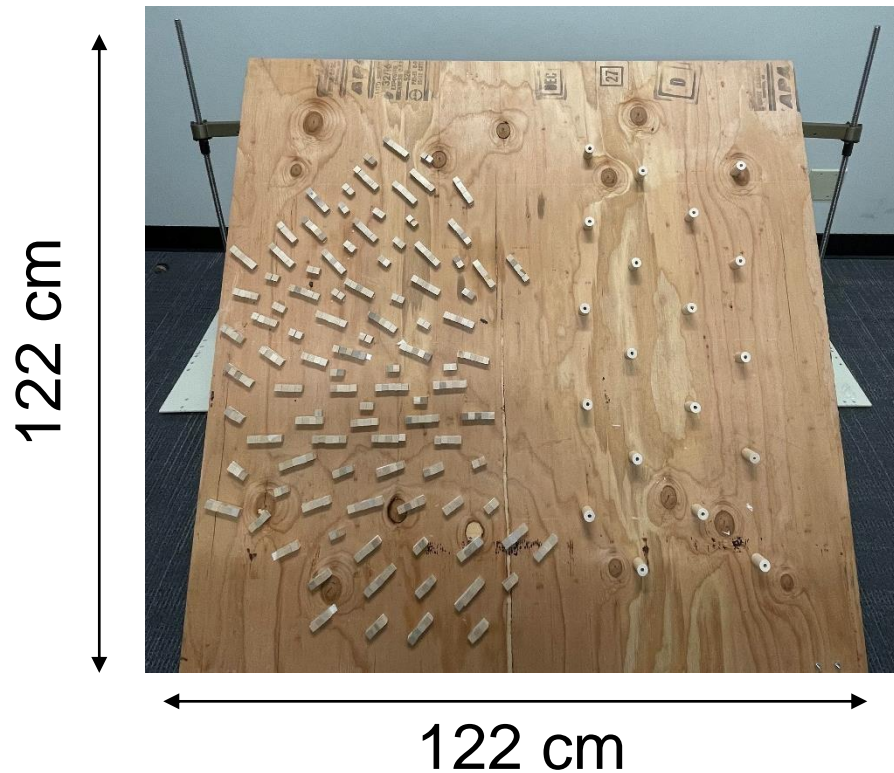


EE599 Project

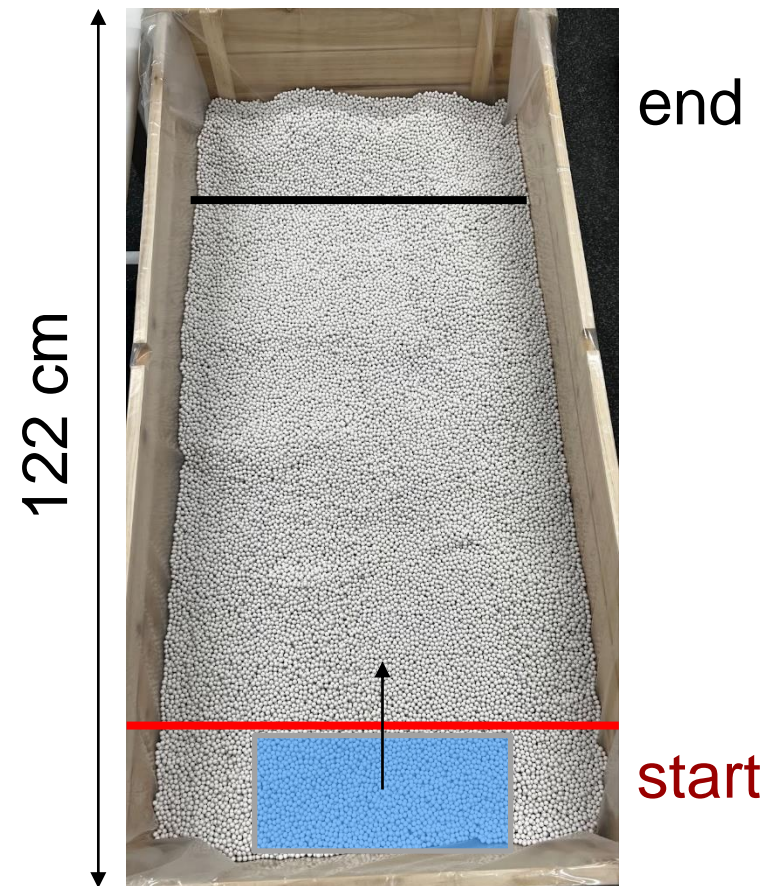
Overview

Select 1 out of 2 challenges

Challenge 1. Inclined obstacle terrain traversal



Challenge 2: Deformable terrain traversal

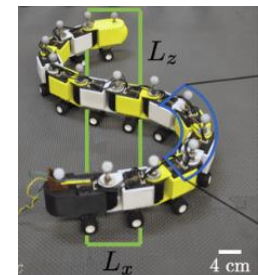
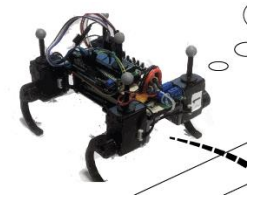


Project tasks

- Propose **one specific research question** relevant to robotic mobility in your selected environment
- **Read literature** to understand what has been understood, and develop your own hypothesis (by 10/26)
- Form your specific hypothesis, and design an **experiment plan to test your hypothesis** (by 11/2)
- Perform experiments with the robot that you assembled. **Report your discoveries** (by 11/16)
- Present the key discovery from your investigation (12/3)

Possible topics to explore

