

Location-Based Services For Mobile Users In Protected Areas

The WebPark project is a European funded research project that aims to develop personalised value-added location-based services (LBS) and create a platform for recreation in coastal, rural and mountainous areas. This service will utilise existing information currently delivered to tourists and professional users of recreation and protected areas via CD, kiosk and web. It will be developed around a personalised user profile maintained centrally with input from the user and a flow of positional information. This enables users to request information from several databases from their mobile phone or Personal Digital Assistant (PDA) and automatically filter the information based on location, time and user profile relevance.

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WebPark Services

-Availability Of Services

A distinction is made between general, freely available services and premium, pay-per-use services. Micro payments are based on an Internet wallet account where individuals can establish a cash balance. The premium services, requiring a user subscription, will provide additional personalisation capabilities and also push services. Example of premium services could be weather changes or avalanche alarms. However, depending on the business model of the service providers of such services, the services could equally be defined as freely available although these are personalised push services.

-Value of Services

From an end-user point of view, the value of services can be judged by the accuracy, relevance and timeliness of the information

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sent to them. Meeting these expectations is achieved by knowing the past and present user location, accurate information provided to the user by the user profile manager and a natural language search engine component. A location-tracking component provides information on an individual's spatial footprint for preparation of relevant maps and other geo-information. The user profile manager enables fast and accu-



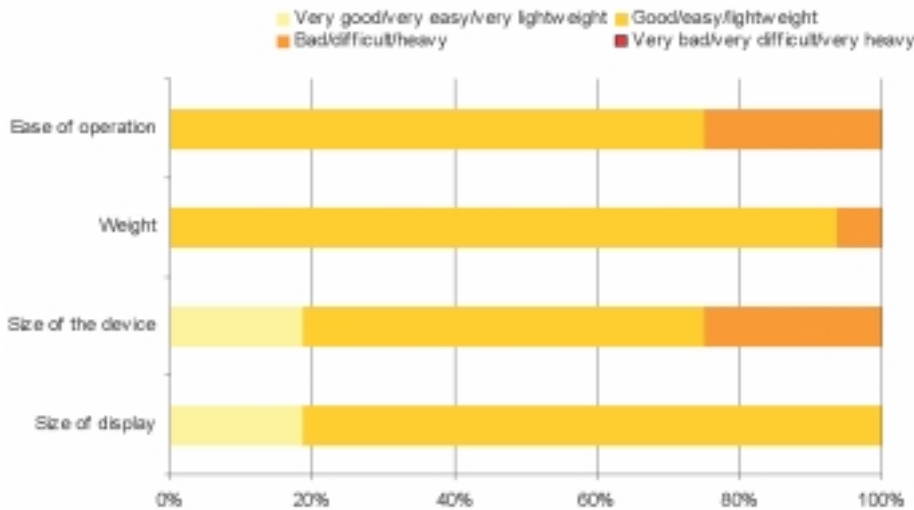
The new geographical commerce (G-commerce) applications can use position and time of the user to offer 'just-in-time' and 'just-in-place' information that leverages knowledge from adaptive personalization. As the results, it enables users to request information from several databases from their mobile phone or PDA and filtering the information based on location, time and user profile relevance. The kind of online information users could expect are: weather and tidal, flora and fauna, routes and tracks, hotels and restaurants, positioning of oneself, unexpected danger, and much more.

rate presentation of data according to the user's specified preferences and interests. Finally, the information query engine provides the most relevant information filtered and elaborated from dedicated databases



Test trails used for the summer testing (the Grimmels region in the Swiss National Park, Map data (c) 2002 Swisstopo (BA024687)).

How do you rate the general handling of the device?



and Internet resources. The service will provide personalised, relevant information on demand for mobile users within recreational areas via wireless connections.

-The Target End-Users

The target end-users for these new location-based information services are people with interests in outdoor protected areas such as national parks and recreational areas. The experience of administrations of such areas suggests that users already take their phones with them when they go hiking, cycling, and mountaineering and will be prepared to buy information to help them make more informed decisions about their daily plans. This information will have to be geographically relevant and charged by micro payment to be an attractive on-site purchase. The extension of service coverage by mobile operators into rural areas also means that protected and recreation area administrations and the safety authorities have an interest in such services. Such bodies wish to deliver alerts to the mobile device to improve conservation and avoid safety problems and use such platforms to implement Enhanced 112 emergency services.

