Independent Design Study - 3

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Mr.Berlett
Independent Design Study 3
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Summary:

The assignment Folder has all the files mentioned in this assignment: IDS

Mr. Berlett’s Grade 12 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 from last year. My goal is to enhance my skills in 3D modelling and printing, using industry-standard engineering software. I aim to finalize the prototype turntable by designing, testing, and printing the final components, ensuring the turntable can handle lightweight objects with the help of a suitable motor.

I researched motor options and improved the previous design. 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, post-print refinement, and better print settings. I successfully completed the modelling and printing phases and finalised the project by incorporating motors and electronics for full functionality as mentioned in the previous IDS report.

As a way to spend my time more efficiently, I will be doing another, unrelated, small project. This will ensure that I have something to work on while big parts are being printed.

Situation:

Mr.Berlett’s Period 4, tech design class at South Huron District High School has been tasked to do an 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 12, 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 I want to develop my skills further by making more complicated models and using more complex software that is used in engineering. The timeline given for this task is ~3 weeks. This is a continuation of my previous Independent design study from Grade 11, 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 the remaining prototypes before I can assemble 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.Berlett has given us three weeks for our IDS, and we are to pick a topic, project, task, or something related to technological design to learn or expand our knowledge and skills on. The first problem is picking a project to do. Since this is the third IDS for the same project, 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 in 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. Even though the object I am creating is not the most impressive, it is a great way for me to build my skills in tech design.

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 26th March 2025, 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 Mr.Berlett. 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 two parts. For more research on this refer back to IDS-1 and IDS-2

I did research on different motors and electronics 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. 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 project 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

Option 6

- Best option
- Includes everything needed and more

I decided to go with Option 6.

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

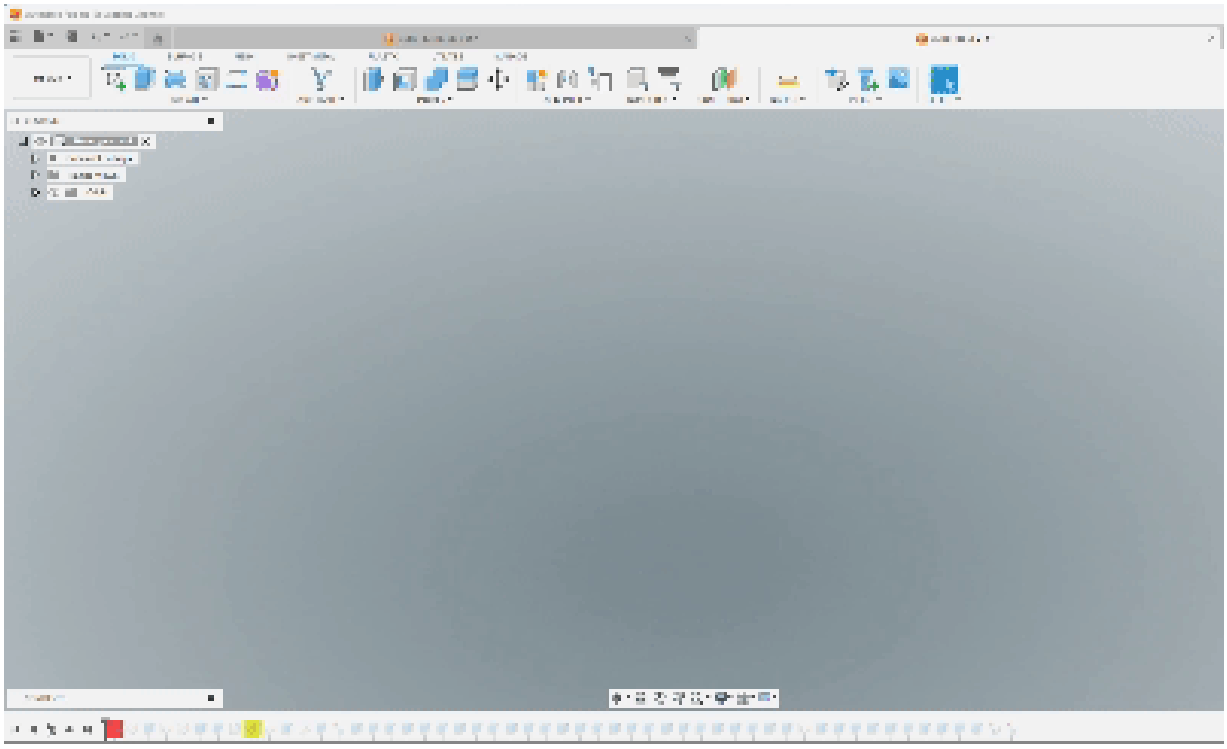
I also fixed a few minor mistakes from last time, which can be seen in the timelapse

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.

