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EE267 Final Project Proposal

Surveying Options for Taking the VRduino Wireless

Motivation and Proposal

The hardware setup currently used for our course consists of the VRduino (a board consisting of a Teensy microcontroller connected to an IMU and four photodiodes for positional tracking) connected to a computer via a USB cable, as well as an LCD screen connected to the computer as an external monitor via a USB cable and an HDMI cable. Information flows from the VRduino to the computer, where it then interacts with a virtual scene in the Chrome browser. The scene is displayed on the externally connected LCD display, which is inserted by the user into a stereoscopic viewer such as a ViewMaster.

While the VRduino presents a powerful teaching tool which could potentially be leveraged by both students and someday VR enthusiasts outside the course, its current setup presents some constraints in terms of mobility (it requires three wires to be connected to a computer) and accessibility (not everyone outside the course would have access to an appropriately sized LCD screen without buying it first for this express purpose). As a result, for my project, I propose to help build on the capabilities of the VRduino by surveying methods to allow it to communicate wirelessly with a virtual scene rendered on the Chrome browser on a mobile phone.

Through the course of my project, I intend to evaluate the feasibility and appropriateness of different wireless modalities, including Wi-Fi and Bluetooth, for the VRduino setup. Specifically, I will attempt to design and prototype a wireless system for the VRduino and develop a better understanding of the advantages and disadvantages of different approaches to this problem. Ultimately, this project will seek to contribute to the eventual development of a fully wireless VRduino interacting with a virtual scene rendered on a mobile phone.

Previous Work

The VRduino as designed by the course staff already collects information from the IMU and photodiodes on the board, and communicates calculated information to a computer via serial. Thus the next step is to evaluate how this information might be transferred wirelessly, and how that information could then be collected and interact with a virtual scene.

Various modules already exist which are designed to allow Arduino microcontrollers to communicate wirelessly. For example, the ESP8266 Wi-Fi chip and NRF58122 Bluetooth module were suggested by the course staff for Wi-Fi and Bluetooth, respectively. Furthermore,

various software libraries designed to interface with wireless parts already exist, and I will identify and use these as appropriate through the course of my project.

Timeline

Given the significant time constraints on this project, the project itself will seek to develop (through research and prototyping) a better understanding of how to provide the VRduino with wireless capabilities and the advantages and disadvantages of various approaches, rather than attempt to build a fully-featured, ready-to-ship wireless VRduino.

Although it will likely change due to the iterative and evolving nature of the experimentation process, I intend to establish the following set of milestones for my project. Ultimately, the nature of this project is such that either success or failure at each milestone will provide valuable information about the most effective way to eventually provide the VRduino with wireless capabilities.

Before Wednesday, 5/31/17: Research and evaluate wireless modalities. Study documentation for hardware suggested by course instructors, and develop plan for hardware experimentation. Identify relevant software libraries and documentation. Compile information on feasibility and suitability of different modalities.

5/31/17: Hardware (ordered on Friday 5/19/17) arrives.

5/31/17 - 6/6/17: Prototype hardware system. Milestones:

1. (Wed 5/31 - Thurs 6/1) *Get the VRduino information to stream out wirelessly.* Can test this by assembling the hardware and then reading the output from a terminal program on a computer or phone.
2. (Thurs 6/1 - Fri 6/2) *Determine how to collect this information and communicate it to a browser.* The ultimate milestone would be to communicate this information to the Chrome browser on a mobile phone.
3. (Fri 6/2 - Sun 6/4) *Identify strategies for using this information to interact with a virtual scene displayed on a mobile browser.* This will include identifying how to communicate this information to a mobile browser, and how to have it interact with a virtual scene being displayed in the browser (if it can be done). If it cannot be done, identify obstacles and alternate approaches. Iterate as needed.
4. (Fri 6/2 - Tue 6/6) *Build a wireless demonstration.*
5. (Fri 6/2 - Wed 6/7) *Evaluate and compile information regarding "lessons learned" and suggestions for future directions.*