Case Study of AR Field Museum for Activating Local Communities

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Abstract. In this research and development, we use virtual reality and Augmented Reality (AR) technology which is experiential media accompanying physicality as social value of space resources (buildings, townships, townscape) with historical and cultural values. It is aimed to communicate to the subjects inside and outside the region by using visualization and experience and further combining with the method of community design to find the possibility of active utilization.

Specifically, we will use VR/AR technology to (1) realize the system of preserving and sharing space resources of the region, (2) research of sharing and transferring historical and cultural values, (3) community activities Research on the motivation improvement method of society, society, society, and society.

Keywords: Augmented Reality · Digital museum · Mobile device
Public exhibition

1 Introduction

In Bunkyo Ward, Tokyo, where many spatial resources with historical and cultural values (buildings, towns, townscapes) are accumulated, the conservation and utilization of them is a problem. However, as its social value is unclear, there are present situations where it is lost or not fully utilized. For example, it is said that Higuchi Ichiba passed and the sento which is said to have been established in the middle of the Meiji era, due to the aging of the facilities and the physical condition of the management, was abandoned in September 2015, being missed in the area, the style of the Miya. A certain building was dismantled and rebuilt into an apartment (Figs. 1 and 2).

In this research and development, we use virtual reality and Augmented Reality (AR) technology which is experiential media accompanying physicality as social value of space resources (buildings, townships, townscape) with historical and cultural values. It is aimed to communicate to the subjects inside and outside the region by finding visualization and feasibility, further combining with the method of community design, and finding the possibility of active utilization. The AR/VR content emphasizes spatial consistency and has an effect of conveying an accurate correspondence relationship between the past space reproduced from the live-action video image and the current real space. Therefore, changes in places, buildings and exhibits by the times are easy to

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convey, visualization of the importance of the target spatial resources and visualization and transmission of the impact on the community due to loss are expected to be possible.

The authors have already carried out activities in collaboration with local construction companies, shopping districts, NPOs, local governments (Bunkyo Ward, and District Culture Resource Center), and the space resources with historical and cultural values (buildings and towns. It is expected that it will contribute to revitalizing and creating community activities and shopping street activities, utilizing the cityscape), and contributing to the development of sightseeing town planning.

In response to the above objectives, the authors conducted a study on (1) the preservation and sharing system of space resources in the region using VR/AR technology, (2) research on sharing and transferring historical and cultural values, (3) Research on improvement method of motivation of community activities, targeting three points, and conducting research and development.

In this paper, we introduce our case study of AR Field Museum for activating local communities .

2 Realization of a System for Archiving and Sharing Space Resources in the Region

In this research, in order to realize a history/cultural VR/AR experience that can be used sustainably in a general urban area, VR/AR experiences of the form that the viewer experiences using individual mobile terminals. We propose a system and carry out long-term demonstration mainly around Kikusaka neighborhood in Bunkyo Ward. Figure 3

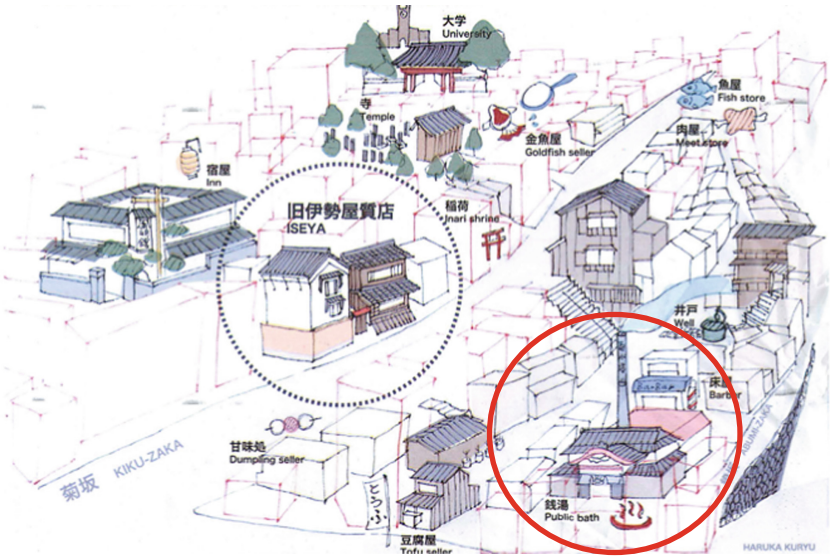

Fig. 1. There are many space resources with historical and cultural values in Bunkyo Ward, Tokyo

Fig. 2. Spatial resources are being lost one by one. “Kikusui-yu”

shows the concept of a field-trial exhibition by personal-owned mobile terminals proposed in this research. Instead of visiting the museum and borrowing the terminal to appreciate the exhibition as before, distribute the exhibition system as an application that runs on the mobile terminal owned by the viewer, and freely. It is possible to appreciate the exhibition. For this reason, we developed a robust AR registration method in outdoor public spaces with large fluctuations such as weather, date and time, targeting various unspecified age groups, sustainable space resources that do not require special markers and support staff AR/VR experiencing system to do.

