

pLog: User Generated Media for Personal LBS

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Abstract This paper proposes a framework for personal location based services with personal life content, for example diaries, schedules and to-do lists. A lot of Internet users are recording their personal experiences and knowledge as text and other digital media on the network. Our proposed tool provides users with an environment to store personal records with related place attributes, and to retrieve these personal records at the right place. There are two applications on this tool, a place-enhanced blog and a LBS client on a mobile phone. The place enhanced blog provides users with blog interfaces for inputting place information. The place reminder is a browser for spatial data on the place enhanced blog. Users can generate place information by writing personal records on their blog. Furthermore, using the LBS client, other users can retrieve personal records at the appropriate spots.

Keywords : Location-Based Service, Blog, Mobile

1. Introduction

Location based services (LBS) have become common. People often use GPS and maps on mobile phones. The GPS integrated mobile phones allow users to find their positions, search points of interest (POI), generate itineraries of their trips using complex time tables of public transportation, and navigate in the real world [2]. Although these commercial LBS can record only using histories and some spatial bookmarks, they cannot record and retrieve user generated personal spatial content on them. On the other hand, people are documenting their lives on the network today, reporting on their emotions, thoughts, plans and actions, to remember and share their experiences [3]. Many of these personal records include spatial information which can be provided as spatial content in LBS.

From these points, we propose a blog based personal LBS in this paper. Personal LBS can provide users with their personal information or services based on locations and their personal information which are managed in blogs. Also, users can easily launch user-generated LBS for themselves as well as other users on the Internet.

User Generated Media that uses geographic information is increasing. Flickr[4], photo and media file

sharing service can add location information to media files or use embedded GPS data in photos. Then these files can be put and viewed on digital map. ALPSLAB video [1] provides user uploaded videos with routes on the map and vertical interval of the routes the three are synchronized through the timeline. Location-based Reminders (LBR) are one of the types of location-based services using personal spatial content. LBR works as Personal Information Manager (PIM) by managing users' everyday tasks like meetings, contacts, documents, events, and so on. Also it provides these tasks depending on location of users [7]. Dey and Abowd [5] defined many types of context-aware reminders. They needed to set all situations and information for delivery. comMotion [8] allows users to command the reminder with speech. PlaceMail [7] has a Web based interface for managing place information and spatial content. Also it has special applications for mobile phones for controlling delivery timing and receiving messages. LBR can be useful to make use of blog records by pushing appropriate past blog entries to users at the right place and time when the users go near the places associated with the blog entries. In common blogs, a user writes memos about some interesting places on the blog. The user view the records only on the blog system by pulling entries on Web browsers, and then

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most of these records will be hidden in dead storage. But if these records can be used as LBS content, users can use them more efficiently.

We have implemented a place enhanced blog which can integrate a blog that has personal information management, and spatial information of places. Most current blogs realize the user environment to manage personal records, for example diaries, schedules, to-do lists and memos. We extend a blog system to spatial information managing functions. We have also developed a personal LBS client application on mobile phones. Furthermore, users can write and read personal spatial information on the place enhanced blog, and can be reminded of appropriate blog entries based on the location of the user through their mobile phone.

2. Recording and Utilizing Personal Spatial Information for LBS

Our proposed system named pTalk which is a software family to realize our proposed framework of personal LBS. pTalk is composed of the following three software components. (1) Place enhanced blog, pLog: A blog with functions for dealing with spatial information. (2) LBS Interface script: LBS clients connect to pLog through this interface script. (3) LBS client application, pCatcher: It is a front-end software running on a mobile device to realize personal LBS through interaction with users. Using this system, users can utilize personal life content that they have generated themselves through normal blogging on the appropriate locations.

2.1 Future Diary: Setting Location-based Reminders

2.1.1 Making an itinerary as a future diary on a place enhanced Blog

When we have schedules, location-based reminders can be useful to automatically provide us with appropriate information at the right places. Our framework pTalk is suitable for such uses. Figure 2 shows an example of registering a schedule of a meeting at Hongo campus of the University of Tokyo on pLog. In advance, a user created the entry of the schedule on pLog. Examples of POIs created by the users are Hongo-Sanchome station, the places to have the meetings and a path from the station to the meeting room. The present pLog uses Google Maps to create and show POIs, paths represented by red lines on maps and diaries.(Figure 1)

