
# Final UCD Report

TEAM E, CPSC 481, FALL 2020

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# Executive Summary

While industries continue to innovate their operations with technological advancements, healthcare practitioners have continued to operate their tasks using old-school print and paper techniques. The aim of this project was to design a pioneer application to launch the medical field into the rise of technology. In addition, to serve as a learning experience for a group of 5 UI/UX students introduced to the User Centered Design Process. Healthcare workers were questioned to learn about their day-to-day tasks. The student group determined workers need their hands free to assist patients while interacting with technology. As a result, augmented reality (AR) was chosen as the applications platform. A series of video simulated prototypes were created to represent the technological design with its functionality in action inside a healthcare environment. The findings showed AR can be theoretically used in the medical field, but further user testing is needed to determine its real-world applicability.

# 1. Introduction

A group of 5 software developer students were given a term-long project to learn a User Centered Design Process by applying it into designing an UX application. After brainstorming ideas of possible designs, a decision was made to make the purpose of the application innovating on a current solution. What proceeded was generating proposals for three projects in different niches:

1. A Looking for Group application to allow gamers to search for other players to play games with.
2. An Esports training application for high skilled gamers to improve their skills.
3. An AR application that would facilitate the day-to-day interactions of industry professionals.

Upon discussing the possibility of creating prototypes for each project, it was determined that the Esports training application was not feasible during the COVID-19 pandemic because the difficulties conducting user research. Following a debate on the remaining project options, the desire to design and prototype an AR technology prevailed resulting in option 3 being selected. The last roadblock was determining the industry the project would innovate day-to-day interactions. After discovering that healthcare workers still use paper to complete many of their tasks, the decision was made to design the AR application for medical practitioners.

# 2. Design Problem

In the fast-paced, human-focused world of healthcare, both time and information are key in treating and caring for patients. For each patient, their doctor needs to know their medical history, what tests were run, and their current vitals, with each bit of information coming from a different source. Having to refer across pages of documents or to a screen takes away time and focus from the individual who currently needs care. With the large strain placed on healthcare workers as of late, the need to quickly access a patient's information while still providing focus and compassion for the patient, is a critical aspect of the healthcare field.

# 3. Design Solution

The solution is called C**AR**E and is an application for AR glasses that visually shows a patient's relevant medical information to tending healthcare professionals. Information that previously may have been on obtrusive screens or on multiple pages of paper is instead displayed simply and modestly through AR technology. Interaction with the system takes place through casual hand movements to ensure focus remains on the patient. This application can be used in various settings such as hospitals, responding paramedics, medical offices, and anywhere healthcare workers need to access patient information. Utilizing AR glasses leaves hands free for whatever needs to be done, while keeping the worker up to date on the patient's current condition, new test results, or other notifications.

# 4. End-User and Stakeholders

The main end-user for the system would be healthcare workers in any patient-oriented field who need to see a patient's information quickly and hands-free. The stakeholders for this product include private and public hospitals, doctors, general healthcare workers, and hospital board of directors, with further descriptions of these stakeholders in Appendix B.

# 5. User Research

## Methods and Process

To conduct user research three methods were used: Competitive Product Survey, A Day in the Life, and Scenario Testing. Starting with a Competitive Product Survey, where similar AR applications were searched up, certain aspects were discovered that could be improved. After potential competitors were determined, A Day in the Life evaluation was completed by asking family and friends in the medical field to inform us about their day. Following the Day in the Life, they were asked for their feedback on AR related scenario tests.

## Findings

The Competitive Product Survey found some similar products on the market, none however had their scope and context related to this project. Despite this there was still takeaways from the competitive products designs such as, keeping information unobtrusive and integrated. The findings from A Day in the Life assisted in learning that every healthcare worker's experience is unique, therefore the system must accommodate different uses. This method emphasized the importance of viewing paperwork, vitals, and imaging. Most of a healthcare worker's time is spent with their patients and every interaction is critical to improve patient care. Using the above findings, certain tasks were designed to improve the quality of the user experience. Finally, scenario testing found saving healthcare worker's time is a key aspect that needs to be highlighted in the system. The feedback also praised how the concept would benefit healthcare workers during the COVID-19 pandemic.

