Motor Attachment Container

Ivan Feng, Yutong Wang, William Zeng,
Brandon Tsui, Issac Yang, Eric He

Team Number: 16099A
Location: 37-02 Main St, Flushing, NY 11354

When creating our component, we wanted to solve the problem of removing the motor to perform maintenance. While driving, screws may become loose and need to be tightened to ensure that components do not fall off the robot during a match. This process can be time-consuming and difficult, especially if there are many mechanisms in front of the motor. For example, large gears such as the 84 tooth may block the two screws that need to be unscrewed to take the motor off. To solve this issue, motor modules may be used to take off with the motor still attached to it, removing the need to unscrew the two screws on the motor. However, two screws still need to be used to screw the motor onto the module. In addition, modules can require many parts and increase the robot's weight.

In our design, the motor does not need to be attached to the container; it is instead placed into a rectangular box with the motor's perfect dimensions. The front and rear side of the box is open, allowing the motor to slide into the container. Two covers are included with the container to ensure that the motor does not slide out of the container unintentionally. One problem with the box design was that the motor was not a perfect rectangular prism; a part protruded out from the front of the motor. An oval hole is cut into both covers. Said part can fit through the hole, but the motor cannot, keeping the motor from sliding out but allowing the part to extrude out of the box simultaneously. The covers can be attached to the box by screwing the attachment holes together, meaning that the screws can be used to attach the container to the robot and the cover to the box. Since there is a cover on both the front and the back, removing the motor is very simple. The back cover can be removed, and since the motor is not attached to the container, it can be pulled out.

To reduce weight and allow the wire to be plugged into the side of the motor, the container design is very minimal, using only a few cubic millimeters of material to form the box shape. The container has 28 attachment holes located on all sides. This means that the container can easily be attached to the front, behind, above, below, or on the side of another part. 20 of the attachment points are positioned parallel to the screw holes on the motor, and eight are perpendicular to it. The extended parts, which contain the holes, are arranged in a cross shape on top and below the box. They are placed so that screws can connect them to c-channels on their interior.

We used Fusion Autodesk 360 to complete the CAD. We first took down the dimensions of the motor, as well as the proportions of screws and c-channels. We then expanded the dimensions by 2mm on each side to create a shell around the motor, serving as the basis for the box. The box is 60.60 by 60.17 by 36.67 (length x width x height) in mm, meaning that the motor dimensions are 54.60, 56.17, and 32.67 mm, respectively. These distances were measured in the CAD using the distance tool. First, the length and width are drawn in a 2D plane before it is extruded using the extrude tool to create the figure's height. Each side of the container was then extended by 20mm to create space for the attachment holes. The diameter of the screw holes of the motor are 3.46mm, and the distance between holes in a c-channel is 12.7mm, or 0.5 inches. With this information, many holes were drilled into the extensions while keeping the dimensions of the space used to hold the motors the same. The extensions were then trimmed as much as possible using the extrude tool, and sharp edges were curved as much as possible using the fillet tool.

To create the cover, the front and back faces of the container were extruded by 30mm. 4mm of the extensions is left as the thickness of the cover, while the other 26mm between the box and the cover is removed. The greatest diameter of the protruding portion of the motor was then determined to be 19.72mm, and the horizontal length as 47.12mm. This information was used to create the oval hole in the cover.

Finally, we trimmed parts of the box using the extrude tool to ensure that the screws fit properly into the holes. The largest diameter of a screw was determined to be 6.6mm, which meant that each hole in the CAD must have a circular space of that size surrounding it. In addition, the motor is powered by a V5 wire plugged onto the side. In the end, we decided to leave the majority of the box open, with guard rails to prevent the motor from slipping out and acting as support.

We had to rebuild the container and reposition the holes multiple times during the CAD process. At first, we tried to estimate the dimensions of the entire container and frequently used estimation. When we extruded the holes using the proper proportions, we were unable to place the holes in the correct position, as the actual dimensions of the box were very far from the predicted ones. We decided to be very precise with our measurements, rounding to the thousandths place instead of the tenths place to solve this problem. Another concern was carving the oval hole in the covers. Measuring the exact dimensions of the protruding part on the motor was a demanding task since they contain many curves. We decided to make the hole as large as possible if we made a mistake while calculating the proportions.