Evaluating a SLAM-based Handheld Augmented Reality Guidance System

Jarkko Polvi[1], Takafumi Taketomi[1], Goshiro Yamamoto[1], Mark Billinghurst[2], Christian Sandor[1], Hirokazu Kato[1]

[1]Nara Institute of Science and Technology, Japan
{jarkko-p, takafumi-t, goshiro, sandor, kato}@is.naist.jp

[2]University of Canterbury, New Zealand
mark.billinghurst@canterbury.ac.nz

ABSTRACT

In this poster we present the design and evaluation of a Handheld Augmented Reality (HAR) prototype system for guidance.

Author Keywords

Handheld augmented reality; guidance; user study.

ACM Classification Keywords

H.5.2 [User Interface]: Graphic user interface (GUI), Screen design, user-centered design.

INTRODUCTION

HAR has a huge potential to introduce Augmented Reality (AR) to the mass consumer market due to widespread use of suitable handheld devices. Compared to other mobile AR mediums, HAR also offers benefits like superior information input methods and a possibility for easier collaboration. However as Grubert et al. [1] and Olsson et al. [2] point out, HAR is not currently considered useful due to, for example, insufficient utility and irrelevant content. Thus, it is important to evaluate how HAR performs in different kinds of practical use scenarios.

In this poster, we focus on the usefulness of HAR in two generic guidance scenarios. We describe the design and evaluation of our prototype HAR guidance system and address its usefulness and usability related issues. The contribution of our work is the lessons learned from the user studies of the prototype system.

PROTOTYPE SYSTEM

Our prototype system was developed for the iPad and it uses Simultaneous Localization And Mapping (SLAM) for tracking. SLAM tracking allows the system to be used more freely in different kinds of unknown environments. The task flow in our system is as follows: First the desired area of interest (a correct SLAM map) must be selected from an overview image of the real environment. After the area is selected the SLAM map tracking needs to be initialized by choosing the correct viewpoint. Finally, the annotations can be seen overlaid onto the real world.

SUI'14, October 4–5, 2014, Honolulu, HI, USA.
ACM 978-1-4503-2820-3/14/10.
http://dx.doi.org/10.1145/2659766.2661212

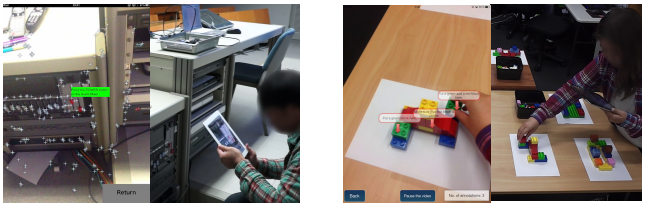

Figure 1: The evaluation scenarios: the device set-up scenario (left) and the object assembly scenario (right).

USER STUDIES

We have performed two user studies on our prototype system. A small-scale study (6 participants) was conducted on the initial prototype in a device set-up scenario (Fig. 1, left) in order to identify usability issues. We improved the system and then conducted a within-group comparative study (27 participants) against two conventional iPad guides: a picture and a video guide. This study was done in an object assembly scenario (Fig. 1, right) where we measured performance and subjective feedback.

We derived five guidelines based on the results of our evaluations: location of the AR environment, the information about the off-screen AR content, navigational shortcuts, view pausing, and feedback. We were unable to find performance benefits from the use of AR compared to conventional multimedia guides. Main reasons for this was the overall complexity of the AR compared to the two other guides and the simplicity of the assembly scenario.

CONCLUSION

We have described the design and evaluation of our HAR guidance prototype. Even though we did not able to prove the superiority of our system, we gained information about the possible improvement areas of HAR in guidance. The use of HAR in generic guidance could be justified if other benefits of HAR are also made use of. Future work will see more improvements based on the results of the comparative user study. We will then expand our system to more complex practical use scenarios that require inputting information and authoring AR content.

REFERENCES

1. Grubert, J., Langlotz, T. and Grasset, R. Augmented reality browser survey. *Graz University of Technology 2011*, (2011).
2. Olsson, T. and Salo. M. Online user survey on current mobile augmented reality applications. In *Proc. ISMAR 2011,* IEEE Press (2011), 75-84.