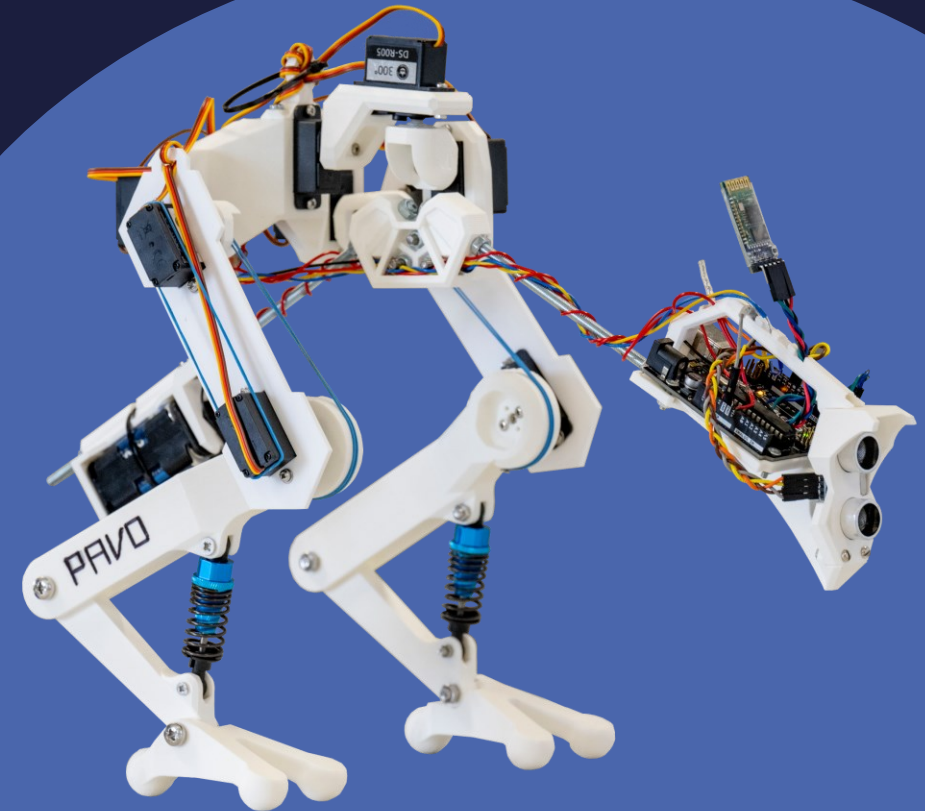


Ryan Khoo Yeap Hong | University of Southampton

Fowl, Fuzzy Logic & Frugality:

A better approach to Bipedal Robots



Robots are Vital

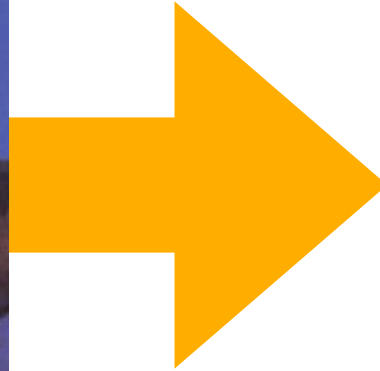
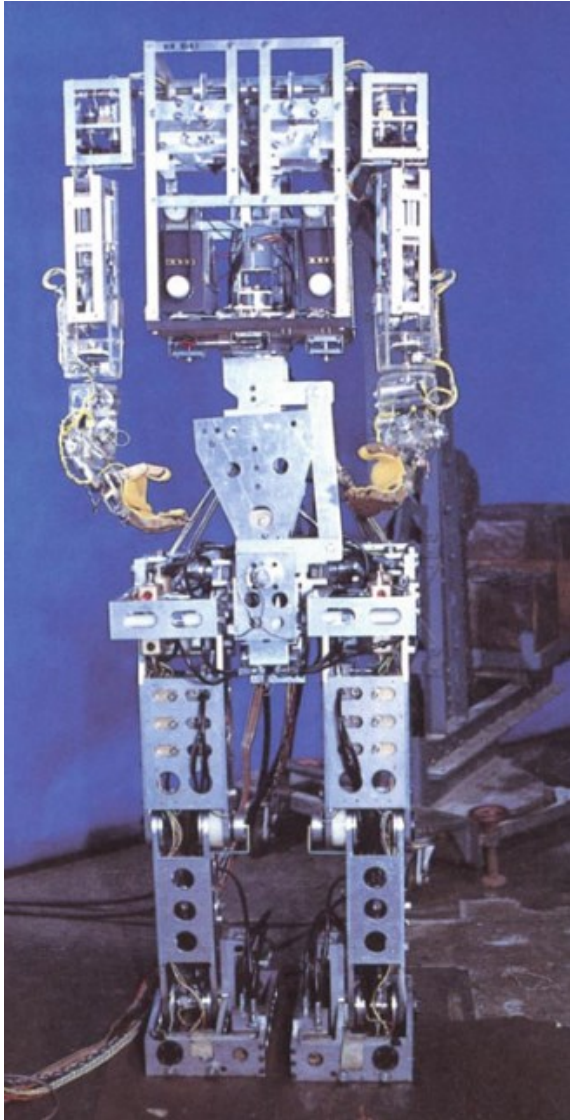


Grylls, Bethan. 2018. "Ocado's Robot Swarm." Retrieved April 24, 2022 (<https://www.newelectronics.co.uk/content/news/ocado-s-robot-swarm>).

Human-centric Environments



Bipedal Robots



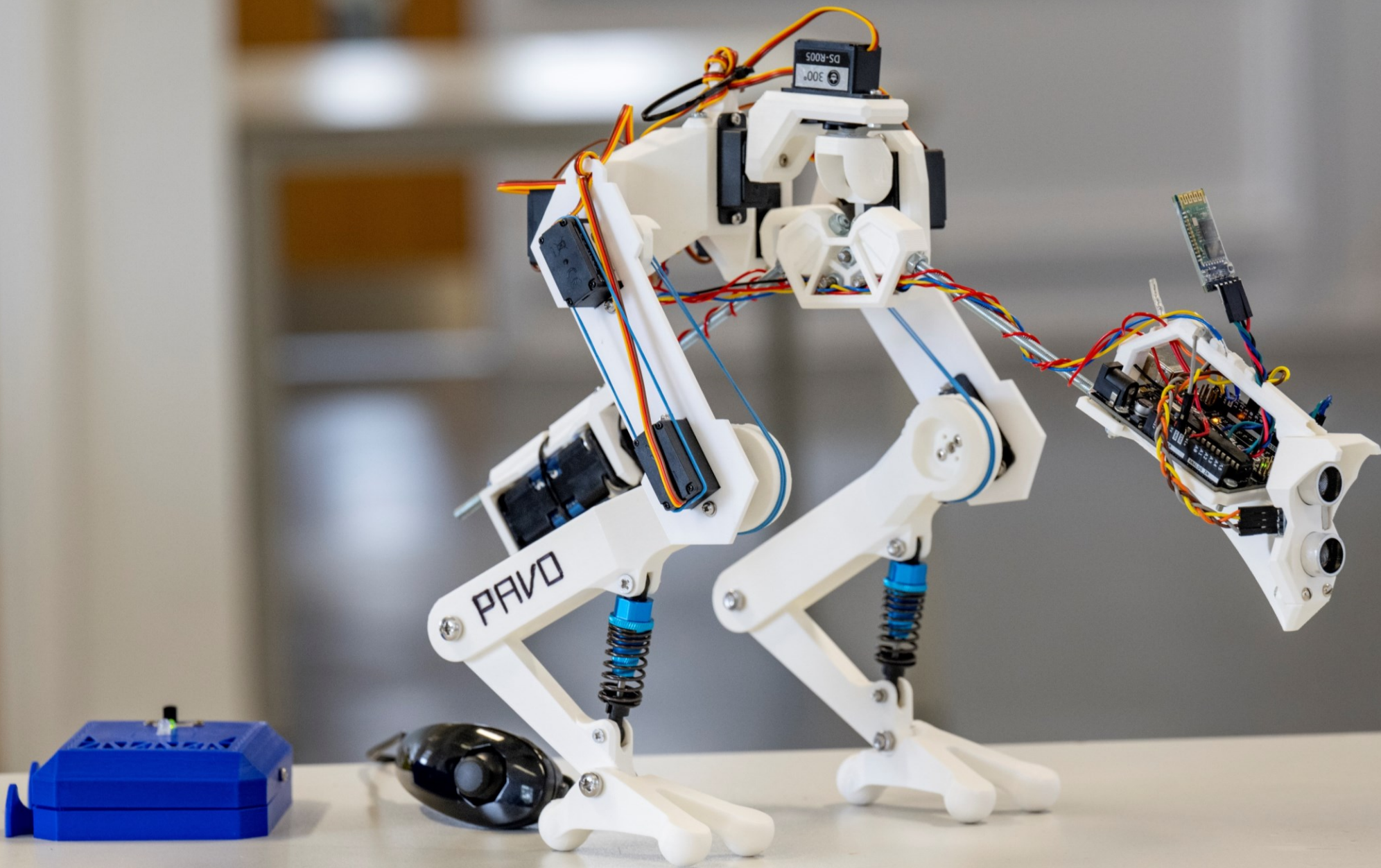
Takanishi, Atsuo. 2019. "Historical Perspective of Humanoid Robot Research in Asia." *Humanoid Robotics: A Reference* 35–52. doi: 10.1007/978-94-007-6046-2_145.

