

CS-570 INTRODUCTION TO HUMAN-COMPUTER INTERACTION  
Fall 2021

PROJECT 2: NOVEL INTERFACES  
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# PROJECT 2: NOVEL INTERFACES

## INTRODUCTION

For our second project we investigated the problem domain of interaction between library employees and IT support in a library IT setting. We conducted our ethnography specifically at the LTG (Library Technology Group) helpdesk located in Memorial Library. IT technicians at the helpdesk interact with other library patrons and employees via a variety of methods. These include phone calls, emails, instant messages, and in person interactions.

We choose this setting specifically because many employees at the university libraries are unfamiliar with a lot of current technologies. Most librarians currently employed by the libraries are an older demographic who have trouble navigating digital interfaces. This is opposed to students who are likely more tech-savvy. Because of the limited knowledge of digital systems that the employees the LTG helpdesk interacts with have, these employees are especially reliant on the helpdesk to resolve a large range of issues that those that grew up with digital systems might not be faced with. We saw this as an opportunity to brainstorm and develop possible solutions to increasing the efficiency of communication between library employees and LTG.

This setting was especially conducive to conducting a design ethnography due to the relatively relaxed nature of the helpdesk. With at least 2-3 student employees working at the helpdesk during any given shift, there were many opportunities to not only investigate how

these IT technicians interacted with the users they seek to assist, but also with each other. Also, because the work of the helpdesk is reactive in nature, as a majority of tasks given to students come from library employees and patrons submitting requests for assistance, there was plenty of downtime between requests to interview helpdesk employees while they were in their work setting.

As previously stated, the forms of communication between IT technicians and library employees are largely antiquated systems, such as phone or email. Email interaction tends to be slow and stilted, leading to a lot of downtime waiting for employees to respond to emails from the helpdesk. Phone interactions are much faster, but don't allow for efficient troubleshooting of software and hardware issues as library employees can often convey inaccurate information about the state of their computers, or have trouble interpreting instructions from helpdesk staff. We sought to focus on these forms of communication specifically, as they seemed the most opportune to innovate upon.

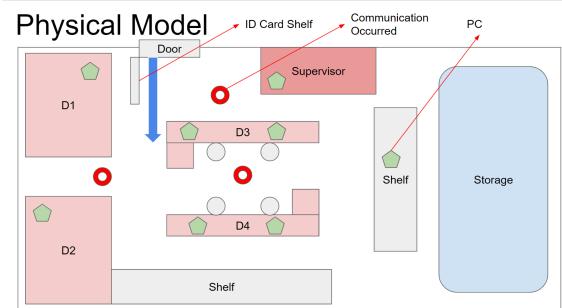
## PROJECT 2: NOVEL INTERFACES UNDERSTANDING

As previously stated, for this design ethnography, we decided to use the Memorial Library IT help desk as our setting. The help desk is located in one large office which all employees share and is in the corner of the third floor of the library.

Our goal was to observe how IT technicians at the desk interacted with those that asked for their assistance. This included noting the tone of conversation, forms of communication, and methods of issue resolution preferred by IT technicians.

This choice of setting and activity supports our understanding of a potential interface which will enable employees to resolve remote issues more quickly and efficiently than they can now. This is because we directly observed many instances of employees resolving remote issues and witnessed the frustrations and breakdowns they encountered while doing so.

From our initial sweep of the setting, we observed that, while the office room was large, the space that was used a vast majority of the time was in the center, and the peripheral areas were not interacted with much. Employees stayed primarily at their desks, both when using technology to communicate or solve issues as well as when talking to one another in person. Because of this, we decided to focus on this central area and the way the employees behaved within it.



*Figure 1: Physical Model of LTG helpdesk*

We did three rounds of fly-on-the-wall observations as well as interviews. For each of these three instances, we observed the helpdesk for approximately 2 hours. By doing this we hoped to record many instances of helpdesk employees interacting with the users they serve and with each other. While observing the office, we took field notes and asked interview questions when opportunities were available.

