Assignment M4

Abhijeet Chavan
achavan8@gatech.edu

Abstract. This project takes you through the **journey** of **discovering** an **entire design life cycle** of buying an NJ Transit Train Ticket to commute from locations in New Jersey (NJ) to New York city (NYC) and vice versa. It studies the **user experience** of the interface that already exists and recommends any improvements based upon numbers of tools and techniques.

Qualitative Evaluation

Prototype: As part of this assignment, I would like to evaluate prototype3 from my previous assignment which is a touch and transfer smart phone app for buying a train ticket. The idea behind the touch and transfer smart phone app is to read the ticket information from the ticket vending machine via its sensor and transfer the information such as payment from the smart phone app to the vending via the same sensor, while performing the task of purchasing the ticket on vending machine. The second feature of this app is to transfer the tickets purchased from one cell phone to another cell phone by touching both the cellphones if they both have the smart app installed on their devices. Refer Appendix A for more details.

Participants: To evaluate this application, I am planning to recruit 3 of my friends, who have been selected based on the following factors.

- User1: Daily commuter of New York City and has idea about purchasing NJ Transit Tickets.
- User2: Occasional commuter to Newark, New Jersey via NJ Transit Train.
- User3: Novice user who has never travelled by NJ Transit.

Venue: All the above diverse participants will be **interviewed** individually at their residence for 60 mins. These 60 mins will be broken down such as 5 min project briefing, 15 mins to go through the textual script, 10 mins to play through and have mental model, 30 mins for interview questions. I have selected interviews over surveys due to the synchronous nature of the protocol, that will help me

interact with the users, provide brief idea about the project, interrupt the user to get ideas on specific activities/tasks etc. In my opinion I can have better control on getting more inputs from the users than if I select surveys. The above participants will evaluate a **single interface**. During the interview, I planning to take **notes** based on their suggestions, comments, opinions and over all what they feel about the product.

Evaluation Plan: The prototype mentioned above will be evaluated for purchasing, activating and transferring the NJ Transit Train ticket along with all appropriate feedbacks. Each **individual** user will be briefed with the background of the project and how it has been evolved leaving all the biases such as confirmation and observation etc. at bay. The interview conducted will be 100% scripted with a well-rounded discussion. The participants will be provided with the textual script of the prototype and will be allowed to go through the same on-site. In case of any questions, the same will be clarified immediately due to the **synchronous** nature of the setup. To interview the participants, I have categorized the questions based on the data inventory. This categorization will help consider all minute details (user needs) captured per earlier assignments.

Task related questions:

- Do you think that the prototype will successfully help the user complete the task of purchasing the train ticket?
- Do you think that the prototype will successfully help the user complete the task of activating the train ticket?
- Do you think that the prototype will successfully help the user complete the task of transferring the ticket to another user?

User needs:

- What do you think about in-process feedback provided by the prototype to complete the above tasks? Do you think that it is sufficient?
- What do you think about the final feedback provided by the prototype in terms of train schedule, alerts, platform information, weather alerts etc.? Do you think that it is enough? If not please explain?
- What do think about the touch and transfer feature, to transfer train tickets to another user's device?

- What do think about the prototype feature to alert user of ticket expiration?

Context related questions:

- What do think about the prototype feature of activating the train ticket while you are driving or walking or jogging?
- What do you think about the feedback provided by the prototype incase if cellphone signal is not available?

Overall Goals (Capture Satisfaction):

- Can you tell me the things that you liked the most about the touch and transfer prototype?
- Can you tell me the things that you did not liked about the touch and transfer prototype?
- Do think that the prototype is user friendly? If not please explain?
- Do you have any suggestions to improve this prototype?

The above interview questions can be easily mapped with the user requirements/data inventory designed in earlier assignments such as user goals, tasks, feedback and the context etc. It will throw light on whether the prototype speaks user's language, provides appropriate feedback, handles memory load, provides consistent interface and over all good representation that will help gauge if the prototype met all the requirements defined in previous assignments.

