# Growing a Tourist Guide

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## ABSTRACT
In this paper, we propose how a truly ubiquitous tourist guide could be 'grown' by its users by ultimately relying upon them to be the suppliers of a comprehensive list of interesting locations. We describe how these locations would be added, and how they could be shared across an infrastructure to effectively reach all users that have an interest in them. We then outline how effective this particular strategy could be in reaching groups of users interested in particular cultural areas.

## Keywords
tourist guides, cultural tourism, ubiquitous computing, mobile computing, learning, adaptiveness, smart environment, usability, context management, sensors

## 1. INTRODUCTION
The advent of mobile and ubiquitous computing technology in the past years has meant that more and more users now possess, and even carry at all times a device with a display, usable amounts of processing power and memory, and potential connectivity. As a consequence of this, and also due to current GPS and cellular cell infrastructures, it is also possible for these users to achieve location awareness throughout the world. This means that if an application were to be written in such a way as to utilize these resources and at the same time be compatible with a large percentage of existing (and future) user devices, it would be possible for it to become a truly ubiquitous system, available in most corners of the world. This potential has led us to have another look at the one of the much discussed applications of nomadic, mobile, and ubiquitous computing: the electronic tourist guide.

This paper is organized as follows: Section 2 provides an overview of current (electronic) tourist guides, with a mention of the problems and issues we believe are inherently present in them summarized in Section 3. Section 4 then describes how these issues could be overcome with the 'growing a guide' methodology we propose, with Section 5 dealing with the workings of our proposed guide at the user level. Section 6 deals with the influence our guide could have on cultural heritage applications, while Section 7 analyzes and concludes the paper.


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## 2. CURRENT SOLUTIONS
Current electronic tourist guides and systems can in our opinion be classified into three main categories:

- electronic maps
- location-aware electronic maps
- intelligent location-aware systems

These seem to be a natural layered evolution of one on top of another, with technological progress making each progressive evolution possible.

### 2.1 Electronic Maps
These are the most rudimentary electronic guides, and essentially consist of collections of electronic maps usually held on a PDA and accessed by the user whenever he or she wants to find a route or directions from location A to location B, or when he or she just wish to browse a map. The bulk of these systems are usually not context aware, not location aware, and generally not anything aware, and truly just serve as an electronic version of a standard printed map, perhaps with some added route generation features. A large assortment of examples can be found at:_http://www.pocketgear.com/ in the 'Travel' section. Several of these solutions contain lists of locations that are believed to have some importance, (and can have their own symbol on the maps interface) and that can in some cases be updated via a server. A nice example of such an application is Vindigo [1], a feature-rich electronic map which works on your mobile phone.

### 2.2 Location Awareness in Electronic Maps
As the next evolution, a number of these electronic maps now have the possibility of using a GPS plug-in, which can make use of, for example, a Bluetooth GPS sensor kept in the general vicinity of a user's PDA. Thus the application becomes location- aware, and can be used to generate routes and location specific directions from the user's current position to a destination of their choosing. Examples include the Port@able Guide and Port@ble Navigator systems [2]. This form of context awareness is, in our opinion, the first key to the development of any intelligent tourist guide system.

### 2.3 Intelligent Tourist Guides
What we believe to be the next evolution in the electronic map application collective is the addition of some sort of intelligence. Usually this is in the form of suggestions tailored to the requirements of a user on the move, and in the world of tourism this means suggesting the most popular locations to visit in the tourist's vicinity. This might mean the most popular historic, architectural, modern, or recreational spots, city landmarks, or places of natural beauty.

Notable examples of systems such as the ones described above include:

- Gulliver's Genie
- Crumpet
- George Square

### 2.3.1 Gulliver's Genie

Gulliver's Genie (Genie) is a context-aware tourist guide for roaming tourists [3]. The main objective of the system is said to be "dissemination of context sensitive information to tourists with particular emphasis on meeting the needs and expectations of cultural users". What is interesting about this system is that it tries to provide multimedia content to a user based on his or her personal preferences through a multi-agent system. It also attempts to do this 'in a timely manner', via limited pre-caching of potential multimedia presentations of interest (based upon general location) until a user's future location is 'known' at which point the correct presentation is assembled and displayed. We believe in this particular example, the location prediction in conjunction with user preferences analysis makes for a powerful and smart tool.