# 6. Important Design Choices

The crucial decisions made as a team included determining functionality, navigation method, visual design, and the overall interaction. In terms of functionality, it was decided to add-in tasks such as scanning a patient's ID and the doctor's ID, since they would be critical for the app's flow. Simple tooltips were added with confirmation dialogs to increase clarity and error handling. In addition, both 3D surgery and security view were eliminated since they were unfeasible. For navigating, small and unobtrusive menus with submenus were chosen to keep navigation organized and to a limited depth. Design-wise following that, a minimalist design with a muted, monochromatic palette was selected to avoid distracting users from their current task. In that vein, notifications are based in a toggle for convenient access. With user interactions, hand gestures aimed to utilize the AR functionality and capabilities. Lastly, scenario-based videos showcased the prototype in a realistic experience.

# 7. Low-Fi Design

After brainstorming and completing the affinity diagram the group gathered and sketched key elements such as the overall flow, UI, and UX. Once that was done, the task load was divided, and each member designed their parts using Balsamiq.

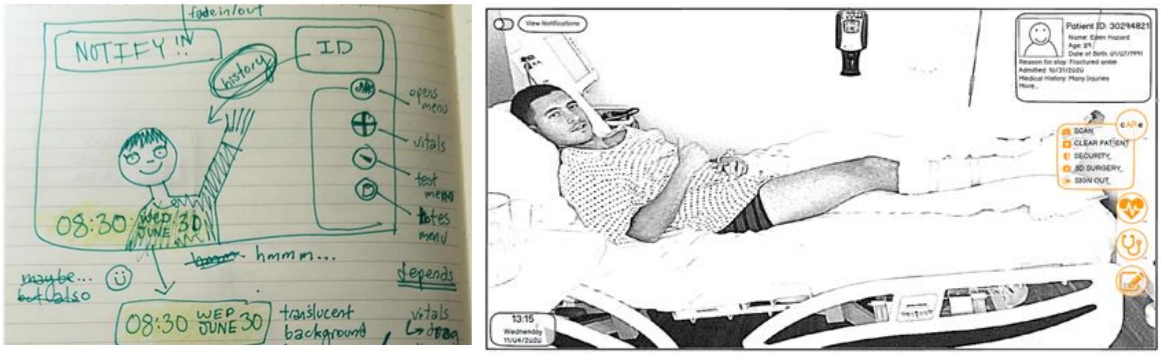


**Figure 1 and 2: Example of a collaborative team sketch and the resulting low-fi prototype.**

Upon completion, the tasks were presented to the rest of the team to collectively provide ideas before finalizing the prototype collectively.

## Lessons Learned

To showcase the interactive element of the low-fi prototype a video using overlaid frames that mimicked the view of AR glasses was created. Production and editing of this video took lots of man hours but all-in-all was the closest representation with the resources and time available. A takeaway from this experience was the effort needed to create the video and that the difficulty of editing lands on one person. In addition, splitting the prototypes tasks between 5 people became a hindrance when coalescing the prototype as there were inconsistent design interpretations.


**Figure 3: Still from low-fi video prototype (00:01:55)**

# 8. Hi-Fi Design

To get started on the final hi-fi design, the developing of the hi-fi visuals were done in Adobe XD based off the low-fi prototype. A heuristic evaluation was then conducted on the first iteration of the hi-fi which found many points lacking clarity. After the evaluation and review, a collective discussion of the hi-fi design pinpointed major issues to fix. To ensure consistency in design, a base template that included buttons, icons, and colors was used. The template allowed members to individually design each task assigned before the final merge occurred.


**Figure 4: Sheet showcasing premade icons and components on the template**

## Lessons Learned

While creating the hi-fi prototype, a similar path to the low-fi design was followed continuing to use a walkthrough video to showcase the prototype, turning out better than expected. Though a design template was used, there were still small miscommunications in design such as dates not matching across different team members' work and team members needing to add to the template. This could have been avoided with a more in-depth design meeting when formulating the template. Learning to focus on having strong project management, such as soft deadlines and divided work was a key takeaway. The final lesson learned related all the way to the initial splitting up of work as some tasks required a great deal more work than expected and could have been split more evenly into subtasks.

