CS6750 Human-Computer Interaction
Assigment-M2

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***Abstract*—**This project focuses on investigating and designing a new interface to provide an alternative and contactless solution to fill the car's tank with fuel at gas stations. This new interface will allow the user to purchase gas and select the appropriate grade of gasoline using a Quick Response code (QR) [1]. Each gas pump is identified with a QR code. The code will be scanned and processed by a mobile application installed on the user's device.

1 NEEDFINDING EXECUTION 1 - SURVEY

The first needfinding method is the survey. A total of 17 questions were designed to understand the demographics of the population and to evaluate the benefits and feasibility of implementing a contactless solution to fill the car's tank with fuel at a gas station. I published the survey to students of this class and external users, and I received 25 responses. Figure 1 in the appendix shows the results of questions from 1 to 4 and Table 1 describes the questions from 5 to 17.

The first four questions were used to understand the demographics of the population. I gathered information about age, gender, country of residency and country of origin. As observed in figure 1 in the appendix, 60% of the population falls in the 30 – 39 age range. Furthermore, 56% is male and 44% is female. Lastly, more than 50% of the population is originally from USA and 76% is USA residents.

Questions five and six were used to understand level of expertise. How familiar is the population with key components that will be part of the solution like mobile applications and digital payment methods? It was not a surprise to learn that 56% is extremely familiar with mobile applications and 44% is extremely familiar with digital payment methods. For both questions 100% of the population responded that they either are somewhat, moderate or extremely familiar.

Question seven: How frequently do you fill your car's tank with gas? This one helped me to understand the goal of the task. In this case all participants are drivers, and they need to fill their tank at least once a month.

Question eight: After the pandemic, I feel comfortable using the physical pump interface. The goal of this question was to mitigate my own confirmation bias. I strongly believe the traditional pump's interface could increase the risk of getting infected with Covid-19. However, based on

the answers there is not data to support my fear. In fact, 20% strongly agree, 24% agree, 32% is neutral, 20% disagree and 4% strongly disagree.

Questions nine and ten helped me to understand that although my motivation to implement the contactless solution was actually not supported (Question eight), still 80% of the population sees the benefits of the solution and will be comfortable using it.

Questions from 11 to 15 helped me to understand at the detail level technical and security concerns. The majority of the participants are comfortable downloading the mobile application and using the digital payment methods. Also, they do not see big technical challenges or complexity during the setup process. It is important to note that there are security concerns in the population. More specifically, 4% strongly agree, 36% agree, 16% is neutral, 32% disagree and 12% strongly disagree.

1.1 Summary

Based on these results, the majority of the participants are familiar with mobile applications and digital payment methods, and they are comfortable using them. They see the benefit in having the contactless solution proposed and they don't anticipate major technical challenges or issues using it. The participants have security concerns, but those are not introduced by this solution. These concerns are intrinsic to the digital payment methods.

1.2 Control for the bias

I anticipated confirmation bias, and to control this bias I phrased the questions in a way that the participants were not pressured to answer one way or another. Originally, most of my questions were yes/no questions, and I modified them to allow more options (e.g., from 1 to 5). Additionally, before publishing the survey I asked a couple of friends to review the questionnaire and provide feedback regarding the verbiage.

It is also important to note this population does not represent all the user types I anticipated. We do not have representation for novice or reluctant users to manage mobile applications. Usually, this segment of the population corresponds to older generations or non-technical individuals. I decided to mitigate this issue by inviting couple of users of these groups to the interview process.

2 NEEDFINDING EXECUTION 2 - INTERVIEWS

The second needfinding method is the interviews. I interviewed four people. An expert using mobile applications and digital payment methods, a novice and a person reluctant to use mobile applications. Important to note that during the interview process I was made aware of a new stakeholder that I did not originally account for, the owner of a gas station. I was able to

interview a person owning multiple gas stations. This user brought to my attention new requirements for the solution I'm trying to implement.

