iPad UI Redesign

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ABSTRACT

The iPad is a powerful tablet computer developed by Apple Inc., initially released in 2010. It currently runs the iOS mobile operating system. Although it is as powerful as a MacBook, the iPad is exceptionally portable, making it a dynamic tool for a wide range of users. However, we have observed that there are a handful of aspects of the iPad that prevent users from using it to its fullest potential. Most of these problems are exposed by performing multitasking work under the current iPad UI. To improve and refine a new UI design for the iPad, we put our design through several iterations of prototyping and testing. Upon creating our final high-fidelity prototype, we concluded by presenting our work to the Human Computer Interfaces class.

PROJECT PROPOSAL

There is a tradeoff between portability and productivity as demonstrated by the elemental differences between the iPhone and the Mac. The iPad is designed to be the ideal device between the two, a powerful, yet exceptionally portable tool that can be used by a diverse set of people. However, the current iPad interface has an inclination to lean towards a side of the spectrum since it is using the same operating system as the iPhone, the iOS. We proposed a redesign of the iPad interface so that the device sits truly at the center between the iPhone and the Mac. We designed a new gesture interface for the iPad inspired by the current trackpad gesture interface that is familiar to most Mac users. This design is optimized for intuition and a small learning curve. To retain the portability of the iPad, we designed the interface mainly for the users to interact with it using their fingers. The buttons are designed to be as large as the buttons one would see on the iPhone to make it touch friendly. To make the iPad as productive as the Mac, we proposed a new window system for iPad apps, Mission Control, and multiple desktops for the iPad.

TASK ANALYSIS

Our overall aim with this iPad UI redesign project is to design a more intuitive multitasking experience for the user. In order to do this, we had to conduct our own task analysis. Firstly, we discussed which parts of the UI could be improved. With this in mind, we created an online questionnaire that was distributed to the Apple community, mainly iPad users, so that we could get a better sense of what experiences users need from the iPad that they're not currently receiving.

Initial discussions

Initial discussions surrounding the iPad interface mainly focused on the observation that the multitasking abilities of the iPad is considerably lacking in functionality. During our discussions, we did realize two particular aspects that we wanted to implement in the new UI. Firstly, we want to implement something other than split screen "windows" in the interface, as traditional windows have proven not to be touch-friendly -- a large reason why they're usually implemented on laptops/PCs and not tablets. Secondly, we decided the launch applications in maximized screen (when the window fills the screen except for the section that contains the dock) instead of full screen, since there isn't really a need to launch it in full screen automatically, unless it is a gaming app or such of the kind. However, there are many ways to implement a multitasking experience in an OS, so we decided that it would be best to reach out to actual iPad users with a questionnaire about how they currently use their iPad.

Questionnaire

The questionnaire is composed of 21 questions that relate to the demographic background of the user and the tasks they perform on their iPad. The questionnaire consists of multiple-choice, checkbox, Likert scale, and short answer questions. We distributed it to the apple community over various web platforms as well as our iPad user friends and acquaintances. We were able to gather 229+ responses from over 20 countries around the world.

Results

We gathered considerable amount of data from the questionnaire about iPad users. According to the questionnaire, the top five tasks that users perform on their iPad are watching videos, email, writing documents, messaging, and playing games -- most of the users are performing these tasks daily. Additionally, we confirmed the need for multiple windows in the OS, as "multiple windows" was one of the most common answers to the question, "What feature do you wish the iPad has but lacks?". Another 30.4% of users disagreed with the statement, "The iPad is good for multitasking, while 26% remained neutral. Additionally, 54.6% disagreed with the statement, "Everything that I want to do on my computer I am able to do on my iPad just as well".

Conclusion

From our task analysis, we learned that 1. iPad users are extremely diverse, so we need to implement a system that is intuitive for many kinds of users, 2. People are still opting for a PC or laptop over an iPad when doing productive tasks, regardless of the power of the iPad, and 3. Multitasking on

the iPad is still frustrating to users and we definitely need to implement some form of multiple windows in our design.