Empirical Evaluation

Out of the 3 prototypes, I would like to select a voice enabled smart app for buying an NJ Transit Train Ticket. This prototype is a complete voice enabled Transit Ticket Assistant. Here, the user can speak to the ticket assistant of the smart phone app and the same will guide through the entire process of purchasing a ticket, activating and receiving all the updates through the app via voice and information displayed on the screen.

As part of the empirical evaluation, I would like to test a task of buying and activating an NJ Transit Train ticket. While evaluating the task I am assuming that the user has already signed up for the smart app and has entered all the required

profile and payment details. This evaluation will only focus on the task of buying and activating the NJ Transit Train ticket.

The best point of comparison would be against an existing NJ Transit Train ticket app ("MyTix"). The comparison will be purely based on the time taken in seconds to perform a complete task of buying and activating the train ticket via both the smart apps (treatments). The total time will be calculated by adding time for each of the sub tasks. This breakdown will further help to evaluate the individual task performance.

Applications	Time taken to complete sub task in secs				Total Time
	SubTask1	SubTask2	SubTask3	SubTask4	1+2+3+4
	Search Origin & Destination	Specify Ticket Details	Payment Info	Activate Ticket	Buy & Activate
Existing NJ Transit Ticket App	XX	XX	XX	XX	XX
Voice Enabled Smart App	XX	XX	XX	XX	XX

Figure 1. Task List for Empirical Evaluation of Smart Apps (Existing vs Voice Enabled apps)

The null and the alternative hypothesis for this evaluation is as mentioned below.

- H_{null}: Time taken to complete the task of buying and activating the train ticket across both the smart apps is equal
  (μ_1 Existing App Task Time = μ_2 Voice Enabled App Task Time)
- $H_{alternative}$: Time taken to complete the task of buying and activating the train ticket across both the smart apps is not equal
  (μ_1 Existing App Task Time $\neq$ μ_2 Voice Enabled App Task Time)
- Category specifying the smart app names will be independent variable
- The total time taken to complete the above task will be the dependent variable.

The hypothesis testing using **student's t-test** will focus on finding the difference in the total time taken (ratio) to complete the main task across both the smart apps. The testing will reveal if the difference is caused by a random chance (statistically significant), in which case the null hypothesis will be rejected, indicating that there is a difference between the total time taken to carry out the task of buying and activating a train ticket across both the apps. Conversely, it will also suggest which smart app takes less time to complete the same activity.

This experiment will be performed **within subjects** where a group of 4 participants (2 novice and 2 expert) will **test all the tasks** from both the smart apps. To avoid

the issue related to the **lurking variables** of which participant experiences the treatments first, I will randomly assign the participants to the treatments. Balancing the mix (novice and expert) and randomness will eliminate the bias towards a particular skill level and would help more rounded evaluation of the treatments.

Application: Existing NJ Transit Train Ticket Interface					
User	Task1	Task2	Task3	Task4	1 +2 + 3 + 4
User 3	XX	XX	XX	XX	XX
User 1	XX	XX	XX	XX	XX
User 2	XX	XX	XX	XX	XX
User 4	XX	XX	XX	XX	XX
Average Time Taken for n1 users (μ1)					XX
Standard Deviation (s1)					XX

Application: Voice Enabled Smart App					
User	Task1	Task2	Task3	Task4	1 +2 + 3 + 4
User 2	XX	XX	XX	XX	XX
User 3	XX	XX	XX	XX	XX
User 4	XX	XX	XX	XX	XX
User 1	XX	XX	XX	XX	XX
Average Time Taken for n2 users (μ2)					XX
Standard Deviation (s2)					XX

Student's t test			
Application	N	Average Time	Standard Deviation
Existing App	4	XX	XX
Voice Enabled	4	XX	XX

$$t - value = \frac{|\mu 1 - \mu 2|}{\sqrt{\frac{s1^2}{n1} + \frac{s2^2}{n2}}}$$

Figure 2. Empirical Evaluation of Smart Apps using Student's t test

The figure2 above shows how to calculate the t-value using the following.

