

Fiber-Based Pneumatic Gripper with Integrated Tactile Sensing

A soft, versatile pneumatic gripper with integrated fiber sensing that identifies and handles diverse objects in both air and underwater environments.

Robotic handling systems often struggle to grasp and assess objects in unstructured or variable environments, limiting their usefulness in manufacturing, inspection, and field applications. This innovation introduces a new class of soft pneumatic gripper that conceptually integrates tactile perception and object manipulation without relying on rigid sensors or fixed contact pads. Unlike traditional planar tactile sensors, the approach uses flexible fiber elements embedded within a soft structure to provide responsive, geometry-aware feedback during gripping. Initial laboratory prototype testing has shown that the system can recognize diverse object types and operate across air and water settings. This capability positions the technology as a pathway for more adaptive, versatile robotic end-effectors.

Technology Validation

Prototype evaluations in controlled environments demonstrated that the gripper can classify and distinguish among multiple object categories through its integrated sensing approach. These tests showed reliable operation in both terrestrial and aquatic conditions using non-enabling assessment methods.

Advantages

- Integrated grasping and tactile perception in a soft, compliant system
- Functional performance across air and underwater environments
- Distributed sensing without rigid external instrumentation
- Potential for low-cost scaling due to simple material system

Applications

- Robotic manipulation in manufacturing and inspection settings

Technology ID

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Category

Robotics &
Automation/Perception &
Sensing
Robotics &
Automation/Automation &
Control
Materials Science &
Nanotechnology/Advanced
Functional Materials

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- Underwater robotic exploration and environmental monitoring
- Adaptive grippers for handling delicate or irregular items
- Research platforms for soft robotics and tactile sensing studies

TRL: 3

Intellectual Property:

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