Introduction
If you are walking or cycling, and don’t want to (or are unable to) spend most of the time focusing on a screen, the use of mobile devices tends to be a frustrating experience. The same is true in bright sunlight or if your eyesight just isn’t good enough to see every detail on the mobile screen.

It is often hard to see text on a mobile screen

The persisting problem of displaying information on the small screens of mobile devices is pushing both display development making use of sounds, gestures and the sense of touch. Improved multimodal perceptualizations (visualization including other senses than the visual) would make applications more accessible and easier to use in actual mobile, navigational situations.

The HaptiMap project, Haptic, Audio and Visual Interfaces for Maps and Location Based Services (FP7-ICT-224675), is aimed at making maps and location based services more accessible by using several senses like touch, hearing and vision.

HaptiMap is a four year project, and is currently half-way: HaptiMap started in 2008 and has been running for two years.

HaptiMap will enable digital maps and mobile location based services to be accessible to a wide range of users. Our strategy is: to develop tools that make it easier for developers to add adaptable multimodal components (designed to improve accessibility) into their applications; to raise the awareness of these issues via new guidelines and to suggest extensions to existing design practices so that accessibility issues are considered throughout the design process.

HaptiMap outcomes
Multimodality is a useful addition for navigation applications, allowing transfer of information from the relatively overloaded visual sense to hearing and touch. In HaptiMap we are looking at ways to effectively employ touch and hearing to make map and navigation applications more useful and engaging as well as more accessible to users with impairments.

HaptiMap progress
During the first year on the project we focused on user studies and on laying the foundations for the implementation work. Our studies of visually impaired, elderly and sighted users indicated general similarities in the types of information all people need, although we observed that in general visually impaired users require a
higher level of detail. The contemporary lack of a proper solution for pedestrian navigation was apparent throughout the year one studies. All user groups stressed the need for better adaptation of information and device interaction to the pedestrian situation (preferably organized in layers to allow different levels of detail). There were also requests for more use of additional sensory channels – as well as hands-free use.

In the second year we have focused more on interaction design research, and iteratively carried out user studies on how to perceptualize maps and navigational information. We have implemented the first version (the core) of the HaptiMap software suite – the HaptiMap toolkit - and in parallel started the design of a set of demonstrators aimed at illustrating the usefulness of the HaptiMap designs and toolkit. To support industrial design development practices we have contributed to standardization efforts, and we have investigated how video scenarios can make developers more aware of accessibility issues. We have also run a set of workshops with industrial developers in order to test and refine our ideas.

HaptiMap was disseminated widely in 2009/2010, through technical papers and presentations at conferences (CHI, Mobile-HCI, Pervasive, LBS& TeleCartography and AAATE to mention a few) as well as through exhibitions at the European Conferences on Disability (2009, 2010), GIExpo, CeBit and Galileo application days. We also organized a workshop “Multimodal Location Based Techniques for Extreme Navigation “ in conjunction with the Pervasive Conference in Helsinki.

To strengthen the commercial participation in HaptiMap a new partner working with the development of innovative approaches to navigation and location-based services, GeoMobile GmbH (Germany), has been added to the consortium.

The user centered activities have been tightly coupled to the research on user interfaces and the planning for the demonstrators to be developed in the next year. There have been studies carried out concerning visual map display for people who have limited eyesight as well
as studies using only vibratory and/or sound feedback for map feature display and guiding. A special study was conducted to determine different causes for getting lost, and another was conducted on the design and recognition of feasible patterns for guiding when using only haptic force feedback via the mobile ViFlex device.

**Testing haptic feedback patterns**

User scenario walks have been conducted to inspire interaction design and discussions on map information content. Furthermore, a study involving blind and sighted users riding tandems together was conducted to elicit information about the type of information required to involve the blind co-driver actively in the route travelled.

**Pointing the device can indicate directions and also provide orientation and overview**

In order to strengthen our efforts to make developers and designers aware of the importance of tactile and audio feedback in mobile applications we have also done interviews and video observations “in the wild” of how mobile applications are actually used.

During the second year we have continued our studies of how multimodality can be employed to improve navigation and way finding. Informed from the year one user studies we have looked different scenarios in which users navigate and how multimodality can be effectively employed and have explored how these situations can be supported with current technologies.

We have found that low-fidelity tactile and auditory information can provide an effective way to communicate information about points of interest and landmarks to users in a way that is both straightforward and unobtrusive. As a means of evaluating this we have released the PocketNavigator onto the Android Market. This means that anybody can download it and allows us to gain useful feedback and follow an iterative development cycle. What we have learned is also being fed into the development of new novel hardware which can be incorporated also into accessories or clothing.

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with mapping and location based services also through the senses of sight sound and touch.

The Haptimap toolkit is adaptable in the sense that, firstly: When built from source it adapts to the target platform’s capabilities, e.g. recognising what capabilities are available (motion sensors, sound player and screen size). And secondly: It is adaptable when in use, for example, a Bluetooth GPS location device may come into range, or may go out of range. The toolkit is cross platform - it builds for use with mobile platforms: Windows Mobile 6.x, iPhone OS versions 3 and 4, Symbian 3rd and 5th editions, Android 2.x and higher (using the JNI), Linux phones (such as Open Moko) and Maemo 4 (Diablo) and 5 (Freemantle). For desktop platforms: Windows (XP, Vista, and 7), Linux and Macintosh OSX (Leopard 4.5 and Snow Leopard 4.6). It can be used to build applications for such versatile applications as route planning and choice of map properties to display when the map is used on a mobile device.

To demonstrate the toolkit we have started to develop nine demonstrator applications. The demonstrators range from more accessible version of commercial applications, such as NAVTEQ Connect or GeoMobile’s JUICY BEATS Event Guide, over to newly developed research applications, to sample applications specifically targeted at developers. More features are to be expected in spring 2011 when the demonstra-

tors will be evaluated in different settings and with diverse user groups.

To support industrial design processes, we have participated in standardisation (ISO/IEC, CEN/CENELEC and ETSI) work in order to develop standards to support accessibility, and we have also worked with different types of materials useful for developers and designers (such as video scenarios). Beside the involvement in standardisation and regulation matters we have discussed our ideas at workshops with Sony Ericsson, Höft & Wessel, and others. In addition we co-organised and participated in the BITKOM industry forum on accessibility in Berlin at the 10th February 2010.

During 2010 we detailed our initial exploitation plans for the potentially commercial results of HaptiMap. The main commercial results will include extensions to the core toolkit and real-world demonstrator applications of navigation solutions. Competitor details, user characteristics, market analysis and financial planning were generated for both the Haptimap toolkit and the commercial demonstrators (event guides) during the year. At this stage, with approximately half (24 months) of the projects lifetime remaining, it is clear that the huge growth in the LBS market means that HaptiMap is a very timely initiative. We believe that the main deliverables of this project, the toolkit and the audio-haptic guidelines, can underpin a profitable business model when used by mobile LBS developers.

Project website: www.haptimap.org