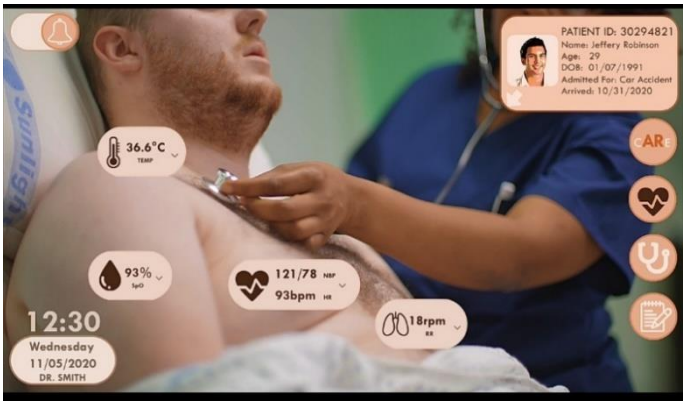


**Figure 5: Still from hi-fi video prototype (00:01:05)**

# 9. Heuristic Evaluation

To complete the heuristic evaluation, a different approach was needed due to the unique and complex UI chosen. Time constraints made it redundant to make two videos showcasing the interactions with the AR app, so alternatively the team evaluated an imagined UX with high-fidelity visuals following the low-fi prototypes interactions. Once the first iteration of hi-fi visuals was done, the team divided into three evaluators and two reviewers. The evaluators revised the prototype, evaluated it, and commented on concerning aspects that should be changed. The reviewers individually went through all feedback and gave each comment a rank depending on severity. Once the reviewers were done, the group collectively went through each point discussing what was important and necessary to change.


**Figure 6: Low-fi prototype, Hi-fi prototype visuals based off the low-fi, and post-heuristic evaluation prototype**

# Findings

The heuristic evaluation shed light on multiple issues with the overreaching issue being that more clarity was needed in the prototype. For the user, it was unclear where they are navigating from as the menu had no difference between selected and unselected icons. The lack of clarity also meant that there were times where it was unclear that an element was interactive such as the patient card. Other points of missing clarity included the similarities between menus and their submenus.

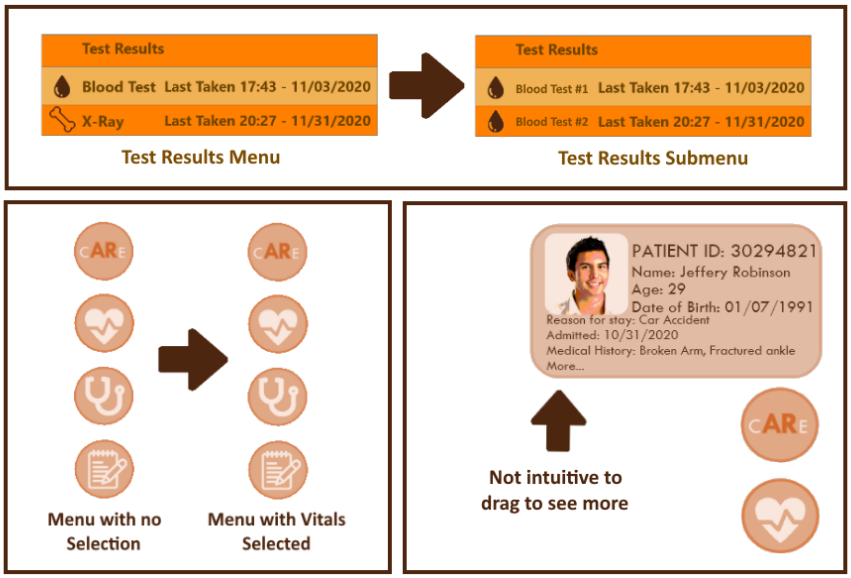


**Figure 7: Examples of confusing points found during the heuristic evaluation**

Another finding was that the prototype failed to utilize AR's ability to track hand gestures, and instead focused on traditional clicking for selection. This would include navigating with a back button instead of swiping away which other application utilize. Another discovery was a lack of user error safety nets. For example, providing confirmation when deleting notes. In the original design, accidently clicking the delete button would delete without any confirmation. Finally, it was detected that there was no function to allow users to edit their to-do lists and notes, a common functionality found in similar systems.