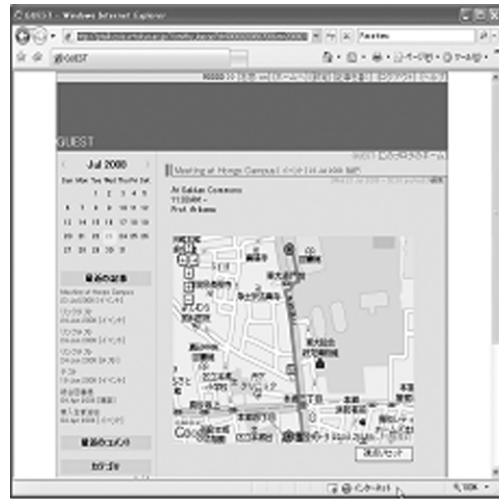


Fig. 1. A schedule Entry of a Meeting at Hongo Campus on pLog.

2.1.2 Personal LBS of the path through pCatcher on a mobile device

When the scheduled day comes, we view pLog entries pushed up to the location on mobile devices. Examples of pLog entries are “When I have arrived at Hongo-Sanchome Station, pCatcher shows me the path”. pCatcher can also provide a map centered on the current location. The map can display some other POIs that were entries representing past diaries. Also, more POIs can be provided by other pLog residents and commercial LBS providers. For example, a Hongo campus guide created by a student can be chosen to be added on the map on the mobile device.

2.2 Ubiquitous collaborative learning of shapes of big fireworks for children



Fig. 2. Recalling pLog Entries, that is, POIs, depending on the Location.(Map images: copyright 2009 Google, copyright 2009 ZENRIN)

Children often wonder if the shapes of big fire-works in firework festivals are the same if viewed from different locations. pTalk can be an appropriate platform for children to learn that shapes of fireworks look like circles from any location. Children can collaborate with one another, take photographs of fire-works from arbitrary positions with their GPS integrated mobile phone cameras, and send the photographs with email messages including the locations where they are taken and other related information to pLog through pCatcher. Children view many photographs of fireworks taken by different children from different locations, and the locations of cameras on maps on pLog through a Web browser (Figure 3). Red circle icons represent locations of cameras. The red circle icons may have their directions from cameras to the location of launching fireworks. The descriptions of directions of cameras can be indicated in the input form on mobile devices



Fig. 3. Photographs of Fireworks in a Firework Festival and their Representative Red Circle Icons attached with Short and Wide Arrows are placed at the Locations of Cameras taking the Photographs on Google Maps.

3. Architecture and Implementations

Figure 4 shows the architecture of pTalk which is designed as an open platform to realize personal LBS based on protocols of the Internet.

pLog and a LBS interface script are coded as Web CGI applications, and they communicate with client

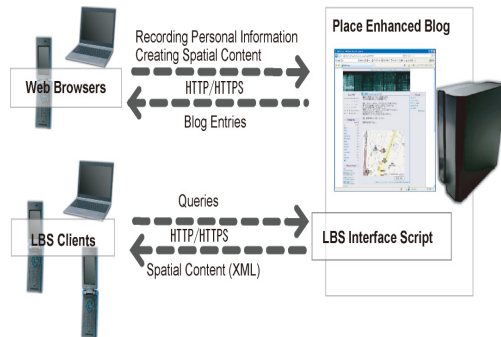


Fig. 4. Architecture of pTalk.

applications using HTTP. pCatcher is a client software of personal LBS. It connects the interface script with HTTP to interactively retrieve and display POIs from the pLog through user-friendly GUI on the screen of a mobile device. Web browsers and LBS clients using LBS interface scripts can choose an HTTPS connection instead of an HTTP connection to protect their communication channels.

3.1 pLog: a Place enhanced Blog

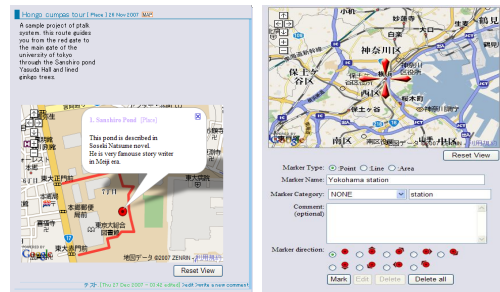


Fig. 5. Entry View and Place Information Input Form.(Map images: copyright 2009 Google, copyright 2009 ZENRIN)

pLog provides users with an extended function of dealing with spatial information such as point of interest (POI) and area of interest (AOI) in addition to general functions of common blog systems such as browsing and managing personal information. Users add place descriptions to their blog entries through blog input interfaces on Web browsers. An entry of pLog is composed of the attributes listed in Table 1.

