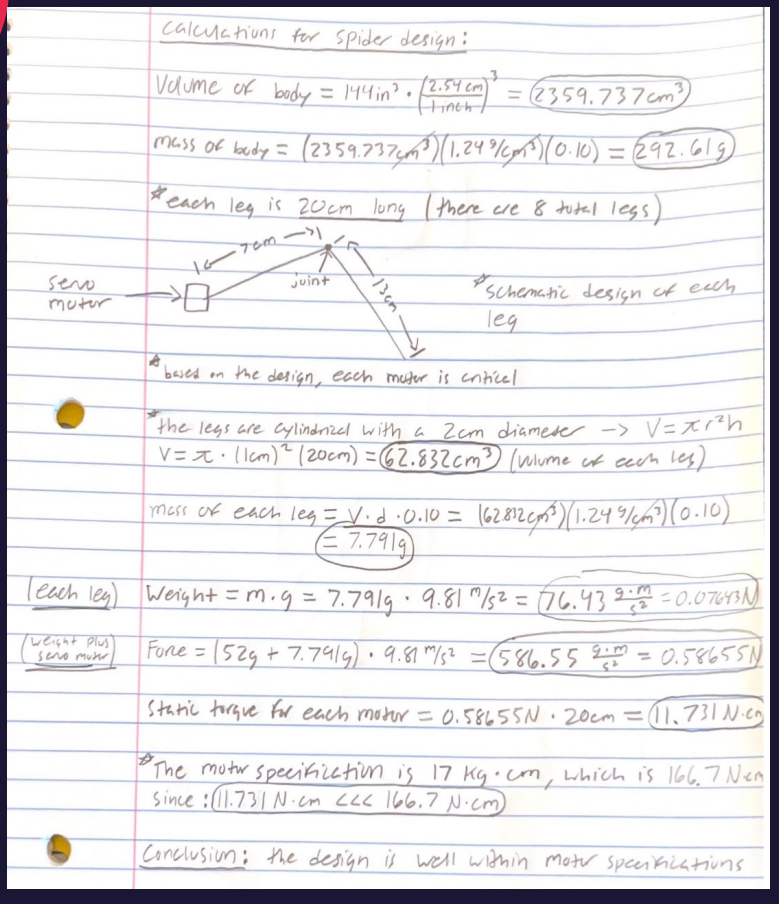
Robotics Studio MECE 4611
Spring 2024
Assignment 1

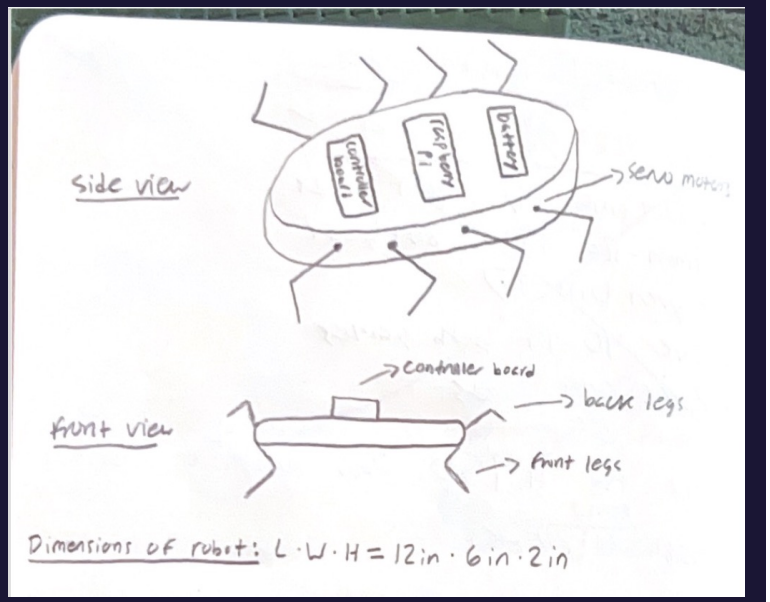
Nicolino Primavera (ncp2136)

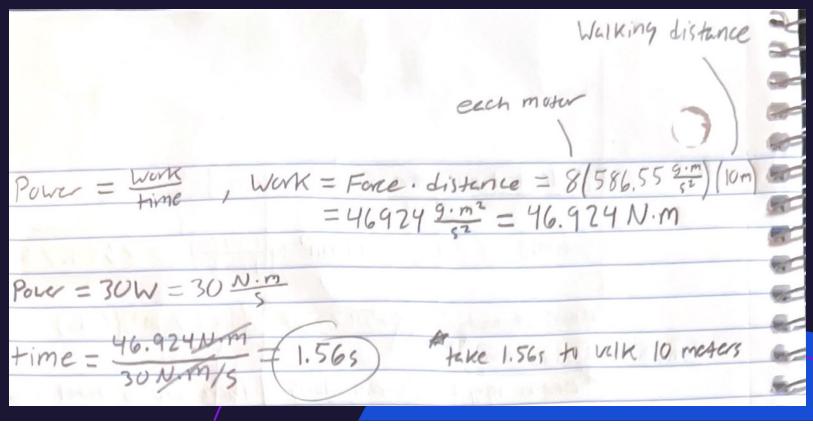
Submission: 1/28/24 at 8:40pm
Grace hours: 96+3:20

Concept 1 – Spider/Arachnid design

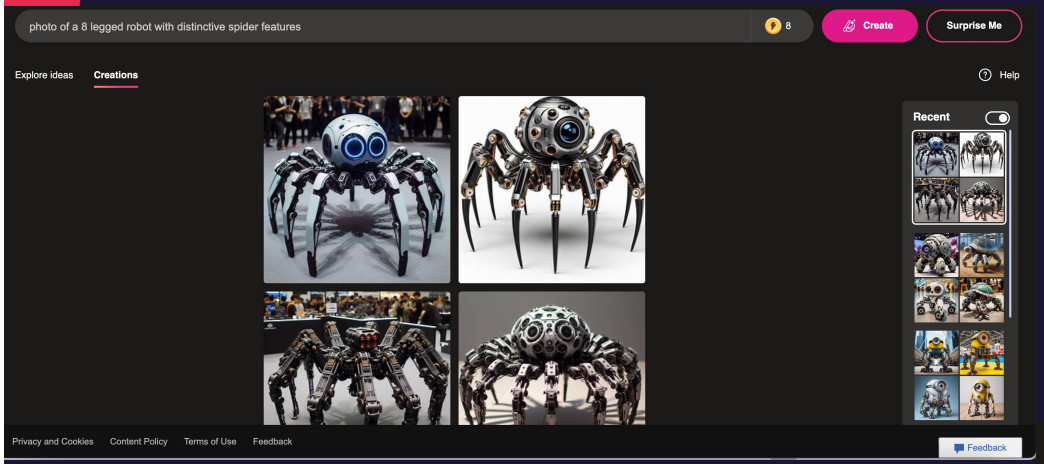
- This design is of an eight-legged robot that is inspired by spiders' physical characteristics.



