Robotics Studio

Sketching

Assignment 1 – Concept Sketches

Sketch out a few potential designs in pencil and paper. Propose at least four different designs. Calculate weight and make sure motors and structure can handle the loads. For an organic look, minimize the use of straight edges, orthogonal corners, and flat surfaces.

Create sketches of at least four different concepts. Sketches should be drawn with soft pencil on blank pages, in perspective. Shading, shadows, bounding boxes and motion axes are a plus. Include rough placement of motors, battery, Computer (Raspberry Pi) and controller board.

Present a draft of your PowerPoint in Monday meeting.

Hand in:

A PowerPoint presentation of your four concepts (Save as PDF). Scan your sketches into the PowerPoint at maximum size and resolution possible, and present them on a clean white background. Add textboxes with name of concept, brief explanation, estimated weight, maximum torque, and maximum power consumption. Add labels and text boxes to explain main components and features of your concepts. Consider adding multiple exploratory sketches of various parts of the concept. For example, show the robot in different poses.

PowerPoint Format:

1. Page 1: Title slide: Robotics Studio MECE 4611, Semester, Assignment 1, Full name(s), UNI(s), Date/Time Submitted, sketch of favorite concept. Grace hours: before submission, used/accumulated in this submission, after submission
2. Page 2: Concept 1. Title of robot.
3. Page 3-X: Sketches of concept 1 with text and details.
4. Repeat for three more concepts (or more)

