

GIS Support for Multi-Modal Mobile Map Interaction

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Within this contribution we want to explain how GIS can be enhanced in order to support multi-modal map interaction for tour planning and navigation with mobile devices within the SmartKom project funded by the BMBF. Partners include the German Research Center for Artificial Intelligence (DFKI) as coordinator and industrial partners like DaimlerChrysler, Siemens or Sony. One of the scientific goals of *SmartKom* is to explore and design new computational methods for the integration and mutual disambiguation of multimodal input and output on a semantic and pragmatic level exploiting the coordinated use of different code systems, like language, gesture, and mimics. These concepts are being tested and demonstrated as running systems in 3 scenarios (we focus only on the 3rd within this contribution:

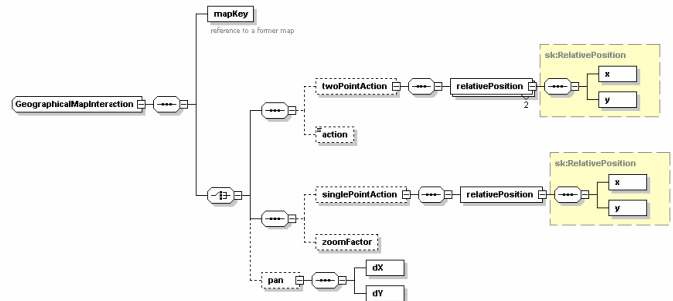
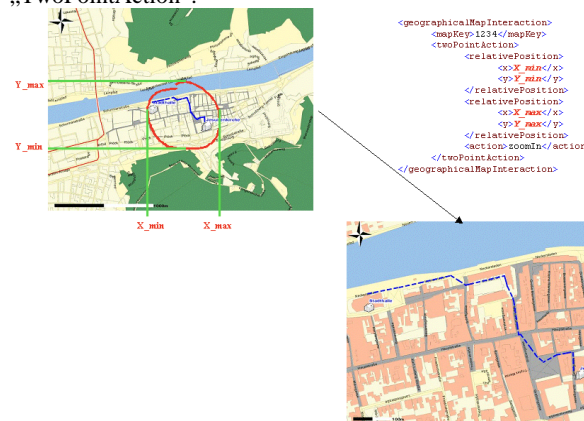
1) *SmartKom Home/Office*: a personal multimodal device comparable to a desktop computer.

2) *SmartKom Public*: a multi-media communication center in central public places

3) *SmartKom Mobile*: the *SmartKom Mobile* device acts as a digital companion that provides the system's functionality and services to mobile users (pedestrian and in car) to support the location-sensitive access to services.

SmartKom Mobile enables the user to plan integrated (pedestrian&car) trips using multimodal interaction (i.e. speech & pointing gestures). The system displays (e.g. routes) output in the form of maps or slide shows on sight. An animated avatar provides further information using synthesized speech. Recently incremental route planning for pedestrians is being enabled. Within this contribution we explain how we have modelled and developed support for multi-modal map interaction for mobile devices within the GIS components of the *SmartKom Mobile* prototype, implemented in the module *service.navigation.pedestrian*, which itself is realized as a multi agent system (MAS) within the overall blackboard system.

Fig.1: realizing a gesture for zooming in as **Fig. 2: GeographicalMapInteraction** as XML Schema „TwoPointAction”.



Different types of map interactions for mobile services have been identified, modelled and are supported directly by the map-service in order to support the dialogue-management components to provide multi-modal dialogues. This facilitates the future use maps in multi-modal mobile applications.

The mentioned interaction types and how they are being supported will be presented in the poster and the interactive demonstration of *SmartKom Mobil* at COSIT. We need to distinguish the following two situations that are being supported:

Trip planning: A trip typically consists of multiple route segments to be covered either by walking or driving. This requires specifying start and destination, as well as optional stops. The user may also wish to specify different route types (e.g. shortest) and other properties. He may be interested in advance in distance, duration, details of points of interest nearby etc.

Trip execution: This includes *incremental* guidance and monitoring. It involves timed presentation of driving directions based also on positioning information. For pedestrians it also involves *proactiveness*, e.g. by presenting additional navigation-unrelated information available from digital maps. The incremental guidance works as explained below:

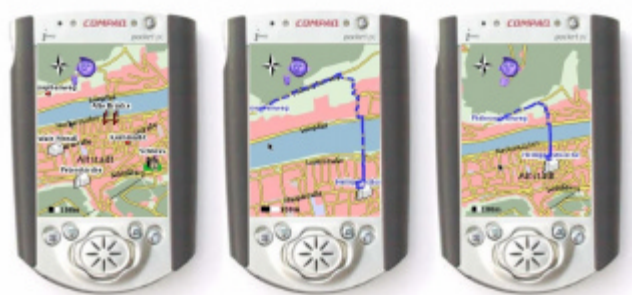


Fig 3: Generated maps with animated avatar „Smartakus“

- (1) The module *service.navigation.pedestrian* receives a request to navigate a calculated route
- (2) Dependent from the position navigation instructions including information on sights along the route are being generated by the system
- (3) The user arrives at the end location.

Within (2) the module incrementally generates messages of type *GeographicalIncrementalGuidance* (which will be explained at the conference) including the needed instructions and information. While this sounds easy we just want to mention the following requirements and resulting properties of the system (A/B):

A) The guidance lasts for a longer period of time. Within that the user also has the possibility to use other system features. The system needs to tread these concurrent input and output.

B) The external situation or user preferences (also according to the interaction) may vary: This means that the same interaction-steps need to be supported by dynamically changing combinations of modalities.

The system is also novel in that it allows integrated trip planning (pedestrian and car) using multimodal interaction. At COSIT we aim for presenting an interactive poster that actually shows the realized multimodal map interaction on a mobile device (if resources will allow to do this).

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