CSE 440: Task Analysis

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Problem and Solution Overview

Musicians have been using iron sheet music stands that cannot be dissembled for a long time. There is no fun in using these because musicians have to place the physical music sheets on the stand, and the pages will not flip themselves. There have been many products that try to digitize sheet music, but few of them have a double-sized screen display or features that would allow more entertainment and flexibility. Our proposed solution is to design a virtual sheet music system, the Virtuoso, which is a device able to be placed on music stands, similar to sheet music now. The device will have a screen large enough to display two pages of sheet music, and a camera for scanning the sheet music using OCR. The system will not only offer additional features to make practicing more convenient than before, but will also replace many tools, such as pens, metronomes, and tuners.

Task Analysis Questions

Who is going to use the system?

Musicians who carry heavy iron sheet music stands and stacks of sheet music around may want their life to be easier. Flipping pages of the sheet music has been reported as a pain for some musicians when they play music. Virtuoso is the proposed solution for musicians who want to digitize the sheet music and have entertaining features that would allow flexibility in practicing individually, or with larger groups such as bands and orchestras. The potential users of Virtuoso are both technical and non-technical musicians from a varying range of musical ability and involvement. Their ages may vary in a wide range too and technologies should not be designed to exclude elder people who might be less technical. We assume the users will have some experiences with electronic devices such as cell phones, computers, TVs, e-book readers, etc., as well as touch screens. Musicians have different work habits and preferences depending on their own capabilities and instruments they play. For instance, according to the context inquiry results, pianists and violinists have different needs in page flipping.

What tasks do they now perform?

The participants we observed and interviewed all refer to sheet music when they play music. The common tasks they perform include placing the sheet music on the stand, flipping pages when they practice, taking notes on the sheets, and keeping sheet music in the folders (organized or unorganized).

What tasks are desired?

Musicians would like to have the pages turned automatically without their performance or practice being interrupted. Musicians take notes on the sheet music, and this functionality must be kept. When multiple changes are made to different parts within a large group such as an orchestra, it is difficult for all the players to figure out how the different pieces will sound like when put together. Musicians transport their music in binders or in their instrument cases. Often musicians do not maintain their sheet music library and allow the stack to grow heavier and heavier. Musicians would like to have a way to keep their sheet music well-organized and easy to carry.

How are the tasks learned?

Currently, musicians learn how to use physical sheet music from practice and study. They learn how to read it (notes, clefs, special symbols, and others), how it is structured, etc. We want to make our digital sheet music easy to navigate and operate for both technical and non-technical people who have used physical sheet music, with no training required.

Where are the tasks performed?

Professional practice rooms, performance halls, and home-based practice rooms are the most common places where musicians would use sheet music. The lightings of these places vary in intensity, and they should be able to get a strong enough light to view sheet music by at all times.

What's the relationship between customer & data?

People have sheet music, and they can use the system to scan, digitize and store them. Users are allowed to register for the system so that they will have account names and passwords to log on to the device. Users' data in the device will be protected, and the music pieces they downloaded from the online library last time will be automatically suggested and loaded to the new device if they use a different one. Customers can preserve and transfer their data in a secure way between devices and online libraries or communities once they have personal accounts and profiles set up. In the near future, customers will likely have a physical collection and a digital collection. The goal is to eliminate the need for a physical music collection.

What other tools does the customer have?

The other hardware tools customers have include computers, cell phones, iPods, and any other electronic devices that will help them get information about Virtuoso and download sheet music. They may also need flash drives to store their data downloaded from the web.

How do customers communicate with each other?

Customers will communicate with each other based on their involvement with organizations. Clearly, members of an orchestra or band that own this device will communicate with each other based on their situation. Apart from organizations, customer to customer interaction is not a large requirement for this product. One possible outlet is through discussion forums centered around the device, which can be used as a customer support mechanism as well. Another is indirect communication through the uploading of sheet music to a database that all customers can access and download or purchase from.

How often are the tasks performed?

The frequency of the tasks performed depends on each individual's experience level. Professional musicians are likely to perform these tasks almost every day, especially if they are part of a larger ensemble. Amateur musicians are more likely to perform the first two tasks on a casual basis, around a couple times a week. Lastly, beginner musicians will tend to perform the first two tasks less frequently, from a few times a week to a couple times a month. Amateur and beginner musicians are not as likely to perform the third task, as it is geared toward those in larger performing groups.

What are the time constraints on the tasks?

Musicians should not have to hassle with sheet music--they should be playing their instruments. We want the device to stay out of the way. Musicians want accessing sheet music to be as simple as possible. Things that do not happen as often can take longer, like searching for music online.

What happens when things go wrong?

In the near future, musicians will have both physical and digital copies of their music. If the device breaks, they can always revert to using their old paper music. This music might not be up to date, but will do in most cases until the device is fixed. In the distant future when musicians have only digital copies, the system will hopefully be robust enough to always be available, similar to how modern computers have replaced filing cabinets.

