I-Flora: A Location Based Service for Determining Flowers in the Dutch Landscape

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SUMMARY

This paper summarizes the I-flora project at Wageningen-UR. The I-flora is an LBS application that enables users to determine plants in the Dutch landscape. A database containing the characteristics of plant species is coupled to geo-information containing information about the presence of plant species at a certain location. As such the determination of plants in the field can be done relatively fast and efficient using small mobile devices like I-mode phone or Smartphones. For the implementation of a general framework based on XML, XSQL and Oracle technology is developed and implemented.

KEYWORDS: *LBS, flora, I-mode*

INTRODUCTION

Today the use of wireless and mobile data facilities is quite common in a large number of European countries. Triggered by the nationwide availability of packet switched networks like GPRS or UMTS and the availability of relative cheap mobile terminals like Personal Digital Assistants (PDA's), I-mode or Smartphones led to an increasing number of services offered to the general public. Various telecom operators provide portals to enable mobile users to access all kind of services ranging form traffic information to games. Currently new types of services and applications are being introduced: location-based and location-aware services.

Location Based Services (LBS) can be described as services that depends on a certain location. Two types of LBS can be distinguished: user requested LBS and triggered LBS (D'Roza and Bilchev 2003). Examples of the first type of LBS are "where is..." services like route planning. The second type of LBS relies on the fulfilment of a certain condition set-up in advance like switching from a cell in a network or an emergency service that can automatically request the location of a mobile device. Location based services have been around for quite some time although not available to the general public. Examples of them are fleet management systems, and tracking and tracing applications. These services are characterised as closed, specialized and expensive (Markkula 2001).

To make LBS available to the general public the network need to be equipped with location-aware facilities. Until now location is only known to and used by the mobile network infrastructure providers for supporting operation and maintenance. In the near future it is expected that location aware networks will be made more widely available. In principle four positioning mechanisms are or will be available: Cell-id, uplink Time Of Arrival (TOA), Enhanced Observed Time Difference (E-OTD) and the Global Positioning System (GPS). Currently only GPS is available as a location provider for LBS services in the Netherlands.

At the Centre for Geo-Information of Wageningen-UR several projects are carried out that explore the use of mobile wireless data and GIS and LBS for education (wireless learning), fieldwork (data collection) and services to the general public. In this paper we will present the development of a requested

LBS service called I-flora. I-flora is an interactive flora on a I-mode phone or PDA/Smartphone. It is used to identify plant species during a field trip. The main goal of the project was to create a service for people, and especially high-school students, that allow for determination of the name for the most common flowers in the Dutch landscape. CD-ROM's with interactive flora are currently being used in a educational context (Marijnissen 2003) but these require flowers to be picked and carried to the classroom. A more general objective of this study is to explore possible concepts and techniques to create a framework that enables LBS support for education.

We start with a brief description of the concept of the I-flora. Next we discuss the components that are used to construct the I-flora and the LBS aspects related with it. Finally we discuss some aspects related to the usability, potential use and shortcomings of the I-flora application and this type of service in general and our future research agenda.

THE I-FLORA SERVICE

An interactive CD-ROM for the Dutch flora was developed by Marijnissen (Marijnissen 2003). This flora was specially developed to enable scholars to determine plants in an educational setting. The use of multi-media and database techniques enables the use of a synoptic determination key which is more easy to use compared to the dichotomous keys used mostly in traditional flora. On the interactive version of the flora almost 40 keys cover characteristics of flowers like flowers, leafs, stems, roots, etc. For the I-flora this amount of keys would mean that the determination process would take to much time. Due to the limited interactivity of the device and the repetitive queries it probably would taken to much time to use the complete set of 40 keys. For the mobile version of the flora the 8 most important keys where implemented: Colour of the flowers, number of stems, shape of the leafs, shape of the leaf edges, symmetry of the flowers, top of the leafs, nerves of the leaves, number of pedals.

Date information was used to filter out all flowers that are in a vegetative stage (not flowering). For this reason the set of possible flowers that need to be searched is smaller. However there is no guarantee that using the 8 keys provided will reduce the number of possible flowers to one (which can be guaranteed if the 40 keys are used). The assumption is however that a reduction to a set of maximal 10 flowers would be sufficient. Such a small subset can be easily browsed by a user using photos and descriptive information to pick the right flower.

ARCHITECTURE

This section provides a brief description of the components and architecture used to realize the I-flora service.

Mobile devices

The basic requirements for a mobile terminal to be usable for public services are that it should be relatively cheap, widely available, easy to carry and able to fulfil multiple functions. An example of such a device is the I-mode phone. I-mode is a GPRS enabled class of mobile phones that can connect to the internet and present web pages specially designed for it. I-mode was introduced in the Netherlands and some other European countries two years ago. I-mode phones typically have a large colour display (at min 256 colours) and a higher resolution (120*128). I-Mode can display web pages, based on the cHTML standard, a subset of regular HTML, and accepts images with a regular GIF format. This enables the use of standard web-solutions and –techniques. A limiting factor is however the fact that the size of an I-mode page cannot exceed the maximum size of 10 kb. Also the navigation possibilities are limited; only one-dimensional navigation is possible.

