# RevisiTour: Enriching the Tourism Experience With User-Generated Content

Youn-ah Kang, John Stasko, Kurt Luther, Avinash Ravi, and Yan Xu

School of Interactive Computing & GVU Center
Georgia Institute of Technology, Atlanta, GA, USA
ykang3@mail.gatech.edu

## Abstract

We have explored design opportunities to enrich the tourism experience of people at the Georgia Aquarium by providing a context of photos and by motivating people to be active creators of content to share their experiences with others. We designed a system named RevisiTour to enable visitors to reorganize photos taken from tour sites and share the photos with others. A visitor's path and timestamp are recorded on a badge with a sensor throughout a trip. After the trip, the visitor can access a website where s/he uploads photos, synchronizes them with the path, and shares the photos with others. We report on how the system was designed, developed, and refined. After developing a prototype, we evaluated a mock-up of the system with actual visitors in the Georgia Aquarium. The analysis and design implications show the possibility of user-generated content systems for tour sites.

**Keywords:** Tour Technology; Ubiquitous Computing; User-Centred Design; User Experience; User Generated Content; Web Services.

## 1 Introduction

Often, a visit to a popular place such as a museum, aquarium, or tour site is a special one-time visit to that place. Unless people live near a site, are particularly interested in that venue, or the site constantly changes its content/collections, they may rarely revisit the tourist venue. Also, visits to tourist attractions tend to be limited to on-site experiences since many people do not gather much information about a site before a visit. Even after a visit, they may soon forget what they saw and how they felt while touring even though they have taken pictures to cherish the memories. In other words, they lose context of their experience.

We found that tourists at the Georgia Aquarium desire more interaction than is currently provided. Tourists not only want to see and feel each exhibit, but they also want to learn more about its history and make an impact on its future. We found that tourists seek to share their personal experiences even with other tourists they do not

really know. Tourists come with cameras in hand, snapping pictures of everything they see, and uploading them to blog posts and media sharing websites such as YouTube and Flickr. Although this evidence shows that people are willing to share their tour experiences with others, there is no integrated system that can support these uploading, accessing, and sharing activities embedded in the process of touring. To address these problems, we must confront two major issues: (1) how to capture visitors' experience without interrupting their current practices of touring and (2) how to make records of the visit (e.g., pictures) meaningful before/after a visit.

Our project, known as RevisiTour, aims to design, build and test an experience-sharing system for tourists who are visiting places of interest. We chose the Georgia Aquarium in Atlanta, Georgia as the environment where our system will be deployed and tested. We first discuss issues from previous research followed by a description of our design process. We then provide an overview of the prototype that was tested at the Georgia Aquarium and conclude with an analysis and discussion of our evaluation.

## 2 Theory/issues

### 2.1 Tour Guide System

Location-tracking systems and mobile computing have been successfully applied to the tourism domain in the context of the handheld tour guides. Cyberguide, a mobile context-aware tour guide, uses a person's current locations, as well as a history of past locations, to provide more appropriate services that they come to expect from a real tour guide (Abowd et al., 1997). The GUIDE system utilizes contextual information such as location and user profile, in order to provide the tailored information and navigation needs of visitors to the city of Lancaster (Cheverst et al., 2000). Researchers also have studied the use of handheld devices in a museum. The Guidebook project, in which nomadic web content was created to explore user experiences with handheld devices in a museum, used a travel guide providing directions, historical context, information, and background stories (Hsi, 2003).

As shown in previous work, a mobile tour guide is often limited to provide richer, just-in-time information or provide a path to the right object. Our attempt here is to involve visitors with creating content and serving information, thereby suggesting a new perspective on tourism-related technology for aspects of the tourism experience.

### 2.2 Photo-Sharing Support

Researchers have recently explored photo-sharing practices on the web to support more meaningful digital record sharing. The Personal Digital Historian (PDH) project

is an effort to facilitate conversation and storytelling for multiple, co-present users to explore digital collections (Shen et al., 2004). In the first application, they suggested a new interface that enables users to annotate, organize and query the digital collections around four questions essential to storytelling: who?, when?, where?, and what?