Revised Tasks

Task One - Start playing the music piece that has been stored in the device

Eric is a student at the University of Washington, and he has just started learning the piano. He is currently trying to learn a new piece, Ode to Joy, by Beethoven. He starts off by starting his virtual sheet music device, and selecting the Beethoven piece. The first two pages have gone well, and now it's time to flip. He plays the last few notes on page two, and then quickly flips the page on the device. The flow continues, uninterrupted by the need to turn the page.

Task Two - Scan the sheet music and play back a specific piece

Heather is an intermediate violin player at the University of Washington and she is learning a new piece and needs to practice her sections. The sheet music is in the form of physical paper, but she wants to access it both at the music building and at home without having to carry it around. Heather is able to accomplish this by putting the sheets on the virtual sheet music device, which then scans it and saves a digital copy. Heather wants to refine her technique in a couple particular sections of the piece, so she simply highlights the sections she wants to practice, and chooses the playback feature. The notes are played back with the correct pitch and rhythm, allowing Heather to understand how she is supposed to play the sections.

Task Three - Sync device with the whole group and use synced note-taking

Steve plays in a Beatles Revival band, and he needs to sync his device with his three other band members so that he can hear what his music would sound like with the others. He is perplexed about one particular section of a song and not sure how to sing his harmony with the lead vocalist. The band decides to use the Virtual Sheet Music system to solve this problem. All band members start up their Virtual Sheet Music stands, sync their devices, and pull up the song. Steve taps the corresponding part in the song, mutes all the non-vocal parts, and hits play. After one listening, Steve is still not confident, so he taps the beginning of that phrase and hits play again. After he listens a couple times, Steve understands how the part should sound.

