ME3500J
Design and Manufacturing II

Guideline - Design Review Presentation

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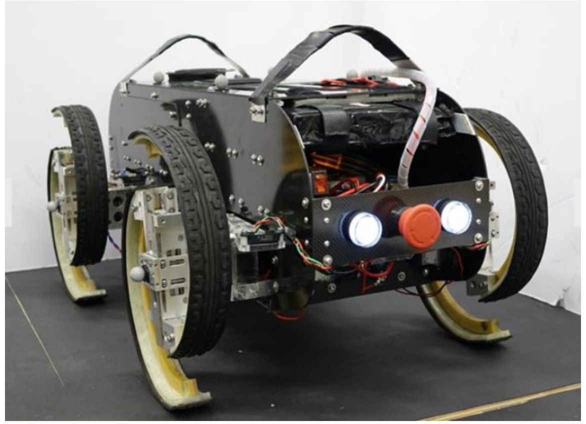
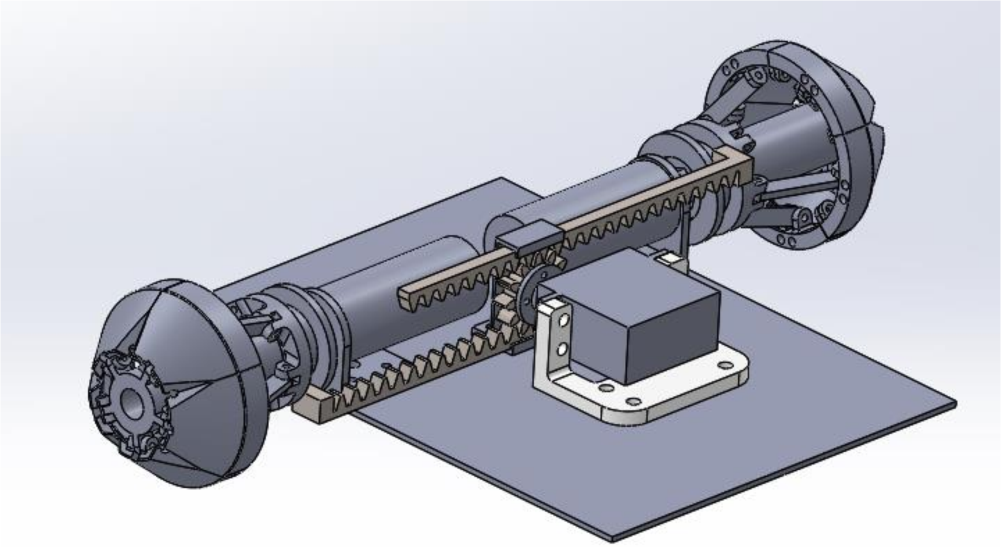
Basic guideline

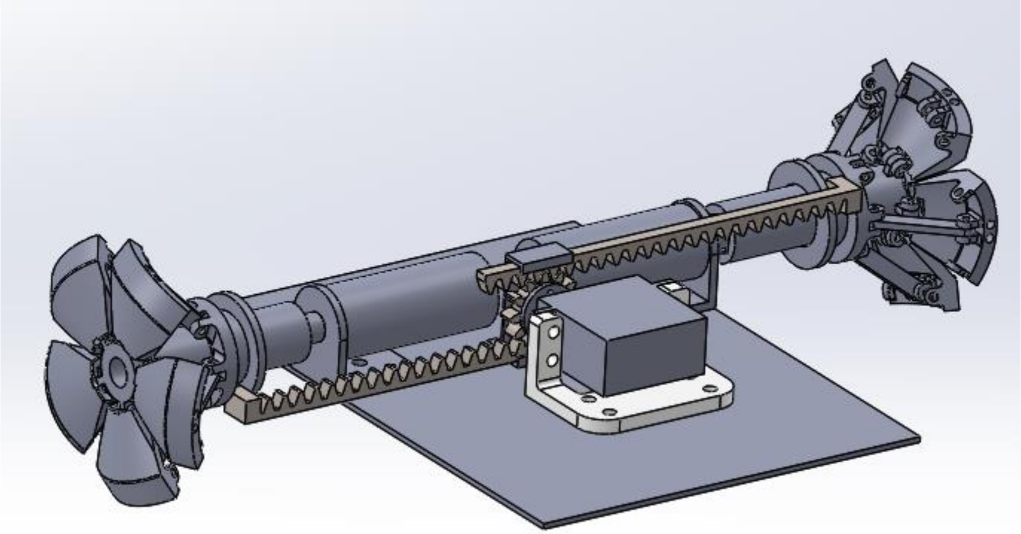


- ✓Presentation schedule
  - Wednesday, 7/9 and Friday, 7/11
- ✓We will give ~12 min to each team.
- ✓All members must participate in the presentation.
- ✓Instructor (and/or TAs) will evaluate the presentation and work progress.
  - We expect ~70% of progress on the project by the time the teams present.
  - Active participants asking critical questions to presenters will gain extra points.