Student ID	First & Last Name	Description	Planned	Actual	Intervention	Comments	Notes
I-584501	I - Heidi Deak	Employee came to work to help the kids, and the employee was not able to do their job because they were not trained on how to do their job. The employee did try doing what ever was needed.	Student A: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."	Student A: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."	Student A: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."	"The employee wants you to stay with daily communication, so I didn't bring them in earlier."	Student A: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."
I-584501	I - Heidi Deak	Employee came to look at their email and helped Student A with her work. The employee did not know what to do with the work and did not know how to help each other to handle the project request.	Student A: "Do you remember a picture I posted earlier?"	Student A: "Do you remember a picture I posted earlier?"	Student A: "Do you remember a picture I posted earlier?"	"How can we handle this?"	Student A: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."
2			Student B: "What do you want me to do?"	Student B: "What do you want me to do?"	Student B: "What do you want me to do?"	"What did we do last time?"	Student B: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."
3			Student B: "I think I am still having the same problem with her." "I think I might have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."	Student B: "I think I am still having the same problem with her." "I think I might have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."	Student B: "I think I am still having the same problem with her." "I think I might have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."	"How can we handle this?"	Student B: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."
4			Student B: "OK."	Student B: "OK."	Student B: "OK."	"Is it possible to work with your partner?"	Student B: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."
I-584501	I - Heidi Deak	Student A received the link from Future A. Since Student A did not receive the link, she did not open it. The student decided to go check and found the problem is gone.	Student A: "Hello, I am learning the link steps. Now I help you guys with the link steps."	Student A: "Hello, I am learning the link steps. Now I help you guys with the link steps."	Student A: "Hello, I am learning the link steps. Now I help you guys with the link steps."	"Are you familiar with the geography of the area? Do you know where the place is located?"	Student B: "Yes" "When I check with my supervisor, he said that you can use the link steps to help you guys with the link steps."
2			Patricia B: "OK, I think I can use the library instead. What about you? Do you think you can use the library instead?"	Patricia B: "OK, I think I can use the library instead. What about you? Do you think you can use the library instead?"	Patricia B: "OK, I think I can use the library instead. What about you? Do you think you can use the library instead?"	"Do you have any family members that can help you with your assignment?"	Patricia B: "Yes" "My mom can help me with my assignment."
3			Student A: "Okay, I will use your PC and you can call me if I don't understand anything."	Student A: "Okay, I will use your PC and you can call me if I don't understand anything."	Student A: "Okay, I will use your PC and you can call me if I don't understand anything."	"Do you have any family members that can help you with your assignment?"	Student B: "Yes" "My mom can help me with my assignment."
5			Student A: "Patricia, I will use your PC and you can call me if I don't understand anything."	Student A: "Patricia, I will use your PC and you can call me if I don't understand anything."	Student A: "Patricia, I will use your PC and you can call me if I don't understand anything."	"Do you have any family members that can help you with your assignment?"	Student B: "Yes" "My mom can help me with my assignment."
6			Patricia B: "OK, I think I can use the library instead. Thank you for your help."	Patricia B: "OK, I think I can use the library instead. Thank you for your help."	Patricia B: "OK, I think I can use the library instead. Thank you for your help."	"Do you have any family members that can help you with your assignment?"	Patricia B: "Yes" "My mom can help me with my assignment."
I-584502	I - Paul Deak	Employee who did not bring his laptop to work was happening in his workplace, how to set up a laptop for another member.	Student A: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."	Student A: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."	Student A: "I think I would have to go back to the office and ask my supervisor if I can do my job differently or if I need more training."	"Do you have any family members that can help you with your assignment?"	Student B: "Yes" "My mom can help me with my assignment."
2			Student A: "OK, you can use my laptop."	Student A: "OK, you can use my laptop."	Student A: "OK, you can use my laptop."	"Are you now available with the communication?"	Student B: "Yes" "My mom can help me with my assignment."
3			Student B: "I think I am still having the same problem with your laptop."	Student B: "I think I am still having the same problem with your laptop."	Student B: "I think I am still having the same problem with your laptop."	"Do you have any family members that can help you with your assignment?"	Student B: "Yes" "My mom can help me with my assignment."
4			Student B: "I think I am still having the same problem with your laptop."	Student B: "I think I am still having the same problem with your laptop."	Student B: "I think I am still having the same problem with your laptop."	"Do you have any family members that can help you with your assignment?"	Student B: "Yes" "My mom can help me with my assignment."
5			Student B: "I think I am still having the same problem with your laptop."	Student B: "I think I am still having the same problem with your laptop."	Student B: "I think I am still having the same problem with your laptop."	"Do you have any family members that can help you with your assignment?"	Student B: "Yes" "My mom can help me with my assignment."
6			Student B: "I think I am still having the same problem with your laptop."	Student B: "I think I am still having the same problem with your laptop."	Student B: "I think I am still having the same problem with your laptop."	"Do you have any family members that can help you with your assignment?"	Student B: "Yes" "My mom can help me with my assignment."

