POINT TO DISCOVER

RAINER SIMON TAKES A PEEK INTO THE PHONE OF TOMORROW AND SOME OF THE FUNCTIONALITY WE MIGHT COME TO EXPECT.

Mobile phones are becoming increasingly feature-rich. Large, bright color screens, megapixel cameras and Internet connectivity have become the norm even for low-end models nowadays. But tomorrow's phones may well come equipped with entirely new features: Integrated GPS, digital compass and tilt sensors could enable future phones to sense their position and orientation in 3D space. The *Point to Discover* project – a joint research project of the Telecommunications Research Center Vienna, Austria, together with Austrian mobile phone operator mobilkom austria and Siemens – explores how these new phones could change the way people navigate, explore and interact with their environment.

Discovery

Imagine you could point your mobile phone at a bus stop to find out when the next bus is leaving; or point at a tourist landmark to get travel guide information; at an advertisement billboard to take part in a prize draw; or at a mountain top to find out the name of the mountain while you are hiking or skiing. *Point to Discover* (P2D) is a joint academic/industry research project that explores the technologies behind this and other innovative concepts for how people might discover and access information about their immediate environment in the near future.

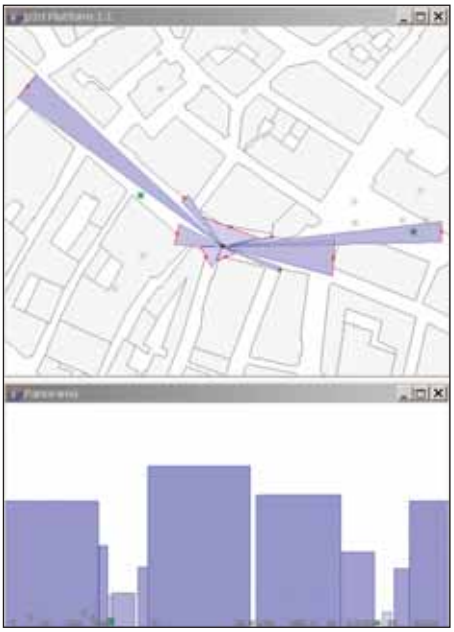
On the World Wide Web, geo-information has recently turned into a fashionable topic: Mapping services like Google Maps, Yahoo Maps or Microsoft Live Search Maps, as well as new geo-browsing applications like Google Earth or NASA World Wind have moved geospatial data and applications into the focus of the public, raising the awareness for the usefulness of geographical information for a variety of purposes – from education, to planning of day-to-day activities, to entertainment. It is this recent popularity of geo-information, combined with the growing trend towards GPS-equipped mobile phones, which has inspired the primary goal of the P2D project: to transfer the usefulness, the intuitiveness, and the excitement of geo-spatial mass-audience applications to the mobile domain. The objective of the project is two-fold: First, P2D aims to create a toolset and an open application platform for building *spatially aware* mobile applications – applications that access, manipulate or produce information related to the vicinity around a mobile user. Second, the project develops a set of prototype user interfaces that demonstrate and test several possible interaction concepts and scenarios in practice.

P2D Application Platform

The P2D platform is the heart of the project's geo-information infrastructure and the server-backend behind *Point to Discover's* spatially aware mobile applications. The platform is built on top of an industry-standard spatial database and essentially acts as a search engine that mobile applications use to query for geo-referenced content in the background.

Since the P2D platform was designed with the unique characteristics of spatially aware mobile applications in mind, its search functionality works different than that of traditional spatial databases or existing geo-spatial search engines on the Web. *Visibility* is the keyword in the P2D search process: Using a three-dimensional block model of the environment, the platform computes which geographic features – points of

Accessing geo-information by pointing.



P2D query engine – result visualization.

interest as well as buildings, as shown in the image – are visible from the user's current location, and which are hidden. The resulting information is encoded, and sent to the mobile phone over the wireless link.

Mobile Interaction Methods

Based on the information delivered by the P2D search engine, different innovative methods for how users can discover, access and interact with geospatial information on their mobile phone are possible: Accessing information by pointing is one of them, but there are more concepts that are being tested in the project. Classical location-based text- or map-based interfaces, augmented with information about the visibility of points of interest, as well as animated, real-time graphical interfaces that react to compass heading are currently under development; for example, a rotating map interface that rotates as the user turns, or a compass-interface that indicates points of interest in the vicinity by arrows on the screen, and which stays aligned with the real-world environment as the user moves and turns. A further type of interface makes use of the platform's ability to compute schematized 360-degrees panoramas (as shown in the image above), presenting nearby buildings and points of interest in a simple skyline-view that scrolls horizontally as the user turns.

Due to the structure of the encoding format in which the P2D platform transmits its query results to the mobile phone, it will be possible to build more advanced user interface types and interaction concepts as mobile phones become more powerful, and orientation sensors become more accurate. With sufficiently accurate positioning, heading- and tilt-detection, the platform could in fact support basic *augmented reality* interfaces, where points of interest are indicated by labels superimposed on the phone camera image. By panning the phone across our field of view, we could reveal information about places and objects in our vicinity: from historical and tourist information, to up-to-date public transport schedules; from real-time environmental monitoring data to virtual notes or 'digital graffiti' left there by other people – mobile phones would uncover a hidden world of geo-information that constantly surrounds us.

Hardware Prototyping

First mobile phones that feature the necessary hardware to realize the vision of spatially aware interaction – such as, for example, the *SonyEricsson W21S* that combines GPS and compass – are already beginning to appear on the market. Despite this emerging trend, no device is available commercially yet that combines all three necessary sensor types – position, heading and tilt – to realize full 3D orientation awareness. A specialized hardware prototype therefore had to be developed in order to be able to test spatially aware applications in the field.

A first generation prototype produced during the project is shown in the image. The prototype combines a 2-axis accelerometer-based tilt sensor with a digital magnetic compass and is mounted to a custom housing that snaps onto the back of a standard, mass-market mobile phone. It has a standalone power supply and communicates with the phone via Bluetooth. A second generation prototype that also integrates GPS as well has been developed as well, and is currently being used for first function trials in the city of Vienna, Austria.

Acknowledgements

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Different user interface types – based on the unified P2D query data format.

P2D hardware prototype.