<https://robots.ieee.org/robots/atlas2016/?gallery=photo1>

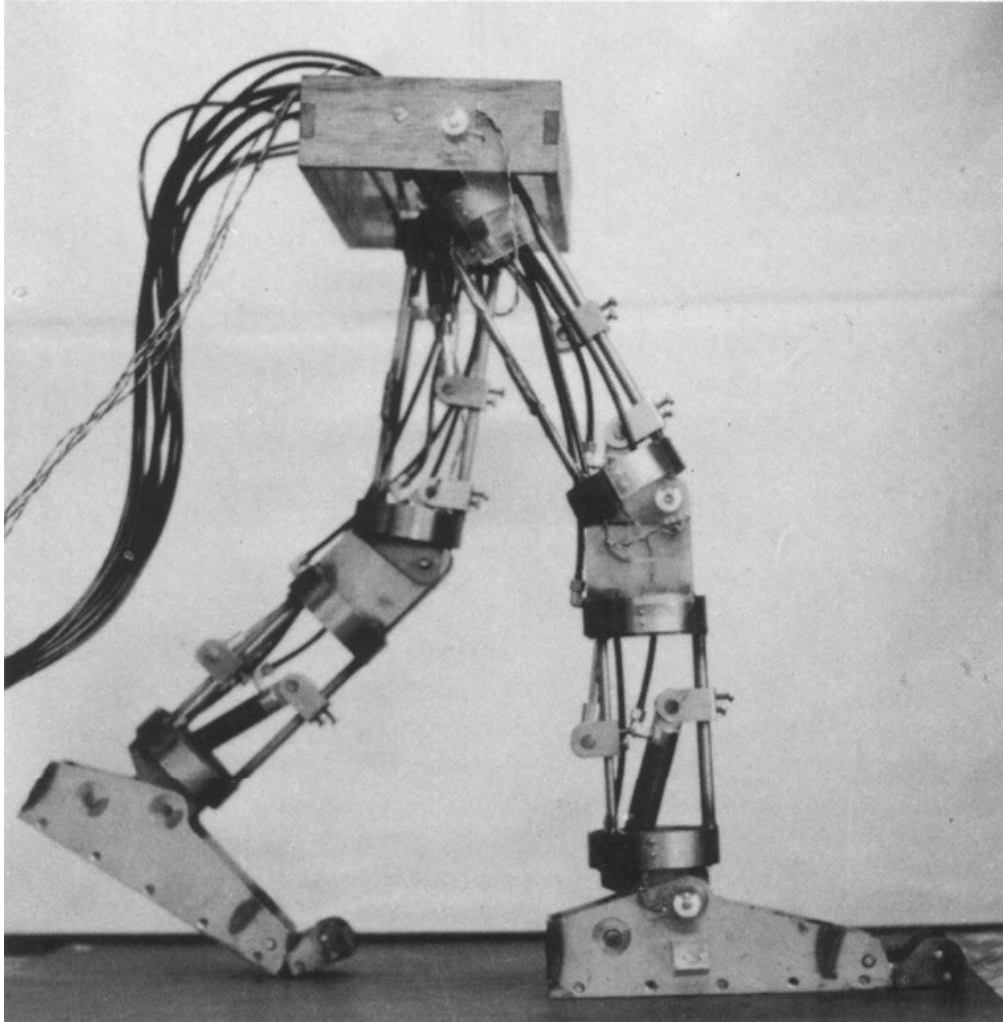
Expensive, Computationally intensive & Unstable



