Team E: Stage 2 Research

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1. Project Idea

A. Description

Our product, C**AR**E, is an application for augmented reality (AR) glasses that would visually show a patient's relevant medical information to tending healthcare professionals. These healthcare professionals include doctors, nurses, EMTs, and any other healthcare worker who needs to see a patient's information quickly and hands-free. Users would interact with the system through specific hand movements such as swiping through X-rays as if interacting with a tablet or pointing at a patient to see a more detailed readout of their information. We expect our product to be used in various settings such as in hospitals, by paramedics responding to 911 calls, medical offices, and anywhere healthcare workers are needed. In a hospital setting, a doctor wearing the AR glasses would be able to quickly see a patient's information such as name, age, allergies, and reason for being in the hospital, while a paramedic could use the glasses to visualize the patient's vitals, condition, what first aid has been done already, and what first aid could possibly be done.

B. Stakeholders

All stakeholders will vary in knowledge when using AR devices.

Stakeholders	Description
Private Hospitals	In a private health care system, the hospital would be invested in the outcome of the product.
Public Hospitals	In a public health care system, the government would be invested in the outcome of the product and would need to provide approval.
Doctors	Doctors would be stakeholders as they would be the ones most often using the product and therefore would 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 products design.
Hospital Board of Directors	Executive board members implement state of the art technology in their hospitals and can provide product feedback and overall user experience.

2. Research methods

The three IDEO method cards that we chose to follow are, in order: Competitive Product Survey, A Day in The Life, and Scenario Testing as they complement each other well. The Competitive Product Survey complemented A Day in The Life as it inspired what we would be looking for when reviewing our data gathered during our Day in The Life. The research gathered through Competitive Product Survey and A Day in The Life helped us formulate our scenarios for Scenario Testing. Our scenarios were more realistic as they were based on what we learned from a doctor's day to day life while also considering competitive products concepts. As an example, convenience is key when a doctor views a patient's x-rays as the doctor needs to study the results and find abnormalities.

IDEO Card 1: Competitive Product Survey - LEARN

We started our research by doing a competitive product survey. We chose this IDEO method card to gain initial knowledge on our idea and to see if it has been done before, and if so, how it turned out.

Summary of Findings

In our research we did not find any glasses-based AR applications that display patient information in a general medical setting. Despite this, there were still a couple applications that have a vaguely similar nature and setting, that can be used to reflect and compare functionality.

tagAR™

tagAR is an AR mobile application that shows a visual nametag over someone's head. Its main purpose is to help people remember and view other people's names upon meeting while also helping people search for people they know. This app would be used in educational environments, conferences, meetings, and social events by anyone who wants to use it, specifically targeted at those with learning disabilities.

