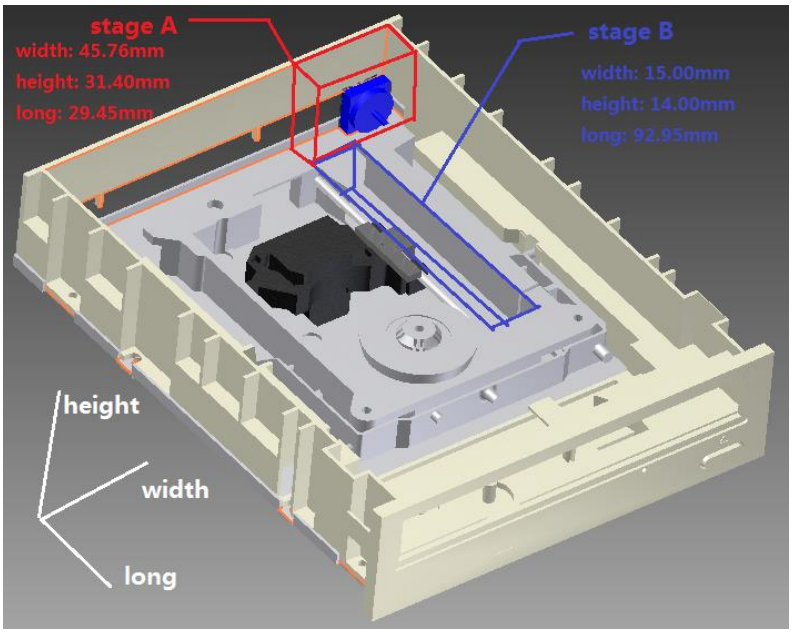
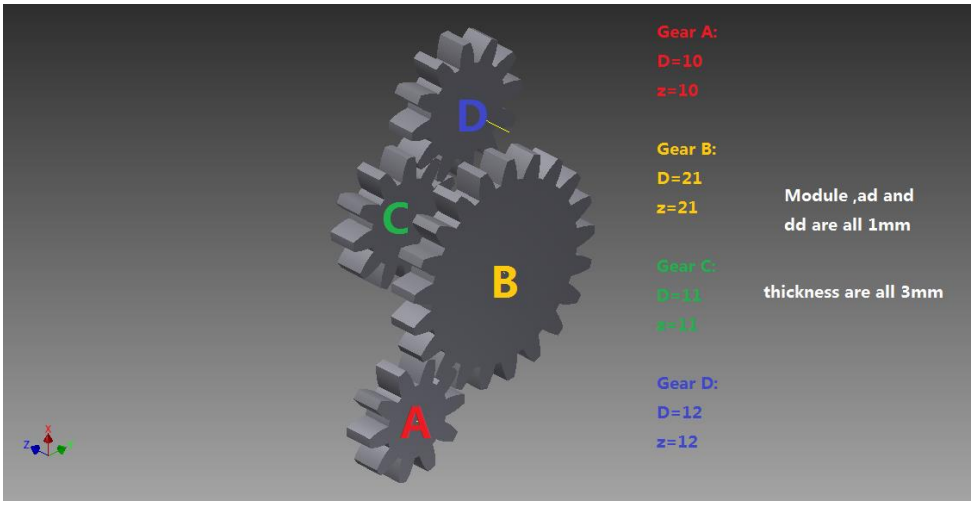
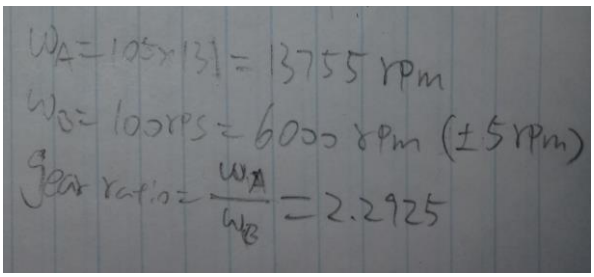
Dimension of stage A and stage B and gear train:





Design process:

Before design the gear train. The first thing to do is calculate the gear ratio for our group. Then list out all of constrains that we must consider and try to figure out the possible gear teeth number combinations to match with the gear ratio we calculated.

