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An energy efficient 3D printed leg for bio-inspired hexapod robots

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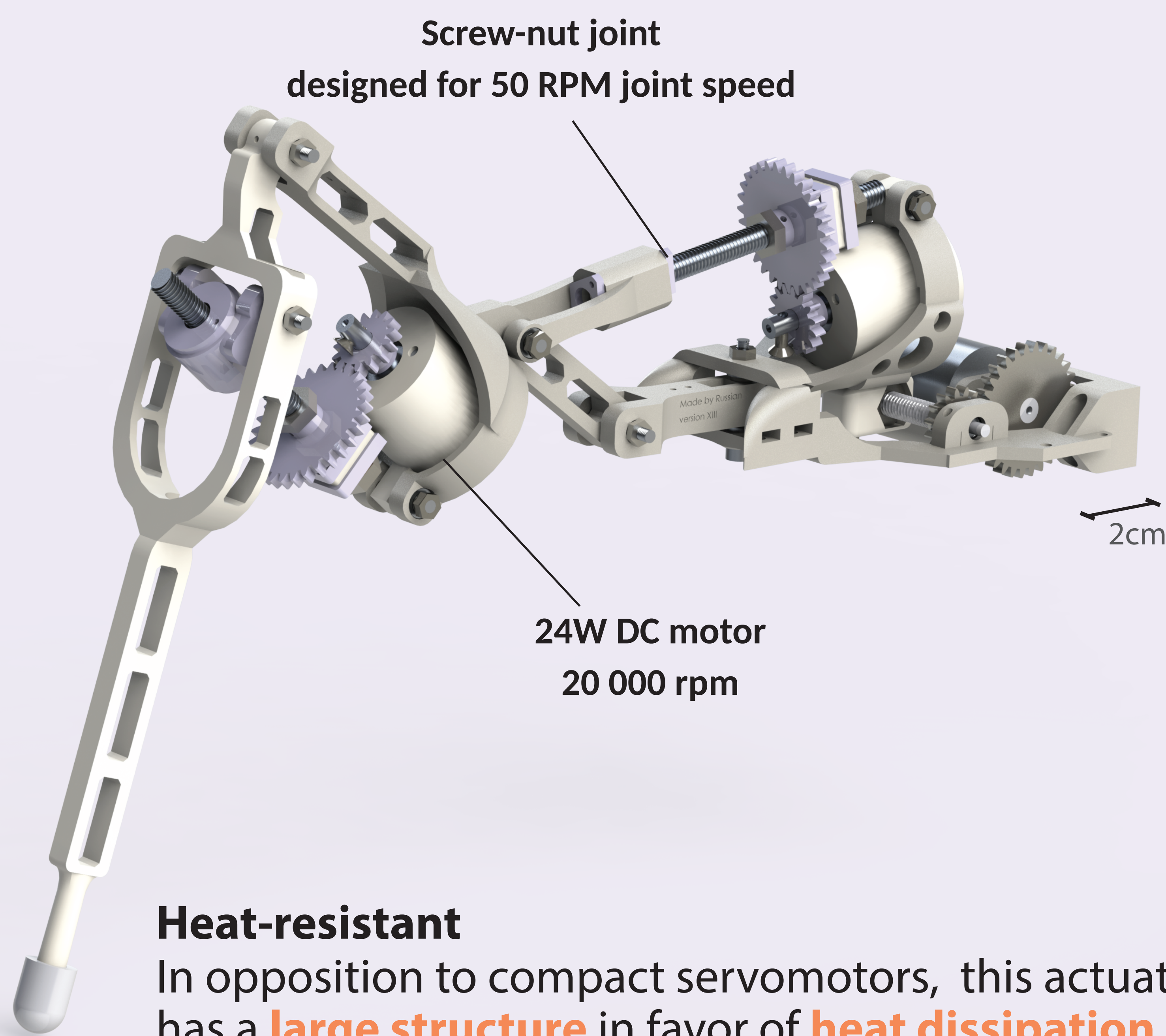
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CONTEXT



Servomotors are the mostly used actuators for small electric legged robots. Is it possible to design a new actuator, optimized for small hexapod robots? [1], [4]

MECHANICS



Heat-resistant

In opposition to compact servomotors, this actuator has a **large structure** in favor of **heat dissipation**.

Design

New 3D printable leg

Mostly composed of **3D printed parts**, this new leg has a reduced price of manufacturing. In association with some aluminium parts, the total mass equals to **300 grams**.

Materials : SLA resin, PLA, Aluminium.

Energy saving mechanics

Screw-nut mechanism is **irreversible**. Therefore, there is no energy consumption when a joint is not used.

