Karlsruhe Institute of Technology

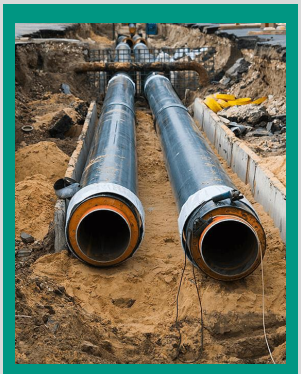
Institute for Industrial Production (IIP)
Chair of Business Administration, esp. Production Management and Logistics
Prof. Dr. Frank Schultmann

Bachelor- / Masterthesis

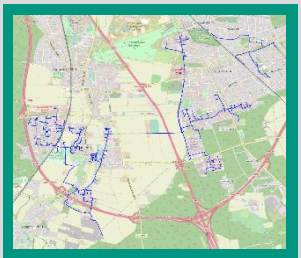
Is innovative district heating surveillance “worth it”? Performing a cost-benefit analysis of UAV-based thermography to assess the potential of preventative measures

Background

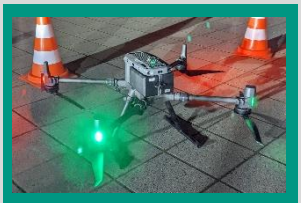
District heating systems (DHSs) are commonly implemented to transport heat to urban areas and end energy consumers on a large scale. Decades of use cause the subterranean pipelines to fatigue, eventually causing leakages with potentially catastrophic and high-cost effects. As many networks lack modern forms of surveillance, it becomes difficult for network operators to assess where exactly losses occur and where to dig up the pipeline area for repairs. Airborne thermography has emerged as a means for DHS monitoring, whereby underground leakages are identified as hot-spots in thermal infrared (TIR) images owing to the increase in temperature they create at the surface. To this end, TIR images are acquired via Unmanned Aircraft System (UAS) and analysed automatically through a developed software pipeline to present network operators with a list of potential candidates. However, the question of economic viability is key to accepting innovative monitoring methods such as this one.



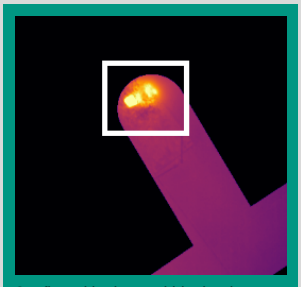
District heating system pipelines
https://rapidenergy.co.uk/blog/what-is-a-district-heating-network/



A DHS (in blue), displayed in QGIS



Unmanned aircraft used for inspection



Confirmed leakage within the dataset

Your Contribution

The aim of this thesis lies in a cost-benefit analysis of preventative, UAV- and thermography-based DHS inspection to identify its potential compared to conventional pipeline monitoring and repair. This will therefore include:

- Researching and identifying currently occurring losses, implemented counter-measures, and ensuing costs for operators
- Calculating the cost of the innovative, TIR-based method and software
- Comparing the outcomes to identify economic feasibility while considering different scenarios (standard vs. emergency excavations, types of pipelines, pipeline lengths, etc)

Requirements

- independent, structured way of working
- enthusiasm for scientific research and working on real-world problems
- proficiency in German and English

Interested?

Please contact Elena Vollmer (elena.vollmer@kit.edu) with your application.

Starting date: as soon as possible.