CS6750, Assignment M5

MingTing Lu
mlu305@gatech.edu

Abstract. For Assignment M, I'm going to research how people use ATM to withdraw money. The ultimate goal of this project is to redesign the process of money withdrawing so that people can manipulate ATM more convenient when they want to withdraw money from ATM.

Qualitative Evaluation

Overview

The Wizard of Oz prototype evaluation (see Appendix A) was conducted with 5 participants. Participants are my friends and colleagues. Some of them worked in the financial industry and some are not. There was two part for each session: first conducting the Wizard of Oz prototype, and then asking 4 questions. The content of each session is consistent in order to glean comparable data.

Raw Results

I asked four questions (see Appendix A) after finishing Wizard of Oz prototype. I took their response in brief notes.

Please refer to Appendix C for raw results.

Feedback Analysis

First, the participants mentioned that there are too many steps. The new process requires a user to enter the identification number first, then the finger-vein, and then the facial recognition. Some of the participants specifically reveal that they would like to try the new process if the facial recognition is removed. Participant 4 inspires me that if the facial recognition is aim to reduce the FAR (false acceptance rate), I could use the traditional PIN code instead. This surprised me that there is an

easier way to accomplish the same goal. Otherwise, the facial recognition should be as smooth as the best experience that the user has ever been experienced. For Participant 4, it is iPhone X's facial recognition.

Second, some of the participants come from the financial industry, but they fail to accept the concept of using biometrics to replace the traditional PIN code method. But still, some participants would like to give it a try. Introducing new technologies on a process people familiar with is really challenging.

Third, the instruction itself is a little hard to be evaluated whether it is clear enough or not. The reason is that the Wizard of Oz prototype is conducted with simulation and imagination. However, biometrics technologies largely depend on physical stuff. The design of the detector, the position of the detector or the camera, the label on the detector, and the context - the promotion or warning stickers on the ATM - will all affect the clearness of the instruction. Further, the screen could display not only text but also photos or pictures. This will help navigate users to follow the guidance and to complete the withdrawal process.

Last, I have asked where the participants would like to use because there are two main possible sites for an ATM in Taiwan: on the roadside or in the convenient store. The answer surprises me that most participants are willing to use at both site but some of them strongly state that "if facial recognition is not required in the new process". It seems that they don't like to use such technology not only because it is not necessary or it makes the process too lengthy, but also they don't like to use it in public area.

Changes Result from Qualitative Evaluation

After conducting the qualitative evaluation, I rethink the necessity of the step of facial recognition. According to Participant 4, I could replace it with PIN code if the acceptance rate is not able to accept or reject the access inquiry. That's really a brilliant idea and alternative. Further, I think I need to use the physical prototype to evaluate the clearness of the instruction, for the result of executing the Wizard of Oz prototype didn't convince me the instruction is good enough or the instruction should be further refined.

Predictive Evaluation for Physical Prototype

I will walk through the physical prototype layout in Appendix B.

The user approaches the ATM because the user wants to use it to withdraw the user's money with the user's smartphone. The ATM is playing promotion video and at the bottom of the screen there is a fixed ribbon with a button on the right side "*NFC Withdrawal*". Press it because the ATM is equipped with a touchscreen.

The ATM will display "Please turn on the NFC and put your smartphone near to the keypad." with an animation of putting a smartphone on the keypad area. Then the user unlocks the smartphone, open the setting, activate the NFC module, and put it on the keypad of the ATM. The smartphone vibrates, which indicates me that the device is connected with the ATM successfully. And the ATM screen displays "Please login bank app and completes the withdrawal process on your smartphone." with an animation of manipulating smartphone. This part I leverage mapping and perceptibility heuristic to let the user know how to use the smartphone.

The user looks at the smartphone and notices that it turns to the login screen of the bank app, looks like it opens up the bank app for the user to login after it connects with the ATM. The user logged in mobile banking account and turns to the money withdrawal page; it usually turns to the homepage. The page consists of three parts. The top is the connected ATM serial number #ABC1234 and the connecting time left. The user could check the ATM serial number is the ATM manipulating. In the middle is an input field with title "Withdraw Amount". The number keypad will show up after clicking on that field. The bottom part has two buttons: "*Withdraw*" and "*Cancel*". Here I will leverage the discoverability and consistency, where the number keypad would be the same as the dial pad. A constraint is that user could only input numbers in the "Withdraw Amount" field; text or other input is not allowed in order to prevent from error.

The user types 1000 because the user wants to withdraw TWD$1,000, and then clicks "*Withdraw*". The app runs for a while and then logged the user out with a success message: "Please take your withdrawal from the ATM #ABC1234 within **30** seconds. Thank you for choosing our bank." Under the success message, there is an animation of taking money. The number 30 is counting down, indicating time left.