I designed the script divided in three sections: basic questions, specific questions for customers, and specific questions for gas station's owners. See details in table 2 in the appendix.

Basic questions: These questions helped me to understand the perspective from the users about getting infected with Covid-19. All of the users were still following guidelines such as using masks and hand sanitizer. Two of them are still using gloves at the gas station when available.

Specific questions for customers: Questions one and two helped me to understand the tasks and the subtasks. All the participants described similar activities. Two of them have incorporated extra steps like using gloves to interact with the pump and hand sanitizer after completing the process.

Question three and four were oriented to receive user feedback to enhance the current interface and to provide recommendations for my contactless solution. The answers were very different, they depended on each type of users:

- From the expert perspective: This participant was not in favor of having one mobile application per brand. He recommended a centralized and unique mobile application that can be used at any gas station. According to him, the application should provide a mechanism to customize the interface based on brand and gas station.
- From the novice perspective: This participant prefers to enhance the current interface by accepting voice commands. The participant understands the security risk that this solution may have when speaking the credit card number at loud but still she insisted on implementing some type of natural language process.
- From a reluctant perspective: The contactless solution is not an option. He prefers to enhance the system to accept cash at the pump. In addition, he said "When it comes to fueling my car, I'm a fan of full service, so I would like to have someone assisting me"

Specific questions for gas station's owners: Questions from 1 to 4 were oriented to understand the operations in the gas station, and the feasibility to implement a contactless solution. Regardless of the brand, the pumps are owned by two vendors. Each vendor owns their cashier system. The gloves are supplied for free by another third-party vendor and the main purpose is not related to the pandemic but marketing and advertisement.

Question 5 - What do you what to see in the contactless solution to improve your business? This question helped me to understand the customer's interaction with the pump from the owners' perspective. The owner said "I expect the system will help to reduce the user errors like

purchasing carwash by mistake, pressing the wrong buttons or lifting the wrong nozzle. As a consequence, this should speed up the process and reduce customer frustrations".

2.1 Summary

Based on the interviews, all the participants described similar tasks and subtasks. Only the expert user and the gas station's owner provided clear and specific requirements for the contactless solution.

2.2 Control for the bias

I anticipated observer bias. To control this bias, I prepared a script that I followed during the interviews with the expert, novice and reluctant participants. I tried to avoid influence them with new questions outside the script or with my own opinion. The perspective of an owner of gas stations is totally different from my perspective. I noticed that the participant was evaluating the solution objectively and was not influenced by my comments. Additionally, before starting the interviews I asked a couple of friends to review the script and provide feedback regarding the verbiage.

I also anticipated social desirability bias. When I walked the participants through my high-level solution, I controlled this bias by hiding my desired responses and only collecting objective data.

3 NEEDFINDING EXECUTION 3 – EVALUATION OF EXISTING INTERFACES

The third needfinding method is evaluation of existing user interfaces. I visited two gas stations. I selected one gas station with traditional interface and a Sam's club gas station with scan and go feature.

I filled my car's tank in the traditional gas station and evaluated the interface. Few observations are described below:

- There were no gloves
- Almost all the buttons in the card reader were damaged and difficult to read.
- The sun was hitting the screen and it was very difficult to read the instructions.
- At the end of the service, I requested the receipt. The only option available was to print it but there were no paper.

When I visited the Sam's club gas station, I was not able to fill my car's tank because I do not have membership of the store, so I stayed around for about 30 minutes and evaluated other customers' interactions. Few observations are described below:

1. The store has their proprietary mobile application for iPhone and Android

2. The customer selects the option: Scan and go
3. The pump has a unique QR code that identifies the pump. Once scanned, the application displays the pump number in the interface for the user to confirm
4. Select a preconfigured payment method
5. Still the customer needs to select the grade of gasoline by using the pump interface
6. The application waits for the service to be completed and confirm the total cost
7. The system sends the receipt to a preconfigured email address.