*Figure 2: Snapshot of Field notes*

After completing these three rounds of observations, we identified the key players in the observation of the desk and interviewed them further to gain a better understanding of how the helpdesk functions and the systems in place to communicate with users requiring assistance.

# PROJECT 2: NOVEL INTERFACES UNDERSTANDING

We found that what emerged as important from our analysis was that student workers usually interacted with their patrons via email. So, they spent most of their work time in the office, working on a computer. However, in some cases, they were asked to visit and see what problems their customers were experiencing. Therefore, supervisors often asked student workers about how their work was going, not in a forceful manner but freely. They started the conversation with daily topics. They behaved as if they were talking to their friends, laughing. From our perspectives, this atmosphere looked overall bright.

In addition, we followed our informants to see how they interacted with patrons when they went to see them in person. They first informed the supervisor that they were going to meet a patron and what problem the patron was experiencing. Then, the worker listened to the customer's problem area and said they would call them back when they resolved it. After solving it, the worker briefly explained why the issue occurred. It seems that they did not talk a lot about technical stuff. Rather, they both showed respect for each other, and the atmosphere looked friendly.

Open coding (concepts)	Axial coding (categories)	Selective coding (causal relationships)
Getting ready in the morning casually; employees communicate well; employees help each other; employees foster relaxing environment; employees communicate in a friendly manner; employees are understanding of one another	Employees getting along and respecting each other	
Helping a patron with an issue in person; patron responding nicely; patron; employees give instructions casually; employees following instructions; employees assuming others get their work done; employee receives help from another; employees work together; employees communicate well; patrons are thankful; employees solve problems; Employee struggling at work; employee has trouble finding equipment; employee has trouble getting into office; employee needs to come back physically to help; employee doesn't know where everything is in library; employees seem a bit bored; employees struggle to solve problem in person; employees prefer to solve problems virtually	Employees solving problems efficiently	
Employee struggling to debug issue with poor remote connection; employee struggles to remember something he typed; employee doesn't get responses from patron's emails issues virtually	Employees running into issues in person	
	Employees running into issues virtually	Employees interacting with people

Figure 3: Snapshot of coding done on our observations

While communication between IT technicians and their patrons was friendly, we did observe breakdowns in the interaction process. Email communication was especially prone to breakdowns, as patrons of the helpdesk were often slow to respond to emails and would often give incorrect information, or not include information requested by the helpdesk in their replies.

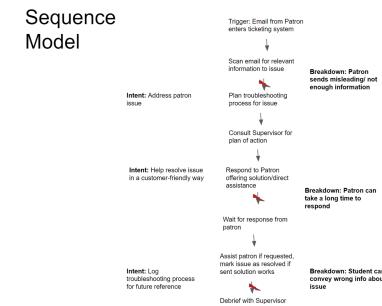


Figure 4: Sequence model showcasing breakdowns in email communication

Phone communication was also prone to breakdowns. Patrons of the help desk often had trouble interpreting instructions from IT technicians over the phone, as well as conveyed misleading information about the state of their issue due to a lack of understanding about digital systems. This confusion often led to phone calls taking a long time to complete, or IT Technicians offering to address the issue in person if possible rather than fumble with communication over the phone.