Storyboards

Sketch One: Application Driven

This interface is driven by what the user needs when they start up the device. The user is presented with a welcome screen which displays all the applications of the device.
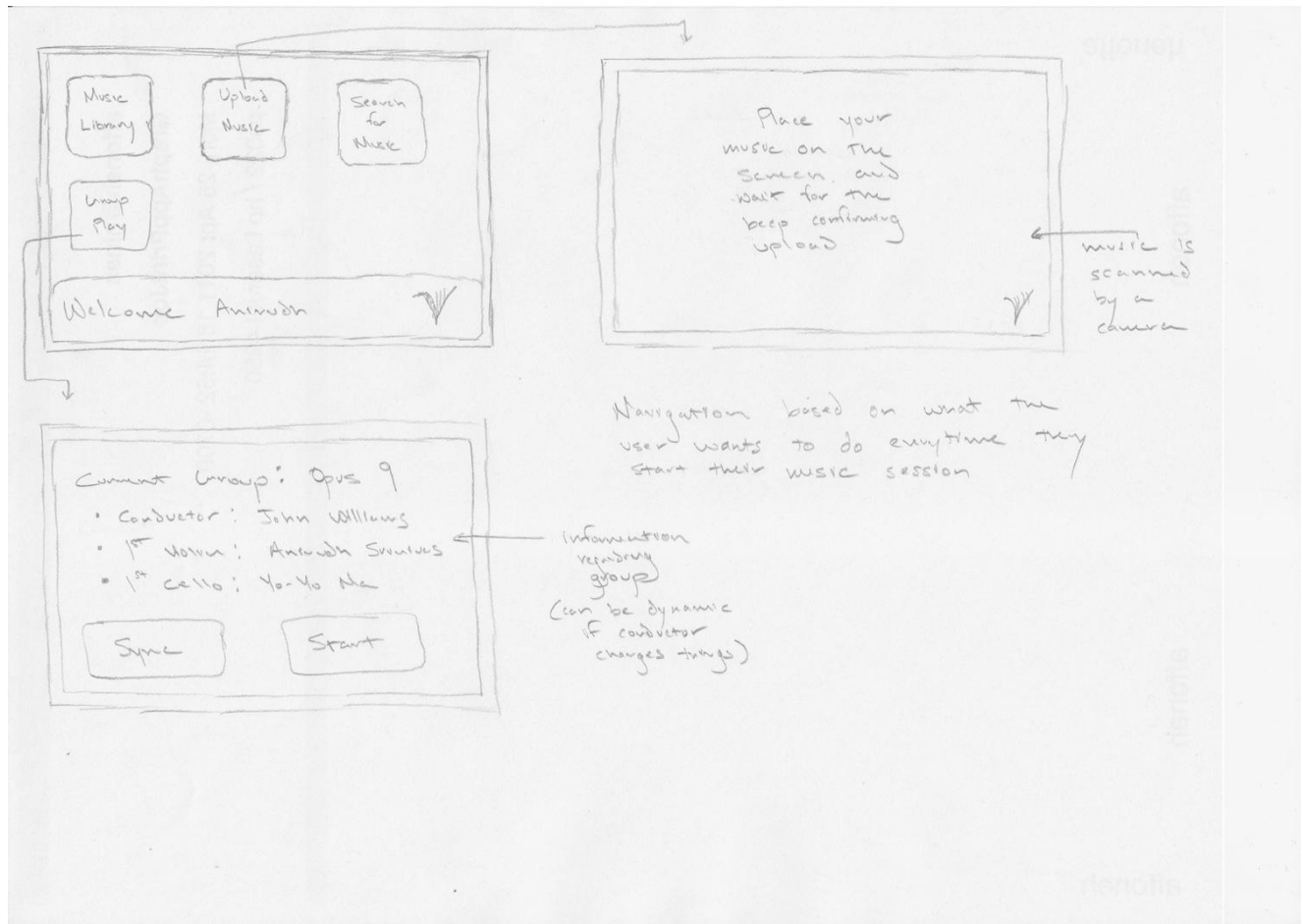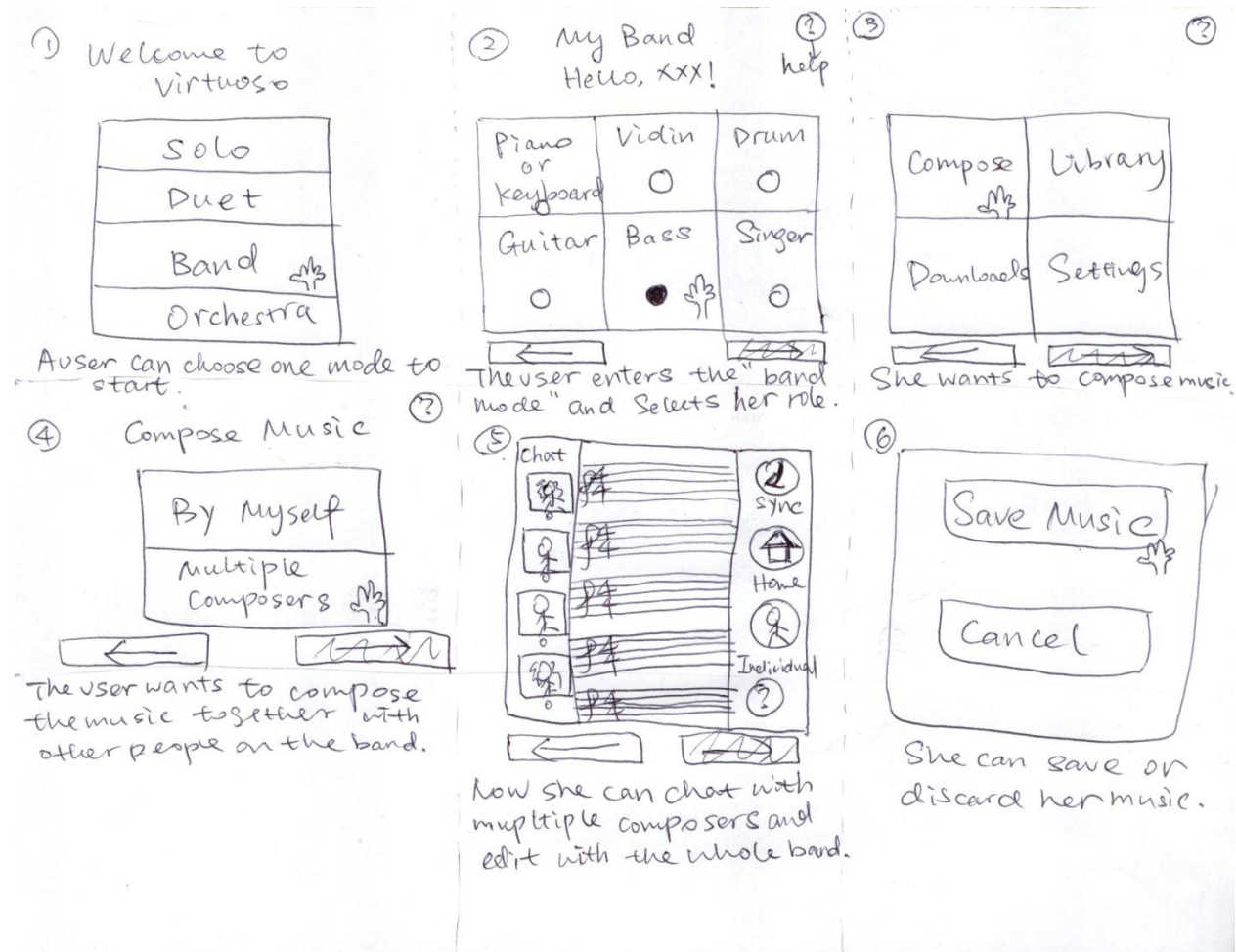
Sketch Two: Music Library Driven

