

PROJECT 2: NOVEL INTERFACES

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eHOFF - AI ASSISTANT

# PROJECT 2: NOVEL INTERFACES

## INTRODUCTION

eHoff is a Virtual Assistant with a built-in holographic display, a touch screen, a microphone, and a speaker that can be used to assist students in Wendt Commons. We designed this device in order to help streamline the flow and Wendt Commons and assist students with learning.

### Problem Domain

Our problem domain about Wendt Commons is on learning. The building's purpose is to be a space where students can come to learn, study, collaborate, design, and invent things.



Our problem domain covered the usability of Wendt Commons' resources and utilizeThe problems we observed were mostly involved with streamlining the process of booking study rooms, tutors, and getting help when needed. During our observations during class-time, a lot of students were wasting time waiting to ask questions from the few available TAs, and some students just were not noticed. In other observations, students spent a lot of time looking throughout the building trying to find a free and available room, some went all the way to Wendt Commons to the 3rd floor looking for tutoring only to find that none were available.

### Setting

For our ethnography we wanted to choose a setting that was used in many different applications. We were interested in spaces that are multi-use, and the particular utilities that these spaces exhibit. We also wanted to choose somewhere on campus that was easily accessible for all group members. We ended up choosing the Wendt Commons.



Wendt Commons is a multi-use building on campus near Union South. The building has three different floors and a basement. The basement is a library and quiet study zone. The main floor has the Makerspace, which is a lab with different tools that students can use to build things. The 2nd floor is a class room/study space with many rooms and projector screens etc. The top floor is a tutoring area, large class room, and private study "offices". We specifically wanted to focus on shared technology and how one single piece of technology can be re-used in many different applications for many different subjects. Initially, when we visited the WISCEL lab, we noticed many types of shared technology including projectors, printers, digital sign-on boards, E-Boards, and laptops. The laptops stood out most to us so we wanted to focus on them.

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For collecting data, we conducted three field tests and four interviews.

## Field Notes

We conducted field tests on the second, third, and fourth floors of Wendt Commons. Each of our team members conducted a field test on the different floors. Each field observation was 1-2 hours in length and the type of activity happening at the time varied.

On the second floor, we observed students working in the Makerspace. Here we saw students working in group tables, studying private rooms, and using the workstations.

On the third floor, we observed students working in class, studying on their own, and working with other students. We were able to notice the importance of both open and reserved rooms in this space.

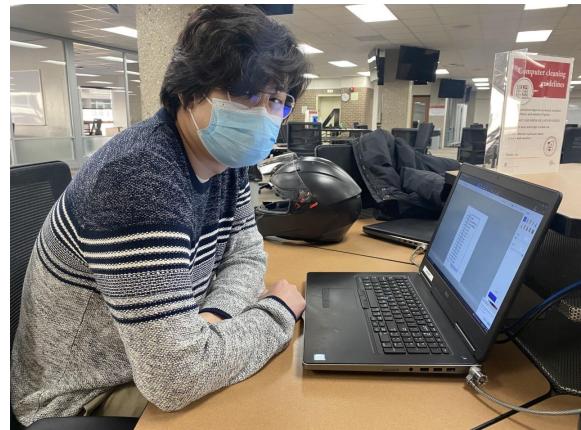
| A     | B  | C                                   | D                                  | E      |
|-------|--|-------------------------------------|------------------------------------|--------|
| Time  | Comments   |                                     | Code 1                             | Code 2 |
| 16:00 | I just arrived at Wendt commons. It's my first time at the building so I'm going to go through all the floors and check out all the rooms to familiarize myself with layout of the building and pick a place to sit.   |                                     |                                    |        |
| 16:10 | I decided to observe the people on the second floor as it had the most people and is pretty lively.<br>The room is comprised of many medium sized tables presumably for group work, small whiteboards, many engineering tools, and some laptops.<br>To my right there is one person working alone on some circuit in a booth. There are other booths that are empty at the moment.<br>To my left are 2 laptops on a stand-up table and some sort of machine.   |                                     |                                    |        |
| 16:15 | In front of there are 3 tables with 5-7 people on each one.<br>The 1st table with 6 people seem to have 2 groups of 3 people as people from each side have yet interact with people from the other side and each group of 3 seem to be closer to each other physically than the other group of 3.<br>Each member of the 2 groups is working on their laptop except for 1 who is using an iPad and is handwriting notes.<br>The 2nd table has 7 people at it and seem to be working together. 4 of them are on laptops, one person has printed papers they are looking at, and the other people in the group. They also have some pieces of wood, wires, and what looks like some 3D printed parts and a circuit board.<br>The 3rd table is comprised of 5 people. 2 people are standing next to a white board and writing things on it while discussing it with the other 3 people are sitting down and working the 2 at the board.<br>The 2nd table seem to be trying to design or build some sort of | 1st table<br>2nd table<br>3rd table | SO, SP<br>WP, DP, MD<br>WP, DP, MD |        |

