

# Preface

The idea of writing this book started developing in 2008, when I was teaching at York University in Canada on an adjunct-professorship basis while I was holding a full-time position as a Defence Scientist with the Federal Government of Canada. I realized the need for a comprehensive coverage information source to cross the horizon of GeoICT as an interdisciplinary field of study that is progressing as a new specialized degree program offered by many departments in Canada and worldwide. In addition, the idea was to target mainly senior undergraduate students, graduate students, professionals, and researchers in geomatics and related disciplines who are using GeoICT but who have no unified source to serve as a reference.

Many courses are widely taken under the rubric of earth science, geography, geology, environmental science, environmental engineering and many other disciplines. The growing trend of GeoICT as a strong economic driver increases the effort in research and development in this field every year. As a field of GeoICT, geomatics is used by many industries for managing natural resources, developing intelligent transportation systems, environmental protection, emergency management and public safety, and health among many other applications.

The need for this book is justified by the requirement for a comprehensive source of information for the growing community of GeoICT. It provides a comprehensive overview of GeoICT technologies and their architectures, capabilities, and limitations. This book is of equal interest to readers with limited or no background in geomatics as well as professionals who are interested in expanding their knowledge of other domains of GeoICTs. This book will serve as a simple and direct first source in the area of GeoICT. Many geomatics programs worldwide can make use of the material covered in this book. This book is the first book of its kind that discusses broad aspects of GeoICT in a simple manner. As such, this book will help synthesize knowledge gained from different other fields, such as computer science, geodesy, and earth science, and connect them to geomatics as GeoICT technologies. It will also help professionals who are working in one aspect of GeoICT and who are interested in expanding their professional scope by exploring the breadth of GeoICT's aspects.

This book can help professionals, researchers, and students to obtain an in-depth understanding of the components and foundations of geospatial information and communication technology (GeoICT), a fast-growing technology with an expanding community. In seven chapters, this book elucidates the core elements of GeoICT and its integration with spatial-positioning technologies and ICTs. This book thoroughly elaborates the components, architecture, operational aspects, capabilities, advantages, limitations, and drawbacks of using GeoICT technology. This book also highlights the accuracy of these systems and discusses the current challenges of and future opportunities for GeoICT.

The first chapter of this book addresses the basics of geospatial information systems beginning with the different meanings of the acronym “GIS,” the components of GIS, and spatial data acquisition, modeling, distribution, and visualization. This chapter provides an overview of the historical developments of GIS and highlights the basics of the foundation and process of geographic-data modeling.

The second chapter discusses the concepts and foundations of spatial-positioning technology. It explains the theory behind the Global Positioning System (GPS) and its various enhancements including Differential GPS (DGPS), Assisted GPS (AGPS), Internet-based Global Differential GPS (I-DGPS), Wide Area Augmentation System (WAAS), other global positioning systems including GLONASS and Galileo. It also discusses network-based (NBPS) and radio-based positioning system (RBPS) highlighting.

The third chapter of the book elaborates on networking and Web services by discussing different aspects of wired network and wireless networking and detailing all types of network protocols and cellular client-server applications as well as peer-to-peer applications. This chapter discusses the usability and application of distributed systems as well as wireless computing. The second part of this chapter discusses Web services and their models, architecture, and operations, as well as the Web service–development life cycle. New technologies, including Wi-Fi and LTE network-based technologies, are explained in this chapter.

The fourth chapter introduces distributed GIS technology by introducing the types, architecture, and functional requirements and technologies for distributed GIS. This chapter highlights technical issues for distributed geoprocessing services.

The fifth chapter discusses mobile GIS and location-based services starting with a brief history of mobile-mapping technology with its components and principles, the principles of direct georeferencing and why there is a need for mobile GIS, and the architecture for mobile GIS and its protocols. This chapter also discusses the wireless-application protocol (WAP) and wireless-markup language (WML) as well as mobile GIS systems and protocols. The second part of this chapter discusses location-based services (LBS) as an element of mobile GIS systems. It introduces system architecture and a classification of location-based services (LBS) as they expand.

The sixth chapter discusses geospatial data integration with an emphasis on different data-collection technologies starting with the concept of spatial database systems and traditional mobile-mapping technology as well as their components

and elements. The chapter then highlights state-of-the-art geospatial data collection through unmanned aerial vehicles (UAVs), autonomous underwater vehicles (AUVs), and sensor networks. This chapter focuses on introducing various means for integrating geospatial data.

The seventh chapter, on GeoICT Standards, highlights the Open Geospatial Consortium (OGC) initiative by discussing the abstract specification, OGC web-mapping services, and OGC geospatial different services. This chapter also discusses W3 and Web3D data standards as well as hydrographic data standards as introduced by the IHO. This chapter introduces the ongoing standardization efforts associated with GeoICT globally from the perspectives of geospatial, internet and telecommunication, and hydrographic data-management technology.

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