Thesis Topic: Sensor deployment mechanism for pipe robots

What is this about?

At the Center for Biorobotics, we are developing mobile robots for inspection and monitoring of urban sewer networks (www.pipeon.eu). In addition to onboard sensing, the robot should be capable of physically placing long-term monitoring sensors (e.g., flow, gas, pressure, etc.) at predefined locations inside sewer pipes.

Figure 1. Fantasized sensor placement generated by AI

Currently, most sensors are installed near manholes due to accessibility constraints. As a result, large portions of the sewer network remain unmonitored. This limits early fault detection and reduces the spatial resolution of monitoring data.

This thesis focuses on the development of a compact, robust sensor deployment mechanism that can be mounted on a sewer robot prototype. The work includes concept development, detailed mechanical design, simulation (if applicable), prototyping, and integration with the robotic platform. The student will experimentally validate the system in laboratory sewer mock-ups and, if possible, in realistic field conditions.

What will you learn?

- Mechanical and mechatronic system design
- Robotics integration in harsh environments
- Prototyping and testing of hardware systems
- Experimental evaluation and technical documentation

Why is this important?

Comprehensive sewer monitoring is essential to prevent failures, environmental damage, and costly repairs. A robotic sensor deployment system enables wider monitoring coverage, improves safety by reducing manual inspections, and supports smart infrastructure management.

Requirements:

- Background in mechanical engineering, mechatronics, robotics, or related field
- CAD and basic prototyping experience
- Interest in robotics and hardware development
- Basic programming skills are beneficial

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