Product Requirements Document
Boundless Workspace

Paul Yoo yoosehy@gmail.com
Peyton Mash peyton.mash@gmail.com
Yingru Alan Feng yingru97@uw.edu
Tianqi Wang tianqiw27@gmail.com

October 19, 2018

Summary

The goal of this project is to leverage augmented reality to improve upon the desktop experience by creating an environment that enables the user to seamlessly switch between the digital workspace and the physical workspace. For this project we are creating a head-mounted augmented reality app that enables users to interact with images, documents, and more in their workspace. Features include the ability to create and annotate virtual sticky notes, whiteboards, photos, and documents. The app supports integration with desktop and laptop computers to bring new files into their workspace. Through this new lens, the user can have a workspace experience that is truly boundless.

Deliverables

Users of the app will be able to be work in an augmented workspace that is integrated with their physical workplace. The app can enhance their desktop working experience with the different tools and features provided in the app.

Examples include:

- Creating whiteboards and sticky notes. These can be drawn and written on using the Magic Leap controller. Sticky notes can be resized to reflect their importance.
- Dragging images and single-page documents from desktop and laptop computers to the augmented workspace. These can be viewed at actual size or scaled for more convenient viewing.
- Placing photos, documents, sticky notes, and whiteboards anywhere in the workspace (e.g., on desks, on walls, or floating mid-air).

Critical Features

Very critical:
- View images and single page documents (texts and images) and move them around in the AR space.
- Being able to attach/unattach the documents to a physical plane (like a wall or a desk) in the workspace.
- Simple drawing functionality on sticky notes and whiteboards.

Critical:
- Network connection capabilities with a desktop or laptop that allow documents to be sent from the desktop to Magic Leap and rendered into the Magic Leap's augmented reality space.
- Being able to use computer monitor as an anchor point to position the Unity objects relative to the monitor. Being able to interact with the computer monitor in the AR space.
- Workspace persistence; saving workspace state so everything can be reloaded at a later time.

Less critical:
Priority Rank:
1) Make notes on the documents (that combines the drawing feature with the document viewing feature) and save the notes.
2) The capability to view multi-page documents (such as PDF).
3) Interact with a physical whiteboard and save the contents of a physical whiteboard into the AR workspace.
4) Group multiple documents/notes in the AR space and expand them to specify arrangements.
5) The ability to view multi-page documents in a way that is similar to a stack of multiple single page documents. It is able to distribute the multipage documents in user friendly and efficient positions.
6) Animate the objects when we are doing operations on them (grouping/expanding/paging).
7) Add frames around the documents while viewing them.
8) 3D drawing in the AR space.
9) Support multiple profiles/workspace. Switch between different saved workspaces.

Performance Metrics

We will evaluate our project base on the following aspects:

- **User satisfaction** - How does the user feel about using our app? Delighted? Frustrated?
- **Stability** of the workspace - Is the experience consistent and reliable?
- **Intuitiveness** of the user interface - Is it easy to use?
- **Effectiveness** - Is the app capable of improving productivity?

Milestones

Week of Oct 22 - 28
Goals for the week:
- Look into Unity and Magic Leap documents and tutorial ways the computer can connect with Magic Leap via network through Unity Networking.
- Learn more about rendering graphics and user interfaces in an augmented reality application on Unity by going through documentation and
- Get to know different Unity objects and how to save the object states.
- Experiment with debug mode on Magic Leap.

Roles of group members:
- Paul: Go over Unity tutorials and documentations on the graphics and UI frameworks and utilities of a Unity AR application.
- Peyton: Do research on the networking functionality that Unity provides. Get *something* running that demos device-to-device communication, even if it's not the final networking mechanism we use.
- Alan: Start a prototype Unity project and experiment with variables and UI tools. Also test out running Unity apps on the Magic Leap device.
- Tianqi: Read Unity and Magic Leap documentation about objects and how to save a particular object in the application.

Week of Oct 29 - Nov 4
Roles of group members:
- Paul: Start implementation of AR drawing using the Magic Leap controller.
- Peyton: Create a demo of network communication of the desktop and Magic Leap through Unity. Finalize choice on how mock OS will be built (with Unity or with something else) so we can make sure there are libraries that can handle the networking details. Begin investigating file transfer between devices if time permits.
- Alan: Start implementing user interfaces on the augmented reality application.

- Tianqi: Start working with the controller. Investigate how to place, move, and resize objects. Visualization of documents in the AR workspace.

Week of Nov 5 - Nov 11

Goals for the week:
- Anchoring of the computer monitor from the AR headset.
- Work towards building a simple desktop application that serves as a medium to send documents to Magic Leap through the network.

