

Independent Design Study - 2

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Mr.Crawford

Independent Design Study 2

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Summary:

The assignment Folder has all files mentioned in this assignment:  IDS-2

Mr. Crawford's Grade 11 tech design class at South Huron District High School is working on an Independent Design Study (IDS). As a student with prior experience, I chose to continue my previous IDS project of designing and 3D printing a scanning turntable. My goal is to enhance my skills in 3D modelling and printing, particularly using industry-standard engineering software. Over three weeks, I aim to finalize the turntable by designing, testing, and printing prototypes, ensuring the turntable can handle weights of 1kg-5kg with the help of a suitable motor.

I researched motor options and improved the previous design by eliminating the handle, adjusting the base, and refining the clip-on mechanism. I documented my progress with blueprints and timelapse videos. Although I encountered issues with support structures and precise fitting, I resolved them through design adjustments and better print settings. While I successfully completed the modelling and printing phases, I plan to further the project by incorporating motors and electronics for full functionality in the future.

Situation:

Mr.Crawford's Period 4, tech design class at South Huron District High School has been tasked to do another Independent design Study. This allows the students to pick a project, topic, or task that they are interested in and further develop their knowledge and skills. We as individuals in the class are to pick something to do or learn in the given time for this IDS.

As a student in Grade 11, and as someone who has already taken this course last year, I want to further develop my skills by learning more about industry-standard software in engineering. I am interested in making 3D models, and want to further develop my skills in this by making more complicated models and using more complicated software that is used in engineering as I am interested in this. The timeline given for this task is ~3 weeks. This is a continuation of my previous Independent design study where I was 3D modelling, and printing a 3D scanning turntable. The goal this time is to finish the project make necessary adjustments and print all the pieces. I will need to print and model some more prototypes before I can print the finished product. This project can be related to areas in engineering such as mechanical design where you need to work on projects with multiple components and parts. This can be related to many engineering fields where you need to find efficient ways to create and design things and products.

Problem:

The task is to pick a project for our IDS and complete it within the given time. Mr.Crawford has given us two weeks for our IDS and we are to pick a topic, project, task, or something to learn or expand our knowledge and skills on. The first problem is picking a project to do. Since this is the second IDS and I plan on continuing the 3D scanning project I started, I already have a topic and assignment picked for this IDS.

I want to do this because I find it interesting and it is a good project for me to improve my skills on 3D printing, modelling, and overall knowledge and expertise in making complex/complicated objects with some restrictions that I will need to find a way to work around and within a specific time period so that I can also improve on time management.

This means I will need to research, design, test, 3D print, and document my progress while making the turntable. I will need to have this done before 14th June 2024 as it is the 3-week deadline for this IDS. I will be doing this alone with the help of online resources and feedback from by Mr.Crawford and Mr.Kirkpatrick. I will be doing this assignment at school for the most part. I will use the school computer for my research, work and documentation, and I will use the 3D printer to print the parts. This can be related to career paths like mechanical engineering/design, electrical engineering, and much more.

Investigation:

I did not have a lot to research for this Independent Design Study as most of it was done during the first part. For more research on this refer back to IDS-1

I did research on different motors I could use for this project. The goal was to have a high-torque motor to be able to move heavier objects on the platform. As an addition to this, I also wanted to add a speed/voltage controller to it, or some kind of circuit board that would control its speed. I started my research by researching similar projects to mine to see if someone had done something similar.

Some factors I considered were:

- Since plastic is smooth friction would not be a problem
- I wanted it to be able to spring objects with masses 1kg-5kg. (1kg minimum)
- The height of the motor so it fits underneath the platform and gear
- Time frame. I had to make sure that I could have the motor delivered in time before the end of the semester

The final product and the goal of this would be to have a nice looking and functional turntable. The main goals are to fix problems from the last IDS and Improve upon them.

