Docket #: S22-155

Spinning-enabled Wireless Amphibious Origami Millirobot

Stanford researchers at the Zhao Lab have developed a wireless, magnetically actuated amphibious origami millirobot that can locomote in narrow spaces and morph their shapes. The researchers have demonstrated that this millirobot can travel on surfaces and through liquid. *Please see news article and videos below.* This robust and multifunctional untethered millirobot integrates capabilities of spinning-enabled multimodal locomotion, controlled delivery of liquid medicine, and cargo transportation. This invention can be used as minimally invasive device for biomedical diagnoses and treatments such as atherosclerosis and targeted drug delivery.

Stanford News
"Stanford engineers develop tiny robots to bring health care closer to precisely targeted drug delivery" (June 14, 2022)

Please see videos and images within the news article.

Stage of Development
Prototype developed and tested.

Applications

- **Minimally invasive device** for biomedical diagnoses and treatments
- Example is **roto-ablation** for treatment of coronary artery disease (atherosclerosis)
- **Targeted liquid drug delivery**
- Can be used for **intravascular procedures**, or in other anatomical systems, such as the urinary system, gastrointestinal system, etc.

Advantages

- **Minimally invasive**
- **Millimeter scale and self-contained robot**
- **Multifunctional**- integration of navigation, roto-ablation, suction, and drug delivery
- **Wireless operation**- magnetic actuation with continuous motion
- **Kresling orgami design** allows for the robot to flip, roll and spin
- **Smooth, continuous operation**- robots can self-select different locomotive states and overcome obstacles in the body

Publications

- Qiji Ze, Shuai Wu, Jize Dai, Sophie Leanza, Gentaro Ikeda, Phillip C. Yang, Gianluca Iaccarino & Ruike Renee Zhao. Spinning-enabled wireless amphibious origami millirobot. Nature Communications 13, 3118 (2022).

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