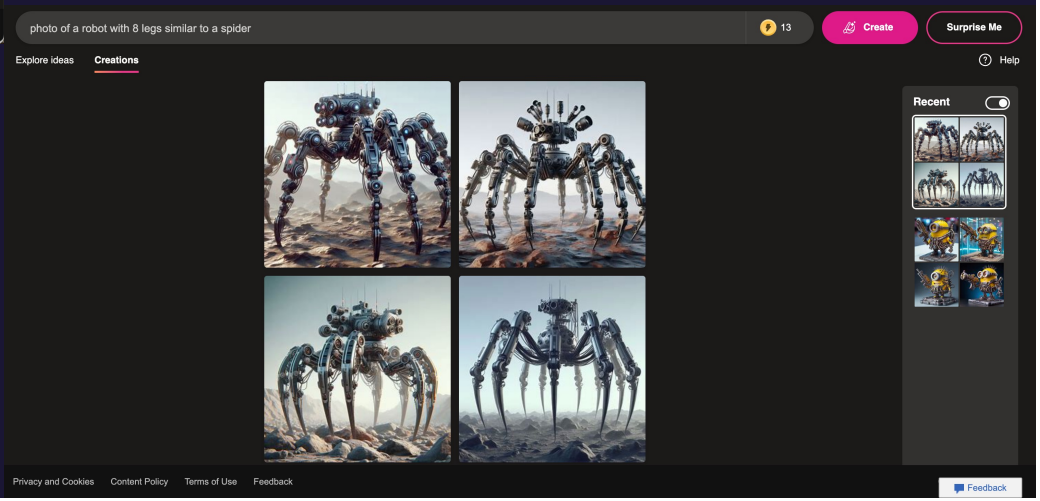




Concept 1 – Spider/Arachnid design using AI

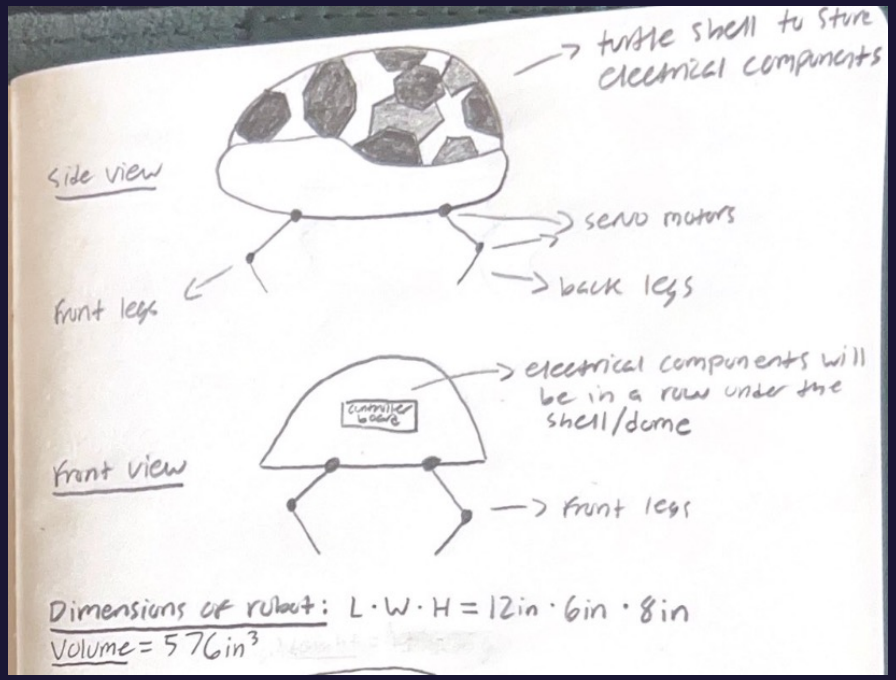


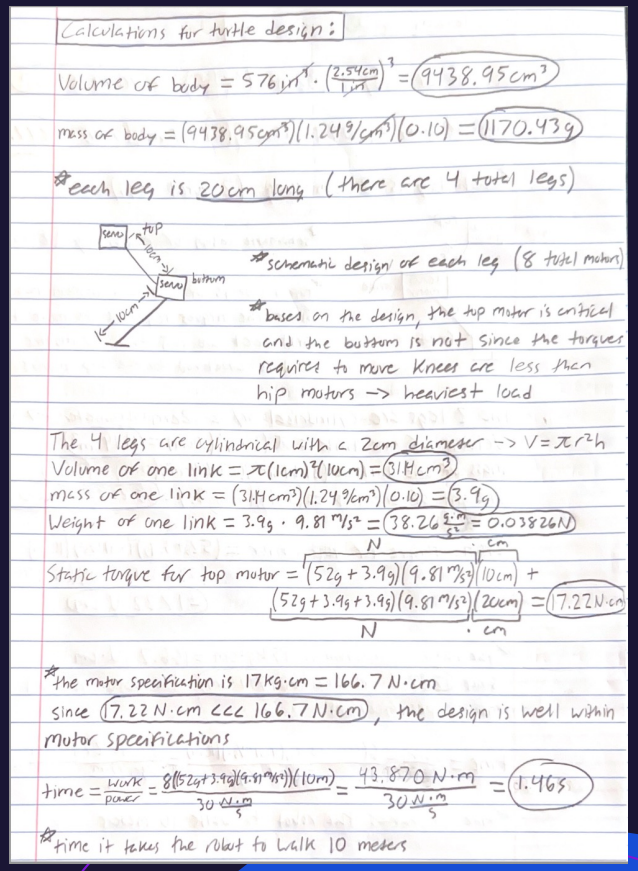
- I used the generative AI models to improve my designs and sketches.
- They helped me position joints and servo motors in spots I wouldn't have initially chosen.



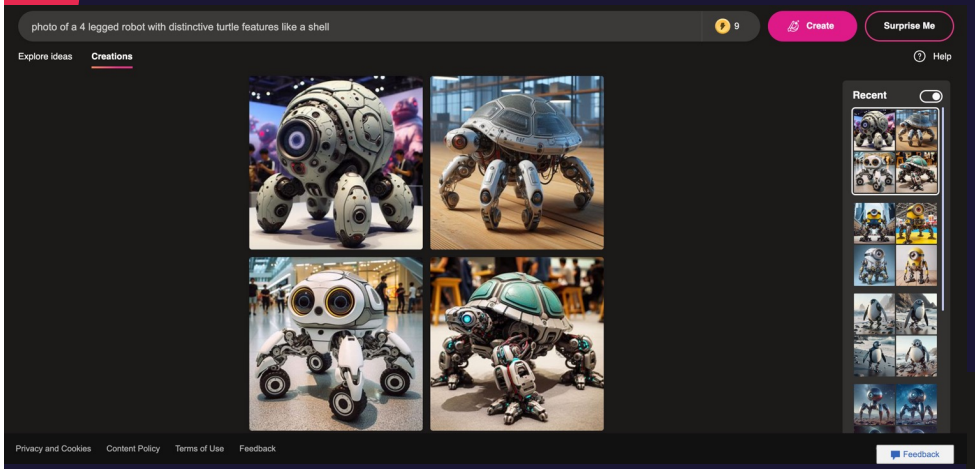
Concept 2 – Turtle/Quadruped design

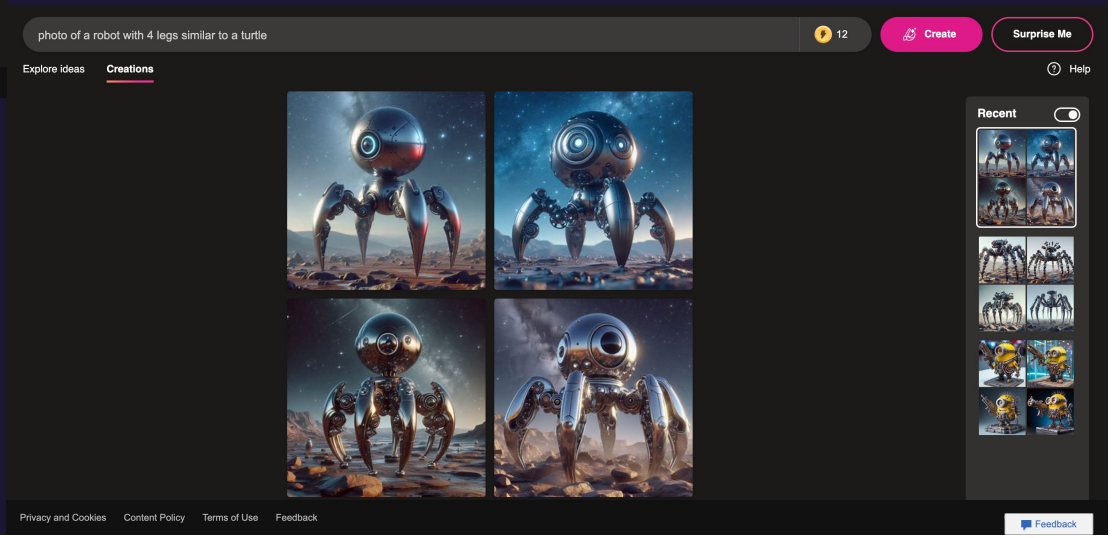
- This design is of a four-legged robot that is inspired by turtles' physical characteristics.





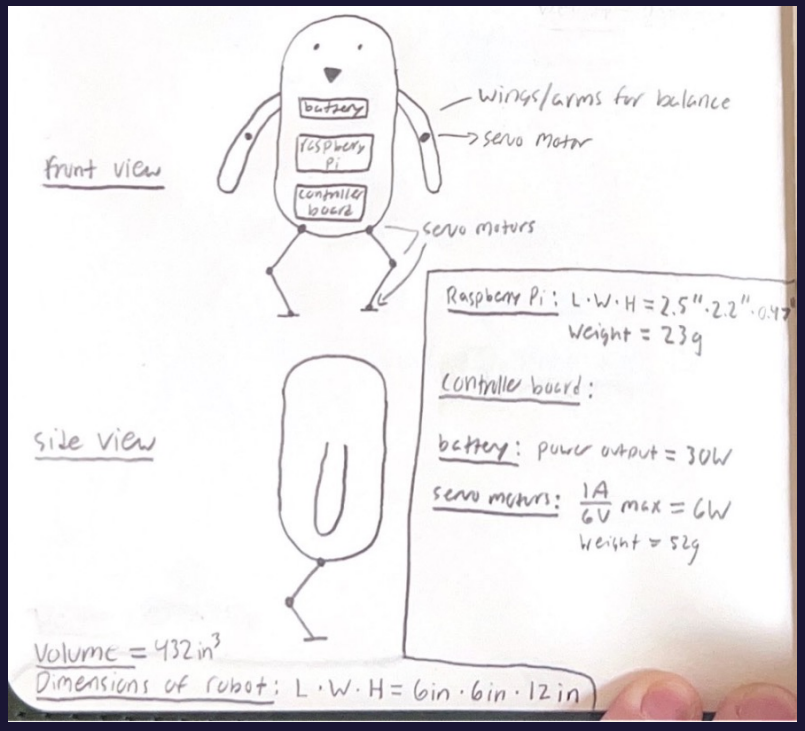
Concept 2 – Turtle/Quadruped design using AI

