WEB-BASED AND CONTEXT-SENSITIVE, MOBILE GEO-TOOLS TO SUPPORT SPATIAL DECISION MAKING IN HEALTH AND EMERGENCY MANAGEMENT

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Abstract: The availability of reliable spatial information is often a prerequisite for rapid decision making in health-, and emergency management. Meanwhile, there are many variations of "Geographical Information Systems" (GIS) on the market, ranging from Desktop-GIS and Internet-based GI-services to various kinds of mobile applications, the latter often localizing themselves via the GPS. The different forms in which GIS occur can be used in various specific situations and for different problem-solving tasks. Some of these technologies are introduced briefly, based on concrete examples from a running research project, called "GeoToolsHarz-Advanced" (GOTHA). Some aspects that are worthwhile to be considered aiming at a better support for health and emergency management through the application of spatial technologies are highlighted.

1 INTRODUCTION

Decision making in health- and emergency management is based on spatial information in many cases. On the one hand, health related issues concern the spatial distribution of medical care stations, hospitals, emergency facilities, and other related entities. On the other hand, many problems occur that concern the spatial relationships between such entities. The "shortest" or "fastest" route between private households and the next hospital, the "nearest" specialized doctor, or pharmacy are examples. Such relationships become significant taking into account an aging society, where elder people, for instance, aren't necessarily able to manage large distances to receive ambulatory care. Both, the spatial distribution of medical facilities, as well as the analysis of spatial relationships between them, has to be seen in different spatial contexts (local, regional, and smaller scales). Geographical Information Systems (GIS) are an adequate means to support the collection, analysis, and visualisation of health related information. This is true concerning the spatial distribution of health- and emergency-relevant facilities, linked to fixed locations, as well as the relationships between them. Furthermore, mobile GI applications are able to track vehicles and control how they can get to a place of accident or a burning house on the fastest way, ideally taking into account short-term traffic information and current troubles caused by roads under construction and similar issues.

This way, GIS in its various forms are effective means to support decision making. Health-related content, processed by desktop-, web based- or mobile applications, can be used "indoors" and "outdoors" and is therefore suitable to support a complete digital information flow.

2 THE GOTHA PROJECT

In its current phase, the "GeoToolsHarz-Advanced (GOTHA)"-project is aimed at the conceptualization and prototypical realisation of webbased and mobile GI applications to support route and travel planning.

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Meanwhile, there are many route planners available showing different characteristics and functionalities. A basic deficit, however, is the lack of opportunities to define individual criteria to modify route and travel planning more exactly due to user requirements. Different user groups have different requirements which have to be taken into account properly, but aren't in many applications so far. Furthermore it has to be recognized that such groups are not homogenous in themselves. For instance, the requirements of bikers in the age between 20 and 30 will be considerably different from those between 50 and 60 (Wilson and Curzon, 2006). This might concern factors such as type of bike, pavement of roads, preferences regarding length of trip, maximal difference in altitude to be conquered, road-types and landscape aesthetics. But also personal needs e. g. shape and health of the individual are important aspects. Such "subgroup"-specific requirements should be taken into account, otherwise the application will not fit the market needs (Pontikakis, 2007). As a consequence, services must provide functionality that enables users to specify their special needs, conditions, and desires. This is a challenge for GUI programming, as well as the implementation of functions to calculate the "right" route under explicit consideration of user-specific criteria (Richter and Duckham, 2008). However, the goal is not to provide prepared, static routes but to enable individual and dynamic planning of such routes, almost enabling the user to modify plans due to changed goal settings. This requires also to combine the route-planning tool with other information that could be helpful during a trip, e. g. accommodation opportunities, public transportation, restaurants, shops, pharmacies, surgeries, etc..

From 2006 – 2008 the state of Saxony-Anhalt in Germany funded the "GeoToolsHarz" project as part of the "competency centre for information- and communication technologies, services, and tourism" (KAT) at the Harz University of Applied Sciences in Wernigerode (Rudert et al., 2008). Within this project, a prototypical web-based geoportal has been developed that couples data of public traffic providers, as well as touristic information in a layer-oriented manner. The entry point is built by a topographical map, other information layers can be overlayed easily. The application is developed using web mapping services conform to the standards and specifications of the Open Geospatial Consortium (OGC 2009).