A second type of devices the I-flora is designed to use are smartphones. The term smartphones is sometimes used for wireless telephones that have computer-enabled features not previously associated

with telephones. A smartphones features may include: wireless e-mail, internet, web browsing, and fax, personal information management, LAN connectivity, camera, graffiti style data entry, local data transfer between phone set and computers, remote data transfer between phone set and computers, remote control of computers, remote control of home or business electronic systems, interactivity with unified messaging etc. They are the result of the merging of PDA's and traditional wireless phones. It is expected that Smartphones will replace the current generation of phones within a few years.

Data connection

Currently GPRS is the current standard for transmitting data over a mobile network (it will be replaced and complemented by UMTS within a short time in the Netherlands. It has a maximum bandwidth of 115 Kbit/sec. Although in practice it depends of the number of timeslots assigned to you by the provider, the device is able to handle and the used coding scheme. Most telecom operators provide a speed of 56 Kbit/sec. Depending on the device this results mostly in a downstream speed of below 50 kbit/sec. The advantage of GPRS is that it is a so called packet switched technique. This means that it is possible to be continuously online and pay only for the amount of data transmitted. This contrary to GSM that is based upon so called circuit switching; you pay for the total time you're connected.

Server

Because the mobile terminals we use have only limited processing power, the I-flora application it-self runs at the server side. Only the results are transferred to the, build in, browser of the I-mode or Smartphone. At the server standard web and map servers are used in combination with Oracle technology (database and application server). The geographical data is stored on a Arc/Ims server. The flower data is stored using Oracle 9i technology.

Data

For the first version of the I-flora a database was used that contained the characteristics and encyclopaedic descriptions of the 505 most common species in the Netherlands.

This is the same database as used in the educational version of the cd-rom version of the flora. Besides the necessary discriminating characteristics for the keys, the database contains encyclopaedic descriptions, ecotopes, etc and at average 3 detailed pictures for each flower. Besides the graphical and textual information for each flower the Latin name was pronounced by a professional voice and recorded in the WAV format. Using the build in media player of the I-mode or Smartphone the WAV can be played

For discriminating characteristic in the key pen drawings were available. These pen drawings ease the interpretation of the terms used in the key by a layman. Especially when trying to identify various characteristics of leaves (for example top or shape) this is a necessary feature.

For the LBS support a geo-database containing information about the presence of species for a km-square in the Netherlands will be used.

IMPLEMENTATION

The I-flora was firstly implemented using Oracle XSQL and XSLT in combination with the Internet Information server. One of the main limitations of the used I-mode phone is the maximum size of the page that can be displayed (< 10 kb). This means that the pictures only could have a limited colourdepth (8 bit) and size (80*80 pixels). Al the pictures and graphics of the cd-rom are converted to a size and format suitable for the I-mode phone.

The required mark-up language (cHTML) imposes limitation to the way a I-mode page can be presented. No table, frame, layers or other aids to help formatting the content can be used. Figure 1 shows the current application. When connected to the application a welcome screen provide the user with some background information. After pressing the start button the main key is presented (2) a user can pick one

of the keys and determine what characteristics apply to the flower he or she is currently examining (3). The example shows the characteristics of the leaf-tops. Each time a user makes a choice the set of possible flowers is reduced. A user can also undo a choice. After the subset is sufficiently small (typically < 10 species) a list can be displayed (4). The user next can interactively browse the flowers and examine the descriptions and photos (5 and 6). There is no predefined order to pick the keys. At all time the application shows the set of plants that fulfil the current set of characteristics.