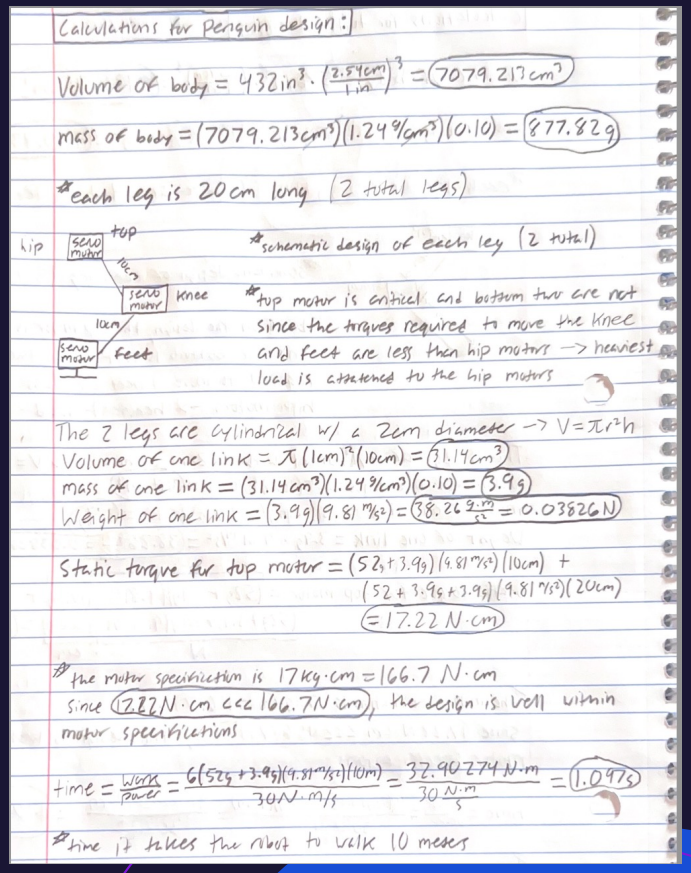




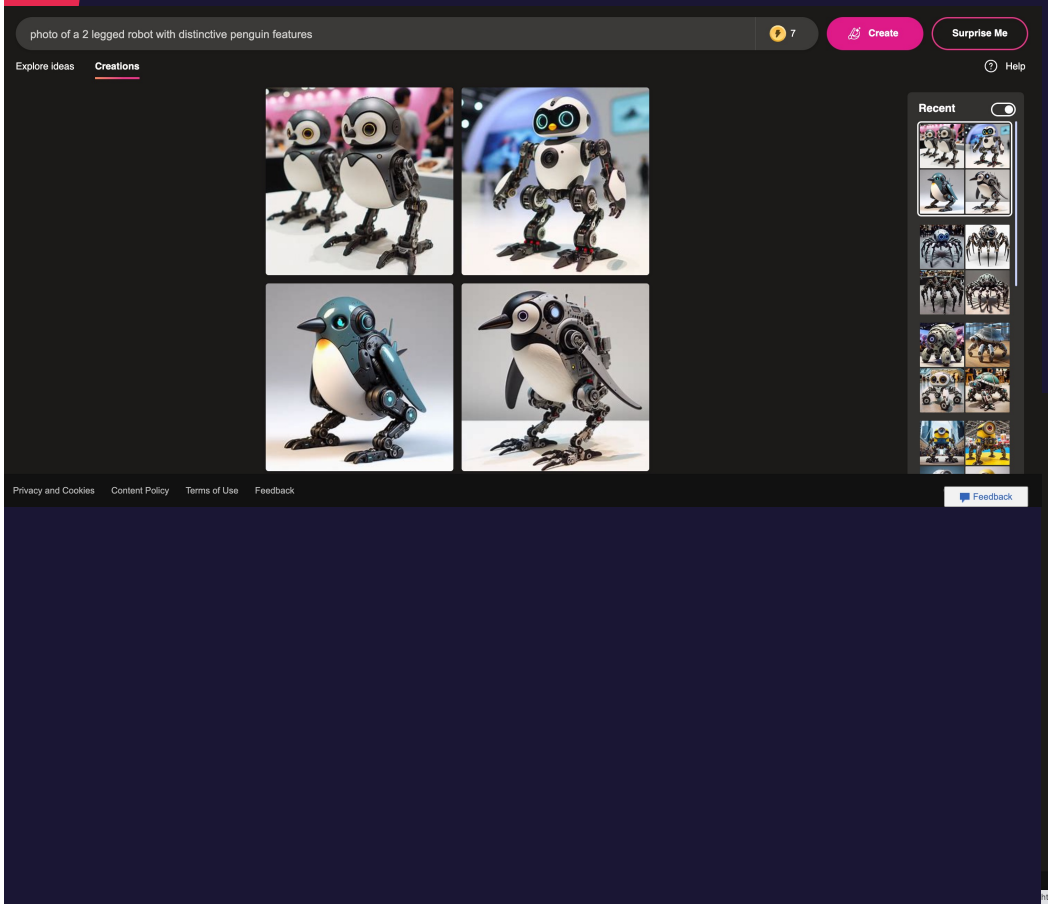
Concept 3 – Penguin/Bipedal Robot design

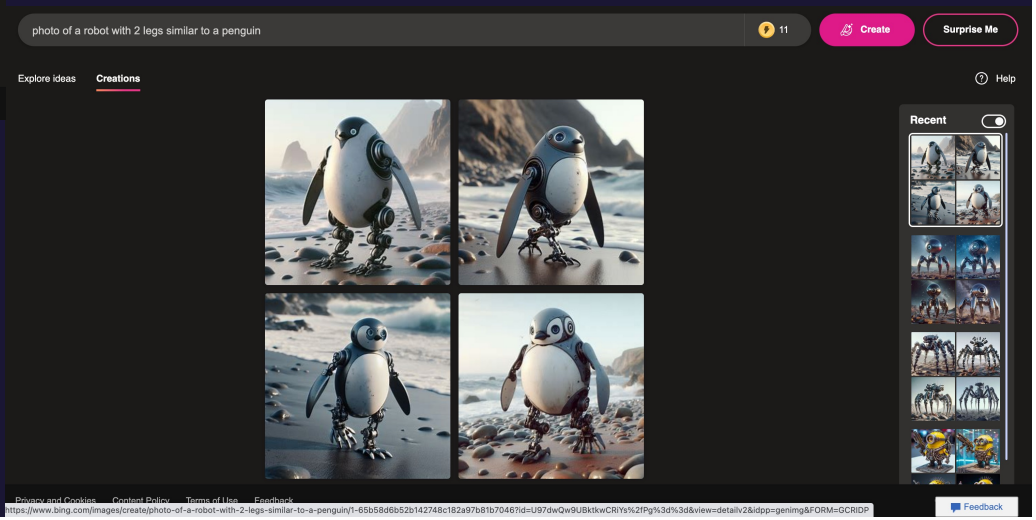
- This design is of a two-legged robot that is inspired by penguins' physical characteristics.





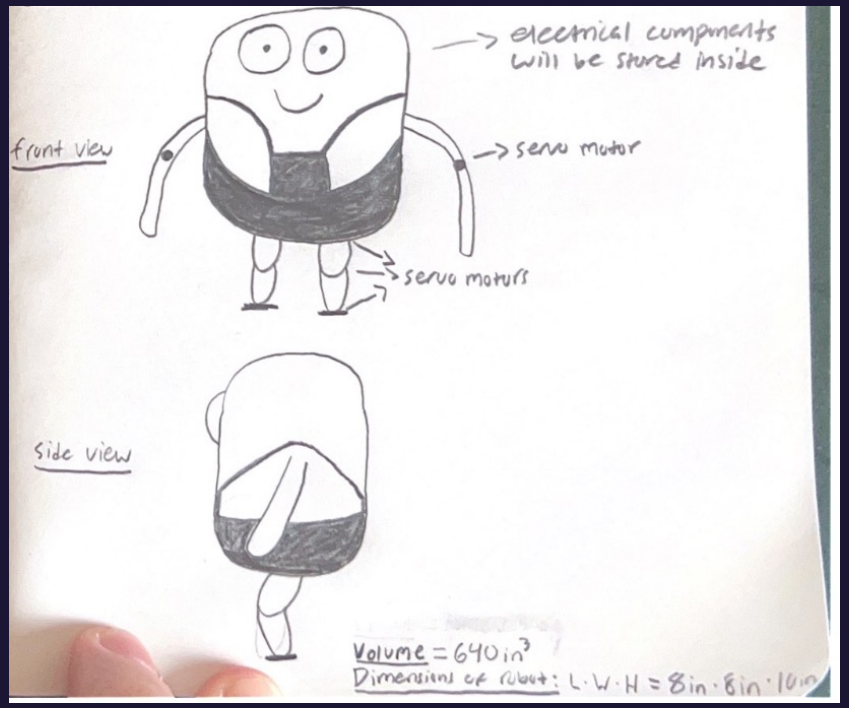
Concept 3 – Penguin/Bipedal Robot design using AI

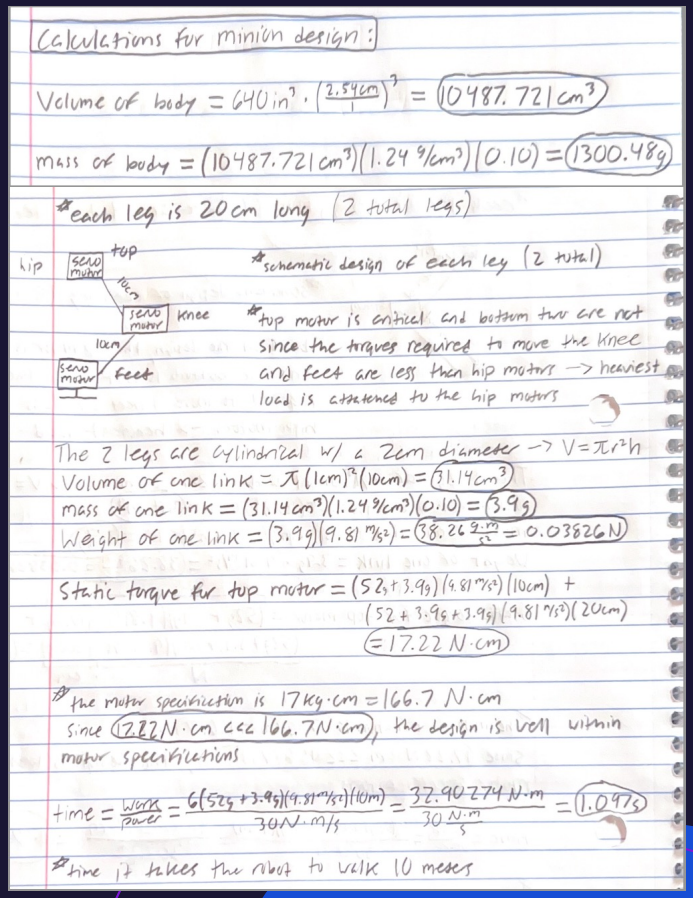




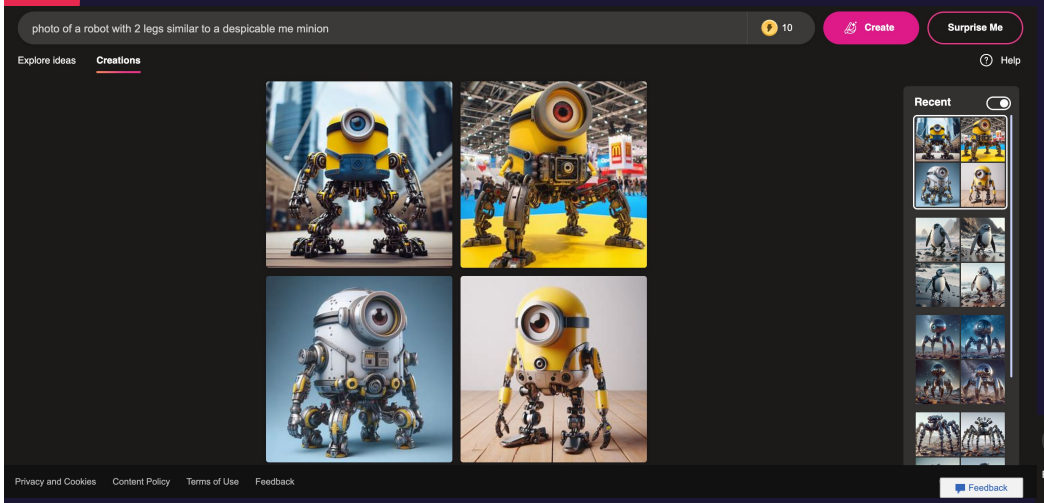
Concept 4 – Despicable Me Minion design

- This design is of a two-legged robot that is inspired by the Despicable Me minions' physical characteristics.

