A Tendon-Driven Bead-Based Spine for Shape Adaptive Mobile Robot

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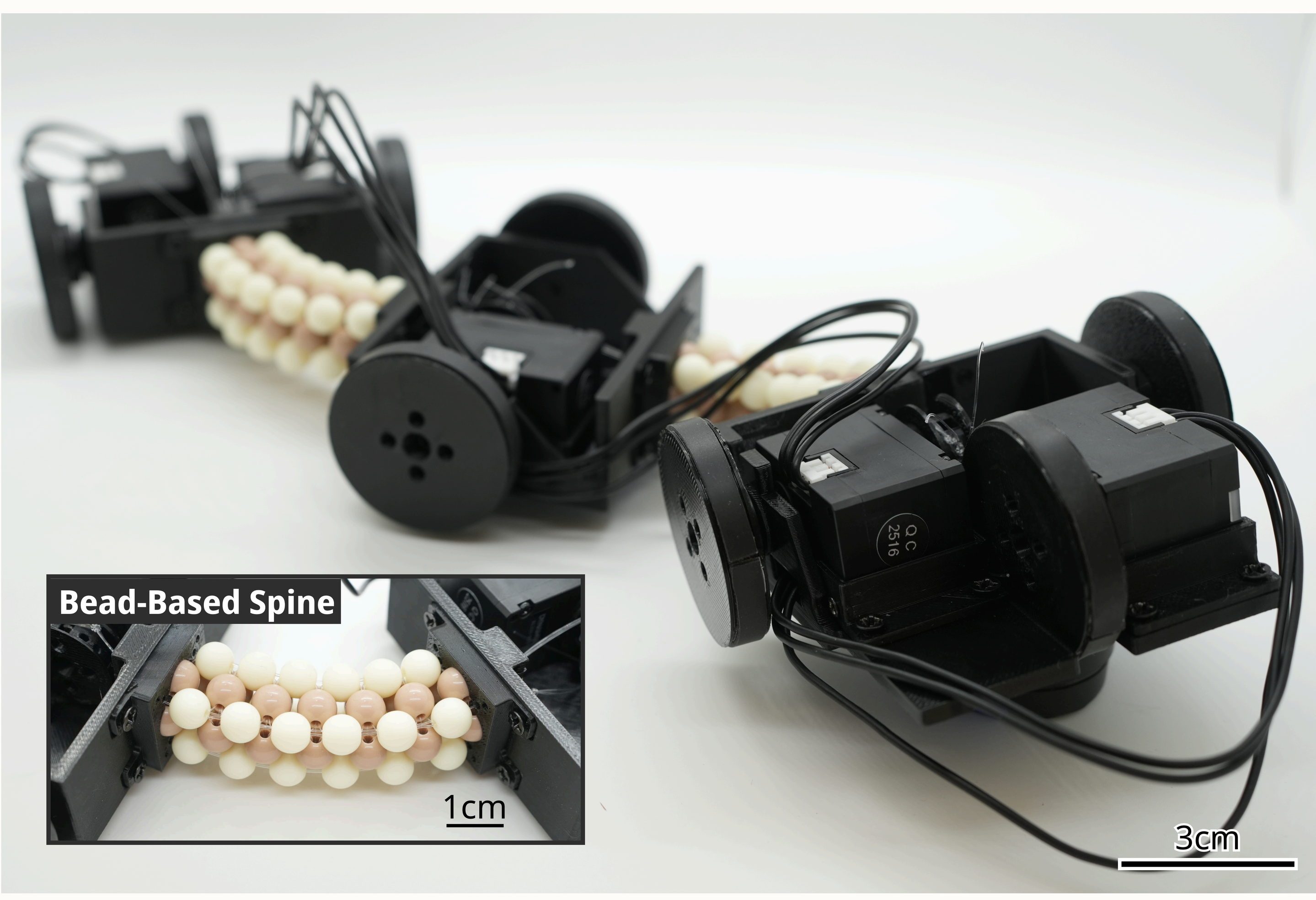
Keio University 1858 CALAMVS GLADIO FORTIOR