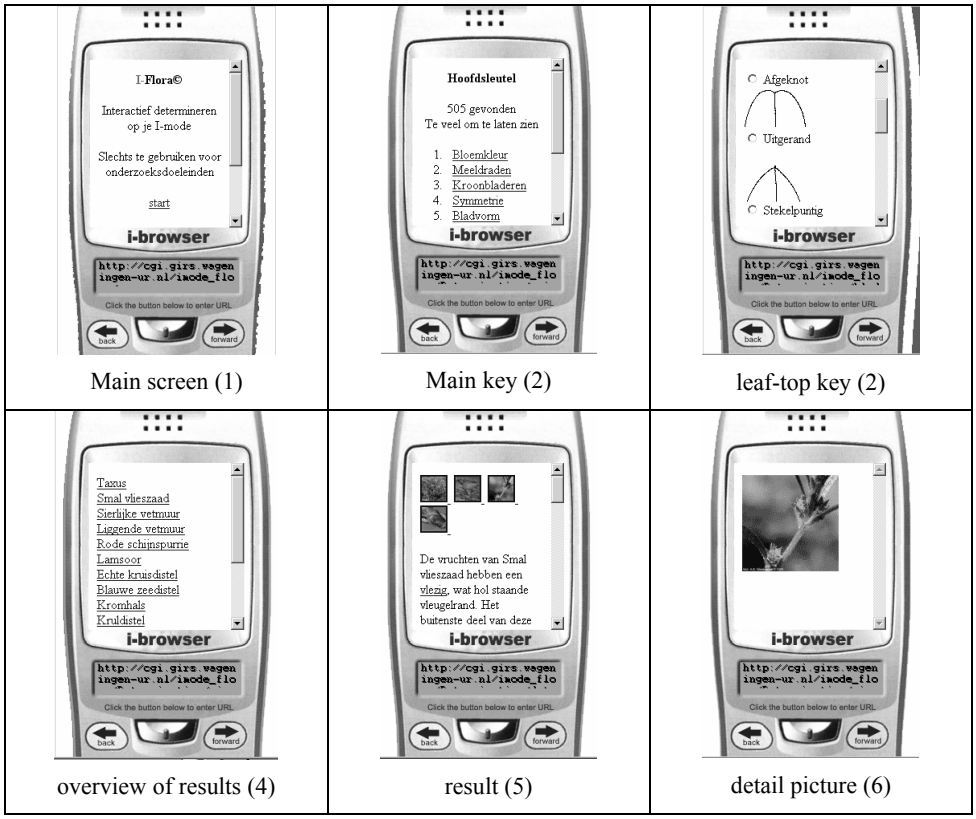

Figure 1: Screenshots of the first prototype of I-flora

The I-flora application adapts dynamically its determination key. According to the species present in the km-squares at a certain location the keys provide only characteristics to the users that are relevant. For this purpose a request is issued to a web service at Wageningen-ur containing the locations of more then 1 million species in the Netherlands. For example if flowers with kidney shaped or needle type of leave do not occur in a certain km-square then these choices are left out of the key. For the current set of 505 species LBS is only of limited value. These are the species commonly found in the Netherlands and these are present virtually everywhere. For the next stage however we will use the complete database of Dutch flowers (>1400 species). For this application we expect LBS support of great value to limit *'a-priori'* the set of flowers that need to be queried and adjust the determination keys accordingly. Without LBS it is not to be expected that the limited determination key will yield a sufficient short result list useful to an untrained user. Figure 2 presents the concept of LBS support for the I-flora service. To be useful as a LBS concept the handset needs to transmits its location to the server. The mobile network in the Netherlands does not have "location awareness" publicly available yet (status in 2003). Neither the location of the cell-id is publicly available. To acquire a useful location the handset needs to be equipped with a GPS for the time being.

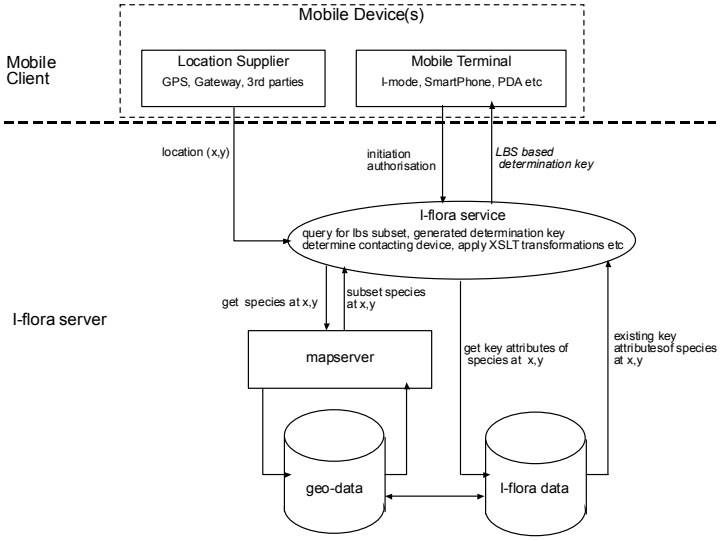

Figure 2: Concept of LBS support for the I-flora

DISCUSSION AND CONCLUSION

Until now we only can draw some preliminary conclusions. The prototype is currently in the stage of testing. However first reactions of beta testers show that the choices made for the keys and presentation of the characteristics appears to be useful. In most cases a user is able to reach a sufficient small subset to browse manually. A major limitation of the chosen I-mode solution is however the small page size that is allowed. This prohibits the use of sufficient large photos. This hampers an easy visual recognition of the flowers on the screen. For the next generation of smartphones this problem will probably be solved. This generation phones do not know these limitations and will have full multi-media capabilities.

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