Towards higher precision Geo-Mashups

Draft for T-111.5550 Seminar on Multimedia

Samuli Karevaara
41568T
Towards higher precision Geo-Mashups

Samuli Karevaara
TKK, Telecommunications Software and Multimedia Laboratory

Samuli.Karevaara@tkk.fi

Abstract

This paper gives a short introduction to what Geo Mashups are. Some popular examples will be given. Differences between the various types of Geo Mashups are outlined. Some of the shortcomings of the precision of the current Geo Mashups are described. Finally this paper will speculate how more accurate Geo-Mashups might be used, created and updated.

1 INTRODUCTION

Mashups are web applications that gather data from different services around the web and present them as one single service. Geo-Mashups are Mashups that have a primary focus on location data. At the heart of every Geo Mashup is a lot of mapping data. This data serves as the platform for the Geo Mashups to build their service on.

Currently there are practical limitations to the precision of the underlying maps and the data presented on the maps. More detailed maps with a lot more objects located on them require significantly more resources to create and maintain.

They key is to automate the creation of the location data. One way to do this is to have small built-in GPS devices in the items that are being tracked or are producing the content that is being tracked. That would enable increasing the amount of located items.

Another way would be to use RFID tags as part of the locating process. Currently the RFID tag technology might not be up to this (Chen & al. 2005, 2071), but recent advances in its technology suggest that it might be in the future. This would allow a lot more precision in the location data.

These more accurate Geo Mashups could be used to locate items inside buildings like shopping malls or closely related areas like amusement parks or holiday resorts.
2 GEO-MASHUPS

Though not the first mapping application, Google Maps was the mapping application that initiated the rise of the Geo Mashups or Map Mashups. Firstly, it included a satellite view of many places, most notably the North America, that the user could switch in view to replace the traditional map view and vice versa. This made Google Maps hugely popular. (Purvis & al. 2006)

Secondly, Google Engineers had included means to manipulate the Google Maps code so that the user could plot their own locations on the Google Maps. Though the location info is at the heart of every Geo Mashup, some Geo Mashups use the location data differently from others.

Other mapping platforms include Yahoo! Map and Microsoft's Live Search Maps. Those too have included satellite and aerial views of the locations to be viewed instead of the traditional map view.

Location based Geo Mashups

Some Geo Mashups focus solely on pinning items on the map. Examples include Flickr Map, Flickrvision, Frappr and Wikimapia. Flickr Map and Flickrvision place photos uploaded to the Flickr photo service on the map. Flickr Map uses Yahoo! Map and Flickrvision (see figure 1) uses Google Maps. Both fetch photos from Flickr. This highlights one key element of the mashups: they can combine different services into a seamless service.

![Figure 1: Flickrvision](image)

Many of the so called web 2.0 services have a social nature: there is a large user group behind them which is entering or altering content themselves. Frappr uses this social angle in a common way. It allows users to create and name special groups that other users can join to. The users can then add themselves on the map and browse the locations of other users of the same group (see figure 2).
Route based Geo Mashups

Some Geo Maps let you place several pins on a map and then connect the pins together to form a route. The routes can be anything from a travel plan to a suggested sightseeing walk by the docks.

Examples of route based Geo Mashups include Dopplr and Wayfaring. Dopplr has a focus on travel routes, whereas Wayfaring (see figure 3) is about creating and sharing a route based map about anything and everything.

Figure 2: Frappr

Figure 3: Wayfaring
3 HIGHER PRECISION GEO-MASHUPS

Current precision of the Global Positioning System (GPS) is about 15 meters. Furthermore, many mapping systems have an accuracy that is a lot less than that. Higher precision means that both the accuracy of the located elements is improved and that the number of the located elements can be increased as well. This should be done without adding the burden of creating and maintaining the data proportionally to the increase in the accuracy.

This means that the adding of the more accurate data should be done in automatic ways. One example of this would be to automatically get GPS information for a photo from the camera with a built-in GPS device. Fujita and Arikawa (2005) have suggested that the photo can then be analyzed and calculated to contain a gazing point. Then the photo could be mapped into three dimensional space on the map.

The current accuracy of the Geo Mashups effectively limits the use of the current positioning systems to outdoors. But several applications and services would benefit from having a more accurate positioning system. Such accurate positioning systems exist, such as the indoor GPS systems and RFID locating services (Chen & al. 2007, 2071).

Uses of higher precision Geo-Mashups

Some use cases for higher precision Geo-Mashups are introduced briefly here. Some of the examples are explored in more detail later in this chapter. Some examples of the Geo-Mashup services that could benefit from the higher precision and the added quantity of the data are:

- Inside a large super market
- Inside a large shopping mall
- At a railway station
- At a bus station
- At an amusement park
- At a camping area
- Tracking deliveries in real time (Civilis & al. 2005)
- A three dimensional view of geo-tagged photographs

Case: Inside a large super market

A large super market contains tens of thousands of different kinds of products. Space considerations require the shelves to be fully packed and relatively close each other. This requires both more data and more accuracy over the current Geo-Mashup solutions.

This could be just an internal service that the store provides, but opening it up as a mashup application means that a recipe site, for example, could then directly provide an in-store route that you can use to pick up the products used in the
Higher precision Geo-Mashups

recipe. The route could be transferred to the trolley used in the store, planned according to the rules of logistics, avoiding extra trips to shelves and back, while searching for items.

Vendors could track where their products are placed inside the store. They could integrate their product layout placement design programs with the layout of the store.

Products could be bundled so that when the system realizes that the customer bought one item, other items are recommended to be bought with that item. For example, buy shampoo, get conditioner for half the price. Then the location of the named conditioner could be shown.

