Development and Social Experiment for a Tourism Information Collection System by Tourists

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Abstract. It can be said that improving tourism facilities will be indispensable for the economy of our country in the future. To improve tourism facilities, tourism information evaluated by tourists should be collected and transformed into useful knowledge, and then this knowledge should be used for the planning and the improvement of tour routes and the infrastructure of sightseeing areas. Therefore, this research describes a tourism information collection system. The collection system was used to identify tourists’ needs accurately, effectively and widely by using a CPCG (Cell-Phone with Camera and GPS) and by developing a SIMS (Sightseeing Information Management Server). To verify the proposed methods, the author carried out a social experiment. The experiment showed that the proposed methods were effective.

Keywords. Tourism information; collection system; cell-phone with camera and GPS; database; cloud computing.

Introduction

It can be said that improving tourism facilities will be indispensable for the development of countries and cities in the future. However, tourism information cannot be collected and managed uniformly in sightseeing regions. Moreover, the methods by which planners can find out the tourist’s opinions of recommended tour routes are limited. In general, after a tour ends, a paper questionnaire survey is distributed. However, in the investigation after the tour ends, it is difficult to obtain an accurate tour evaluation because the state of a person’s memory in the first half of the tour is different from that in the latter half of the tour. Moreover, processing the paper questionnaire data is time-consuming. Therefore, collecting the tourists’ opinions is not enough to plan and improve tour routes and infrastructure.

Recently, ICT (Information and Communication technology) has started to be developed, and this has led to the widespread availability and diffusion of the cell-phone. Moreover, cell-phones are equipped with various functions such as an Internet connection, cameras and GPS. Therefore, they can be used as an interface with cloud computing in a mobile environment. There are few systems that allow tourists to evaluate locations on tour courses with a view to planning and/or improving the tour course and infrastructure, though previous studies are described in chapter 2.
Therefore, this study describes a tourism information collection system that enables tourist’s needs to be collected adequately and efficiently by using a CPCG (Cell-Phone with Camera and GPS) and by developing a SIMS (Sightseeing Information Management Server), and supports the planning and the improvement of tour courses and infrastructure of sightseeing area.

**Previous studies**

In this study, the tourist visits the site, and a method by which the tourist’s needs can be collected in real time using the CPCG is developed. Homma (1998) proposed a Network-Based Dynamic Evaluation Process (NDEP) in order to achieve a consensus decision between the public and the designer in the design process. However, in the NDEP, we cannot obtain an accurate evaluation because changes in the impressions recorded are caused since the evaluation data is input by an evaluator on the Web, not onsite.

On the other hand, position estimation technology such as GPS, IC tags, and GIS have also been used, and studies on tourist tracing and tourist route guide systems etc. have been reported in recent years in the sightseeing field (Nabeel 2008; Nomura 2005). However, the tourist’s action analysis is the purpose of the study by Nomura (2005), and tourist’s needs were not considered.

Moreover, there is a study on a method of collecting information from a testee who has visited a site and evaluated it. Todspol (2004) developed a system that arranges information collected on the site on a 2D map and a 3D map by using GPS technology. However, there is a problem that the study was not general enough for use when many tourists are targeted, as in this study, because a specific PDA was used to gather information. Bauke (2008) used Geo-Tracing, which can read and correct the collected information on the web. However, in this system, the problem with poor generality also occurs because of the necessity of installing MobiTracer on a tourist’s mobile phone. In addition, Kaga (2006) developed a system that in real time collects the testee’s landscape evaluation information by using the CPCG. However, the purpose of the research was to arrange collected images in 2D and 3D space and to share information, and consideration of the collected material was insufficient.

**System development**

**System outline**

In this study, the collection system that consisted of a CPCG and the SIMS was developed. Figure 1 shows the system concept. The developed system can identify the tourists’ needs and their evaluations in real time adequately and efficiently on the spot. In addition, the amount of information collected during a tour course is improved by developing a general system that uses a CPCG.

In the evaluation form of the collection system, question items about the level of acknowledgement (very familiar, familiar, average, unfamiliar, very unfamiliar) and level of evaluation (very good, good, average, bad, very bad) were prepared. Then, according to the answers to these two question, the evaluation information was stored in four groups; Confirmation, Discovery, Disappointment and Dislike. This made it easier to classify the large quantity of sightseeing information. Figure 2 shows the construction of the evaluation form.
System composition
This system was composed of a CPCG, mail receiving server, CGI program and the SIMS. The programming language of the system was PHP (Ver.5.2.10). PHP is a widely-used general-purpose scripting language and is especially suited for Web development. PHP can be embedded into HTML. The database used MySQL (Ver.5.1), which is excellent open software featuring high speed and security. Next, the user’s authority is described. The evaluator can upload sightseeing information. However, the evaluator cannot browse, add, or correct information in the SIMS from a CPCG. On the other hand, the manager can browse, add, and correct sightseeing information stored in the SIMS. Figure 3 shows the system composition.

