X^{pmi} an eXtensible Personal Mobility Interface (A Semantic Web of Mobility Devices)

Simon Harper[1], Stephen Pettitt[2], and Carole Goble[1]

[1] Dept. of Computer Science, University of Manchester, Kilburn Building, Manchester, M13 9PL, UK (simon.harper@man.ac.uk)

[2] Salford Electronic Consultants Ltd., Technology House, Lissadel Street, Salford, M6 6AP, UK

1. Introduction

Personal mobility - mobility can be thought of as the ease as opposed to the opportunity for travel - is important not just for the implicit benefits of easy and accurate navigation and orientation, but also because it supports the less tangible factors of self worth, freedom, and independence. A high level of mobility can be difficult for visually impaired and sighted individuals alike, especially when in unfamiliar and complex internal or urban environments such as airports, bus or train stations, shopping centres, and unfamiliar cities. Signage can help both groups (as long as it is appropriate), however complex environments seem to encourage complex and confusing signage that can handicap everyone. The problem is further complicated because signage is not descriptive, dynamic, or tailored to an individual's personal journey and therefore mobility.

Some systems have already been proposed to alleviate these problems but these have mainly been concerned with large-scale environments centring on Global Positioning (GP) and Mapping technologies. There have been very few systems concerned with mobility within small complex internal or urban environments. And the problems that persist with the systems that do exist are many (1) They are bespoke and closed; (2) Cannot share information; (3) Multiple devices to receive information from each system are needed; (4) Use different transmission methods (Infrared, Radio, etc); (5) Are reliant on specific hardware for data access; (6) Only appeal to certain sections of the community (like visually impaired users). Hence systems are not cost effective and therefore unworkable in any large-scale implementation [Green and Harper, 2000].

We theorise that with the advent of the semantic web solutions to these problems might be found by the creation of a 'semantic web of mobility devices'. These devices will use the ontology languages that underpin the semantic web to communicate more effectively. We will enable our system by describing the type and capabilities of the device, by describing the environment and the information needed to be mobile within that environment, by separating the data structures from the data, and by describing all data elements by using DAML+OIL ontologies [Horrocks, 2002]. Along with these descriptions we will create a dynamic description of the local area and tie this to signals sent from devices – using pervasive (ambient / ubiquitous) computing methods – statically located within the environment.

2. Example Scenario

Our user walks through the entrance to an office building, the Bluetooth device at the entry transmits information about the environment in the form of a URI pointing to an XML document (which has a URI to a DAML+OIL ontology encoded within it) to a Bluetooth enabled mobile device carried by the user – initially we see this as being a mobile phone (currently the most ubiquitous mobile device). Optionally the phone may transmit user information (for a 'light' security check), the buildings appointment system may be accessed and a route to the destination office generated if appropriate. The user then starts the journey within the ambient environment, the phone receiving infrared signals from small cheap devices – normally located on the ceiling – sending at a minimum their identification code. This code along with the stored URI is then sent (via GRPS) to a system for processing – initially on the Grid - and a description about the location is sent back to the phone. This description will be dynamic and will change based on the required journey (if set), the devices already encountered (so direction and distance are accurate), and the type of device encountered. Each device can be from a different supplier (as long as it has some type of ontology associated with it) and so the lift device may be from Otis, the phone maybe from Nokia, and the beacons to the fire exits may be bespoke to the building.

3. Summary

X^{pmi} is initially specifically aimed at countering unfamiliarity in small complex internal or urban environments and therefore it will not replicate other mobility research projects. By using the semantic web, X^{pmi} will attempt to solve the dual sets of problems associated with both good general mobility and those failings found in previous systems by providing a (1) Dynamic; (2) Open; (3) Appropriate; (4) and Personal (egocentric); system to enhancing mobility taking into account the environment being traversed, the individual feedback required, the purpose of an individual's current travel task, and the multitude and types of devices supplied by possibly several different companies, and for a number of different travel purposes. We expect our initial work to produce useful findings within the next year.

4. References

[Green and Harper, 2000] http://www.man.ac.uk/towel/poli.html
[Horrocks, 2002] http://www.cs.man.ac.uk/~horrocks/Publications/download/2002/edbt02.pdf