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ME I 6500

Professor Gollins

3/9/2018

Reverse Engineering of a Product Report

Overview:

The object I chose for this project was a computer mouse (figure 1b). The major components for this project were the base, the side surface, the top surface, and the scroll wheel. I decided to model each of these parts separately instead of modeling them all at once. The components were labeled in figure 1a. For this project, the mouse I chose was symmetrical, so I could "mirror" the entities about the centerline. However, this mouse still couldn't be modeled simply by "extrude" or "cut." It contained complex curves. Therefore, I hope I could use more advanced technics such as loft and 3D sketch to make the model.
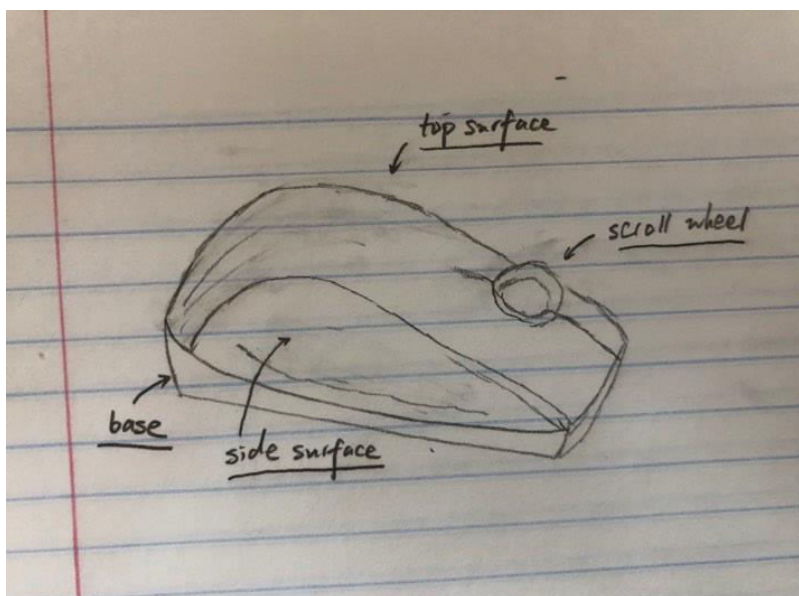

Figure 1a: Freehand sketch with major sections labeled.

Figure 1b: The real object

Procedure:

There were four major parts of the mouse for this project, which were the base, the side surface, the top surface, and the scroll wheel. I decided to model each of them separately, and the first part I tried to model was the base.

Part 1: The base

The first step I did for creating a base was to draw the contour of the lower edge of the base (figure 2a). I placed the mouse on a white paper and carefully drew the contour of the lower edge. Also I used the ruler to measure the dimensions (figure 2b). After I got the sketch of the contour, I scanned the sketch and inserted the sketch into Solidworks. Then I used the "spline line" to trace the contour (figure 2c) and created the surface by using "Surface Fill" in Solidworks (figure 2d).
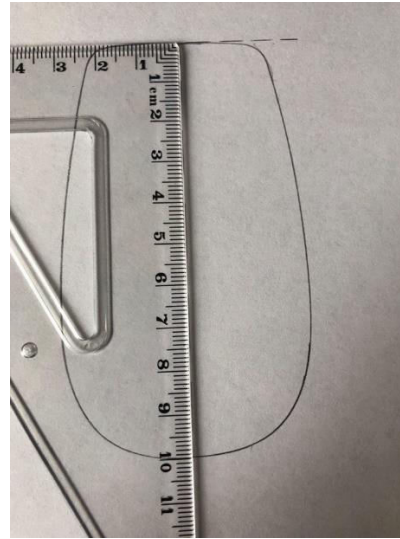
Figure 2a: drawing the contour

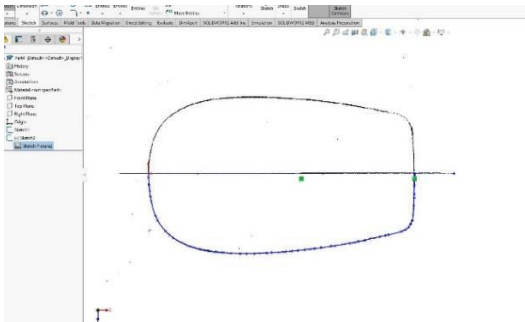*Figure 2b: dimensioning*

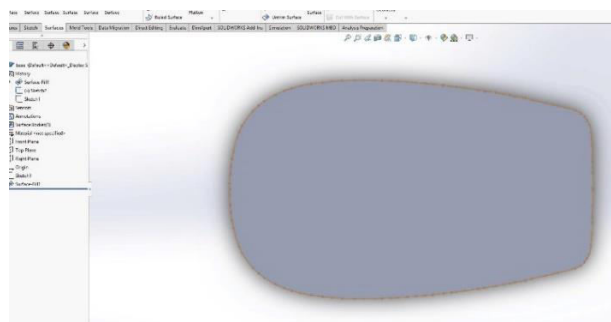*Figure 2c: tracing contour in Solidworks*

