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# **Socio-Spatial-History Recorder: A Single User-Action Solution to Creating, Tagging, Geo-Coding, Archiving, Sharing, and Streaming of Digital Artifacts, Objects, and Content**

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### **Abstract**

The Socio-Spatial History Recorder system provides a one-stop single-user action solution to creating, tagging, geo-coding, archiving, sharing and streaming of digital artifacts. Users of this solution will no longer need to perform intermediary actions to edit, prepare, and publish their digital artifacts to the Internet or their social networks. For example, in the case of digital still images, this system offers a one-click solution to sharing a digital artifact. An user can shoot a picture, geo-code the picture, display the picture in a mapping application, and share it with another user all by one and only one shutter click on the digital still image capturing device. Social sharing rules and rights can be set up in advance or dynamically configured and the digital artifacts can be encrypted if desired or required. Practical uses of this system in the social domain include unobtrusive social sharing of digital artifacts embedded in their rich interactional contexts. Practical uses are also in application domains that require or would benefit from unobtrusive collection of rich ecological data without disrupting and/or interrupting the user's primary activity cycle.

### **ACM Classification Keywords**

H.5.1 Multimedia Information Systems: *Artificial, augmented, and virtual realities.*

H.5.2 User Interfaces: *Evaluation/methodology, Theory and methods, Training, help, and documentation, User-centered design.*

### **Introduction**

The rapid diffusion and adoption of information and communication technologies (ICT) has resulted in a

world that Marshall McLuhan foresaw as the "global village" (McLuhan & Powers, 1992). A village is characterized by a small geographically defined physical place that is also a socially shared space. Further, a village is also characterized by a communal sense of belonging and sharing together. However, in the ICT enabled "global village", creating and preserving strong senses of belonging and sharing currently require users to perform many actions in different activity systems (Kaptelinin & Nardi, 2006). An activity system consists of actors embedded in a community who are oriented towards objects to achieve certain goals and objectives. Actors of an activity system utilize tools and follow rules while being situated in a division of labor framework. Currently actors are required to deal with different activity systems for each of creating, tagging, storing, and sharing digital artifacts. To overcome this problem the Socio-Spatial-History Recorder provides a single user-action solution to creating, tagging, geo-coding, archiving, sharing, and streaming of digital artifacts, objects, and content. Dynamically dependent on the in-situ usage-context and user-preferences all or some of the above services (creating, tagging, geo-coding, archiving, sharing, and streaming) will be available for all or some of the of digital artifacts, objects, and content (audio, images, video, annotations, tags, text, 3D avatars, Global Positioning System (GPS) way points, GPS log, GPS tracking etc...). For example, in the case of digital still photography, when the user captures a digital image using the Socio-Spatial-History Recorder system or a service or a solution provided by the system, the digital image is automatically coded with a geo-code (GPS information) and concurrently tagged with user-generated tags, archived on the user's personal media

storage devices/servers, shared with the user's social networks of choice, and streamed in real-time to customized environments like Google Earth or Microsoft's Virtual Earth or Linden Lab's Second Life with the corresponding meta-data.

The remainder of this position paper is organized as follows. The first section discusses current state of the art. The second section describes prior art. The third and final section discusses several usage scenarios envisioned by the "Second Earth"<sup>1</sup> suite of applications that implement the single user-action system.

### **Current State of the Art**

Currently, we are not aware of any such system or solution or service with the above-mentioned integrated capabilities. Users are required to first create digital artifacts and then separately edit them and then only then can they publish their digital artifacts to the Internet. Further, sharing and streaming of these digital artifacts requires additional steps and involves the active engagement of the recipient users. Currently, users with consumer grade digital cameras must do the following to share their digital images:

**Step 0:** Obtain a standalone GPS Recorder and a digital still camera.

**Step 1:** Start the GPS recorder. Once connected to the GPS satellite system, the GPS recorder will

<sup>1</sup> The term "Second Earth" was coined by Wade Roush who envisions the World Wide Web being assimilated into a simulation by combining elements of Second Life ([www.secondlife.com](http://www.secondlife.com)) and Google Earth ([earth.google.com](http://earth.google.com)). See (<http://www.technologyreview.com/Infotech/18911/?a=f>).

automatically store GPS information of the location and/or the trip.

