Virtual Reality Interaction Using Mobile Devices

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Abstract

In this work we aim to implement and evaluate alternative approaches for interacting with virtual environments on mobile devices for navigation, object selection and manipulation. Interaction with objects in virtual worlds using traditional input such as current state-of-the-art devices is often difficult and could diminish the immersion and sense of presence when it comes to 3D virtual environment tasks. We have developed new methods to perform different kinds of interactions using a mobile device (e.g. a smartphone) both as input device, performing selection and manipulation of objects, and as output device, utilizing the screen as an extra view (virtual camera or information display). Our hypothesis is that interaction via mobile devices facilitates simple tasks like the ones described within immersive virtual reality systems. We present here our initial implementation and result.

Our system

Our system consists of virtual environment and mobile device. Both are based on OpenSceneGraph: we use CalVR [5] for our virtual environment and OpenSceneGraph running natively on the android. This creates two similar scenes one on the CalVR system and the other on the android device. To move these two scenes simultaneously we need to connect the CalVR system and Android device via TCP/IP protocol. This delivers a single synchronized scene to the user and enables him to interact with a single environment. All this happens by sending and receiving the tracking system transformation data that moves the virtual camera on the Android device. In addition to that we can send the object transformation to change the object position in the virtual environment.

Our research consists of two interactions:

1. Camera Manipulation
Viewing the object from different orientations using the mobile device
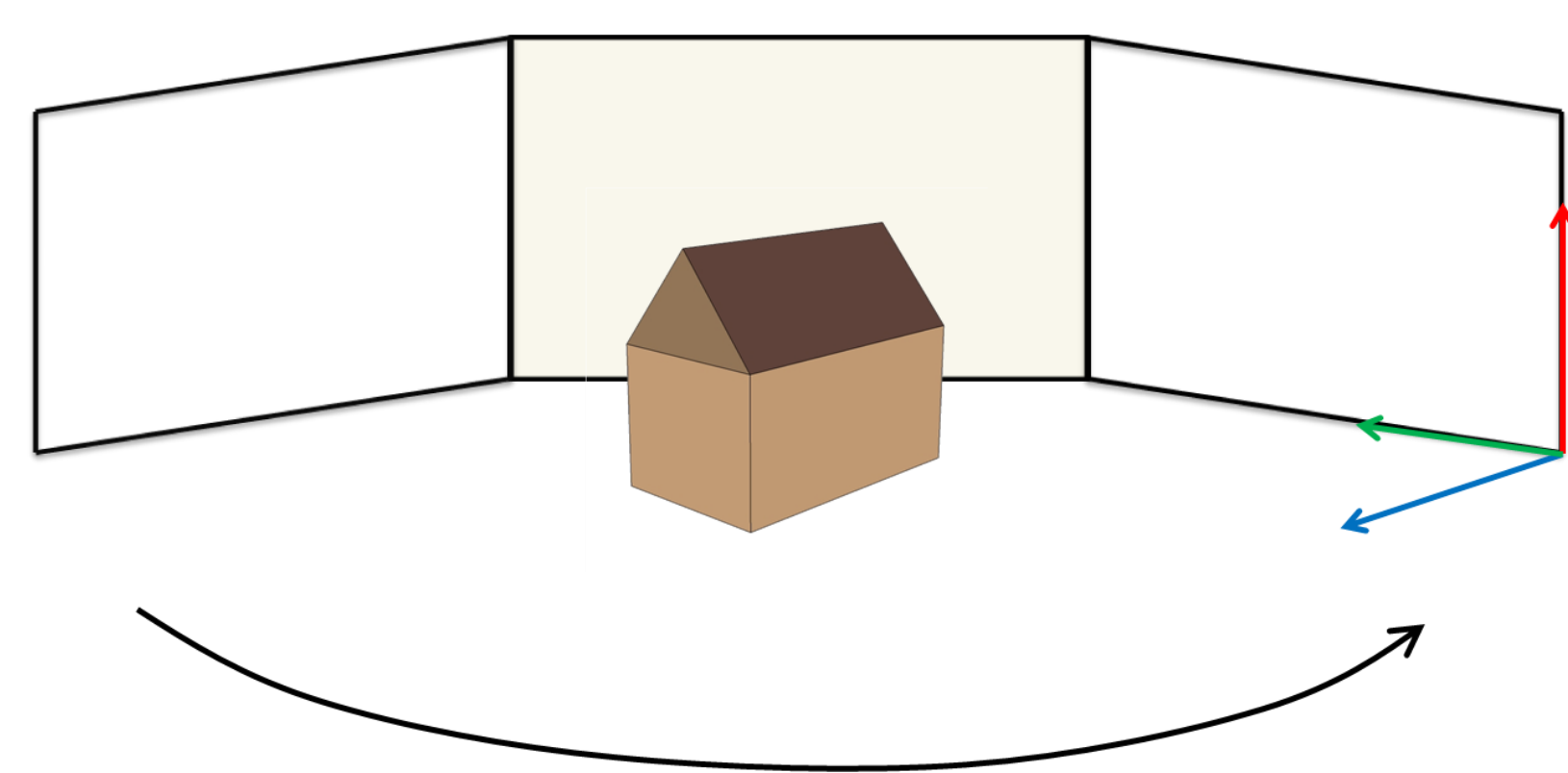
2. Object selection
By the mobile touch screen we can drag and drop the object into a new place
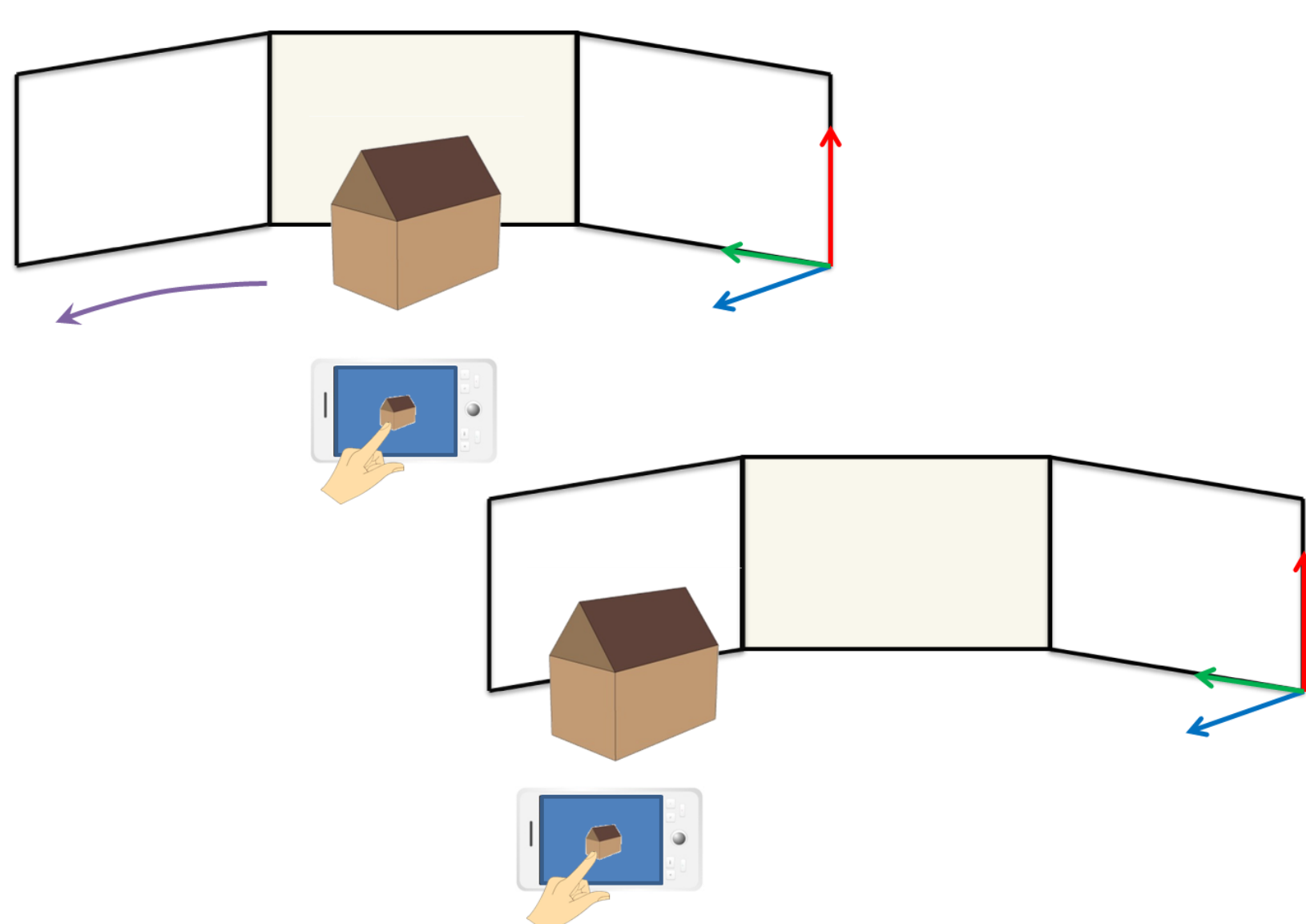
Methodology

