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Generating Residential Water Demand Profiles Through EPANET Plugin Development

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Abstract: In this work, we develop a plugin within the EPANET UI environment that syntactically generates diurnal demand patterns (DDPs) for residential households. Increasing deployment of advanced metering infrastructure has enabled water utilities to achieve improved monitoring of water consumption at a household level, which supports the management of municipal water systems through minimizing technical and physical losses and developing more precise simulation models. Characterizing residential DDPs and understanding the factors that influence their temporal variability is central for assessing the impact of population dynamics, socio-economic changes, and conservation strategies on urban water infrastructure. Modern inexpensive water meters provide water consumption at fine temporal resolution (~min) and enable the development of data-driven models to simulate DDPs. Several factors affect the magnitude and shape of demand profiles including household (e.g. number of people per household, socio-economic status) and appliance features (e.g. volume and frequency of use of individual fixtures). In this work, we develop a plugin that, based on the input provided by the user about household and respective appliance characteristics, synthetically generates DDPs using a data-driven model. The suggested algorithm is validated by comparing the simulated results to the available metered data. Several data sets are provided within the developed plugin. Furthermore, the user has the flexibility to upload custom data and to calibrate the algorithm to the specific data set. The developed plugin enhances the current capabilities of EPANET and provides a framework for further development and contribution within the new EPANET UI.

Keywords: EPANET, Plugin Tools, Graphical User Interface.