Contents of the design review slide

1. Introduction (Background)
2. Objectives
3. Project plan (Gantt chart)
4. Design
5. Manufacturing
6. Analysis
7. Mechatronics
8. CAD simulation
9. Showcase of initial prototype





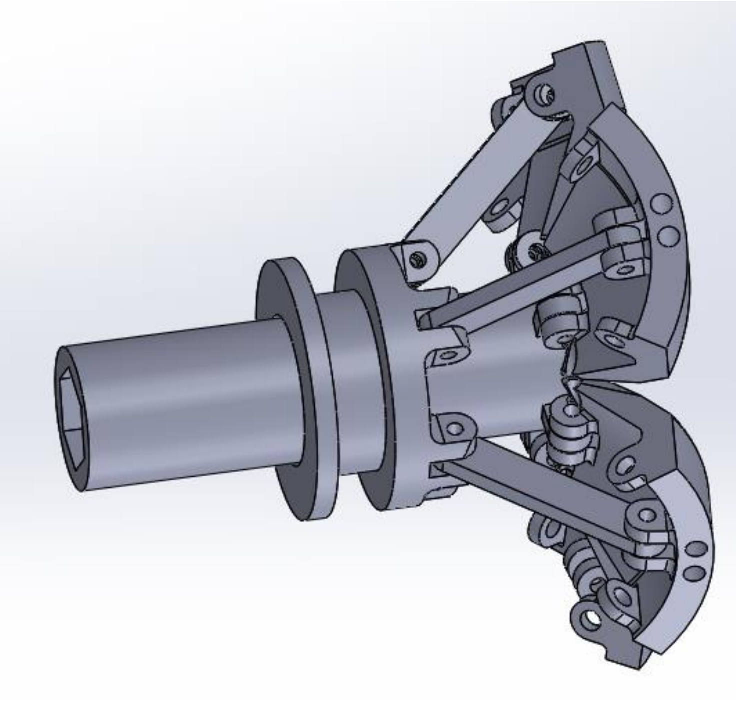
Introduction (Background)

✓ Explain **why**

- Why is your design important in association with the game rules/applications?
- May need literature review – other devices

✓ In your project, you may consider these:

- Why need a climbing robot with a locking mechanism
  - Compared yours with the other devices.
  - Address it with the game rule as well.
- What technical aspects should be improved?
  - Creative linkage design
  - Creative locking design
  - Others



Objectives

✓In your project, you may consider this, for example,

- **Phase 1: Ascent & Zero-Power Lock (Ø 0.3m Pier)**
  - Robot ascends vertically to **1.2m height** on a **0.3m-diameter pier**.
  - Upon reaching 1.2m, **power is cut** (remote).
  - The robot must **remain locked in place without power for 60 seconds** (no slipping >1 cm).
  - After 60s, power is restored; robot descends to base autonomously.
- **Phase 2: Transition & Second Ascent (Ø 0.6m Pier)**
  - The robot is repositioned at the base of a **0.6 m-diameter pier**.
  - Ascends to **1.2m height**, power cut again, and maintains position **without power for 60 seconds**.
  - Power restored; descends to base.

✓Critical Requirements

- **Fail-Safe Locking:** Clamping mechanism must hold position **passively** (no power draw) during 60s tests (e.g., mechanical springs, friction brakes, or self-locking gears).
- **Bi-directional Control:** Drive system must enable **controlled descent** (no free-falling; speed ≤10 cm/s).
- **Position Accuracy:** Stops at 1.2m must be within **±2 cm tolerance** (closed-loop sensors required).
- **Time Limits:**
  - Full mission (both piers) completed in **<10 minutes**.
  - Max 3 attempts total.

