IoT for Supervision and Control of Water Distribution Systems

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1 Introduction to the Project IoT.H20 [1]

Water distribution systems (WDS) received attention due to his critical operation and high costs, motivating studies about networking planning [2]. A typical water distribution system network consists of reservoirs connected by pipes to pumps. From an operational perspective, appropriate pumping scheduling has the potential to avoid water losses and to save energy due to the fact that his operation has a significant impact on the costs associated with WDS. Currently, the major systems are monitored and controlled by SCADA (Supervisory Control and Data Acquisition) systems, an approach technically complex and expensive to small water utilities. Due to this fact, IoT (Internet of things) technologies present a potential path to building solutions with a relatively low-cost to monitor and control water utilities. Thus, the intention of this project is to propose a solution based on IoT to control and monitor WDS to avoid water losses at the same time that provide energy conservation.

2 Contributions

Our goal is to improve the operation of the pumps, scheduling them according to the demand for water and respecting some constraints. These constraints imposed for the system are, for instance, a minimum pressure guarantee in the pipes, avoiding water losses due to overflows, at the same time that the water supplied has quality. For that, we proposing an approach based on Decentralized Partially Observable Markov Decision Process (Dec-POMDP) [1]. We believe that Dec-POMDP is suitable for this scenario due to his capacity to handler with uncertainties inherent of the environment at the same time that provide an architecture to make joint decisions. In this sense, combining small devices such as sensors, with the capacity to provide information about the current state of the system like the pressure and flow in the pipes, and the amount of water in the reservoirs, improves the reliability of the decision process, with flexibility not found in some other approaches.

References

[1] Frans A. Oliehoek and Christopher Amato. *A Concise Introduction to Decentralized POMDPs*. Springer Publishing Company, Incorporated, 1st edition, 2016.

[2] Manish K Singh and Vassilis Kekatos. Optimal scheduling of water distribution systems. *IEEE Transactions on Control of Network Systems*, 2019.

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