Soft Burrowing Robot for Simple & Non-Invasive Subterranean Locomotion

Tech ID: 29968 / UC Case 2019-158-0

BRIEF DESCRIPTION

A soft robot that can successfully burrow through sand and dirt, similar to a plant root.

BACKGROUND

Although robots have been successfully developed to recreate movement through the above-ground environment, subterranean locomotion remains a challenging endeavor. Part of this challenge is a result of the substantial forces underground resisting forward movement. A majority of current research on subterranean locomotion has centered on the field of conventional drilling. While such a method is effective at creating holes and tunnels through soil and rock it is not ideal for small subterranean robots due to the power and heavy equipment required. Burrowing animals and plant roots have inspired several recent attempts to create robots capable of subterranean locomotion however few robots can successfully maneuver through the ground.

DESCRIPTION

Researchers at the University of California, Santa Barbara have created a soft robot that can successfully burrow through sand and dirt, similar to a plant root. Through extension from the top of the body, this robot can substantially increase in length from its original size and can actively control growth direction making it possible to move through tightly constrained environments typically associated with subterranean locomotion. Because lengthening from the tip involves no relative movement of the body with respect to the environment, the body can lengthen along constrained paths without friction. This robot is perfectly suited to assist in search and rescue efforts where exploration of underground areas is imperative. It can also be used to deliver fluids too hard to reach areas. Its burrowing characteristic can be applied to above ground situations as well, such as the cleaning or inspection of difficult to reach spaces in complex machinery.

ADVANTAGES

- Can be implemented into existing robots
- Allows easy and continuous growth underground
- Inexpensive and noninvasive approach to burrowing
- Possible to grow greater than 100% in length

APPLICATIONS

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OTHER INFORMATION

KEYWORDS

indadvmat, Advanced Materials, Agriculture, Mining, Robotics, Medical, Aerospace, Search and Rescue, Non-invasive Installation, Foundation Structures, Complex Machinery, Irrigation, Installation of Wires, Soft Robot

CATEGORIZED AS

- **Materials & Chemicals**
  - Other
- **Nanotechnology**
  - Materials
- **Semiconductors**
  - Materials
- **Sensors & Instrumentation**
  - Medical
- **Engineering**
  - Robotics and Automation

RELATED CASES

- Search and rescue requiring subterranean locomotion (i.e. mudslides)
- Non-invasive installation of underground irrigation or communication lines
- Root-like foundation structures
- Cleaning or inspection of difficult to reach spaces (i.e. complex machinery or aircraft)
- Delivery of fluids to difficult to reach spaces
- Installation of wires or irrigation in subterranean areas
- Surgical tools

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,633,849	04/25/2023	2019-158
Patent Cooperation Treaty	Published Application	WO 2020/060858	03/26/2020	2019-158

RELATED MATERIALS

- Soft Robotic Burrowing Device with Tip-Extension and Granular Fluidization - 01/06/2019

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Everting Pre-Shaped Soft Device for Access during Medical Interventions
- Self-Anchoring Burrowing Device for Sensor Placement with Low Reaction Force
- Fluidic Camming for Grasping

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