**Step 2:** Start the digital camera and take digital still images.

**Step 3:** Import the GPS travel log onto a personal computer by establishing a USB connection between the GPS recorder and the PC.

Even though GPS receivers connect to personal computers via Bluetooth, the GPS travel logs require a USB wired connection between the devices. This is mostly due to the missing file transfer profiles in the Bluetooth stack of the GPS receivers.

**Step 4:** Import the digital still images onto the same personal computer by establishing a USB connection between the digital camera and the PC or by establishing a Bluetooth connection<sup>2</sup>. Some cameras, e.g. the Nikon COOLPIX S51c<sup>3</sup>, can also transfer pictures over a Wi-Fi connection.

**Step 5:** Use a proprietary software (such as Sony Picture Utility) or a freeware tool (such as JetPhoto<sup>4</sup>) to synchronize the timestamps of the digital images with the GPS recorder log track points and to geocode the images.

<sup>2</sup> The Ricoh SE 500 provides picture transfer with Bluetooth.

<sup>3</sup>

<http://www.nikonusa.com/template.php?cat=1&grp=2&productNr=25575>

<sup>4</sup> <http://www.jetphotosoft.com/>

**Step 6:** Initiate an upload process to photo sharing sites such as Flickr<sup>5</sup> or display them in mapping applications such as Google Earth<sup>6</sup>. Usually, this process is handled by an upload wizard application that provides automated uploading for the selected set of digital images.

**Step 7:** Share the URL for the geo-tagged digital images with friends and family.

**Step 8:** The URL recipients then need to access the Internet to view the geo-tagged digital still images.

So, currently the process of sharing a geocoded photo is rather cumbersome. Building the GPS unit into the camera itself could reduce the complexity somewhat. We are not aware of any commercial cameras with built in GPS, although some cameraphones do have this functionality. Some cameras can interface with standalone GPS units, such as the Ricoh SE 500 (Figure 1).<sup>7</sup> In addition the Nikon MC-35 GPS Adapter Cord can be used with D3 D300 D2HS / D2X digital cameras to support a direct connection between camera and the GPS units. In both cases photos downloaded from the camera have geocodes embedded already thus eliminating steps 3 and 5.



<sup>5</sup> <http://flickr.com/groups/geotagged/>

<sup>6</sup> <http://earth.google.com/>

<sup>7</sup> [http://www.ricoh.com/r\\_dc/caplio/500se/features/index.html](http://www.ricoh.com/r_dc/caplio/500se/features/index.html)

Figure 1: Ricoh SE 500 GPS Enabled Camera

Another approach that avoids steps 3 and 4 is to use the Sony UX series of Ultra Mobile Personal Computers (Figure 2) which when paired with an external GPS receiver can automatically geocode the photos taken using the built-in cameras.



Figure 2: Sony UX-490N UMPC

Another possibility is to eliminate steps 4 & 6 by using a Wifi (IEEE 802.11 a/b/g/n) enabled Secure Digital memory cards from Eye-Fi<sup>8</sup> which can automatically upload images to photo sharing services such as flickr.

By combining the eye-fi card with the Ricoh SE 500 GPS enabled camera and an appropriate standalone GPS receiver the majority of the arduous steps in the sharing/coding process can be eliminated, and this currently represents the simplest approach. We are not aware of anyone having taken this approach, and are currently developing a single client unit based on this combination.