Frohlich et el. (2002) studied 11 families and identified photo-sharing practices using ethnographic field observations. Some of their findings included that: people are motivated to do some basic organization immediately; people complained about forgetting details of people and events; and several people want more specialized photo archiving (e.g., putting together special milestone projects to mark a significant life event). In a study that examined photography practices, socialization styles, and perspectives on privacy, Miller and Edwards (2007) found that people used a chronological organizational strategy as their primary method.

Bamford et al. (2007) implemented LogoBlog, a space-time photo travel blogging service that consists of the mobile application and associated website. The service provides a unique way for individual users to record their travels and also provides the family and friends an interactive way of sharing travel experiences in real-time.

## 3 Methods / procedures

Our design process included the following phases: user research and secondary research to identify needs and requirements; and sketching and ideation to develop multiple design alternatives and explore the design space.

### 3.1 User research

We conducted user research including several interviews and online reviews in order to better understand our target users. We focused on various types of user groups and how those groups differ in terms of interests and group dynamics.

We found that different user groups have different purposes and we need to fulfil each group's requirements. Basically, we identified two main goals of people visiting an aquarium: for educational purposes including information seeking and simply for having fun and enjoying the experience. Individuals who attend the aquarium with these different goals in mind show different behaviours while staying in the aquarium. Education-seeking visitors try to obtain as much information as possible by reading descriptions, querying the staff, and taking pictures of the animals. The fun-oriented visitors simply enjoy the atmosphere of the aquarium and place more emphasis on being in this beautiful place with other strangers. Of course, many visitors come to the

aquarium with both goals in mind, but we felt it important to carefully consider these two different goals in the design of the system.

Differing technological abilities and familiarities of visitors was another design implication. Visitors to the aquarium may range from a 5-year-old child to a 70-year-old grandparent, from a person without any computer experience to a technologically savvy student. Our design must be appropriate for this wide range of individuals. Also, the system is not an application being used routinely in people's everyday lives. Visitors are likely to use it several times a year at most and that is even only for frequent aquarium visitors. This highlights on an important design implication: the interface should be intuitive and easy to use without training.

### 3.2 Secondary research

In this phase, we explored existing systems that people use when they are visiting a tourist venue or when they share their tour experience before or after a visit. While there was no existing system that could systematically support experience sharing for tourists, through interviews and online resources we examined different systems that had similar functionalities and characteristics. We found evidence that tourist venues are beginning to realize people's desires for both knowledge and entertainment, and current efforts are scattered into different systems that were designed for different groups of users. The existing sources of information and experience sharing we reviewed include: (1) Official website of Georgia Aquarium, (2) Tour guides, (3) Information Placards in front of each exhibit, (4) Displays for each of the sections, (4) Flickr, a popular online photo sharing website where one can fine more than 27,000 photos for "Georgia Aquarium", (5) YouTube, an online video sharing website where 545 videos are found by a search on "Georgia Aquarium".

From the systems listed above, we found that there have been many efforts from the aquarium to provide more content to visitors, and visitors are starting to use different platforms provided by third parties to share their experience. The examples of YouTube and Flickr demonstrate tourists' desire to share their experience with others. Interestingly, the Georgia Aquarium website has attempted to integrate different experience-sharing resources, for example, the site links to related web pages on Flickr and YouTube. We seek to go beyond this to provide an integrated system that can support accessing, reading, uploading and commenting on the tour experience.

### 3.3 Sketching and ideation

In the ideation phase, we generated several sketches and scenario concepts. This process helped us identify key system features and narrow the design space. In

particular, we wanted to answer key design questions regarding possible options. Our design alternatives varied in the design space listed below.