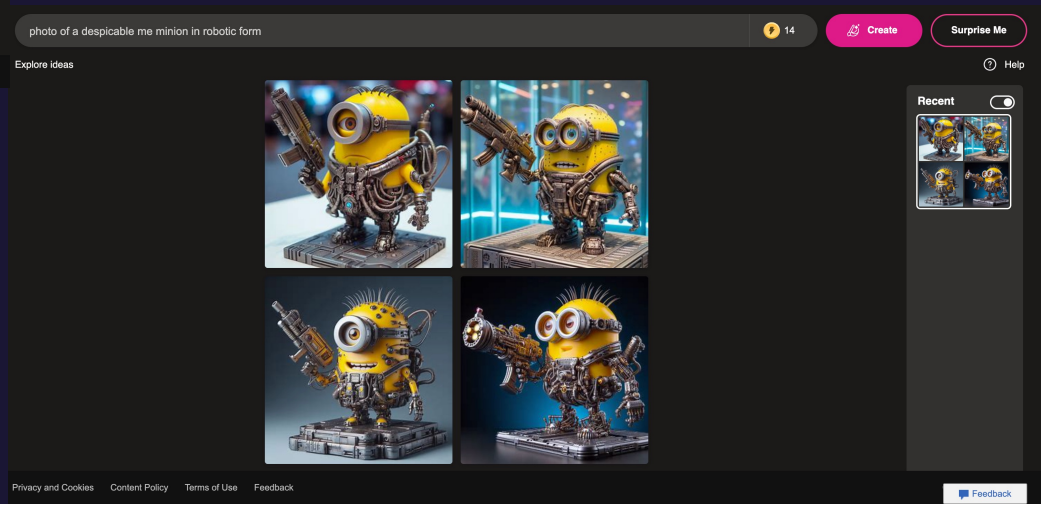




Concept 4 – Despicable Me Minion design using AI



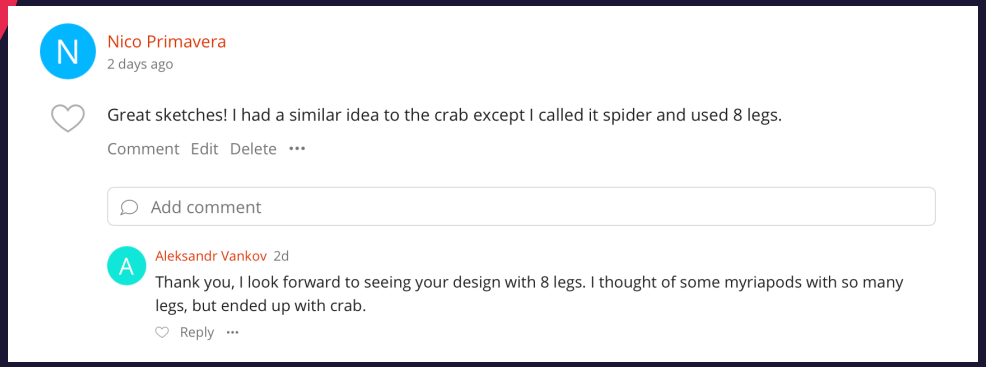
- The minion in the bottom right corner is exactly what I look to do.

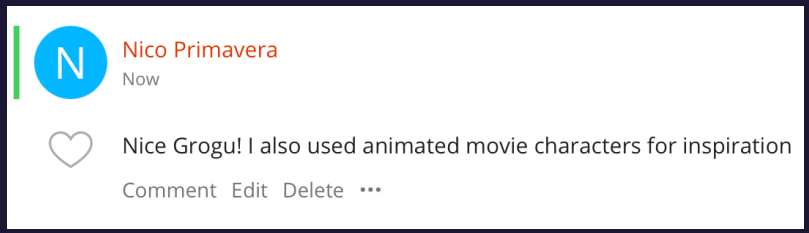


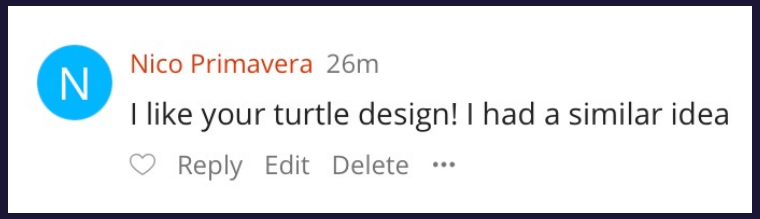
Rubric Checklist

- At the end of the assignment, list all the rubrics and points you believe you should receive, along with page numbers to support your claim.
- 5 Points Title slide complete (slide 1)
- 5 Points overall aesthetics, layout and formatting of the slides
- 5 Points posting a sketch of your robot on the discussion board at least 24h in advance of the deadline (slide 12)
- 5 Points Comment (constructively) on at least three other's postings (slide 11)
- 5 Points showing three robot designs from an AI-generator (e.g. StableDiffusion) along with the prompt (slides 3, 5, 7, 9)
- 5 Points 3D sketch, with key dimensions and labels (slides 2, 4, 6, 8)
- 5 Points shading and shadows (slides 4 and 8)
- 5 Points weight estimate, gait and stability analysis (slides 2, 4, 6, 8)
- 5 Points power estimates (including estimated run time) (slides 2, 4, 6, 8)
- 5 Points including Computer, controller, battery labels (slides 2, 4, 6, 8)
- 5 Points showing in multiple poses (slides 2, 4, 6, 8)
- 10 Points showing generative AI assistance (slides 3, 5, 7, 9)

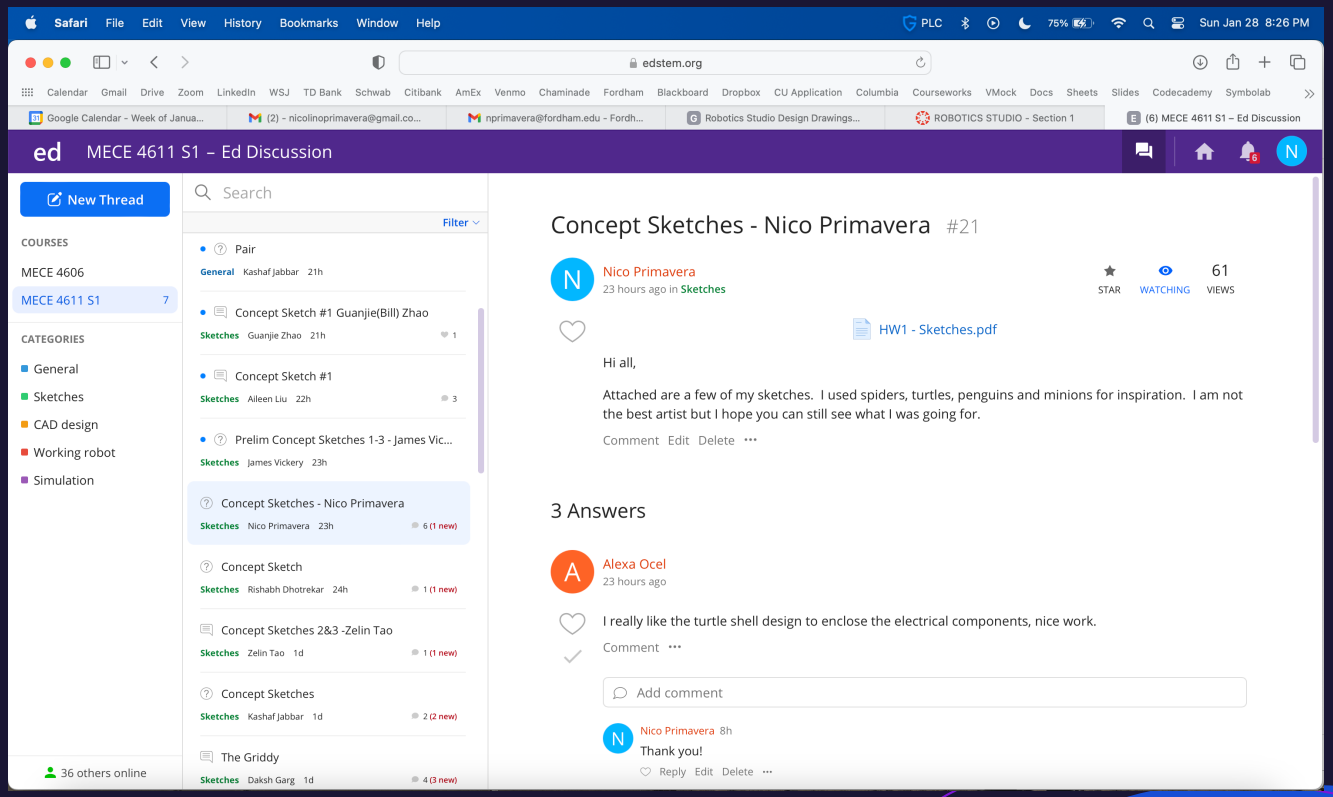
Comment (constructively) on at least three other's postings

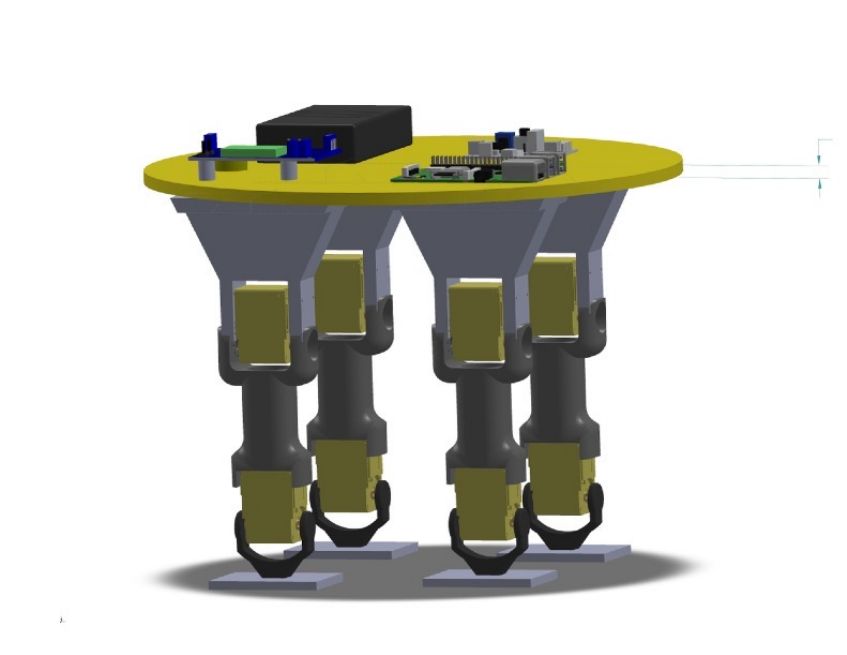






ED Discussion Board post





Robotics Studio MECE 4611
Spring 2024
Assignment II
Nicolino Primavera (ncp2136)
Submission: 2/4/24 at 10:45pm
Grace hours: 99:20 + 1:15 hours
Bob the Minion
Preliminary CAD Model