Figure 2d: filling the surface

The next step I did was to draw the top edge of the base. For this step, I took a picture of the mouse from the side view first, and directly inserted the picture into Solidworks. Then I traced the edge by using "spline line" (figure 3a). (NOTE: I made a mistake in this step. The mouse should be reversed in direction when I took the picture because the direction did not match with the drawing of the edge of the lower base I did in the previous step. I fixed this problem later by using "mirror" at the centerline of the sketch, and then deleted the wrong sketch.) Also I extruded the surface along that traced curve by using "surface extrude" (figure 3b).
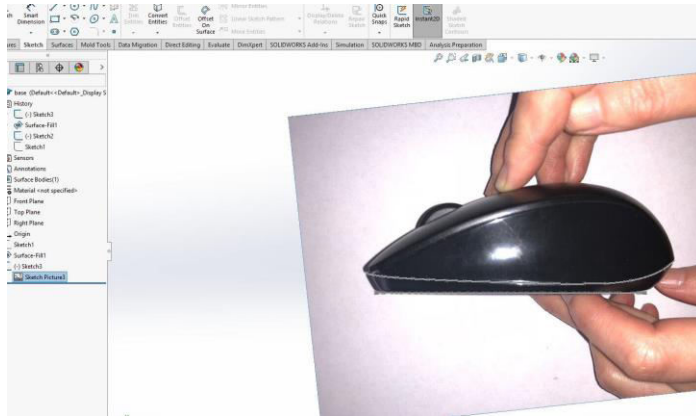
Figure 3a: Tracing the curve. [note: the direction of the mouse should be reversed]
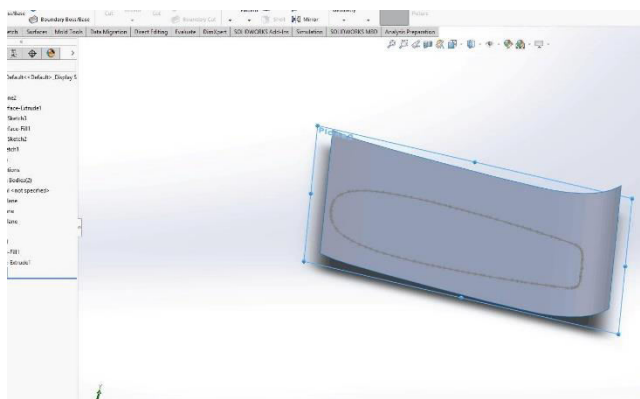

Figure 3b: extruding the rectangular surface

After I obtained the rectangular surface of the tope part of the base, I needed to sketch the exact shape of the top part of the base, so I took the picture of mouse from the bottom view so I could get the dimensions for the top edge. I repeated previous step to trace the contour. Then I used "wrap" in Solidworks to make this sketch lie on the rectangular surface. After having the top surface of the base, I then used the same side view picture I took in the previous step for tracing the guide curves (figure 4a). Then I used "Loft" in Solidworks to create the base in solid (figure 4b).
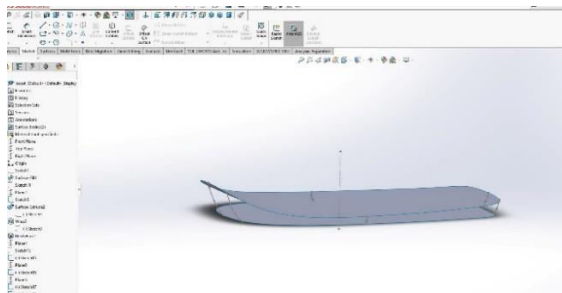

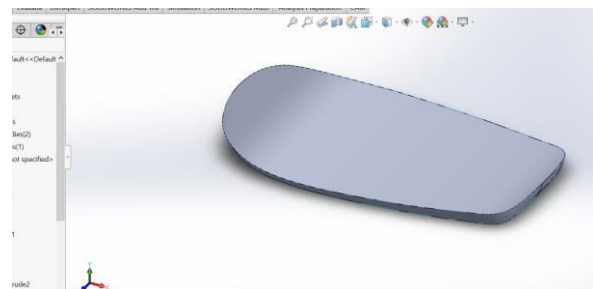*Figure 4a: base surfaces with guide curves*

Figure 4b: The base of the mouse

Part 2: Top surface

For the next two parts, which were the top surface and the side surface, I decided to use "surface" tools because of the complex curves and shapes of these surfaces. The first surface I decided to do was the top surface.