Servomotor vs Irreversible Joint

	Servomotor (ex : AX18-A)	Ir. Joint
+ Price	<100€	~20€
- Speed	100 rpm	~50 rpm
= Torque	1.7Nm	3.6Nm
+ Passive State Power	3.6W	0W

BIOLOGICAL ASPECTS

Bio-inspired leg

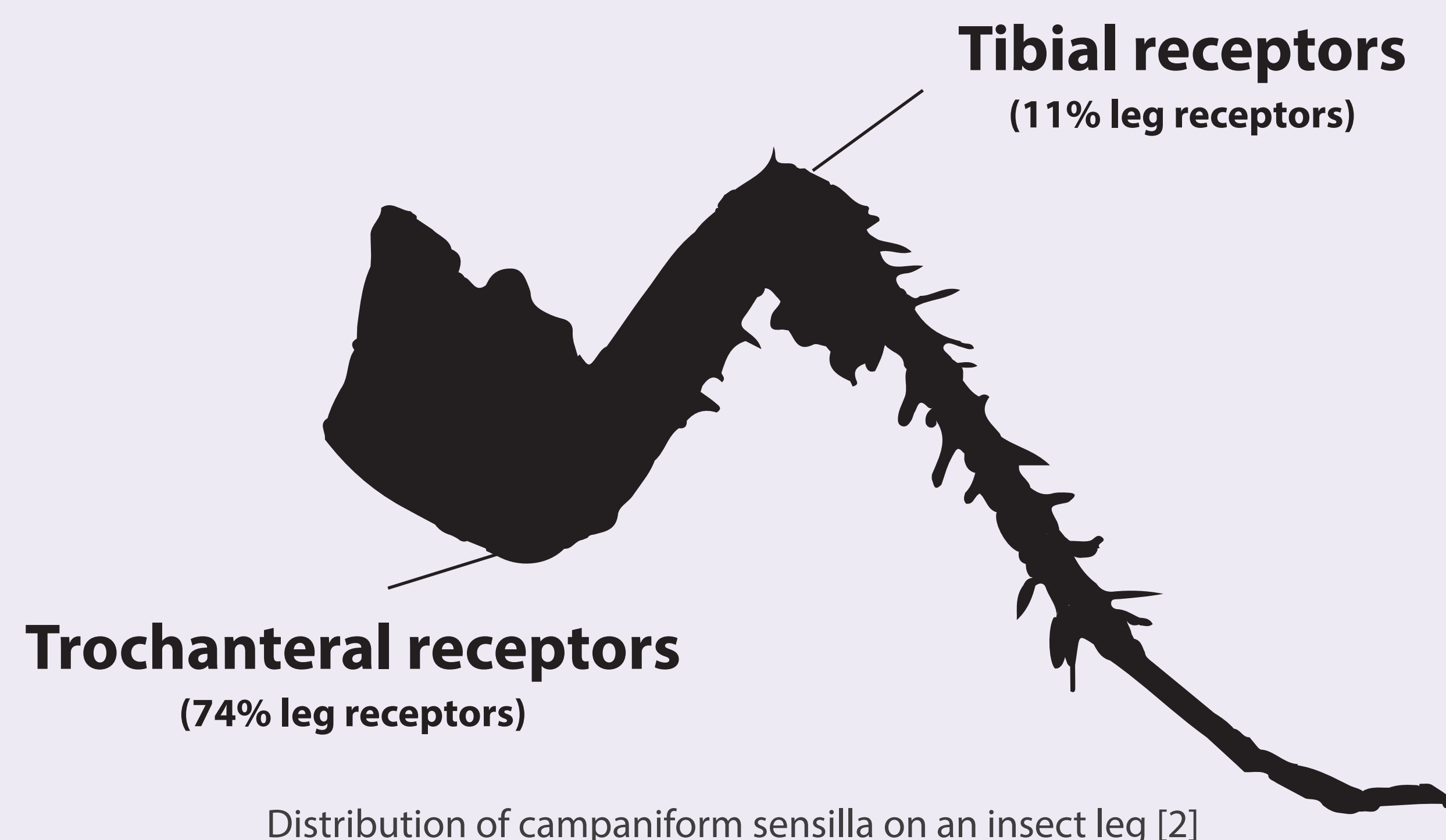
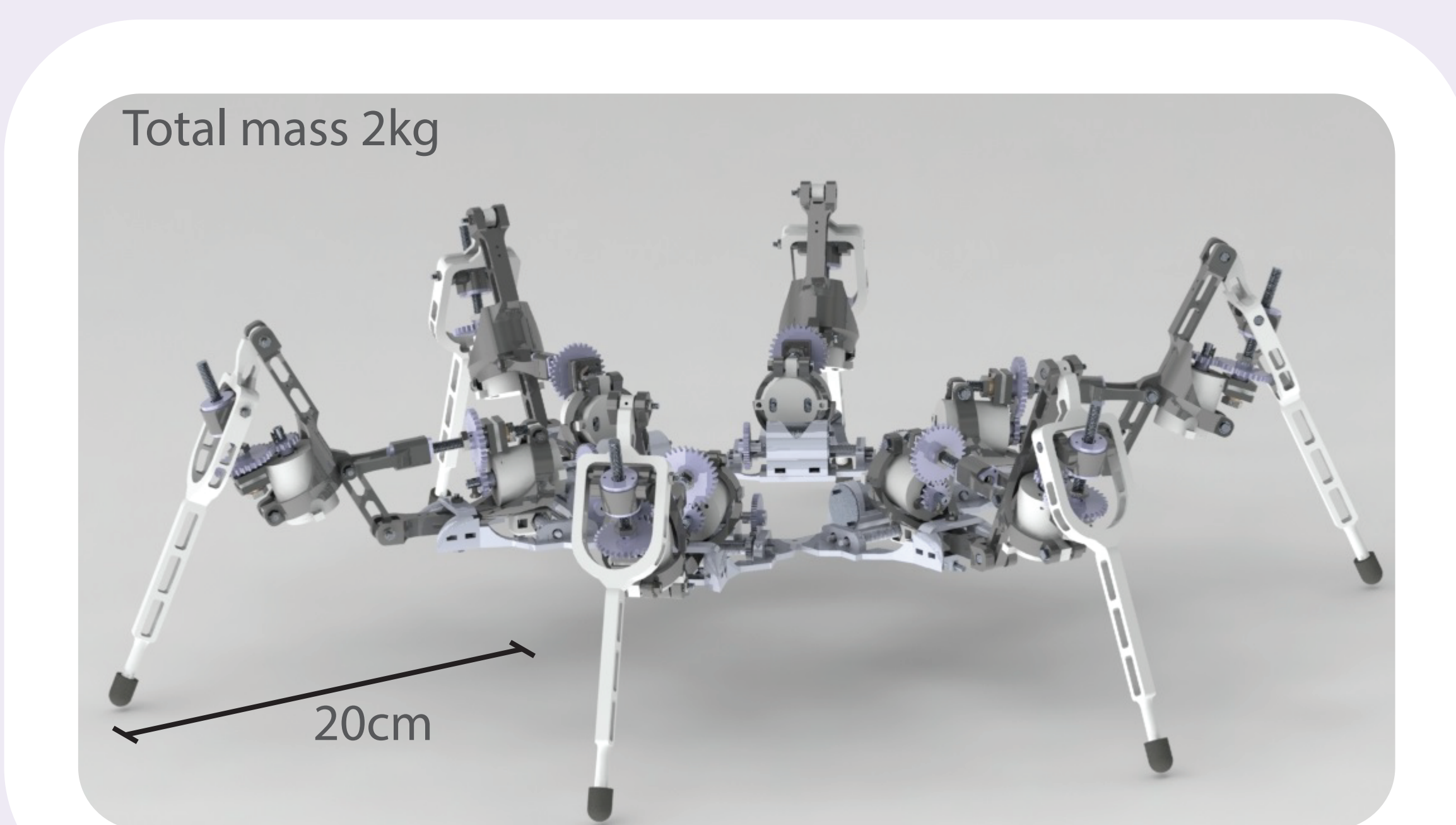
Sized from Cataglyphis Fortis ant

To provide a reliable leg structure able to be used by biologists as a **model for hexapod insect-type robots**. The joints angles limits and lengths were measured from ants and scaled 1:20. [1],[3]

Perspectives

Force sensors

Next step of the project is to implement **force sensor at strategic location**, most representatives the campaniform sensilla groups. [2]



Bio-inspired hexapod robot

New robot leg should be tested on a **hexapod robot**, to verify its accuracy and efficiency compared to classical servomotor based robot. [1]

[1] J. Dupeyroux, J. R. Serres, S. Viollet, Science Robotics, 2019

[2] S. Zill et al., Arthropod Structure & Development 33, 273–286, 2004

[3] R. Wehner, Senckenbergiana biol., Vol 64, pages 89-132, 1983

[4] K. Sangbae, P. M. Wensing, Foundations and Trends in Robotics, Vol 5, 2014