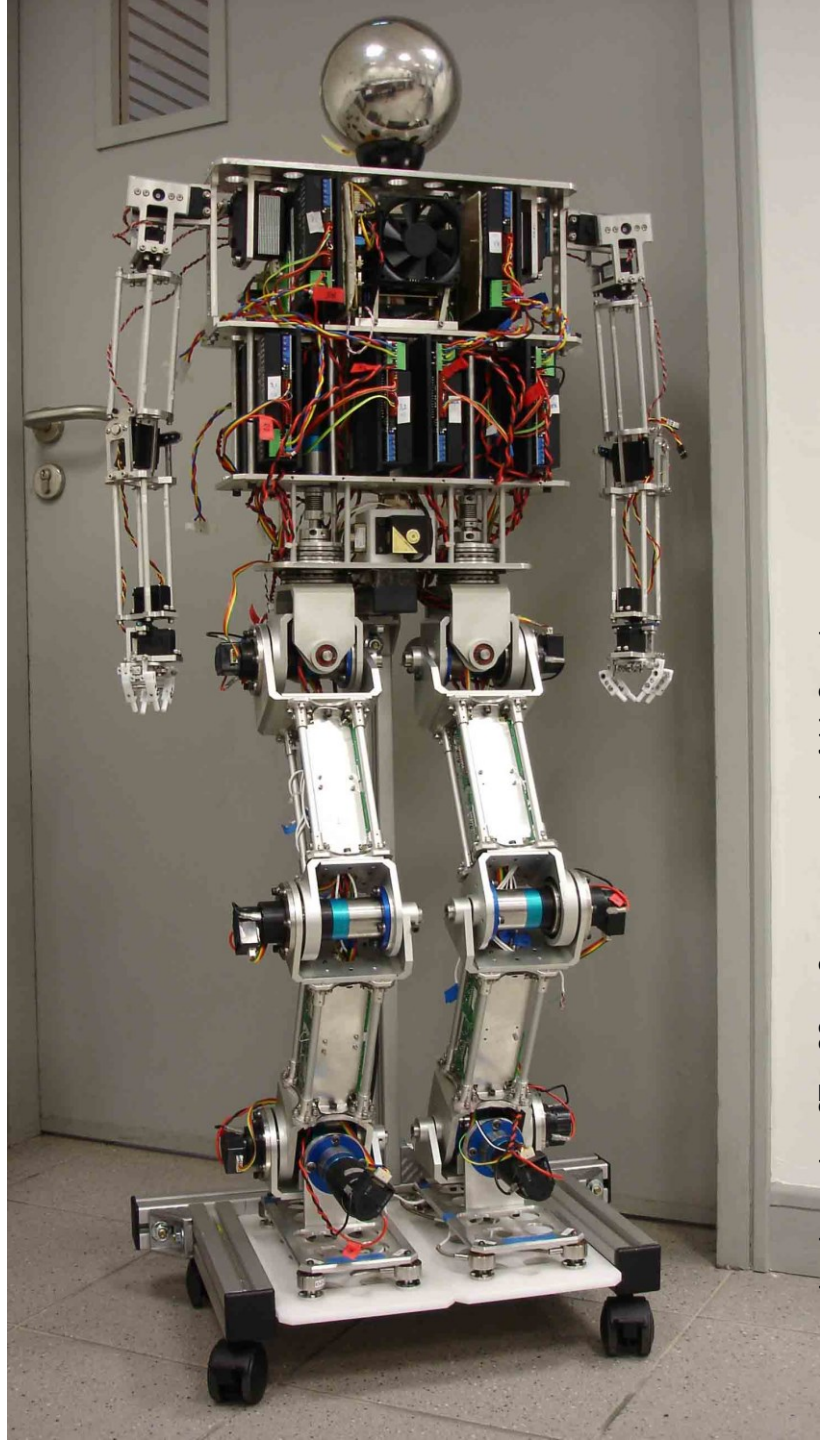
<https://www.bostondynamics.com/>



Human-Based



Takanishi, Atsuo. 2019. "Historical Perspective of Humanoid Robot Research in Asia." *Humanoid Robotics: A Reference* 35–52. doi: 10.1007/978-94-007-6046-2_145.



https://guppy.mpe.nus.edu.sg/~legged_group/3dipicpictures.htm

Bird-Based

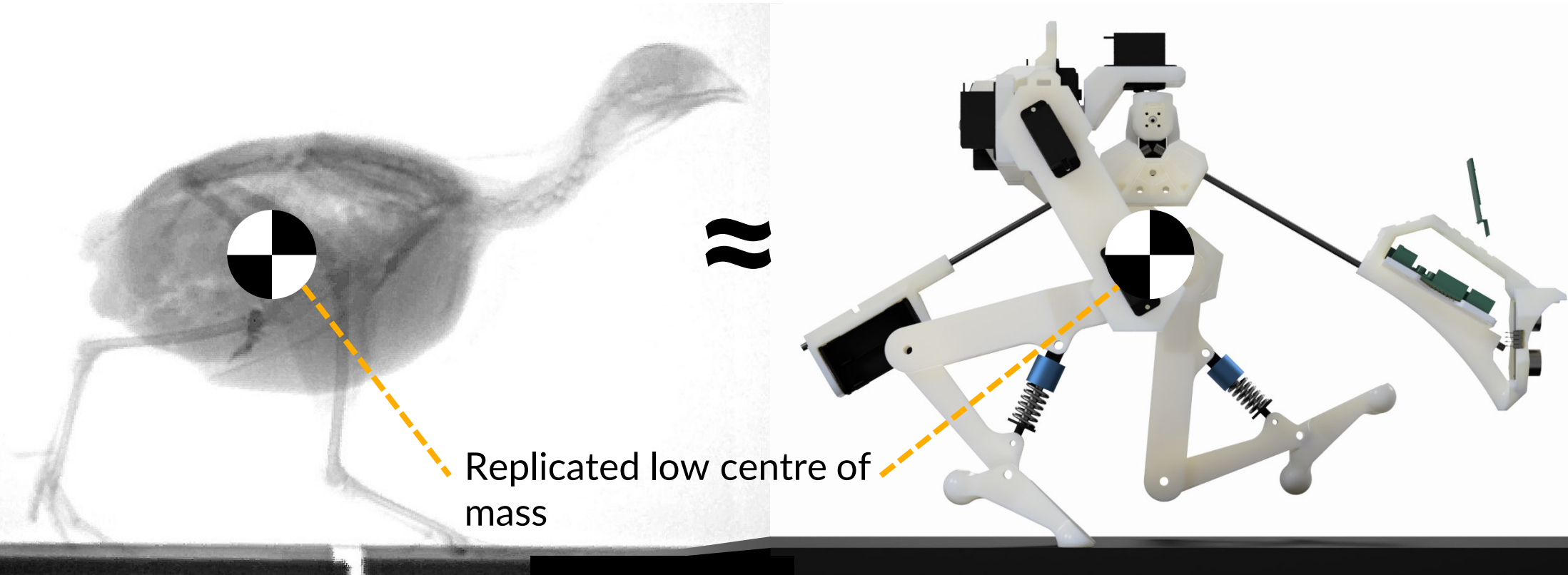


<https://www.birdguides.com/gallery/birds/coturnix-coturnix/309140>



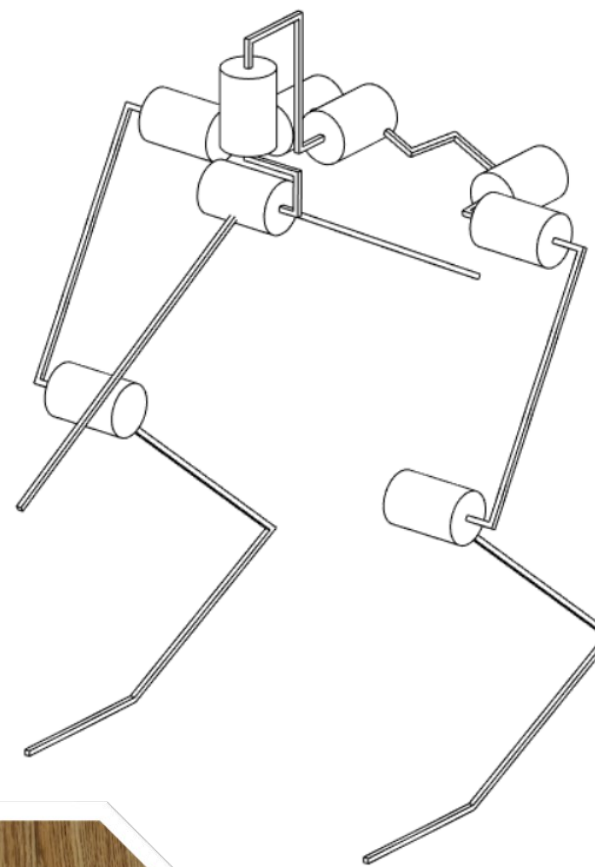
<https://museum.wales/articles/1011/Archaeopteryx---the-missing-link-between-dinosaurs-and-birds/>