In order to model the surfaces, I needed the contour lines to guide, and I used the steel wire as the tool to help to sketch the contours of the top surface (figure 5a & 5b). Also I used caliper to measure the distance between the wire and the centerline of the mouse so I knew where the contour lines should be located (figure 5c). After I obtained the sketch, I inserted it into Solidworks and used spline line to trace the contour (figure 6).
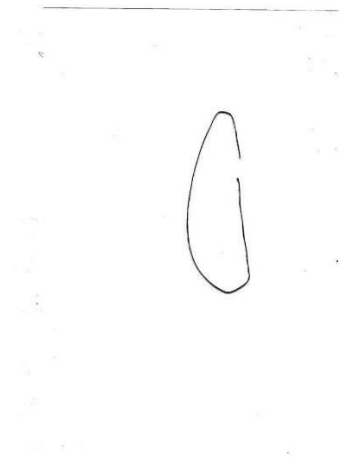

Figure 5a: steel wire on the mouse

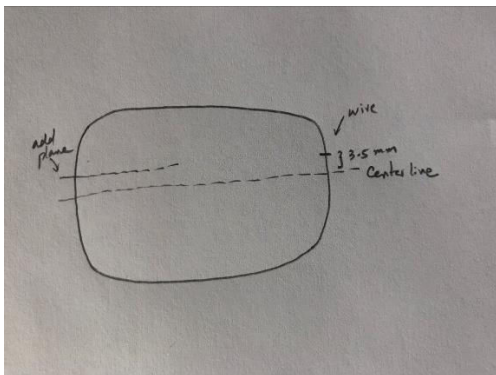*Figure 5b: shape of the wire*

Figure 5c: distance between the wire and the centerline
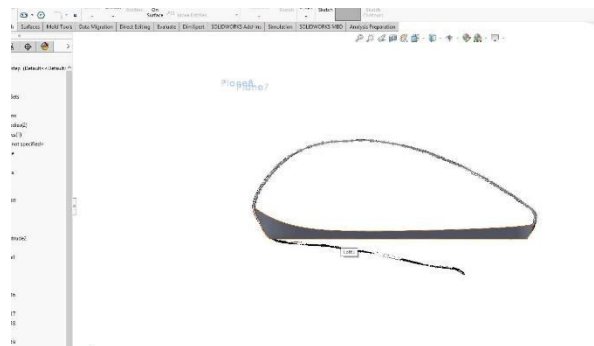

Figure 6: Tracing the contour

Since one guide curve for creating the surface was not enough, I repeated the previous step for five times to create more guide curves for the surface at different locations. After having six curves, I used same method, steel wire method, to get the horizontal curves of the top surface for more guide curves. I repeated this step for seven times (figure 7).
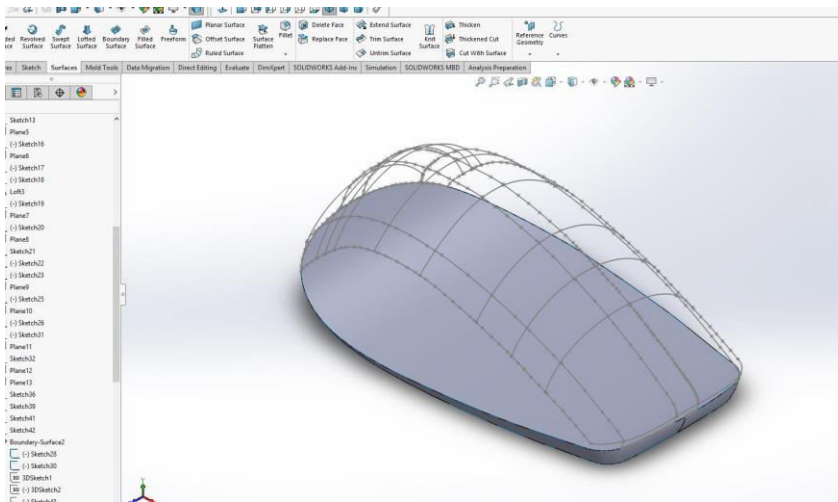