- Deformable terrain traversal
 - Effect of leg/flipper touchdown angle/speed
 - Effect of leg/foot shape/compliance
 - Snake undulation / sidewinding waveform
 - Worm-like anchoring/burrowing mechanism
 - Leg-body coordination
 - ...
- Inclined obstacle terrain traversal:
 - Effect of snake undulation waveform / joint compliance
 - Tail-assisted turning and climbing
 - Multi-agent collaborative climbing
 - Gait transitions
 - RiSE-style dynamic climbing
 - ...



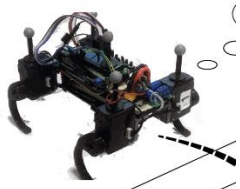
Project material

- Each team will have the following material:
 - 8x Dynamixel XL-320 servos
 - 1x Arduino Uno
 - 1x Dynamixel shield + 1x serial reader
 - Mechanical accessories included in your lab kit
 - Battery + charger + adapter boards

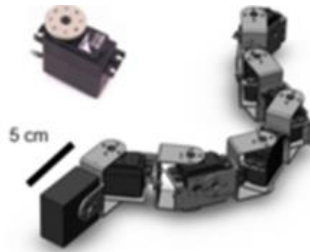
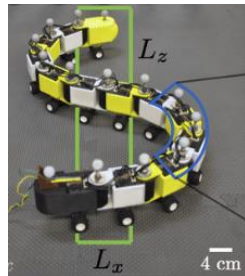
Robot design

