Chapter 11
NB–IoT–Based Smart Water Network

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ABSTRACT

Water leakage is a common problem that often results in water waste, damages, and hazards to public health. Because of their potential danger to public health, economic loss, environmental damage, and energy waste, underground water pipelines leaks have received more attention globally. One of the great concerns in the water industry is the existence of non-revenue water (NRW), which is produced but fails to reach the consumer due to loss along the distribution network. The global volume of NRW has been calculated to be 346 million cubic meters per day or 126 billion cubic meters per year. The non-revenue water reaches an alarming 35%. The installation of right sensors, a feasible radio network and the effective processing of gathered information by ICT in the water distribution network helps to reduce non-revenue water volumes at various stages. This chapter justifies the use of NB-IoT to manage smart water networks.

INTRODUCTION

Water is a critical source of life on our planet; in recent years due to rapid urbanization more than half of the global population lives in towns and cities. By 2050, that proportion is expected to rise to two-thirds. Safe drinking water systems and adequate sanitation will be essential to ensure cities and towns grow sustainably and to keep humanity healthy. Urban water is regularly transmitted using underground pipe-

lines. Water transmission pipelines periodically lose an average of 20% to 30% of the water transmitted through them, and those numbers can escalate up to 50% in old systems especially ones that have suffered from inefficient maintenance. There are multiple causes for loss of water in transmission pipelines which include leakage, metering errors, public usage such as firefighting, and theft. Losses from distribution networks can be effectively reduced and controlled in a sustainable manner by adopting proactive detection mechanism and ICT tools. This chapter presents an insight into role of the Narrowband Internet of Things (NB-IoT) for Smart Water Management system. NB-IoT is a cellular technology facilitating as ICT enabler for machine to machine communication and Internet of Things (IoT) devices and mainly focusing towards application in Smart Water management requiring wireless transmission over a more extended range at a relatively low cost and using little power for long battery lives.

The remainder of the chapter is organized in five sections. Section 1 discuss about related works and suitability of NB-IoT. Section 2 of this chapter provides an overview of Non-Revenue Water (NRW) assessment and current practices. In addition, it also addresses the role of ICT in reducing the levels of NRW with respect to water Industry. Section 3 highlights the use of NB-IoT to cater the intended objective, namely flexible deployment, extended coverage, long battery life, low device complexity, low device cost, latency, and massive device connectivity. Section 4 provides a detailed framework for smart water management systems and implementations done using LPWAN technologies and use case to highlight the feasibility of NB-IoT for smart water. Finally, Section 5 concludes the key features of NB-IoT that can act as a key enabler for Water Industry augmenting the existing SCADA systems.

Literature Review

In today's digital ecosystem, the contribution of Internet of Things (IoT) to smart management has acquired immense potential due to its multi-faceted advantages in various fields. IoT paves a way to associate and virtually control everything in almost every domain of society. The low power wide area network (LPWAN) technologies, which are now embracing a booming era with the development in the Internet of things (IoT), may offer a brand new solution for current requirements of communications due to their excellent features of low power, long range, and high capacity. The mission-critical smart communications require secure and reliable connections between the utilities and the devices with high quality of service (QoS). This is difficult to achieve for unlicensed LPWAN technologies due to the crowded license free band. Narrowband IoT (NB IoT), as a licensed LPWAN technology, is developed based on the existing LTE specifications and facilities. Thus, able to provide cellular-level QoS, and hence forth can be viewed as a promising candidate for (mMTC) massive machine type communications- Li et al.(2017). Anand and Routray (2017), presents the utilities and applications of

IoT for healthcare. In this framework, IoT can be very useful in supporting several needs of healthcare. There are many instances in healthcare provisioning where continuous monitoring of patients is essential and the same holds good for the smart water management which is the focus of this work. This was done through NB-IoT sensors. The information obtained from monitoring should also be sent to the healthcare providers. This can be done through NB-IoTs. For a large scale deployment of healthcare, NB-IoT is preferred over the other forms. It is cost effective and uses low power which suitable for human uses. Rumana Yasmin et al. (2020) discuss the deployment and reported the practical performance of a single-cell NB-IoT deployed as a part of the 5G Test Network (5GTN) and controlled by a smart-campus micro-operator. They investigated the performance of a single-BS micro operator NB-IoT deployment in which the connectivity services are required not only by the people, but also by the versatile machines,

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