## PROJECT 2: NOVEL INTERFACES IDEATION

As we mentioned in the previous segments, we chose to work with the IT help desk of the Memorial Library as our setting, and our focus was to observe how student workers interact with their patrons.

Through thorough observations, we came to see some breakdowns that existed in the setting. More specifically, there were limitations on remote communication between patrons and student workers. For example, a patron found it difficult to explain one's problem via email because it usually involves convoluted software knowledge. In addition, a patron would not expect to receive immediate feedback from the help desk. With these limitations, we started to consider the design ideas to support the interactions we identified in our ethnography.

Our group built several design ideas that we think will enrich our ethnography. One idea is to make use of video call functions for communication. As the problem domain involves lots of complicated technical concepts, a patron might want to show their PC screen. We expect a technician to figure out the problem effectively through a video call.

Similarly, remote control functions would fit well to solve many communication problems in the setting. A technician can control a PC remotely, then check the problem directly through remote control. The actors can save time because they do not need to meet up or explain complex things. However, this method requires the patron to download a remote control program on their PC, which we think is a little too much.

Of all, the most powerful suggestion is to establish a robot that helps technicians assist a patron in fixing something. The robot can aid in communication among the actors on many levels. Patrons expect to receive an immediate response from the help desk and better explain one's situation through readable user interfaces of the robot.

With the last design idea, our group built a couple of sketches and possible scenarios about how the robot is used in the setting. We made three sketches as follows:

- A technician assists a patron in fixing something via telecommunication through a robot.
- An IT technician resets a server at a remote location via communication with a robot.
- A patron activates a robot to receive assistance from a technician.

Then, we made detailed scenarios, as shown in the image below.

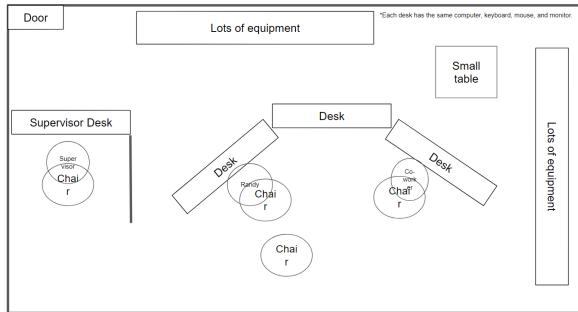
1. Frederick is a circulation technician at the local library. Using his computer he logs books returns and checkouts throughout the day. Frederick doesn't have much experience with computers beyond his work duties, so when he presses a button on his monitor and it suddenly switches to a new input, he is at a loss. Luckily, his library has an IT support group. Unfortunately, this IT group is in a different building and he needs support immediately. Frederick calls the IT office to ask for assistance. Llewellyn is an IT technician that picks up Fredericks call. Frederick explains that he hit a button and his monitor switched to a new screen. He needs assistance immediately as there is a line of people waiting to check out books. Llewellyn activates the remote assistance robot behind the circulation desk. The remote assistance robot has adjustable arms and hands to assist with hardware issues. Llewellyn can also see first person through a camera on the robot, and his face is streamed to a screen on the robot's upper body. Llewellyn directs the robot to Frederick's monitor and presses the input button. This switches the input back to the desktop and resolves Frederick's issue. Llewellyn then returns the robot to its docking station and disconnects.

*Figure 5: Scenario 1*

The first scenario shows how a remote control robot could be in use. In the play, the patron Frederick is a circulation technician and wants to ask for assistance from the help desk because he presses a button on his monitor by mistake. Since he needs assistance immediately, he

## PROJECT 2: NOVEL INTERFACES IDEATION

attempts to activate the remote assistance robot behind the circulation desk, not waiting for an assigned technician. The robot has adjustable arms and hands to assist with hardware issues. An IT technician controls the robot to solve the ongoing problem, as shown in Figure 2.