- Average total time taken by the task (Total time by all the users/no. of users) for both the smart apps.
- Standard deviation of the time taken to perform the tasks for both the smart apps.

Once the t-value is calculated, I will perform a two-tailed t-test. In order perform the t-test first we will find the critical value "tc" using the t table. Using the degrees of freedom (calculated based on sample sizes) (n1 + n2 - 2) and probability of 0.05 (during which the null hypothesis will not be rejected), I will find the critical value tc. Now if t > tc then we reject the null hypothesis indicating that there is a difference between the total time taken to carry out the task of buying and activating a train ticket across both the apps.

Predictive Evaluation

As part of this assignment, I will be performing a cognitive walkthrough of a redesigned model of NJ Transit Train Ticket smart app. The goal here is to navigate the app to purchase and activate the train ticket. I am assuming that the novice user (played by me) has already signed-up and provided all required information such as preferences and payment etc. The figure 3 below, shows different

components of the redesigned interface that I will navigate such as home, search and train details, to complete the above-mentioned task.

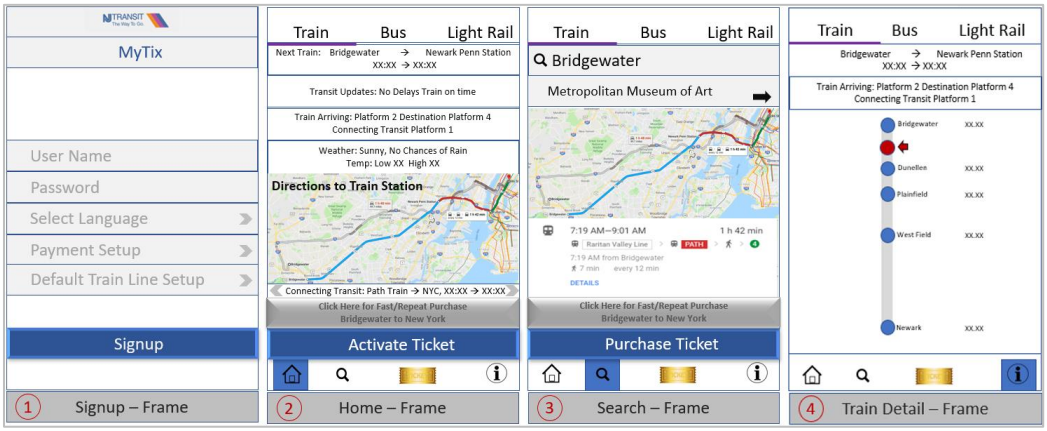

Figure 3. Predictive Evaluation of re-designed NJ Transit Train Ticket App

Goal: Navigate the app to purchase and activate the train ticket.

Plan: As soon as I hit the home page, I see number of options such as a purchase button (this is a toggle button with Activate option) to start the purchase and activate process, navigation buttons such as search, my-tickets and train details to perform tasks e.g. search origin and destination train stations, search destination station by theme, view all the purchased tickets and view the train details. The above-mentioned options provide better **discoverability** to navigate and perform number of tasks without being impacted.

Specify: The home page clearly specifies what action should the user take e.g. click on the purchase button to start purchasing the ticket. Once the ticket is purchased the home page displays the activate button to activate the purchased ticket. This being a toggle button it is easier for the user to **learn** and perform required actions.