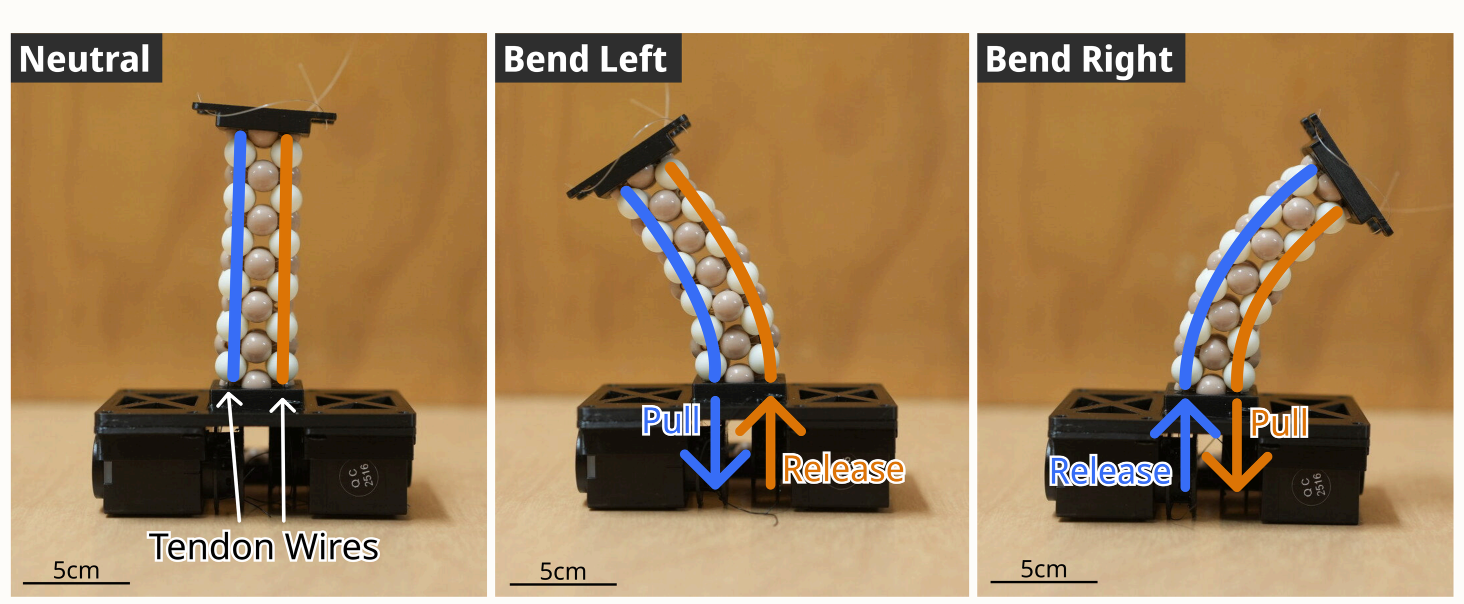
Project Overview

Wheel-based mobile robots can move efficiently on flat ground, but their fixed bodies often have difficulty moving over obstacles, making sharp turns, and operating in unstructured environments. This project presents a tendon-driven mobile robot that improves wheel based locomotion with active body deformation using bead-based spine.