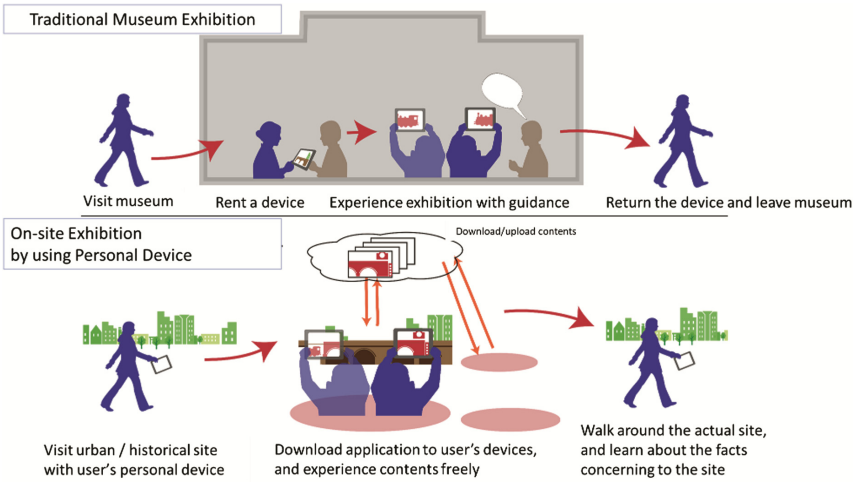

Fig. 3. The concept of AR Field Museum by using individual mobile terminals

The outline of our proposed system is as follows:

1. Users visit the exhibition location. They install the appropriate application onto their own mobile device either on-site or in advance.
2. They look for the point where a photograph of a past scene was taken by holding their mobile device toward the present scene.
3. The application compares the device camera image to the reference scene image taken in advance, and calculates the device position and orientation.
4. If the application determines that the user is standing at the correct point and facing the proper direction, it renders the whole-sky image area of the past scene generated using photographic materials.
5. By moving their devices around, users can see the past scene in the direction they are facing through the screen of the device. They can also easily compare the present scene to the past scene by changing the transparency of the device camera image.

3 Research on Sharing and Transmission Technology of Historical and Cultural Values

In this research, we also constructed a mechanism to collect and share AR/VR content by collective intelligent approach. In the area AR system "mobile cloud type remembrance window" developed for mobile terminals, we introduced a platform that allows users to participate in content creation as well as appreciation by incorporating elements of UGC (User-Generated Containment) 1). In creating AR contents, historical images such as past photos superimposed on the actual landscape are required. In order to gather historical images from many users, we created a system that can post historical images in web pages and applications, and created a system that can be shared by all users (Figs. 4 and 5). With this platform, it became feasible to realize a mechanism for

enriching contents by using photos of memories owned by users and pictures with high historical value.

Fig. 4. Crowd-Cloud Window to the Past

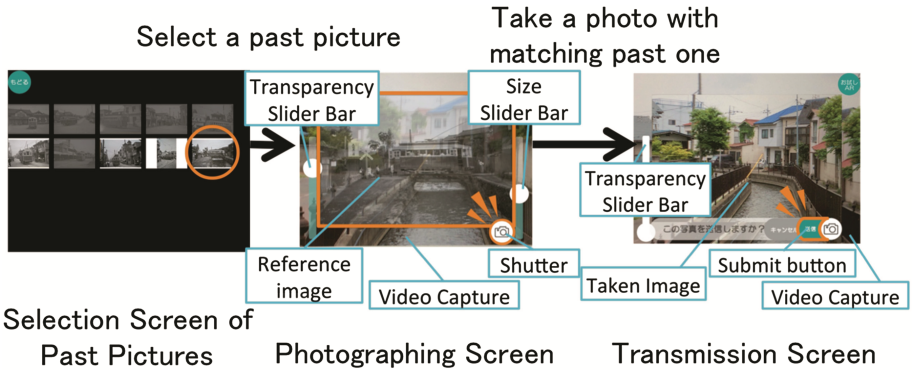

Fig. 5. Application to capture and collect current pictures at estimated photographed positions by users.