Project plan

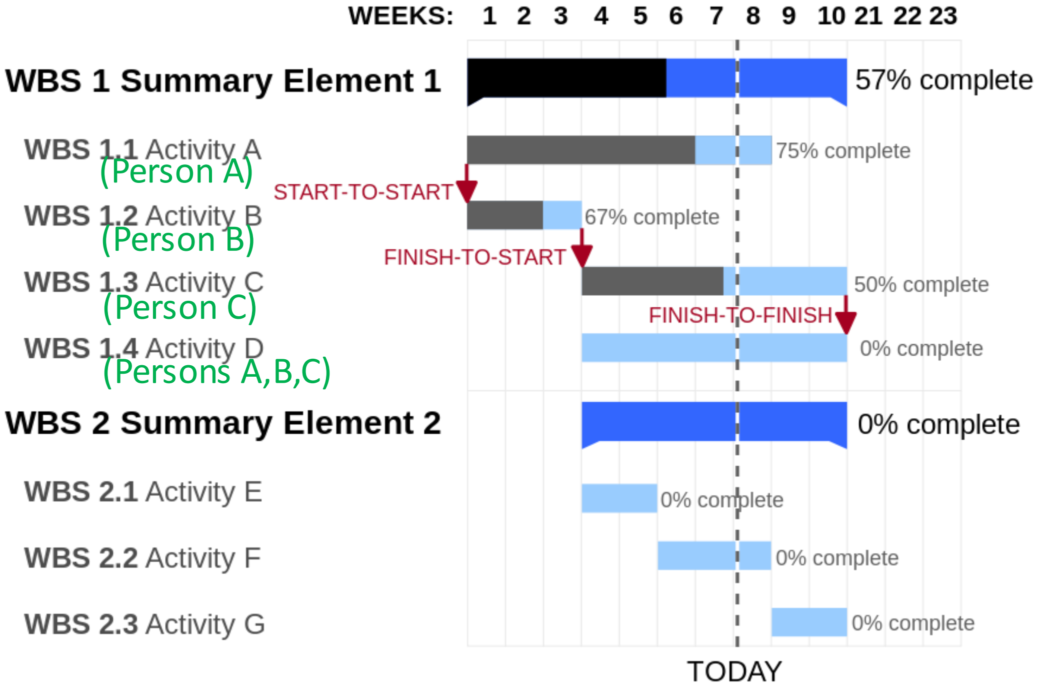
✓Specific plan

- may add Gantt Chart (by indicating each member's contribution).

✓Tasks for each member

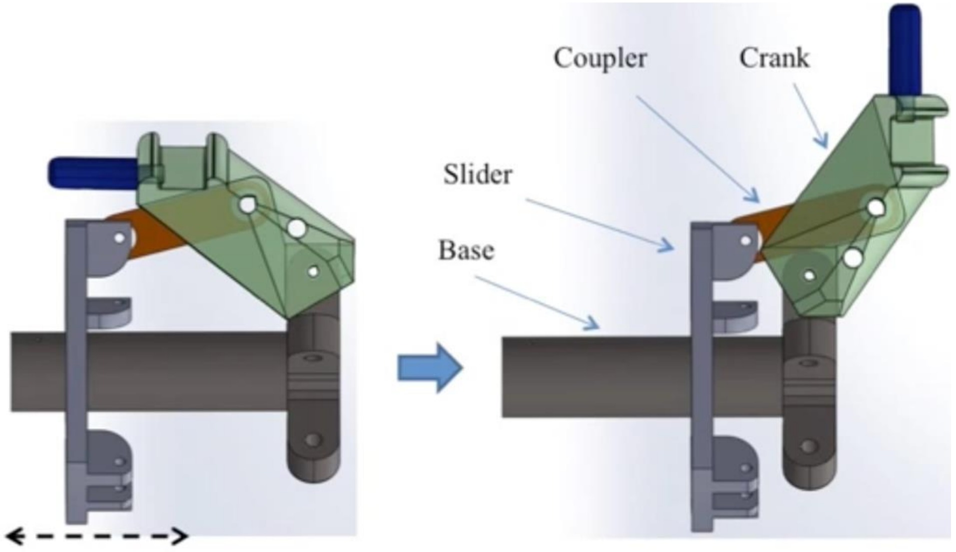
✓**Explain each component, for example**

- Climbing robot with locking mechanisms
  - Graphical linkage synthesis
  - CAD drawing & simulation
  - Manufacturing (3D printing or others)
  - Analysis
    - Position analysis (MATLAB simulation)
    - Force analysis (MATLAB simulation)
      - Selection of motors
      - Design of gearboxes
- Programming of microcontroller
  - Selection of sensors
  - Strategy to integrate with the main device



Synthesis (Design)

- ✓Creative design compared to others?
- ✓Graphical linkage synthesis
  - o Two position or three position synthesis.
  - o Justification of linkage size for both expansion and shrink modes.
- ✓You can use other mechanical systems taught in class other than linkage system and provide equivalent graphical explanation.