On the fourth floor, we observed students both in and out of class in the space called the WISCEL lab. We observed from the back of the lab and took notes on what students were doing. We did not limit our field tests to just the shared laptops, we wanted to observe a full spectrum of the space and how everything works together

to produce a productive space. In some there was a class, and in others there was just open study. Those are the two main uses of the WISCEL lab, but how those activities are conducted can differ greatly.

We noticed that taking field notes is one of the easier tasks since it does not require any analysis. You get to sit back and just observe what is happening in front of you. We were able to take a lot of field notes because the space is large and there are a lot of things going on.

## Interviews



When we conducted our interviews, we wanted to make sure we interviewed people from the different breadths of activity. Therefore, we had 4 interviewees. When approaching our interviewees, we confronted them and explained what we were doing here and asked for their consent to interview. We initially approached people who we observed doing certain tasks, or taking on certain roles in the space. We asked a total of five people, and only one person declined. When we conducted the interviews, we sat where we first approached the interviewees. We took a video of the recordings just so we had verbal and visual documentation of how the

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interview happened for reference. We wanted to make sure we had this data for the coding part. We also took notes, and then later when transcribing the interview, we could watch back the video and make sure we did not miss anything.

Conducting interviews was somewhat hard for us. Because we did not have a list of questions, the interviews were more free flowing and we had to adapt to bring the interview in a direction that best suited us.

## Coding

After each of our interviews, we immediately made corresponding affinity diagrams as a group. Then we combined the main ideas into one main affinity diagram that could represent our field notes and interviews. The affinity diagram allowed us to come up with the most important actions and that could be used for coding.



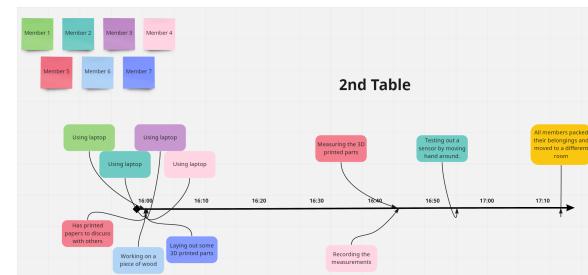
We wanted to keep the coding simple and efficient so we could have

precise data. We were able to come up with important activities that occurred in Wendt Commons for the open codes. Later we classified these into more of a general concept in the axial codes. And lastly, we came up with a simple selective coding.

| A               | B   | C  |
|-----------------|---|--|
| Code Type       | Code Description  | Code   |
| Open Codes      | Working on projects outside of class at Wendt Commons<br>Testing personal and school project using the utilities of Wendt Commons<br>Prototyping working projects using the Wendt technologies<br>Modeling working projects using the Wendt technologies<br>Asking for help from tutors and instructors<br>Working in class on a class exercise at the Wendt Commons<br>Studying outside of class in the study spaces | WP<br>TS<br>PT<br>MD<br>AH<br>WC<br>SO       |
| Axial Codes     | Positive in-class experience (PE)<br>Negative in-class experience (NE)<br>Designing a project (DP)<br>Studying for school (SS)  | WC, AH<br>WC, AH<br>WP, TS, PT, MD<br>SO, AH |
| Selective Codes | Going to Wendt Commons  | PE, NE, DP, SS                               |

## Models

With the observations from our field notes, insights from our interviews, and coding, we made the following model to represent important scenarios, actions, and actors.