Figure 7: six vertical contour guide lines with eight horizontal contour guide lines

After I got all the curves, I used "surface" tool to create the top surface. I noticed that this surface does not have any thickness yet.
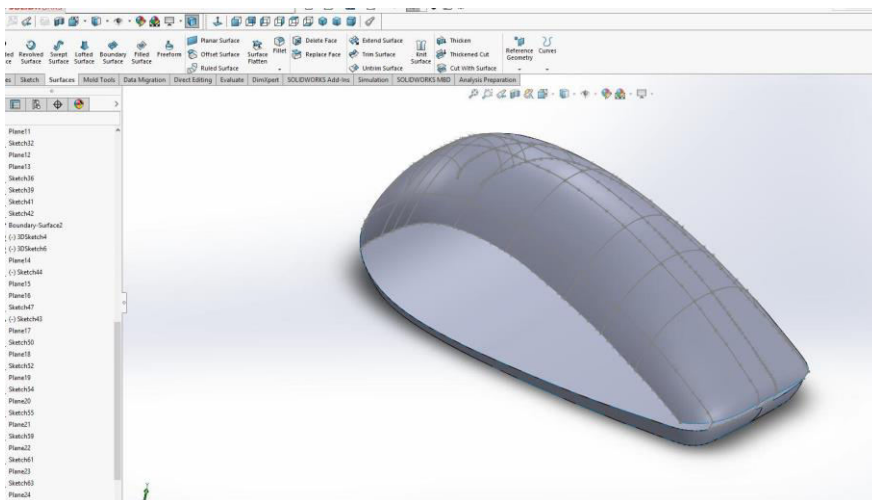

Figure 8: Top surface of the mouse

Part 3: Side surface

For the side surface, the steel wire method I used for the top surface was not a good way to do to obtain the contours. The reason was that the wire was not thin enough for measuring the small curves and details on the side. I tried to use the contour gauge for this part. I slowly pushed the contour gauge to the side of the mouse. I pushed the contour gauge slowly because the wires on the contour gauge might bent if I pushed it very fast. After I got the shape of the side, I took a picture of the contour gauge (figure 9).
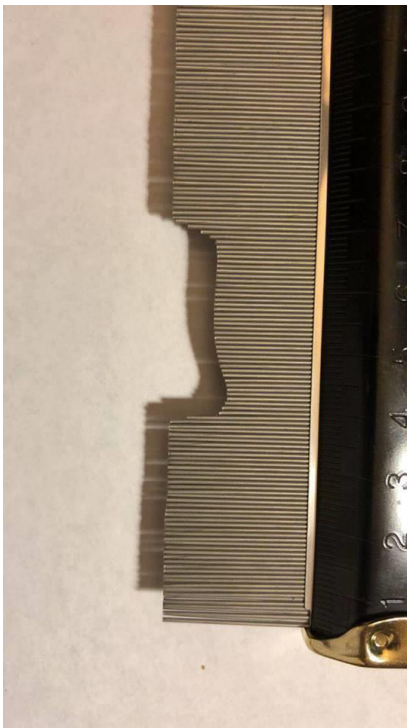

Figure 9: Contour gauge with the shape of the side of the mouse

Then I inserted the picture into Solidworks, and traced the contour of the mouse. Also for this step, only one contour curve was not enough, so I repeated the previous step for two times. After I got all the contour curves for the side, I used "surface" to model the side surface. After this step was done, all the surfaces of the mouse were obtained.

Next, I used "Surface-Knit" to connect all surfaces and then chose "create solid" to make the entire body a solid (figure 10).
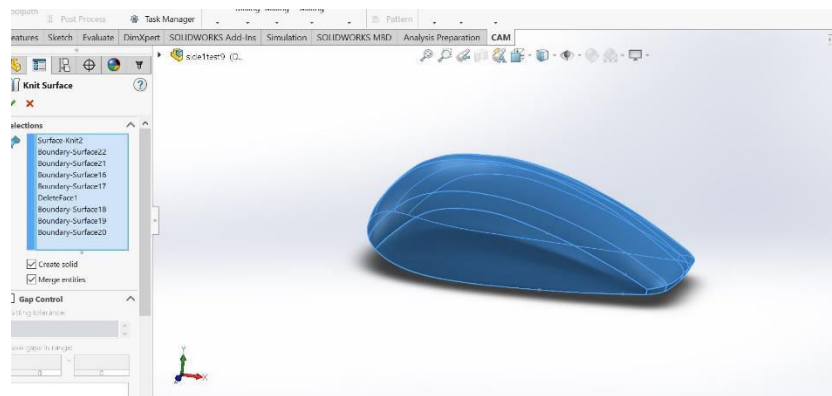
Figure 10: Surface-Knit with "create solid" selected

