

## **Project Name: Carmen Sandiego**

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### **Motivation and Objectives**

Online photo albums have become a method for people to share memories and experiences with people all over the world. Online albums such as Flickr, Picasa, Webshots and many others exist to make the creation and sharing of electronic pictures easy. Though much effort and work has been put in by countless software engineers and UI designers to develop the best online experiences for users, much work still needs to be done to make online albums more useful, informative, and easy to navigate. At a recent Tech Talk at Georgia Tech, Alan Warren from Google asked the audience members to raise their hands if they tagged the people in all their pictures and wrote captions by all pictures. Not many raised their hands. Adding meta-data to digital photos is a tedious task and because of this many users do not experience the associated benefits of tagging.

When considering the value of photographs, the idea of location and time is almost as important as content. Photos capture not only "what", but also "where" and "when". The latter two can be used to provide a more general classification of photos and therefore can be a more useful retrieval mechanism: a photo from your trip to San Francisco (location) or from Christmas (time) is found more easily by location or time than by content. Additionally, the "when" and "where" classifications allow for a more generalized association between photos: viewing all photos from San Francisco (location) or from Christmas (time).

The goal of *Carmen Sandiego* is to develop an easy way for user to tag their photos by time and location and display them on an easy to navigate template. With just a GPS device and digital camera, users can run our script and see their pictures displayed on a geographic map. One day, with the momentum of current research for digital imaging, cameras may have embedded GPS chips [1]. Until then two separate devices are used. *Carmen Sandiego* allows users to navigate pictures by when and where they were taken in addition to just a name of an album or a name of a photo. Also, this tool allows for automatic archiving and organization of pictures by location and time.

### **Related Work**

Much research has been accomplished to investigate the idea of location based tagging of photos. Tools such as Flickr[2] and Picasa[3] have manual location tagging options. Flickr also has a method of placing text over location on a map to better define a map. However, manual tagging has proven to be tedious and therefore is not widely prevalent. Therefore, computer scientists have been researching ways to automate location-based tagging. The GT-800BT Bluetooth GPS EverPhoto[4] developed by Evermore is a device that combines Bluetooth GPS with geo-tagging software. It uses software to import the image onto Google Earth for viewing. This device is still limited by cost and is relatively new so it has not yet been tested in the consumer market. Researchers from Microsoft have explored different method of attaching geo-spatial data to digital photographs. Their focus is on the World Wide Media eXchange and indexing images by location, user, time and other meta data to provide a database similar to the World Wide Web [5]. We will be using the method mentioned in Section 5.3 of [5], "From Location-Aware Device", to tag our photographs. In [6] the authors discuss various meta-data (e.g., Events, Light Status, Weather) "cues" that can be automatically determined about a photograph given its spatio-temporal information. They tested the usefulness of these different cues in user-recall. We will use a subset of their research to determine ways to present a collection of digital photographs to a user. In [7] the authors discuss a method of clustering photographs to provide hierarchical navigation of photographs based on location and event. We will implement this idea of hierarchical clustering and zooming in order to present a user's collection of photographs in a meaningful way. In [8], the authors focus on the organization of images taken from a mobile phone. The authors declare that people now use devices like their phone to record events that happen in their life. Therefore, these

phones contain a large amount of personal digital data that is not organized. They propose a method to organize the personal image collection acquired strictly from a cell phone. These images can be organized by date and location, since cell phones have a concept of GPS and time. The authors of [9] focus on novel methods to browse photo collections based on location and heading of metadata associated with the photos. This method requires manual addition of geo-location information to pictures and adding those images to the web for sharing. The authors present the different sites that offer manual geo-tagging. As previously mentioned, manual tagging is tedious and is something that has not taken off on the user end. Authors of [10] propose a community focused method to allow people from all over the world to link pictures taken from the same location. This method is for the photos that are publicly available. It clusters images from different users taken from the same cities to allow users to compare pictures and experiences with one another.

As seen from the many papers already presented, different groups have researched different methods of improving geo-tagging of images- private and public. Our method will provide users with a simple way to combine their camera with any GPS device and view the images on the familiar template of Google Maps.

## Proposed Work

Our goal is to automate the tagging of photos with location and time in order to provide the benefits arising from these additional classifications without necessitating the effort related to manually tagging. There has been much prior work in this area; however, no adequate tools have been released to the public in a cross-platform, open-source version. Using Java, we will implement the timestamp-based geo-tagging algorithm seen in Section 5.3 of [5]. This will provide us with geo-tagged photos with which we can experiment.