Delivery platform

3rd generation digital mobile operators will offer users high bandwidth mobile Internet services; some 2G/3G operators already deliver real-time LBS using positioning derived from the GPS or network triangulation methods. The availability of smart phones and PDAs makes it possible to deliver maps, imagery, photographs and text to mobile devices with screens ranging from 120 x 160 to 480 x 640 (VGA) resolutions. With the progress of geographic

information (GI) data integrators there is now a supply of digital GI content that can be delivered using e-commerce.

New geographical commerce (G-commerce) applications can use the time and position of the user to offer 'just-in-time' and 'just-in-place' information that leverages knowledge from adaptive personalisation. Such LBS can offer the user services that are adapted to their interests and current situ-

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ation, as well as providing them with control over their private location and transactional information. Delivering on the promise of info-mobility in GI requires that groups of G-commerce partners be brought together to form new value-chains. Since many of the GI data providers are in the public sector, the WebPark project would offer opportunities for protected and recreation area administrations to exploit their information. WebPark aims to be innovative both on the level of the overall architecture and business model, and also at the level of its technology and GI data integration process. The project contributes to research in GIS architectures, digital terrain models (DTM), visualisation, info-mobility, G-commerce, intelligent agents, geo-library protocols, protected area administration and tourist development.

Location Positioning Techniques

Positioning techniques for mobile devices in rural areas have different characteristics to techniques in more built up areas. Network coverage is likely to be more sporadic than in urban areas resulting in more frequent loss of service and hence occasions when the device cannot be located. The Swiss National Park, a WebPark testbed, has particularly good coverage for a rural area (as the park is cut by a communication road, which makes the installation of base stations economic) even so, positioning from the network is unlikely to prove sufficiently reliable for fine resolution location-based services.

-Network Positioning Techniques

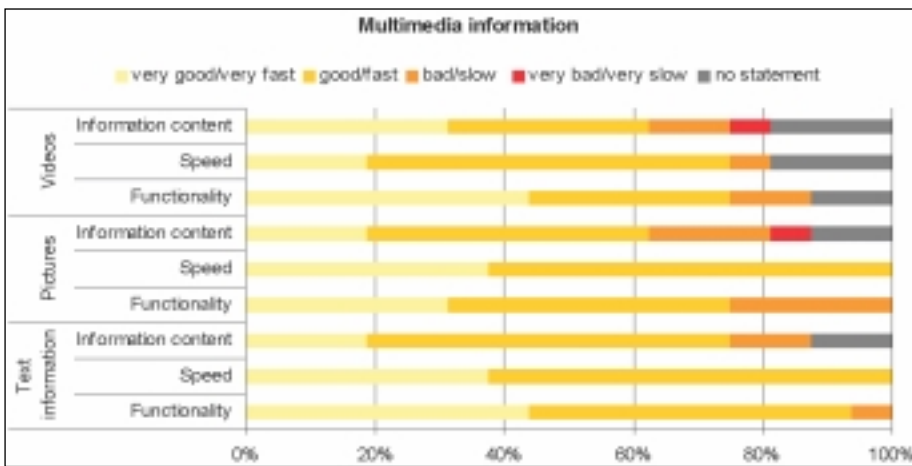
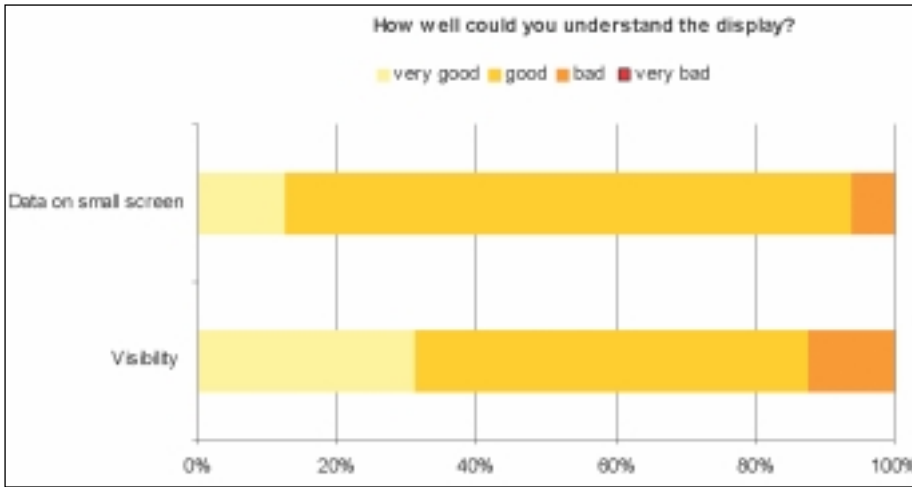
Network positioning techniques are generally more accurate in areas with a high concentration of base stations. This is true for both cell identity and network triangulation techniques, whether enhanced by considering the direction or distance of the device with respect to the base station or not. For outdoor applications the increasing availability of integrated GPS and PDA technology offers a more robust positioning service that can continue to provide location-based information even when a network connection is lost completely.