Part 4: Details

After I modeled the entire body of the mouse, I added the details to the mouse such as adding scroll wheel to the mouse. The first step I did for this part was to measure the location and dimension of the scroll wheel by using the caliper (figure 11d). Then I sketched a rectangular box in Solidworks and use "Wrap" to cut through the mouse for the space for the scroll wheel (figure 11a). Furthermore, I used "Wrap" and "Cut-Thicken" to cut the space between the left click and the right click buttons (figure 11b). Then, I extruded the scroll wheel and the shaft (figure 11c).

For the bottom part of the mouse, I used caliper to measure all the dimensions and locations, and then used "Extrude" and "Cut Extrude" tools to model in Solidworks (figure 11e and 11f).
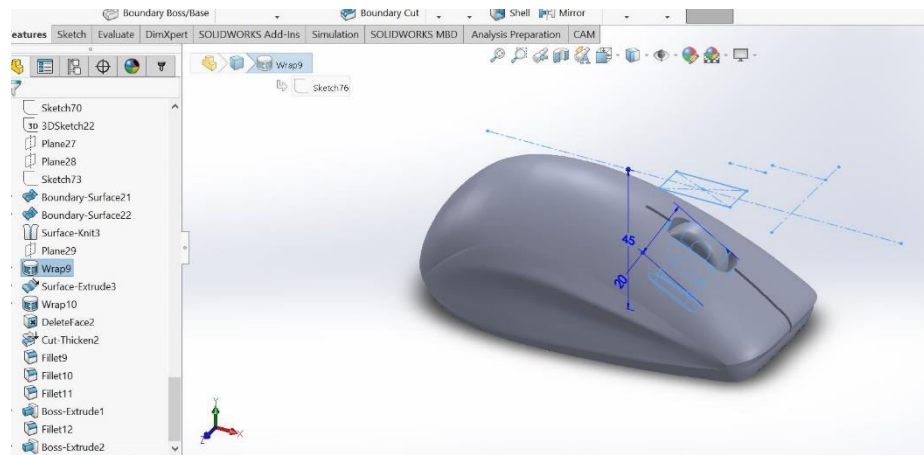
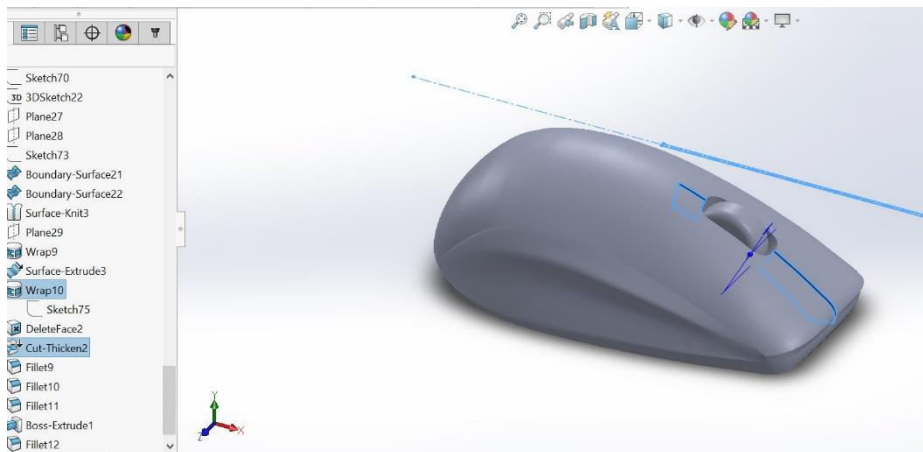*Figure 11a: Rectangular box in Solidworks for Wrap to cut the mouse*

