Table of Contents

List of Reviewers xv

List of Contributors xix

1 LBS and TeleCartography II: About the book 1
Georg Gartner

1.1 A Series of Symposia on LBS and TeleCartography 1
1.2 Progression of Research 3
1.3 Structure of the Book 6
1.4 Summary 8

Section I: Modelling 9

2 A Formal Model for Mobile Map Adaptation 11
Martin Raubal and Ilija Panov

2.1 Introduction 12
2.2 Use Case and Problem Statement 13
2.3 Related Work 16
2.4 A Conceptual Model for Mobile Map Adaptation 18
2.5 Application and Formal Model 22
2.6 Discussion 29
2.7 Conclusions and Future Work 30

3 Using Activity Theory to Identify Relevant Context Parameters 35
Haosheng Huang and Georg Gartner

3.1 Introduction 35
3.2 What's Context? 37
3.3 A Method Based on Activity Theory (AT) 37
3.4 Context-Aware Pedestrian Wayfinding Services 42
3.5 Conclusions and Future Work 44

4 Congestion Visualization Based on Probe Vehicle Data 47
Masria Mustafa, Meng Zhang and Liqiu Meng

4.1 Introduction 47
4.2 Methodology 49
4.3 Results and Discussions 53
4.4 Conclusions 60

5 Where do you Roll Today? Trajectory Prediction by SpaceRank and Physics Models 63
Stefano De Sabbata, Stefano Mizzaro and Luca Vassena

5.1 Introduction 63
5.2 Related Work 64
5.3 Trajectory Prevision 68
5.4 Preliminary Evaluation 73
5.5 Conclusions and Future Work 77

6 Ways of Walking – Developing a Pedestrian Typology for Personalised Mobile Information Systems 79
Alexandra Millonig and Georg Gartner

6.1 Introduction 80
6.2 Pedestrian Behaviour Monitoring 80
6.3 Current Triangulation Approach 81
6.4 Heuristic Phase 82
6.5 Results 84
6.6 Discussion and Comparison of Results 89
6.7 Outlook: Deductive Phase 91
6.8 Conclusions 92

7 Mapping Pedestrian Movement: Using Tracking Technologies in Koblenz 95
Stefan van der Spek

7.1 Introduction 95
7.2 Research 98
7.3 Results 100
7.4 Conclusions and Evaluation 111
7.5 Concluding Remarks 115

Section II: TeleCartography 119

8 Evaluation of User Variables in Topographic Feature Recall for the Informed Selection of Personalized Landmarks 121
Birgit Elias, Volker Paelke and Marcel Chaouali

8.1 Introduction 121
8.2 Related Work 122
8.3 User-Questionnaire – Planning and Performing 125
8.4 Data Analysis 128
8.5 Conclusions and Outlook 133

9 Measuring the Impact of Location-Awareness in the Acceptance of Mobile Systems 137
Eduardo Dias and Euro Beinat

9.1 Introduction 137
9.2 Technology Acceptance Model 141
9.3 Protected Area's Information System Acceptance Model 145
9.4 Results 147
9.5 Conclusions 152

10 Impact of Restricted Display Size on Spatial Knowledge Acquisition in the Context of Pedestrian Navigation 155
Georg Gartner and Wolfgang Hiller

10.1 Introduction 155
10.2 Spatial Cognition and Wayfinding 156
10.3 Methodology 158
10.4 Results and Interpretation 160
10.5 Conclusions and Outlook 165

11 User Requirements for Location-Based Services to Support Hiking Activities 167
Annu-Maaria Nivala, Tiina Sarjakoski, Katri Laakso, Joonas Itäranta and Pyry Kettunen

11.1 Introduction 168
11.2 Materials and Methods 170
11.3 Results 174
11.4 Discussion 180
11.5 Summary 182

12 Geo-Identification and Pedestrian Navigation with Geo-Mobile Applications: How Do Users Proceed? 185
Ioannis Delikostidis and Corné P. J. M. van Elzakker

12.1 Introduction 186
12.2 Personal Geo-Identification in an Unfamiliar Area 187
12.3 The Experiment 189
12.4 Mobile Observation and Thinking Aloud in the Field 196
12.5 Results and Analysis 199
12.6 Conclusions 203

13 Neo-Cartographic Influence on Map Communication in LBS 207
Markus Jobst and Jürgen Döllner

13.1 Introduction 207
13.2 Neo-Cartography 208
13.3 Metamorphosis of the Communication Model 209
13.4 Relations and Main Factors in a Conceptual Mass-Communication 211
13.5 The Differentiation of Media in Neo-Cartography 213
13.6 One Crucial Aspect of Visual Geo-Media Techniques in Neo-Cartography 214
13.7 A Common Relevance for Geospatial Communication in Neo-Cartography? 215
13.8 Conclusions 217

Section III: Location Based Services and Applications 221

14 The Adoption of Mobile Location-Aware Systems for Field Police Work: Evaluation of a Pilot Initiative at the Dutch Police 223
Filippo Dal Fiore and Euro Beinat

