Project Plan

Main plan:

The main objective of this project is to design an assistive device that allows wheelchair users to safely and efficiently navigate stairs without compromising the wheelchair's normal functionality on flat ground.

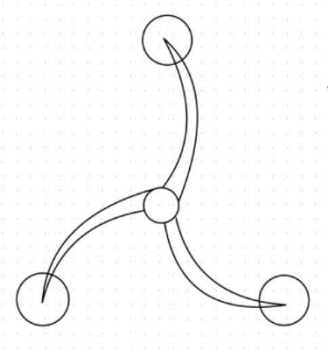
To start building the device, we will follow a systematic approach that includes the following steps:

1. Research and Analysis:

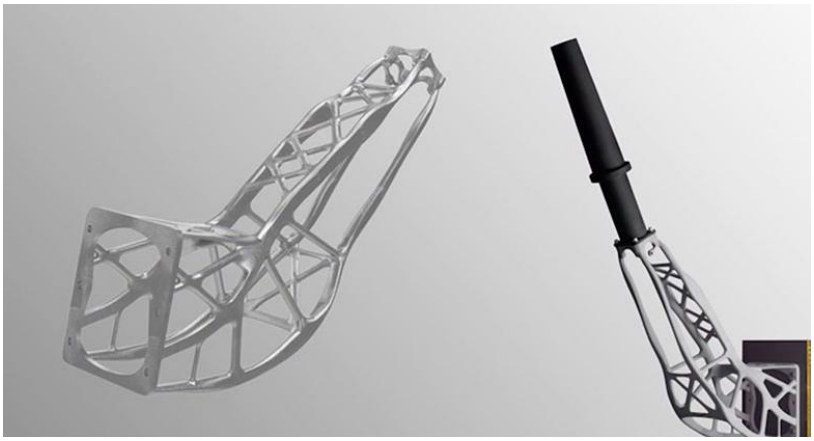
- Gather information on existing assistive devices and technologies.
- Analyze the specific requirements and constraints of the project.
- Identify suitable design methodologies and principles.

2. Conceptualization and Design:

- Develop design concepts that integrate the S-shaped wheel with three legs for the front active wheel and the triangular wheel system for the rear. (Design of machine elements class)



- Use topology optimization techniques to optimize the device's performance and efficiency. Topology is not just a member, it can be extended to external devices below the entire wheelchair. (Scientific computing for mechanical engineering class)



- Design the power system, control system, and damping system, considering the project's requirements. If the shock absorber is connected to the power source, some power will be lost, and we may adjust the shock absorber position. To achieve an appropriate output efficiency ratio. As well as the shape and size of the damping structure, it is necessary to first determine some parameters of the wheelchair, and then adjust the overall frame structure appropriately. Create the most suitable and stable structure. It is worth noting that the key is to determine the size of the wheels before continuing to design the size, shape, material, and size of the shock absorption structure and the main mechanical connecting rod. (Dynamics & control of mechanical system class)

3. Prototyping and Testing:

- Build a small-scale prototype of the assistive device based on the finalized design.

- Conduct comprehensive functionality tests, including stair navigation and stability on flat ground.

- Use appropriate measurements, such as angles, forces, and motion tracking, to evaluate the device's performance.

To ensure the functionality of the device, we will carry out the following detailed validation steps:

a) Stair navigation testing:

- The device will be placed in front of stairs for stair navigation testing.

- The test will include evaluating the device's ability, stability, and safety while navigating stairs.

- We will use sensors to monitor the device's position and posture on the stairs and record relevant data to assess its performance.

b) Stability testing on flat ground:

- The device will be placed on flat ground for stability testing.

- The test will assess the device's stability and resistance to tilting on flat surfaces.

- We will use force sensors to measure the forces and pressure distribution on the device and evaluate its stability.

c) Functionality measurements:

- We will use angle measurements to assess the device's range of motion and posture control ability.

- Force sensors will be used to measure the forces applied by the device on the ground and handrails.