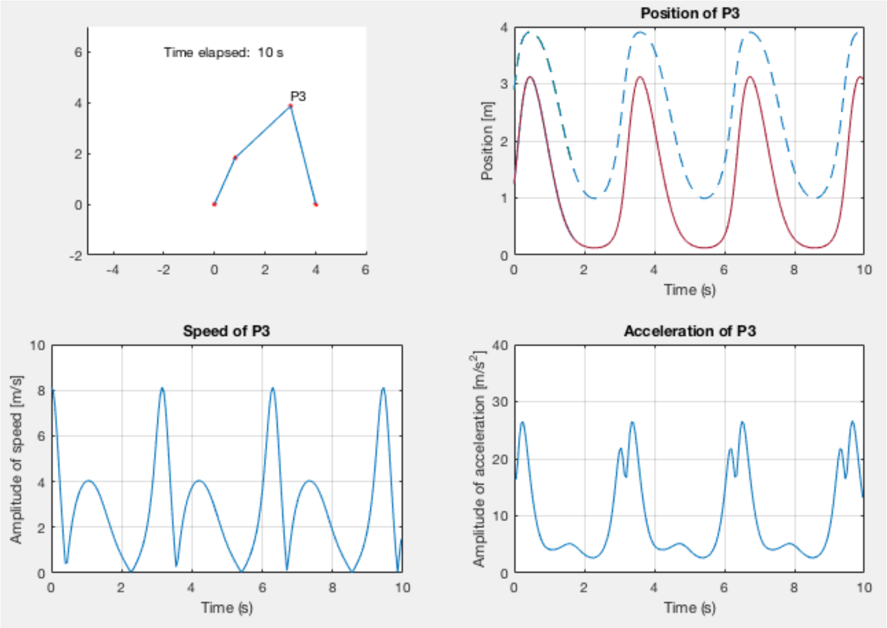
(a) Closed position (b) Opened position

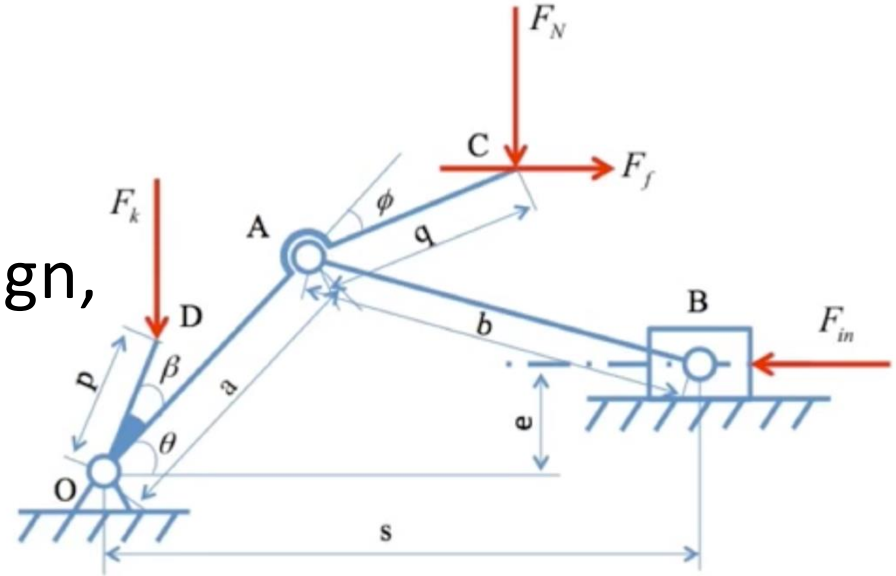
Fabrication and Assembly (Manufacturing)

- ✓ Selection of materials with sound justification
  - Main body components
  - Supplementary components
  - Motors
  - Sensors
- ✓ Describe the procedure of manufacturing method used.
- ✓ Describe the procedure of assembly of components, motors, sensors, etc.