Section 1 shows two screens of the user's music library. The first screen shows a visual view of the user's active library. The user has the option to group music by category or archive them. Clicking on the archive goes to the second screen, which shows a more tabular view of the archived music. Archived music is automatically sorted by different features like name, composer, and date archived. Choosing a song goes to Section 2 which is the main music view. The sheet music is the highlight of the page, with other accompanying features on the side. At the top are menu buttons to go back home, or to bring up metronome or syncing options. From the main menu, choosing to add a new piece goes to section 3, which allows the user to choose to scan their physical sheet music or search online.
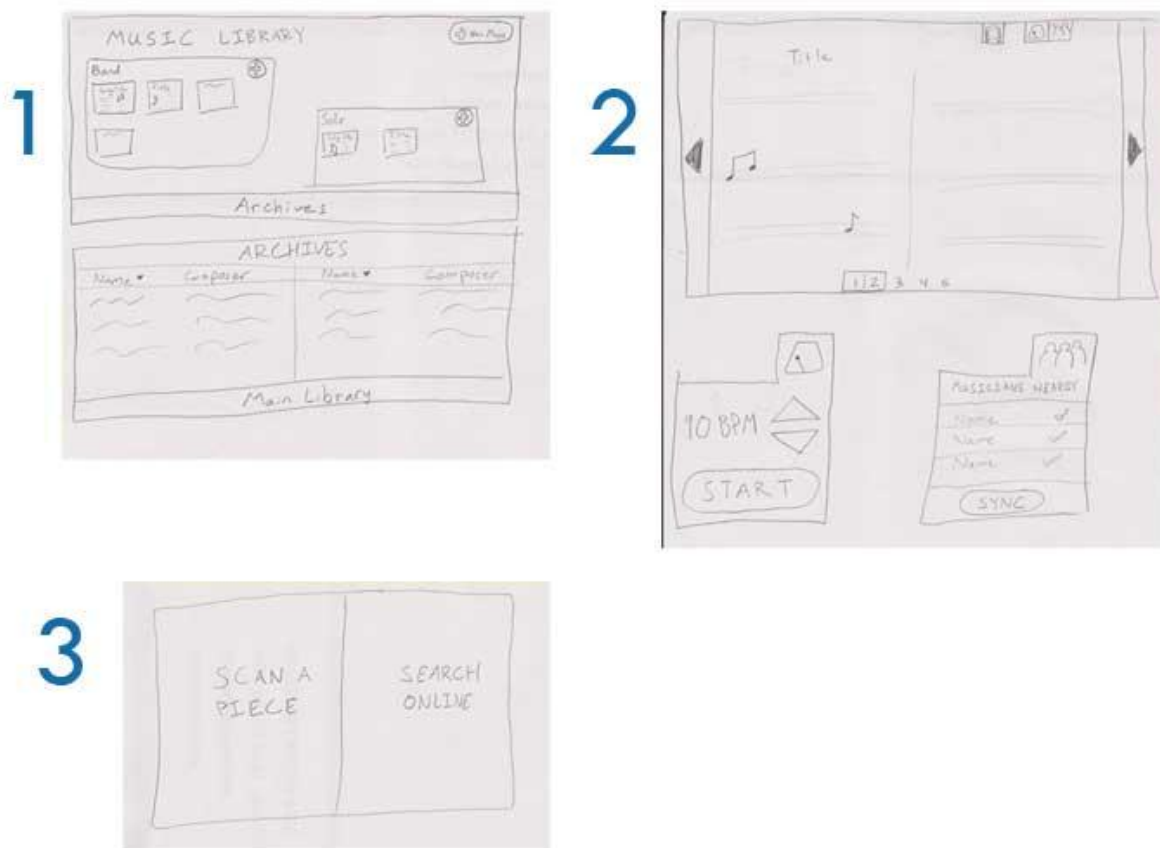
Sketch Three: Mode Driven

This set of sketches present an idea that users can select different modes depending on their practicing or performing scenarios. Multiple modes would allow users more flexibility to compose, edit, and rehearse in a larger band or orchestra setting. A user can sync her device with others' devices so that the group together can learn how the music would sound effectively and collaborate on the desired tasks at the same time online.

① Welcome to Virtuoso

| Solo |
| Duet |
| Band |
| Orchestra |

A user can choose one mode to start.

② My Band — Hello, XXX! — help

| Piano or keyboard | Violin ○ | Drum ○ |
| Guitar ○ | Bass ● | Singer ○ |

The user enters the "band mode" and selects her role.

③

| Compose | Library |
| Downloads | Settings |

She wants to compose music.

④ Compose Music

| By Myself |
| Multiple Composers |

The user wants to compose the music together with other people on the band.

⑤ Chat

Sync / Home / Individual

Now she can chat with multiple composers and edit with the whole band.

⑥

| Save Music |
| Cancel |

She can save or discard her music.

