Hitchhiker's Guide To Earth: The Mobile Tourist Guide

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ABSTRACT

In this paper, I describe Hitchhiker's Guide to Earth (HHG2E), a mobile interface to a web-based system that connects geographic data with user-editable content from *Wikipedia*, the online encyclopedia freely editable by all users [1]. HHG2E runs on location-aware, web-enabled mobile devices, automatically retrieves relevant content, and allows the user to rate the information provided.

The system is designed to facilitate the process of spatial tagging and, more importantly, to provide the user with greatly increased awareness of his surroundings.

The HH2GE design process consisted of contextual inquiry, low and high fidelity prototype tests, and an assessment of the feasibility of the interface given existing technologies (GPS, wireless Web, etc.). A number of versions of the interface were tested; the primary differences between versions was in the amount and type of user input required, as well as in how the users were made aware of the information related to their current location. The approach to the design of the system was altered according to the results of the user tests at every point in the study.

Author Keywords
Travel, mobile, tour guide, location awareness, GPS, wiki.

ACM Classification Keywords
H5.2. Prototyping, Interaction Styles, Graphical User Interfaces, user-centered design.

INTRODUCTION

One of the primary pleasures in tourism lies in gathering knowledge about the locations and landmarks one visits during one's trip. While much of that knowledge can be found at the locations (the view of the location itself, descriptive plaques, brochures, etc.), tourists and sightseers often find themselves in the position of not knowing enough about where they are – not in terms of address, but rather in terms if interesting historical, cultural and geographic facts. That problem is especially pertinent for those who prefer less traveled areas; whereas the Brooklyn Bridge in New York City has signs with its detailed history, the historically important Telegraph Avenue in Berkeley has absolutely no embedded information about it.

To address this problem, I proposed a tour guide application, named Hitchhiker's Guide to Earth (HHG2E), that would run on location-aware mobile devices (such as smart phones and Wi-Fi / Wi-Max enabled PDAs) and would use positioning data to determine the user's location and retrieve relevant information about it from an online wiki repository. The user would be able to immediately edit the information provided or to create new pieces of data if none existed.

PRIOR WORK

There are a number of research papers related to the work done in this study. Among these are:

- Cyberguide, the paper detailing a prototype of an electronic guidance system developed by Gregory Abowd and others at GIT. [2]
- Mobile Guide, the location-aware electronic commerce system developed by Radu Popescu-Zeletin and others at the Technical University of Berlin [3]
- Lancaster Guide, a mobile route and location assistant developed by Nigel Davies and others at Lancaster University [4]

- GeoNotes, a spatial annotation system developed by Fredrik Espinoza and others [5]
- GeoURL, a database of geographic coordinates / URL associations (based on ICBM meta tags)
- Geo-Caching, the GPS based treasure hunt game.
- Wiki-Wiki-Web, the explanation of Wiki concept and philosophy by Wiki inventor, Ward Cunningham. [7]

CONTEXTUAL INQUIRY

Initial Observations

On two separate occasions, I conducted field observations of tourists around major destinations in San Francisco: The Legion of Honor, the Golden Gate Bridge, and the Cable Car Turntable, as well as around less popular attractions with rich history and/or architecture: Fisherman's Wharf and the Tea Garden in San Francisco, and Telegraph Avenue in Berkeley.

On a number of occasions, I observed tourists shuffling their cameras, maps, and guidebooks at the same time, while attempting to read up on a certain object of interest. Frequently, tourists initially sought to obtain the information from stationary sources (plaques, kiosks, booklets), only reverting to their guide books when absolutely necessary. While it was difficult to judge whether these tourists were able to find the information they needed, their experiences appeared awkward and frustrating. The observations also implied that the entire paradigm of tourist behavior was based on suggestive guidance: that is, the tourists were visiting sites that were put forward by their guidebooks' descriptions, rather than simply moving around and finding descriptions of their locations along the trip.

Interviews

To continue contextual inquiry in greater detail, I conducted interviews with 3 users, all of whom self-identified as avid travelers (2 are architecture photographers, and one is a visual arts student and an independent filmmaker). When asked about their experiences with touring previously unseen areas, all three indicated that, on multiple occasions, they've had problems finding information on their surroundings as they traveled. Two of the interviewed users (the photographers) indicated that they used the famous "Eyewitness Guide" books when they traveled through Europe, but frequently found themselves lacking information about a particular location or building they were observing (as architecture photographers, they would frequently seek information about lesser-known buildings that attracted their attention.) While the guide books provided enough information about major attractions, they did not go into sufficient detail about less important landmarks and left their readers craving more information. The visual arts student pointed out that as she travels, she frequently wants to know "where to go next," but does not have a good knowledge of interesting spots nearby. She described frequently wandering around aimlessly and "bumping" into "things worth seeing" completely by accident.

