Steerable Walker Project: Harambot

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Overview

Mechanical walkers are reduced actuated walking robots that traverse due to leg mechanisms. With the walker project, the application utilized for the design is to provide service and assistance to disabled animals.

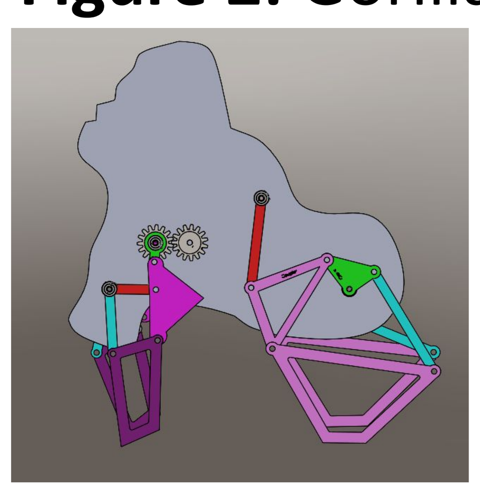
Figure 1: Disabled Pets

Objective: Design a steerable mechanical walker that may serve and provide better mobility to disabled animal that utilizes a single driving motor and a single steering motor.

Solution: The Steerable Gorilla Mechanical Walker offers reduced actuation that allows for a large payload space to hold cargo or a disabled pet.

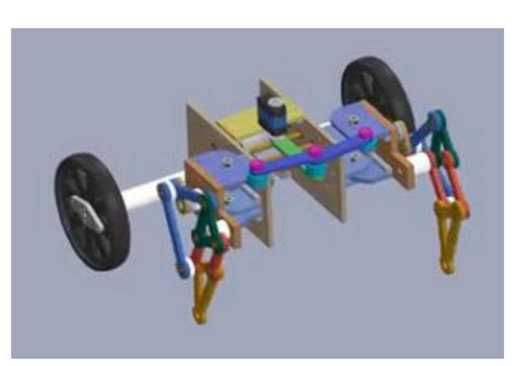
Design Selection

Figure 2: Gorilla Walker



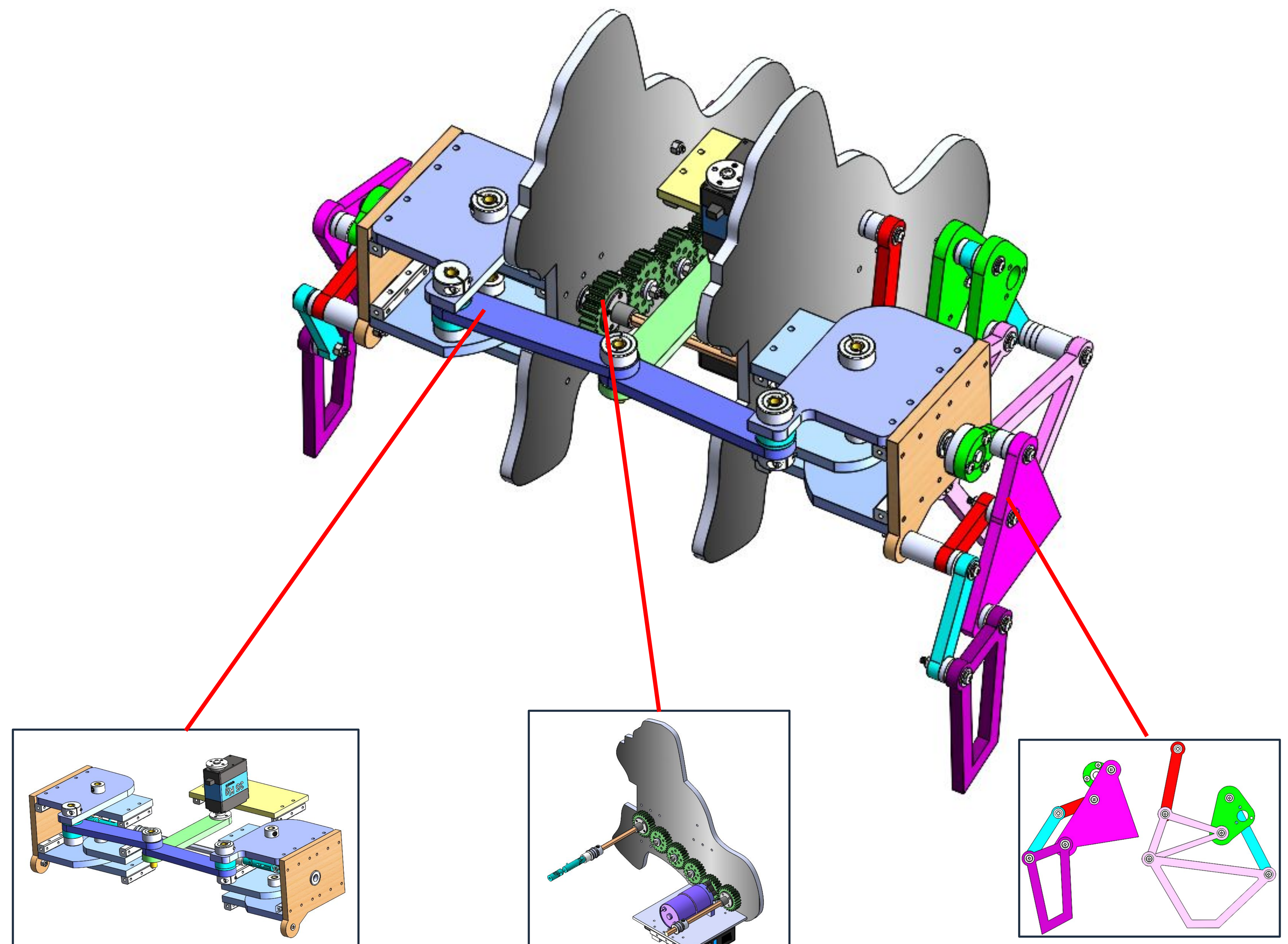
- Non-Steerable
- Skew Pantograph and Rectilinear Legs
- 2 Drive motors

