Photo-shoot localization for mobile AR based on registered images in virtualized reality models

Jun Nishida*
University of Tsukuba and AIST, Japan

Koji Makita†
AIST, Japan

Tomoya Ishikawa
AIST, Japan

Takashi Okuma
AIST, Japan

Masakatsu Kourogi
AIST, Japan

Thomas Vincent
Université Joseph Fourier, France

Laurence Nigay
Université Joseph Fourier, France

Jun Yamashita
University of Tsukuba, Japan

Hideaki Kuzuoka
University of Tsukuba, Japan

Takeshi Kurata
University of Tsukuba and AIST, Japan

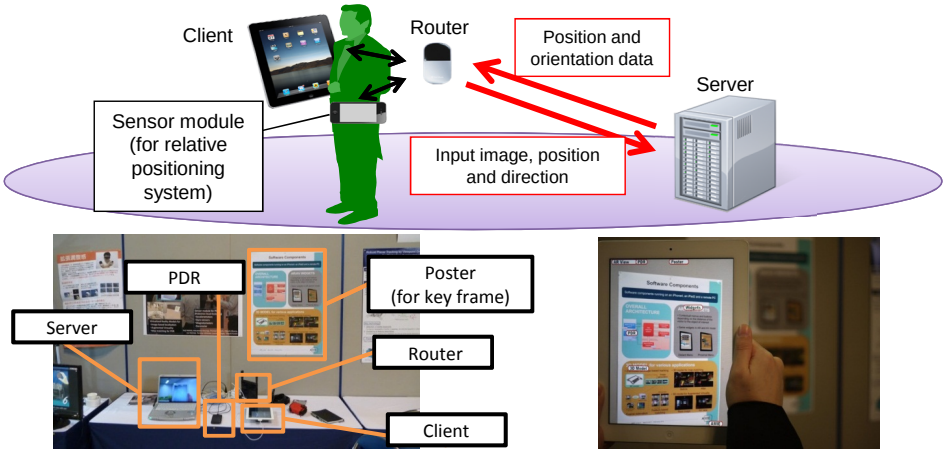

Figure 1: System architecture and data flow.

ABSTRACT

This paper presents a study on estimating photo-shoot location and orientation in indoor environments for augmented reality applications. The proposed method is based on registered images in virtualized reality models [1]. Registered images are secondary products of model creation, and contain photo-shoot location, orientation, and depth information. Therefore, additional data for special purposes need not be created. The upper and lower left parts of Figure 1 show the system architecture and data flow. We assume that the proposed method is used in combination with a relative positioning system, for example, Pedestrian Dead Reckoning (PDR). In the proposed system, a real image taken by a mobile device is sent to a server, and the image is compared with the registered images. In this study, we compare the localization performance of the proposed system using mutual information, edge information, SURF, ORB, and FREAK features.

Our system uses the PDR system [2] as the relative positioning system. The lower right part of Figure 1 shows a sample image of an implementation of our AR application. The AR application uses model-based and PDR localizations. As a part of this study, we performed three experiments using real images taken by a mobile device with registered images as key frames. In order to confirm the advantages and drawbacks of each feature, three scenes were prepared. In scene 1, the experiments were performed in a virtual environment, where each method was expected to work well. In the experiments, both input images and key frames were created by the model. In scenes 2 and 3, the experiments were performed in a real environment. Both input images and key frames were created using the photos taken by a mobile device in a real environment. In addition, scene 3 contained many texture-less images. Therefore, it was assumed that estimation methods using feature points do not work well in scene 3. In all the three scenes, the experiments were performed to estimate the position and orientation using each feature. Among the methods using feature points, the method using the SURF feature showed particularly good results. On the other hand, there were scenes where the methods using feature points did not work. In such scenes, methods using mutual information have a better probability of producing high-accuracy results. However, when we use mutual information methods to estimate the position and orientation in a large area, the computational cost is correspondingly higher. Therefore, it is necessary to apply parallel processing to use the AR applications. We have demonstrated the feasibility of the method by combining several features for AR applications in large indoor environments.

*e-mail: nishida-e0711251@aist.go.jp
†e-mail: k.makita@aist.go.jp

REFERENCES

[1] T. Ishikawa, K. Thangamani, M. Kourogi, A. P. Gee, W. Mayol, K. Jung, and T. Kurata, " In-Situ 3D Indoor Modeler with a Camera and Self-Contained Sensors, " In Proc. HCII2009, LNCS 5622, pp. 454-464, 2009.

[2] M. Kourogi, and T. Kurata, " Personal Positioning Based on Walking Locomotion Analysis with Self-Contained Sensors and a Wearable Camera, " Proc. IEEE International Symposium on Mixed and Augmented Reality (ISMAR2003), pp. 103-112, 2003.