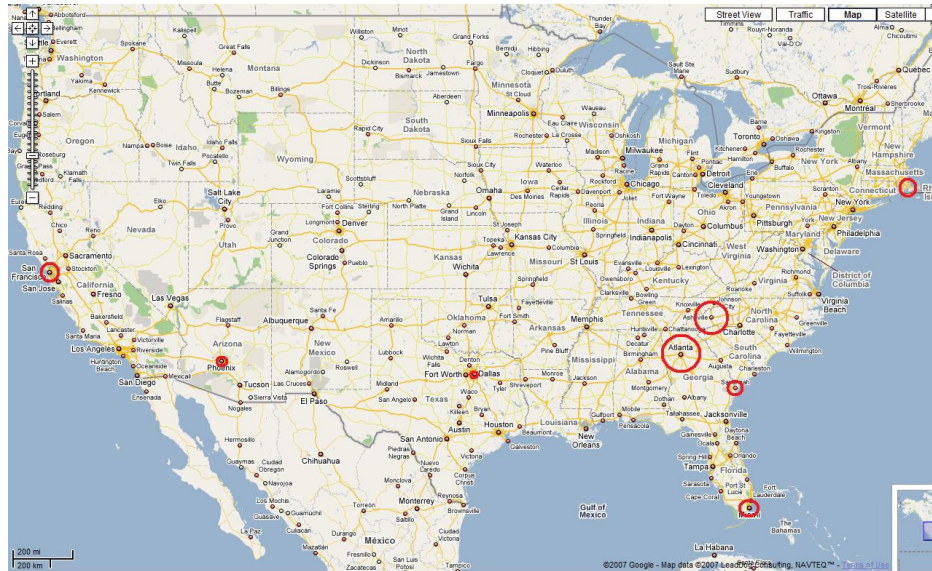
Additionally, we will implement and extend research on associations between digital photos. This association includes clustering photos by location and time on a geographic map. This feature allows the users to visually see the photos by when and where they were taken. Recalling events and photos by time and place may be easier than recalling photos simply by a tagged name or caption.

The features for *Carmen Sandiego* will include:

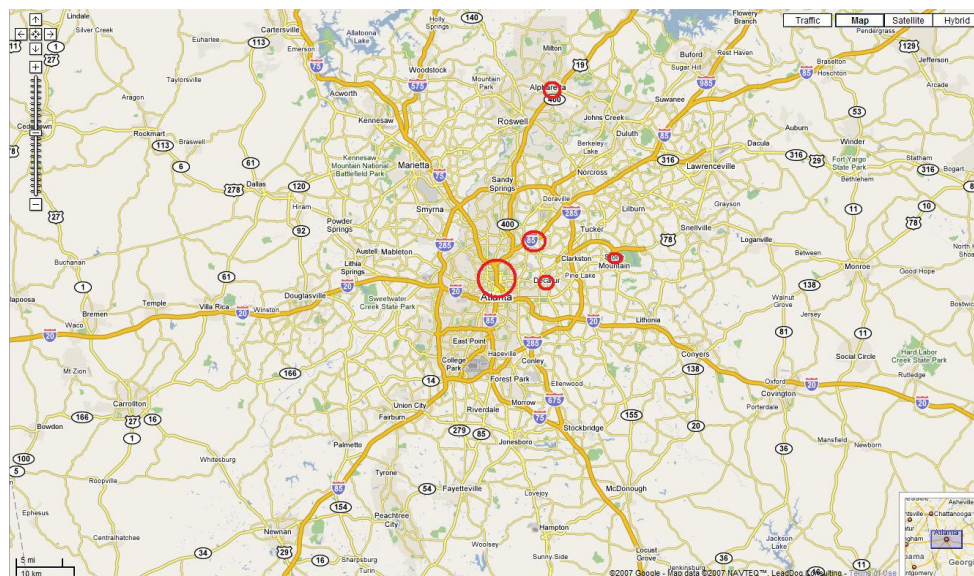
- Use of GPS: acquire a GPS and trace movements for 6 weeks of the project
- Take pictures during those weeks on a camera that supports digital time stamping
- Tag photo with latitude and longitude obtained from GPS with a custom-made computer application
- Display photos on a map, using clustering by area similar to clustering in Project Lachesis[11]
- Display time periods using database clustering to find similar photos
- Map photos to a geographic map using Google Maps API and custom website with photos/metadata in database.
- Allow of zooming in geographic map to images in more specific locations. See **Figures 1, 2, 3.**
- Filter by time (significant events) so only similar-time photos are shown
- Filter by location (significant places) so only similar-location photos are shown-

Using a GPS device and camera, users will be able to automatically get the latitude and longitude of the images an map that onto a geographic map. **Figure 4** displays a sketch of the data flow from the GPS device and the camera through the application and onto a map.