Electrical Component Specifications

Dimensions (L x W x H):

- Raspberry Pi 3A+ = 2.56 x 2.2 x 0.47 in
- Battery Pack = 1.1 x 3.35 x 5.7 in
- LX-16A Metal Servos = 1.38 x 0.97 x 1.78 in
- Small Servo Controller Board = 4.7 x 3.1 x 1.2 in
- 10A Stepdown DC to DC Buck Converter = 3.74 x 2.24 x 1.22 in
- DROK DC Converter = 3.23 x 2.05 x 1.26 in
- Raspberry Pi Camera = 0.98 x 0.90 x 0.35 in

Mass (grams):

- Raspberry Pi 3A+ = 50g
- Battery Pack = 190g
- LX-16A Metal Servos = 52g
- Small Servo Controller Board = 62.4g
- 10A Stepdown DC to DC Buck Converter = 9.072g
- DROK DC Converter = 68g
- Raspberry Pi Camera = 3.4g

3D Printed Component Specifications

Dimensions (L x W x H = Volume):

- Oval Base: 6.5 x 6.0 x 0.3 in
- Motor Harness (from Solidworks: Evaluate→Mass Properties): V=7.81 in^3 , SA=39.29 in^2
- Thigh Link (from Solidworks: Evaluate→Mass Properties): V=3.65in^3 , SA=27.39 in^2
- Foot Attachment (from Solidworks: Evaluate→Mass Properties): V=0.401in^3 , SA=5.92in^2
- Foot (from Solidworks: Evaluate→Mass Properties): V=1.02in^3 , SA=12.03in^2

Mass (grams): mass = volume (L x W x H) x density (1.24 g/cm^3) x infill percentage (0.10), 1in^3 = (2.54cm/1in)^3

- Oval Base = 23.774g
- Motor Harness = 15.87g
- Thigh Link = 7.42g
- Foot Attachment = 0.815g
- Foot = 2.073g

GrabCAD Designs for Components - Citations

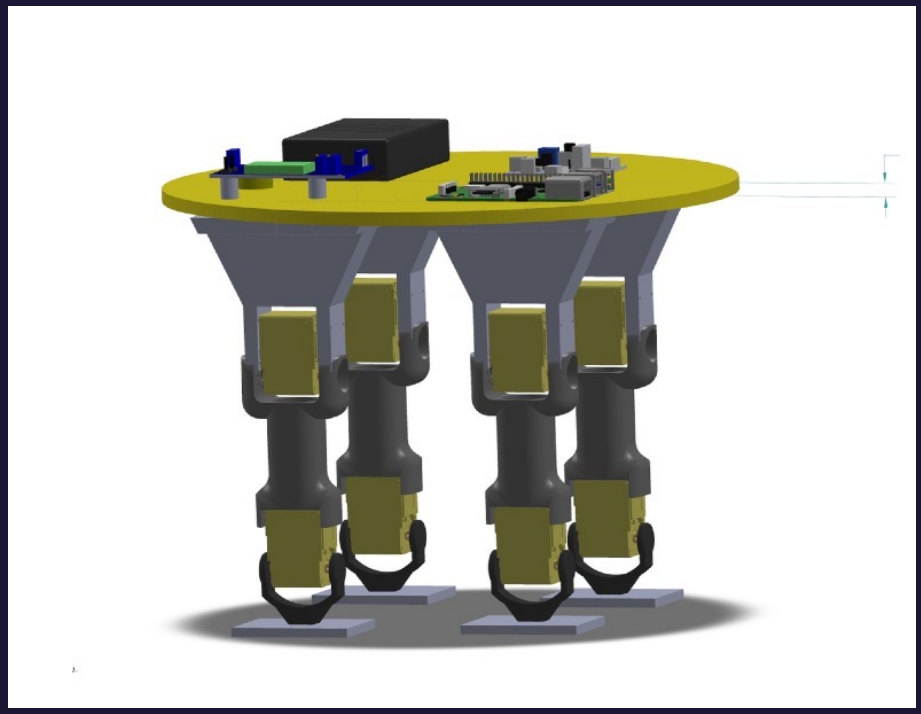
Incorporated in preliminary design

- LX-16A Metal Servos: https://grabcad.com/library/lewansoul-lx-16a-bus-servo-1
- Small Servo Controller Board: https://grabcad.com/library/lewansoul-lx16a-controller-board-1
- Battery Pack: https://grabcad.com/library/talentcell-rechargeable-12v-3000mah-lithium-ion-battery-pack-1
- DROK DC Converter: https://grabcad.com/library/drok-dc-converter-5-3-32v-to-1-2-32v-1
- Raspberry Pi 3A+: https://grabcad.com/library/raspberry-pi-3-4
- Motor Harness: https://grabcad.com/library/robot-skeleton-and-modular-motor-harness-1
- Thigh Link: https://grabcad.com/library/leg-piece-2
- Foot: https://grabcad.com/library/lewansoul-lx-16a-motor-connector-1

Did not incorporate these yet

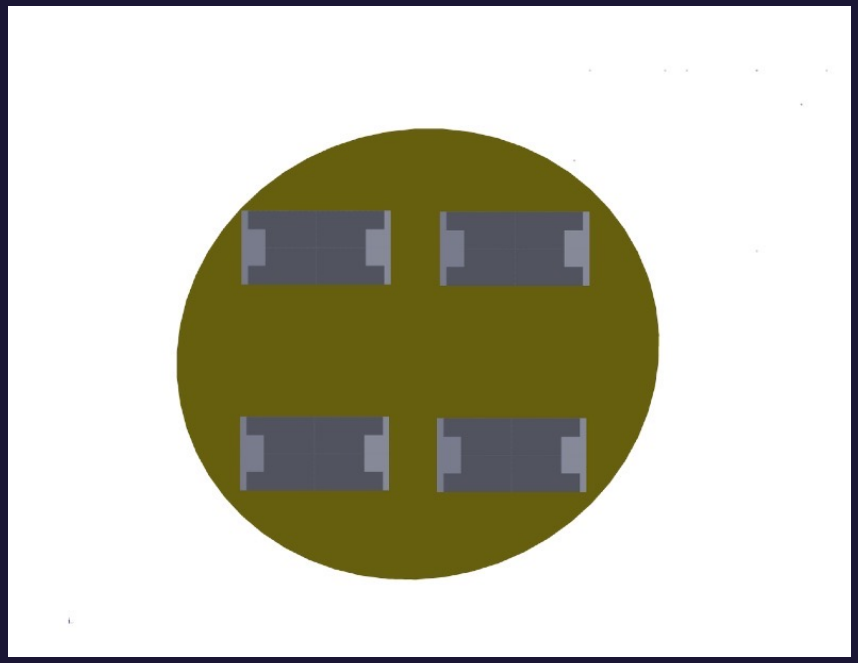
- IMU (Adafruit): https://www.thingiverse.com/thing:4602596
- Raspberry Pi Camera: https://grabcad.com/library/raspberry-pi-camera-module-v2-1
- Mini USB Microphone: https://grabcad.com/library/raspberry-pi-camera-module-v2-1
- Motor Wheels: https://grabcad.com/library/motor-shaft-adapter-for-lx-16a-1