Analysis

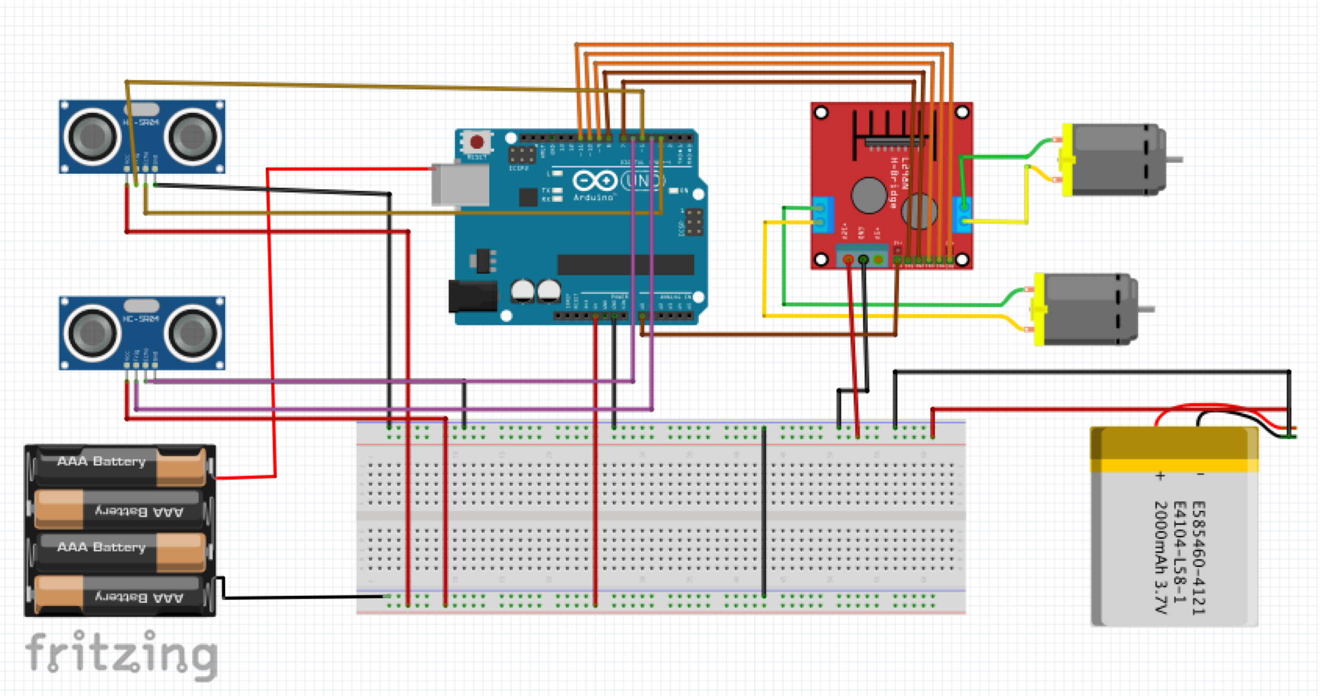
- ✓ Classification of the designed linkage
  - ○ DOF
  - ○ Crank-slider, crank-crank, etc.
  - ○ Grashof condition
- ✓ Position analysis (MATLAB simulation)
- ✓ Force analysis with free-body-diagrams (MATLAB simulation)
  - ○ Required input torque to lock the device.
    - Justification of the selection of motors
    - Design and analysis of external gearboxes if added.
- ✓ If you do not use a linkage system on your design, please provide equivalent analysis.