Perform: The moment I visit the home page, it does display the purchase button, but it would be preferable to put a **signifier** such as “Click here to purchase the train ticket”. This will help users who are buying the ticket for the first time, and for the regular users, if all the tickets they purchased are exhausted. This will help

minimize the gulf of execution. Clicking on the purchase button brings me to the search screen where I have options to specify origin and destination train stations or specify destination by theme (**feedback**). However, this screen should provide a search functionality for selecting train lines that will **filter** the origin and destination train stations and further **minimize** the gulf of execution. After entering the origin and destination train station, it immediately provides me a **feedback** via a map, the earliest train time and the total trip time. The screen also displays a next button. After clicking the next button, the app takes me to the screen where I can select the type and number of tickets and click on the payment button to pay for the ticket. The payment screen provides me number of options (**flexibility**) such as pay by credit, debit, split pay, PayPal and Apple pay. It also provides an option of default pay where it will charge the card provided during the application signup process. After I make a payment, it takes me to the my-tickets screen and shows all the tickets that I purchased along with the option to activate. I can now click on the ticket activate button to activate and download the ticket. The interface allows me to visit the train details screen that shows the train path with all the stations and the current location of the train. After purchasing the ticket, the home page screen keeps track of and displays number parameters such as map, transit and weather alerts, train arrival platform, destination platform and connecting transit information. The home page provides an option to repeat (**flexibility**) the purchase based on previously bought tickets and provides a fast ticket purchase feature based on a default train line and payment information provided during the user sign up process.

Perceive: I was able to search, purchase and activate train ticket. After purchasing the ticket, the interface showcased all required information such as tickets purchased and activated, map, transit and weather alerts, train arrival platform, destination platform and connecting transit information etc. It also provided me an option to repeat the purchase based on the past purchases.

Interpret: Now I have all my tickets saved on my-tickets screen. I can activate these tickets before on-boarding the train. The home screen also provides driving directions to the origin train station and all required information as mentioned above.

Compare: After performing all the above actions, I can now say that my goal of purchasing and activating the train ticket has been successfully fulfilled.

Conclusion: After performing the above actions, I felt that there were few factors that may cause gulf of execution and the same can be minimized by providing appropriate signifier for a purchase button and an option to select train lines on the search page. This will minimize the gulf of execution. As part of this exercise, I realized that I has forgot to provision the "Default Train Line" setup on the sign-up screen that can be used for fast purchase. Besides that, the prototype provides appropriate discoverability, affordances, flexibility, feedback, learnability, comfortability and overall good representation.

Preparing to Execute

In my opinion it is always good to receive one on one feedback from the individuals about one's work. As far as, I handle the biases right, I can really have a frank and in-depth conversation about the prototypes that I have built. I will also be in a better position to control the pace of the conversation and extract quality information from this setup.

I can easily hone onto specific points of concern and this will help built a better product per the user's needs. The touch and transfer smart phone textual prototype and the redesigned "MyTix" NJ Transit Train ticket smart phone wireframe prototype, both can share similar setup where I can recruit participants based on criteria mentioned earlier.

I can brief, interview and play with the participants for both the prototypes in question. This synchronous interaction with the users will help me receive instant feedback not only in terms of words but also gauge their satisfaction based on their actions and their body language.

References

1. Dr. David Joyner, Human Computer Interaction course video series, referred from 10/14/2018 to 10/18/2018.
2. I. Scott Mackenzie, Human Computer Interaction, An Empirical Research Perspective, referred on 10/17/2018
3. Jukob Nielsen and Rolf Molich, HEURISTIC EVALUATION OF USER INTERFACES, referred on 10/18/2018

Appendices

Appendix A: Assignment M3

Assignment M3

Abhijeet Chavan
achavan8@gatech.edu

Abstract. This project takes you through the **journey** of **discovering** an **entire design life cycle** of buying an NJ Transit Train Ticket to commute from locations in New Jersey (NJ) to New York city (NYC) and vice versa. It studies the **user experience** of the interface that already exists and recommends any improvements based upon numbers of tools and techniques, including **ground realities** captured via surveys, interviews and interface evaluations etc. This topic is so **vital** as it serves approximately 162 train stations and roughly a million riders, from every walk of life, meeting one goal of “reaching on time”, that justifies its selection.

