NAVIGATING BY EXPERIENCE RATHER THAN ALGORITHMS

Navigation 2.0

Navigation is a daily activity for many as they move from place to place. With increasing complexity in transportation networks has come a rising demand for navigational assistance. Over the centuries systems able to provide such assistance have evolved through three distinct eras. This article focuses on a new third era, in which navigation uses social networks and user experience. We here present a social navigation network (SoNavNet) developed at the University of Pittsburgh.

To give a sense of the evolution, navigational assistance development is categorised into three eras. The first we will call ‘Where is north?' This refers to the first navigational assistance device ever reported in literature, the south-pointing chariot. The second era, which we call ‘Where am I?', started when GPS became reality, about a quarter of a century ago. This was based firstly on GPS showing its promise of being a truly ‘global' positioning system with reasonable accuracy for navigation. Secondly, GIS was on its way to becoming a mature technology for various applications, including navigation. It was the potential for integrating GPS and GIS that gave birth to the concept of in-car navigation systems. The third era, which we call ‘What is recommended?' is now emerging, prompted by two main reasons: ever increasing interest in Web 2.0 technology, and the growing dominance of mobile devices over daily life.

Navigational Assistance

During the first era, charts were used for navigation in a static manner and paper maps played an essential role in this. The second era was about dynamically integrating information obtained from various sources to provide navigational assistance, and here geo-positioning sensors such as GPS played an essential role. Navigational assistance in these eras was primarily based respectively on mechanical devices and computer systems. They shared the common feature that maps represented transportation networks. Hence the first two eras might be referred to as ‘model-based'; they model real-world phenomena (roads etc) to provide navigational assistance by measurement (using paper maps) or computing (using digital maps). A map as model of the real word is an approximation, and susceptible to incompleteness and error. These shortcomings represent one reason why even modern systems provide solutions that are sometimes inaccurate.

Experience-based

Compared to the first two eras, the third era may be considered ‘experience-based'; using social networks, people would share their navigational experience, in particular points of interest (POIs) and routes. Even though maps could be used in this third era, their presence would be mainly for communicating recommendations to others, in contrast to the first two eras in which maps were the means for measuring and computing navigational information. This ‘experience-based' navigational assistance is now possible through the social networking techniques of Web 2.0 technology. As people are increasingly attracted to the various social networks for sharing information such as pictures, videos and so on, they are expected to rely more on existing and emerging social networks for information relevant to, and having an impact on, their daily activities. Table 1 summarises some key differences between model-based and experience-based navigation assistance.

SoNavNet

At the Geoinformatics Laboratory of the School of Information Sciences at the University of Pittsburgh we have developed a framework for social navigation networks we call SoNavNet. Unlike model-based navigation systems that use map models to compute information, SoNavNet facilitates sharing navigation experience. SoNavNet members can recommend POIs and routes to all or selected fellow members for any indoor or outdoor activity, at any time and for any geographical location. In general, members of SoNavNet can both recommend and request POIs and routes. The architecture, components and functions of SoNavNet (see Figure 1) will now be described.

Access to SoNavNet is provided through two media; web browser on a desktop or laptop machine, or mobile device (smartphone) application. Both are connected to a web server for access to the system. Since the central goal of SoNdavNet is navigation, an online

mapping service is included in the architecture to give the user a display of navigation information.
To further assist them, current user location information is gathered from external sources. When available on the mobile application, priority is given to a GPS reading, and Wi-Fi geocoding is used as a backup for both mobile and desktop versions.

Three Functions

SoNavNet offers three main functions. The first allows the user to manipulate a map of their surrounding area and to place on it POIs, routes and regions, thus letting them keep track of places they have been and how they got there. This is enabled through the online web-mapping service, results of which function are displayed as in Figure 2.

The second function is a request/recommend service. Users wanting a recommendation are able to message their friends with a map on which they have marked off an area and request a POI (restaurant, gym, etc) within it. Their friends can then respond by placing their recommended POIs on the map and sending it back to the user. The same can be done with routes: users specifying a beginning and end point and sending the request to their friends, see example in Figure 3.

Recommendations might also be offered that go beyond the user's actual request. A user might eat at an Italian restaurant, experience an excellent meal and service, and want to tell their friends about the place. Using SoNavNet they can place a POI on the map pinpointing the restaurant, add the route they took to get there, and then send a recommendation to any friends who like Italian food. These will then receive a message containing a map marking the location of the restaurant and a route to reach it. The recommendation could also be posted to the social network for all members to view.

The third function is a user-tracking service. This can be realised using GPS or Wi-Fi geocoding, depending on the device used to access the system. Maintaining the current user's location allows a user to see the POIs and routes on the map in their immediate vicinity. It also allows their friends, in the case of meeting up, to see where they are. Likewise, if they see that a user is near a good coffee-shop, they can send them a message letting them know its location so they do not miss it.

Sharing Information

This method of navigation differs from the ‘model-based' one in that it provides the recipient with a tested route to a POI, based on another person's experience of getting there. This ‘experience-based' navigational assistance encourages the sharing of information between members which is already part of the backbone of countless social networks. The information available to users of SoNavNet comes from friends who have visited the places they add, having walked or driven the routes placed on the system. The information comes not from an algorithm, but from experience.

Collaborative Mapping

Aside from providing ‘What is recommended?' era navigation information, other applications showed promise when we were using the SoNavNet framework. One is collaborative mapping. A project is underway to study mapping of pedestrian networks through SoNavNet. As collecting pedestrian network data is time-consuming and expensive using current means, a social network of volunteer data collectors is a possible efficient alternative means. Members with GPS-enabled mobile devices might employ the user-tracking functions of SoNavNet to record pedestrian network data as they walk about a city. Once they have reached their destination, their pedestrian network trajectory can be shared with other members via SoNavNet. Also harnessing the functions of SoNavNet, areas where data still needs to be collected can be ‘recommended' for collection. Because of the highly passive nature of this method of collection, members can be gathering data during everyday routines such as walking to work. A pedestrian network might thus be collected cheaply and gradually over time, employing collaborative effort.

Further Reading

Karimi, H. A. Zimmerman, B. Ozcelik, A.and Roongpiboonsopit, D., SoNavNet: A Framework for Social Navigation Networks, in International Workshop on Location Based Social Networks (LBSN'09), Seattle, WA, November 3-6, 2009.

Kasemsuppakorn, P. and Karimi, H. A., Pedestrian Network Data Collection through Location-Based Social Networks, at the 5th International Conference on Collaborative Computing: Networking, Applications and Worksharing, Washington DC, November 11-14, 2009.