### 2.3.2 Crumpet

This EU funded project is similar in essence to Genie, in that it also applies "location-aware services, personalized user interaction, seamlessly accessible multi-media mobile communication, and smart component-based middleware or 'smartware' that uses Multi-Agent Technology" [4] to the tourism domain. Particularly noteworthy about this system is the notion of learning user preferences implicitly through a statistical analysis of context history, namely the types of location that a particular user tends to visits more often. This is a feature which, if working correctly, could help a tourist guide system achieve more accurate and importantly far more interesting results for a dedicated user.

### 2.3.3 George Square

The George Square system is another intelligent electronic map, but this time with what we consider and important twist: it allows its users to add certain data into the system. Essentially, users of this system are encouraged to share their experiences with others through photographic, voice and location data. This data can then be viewed by others through a collaborative filtering algorithm that uses historical data of previous visits to recommend photos, web pages and places to new visitors [5], as suggested by previous visitors. We consider this use of collaborative ubicomp key, as will be demonstrated in Section 4.

## 3. ANALYSIS AND COMMENTS

One issue that we have identified with a number of intelligent tourist guides such as the ones described above, and which is definitely prevalent in the previous incarnations of electronic maps, is the problem of authoring location information. Most electronic maps and guides claim to have obtained their important location lists from 'reputable' sources in the form of various tourist bodies, heritage organizations, city councils, or popular newspapers. This is an understandable approach, as these listed entities are likely to have some form of the desired data, and probably have an interest in making this data available to as many tourists as possible. Another source might be other map sites, which might gather location lists for commercial reasons. But herein lie several problems.

First, we believe that data thus obtained must be naturally biased by the opinions of the body that compiled it. Hence 'popular destination' data obtained from a city council, for example, will not be a sound statistical analysis of all the city locations that tourists found beautiful or considered to be interesting, and why. Instead, it might rather be a broad list considered to be noteworthy by the locals, which (although usually a good indicator) could either be a smaller subset or a much larger superset of the locations that tourists actually find attractive. Any available metadata about any location so gathered will probably be further biased by metadata authoring due to similar reasons. In any case, this location/metadata tuple will be compiled for the average general tourist, and thus might have a broad category designed to satisfy the majority (and rightly so), but perhaps not be specific enough for someone with specific tastes.

With locations lists from commercial sources, we believe this issue is even more compounded, due to money issues. A restaurant guide of a town might not contain any establishments that did not register with the restaurant guide authors, or contain skewed metadata about those restaurants that paid a premium subscription fee, for instance. If such data is sold on, it would provide an electronic user guide with a usable basis, but we believe that a different approach altogether should be used.

Thirdly, many remarkable areas and locations around the globe are not covered by any location list database. Whether this is due to the fact that they might be in a category that is not covered in any location list, or in a country where luxury items such as location lists are unheard of, it means that traditional methods of covering these locations with electronic guides will fail.

## 4. A TOURIST GUIDE THAT GROWS

The solution we propose for dealing with the above problems is this: we believe that it should be the users themselves that should ultimately populate a tourist guide system with their own list of locations. Combined with a notion of a centralized location server and a way to share user-added locations between devices either via the server or directly in a collocated situation, it should be possible to dynamically generate a list of interesting locations far superior to any that could be generated statically by a tourist guide creator and shipped with their product. This list generation and update scheme that we propose is summarized in Figure 1 below.

Further, we propose that as each user creates a location within his or her device, and hence in the whole system, the user should provide metadata about the location. Hence, this location would then only be delivered to users which specify that they are interested in a particular type of location by making a comparison against some personal preferences data stored on their own mobile device. This approach does not directly exclude the initial seeding of the system with a list of widely accepted interesting location and metadata, but rather complements it. The initial seeding would ensure that the system is able to provide results from the first instant of being put in service, and refines itself as it goes along. Particular areas could then become populated by naturally generated patterns of user-defined locations via 'standard' usage by a number of interested visitors, with little work necessary before product distribution.

