An Introduction to the Special Issue on LBS and GIS

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Currently geospatial information (GI) technology can be characterized by two important developments: (1) it goes beyond the application stages towards more conceptual and theoretical developments, dealing with more profound issues around geographic information science, and (2) it continues to be application or service oriented in serving our modern society, hence location-based services (LBS) arisen out of convergence of GI technology, the Internet, mobile wireless telecommunication and positioning technologies. The convergence of GIS and various technologies has been existing since the widespread availability of the Internet, and it is reflected in a series of GIS terms such as Internet GIS, web GIS, wireless GIS, and mobile GIS. Nowadays it appears that all the "GIS" come to a pot with a more fashionable term – LBS.

Although LBS have emerged only in recent years, the development of LBS in the market is tremendous. Some reports estimate that the worldwide revenue ends up to $20 billion annually by the end of 2005. However, many have argued after the past couple of years' observation that the profits have been widely overestimated. Virtually nobody has ever gained any profits as service providers, but rather as software developers. To get a sense of how hot LBS are, we could simply type it or location services in Google to see the number of hits and compare it to that of GIS. Indeed, several business surveys report that LBS have been far more rapidly developing than GIS, although in essence they both are inseparable.

In order to promote the development of LBS in the software industry, Open Geospatial Consortium (OGC, 2004) launched the Open Location Services Initiative(OpenLS) to develop open specifications for LBS. Various LBS applications have been developed such as map oriented services (mapquest, 2004; mapblast, 2004), telematic applications (e.g. fleet management), car and human navigation systems, and others from dating services to child surveillance. On the other hand, various workshops and forums have been organized towards the discussions and exchanges among LBS researchers, e.g. the specialist meeting on Location-Based Services (CSISS, 2001), W2GIS workshop series(W2GIS, 2004), the biannual workshop on Design of Mobile Map Services (MobileMaps, 2003) and several workshops organized by the international cartographic association commission on maps and the Internet (ICA, 2004), just to mention a few examples. LBS related research topics have appeared in the GIS research agenda; for instance, LBS, social implications of LBS, and pervasive computing are the three most relevant topics in the UCGIS research agenda (UCGIS, 2004). A recent book edited by Karimi and Hammad (2004) provides a comprehensive coverage on the theoretical, technological and application development of Telegeoformatics, another name for LBS.

Presented in the special issue is a set of papers focusing on LBS and GIS. The papers were selected from the recent Geoinformatics 2004 conference, and the post-conference workshop on Ubiquitous GIS (Geoinformatics, 2004). The papers that follow were reviewed by two or three anonymous referees and have been significantly improved afterwards following the review processes. The papers, contributed by various researchers from the domains of geoinformatics and informatics, present a diverse scope of recent developments of LBS and GIS.

This special issue starts with Sui's conceptualization of LBS as new media based on Marshall McLuhan's laws of media. From a media perspective, the author suggests that LBS be treated as new media, thus McLuhan's laws of media could tie the technical, business and social aspects of the emerging technology. From a message perspective, the author elaborates on LBS in terms of the McLuhan's law of media, i.e. enhancement ("what does LBS enhance?"), obsolescence ("what does LBS make obsolete?"), retrieval ("what does LBS retrieve?") and reversal ("what does LBS reverse into?"). Furthermore the author introduces a set of laws of LBS based on the existing laws of Robotics for dealing with legal and ethical aspects of LBS.

LBS appear to be a promising technology that is of particular value for logistics and management in the forestry industry. Wing and Kellogg review a series of locating and mobile measurement techniques and tools for forest applications. The paper also at the end provides some visionary discussions on potential integration of the variety of technologies that lead to a prosperous future of applications. Rinner and Raubal consider LBS as a personalized decision support system, thus providing a prototype of multi-criteria analysis with mobile devices. Such a system is able to translate user preferences into analysis processes for a personal decision strategy. The paper extends LBS from simple geospatial queries to more

1082-4006/04/1002-89$5.00

advanced spatial analysis and decision-making processes. Lee and his colleagues examine the performance issue of Geography Markup Language (GML) for transmitting geospatial data on wireless networks. The findings can be important and fundamental for designing an appropriate architecture for LBS applications. Additionally, this paper presents the concepts of mobile and web GIS, and GML in terms of their evolution and recent developments.

Stahl and Heckmann's work aims to develop a working prototype for pedestrian navigation within buildings. The prototype system consists of two parts: one (i.e. UbisWorld) for location, user and context modeling using semantic web technology, and another (i.e. YAMAMOTO) for visualization or map modeling. Bill and his colleagues provide a comprehensive review of indoor and outdoor positioning technologies, a complementary and updated view to the existing literature. Furthermore, the paper investigates in particular WLAN-positioning in terms of its accuracy in both indoor and outdoor contexts. Misund and Mindh introduce a prototype system by extending mobile messaging to location message services that integrate time and location sensitive information for a kind of LBS. It is implemented with a smartphone with the client-server architecture.

Haeussler and Zipf review recent developments regarding user adaptive tour planning and multi-modal user interfaces, based on several developed prototypes. They also compare them to a recent OpenLS specification in terms of applicability for developing multi-modal map interaction for adaptive tour planning. The paper by Broberg and his colleagues investigates the impact of information technology in general and location-based technology in particular in terms of how the technology can be used to amplify human cognition. The contribution consists of both theoretical and technical aspects. At the theoretical level, a theoretical framework is introduced by pulling together a set of theories from various related domains. At the technical level, a set of map-and proximity-based tools is introduced, and the related field studies using the tools for improving human cognition are briefly discussed. The studies are of value for developing some LBS applications. Finally the paper by Follin and his coauthors targets the issue of multi-representation and generalization, widely known as vector streaming in the networked environments like LBS. It presents a client-server architecture for the purpose of file transferring and considers the density as a major factor for deriving the data display at different levels of detail.

On the occasion of this publication, we, as guest editors, want to thank all the authors for their contributions and collaboration in the process of editing the special issue. Thanks also go to the colleagues for their help in reviewing the papers: Gennady Andrienko, Michela Bertolotto, Jan Terje Bjorke, Christophe Claramunt, George Gartnar, Lars Harries, Bo Huang, Hassan A. Karimi, William Mackaness, Liqiu Meng, Itzhak Omer, Juval Portugali, Anne Ruas, Marius Thériault, Xiaobai Yao, and Guoqing Zhou.

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