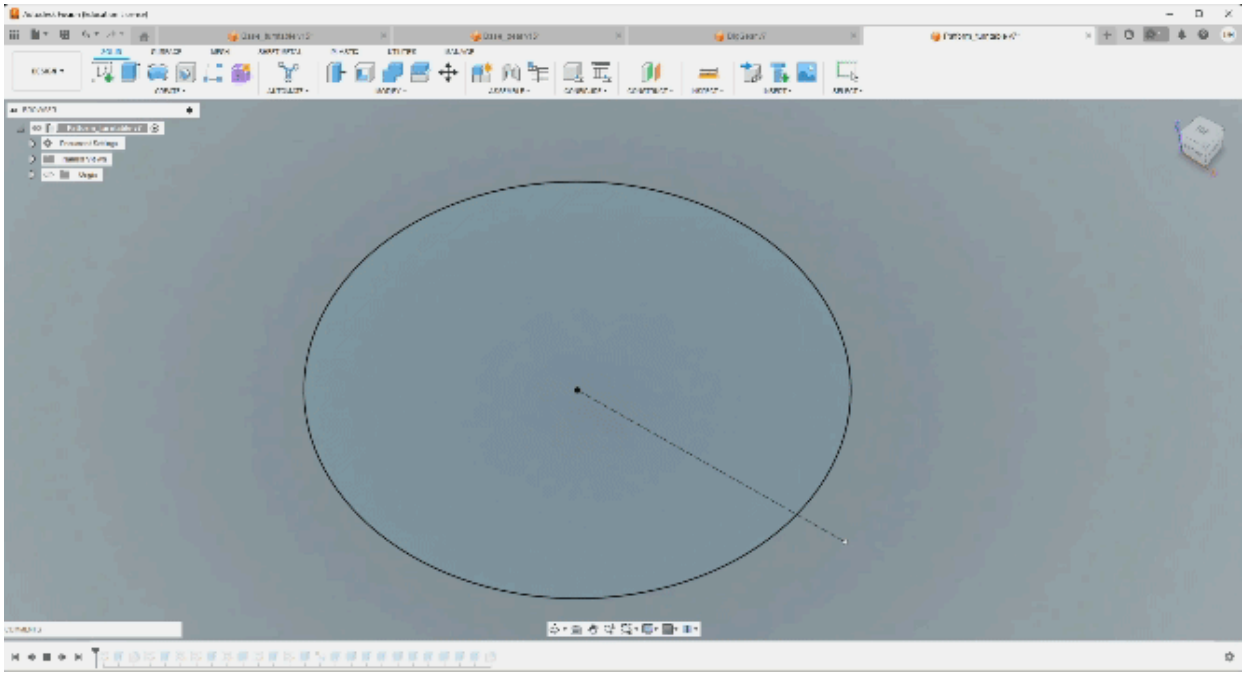
Here is a timelapse of my process of making the different parts from where I left off last time, to the finished products. The Small gear had a minor

adjustment of adding a hole to the centre to fit the diameter of the motor, since this was not a major change, there is no timeplapse for it.