Similar Design found online:

<https://www.instructables.com/3D-Printable-Timelapse3D-Scanning-Turntable/>

- Comes with great detail about how to build with the exact motor used

Motor Options:

[Motor Option 1](#)

- Cheap
- Had multiple motors
- I think this is a good option but I do not know whether it could move heavier objects

[Motor Option 2](#)

- It is slightly more expensive than the option 1 motor but has better specs
- Slightly higher than what I can fit

[Motor Option 3](#)

- Cheap
- Multiple motors
- Similar to Option 1

Motor option 4

- \$19
- Sturdy and much better specs than the rest
- Would fit in the gap
- Had less Horsepower than the rest

Motor Option 5

- Comes with circuit boards
- Relatively cheaper considering the quantity
- The same one used in similar design
- Probably the best option

Construction:

I started this IDS by fixing some of the things that were a problem from the last IDS. I decided to remove the idea of a handle as I would not be able to complete it within the given timeframe.

List of changes made:

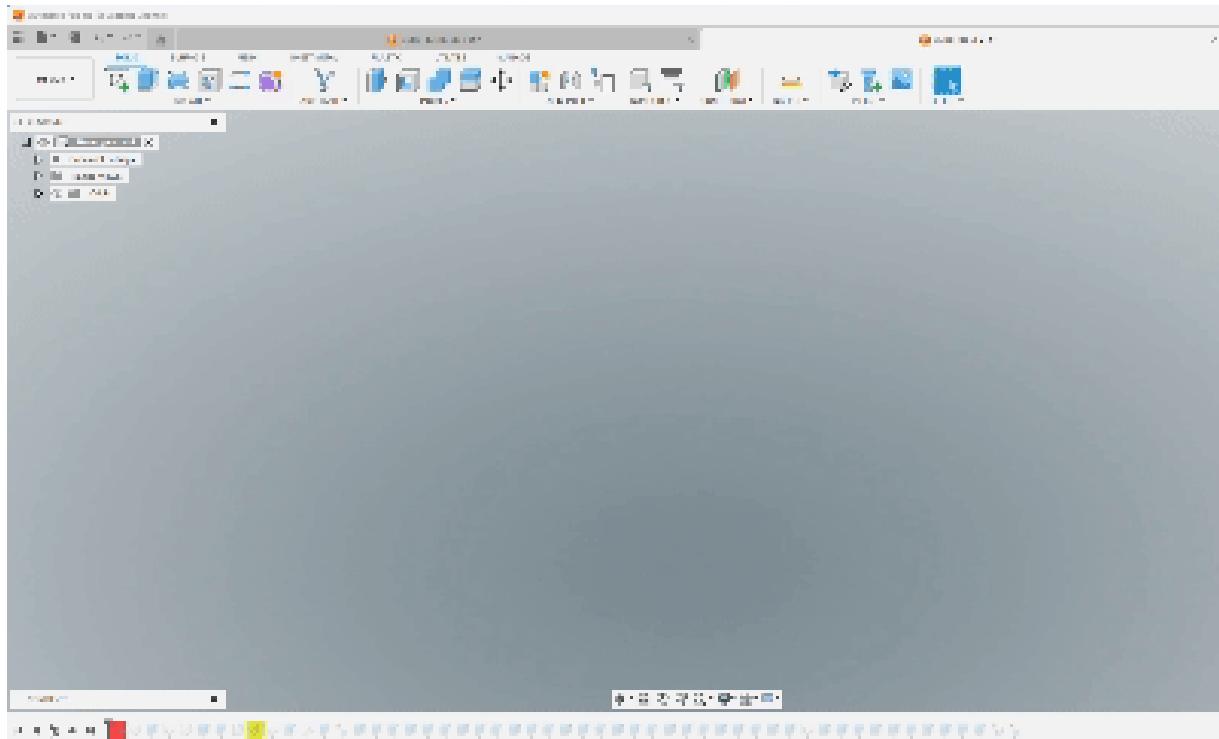
- Completely removed handle
- Make the base taller and remove the hole going through it
- Made it so that the end of parts, that would clip onto each other, have more room for error as the printer is not always precise.
- The platform hole was fixed to match the alignment of the gear rod.
- Fixed print settings to have the best possible 3D print

I also fixed a few minor mistakes from last time, which can be seen in the timelapse

