

Overview

We were tasked with making a 4-legged steerable mechanical walker capable of walking in all directions and turning. Using previous designs as a reference, we were able to create a walker with slimmer legs, different motors, and a different personality

Requirements

- Must have 4 legs
- Use a stepper motor
- Tank steering
- Have a speed higher than 1.5fps
- Weigh less than 7 lbs



Existing Designs

Chenhao's project

A previous Walker which is the main project reference that Professor McCarthy was affiliated with. Our goal was to refine this walker while including new ways of motorization.

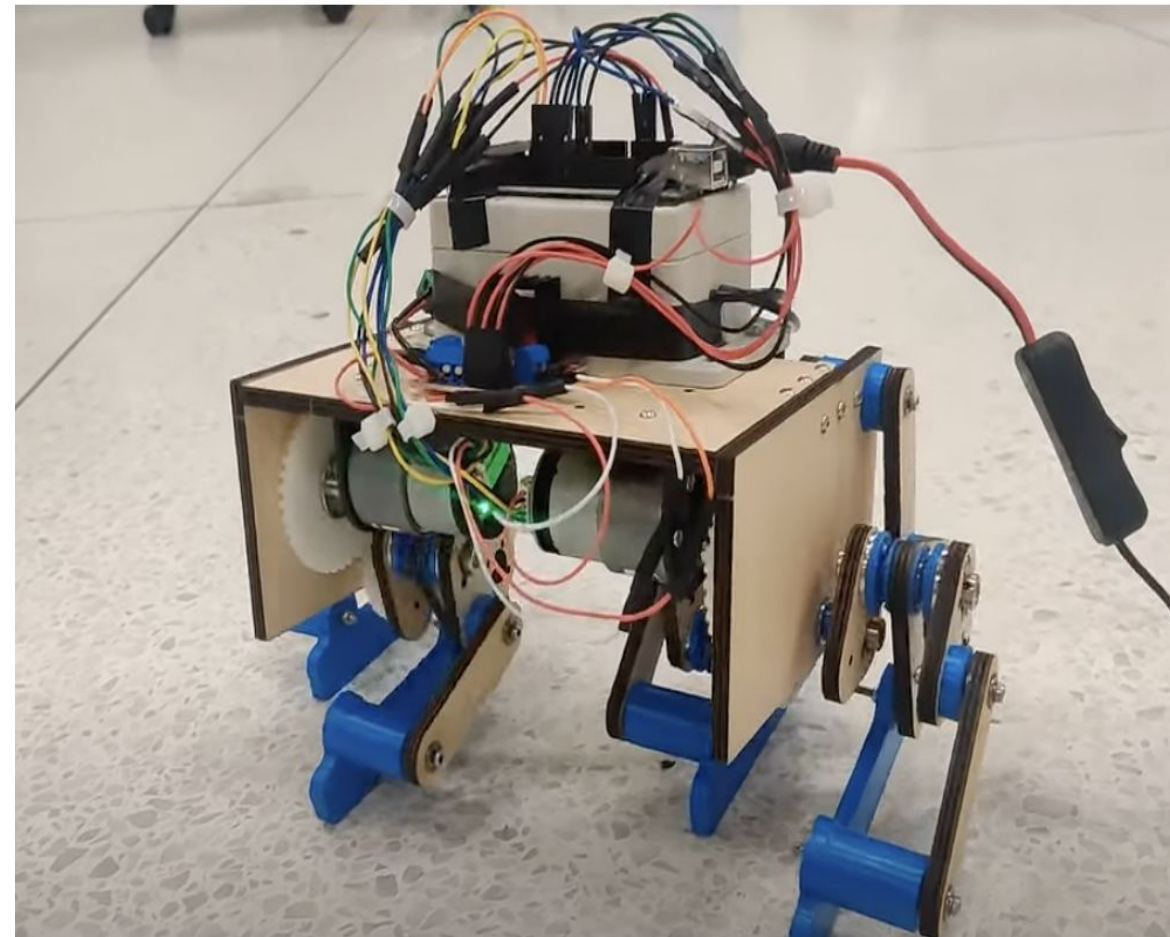


Fig 1: Chenhao's Design

Aesthetics Inspiration



Fig 2: GNK Droid Variants

GNK droid from the Star Wars franchise used as inspiration for the walker's visual personality

