Virtual Whiteboard

Abstract
In this project, our team explored various uses of virtual reality (VR) and augmented reality (AR) in an enterprise environment with the aim to increase productivity of long-distance collaboration among employees. The current ways of collaborating over long distances involve video chats and online documents. The biggest problem with long-distance communication is the lack of presence shared by collaborators, and the inability to visually express and build on ideas.

The Virtual Whiteboard affords users the ability to simultaneously collaborate over long distances on a virtual whiteboard, as if they were in the same room using the same physical whiteboard. The images created can be saved and brought back up to edit later. Through VR technology, the user can easily collaborate over distances while also adding a fun and exciting aspect to the work environment.

Results
The Virtual Whiteboard provides users with a collaborative space that affords two-dimensional and three-dimensional drawings that allow for maximum creativity in the space. Created with the Unity game engine and developed to use the HTC Vive, the application is designed to be easy to pick up and use without a large learning curve. The features include:

- **Drawing lines**
  - 2D on a whiteboard
  - 3D in the virtual room

- **Multi-user capability**
  - Allows for multiple users to draw and edit the same space in different locations

- **Save/Load Rooms**
  - The users can save rooms and then continue editing them at a later date

- **Erasing Function**
  - Allows the user to point at drawn lines and erase them from the room

- **Color Options**
  - The users can cycle through different colors when drawing in the space

Architecture

<table>
<thead>
<tr>
<th>Network</th>
<th>Sending/ Receiving Vectors</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>htc VIVE</em></td>
<td><em>unity</em></td>
</tr>
<tr>
<td>User 1</td>
<td>Sending/ Receiving Vectors</td>
</tr>
<tr>
<td><em>htc VIVE</em></td>
<td><em>unity</em></td>
</tr>
<tr>
<td>User 2</td>
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Impact
Our project’s impact is on pushing the boundaries of enterprise collaboration tools by developing an application around virtual reality, which allows users to collaborate over distances in a new visual way. The Virtual Whiteboard gives Citi a new interactive way for employees to work on designs and ideas that helps facilitate their creative side. The amount of useful features that can be added to this application are only limited by one’s imagination.

Metric
Our metric for this project was based on the successful completion of the main functionalities of the project, which included multi-user editability and drawing in 2D/3D space. Our demo demonstrated not only these, but also added color features and different styles of virtual rooms.

Summary
This semester our team of computer scientists was tasked with coming up with an idea for virtual reality use within an enterprise setting. With the help of our company sponsors and faculty adviser, we were able to narrow down the idea to a collaboration tool named the Virtual Whiteboard.

The application is designed to be used within Citi to allow employees to collaborate over long distances. The ease and simplicity of the tool provides numerous amounts of uses.

The tool does have its limitations with having to be used with the HTC Vive which is a stationary piece of VR hardware.

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