Thesis Topic: Electronics and software for a robot-deployable sewer sensor node.

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 monitoring devices (including e.g., flow, gas, pressure, etc. sensors) at predefined locations inside sewer network.

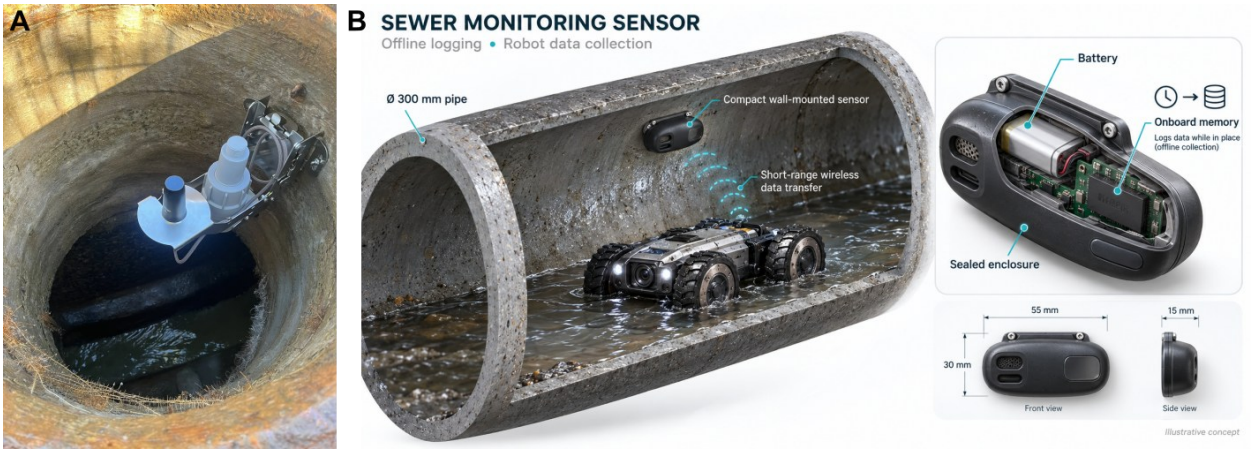


Figure 1 A: Example water level device from Kallipr Pty Ltd B: Illustrative concept proposed by OpenAI

Currently, most sensors that are deployed in the sewer network are bulky and are not designed to be deployed from a robotic platform. Therefore, most of the remote monitoring is done close to manholes where power and communication are available. As a result, only accessible parts for humans of the sewer network are continuously monitored. This limits early fault detection and reduces the spatial resolution of monitoring data.

This thesis focuses on developing the electronics and software for a compact, low-power sensor logger node that can be deployed by a sewer inspection robot. The node will record and store measurements locally. When the robot passes nearby, it will establish a short-range wireless connection and retrieve the stored data for later analysis.

The work includes reviewing existing solutions, defining system requirements, selecting sensors and communication technology, designing the PCB and firmware, manufacturing a prototype, and laboratory testing. Evaluation will focus on measurement performance, power consumption, reliable data storage, and successful data retrieval during robot passes. Integration testing with the robotic platform and field trials will be conducted where feasible.

What will you learn?

- Designing electronics and software for sensor systems
- Integration of sensor electronics with a robotic platform
- Prototyping and testing electronic hardware
- Evaluating system performance experimentally and preparing technical documentation

Why is this important?

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

Requirements:

- Background in electronics and programming
- PCB design experience
- Interest in embedded systems and robotics
- Embedded programming experience is beneficial

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