*Figure 6: An IT technician controlling a remote control robot at the office.*

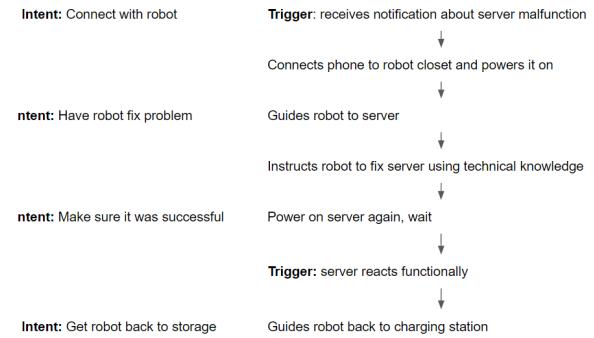
Thus, this design idea sounds very time-efficient for both the technician and patron, while it has a significant drawback for a robot to be in place at a patron's location.

- Randy is an IT technician at a local library. When IT problems are not solvable with typical remote means, he finds himself having to walk or even drive out several miles to handle these types of problems. They most commonly occur when servers are experiencing issues. However, recently his IT workplace has implemented robots that are stationed in most server locations. In one situation, while going about his typical workday, Randy receives a notification that one of the servers providing services to a library all the way across campus. Instead of feeling frustration like he usually would, he now instead activates the robot at this library. Using a set of controls he is able to use either on a desktop or on his phone, Randy commands the robot to leave its station and move towards the malfunctioning hardware of the server. Using a camera system, he is able to accurately control where the robot is going. He moves the robot and instructs it to reset the server hardware that is malfunctioning. It does so with ease, as it is designed specifically for interaction with these servers. After a few minutes, the server is back online and functioning. Randy instructs the robot to go back to its station and all is well again.

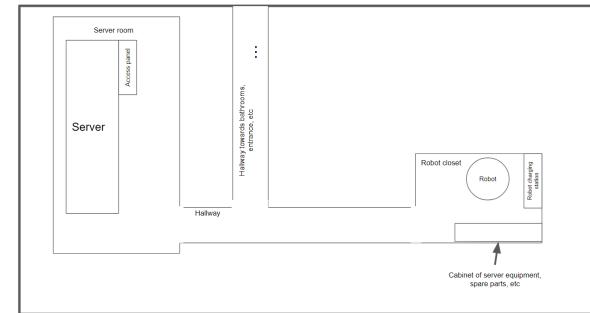
*Figure 7: Scenario 2*

The second scenario shows how to troubleshoot server problems effectively, the most common issue. In the play, a technician, Randy, finds that many problems are because a server is malfunctioning. Not having to walk or drive out several miles to handle these problems, he attempts to use a robot stationed in most server locations.

So, asked to solve a server problem, he uses a robot either on a desktop or his phone. Then, Randy controls it to reset the server hardware not up and running, looking through the camera attached to the robot. Figure 4 shows the process of how the robot works.



*Figure 8: Sequence model for scenario 2.*



*Figure 9: Server Room*

After done with work, he moves the robot back to its station, as shown in Figure 5. This design idea has similar pros and cons as the first scenario. However, since someone must address server problems in person, a remote control robot appears to play out effectively.

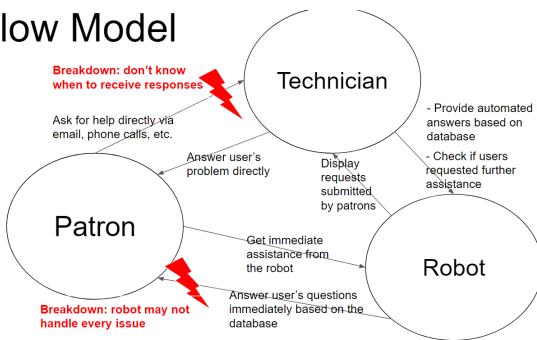
## PROJECT 2: NOVEL INTERFACES IDEATION

3. Sara is a student at UW-Madison, majoring in Computer Science. She is a freshman and doesn't know much about campus life. She needs urgent assistance from the help desk at this moment. She wants to access a library resource like books for her assignments but does not know how to do it. Her assignment is due today. She is anxious if her problems would be resolved today because there are lots of variables going on with the process of asking for help from the help desk; a specialist may not contact her immediately for some reason. So, she decided to get help from the robot that was recently published by the help desk because she thought her problem was kind of light. The robot is an automated service that patrons can expect to receive immediate responses. So, she activates the robot, and it offers a bunch of options to choose from, which explains her situations the most: Technical Issues, Access Library Resources, etc. She selects the option Access Library Resources, and then the robot redirects to the information page showing how to look up the library resource. With this incredible technology, she could resolve her issue within a few minutes.