Acknowledgements

Special thanks to Professor J. Michael McCarthy for making this project possible

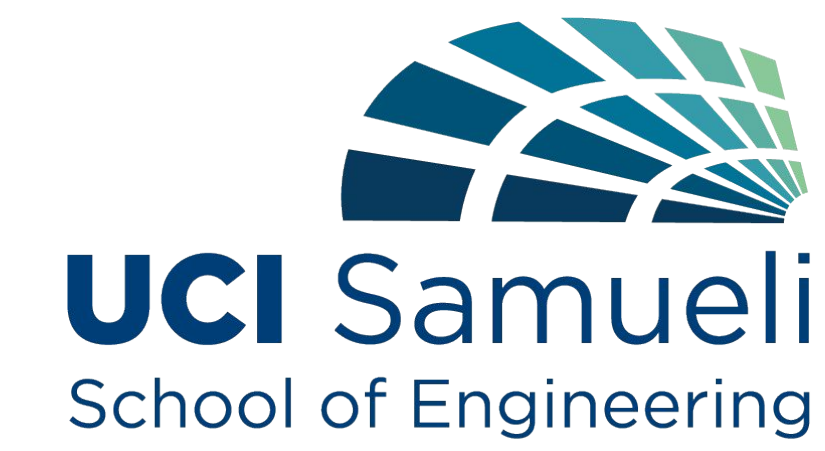
References

Professor J. Michael McCarthy, theBoredRobot.com, and Allegro™

Members:

**Jonathan Chavez, Connor Linklater,
Jonathan Lu, Tom Nguyen**

Sponsored by : Professor J. Michael McCarthy



Department of
Mechanical and
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New Leg Design

- More compact
 - Lighter
 - Stable
 - Reliable
- Minimizes cantilever moments experienced by the legs