LOW-FIDELITY PROTOTYPE

We implemented all of our features in our low-fidelity prototype. We first sketched them out with pen and paper and then redrew the images in perfect symmetry using Apple's Keynote application. We then printed out the images on paper to use for our user tests. We cut our prototype into little components to simulate interactions when the user is interacting with our low-fidelity prototype.

Features

We proposed a handful of novel features to actualize our goal of a more intuitive multitasking iPad user interface. A new touch-friendly window system, a new dock interaction and indicator, mission control and multiple desktops for iPad, to name a few.

Windows

We introduced a new touch-friendly window system that utilizes the iPad's screen real estate optimally. In previous iPads, applications open in full screen in default. This makes it harder for users to use several applications at once when doing a productive task. Apple did introduce some features that enable multitasking such as Split View, Slide Over and Picture in Picture since iOS 11, however users find them hard and unintuitive.

In our new window system, applications do not open in full screen in default, instead open in a new window. The window is maximized in default. A window could be in maximum size that takes the whole width of the screen, 1/2 size that takes half the width of the screen, 1/3 size that takes one third of the width of the screen and 2/3 size that takes two thirds of the width of the screen. An application could also be in full screen mode, which takes the whole screen of the iPad. Figure 1 shows the different sizes an application window can be in.

Besides being resizable, an application window is also movable. A window could be snapped to the left or the right of the screen, enabling users to interact with two of them side by side. Figure 2 shows the different positions an application window can be placed.

Figure 1. Different window sizes

Figure 2. Different window positions

Dock interaction

Since applications do not open in full screen in default anymore, the dock is visible most of the time. Thus, any kind of interaction with the interface could be done at the dock. Resizing and the moving of windows can be done at the dock. Making an application in full screen mode and closing an application can also be done at the dock. Users could interact with the icon of the application of choice at the dock according to their desire. Swiping the application icon to the right snaps the application window to the right in 1/2 size. Swiping the application icon to the left snaps the application window to the left in 1/2 size. Swiping it up makes it full screen. Swiping down closes the application. Double clicking the icon maximizes the window screen. Swiping an application window to the right when it is already half size and snapped to the right changes its size to 1/3. Swiping it to the right again changes its size to 2/3. The same will occur at the left side respectively. Figure 3 shows the different interactions one could do to an application icon at the dock.

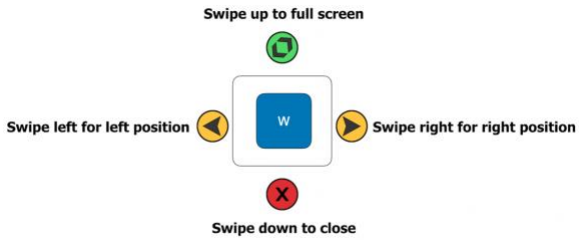

Figure 3. Dock application icon interactions

Dock indicator

A user could only retain so much information in their head at a time. When performing a productive task, it is normal for someone to use a significant number of applications at a time, thus opening a lot of windows. When this happens, remembering the state of each window could be a daunting task for the user. Therefore, we introduced a novel dock indicator system to prevent this. An indicator at the bottom of the application icon at the dock shows the state of the application window. If there is no indicator at the bottom of an application's icon, that indicates that there is no window open for the application. The indicator itself is a recognizable icon that shows the current state of the application window as shown in Figure 4. Figure 5 shows all the possible indicator for an application window.

