

FROM CONCEPT TO REALISATION OF AN ISPRS RELATED LBS COMPETITION

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ABSTRACT:

With this paper we plan to initiate an open ISPRS related LBS competition. The contact point for all interested in this competition is the home page of ISPRS working group 4.6 (<http://www.isprswg46.hft-stuttgart.de>).

This initiative aims at taking up current trends in GeoTagging in combination with a proposal of a location based service. The basic idea of the initiative is to create a very special window to LBS technology and relate it to a more traditional field of expertise of the ISPRS. GeoTagging stands for the process of adding metadata suitable for geographical identification of resources to various media, for example, to images, to websites or to RSS feeds. A review of the state-of-the-art of GeoTagging in this paper will reveal that this process requires a lot of interactivity and automating this process is one of the challenges.

The competition is based on the creation of a location based weblog (blog) application. Given the website where entries are made available, images or sound recordings combined with location data for GeoTagging can be uploaded. The recording equipment for the images and the location data should support automated GeoTagging, for example, by using digital cameras combined with external GPS receivers and mobile computers. But other components and concepts like those based on mobile phones may also be taken into account.

Some first experiments in this direction have been carried out by students of our university. The idea of an LBS service "height for a certain object" using a camera and a GPS mouse is the basis of this student work. We shortly report about first results and outline the forthcoming steps.

1. INTRODUCTION

Since a few years it can be observed that resources related to the earth are enriched with additional information about their location. This data usually consists of latitude and longitude coordinates, often referenced to WGS84, though it can also include locational parameters like names for places of interest.

The process of adding geographical identification metadata to various resources such as websites, wikis, RSS feeds or images is called GeoTagging, sometimes referred to as geocoding. The term geocoding is used in a much broader sense compared to its understanding in Remote Sensing and in GIS. It also refers to approaches which convert non-coordinate based geographical identifiers (secondary locational parameters), such as a postal address, into geographic coordinates.

GeoTagging can be used to add locational information to every resource in the World Wide Web like hosts (represented by IP addresses), text documents, images, news etc. The number of publicly available GeoTagging services increases and the services diversify or specialise by relating its activities often to a specific media type or a specific subject.

Two examples shall exemplify these developments. Aiming at world travellers the website www.blogabond.com/ allows registered users to blog about their travel by digitizing travel locations, reporting the travel diary and posting photos. An example is shown in Figure 1.

Recent photo sharing websites for bloggers such as Zoomr (<http://beta.zoomr.com/home>) and Zoto (www.zoto.com/) allow users to directly enter a GeoTag inline without the need of an external service or going off-site. Visualisation of the location in a map or satellite image and showing nearby photos are standard functionality of this kind of weblog. Zoto supports uploading photos from camera phones and other mobile device via email.



Figure 1: Travel blog showing the location of different posts and associated images (Source; <http://www.blogabond.com/-TripView.aspx?tripID=83>)

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The goal to develop a specification for storing interchangeable information in image files was the basis for the image file format Exif, which stands for exchangeable image file format (for digital still cameras). This standard was created by the Japan Electronic Industry Development Association (JEIDA). The specification uses JPEG, TIFF and some other formats and adds a broad spectrum of metadata tags. Beyond date, time, various camera settings the most important tag in the context of this paper is location information (Harvey 2006).

In the following we will review GeoTagging in tag based systems and show some blogging examples which exploit GeoTags (Section 2). Related standards like the geocoded RSS feeds (GeoRSS) and standardization efforts will be outlined in Section 3. First experiments to create a weblog based LBS service "height for a certain object" using a camera and a GPS mouse have been carried out and will be presented in Section 4. We finally conclude with a short summary and recommendations for future work.

2. GEOTAGGING IN TAG BASED SYSTEMS

Tagging in general simply means adding meta-information to a resource. Such tags can be predefined making it easier to search for similar resources or defined specifically by a user (like genre, subject, or name tags). GeoTagging, as mentioned above, deals specifically with assigning latitude and longitude values to single resources. Geotagging provides web-based information for a variety of different application fields.