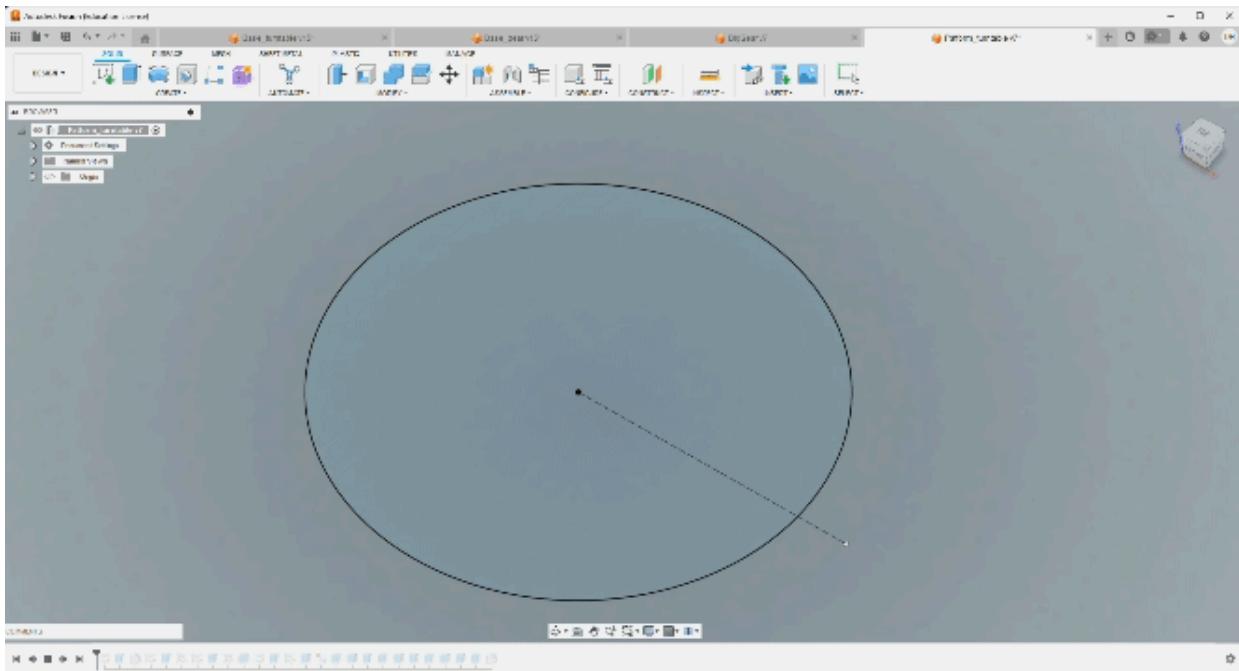
Instead of uploading pictures for every step of the modelling process of these parts, I decided to make a timelapse of the parts as it is more efficient.

Here is a timelapse of my process of making the different parts from where I left off last time, to the finished products. The Small gear stayed the same and so there is not a timelapse for that.