The user checks the cash dispenser and there is $1,000 cash, and the ATM displays a countdown clock, mapping to the clock on the smartphone.

After taking the money from the ATM, the ATM displays "Thank you. Do you want a paper recept? (You could also view your transaction on your bank app.)" with two buttons: the right one is "*Print*" and the left one is "*No*". The user presses "*Print*" and takes the receipt. This consistent with the traditional process. The withdrawal is over.

Evaluation Summary: Plan for Next Iteration

Needfinding

My first needfinding found that there is a need for those who forget to or not willing to bring their bank card. Therefore, I came up with 20 ideas and developed 3 of them into prototypes. Both my prototypes evaluated in this assignment involves some new technologies. I want to figure out the accept rate for using new technologies on ATM. Do users think it's safer or more dangerous than the current process? Further, I want to know how long is acceptable for users to complete the withdrawal process. Probably I need to really time up how quick user withdraw their money from an ATM. Moreover, I want to know whether the withdrawal amount will differ with different withdrawal method so that I could know whether I should add a withdrawal limitation for the new process.

Design Alternatives

The most important idea from this experience comes from Participant 4 in my qualitative evaluation. Combining with the traditional way with the innovating methods. I could brainstorm more ideas about a combination of new and old technology. For example, replace PIN code with finger-vein or fingerprint, or replace bank card with finger-vein.

On the other hand, adding some constraints might also make the process more smooth or errorless. Through predictive evaluation, I notice that I focus on restraining the user not to input text in the "*Withdraw Amount*" field, so by tapping that field, a number keypad will show rather than a keyboard. This inspires me that I

could add constraints on the current process. For example, on the page of entering withdrawal amount on ATM in the current process, I could display adding and subtracting buttons to limit users not to enter a number that will be rejected by the ATM, such as $1,234. (Mostly, ATMs in Taiwan offers thousand-note but not limiting the amount entering.) This will significantly reduce the wrong entering.

Prototyping

As mentioned above, I would like to revise my biometrics prototypes with two points. First is eliminating the facial recognition because it is too lousy for general users and it might take longer to authenticate the ATM. Instead, I could replace it with the PIN code set by the users when they opened their account. This will only happen when the finger-vein recognition is in between the acceptance and rejection.

Second, after authenticating the ATM to withdraw money, I would like to redesign the amount entering page with adding and subtracting buttons. This is aim to reduce the wrong amount entering rate and make the amount entering more intuitive. All the user needs to do is to tap (if the ATM equips with a touch screen or screen-side buttons) to add up to the target amount, and tap to subtract if the amount exceeds the target amount. The unit of adding up or subtracting down could be designed such as 1,000 and 5,000 in order to reduce the time and clicks required for those who will withdraw a big amount of money.

Evaluation

After adapting those changes, I would like to conduct an empirical evaluation to evaluate the new prototype. I want to test whether participants think it is safer with finger-vein recognition, how much more time will be taken, and whether the time taken is acceptable for them. Further, I want to know whether the constraint which is added to the amount entering the page on ATM is better to manipulate (whether the new design increases the satisfaction or not). I would like to glean data to figure out and prove all the question above with empirical data.

Appendices

Appendix A: Qualitative Evaluation Plan

Wizard of Oz Prototype: Biometrics Authentication

I choose to combine my two biometrics authentication ideas from the brainstorming: finger-vein patterns and facial recognition. Since the process involves the body, I think Wizard of Oz prototype is a good way to prototype.

- Now, you are approaching an XYZ bank's ATM. You press the button "*Biometrics Authentication*". The ATM requests you to enter the ID number.
- Success. The ATM requests you to put your finger flat on the detector.
- Success. The ATM shows the preview of front camera and requests you to move your body and face into the shape prescribe on the screen.
- Success. The rest process would be the same as you type in the PIN code after inserting a bank card.

Evaluation Plan: Post-event Protocols

Since post-event protocols work well with Wizard of Oz prototype, I choose post-event protocols as my qualitative evaluation toward my Wizard of Oz prototype. The participant will be my family and colleagues and I will ask them for 5 to 10 minutes to complete the qualitative evaluation.

The evaluation will take place in a quiet room if the participant is my family, and in a meeting room if the participant is my colleague. The room should be quiet and will not be observed by others in order to reduce the uncomfortable feeling while roleplaying for my participants.

Evaluation Content

For the directions that the participants will receive, please refer to Appendix A - Wizard of Oz Prototype. I would like to glean the reaction of my participants for each direction is given. Would they confused? Which part? Why? How to reduce the confusion?

Further, I will ask the following questions after the evaluation:

1. Are the instructions clear enough?
2. Which part do you think the process could be improved? (faster/ securer/ other factor)
3. Would you like to use this to authenticate an ATM in a convenient store? How about ATM on the roadside? Why?
4. Do you satisfied with the new process? (Notice for the desirability bias)

Appendix B: Predictive Evaluation Plan

Physical Prototype: Device (NFC)

I'd like to prototype the NFC approach with a physical prototype. A smartphone should be prepared and the scene will be nearby a real ATM. And my script is designed as follow.