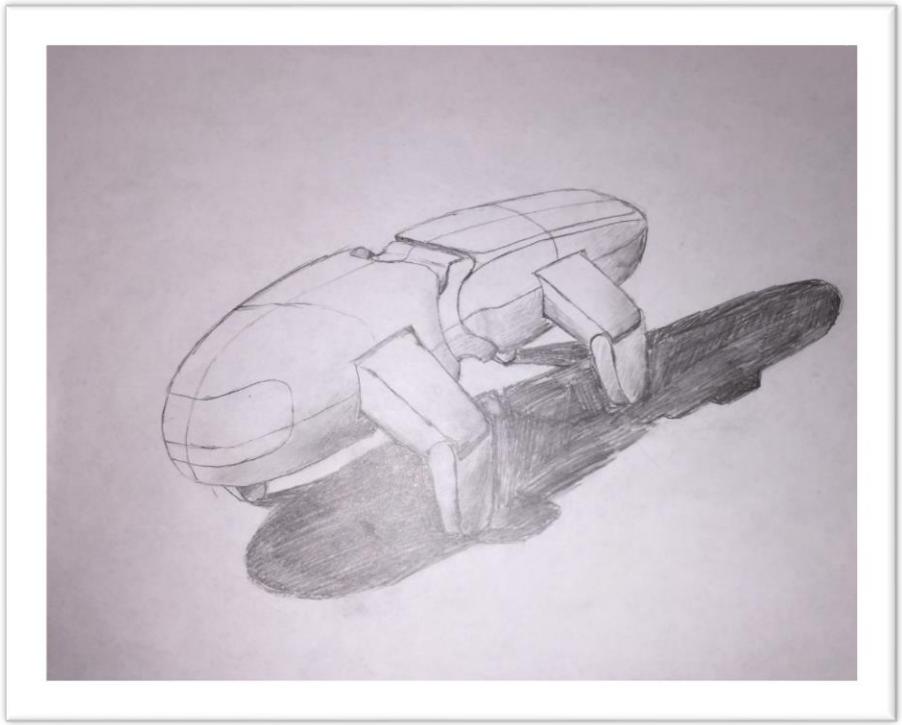
Grading

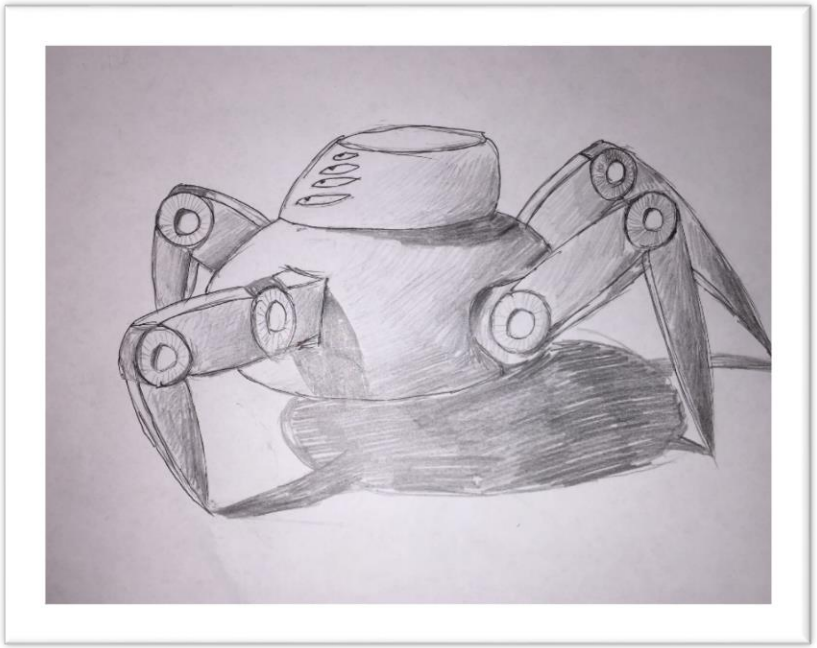
Grading of this part is incremental. You get points for various aspects and the more you do the more you get. 100 Points maximum

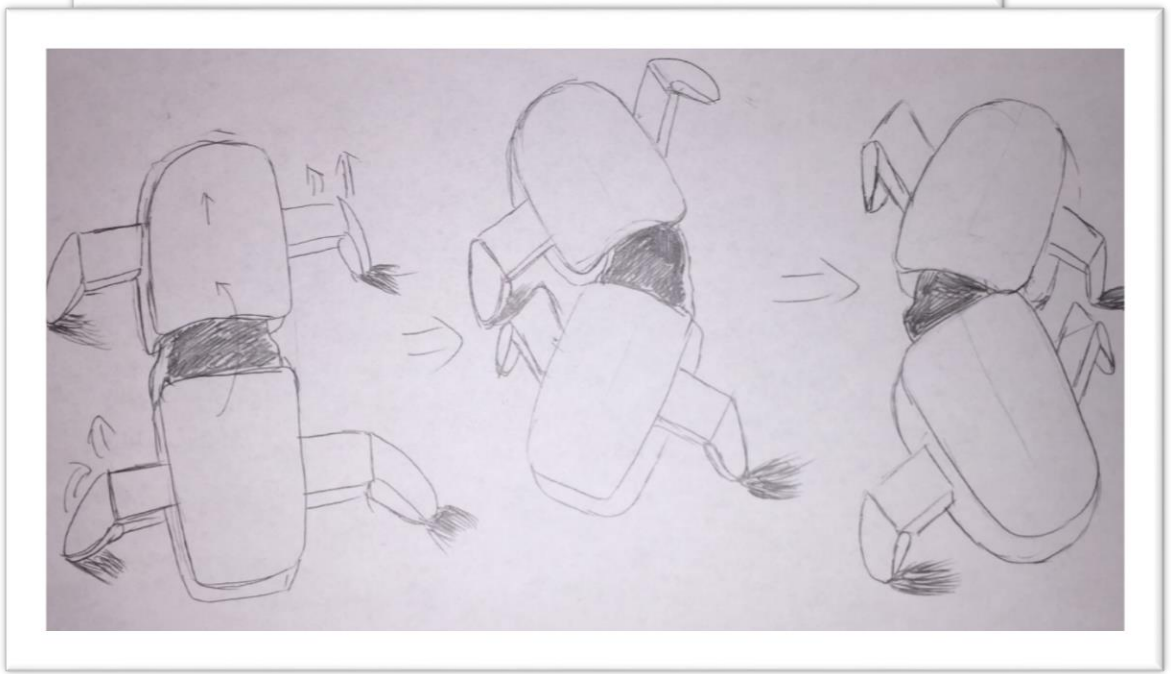
1. 4 Points for good title page with all information

Each concept is worth 25 points. Four concepts = 100 points. Following are point rubrics you can receive for each concept:

1. 4 Points 3D sketch
2. 4 Points shading
3. 4 Points shadows
4. 4 Points Weight and dimensions
5. 4 Points power calculation
6. 4 Points including Computer, controller, battery
7. 4 Points showing in multiple poses
8. 4 Points showing “Zoom in” of some feature
9. 4 Points overall aesthetics of the presentation







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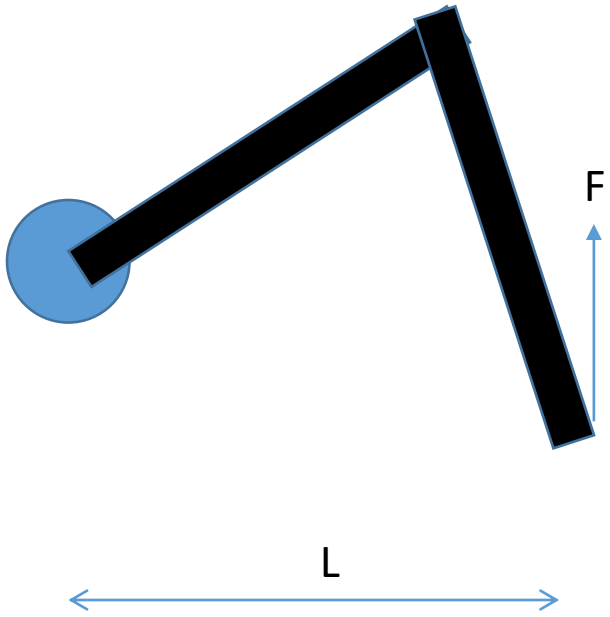
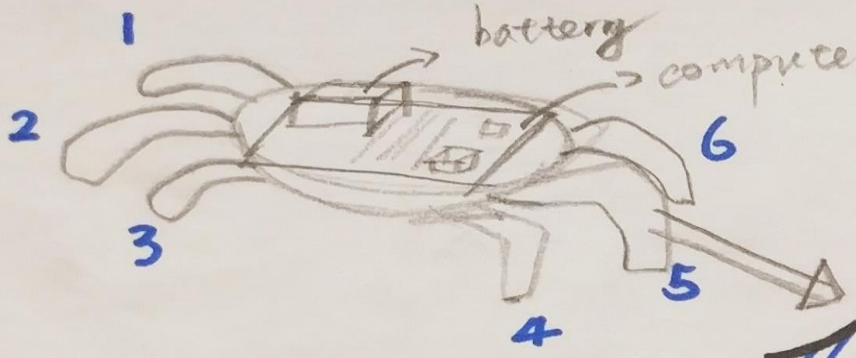
Sep 28, 2018