- Hands-off and unobtrusive interaction versus access to information: the system should be designed to be unobtrusive when users are focusing on the tour and moving around on their feet. However, as found in interviews, tourists want more information on-site; they are more interested in getting information about exhibits when they actually see them. While hand-held devices can provide better access to "information on-the-go", they tend to be obtrusive, especially under mobile circumstances. It is crucial to find a balance between accessibility of information and physical demand.

- Private expression versus public presence: while we try to encourage tourists to share their experiences, we need to keep in mind that everyone has different levels of privacy concerns. Some people enjoy sharing their pictures with the public but some do not. The design needs to address these different levels of privacy requirements, allowing tourists to have the freedom to decide which content they want to share and how they want to share it.

- On-site versus off-site subtasks: some of the functions of the system we envision could be done either on-site or off-site (e.g., sharing photos). We need to compare the cost, difficulties, and benefits of on-site and off-site tasks and decide upon an effective and user-satisfying solution.

## 4 Results

### 4.1 RevisiTour: the design

Our design focuses on off-site experience sharing. Tourists' experiences (pictures or videos) are organized by both location in the Aquarium and time. This information is detected and recorded silently by a wearable tag that measures the proximity between the tourist and the exhibit and the related timestamp. Visitors tour the Aquarium as they normally do. Upon exiting, the badge automatically uploads their organized experience as a package to the website, which tourists can later visit to view their path through the Aquarium, sort their photos and videos by location and time, share their experience with others, view others' shared content, and comment and rate content. We call this experience-sharing system RevisiTour.

Our RevisiTour system prototype consists of multiple components. Zigbee technology is used for the location-tracking component. The online website Flickr is used as the

repository for user's pictures. Finally, a custom web-interface and database is used to merge photos, timestamps, and location data in order to present them to the user in an intuitive and interesting way.

The RevisiTour system does not disrupt the on-site touring experience: tourists make use of their traditional way of recording the experience, either by digital cameras or camera phones. The Zigbee tag for recording proximity information and timestamps works automatically without disturbing the tourists.

### 4.2 Usage scenario

In order to better understand the prototype developed, we provide a typical visitor scenario and describe the system. The scenario refers to a tour of a family.

*Eileen is a 41-year-old mother, who has a 5-year-old son, Dan, and a 9-year-old daughter, Alice. One weekend, Eileen decided to take her daughter and son to the Georgia Aquarium. When they arrived at the Aquarium, there was a long line waiting at the entrance. While they were waiting, they noticed a big display on the wall of the entrance, showing the pictures that previous visitors had taken and shared. After they entered the aquarium, a staff member gave Eileen a small tag that she could pin onto her t-shirt. During the tour, she was busy watching her children and taking pictures. She forgot about the tag that she was wearing.*

*After three hours, Eileen and her children finished the tour. While passing through the exit, Eileen's tag automatically uploaded her family's location data to the Internet. At night, Eileen wanted to go over the pictures that she had taken. She connected her digital camera to her laptop and uploaded all the pictures to her personal Flickr account. She then navigated the Georgia Aquarium website and logged in using her ticket ID and Flickr ID. She was presented with all her pictures sorted by location and time, which helped her renew her memory. She went over the pictures following the route she took in the Aquarium, as if she revisited the aquarium.*

### 4.3 Prototype development

Here, we describe three elements of our prototype: Zigbee technology, Flickr, and a web-based visualization tool with a database. While we did not build the hardware design, we fully implemented the system interface and built the website including database and web-based visualization tools.

#### 4.3.1 Zigbee technology

Zigbee technology is used to unobtrusively track the visitor paths through the Aquarium. Zigbee is a short-range wireless communication standard similar to

Bluetooth that is ideal for low-power, limited-memory computing devices (Adams and Heile, 2006). For our application, Zigbee nodes can be fixed to each exhibit and also given to each visitor in the form of a tiny, wearable badge. The visitor Zigbee node can measure the radio signal power between itself and all nearest nodes and then simply record the ID and timestamp of the exhibit node that provided the highest signal power. A major benefit of Zigbee technology is its scalability, robustness, and cost-effectiveness. With these advantages, Zigbee technology provides an unobtrusive location tracking system and visitors can tour the Aquarium the way they normally do.