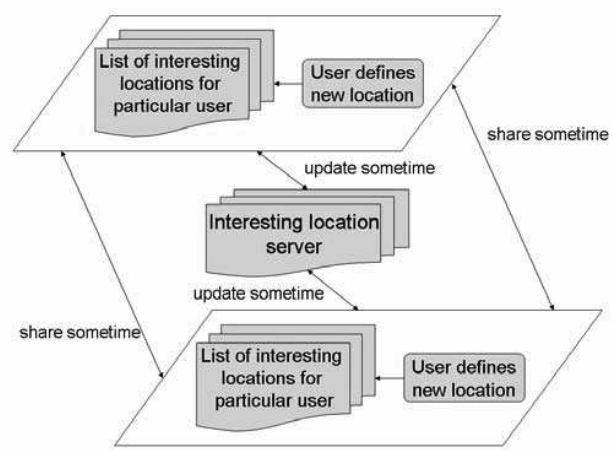


Figure 1. The location list generation and update scheme

One could also claim that such a scheme would allow for almost unbiased location list authoring, as the bias at the author end could easily be considered a plus at the recipient's end given the recipient has similar preferences. In essence a personal bias/preference could be made to work for better accuracy when suggesting to others with similar interests.

Further, this location generation scheme would allow for any corner of the globe to be populated with locations. This is of course assuming that GPS and/or GSM cells are now available almost everywhere.

## 4.1 Getting Updates from a Server

Users should be able to get an update of interesting nearby locations from the guide's central location server whenever they wish and have connectivity. A good idea would be to do it before a holiday, so doing an update for a known future location should be an option, as of course when arrived at the actual general location. Requesting an update when no connectivity is available should result in a scheduled event waiting for connectivity, at which point the update would happen automatically. Further, as the guide is location aware, we propose that it should proactively update itself when it notices that it is in a new location. Whether to actually do this automatically or not should of course be up to the user. In any case, we envisage that the general process would generally happen so:

Whenever an update is requested, the user's preferences and location (or future location) are sent to the server. The server would then be in charge of calculating a measure between the user's preferences list and all the locations available in the general vicinity (which would be definable). A list of <location,metadata> tuples would then be sent back to the user.

Although this is not in the scope of this paper, a very important consideration to make at this point is one about security and privacy: the device knows your location and knows your personal preferences, and is sending this data out to some server somewhere. Hence the mechanism to do this would have to ensure that a user's identity is kept secret. Randomly generated keys could be used to link requests with resulting generated location lists, making sure the server cannot link the data it receives to any particular person.

## 4.2 Collocation-triggered Updates

Further, as the spirit of this guide is in the collective effort of its users to build it up and make it better, we believe that it would be possible to make devices that use the guide update themselves by talking to each other when in close vicinity of one another. This could be initiated by the users, and could work in a similar fashion as users sharing mobile phone address book contacts via Bluetooth or IR, over coffee when discussing what they had just seen, for example.

It could theoretically be up to the device to occasionally search for other guides within earshot and initiate an update, and in this case security of the type mentioned in the section above would play an even more central role.

# 5. AT THE USER END

We believe that almost all of the infrastructure described in section 4 should in effect be hidden from the user. The user should of course have control of when and what to send/update, but once this is initially set up, updating the system could become automatic.

Essentially we propose that our system should have standard smart electronic map functionality with GPS navigation and route generation, and on top of that the following features should be present:

## 5.1 Intelligent suggestions to the User

Although the infrastructure from section 4 should ensure that a user only gets updates relevant to themselves, we believe that there should be an intelligent mechanism on top of that to ensure that location suggestions/information is delivered at the right time and in the right way.

The intelligent proactivity (or suggestion) mechanism we propose for our guide is loosely based on Figure 2 below. As one can see we expect to integrate the user's distance from a list of nearby appropriate locations together with the user's preferences and other available contextual data through an intelligent proactivity enabler, that would be in charge of formulating a suggestion on the user device.