We presented a crowdsourcing system that constructs a database for AR contents by user generation and applied it in "Window to the Past," which runs on personal mobile devices. In "Window to the Past," the system designers had to prepare the contents by themselves, so there were only a limited number of contents. We overcame this problem by implementing a system in which many users can participate in creating contents by crowdsourcing. This will extend "Window to the Past" to a larger area with more data created by many users.

We proposed a crowdsourcing system in which users identify the location of the past pictures and capture the current reference pictures. This system helps users generate contents for "Window to the Past" with enjoyment. The database contains current reference pictures of the past pictures, GPS information of the locations, and annotation of the pictures. Our proposed system is realized as a smartphone and a tablet device application. Users explore the spots where old photos were captured on behalf of the designer. They only need to take photos at the correct position and angle where the semi-transparent past image matches the background, and then they can easily add a series of

necessary information for "Window to the Past" to our database. We integrate "Window to the Past" and this crowdsourcing database construction system into one application named "Crowd-Cloud Window to the Past."

Through our experiment, we evaluated this proposed crowdsourcing system. The results showed that users who knew a bit about the photographed place in the past picture were able to identify the locations and take photos there. In most uploaded pictures, the distance from the photographed place to the correct location was within 10 m. Moreover, all photos were taken at approximately the same camera angle, which could be sufficiently used as the reference images for "Window to the Past." If the appearance of the uploaded images was significantly different from the corresponding past pictures such as in Pattern 2, they were unable to judge accurately because there was very little information for making a decision. Moreover, users were unable to evaluate the correctness of the present pictures accurately if the appearance of the images was significantly different from the corresponding past ones. We should incorporate functions to judge the accuracy of the pictures.

In addition, we distributed this application, "Crowd-Cloud Window to the Past" through the Internet. We held workshops using this application in cooperation with many local communities and evaluated the interest and feasibility of this application. Here, we found that this application was slightly complex and time-consuming, but it had many interesting and acceptable aspects. For example, our application for looking for photographed positions provides users with entertainment, like games. Although we should sophisticate its user interface and user-motivating design, these results suggest that the proposed system could work well in gathering valuable user-generated contents to provide a richer AR experience.

In addition, we aim to extract the semantic importance of AR/VR contents for sharing and communicating historical and cultural values, and to construct a presentation interface and curation system at AR/VR experience based on its importance. So far, research on AR/VR technology has been focusing on reproducibility and spatial consistency

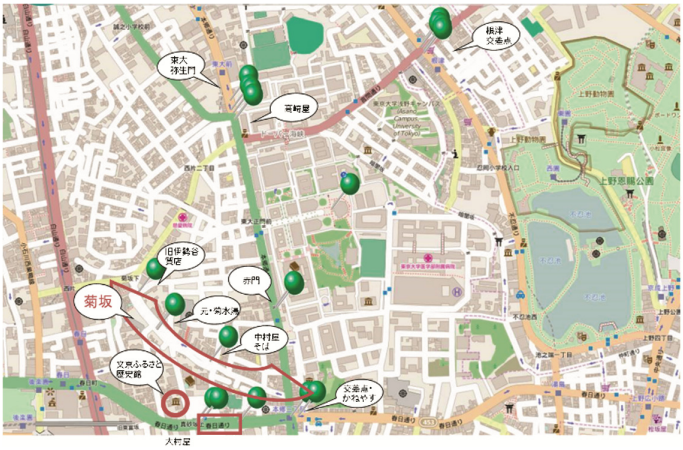

Fig. 6. One participant of our workshop registered

focusing on spatial resolution and three-dimensional accuracy, and semantic contents such as editing historical images. We have not dealt with the technology concerning it. For this reason, at the time of experiencing AR/VR contents, the user does not know what to experience from the degree of freedom, and it is currently impossible to share or communicate value only through AR/VR.

For that reason, weighting is given to the importance of spatial resources registered as images and images with semantics, and we are developing technologies to support experiences. In video materials, there is an attempt to generate content that allows the user to intuitively understand the information of exhibits appropriately by appropriately selecting and selecting portions with high historical value. We appropriately reflect the adjustment by the curation, dynamically adapt to the user's appreciation behavior, present the video, and make it easier to grasp the contents of the whole contents.