- Now, you are approaching an XYZ bank's ATM. You press the "*NFC Withdrawal*" button on the top-right ATM screen.
- An instruction displays on the ATM screen "Please turn on the NFC and approach your smartphone to the keypad."
- The ATM displays "Please login XYZ bank app and completes the withdrawal process on your smartphone." Your phone vibrates that indicates it detects the ATM and open the login screen of XYZ bank app. You now logged in with the bank app.
- The app turns to the withdrawal page, which consists of ATM serial #ABC1234 (you can check the numbers on the ATM and this number is the same or not), withdrawal amount and two buttons on the bottom of the screen: "*Withdraw*" and "*Cancel*". You enter NTD$3,000 (roughly equivalent to USD$100) and press the "*Withdraw*".
- Your app logs you out and displays "Please take your withdrawal from the ATM #ABC1234 within **30** seconds. Thank you for choosing XYZ bank." The ATM starts to count the cash, and now you can take your money from the cash dispenser.

- The ATM now displays "Thank you. Do you want a paper receipt? (Otherwise, you can view it on XYZ bank app." with two buttons: "*Print Receipt*", "*Log Out*". You press the print one and take your receipt, and leave the ATM, completing your withdrawal.

Evaluation Plan: Cognitive Walkthrough

For my physical prototype, it might be too hard for participants to interact with a virtual app through pure imagination. Thus I decide to evaluate physical prototype with predictive evaluation.

Further, the process would be very new to all users; that is, every user will be a novice user. I want to figure out how to navigate a novice user to this new process, new interaction, but with 2 familiar interfaces (ATM and bank app, assuming user are already familiar with it). Hence the cognitive walkthrough would be more ideal than a GOMS model.

Tasks Addressing

According to "*How to Conduct a Cognitive Walkthrough*" (Paul Veugen, 2017), there are four questions need to be answered while conducting cognitive walkthrough:

1. Will the user **try** and **achieve** the right outcome?
2. Will the user **notice** that the correct action is available to them?
3. Will the user **associate** the correct action with the outcome they expect to achieve?
4. If the correct action is performed; will the user see that progress is being made towards their **intended** outcome?

Every step should be reviewed with these 4 questions and it will be a long list shouldn't be put here. However, I think there will be 2 key steps need to focus on to navigate a user:

- When the manipulation transfer from ATM to the bank's app.
- When the manipulation on the app is finished and the user needs to transfer focus back to the ATM to take money.

Appendix C: Raw Results for Qualitative Evaluation

Participant 1

1. A little bit not clear. Do user really know where to put which finger and where is the camera to look at?
2. “Fingerprint”(finger-vein) is much safer than password.
3. Facial recognition is a little bit weird if the ATM is set on the roadside.
4. It’s a pretty cool process. He will try if he forgets bringing his bank card.

Participant 2

1. It’s okay if they are well-labeled. It depends on whether the physical modules are clear.
2. Don’t want to take so many steps to withdraw my money. It might be too slow comparing to the current process.
3. Not in a convenience store because there might be someone waiting to use.
4. Not really. It might take too much time in my imagination.

Participant 3

1. Clear.
2. A little bit too many steps for identity authentication.
3. Both are okay.
4. Pretty good. But a little bit too lousy.

Participant 4

1. Clear. Questioning how to put finger on the detector.
2. Facial recognition is not necessary. If the confidence level for the “fingerprint" (finger-vein) is in between of clearly acceptance and rejection, use the PIN code to further confirm is good enough for general users.
3. Both are good in her opinion if no facial recognition. Or if the facial recognition is as smooth as iPhone X.
4. She will try to use and if the success rate is high and it’s smooth as the prototype, she will not bring her bank card anymore.

Participant 5

1. The participant answered the instruction is clear. (Not that clear in my observation, for he will clarify after instruction was given.)
2. No need to enter PIN code is good. But he wants to keep the action of inserting bank card rather than entering identity number, for he doesn't want to enter anything to the ATM.
3. Both are acceptable to him.
4. Pretty cool, and he will try if the function is available in the real world.

Appendix D: Interface Requirement Defined in Assignment M2

1. **Easy to learn and to use**, for users range from 18 to 50-year-old.
2. **Similar to the current process**, for the new process will make the experts be a novice. Similar to the current process makes the new one easier to learn.
3. **Efficient**, for people won't expect they spend longer time to withdraw money (most of the users are expert on withdrawal).
4. **Stable and secure**, for people do think the ATM is reliable (which will give the exact amount of money), and people do care whether their money will be easy to taken or not when bad guys want to do so. The new process should be stable and secure as well.