Because of the high density of the products, the supermarket scenario could also benefit greatly from an integrated enhanced reality solution to the high precision Geo-Mashup.

In virtual reality solutions, the entire surroundings are computer generated. Enhanced reality means that information is added on top of the real picture (Bowskill and Downie 1995). In the supermarket case it could be that the trolley has a video camera and a small LCD screen showing the real time image of the trolley camera. Then the directions to the specified product could be rendered on top of the trolley camera image. The similar effect is illustrated in figure 4 (image by Scott O. Smith).

An even more sophisticated solution would be to have the customer to wear a special kind of headset, see figure 5 (image from stratos.com). The headset would operate as normal eyeglasses expect that the same enhanced reality information could be produced to the image seen through the headset.
Case: Photos in 3D space

Fujita and Arikawa (2005) propose a new kind of framework that could map photographs to a three dimensional space in hyper space, and then also locate the photographs on a map. The photographs would be directed, meaning that along with the point in space they would contain a gazing point vector (see figure 5, from Fujita and Arikawa 2005).

Microsoft has created a similar prototype software called Photosynth. It takes a large number of photos and calculates distinct features from each photograph. It then stitches each individual photo as part of a larger canvas by combining these extracted features.

If the photo set contains for example a lot of photographs of the Statue of Liberty, the program is able to identify the same object from each separate photograph. Then based on mathematical perspective models the distance and angle of the Statue of Liberty on the photograph can be calculated. Based on this
information the photographs start to build a three dimensional and a high precision view of the area around the Statue of Liberty.

Case: At an amusement park

An amusement park could identify it's rides on a dynamic map. Users could then review and rate their favorite rides. The extended mashup service of the amusement park could also allow people to attach photographs that they have taken of each ride. The “Photos in 3D space” example from above could be used in combination, forming a virtual panoramic view of each of the amusement park rides.

Because there are a lot less items at the amusement park than in the super market, for example, the active RFID technology could be used in this case. Active RFID tags have a much longer range, up to 500 meters, than passive RFID tags, less than half a meter (Chen & al. 2007). The active RFID tags could be attached to kids, making it possible to track a lost child from a Geo-Mashup.

If the amusement park is large, over 500 meters in one direction, more stations recognizing the RFID tags should be set up. Amusement parks are often divided in sections. Passing from one section to another could go through a gate that then reads the RFID information.

The amusement park example could have similar recommendations than the super market case had. This would mean that the visitors would get a hand held device that they could operate the Geo-Mashup of the amusement park with.

4 RESULTS AND ANALYSIS

Currently the technology lacks to have automatic high-precision geo-location services. Also the legislation is unclear on the borders of the automatic tracking of information that can be tracked back to persons.

Technical issues

The RFID-technology can't currently be read from far enough to allow locating or tracking of the devices from a distance (Chen & al. 2007, 2074). For the tracking of larger moving objects with an accuracy required to follow them hon a highway, for example, is already possible with GPS (Civilis 2005).

However, improving the GPS accuracy from it's current state to be able to spot items on a super market shelf requires a lot of investments in new technology. A cheaper alternative might be to utilize some of the wireless network techniques.

Social issues

There are obvious privacy concerns in services that allow accurate and real time tracking of people or objects that can be tracked to people, such as vehicles. The legislation of several countries has has it's boundaries broken and renewals because of new kinds of services on the web that possible violate or at least lower the privacy of people.
In the amusement park case there was an example that an RFID tag could be attached to a kid, making it easy to track a lost child. If the Geo-Mashup is public, then unwanted people can track the movements of these kids also. This makes it necessary to password-protect the mashup. RFID tags send radio waves, which in theory can be eavesdropped by unwanted persons too. But this can be made unpractical by encrypting the transferred data.

5 CONCLUSION

There are obvious benefits from adding more precision to Geo-Mashups. But with the added data comes added responsibilities: technological challenges emerge, along with the social challenges. Technical challenges are usually the easier ones, there are cases in which most people agree that the original issue has been solved. For example, if the required data can be gathered accurately and effectively, without the risk of loosing it or making it visible to the unwanted eyes.

The social challenges are more difficult. There are many viewpoints, and no measurable way to say which is the correct one. With completely new kinds of data gathered about people, vehicles, goods and services automatically it is hard to draw the limits of ownership and visibility.

The multitude of the different kinds of Geo-Mashups already available speaks volumes about the popularity of them. There is no reason to assume that people would not continue developing different kinds of Geo-Mashups, including the ones with added accuracy and quantity of data, with all of the problems mentioned above. It seems that the only way to advance these services is a little by little, solving each problem, as they arrive, to our best knowledge.

REFERENCES


APPENDIX A: LIST OF THE MENTIONED MASHUPS

Dopplr
An online tool for frequent business travellers.
http://www.dopplr.com/

Flickr
Maybe the most popular online photo management and sharing site on the web.
http://www.flickr.com/

Flickr Map
Flickr's own service to place it's photos on a map.
http://flickr.com/map/

Flickrvision
A service that shows some recently uploaded photos from Flickr on a map, updating the view in real time.
http://flickrvision.com/

Frappr
Social mapping service that allows the user to create a special interest group that others can join. The users of the group can then add themselves on the map.
http://www.frappr.com/

Google Maps
The most prominent web mapping application.
http://maps.google.com/

Live Search Maps
Microsoft's web mapping application.
http://maps.live.com/

Wikimapia

Project to describe every place on earth. A rectangle can be added to Google Maps, along with a short article about the place and/or a link to Wikipedia.

http://www.wikimapia.org/