Hartford Hospital Final Report

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Activity Report

Abstract—A basic app is being developed to help heart transplant recipients facilitate pillbox-specific education throughout the recipients' hospitalizations by optimizing the process and incorporating more opportunities for patients. This app will be used to optimize the education process and provide recipients with the opportunity to practice filling a virtual pillbox using a virtual medication list, virtual pill vials and scenarios regarding dose adjustments and titrations. This problem does not have a complete and comprehensive solution which addresses all the aspects of the education process used by Hartford hospital's heart transplant division. Potential existing solutions to this problem, both of which have gaps and limitations, include solutions which employ a pillbox as well as reminder and tracking solutions. The proposed solution will employ all aspects of the education process used by Hartford hospital's heart transplant staff and will effectively replace the constant need for hospital staff to assist during the education process.

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1 IMPACT

The desired impact of this project is to provide extensive education to post heart transplant recipients in accurately facilitating medbox-specific operations through an app (this report will refer to a pillbox as a "medbox"). Each step in the design and implementation of this project is of high importance as this solution will prevent post-transplant hospitalization due to mistakes being made by the patient when attempting to follow a strict, complicated medication routine. Incorrect doses can cause the newly transplanted heart to be rejected and, in some cases, destroyed. The current form of education employed by the hospital is primarily verbal and lacks multiple opportunities for patients to gain experience with filling and refilling their medication boxes. The proposed solution will allow recipients to learn to accurately use a medication box (i.e. "medbox") when managing their medication doses, dose adjustments and dose titrations without the constant presence and/or assistance of hospital staff.

2 RELATED WORK

Potential existing solutions which were researched and considered include solutions that employ a medbox as a primary feature as well as solutions which feature medication reminders/tracking. Both types of existing solutions have a combination of non-requirement features paired with a lack of required features.

Solutions that employ a medbox as their main feature include EllieGrid Inc's EllieGrid [1], Pillboxie by Nice Boy LLC [2], and Pillbox by Acromax [3]. EllieGrid, Pillboxie and PillBox all lack a pillbox-filling tutorial based on a medication list, a pillbox with the desired dimensions, pill visuals/encryptions that reflect the actual appearance of pills, practice with dose adjustments/titrations and audio/visual feedback. Additionally, PillBox is in the Spanish language.

Solutions which feature medication reminders/tracking include Pill Reminder – A Meds Tracker by Pheonix Games LLP [4] , Meds- Reminder by Stefan Volker [5] , and AlloCare by CareDx Inc [6] . The main feature of

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these solutions is to track medications and remind the user to take their medications. These are both features that will not be used during the education process of medbox-filling facilitated during hospitalization post-transplant. Additionally, these solutions lack required features mentioned above for potential solutions which feature a medbox as a primary feature.

3   SYSTEM REQUIREMENTS

After thorough discussions with the stake holders, a list of requirement and constrains are defined below.

3.1   Tutorial

3.1.1   Functionality

The educational game must include a tutorial. This is pivital in the success of the user learning how to use the medication box in conjunction with the medication list provided. The tutorial should give the user a good understanding of the mechanics of the game and slowly increase difficulty to keep the user engaged.

3.1.2   Acceptance Criteria

The user is introduced to and has certain amount of practice with every rule of the game. There shouldn't be anything new to the user when they are done with the tutorial.

3.2   Core Gameplay Loop

3.2.1   Functionality

The core gameplay loop of the software should emulate the training received in the hospital from the staff. This should essentially replace the hospital staff and replicate the same end results of the user being familiarized with both the medication list and box.

3.2.2   Acceptance Criteria

The user is confident in their ability in both filling their medbox (virtual and physical), and making changes to their fill medbox according to the incoming instructions of medical professionals.
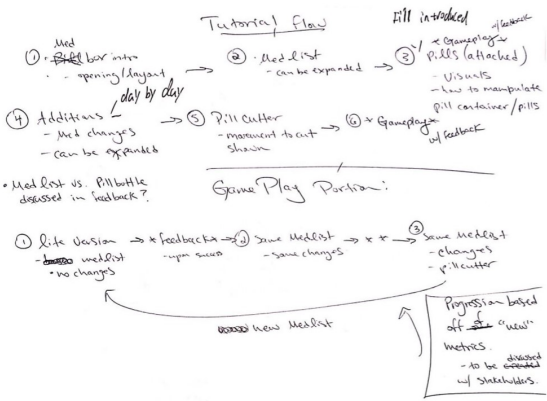

Figure 1. Logical Flow Diagram

3.3   Constraints

The software must be usable for common ages and learning abilities. Patients of all ages are given heart transplants and therefore this app needs to be able to cater to the general populus. It should be engaging and fun as to keep patients of all ages and backgrounds interested in the game.

The app needs to be compatible with the Apple environment and be able to be used with the App Store. The Hartford hospital has several iPads available to be used for this game and will be the primary device running this software.

4   SYSTEM DESIGN

Based on all analysis made above, a logical design diagram is then generated as shown in Figure 1. During the tutorial, the user will be introduced with all the basic rule sets first such as the medical list, the pill bottle area and the med box itself. Then a practice level is given to the user to complete. The next phase of the tutorial is adding medication changes and more complex dosage timing. Then another short game-play session is given to make sure that the user is familiar with every element of the game.