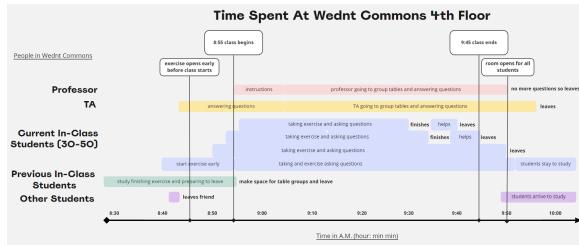


In the model above, we created a Time Model depicting a group of students working together at a table in the Makerspace. Important actions for each student include initially sitting at the table, using their laptops, measuring a 3-D printed part, and leaving the table. We made similar diagrams for two other tables that we observed in the Makerspace.

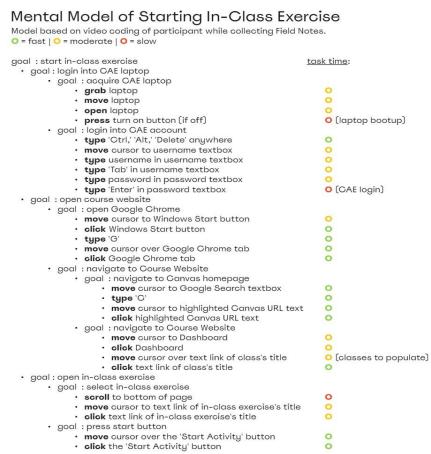
We made another Time Model for observing a class in the WISCEL lab on the fourth floor. In this model, the main actors were the professor, TAs, current in-class students, previous in-class students, and other out-of-class students. From this

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model, we were able to observe the timeline of the class and important events that occurred at different times. In the model above, you can see our Time Model showing students and instructors arriving, their important classroom actions, and when they leave.



Because we found the classroom setting to be so important, we made another model focusing on a classroom action. We made a Mental Model depicting a student arriving in the classroom and starting an in-class exercise that we had observed from our field notes. In this model, we tracked the specific actions the student was doing and the task time for each action. By doing this we were able to find any breakdowns for specific goals the student had. For example, with the goal of acquiring a CAE laptop, turning on the laptop had a slow task time showing a breakdown in the process.



## Findings

One of the things we found from our observations and data from our field and interviews is a frustration of students who want to better utilize the building resources and utilities. Specifically, one important action we noticed is reserving tutoring sessions and private study rooms. Students who wanted to request these resources included both in and out-of-class and students.

Another important breakdown we gathered was the need for assistance while being heavily involved at certain workstations and in-class exercises. We noticed this occurring in the Makerspace and in the WISCEL lab.

We found that in classes in WISCEL lab, the laptops are very important to the work-flow of the class. Because students needed to log into the CAE domain, the laptops had to be set up specifically for the network. Therefore students who wanted to work together had to get there early enough to find a table that had enough open seats. It seemed from one of our interviews that these laptops were certainly outdated. The students are somewhat forced to use these because there is not an easy way setup for them to connect to the domain from their personal devices. The classes we observed were also known as split classes. These promote group work and collaboration to solve exercises. It seemed many students needed help and that there was a bottleneck of the number of TAs to the number of students.

According to our interview with a student, some of them need to wait up to 15 minutes to get help from a TA. For some students who understand the content, they

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are allowed to walk around and help other students. In each class we were able to identify at least three students who took on this pseudo-TA role. From this information, we noticed that many students would benefit from adding additional TAs or professors that would assist in this process. It seemed a lot of students got off-track when waiting for TAs to answer questions, and some never got to finish the activity.