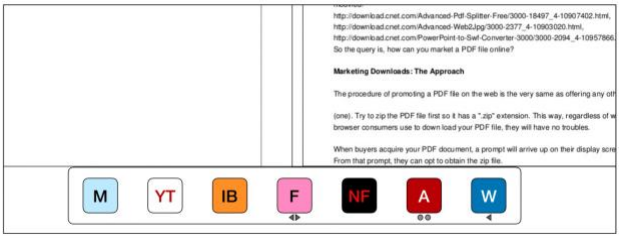

Figure 4. Dock application icon indicator examples

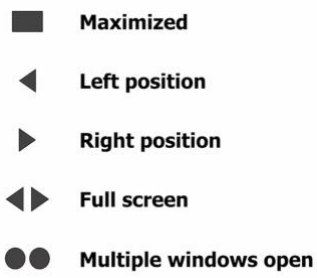

Figure 5. Different dock indicators

Mission control

When performing a productive task, a user could be overwhelmed with the number of windows open. Keeping track of all the different windows and doing different tasks at once requires a substantial amount of mental effort. In order to ease this process, we introduced the Mission Control for the iPad. The Mission Control for the iPad is considerably similar to the Mission Control on MacOS. It shows an overview of all the open windows in the current desktop as shown in Figure 6. This enables users to keep track of open windows. Users are also able to close applications from Mission Control by sliding the window upwards just like the previous iPads' recently opened applications screen.

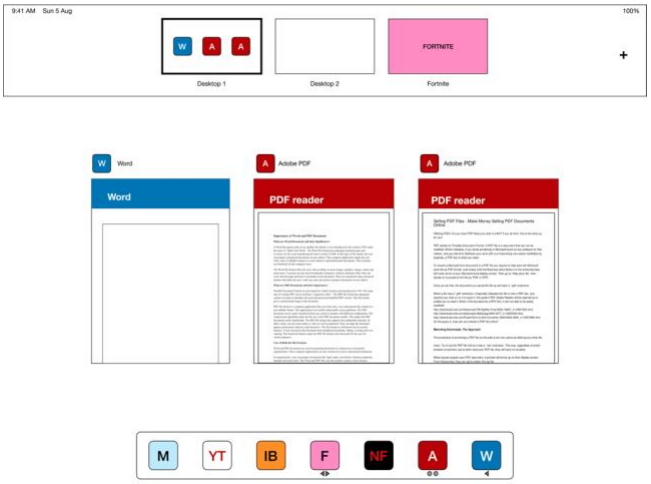

Figure 6. Mission Control screen example

Multiple desktops

We also introduced Multiple Desktops for the iPad, similar to the one in MacOS. This further assists users to manage a multitude of windows by compartmentalizing them into a number of sets as shown in Figure 7. Furthermore, an application that is opened in full screen will be treated as a desktop similar to MacOS. Figure 8 shows all the different desktops when there are two desktops and one full screen application are opened.

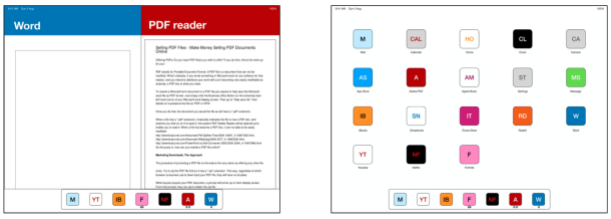

Figure 7. There are windows open in Desktop 1 (left) but no windows open in Desktop 2 (right)

Figure 8. Multiple desktops example

New gesture system

We proposed a new, yet familiar gesture system for the iPad. We took advantage of the fact that the latest and upcoming iPads will no longer have a home button by using gestures for most of the interactions and screen navigations on the iPad. We know for a fact that statistically, most iPad users own a device that runs MacOS. We then implemented the MacOS trackpad gesture system to the iPad. This warrants consistency between different devices and also allows users to use the iPad without a learning curve. Figure 9 shows the different gestures available. Swiping left or right with four fingers enable users to move between different desktops and full-screen apps just like the current iPad. Swiping up with

four fingers invokes the Mission Control similar to MacOS. Pinching with thumb and three fingers opens the launchpad identical to MacOS and closes a full screen app like the current iPad. Spreading with thumb and three fingers closes the launchpad much the same as in MacOS.