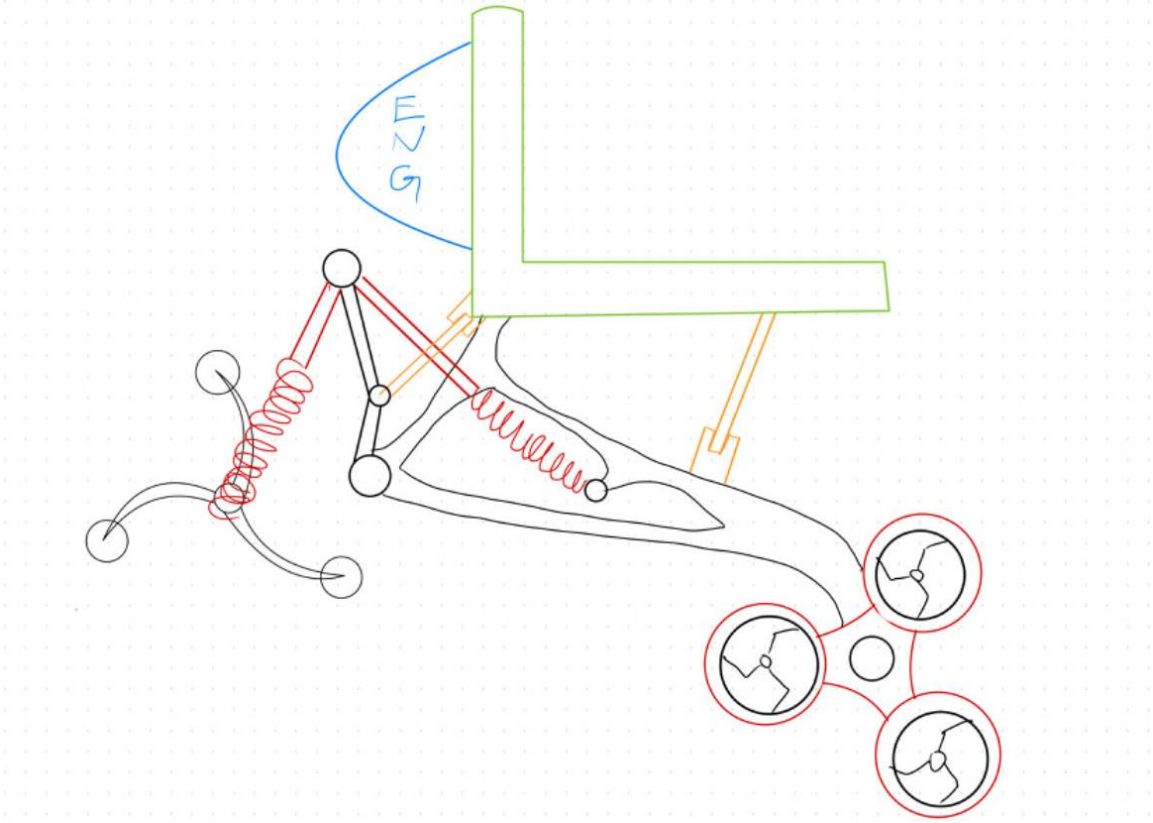
- A motion tracking system will record the device's movement trajectory and speed.

d) User feedback:

- We will invite wheelchair users to participate in the testing and gather their feedback and opinions.

- User feedback will help us evaluate the device's usability and user experience.

Through these detailed validation steps, we will be able to comprehensively assess the device's performance and make improvements and optimizations based on the test results.



Time plan:

Phase 1: Research and Concept Development (2 weeks)

- Conduct research on existing assistive devices and technologies for stair navigation.
- Brainstorm and develop initial concepts for the device.
- Identify key design requirements and constraints.

Phase 2: Preliminary Design (2 weeks)

- Create 2D and 3D CAD models of the device.
- Perform structural and stability analysis using simulation software.
- Optimize the device's design for weight and strength.

Phase 3: Detailed Design and Component Selection (3 weeks)

- Finalize the device's design, considering user feedback and optimization results.
- Select appropriate components, such as motors, sensors, and shock absorption systems.
- Conduct feasibility studies and cost analysis for the selected components.

Phase 4: Prototyping and Testing (4 weeks)

- Build a small-scale prototype of the device based on the finalized design.
- Conduct comprehensive functionality tests, including stair navigation and stability on flat ground.
- Use appropriate measurements, such as angles, forces, and motion tracking, to evaluate the device's performance.

Phase 5: Iterative Design and Optimization (3 weeks)

- Analyze the test results and user feedback to identify areas for improvement.
- Make necessary design modifications and optimizations to enhance the device's performance.

- Conduct additional testing and validation to ensure the effectiveness of the improvements.

Phase 6: Final Design and Documentation (2 weeks)

- Finalize the design based on the iterative improvements.

- Create detailed technical documentation, including drawings, specifications, and user manuals.

- Prepare a final project report summarizing the design process, testing results, and recommendations for future enhancements.

Resources and Budget:

- CAD software licenses for design and simulation.

- Prototyping materials and equipment.

- Testing equipment, including sensors and motion tracking systems.

- Budget for component selection and procurement.

Team Plan:

- Assign team members specific tasks based on their expertise and interests.

- Hold weekly meetings to review progress, discuss challenges, and make collective decisions.

- Maintain effective communication channels within the team to ensure smooth coordination.

Timeline (2-week intervals for 3 months):

Week 1-2: Research and Concept Development

Week 3-4: Preliminary Design

Week 5-6: Detailed Design and Component Selection

Week 7-10: Prototyping and Testing

Week 11-12: Iterative Design and Optimization

Week 13-14: Final Design and Documentation

Please note that the provided timeline and activities are a general outline. Adjustments may be necessary based on the complexity of the project and the availability of resources.