-Device Positioning Strategy

In developing a device positioning strategy, the WebPark consortium has chosen to include the combination of GPS equipped PDA, either the users own device or one rented locally as a 'wireless tour guide' for the duration of the visit. This approach is also motivated strongly by safety; a device that can position itself independently and store locally cached maps can guide the user back to help or shelter. A device that relies upon a network connection can give the impression of safety but may fail at the time of need.

Spatial And Temporal Metadata

In order to provide the user of a service with timely and location-based information, it is essential that comprehensive metadata is stored for all entities and phenomena that form the service's database. Defining the geographic relevance of the data (that is its spatial and temporal range and characteristics) is crucial to the efficient supply of personalised information to mobile users since this can increase the value to that individual. A study, assessing user needs



tors will be asked to “opt in” to the service that, for the duration of their visit, will track their movements and assist their enquiries. Analysis of their spatio-temporal behaviour can reveal preferences and characteristics such as whether they prefer the town or the country, the times of day when they are active, the types, lengths and difficulty of trails they like to walk and their walking ability. Comparisons between an individual user’s progress along a trail and that of previous walkers can reveal how long the remainder of the route is likely to take them and provide warnings if they are unlikely to return before nightfall. A viewshed from their immediate location can be overlapped with points of interest and their preferences used as a filter to push information pertinent to them. Such combinations of techniques promises smart delivery of information to visitors, moving away from the ‘one size fits all’ approach and instead sending geographically relevant information that is of use and interest to the individual.

Webpark Research and Development Initiatives

The WebPark consortium attaches paramount importance to and stresses continuous research, testing and development of the WebPark concept and system. Continuous research and testing are necessary to capture constant end-users needs, information availability and new technological developments within the IT field. This in turn enables the project to build and deliver a robust, interoperable LBS platform that provides information relevant for users. Matching users’ information needs to information availability is one of the central subjects within the WebPark project. In preparing the WebPark service it has been important to understand:

- the character of the available information;
- the characteristics of the information delivery mechanisms;
- the drivers behind the ‘information needs’ of the potential user, especially their tasks;
- the modes of access supported by the system.

-Information Audit

By implementing an information audit, the WebPark consortium has been trying to determine the kinds of information that might be relevant to potential users in specific testbed locations. The three essential issues involved in the information audit are the information,

based upon visitor shadowing in the Swiss National Park found that 60 percent of unprompted visitor questions had either a spatial or temporal reference. In most cases a ‘range’ could be placed on the query. For example, “Are Ibex found here?” has a wide spatial range measured in hundreds of meters, whilst “Are these caves man-made?” is relevant only to a specific location.

-Spatial Metadata

Metadata is often more concerned with the nature of the data itself rather than its geographic location. GI scientists are familiar with the notion of spatial metadata from different disciplines. The forthcoming ISO19115 standard aims to bring the diverse approaches together. In addition the Open GIS Consortium (OGC) open location services initiative (OpenLS - www.openls.org) provides a framework by categorising the types of services that will be available to users of mobile devices.

-Temporal Metadata

Temporal metadata however has traditionally been used for data versioning and may be limited to a single time-stamp, if included at all. This fails to consider the true temporal footprint of entities and phenomena such as the degree of permanence of

the data or any cyclical trends. Many phenomena observed in the Swiss National Park are influenced by natural temporal cycles that occur daily, annually or based on other timescales. Alpine meadow plants like edelweiss tend to flower in June and July; this can be used to define a cyclical temporal pattern for when queries about the flowers themselves are relevant. Combined with a spatial footprint based upon habitat preferences for individual species (such as elevation, steepness of slope, aspect and known land-use) the geographic relevance of specific plants to different locations at different times can be stored. Other types of information, such as events, have a fixed period of relevance that once exceeded, immediately becomes of limited use. Such understanding of the data can assist user queries in the field, predicting their information needs based upon their location and the time.