Figure 11b: Space between the left and right click button

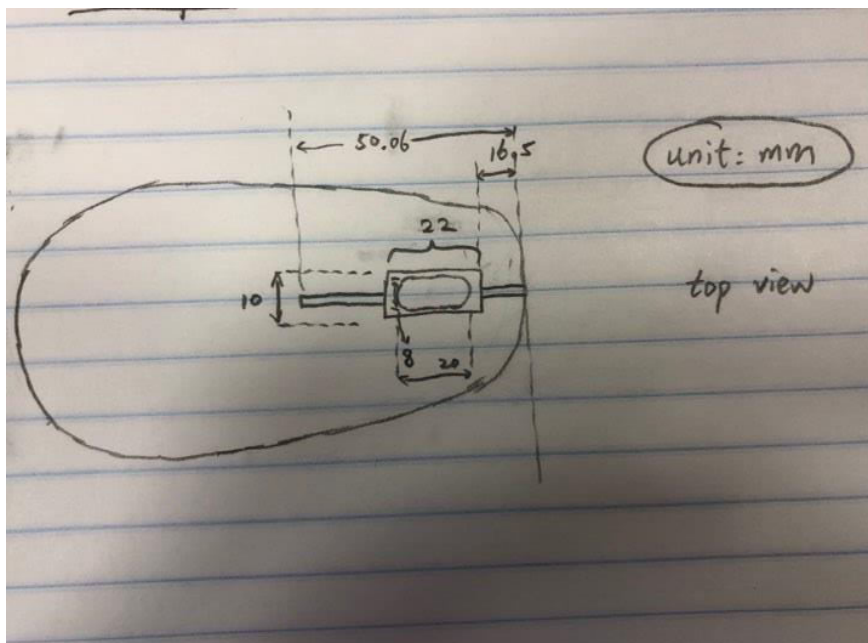*Figure 11c: Extrude the scroll wheel*

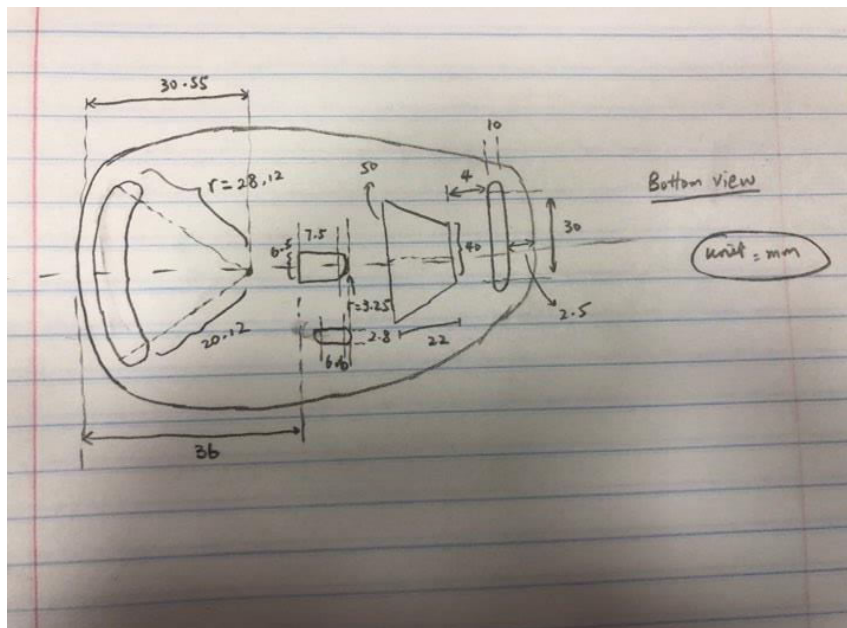*Figure 11d: Sketch from the top view*