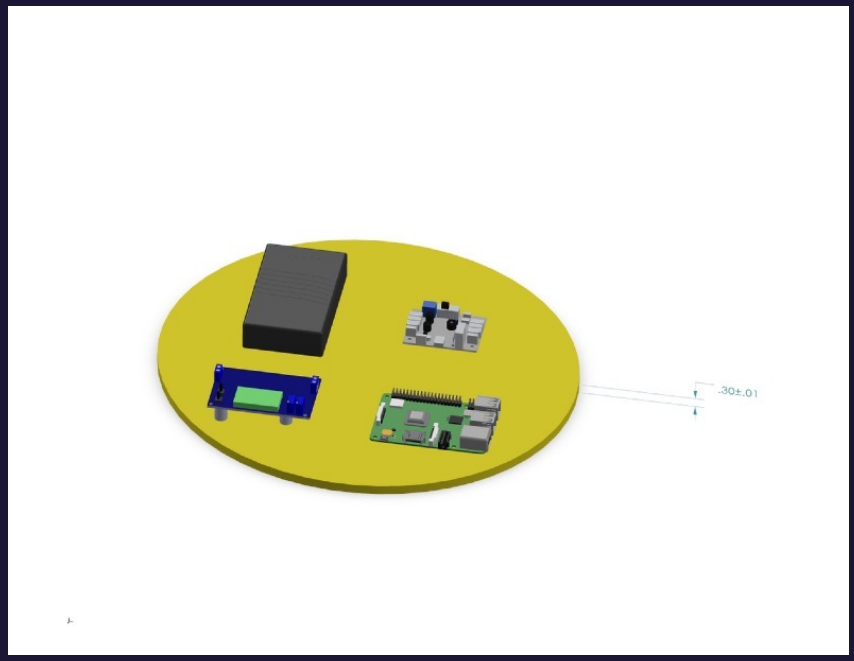
Renderings – Full Robot



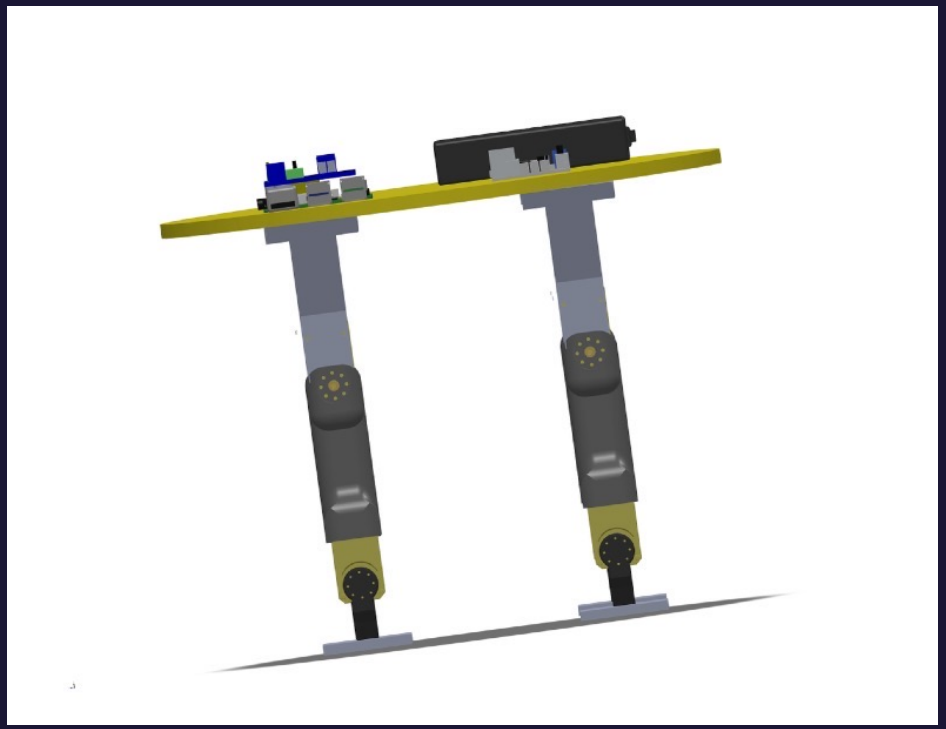
- So far, I have completed the legs and base designs of the robot
- Next step will be to incorporate the Despicable Me Minion features
- The robot legs are approximately 10 in long and the oval base is 6.5 by 6.0 in
- The electrical components will be covered in the final design
- Based off my initial calculations it will take ~1.5 seconds to walk 10 meters
- The motors are positioned to be able to walk forwards and backwards
- I opted for four legs instead of two for increased stability and so the robot can support more weight

Renderings – Arial View

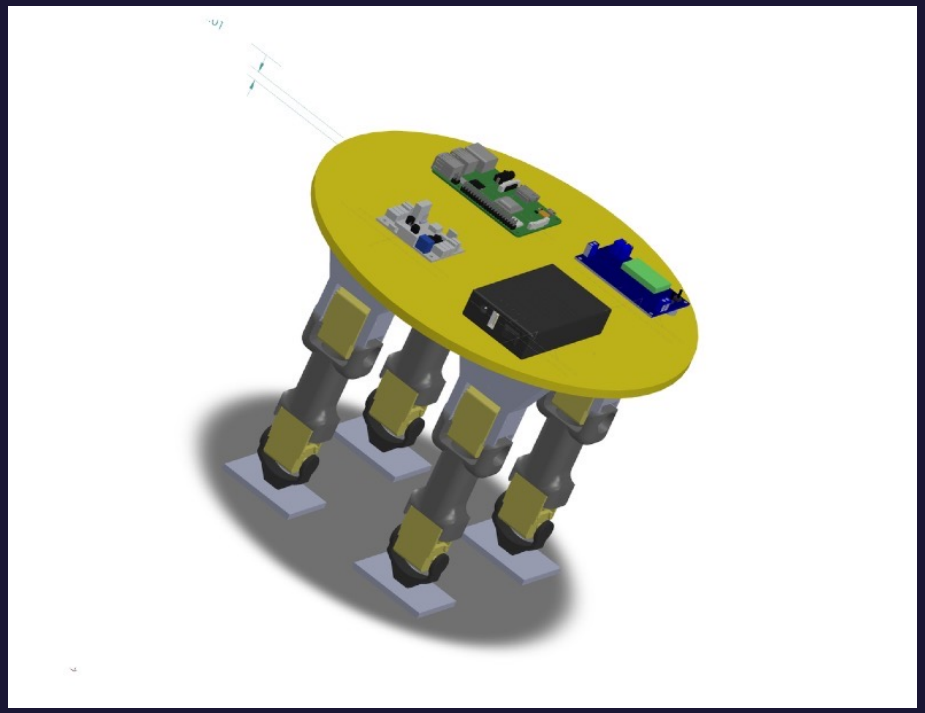


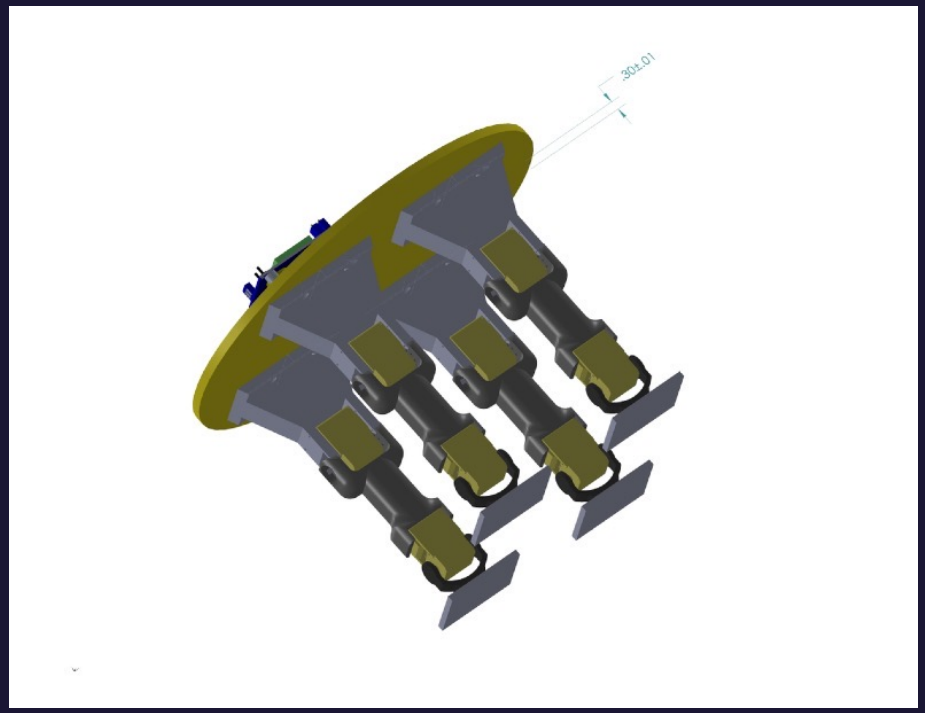


Renderings – Leg Design



Renderings – Full Robot





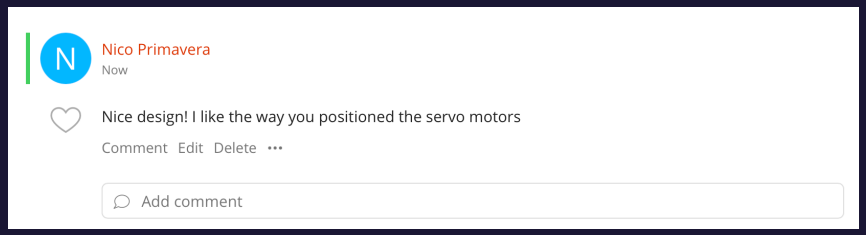
Next Steps

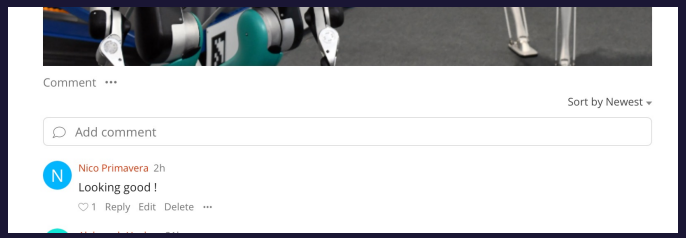
- Finalize leg design by adding fasteners, mounts, bearings, cables, through-holes, cable fasteners, surface texture, etc.
- Find the best way to incorporate the minion design found on GrabCAD
  - Extruded cut of minion design found on GrabCAD
  - Shrink-wrapping (“Monokoting”)
- Find the best place for a camera
- Decide if an IMU is necessary (probably not since 4 legs will provide stability)

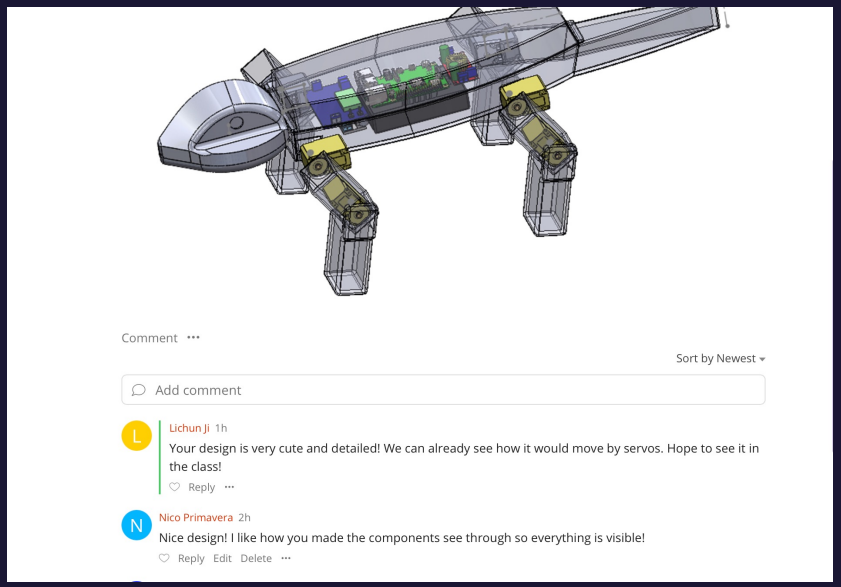
Rubric Checklist

- 5 Points Title slide complete (Slide 13)
- 5 Points overall aesthetics, layout and formatting of the slides (All slides)
- 10 Points posting some rendering of your robot on the discussion board at least 24h in advance of deadline, and commenting constructively and positively on at least three other's postings (show screenshots) (Slide 23-24)
- 10 Points 3D Renderings in perspective (Slides 17-20)
- 10 Points Key components included (Slides 17-20)
- 10 Points organic shape (no/few straight edges) (Slides 17-20)
- 10 Points photorealistic rendering (Slides 17-20)
- 10 Points context rendering (Slides 17-20)
- 10 Points animation
- 10 Points exploded view (Slides 17-20)
- 10 Points key specs listed including speed (Slides 14-15)
- 10 Points multiple poses shown (Slides 17-20)
- 10 Points detail close-up shown (Slides 17-20)
- 10 Points side views with main dimensions (Slides 14-15, 17-20)
- 10 Points sharing a relevant CAD component on GrabCAD or Thingiverse (show screenshot)

Comment (constructively) on at least three other's postings







ED Discussion Board post

Preliminary CAD Model #57

N

Nico Primavera
1 minute ago in **CAD design**

STAR WATCHING 3 VIEWS

Hi all,

Attatched is my preliminary CAD model. I am still working on a few things but this is the general concept. My end result is a four legged minion. I have created the base so far, and I found this great minion design on GrabCAD that I am hoping to use. I am not sure of the best way to cut and scale everything from GrabCAD so if anyone has any ideas please let me know. As of right now I am planning on cutting the top half of the minion design and using it as a cover.

