Up-to-date Virtual UX of the Kesennuma-Yokocho Food Stall Village: Integration with Social Media

Ryosuke Ichikari*  Ryo Yamashita†  Kalaivani Thangamani*  Takeshi Kurata*
*National Institute of Industrial Science and Technology  †Kansai University

Abstract

The objective of this study is to develop a 3D application that provides an up-to-date virtual experience of the Kesennuma-Yokocho food stall village. This app aims to enable users to feel the “here and now” atmosphere of the site, even from a remote location. To this end, we integrate visualizations with 3D-CG models and articles on social media to keep the contents fresh. Using social media allows a user to check the status of the site, which changes each day. However, there could be too much information posted on social media. In this research, we propose a filtering method to estimate the freshness of each article, based on timestamps and text data including date descriptions. These up-to-date articles can be superimposed on the visualization of photorealistic 3D-CG models which also can be updated with reasonable costs.

CR Categories: H.5.1 [Multimedia Information Systems]: Artificial, augmented, and virtual realities; I.2.7 [Natural Language Processing]: Text analysis;

Keywords: service engineering, 3D modeling, virtualized reality, information extraction

1 Introduction

Following the 2011 Great East Japan Earthquake, a number of reconstruction support projects have been established, such as Project Fumbaro* Eastern Japan and Reconstruction 1000 Projects for Tohoku†. In addition, initiatives are being carried out from a variety of perspectives, including regional revitalization and tree planting campaigns. The National Institute for Industrial Science and Technology has also carried out the Kesennuma Kizuna Project in collaboration with disaster affected residents and corporations in Kesennuma. This project provided solutions to local problems based on technologies held by the firms, and its post-disaster reconstruction support initiatives were carried out between 2011 and 2013. As part of this project, a virtual food stall village app for Fukko Yatai Mura Kesennuma-Yokocho (hereafter, Kesennuma-Yokocho or Yokocho) was developed using 3D modeling. One of the objectives of this development is to motivate users to visit the real Kesennuma-Yokocho by providing them with the feeling of being at the site even when they are far away. In order to experience this feeling, users need to be provided with up-to-date information about the constantly changing site (e.g., the atmosphere at events or daily information). However, the extent to which static 3D models alone can express this feeling is limited. Coupling 3D models with other media is known to be more effective. To this end, we first superimpose articles posted to social media onto 3D models and omnidirectional panoramic images (hereafter, panoramas) to improve the experience of the “here and now” of Yokocho. In addition, in order to continue to transmit useful “here and now” information, we propose a filtering method for keeping the displayed articles up-to-date. How to update the 3D model is also one of our research questions, and developments concerning this issue are discussed in Section 5.1.

2 Related studies

2.1 Methods for Remote Comprehension of the Site

A previous initiative that enabled the virtual experience of Yokocho was Kadinche3 PanoPlaza (see Figure 1). PanoPlaza is a web-based service that allows users to experience the atmosphere of the shop interiors and the entire food stall village while understanding the spatial relationship between stalls within Yokocho. This is done by moving between panoramas taken at the Yokocho main square and inside each stall. However, because moving from one panorama to another involves clicking a button that has been set up in each panorama, the user cannot experience the sensation of actually moving around within Yokocho. Above the panoramas in PanoPlaza, there are also articles posted to Facebook by the Yokocho secretariat so that users can view information about items such as events. However, old and new articles for each stall are mixed together, and thus the information is not necessarily useful to users.

A service that enables users to virtually experience movement around a location or site is Google Maps Street View.4 However, as users cannot view the site from their desired perspective, their actions become limited, and this can be a source of stress in the experience. To add to this, street view is slow to update. As a

Figure 1: Outside panorama and panorama in a stall

*e-mail: r.ichikari@aist.go.jp
† http://fumbaro.org
‡ http://www.tohoku1000.jp

3 http://www.kadinche.com
4 https://www.google.com/maps/views/streetview?gl=jp
result, we decided to use 3D models which can be updated by ourselves for enabling an up-to-date virtual experience from perspectives similar to those at the actual site.

