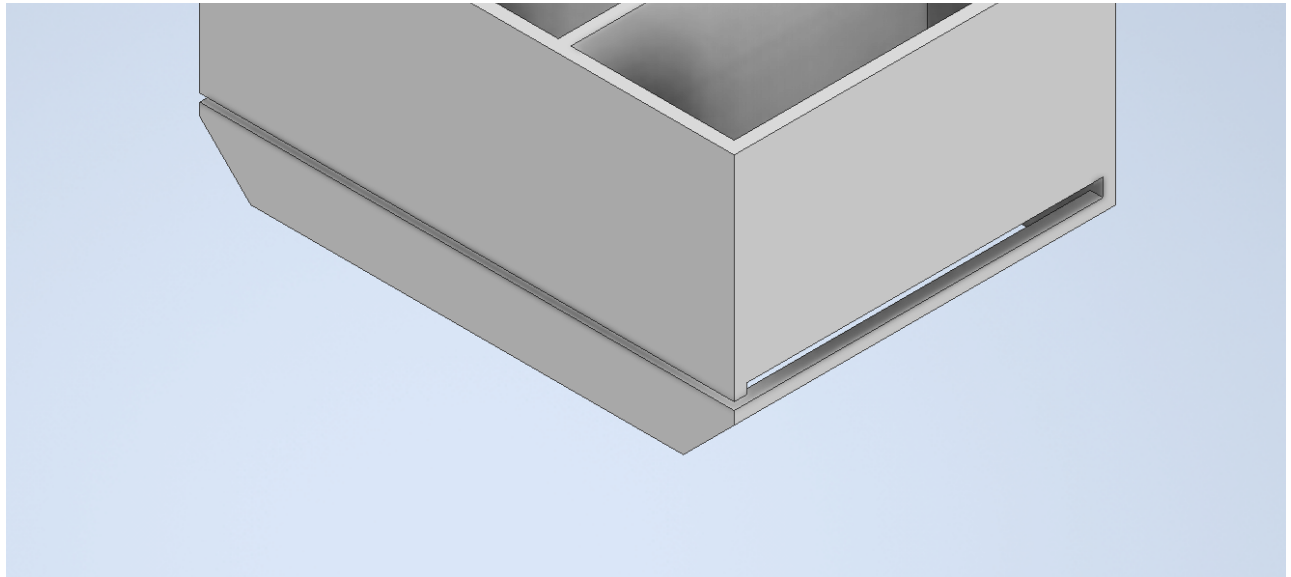
The lower compartment of the chassis will measure 9.175" x 11.8" x 3.25" and will serve as the housing of the major electronic components including the microcontrollers, drivetrain, and power supply system. This component will be constructed using acrylic sheets. The upper chassis will be constructed as an 9.175" x 11.8" acrylic platform that will be affixed to the turntable. The rear half of this platform will be raised an additional 2.15" and will serve as a platform for the robotic arm and shooting mechanism motor. A gap in this platform allows the robotic arm to fold into itself before the competition begins. The horizontal, load-bearing platforms of the robot will be constructed from 0.25" thick acrylic sheets, while the remaining acrylic components will be 0.125" thick. This choice was made in order to reduce the flex on the acrylic. The total necessary acrylic is shown in the table below.

	Dimensions	Acrylic (sq. inches)
.25"		
Upper Chassis	9.175 x 11.8	108.265
	6 x 4.920 + 4.25 x 3	42.27
Lower Chassis	9.175 x 11.8	108.265
Total:		258.8
.125"		

Upper Chassis	2.15 x 6	12.9
	2.15 x 3	6.45
	2.15 x 3	6.45
Lower Chassis	11.8 x 3.25	38.35
	11.8 x 3.25	38.35
	9.175 x 3.25	29.81875
	9.175 x 3.25	29.81875
Shooting Mech. Housing	4.835 x 9.125 + 2.835 x 4.375	56.5225
	5.75 x 9.125	52.46875
	4.835 x 0.849	4.104915
	7.67 x 5.75	44.1025
Total:		319.336165

Additionally, the upper chassis will house the shooting mechanism and a 3D printed compartment for sorting and storing the beads. The shooting mechanism housing rests on a 5.75" x 9.25" platform. Three vertical walls extend upward to support the belt's rollers and the storage compartment. This compartment measures 5.25" x 3.75" x 2.8" and contains a false bottom that will hold the beads in place until a motor slides the false bottom free of the container. A geared tab on one side of the false bottom was included to facilitate this movement. A motor will be mounted to the compartment to drive the false bottom. This reload motor will be outlined in the design of the shooting mechanism. It was determined that the compartment should be 3D printed due to the tight tolerance between the compartment and the false bottom as well as to reduce weight.





Bead Compartment



False Bottom

The varying aspects of the chassis will be laser cut to include finger joints for connecting the acrylic sheets together. Additionally, a 3D Printed mounting bracket will be included in each corner to connect the pieces. The mounting bracket is shown below. A brass press-fit insert will be inserted into the hole in the acrylic, and a bolt will be threaded through the mounting bracket and into the insert, securing it to the acrylic. The total width of the acrylic and mounting bracket is $\frac{1}{4}$ ", and the threaded

insert is 2-56 sized thread, so ¼" Long 2-56 Thread size screws were selected as the fasteners.



Mounting Bracket

Verification

The most crucial design constraint of the chassis is that it must conform to the 12 cubic inch specification as outlined by the competition. Without meeting this constraint, the robot will be disqualified from the competition, rendering all other design aspects pointless. As evidenced above, this compliance was verified by constructing a 1:1 scale 3D model of the chassis and external subsystems. To assist with the more complex elements, third-party 3D models of the robotic arm and mecanum wheels were imported and used. Using the CAD software's measurement tool, the chassis in its current design iteration was measured to be 11.786" x 11.97" x

11.739" which complies with the specification. Additionally the upper chassis begins at a height of 3.25" off the ground, which allows it to freely turn above the 2" barricades that surround the track.

Bill of Materials



Acrylic Available at [McMaster-Carr](#)

Threaded Inserts Available at [McMaster-Carr](#)

Screws Available at [McMaster-Carr](#)