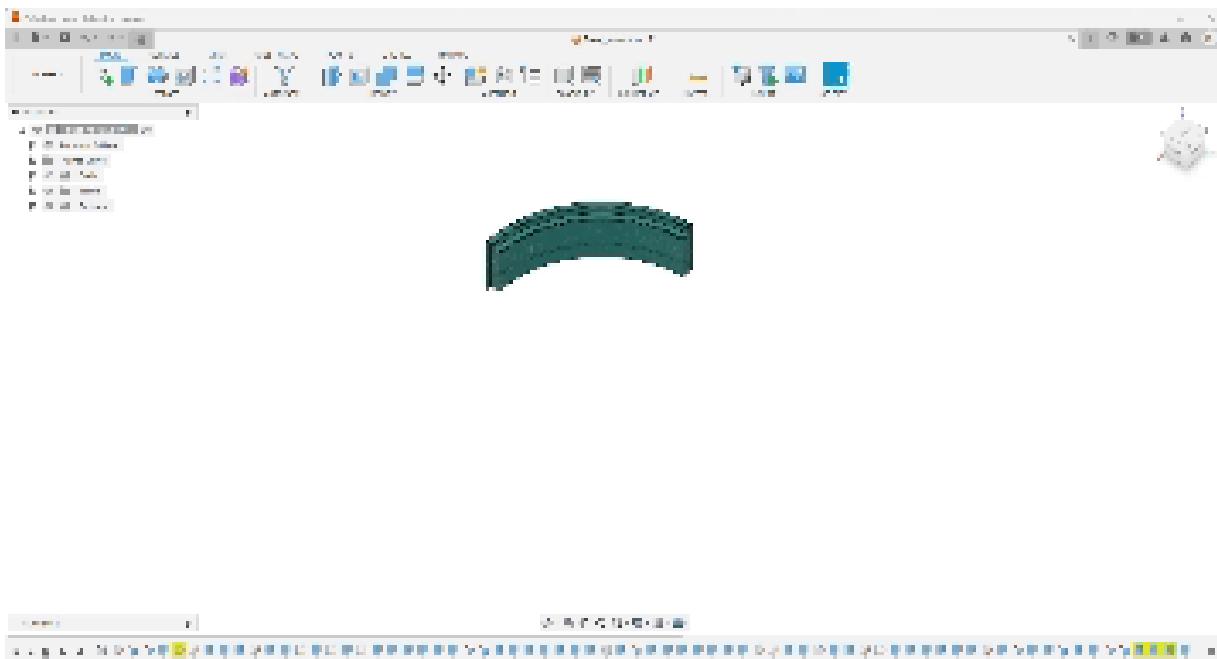
Big Gear:



Platform:



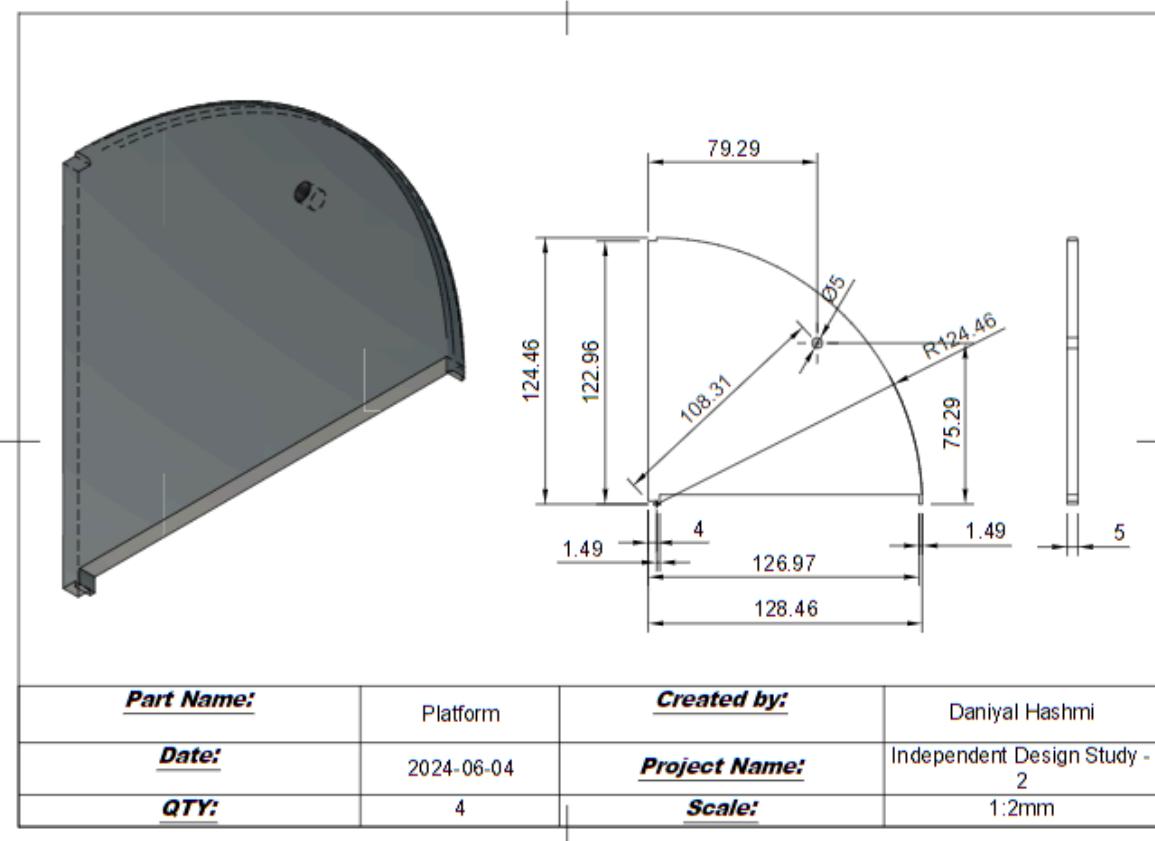
Base:



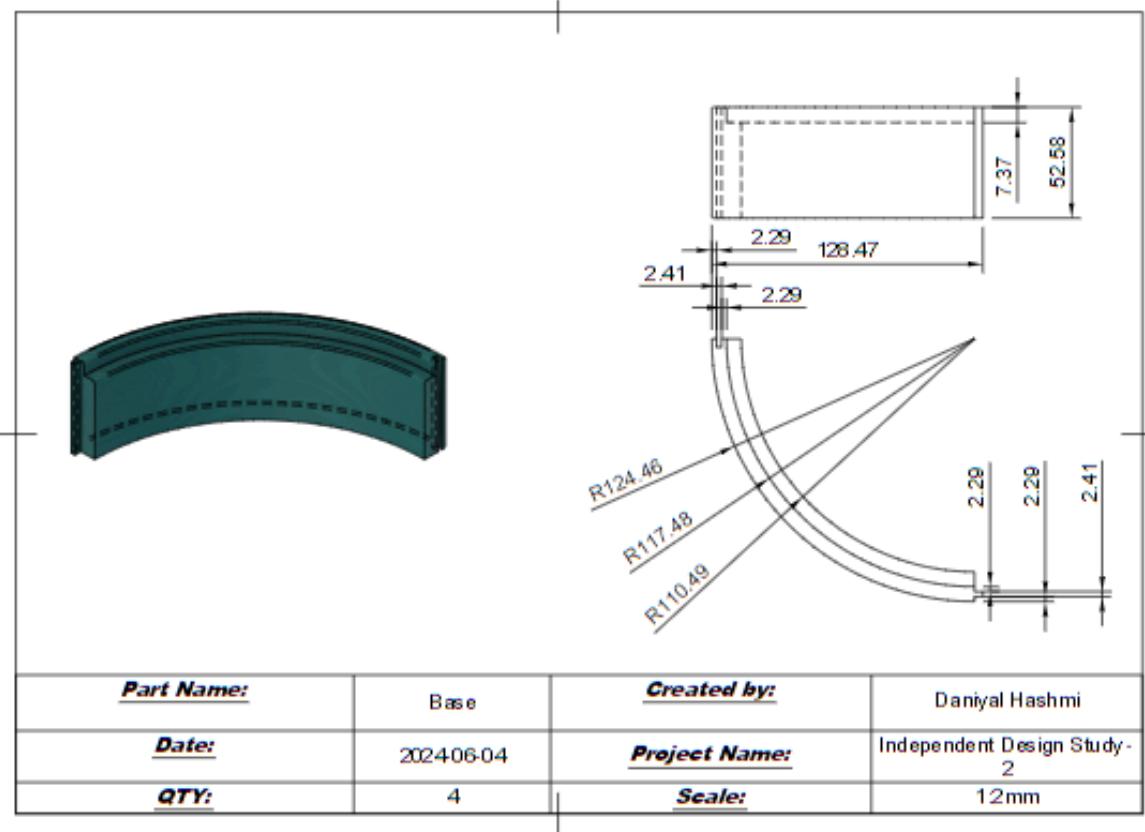
For better quality, the videos can be found in the [IDS-2](#) Google Drive folder

After finishing modelling all of the pieces, I decided to make blueprints for the parts as this would allow me to continue working and expanding on the project while using the AutoCAD and blueprint skills we learned this semester. PDF versions of the drawings can be found in the folder. I dimensioned the necessary parts which would allow anyone to replicate these parts if they decide to build this themselves.