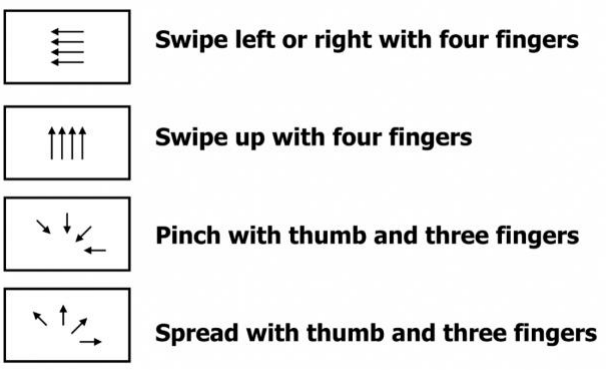

Figure 9. Different gestures

More than one instance of the same app

Some applications like a PDF reader should be able to open more than one instance so that a user could view more than one document at a time. The current iPad UI does not offer that capability despite the fact that a UNIX based operating system like the iOS should. Our redesign proposal allows users to open more than one instance of an app by invoking an application menu using Force Touch. When more than one instance of an application are opened, an indicator is showed below the application icon at the dock. Clicking the icon shows the open windows for all the instances of the application as shown in Figure 10. For each application window icon, there is an indicator showing the state of the window and users can perform dock icon interactions shown in Figure 3 on it as well.

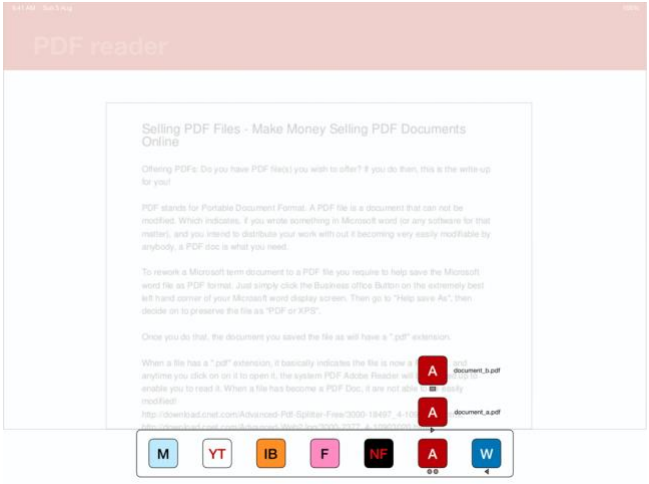

Figure 10. Multiple instances of an app example

Paper prototype

Figure 11 shows our paper prototype. The paper prototype is used for user tests conducted throughout the project.

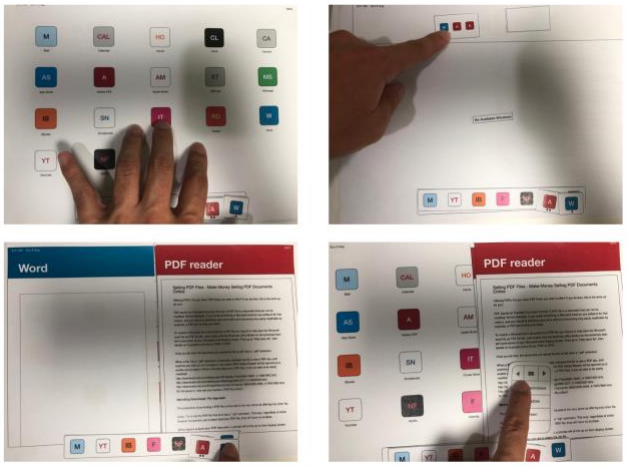

Figure 11. Paper prototype

VIDEO PROTOTYPE

We created a concept video using a rapid prototype to illustrate scenarios. To do so, we developed a rapid prototype that can be used to demonstrate how someone could work on an assignment using an iPad with our new UI. In order to fully demonstrate all of the features we have developed, we came up with the following storyline which the user will follow in the video. Figure 12 shows a few screenshots of the video clip.