Characteristic attributes of an entry stored in pLog are described in the following sections.

Table 1. Attributes of an Entry stored in pLog

Id	Identifier for an entry. It includes the author's ID and serial number.
Type	Type of an entry (memo, diary, to-do, and schedule)
Shared group	groups allowed to access an entry
Date	Date when the events described in an entry happened
Category	Category assigned to an entry
Title	Title to explain the content of an entry
Body	main text of an entry
Transaction date	Date when an entry was posted or edited
Place	A representative point of an entry. It is allowed to be blank.
Attached files	media files attached to an entry, such as image, audio and video files

3.1.1 Entry types and behavior.

The Type attribute of all entries must be set to one of the selections including memo, diary, to-do and schedule. The Type attribute is used for calculating the importance levels for displaying blog entries on a screen or a map. Memo entries are considered general information and less important in the order of visualization, because they do not have specific date attribute settings. Diary entries have specific date attribute settings, but they are also considered less important in the order of visualization. They can be selected and set away by temporal queries. To-do entries are considered more important in the order of visualization. They do not have specific date attribute settings. Examples of To-do entries are places to go and things to buy. Schedule entries are considered more important in the order of visualization if the specific date or time is close to the current date or time. They are treated as the most important when the specific time is now. To-do and schedule entries have special behaviors on pLog and pCatcher. All to-do entries and entries about schedules within one week float to the top of the entry list on the web browser to hold the attention of the blog owner. Moreover, our system pushes to-do and schedule entries to the LBS client when a user meets conditions for distribution. pTalk server delivers a

to-do entry when a user locates near the place related to the information in the to-do entry in the real world. Also it delivers today's schedules. This feature works as a location based reminder. For instance, a user registered a memo about some books he wants to read on the pLog with his favorite book store location and he runs pCatcher on his mobile phone. pCatcher notifies his current location to the server regularly and when he moves near the book store, the server sends the to-do entry to him.

3.1.2 Access Control.

On the pLog, users can control accessing entries flexibly. For utilizing personal information what a user does not want to open (ex. Personal schedules, closed messages within fellows and announcements for registered users), pLog provides the shared group attribute. This attribute is used for managing data access control. Special instances of the attribute values are "private" and "public" for entries to be prohibited and to be opened to the public. "friend" setting in the attribute "Shared group" is prepared for setting and creating groups for sharing entries. Only users belonging to group A can access entries of group A.

In common blogs, users can control accessing each entry but they cannot control accessing each arbitrary part of an entry body text. On the pLog, blog owners can limit access to each arbitrary part of an entry body text by using group tag [group gid]. Group tag is a paired tag so it has a start tag [group gid], gid represents a target group to allow showing the part, and an end tag [:group], the tag word starts with a colon. Owners put a part of a text between the start and end tags.

Doors open at 6:00pm

[group Staff] Staff must come at 4:00pm [:group]

Members of group Staff view the whole text on this entry but other users can view only first line on this entry.

3.1.3 Spatial Objects on User Content.

Spatial objects have location data and six other attributes(see Table 2.).

When users click an object to check its information, it expands an information balloon on the digital map if it has a name or description attribute. Area is a set of points. It is constructed by four corner points and a representative point. Users can edit locations of all corner points freely and the repre

Table 2. Attributes of Spatial Information.

Geometry type	Type of geometry for aspatial object (Point, Line, and Area)
Direction	Direction of a spatial object. The semantics of the direction is flexible.
Latitude-Longitude, Zoomlevel	The location of aspatial object and the zoom level of a map displaying thes patial object are generated from the Web API of Google Maps.
Object name	Name of a spatial object
Category	Category name assigned to aspatial object
Description	Description of a spatial object.

sentative point is defined automatically from the locations of corner points. Name, category and description data are set as the attributes of the representative point.

Continued multiple line type point objects make a polyline, which doesn't have a representative point. Line type points that have names or descriptions are clickable to check their information.