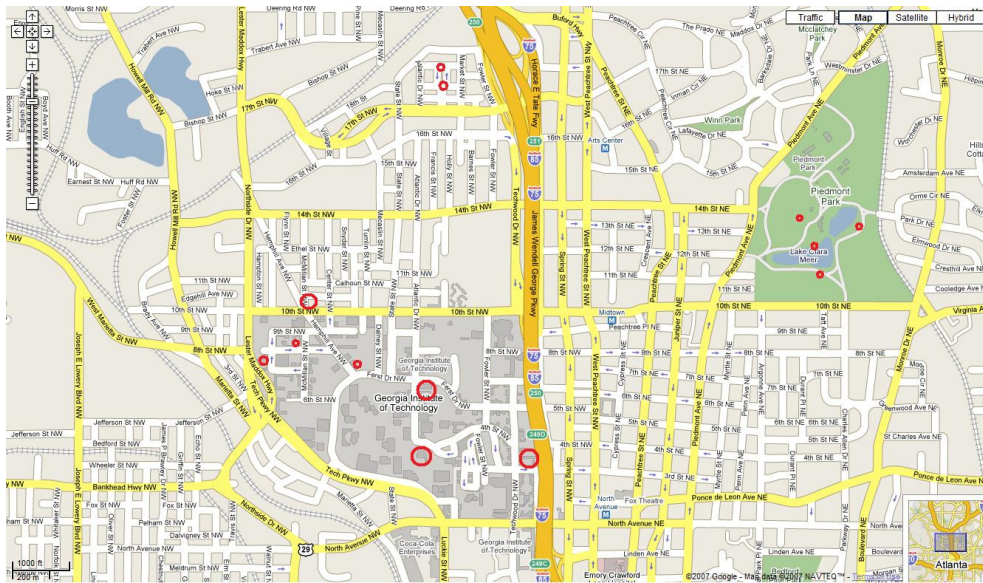
On this map they will be allowed to zoom out to see the pictures across a large area or zoom in to see pictures at specific areas (restaurants, parks, schools). Circles are used to indicate the number of photos at each location. Larger circles indicate more pictures as displayed in **Figure 1**, a map of the U.S. Circles will be relative to one another. For example, a circle of 1cm on a map of the U.S. may indicate 100 photos, but a circle of 1cm on a map of Georgia Tech may indicate 5 photos. See **Figure 1**, **Figure 2**, and **Figure 3**. Clicking on the circles will give an option to see all images from that particular location. An added feature will be the filtering of images by the time to allow users view images on a geographic map from a certain period of time.



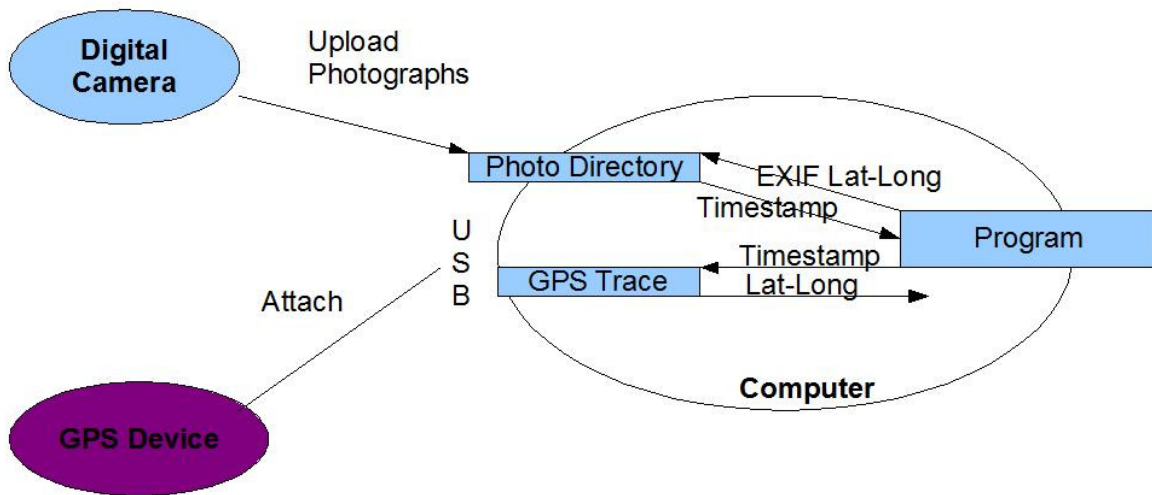
**Figure 1: Photo Album sizes displayed as circles on US map**