- No constraint on robot morphology

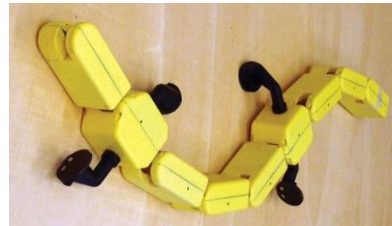
Legged



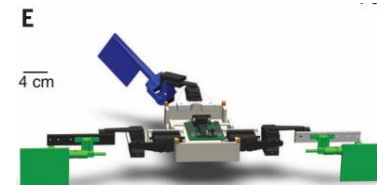
Full-body



Body + Legs



Arms/Tails



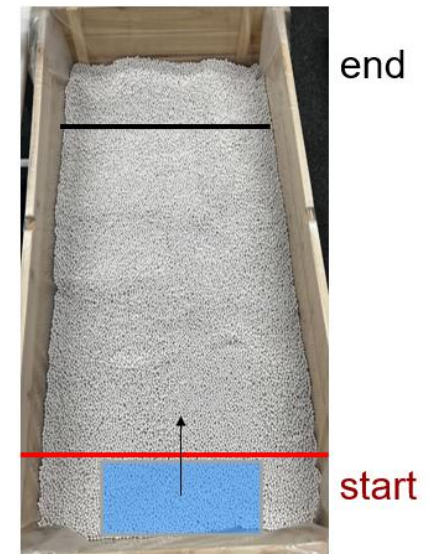
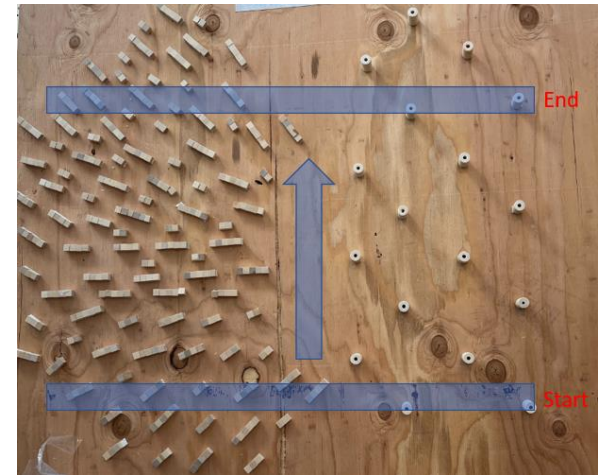
Multi-agent



- Size limit and optional add-ons
 - Size limit: full robot should not exceed 20cm in any direction (L, W, H)
 - Can choose to add additional design (e.g., 3D-printed foot, compliant structures) or sensors if desired, but NOT required and NOT supported by the teaching team (but we'd be happy to discuss with you about your ideas!)

Evaluation

- **Checkpoint deliverables (12%)**
 - Project proposal (literature review + hypothesis)
 - Proposed approach (experiment plan + robot design)
 - Results report (results + analysis)
- **Final presentation (10%)**
- **Final demonstration (8%)**
 - Obstacle incline traversal: starts at 14 degree, can challenge higher slope with an increment of at least 5 degree once succeeded. 3 trials allowed for each slope. Timeout in 2min.
 - Deformable terrain traversal: 3 trials, average speed (body length per sec) will be recorded.
- **Conference-paper style final report (10%)**



Important project dates

- 10/19/2022 --- Group selection and challenge selection due. Discuss project ideas and robot design with the teaching team during the lab session.
- 10/26/2022 --- Project proposal (literature review + hypothesis) due, work on assembling and programming the robot during lab session
- 11/2/2022 --- robot design and experiment plan due, start performing preliminary experiments.
- 11/9/2022 --- finish collecting data and start analyze results. Discuss preliminary results with teaching team to get feedback.
- 11/16/2022 --- results and analysis report due
- 11/28/2022 --- Final presentations.
- 11/30/2022 --- Demo day. Final project due

Schedule

16	17	18	19	20	21	22
Oct 19	Group formation + challenge selection					
23	24	25	26	27	28	29
Oct 26	Lit review + hypothesis due					
30	31	Nov 1	2	3	4	5
Nov 2	Design + experiment plan due					
6	7	8	9	10	11	12
Nov 9	Produce results					
13	14	15	16	17	18	19
Nov 16	Results + discussion due					
20	21	22	23	24	25	26
Nov 23	Thanksgiving					
27	28	29	30	Dec 1	2	3
Nov 28, Nov 30		Project presentation	Project demo Final report due			

Logistics

- Team size: 3-4 people. 3 by default. 4 needs to be approved.
- For teams with 3 people, you can get 2 additional motors from the TAs when you begin to design/assemble your robot.
- Note: please be careful with your team's parts. We only have limited spares (especially motors) so if you break more than one you may be asked to purchase your own replacement.
- Starting the week of 11/6, TA office hours will be held in EEB B18 so that you can access the project space during TA office hours.
- If you need additional time to access the space, please contact me or the TAs to see if arrangements are possible. Note that this additional support is not guaranteed.

Due next lab (10/19)

- Form your team
- Select your challenge