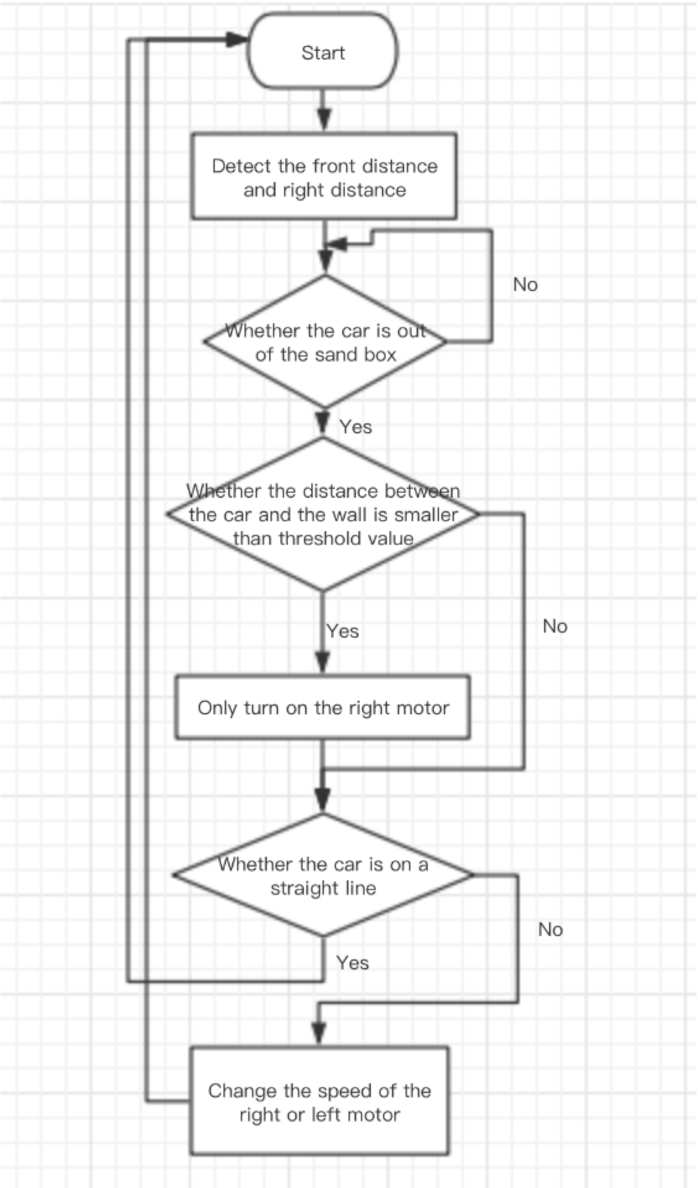




Mechatronics

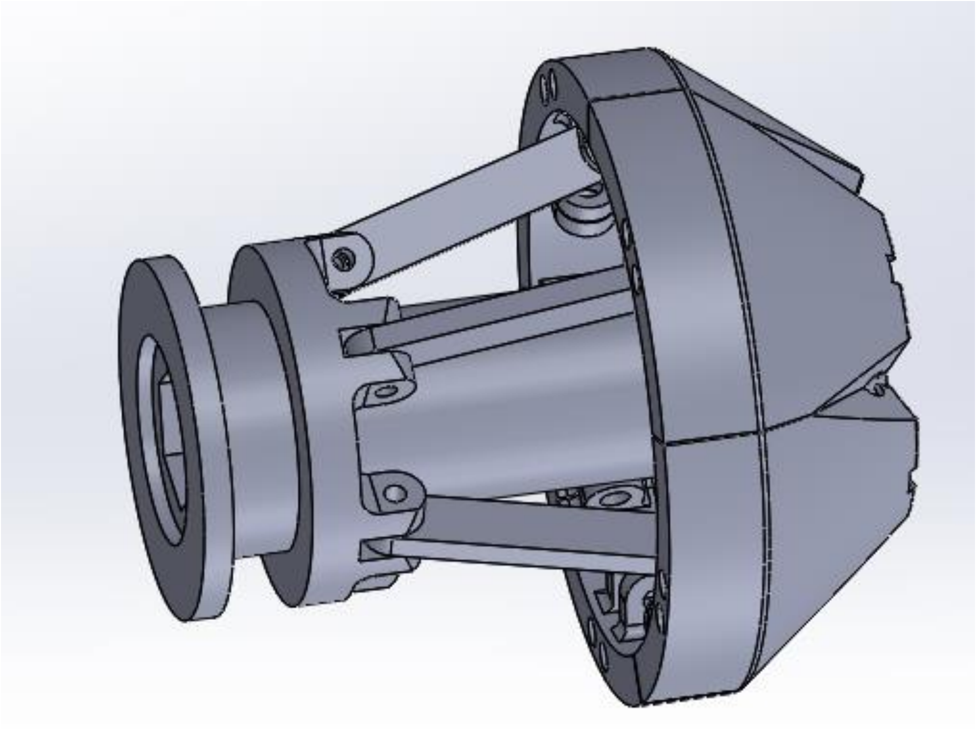
- ✓Flowchart of Raspberry PI programming
- ✓Circuit diagram
  - ○ How did you connect sensors and actuators