**Figure 2: Map zoomed to Atlanta level**



**Figure 3: Map zoomed to Georgia Tech level**



**Figure 4: Data flow for synchronization of camera and GPS**

The success of *Carmen Sandiego* will be evaluated by the finished application and the display of clustered images on Google Maps. The images will have timestamp and latitude and longitude attributes and those attributes will be used to create a user interface over a map. The interface will allow for zooming and filtering by location and time.

## Plan of Action

With only seven weeks remaining to finish the project, the team will meet weekly on Mondays at 6:00pm. The GPS device and camera will be provided by the group members. The image, location and time stamp syncing will be done using Java and the Google Maps API. The timeline by week is displayed below:

### October 15<sup>th</sup>

- Obtain GPS and digital camera
- Begin coding of script to sync timestamps from GPS device with timestamps from the digital



camera

## **October 22<sup>nd</sup>**

- With a script to sync timestamp from GPS and camera finished, use Google Maps API to put pictures onto Google Maps according to the latitude and longitude provided by the GPS device
- Determine best design to display albums as circles on the map depending on the size of the album. These circles are either albums or images clustered by location.

## **October 29<sup>th</sup>**

- Using Google Maps API, do actual implementation of importing images into Google Maps and draw circles by image clusters.
- Test with existing GPS data and photo directories.

## **November 5<sup>th</sup>**

- Add zooming feature maps (See figures 1, 2, 3). There may be one large circle over Georgia, but zooming in will produce more individual circles over Atlanta, and zooming in some more will produce circles over different parts of Atlanta, etc.
- Start work with filtering by location and time on the map. If a user wants to see only pictures from a 2 week road trip across the United States, he should be able to see only those pictures mapped on the geographic map of the U.S.

## **November 12<sup>th</sup>**

- Finish the work of image filtering by location and time. Test on images taken since day one of the project.

## **November 19<sup>th</sup>**

- User testing with cognitive walkthroughs
- Use 3 participants, each participant keeps the camera and GPS device for one day. We sit down with them in the evening to sync the device with map and allow the user to evaluate the product.

## **November 26<sup>th</sup>**

- Finish testing and evaluation. Perform focus group if not yet done.
- Finish final project summaries
- Prepare for due date the following day

## **November 27<sup>th</sup>: Workshops start**

**December 3<sup>rd</sup>: DUE DATE**

## **Evaluation and Testing Methods**

User centric projects like *Carmen Sandiego* require user testing as a key evaluation method to ensure that it is a product that would be useful to the users. These testing methods include focus groups, cognitive walkthroughs and observation of users. Some key topics would be the easy of use, the need for automatic of location tagging, and the willingness of users to obtain an extra GPS device to utilize this features. We will evaluate the need and incentives for *Carmen Sandiego*.

### *Cognitive Walkthrough*

In this testing method, we will give the user a camera and GPS device to use for a day, taking pictures from all the locations they visit. We will then sit down with them at a computer, give them a list of instructions and observe as they interact with the system. These instructions will roughly include:

- Sync the GPS with photos on the camera
- Log on a Google account and sync the GPS tagged photos with Google maps to display photos visually on the map, like in figure 1.
- Zoom in and out at each location to see pictures at different levels of the map

In order for this tool to be successful, the user must be able to easily follow the instructions and see a real use for automatically tagging their pictures.

### *Focus Groups*

After individual user observations, the users will be asked to attend a short thirty minute focus group to discuss *Carmen Sandiego*. A group member will lead the discussion but allow the participants to steer the discussion in different directions to better understand what the users liked, did not like and what the users would like to see. Some topics for this group will include the cost of a GPS device, the burden of an extra GPS device and the usefulness of a script that automatically syncs the images with location and times on a geographic map.

In addition to user testing, testing methods to ensure that the script is robust for large files and large amounts of images. Other features to test include image data clustering effectiveness and zooming capability on the maps, repainting the maps at each step with new circles for the newly clustered images at each location. These tests will be done by using real images and GPS data mapped onto the geographic maps.

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