2015

Augmented Reality and Gesture-Based Control

Camille Eddy

Josh Johnston

Augmented Reality and Gesture-Based Control

Abstract

This research investigates methods for interacting with 3D visualizations of science data. Even with higher resolution, large format, and stereoscopic displays, most visualization still involves the user looking at the result rendered on a flat panel. Changing perspective, zooming, and interpreting depth is often disorienting and frustrating. Specialized hardware and software solutions like large format displays and CAVEs address these issues with infrastructure limited by cost, complexity, and size.

We investigate low cost commercial hardware solutions for their potential application to this problem. The Leap Motion Controller and Kinect Motion Sensor are assessed for gesture-based visualization control. The Oculus Rift is considered for immersive virtual reality combining head tracking and close-to-eye wide angle display. Finally, Android devices are used for augmented reality by overlaying rendered 3D objects on a camera video stream to react to a user's perspective. These devices are integrated with the Unity 3D gaming engine as a tool for connecting input from the sensors to both the Oculus and flat panel displays. The visualizations use example models created from scientific data.

Augmented Reality and Gesture-based Control

BOISE STATE UNIVERSITY

Camille Eddy and Josh Johnston

Boise State University

camilleeddy@u.boisestate.edu jjohnston@boisestate.edu

Motivation

This research investigates methods for interacting with 3D visualizations of science data. Even with higher resolution, large format, and stereoscopic displays, most visualization still involves the user looking at the result rendered on a flat panel. Changing perspective, zooming, and interpreting depth is often disorienting and frustrating. Specialized hardware and software solutions like large format displays and CAVEs address these issues with infrastructure limited by cost, complexity, and size.

We investigate low cost commercial hardware solutions for their potential application to this problem. The Leap Motion Controller and Kinect Motion Sensor are assessed for gesture-based visualization control. The Oculus Rift is considered for immersive virtual reality combining head tracking and close-to-eye wide angle display. Finally, Android devices are used for augmented reality by overlaying rendered 3D objects on a camera video stream to react to a user's perspective. These devices are integrated with the Unity 3D gaming engine as a tool for connecting input from the sensors to both the Oculus and flat panel displays. The visualizations use example models created from scientific data.

Research Goals

- Characterize functionality of the Kinect V2 sensor and SDK
- Find an application that works with the Kinect
- Characterize functionality of the Leap Motion System
- Use existing Boise State models to make a working Leap app
- Use existing Boise State models to make a working Vuforia app

Integration of Programs

This project researched different augmented reality programs and the compatibility between them. The integration of Leap Motion with a 3D model made in Unity provided the best results. Other research was also done in Kinect and Vuforia. Kinect was ultimately placed to the side because it offered too much functionality with its full skeletal model. We decided that it would be best to work with only the hands. Vuforia allows a user to examine a 3D environment similar to the Leap/Unity 3D integration but it is made for a 2D interaction with a 3D environment.

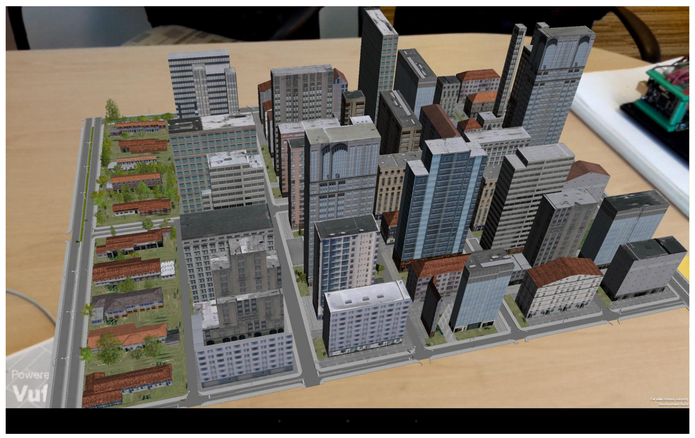

Figure 1: Vuforia lays a 3D projected image on top of marker.

Kinect

We first considered the Kinect for Windows, its SDK and the v2 sensor. This new version has limited backwards compatibility with existing work in gesture based systems. Due to the complexity of its skeletal model, developing the desired flythrough of a 3D model was determined to take more time in research and coding than was available.

Figure 2: The Kinect Evolution App shows the different forms of information the Kinect projects.