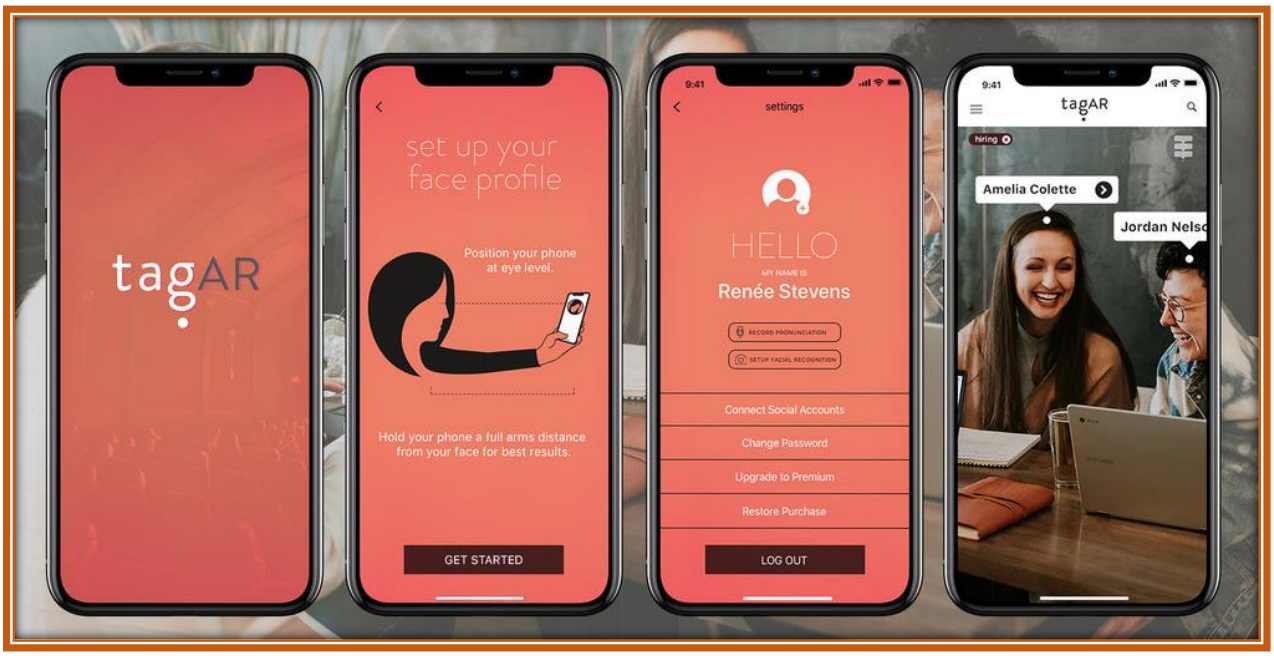

Figure 1: Final Working Designs of tagAR Including Multiple Screens.

While this application seems very different in many respects from our idea, the use of AR to visualize information about people runs similar. Our idea uses glasses-based AR rather than phone-based and the setting and the users are quite different. Still from this app, we can take away the general unobtrusive feeling of the UI and the workflow and screens needed in AR that is dependent on facial recognition.

Xvision

Xvision is an AR headset-based navigation system that is used in surgery by surgeons to visualize their patients' 3D spinal anatomy by superimposing the surgeon's tools onto the patient's spine. This allows surgeons to accurately navigate instruments while looking directly at the patient in a surgery setting.

Figure 2: Screen Capture From Xvision Example Video.

This application, though it uses AR glasses in a medical setting, is more niche in its context than our product. Our idea focuses more on general medical settings than specific surgical settings, but we can still gain inspiration from the UX for medical imaging and the use in surgery.

IDEO Card 2: A Day in The Life - LOOK

We picked A Day in The Life to gain insight on what a day of being a healthcare worker would be like to help with our goal of improving the quality of life in the medical field. This IDEO card helped show us the unanticipated issues and routines that healthcare professionals experience day-to-day which in turn helped us gain a better understanding of our products context and environment.

Summary of Findings

We modified the execution of this IDEO method card to adhere to social distancing rules. Instead of interacting with the users in person, we virtually asked users to describe what a day in their life entails and then catalogued the activities. The pool of healthcare workers asked came from our team's family members and friends who work in healthcare. More detailed descriptions of each of their daily lives can be found in Appendix B.

We learned from observing various healthcare workers that everyone's experiences differ based on what field they are in. Therefore, it is important that we find a way to accommodate each of our various user categories.

It was also found that there is a very important need to view paperwork, vitals, and imaging. Overall, most of a healthcare worker's time is spent with their patients and every time they interact it is critical, to know all the relevant information related to that patient.

Figure 3: Example Stock Image for A Day in The Life

IDEO Card 3: Scenario Testing – TRY

We chose Scenario Testing as our last IDEO research method since it gave us a better picture of the features that should be designed and implemented in our product. By showing end users this series of scenarios and asking for their feedback we can observe their reactions and opinions. This offers us an idea of how they would interact with the product and the value that it would provide. Based on their scenario feedback, we can scope the features that need to be included to help our users accomplish their tasks.

Figure 4: Example Stock Image for a Possible Scenario

Summary of Findings

After coming up with several scenarios we asked various healthcare worker for their reactions to them. More detailed descriptions of the scenarios created and the responses to them can be found in Appendix C. One of the biggest reactions to our scenario testing was the positive feedback given to saving time through our product. For example, when we shared our scenarios with nurses, the first reaction we would got was how it would make work so much easier and save a lot of time for them. With having a busy schedule and a lot of unexcepted emergencies, saving time on a simple task can reduce a great deal of stress. Another reaction to our scenarios was how our product could greatly benefit healthcare during the current COVID-19 pandemic. Nurses highlighted that being able to view vitals from a distance would be beneficial during the pandemic, since it lets them get information about patients without having to get close.

IDEO Method Assessment

What we found after doing our research is that there are many ways to complete research while remaining safe and physically distanced. Overall, it generally went well since the information gathered was very helpful in our research. In addition, we realized that a Competitive Product Survey was key in understanding the medical AR industry and where it is at. While on the other side, Day in The Life and Scenario Testing allowed us to gain a more in-depth personal understanding of the field. We found it difficult to interview a lot of users due to the pandemic and our targeted users increased workload. In addition, we did not get information from individuals who were not close to group members, therefore there is the potential for bias. If COVID -19 was not prevalent and we could, one of us would have hopefully observed workers at a hospital to learn the small routine details that the workers might not realize themselves and therefore left out of their retelling of their day.