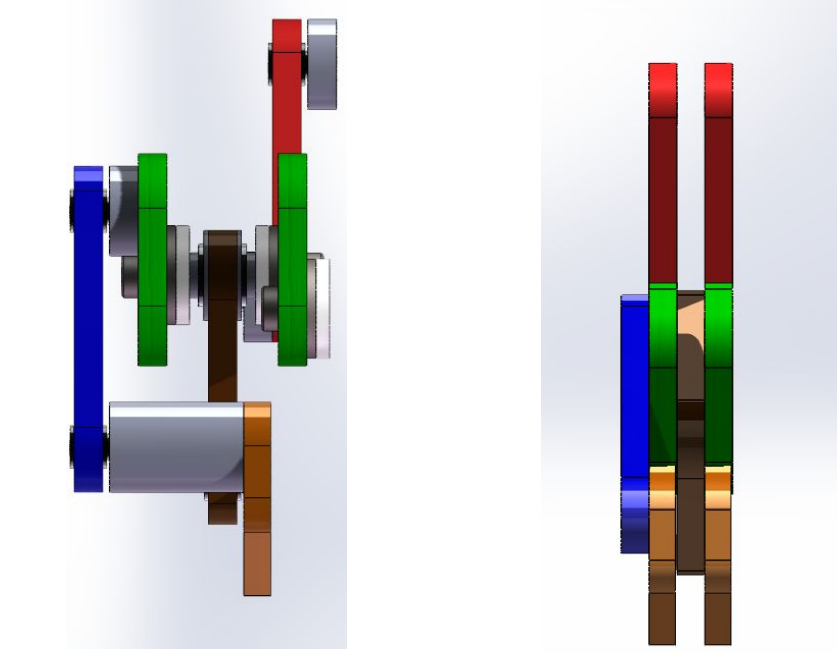


Fig 7 & 8: Front View of old and new leg design

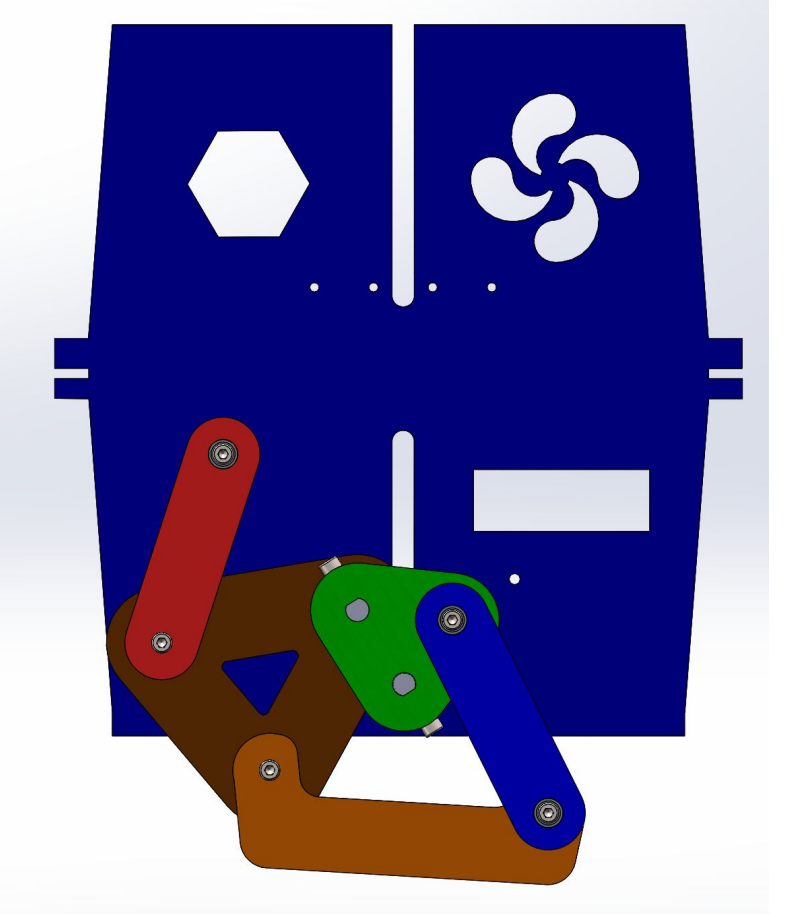


Fig 6: Leg design

Digital Prototype

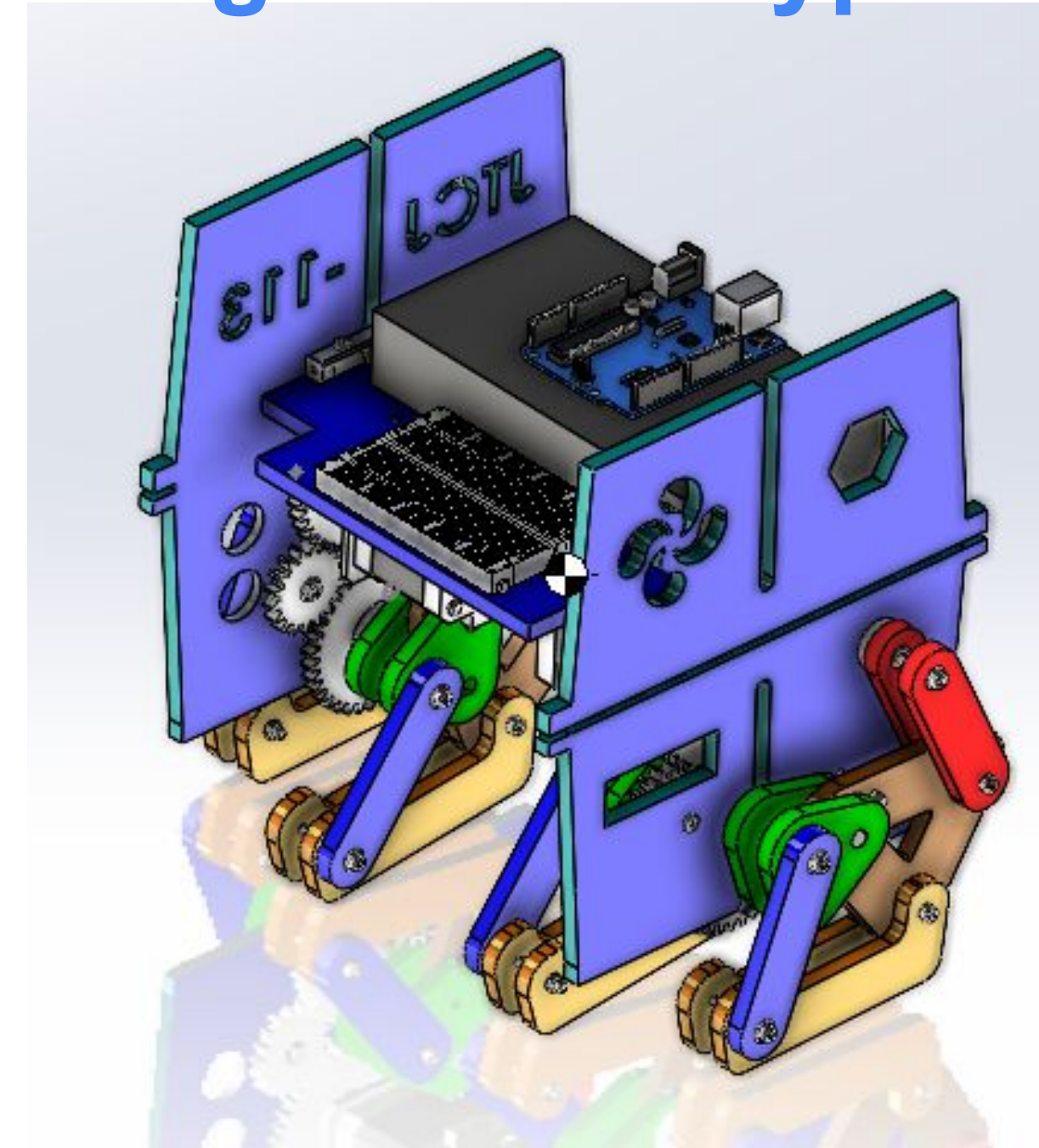
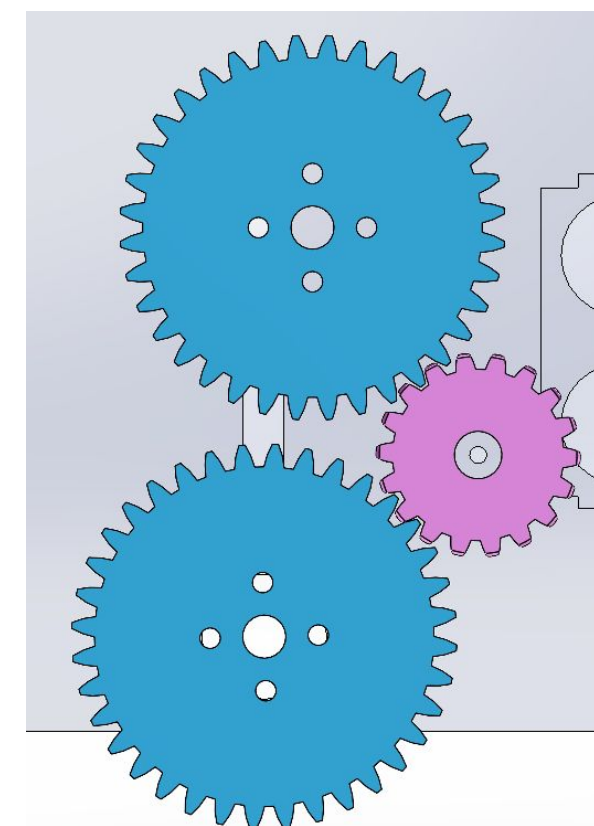


Fig 3: Solidworks model of Walker

Drivetrain



- Two 36 Tooth Gears Connected to:
 - Stepper Motor
 - Rotating Axis for Legs
- One 14 Tooth Gear:
 - Allows for vertical clearance between the leg mechanism and stepper motors