# Design Changes Made

The design changes made based on the heuristic evaluation involved first adding more contrasted colors to make it clear which section of the UI users were currently on. The addition of labels appearing when a button is being hovered lets users know what each button does. Implementing an additional swiping gesture to close

items further utilizes AR technology. The last major design changes were adding error messages, an initial patient scan pop-up, and bounds. In the case that users want to delete a note, a notification would pop up asking if they are sure they would like to delete it. Furthermore, when starting the application and after a user has logged in, a prompt to scan a patient's ID was included.

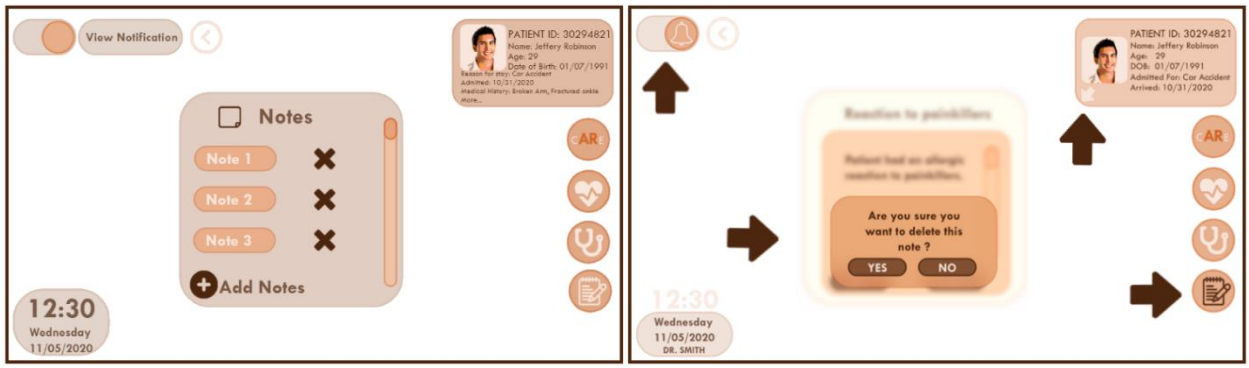


**Figure 8: Initial Hi-fi design (left) and Hi-fi design with changes made (right)**

In addition, an arbitrary bound was added to prevent users from moving elements in areas that are not permitted. Lastly, visual cues were added to indicate that more can be seen if the element was clicked and one which allows users to edit their notes and to-do lists.

# 10. Final Hi-Fi Design

In the final hi-fi prototype, the changes consisted of cosmetic changes such as increases in transparency. The background of notes and to-do lists were blurred when typing so the keyboard would be the focus. The team then ensured that notes and to-do lists appeared clickable by adding arrows. Another change was in the video, a subtle indication was added of what elements were being tapped.