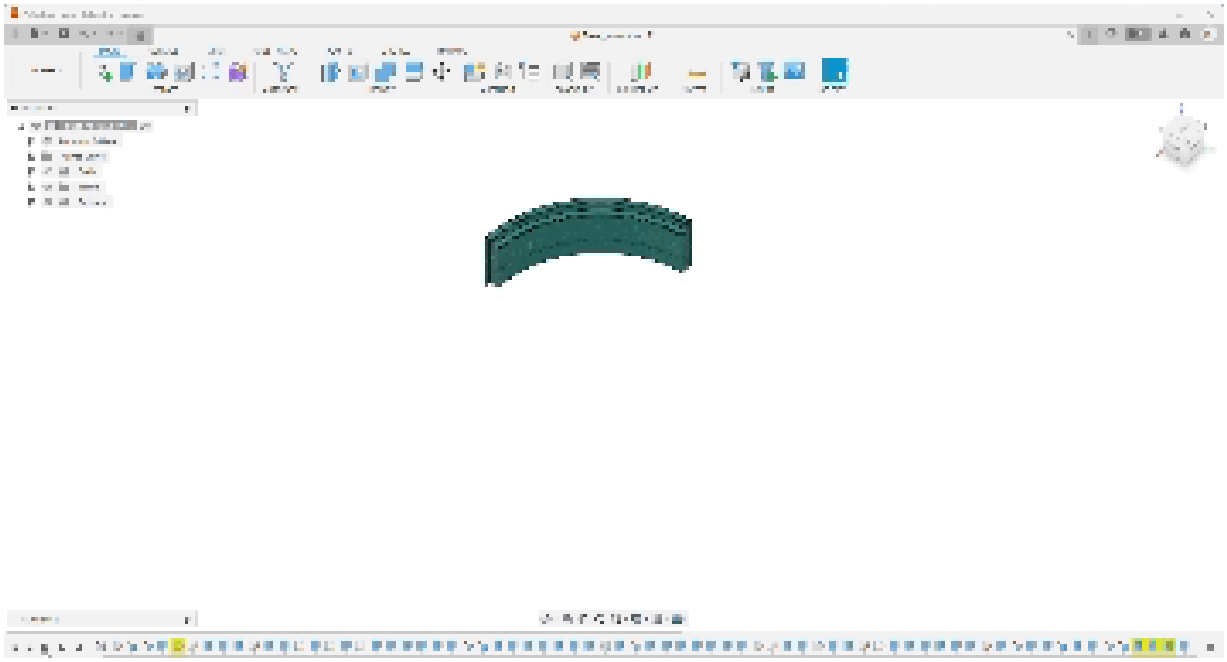
Big Gear:



Platform:



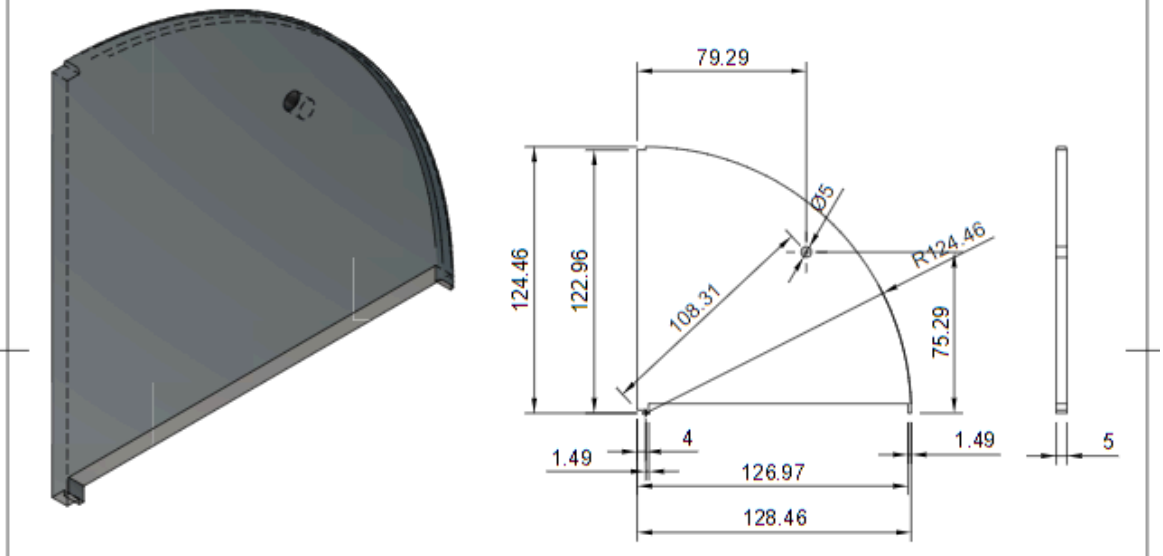
Base:



For better quality, the videos can be found in the IDS Google Drive folder

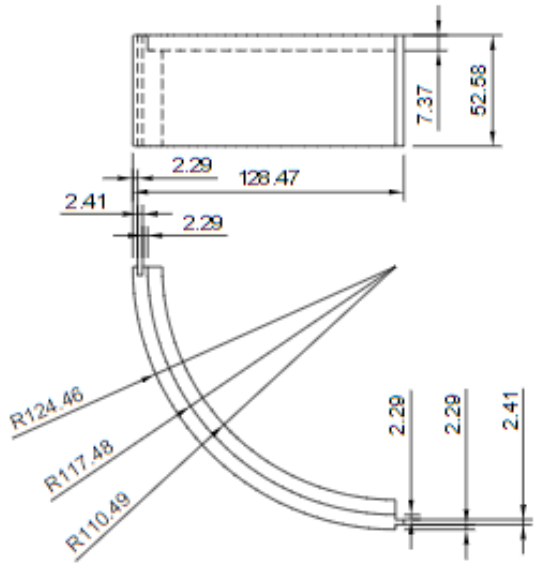
The following are technical drawings made using AutoCad for every part:

Platform:



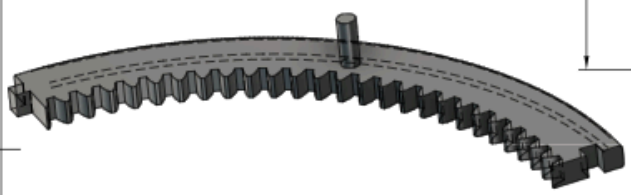
Part Name:	Platform	***Created by:***	Daniyal Hashmi
Date:	2024-06-04	***Project Name:***	Independent Design Study - 2
QTY:	4	***Scale:***	1:2mm

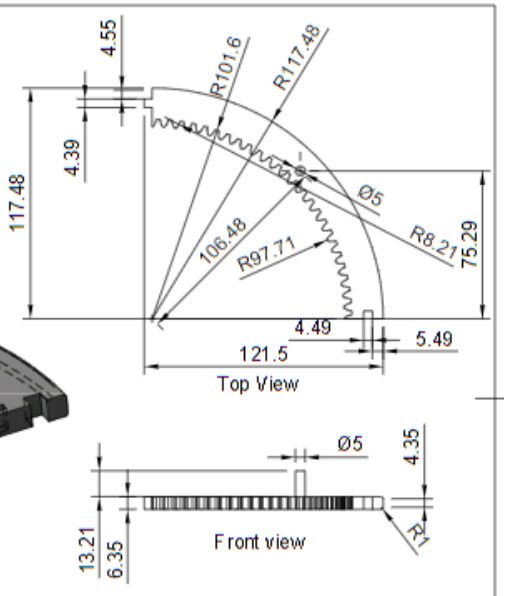
Base:



Part Name:	Base	Created by:	Daniyal Hashmi
Date:	2024-06-04	Project Name:	Independent Design Study - 2
QTY:	4	Scale:	1:2mm