2.1 Geotagging for MediaWiki content

MediaWiki is a free software package originally written for Wikipedia which now is used by several other projects of the Wikimedia Foundation and by many other wikis (<http://www.mediawiki.org/wiki/MediaWiki>). More and more articles in such wikis are geotagged as shown by Figure 2.

Capital	Panaji
- Coordinates	- 15.29° N 73.49° E
Largest city	Vasco da Gama, Goa
Population (2001)	1.4 million (25th)
- Density	- 363/km ²
Area	3,702 km ² (28th)

Figure 2: Locational information in Wikipedia for Goa (<http://en.wikipedia.org/wiki/Goa>).

Location in Wikipedia is linked to geolocalization and mapping services. The web site kvaleberg.com is addressed using a REST call and works as a portal site to a surprisingly large number of such services throughout the world (http://kvaleberg.com/extensions/mapsources/index.php?params=15.29_N_73.49_E_type:city).

There are several wiki extensions to add locational information.

- The *Google Maps Extension* (WikiMedia 2006) uses XML notation and allows wiki users to insert satellite and street maps with custom place markers.

- The `googlemap` element has attributes like centre coordinates, width, height, and zoom level which are closely related to the Google Maps PI (Google Corp 2006).
- The *geo-element* allows entry of geographical coordinates referenced to WGS84 following ideas originally published by Davis (1996). For example, specifying degrees, minutes and seconds of latitude and longitude reads as

```
<geo>48 46 36 N 121 48 51 W</geo>
```

Additional parameters, for example, for country, region, etc. which are influencing the default map scale, can optionally be supplied.

- If MediaWiki's *GIS database extension* is enabled a function can be used to display geographic neighbourhood articles which lists neighbouring articles, their distance and direction from the current point.

```
$mediawiki/extensions/gis/index.php?
near=GEOBODY&dist=DIST
```

where GEOBODY is the content of the `geo` element and DIST is the maximum distance measured in kilometers along the great circle.

2.2. GeoURL

GeoURL (<http://geourl.org/>) is a web service which allows finding URLs by their proximity to a given location. The geolocalization is based on HTML meta tags (see next section).

2.3. GeoTagging in Web Logs

A weblog is, literally, a "log" of the web, or often of a person's life, a diary-style web site, in which the author (a "blogger") enters short texts related to certain categories or provides links to other web pages he or she finds interesting.

There are quite a few freely available or commercial weblog systems, some of them supporting GeoTagging of blog entries:

- *Serendipity* offers plugins to display a Google Map with geotagged entries and Frappr maps (Hicking 2006).
- *Movable Type*, a proprietary weblog publishing system, is extensible through a large library of third-party plug-ins. MTYahooMaps allows to integrate Yahoo Maps, MTGoogleMaps enables the software to embed Google Maps in weblog entries (Six Apart 2006).

The integration of geography however is most extensively implemented in the *WordPress* publishing system (<http://codex.wordpress.org/Plugins/Geo>). The tools can be categorized as follows:

- *Localization of visitors*: Based on IP addresses the location of visitors is stored in the database and visualized on a map.
- *Assigning geotags*: Locational information (coordinates or country names) is added as metadata to single blog entries or to specific place names. Preset locations can be re-used as a matter of user friendliness.
- *Visualization*: Geotags are used to visualize blog entries or placenames using mapping services like Google Maps® (Figure 3) or worldKit (<http://worldkit.org/>):



Figure 3: Example for geolocalization of a blog entry (Source: http://www.gis-news.de/blog/?page_id=57)

Geotags are stored as metadata in a database table. Appropriate HTML meta tags (see section 3.3) are automatically added to the head section of the generated HTML pages where they can be evaluated by search engines or by the GeoURL service.

```
<meta name="ICBM" content="60.171733,
24.941068" />
<meta name="DC.title" content="GIS" />
```

In this case coordinates are expressed in latitude and longitude as signed decimal numbers (Daviel 2006). The identifier `DC.title` refers to the Dublin Core metadata set initiative (<http://dublincore.org/>).

