Developing a GIS Using a Mobile Phone equipped with a Camera and a GPS, and its Exhibitions

Noriyuki Ueda*, Yasuto Nakanishi**, Shohei Matsukawa***, Masashige Motoe****
** Graduate School of Information Systems, Univ. of Electro-Communications, ** Tokyo Univ. of Agriculture & Technology, *** 000studio, **** Miyagi University*
{ ueda@vogue.is.uec.ac.jp, yasuto@cc.tuat.ac.jp, sho@000studio.com, motoe@myu.ac.jp}

Abstract

In this paper, we introduce our geographic information system using a mobile phone that is equipped with a camera and a GPS and its exhibitions. We aim to provide a social information spaces for local communities or towns. Users can annotate not only text notes but also photos to physical spaces by sending emails with photos and location information by GPS attached from mobile phones. Any users using such mobile phones can annotate information to physical spaces when and where they want to do it and act as content provider. We exhibited our system as a photography exhibition in Tokyo and Sendai.

1. Introduction

In the fields of town management and urban planning, the GIS (geographic information system) aimed at helping citizens in making themselves maps has been developed [1-3]. The purposes of these systems are to allow citizens to participate in making a city master plan or to exchange information among niche communities. Users annotate physical spaces with text notes and photos, and share information in the real spaces. However, because most of these systems have been developed as WWW-based systems, users can't upload useful information where they want to do it, and they have to perform this operation on a PC and specify location on the map with using mouse. When a user wants to upload a photo, he or she must transfer it from a digital camera to a PC and then upload it to a WWW server, requiring a more complicated process. There are many self-governing bodies offering such a system, however, uploading information requires some operations, and the problem that such a system needs effort might be one of causes not to promote contribution from citizens.

Within the fields of augmented reality, wearable and ubiquitous computing, some location-based focus on users' annotations to physical spaces which direct to oneself as reminders or documents [6-8]. Other location-based systems allow users to participate as content providers for making social and dynamic information spaces [4, 5]. Users annotate text notes to physical spaces utilizing PDAs, and this allows users to submit information where they want to do it. However, in those researches, utilized devices are equipped with extra devices (a GPS card or a WLAN card), which let users to utilize applications developed specially, and users can't annotate pictures.

In Japan, it has become popular to use a mobile phone to send an email with a picture attached and most recently marketed mobile phones are equipped with cameras. Especially, most of mobile phones released from KDDI (one of the major Japanese mobile phone companies) are equipped with a GPS chip, "gpsOne", manufactured by Qualcomm. These mobile phones allow users to attach not only a photo but also location information regarding the sender (longitude and latitude) to an email.

This paper introduces our GIS using a mobile phone that is equipped with a camera and a GPS. Our purpose is same as [1-5, 8], however in our system, users post annotations by sending an email to which pictures and location information are attached. This enables users to post not only text notes but also photos where and when they want to do it. The utilized devices in our system are popular consumer products, which would allow many users to act as content provider and achieve social environments and solve problems in the conventional GIS mentioned above.

2. System

In building a GIS using a mobile phone that is equipped with a camera and a GPS, we developed a system that mapped emails containing photos according to their location information. Our system consists of a mail server, an email client developed with JavaMail API, a WWW server (Tomcat4.1.2) with a database (MySQL3.23.52), a Java Servlet and a viewer client developed with Macromedia Flash (Figure 1).

Figure 1. The system architecture in our system

Figure 2. The viewer-client in our system: showing photos from mobile phones on a map according to location information.

As a content provider, each user sends an email with a picture and location information attached to a destination email address which was decided beforehand for each town or each community. Then the email-client receives sent emails every one minute, and then obtains the email address of the user, the subject, the content text, the sent time, the latitude, the longitude and the attached photo from the received email. The photo is saved into the WWW server as an image file, and the email-client stores its URL address and the other obtained information for each received email into the database table according to the destination email address.

The viewer-client sends parameters to the Servlet every two minutes periodically. The Servlet sends a query to the database with making a SQL command from the parameters, and returns the searched result to the viewer-client. The parameters are times, longitudes and latitudes. When the viewer-client was loaded initially, it sends two longitudes and two latitudes, and sent emails which location information is in the area specified with them are shown. After it was loaded, it sends current time and the time when it sent a parameter last in addition to the latitudes and the longitudes every two minutes. This enables to automatically show emails those were sent recently.

After receiving the searched result that contains all information about sent emails, the viewer-client parses it and gets information about each email. Then it begins to download pictures from the WWW server with using URLs written in the searched result, and shows email information and pictures using location information on a map of the specified area.