Avian Inspiration



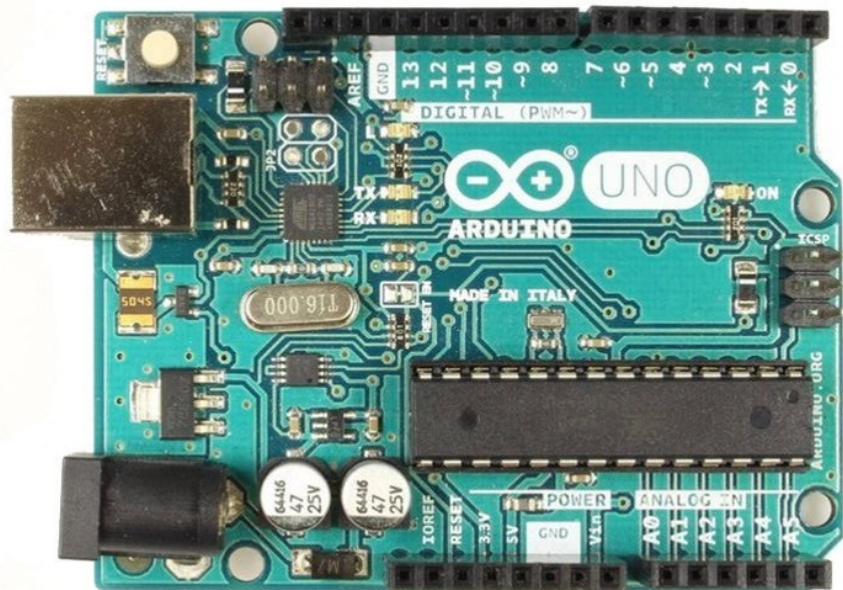
Building Pavo

- Cost-effective off-the-shelf parts
- 3D printed and laser cut
- Minimum degrees of freedom

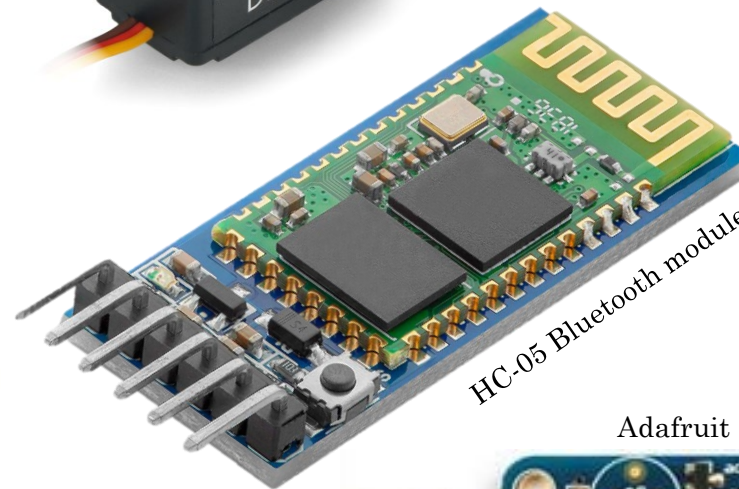
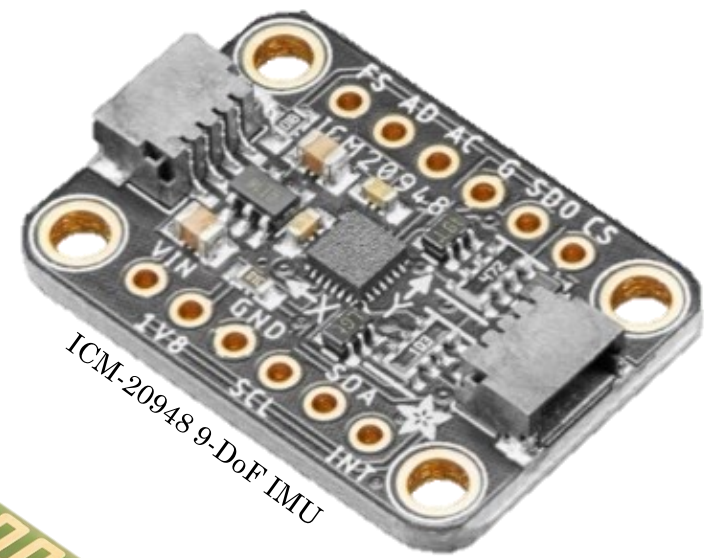


Arduinos

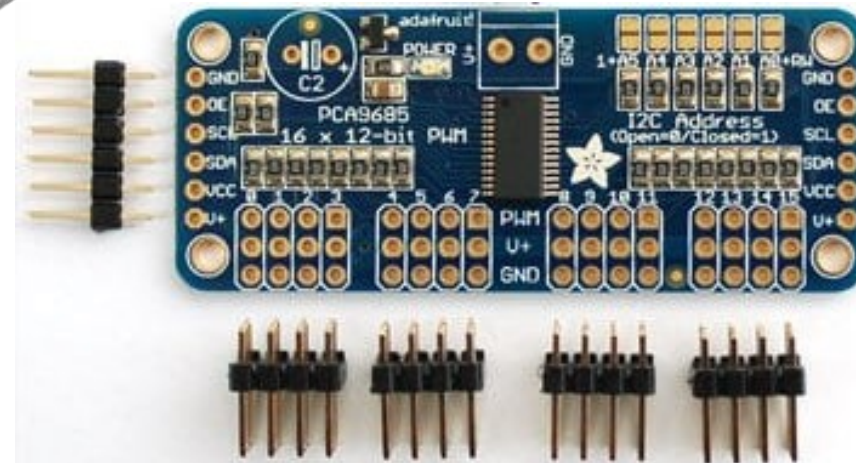
- Simple to use
- Cost-effective
- Compatible



Servos SER0056



Adafruit 16- Channel 12-bit PWM Servo Driver



Computationally Intensive

Modern robots have complicated control systems requiring intense computational power, increasing complexity and cost

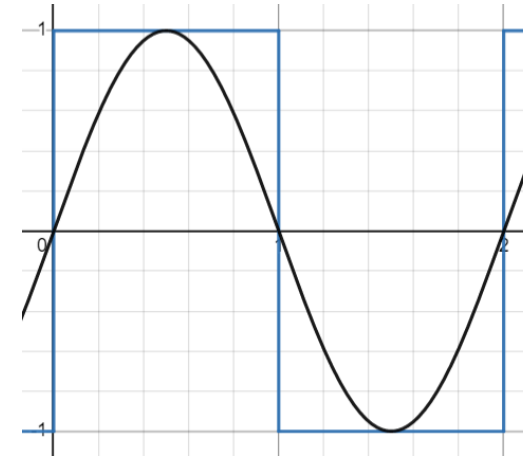


<https://www.technologyreview.com/2021/04/08/1022176/boston-dynamics-cassie-robot-walk-reinforcement-learning-ai/>

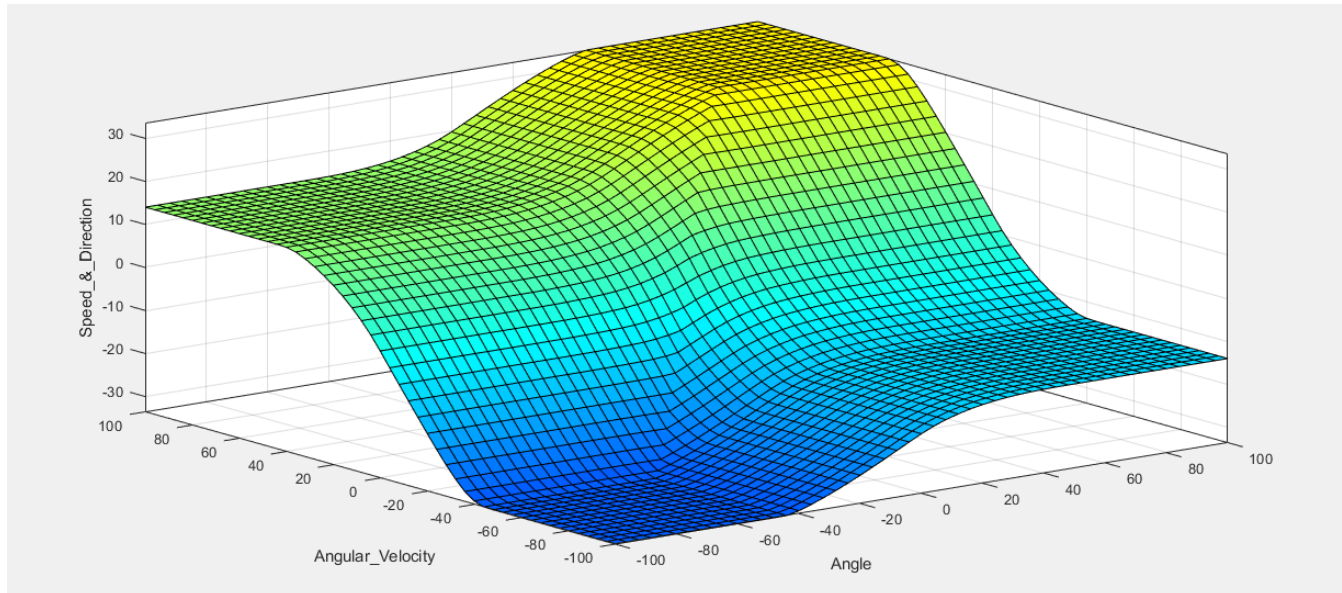
<https://www.youtube.com/watch?v=EezdinoG4mk&t=29s>

