



Student Press

An Interaction of Merged Virtual and Physical Object

guan, jie

Suggested citation:

guan, jie An Interaction of Merged Virtual and Physical Object. [Project] (Unpublished)
Available at <http://openresearch.ocadu.ca/id/eprint/3923/>

Open Research is a publicly accessible, curated repository for the preservation and dissemination of scholarly and creative output of the OCAD University community. Material in Open Research is open access and made available via the consent of the author and/or rights holder on a non-exclusive basis.

The OCAD University Library is committed to accessibility as outlined in the [Ontario Human Rights Code](#) and the [Accessibility for Ontarians with Disabilities Act \(AODA\)](#) and is working to improve accessibility of the Open Research Repository collection. If you require an accessible version of a repository item contact us at repository@ocadu.ca.

An Interaction of Merged Virtual and Physical Object

Jie Guan*

OCAD University

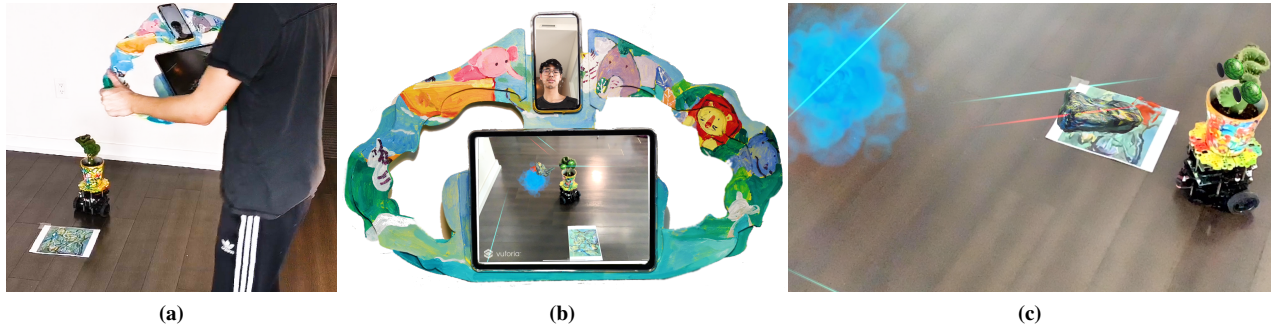


Figure 1: (a) The scene demonstrates the user engaging with the Augmented Reality device and the cyborg plant. (b) The holder with the iPhone and iPad. (c) The Augmented Reality scene displaying the virtual eyes attached to the physical cyborg plant, virtual cell and water.

1 Introduction

Representing physical and virtual objects together on a two-dimension screen is used widely in today's mobile phones, tablets, and Mixed Reality glasses. The term "Augmented Reality" (AR), referring to virtual objects (generated by computer graphics) and "augment" the real environment by merging virtual and physical objects, is increasingly discussed in the literature[Milgram and Kishino 1994]. Interactions among virtual elements are explored in various apps, including games, education, and virtual shopping. However, research addressing the application of interaction to the physical objects remains limited; consequently, I believe that enhancing interconnections among virtual and physical objects, and humans, may promote research advancements in the Mixed Reality domain.

The contribution of this project includes: i) exploration of merging physical and virtual objects as unity, ii) interactions between human, physical machine, and virtual elements displayed the electronic devices, and iii) embodiment of Donna Haraway's cyborg concept of hybrid machine and organism body[Haraway 2006].

The manner in which users engage the holder with AR Apps to view and interact with the virtual cell and the cyborg plant is displayed in Figure 1(a). The components of the project include a custom holder to which an iPhone and iPad are attached (Figure 1(b)), a cyborg plant, a virtual cell, and virtual water displaying in AR. A cyborg plant is a merged object with virtual eyes attached to the physical organism-robotic body (see Figure 1(c)).

2 The Interaction and Approach

By opening or closing the mouth and eyes, the user has the ability to control the animation of the virtual cell displaying in the AR screen. The movement of the cyborg plant is manipulated by the position of the virtual cell. The goal for the user is to control the virtual cell to "guide" the cyborg plant to reach the virtual water. Once the cyborg plant reaches the virtual water, it will display a happy scene with colorful particles.

Both apps are made in Unity and can be operated on the iPhone and iPad. The iPhone X has a built-in feature to capture three-dimensional data of the human face, and I use ARKit to acquire the states of the mouth and eyes. By contrast, Vuforia (an AR engine)

is used for visualized virtual eyes attached to the cyborg plant, as well as depicting the virtual cell and the virtual water to the central marker in the Mixed Reality scene.

There are two logic systems to determine the movement of the virtual cell and the cyborg plant. When the user opens or closes the mouth, it controls the virtual cell moving forward or stopping. The closing of the right or left eye will affect its direction of movement. Additionally, there is Ray Detection on the virtual eyes of the cyborg plant. If Ray detects the virtual cell, the cyborg plant will go straight. Otherwise, it will continue to rotate.

The robotic body of the cyborg plant is Turtlebot 3, which runs within the Robot Operating System (ROS). With the ROS Sharp plugin using in Unity, the virtual Ray located on the eyes sends control to the physical robotic body. Additionally, communication between the iPhone and iPad is supported by Socket.io in Unity.

3 Future Work

Future research should be conducted in support of exploring additional opportunities to control virtual objects applied to a human's physical body. For example, an individual deploying a virtual arm to extend his ability to interact with the virtual content generated by a computer graphic. As mentioned above in reference to the cyborg concept, I believe that the computer graph applied to the human body may also be considered as a cyborg body. Additional investigations into this idea is warranted.

References

- HARAWAY, D. 2006. A cyborg manifesto: Science, technology, and socialist-feminism in the late 20th century. In *The international handbook of virtual learning environments*. Springer, 117–158.
- MILGRAM, P., AND KISHINO, F. 1994. A taxonomy of mixed reality visual displays. *IEICE TRANSACTIONS on Information and Systems* 77, 12, 1321–1329.

*e-mail:jieguann@gmail.com