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Smartpipes, Monitoring Assets for Efficient Maintenance

CaoVinh Tran

cao.vinh@wetsus.nl

Motivation

Replacement activities of drinking water mains are not only costly but also inconvenient for water distribution companies as well as customer, especially in dense areas (Figure 1). Moreover, pipes that are either in good or defected condition are often entirely replaced if they failed more times a year, resulting in increased cost. Asset managers of drinking water companies want to have a continuously detailed picture of the state of assets to efficiently manage and schedule the replacement activities of the degraded pipes with other groundworks. Consequently, we propose Smart-Pipes, which are polyvinylchloride (PVC) pipes that comprise of multi kind of distributed sensors to collect the required information and communicate together to send data to the data center (Figure 2).

Despite there is a variety of sensors and methods for monitoring and inspecting water mains, deploying and combining them into Smart-Pipes in practical is still challenging in both technological and financial aspects [1-3]. It requires researches for the optimization in selection, placement and installation of sensors, the relationship between information and benefit, the signal processing for multiple sensors data into useful information.

Figure 1: Water mains replacement

Technological challenge

Smart-pipes may consist of a huge number of "Fit and Forget" nodes with different kinds of sensors which are buried underground or place inside the pipes, and they must operate for many decades. Therefore, the challenges are:

1. Identifying the required information and its benefit in getting the insight into the PVC pipes.
2. Determining the optimization of the amount, type and location of sensors in a network or subnetwork.
3. Determining the signal processing methods corresponding to the information.
4. Building an efficient underground / in-pipe communication network in both energy-efficient and reliable aspects.

Research goal

* Developing insight into the PVC water mains by utilizing a multitude of sensors.
* Understanding what requirements are needed for getting the optimal information of the water mains
* Development of a communication method for the sensors network.
* Developing insight into the energy supply of the system

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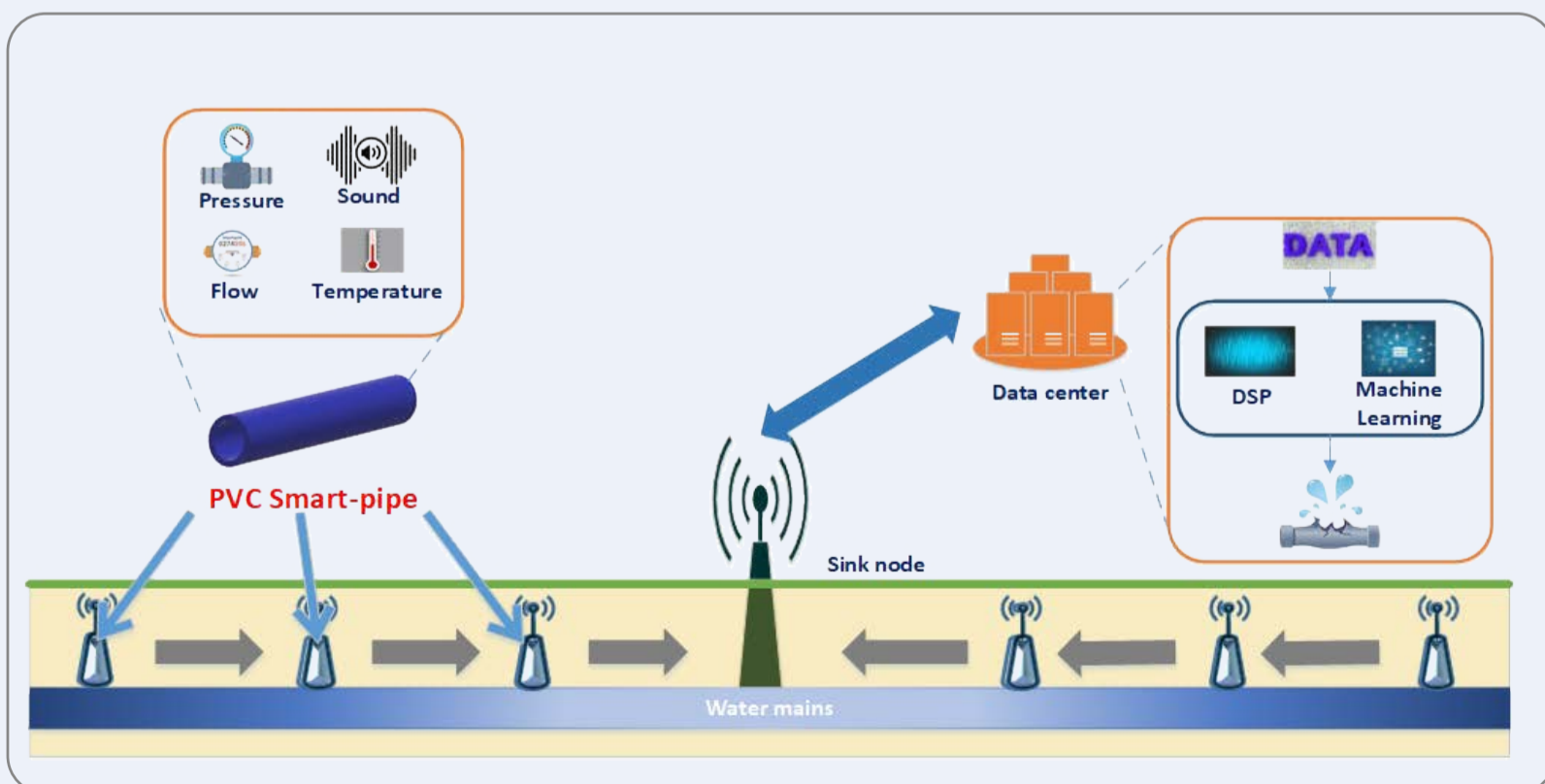
Figure 2: The operation of Smart-Pipes

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CaoVinh Q. Tran BA., dr.ir. D.R.Yntema, prof.dr.ing Paul Havinga, dr. V.D.Le

UNIVERSITY OF TWENTE.