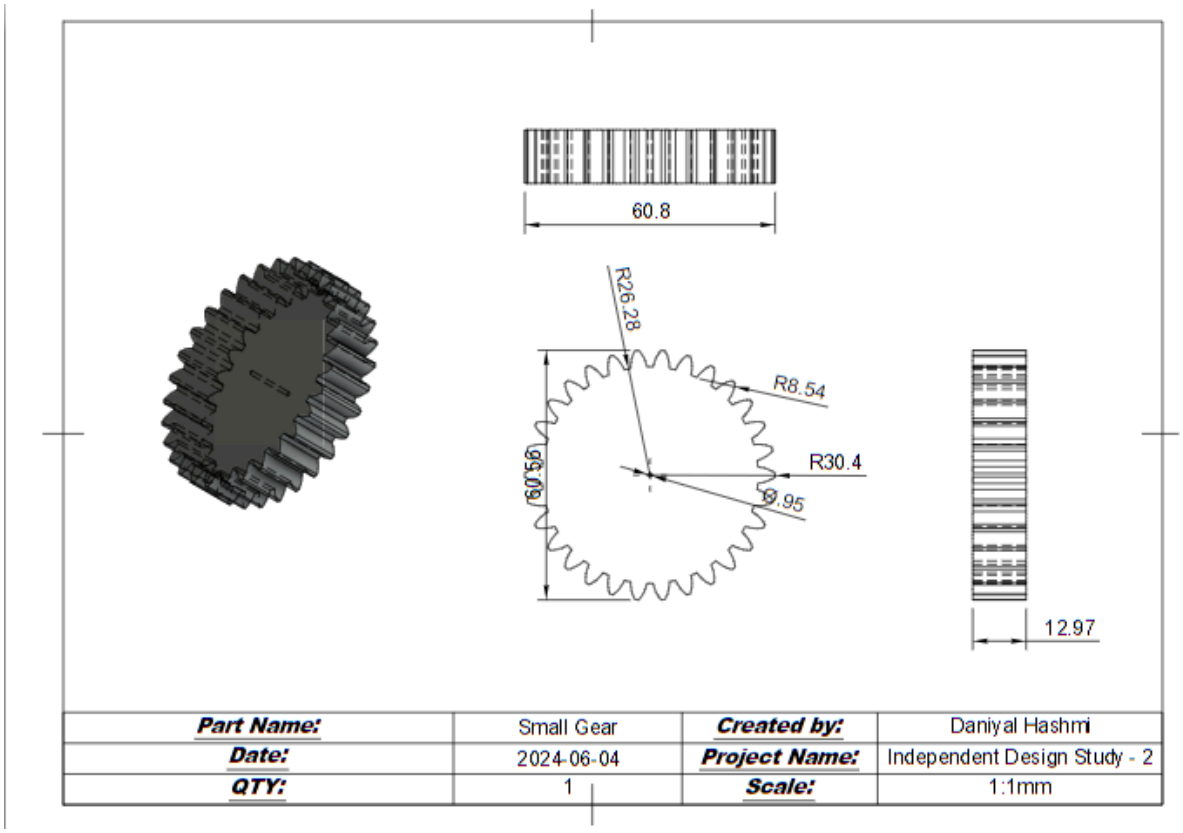
Big gear:





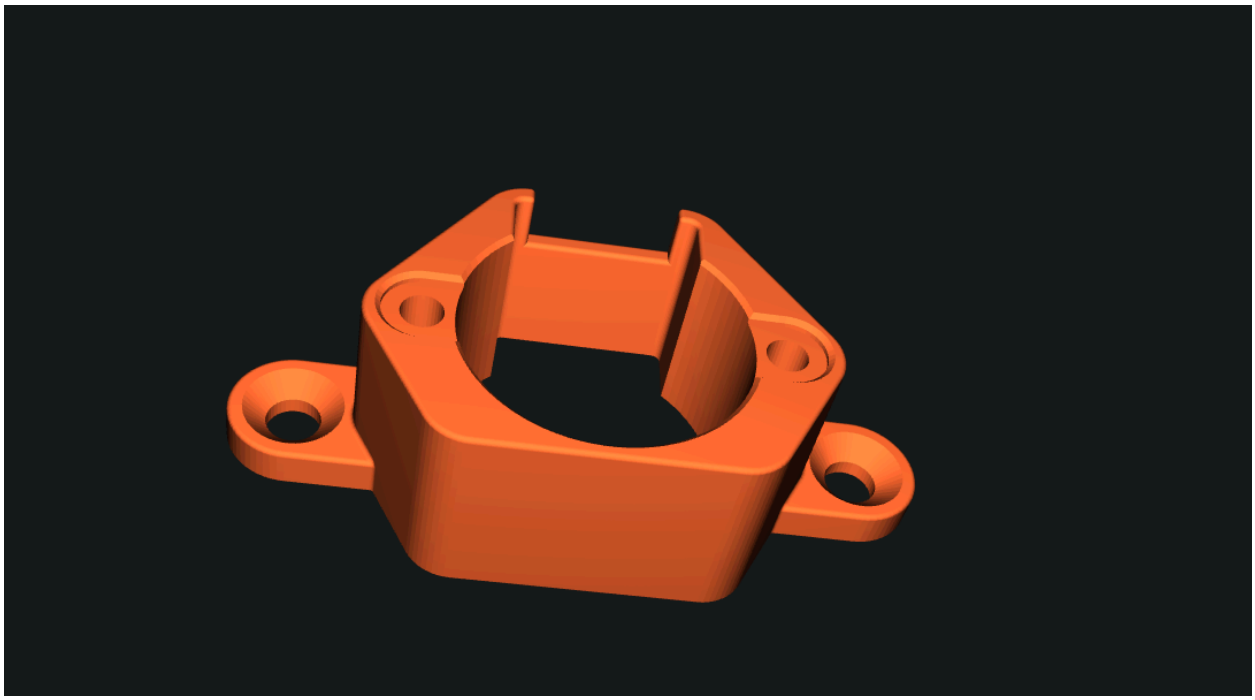
Part Name:	Big Gear	Created by:	Daniyal Hashmi
Date:	2024-06-04	Project Name:	Independent Design Study - 2
QTY:	4	Scale:	1:2mm