3.2 pCatcher: Mobile Client for personal LBS

A LBS client can provide a rich environment for a user to interactively retrieve and display entries of the user's interest and other spatial information stored on the place enhanced blog. Users can send their queries to a place aggregator on a personal LBS server through the place catcher interface, and then the place catcher displays spatial query results with digital maps. Moreover, place catcher can have other high-level functions like a pedestrian navigation system, a digital content viewer and so on.

pCatcher is an implementation of a place reminder as a software application on a mobile phone. It allows users to browse blog entries and other spatial content including not only text and image data. In addition, pCatcher can track a line on digital maps at levels of walking speed if users select a line from multiple lines on the maps. Maps are scrolled automatically and choose spatial information closest to the center. This function can be used as a simple navigation method for a pedestrian.



Fig. 6. PCatcher: a Personal LBS Client on Mobile Phone.(Map Images: copyright 2009 Google, copyright 2009 ZENRIN)

4. Creating Blog Entries with Place Descriptions

In this section, we introduce a software module to create pLog entries or blog entries with place descriptions through web browsers respectively. pLog can deal with assigning place information such as POI and AOI to blog entries. It is almost the same to create entries on pLog as to create entries on common blog systems through web browsers.

4.1 Creating Place Information on pLog

pLog allows users to create and modify spatial objects in the database of pLog by creating and operating place markers on Google Maps (Figure 7). Figure 7 is an interface of pLog to create spatial objects. The followings are step-by-step explanations for using the pLog place description module.

- (1) Choosing "Marker type".
- (2) Moving the map and centering a target point.
- (3) Filling in input fields of place information, such as POI/AOI, Title, Category and Description. All the fields are not mandatory.
- (4) Pressing the "Mark" button to put a location marker

4.2 Creating poi Tags Referring to POIs from Entries

pLog can indicate many to many connections between an entry body text and included points of interest in an entry using Poi tag, [poi #]. Poi tag is a paired tag so it has a start tag [poi #], The number (#) represents a target spatial object, and end tag

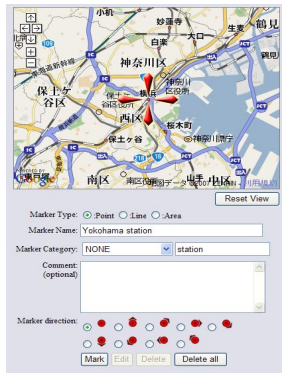


Fig. 7. Input Form for creating Place Information (Map Images: copyright 2009 Google, copyright 2009 ZENRIN)

[poi], the tag word starts with a colon. Owners put a part of a text that can include other tags, between the start and end tags.

A part of text will turn to a highlight when it has connected to a spatial object and a user mouses over it. If users click a highlighted part then the map view on the browser centers on the spatial object and expands the information balloon of the spatial object on the digital map. Moreover, connected parts are delivered to LBS clients as description texts of the spatial objects included in XML.



Fig. 8. A POI Tag makes a Connection between a Part of Body Text and a Spatial Object.

5. Recalling Entries Depending on the Locations

The LBS interface script provides accessibility for personal spatial content on the pLog to LBS client applications using HTTP and XML. When users

make spatial queries, the interface script searches matched available personal spatial content, and returns the results of the queries to the client with XML text. The interface script allows each type of HTTP client to connect and use personal spatial content on pLog. Users make queries to pLog using pLog interface script to retrieve spatial content. For example, a user sends the following query to the interface script.

```
uid=smith
pass=pass
date=all
place="139.7,35.7,1"
```

“place” represents location and range for searching. The first and second numbers mean longitude and latitude of the center point. The third number is the radius from the center point.

pLog interface script searches blog entries of user smith and the search area is 1km square around the center of the area located at longitude 139.7 N, latitude 35.7 E. pLog interface script returns an XML text containing spatial content information

```
<ENTRY>
<UID>09823</UID>
<EID>0982320071102</EID>
<TITLE>Colloquium</TITLE>
<CATEGORY>Schedule</CATEGORY>
<DATE>8 Nov 2007</DATE>
<TEXT>At iii building 1F meeting room 10:00-
</TEXT>
</ENTRY>
<POI>
<POIID>098230001</POIID>
<PARENT>0982320071102</PARENT>
<TYPE>0</TYPE>
<DIRECTION>0</DIRECTION>
<LONGITUDE>139.7610</LONGITUDE>
<LATITUDE>35.7117</LATITUDE>
<ZOOM>17</ZOOM>
<CATEGORY>Place</CATEGORY>
<NAME>iii office</NAME>
<DESCRIPTION>Main office of iii
</DESCRIPTION>
<DESCRIPTION>Next door of the entrance of
the Library</DESCRIPTION>
</POI>
```

Figure 9. Sample XML Text of a pLog Entry.