Roles of group members:
- Paul: UI design for drawing features that let users choose the properties of their brush such as the thickness of a brush,texture of a brush, and the color of the brush. Design the sticky note feature.
- Peyton: Investigate how the Magic Leap can locate the user's laptop or desktop computer. Probably using a QR code displayed on screen, but consider other possibilities as well. Create a small demo that shows detection working.
- Alan: Start investigating on the interactions with real physical objects such as attaching a document to the wall or the desk.
- Tianqi: Implement function to place file/images on walls. Work on restoring the elements in the workspace to relative location with respect to the anchored screen / without the anchored screen.

Week of Nov 12 - Nov 18

Goals for the week:
- Designing UI of the workstation through Unity.

Roles of group members:
- Paul: Design/implement workspace menu. Expand the sticky note feature to support whiteboard.
- Peyton: Focus on making the app usable even without desktop. If the headset can't find a laptop/desktop computer, the user should still be able to open their workspace.
- Alan: Work on the interactions with real physical objects.
- Tianqi: UI implementation of file/image viewer. Implement overall menu layout. The user should be able to open/close files. They should also be able to delete files.

Week of Nov 19 - Nov 25

Goals for the week:
- Improve toolbox for sticky notes/whiteboard.

Roles of group members:
- Paul: Improve UI/toolbox design for sticky notes and whiteboard.
- Peyton: Resume working on networking stuff. Get file transfer working if it isn't already. Consider what could go wrong (e.g., one device crashing) and make sure it's handled gracefully. In other words, focus on networking-related stability.
- Alan: Work on the interactions with real physical objects.

- Tianqi: Help with anyone who is have trouble finishing his part. Collect feedback from non-team members and adjust the features accordingly.

Week of Nov 26 - Dec 2
Goals for the week:
- Implement animation and motion of moving the sticky notes and documents around (in/out of the desktop). Thanksgiving week.

Roles of group members:
- Paul: Adding animations. Integration of drawing with document viewing.
- Peyton: We should have file transfer by now, but may not actually be able to do anything with/see the file that was transferred onto the headset. Focus on getting them into the workspace.
- Alan: Work on ability to group documents.
- Tianqi: Implement animations, let the user to place a selection of 3D objects. Potentially allow the user to import their own 3D objects.

Week of Dec 3 - Dec 9
Goals for the week:
- Final wrap-up of implementation and functionality.

Roles of group members:
- Paul: Wrap up, Potentially implement document highlighting/annotating.
- Peyton: Finalize the file transfer workflow. This may involve mostly UI stuff if everything else is in good condition.
- Alan: Keep working on document grouping.
- Tianqi: Bug fixes. Work with Paul and Alan for additional features.

Week of Dec 10 - Dec 13 (Final Demo Day)
Goals for the week:
- All members work together on final product testing and recording the demo.

Materials and any external help needed

Hardware Platform: Magic Leap One
3D Assets (described in Budget section)

Budget

$200 - 3D assets. For example:
- Frames for pictures, documents.
- Animations of different operations such as dragging and deleting files.
- Small 3D objects the user can place into their workspace (clock/timer, candle, small toys, decorations).

$30 - Upgrade to a paid Weebly plan (for website) if we end up needing advanced features.

Risks and how they will be addressed

Risk 1:
Potential issues when deploying app on Magic Leap since it's so new (e.g., maybe the APIs won't work exactly as described or won't be super well-documented). Maybe some of the features is not supported on Magic Leap (very unlikely).
Solution:
Start working early so we know how the API and everything looks like. If we do encounter any problem, we will do our best to work around the issue (and report it to Magic Leap). Worst-case scenario, we will switch to another platform, namely Microsoft HoloLens.

Risk 2:
Features are not working as we intended. We aim to create a better environment for users to work more productively. However, if users feel no need to use some of the feature or struggle to get the functions working as they expected, then our goal will not be achieved.
Solution:
We want invite someone not in our team to test out the basic features during the developing process to give us feedback on where we should improve and where we should change.

Risk 3:
Not enough time to finish all the features we want to add: We are excited about many potential features that could be very interesting and fun to use. Those features may drastically improve the user experience. However, we do have a limited time and we need to prioritize some of the more critical features.
Solution:
Start early. Meet at least two times outside of lecture and lab to ensure everyone have their own tasks to work on. Update and revise our plan weekly. Have one person in the team with more flexible schedule so he can help whenever other members encounter issues.

Risk 4:
Readability of AR documents. It might be difficult for the user to read the text in AR environment. The goal is to make reading virtual documents in augmented workspace as easy as reading actual physical documents.
Solution:
Make text larger enough. We will test different font size and choose the best one that provides a clear representation on the information and at the same time does not take too much space so users are able to open up multiple documents without overlapping.