*Figure 10: Scenario 3*

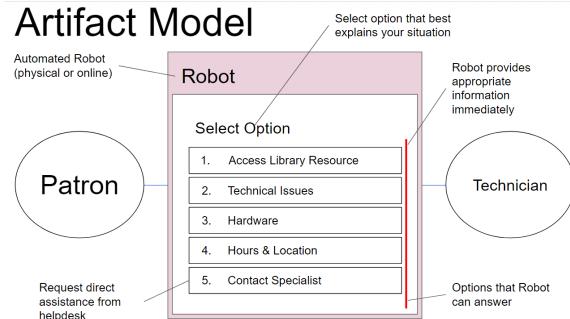
The last scenario shows how a patron would use the robot to ask for help from the help desk. In the play, the fictional character Sara is a freshman who lacks knowledge about campus services. She needs urgent assistance from the help desk to access library resources.

### Flow Model



*Figure 11: Flow model for scenario 3.*

As shown in Figure 7, patrons often get late responses from the office, so she decides to use the robot. She connected to the robot using her phone and followed the instructions shown through the robot, as shown in Figure 7.



*Figure 12: Artifact model of the robot.*

She inputs the option that best explains her situation, and the robot returns optimal output immediately. The process lasts short, not requiring direct assistance from the help desk. However, the robot does not cover every problem. In those situations, it redirects the patron to the next available technician. So, there is a limitation that the robot cannot deal with every issue, but it is helpful in most situations.

In a nutshell, we focused on some design ideas that would solve ongoing problems in our ethnography and verified the availability of these ideas by looking at the corresponding sketches and scenarios for each of them. Using these scenarios, now we move on to the next segment to develop video scenarios in detail.

## PROJECT 2: NOVEL INTERFACES PROTOTYPING

In the previous segment, we created several textual scenarios about the application of remote control robots. Now, we are moving forward to developing video scenarios for the first two scenarios.

For the first scenario, we have two actors, Llewellyn and Frederick. Llewellyn is a maintenance engineer, and Frederick is a patron who works as a librarian.

Through qualitative data from our ethnography, we created personas and vignettes of the two actors. Please look at the following figure.

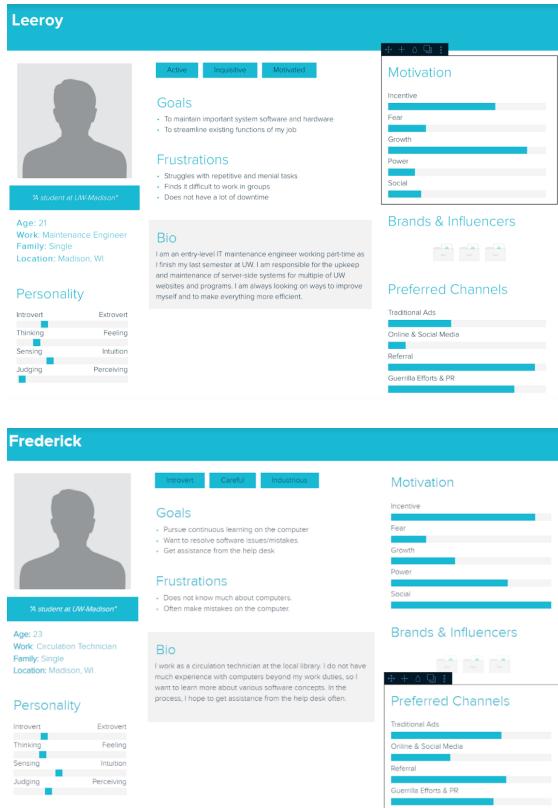


Figure 13: Personas and Vignettes of Llewellyn and Frederick

Leeroy pursues self-development to maintain significant system software and hardware using the existing functions of his job. Looking at the motivation chart, he is a

person who is adventurous and seeks to learn new things.