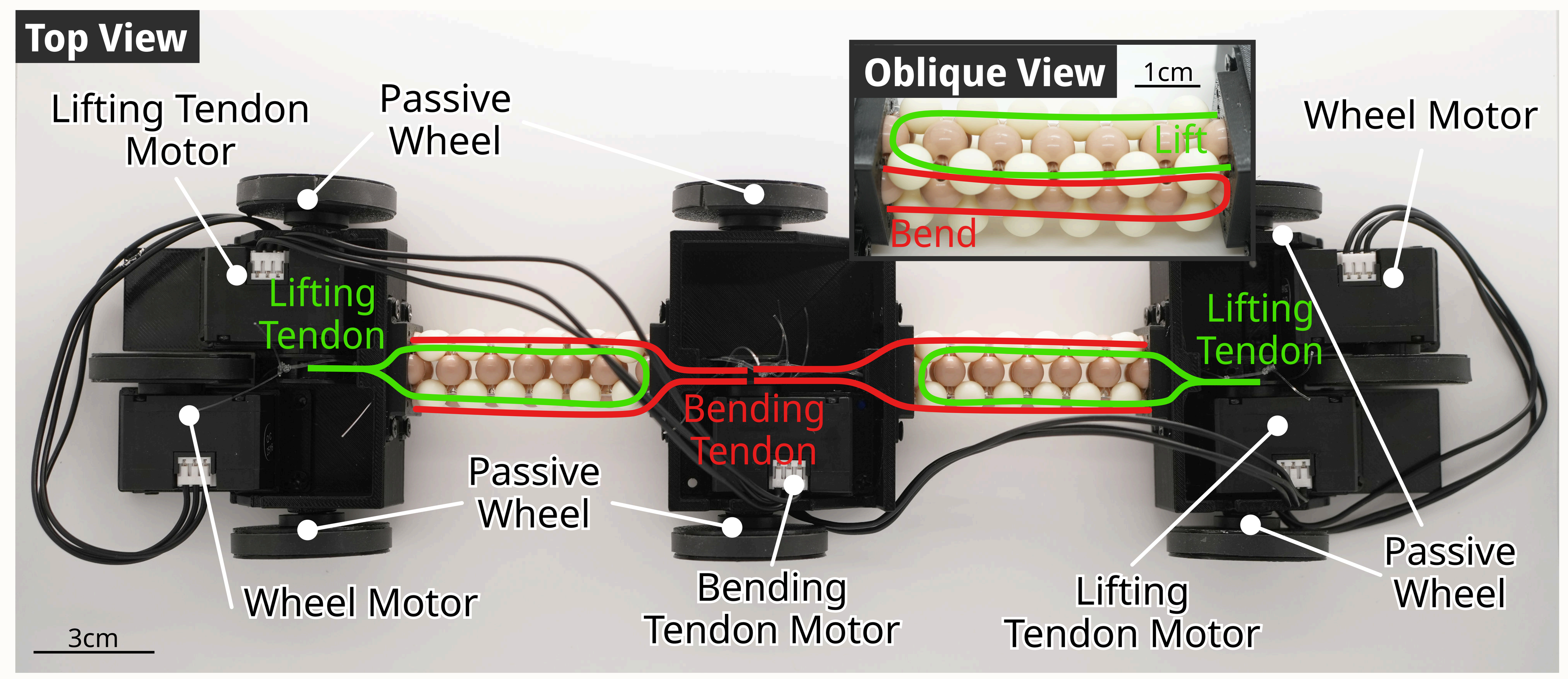
Control of Bead-Based Spine

Beads are woven into a flexible three-dimensional spine. Two tendons control the bending direction.



Routing additional tendons around the spine enables bending in multiple planes. The flexible bead structure can also deform passively when it contacts the environment.