2.2 3D Modeling Researches

The 3D models used in this study were created by reconstructing the geometry and texture of target objects from photographs. Technologies that create 3D-CG from 2D photographs can be divided into fully automated methods and semi-automated methods. Fully automated methods generally determine fine details of the environment geometry using computer vision. Thus, the file size of the resulting geometric data is large and difficult to handle in mobile apps. In recent years, methods that reconstruct a 3D environment using RGB-D cameras [Newcombe et al. 2011] has been developed. Infrared is normally used to measure depth, but sunlight can affect the quality. Semi-automatic methods use interaction between the user and system to allow modeling in conditions that are difficult for fully automatic methods. On the other hand, the accuracy of the reconstruction and the labor costs involved are problematic. This study used a semi-automatic 3D indoor environment modeler [Ishikawa et al. 2013; Thangamani 2013].

3 Proposal

3.1 Design Principles

Our virtual food stall village app not only provides virtual experiences from remote sites, but also can be employed when users actually visit the site. However, functions that motivate users to keep using the app is required. Therefore, we considered the design principles from three perspectives (see Figure 2)

- Functions that allow users to get to know the “here and now” of Yokocho
  By always displaying new information in the app, we can help users who have never visited Yokocho to understand the status of the site, even from remote sites. In addition, those who have been to Yokocho before can view the changes from the time of their visit, and this can be an impetus for them to revisit. It is difficult to experience the atmosphere of a site with 3D models alone, and the cost of frequently updating the models remains an issue. In response to this, the current study integrates up-to-date social media, as can be seen in PanoPlaza. It uses the Facebook page5 and Ameba blog6 operated by the Yokocho secretariat. On the other hand, excessive amounts of articles could be transmitted at once, meaning that users cannot necessarily view all relevant articles without missing something. One example of this is when the Yokocho secretariat posts the opening hours of each stall for the end-of-year period. Because there are more than 20 stalls, if the articles are displayed in a timeline format, the user is less likely to view specific notifications that were posted first. Such oversights can be prevented by our proposed app, which divides up the articles for each stall.

- Functions that allow each stall to present the details
  The articles via social media is currently provided by the Yokocho secretariat, making it difficult to continuously update detailed info about the more than 20 stalls. Therefore, we are equipping the app with functions that allow each stall to freely post descriptions and photographs of menu items visitors can eat as well as products visitors can buy. For this function, we are considering displaying such info inside stalls in order to reflect the individual characteristics of each stall. This would allow users to distinguish between the atmospheres of each stall. Additionally, stalls will be able to inform users when new products have arrived, and they may also be able to link this to e-commerce.

- Functions that allow users to view information about the surrounding area
  Currently, the Kesennuma area cannot be described as having fully recovered. Partly because the public transport network is not fully operational in less developed areas, the site is not easy to access. Therefore, those without cars who visit Yokocho must check public transport timetables, and plan their travel schedule accordingly. The proposed app would become a portal that includes functions for viewing timetables for transport to Kesennuma, opening times and location of facilities around Yokocho, and other experiential information such that users can easily obtain information about the site and its surroundings. The implementation will be based on the above design principles. As part of this initiative, we first implemented functions that allow users to learn about the “here and now” of Yokocho.

3.2 Article Freshness Filtering

For some articles posted on social media (e.g., announcement about an event being held the following week), users would benefit if these had a freshness date. The proposed app would define the time an article should no longer be displayed as the “article freshness date.” This “article freshness date” refers to the date on which the usefulness of the information expires. For example, for articles that contain dates of scheduled events, that information could be described as useful only until the event date. In order to determine the freshness date of each article, judgments must be made based on the content of the posting. Thus, we investigated a method for determining article freshness dates.