3. Tasks

Must-Haves

These tasks that are required to complete our project.

Task	Task Description
Display patient's chart (e.g. vital signs)	Displaying a patient's current body temperature, pulse rate, respiration rate, and blood pressure.
Display patient's medical history	Pulling up a patient's medical history such as medication, allergies, previous surgeries, etc.
Check diagnostic test results	Viewing recent and past diagnostic test results, for example, viewing X-rays, CT scans, ultrasounds, etc.

Should-Haves

These tasks are distinct features that benefit our project.

Task	Task Description
Add notes	Adding notes about a patient's progress, prognosis, treatment, etc.
To Do list	Creating to-do lists or treatment plans for specific patients.
Get visual notifications	Notifying that patients have asked for assistance and reminding workers of to-dos.

Nice-to-Haves

These tasks are not necessary but would be good to have.

Task	Task Description
Security clearance	Viewing if a certain person has security clearance on a specific medical unit.
Surgery 3D visualizations	Displaying images of organs through skin and tissue mid-surgery.

4. Team Portfolio and Repository

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 our work for stage two can be found under the feature branch: ***stage_two.***

Appendix

Appendix A: Competitive Product Survey

tagAR™

http://reneestevens.design/tagar

Xvision

https://augmedics.com/

Appendix B: A Day in The Life

Charge Nurse on the Cardiology Unit at Foothills Hospital

I wake up at 6, get ready for work. My lunch was prepacked the night before. Get to work around 650- since it's pandemic I have to change into hospital scrubs. Then I check in for work, get my temperature checked and do the COVID-19 survey to make sure I'm fit for work. Then I research my patients, get report from the nurse leaving, pull my meds, print my telemetry strips. Check in with my buddy and my nursing attendant so see how our workload is for the day. Initial rounds start at 730- do my initial vitals, head to toe assessments, morning medications. Once done all that, I try and chart as soon as possible incase my day gets busy. The rest of the shift depends on the patient's needs- medication administration, prepping and sending for tests and surgeries, IV starts, dressing changes, patient education, repositioning, bed baths, assisting in ambulatory and physio. But still constantly checking for new doctor's orders, trying to check in with the doctors themselves. Updating families cause no visitors at the moment. Checking with my coworkers to see who's busy/who needs help, but also covering the unit clerk and charge nurse to cover the front desk. Mid shift I have to recheck my temperature and do the COVID-19 survey again. A lot of time at work is spent donning and doffing in PPE and cleaning basically everything we ever touch. My day ends at 1515 when I give report to the oncoming nurse and usually say bye to my patients, so they know not to expect me.

Family Doctor

Note: This was taken over the phone

When the doctor arrives at work, she opens her laptop where her schedule of all the patients she will be seeing throughout the day is located. Once a patient has arrived, she greets the patients and proceeds to ask what the patient is in for. She then briefly examines the patient then comes up with a diagnosis and a plan for how she can help. Either while the patient is there or after depending on the patient, she would take visitors notes so she may add that to their file. Visitors notes consist of what they were in for and the plan of treatment. Sometimes it is difficult to write notes while patients are there if they suffer from mental health because she must engage with them. Between seeing patients, she may talk to home care nurses that have questions, communicate to pharmacies by FAX to clarify prescription, write referral letter, and look at her tasks. All doctors have a tasks page and when a patient has done an X-ray, blood test, or lab work all the results are found on the task page. When she sees a task, she opens the patients page and if she sees any abnormal results, she communicates to the front desk that the patient needs to make a follow up appointment. 80%-90% of her day consist of seeing patients while the other portion is doing other paperwork. If she does not have time to finish things at work, she brings it home. Everything is done on her

laptop and the workplace has gone paperless and has been using EMR (Electronic Medical Records). However, it has not gone completely paperless, imaging still requires paper because the images are faxed and then the reception must scan them to add them digitally. Once it is online then the doctor will be able to see it.

Appendix C: Scenario Testing

Charge Nurse on the Cardiology Unit

Scenario 1

Suppose that you had special glasses and when you looked at a patient it showed you their vitals (e.g. current body temperature, pulse rate, respiration rate, and blood pressure). You can interact with the holograms, using tap gestures similar to a tablet.
How would you feel about this?

I think that would be awesome! Would save a lot of time during assessments and be super helpful in an emergency/code situation so the team can act faster. Would also be great during COVID times cause most of my closest patient interaction is with vitals, so this would give me the distance I need to be safe.