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Sketch 4: Play Driven

This design is influenced by the idea that the easiest (and most prominent) use of Virtuoso should be bringing up sheet music to play, making other uses relatively easy to use but secondary to playing a piece. It also aims to make the screens where navigation decisions happen simple and clean, so that a user can easily get to what functionality they want to use. The sheet music area (as cluttered as it looks right now) aims to provide some navigation while leaving the actual music itself fairly clean.
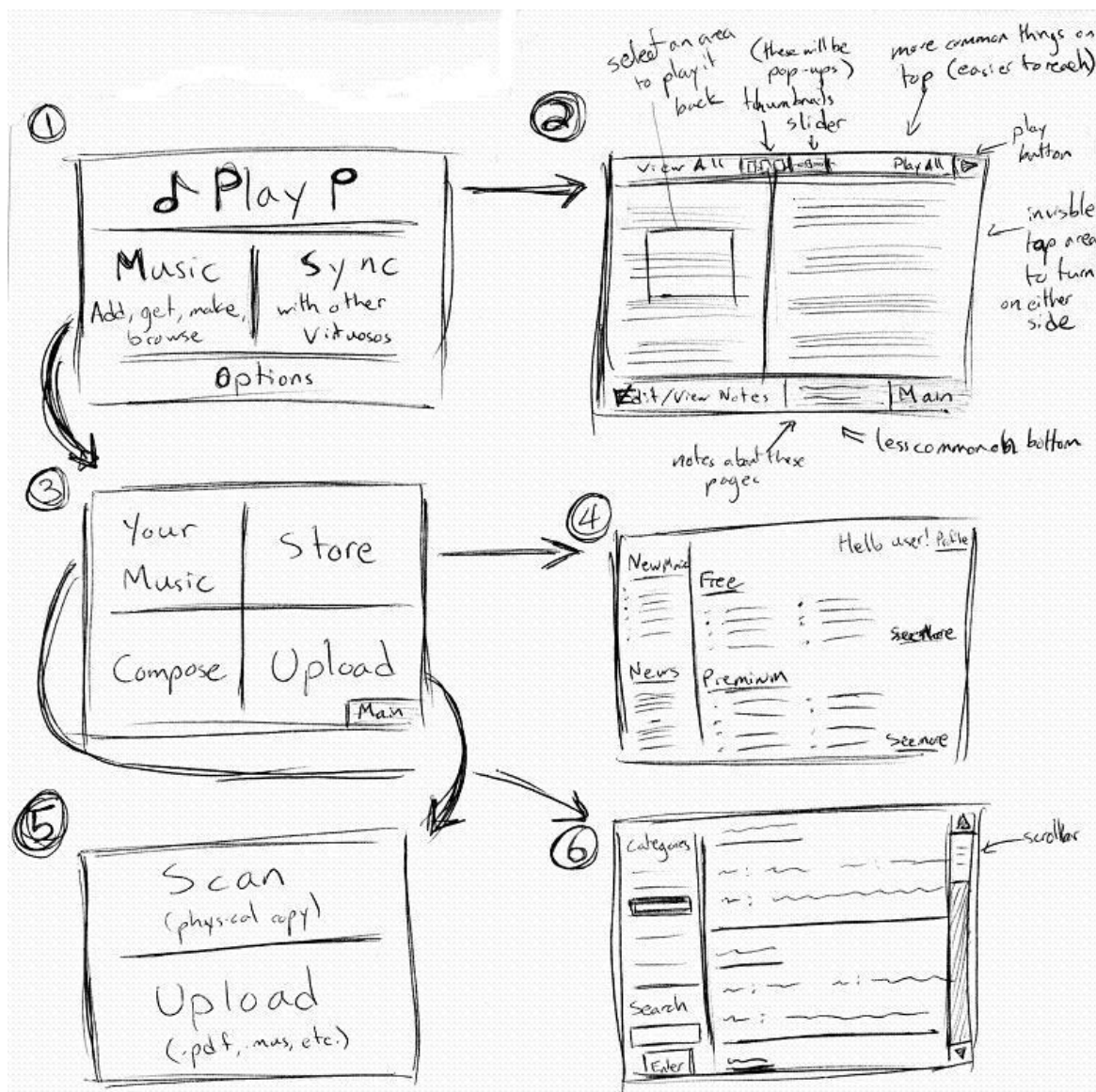
Selected Interface Design