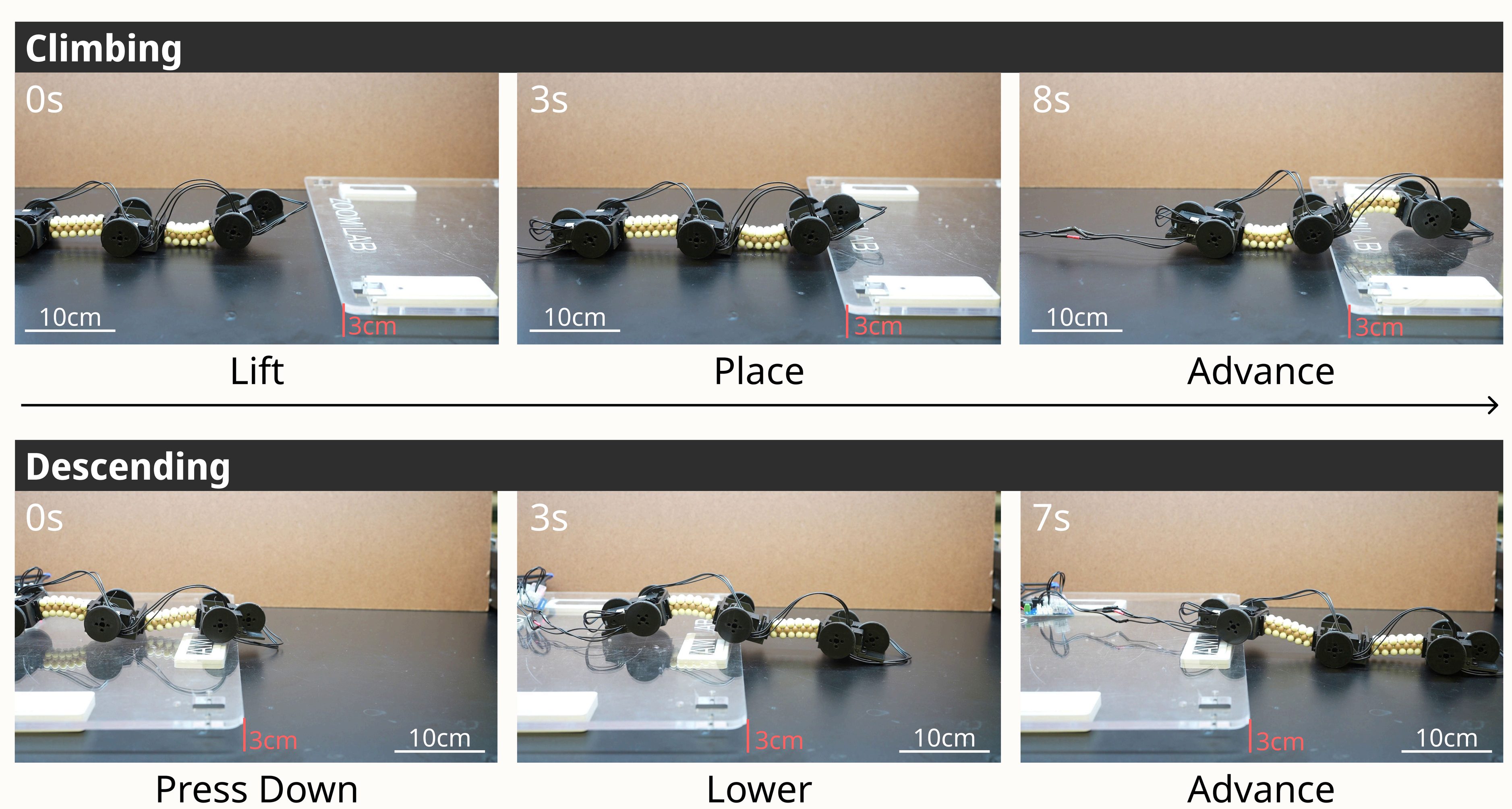
Design Overview



Two motors drive the wheels. Three tendon motors control the two bead spines. The left and right tendon motors independently lift their respective spines. The center tendon motor bends both spines in the same direction.