Figure 11e: Sketch from the bottom view
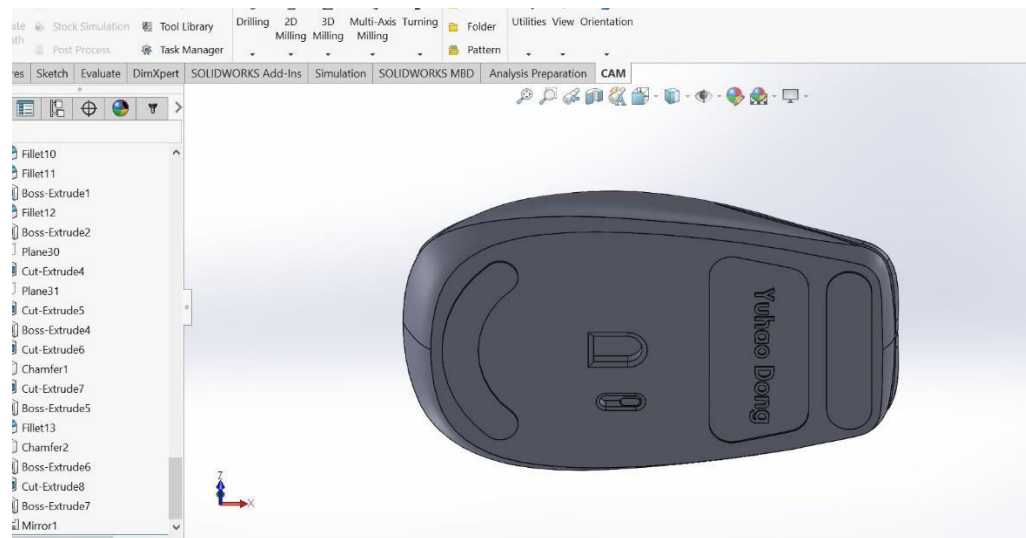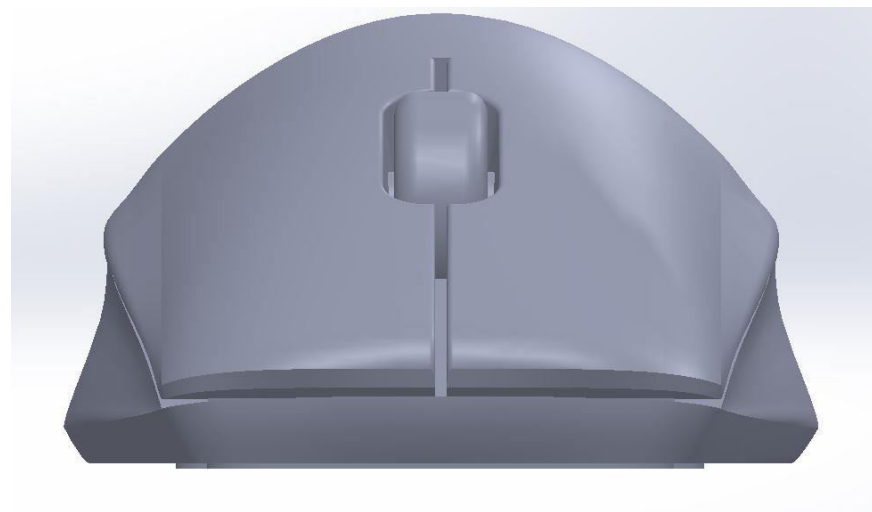

Figure 11f: Extrude and cut of the bottom view

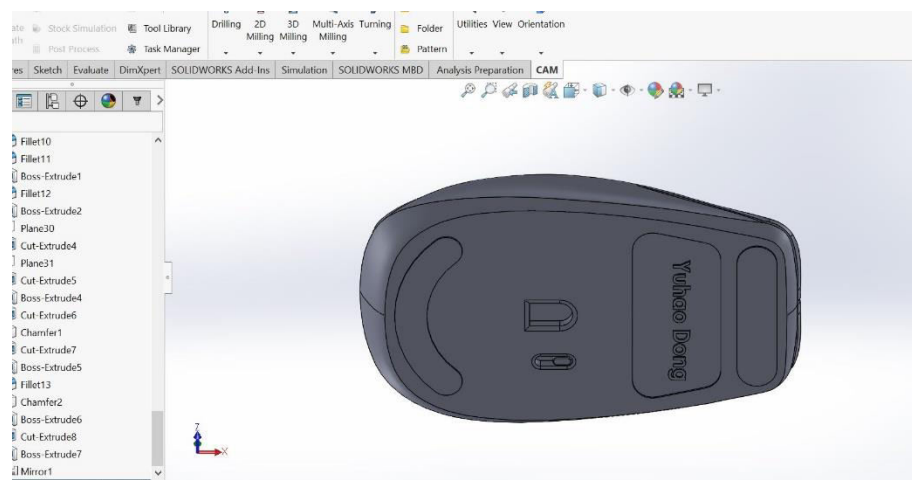Finally, this model was completed.