Fuzzy Logic

- No discrete true/false
- Human understandable rule-sets
- Off-loading computation



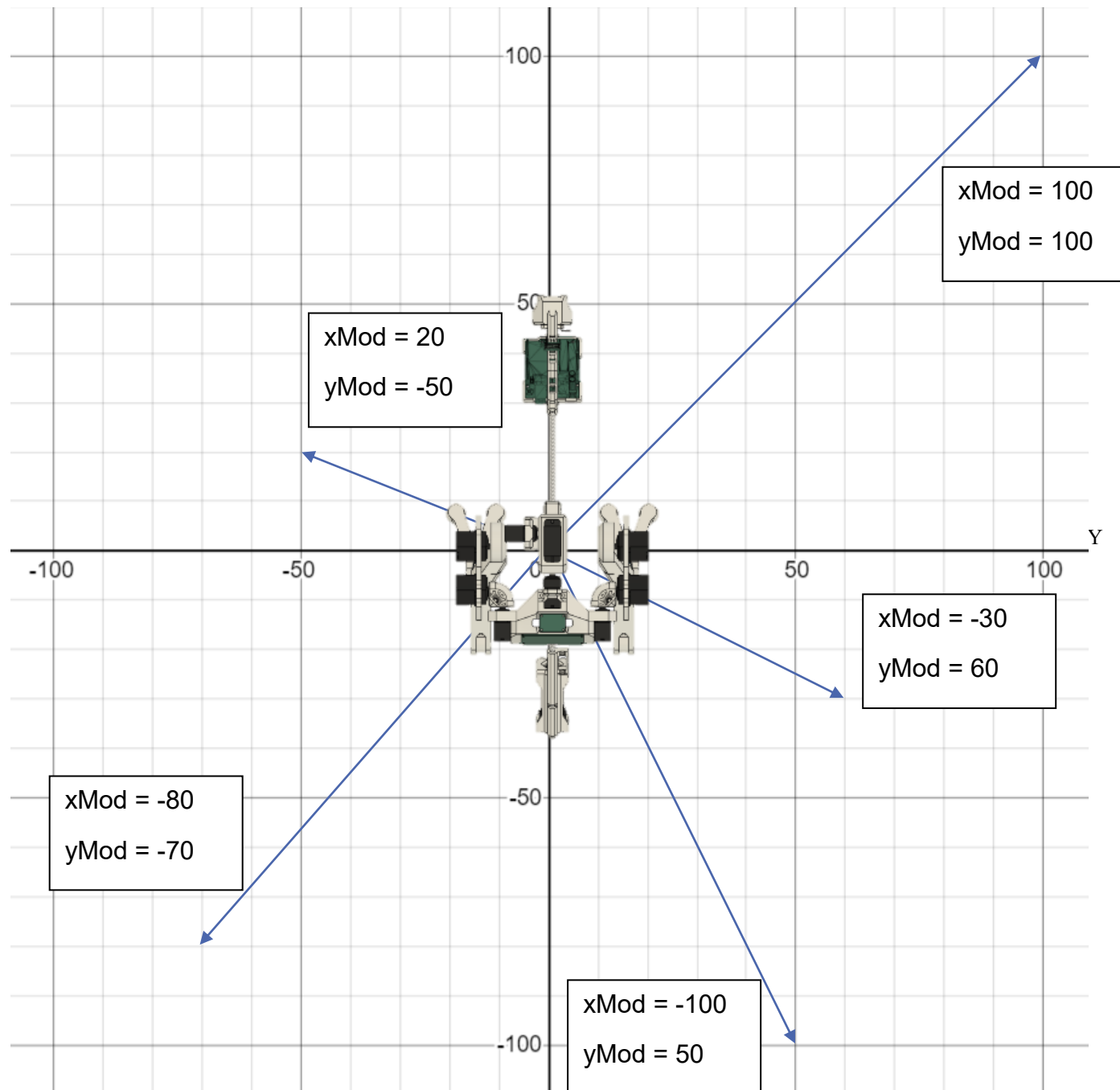
If (falling forward) then (walk forward)



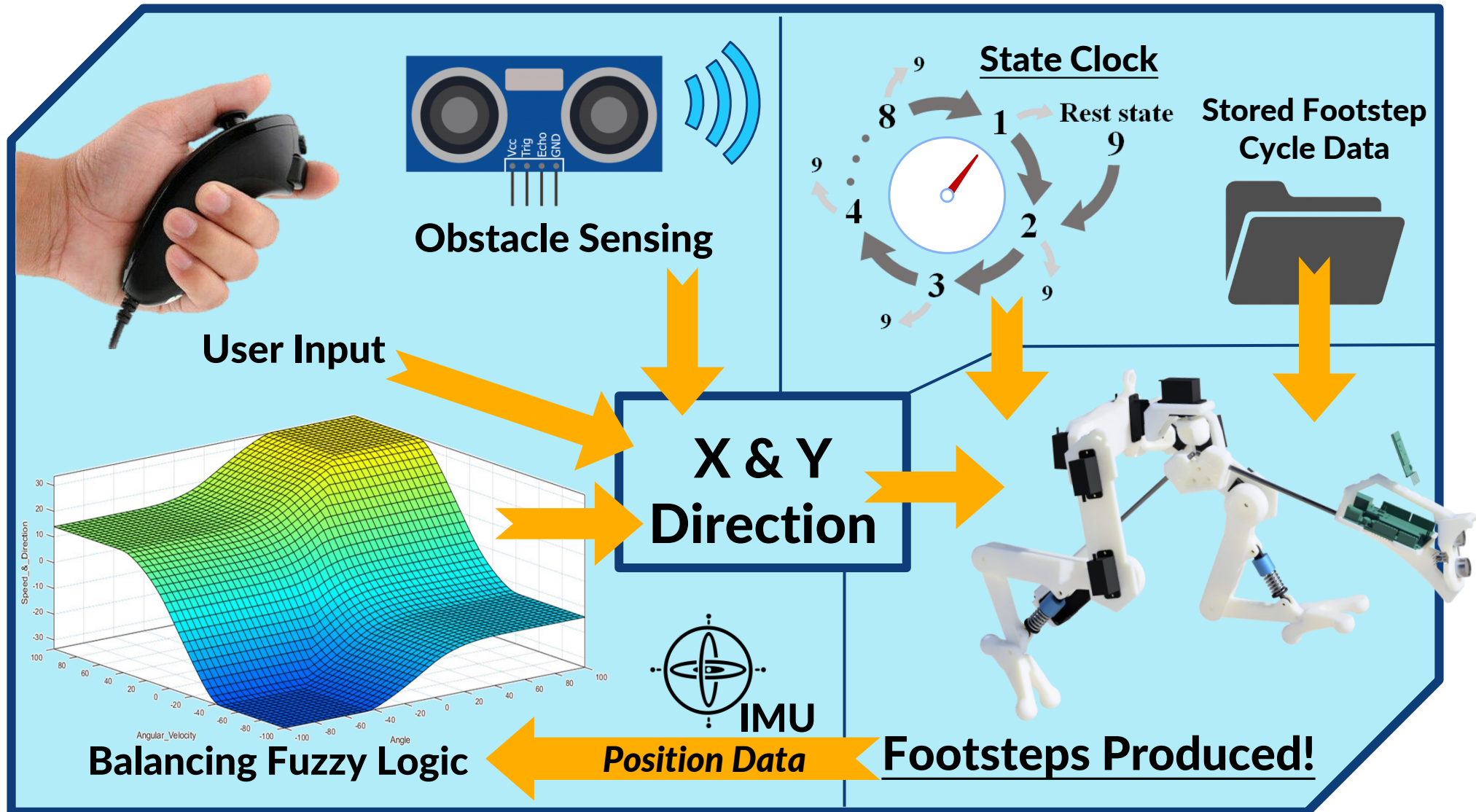
(A large numerical table)