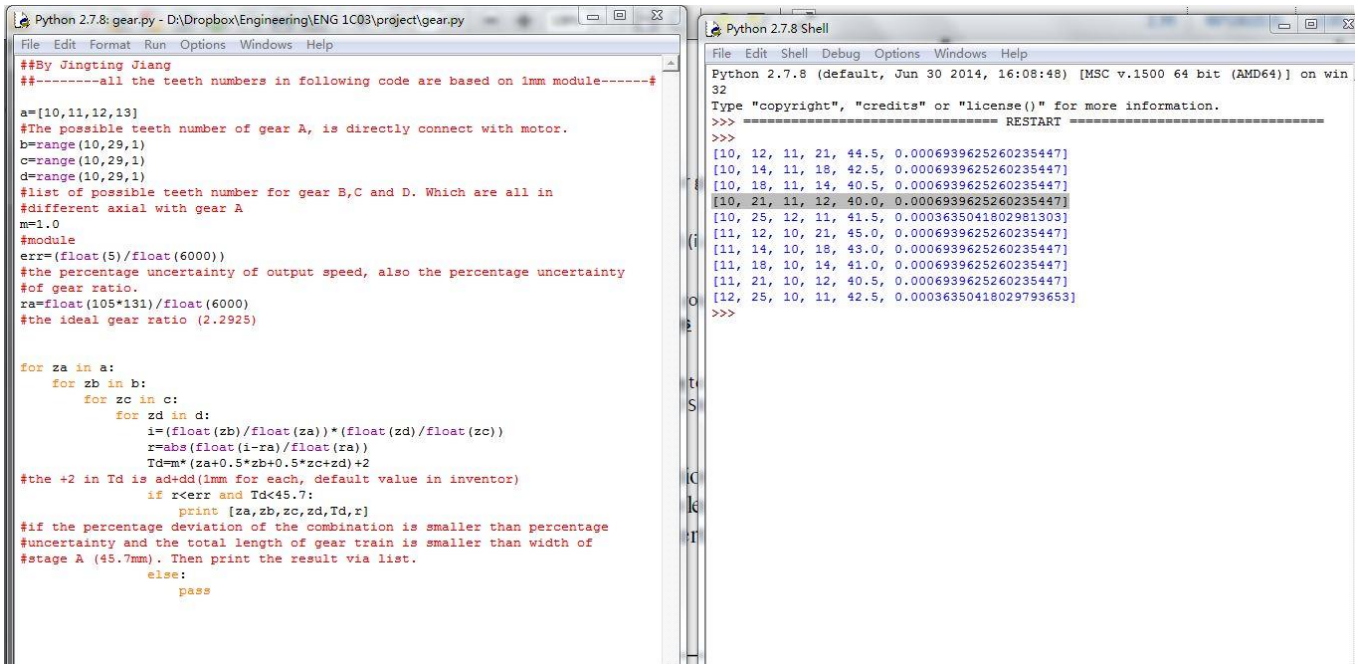


Limited by the size and position of motor, the outside diameter of driven gear (which

connects with motor) must smaller or equal to the motor size. For the other gear(s) which in different axial, the outsider diameter must no more than the height of chassis.

The minimum number of teeth for each gear is 10 in order. And we also need to consider the resolution of 3D printer. The minimum module for gear must no less than 1mm by experience. That means the number of teeth would be greater or equal to the pitch diameter of gears.

Since too many variables and constrains need to considered. After I make sure all the constraints exactly then I use python write a code to help me find out all the possible gear combination. The code would output all the possible 4 gears combination and percentage deviation for each combination. Here is my code and output (or open this link: https://www.dropbox.com/s/wbb2u5bx2zhgzvk/gear.py?dl=0)



Gear parameter:

Gear name	Pitch Diameter (mm)	Module (mm)	Number of teeth
A	10	1	10
B	21	1	21
C	11	1	11
D	12	1	12

Verification:

Object requirement	Actual result	Pass/Fail
Ideal rotational speed: $6000 \pm 5\text{rpm}$	$13755 \div \left(\frac{21}{10} \times \frac{12}{11}\right) = 6004rpm$	In the acceptance interval ($\pm 5\text{rpm}$). Pass
Inside the CD drive: Height=31.4mm	Outside diameter of largest gear: $21 \times 1 + 2 = 24\text{mm}$	Smaller than height Pass