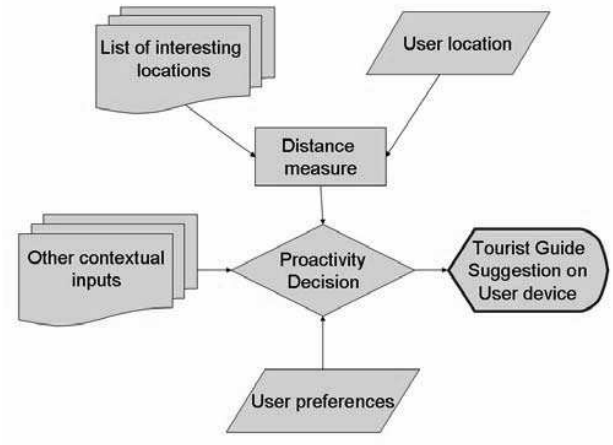


Figure 2. The user targeted suggestion scheme

Describing the details of this is not really the scope of this paper, however we are considering a Bayesian Belief Network approach. Key to this approach is the principle that a BBN may be both hardwired with initial response patterns, and also automatically learn and (re-)calibrate itself later. In fact, it can initially set up in a default mode, and then as it is being used it can learn from user activities, thus being able to automatically calibrate itself towards a particular user after it is deployed and as it is being used [6]. Further, with a satisfaction measure of the location just suggested easily available via analysis of the user response to the suggestion (i.e. was the suggestion followed?), a reinforcement learning scenario is also possible.

## 5.2 Adding locations

Whenever a user finds a location that they consider to be striking, important, or noteworthy in some way, we envisage that the guide should have an easily accessible button on its user interface that would allow a user to add a new location into his device (and into the whole tourist guide system by proxy due to the nature of the update schema).

Further, to make dissemination to users with similar interests possible, users should author information about locations. The data authored should include some keywords, a category classification, some data relevant to the given category classification of the location (e.g. if it falls under a 'place to eat' category, opening times & cuisine type might be an idea, etc..) and perhaps a picture if the device has a camera. A series of checkboxes on one screen should be enough to provide this data, with a possibility to add more later at the hotel for example.

A further enhancement we propose is that similar to the work carried out by [7], a user could potentially get a gentle 'nudge' to add a location if he or she spends considerable time at a particular location, or when GPS signal is lost upon entering a building.

# 6. CULTURAL HERITAGE RELEVANCE

We believe that the architecture described in sections 4 and 5 can be effectively brought into play when being applied to culture-specific or interest-specific applications. By this we mean that if one expert user visits a particular area, say Canterbury City Center for example, and is particularly interested in the subject of Norman architecture, then if that user adds a significant amount of locations labeled with 'Norman architecture' metadata, then his or her activity would enable future enthusiasts on that subject to come into the City center and use their guide for this subject specific tourist activity with great ease. Essentially, this aspect means that particular areas could achieve 'location seeding' by an expert user. This could of course be done manually in the locations database, but one would have need of the subject expert at some point in any case.

This in our opinion is a powerful feature, as it allows our guide to be easily configured for subject specific activities in particular areas, and in fact means that any area with a clear view of the sky (if using GPS) may beconfigured as an interest hotspot for a certain group of people with certain preferences. A large archaeological site could be 'populated' by experts from the heritage organization in charge of it for future guests, for example, rather than leaving this task to random visitors.

One important point we wish to make at this stage is that any such activity as described above would not interfere with any of the basic functionalities of the guide, and indeed the area would still be perfectly usable to any users with different interests and preferences. In fact areas of different interest could easily overlap, while allowing natural user-generated patterns to emerge as well.

# 7. ANALYSIS & CONCLUSION

We believe that a system like this is a step forward in that it has the potential to provide true ubiquity and unbiased service to tourists in most corners of the world.

It would be a system that learns from its users to better work for its users, and one which could intelligently and proactively suggest from a wide, unbiased list of locations that *you* like.

Further, its potential to seed areas by experts would make it a good choice for local entities in charge of tourism and heritage sites at particular locations or areas, as this feature would allow for localized delivery of information to tourists without having to develop any local infrastructure.

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