#### 4.3.2 Integration with Flickr

In our system, media sharing in an online community would be an important component. To serve the purpose of a photo organizing and contextualizing tool, we decided to integrate our system to Flickr using the Flickr API rather than building an online community *per se* for the following reasons.

Even before the phase where we conducted user and secondary research, we had come to the realization that many tourists were already sharing their experiences via media sharing websites such as Flickr and YouTube. As a result, Aquarium staff had placed links on the Georgia Aquarium website to areas of Flickr and YouTube where media created by tourists were being shared. Beyond this, however, the Aquarium was looking for ways to explicitly take advantage of these emergent tourist activities and leverage them towards something more closely tied to the Aquarium itself.

Also, we thought that the Flickr interface does a good job of presenting media sharing capabilities to users in a straightforward, easy-to-use way. It was daunting to simulate such an extensive online community, so we decided to build our system in such a way that it could integrate with Flickr's functionality, simultaneously leveraging Flickr's huge database of photos and functionality and providing services to Flickr users that make their photos of the Georgia Aquarium more meaningful and interesting.

#### 4.3.3 Web-based visualization

Anyone who visits the RevisiTour website (http://revisitour.kurtluther.com/) will have a number of options from which to choose. Without providing his or her ticket ID, the tourist can browse the photos that other tourists have synchronized. This option, which we refer to as the **spatial or map visualization tool**, is selected by default when the RevisiTour website is accessed. If a tourist mouses over a sector of the map, as shown in Figure 1, that sector becomes translucent, uniquely coloured and its boundaries are made explicitly visible. The sector's name and the number of synchronized photos for that sector also appear. If the tourist clicks a sector, the photos in that sector appear as thumbnails in a translucent, overlaid, modal window. The tourist also has the option of viewing the most interesting photos and most recent photos of the Georgia Aquarium that are tagged on Flickr.