Another important factor we noticed was the inability for students to use their own laptops to complete these exercises. These laptops are quite outdated and take up a lot of desk space. In the interviews, our student expressed to us that using these laptops was not a good use of their time, and it took up a lot of table space that could be used to accommodate more students in larger groups. They suggested that a use of a VNC viewer to login to a CAE virtual machine could be a better solution to this problem. Although not all students mentioned this, we did notice that almost every other student had a personal device of some sort, either a laptop or a tablet that they were also using on the desk at the same time. This seems like an inconvenient use of the WISCEL space. From this, we wanted to know more about the multi-use nature of the space. Without these laptops would it open up the space for more students? Larger group tables? Perhaps even more tables? The answer seemed to be yes. Not all students even used the laptops.

In the other field observation, the students were not in class, instead it was just open work space. These laptops were taking up unnecessary space and not being used by the majority of the occupants. Overall, these large classes that take place

in the WISCEL lab could benefit from adding more TAs, allowing students to access the domain through a VNC viewer (this would also allow for remote connection if students are sick), and the space could be much more accessible to more students and allow for more study space if these laptops were gone.

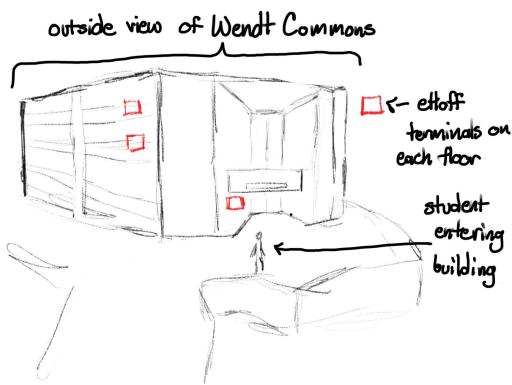
One thing that surprised us is how many different uses that space has, over our observations and interviews there were people in that space for at least 5 different reasons. This made our ethnography a bit more broad than what we expected, but we were able to identify the main goal and what we wanted to focus on. A lot of our field observations are quite useful as watching how people interact with technology is often the best way to understand what they like/dislike about it. We learned that in this seemingly “optimal” learning space, there were some improvements that could be made to streamline workflow and optimize collaboration.

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## IDEATION

### Solution Ideas & Initial Sketches

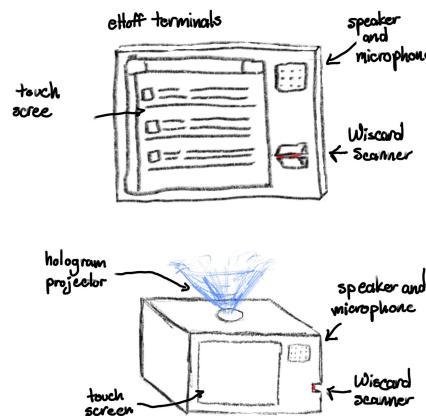
Because of the multi-use nature of Wendt Commons, our solution had to be something that serves more than just one purpose. We wanted to incorporate all aspects of Wendt Commons into our solution. Originally we were going to focus on designing something that was intended to just be used during class, either an AI assistant, or some device that students could use to call an extra TA over or some one to help. After thinking about that idea, we thought, why not make the AI assistant available in all rooms. Besides, it fits the futuristic nature of the interior of that building. We decided to incorporate a terminal on each floor, where you can book rooms, tutors, or reserve personal study space.



Those terminals can also answer questions about the building, or be used to help. These would be found near the entrance to each floor. Another part of the design we wanted to be accessible to wherever a student was, this is how we came up with the end point eHoff AI's that are located on almost every table as well as built into different sections of the Makerspace. These can be used hands free to answer questions, display guides or tutorials, and even use its AI power to teach

a student just like a TA. Another approach we were initially interested in was a VR headset that students could wear to interact with virtual TAs or even real life TAs that were in a different location. These single problem solutions just didn't fix what we sought after.