Vuforia

Vuforia allows applications to overlay models on video feeds. It can recognize and track images, objects and markers. This provides a great visualization experience. Load the app on your device and hold it up to the image below.

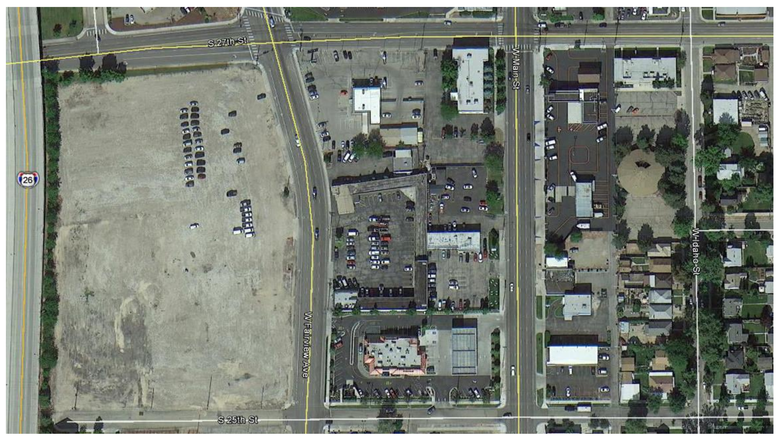

Figure 3: Vuforia marker.

Unity 3d

Unity 3d is a game development suite that provides powerful tools to manipulate a 3D environment. With a well developed user interface and large functionality built in, it provides an excellent environment for game development.

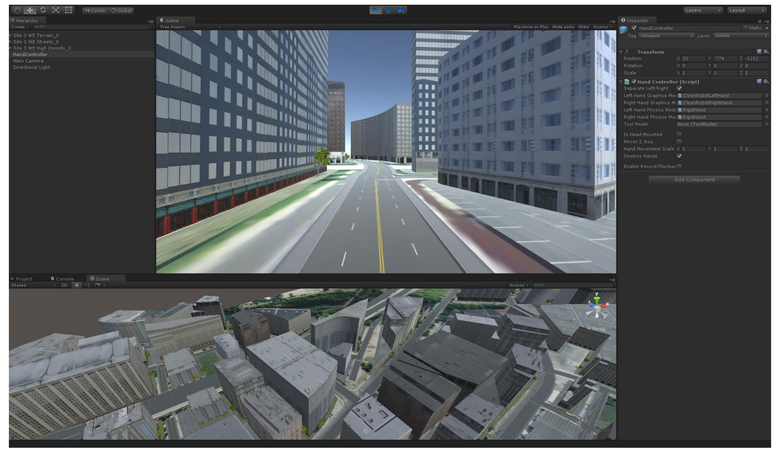

Figure 4: Sample CityEngine scene exported to Unity 3d with added player controller.[5]

Leap Motion

The Leap Motion device can see a user's hands and fingers. It allows a user to swipe, point, pinch and reach in a 3D environment. We wrote scripts to implement functionality for flying through models and other computerized data.

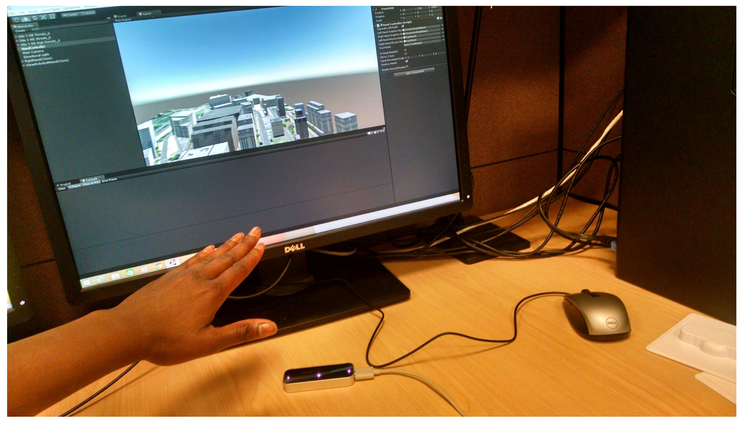

Figure 5: Leap Motion navigates CityEngine scene in Unity 3D.

Acknowledgements

- All of the Idaho ESPCoR project staff and collaborators on 2014 CI-Viz iSEED
- This project is supported by NSF award number IIA-1301792 from the National Science Foundation. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NSF