Personalisation

Approaches to spatial and temporal metadata used to define geographic relevance can also be applied to the visitors to rural leisure areas to tailor the information sent to them, hence increasing its value. In addition to demographic information, visi-

the delivery mechanism and the user preferences. Specifically it relates the spatial and temporal characteristics of the information types to the the location, time and preferences of the users via the WebPark delivery mechanism. While each of the WebPark software components must be developed independently they must also operate together.

-Surveys on Users' Information Needs

In addition to information audit, the WebPark consortium has been carrying out surveys on users' information needs through various research techniques, including questionnaires and prototype services. The latter aims to test the WebPark concept by shadowing and monitoring real potential users in recreational parks. To cover cultural background differences and country specific technological development, the WebPark consortium had carried out questionnaire surveys by means of mailing and online questionnaires in three different countries within the first half year of this project. Surveys had been conducted in the Swiss National Park (SNP, Switzerland, main test area), Waddensee National Park (the Netherlands) and Dartmoor National Park (England).

Below are a few important points raised by potential end-users about the type of information required during the survey:

- Safety information, such as actual information on the state of the trails and weather changes, is of key importance for outdoor recreation.
- Visitors are generally interested in navigation media. In the context of LBS, not only do digital maps have to be provided but also tools for the profile-visualisation of the planned trip and actual location based information on the topography of the route.
- Wildlife information is highly demanded so thematic maps for vegetation and animal occurrence are necessary (this should be enhanced by further information sources on these topics).
- The information provision has to be quick and to be provided on request. Audio mobile alerts and spoken content were not favoured.
- The general results showed that the user wishes to maintain control over information content, delivery (pull/push, visible/audible) and personal privacy and security.

-Prototype Demonstrations

In addition to the questionnaire surveys, demonstrations are essential for an appro-

priate adaptation of the information service to user needs. In order to simulate an as close to real testing environment as possible, extensive testing of the WebPark concept was carried out at the SNP in July 2002. A preliminary prototype demonstration of the WebPark service had been created based on current technology for the purpose of the testing:

- Using existing mobile GIS to show the position and progress on maps, using different functions such as zoom and pan, giving additional information such as an occurrence probability of different animal and plant species and giving background for these species in form of text information, pictures or videos.
- A Java based route profile application, developed by the WebPark consortium particularly for this event, to provide the position related profile of the test participant of the selected route. The profile includes information like the height, the distance to go and distance already covered.
- Network connectivity and data delivering capability in rural areas were tested by retrieving map data through a mobile web-mapping tool.

-Initial User Experience

The testing mainly aimed to examine the initial user experience and perception of the first prototypes of the WebPark concept and the current technology capabilities in rural areas. Technology testing includes testing of positioning technique (GPS), network connectivity and data delivering system (GPRS) capabilities. The results have been used as a further guidance in developing the WebPark architecture. Some essential information on how users feel about receiving location-based information through mobile devices is plotted on the graphs in this article.

-Positive Feedback

In general, the outcomes of the initial testing met the pre-defined test objectives and on the overall, positive feedbacks were given on the WebPark concept. Simplicity and speed of such a service seem to get highest rate of importance in the eyes of the testing participants, while display of position on different media (map, profile or DTM) is viewed as innovative. As part of the project, shadowing activities are being carried out at SNP throughout the year and trials are planned for the next two years. This approach ensures constant awareness of user needs

and requirements that shape the eventual WebPark system and service.

WebPark Consortium and Partners

The WebPark consortium has partners with expertise in dealing with users, geographic information content services, location-based services, value-added G-commerce, web portal architectures and exploitation. These competencies mirror the project work to be undertaken and cover all aspects of the value chain envisaged. The following companies and institutions make up the WebPark consortium:

- Geodan Mobile Solutions, Amsterdam, the Netherlands;
- EADS, Toulouse, France;
- Swiss National Park, Zerne, Switzerland;
- City University, London, UK;
- University of Zurich, Switzerland;
- LNEC, Lisbon, Portugal.

SwissCom recently became the sponsor of the SNP and is considering using WebPark services as a testbed for future mobile development. Dutch mobile phone operators also expressed interest in cooperating with the project consortium in the WebPark project.

Contacts Are Welcome!

The WebPark project is a research and development project and we welcome contact from any companies or institutions (such as content providers, park administrators, telecom operators, hardware suppliers, outdoor enthusiast organisations and so on) that may wish to collaborate on the exploitation and trial phase of the WebPark system. For additional information, please visit our website at <http://www.webparkservices.info> or alternatively contact the project coordinator.

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