The challenging thing was designing something that could be useful in all applications, a VR headset would be impractical for booking study rooms or finding a tutor, an AI TA that was only located on the top floor tables wouldn't solve the problem of managing the buildings rooms and tutors. So we had to figure out how to combine all important aspects of our design into one.



Here is an example of the endpoint systems found on work tables all across the Commons. It can display anything possible and can be interacted with hands free. This is especially useful in the Makerspace because a lot of the time everyone's hands were busy and wouldn't be able to reach for their laptop, but would instead have to pause what they were doing. Because of this we felt it was important to design something that can be out of the way, small, and hands free.

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### Noteworthy Interactions

Some students came to Wendt Commons to get additional support in the form of tutoring or meeting with faculty members. And since these resources are in the 3rd and 4th floor students had to go all the way up to check if any spots are available. Students also had to pull out their laptops or iPads in order to reserve spots in tutoring even if they were already at Wendt Commons.



Here is an example of a student reserving an appointment from a different floor in the building without using their own personal device which sends the TA or tutor a notification informing them of the reservation so they could prepare for it.

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# PROTOTYPING

### Personas

We developed personas focusing on students and instructors that used Wendt Commons. The students can be categorized as in-class and out-of-class students. And the instructors can be divided into TAs and professors. With these factors taken into account, we combined them with stories taken from our field notes and interviews, and produced the following personas.

Max - Age 19, Computer Science & Computer Engineering student. Max represents a struggling student in his calculus class. Max uses Wendt Commons because he has class there and is familiar with the space.

*Goals:* Requesting tutoring for his classes he is struggling with.

*Frustrations:* Online tutor request system is clunky and out-of-date. No easy way to see what rooms are available.

Sam - Age 21, Computer Engineering student. Sam represents a student who is studying for an upcoming exam. Sam wants a private study room so he can focus distraction free. Sam also represents an in-class student with a class in the WISCEL lab on the fourth floor.

*Goals:* Reserve a private study room to study for ECE 220 exam and ask for help for

*Frustrations:* Difficult to reserve study rooms and hard to study in many of the open spaces in Wendt Commons. Bothered by how long he needs to wait for questions to be answered in class.

Dan - Age 20, Mechanical Engineering student. Dan is the depiction of an out-of-class student who commonly uses

the Makerspace for his own personal projects and for class projects. Dan often uses the workstations in the Makerspace for soldering and 3-D printing.

*Goals:* Use reference manuals and class materials while in the Makerspace.

*Frustrations:* Not being able to access notes and materials while soldering in the circuit workstation.

Alyssa - Age 23, Math Grad Student. Alyssa is a TA/Tutor for Math 234 (ECE 220/ Multivariable Calculus). During off-times, Alyssa spends it in Wendt Commons waiting for someone to request tutoring, then responds to the request if available, and meets the student in the designated room.

*Goals:* Respond to tutor requests and help students with math related work.

*Frustrations:* Not being able to do her job as a TA/Tutor and help students in need.

### Design Vignettes

For our video prototype, we developed four design vignettes: reserving a tutoring session, reserving a private room, requesting a reference manual, and asking for TA assistance.

#### Vignette I: Reserving a Tutoring Session

Our first design vignette covers an out-of-class student reserving a tutoring session provided by a TA via the eHoff terminal. Max enters Wendt Commons and stops at the entrance to eHoff. At the entrance of the building, there is an eHoff device located on the wall. Since Max is struggling with calculus, he wants to request a tutoring session with a TA. Max goes up to the eHoff device and asks if there are any tutoring sessions available for calculus. With

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the data about Wendt Commons' resources and utilities, the eHoff AI can tell the availability of tutoring sessions. The eHoff AI notices an open calculus tutor and tells Max the available times. Max books an open time. Later, Max goes up to the tutor on the fourth floor.

On the other hand, Alyssa, a TA, receives a notification on an eHoff device situated on the table in the tutoring room. The notification allows Alyssa to set up and prepare materials in preparation for Max.