Figure 1. The low-fidelity, 'Wizard of Oz' prototype on a Web-enabled cell phone, Motorola V551

LOW-FIDELITY PROTOTYPES

Cell-phone based prototype

In order to assess the proposed hardware basis for the Guide, I created two low fidelity prototypes and used them in 'Wizard of Oz' studies with 4 users: two first-year Ph.D. students from U.C. Berkeley and two young professionals who were visiting the Bay Area as tourists.

The first prototype was based on a Motorola V551 phone, a Java-powered phone with a 16-bit 176 x 220 display. The prototype was based entirely on the phone's built-in SMS message functionality without any additional software. Before the beginning of each test, the users were given an explanation of what the system is. The test then proceeded as follows.

I accompanied the users along the streets in Downtown Berkeley, suggesting the general direction of travel. Prior to that, I loaded 100-150 word descriptions of a number of sites in the area as text notes into another cell phone that I had with me. Whenever the user approached one of the sites I had a description for, I sent an SMS with the description (if the description was too long, it would split into multiple messages automatically) to the phone held by the user. The user's cell phone would signal the reception of the message within less than a minute after it was sent, simulating the behavior of a location-aware mobile application that retrieved an "article" relevant to the current location. The users were then asked to read the text of the article, and "edit" it. When they were asked to edit the article, I would take the phone from the user and set it to create a new SMS message, with the "article" text pasted into it. The users were then asked to change as much or as little text as they wanted.

This prototype had a number of usability issues associated with it. All users complained that it was extremely uncomfortable to enter extensive amount of text on the cell-phone's keypad, even with predictive typing turned on.

Furthermore, all but one user complained that the screen was too small for reading articles and that frequent scrolling was "distracting" and "disorienting." When asked about the general

method of information delivery, three out of four users preferred this method to guide books. One user suggested that it would be easier to use if the device had a form factor of a "regular paperback."

Hiptop (Sidekick) based prototype

The same low fidelity test was repeated with a different device, a T-Mobile Sidekick, based on the Hiptop platform developed by Danger, Inc. Sidekick has a QWERTY-keyboard and 240x160, 16-bit screen.

Two users reported that, by comparison, reading the text on the Sidekick was much easier than on the cell phone, mostly due to the Sidekick's scroll-wheel, rather than screen resolution (virtually identical to that of Motorola V551). All users also reported that editing the text on the device was significantly faster and easier in comparison to the cellphone. However, 3 out of 4 users did not think that they would ever edit large amount of text while on a trip. When asked for reasons, the users stated that: (1) editing descriptive text requires extensive knowledge of the subject (which, for articles describing sites they are visiting for the first time, they would not possess), (2) editing text requires concentrating on the device for extended amount of time, which would take attention away from sightseeing, defeating the major purpose of tourism.

Two users suggested that rather than editing, it would be easier to provide some type of "quick" feedback on the content of the article.

HIGH-FIDELITY PROTOTYPE

Based on the results from the low fidelity prototype testing, I made modifications to the initial proposal and built a high-fidelity prototype, based on the Oqo model 01, a portable PC with characteristics comparable to modern laptops. Oqo is about 5" by 3.5", and has an 800x480, VGA screen, that slides to reveal a small QWERTY keyboard. In addition to the keyboard, the device is equipped with touchscreen capability and can be operated with a stylus.

The initial proposal was modified as follows:

1. Based on user feedback, it was decided to base the Guide on a PDA, or a portable laptop device (such as Oqo), because of the issues of reading text on a small size screen. In addition, cell phones do not normally have access to positioning services, whereas PDAs can be easily extended with GPS units.
2. The ability to edit the incoming articles was replaced by an option to rate the article on a scale from 1 to 4. As described in the previous section, users indicated that they would not normally edit large amounts of text on the go, but they would submit feedback.

The system was initially tested with an attached GPS device to assess feasibility. The GPS device sent out data over a serial connection that was sent to Oqo via an Iomega serial-to-USB adapter. The serial signal was then relayed to a TCP socket, using software written by Hernando Barragan of IVREA.

Figure 2. User holding the high-fidelity prototype while walking down a street during a user test.

A Flash application queried the socket for the GPS data every 10 seconds, and sent the acquired coordinates to a Web server (the tests were conducted on Berkeley and Stanford campuses, where Wi-Fi Internet connection was available in many outdoor areas). On the server side, a Python web script received the coordinate data and looked for nearby entries in a small mySQL test database specifically created for the purpose (the database associated coordinates with URLs). If one or more entries were found, the script returns the URLs to the mobile application, sorted by proximity to the current location.

The feasibility tests showed that the application performed quite well outdoors and provided accurate information about the current location. GPS data was accurate enough to limit the location search radius to about 50 meters (about a quarter of a football field).

The user tests with the high-fidelity prototype were conducted in the 'Wizard of Oz' fashion, because the GPS device available for this study was rather unwieldy, with multiple cables and connectors, and would have distracted users from interacting with the system.

For that purpose, the Oqo device was connected to a compact USB Wireless keyboard receiver, and the location-triggered events were simulated by the tester from a wireless keyboard.

As in the case of the Low Fidelity prototype tests, the device was triggered to produce a signal (in this case, a subtle chirping sound) when the user approached a certain location. The device then displayed a prompt, as shown in the left image of Figure 3.

