Bio-Inspired Feet Design for Salamander-Like Quadruped Robot

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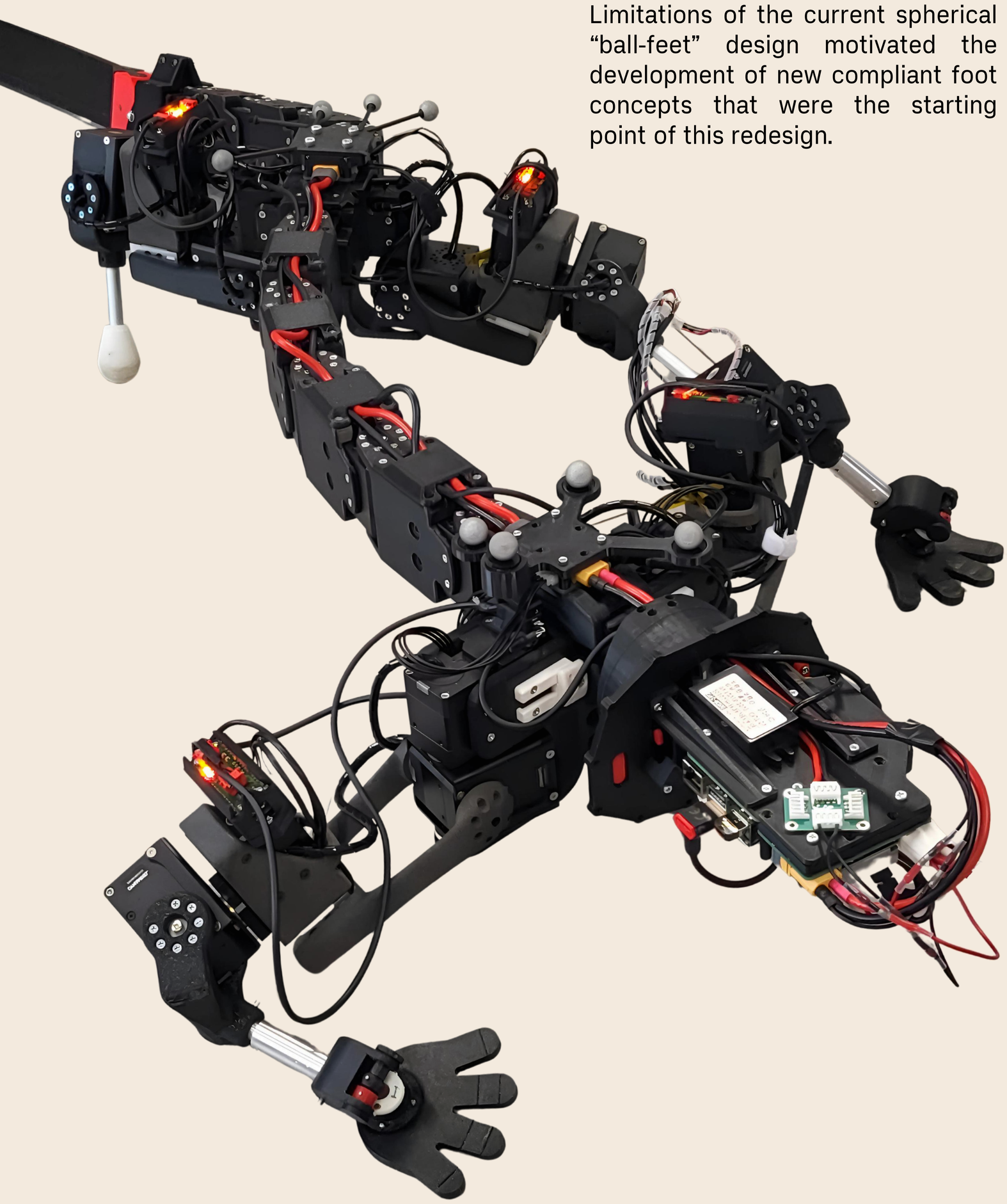
Introduction

Animal motion is remarkably efficient and versatile, making it a rich source of inspiration for robotics. *Pleurobot*, developed by the BIOROB lab, is a salamander inspired amphibious robot capable of both walking and swimming.

This research aims to redesign its feet to enhance its walking performance by increasing energy efficiency and adaptability to different terrains.
The main challenges were to keep the feet fully passive and to find balance between stiffness for propulsion and compliance for adaptability.
Limitations of the current spherical “ball-feet” design motivated the development of new compliant foot concepts that were the starting point of this redesign.



Methodology

The first and greatest step was to design the new foot in CAD and define its dimensions through calculations

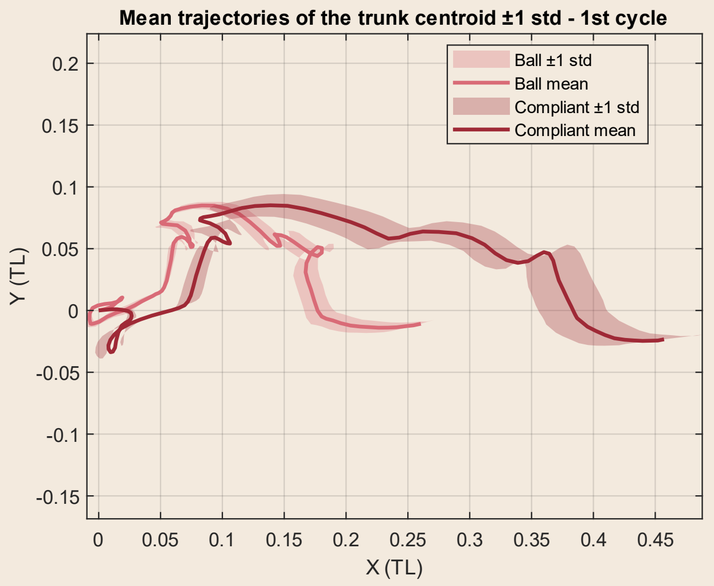
Rapid prototyping with 3D-printing was then essential to compare variants and identify weak points or assembly difficulties, leading to iterative improvements.

Two selected prototypes, along with the original ball-foot, were connected to *Pleurobot* to be evaluated with motion captures experiments.

Finally, the raw position data needed to be polished through data analysis. A MATLAB script extracted and calculated the key comparison points (trajectories, stride length,...)

Results

The compliant foot showed overall better walking performance, with higher stride length and forward velocity compared to the ball foot.
However, this came at the cost of reduced predictability and repeatability, as reflected by the larger standard deviations. In addition, the compliant foot tended to drift sideways.



Conclusion

This work shows that the compliant foot design can significantly improve *Pleurobot*'s locomotion. However, stability remains an issue and should be addressed through further testing, for example by tuning spring stiffness.