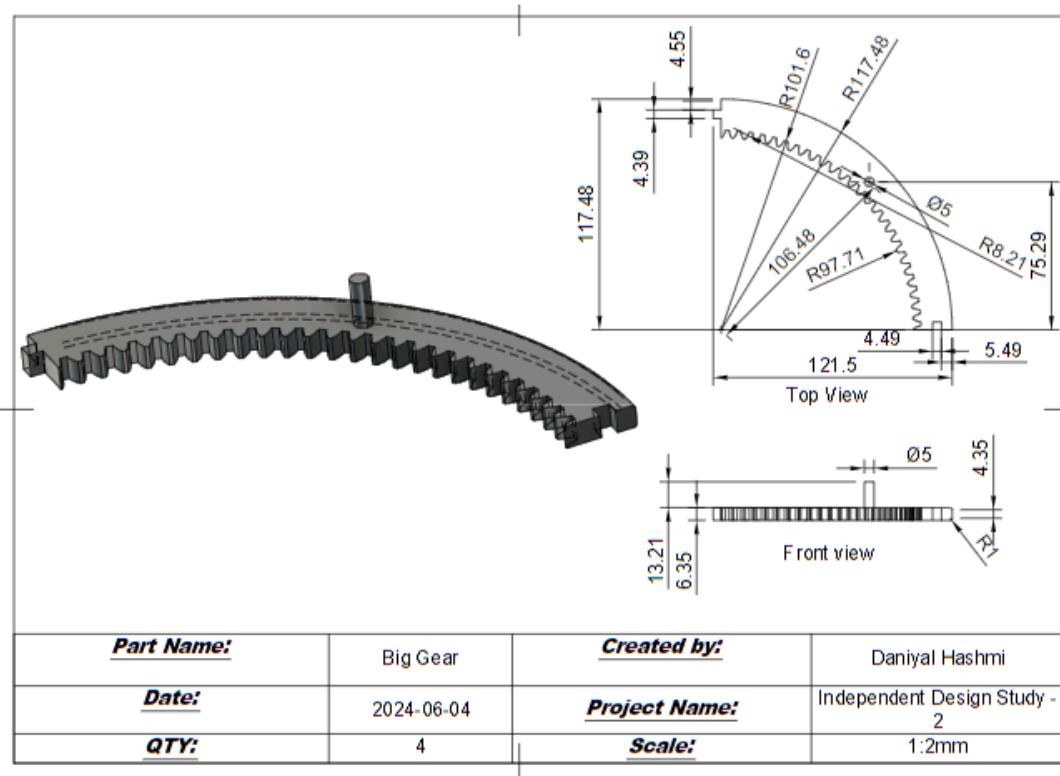
Platform:



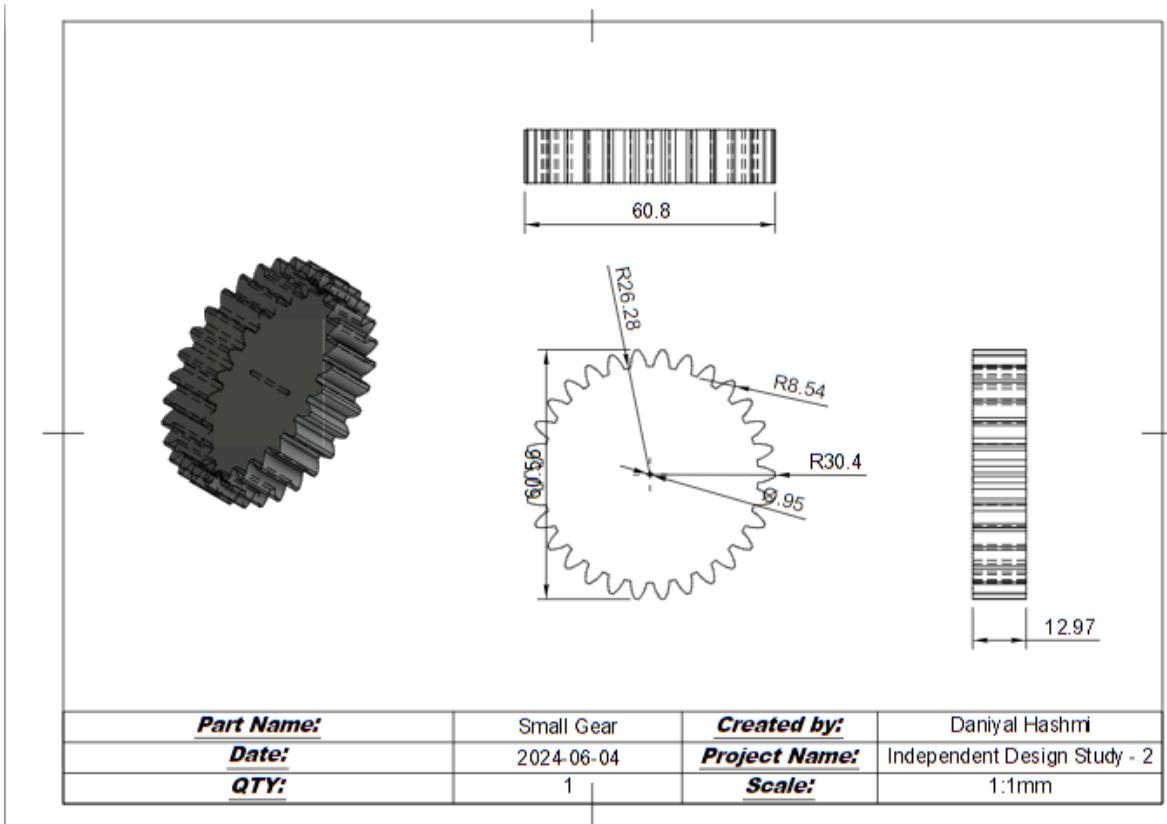
Base:



Big gear:



Small Gear:



Some problems I ran into:

- When Printing a hollow part within the parts the printer would use supports to build over the gap, but I was not able to remove these supports which would ruin the clip-on functionality of the parts.

I fixed this by removing the supports and making it so that my model did not require any supports and there were no hollow spots in my model

- The pieces clipping onto each other were very slightly off as the circular shape made it hard for them to join perfectly together.

I simply fixed this by filling down the ends so they fit better. If needed I can simply glue the pieces together

- The small circular rod coming out of the big gear to attach to the platform would break.

To fix this I made it edited the 3D print settings to print more precise and use more material. This took more time to print and used more material but ensured that it would not break as easily.