Minion example.pdf

Side View of the Robot.pdf

Comment Edit Delete •••

Add comment

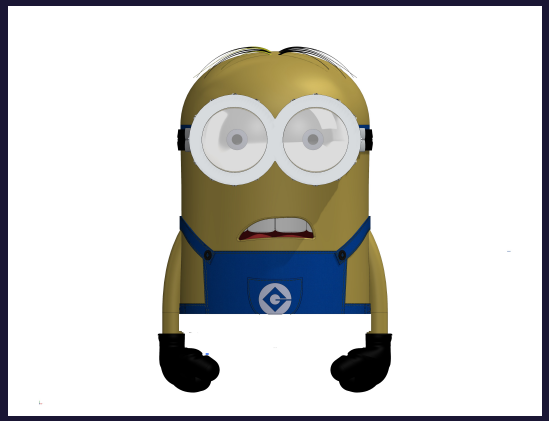
Robotics Studio MECE 4611
Spring 2024
Assignment III
Nicolino Primavera (ncp2136)
Submission: 2/19/24 at 7:30pm
Grace hours: 100:35 - 19:30 = 81
Bob the Minion
General Robot Rendering

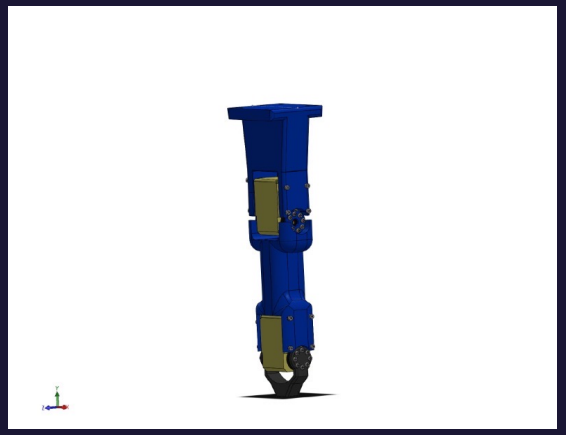
GrabCAD Designs – References

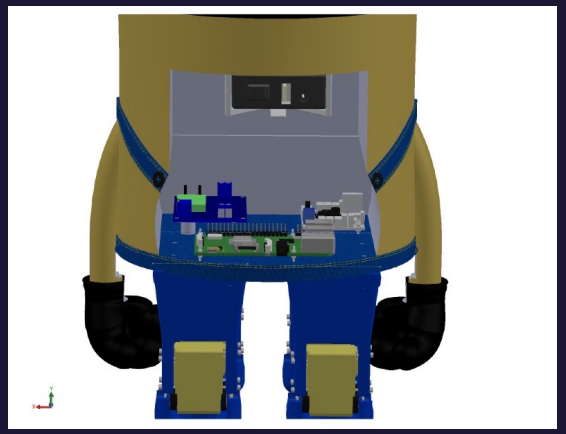
- LX-16A Metal Servos: https://grabcad.com/library/lewansoul-lx-16a-bus-servo-1
- Small Servo Controller Board: https://grabcad.com/library/lewansoul-lx16a-controller-board-1
- Battery Pack: https://grabcad.com/library/talentcell-rechargeable-12v-3000mah-lithium-ion-battery-pack-1
- DROK DC Converter: https://grabcad.com/library/drok-dc-converter-5-3-32v-to-1-2-32v-1
- Raspberry Pi 3A+: https://grabcad.com/library/raspberry-pi-3-4
- Motor Harness: https://grabcad.com/library/robot-skeleton-and-modular-motor-harness-1
- Thigh Link: https://grabcad.com/library/leg-piece-2
- Foot: https://grabcad.com/library/lewansoul-lx-16a-motor-connector-1
- Motor Wheels: https://grabcad.com/library/motor-shaft-adapter-for-lx-16a-1
- Spacers: https://grabcad.com/library/standoff-male-male-m1-6-1
- Thermoplastic inserts: https://www.mcmaster.com/94180A307/
- 12mm Screws: https://www.mcmaster.com/91292A834/
- 8mm Screws: https://www.mcmaster.com/91292a832
- 6mm Screws: https://www.mcmaster.com/99461A921/
- 4mm Screws: https://www.mcmaster.com/99461A918/
- Battery Holder: https://grabcad.com/library/talentcell-battery-holder-24v-lithium-ion-battery-pb240a1-1
- Minion: https://grabcad.com/library/minion-3

Key Components/Parts

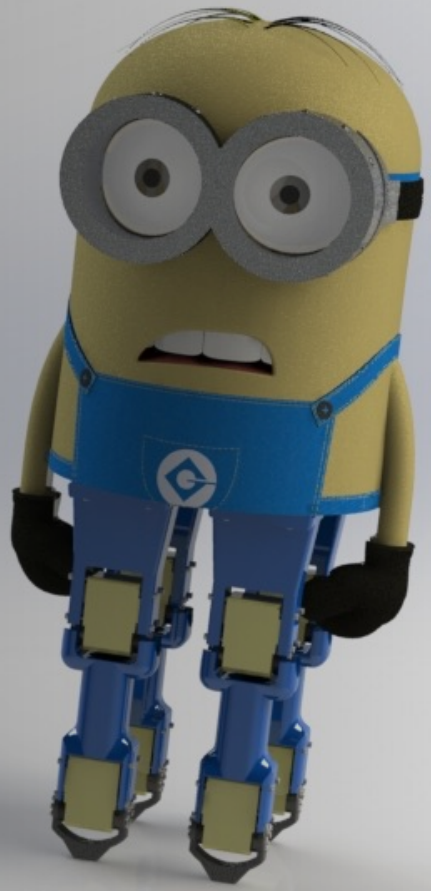
- Legs (4)
  - Hip – Thigh – Foot
- Minion – Aesthetic Design
- Electrical Components