The project "GeoToolsHarz-Advanced (GOTHA)" started in January 2009 and is continuing the previous work under some new goal settings. GOTHA is now based on a public-private-partnership. The brain SCC GmbH Merseburg is supporting the project financially due to the identification of common approaches and goals. One aim of the project is to bring the expertise of both institutions together to achieve a more sophisticated approach to user-centred applications.

One focus of GOTHA is, apart from the web based application for route-planning, the mobile component. Currently, tests are carried out with different kinds of cell- and smartphones to provide geographic information, combined with context-sensitive information about the surroundings of a user.

Figure 1 shows a prototypical implementation of a web map service developed within GOTHA, running on a cell phone and showing points-of-interest in a city centre.

Figure 1: The mobile component of a webbased GI-application, developed within the framework of the GOTHA-project, showing points of interest (POI) in an urban environment.

3 TRANSFORMATION OF CONCEPTS TO NEW APPLICATION AREAS

The results achieved so far indicate clearly that the concepts developed in GOTHA can easily be transformed to other application areas. Web mapping services, for instance, can be used to visualize the location of health- and emergency-

related facilities. On the one hand, they must be made available for the Internet via standardized web mapping services. On the other hand, they can be transferred to a mobile GI-tool which enables the user to explore maps for the best route from A to B or to find the next pharmacy, surgery, hospital, police- or fire station. Of course, current attributive information, or content, must be linked to such points-related objects. This way, the web GIS as well as the mobile GIS give comprehensive information that helps to make the right decision in a concrete emergency situation or in case of a more or less sudden occurrence of an illness (Figure 2). Such tools are especially helpful in unknown areas. They can be used by citizens, but also experts, such as emergency helpers, firemen, and many other persons confronted with healthcare- or emergency-cases. They have to rely on such tools that allow access to spatially referenced information wherever and whenever they want.

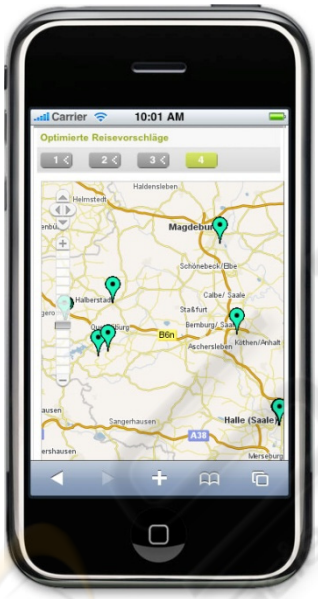

Figure 2: A variant based of the mobile tool, based on another hard- and software platform; every POI enables access to further content, e. g. healthcare- or emergency-related information.

Figure 3 gives an overview of the current prototype that underlies the GOTHA applications. It combines a content management system (CMS) (Typo3 and GeoCMS) to extract specific content for the web application on the one hand, and the mobile application on the other. On the right side the POI extension, the route planner and other applications are linked to the CMS. The mobile component, however, gets further content due to its capability to locate itself via GPS and therefore can give hints on specific facilities near to the current location of the user. In an emergency case, for example, this can be the locations of the next surgery and a fast calculation of the best way to the nearest doctor or hospital, functionalities that provide automatically urgently needed information to the user.

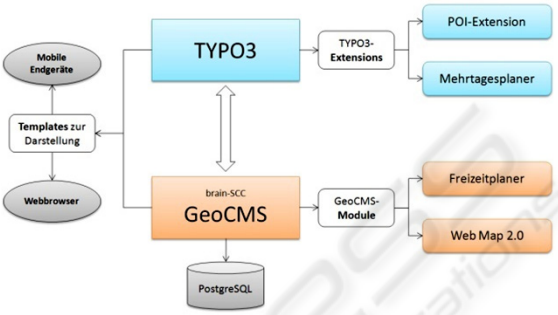

Figure 3: The content for the webbased and the mobile application is, among other sources, extracted from a Content Management System (CMS).

4 CONCLUSIONS

The results achieved so far are promising to achieve the goal of more individual GI applications on the one, and more sophisticated mobile applications on the other hand. Users can easily access complete content about health- and emergency specific conditions in a rural or urban area.

Mobile GI tools, however, can provide the same services. Additionally they can provide context-sensitive information. If required, individual aspects can be entered to get more user-centred results. Such additional functionalities can be extremely helpful especially in situations in which only little time is given to search for relevant information (Pundt 2008). In emergency cases, however, such location based, and context-sensitive tools as they are under development in the GOTHA project, can represent an important support.

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