Fig 4: Drivetrain Configuration

Electrical System

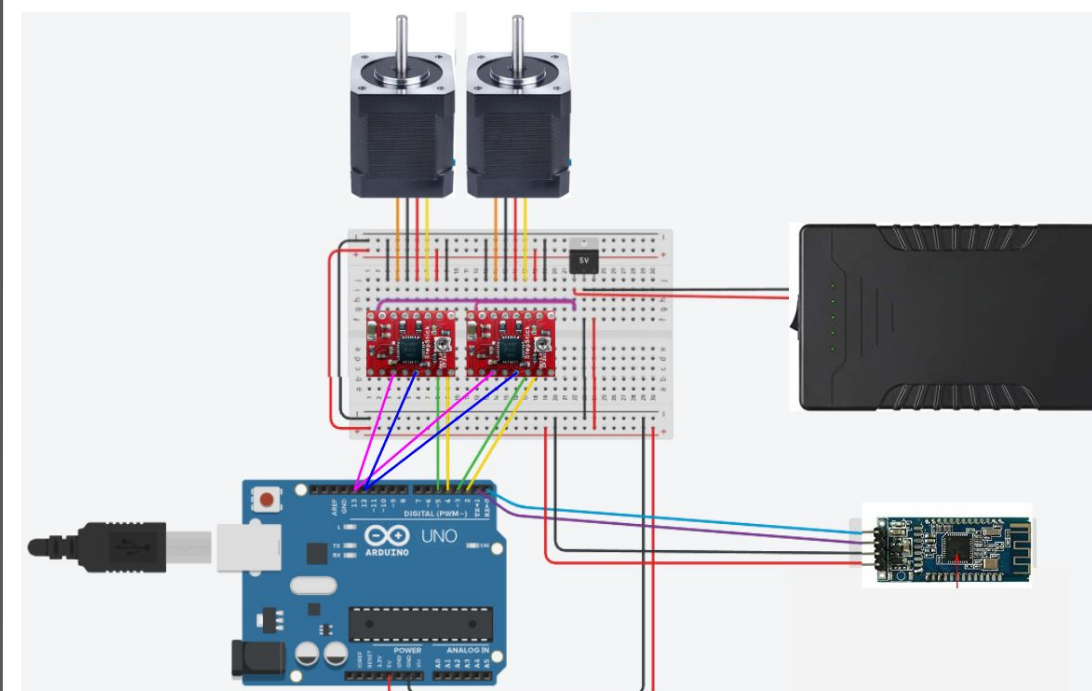


Fig 5: Wiring Schematic

- Arduino Uno
- 2 Nema 17 Stepper Motors
- 2 A4988 Stepper Motors Drivers
- HM-10 Bluetooth Module
- 12V battery