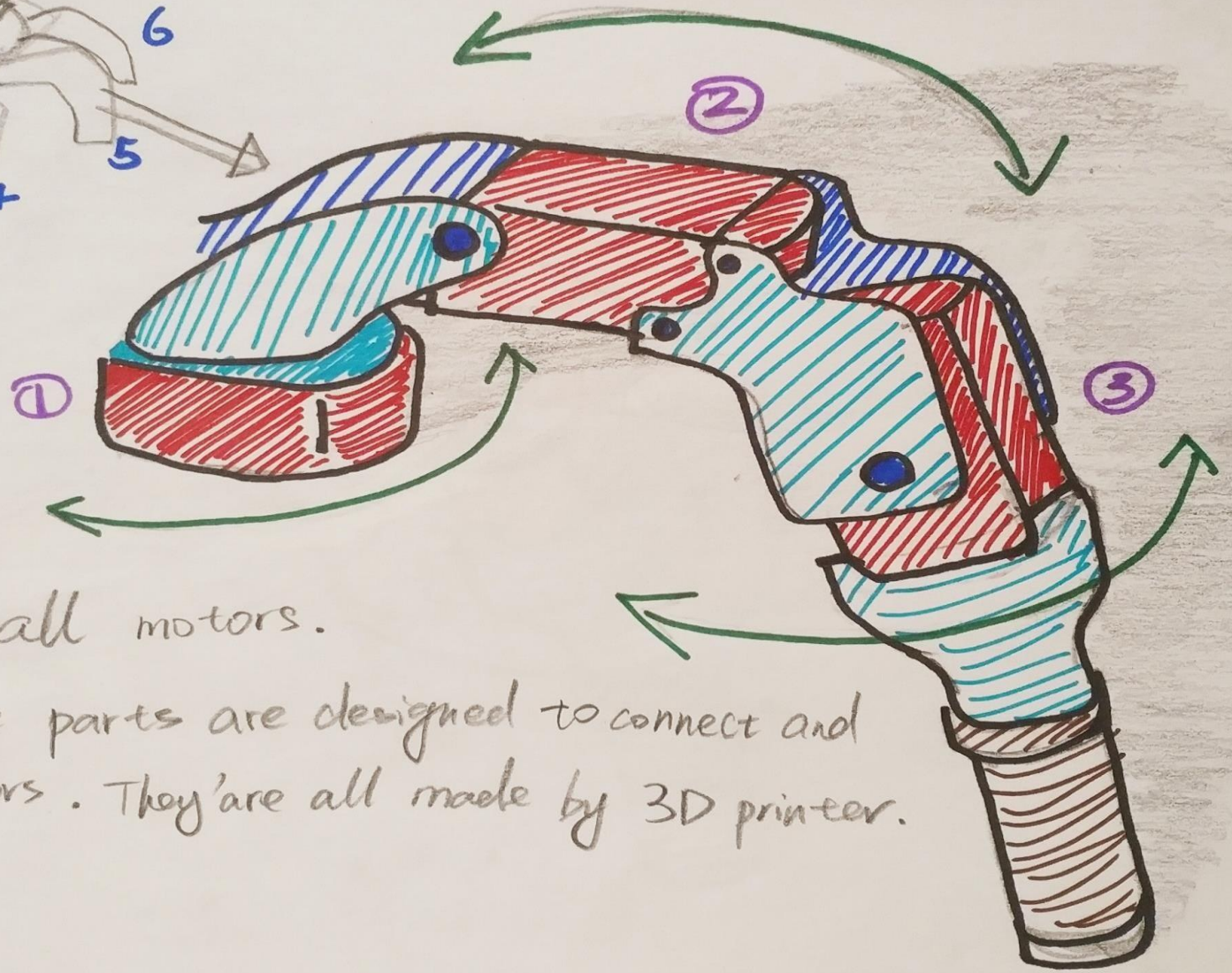
Weight/Torque calculation

- Estimate total weight of robot
- Estimate maximum static moment/torque on motors
  - T = L*F
- Estimate dynamic torque
- Verify stability
  - Center of gravity inside footprint
  - Maximum tilt





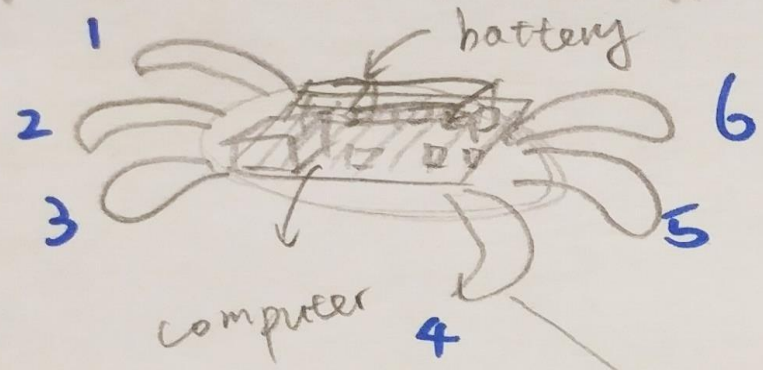
2 and 5 legs are like this.