Small Gear:



Part Name:	Small Gear	***Created by:***	Daniyal Hashmi
Date:	2024-06-04	***Project Name:***	Independent Design Study - 2
QTY:	1	***Scale:***	1:1mm

Step Motor Mount:



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 filing down the ends so they fit better. I also glued the pieces together at the end using hot glue to make sure they are sturdy and wont fall apart.

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

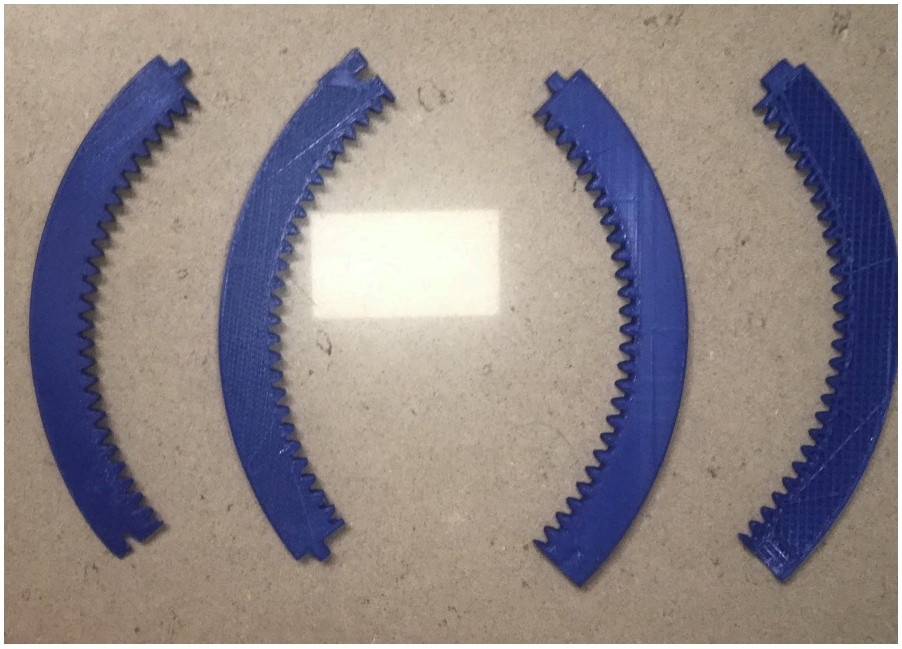
  To fix this I made it edited the 3D print settings to print more precise and use more material. This took more time to print and used more material but ensured that it would not break as easily.

- The motor needed something to be mounted on so that it wouldn’t be moving when trying to rotate the gears

  I 3d printed a mount for the motor, which I attached to a wooden base to stop the motor from moving with the gears

- 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:

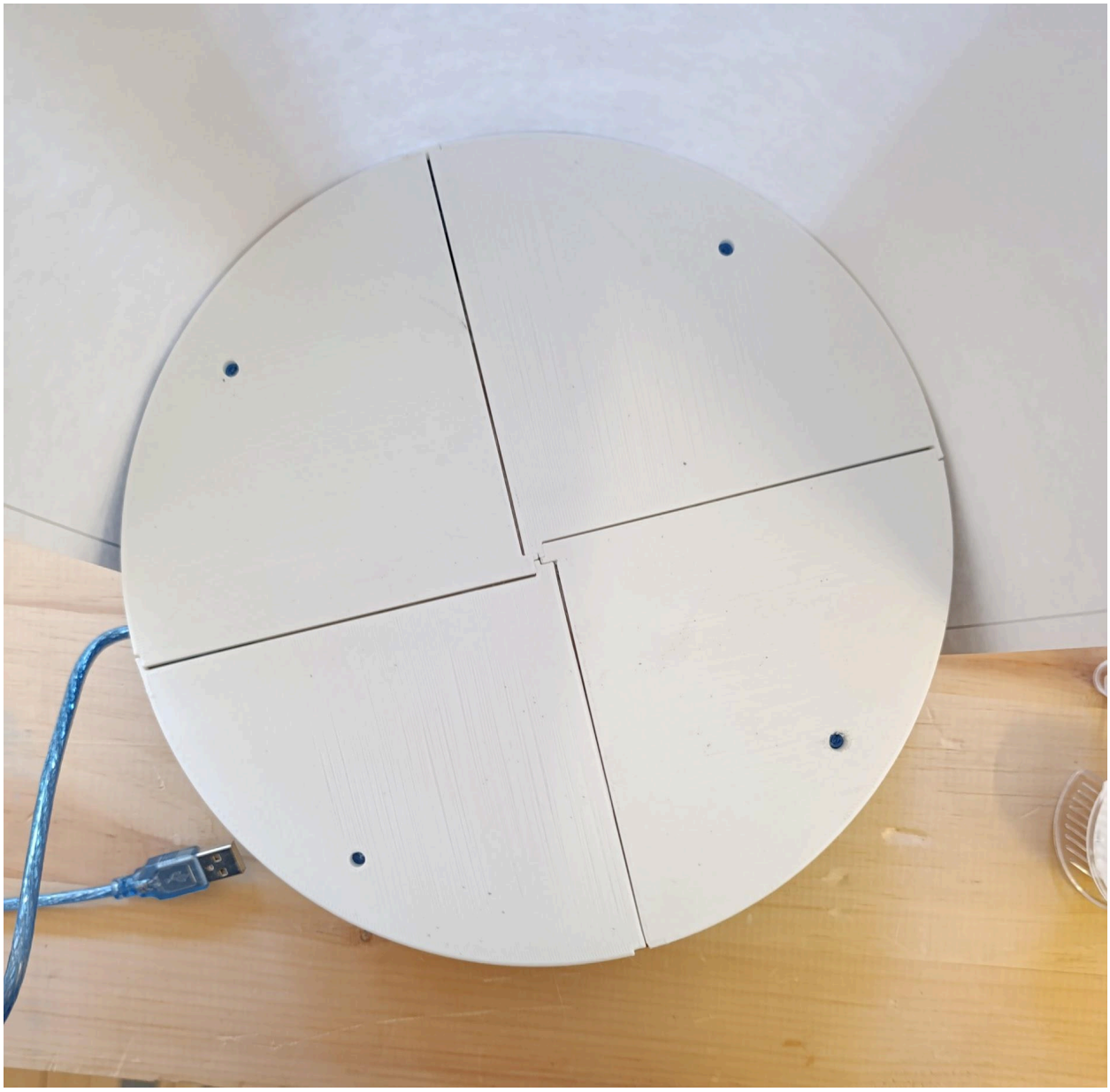


Lastly, I had the idea of printing the different pieces in different colours as it would make the table look much better.

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 and 2 where I went more in-depth about the specifications.

Here are images of the final product:



Here is the code for the electronics and programming used (with instructions):

Code to upload to Arduino Board:

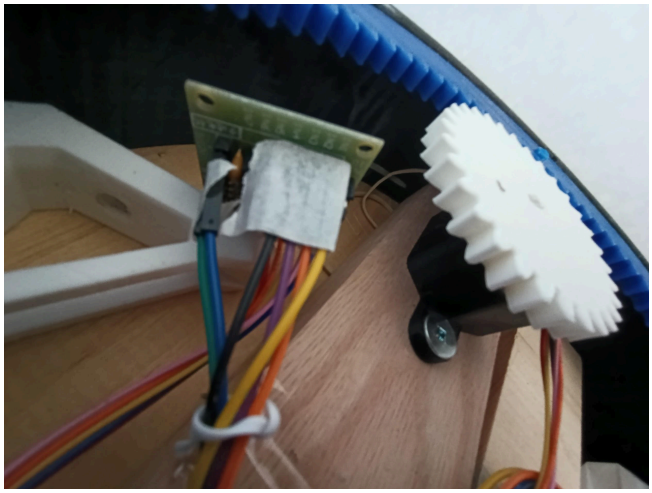
arduinoCode

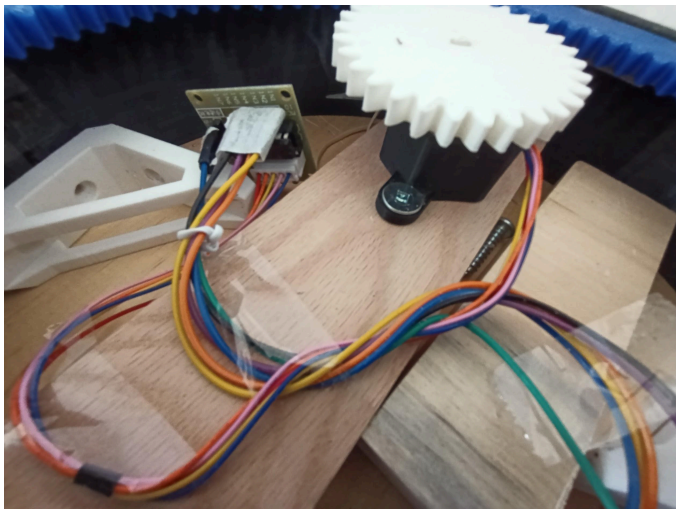
Code to run on phone (Change IP address to your phone's IP address):

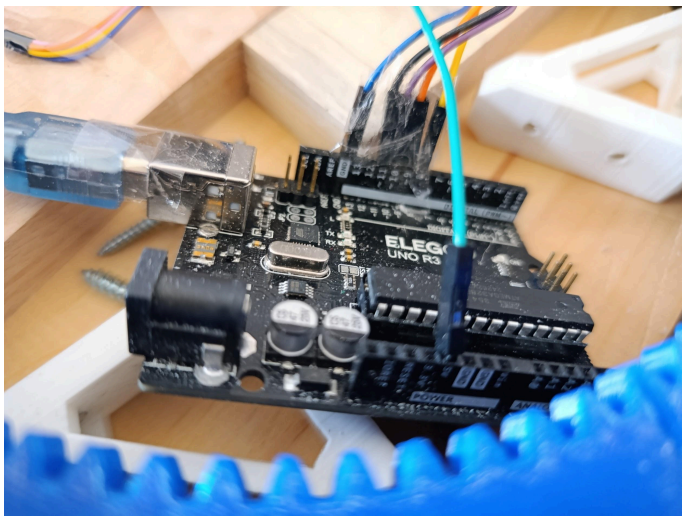
serverCode (Phone)

Code to run on computer/secondary device which will be connected to Arduino board (Change IP address to your phone's IP address):

clientCode (computer)







1. Assemble the system as detailed in the pictures above. Attach the stepper motor to the motor driver. Attach the wires as shown in the images below. Use the colour of the wires to determine where to attach each wire.
2. Download Arduino IDE
3. Upload code to Arduino Board
4. Check which COM the Arduino board is connected to
5. Install QPython3 on your Android phone and give it all permissions from settings
6. Install an IDE that can run a Python script on your computer.
7. Connect the Arduino board to your laptop/computer
8. Upload the client.py script to your computer and ensure that the COM is the same as the one shown on the Arduino IDE
9. Upload server.py to QPython3 on your phone
10. Ensure that the IP on both client.py and server.py is the same as the IP of your phone.
11. Make sure that the Arduino IDE is closed on your computer
12. Run the script on your phone
13. Run the Script on your computer
14. The motor should start spinning, and your phone should start taking pictures

Evaluation:

I was able to print and finish modelling all of my parts in this IDS as well as assemble, code, and run the turntable. 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 this project are polishing the prints/3D models, make it look better, and maybe even change the design so it is more efficient. Overall, I really liked the outcome of this project. I was successful in what I planned on doing and completely finished the product. The clip-on feature worked 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. The coding and assembling the electronics was easy as there were multiple online resources to get help from. Next time, if I were to do a project like this again I would make a more detailed plan with improvements, learn from the errors I made in this IDS, and manage my time so that it will be done within one IDS instead of three such as this one.