Results

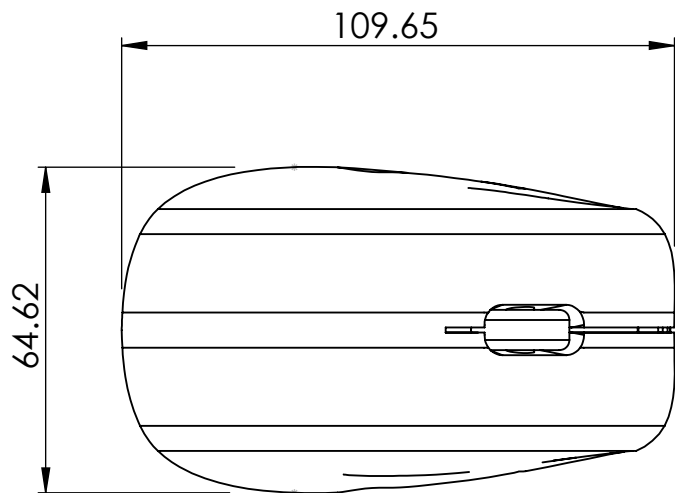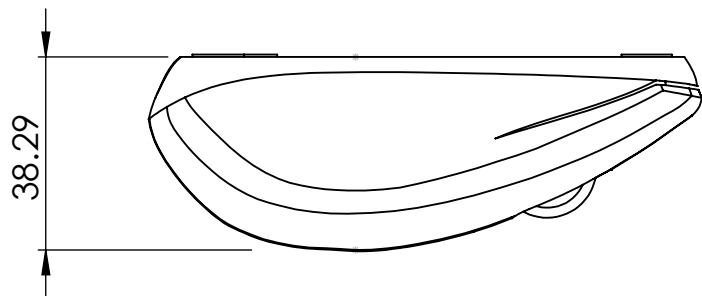*Isomeric view of the completed solid model*
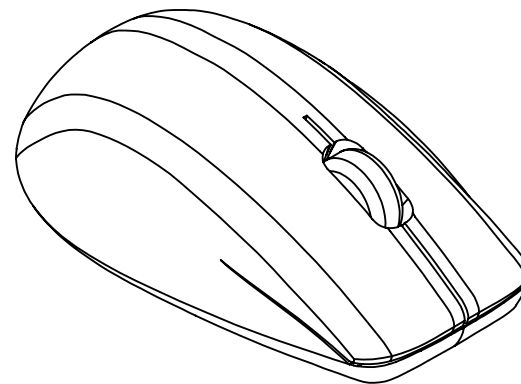

Front view of the completed solid model

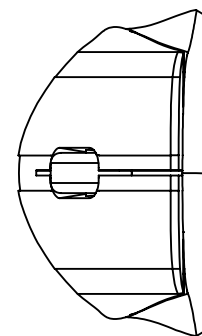*Bottom of the completed solid model (I tilted it for a clear view of extrusion)*

2

1

B

B

38.29

109.65

64.62

A

A

PROJECT # 1

NAME:

YUHAO DONG

SIZE A	Dimensions MM		REV
	SHEET 1 OF 1		

2

1

Discussion

The most difficult part of making the model for me was to fill the surfaces. I had to make sure all the end points of a curve were connected to the end points of other curves. Also I needed many guide curves to guide to fill the surfaces. I only had 3 curves in total when the first time I tried to fill the surface. It did not give me an accurate result. After I added more guide curves in the Solidworks, the surface became more accurate and more smooth. Also, measure the dimension of the mouse was very difficult. Because of the complex curves and shapes of the mouse, I had to use some tools, such as steel wire, contour gauge, camera, to help me to measure the contour.

My model was not 100% accurate. There were few mistakes I made that caused this inaccuracy. The first problem was that the usage of the steel wire. When I tried to make it into the shape of the mouse, the wire will spring back a little bit after I bent it. The spring back of the wire caused the inaccuracy in sketching the contour of both top surface and side surface. The second problem was that there were still too few guide curves. Even though I added more guide curves, the surface did not 100% follow the shape of the real object. The last problem was that there were many tiny details I did not notice or ignored. I also replaced the words in the bottom of the mouse by my name.

I could make my model better next time in many ways. First, I could use tape to stick the two ends of the steel wire to make it less likely to spring back. Also I could draw more guide curves to make the surface more smooth and accurate. Moreover, I could pay more attention to the small details.

The lesson I learned from this project was that when I measure or sketch the model, I need to make it as accurate as possible. A small mistake could make everything goes wrong. If

the end points of the curves do not connect to each other, the surface will not be filled. Moreover, all entities must be closed. Also, from this project, I learned how to use loft, surface, and many other tools in Solidworks to create a complex, irregular shaped object.