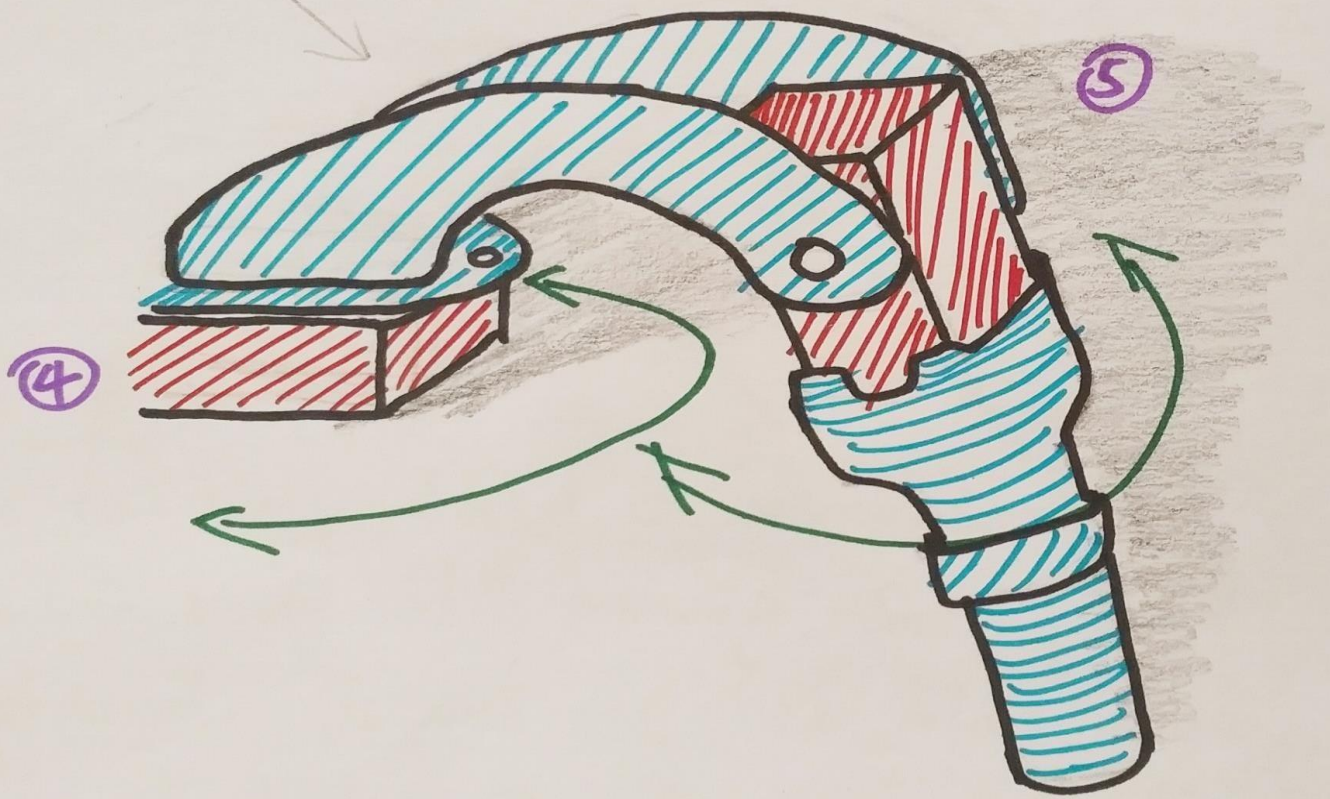
Because the motors are all in the air. So we do not need to consider the heat made by working motors.

①②③ are all motors.

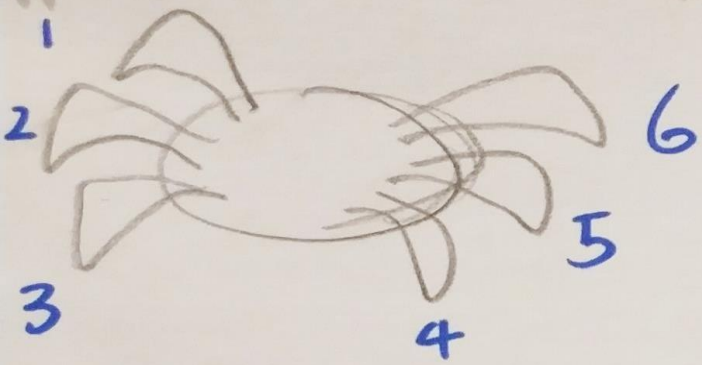
The other blue parts are designed to connect and support the motors. They are all made by 3D printer.