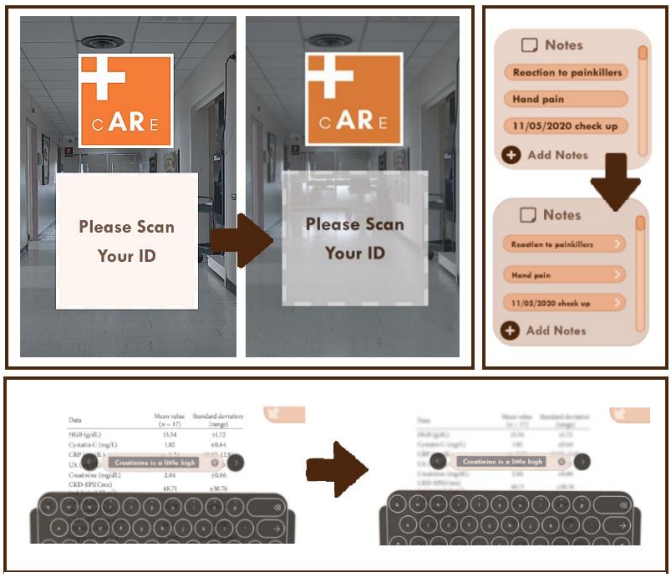


**Figure 9: Changes between Stage 4 hi-fi and Stage 5 hi-fi**

For the final design, there were time constraints and difficulty in redoing everything. The team found it unrealistic to redo the entire prototype and potentially not complete it. Additionally, it was found that it would be best not to change the colours as the system was for everyday use by practitioners [1]. It can be shown that the muted orange is easier on the eyes while saturated colors could cause distraction and potential headaches.

## Future Changes

The team is confident that the final product is well done although in design there is always room to improve the product. While revisiting the video of the final hi-fi prototype, the test results task opened a conversation. There is strong belief that the way in which add notes to a test functionality was implemented should suffice for practitioners to jot

down notes on the scans. However, there is a possibility to bring changes to improve the UI and UX of the product.

While doing brief research on how medical test images and reports are being visualized today, the concept of AI in the radiology field was stumbled upon. This gave an idea of a change that could be made to the adding notes functionality while keeping the product up to potential future standards. Currently, artificial intelligence is being utilized in radiology to scan test images and detect injuries such as fractures, tears, and hemorrhages. This concept could be utilized in the prototype and change the functionality of adding notes to a test result. Instead of adding the notes manually by placing a circle on a test image; practitioners would have the ability to let an AI scan the image for potential problems.


**Figure 10: Initial scan (left) and AI severity note on scan (right)**

Artificial intelligence would then detect the issues and determine their severities keeping the severity concepts in the system. The textual content of the note would be scrapped since it's assumed that medical professionals would have the ability to determine the problem detected by the AI. As a team it was decided to not change the functionality for this stage as it is uncertain that the way it is implemented is adequate for this application.

# 11. Conclusions

Overall, a lot was learned in each stage, from brainstorming ideas to creating a low-fi prototype, then taking feedback and evolving it into the final hi-fi prototype. Plenty of user research was done for AR in the medical field including reading information online and asking potential users in the field. Then the necessary tasks were created, and ideas were being drawn. Following this, the team decided to make the design minimalistic, consistent, and efficient to use which is the core of the design philosophy behind the product. The creation of the low-fi prototypes brought these ideas to life. The transitioning to a hi-fi prototype allowed the team to take a step back by evaluating the heuristics of the overall flow and design. Based on feedback, crucial issues arose such as: lack of clarity; missing common key functionality, like editing and deleting; and user error prevention. This feedback was taken into consideration while implementing the final modifications into the hi-fi prototype. The result is the final hi-fi prototype in which the team is confident in. Thank you for following the journey. The C**AR**E team cannot wait to show more in the future.

# References

[1] F. Bonato, L. Alfieri and A. Bubka, "Display color affects motion sickness symptoms in an optokinetic drum," *Aviat Space Environ Med,* vol. 4, no. 75, pp. 306-11, 2004 Apr.

# Appendix

## Appendix A: Website and GitHub Repo

### Portfolio

You can visit our team's progress at:

https://manols0398.wixsite.com/cpsc481-team-e

### Repository

You can visit our public GitHub repository at:

https://github.com/gabyrgonz/CPSC481-F20-Tutorial1-TeamE.git

All the work for stage five can be found under the feature branch: ***stage_five.***

## Appendix B: Stakeholder Descriptions

| Stakeholders | Description |
|---|---|
| **Private Hospitals** | In a private healthcare system, the hospital would be invested in the products outcome. |
| **Public Hospitals** | In a public healthcare system, the government would be invested in the products outcome and would need approval. |
| **Doctors** | Doctors would be stakeholders as they would most often be using the product and have an important say in its design. |
| **Healthcare Workers** | RNs, LPNs, nurse practitioners, lab technicians, and other healthcare workers would also be using the product frequently and have a say in the design. |
| **Hospital Board of Directors** | Executive board members implement state of the art technology in their hospitals and can provide feedback and overall user experience. |