Shape Adaptive Step Traversal

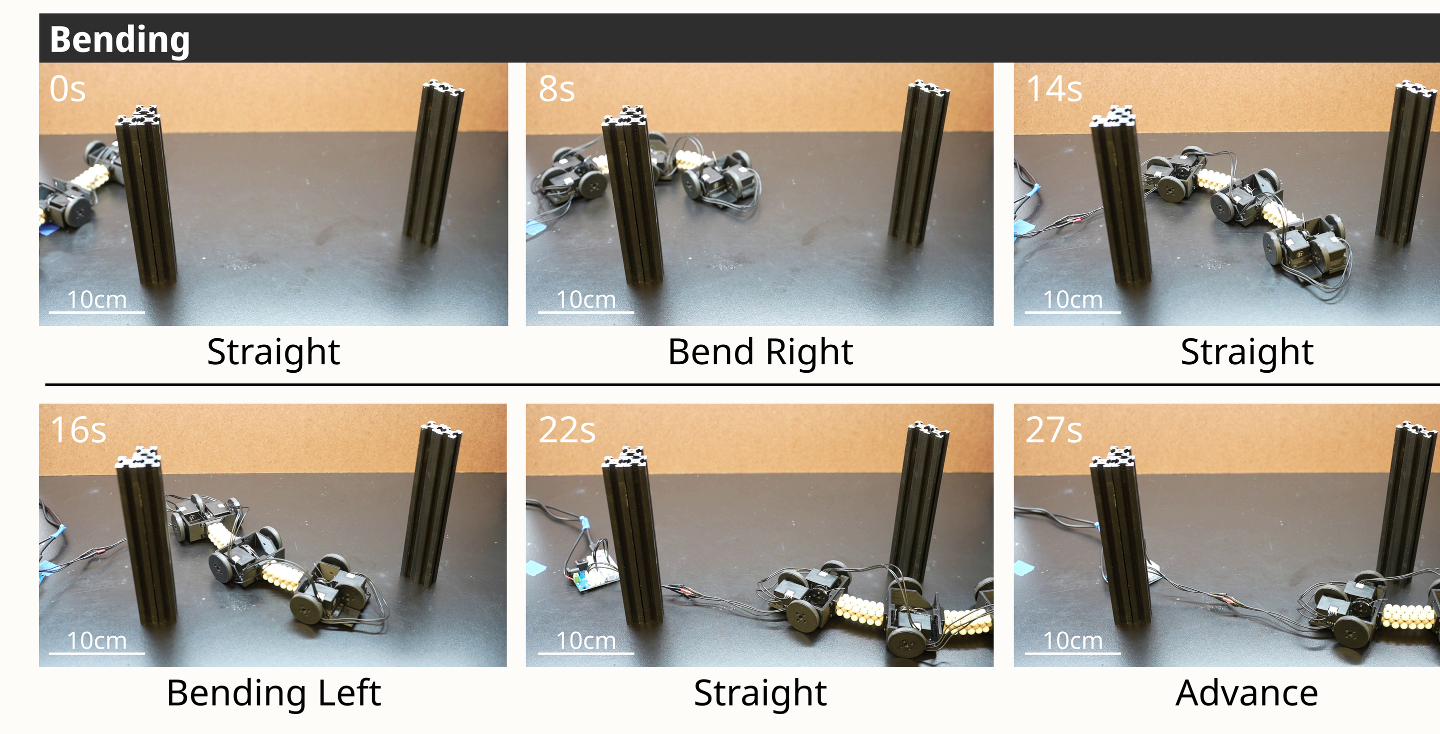
Body lifting enables climbing and descending.



During contact, the flexible bead spine passively changes shape to match the obstacle. This enables climbing and descending without precise lift-height control.

Shape Adaptive Turn

The robot bends both spines to change its body curvature, drives through the turn, and then returns to a straight shape.



Conclusions

Contributions

- Integration of tendon-driven bead structures as shape-controllable spines in a wheeled robot.
- Demonstration of multiple locomotion behaviors through active shape control and passive body adaptation.

Future Work

- Quantitatively characterize passive deformation during obstacle contact.
- Evaluate simple-control traversal across different obstacles.

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More details