3. RELATED STANDARDIZATION EFFORTS

3.1 GeoRSS

RSS in general is an XML grammar defining a family of formats (Atom, RSS, RDF), for syndication of news, weblogs. GeoRSS extends RSS describing several ways to encode their location (Wordkit 2006). Due to its versatility and simplicity GeoRSS has the potential to make system interoperable. It is already used in mapping applications like Yahoo! Maps Simple API, worldKit, and mapbuilder.

Currently, two encodings are proposed called *GeoRSS GML* and *GeoRSS Simple*. GeoRSS GML is supposed to be a formal GML Application Profile whose XML schema can be found at <http://georss.org/xml/1.0/gmlgeorss.xsd>. Designed for use with Atom 1.0, RSS 2.0 and RSS 1.0, it supports – according to GML’s specification – a greater range of features than GeoRSS Simple, notably different coordinate reference systems. One example from the GeoRSS web site shows the encoding of a point feature:

```
<entry>
  <title>Crossing Muddy Creek</title>
  <link href="http://www.myisp.com/dbv/2"/>
  <id>http://www.myisp.com/dbv/2</id>
  <updated>2005-08-15T07:02:32Z</updated>
```

```
<content>Check out the
  salamanders here</content>
<georss:where>
  <gml:Point>
    <gml:pos>45.256 -110.45</gml:pos>
  </gml:Point>
</georss:where>
</entry>
```

Additionally it can be used just easily in other XML encodings.

GeoRSS Simple has greater brevity, but also has limited extensibility.

```
<georss:point>45.256 -71.92</georss:point>
```

GeoRSS serves informally as an extension to the W3C geo (point) vocabulary.

3.2 W3C’s GeoTagging approaches

The World Wide Web Consortium’s Semantic Web Interest Group proposed a simple GeoTagging vocabulary, also related to WGS84 (World Wide Web Consortium 2006a).

The consortium recently announced the foundation of the W3C Geospatial Incubator Group (World Wide Web Consortium 2006b) which indicates the need for standardized GeoTagging.

3.3 HTML Meta tags

GeoTagging using HTML meta tags was proposed by Daviel (2006). The identifier `geo.position` is used for latitude, longitude and optionally elevation, the identifier `geo.region` is used for the country subdivision code according to ISO 3166-2 (optionally extended with a 2-character state/province abbreviation), and the optional identifier `geo.placename` is used for a free textual representation of the position, for example "state, country", or "town, county, state".

```
<META NAME="geo.position" CONTENT="15.29;
73.49">
<META NAME="geo.placename" CONTENT="Goa,
India">
<META NAME="geo.region" CONTENT="IN-GA">
```

For `geo.position` coordinates are expressed in latitude and longitude as signed decimal numbers (Daviel 2006). Such meta tags can be automatically generated using <http://geotags.com/geo/DMS3.html> after provision of certain locational information.

3.4 IETF’s Encoding of Geographical Location

The Internet Engineering Task Force (IETF, <http://www.ietf.org/>) published several requests for comments dealing with GeoTagging of web resources. Farrell (1994) and Davis (1996) propose a DNS encoding of geographical location, Cuellar’s request for comment (2004) focuses on the authorization, security and privacy requirements for such location-dependent services. In the IETF community geographic addressing has been discussed several times, but without final results (Chiappa 2003).

4. TOWARDS A PHOTOGRAMMETRICALLY MOTIVATED BLOG APPLICATION

First developments towards a weblog application, in which GeoTagging combined with a photogrammetric/geodetic service, have been carried out by students of our university. The idea of an LBS service “height for a certain object” using a camera and a GPS mouse is the basis of this student work.

Conceptually the overall task was divided into the following work packages:

1. Images and location data are captured for an object of interest. The location either refers to the object of interest which is taken by the camera or to the camera position. The location data are recorded with a GPS mouse.