Brainstorming Plan

The brainstorming plan for efficiently buying, activating and validating the NJ Transit Train ticket via smart phone app will be composed of the following.

- Individual brainstorming session, where I would like to spend 2 hours focusing on the core problems to generate number of ideas. These ideas will not be limited to the existing application (“MyTix”) but will go beyond considering diverse categories such as gestures and voice etc.

- Group brainstorming session, where I would like to bring the 3 folks that I interviewed earlier for an hour to brainstorm on the ideas. This session will follow all the rules of engagement of group brainstorming such as going through individual ideas, set clear rules of communication and expectations etc. The session planned will encourage the participants by giving them a chance to express themselves. During this time the ideas will not be questioned or evaluated.

The expectation of this brainstorming plan is to generate multiple ideas focusing diverse user types to efficiently carry out the above-mentioned tasks.

Brainstorming Execution

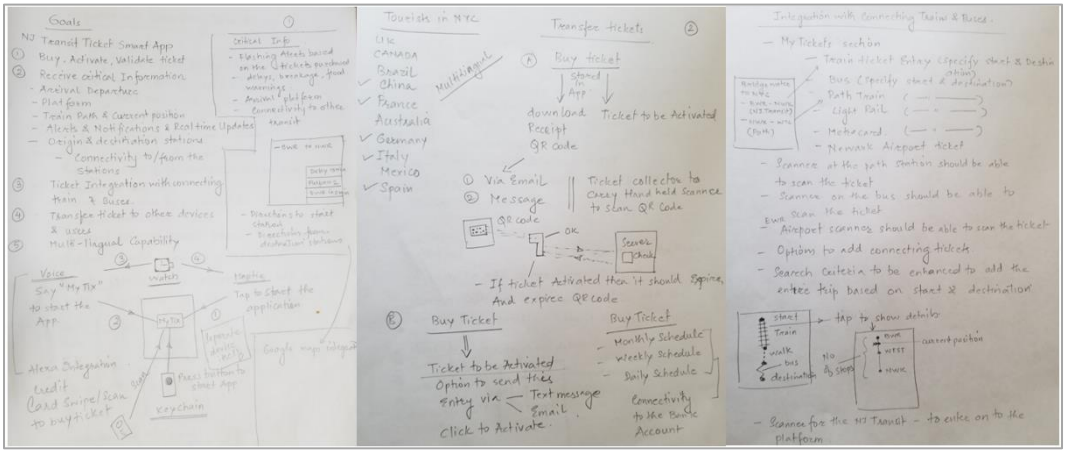

Figure 1. Individual Brainstorming Execution

The figure 1, above shows a picture of a brainstorming sheet that lists out all the goals and different ideas. Following is the list of ideas, based on main goals and tasks associated with those goals.

Buy, Activate and Validate an NJ Transit Train Ticket

- Voice enabled search functionality to find origin and destination train stations. Voice enabled buying, with options to buy single ride or multiple ride tickets e.g. daily, weekly and monthly. Finally, Voice enabled ticket

activation. The idea here is to provide voice option to the user to buy and activate ticket. Alexa enabled app to leverage voice functionality.

- Use smart watch to buy the ticket. Use tap to invoke the smart app via smart watch. Use a button on a keychain to invoke smart app to buy and activate ticket. Credit card scan to buy ticket.
- Create a separate ticket manager device to buy, activate and validate tickets. Touch and transfer app to buy and activate the ticket
- Re-design the existing smart app to accommodate all the latest features such as google maps, application programming interfaces for voice and other device signals

Transfer Tickets

- Download QR code along with digital ticket link. Distribute the QR code via email or message. The ticket collector to have a portable scanner to validate the QR code and mark all the ticket references as validated
- Enable the app to send the ticket digital link itself via email or text message. The user can then download the ticket, activate and validate
- Beam the ticket to another device. Transfer the ticket via touching devices. Voice enabled ticket transfers

Multi-Lingual

- Multi-lingual app that will allow users to buy NJ Transit ticket via the most popular tourist languages in NYC in addition to English e.g. Chinese, French, German, Italian, and Spanish etc.

