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Articulated Actuated Finger with Self-locking Joints

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Robotics

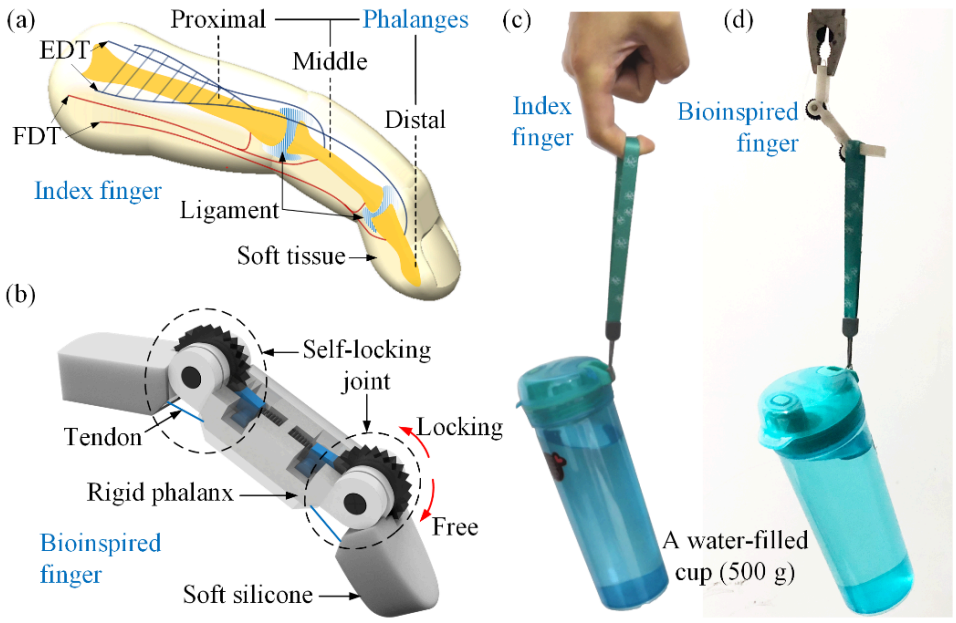

Fig.1 The bioinspired design of the proposed finger according to an exemplary embodiment of the present invention.

IP Status
Patent filed

Technology Readiness Level (TRL) 5

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Opportunity

Robotic gripping structures are used in a wide range of industrial and commercial applications, such as manufacturing processes, hazardous materials handling, prosthetics or other assistive devices, and unmanned devices and vehicles, including those used in space exploration and research. For optimal performance, these structures should provide a strong, sustainable, and precise gripping force that can be externally controlled. The human finger is a highly precise and dextrous structure that can inspire mechanical and robotics engineers to develop and improve finger-like gripping devices. Ideally, such devices would be combined to form multi-finger structures that can be incorporated into both industrial and assistive devices (e.g., prosthetics).

Technology

A robotic articulated finger structure is first described, wherein phalanges (i.e., finger bone-like structures) are connected by self-locking joints that restrict the motion of each joint in one rotational direction. The phalanges that comprise the finger are connected using ratchet gears that lock via a

pawl that sustains the grip force without requiring a power input. The finger can be closed and opened using grip and release actuators controlled respectively by long and short shape memory alloy coils that mimic tendons. Multiple fingers can be affixed to a gripper body powered by an electric battery, with at least one finger oriented so that it bends in the opposite direction of the other fingers. This opposing orientation provides a strong grip force via the self-locking ratchet gears, and the resulting portable gripper can be used in prosthetics and unmanned devices.

Advantages

- Self-locking joints that support load bearing and help maintain grip
- Ratchet mechanism also supports grip without requiring power input
- Shape memory alloy coils are used to facilitate gripping and release of objects
- Portable multi-finger gripper has one finger oriented to close in the opposite direction to other fingers to secure grip
- Multi-finger gripper can be placed in unmanned devices and controlled externally or used in prosthetic devices

Applications

- Robotics
- Hazardous site mitigation
- Unmanned vehicles in space exploration and research
- Assistive devices/prosthetics