---

5 https://www.facebook.com/fukkoyatai?ref=profile
6 http://ameblo.jp/fukko-yatai/
4 Proposed System

4.1 Implementation

The appearance of the app is shown in Figure 3. In the outside walking mode, users can move around Yokocho with the 3D model. The articles filtered by freshness date are superimposed on the entrance to each stall. Additionally, clicking “enter” menu on the bottom lets the user enter the stall. The inside of each stall is illustrated with a panorama. This is because the stalls are compact and there is no need for users to move around in them; image quality has been prioritized over freedom of perspective. In this panorama, we plan to implement menu display functions as described in Section 3.1. Social media articles are obtained using a Web crawler and categorized based on the stall names contained within them. If articles do not contain the names of specific stalls or they relate to site-wide events, they are displayed in front of the Yokocho secretariat building.

In order to filter articles by freshness date, we focused on date expressions and other terms that express dates in the articles. Three types of date expression formats were targeted in Japanese: “January 1,” “the 1st,” and “1/1.” Of these date expressions, expressions that do not relate to article freshness dates were excluded (e.g., “at the soonest possible date,” “once a day,” and “one-day manager training,” all are similar to the expression “the 1st” in Japanese). In addition, a total of 10 terms were targeted as terms expressing “today” and terms expressing future dates (see Table 1). Freshness dates were determined from these expressions and terms, and attached to each article. For instance, if an article posted on April 1 reads “x event will be held on April 6,” then the freshness date would be April 6 and the article display period would be from April 1–6 (see Figure 4).

4.2 Evaluation

The accuracy of the article freshness date filtering was evaluated. In order to conduct this evaluation, a total of 1,260 articles were collected from the Facebook page and Ameba blog of Yokocho on October 6, 2014. We separated only those that included date expressions and terms expressing dates, and manually assigned the correct value to each. The results are shown in Table 2. In order to test the effectiveness of the proposed method, it was compared with a method that defined freshness dates as the date the article was posted. The results indicate the potential of this method to provide users with more useful articles by adopting the article freshness date as an indicator. We believe this indicator can alleviate the problem of users overlooking useful articles within a large volume of articles, and prevent useless articles from continuously being displayed in the app. There were two reasons for inaccurate determination, as described below.

- Terms written in ways that are difficult to read automatically

Social media is a form of media that allows anyone to freely transmit information. Thus, it is not uncommon for it to include colloquial and ungrammatical expressions. It is also difficult to automatically determine the freshness date if there are multiple date expressions in one article and each is expressed in a different format.

- End and beginning of year announcements

In the holiday season at the end of the year, the Yokocho secretariat posts information about the opening times of each stall. These articles include information about the end of one year and beginning of the next, mixed together. Therefore, it is difficult to automatically determine whether an article relates to the end of one year or the beginning of the next, and this produces a large number of inaccurate determination results.

Based on the results of the automatically determined freshness dates, we are currently investigating a method for updating article freshness dates using things such as the browser history of the user. For example, a function that allows users to “like” or “bookmark” an article could be created and the number of “likes” or “bookmarks” and the length of time since these were added could be used to regularly update freshness dates. In addition, in order to take public opinion into consideration, we are considering using the number of times that terms within articles have been “tweeted” on Twitter to gauge interest, and updating the article freshness date accordingly.

5 Future Prospects

This section discusses the functions of the app under consideration and their future prospects.

---

Table 1: List of terms expressing dates

<table>
<thead>
<tr>
<th>Terms expressing “today”</th>
<th>Terms expressing due dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today, this day, right now (×3 written variants in Japanese), shortly (×2 written variants in Japanese), final day</td>
<td></td>
</tr>
<tr>
<td>Tomorrow, the day after tomorrow</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Results for two methods (Total articles: 602)

<table>
<thead>
<tr>
<th>Determination criteria</th>
<th>Correct</th>
<th>% accurate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of posting as freshness date</td>
<td>381</td>
<td>63.2</td>
</tr>
<tr>
<td>Proposed method</td>
<td>525</td>
<td>87.2</td>
</tr>
</tbody>
</table>

---

7 http://www.fukko-yatai.com/appli/
5.1 3D Model Update

The current study aims to allow users to experience the “here and now” at Yokocho by superimposing articles extracted from social media without the need to conduct labor-intensive updating of the 3D model. Ideally, when there is some kind of change to the appearance of the site, the target is remodeled to maintain up-to-date conditions at all times. We are conducting the research outlined below in the field of 3D model updating.