Moreover, by asking the user to register language information such as voice at the time of experiencing, the evaluation of the importance of the registered contents is performed by the speech recognition and analysis by the oral history approach, and based on the importance thereof, the user's. We adapted the method to induce appreciation behavior and shared important information.

Fig. 7. Meeting to hear the memories of Hongo 2017

Specifically, as various historical buildings and shops in Bunkyo-ku and Hongo are lost, recently we have talked to people who kept Hongo's "Kioku" such as ryokan and old shop owner, We held a meeting to think about what is the likeness (Fig. 6). As a guest speaker, President of the Imperial Ryokan's Feng Ming Library, also a well-established tea ceremony Bonna maiden, cafe tea shop owner shop owner, calling Oshima and shopkeepers who had been operating but stopped Chinese restaurant for many years, calling for Oral History's I listened (Fig. 7). The results are converted into data as audio and moving images, and are shared with social science researchers.

4 Study on Motivation Improvement Method of Regional Activities

By giving a sense of connecting the landscape of the long-lasting landscape to the future through the history exhibition of the area using the system constructed in Sects. 2 and 3, it is aggressive from the people who know the form of the neighborhood residents etc. We demonstrated and evaluated whether it is possible to revitalize the region while gaining participation. We held a regional experience workshop, evaluated whether we could register old photographs of elderly persons themselves, and brushed up the system while giving feedback.

This project is a "Cultural Resource Conference" (http: // tohbun (http: // tohbun)), organized by volunteers of experts and practitioners in various fields such as the Cabinet Office, Ministry of Land, Infrastructure and Transport, Agency for Cultural Affairs,.jp/) Hongo Project Team, through the kick-off symposium etc., we are deepening the introduction and understanding of the preservation of cultural resources to the residents of Hongo area. At this symposium, exhibitions and event announcements of Hongo's cultural resource materials collected so far (comments from users, recorded videos, pictures, etc., sent to Kikusui hot water disposal) were made on site. After that, we talked about the history and feelings about Hongo's Kioku and shared it, centering on Professor Tanigawa, Associate Professor Tanigawa, Mr. Hosomi Matsushita, others related to cultural resource conservation and utilization. A workshop was held with the theme of utilizing the cultural resources of Hongo, and all the participants gave free ideas on future activities and adopted it as guidelines for future activities (Fig. 8) .

Fig. 8. Kick-off symposium of Hongo Project Team

Fig. 9. Healthy town development festa in Bunkyo & Taito Ward

Fig. 10. Koto Ward AR tournament event tour

Efforts from a health point of view also started. Through regional science town planning, healthy community making festa in Bunkyo and Taito, I was able to ascertain how we can induce local streets walking around the place where old pictures were taken (Fig. 9). We also conducted demonstration experiments to see if it could actually be applied from the viewpoint of sightseeing. We organized an event tour around the Shenzhen during the 1964 Tokyo Olympics hosted by the Koto Ward Tourism Association. Applicants were responsible for building the AR system and customizing the contents, asking the Koto Ward guide meeting today to guide the guide and photograph preparation. Participants were publicly offered by Koto Ward newsletter, and there were a large number of 36 people, including 62 people, for 15 people. Participants got a very memorable remark about the city and got a comment from the guide that they understood

the value as a new cultural resource of Shenzhen well (Fig. 10). We have already decided to carry out the second tour of the guided tour next year, we are currently in talks on the concrete contents of the tour, and it is deploying more than originally assumed.

5 Conclusion

The proposed method consists of building an AR system that can be operated sustainably and in a long-term space in public space and daily space, low cost such as content in a wide range, affinity to the environment, low labor cost and maintenance cost, environmental change, disturbance. It is possible to realize robustness to fool proof etc., autonomous development of AR content through user participation mediaization.

In addition, AR contents that can actually enjoy going out with fields of daily human activities as a field are already causing great influence on real economy economy, effect and market size is large. In addition, by creating and communicating AR contents closely tied to the area by themselves, revitalization of visiting behavior and promotion of participation in residents themselves are not limited to transient, but sustainable and autonomous. It can be a phenomenon.

This research applies this knowledge to the framework of community participation of experiencers themselves, making it possible to design social roles and activities of elderly people using ICT. It is also expected to have a great ripple effect on other museums from the viewpoint of collection, preservation and transmission of knowledge and experience of elderly people lost and materials and materials. Not only for museum use but also for the research and development of a wide range of fields related to aging, robust AR presentation method with high usability is desired, so the collection and sharing of regional contents achieved in this research and development. Exhibition technology is expected to have a large ripple effect.

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