A Mobile Application for improved Communication in Cognitive Cities

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Introduction

The ongoing urbanization brings challenges and chances for cities and urban regions [6], [4]. Thereby, the concept of a city is challenged and transformed through a new city concept [4]. Smart cities and cognitive cities as defined by Mostashari et al. focus mostly on technology. This dissertation and its underlying papers enhance the concept of smart cities with cognition [2], [3], [5]. The focus of this dissertation lies in the enhancement of the concept of cognitive cities and in the creation of a mobile application. This mobile application intends to serve as a Personal Digital Assistant (PDA). Through the usage of the mobile application the creation of a cognitive city is one step ahead. The idea and the concept of the mobile application represent an augmented interaction between the users in a cognitive city by improving their calendar and mobility management through (semi-) automated reasoning. Applying Design Science Research [1] the mobile application is created based on an iterative cycle. Every included paper represents a further step towards the realization of the mobile application. The motivation was to build something new by adapting and synchronizing existing applications and enhancing them with cognition. Current concepts and applications (e.g., Google Now[1], IBM Watson[2]) use technology and computational intelligence to give suggestions and inputs. Whereas the idea of the mobile application created through this dissertation goes further and acts on the behalf of the user. The papers of the dissertation show the creation of the idea of the prototype (paper 1 and paper 2) in the context of e-government. Paper 3 presents the initial development of a paper prototype through further requirements engineering. This paper prototype was refined and subsequently evaluated with various experts. Paper 4 shows the evaluation of the paper prototype. The results and insights of the evaluation were the starting point for the development of a software prototype of the application. Subsequent requirements engineering as well as technological assessments were applied in the software prototype which is presented in paper 5. Paper 6 presents another prototype which is based on the same concepts but applied in another context. Instead of acting as PDA, the prototype presented in paper 6 shows a dynamic route planner in the tourism context. The papers included in the dissertation are published through international conferences and book chapters. The following list shows the titles, the names of the authors, the publishing venue of the included papers and the URLs.

Paper 1: Applying the Fuzzy Analytical Hierarchy Process in Cognitive Cities
Authors: Kaltenrieder, P., Portmann, E., D'Onofrio, S, Finger, M.
Publishing venue: International Conference on Theory and Practice of Electronic Governance (ICEGOV), 2014.
URL: https://dl.acm.org/citation.cfm?id=2691227

Paper 2: Enhancing Multidirectional Communication for Cognitive Cities
Authors: Kaltenrieder, P., Portmann, E., D'Onofrio, S.
Publishing venue: International Conference on eDemocracy & eGovernment (ICEDEG), 2015.
URL: https://ieeexplore.ieee.org/document/7114476

Paper 3: Digital Personal Assistant for Cognitive Cities: A Paper Prototype
Authors: Kaltenrieder, P., Papageorgiou, E., Portmann, E.
Publishing venue: Towards Cognitive Cities: Advances in Cognitive Computing and its Applications to the Governance of Large Urban Systems, Springer International Publishing, 2016.
URL: https://link.springer.com/chapter/10.1007/978-3-319-33798-2_6

Paper 4: Fuzzy Knowledge Representation in Cognitive Cities
Authors: Kaltenrieder, P., Portmann, E., Myrach, T.
Publishing venue: IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), 2015.
URL: https://ieeexplore.ieee.org/document/7337951

Paper 5: Personal Digital Assistant 2.0 – A Software Prototype for Cognitive Cities
Authors: Kaltenrieder, P., Altun, T., D'Onofrio, S., Portmann, E., Myrach, T.
Publishing venue: IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), 2016.
URL: https://ieeexplore.ieee.org/document/7737872

[1] http://www.google.com/landing/now/
[2] www.ibm.com/smarterplanet/us/en/ibmwatson

Paper 6: A Dynamic Route Planning Prototype for Cognitive Cities
Authors: Kaltenrieder, P., Parra, J., Krebs, T., Zurlinden, N., Portmann, E., Myrach, T.
Publishing venue: Designing Cognitive Cities, Springer Nature Switzerland AG, 2019.
URL: https://link.springer.com/chapter/10.1007/978-3-030-00317-3_10

References

[1] Johannesson P, Perjons E (2012) A design science primer. In: Create Space Publisher
[2] Kaltenrieder P, D'Onofrio S, Portmann E (2015) Enhancing multidirectional communication for cognitive cities. In eDemocracy & eGovernment (ICEDEG), 2015 second international conference on, pp 38-43, IEEE, 2015
[3] Kaltenrieder P, Portmann E, D'Onofrio S, Finger M (2014) Applying the fuzzy analytical hierarchy process in cognitive cities. In: Proceedings of the 8th international conference on theory and practice of electronic governance, pp 259-262, ACM, 2014
[4] Kelly III JE, Hamm S (2013) Smart machines, IBM's Watson and the era of cognitive computing. Columbia University Press, New York, Chichester, West Sussex
[5] Mostashari A, Arnold F, Mansouri M, Finger M (2011) Cognitive cities and intelligent urban governance. Network Industries Quarterly 13(3):4-7
[6] United Nations Department of Urban and Social Affairs (2008) World urbanization prospects: The 2007 revision – executive summary. http://www.un.org/esa/population/publications/wup2007/2007WUP_ExecSum_web.pdf. Accessed 8 June 2015