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Distributed Sensor Networks Deployed by Soft Growing Robots

Stanford engineers have prototyped and tested a flexible, soft growing robot that can deploy sensor networks for investigation in constrained spaces (see video below). Existing sensors for growing robots have focused on moving with the tip of the robot. This method uses flexible printed circuit board (fPCB) technology to create modular bands of sensors that are distributed along the robot, for continuous monitoring of the immediate environment. fPCB technology is a versatile platform for many types of measurements. Currently, the prototype sensor modules include temperature, humidity, acceleration, and orientation. This work advances the capabilities of soft growing robots, as well as the field of soft robot sensing.
Video

Video Credit-inventors

Stage of Development:
Prototype tested

Applications

- Navigation, exploration, and manipulation tasks
- Building health monitoring
- Underground animal burrow monitoring
- Oil and Gas inspection
- Nuclear decommissioning and plant inspection
- Aircraft/Military inspection
- Other exploration and inspection e.g. retrieving samples or delivering payload

Advantages

- **Distributed sensors** - all along the length of the robot, not just the tip
- **High Stability** – has ability to move without sliding relative to their environment
- **Flexible, adjustable length** - robots can grow to long lengths in highly constrained spaces of unknown shape
- **Low cost per unit length and easy to deploy**
- **Human-safe and adaptable** manipulators
- **fPCB technology** - allows for a wide array of traditional MEMS surface-mount sensors to be used without alteration, making this a versatile platform for many types of measurements

Publications

- Gruebele, A. M., Zerbe, A. C., Coad, M. M., Okamura, A. M., & Cutkosky, M. R. "Distributed Sensor Networks Deployed Using Soft Growing Robots." 2021 IEEE 4th International Conference on Soft Robotics (RoboSoft). IEEE, 2021.

Patents

- Published Application: 20220187153
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