<sup>8</sup> <http://www.eye.fi/>

Even with a client that makes use of the very latest of the shelf technology, the user still has to navigate multiple activity systems. Our objective with the Socio-Spatial-History Recorder is to consolidate the multiple activity systems involved into one automated system so that senders and receivers of digital artifacts can better enjoy the social processes of interaction and digital artifacts than be encumbered with manual technical work. The proposed single-action solution makes the overall process transparent by the automated concurrent execution of the various activity systems.

The key invention of the Socio-Spatial-History Recorder is to give the user the ability to share an artifact such as a geotagged photo with exactly the same action as is required to generate that artifact, e.g. take the photo. Given appropriate settings for privacy digital artifacts will be available to friends, relatives and colleagues with no additional effort on the part of the user.

### **Related Work**

"Neogeography" as Turner (2006) articulates "consists of a set of techniques and tools that fall outside the realm of traditional GIS, geographic Information Systems (p.2)." Traditional GIS systems are large databases of digitized geographical data that are queried by experts who have learnt their particular idiosyncrasies. The new techniques and tools that Turner refers to are the often web based geographic tools such as the Google Maps API, that allow the public to query, save and share geographic data as part of a community. Our objective is to ensure neogeography's intention of being a truly social and collaborative enterprise by enabling automated and at the same time unobtrusive sharing of digital artifacts, objects and

content in real-time. In the next few subsections, we discuss previous work in the geocoding of digital images.

### *GeoPix*

Carboni, Sann, and Zanarini (2006) describe a "multichannel, mobile, and location-based application called GeoPix developed as a proof-of-concept for several use cases related to eTourism (p.169)." Figure 3, below, taken from (Carboni & Zanarini, 2006), depicts the key elements of the GeoPix prototype.

GeoPix Mobile gets information about actual user position by means of a Bluetooth. The application runs on a cameraphone and once the image has been captured, GeoPix saves timestamp information and current latitude and longitude, then it displays the metadata form. The user has to fill it with a title, some attributes and optionally give a short description.

Some GeoPix users suggested the use of "posting sessions" whereby photographs are automatically associated with a new or an existing itinerary, and posted without any further configuration task. Carboni et al suggest the phone itself could be placed in a car and programmed to take and post pictures automatically on a regular time interval.

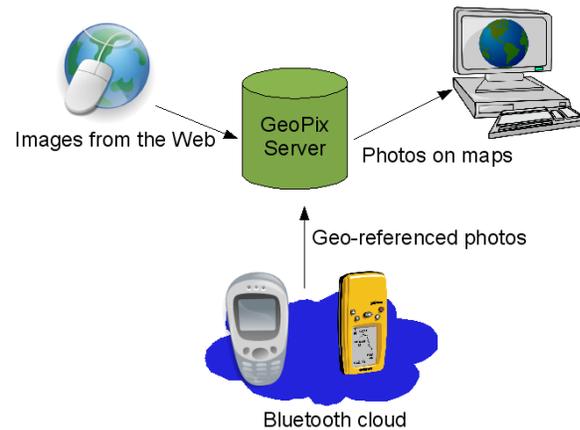


Figure 3: GeoPix System Overview (Image Taken from (Carboni & Zanarini, 2006))

#### *Context Watcher*

Context Watcher (Koolwaaij et al.) "mobile application that aims is to make automatic recording, storage, and usage of context information easy for the end-user<sup>9</sup>." ContextWatcher is a part of the MobiLife<sup>10</sup> project. The MobiLife project's stated objective was to "to bring advances in mobile applications and services within the reach of users in their everyday life by innovating and deploying new applications and services based on the evolving capabilities of the 3G systems and beyond." Figure 4, below, taken from MobiLife website depicts the three "communication spheres" that are the focal areas for the MobiLife project.