In this sample query, an interface script returns a blog entry from pLog and map image data of the area from the map server.

A spatial object has multiple description nodes on the POI object in XML text, when the object is included and connected from multiple entries. For example, when entry A, B and C have poi tags that are connected to the spatial object O then O and the entries are retrieved through a LBS client,

6. Using pTalk

To evaluate a prototype system of our proposed personal LBS, we tried out the system in a class. Four graduate students of the University of Tokyo used pTalk and each student created town guide content on the pTalk system then students experienced this content on these sites in December 2007 and December 2008.

6.1 Creating Spatial Content

Students created content as an assignment after a lecture using pTalk for an hour. The content was a walking guide for an area around Tokyo. Students created some entries including related POIs and lines on the pLog. POIs represent favorite restaurants, interesting hobby shops, view points and so on. Lines represent some route to walk the area.

Most students created his/her content in a night. The target area and numbers of spatial objects in the content is in Table 3. From entry time stamps, they did not spend much time for creating content.(see Table 3.).

6.2 Writing Styles of Entries

There were two writing styles of relevance between body text and geographical objects on an entry. One to one relationships and many to many relationships.

Most students created entries and spatial objects with one to one relationships. It includes only a topic and a related spatial object in an entry on their blog. With this style the relationship between a blog text and a spatial object is easy to understand, thus owners don't need to put poi tags in their entries to represent connections between a spatial object and a related part of text.

A student can put multiple spatial objects in each entry, but these entries don't have any poi tags,

Table 3. Numbers of Entries and Spatial Objects in Content

	Route Count	POI Count	Entry Count	Making Time
S1	3	29	3	-
S2	3	27	30	2:40
S3	1	13	14	0:50
S4	3	22	25	4:00
S5	2	20	22	0:40
S6	1	20	21	1:00
S7	0	20	20	3:00
S8	1	7	7	0:30
S9	1	21	22	1:00
S10	2	20	22	1:20
S11	4	20	24	2:00
S12	0	13	13	2:30

hence users need matching between lines and spatial objects. Using poi tags, owners can indicate the connections explicitly, and many to many entries must have equivalent understandability as one to one entries.

We will provide owners with easier interfaces to make connections between a part of text and a spatial object. For example, an owner selects a spatial object and a part of text that is related to it then the owner clicks the Make connection button.

6.3 Experience on the Sites



Fig. 10. Experience of Spatial Content on pTalk

Students experienced pTalk spatial content with each other using pCatcher application. They tracked a route in a content and checked places of POI described.

Current pCatcher does not use GPS thus users must read the digital map and match his/her position to the displayed position on the mobile phone. Hence some students lost his/her way.

There are some students' voices after this experience in the following lines. "pCatcher needed some getting used to" "It is very interesting to relive the experiences of someone else." "I was prone to get lost with GPS-less navigation." "It was easy to make spatial information on the pLog and it was very useful to create spatial content."

7. Conclusion

In this paper, we have proposed the personal LBS framework and reported our implemented prototype system of the personal LBS for using personal life content. The prototype system provided users with a useful environment to create and use personal life content with spatial information as an extended blog system. Then, we confirmed the effectiveness of our proposed personal LBS.

Useful interfaces and easy operations of pLog allows trial users to create many blog entries as a spatial content on the pLog in a short time, after only a simple short lecture for using pTalk.

In the experience of pTalk, we acknowledge that personal spatial information is valuable as spatial content of LBS. It helps users to purchase a product or helps to choose a restaurant, and so on. But it is not enough that an LBS contains only personal spatial information. Therefore it is important to integrate between personal LBS and commercial LBS. For instance, when a user walks around Akihabara downtown in Tokyo, this system retrieves user's to-buy list in personal records and related shops' information on the commercial services, then this information is displayed on his/her mobile device synchronized with places of the users. Pushing users' past blog entries to each user can make them remember past forgotten memories and clarify their present situation from the life-span viewpoint.

We have proposed a place enhanced blog for personal LBS in this paper. LBS are generally developed on the commercial telecommunication network services, and are usually not open in technical and use senses. Our proposal of place enhanced blogs are open on the platform of the Internet. Individuals can create and modify their own services by themselves using web browsers and special software on mobile devices.

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