Interface Description

The sketches of the interfaces are based on the idea of "mode-driven design." The sketches are color coded so that they will be easier to describe. Screen 1 is the welcome screen that displays the name of the system. Screen 2 is a log in screen where a user has to type in his account name and password. When logged in, the user will be directed to Screen 3, where "Solo" mode and "Group" mode will be available for selection. When the user chooses the desired mode, she will be directed to Screen 4 which contains four options before she proceeds to compose or open a digital music piece. The four options include "Compose" which means the user wants to write her own music; "Scan Sheets", which will allow users to scan the sheet music in; "Downloads", which will allow users to visit the music library (where downloaded music is stored, and new music can be downloaded to); and "Upload", which will allow users to upload her own digital music stored in Virtuoso or a flash drive.
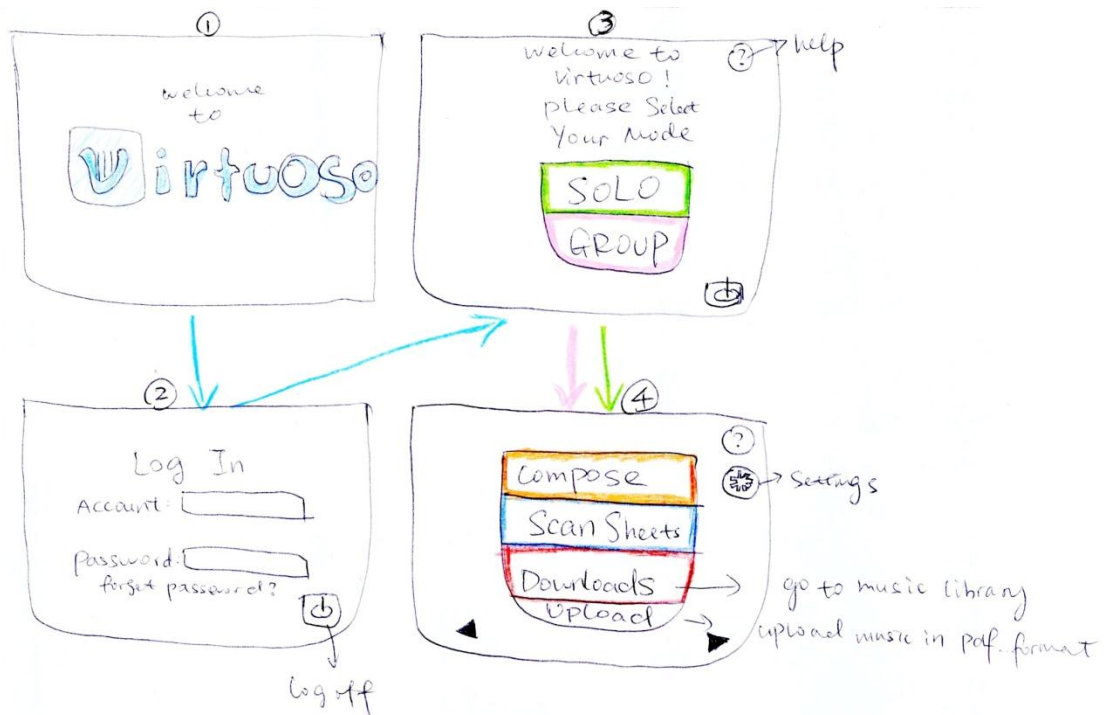
Screens 5, 6, 7 show the process of composing and saving a music piece. On the left side of screen 5, four major functions are available: edit, delete, play back, and pause/stop. The music scores are in the middle, and on the right side, the user can select "Help," "Save," "Discard," or "Home."

Screens 8,9,10 show the interface scanning and saving sheet music on the system. A user can always save the music in the local device itself, in the online music library/database, or in other mobile devices (e.g. flash drives).

Screen 11 displays the interface with Music Library (the online database). The music library serves as an archive of music online and music that is downloaded.