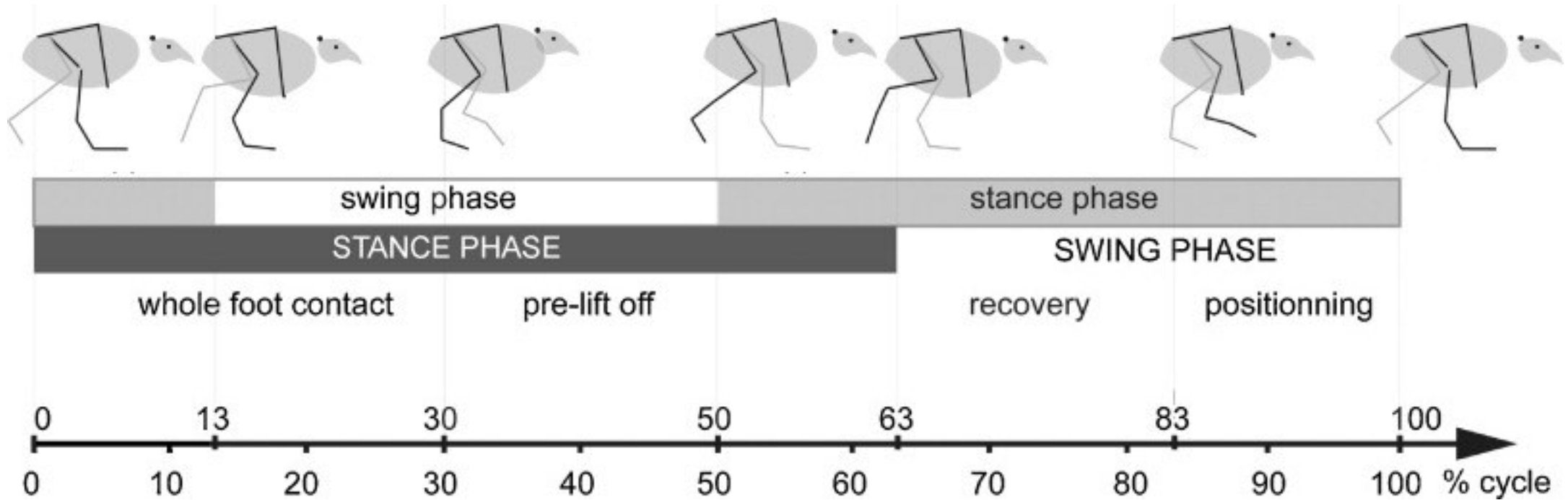
X & Y Variables

- Governs system
- Motivates movement
- Constantly change and adjust based on environmental inputs