### Vignette 2: Reserving a Private Room

In the second vignette, an out-of-class student is reserving a private study room on the third floor. Sam enters Wendt Commons looking for a quiet and private place to study for his ECE 220 exam. It's convenient for Sam to study in Wendt Commons because his class for his final meets on the fourth floor. He goes up to the third floor and approaches an eHoff terminal. On the wall, there is an eHoff terminal which shows the availability of the rooms. Sam goes up to the device and reserves a private study room. This allows Sam to effectively study for his final exam without any disturbances or conflicts from other students.

### Vignette 3: Requesting Reference Manual

Our third design vignette depicts an out-of-class student requesting a reference manual while using a workstation in the Makerspace. Dan is soldering circuits for an Arduino Beetle, the circuits workstation for his final project. Dan is in the middle of soldering an integral sensor to his Arduino Beetle so he cannot get up. However, he needs to check his notes in order to solder. But he left them at a different table. Thus,

Dan asks eHoff to pull a soldering tutorial for the Arduino Beetle. An eHoff device is right next to Dan and there is one located at each of the circuiting workstations. eHoff responds to Dan and projects a circuiting tutorial from his class. This allows Dan to keep his hands on the solder and Arduino beetle.

### Vignette 4: Asking for In-Class Assistance

In our fourth vignette, an in-class student is asking for help from an instructor during an in-class exercise on the fourth floor. Sam is working on his in-class exercise at a group table, but he is confused on the first problem. He raises his hand for help, but the instructor, Alyssa, is busy answering another student. Sam has raised his hand for a couple of minutes and still not received any assistance. Instead, Sam turns on eHoff by touching the screen on the eHoff device located on his group table. Sam then asks eHoff to explain the first question. Using the in-class exercise data provided by the class faculty and its own AI, eHoff re-explains the question and offers hints to Sam. This allows Sam to receive help for the question and not fall behind during this activity. And in turn, frees Alyssa from having to help Sam and makes her job easier.

### **Script**

Due to the time limit of the video prototype, we recognized we needed to constrain the number of our personas. We combined our personas into one student, Max, and one instructor, Alyssa. We believe it's pretty realistic to imagine one student using Wendt Commons for the multiple actions of our initial personas.

### Description of eHoff

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Narrator: eHoff is an AI assistant that's integrated with Wendt Commons resources and equipment that aims to help students and instructors achieve their goals for learning. The AI system will have multiple terminals on different floors and workspaces that can be interacted with by the usage of a microphone and touchscreen. eHoff can respond to students and instructors through a speaker or hologram visual. eHoff also has a Wiscard scanner to verify that only authorized persons are using its service.

### Scenario 1: Reserving a Tutoring Session

Narrator: Max is an engineering student who uses eHoff to utilize Wendt Commons resources. Max walks into Wendt Commons and goes up to the eHoff device looking for a calculus tutor.

Max: Hey eHoff what time slots are available for calculus tutoring tonight?

eHoff: There are open slots later today at 7:30 pm and 8:00 pm.

Max: Please, book the 7:30 slot.

eHoff: please scan wiscard.

(Max scans the card)

eHoff: booking complete

Narrator: After booking is complete. Max then goes up to his tutoring room at the time he booked, and the tutor is ready and waiting for him.

Narrator: The assigned tutor gets a notification from eHoff at the time they are booked for. This gives the tutor time to set up and prepare material for the student.

### Scenario 2: Reserving a Private Room

Narrator: Max has an ECE 220 exam and he is desperate to study before the final so he wants to request a room where he can study alone.

Narrator: eHoff has a terminal at the entrance of each floor. eHoff can be used to see room availability as well as to reserve one of the private study rooms.

Narrator: As you can see here, Max is reserving a room for a private study session on the second floor. eHoff devices are also found on each table of the private study rooms for assistance to help each of the students.