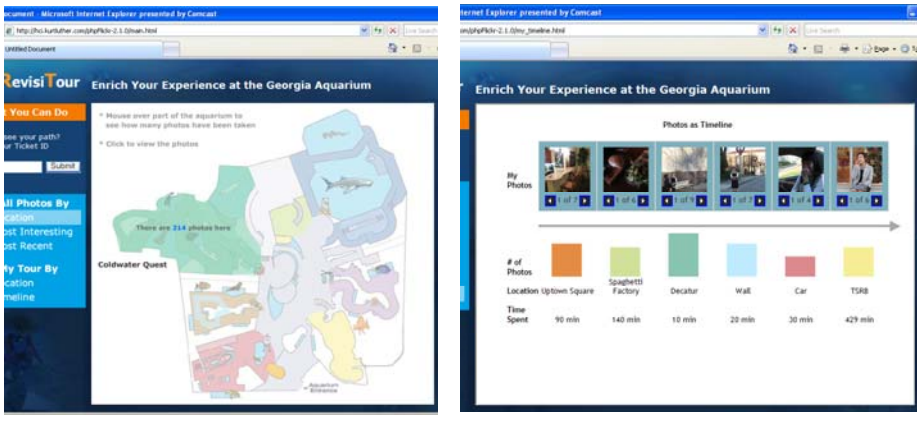


**Fig. 1.** Two visualizations: spatial (left) and temporal (right) view

At any time, the tourist may type his or her ticket ID into a textbox in the interface to view his or her *own* location data and synchronize his or her *own* photos. Once the ticket ID is typed and submitted, the tourist is brought to the **temporal or timeline visualization tool**, shown in Figure 1, where his or her location data is presented. The temporal visualization tool presents the tourist's path through the Aquarium as a sequence or timeline, moving from one sector to the next. For each sector that the tourist visited, the name of the sector is presented. In addition, the time spent by the tourist in each sector is presented, allowing the tourist to easily ascertain where he or she spent the least and most time. Besides time and location data, the temporal visualization tool also associates photos with each location visited by the tourist. In this view, the photos shown are those taken by other tourists during the same time period that the tourist was in that sector. Thus, the tourist can see what other tourists photographed and found interesting in the same place at the same time that he or she was there. By clicking small arrows, the tourist can cycle through thumbnails of these photos. Beneath each thumbnail is a bar graph visualization of the relative number of photos available for each sector, revealing at-a-glance the sectors that prompted tourists to take the least and most photos.

Besides viewing the photos that other tourists took, the tourist may also want to see precisely where, within the Georgia Aquarium, his or her own photos were taken. To take advantage of these additional features, the tourist must synchronize his or her Flickr photos with the location data stored by RevisiTour. When the tourist's Flickr account username is provided after s/he logs into RevisiTour with his or her ticket ID, RevisiTour will then use the tourist's location data to synchronize his or her Flickr photos and import them into the temporal visualization tool, replacing the photos of

other tourists that were presented previously. Likewise, the bar graph visualization representing the relative number of photos taken by the tourist will also update to reflect the tourist's own synchronized photos.

# 5 Evaluation

We deployed the prototype in the Georgia Aquarium to assess our design with real visitors and find room for improvement. As the RevisiTour system is comprised of an on-site (aquarium-based) component and an off-site (web-based) component, we divided the evaluation process into two phases. The first phase evaluated the tourist's experience with the location tracking system at the Georgia Aquarium, while the second phase evaluated the tourist's experience with the web-based visualization tools on the RevisiTour website.

## 5.1 On-site Evaluation

Since it would require tremendous resources to implement the real location-tracking system, we constructed a system for evaluation purposes that, from the tourist's point of view, is completely indiscernible from how the real system would operate. We simulated the automatic location tracking provided by the Zigbee infrastructure by simply observing where tourists go throughout their visit and recording this path without informing the participants. This approach yielded a data set identical to that which would be generated by the Zigbee infrastructure. After they finished the tour, participants filled out a brief questionnaire. We asked each about how they felt having his or her location tracked and recorded. Specifically, we were interested in to what extent they were sensitive to obtrusiveness and privacy issues. Some questions asked whether the location-tracking badge was obtrusive and whether they felt uncomfortable about being tracked.

## 5.2 Off-site (Observation, Survey, Interview) Evaluation

The RevisiTour website and visualization tools were fully implemented. In the real world, tourists would use this part of the system in the privacy of their own home or workplace. However, we evaluated the system at the Aquarium simply because we wanted to observe the tourist using our system and to collect data firsthand.

After the subjects finished touring, they were taken to a room where they could access a laptop and wireless network. They were provided with an instruction sheet that included how to use the system and a description of the tasks to perform. After they finished the session, we asked them to complete a questionnaire. Though we did not measure objective performance such as task time or accuracy, we asked Likert-scale

questions to obtain quantitative data. We also conducted a follow-up interview to solicit more detailed responses on our system. The interview was semi-structured; we generated questions based on what we had observed.

### 5.3 Users Involved and Tasks

We recruited subjects in advance and had them to visit the aquarium and use our system. We had 13 participants (5 female). All the users were familiar with computer and Internet usage. Most of the users had photo-sharing experience, but only one user had experience in Flickr.

In the off-site evaluation, users were asked to take photos while touring the Aquarium as they normally would. Though we did not list a set of benchmark tasks for the on-site evaluation, there were several main tasks that users were asked to perform when they interacted with the RevisiTour site. The tasks included (1) creating a Flickr account, (2) uploading photos to the Flickr website, (3) visiting the RevisiTour website, (4) logging in using a Ticket ID, (5) synchronizing photos using Flickr ID, and (6) exploring the website as they would like to do.

