Chapter 12
Empowering Safety by Embracing IoT for Leak Detection Excellence

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ABSTRACT

Improvements in connectivity and data analysis enabled by the internet of things (IoT) are set to revolutionize various sectors, with a particular emphasis on making workplaces safer. Manual leak inspections, which can be both time-consuming and dangerous, are quickly being replaced by IoT-driven devices. These systems are more than just an improvement in technology; they usher in a new paradigm with their ability to monitor in real time, issue immediate alerts, and locate leaks with pinpoint accuracy. Because of the benefits that IoT provides, several sectors are making the switch from more traditional practices. Leak detection enabled by the internet of things represents a step toward safer, greener production. The promise of improved worker safety and environmental sustainability lies at the heart of the internet of things, which should be rapidly adopted by businesses.

INTRODUCTION

The fast expansion of IoT has revolutionized leak detection, delivering effective preventative measures for safer homes and workplaces. Networks of intelligent sensors strategically installed in pipelines,

DOI: 10.4018/979-8-3693-1194-3.ch012

storage tanks, and other vital places provide real-time monitoring and data recording for IoT-based leak detection systems. This information is sent to central computers, which are processed and analyzed quickly by advanced analytics and Artificial Intelligence (AI) algorithms. The system can detect leaks and irregularities using AI-driven analytics, allowing rapid steps to reduce dangers. Water waste, environmental harm, and infrastructure disruption may all be avoided with the help of IoT leak detection thanks to its real-time monitoring and early warning capabilities. As a result of these developments, IoT leak detection systems are widely used across many sectors, from improving water management in intelligent cities to strengthening safety protocols in manufacturing plants.

Leak detection in the IoT shows potential for future development and widespread use, which bodes well for all buildings' safety and sustainability (Banerjee & Banerjee, 2023).

Risk management has become increasingly important in today's fast-paced, linked society. The IoT has ushered in a new era of technology, revolutionizing many facets of modern life, including leak detection. The IoT has enabled digital and physical systems to merge through the years by connecting them without any hitches. Thanks to this networked infrastructure, we can now collect, analyze, and respond to data in real time, making the world more connected and innovative (Bedi et al., 2018).

Historically, Leak detection has been performed reactively and manually, resulting in delays and sometimes catastrophic consequences. However, things have changed drastically since the introduction of IoT, which allows for the 24*7 monitoring and proactive leak detection of vital infrastructure. Leak detection systems based on the IoT can track and report important metrics like temperature, pressure, and flow rate thanks to intelligent sensors and constant data transfer. This data is analyzed by centralized servers using advanced analytics and machine learning technologies, allowing for early detection and remediation of leaks.

Figure 1 illustrates how IoT, AI, and data analytics enhance leak detection and safety.

Figure 1. IoT system architecture for enhanced leak detection