I-FLORA: *Flora* ON *the* PHONE

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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, an increasing number of services is offered to the general public. Various telecom operators provide portals to enable mobile users to access all kind of services ranging from traffic information to games.

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 LBS service called I-flora. I-flora is an interactive flora on an 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 most common flowers in the Dutch landscape. Cd-rom's with interactive flora are currently being used in an 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 easier to use compared to the dichotomous keys used mostly in traditional flora. On the interactive version of the flora 32 keys cover characteristics like flowers, leaves, stems, roots, etc. Due to the limited interactivity of the I-mode device and the repetitive queries it probably would take too much time to use the complete set of 32 keys.

For the mobile version of the flora the 8 most important keys were implemented: colour of the flowers, number of stems, shape of the leaves, shape of the leaf edges, symmetry of the flowers, top of the leaves, nerves of the leaves, number of pedals. 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 32 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 however is 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 for which the I-flora is designed are Smartphones. The term Smartphones is used for wireless telephones that have computer-enabled features not previously associated with telephones. 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.

Server

The current class of I-mode terminals have only limited pro-

cessing power, the I-flora application itself runs at the server side. Only the results are transferred to the, built-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).

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 three 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 built-in media player of the I-mode or Smartphone the WAV can be played (not implemented in the public version).

To assist the user in choosing the right characteristic pen drawings were available. Especially when trying to identify various characteristics of leaves (for example top or shape) this proved to be an essential feature.

Implementation

First version of I-flora

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 species) a list can be displayed (4). Next the user 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.

LBS version of I-flora

Recently a version of the I-flora was developed that adapts dynamically its determination key. According to the species

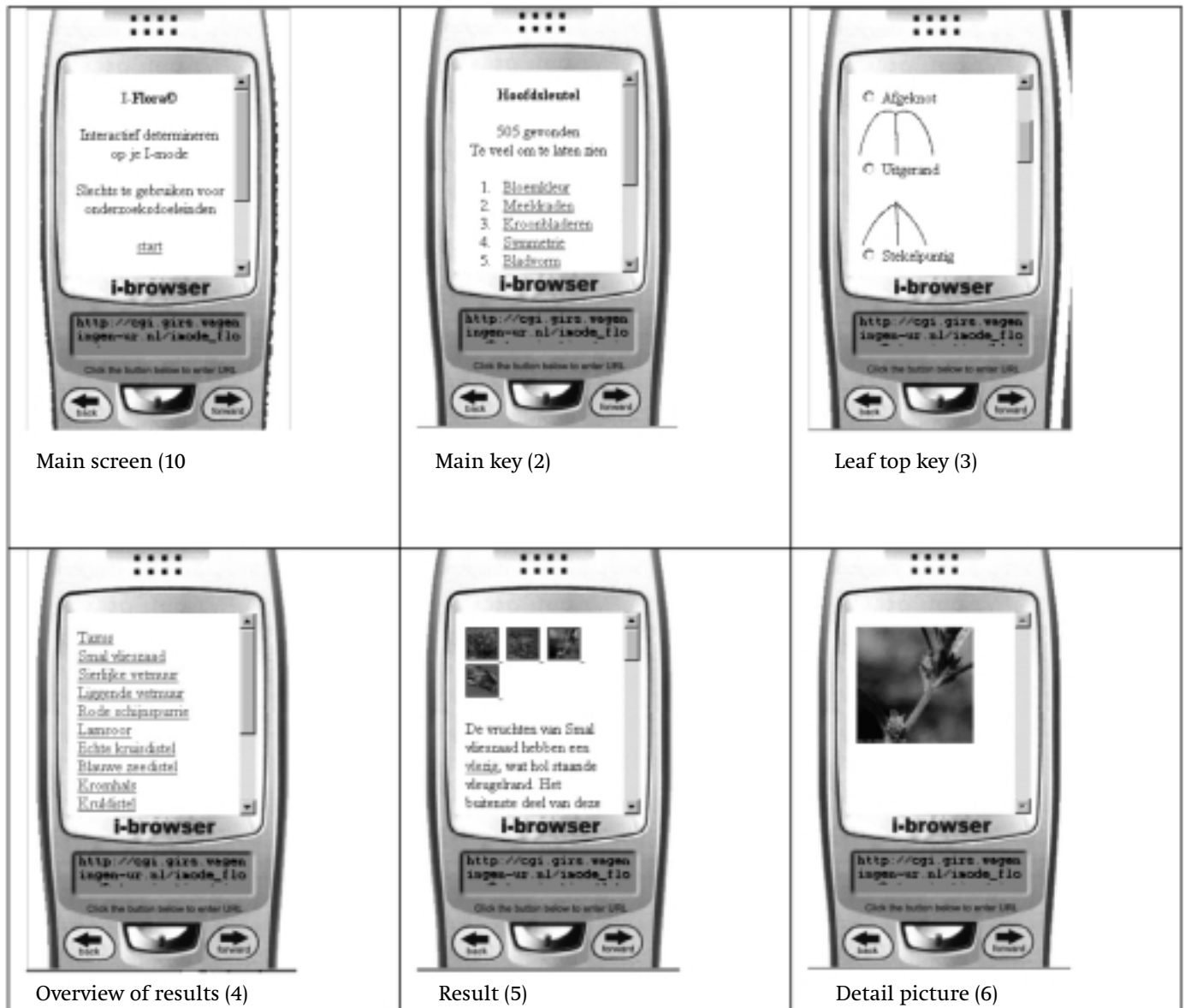| Main screen (10 | Main key (2) | Leaf top key (3) |
| Overview of results (4) | Result (5) | Detail picture (6) |