### 5.4 Evaluation Results

We analysed the data gathered through surveys and interviews and then divided our findings by themes or topics. Two are *feature*-based themes—location tracking and photo sharing—and two are *usage*-based themes: usability and desirability.

#### 5.4.1 Location tracking

We knew that location-tracking component of our system would lead to a host of privacy issues. Our question was whether tourists would see the value brought about by the location tracking as offsetting the perceived costs of allowing themselves to be tracked and having this data stored as they roamed around the Aquarium. To help illuminate this issue, we asked participants how comfortable they were with relinquishing their location data at varying granularities: having their location tracked at all, having the data used by the Aquarium, connecting the participant to her data through the ticket ID, and storing and accessing this data online. The data showed that participants, across the board, were very comfortable with having their locations tracked in the Aquarium and their location data made available on the RevisiTour website. Though some expressed concern about the data being made available to outsiders through intention or security flaws, overall, participants had a favourable reaction to the location tracking system and how it handled privacy concerns as one user commented: *"As long as the tracking information stays within the aquarium with the purpose exclusively for the aquarium, there is no objection against it"*

### 5.4.2 Photo sharing

We sought to get a feeling for how our participants felt about photo sharing, in terms of both sharing their own photos and looking at photos shared by others. We also wanted to see how difficult it would be for tourists unfamiliar with Flickr to get up and running with it. The ratings of each question showed that participants were active in sharing their photos with others and viewing shared photos by others. Participants were also generally willing to learn to use Flickr. Though participants did not express particularly high levels of enthusiasm for viewing photos shared by others, we suspect that if more photos were available—for the evaluation, RevisiTour only showed a small number of photos—the viewing experience might be more rewarding.

### 5.4.3 Usability

To solicit holistic feedback on the entire experience, we asked participants questions about how easy or difficult the system was to use. Overall, the results of our usability-focused data were very favourable. Participants reported that the RevisiTour website interface was easy to learn; as learnability was a crucial usability attribute we were seeking to address, these results were very encouraging. Participants also indicated that navigating the RevisiTour website, once they knew how to use it, was quite easy. Some participants requested additional features for the website: *"It's very good to add the fish database, such as fish's name and short characteristic explanation and a listing of what was contained in each exhibit to help with tagging."*

### 5.4.4 Desirability

Since RevisiTour is designed to supplement tourism experiences, it was important for us to evaluate whether RevisiTour seemed to make tours more fun than they already were. Did they enjoy using it? Would they use it again if they had the chance? We asked participants several questions across a variety of dimensions, ranging from entertainment to usefulness to aesthetics. Though the ratings were not as high as we expected, all questions met with relatively positive results from participants. They felt that the system was mildly desirable but a few were quite excited about RevisiTour as some participants commented: "*…I have never seen such a synchronization method of sorting pictures by location, very fresh experience." "…I feel this system has great potential to be a value-adding tool to the experience. The most difficult part of owning a disk [unintelligible] is remembering the specifics of where/what/when I took pictures. Your system shows me which general area I was in…*"

## 6 Conclusions

This paper has presented a design case study of an experience-sharing system for tourists. Preliminary studies have identified a need for better support for media

sharing with such spaces and other tourists. User study and secondary research narrowed down possible design spaces. After initial sketching and design, we created the RevisiTour system, a location-based experience sharing system for visitors of the Georgia Aquarium. It provides an integrated system with which tourists can upload, access, and share their personal experiences embedded in the process of touring. We built a prototype and conducted an evaluation with actual visitors under a real environment. While the analysis showed the possibility of RevisiTour as a new way of experience-sharing system, it still leaves a room for improvement in supporting for exhibit information and better integration with Flickr.

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## Acknowledgements


We would like to thank the staff of the Georgia Aquarium for supporting us throughout the process and especially Joseph Handy for helping us to communicate with the Aquarium.