Scenario 2

You are working at the Emergency Department, that's short-staffed and admitted more patients than your team can handle. Suppose that you had special glasses and when you looked down the hall of all your patients, their basic information and vitals would be displayed beside each room, without having to walk to each room. You can interact with the holograms, using tap gestures similar to a tablet.
How would you feel about this?

Definitely a realistic situation so this technology would be great. Would assist in making sure the patients are safe and stable in their rooms, without actually having to be physically present. Would also help me prioritize who needs to be seen next/more urgently vs. who's okay to wait longer.

Scenario 3

Suppose that you had special glasses and when you looked at a patient, all their medical history would be displayed and sorted based on the history type (e.g. allergies, illnesses, surgeries, immunizations). You can interact with the holograms, using tap gestures similar to a tablet.
How would you feel about this?

That would save so much time with my patient's research in the morning. And trying to figure out what's going on if they were to go downhill. Patients come in for cardiac reasons but all their other health history plays a big part in the care we give to them.

Scenario 4

Suppose a doctor enters the patient's room, and when they look at the patient while wearing AR glasses they see a heads up display where they can use their hands to click on the holographic button. Once clicked they

can view the patient's diagnostic results, where they can pull up the patients x-rays and CT scans, etc. The doctor then zooms into the diagnostic to get a better understanding.
How would you feel about this?

Would be so good! Especially during COVID. We're not allowed computers or charts in the rooms so having access to that would save time and safe PPE! Which were always worried we're gonna run out of. Also nice that we can see the test results right by the patient, rather than looking at them and then walking in. Would be easier and more thorough giving the results while having them in front of you. Would also be easier showing the patient their own results in front of them and explaining them at the same time.

Scenario 5

Suppose you were working a 24-hour long shift and taking care of dozens of patients. Instead of charting handwritten notes for each patient, you have AR glasses that display patient notes on your vision has the option to transcribe your audio notes into digital text notes. These text notes then would be attached to the patient's digital chart. These digital charts also include any notes made by your family physician and other specialists.
How would you feel about this?

Again that would save us so much time! If I were to work a 24 hour shift with dozens of patients, this would be safer so I wouldn't get patients mixed up. Also would be great cause it would be more realistic to chart in real time, which is always encouraged for us- and would also prevent charting errors cause I'd have less of a chance of confusing patients.

Scenario 6

Suppose your unit just had an outbreak of COVID-19 and management has restricted access to your unit. There are no visitors allowed and only authorized hospital employees are allowed in. Suppose you had AR glasses that would scan any hospital employee's ID that would display their information and if they had clearance to visit the unit.
How would you feel about this?

Lol my unit did have an outbreak and the medical officer of health actually restricted our visitation 😂 *but yeah that would be great! Would make people coming in and out more efficiently. Plus we had an incident a couple of days ago where someone snuck in using a porter uniform to see their family member, which is super unsafe when the unit is on outbreak for a reason.*

Scenario 7

Suppose a doctor or nurse needs to give the patient certain medication over a period of time. They view the patient with their AR glasses and adds a virtual note that displays the necessary tasks to be done when checking up on a patient... Later in the day a nurse enters the room and sees that there is a virtual note saying give a certain dose of medication.
How would you feel about having access to a product that performs this?

That would prevent medication errors which can be common during busy days. It would be great to have that virtual note when seeing the patient cause it would basically be direct communication with the doctor/nurse

and what tasks they needed. Would not need to physically speak with them face to face or over the phone to clarify tasks, when's it's laid out in front of you.

Scenario 8

When doing a scheduled round of patient checkups, you finish checking up on a patient but then shortly after they press the assistance button on their bed. Since you recently checked up on them, you don't expect them to require assistance at the moment so you don't see their room light lit up.
Suppose that you were wearing AR glasses that would display a notification on your vision to make you aware that the patient requires your assistance.
How would you feel about this?

Would save me some walking time.. especially if I was on my way to do something else. Plus would help build a better rapport with the patient if I were to attend to their needs sooner.

Scenario 9

In a surgical procedure where you have a limited view/image of what the problem area is (injury, blockage, more medical problems); imagine that you have a pair of AR glasses that help you visualize the problem area as a 3D hologram. You are able to interact with the model by rotating it to view it from a different angle. You can zoom in on the model and/or take it apart into different pieces to see more details about the model.
How would you feel about this?

Greys had that.
In Christina's new hospital.
I feel like that's where medicine needs to go to perform procedures and surgeries more safely and accurately. This would improve patient outcomes and help the team know exactly what to do, rather than waiting to see till they open up a patient.