Screen 12 is the interface of the most common feature of Virtuoso: reading the digital music sheet. The interface has two big arrow buttons so that user can tap and flip the page easily. Under the two-page display of the digital music is a bar that indicates which two pages the user is currently at. A slider that will allow quick selection of a page is under the page number bar.
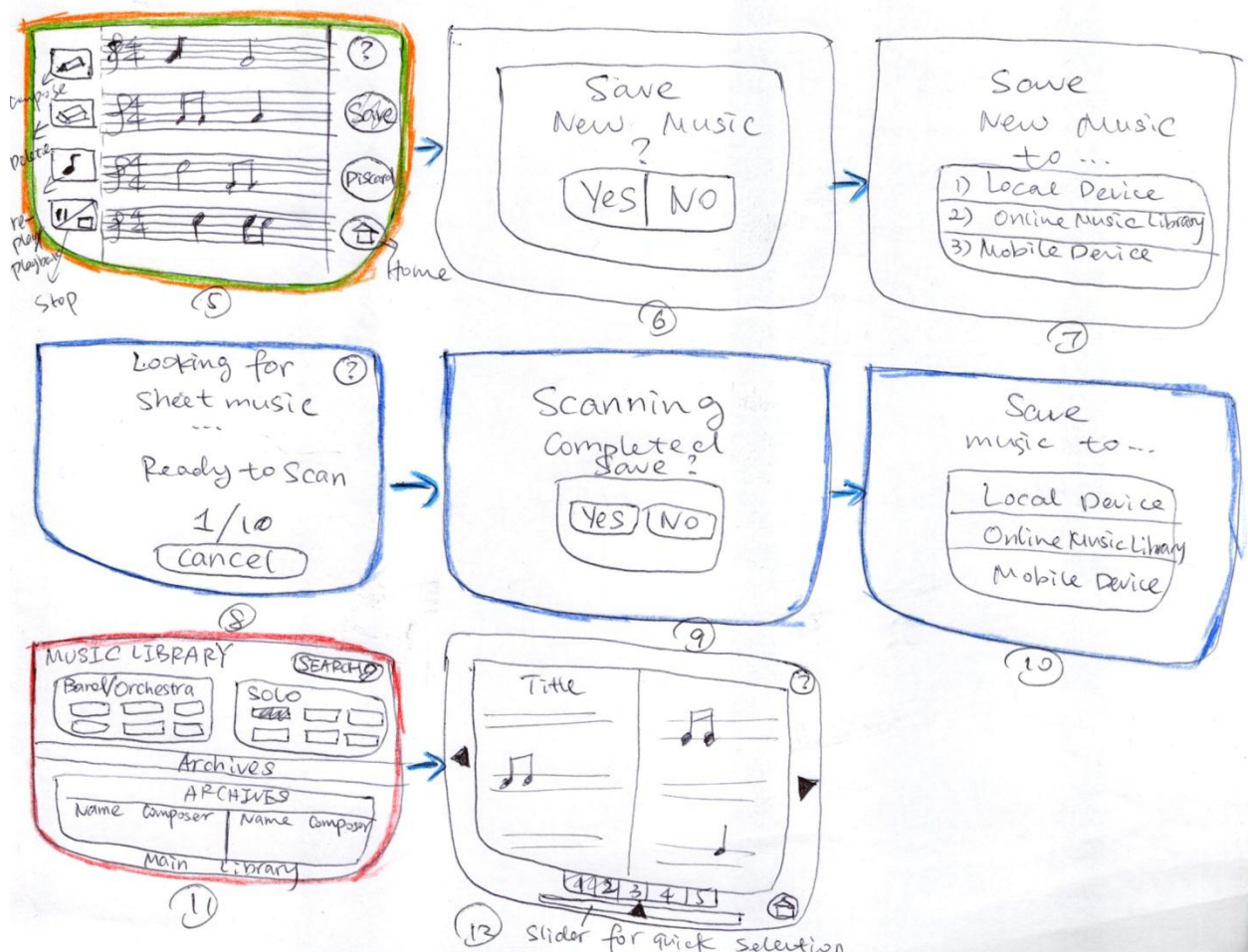
Screen 13 is the screen that presents the view of group editing on the same piece of music at the same time. People in the same music group (a band, an orchestra, etc.) can chat with each other and edit music together. Most importantly, there is a "Sync" button available when "Group" mode is enabled. People can sync their devices with others when they work in a group and they can use the "Play Back" to hear the assembled piece when different parts of music are put together. Screen 13 is the one-page view of group editing.
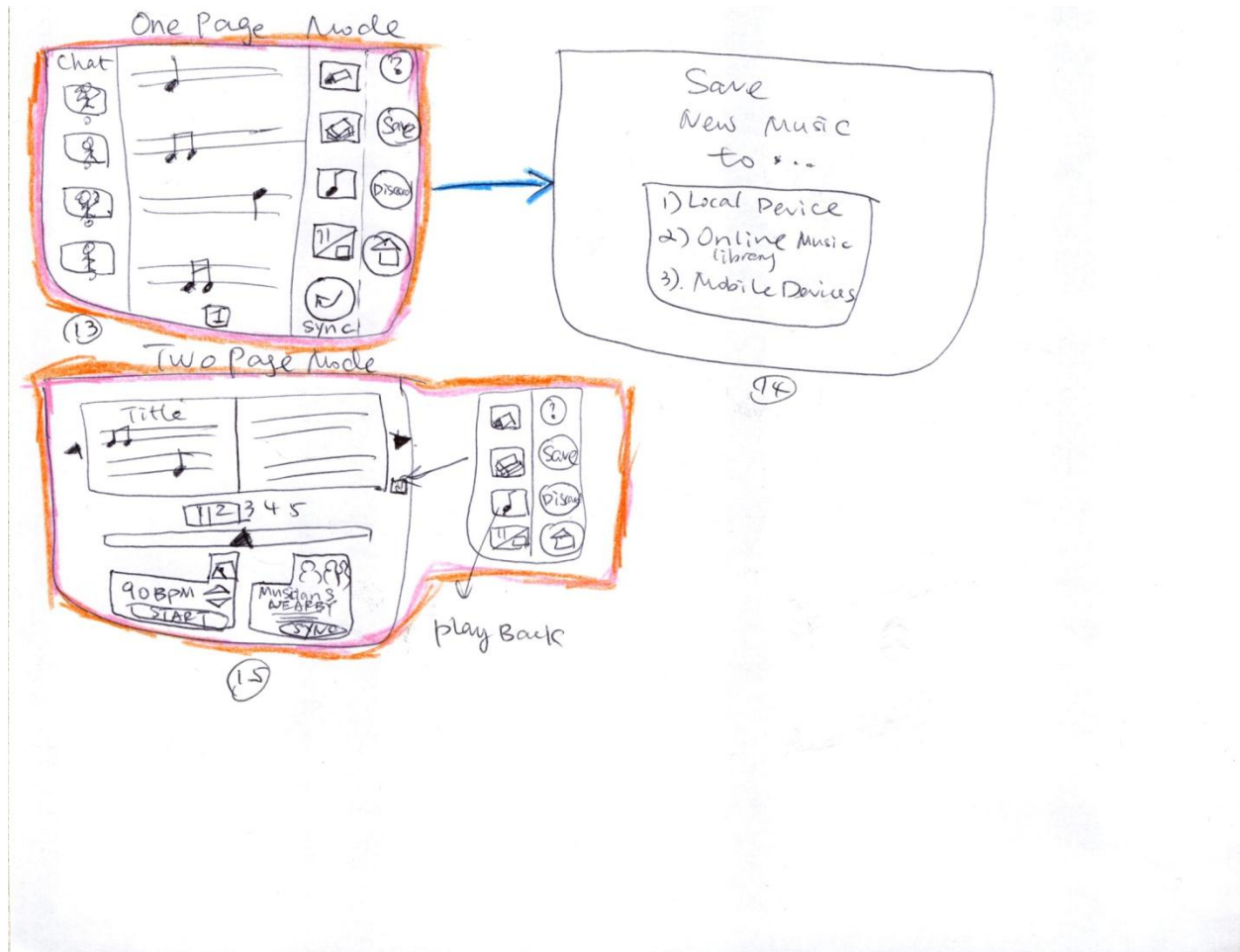
Design Rationale