14.1 Introduction 224
14.2 Background Literature 224
14.3 Description of the New PDA Applications 225
14.4 Research Design and Data Collection 227
14.5 Findings 230
14.6 Conclusions 237

15 Enhancing the Experience of the Landscape: The Digital Dowsing Rod 239
Arend Ligtenberg, Ron van Lammeren, Martin Goossen and Jandirk Bulens

15.1 Introduction 239
15.2 The Concept of the Digital Dowsing Rod 241
15.3 Digital Dowsing Rod Framework 243
15.4 User Acceptance Test 248
15.5 Spatial Behavior 258
15.6 Discussion and Conclusions 258

16 MNISIKLIS: Indoor Location Based Services for All 263
Vassilis Papataxiarhis, Vivi Riga, Vangelis Nomikos, Odysseas Sekkas, Kostas Kolomvatsos, Vassileios Tsetsos, Panagiotis Papageorgas, Stelios Vourakis, Vasileios Xouris, Stathes Hadjiefthymiades and Georgios Kouroupetroglou

16.1 Introduction 263
16.2 Related Work 264
16.3 System Architecture and Implemented Services 265
16.4 Positioning Subsystem 267
16.5 Middleware 271
16.6 User Interaction Subsystem 276
16.7 Conclusions and Future Work 280

17 geoHealth Monitoring – Real-Time Monitoring for Action Forces During Disaster Operations 283
Michael Lippautz, Manuel Kohlmann, Christian Sternig, Irene Piralli, Renate Rauchenschwandtner, Peter Haber and Simon Kranzer

17.1 Introduction 284
17.2 Intra System Communication 285
17.3 Sensor 286
17.4 Embedded System 288
17.5 Command and Control Client 291
17.6 Advantages / Disadvantages 298
17.7 Conclusions 299

18 Modelling Home and Work Locations of Populations Using Passive Mobile Positioning Data 301
Rein Ahas, Siiri Silm, Erki Saluveer and Olle Järv

18.1 Introduction 301
18.2 Theoretical Framework 302
18.3 Data and Methods 304
18.4 Results 306
18.5 Discussion and Conclusions 313

19 A Geographical Information System for Real Estate (GEOVAL) ... 317
Efstratios Stylianidis, Themistocles Roustanis and Nikolaos Karanikolas

19.1 Introduction 318
19.2 GIS Applications for Real Estate 319
19.3 The GEOVAL System 321
19.4 Conclusions 326

Section IV: Positioning and Sensor Fusion 331

20 Quality Assurance / Quality Control Analysis of Dead Reckoning Parameters in a Personal Navigator 333
Shahram Moafipoor, Dorota A. Grejner-Brzezinska, Charles K. Toth and Chris Rizos

20.1 Introduction 334
20.2 Introduction to QA/QC Analysis 336
20.3 QA/QC Analysis 337
20.4 Performance Analysis 343
20.5 Conclusions and Future Work 349

21 Efficient Overlay Mediation for Mobile Location-Based Services ... 353
Amine M. Houyou and Hermann De Meer

21.1 Introduction 353
21.2 Related Work 354
21.3 Overlay-Based LBS Design 356
21.4 Analytic Study to Query Overhead 359
21.5 Simulation Scenarios 364
21.6 Conclusions 370

22 Three-Dimension Indoor Positioning Algorithms Using an Integrated RFID/INS System in Multi-storey Buildings 373
Kefei Zhang, Ming Zhu, Günther Retscher, Falin Wu and William Cartwright

22.1 Introduction 374
22.2 3D RFID Positioning Algorithm 375
22.3 Integrated RFID/INS Positioning Algorithm 378
22.4 Experiments and Analysis 381
22.5 Conclusions 384

23 Prediction of GNSS Availability and Accuracy in Urban Environments – Case Study Schiphol Airport 387
Frank Kleijer, Dennis Odijk and Edward Verbree

23.1 Introduction 388
23.2 Line-Of-Sight Computations 389
23.3 GNSS Availability 392
23.4 GNSS Dilution of Precision 400
23.5 Conclusions 404

24 An Investigation of the Signal Performance of the Current and Future GNSS in Typical Urban Canyons in Australia Using a High Fidelity 3D Urban Model 407
Kefei Zhang, Gang-Jun Liu, Falin Wu, Liam Densley and Günther Retscher

24.1 Introduction 408
24.2 The Development of a High Fidelity 3D Urban Model 409
24.3 GNSS Performance Simulation 413
24.4 Conclusions 419

25 Using RFID and INS for Indoor Positioning 421
Qing Fu and Günther Retscher

25.1 Introduction 421
25.2 Positioning Using Active RFID 423
25.3 Determination of the Trajectory Using INS 429
25.4 Experimental Results 433
25.5 Summary 437

26 GPS/WiFi Real-Time Positioning Device: An Initial Outcome 439
Joon Wayn Cheong, Binghao Li, Andrew G. Dempster and Chris Rizos

26.1 Introduction 439
26.2 Developing and Testing the WiFi Positioning Algorithm 440
26.3 GPS-WiFi Integration 447
26.4 Conclusions 455