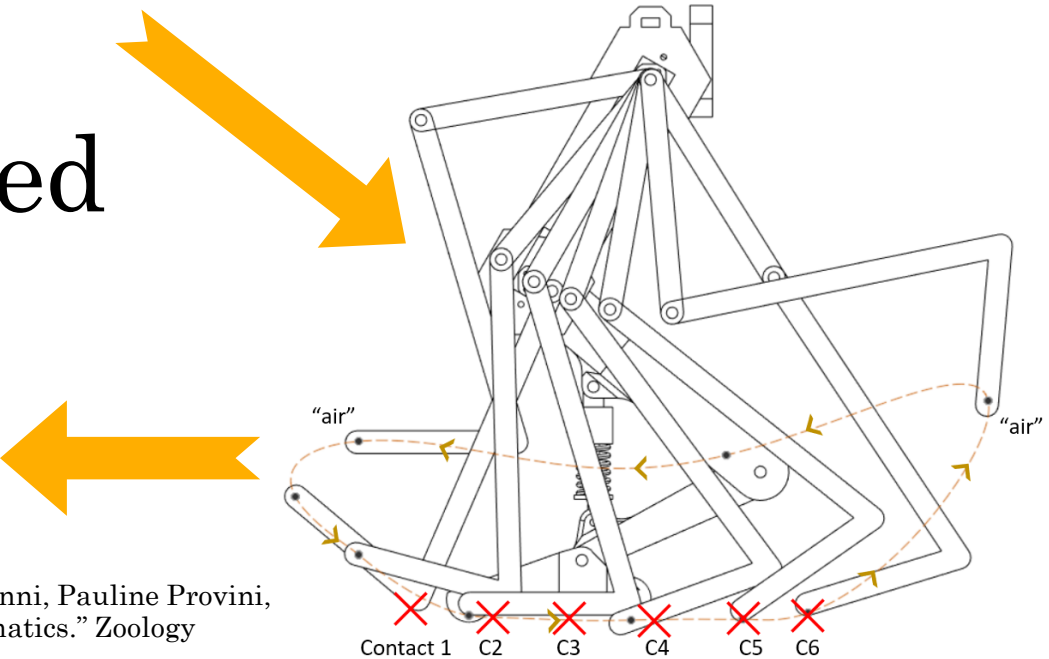


The Control System

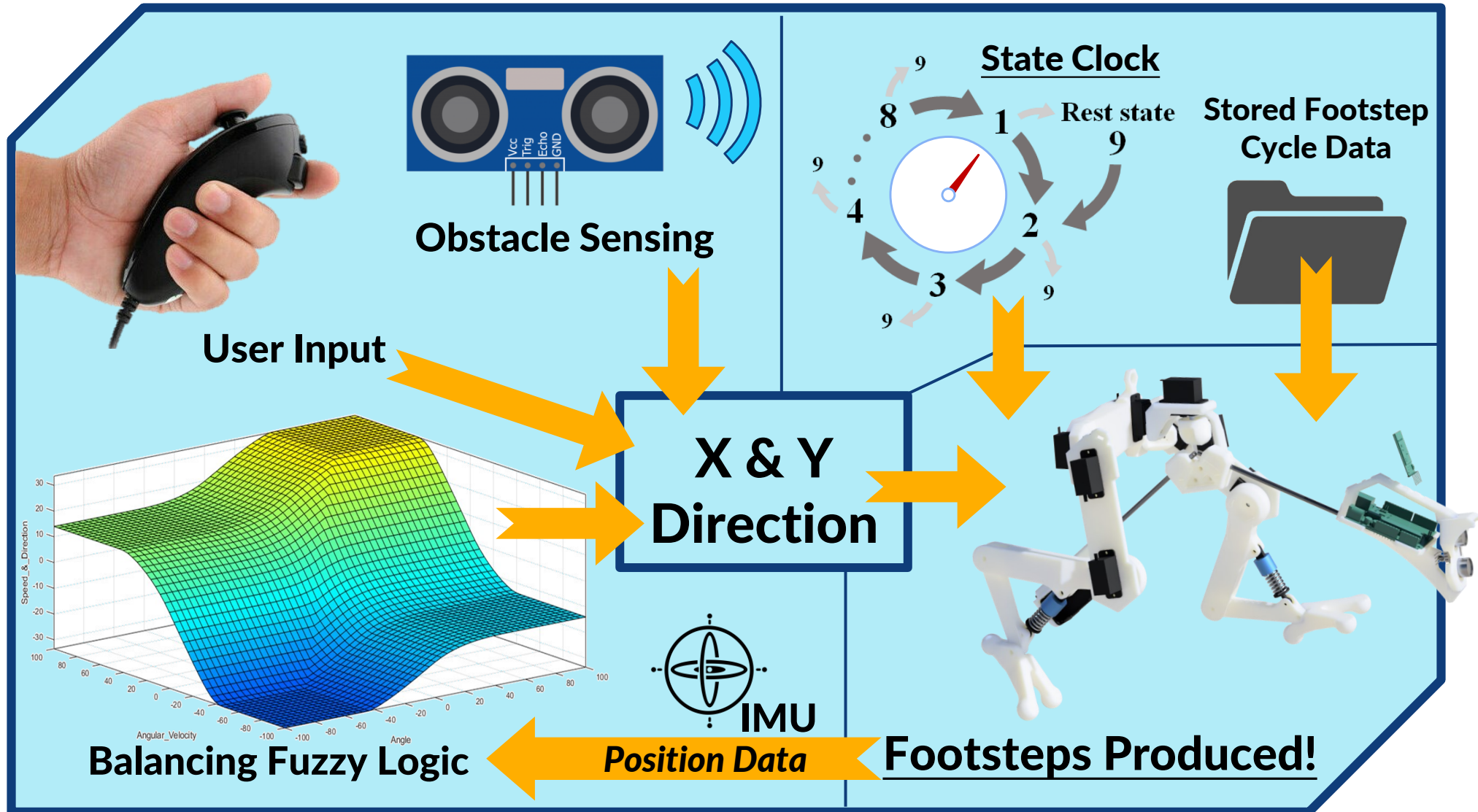


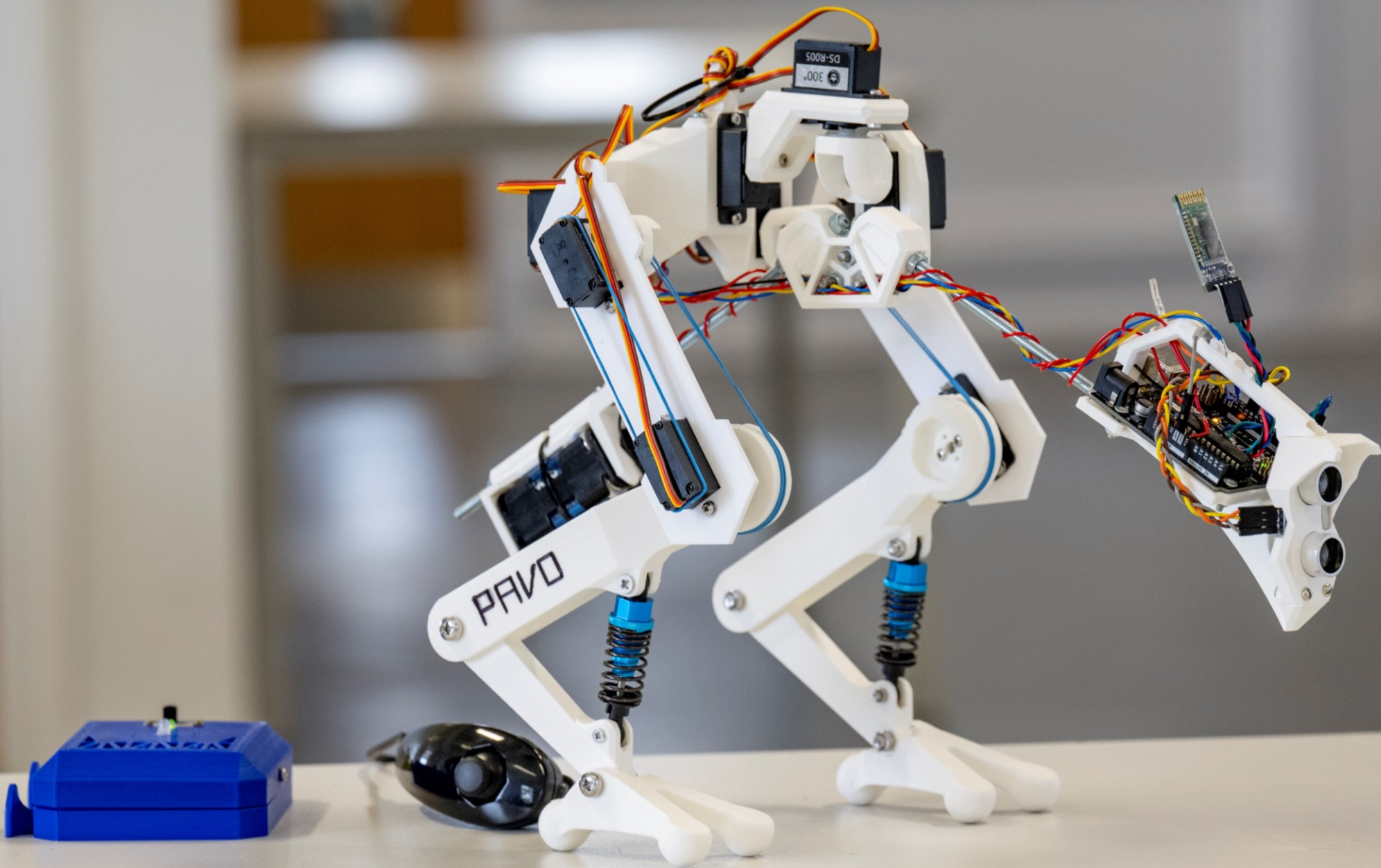


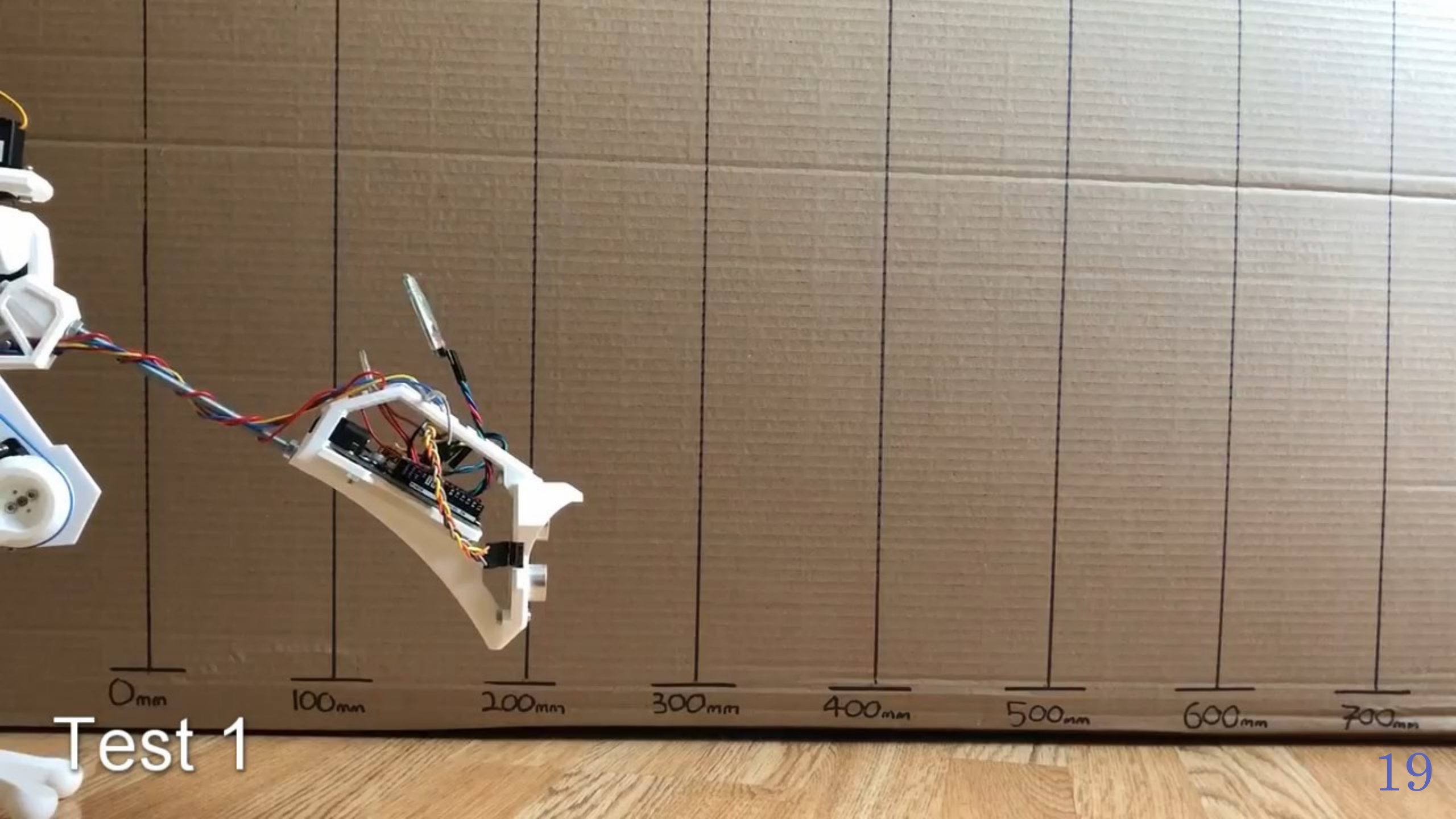
Quail Gait Cycle Mimicked



The Control System



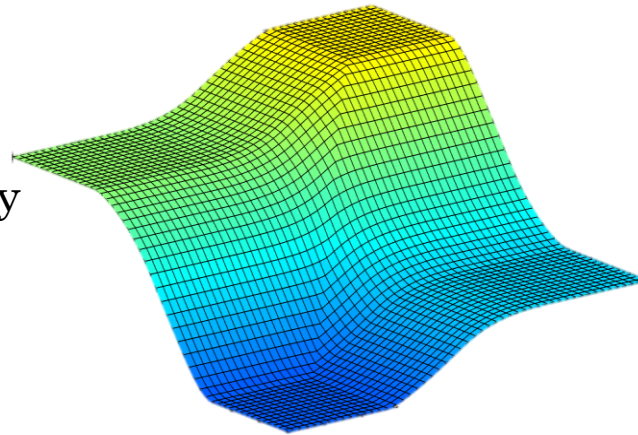




Test 1