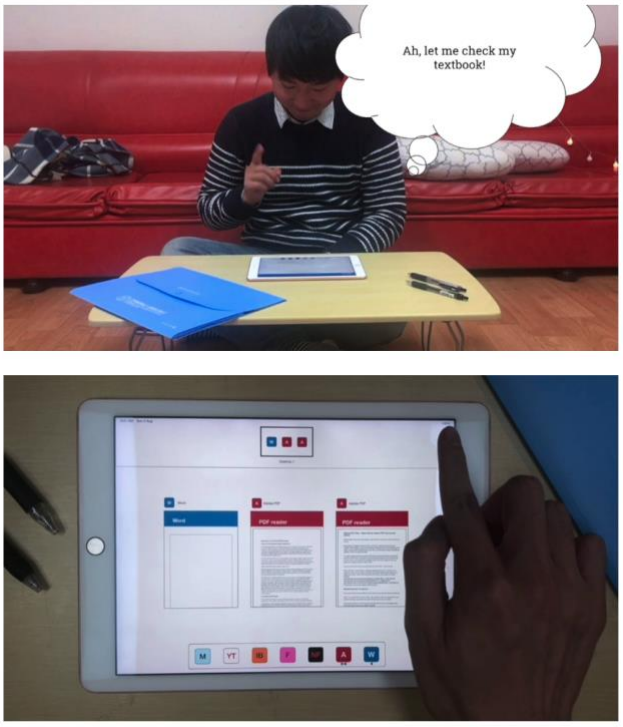

Figure 12. Video clip screenshots

Scenario
The video shows a user trying to complete an assignment using an iPad with the proposed user interface redesign. He first opens a Word application and a PDF reader application side by side. He then opens another instance of the PDF reader application to check the assignment instructions through the app menu using Force Touch. He then snaps the assignment instruction PDF window to the right using the new dock interaction. Right after, he invokes the Mission Control by swiping up four fingers and creates a new desktop. In the new desktop, he opens a mail application to send an inquiry email to the TA regarding the assignment due date. While waiting for a reply, he decides to play a quick game of Fortnite. Therefore, he opens the launchpad by pinching with thumb and three fingers and opens the Fortnite application from the launchpad. The application opens in full screen, thus treated like a desktop by the user interface. Upon receiving an email reply from the TA saying the assignment is due in a week, the user quits all the applications and goes back to sleep.

Features shown
Opening an application with maximized window

Opening two applications side by side

Opening two instances of the same app using Force Touch

Opening Mission Control using a gesture

Making a new desktop from the Mission Control

Move between desktops using gesture

Move between desktops from the Mission Control

Opening an application in full screen mode

Closing an application in full screen mode

Closing an application using the Force Touch menu

Closing an application from the dock

HEURISTIC EVALUATION
We used a paper version of our prototype for users to evaluate. Since this project involves redesigning an entire OS interface, it would be very difficult and inefficient to try and build a high-fidelity prototype that users can interact with independently. Gestures such as swiping up or to the side was difficult to implement in a prototype, so we decided that a paper prototype would be the most efficient way to recreate a user's experience with the design. We split our roles into facilitator (gives instructions and tasks), computer (conducts the actions of the model), and observer (takes notes and records comments). Before the evaluation began, we briefly explained the basic features of the interface design and then showed the users our concept video. Then, we asked the users to recreate the actions portrayed in the video, giving vague instructions such as, "Now, you need to email your TA" or "You would like to work on the Word document and see your textbook PDF side by side". If a user had trouble, we would give hints such as "use the dock" or "try using a gesture". Upon completion of the test, we would ask users to evaluate the design based on the [1] Nielsen's 10 Usability Heuristics.