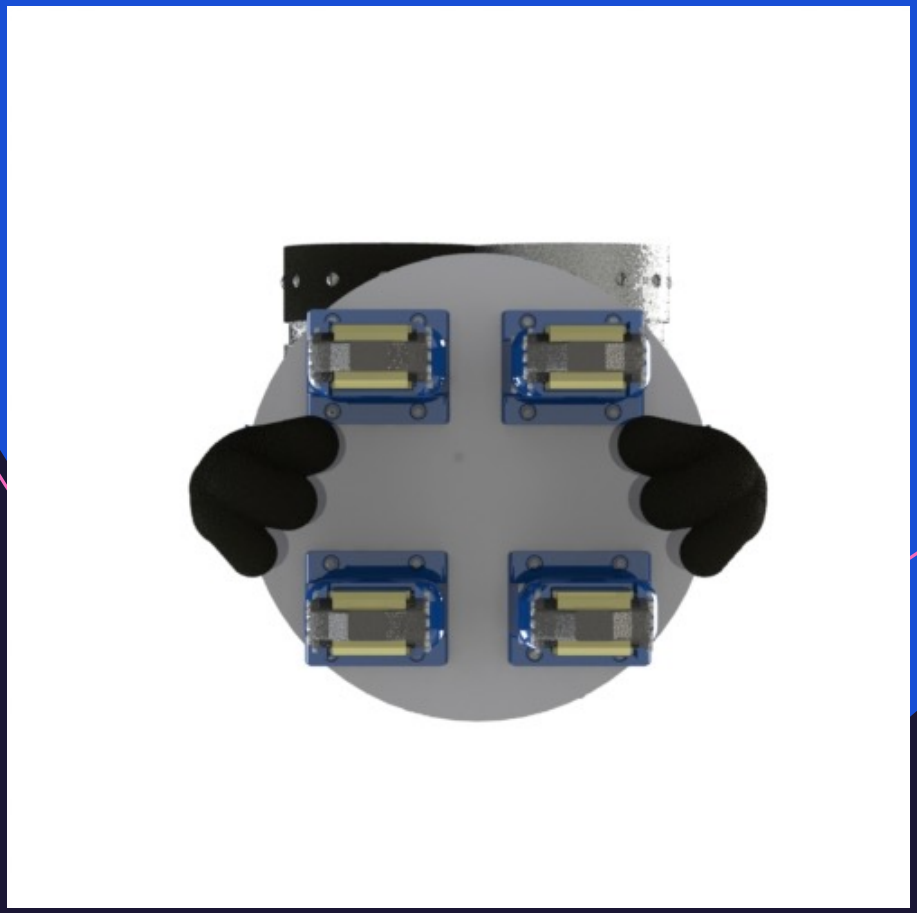


Photorealistic Rendering

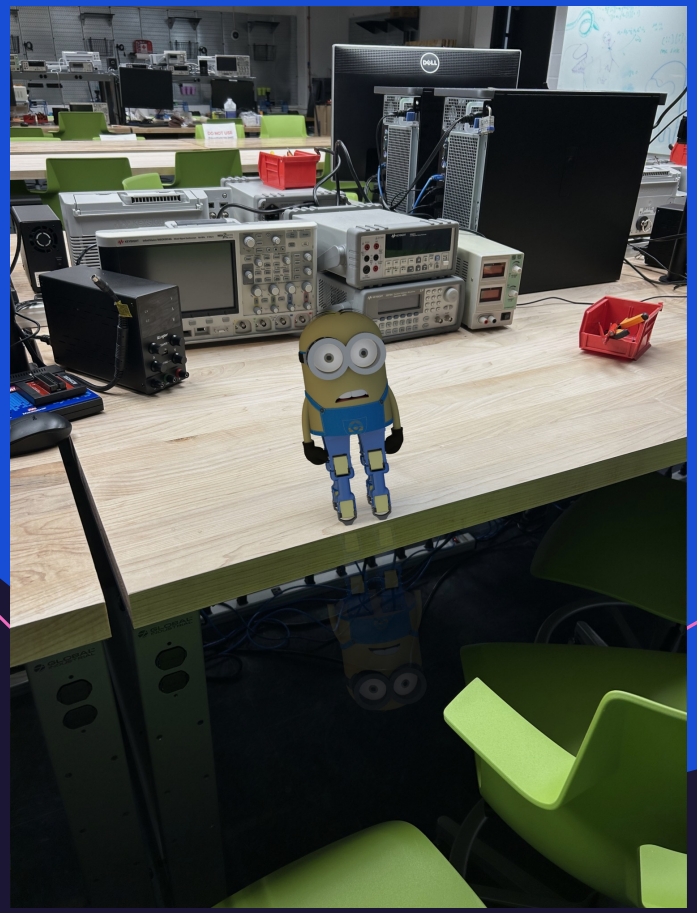


Photorealistic Rendering

Photorealistic Rendering



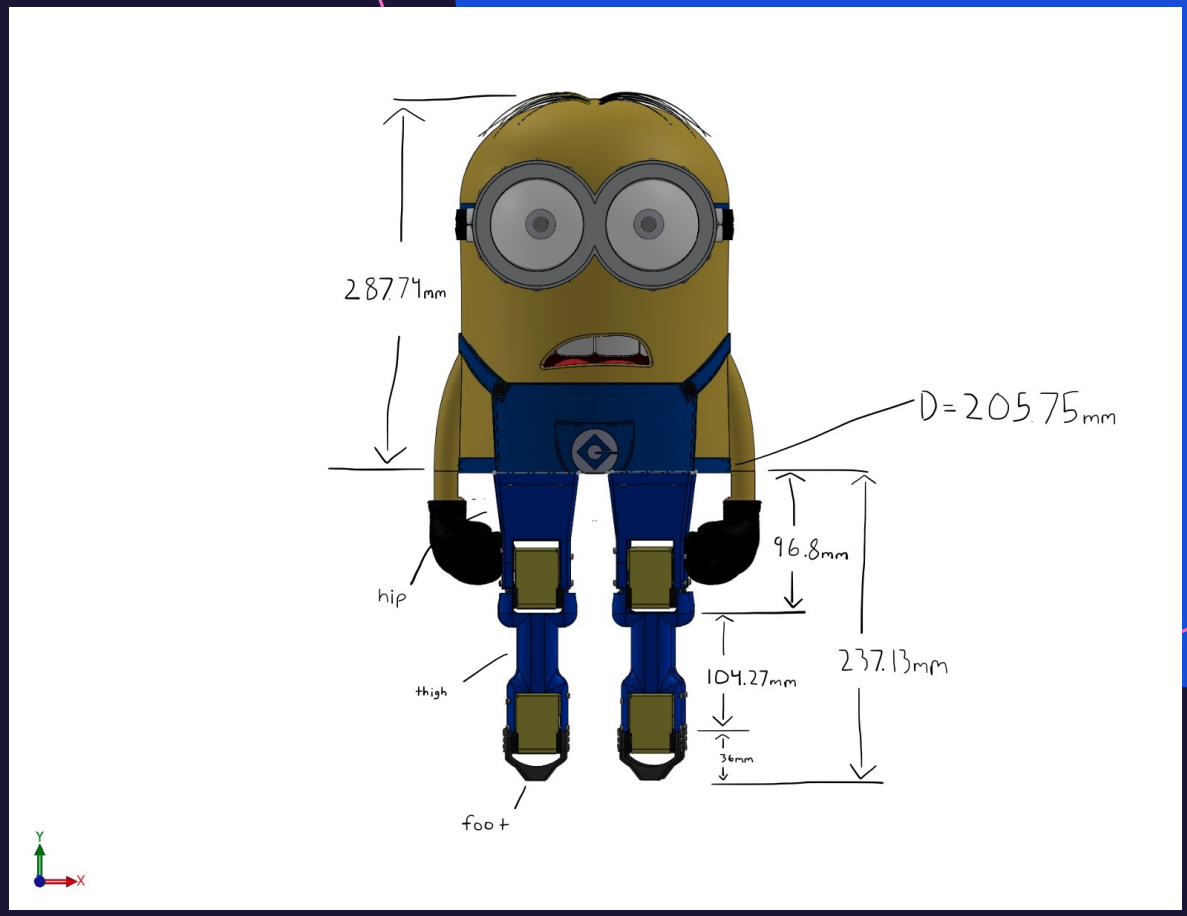
Photorealistic Rendering in Perspective



Bill of Materials (BOM)

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Minion - Scaled by 0.36 uniformly - to use for final		1
2	newlegSliderHolder		4
3	Servo Motor.stp	Rhino converted to STEP	8
4	91292A834	18-8 Stainless Steel Socket Head Screw	48
5	Motor Adapter (LX-16A)		8
6	Shaft Adapter (LX-16A)		8
7	Thigh		4
8	91292A832	18-8 Stainless Steel Socket Head Screw	32
9	99461A921	Phillips Rounded Head Thread-Forming Screws	132
10	Lewansoul lx 16a servo connector		4
11	94180A307	Tapered Heat-Set Inserts for Plastic	80
12	Battery		1
13	battery holder	Rhino converted to STEP	1
14	servo controller board		1
15	Standoff M1.6 M-M H 5mm	Rhino converted to STEP	8
16	RASBERRY PI v6 v4.step		1
17	dc power converter		1

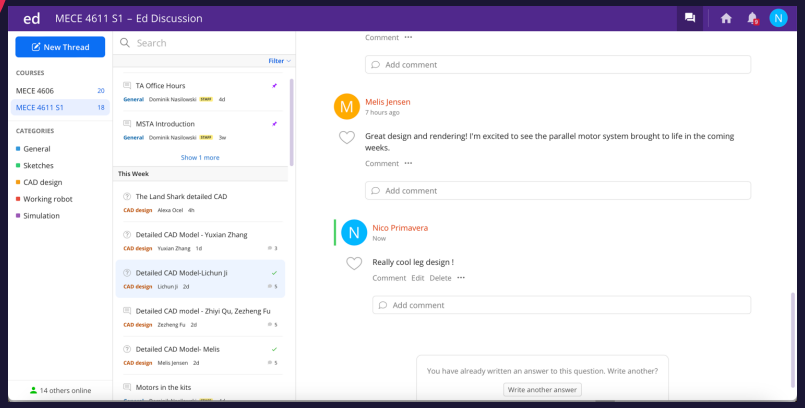
Main Dimensions

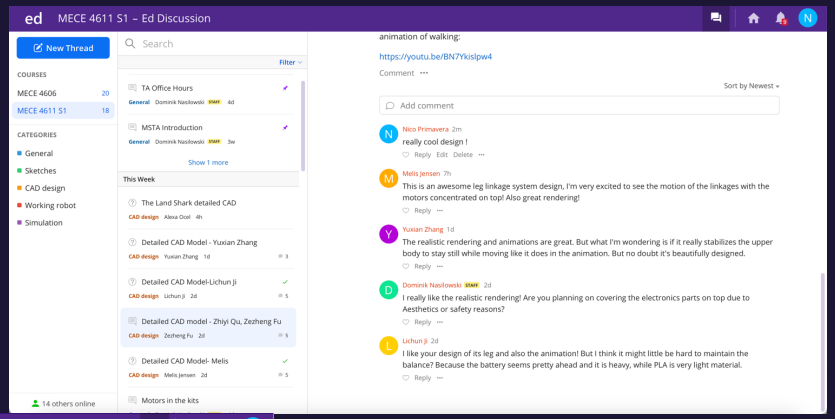


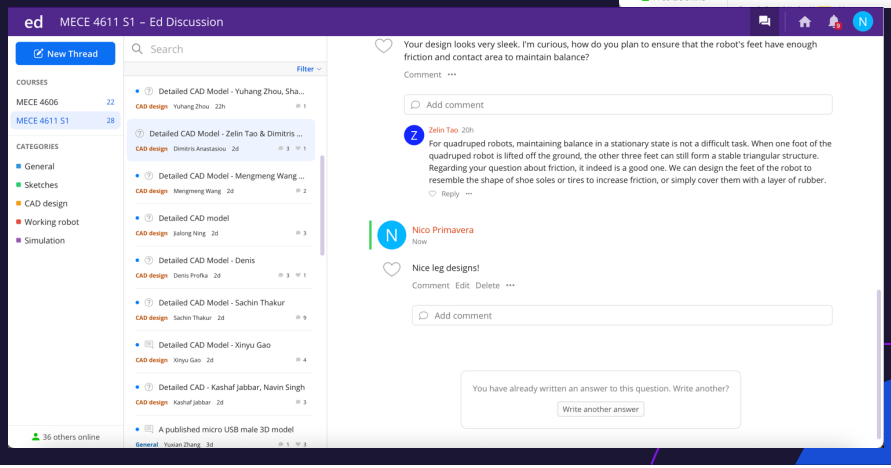
Rubric Checklist

1. 5 Points Title slide complete (Slide 25)
2. 5 Points overall aesthetics, layout and formatting of the slides (All Slides)
3. 10 Points posting some rendering of your robot on the discussion board at least 24h in advance of deadline, and commenting constructively and positively on at least three other's postings (show screenshots) (Slides 35 - 36)
4. 10 Points 3D Renderings in perspective (Slide 31)
5. 10 Points all key components included and labeled (Slide 27, 33)
6. 10 Points organic shape (no straight edges) (Slide 29)
7. 10 Points photorealistic rendering (Slide 25, 28, 29, 30)
8. 10 Points animation
9. 10 Points exploded view
10. 10 Points key specs listed including speed, weight
11. 10 Points multiple poses shown (Slide 29)
12. 10 Points detail close-up shown (Slide 27)
13. 10 Points side views with main dimensions (Slide 33)
14. 10 Points Bill of materials (Slide 32)

Comment (constructively) on at least three other's postings







Nico Primavera
Now in **CAD design**

STAR WATCHING 1 VIEW

Hi all,

Attatched is my detailed CAD. Please let me know if you have any comments or reccomendations!

ED Discussion Board post