Dimensions & Center of Gravity

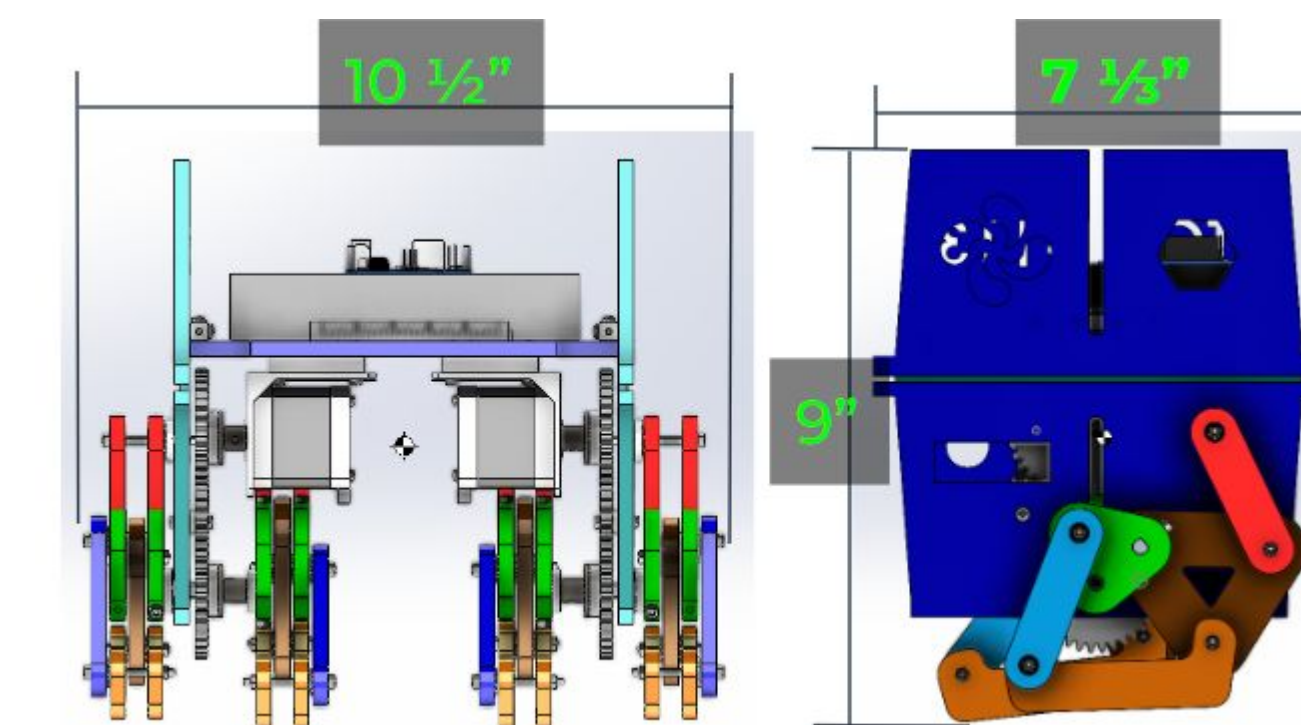
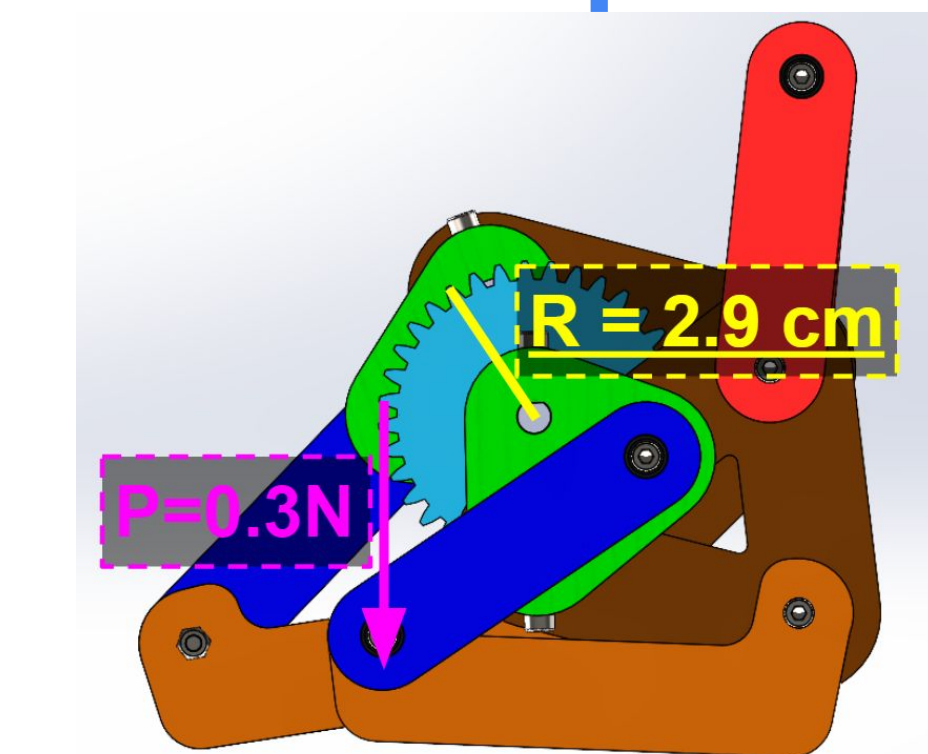


Fig 9: Front and Side profiles of the digital prototype with CG shown, and dimensions of 10.5" x 7.33" x 9"

Required Torque Analysis



$$T_{req} = P * R * \sin(90)$$

$$T_{req} = 0.3N * 2.9cm * 1$$

$$T_{req} = 0.87 Ncm$$

- Illustrates the smooth rotation of a leg assembly when not under load

Fig 10: Illustration of the minimum torque required to rotate the leg

Future Improvements

Addition of guidance sensors to allow for autonomous control