Future Work

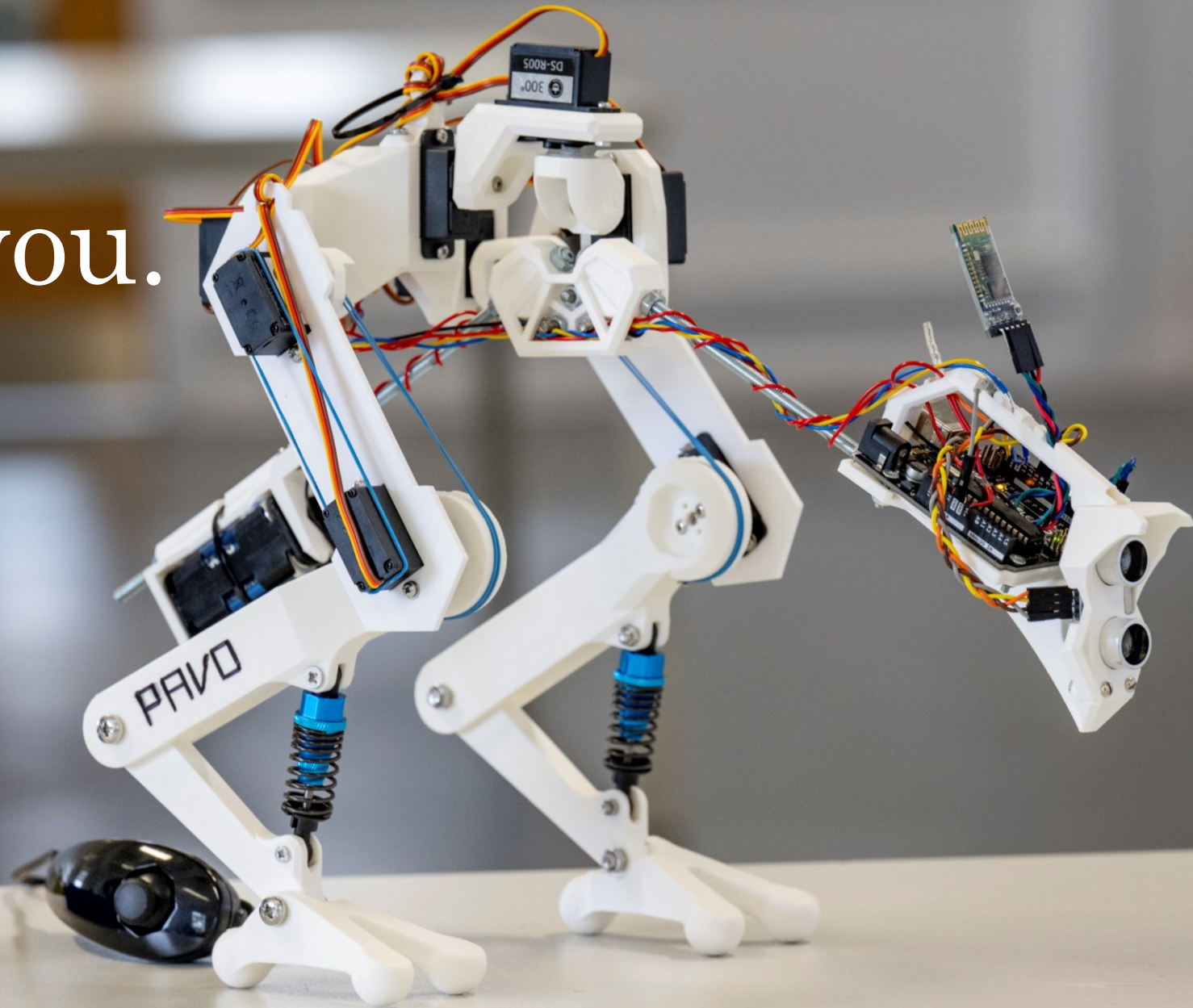
- Upgrading servos
- Upgrading hardware
- Upgrade processors
- Fuzzy logic
- Footstep cycles
- Further functionality



<https://www.engineering.com/story/generative-design-comes-to-fusion-360>



Thank you.



<https://linktr.ee/ryan101011>