Chapter 1

Introduction Chapter: From Land Surveying to Geomatics - Multidisciplinary Technological Trends

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Additional information is available at the end of the chapter

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1. Growing technological trends in geomatics

Substantial work has been done by the geomatics community to evaluate and develop mechanisms and interrelationships that are required for integrating data, procedures, and protocols in an effective way. Targeting higher levels of integration and coordination with domains is the link that is found to be efficient in connecting geomatics communities, remote sensing, GIS, and global navigation systems. It attempts to achieve the desired level of effectiveness by providing low-cost, highly efficient, highly accurate systems. This integration can help with the ability of freely exchanging all kinds of geospatial data and information, through accessing various data sources and systems over networks. This includes the ability of processing large volumes of data and analyzing it through utilization of effective hardware and software. This can help with achieving a combined decision-making approach which incorporates all user classes.

The growing trends in geomatics technology are of special importance, because they bring many challenges and opportunities to the user community. The user community can be application users, developers, or technology integrators, in addition to educators. All these communities are contributing to the development of geomatics through providing new approaches and means that leads to progressive advancement in the field, especially in the last few decades. An increasingly important and popular development is in geomatics education and the use of technological means to equip future generations with the foundations to excel in this important domain. Geomatics, hydrography, or applied earth sciences all address the fields of geomatics, whether it be global navigation and positioning technologies, geospatial information technologies, remote sensing technologies, or photogrammetry and field surveying technologies, together with advanced training that supports the moving trends in the important domain. Four major aspects of technology development share the

importance of helping wider application and the use of geomatics: (1) environmental monitoring and detecting what changes have occurred, over a specific timeframe, (2) identifying and filling gaps in the user community application cycle, (3) measuring and planning for few advancement in form software and hardware to address the growing user community, and (4) assessing the current level of utilization and adoption of technology. Techniques to utilize geomatics technologies to solve day-to-day issues are on the rise; as such the ease of technological tools are also on the rise, because of increasing versatility in manipulating digital data and increasing computing power. Still, some work needs to be done for the determination of the qualitative accuracy of the different geomatics data collection tools, along with ancillary data acquisition system. The primary objective of this work was to highlight the different levels of ongoing trends in the field of geomatics technology and what type of change has occurred over the recent decades. The main objectives were (1) to provide coverage for some of the important trends in geomatics technology that might influence the user community in all the aspects associated with the themes of geomatics collectively, (2) to highlight the issue of trends in geomatics education, and (3) to perform an evaluation of the role of public participation in geomatics technologies.

2. Data remains central in geomatics

Geomatics aims to secure an automated process which will allow for using different data products, services, and tools across and beyond organizational boundaries. This helps by making data and information available for all the three levels involved in decision-making and acquisition processing, whether at the local level, provincial level, or at the state or country level. Geomatics systems provide integration between hardware, software, and user that take into consideration spatial data storage manipulation, analysis, and visualization. The Internet has played a major role in connecting systems together over a common network protocol, that is, Transmission Control Protocol-Internet Protocol (TCP/IP). This protocol has truly revolutionized the era of information technology; as a result a great deal of interest toward disaster management applications using Internet infrastructure is rapidly evolving. This advancement in Internet technology in addition to the other advances in high-speed broadband Internet-added capabilities has significantly contributed for data interoperability for disaster management applications. Geomatics is a science related to the techniques related to urban data in its digital form, which includes spatial or geographic information systems, including the collection of urban information and work on processing, analysis, and presentation, and the formation of maps and management of urban data. Due to the evolution of information and communication technologies, this has led to the development of geographic information systems and maps and geomatics. Traditional geography has evolved, and Earth observation activities have evolved considerably. Satellites are being used for Earth observation and remote sensing. The use of modern technologies results in a huge amount of data that must be processed and analyzed so that they can be used, and this data is processed in several ways. Geomatics (geos: Earth; matics: informatics) can satisfy such requirements.

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Geomatics include the fields of mapping, surveying, remote sensing (LiDAR or HDS scanning), hydrography, photogrammetry, global positioning systems (GPS), and geographic information systems (GIS).

3. Location and user information

In geomatics location is the main factor which is used to integrate a very wide range of data for spatial analysis and visualization. Geometrics engineers apply geometrical principles to spatial information, managing spatial data infrastructures of various types, whether local, regional, or global. The extensive availability and the use of sophisticated technologies, such as global navigation satellite systems (GNSS), remote sensing, and geographical information systems (GIS), increase the precision and productivity of the profession.

Although land surveying uses direct contact with everything measured, remote sensing is a type of measurement that collects data from the air using LiDAR, from the ground with high-definition laser scanning (HDS), or from an automobile using mobile mapping. Although LiDAR can survey high large areas in a short time, it is limited to the acquisition system altitude and swath. On the other hand, HDS equipment mounted on survey tripods is operated similarly to a surveyor's robotic total station. The move from one control point to another can gather up to 50000 points per second, depending on the scanner of the data. HDS has found many applications in different fields from architectural modeling, historical preservation, and civil engineering design to food processing and manufacturing, industrial renovation, and mechanical engineering designs. Photogrammetry combines with LiDAR oftentimes by the high-resolution pictures taken from an aircraft, which is hundreds of feet from the ground. The overlapping of images and their association with aerial panels to control the surface survey result in data processing, correction, and utilization. Hydrography uses a combination of land-based GPS control, ship-mounted GPS receivers, and sounding equipment to map accurately the floor of bodies of water. The use of these geomatics elements or any combination thereof, together under a layer scheme for design purposes or into a geographic information system (GIS), leads to best analysis of our three-dimensional world. Database information are combined together with spatial information about a particular structure or object feature within GIS to provide for analyzing or tracking of features in our environment. Geodesy is a mathematical science that determines the shape and size of the earth and the nature of the earth's gravity. The use of geomatics and its sophistication with the techniques are evolving and continue because of the need to integrate them with modern technologies to be used in several fields, including artificial intelligence, geo-analysis, and geospatial information. The availability of more sensors as a result of their low cost under the Internet, free and open source objects and software, and the availability of high-performance infrastructure all led to the development of geometrics. It is a science that includes many important aspects, so we focus on all geomatics trends.

4. Is there any way forward?

Geomatics approaches and products have been widely used for many applications. This book targets many groups that are of interest to the geomatics user community. This book highlights various trends in the user side, focusing on public participation (GIS); in the geodesy and navigation sides, focusing on some mathematical modeling for geodesy; and in the growing trend of geomatics education, and a focus to provide detailed knowledge for future generation on best available solutions and best practices that utilize geomatics technologies is needed.

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