<sup>9</sup> [http://www.istmobilife.org/index.php?option=com\\_content&task=view&id=70&Itemid=58](http://www.istmobilife.org/index.php?option=com_content&task=view&id=70&Itemid=58)

<sup>10</sup> <http://www.ist-mobilife.org/>

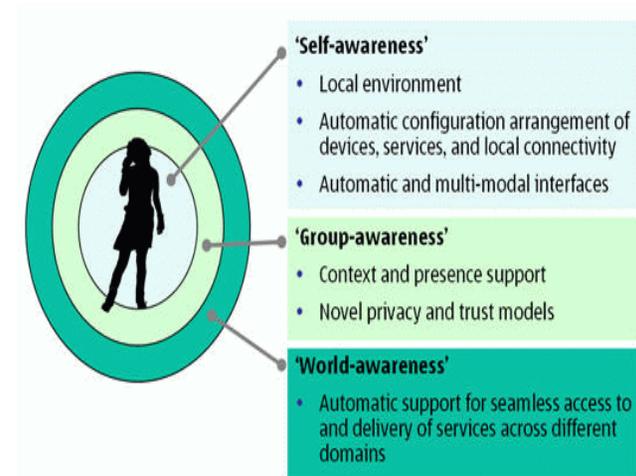


Figure 4: Communication Spheres (MobiLife Project)

The Shared Experiments has similar objectives as the MobiLife project but differs in the focus. Our focus is on the enabling the rich sharing of experience and facilitating unobtrusive communicative services to achieve social communion possibilities. Further, the Single User Action is a solution to automated social sharing of digital artifacts, objects, and content besides supporting enhanced context awareness. Marshall McLuhan formulated technologies as extensions to human bodies (McLuhan, 1994). We formulate technologies as extensions to human minds. In that regard, the Single-User-Action solution offers a seamless integration of psyche and techne by offering an automated real-time integration of physical and virtual worlds.

### MMM2

The MMM2 system (Davis et al., 2005) provides “the ability to automatically upload photos from a cameraphone to a web-based photo management application and to automatically suggest sharing recipients at the time of capture based on Bluetooth-sensed co-presence and sharing frequency” (p.1335). Figure 5 below taken from (Davis et al., 2005, p.1337) presents the original and modified camera capturing interface screens for a Nokia camera phone.

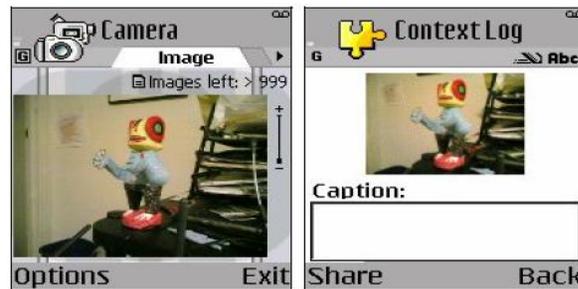


Figure 5: Original Nokia Camera Application Screen and the MMM2 Modified Context Application Screen, taken from (Davis et al., 2005, p.1337).

Figure 6 below presents the MMM2 sharing interface screen.



Figure 6: MMM2 Photo Sharing Interface Screens, joined screenshots taken from (Davis et al., 2005, p.1337).

*(Ueda, Nakanishi, Matsukawa, & Motoe, 2004)'s System*

Ueda et al., (2004) have designed a geographic information system (GIS) consisting of a mobile phone with a camera and a GPS receiver to "allow citizens to participate in making a city master plan or to exchange information among niche communities" (p.1). Figure 7 below presents the system architecture.

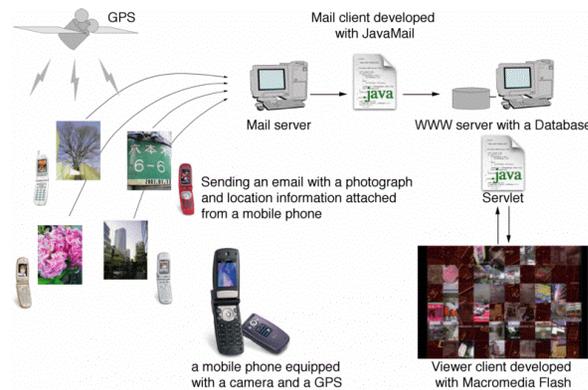


Figure 7: System architecture, taken from (Ueda et al., 2004, p.2).