By using a CPCG, a tourist acquires the present location information by using GPS, and takes a picture (Figure 3-(1)). Next, when the tourist uploads the photograph information with the location information to the SIMS (Figure 2-(2)), a CGI program in the SIMS stores the photograph information in a
specific folder in the SIMS. The photograph file name and the location information are stored in the SIMS database at the same time (Figure 2-(3)). The CGI program replies to tourist’s CPCG mail automatically after storing the photograph information and the location information (Figure 2-(4)). A URL to access the evaluation form to register evaluation information and uploaded photograph information are appended to the main body of the e-mail (Figure 2-(5)). The tourist accesses the URL and inputs evaluation information (Figure 2-(6)). Finally, when the evaluation information is uploaded to the SIMS, the CGI program registers it in the SIMS database (Figure 3-(7)).

**Developed functions**
The developed functions were the following five: Extraction and registration function of images appended to mail, Extraction and registration function of GPS information, Automatic e-mail reply function, Evaluation form display function, and Evaluation information registration function. These functions are described in detail as follows.

1. **Extraction and registration function of images appended to mail**
Photograph information is extracted when such information attached to an e-mail is sent to the SIMS. At that time, the file is renamed to date (“Y-m-d.H-i-s”)”jpg” using the CGI program. Then, the file path and this renamed filename are registered to the SIMS. In this system, the file path and this renamed filename are registered to a particular directory in the SIMS which is open to the network system. Therefore in terms of performance and database size, this method is more useful. However in regard to database management, security, backup, recovery, expansion and flexibility, this is not as good as the method in which actual photograph data is registered to another directory in the SIMS.

2. **Extraction and registration function of GPS information**
GPS information such as position information on latitude and longitude is included in the EXIF (exchangeable image file format) information. The Exif_read_data function extracts this EXIF information. Then, the ID number, renamed filename, extracted cellular phone type, cellular phone model, latitude, longitude, and date-time information are registered to the SIMS. The ID number is generated automatically using the auto_increment function and registered to the SIMS. The extracted latitude and longitude information are transformed and registered by the DMS unit.

3. **Automatic e-mail reply function**
When the SIMS receives an e-mail from a tourist, the CGI program for extraction and registration program for images attached to e-mails, the extraction and registration program of GPS information, and the e-mail reply program begin automatically. This automatic boot is realized because CGI program name and the program directory path are set in the “.mailfilter” file. In the previous system (Kaga 2006), the load on the server and the time lag were large because the mail reception program was always working. In the new system, the load to the server and the time lag are reduced because there is a direct setting of the server.

4. **Evaluation form display function**
A tourist receives the evaluation form made by the CGI program when he receives a reply e-mail, and goes to the URL in the e-mail. The evaluation form is composed of a text box, a check box and a radio button. The question items are the following six: gender, title, object, level of acknowledgement (very familiar, familiar, average, unfamiliar, very unfamiliar), level of evaluation (very good, good, average, bad, very bad), and comment.

Title and comment have text boxes, and the tourist can describe his opinion freely. Gender has a radio button, and the tourist selects either male or female. Object has a check box, and the tourist selects some of the items such as structure, sign, signpost and so on. Level of acknowledgement and level
of evaluation have selection boxes, and the tourist selects a suitable item.

5. Evaluation information registration function
The evaluated information is registered to the SIMS after the tourist fills it in. The evaluation information is sent by the POST method when it is registered to the SIMS. At this point, the DB function of PHP Extension and Application Repository (PEAR) is used. In addition, to relate the ID number of the evaluation information with the ID number of the photograph information and GPS information, the ID number is also got across by the GET method and registered to SIMS. In the POST method, the tourist cannot see the sending data from the URL because the data is got across in the body of the request message. In the GET method, the tourist can see the sending data from the URL because the data is got across at the end of the URL.

System flow
The image and user flow is as follows (Figure 4, Figure 5). When the user takes a photograph of a good place or a bad place by CPCG (1), he then sends a mail attaching the photograph information with GPS information (2). Next, the user gets a reply mail from SIMS (3) and goes to the URL in the e-mail, which has an evaluation form (4). After the user replies to the evaluation form (5), he returns the form to SIMS (6).

System evaluation by social experiment

Experiment outline
A social experiment was executed to verify the tourism information collection system and the error margin of the location, to validate the system, and to evaluate the valid sample data. Table 1 shows the outline of the experiment. The experiment was conducted five times in total from November 21st to 28th, 2009. Each guided tour lasted about two hours. Osaka City and Omihachiman City in Japan were selected as target cities. There were 37 testees, of which 11 were male and 26 were female. Regarding age, 19 people were in their 20s, seven were in their 30s, eight were in their 40s, and three were in...