- Use of existing resources to update the required portion only
  We are researching frameworks for using previously modeled portions to efficiently update the required portion only which is reported by the local community members such as the Yokocho secretariat. For example, when only a stall or its sign has changed, we will be able to update it efficiently using the least amount of labor possible (see Figure 5). We are currently implementing the on-site AR application that supports shooting photographs for the texture updates. The AR application is designed to visualize area where its texture needs to be updated and automatically calculate the camera position by outdoor camera tracking methods based on GPS, beacons, and so on. Figure 6 shows a current prototype of the application for supporting the shooting for the texture updates. Current prototype adopts image composition of captured image and the old texture for manually aligning the captured image and 3D model.

- Maintaining geometric/optical consistency with the updated portion
  When only one portion is being updated, as in the above example, discrepancies may arise with respect to the lighting or texture. We will conduct research on methods to address these geometrical or optical discrepancies.

5.2 Log Analysis

Although the current study has primarily discussed display methods and content for the app, if we could enable the recording and analysis of a user movement log for the virtual food stall village, this could be applied to marketing as well as used in research experiments in service engineering or other areas.

5.3 Releasing the App as a Multi-platform App

We are implementing the 3D app on Unity3D\(^8\) framework. Since Unity3D supports building as multi-platform apps, we build Kesennuma-Yokocho app for three different platforms, which are Android, WebGL and PC-standalone build for displaying with binocular stereo HMD.

5.3.1 Android-build for Smartphones and Tablets for the Mobility

The number of the users of smartphones/tablets is dramatically increased these days. Therefore, they are suitable platform for widely releasing the application. And they can be used for one-site application thanks to their mobility. As we described before, we plan to implement on-site AR application with the function for supporting update of the 3D models.

---

\(^8\) https://unity3d.com
5.3.2 WebGL-build for PC users

For PC users, we build the proposed app as a WebGL application. It is easy to maintain and update contents with WebGL, since the contents of the application are in our web server. We already released alpha version of the WebGL-based app on our web server.

5.3.3 HMD-build for Providing the Feeling of Immersion

In recent years, low cost immersive Head Mount Displays (HMDs) are rapidly developing. Figure 7 lower shows the appearance of a walk-through demo of the virtual food stall village conducted at an exhibition using the Oculus Rift. The user can walk through by marching in place and by looking around. For walking forward in the virtual food stall village, we implemented stepping gesture recognition by accelerometer mounted in Oculus Rift. Also we implemented gaze point detection for other UI. If users keep watching the sign of the booth for few seconds, the users can enter/leave to/from the each booth. By using gesture interfaces, the user can experience walk-through with intuitive UIs. And additional devices are not required for UI. Such immersion experiences in combination with obtaining and transmitting of information from/to social media will continue to become more commonplace. It will soon become crucial to create site-focused applied initiatives within this trend. We also released an immersive type of the Kesennuma-Yokocho app for Oculus Rift developers/users.

6 Conclusion

Currently, we are developing a 3D app to enable users to realistically experience the “here and now” of a site, even from a remote location, with the aim of promoting service development for post-disaster recovery of Kesennuma. So that users continue to use the app, we proposed a method of integrating it with social media to constantly provide a “here and now” experience of Kesennuma-Yokocho. In addition, to deal with the possibility of a huge volume of information coming in through social media, we proposed to determine the article freshness date. Although the effectiveness of the proposed method was indicated by our results, we also found a number of issues that could not be solved using the proposed method. After the app is released, we plan to have users actually use it, and improve the app based on their evaluations.

Acknowledgements

This research is partly supported by Grant-in-Aid for Young Scientists (B) No.26870905.

References


9 https://www.khronos.org/webgl/