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Gonçalo Marques • Jagriti Saini
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IoT Enabled Computer-Aided Systems for Smart Buildings

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RESEARCH MEETS INNOVATION

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Preface

Smart buildings can improve quality of life by a considerable level. It is not just about the comfort of having everything under control with remote controllers and mobile-based actions; instead, smart buildings even provide an enhanced lifestyle to elderly people, disabled patients, and children as well. There are plenty of advanced technologies that can be used to create smart building environments. This book focuses on the integration of IoT and computer-aided systems for the development of smart buildings. The scope of this book includes, but is not restricted to, advanced technologies for monitoring, energy management, protection, safety, assisted living, and intelligent operations. It covers the wide aspects of interconnected smart services with convenient interfacing to the end-users.

To be more precise about the content of this book, the seven chapters shed light on the assessment, control, and management of various smart building applications. In the first chapter entitled "Environmental Data Control in Smart Buildings: Big Data Analysis and Existing IoT Technological Systems," **David Galán-Madruga** exhibited diverse arguments evidencing the implementation of technological tools relying on IoT systems for managing smart buildings, which helps preserve or improve the comfort and wellbeing of indoor occupants, to provide potential readers with an informative benchmark, encompassing aspects such as the control of thermal, security, lighting, and noise and air quality. In the second chapter entitled "Need of Technological Interventions for Indoor Air Quality and Risk Assessment upon Short-Term Exposure: A Futuristic Approach," **Khan et al.** analyzed conditions causing short-term exposure to polluted air along with the need for technological interventions and risk assessment for better outcomes. **Beucker et al.** in their chapter entitled "Climate-Neutral Districts with Decentralized Energy Production, E-Mobility and Through the Formation of an Energy Community Exchange of Electricity and Heat," described various modern energy production methods in different types of buildings along with essential requirements and constraints in the e-mobility application domain. **Mohapatra et al.** in their chapter entitled "IoT Enabled Zero Water Wastage Smart Garden" provided experimental details of a low-cost sensor-based soil moisture and temperature monitoring system to ensure real-time assessment of plant health. These smart systems can further help in

controlled irrigation management for roadside plants, city park fields, and gardens. These zero water waste gardens can be an impressive addition to smart buildings. Another chapter entitled "IoT-Based Human Activity Recognition for Smart Living" by **Saha et al.** highlighted the importance of IoT-based human activity recognition system for smart living. The chapter provided valuable insights into general architecture, design principles, essential components, and research challenges associated with developing a proposed IoT-based human behavior supervision system. **Willets et al**. in their chapter entitled "Application of Data Mining to Support Facilities Management in Smart Buildings" discussed data mining applications using big data gathered from smart sensor systems that can be further utilized to support resource conservation, energy management, and sustainability. In the last chapter entitled "Application of Artificial Intelligence in Ambient Assisted Living to Support Elderly People in Smart Homes," **Bastaki et al.** presented valuable information on ambient intelligence paradigms to improve healthcare services to older residents living in care centers or independent homes. This study emphasizes the contribution of artificial intelligence, context awareness, wearable technologies, and ubiquitous/pervasive computing to design ambient assisted living environments.

The chapters in this book provide valuable information on the utilization of advanced technologies for designing smart building applications. This book throws light on challenges, opportunities, and applications of IoT and computer-aided systems to enhance human lifestyle with improved building environments. This book may help upcoming researchers to understand the potential of emerging technologies to create smart building environments along with considerable problems in this research area.

The editors want to thank the contributions of several insightful writers, expert reviewers, and the supporting editorial team of European Alliance for Innovation (EAI) and Springer to complete this book. We congratulate all the writers for their valuable efforts in creating, submitting, and updating articles as per the reviewer comments. Finally, we would like to extend our sincere gratitude to Eliška Vlčková for his support in the entire book publishing process.

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Editors want to extend special thanks to all the reviewers who participated in the double-blind review process for this book:

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About the Book

Smart buildings can improve quality of life by a considerable level. Smart buildings provide an enhanced lifestyle to elderly people, disabled patients, and children as well. There are plenty of advanced technologies that can be used to create smart building environments. This book focuses on the integration of IoT and computer-aided systems for the development of smart buildings. The scope of this book includes, but is not restricted to, advanced technologies for monitoring, energy management, protection, safety, assisted living, and intelligent operations. It covers the wide aspects of interconnected smart services with convenient interfacing to the end-users. The chapters in this volume provide valuable information on the utilization of advanced technologies for designing smart building applications. Moreover, this book throws light on challenges, opportunities, and applications of IoT and computer-aided systems to enhance human lifestyle with improved building environments. This book may help upcoming researchers to understand the potential of emerging technologies to create smart building environments along with considerable problems in this research area.