When it contains a lot of photos, it might not be appropriate to show each photo according to its location information accurately because some photos will be overlapped and it will be difficult to see a map and pictures. Our current viewer-client is assumed to show several hundreds pictures, and we have a grid with an interval of two seconds to cope with this problem. Each photo is mapped to a cell of this grid according to its location information. When a cell contains some photos, it manages them with using a list sorted by the sent time and shows them sequentially with letting each photo fade in and fade out (Figure 2). This enables us to see pictures without overlapping and to see a map and many pictures. When the mouse is put over one cell, the email title or text about the shown photo is displayed in the cell.

3. Exhibition

We introduced our system in an exhibition of urbanism and architecture held in an art gallery at Tokyo [9] (30/01/2003-31/01/2003). The pictures were taken within a 1km area that is around the gallery. In this exhibition, the viewer-client was projected onto a large floor (16m x 12m) using sixteen LCD projectors those were set up on the ceiling, and visitors enjoyed

watching pictures from mobile phones while walking on the map (Figure 3 and Figure 4). In this exhibition, we used the mobile phones equipped with cameras of 0.3M pixels and we showed 500 pictures sent from mobile phones.

Figure 3. Projecting the viewer-client onto a large floor at an exhibition in Tokyo.

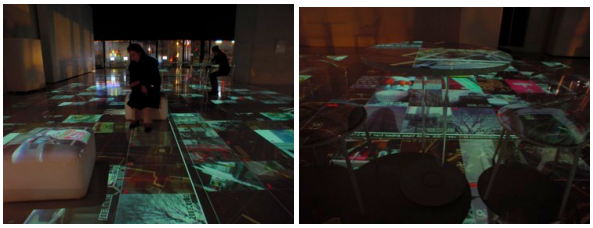

Figure 4. The image was also projected onto sofas and tables in the gallery.

We took photos of visitors' faces and sent photos in emails to our system with mobile phones in order to make interactions in our exhibition. If we attach location information of the exhibition space to the email, only one cell shows pictures of visitors' faces. We coped with this problem by assigning a name expressed as two alphabets to all cells. The email that title is one of these names is shown in the corresponding cell regardless of whether location information is attached or not. The visitors evaluated that pictures taken with mobile phones were shown in a large public display immediately. Most of the visitors who came in a group wanted to take a picture of each member and most of them found fun in stamping their friends' faces.

We also exhibited our system on a shopping street in Sendai (05/2003-01/06/2003), and the viewer-client was projected onto a street using two projectors those were set on the shopping arcade (Figure 5 and Figure 6). We put a screen which size is 5.4m x 3.6m, and it is made of retro-reflective sheet, which consist of thousands of precise prism particle per square inch and have superior reflection ability.

Figure5. Projecting the viewer-client onto a shopping street in Sendai.

Figure 6. The viewer-client in our exhibition at Sendai.

Although we ourselves took pictures for the exhibition in Tokyo, in the exhibition at Sendai, the members of the photography club in Miyagi University took and sent pictures. They usually take pictures with single-lens reflex cameras and have also general exhibitions in galleries with putting their photographs in frames. Some members have mobile phones equipped cameras, however, it was the first experience for them to hold a photography exhibition using cameras in mobile phones and to have an exhibition on a street. In this exhibition, they used the mobile phones equipped with cameras of 1.5M pixels released newly and we showed 700 pictures sent from mobile phones. Photographers would be good at

discovering values hiding behind in ordinary places or in daily scenes, and in the exhibition at Sendai we succeeded in raising quality as a photography exhibition. However most of emails were sent beforehand by the photography club members, some visitors sent emails with using their own mobile phones in the exhibition period. This fact would show the merit that the utilized devices in our system are popular consumer products.

In this exhibition, not only visitors but also persons who happened to pass by enjoyed seeing pictures sent from mobile phones while walking on the map. Because the street where we installed our exhibition is one of the active shopping district in Sendai and its location was in front of a long-established department store, more passers-by watched it than persons who visited in order to watch it. Such experiences, which are different from watching the client with a PC monitor, might encourage social communications between users more actively. We handed the leaflet which explained our exhibition to the persons who stopped for our system. For those who had more interest in our system, we took pictures of their faces and sent them as emails to the map. Estimating from the number of the leaflets that we handed, the number of the persons who heard our explanation is approximately 1000.

4. Discussions and conclusions

In this paper, we introduced our geographic information system using a mobile phone that is equipped with a camera and a GPS and its exhibitions. Our purpose is to provide social information spaces for local communities or towns. Users can annotate not only text notes but also photos to physical spaces by sending emails with photos and location information by GPS attached from mobile phones. This enables any users to annotate information to physical spaces when and where they want to do it and act as content provider. We exhibited our system as a photography exhibition in Tokyo and Sendai.

When walking on our map, most persons seemed to think that some interactions would occur by stamping the screen or according to the location of person. However we don't have developed such interactions, we will bring dynamic interactions with embedding sensors in the floor screen or putting location sensors using image-processing

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