Transit Connectivity

- Smart app to suggest travel options based on origin and destination train stations. This can include travel via train, bus, path train and light rail etc.
- Standardize the ticket options across different authorities, train, bus, path train and light rails etc. Scanning technology to be standardized across different authorities. Scanning turnstiles to be introduced for NJ Transit commuter to enter the platform like path trains. Smart phones and Smart watches to be used as scanners.

Critical Information

- Weather alerts impacting the commuters travel based on the ticket purchased. Delays, breakdown, rain and flood warnings based on the tickets purchased. Train arrival and departure information along with platform assignment and connectivity information to another transit. All to be delivered via messages and voice over smart app and watch.

Selection Criteria

Personas and Scenarios in my opinion would be best suited as selection criteria.

Additionally, technology feasibilities will also filter most of the ideas chalked out earlier. Following user types were discussed as part of the need finding exercises and I would like to create a persona and scenario for each of the user types.

- User1 - Non-Disabled/Adult/Daily Commuter/English Speaking. Scenario for this user would be an expert who would want the app to be very efficient. Would try to buy ticket in different context's such as while driving car to the train station or on the train or rush from the parking lot to the train platform. The user needs quick 3 to 4 steps to buy and activate the ticket
- User2 - Non-Disabled/Senior Citizen/Visitor/Non-English Speaking. The user would want the app to provide multi-lingual option to buy ticket and provide critical information in the language of choice. The user will probably buy the ticket while at hotel, before heading to the train station. The user would need directions to the train station and as well require all the detail guidance until the user reaches the destination
- User3 - Disabled/Adult/Daily Commuter/English Speaking. The user would want flexibility in buying, activating and validating the train ticket. Prefer to buy the ticket via voice. Would be in the same situation as user 1 but with more challenges.

Based on the personas, scenarios and technology feasibility, I would like to consider following 3 alternatives.

1. Re-design the existing smart app to accommodate all the latest features such as multi-lingual, google maps integration, ticket transfer, integration to other transits and critical information alerts etc.
2. Voice enabled smart app to search, buy, activate and receive feedback via voice, message, maps, ticket purchase and QR code
3. Touch & Transfer app to search, buy, activate and receive feedback via voice, message, maps, ticket purchase and QR code

Prototype 1 (Wireframe) Re-design “MyTix” app

The redesigned “MyTix” smart app will be available on IOS and android OS.