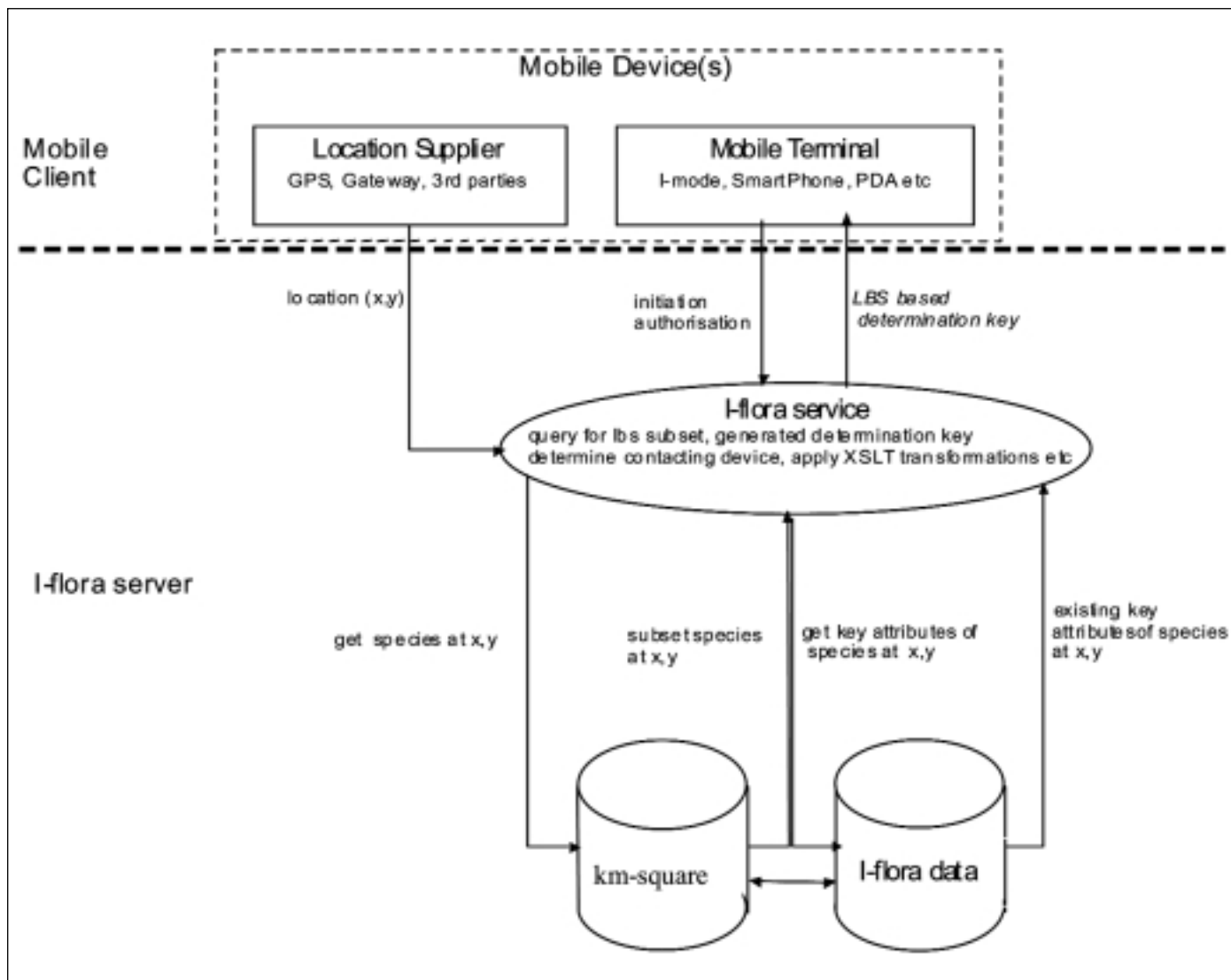*Figure 1: screenshots of the first prototype of I-flora*

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

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 one million species in the Netherlands. For example if flowers with kidney-shaped or needle-type leaves 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 transmit its location to the server. The mobile network in the Netherlands does not have 'location awareness' publicly available yet (status in 2003). Neither is the location of the cell-id publicly available. To acquire a useful location the handset needs to be equipped with a GPS for the time being.

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 appear 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 - which 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 of phones does not know these limitations and will have full multi-media capabilities.

Fitire research

At the moment the major limitation for the first version of I-flora is the allowed page size in the I-mode protocol. This is not a limitation that can be overcome by research. It is matter of waiting for a new generation of I-mode telephones that can handle larger page sizes.
Other ideas for future research are:

- Develop for other platforms (e.g. Live of Vodafone).
- XML-based data exchange to improve interoperability.
- Integrate LBS module in current prototype.
- Migrate to Oracle, MySql or SQL server.
- Authorisation and subscription module.
- Upgrade to all plants of The Netherlands (1300).
- Extension of determination key (towards 32 characteristics).
- Implement dynamic key.
- Change to dot.net or JSP in combination with servlets.

Acknnowledgements

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