The application in this poster was developed using CalVR. CalVR is a virtual reality framework, based on OpenSceneGraph, which was developed in the Immersive Visualization Laboratory at Calit2 [5]. Our main mode of operation is to send and receive data transformations from CalVR to the android devices and vice versa.

Here are the main steps of our system:
• Run the ClaVR plug-in on ClaVR system as server.
• Run the OpenSceneGraph on the Android device as client by using Android_NDK.

• Using TCP/IP protocol to connect between the server side and client side to send the transformation data between server and client.
• We have two scenes one on the CalVR system and the other on the android device both are based on OpenSceneGraph. Any changes in each of the scenes we can see it in on the screen as single scene.
• Camera manipulation interaction is implemented by moving mobile device in order to change the virtual camera position in the virtual environment using tracking system. When we change the tracking system position the data transformations send over the socket from server to client to change the camera position.
• In object selection interaction we change the object position in virtual environment using the mobile touch screen by dragging and dropping the object from one place to another.

Conclusion

In this research we develop a CalVR plug-in that has been used with many applications to interact with virtual environment. We aim to investigate the use of mobile devices in terms of interaction within the virtual environment. This provides many possibilities for 3D graphics and virtual world visualizations because it offers independence from traditional inputs while moving and interacting with 3D space objects. Using our idea to describe alternative approaches for interacting with virtual environments on mobile devices for navigation, object selection and manipulation gives us lots of further explorations in the concepts of 3D visualization on mobiles. The following picture displays the project.

As future research direction uses study and evaluation to present different approaches for interacting with virtual environment on mobile devices and to compare different kinds of interaction. Moreover, we will add interaction to select objects to receive meta-data about them. And we will add more techniques to navigate, manipulate and select object in the virtual environment.

References

[1] Nalbant G., & Bostan B. (2006) "Interaction In Virtual Reality", 4th International Symposium of Interactive Media Design (ISIMD).
[2] Bill Buxton and George W. Fitzmaurice. Hmds, caves & chameleon: a human-centric analysis of interaction in virtual space. *SIGGRAPH Comput. Graph.*, 32(4):69-74, 1998.
[3] A. Henrysson, M. Billinghurst, and M. Ollila. Virtual object manipulation using a mobile phone. In *Proceedings of the 2005 international conference on Augmented tele-existence - ICAT '05*, page 164, New York, New York, USA, 2005. ACM Press.
[4] A. Kotranza, K. Johnsen, J. Cendan, B. Miller, D. Lind, and B. Lok. Virtual multi-tools for hand and tool-based interaction with life-size virtual human agents. In *2009 IEEE Symposium on 3D User Interfaces, pages 23–30, Lafayette, LA, 2009. IEEE.*
[5] http://ivl.calit2.net/wiki/index.php/CalVR

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