2. Image data and GPS coordinates are synchronised and the location information is integrated as metadata into the image file using the Exif Standard. The software for synchronising the recorded image and GPS data solves the GeoTagging in an automated way.

Alternatively to synchronising the data in the field, the time and location data can be transferred to the weblog page and a process which accesses the weblog site may serve for GeoTagging.

3. A weblog site serves as a backbone for the application. Internet access of the mobile computer allows promptly uploading all data taken in the field. The weblog site visualises and provides the data for further use in terms of an LBS service.

4. A service application based on the geotagged imagery may be oriented at a more traditional geodetic or photogrammetric task, for example the photogrammetric documentation of historic buildings, bridges or other objects.

The application developed by the students aims at measuring height information related to a certain object, e.g. a building. For this purpose height has to be transferred from height control points to the object of interest using the principles of a classical levelling approach. Figure 4 shows the Matlab GUI implemented by Shakya, et al., 2006.

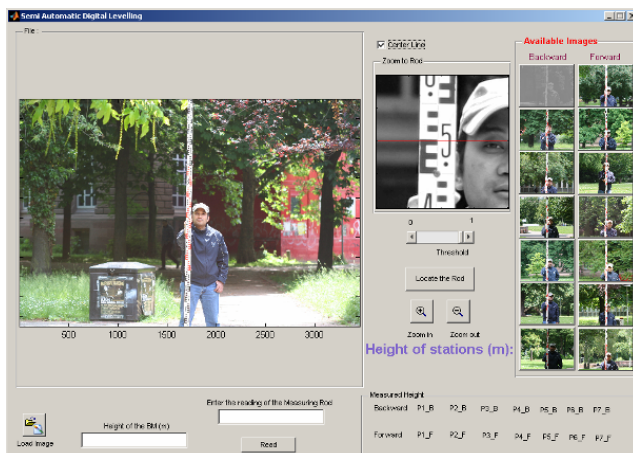


Figure 5: A levelling rod was used for height transfer and height measurement at specific objects.

The photogrammetric aspects on how to transfer the traditional geodetic levelling principle into a camera based approach are beyond the scope of this paper. Replacing a professional levelling instrument by a digital camera causes of course some problems in producing a horizontal line of sight with the consequence that the accuracy of height transfer is in the order of cm or dm rather than mm.

Similarly, measuring height at objects, for example facades, takes advantage of other photogrammetric processes, in particular of the rectification of the image. The levelling rule put at such an object for this task helps to measure height or distances in those images.

GeoTagging the images with the help of GPS opens the field for weblog based processes. The GPS accuracy, in our experiments in the order of 5 to 10 m, has an influence on those processes. If the main goal is a proper documentation of the recorded images in the context of a corresponding map the accuracy is of minor importance. This is different if geometric operations like selecting neighbouring images have to be carried out as a part of the overall process. Tasks like this are presently under investigation.

5. CONCLUSIONS AND OUTLOOK

It is evident that GeoTagging is of great importance for resources on the web. Different formats are used for GeoTagging and tools for inline GeoTagging as a functionality of a weblog or as an off-site standalone routine are available. Currently the GeoTagging applications require manual work (i.e. digitization of the location) which can be tedious and erroneous. Automatic procedures using location based information during the creation of the web resource or by automated GeoTagging using the images or other data can be taken into account if new weblog applications are generated.

A contribution of our university to this competition is based in the idea of an LBS service “height for a certain object”. A rough concept is presented and first steps of implementing the application using a camera and a simple GPS receiver are outlined.

As stated above an overall goal of this paper is to initiate an ISPRS related LBS competition open for all interested in this subject. The fundamental idea is to pick up current trends in GeoTagging and use it for a location based service proposal. Details of the competition are provided on the home page of ISPRS working group 4.6. A workshop is planned in June 27-29, 2007 by the ISPRS working groups II.3, IV.4 and IV.6. One theme of this workshop will be this LBS competition.

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