*Amazon's "One-Click" Patent*

Amazon's "one-click" patent (Hartman, Bezos, Kaphan, & Spiegel, 1999) is the closest concept with regard to prior art. However, Amazon's patent as related to electronic commerce has little bearing on the social sharing of experience enabled by the single-user action. Our solution connects people, digital entities, the rich real-world information and user-generated meta-data seamlessly instead of just enabling express purchase of merchandise.

**Usage Scenarios**

*Scenario #1: My Day: a Socio-Spatial History Recorder*

Ravi had a busy day in the concrete jungle today. He had to catch the bus to go to school, drop books off at the library, return videos to Blockbuster, purchase groceries and mail a few packages from the post office. Ravi hasn't had a chance to pay much attention to his surroundings all day. During the day, Ravi's GPS receiver coupled with "Virtual Me" avatar tool have been communicating with the Shared Experiment application have been dutifully and non intrusively recording information about Ravi and any potential friends of Ravi in his pre-defined social proximity space (Ravi defined it as being within 300 meters range). Every once in a while Ravi's Smartphone beeps a "person-in-proximity" beep. Finally Ravi is at home. He launches the "My Day" application to receive a personally relevant socially punctuated highlight of the day. He leaves messages to his friends in the Shared Experiment application and makes first contact with Konda who has an equal dislike of Bollywood movies. They trash the Bollywood for a few minutes and pleased with their own transcendence over a billion people back home in India, they add each other to their contact lists. Ravi then checks on the traffic congestion on King ST earlier in the day. He then logs off Second Earth.

IMPLEMENTATION ANALYSIS:

Application functionality

- Provides an unobtrusive personally relevant social history of a time period.
- Allows for analysis of activity routines, discovery of activity patterns, "missed connections"

- A "new age" style contemplation of life style
- Can also be a travel log

#### Services

- Location and orientation of the primary user
- Location and orientation of users in the social proximity of the primary user
- Proximity analysis applies to locations and events as well as persons \*"Virtual Me": Social Avatar Management Service \*"My Day": Mixed Reality History Service
- Full visual models of (probably urban) environments one might visit
- Given a video image with location track, merge this image with full registration with the visual model

#### Technologies

- GPS
- WiMax
- Google Earth + Second Life
- mobile video streaming (upload)
- Immersive visual environment (whether headmounted, big screen, ...)
- Motion control (to look around outside the recorded video)

#### *Scenario #2: My Place*

This is the last semester of Bunni's graduate career at Manoa. She wishes to know about the campus in an embodied way. Bunni dons on AR headset and launches the "Layers of Manoa" application. She selects the Botany layer. The application suggests a botanical tour of the Manoa campus starting from her present location. As she walks on the campus she sees virtual botanical information beautifully registered with the real botanical objects. Bunni gets intrigued by some rocks. She selects the "geology" layer and the rock details get rendered seamlessly. Bunni suddenly remembers that she needs to pay the library dues and bookmarks the present location on the tour and dons off the AR headset. Bunni decides to take the rest of the tour seated at the cafeteria.

#### IMPLEMENTATION ANALYSIS:

##### Application functionality

- Superimposes "knowledge-layers" over everyday reality
- Annotations on the real world

##### Services

- Location and orientation of the user
- "Knowledge-layers"

##### Technologies

- GPS
- Wimax

- High resolution video with inertial head tracking
- Seamless registration

### Discussion

The Single User Action service provides a one-stop single-user action solution to creating, tagging, geo-coding, archiving, sharing and streaming of digital artifacts. This solution in turn enables the user to unobtrusively share experiences and environments with significant others. In conclusion, we envision a suite of applications and services that blur not the boundary between the real and the virtual but also between places and times and make individual environments and experiences collective. Appendix A presents the system architecture diagram.

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## Appendix A: System Architecture