### Scenario 3: Requesting Reference Manual

Narrator: In addition to serving as a building resource manager for rooms and tutors, eHoff can also be used as a personal assistant for students who are in need of reference manuals and other helpful material when using equipment in the Makerspace.

Narrator: Max is in the middle of soldering for his final project. His hands are busy and he can't get up to look at his notes for the soldering guide.

Max: Yo eHoff, can you please pull up the Arduino Beetle soldering tutorial, please?

eHoff: Now playing: how to solder sensors to Arduino Beetle.

### Scenario 4: Asking for In-Class Assistance

Narrator: On top of being able to pull up media and other information from the internet, eHoff also serves as a virtual TA in learning environments.

Narrator: As you can see Max is confused on what he has to do for his assignment,

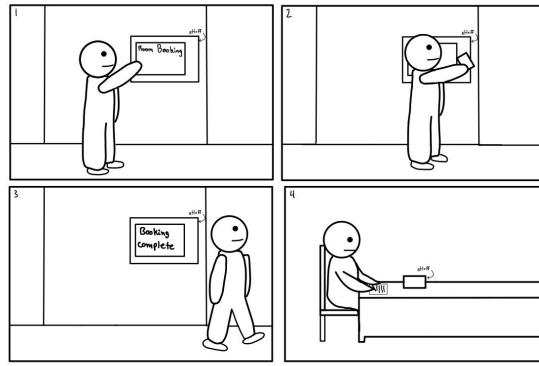
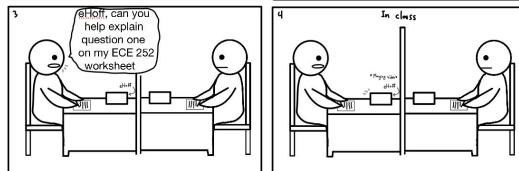
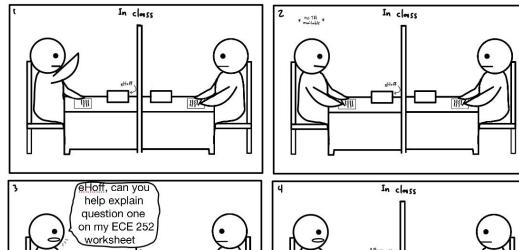
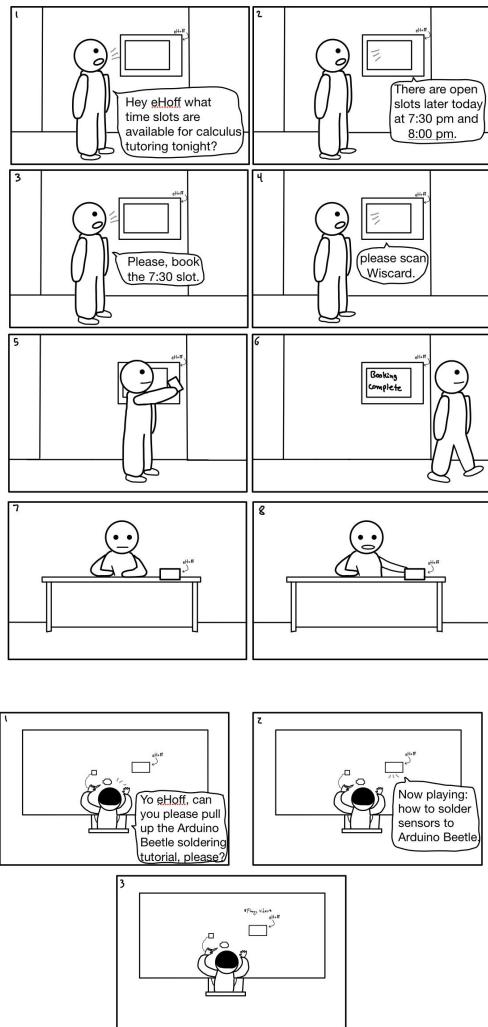
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but there are no TAs available. Instead Max activates eHoff.