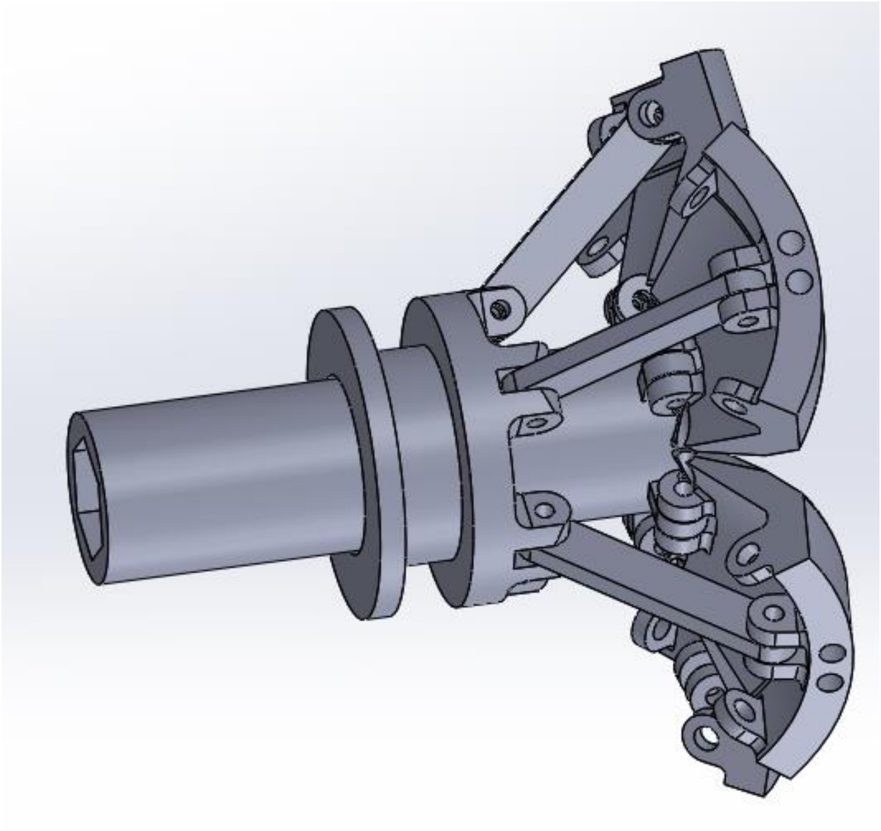




CAD simulation

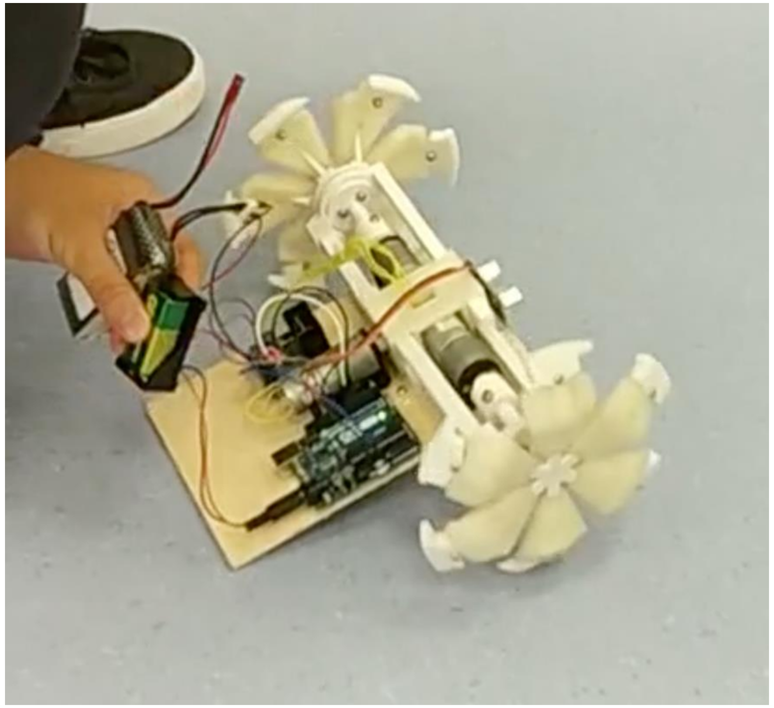
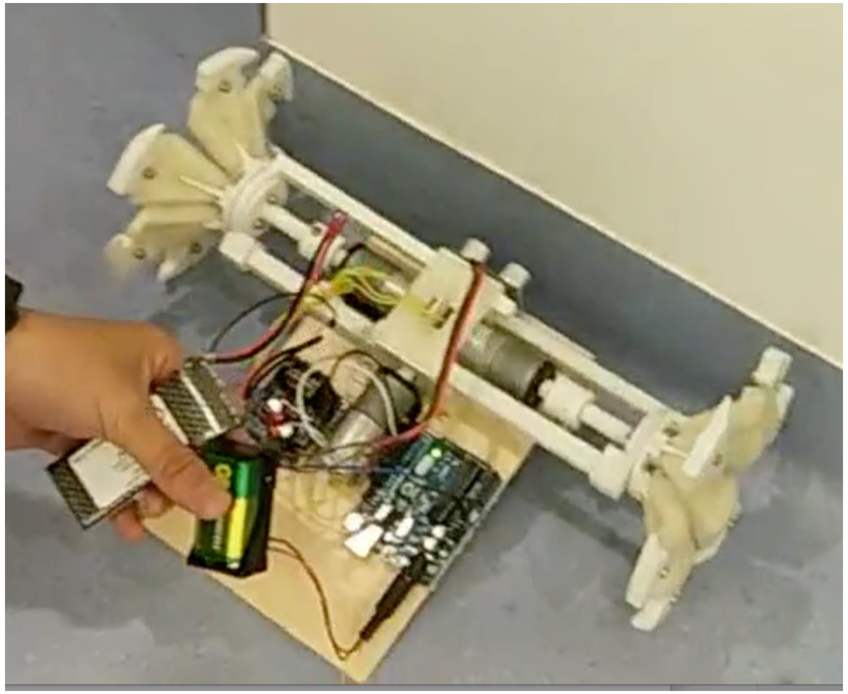
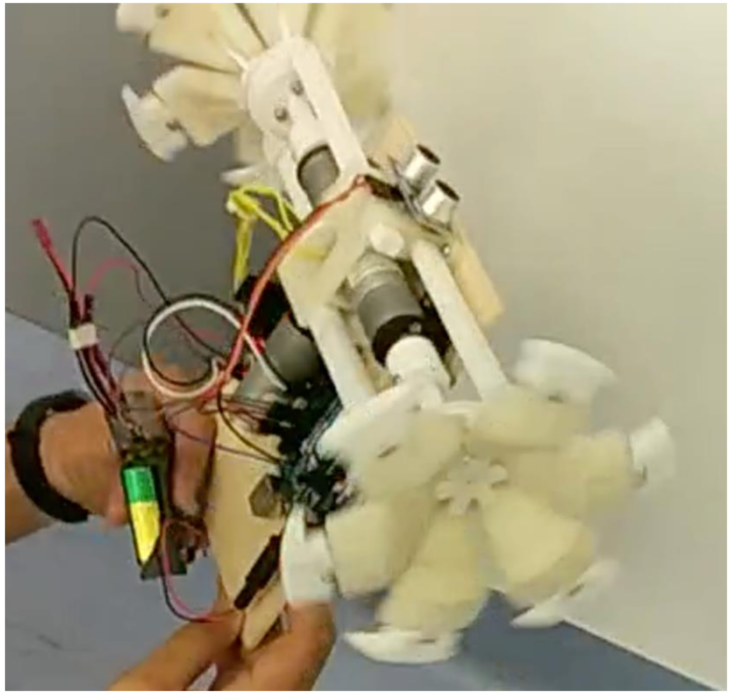
✓Virtual demonstration of the designed device





Initial prototype

✓You may show your initial prototype.
- Videos or pictures

Evaluation form

Grading Sheet for Design Review

Grader: _______________

Group #_______________

Grading Policy: The median grade should be between 75 and 85.

1.	Introduction: o Why is the design of your device significant regarding the game rule? o What technical aspects should be improved? o Good literature review?	5	
2	Objectives (what) - Specific design goal on your device?	5	
3	Project plan (Gantt chart); tasks for each member - How much have you finished - Plan for the rest	5	
4	Creative design compared to others?	5	
5	Design & Manufacturing details - Graphical linkage synthesis (or equivalent mechanical system synthesis) - CAD drawing of the device and components (also in part 8) - Justification of the selection of materials and manufacturing methods using mechanics	20	
6	Analysis (other mechanical systems need equivalent analysis) - Classification of the designed linkage o DOF o Crank-slider, crank-crank, etc. o Grashof condition - Position analysis (MATLAB simulation) - Force analysis with Free-Body-Diagrams (MATLAB simulation) o Required input torque to lift the device o Required input torque to lock the linkage (Justification of selection of motors)	20	
7	Mechatronics - Flow chart of Raspberry Pi code - Circuit diagram	5	
8	CAD drawing & Initial prototype	10	
9	Initial prototype (pictures and videos) – 70% done?	20	
10	Peer evaluation	5	