The core game-play loop consists of the user being given a full med list and an empty box first. They will be asked to fill the box according to the given medlist. After that, a short feedback screen will display. As the user

progresses through the levels, they become increasingly more difficult and lifelike. By the end of the hard level, the user is completely confident in their ability to fill their medbox to the standard of the hospital.

5 EXPERIMENTAL DESIGN

As proposed in the Experimental Design report, the question the design team sought to answer was "Will the development and use of this app provide extensive education to post heart transplant patients at HartFord Hospital in facilitating medbox-specific operations accurately?". Testing and experimental results were proposed to be based off rigorous studies performed on patients using the pillbox application. This was not possible however due to the limited resources and time available to the design team. This might not be the case for future teams working on this design project.

Due to these limitations, results were instead measured quantitatively using a 1-5 number review scale based on the opinions of a focus group. This focus group was composed of a variety demographic to include age, race, and gender. The users were asked to rate the application based on five criteria: User interface friendliness, engaging, informational, functionality, and usefulness in a hospital setting. This data is not only relevant to the improvement of the application but also answers the proposed question of effectiveness for research purposes.
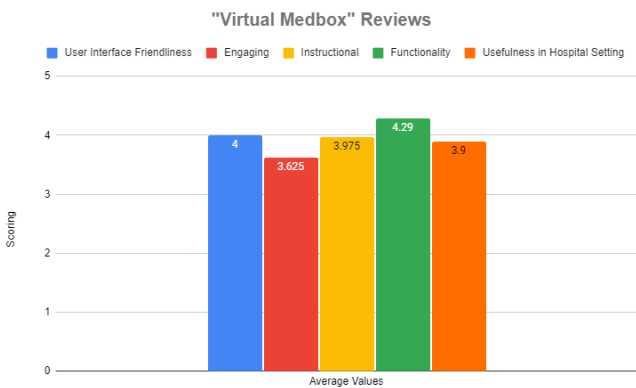
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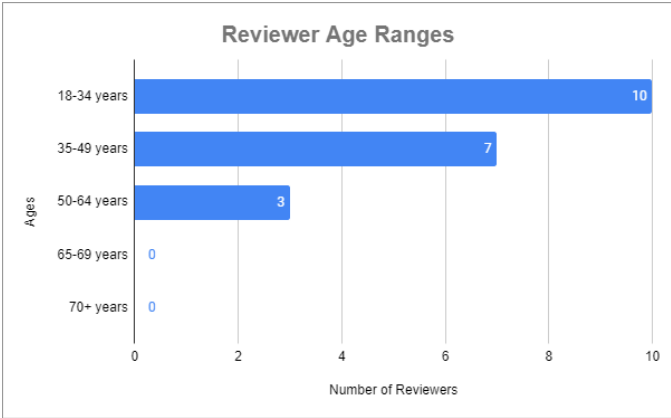

Figure 2. Review averages in each category

Figure 3. Reviewer age ranges

Shown in Figure 1 is the rating from twenty users who were surveyed randomly on the Virtual Medbox application.

Shown in Figure 2 is the age range of the focus group that was asked to be surveyed.

The results of the survey showed on average a four out of five star rating in each category. This data is a good indicator of the overall application, but a larger sample size would give more accurate response. As shown in Figure 2, the range of viewers that were surveyed was mostly ages 18-24. On average, patients that are receiving heart surgery from Hartford Hospital are much older, around 50-64 years of age. Future experiments should take this into account and adjust the focus group being tested.

7 DISCUSSION

The results were heavily in favor of the application, but showed there is room for improvement in some facets. The data was promising, but it should be taking into account that the overall focus group was small and should have reflected an older audience to better represent the hospital demographics. These results proved that the Virtual Medbox would have a place in the hospital environment and was generally favored by users in terms of functionality and user experience.

7.1 Limitations & Future Work

There were some unique and difficult limitations that were experienced as a result of this design project. For instance:

- **Limitation 1:** Location. This design project is created and worked on at the University at Albany in Albany, NY. This is two hours away from Hartford Hospital. As a result of this, testing and feedback is much more difficult than if the hospital was closer.
- **Limitation 2:** Resources. In order to fully test and implement the application for patient use, real patients would have to be studied by medical professionals in a controlled environment. Currently this is not possible due to limitations in resources.

Future teams working on this project will have several things they will be working on. This year the design team was able to build out and design the basic functionality and artwork of the level select and first level portion of the application. Future teams would need to improve on the game animations, complete the other two levels, and improve upon the artwork of the application. If they do complete the application, they would also need to publish it onto the App Store or Google Store and start testing with patients at the hospital.

8 CONCLUSION

The experimental results shown in this report clearly show that the fundamental question of this application, "Will the development and use of this app provide extensive education to post heart transplant patients at Hartford Hospital in facilitating medbox-specific operations accurately?" was a resounding yes. The results shown in Figures 1 and 2 clearly show that the simulation software was successful in this endeavor. This software is a clear step forward toward making the patients at Hartford Hospital more proficient in filling up their medication boxes. These results show that the the application was useful in a hospital setting, functional, instructional, and user friendly. It is an exciting breakthrough that this project will eventually be improving the lives of many at Hartford Hospital.

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