Heuristic evaluation overview
We interviewed a total of three evaluators and summarized their thoughts on what heuristics they believe were violated in Table 1.

	Violation	Number of violations	Severity
H2-1	**Visibility of System Status**	**0**	**0**
H2-2	**Match between system and real world**	**0**	**0**
H2-3	**User control and freedom**	**1**	**2**
H2-4	**Consistency and standards**	**2**	**3**
H2-5	**Error prevention**	**1**	**1**
H2-6	**Recognition rather than recall**	**1**	**2**
H2-7	**Flexibility and efficiency of use**	**0**	**0**
H2-8	**Aesthetic and minimalist design**	**0**	**0**
H2-9	**Help users to recognize, diagnose and recover from errors**	**0**	**0**
H2-10	**Help and documentation**	**0**	**0**

Table 1

Managing windows
Problem
It is hard for users to remember how to move, resize, and quit windows.

Violation
H2-4, H2-6

Analysis
In traditional computers such as the MacBook, and Windows PCs there is a consistent standard on how to move, resize and quit windows. The new iPad UI redesign does not follow the standard since the traditional interface is not touch friendly, but instead introduces a new gesture based interface using the dock to control windows. This might be a shock to new users who are used to using traditional computers.

Suggestion
One way to fix this problem is to display some familiar icons consistent with the industry standard when the user is

attempting to swipe the icon. The user will recognize the icon and act accordingly to their desire.

Closing an app with more than one window open

Problem
Users encounter confusion when trying to quit an app with more than one window open.

Violation
H2-3, H2-4, H2-5

Analysis
Swiping down an icon from the dock is a gesture to quit an app, but the UI does not let users do the same thing when quitting an app with more than one window open.

Suggestion
One way to fix this problem is to let users quit an app with more than one window open using the same gesture. However, before quitting the app, the UI should prompt a warning to warn users that the current app has more than one window open, to confirm whether the user is sure to quit all of them. This is to prevent H2-5 violation since it prevents the user from performing an error.

HIGH-FIDELITY PROTOTYPE

Since this project requires redesigning an entire OS interface, it would take a team of highly skilled engineers to implement a highly interactive high-fidelity prototype that users can interact with independently. Features such as multiple finger gestures and functionalities such as Mission Control and multiple desktops are beyond the capability of currently available application or website SDKs or any conventional prototyping tools. Therefore, if they were to be implemented in code, it would require low-level access to the operating system's IO device API which then would require a substantial amount of low-level programming labor. After considering a few alternative options, we settled on using Apple's Keynote application to emulate our design in high detail. Figure 13 to Figure 18 show screenshots of our high-fidelity prototype.