<table>
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<th>Experiment</th>
<th>Date</th>
<th>Location</th>
<th>Number of testees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nov. 21st, 2009</td>
<td>Osaka city</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Nov. 21st, 2009</td>
<td>Osaka city</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Nov. 24th, 2009</td>
<td>Omihachiman city</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Nov. 28th, 2009</td>
<td>Osaka city</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Nov. 28th, 2009</td>
<td>Osaka city</td>
<td>7</td>
</tr>
</tbody>
</table>
In the experiment, the testees participated in the guided tour and used a CPCG. Photographs to which GPS information was added were taken of points of interest and places where tour routes could be improved, and this information was uploaded to the SIMS. After the guided tour ended, the points of interest and tour route improvement areas, which each testee had memorized, were filled in on the paper map. After the map had been filled in, the evaluator opened the received mail generated as an automatic reply to the CPCG, answered the evaluation form, and uploaded it to the SIMS. The evaluator received the same number of e-mails as uploaded photographs, and repeated this evaluation work. Finally, the testee answered the questionnaire on the usability of the developed system.

**Result**

1. **Verification of the tourism information collection system**

   In the social experiment, 368 items of data were uploaded to the SIMS. Data containing photograph information, location information, and evaluation information was defined as valid data. After verification, 287 items of valid data remained (78.0%), and 81 items (22.0%) of invalid data. Table 2 shows the result.

<table>
<thead>
<tr>
<th>Data</th>
<th>Number of samples</th>
<th>Ratio [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>287</td>
<td>78.0</td>
</tr>
<tr>
<td>Invalid</td>
<td>81</td>
<td>22.0</td>
</tr>
<tr>
<td>Sum</td>
<td>368</td>
<td>100</td>
</tr>
</tbody>
</table>

2. **Verification of the error margin of the location**

   The error margin of the location information obtained by GPS was verified. As a result, when CPCG was used outdoors, the number of total samples was 203, and the error margin was 33.6m on average, with a standard deviation of 30.3m. The number of samples within a 10m error margin was 42, and most. On the other hand, when CPCG was used indoors, the error margin was within the range from 6.2 to 525.7m at a constant rate. Figure 6 shows the result.

3. **Validation of the tourism information collection system**

   Method A of filling in the evaluation of the tour directly on the paper map, and method B of providing the evaluation of the tour with CPCG were compared, and analyzed. The total number of comments obtained was 287 in method A, and 192 in method B. Figure 7 shows the result. The number of comments by the sentence (comments about improvements, comment about impressions, and other comments) was 65.3% (126) in method A and 89.2% (256) in method B. Moreover, the number of problematic comments (incomplete sentences or incomprehensible) of method B was less than that of method A. As a result, it can be said that the developed collection system can adequately collect a lot more sightseeing information that remains in the memory compared with earlier methods.

4. **Valid sample data evaluation**

   Valid sample data of the database were evaluated. Of the 287 valid data items, 89 (31.0%) were from the Confirmation group, 154 (53.7%) were from the Discovery group, 8 (2.8%) were from the Disappointment group, and 24 (8.4%) were from the Dislike group. The others were invalid data because the testees did not select the level of acknowledgement and/or the level of evaluation. Table 3 shows the results.

<table>
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</tr>
</tbody>
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In the Discovery group, there were 16 (9.6%) items of information about hopes or questions such as “I’d like to know more”, “I want to go”, and so on. In the Disappointment group, there were 5 (62.5%) items of information about illegally-parked bicycles, abandoned bicycles, and graffiti. In the Dislike group, there were 7 (29.2%) items of information about meaningless signs, narrow roads, and roads with no pavement. Table 4 shows the example of sample data in the Disappointment group.
Figure 6
Verification of the error margin of the location

Figure 7
Validation of the tourism information collection system
Conclusion

In this study, a tourism information collection system that enabled tourists’ needs to be collected adequately and efficiently by using a CPCG and a SIMS was developed. Next, a social experiment was executed using the system, and the system was validated. The social experiment succeeded in obtaining 80% valid data. Of the 287 valid items of data, the Confirmation group had 89 (31.0%), the Discovery group had 154 (53.7%), the Disappointment group had 8 (2.8%), and the Dislike group had 24 (8.4%). Moreover, the difference in the location information error margin using GPS outdoors and indoors was confirmed. Also, it was suggested that the developed system can adequately collect much more sightseeing information remaining in the memory compared with earlier methods.

For future work, the following four points could be considered: shortening of the GPS initialization time for acquisition of positional coordinates, improvement of the interface, consideration of information shortfall regarding senior citizens etc., and customization of the system according to age group.

Acknowledgements

A portion of this research was done with the

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<thead>
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<th>Group</th>
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<tbody>
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<td>Confirmation</td>
<td>89</td>
<td>31.0</td>
</tr>
<tr>
<td>Discovery</td>
<td>154</td>
<td>53.7</td>
</tr>
<tr>
<td>Disappointment</td>
<td>8</td>
<td>2.8</td>
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<tr>
<td>Dislike</td>
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<td>8.4</td>
</tr>
<tr>
<td>The others</td>
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<td>4.2</td>
</tr>
<tr>
<td>Sum</td>
<td>287</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3
Valid sample data evaluation

Table 4
Example of sample data in the Disappointment group
assistance of subject number 211049 of the 2009 Support Project of Regional Activities for Understanding of Science (Japan Science and Technology Agency (JST)). The authors would like to appreciate “Osaka Tabi Megane” which is a community tourism program in Osaka city and participants in Omihachiman city for the cooperation in the social experiment.

References


