Chapter 12
Integrating Cutting-Edge Technologies for Enhancing Environmental Monitoring and Public Health

R. Anto Arockia Rosaline
School of Computing, SRM Institute of Science and Technology, Kattankulathur, India

G. Padmapriya
School of Computing, SRM Institute of Science and Technology, Kattankulathur, India

Prithi Samuel
https://orcid.org/0000-0001-5648-8891
School of Computing, SRM Institute of Science and Technology, Kattankulathur, India

M. Suresh Anand
https://orcid.org/0000-0002-1055-6083
School of Computing, SRM Institute of Science and Technology, Kattankulathur, India

ABSTRACT

Integrating advanced technologies like AI, IoT, remote sensing, and biotesting is transforming environmental monitoring, enabling precise tracking of environmental hazards that impact public health. As urbanization, industrialization, and climate change heighten health risks such as air and water pollution these tools provide real-time data and predictive insights crucial for proactive health interventions. For instance, IoT sensors in major cities monitor pollutants continuously, supporting timely public health advisories. Remote sensing via satellites and drones offers extensive geographical coverage, helping identify pollution patterns tied to factors like traffic or industrial activity. Bioindicators and microbial assays further enhance detection of water and soil contaminants, providing crucial data for environmental policies and health protections. By combining these innovations, environmental monitoring not only becomes more responsive and preventive but also supports efforts toward environmental justice, ensuring that health risks are addressed equitably across communities.

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1. INTRODUCTION

The intricate relationship between environmental health and public health is becoming increasingly complex due to factors such as urbanization, industrialization, and climate change (Dong et al., 2021). While these processes contribute to economic development, they often result in environmental degradation that adversely affects human health (Quito et al., 2023).

Environmental degradation has evolved into a global concern with significant implications for human health. For instance, urban emissions and industrial pollutants have been linked to increased respiratory and cardiovascular diseases (Purohit, 2023). Water contamination from industrial runoff and inadequate waste management poses risks of waterborne diseases and toxic exposures (Thanvisitthpon et al., 2018). Soil degradation due to overuse of agrochemicals and deforestation undermines food security and agricultural sustainability. Climate change exacerbates extreme weather events and intensifies vector-borne diseases, further challenging public health systems (Osman et al., 2021).

In this context, environmental monitoring plays a crucial role in protecting public health. Systematic observation and analysis of environmental parameters enable the early detection of hazards and inform timely interventions (Dong et al., 2021).

Integrating environmental monitoring with public health strategies enhances societal resilience. Data-driven insights allow policymakers to implement targeted interventions, such as stricter emission controls and improved waste management systems. Public health systems can proactively address emerging health threats, thereby reducing morbidity and mortality associated with environmental hazards (Quito et al., 2023).

Addressing the intertwined challenges of environmental and public health necessitates a collaborative, multidisciplinary approach. Stakeholders, including governments, researchers, industries, and communities, must work together to align human activities with sustainability principles, ensuring a healthier future for subsequent generations (Purohit, 2023).

1.1. Background on Environmental Challenges and Public Health

The increasing prevalence of health problems linked to environmental factors is an escalating global concern that threatens public health on an unprecedented scale (Gordon-Larsen et al., 2006). Modern urbanization, industrialization, and climate change have aggravated these challenges, resulting in dire consequences for human health and well-being (Patz & Kovats, 2002).

1.1.1. The Alarming Growth of Environmentally-Induced Health Issues

The increasing prevalence of health problems linked to environmental factors is an escalating global concern that threatens public health on an unprecedented scale. Modern urbanization, industrialization, and climate change have aggravated these challenges, resulting in dire consequences for human health and well-being (Nardone et al., 2021).