Frederick works as a circulation technician and pursues continuous learning on the computer. Looking at the motivation chart, he seems to be a social person, and he often gets assistance from the help desk.

With the information about the actors, we created the script and storyboard of this scenario, as shown in Figure 14.

"Frederick sits working at his desktop computer, rummaging through files and logging information on books"  
"He reaches over to take a sip of his coffee and accidentally presses the input button on his monitor, causing the screen to turn black"

Frederick : Oh for goodness sake!  
"Frederick taps the keyboard and moves the mouse to no avail"  
Frederick : I guess I should call the helpdesk...  
"Frederick picks up his phone and dials the number for the IT support desk"  
Cut to helpdesk, Llewellyn looking over technical things before hearing the phone ring

Llewellyn: Library IT, how can I help you?  
Frederick : Hello. I accidentally pressed a button on my screen and now its black!  
Llewellyn: I see. Let me take a look.  
"Llewellyn executes some commands on his computer"  
Cut to robot docking station. Robot boots up with Llewellyn's face on the display  
"Frederick approaches the robot"

|  
Frederick : My computer is right over here  
"The robot follows Frederick over to his computer at the desk and looks at the monitor"  
Llewellyn: Ah, I see, you must have switched the input on the monitor. Let me fix that for you.  
"The robot presses the input button and the monitor once again displays the desktop"  
Frederick : Oh wow! Thank you so much!

Llewellyn: You're welcome. Have a nice day!  
"Llewellyn directs the robot back to its docking station as Frederick gets back to work"  
"Llewellyn disconnects from the robot and gets back to work"

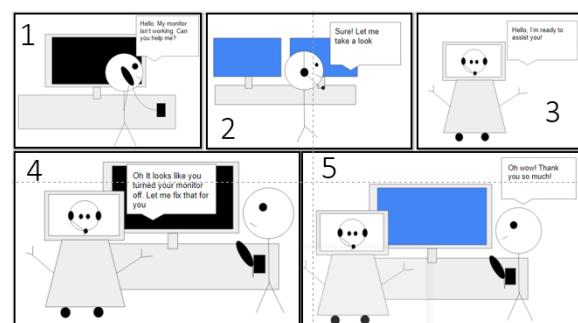


Figure 14: Script and Storyboard for SI

## PROJECT 2: NOVEL INTERFACES PROTOTYPING

For the video production process, our group took turns playing the two actors at the WSUM office. Two of our group members played Frederick and Llewellyn, and the other recorded it.

The video begins with the scene where Frederick works on his desktop. We reproduced the situation in which Frederick pressed a monitor button by mistake. Frederick made a phone call to the office, and Llewellyn tried to connect to a remote control robot to handle the issue. The robot in the video is a wireless robot car, and we decorated it with paper to make it more realistic. Also, we used Zoom to represent video call functions. In addition, we temporarily attached a stick to the robot for adjustable arms. You can see Llewellyn successfully assists Frederick in fixing the problem via the robot.

For the second scenario, there are two actors, Frederick and Rudy/Randy. We introduced Frederick previously, and similar to the first scenario created the personas and vignette of Rudy/Randy in Figure 16.

Then, we created the script and storyboard for this scenario, as we did for Scenario 1, as shown in Figure 17.

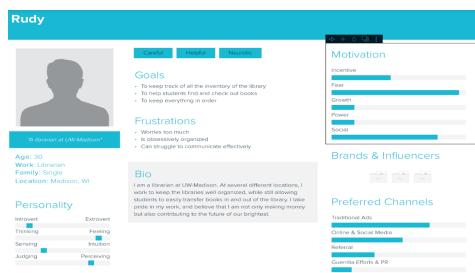


Figure 16: Personas and Vignettes of Rudy

Rudy works as a librarian and is responsible for library services, including checking out books. He is timid and tends

to be cautious about everything. He shows weakness in communication skills.

