Riverine robots for sampling microplastics in inland waterways

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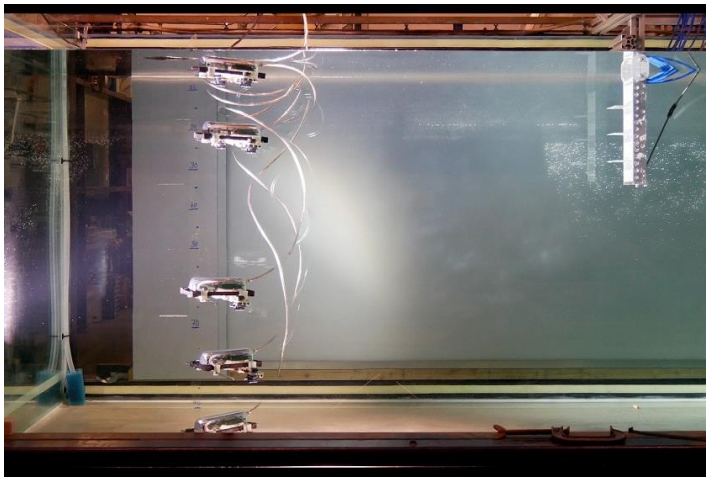
Proliferation of small-scale computation and sensing has greatly expanded the scope of robotic environmental monitoring. Oceanographic robots now routinely make voyages lasting months. However, extended robotic data collection for inland waterways remains rare.

At the same time, observation of the UK's 200,000 miles of waterways (and 1,000,000 miles of culverts), faces increasing pressures on monitoring costs, even as understanding the mounting problem of microplastic waste requires considerable additional data. The most recent Environment Agency report finds 86% of UK rivers below ecological standards and existing approaches using static sensor installations scale poorly in both price and manpower.



A small robot moves down the water column collecting data.

This project will use a prototype riverine robot with flow sensing capabilities to sample water for microplastics, by controllably filtering incoming flow. By constantly sensing local water velocity the robot will be able to provide hydrographic data while ensuring consistent sampling conditions for microplastic collection. Using a mobile robot will allow sampling along the entire course of a river, with greater spatial resolution and adjustable sampling procedures. This will include subsurface sampling at prescribed depths, so that microplastic occurrence in inland waterways can be better understood. Microplastics are typically only sampled from the surface layer of environmental waters, meaning little is known about their subsurface occurrence.

This project will combine existing robot designs with flow sensing and a water sampling unit, allowing long duration data collection missions that include cluttered, shallow water areas. Strong emphasis will be placed on constant field testing, and the project will culminate in extended missions along regional waterways.

Training opportunities:

The student will have the opportunity to deploy robotic measurement systems in the field, gaining simultaneous experience in fieldwork and engineering development, supported by experienced roboticists. The student will experience a variety of prototyping techniques and become comfortable in the rapid build-test cycle found in modern robotics. The project will take place in a welcoming environment of more than 30 researchers and academics working in experimental fluid mechanics, robotics and environmental science.

The lead project supervisor has an ongoing involvement with an ESA-supported robotics company, HayBeeSee ltd., which develops mobile robots for agriculture. As agriculture is one of the largest contributors to waterway pollution, there is considerable interest in water monitoring. The candidate with have the opportunity to take a placement with the company and gain experience translating research into practice.

Student profile:

This project would be best suited to a student having a background in mechanical, electrical or aerospace engineering, with an interest in robotics and environmental science.

Experience with embedded computing in Python or C++ would be advantageous, as would any practical experience with mobile robotics or mechanical design. Background in control would also be a significant asset.

A desire to learn about environmental monitoring and water management is also necessary.

https://research.reading.ac.uk/scenario/