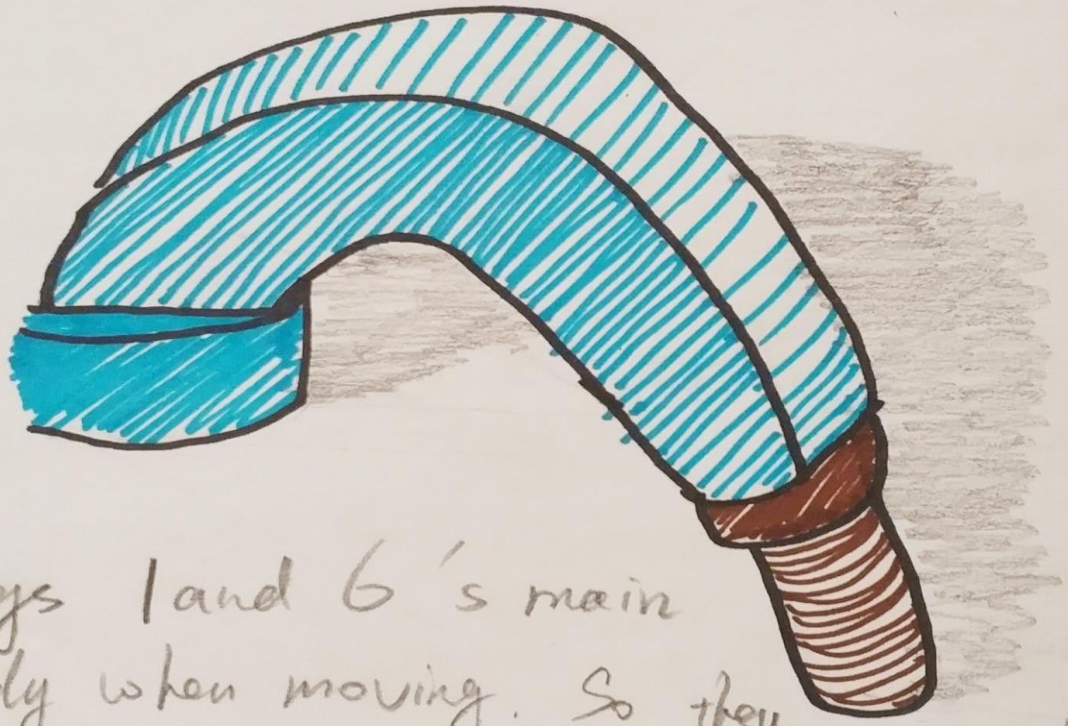
3 and 4 legs are like this



Red are motors.



1 and 6 legs are like this



These two legs 1 and 6's main function are supporting the whole body when moving. So they are alway connected to the ground. When the crab robot move, there are alway 4 legs support the body. So it can move stably.

Estimate Power requirement

- Each motor 1A/6V max = 6W
- Battery power output: 30W

Need help sketching?

- Warmup: https://www.youtube.com/watch?v=cE6JBbTvTp4
- Perspective: https://www.youtube.com/watch?v=JK0qlnnG1WA
- Contour lines: https://www.youtube.com/watch?v=YEYQe_81M4U
- Basic Sketching: https://www.youtube.com/watch?v=IM_zvACz2og&t=12s
- Basic Shapes: https://www.youtube.com/watch?v=IDrnj8BPp9w
- Random shapes: https://www.youtube.com/watch?v=QNNbpLO4mEI
- Organic shapes: https://www.youtube.com/watch?v=_JK73WLM3xQ
- Shadows: https://www.youtube.com/watch?v=umuPO77DEbA
- Two point perspective: https://www.youtube.com/watch?v=YInBreaClY0
- Presenting ideas: https://www.youtube.com/watch?v=iVy0qGqmKFU

Modularity

- Consider making robot in parts (modules)
  - Easy testing and reprinting subcomponents for fast iteration
  - Keep prints under 12h limit, print in parallel
  - Optimize print orientation for each part
  - Interchangeable components for better functionality
    - Interchangeable feet for tile vs. carpet
    - Snap-on skin for different visual effects