Frederick : \*calls Rudy\* "A server is down at the Middleton location!"

Rudy : "Okay what do you want me to do?"

Frederick : "Can you remote into the robot and reset it?"

Rudy : "Sure thing!"

\*Shots of fixing server

Rudy : \*Calls back\* "I've reset the server for you. All the lights are green now. You should be all set!"

Frederick : "Thanks, that was efficient!"

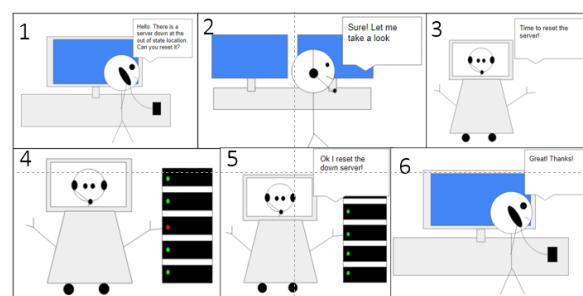


Figure 17: Script and Storyboard for S2

For the video production process, we filmed the video at the help desk of the Memorial Library, and it begins with the problem in which a server is down at the Middleton location. Frederick calls the office, and Rudy responds. Rudy, an IT technician, is asked to remote into the robot to reset the server. He attempts to access the robot on his desktop and control it to go to the server and push the reset button. As mentioned previously, we attached a stick to the robot to reproduce adjustable arms, and they are used to click the reset button. After completing the work, Rudy moves the robot back to its station, then notifies the patron of the server up and running again.

We talked about video scenarios and the video production process. The next segment summarizes all the findings of our ethnographic research.

# PROJECT 2: NOVEL INTERFACES

# FINAL SOLUTION

Our final solution was a robot that was able to be deployed remotely in a fashion that could help solve technical issues both by communicating with patrons in person or by fixing technology directly via a remote control.

The robot's technology is developed to be able to handle a wide range of difficulties. It is not only equipped with specific tools for specific jobs (i.e. equipment to interact with server hardware directly) but also with a screen displaying the controller's face to make it easy for patrons to feel comfortable while receiving help. It allows them to interact with the robot not only in a technological way but also in the way one would interact with a person.

Our video consists of two scenarios. In the first, the robot is called in to help a librarian fix an issue with his monitor. The robot displays on its screen the face of the technician controlling it, in order to make the librarian comfortable so it seems like he is receiving help from a person rather than a lifeless object.



Figure 17: A patron receives help in person

This emphasizes a few of our principle design features—not only the video display and audio connection to the person controlling the robot—but also the versatility and flexibility of the robot's

movement and actions, which show how it can adapt to any particular situation. Though it was not created to be optimized for this scenario with the librarian, its wheeled movement system and appendages allowed it to adapt to the given situation with ease. This adaptability was furthered by being remote controlled in real time, so a real person could fully make use of all its possible movements.

The second scenario, as detailed above, consists of an IT technician who is called in to fix a problem with server hardware that is not at his current location. So, instead of travelling there, he deploys the robot. This scenario details more of the robot's important design features, this time from a more technical standpoint.



Figure 18: The robot interacts with a server using specialized hardware

This time, instead of asking a patron for instructions, the person controlling the robot chooses to dictate its exact movements himself, taking care not to cause damage to any other hardware. This is not difficult, as the current tools and the remote controller used are specifically designed to interact with this hardware.

## PROJECT 3: NOVEL INTERFACES FINAL SOLUTION



*Figure 19: A technician controls the robot using a handheld remote controller*

Beyond these features, we also included a dock for the robot in our design, where it resides whenever it is not actively being used. In addition to charging the robot's battery, it also has a wide variety of tools at its disposal, allowing the robot to swap out parts for even more versatile functions.

In conclusion, the robot is an efficient, versatile piece of technology designed to remotely solve problems that would otherwise require a real person to be physically present. It can either physically interact with patrons who would otherwise struggle with assistance online or over the phone, or it can complete technical tasks directly. In either circumstance, a technician is in direct control, making certain that there is always a genuine human connection made in any situation.