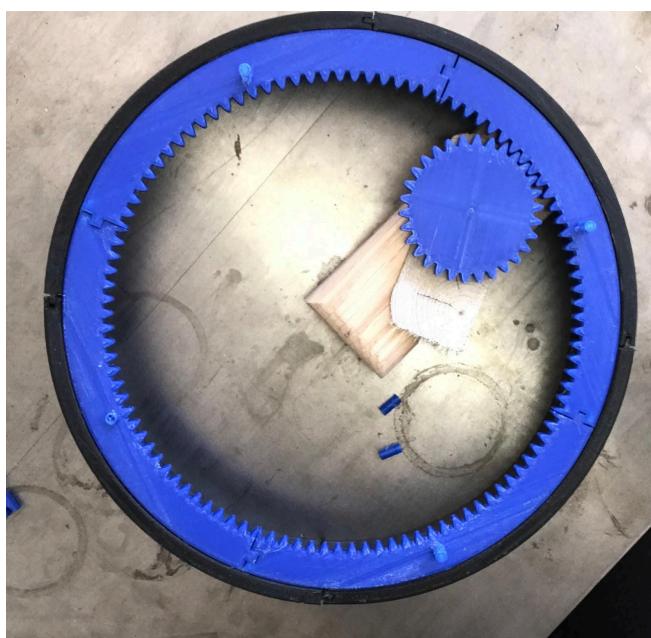
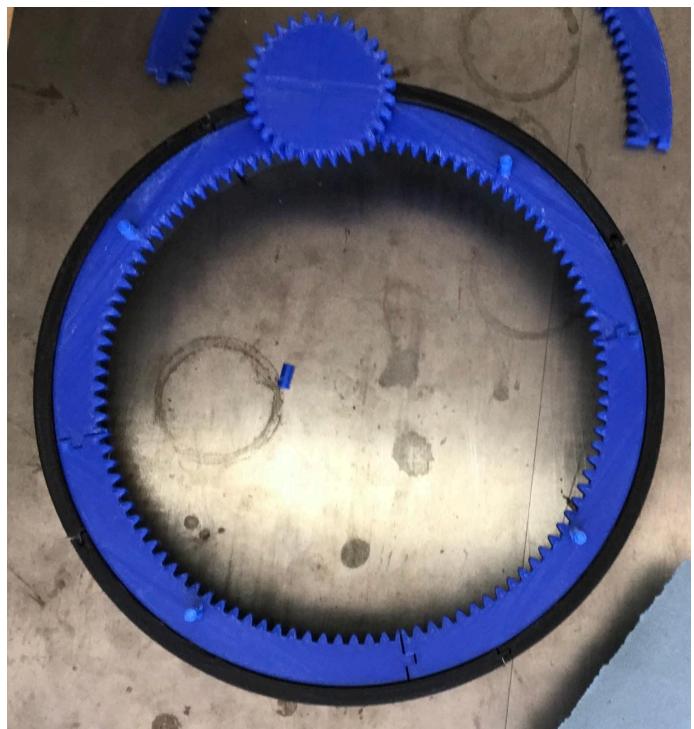
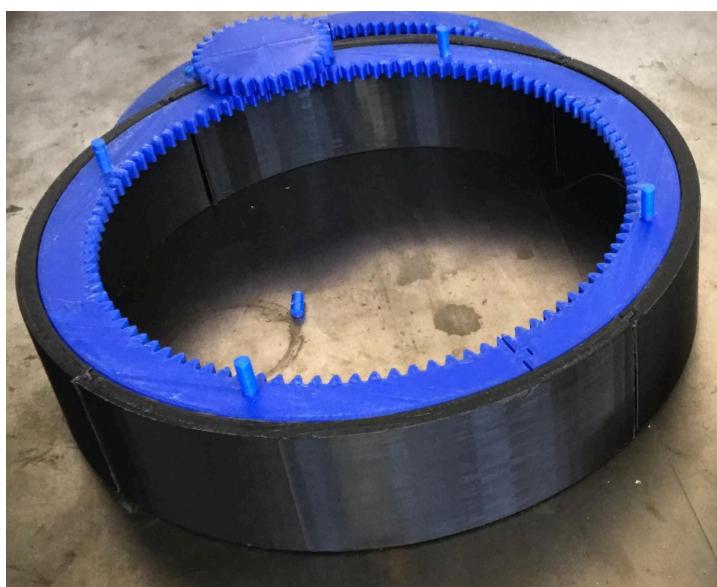
- There were some prints that did not print properly at the beginning but I found a way to solve that by changing some of the settings for the 3D printer. A picture of failed prints is below:



Lastly, I had the idea of printing the different pieces in different colours as it would make the table look much better.

Here are pictures of the final prints for the gears and base, however, the platform was still printing, and I was unable to take a picture of it.

For any more details about the parts, please refer to IDS 1 where I went more in-depth about the specifications



Evaluation:

I was able to print and finish modelling all of my parts in this IDS as well as doing a few extra things. For example, I used the extra time to research the next steps for how I can make it functional, e.g. motors and circuit boards, and also make blueprints for these models so they can be easily replicated. I was able to solve the problems from the previous IDS and other issues that I found out about while doing this IDS. The next steps I could possibly take if I ever return to finish this project are buying the electronics needed and by assembling everything, and making a base with either plywood or some other material to attach the motor and base to. Overall, I really liked the outcome of this project, and wish to finish it sometime. I was successful in what I planned on doing but could not completely finish the product. The clip-on feature worked almost perfectly but needed some filing and sanding to get rid of excess material that may have been extruded by the printer in the small areas where the “clips” are. The designs of the pieces themselves looked good and were exactly what I was looking for in this prototype. The places where I went wrong, e.g. print setting, minor dimensioning problems, etc., I fixed and improved on. Next time, If I were to do a project like this again or even continue this project I would plan ahead of time so that I can make sure I get it done within the semester I would take this class.