Max: eHoff, can you help explain question one on my ECE 252 worksheet?

(eHoff pulls up worksheet and restates question)

### Storyboards



### Video Production

For the setting of the video prototype, we, of course, went to Wendt Commons to record. We decided to take photographs rather than a video recording so the viewer could better see the details of each scenario. We went to the actual floors where each scenario would truly occur. Thus, we took pictures at the entrance, stairs, second floor, third floor, and fourth floor.

Despite using photographs rather than a video recording, we followed our script while we were at Wendt Commons to make sure we illustrated the important details of each scenario. This also allowed us to make any changes to the script that we noticed while recording.

We brought a physical prototype of our eHoff device so we could better

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illustrate our personas' interaction with it during our scenarios. But we did not use a physical prototype for the eHoff terminals on the walls located at the entrance of each floor. For these eHoff terminals we would later edit them as well adding changes to our physical prototype.

Once we were done recording in Wendt Commons, we edited our photographs to add the eHoff terminals on the walls and technological features to our physical prototype. Then we adjusted our script to the details that we noticed while at Wendt Commons. Afterwards, we added narration and voice acting for our personas and the eHoff device. We made final touches by adding transitions, text and music in iMovie. We struggled to keep the video below three and a half minutes because we want to include more personas like another student or an instructor. However, we felt that we had covered the most important persona being the student very well.

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# FINAL SOLUTION

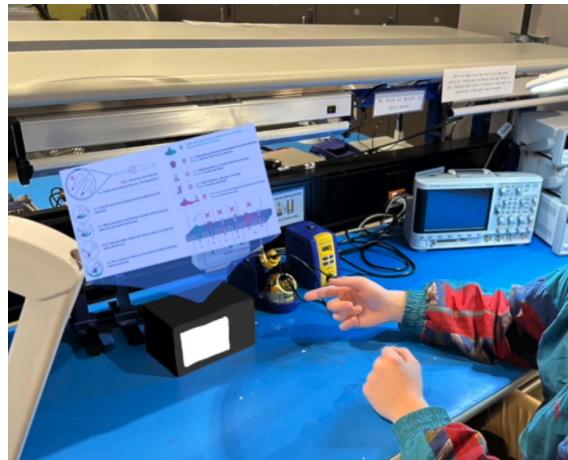
Our final solution was a video prototype depicting our eHoff devices being used in different scenarios in Wendt Commons. The terminals and devices stationed throughout allow for the interactions between students, instructors, and the eHoff AI. For the eHoff terminal and devices we decided to use a simplified version of our initial prototype.



In the picture above, one of the eHoff terminals is shown. These eHoff terminals would be placed at the entrance of the building and on each of the floors. The eHoff terminals would be connected to the building's resources and utilities.

The white rectangle represents a touch screen. On the touch screen, current classes, tutoring sessions, and room availability would be displayed for students and instructors. This allows a student to quickly check how busy Wendt Commons is in general. In the top right corner, the gray rectangle represents the microphone and speaker input and output for the eHoff terminal. Thus, students can speak to the eHoff to ask questions about the current status of the building and make reservations for tutoring and study rooms. And eHoff will respond back to the student, allowing for hands-free usage. And in the bottom

right, there is a traditional Wiscard scanner. Students can use the Wiscard scanner to confirm requests for tutoring and study rooms. The Wiscard scanner ensures that only authorized students are using Wendt Commons' resources and utilities.



In this picture, one of the eHoff devices is shown in a circuiting workstation in the Makerspace. Unlike the eHoff terminals, these eHoff devices would be placed in classrooms, study rooms, and workstations throughout the building.



Similar to the eHoff terminals, the eHoff devices have touch screens which are depicted in the white rectangles. The devices also contain a microphone and speaker input and output for audio interaction. And lastly they have a hologram

## PROJECT 2: NOVEL INTERFACES **FINAL SOLUTION**

projector on the top which allows the device to show information such as images, diagrams, videos, and more in a versatile setting.