Figure 3: Gomez Walker



- Steerable
- 2 Legs and 2 Wheels
- 1 Drive motor and 1 Steering Motor

Harambot



A. Steering System **B. Drive System** **C. Leg Mechanisms**

Main Subassemblies

A. Steerable Legs use a servo motor to steer front legs, which are driven by universal drive shafts.
B. The DC motor connects to a gear train that drives the D-shafts and universal drive shafts
C. Skew pantograph legs are used in the front and rectilinear legs are used in the back.

Control & Electronics

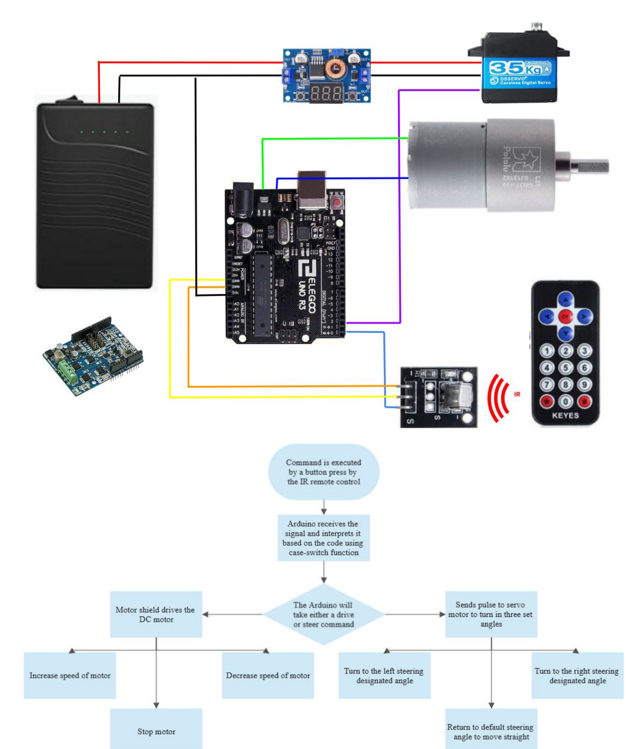


Figure 4 & 5:

- Electrical schematic utilizing an infrared remote controller to send signals to the UNO for drive and steer commands.
- Control diagram when a button on the remote is executed.

Analysis

Utilizing the digital model we are able to calculate our walker's performance to see if it meets the required speed and turning rate.

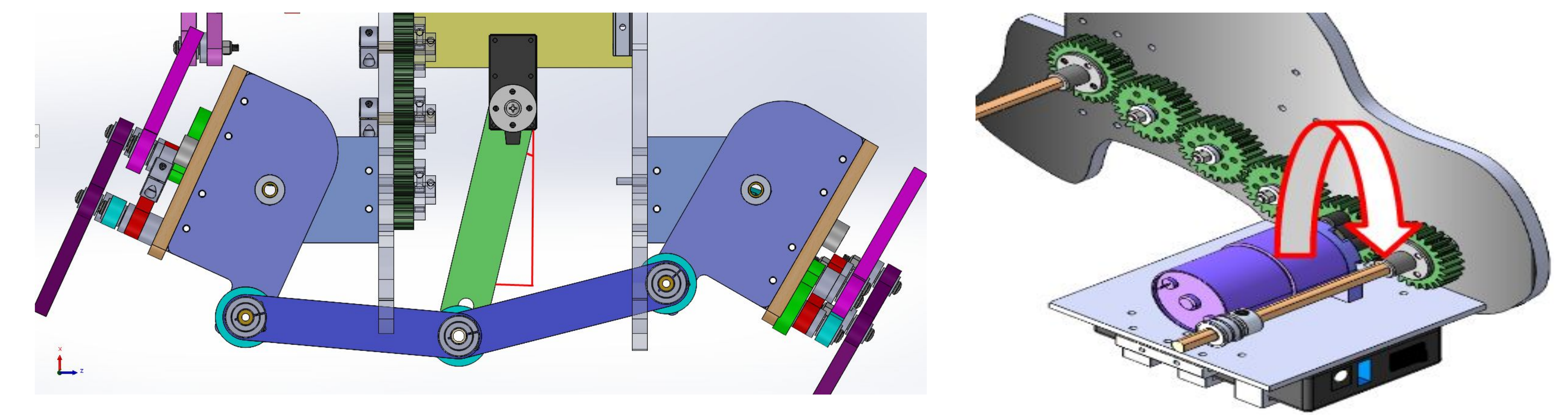


Figure 6 & 7: Top view of steering system and trimetric view of drive system.

- Steering angle of 30° allows walker to follow a 6 ft diameter circle
- Running at 100 RPM and with a step size of 5 inches- Harambot walks at a rate of 16.6 in/s

Prototype Verification

We require a complete motion analysis for validation before moving to the manufacturing phase. In the motion analysis, we look toward the steering system turning and the gears translating all four legs without issues.

Future Improvements

Increase space for payload

- Move the steering system to the bottom of the chassis
- Introduce additive manufacturing to reduce part count

Explore alternative Drive Systems

- Large number of gears and friction may cause failure
- Research implementation of a belt drive system

Acknowledgements

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References

(1) Design of Mechanical Walking Robots (2) Kinematic Synthesis of Mechanisms (3) Handicapped Pets Canada