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About the Editors

Gonçalo Marques holds a Ph.D. in Computer Science Engineering and is a Senior member of the Portuguese Engineering Association (Ordem dos Engenheiros). He is currently working as Assistant Professor lecturing courses on programming, multimedia, and database systems. Furthermore, he worked as a Software Engineer in the Innovation and Development unit of Groupe PSA automotive industry from 2016 to 2017 and in the IBM group from 2018 to 2019. His current research interests include the Internet of Things, Enhanced Living Environments, machine learning, e-health, telemedicine, medical and healthcare systems, indoor air quality monitoring and assessment, and wireless sensor networks. He has more than 80 publications in international journals and conferences, is a frequent reviewer of journals and international conferences, and is also involved in several edited book projects.

Jagriti Saini was born in Himachal Pradesh, district Mandi in 1992. She holds a Diploma in Electronics and Communication Engineering (2010) from GPW Kandaghat and completed her B.Tech. in Electronics and Communication Engineering (2013) from HPU. She received a Master's degree in Electronics and Communication Engineering from the National Institute of Technical Teacher's Training and Research (NITTTR), Chandigarh (Panjab University), India (2017). She was awarded a Gold Medal for securing the highest percentile in the entire university during her Master's degree. Jagriti completed her Ph.D. thesis from NITTTR (Panjab University), Chandigarh. She also recieved an INSPIRE fellowship from the Department of Science and Technology (DST), India, for carrying out her research work. Her current research interests include artificial intelligence, the Internet of Things, environmental monitoring, indoor air quality monitoring and prediction, healthcare systems, e-Health, and autonomous systems. Her Ph.D. thesis entitled "Design and Development of Intelligent Indoor Air Quality Monitoring and Prediction System – Vayuveda" is mainly focused on developing cost-effective real-time monitoring and prediction system for indoor air quality management. She published more than 25 papers in reputed peer-reviewed international journals and conferences. Other than this, she is a frequent reviewer of journals and international conferences and is also working on several edited book projects.

Maitreyee Dutta was born in Guwahati, India. She received a B.E. degree in Electronics and Communication Engineering in 1993 from Guwahati University and was Gold Medalist in the same year. She obtained an M.E. degree in Electronics and Communication Engineering and a Ph.D. degree in the Faculty of Engineering from Panjab University. She is currently a Professor and Head of Information Management and Emerging Engineering and a Joint Professor in the Computer Science and Engineering Department, at the National Institute of Technical Teachers' Training and Research, Chandigarh, India. She has more than 22 years of teaching experience. Her research interests include the Internet of Things, security of data, IP networks, Internet, authorization, data privacy, Public Key encryption, pattern clustering, cloud computing, and data compression. She has more than 100 research publications in reputed journals and conferences. She completed two sponsored research projects: Establishment of Cyber Security Lab, funded by the Ministry of IT, Government of India, New Delhi, amounting to Rs. 45.65 lac; and Establishment of Advanced Cyber Security Lab sponsored by MeitY, New Delhi, amounting to 62 lacs. One sponsored project Securing Billion of Things-SEBOT funded by All India Council of Technical Education, New Delhi of amount Rs. 14.98 lacs is in progress.

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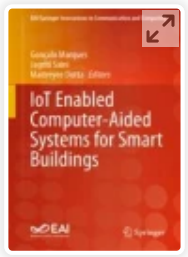

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Need of Technological Interventions for Indoor Air Quality and Risk Assessment Upon Short-Term Exposure: A Futuristic Approach

Tahmeena Khan & Alfred J. Lawrence

Chapter | First Online: 22 April 2023

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Abstract

The variation in ambient air pollution hampers indoor air quality (IAQ), and even the short-term variation is very hazardous for the exposed population. Technological interventions including sensors, smartphones and other gadgets are implemented to build smart environments. However, these interventions are still not fully explored in developing countries like India. The COVID-19 pandemic has made it very important to keep a tab on the air we breathe in as those already

suffering from respiratory troubles are prone to fall victim to the deadly disease. In such a scenario, even a rise in pollution for a short duration is dangerous to the exposed pollution. Such short-term exposure facilitated by the meteorological creates a disaster for environmental health. The short-term rise in the concentration of pollutants makes things worse for the exposed people, even indoors. It is therefore critical to come up with a concrete solution to predict the IAQ instantly and warn the exposed population which can be only achieved by technological interventions and futuristic Internet of Things-based computational predictions. This chapter is intended to elaborate the health hazards linked to short-term rise in pollutants, which often goes unnoticed but has a critical impact and how with the help of IoT-based applications, the short-term variation can be predicted through different strategies. Similarly, the assessment of the health impact associated with short-term exposure to air pollution is also significant, and different exposure assessment models and computational strategies are discussed in the course of the study.

Keywords

Internet of Things **Smart environment**

Exposure **Short-term** **Health**

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