

Designing, Developing, and Facilitating Smart Cities

Vangelis Angelakis · Elias Tragos
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Editors

Designing, Developing, and Facilitating Smart Cities

Urban Design to IoT Solutions

 Springer

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Preface

The trend of cities leveraging Information and Communication Technologies (ICT) to sustain their growth and offer additional services to citizens became mainstream in the past few years. This has been increased with the emergence of technologies, such as the Internet of Things (IoT), that allow a digital representation of physical environments. Many predictions are made regarding the way IoT will change everyone's lives. To understand the implications and instead of making more predictions, this book combines in-depth explanations of the latest results from IoT research and technology with societal, economical and legal perspectives. This interdisciplinary approach makes this book unique as it covers a broad spectrum of smart city aspects. We believe that this broad view is necessary to maintain citizens' well-being and privacy in a "Smarter" city.

We have not found many reference books covering the topic of smart cities from motivation to enabling technologies and use cases in such a broadened approach. The book provides a comprehensive guide to selected topics of research, both ongoing and emerging, in the broad area of ICT enablers for smart cities, using a pedagogical approach. Technologically, the areas of cloud computing and IoT are considered highly relevant to be understood in their limitations as well as in their offerings to successfully build an ICT enabled smart city. The contributions to this book come from worldwide well-known and high-profile researchers in their respective specialties; selected topics covered in this volume are related to assumptions (Chaps. 1–4), enabling technologies (Chaps. 5–10), and experiences of solutions designed for smart cities. (Chaps. 11–14). We have prepared this book hoping that it proves itself to be a valuable resource, dealing with a broad spectrum of smart city aspects. And we hope that it will be a helpful source and reference for instructors, researchers, students, engineers, scientists, city managers, and industry practitioners in this exciting new field.

Book Overview and Features

The book is organized in 14 chapters, each written by well-recognized experts in the area covered. Chapters have been integrated in a manner that renders the book as a supplementary reference volume or a textbook for use in both senior undergraduate and graduate courses on smart cities. Each chapter has an expository, but also a scholarly or survey style, on a particular topic within the book scope.

Chapter 1 proposes an analysis of past urban developments in an attempt to predict how future developments may look like, and how the technology could be used to overcome current spatial cities' barriers towards a sustainable vision for future generations, on both social and economical levels.

Chapter 2 investigates who the assumed user in the contemporary smart city is. Building a critical framework using examples from contemporary smart cities projects, it reflects on the characteristics of the assumed user, and which users may have been unwittingly overlooked during design and development.

Chapter 3 discusses how the onlife manifesto principles can be turned into guidelines for smart city frameworks and IoT development leveraging experience from research and innovation projects.

Chapter 4 identifies and analyzes some of the expectations and possible long-term effects of big data and the Internet of Things. Without reducing the importance of success stories achieved so far it points out areas that need further attention in the future, such as security at large and proposes to trigger a wider discussion about the impact on society and unforeseen side effects.

Chapter 5 recognizes that it is quite common in the last few years for large cities to form strategic agendas for "smartification" through IoT technologies. It provides an overview of the challenges, a methodology, and shortly summarizes the latest attempts for manifesting security and privacy protection already in the IoT architectures for smart city environments.

Chapter 6 provides an overview of the challenge of personal data protection within smart cities and shows how to formulate technological requirements that meet legal requirements. It also shows how to address the challenge to implement Privacy by Design and gives an example on how to achieve data minimization in a smart transport scenario.

Chapter 7 gives a primer on general information security, its main goals, and the basic IoT security challenges in the Smart City. Built upon the basic IT security goals for confidentiality, integrity, and availability, this chapter additionally addresses security and privacy problems. Thereby it awards recognition how the latter may be a key acceptance factor of smart city ICT solutions and introduces the reader to the technical privacy goal of unobservable communication.

Chapter 8 gives an overview of the main IoT-based communication technologies which can enable services for smart cities, further commenting on the main advantages, disadvantages and open challenges involved in applying each technology to the smart city ecosystem.

Chapter 9 presents the Cloud-IoT architectural vision, as a key service provisioning technology for the smart city. The chapter exposes open challenges and points to a set of different research initiatives that aim to address them. A promising architecture for enabling Cloud-IoT services in smart cities is presented together with a case study that reveals the cloud's high potential in the context of smart cities.

Chapter 10 introduces a framework encompassing FIWARE and the IoT-A to develop innovative IoT platforms and services, and include generic IoT devices that are independent of connectivity modes and are not coupled to specific IoT protocols.

Chapter 11 gives an overview of different mobility data sources and their characteristics and describes a framework for utilizing the various sources efficiently in the context of traffic management.

Chapter 12 focuses on the energy sector advocating how ICT and signal processing techniques can be integrated into next generation power grids towards increased effectiveness in terms of electrical stability, distribution, improved communication security, energy production, and utilization. The chapter also features big data analytics for demand response and serious games as a tool to promote energy-efficient behaviors from end users.

Chapter 13 is about each building getting "smarter" to serve the inhabitants needs better. It takes the approach to incorporate user involvement, which has been successfully applied in many areas, to the engineering process of smart buildings. Smart buildings will no longer be built just as a shelter for people and a more user driven building sector suits the smart city.

Chapter 14 is motivated by the need to restructure healthcare services through a platform to empower patients to actively engage in the management of their well-being. The chapter discusses challenges of developing smart home technologies for health and care breaking down the various facets of the home and the diversity of its residents.

Overall this book has a set of unique features:

- It is designed, in structure and content, with the intention of making it useful at a broad range of learning backgrounds and levels.
- The book's authors are prominent academics, researchers, and practitioners, with solid experience and exposure on the domain.
- The authors of this book are distributed in a large number both of disciplines and countries and most of them are affiliated with institutions of worldwide reputation. This gives this book a strong international flavor.
- The authors of each chapter have attempted to provide a comprehensive bibliography of their topic, which should provide the reader with at least a good starting point to further dig into each area covered.
- Throughout the chapters of this book, core research topics from a wide range of technologies and science and engineering domains have been covered; making the book particularly useful for city managers and practitioners working directly

with the practical aspects behind enabling the technologies for city smartification.

- We allowed the authors, who are experts in an interdisciplinary range of fields, to provide in-depth inside to their views on the topic from their different disciplines and backgrounds; our goal was to transport this expertise rather than trying to achieve perfect homogeneity, but we have attempted to make the different chapters of the book as coherent and synchronized as possible.

Intended Audience

We have attempted to design the overall structure and content of the book in such a manner that makes it useful for all learning levels. The book is written to primarily target students, of a broad spectrum of disciplines. This includes students of senior undergraduate and graduate levels, in the broad range of skills employed towards turning a city smarter. A secondary audience for this book is the researcher and practitioners' community, in academia, the ICT and IoT industry, and city planning. To this end we have taken into consideration the need for getting insights not only of the practical significance of the topics, but also need to discover how this scope of knowledge and the ideas are relevant for applications and technologies enabling for smart cities.

Acknowledgments

We are deeply thankful to the 70 authors of the 14 chapters of this book, who have worked hard to bring this unique resource forward for helping the students, researchers, and smart cities community at large. We note that as the individual chapters of this book are written by different authors, the responsibility of the contents of each of the chapters lies with the concerned authors.

We would like to thank Springer and Ms. Mary James, Senior Editor, who worked with us on the project from its inception, for her professionalism and support. We also thank Mr. Brian Halm, who tirelessly worked with us and helped us in the publication process.

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