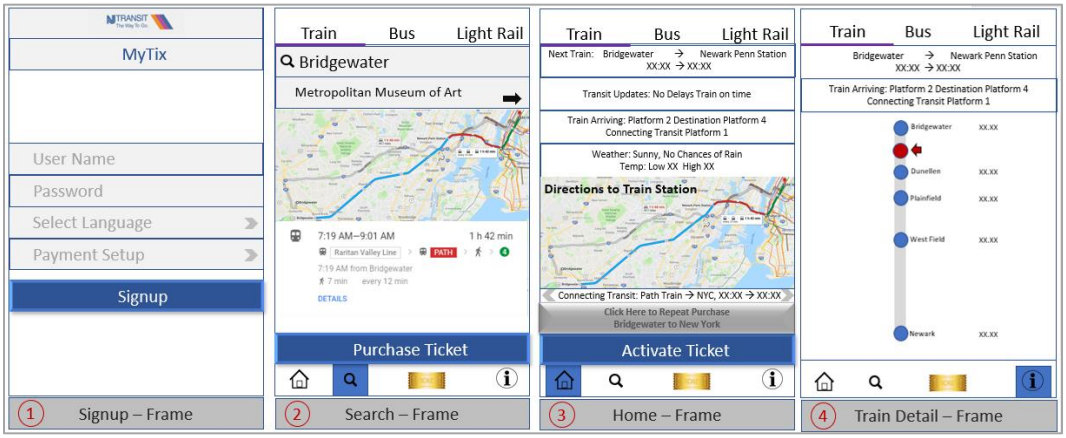

Figure 2. Re-designed wireframes of NJ Transit Smart App

1. The interface will allow the user to **select** the language of choice (**multi-lingual**) during signup process. Additionally, it will allow the user to setup payment profile and select default train ride specifying the origin and destination train stations. Once the signup is complete the interface will **display** the screens based on the choice of language.
2. To purchase the train ticket, the user can search based on the origin (start) location, train lines, or based on a travel theme such as visit “Metropolitan Museum of Art, NYC”. The app will then show options (**feedback**) to reach the destination e.g. train, bus and light rail etc. The interface will then allow the user to purchase a ticket for NJ Transit and other transit authorities.

3. Once the ticket is purchased the interface will provide (**feedback**) train schedule, train updates, platform alerts, weather updates, directions and connecting transit information on the home page based on the purchase. The home page will also have a toggle Purchase and Activate button (**affordance**). Based on the ticket availability the interface will present the user with appropriate above option. The user can also have a **flexibility** to tap the "MyTickets" option for specific ticket activation. For the **expert** users, the home page will provide a "Repeat Purchase" option that will allow the user to purchase ticket on a single click and immediately activate the same via the Purchase/Activate toggle button. This will improve the user **efficiency** considerably by **transferring** the **cognitive load** to the interface. The interface will also allow the user to **transfer** these tickets to any other smart phone via a message or email. The recipient can then download and activate the tickets.
4. Once the user on-boards the train the smart app will **automatically shift** to the "Train-Detail" mode where the interface will provide all **optimal details** (**takes out extraneous details**) such current location, next stop, schedule, connecting transit, connecting schedule and platforms for arrival and departures of the trains and buses etc.

Users that I interviewed earlier provided their feedback. I walked them through the wireframes that I created, and all the 3 users were enthused to see that all their needs were accounted, right from google maps integration to the integration of the connecting transit authorities.

Prototype 2 (Wizard of Oz) Voice Enabled smart app

Figure 3. Voice Enabled NJ Transit Smart App

My second prototype is a complete voice enabled Transit Ticket Assistant. Here, the user will speak to the smart phone or a watch app and the ticket assistant will guide through the entire process of purchasing a ticket, activating and receiving all the updates through the app via voice and messages displayed on the screen. To work with the app, the user will have to signup for the app where the user will have to setup the profile and payment information etc. Post that the user is all set to use the application.

Instructions to the user

- You are going to buy a Transit ticket via a voice enabled smart phone app. You can use a command “Buy Ticket” to initiate the process. Restrict your answers to few words to avoid mistakes. The app will use the payments instructions provided by you during application signing up process.
- You can use commands e.g. “Activate Ticket” to activate your ticket, “Directions to origin” to invoke google maps via app to provide directions to the origin station, “Platform information” to find the train arrival and destination platform information and “Transit Connections” to find the connectivity options at the destination train station.
- You can use commands like “Pause”, “Stop” and “Play”, to pause the voice messages being played, stop the messages and play the messages respectively. “Send to Text” to send text messages with details to the cell phone. “Language xxxxxxx” to specify language of your choice

Play between the user and myself as Transit Assistant

Transit Assistant (TA): Welcome !!!, In what language should I communicate?

User: Language English

TA: OK, “How can I help you”?

User: Buy Ticket.

TA: Where do you want to go? Or What would you like to visit?

User: Newark Penn Station

TA: OK, please specify your origin train station

User: Bridgewater, NJ

TA: How many tickets you want to buy?

User: 1

TA: Do you want to buy a single ride or a round trip or a multiple ride?

User: Round Trip

TA: OK, it will cost you 16 dollars. Can I proceed with the purchase?