The user was able to modify a number of options to fine-tune the tour guide. The options included: filtering locations by category (e.g., setting it to displaying only museums and theme parks), changing the search radius, and filtering out articles below a certain rating. Another option allowed the user to skip the choice-making, by letting the device pick the closest location and display the article automatically.

When reading the article, the users were able to use a "Rate" popup window in the bottom left corner to rate it.

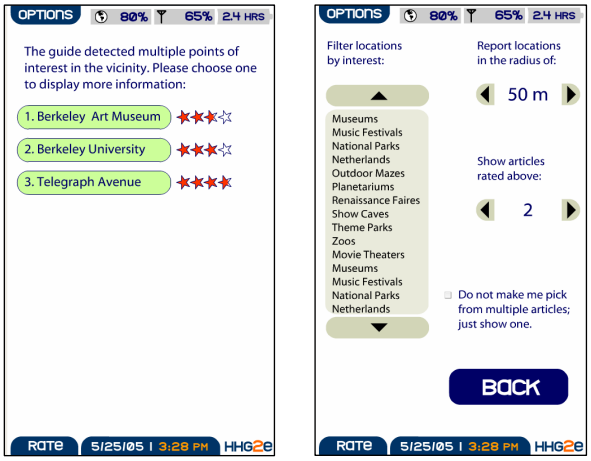

Figure 3. On-screen interface of the high-fidelity prototype

The indicators at the top of screen showed the simulated strength of the GPS and the wireless signals, changing at random time intervals to create a realistic user experience.

RESULTS

The high fidelity tests were conducted with the four users who participated in the lo-fi tests, as well as with two other users, who did not see the prior versions of the interface.

All users responded positively to the new interface and the form factor of the device, commenting that the text was much easier to read on a larger screen (in addition to size, this screen was also of higher resolution and the device itself allowed for text to be anti-aliased). The users also indicated that they understood the information displayed on screen (signal strength indicators, battery level) as well as the options provided to them. The users also suggested improvements, which included:

1. The option to make the device operate in "silent mode," so that it would provide information only when requested.
2. A less precise rating scale (i.e., 1 to 4 with steps of 1, instead of steps of 0.1)
3. The ability to bookmark articles to retrieve or read later.

In general, 4 out of 6 users liked the new paradigm of assistive, rather than suggestive, tour guidance. They thought the device was "significantly better" in comparison to other methods of tourism-related information they have used before, and allowed greater freedom. One user said, "This [interface] is great for random exploration, but it works as a regular guide, too."

CONCLUSIONS & FURTHER WORK

I have presented the Hitchhiker's Guide to Earth (HHG2E), a mobile application for tourists that is intended to run on location-aware, web-enabled PDAs and portable laptops. The application automatically retrieves location-related content, as well as allows the user to rate the information provided.

The final interface, changed from the original proposal, fared well with users in hi-fi prototype tests. Users found the assistive guidance paradigm to be less restricting than the suggestive guidance provided by the regular guide books, and most thought that carrying a small electronic device was much easier than bringing a "library" of tour books with them.

However, the interface presented here is only the first step in the design of the HHG2E system. The system is currently missing the most important component for successful functionality: the user-editable database that would link geographic coordinates with the Wikipedia articles. While the interface for that component of the system was beyond the scope of this project, it would need to be developed and tested to examine whether it would attract as much user participation as Wikipedia; without large user participation, the entire system would be non-functional.

Furthermore, the current interface prototype was tested on a device that is as fast as a regular PC. While such devices are likely to be inexpensive in the future, they are currently only affordable for a small segment of the population. The interface will need to be developed and tested on cheaper devices, such as PocketPC-equipped phones.

I hope to continue working on the Guide during the summer of 2005 and beyond.

REFERENCES

[1] **Wikipedia, The Online Encyclopedia.** `http://en.wikipedia.org`

[2] **Cyberguide: A Mobile Context-Aware Tour Guide**, Gregory D. Abowd, et al. *Wireless Networks 3 (1997)*, pp. 421-433

[3] **Applying Location-Aware Computing for Electronic Commerce: Mobile Guide** Radu Popescu-Zeletin, et al. *Proceedings: 5th Conference on Computer Communications*, AFRICOM-CCDC'98, Tunis, October 20-22, 1998

[4] **Using and determining location in a context-sensitive tour guide.** N. Davies, et al. *Computer*, 34(8):35–41, 2001.

[5] **GeoNotes: Social and navigational aspects of location-based information systems.** F. Espinoza, et al. In Ubiquitous Computing, pages 2–17. Springer-Verlag, 2001.

[6] **Can you see me? Exploring co-visiting between physical and virtual visitors.** A. Galani and M. Chalmers. In *Museums and the Web.* Archives & Museum Informatics, 2002.

[7] Ward Cunningham. **WikiWikiWeb.** `http://c2.com/cgi-bin/wiki`.

[8] **GeoURL Project.** `http://www.geourl.org`