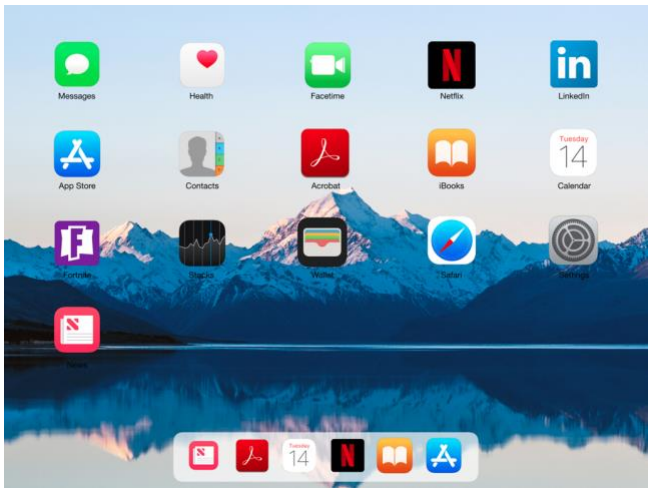

Figure 13

Figure 14

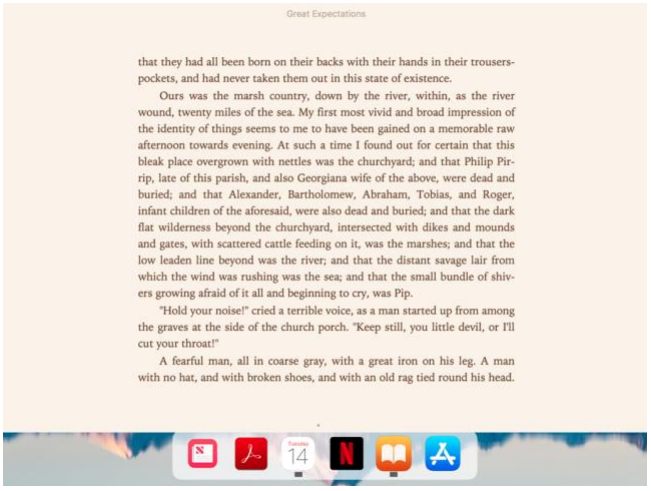

Figure 15

Figure 16

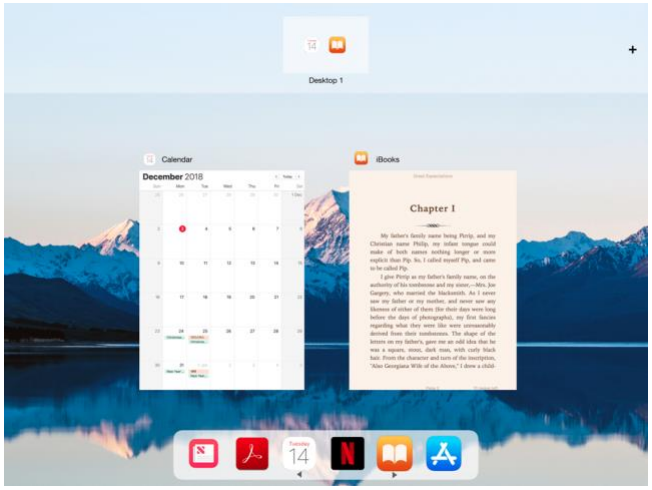

Figure 17

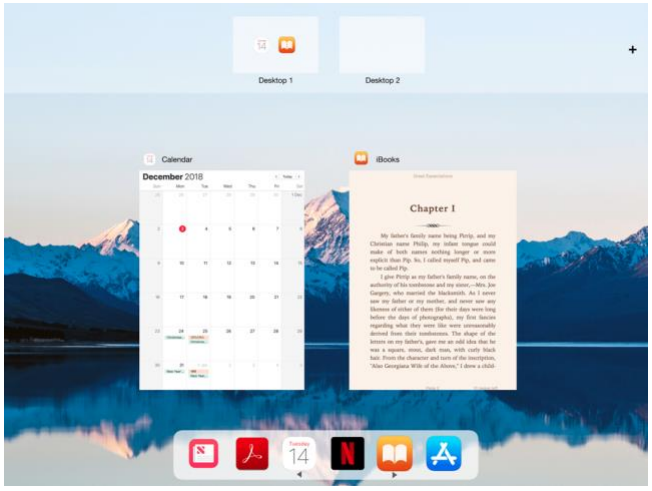

Figure 18

CONCLUSION

Overview

This project has executed all six stages of the design process including: project proposal, task analysis, low-fidelity prototype, rapid prototype, heuristic evaluation and video prototype to achieve the final product. The final product turned out to have a satisfactory response from the audience for being a creative and ingenious solution to the current iPad's multitasking limitations.

Further/Future developments

We believe that a redesign of the file management system as an addition to our proposed design would further enhance the productivity of the iPad. An optimized iPad version of the iconic Finder application on the MacOS will make the iPad less app-oriented and more file-oriented, thus allow users to work with files more conveniently.

REFERENCES

1. Jakob Nielsen. 1993. *Usability Engineering*. Academic Press