User: Yes

TA: Ticket purchased!!! Enjoy your trip

Prototype 3 (textual) Touch and Transfer App

The 3rd idea came out of the group brain storming exercise. The idea is a touch and transfer information between a vending machine and smart phone and between the two smart phones. The transit ticket vending machines today have a place where you can scan a plastic ticket card to add trips to the same.

On similar line, the idea here is to build a smart phone app that can be scanned like the plastic card as mentioned above to purchase the NJ Transit Train ticket, path train ticket and NJ Transit bus ticket etc. This app will store all user **relevant data** such as **data of birth** and **payment** related information. To purchase a ticket, the user must start the smart app and touch it to the sensor on the vending machine. This will initiate the ticket purchase process. The user can then specify on the vending machine as to what type of ticket the user wants to buy e.g. single ride, weekly, monthly and yearly etc. What is the origin/destination train station? After entering all the relevant information, the vending machine will ask the user to touch the smart phone app to the sensor. The app will then transfer all the relevant payment information to the vending machine. The vending machine will then process the payment and upon successful completion transfer the tickets to the smart phone app. The user can then find these tickets under “MyTickets” tab of the application. The user can then activate these tickets before on-boarding the train.

Another functionality this smart app will provide is the touch and transfer the tickets to another smart phone device. To initiate this, the user who wants to transfer the tickets will start the app and navigate to the “My Tickets” tab. The user will then check mark the tickets to be transferred and simply touch the other smart phone device with similar app to transfer the tickets. The other user can then activate this ticket before on-boarding the train.

This touch and transfer app will also store all the relevant transit information such as train arrival/departure schedule, platform information, weather updates and train alerts. Accordingly, this smart app will notify the user. This smart app can be used at various train station entry points and on the bus thus providing a lot of flexibility.

References

4. Dr. David Joyner, Human Computer Interaction course video series, referred from 10/01/2018 to 10/03/2018.

Appendices

Appendix A: Group Brainstorming Exercise

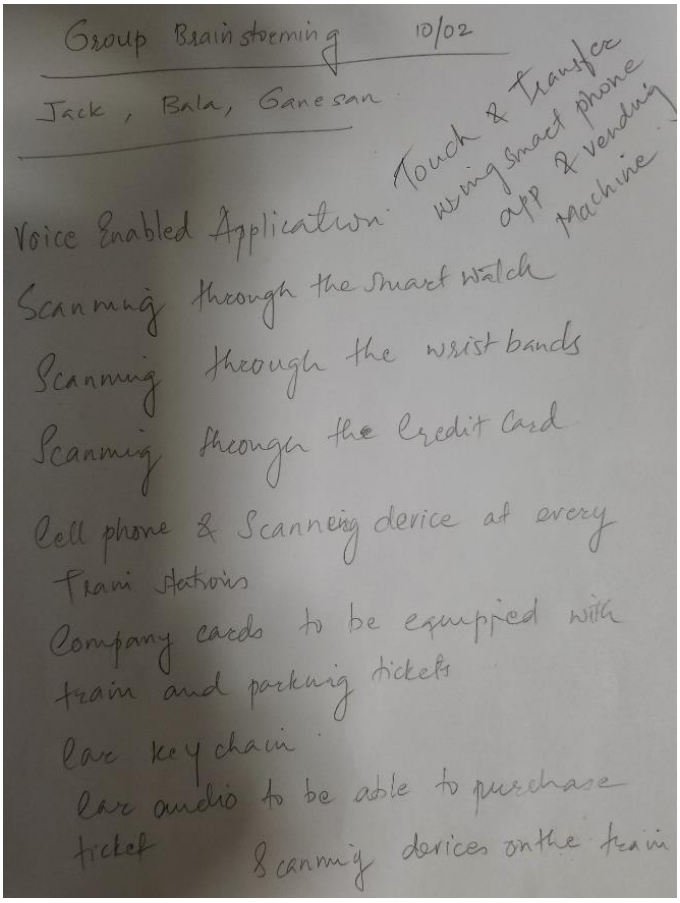

Figure 4. Group Brainstorming Execution