

# Preface

Research, design, implementation, maintenance, and replacement of smart technology in developing countries are very different from those in developed countries. Lack of funding, inadequate government backing for startups, and inequality are considered the most important deterrents to technological progress in developing nations.

Amid milestones such as the invention of the internet, trends towards miniaturization of technologies governed by Moore's law, the increasing popularity of social networking/awareness and the worldwide focus on automating information distribution, smart cities have evolved as central hubs in autonomous and ubiquitous information systems. A central theme of these systems is providing people with up-to-date, real-time, and relevant information about their environment. The range of applications is dramatic, but in a fast-growing urbanization era, people are becoming more mindful of anthropogenic pollution, its numerous sources and its effects on their own health.

Developing countries often rely on international collaboration and in many cases the goodwill of nonprofit organizations to assist in integrating new and sustainable technologies in urban and/or rural areas. This has been accomplished successfully in many cases, but the more serious problem is the long-term operation and maintenance of these systems, which require significant investments in skills development. This book, *Microsensing Networks for Sustainable Cities*, aims to provide content that is relevant to researching technology trends aimed at creating smart and sustainable cities in developing countries. The information provided in this book can be used as initial reference and research guidelines, applicable references to create awareness of obtainable and cost-effective technologies, issues to expect and address, which might not be recorded in publications but found in other sources (commonly in case studies) and consciousness of best practices when researching new and innovative solutions, as well as introductory mathematics. The intended readers of this book will mainly be researchers, research students and prospective practitioners in technology who are committed to identifying,

monitoring, and modeling air and water pollution and other applications relevant to smart cities, but more importantly, to sustainability and continual reuse.

Microelectronic component advancements are enabling ubiquitous computing through propriety technologies such as wireless sensor networks and radio-frequency identification to create a global network of connected devices, termed the Internet of Things (IoT). These devices are spatially distributed in cities and across rural and suburban landscapes to monitor the environment. Their small size makes these devices unobtrusive and ideally invisible to the local population. The large drive in mobile computing and especially in cellphones and tablets have invigorated research and development in the field of mobile hardware, low-power devices, sensors, and mobile-friendly operating systems. The synergy of these disciplines is having a ripple effect in developed and developing countries alike and young students are eager to pursue research focused on technology improvements that contribute to the information age. A common denominator in any technology is its energy source. In developing countries, lack of stable and accessible electricity is driving research into renewable and sustainable energy sources.

Various alternative renewable energy sources and techniques of energy harvesting, such as wind energy, hydropower, solar radiation, and energy from mechanical deformation can power, for example, IoT devices. However, there is still a demand for higher voltage supplies (ideally obtained from utilities) to power central storage servers, long-range transceivers, and Internet-connected interface devices. Again, there is a significant difference between developing and developed countries' abilities to provide stable and continuous energy. Economic growth can be severely suppressed by a country's inability to supply its citizens with electricity (only 5.1 % of South Sudan's population have access to electricity); stagnating technological development is inevitable. Such statistics point to major underdeveloped infrastructure and difficult conditions to initiate smart city developments and future sustainability. The countries concerned rely on skills development for their sustainable future and this book aims to provide the necessary baseline to encourage developing countries to initiate new research in the field of microsensory networks for sustainable cities during rapid urbanization.

The final three chapters of this book focus less on technical considerations and mathematical derivations and more on studying planning possibilities for ecologically aware, smart, and sustainable cities in developing countries. This is done by highlighting aspects that have contributed to successful implementation in developed and developing countries.

The authors strongly believe that in order to contribute to sustainability in developing countries, particularly in urban environments, prospective researchers, students, and practitioners must identify and understand the underlying causes and effects of overpopulation, the enabling technologies for smarter cities and possible limitations (technological and economic). The authors have taken it upon themselves to write this book specifically to address these topics and empower developing nations to improve their quality of life through technology.

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Lambrechts, W.; Sinha, S.

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