
Robots in Blood Vessels using Magnetic Resonance Imaging Systems

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Background

Medical applications of microrobotics is a burgeoning field held back only by the challenge of producing miniature, safe and energy efficient propulsion systems. Magnetic Resonance Imaging (MRI) were developed and used mostly for diagnostic, their high capital cost and their high potential led to new usages such as interventional imaging or effective and convenient way of controlling a robot for applications in blood vessels.

Technology

The MR-Sub (Magnetic Resonance Submarine) technology provides surgeons a robot capable of being controlled inside blood vessels.

The technique consists of applying magnetic gradients generated by an MRI system to exert a displacement force of the ferromagnetic core embedded onto a miniature device. MRI propels the microdevice in the human blood, determines its location, computes the corrective actions through a feedback control algorithms and adjusts the magnetic gradients according to the navigation of preplanned path.

Applications

MR-Sub opens the door for Minimally Invasive Surgery (MIS), thus providing shorter recovery periods for patients. The descendents of MR-Sub could be even more widely employed with the introduction of remote wireless controlled devices that have a maximum dimension of a few hundred micrometers. At this size and precision, these magnetically propelled robots can be used to reduce the risks of obstruction of the blood vessels and of

tissue damage caused by friction of the tether wire currently used within complex pathways. Other MIS applications include angioplasties and highly localized drug deliveries for chemotherapy or biopsies. In cancer therapy, they would provide a greater ability to target the site of interest.

Competitive Advantages

ACCESS TO INACCESSIBLE SITES. Access to specific hard to reach locations would have a relatively large impact on modern medicine by providing the foundation for a host of new clinical procedures.

VARIABLE ROBOT SIZE ACCORDING TO TASK. The quantity of ferromagnetic particles is related to the size of the robot and determined by the blood flow at the location where the treatment is performed within the body, making this technology highly adaptive and flexible.

MAGNETIC PROPULSION. The magnetic propulsion concept is an extremely promising method for in vivo applications using micro robots. This magnetic propulsion system is easy to fabricate and miniaturize and MRI machines are already present in almost every hospital.

Patent Status

A set of IPs that extend the use of MRI toward interventional procedures, including controlling devices for drug delivery for instance with MRI, real-time tracking of any size medical devices with MRI and quantitative evaluation with MRI.

Business Opportunity

Univalor is seeking partners to support research and to commercialize or license this technology.

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