Synthesis Lectures on
Emerging Engineering Technologies

SYNTHESIS
COLLECTION OF TECHNOLOGY

Ana Cristina Faria Ribeiro · A. K. Haghi

Smart Water Resource Management

A Practical Introduction

Springer

Synthesis Lectures on Emerging Engineering Technologies

This series publishes short books on current engineering technologies that are gaining prominence, as well as promising technologies that are being developed, for an audience of researchers, advanced students, engineers and other professionals, and entrepreneurs.

Ana Cristina Faria Ribeiro · A. K. Haghi

Smart Water Resource Management

A Practical Introduction

Springer

Ana Cristina Faria Ribeiro
Department of Chemistry
University of Coimbra
Coimbra, Portugal

A. K. Haghi
Department of Chemistry
Institute of Molecular Sciences,
University of Coimbra
Coimbra, Portugal

ISSN 2381-1412 ISSN 2381-1439 (electronic)
Synthesis Lectures on Emerging Engineering Technologies
ISBN 978-3-031-60798-1 ISBN 978-3-031-60799-8 (eBook)
https://doi.org/10.1007/978-3-031-60799-8

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

It's important to pay the world today serious attention to environmental engineering and smart water systems for water reliability, economic efficiency, and sustainable development. The topic of loss control in water facilities is of particular importance. The value of water production in the 22nd century will be many times higher compared to the production of water in the 21st century. The reason for the increase in the cost of water production is the inevitable implementation of consumption management programs in the future. In other words, water production will be equivalent to the most expensive production resources in the future. The effective factors in the actual amount of water losses include topography, network length, number of branches and service standards, maintenance quality, and network performance. In a well-functioning network, water losses must be continuously controlled. A comprehensive analysis of the water distribution network can be effective in evaluating the existing conditions. this method makes possible appropriate decisions in the design of the hydraulic model of Non-Revenue Water (NRW) which is the reason the present work was written. Consumption management activities may change the time and size of new distribution network facilities such as sources and reservoirs, transmission, and treatment facilities. Consumption management can save water and financial resources. The implementation of the water consumption management program leads to a reduction in costs. Water consumption management and demand forecasting are prerequisites for evaluating the cost-benefit of implementing programs and understanding the challenges facing water systems. Forecasting the demand in the distribution networks of an isolated, sparsely populated area is considered one of the basic measures. During the water demand forecasting period, the water use efficiency program or public education plans are implemented to reduce water consumption. Prediction of water consumption or demand is an important part of the planning process in terms of consumption management plans. Predictions range from simple estimates based on population growth to Predictions based on complex models that consider different variables in water consumption, and the change the predictions can be made for the whole network. the predictions for different groups of consumers (residential, commercial, public) are more accurate. Today, there

are various methods to collect water consumption data. Approximate estimates are the only method that was used in the past, while with the advancement of engineering tools and equipment, today more accurate measurements can be used to estimate the amount of consumption of each device. Investigating different consumption management options to prevent water loss should include all types of analysis including cost-benefit analysis. The cost-benefit analysis includes current production cost, income level, profitability of project implementation, and technical, economic, and operational comparison of different projects. In the conditions of lack of financial resources, it is necessary to perform a cost-benefit analysis. To prevent water wastage, household consumers can control the uses outside their home, such as gardening, and car washing, through different methods. The first step in the scientific exploitation of the water systems is to update the map information of the facilities in the computer and the form of geographic information system (GIS). Considering the vast amount of operational information, while updating the map information of facilities in GIS format, different data can be extracted from it in minimum time. This work aimed geo-referenced computer model that can be the solution to the problems of water facilities. The paper presents a geospatial information system (GIS) as one of the efficient methods for the control of a set of reservoirs used for water distribution networks in compliance with the internet of things (IoT). Another novelty of this study informs engineers about the state of the use of remote sensing (RS) facilities equipped with networked sensors, advanced modems, data loggers, and the IoT. This can lead to reducing water loss and non-revenue water (NRW) for saving drinking water. The present work also investigated GIS as a high-precision and quick method of incorporation with the RS and IoT for rapid data intercommunication to reduce the water retention time in reservoirs. This work finally showed that GIS can be linked to new techniques including RS and IoT which can be serious subjects for future research in the fields of environmental engineering, mechanical engineering, Electrical engineering, and control engineering in universities and industries.

Coimbra, Portugal — Ana Cristina Faria Ribeiro

A. K. Haghi

Contents