We chose the mode driven design due to its simplicity and ease of use. We felt that our design should focus on appearing intuitive without requiring much thought from the user. A person using this device should be spending time practicing their music rather than messing around with a clunky user interface or wading through layers of menus to reach some functionality. This is an interface with little learning curve, and by limiting the number of elements presented, we are ensuring that the user can pick up the device and immediately be productive.

The design contains all of the functionality as required by our tasks. The most basic functionality of this device is to display sheet music in digital form, allowing the user to quickly turn the pages through large buttons on a touch screen. A user can quickly access their pieces via the music library, where sheet music is stored on the device. The selection of a particular piece brings up the piece itself, along with large left and right buttons on the sides of the screen. Flipping forward through the sheet music can be accomplished by pressing the right arrow button, and flipping back can be done by pressing the left arrow button. This procedure is done much more quickly using a touch screen compared with physical paper.

The actual notes from the sheet music can be played back by the device as well. This helps the user get a feel for what the music is supposed to sound like before even playing a single note.

Another function of this device is the ability to put existing physical sheet music onto the device. This is a fairly critical feature of this device, one that will be used many times. The feature is exposed after "Scan Sheet" is selected. The physical sheet music is then placed on the actual screen, and the device scans the piece page by page, prompting the user to flip the page after the preceding page has been scanned successfully.

The last function of this device is the ability for multiple virtual music readers to be synchronized together in a group setting. We feel that this sort of functionality will be useful for an orchestra where there is a conductor leading the instruments. This could also be useful in a smaller group context, a garage band, for example. The user can see groups in the near vicinity and has the option to specify a particular group to join. The synchronization aspect helps musicians in group to keep in sync with their section as well as with their conductor or lead. Often in orchestras, the challenge is to keep everyone together, as a single person who is off can result in a poor performance. This feature also opens up additional functionality in the form of annotations. Notes or modifications to a

group's sheet music can propagate throughout a section or the entire orchestra. This can be very powerful when a conductor wants to make quick adjustments during practice or even right before a performance.

Functionality Summary

Virtuoso will allow users to have an interactive experience with the music via digitizing the sheet music. The features will be available depending on the certain mode the user chooses. The main features of the system will include:

- Scan in physical music sheets and store them as digitized sheets
- Automatic page flipping, and if the feature is turned off, users can tab to flip
- Quick page selecting (e.g., a slider, thumbnails, etc.)
- Play-back feature
- Synchronization with other Virtuoso devices
- Database of and store for electronic sheet music

Scenarios

1) An amateur musician is learning to play an instrument. He/she turns on the virtual sheet music device with a push of a button, and is presented with a home screen. They select the solo option on the home screen, and then select the instrument that they are learning. They decide to play a song that is already on the device, so they then select the "Library" from the list of choices. The piece they are looking for is in the list, so they select that and the sheet music is then displayed. There are two columns of options on either side of the sheet music, along with the page forward and page back buttons at the bottom. All the musician wants to do is learn the notes to this piece, so they pick up the instrument and follow the notes, briefly touching the page forward button every time they reach the end of the current page.

2) An intermediate violinist is setting up to practice a new piece, which is not yet in their music library. They turn on their Virtuoso and select 'Solo', and then go to scan in their sheet music by selecting the option. When they've done that, they lay it out as directed, and then wait for the camera to scan the first two pages, replacing it with another two pages to be scanned until the entire piece has been scanned and stored in the violinist's library. Since they are done scanning, the violinist elects to start practicing then and selects the option to play this piece immediately.
After looking through the piece, the violinist wants to hear some of the more difficult sections to hear how they are supposed to sound. They drag a finger from the start of one measure to the end of another few measures, then press 'play' and listen to the section. After practicing and playing back the section a few times, they turn to another page and do the same with a different section until they can go back and practice the entire piece from beginning to end.

3) A professional orchestra is rehearsing a piece for an upcoming concert. The cello bowings in one particular section of a piece are incorrect, and they want to fix them quickly in time. With physical sheet music, a situation like this would be a disaster, requiring all musicians to copy the correct bowings into their parts. With Virtuoso, the situation can be handled easily. All musicians in the orchestra turn on their devices, go to Group Play, and find the orchestra group to sync with. Once their devices are synced with each other, each musician can choose what section they play in, and all devices in the same section will have synced note-taking. The lead cellist can then write in the bowings into her part, and the changes will show up in all cellists' music.

Appendix

Here are some complementary sketches that are critical to the integrity of the interface design.