3.1 Summary

Based on the results, the Scan and go mobile solution is faster than the traditional implementation. In addition, the process to fill the tank in the traditional pump is more prompt to user errors. There are couple of factors contributing to these problems, if the user needs to enter a pin and the numbers are not visible, and if the instructions in the screen cannot be clearly read the user may select the incorrect option.

Although the Scan and go feature provides a better solution than the traditional mechanism, still the application requires a lot of improvements like implementing features to select the grade of gasoline, customize the number of gallons to serve, stop the fueling process, and configure multiple options to receive the receipt.

3.2 Control for the bias

I anticipated confirmation Bias. To control this bias, I also prepared a script for me to follow during the observations and the evaluation process. I tried to be objective by recording the observations and not the interpretation. In addition, I involved a couple of friends in the evaluation process.

4 DATA INVENTORY

This section focuses on answering the main seven questions used to gather data during the needfinding plans:

- Who are the users?
  Based on the survey, the population is composed by 88% of GaTech students and 12% of external users. All of them are drivers. 60% of the population falls in the age range of 30 – 39. The gender distribution is somehow balanced, 56% is male and 44% is female. In terms of digital knowledge expertise, 100% of the population is somewhat, moderate or extremely familiar with mobile applications and digital payment methods.
- Where are the users?
  Based on the survey, the participants are mainly located in USA. 76% of the population resides in USA.
- What is the context of the task?

Based on the interviews, the context of the task for the customer is while driving their cars, and they need to stop at a gas station to fill the car's tank. For the owner of the gas station, the context of the task is at the cashier inside the store. The customer may need to go inside to purchase gas with cash, report an issue that happened filling the tank, or to buy other products.

- What are their goals?
  The goal of the customer is to fill their car's tank with gasoline at the gas stations. Based on the survey, all of them need to fill the tank at least once a month. 4% do it more than twice a week, 24% Once a week, 44% Once every other week, 28% Once a month, 0% Never.
- What do they need?
  Based on the interviews, the customers of the traditional interface need four main things:
  1. Gas station: Physical location that has fuel and may have a store or minimarket.
  2. Cashier station: If the users need to pay with cash, they need to visit the cashier station. Additionally, when the customer gets an error during the transaction at the pump or makes a mistake, the customer needs to go in to the cashier for resolution.
  3. Pump: Physical object to serve fuel. Customers need information of the type of fuel and the grade of gasoline provided.
  4. Payment method: Users need information about the payment capabilities to make the transaction. Are they going to pay with cash or credit card? Does the pump support digital payment method or not?

  Based on the evaluation of existing interfaces, if the customer is registered to Sam's club Scan and Go feature, there are different needs:
  1. Gas station: Physical location
  2. Pump: System already integrated with the Scan and go system
  3. Mobile application: For the user to request the service, make the payment and receive the receipt

- What are their tasks?
  Based on the interviews and the evaluation of existing interfaces, the customers plan to fill the tank based on consumption. Typically, if there is no urgency, they go to their preferred gas station based on brand, location or gas' price. While driving, if they are in an rush situation because the tank is empty, and the system is alerting the user to stop at the first available gas station.

- What are the subtasks?
  Based on the interviews, in general the users of the traditional interface perform below subtasks:
  1. Select a gas station and the pump servicing the type of fuel and grade of gasoline required for the car
  2. Park the car
  3. Insert payment card

4. Interact with the pump's interface
5. Select the grade of the gasoline
6. Open the tank
7. Lift Nozzle
8. Wait for servicing to be completed
9. Put the nozzle back into the pump
10. Close the tank
11. Print or not the receipt
12. Get in the car
13. Turn on the engine
14. Drive away from gas station

Additionally, there were two participants that added few subtasks to the process related to Covid-19 precautions. After step two (2.) and before interacting with the pump (3.), they look for gloves, and if there are no gloves they use their own. If they do not have gloves, then they manipulate the credit card with one hand and the rest of the interface's elements with the other hand. Once the service is completed, they get in the car and use hand sanitizer before touching anything else.

Based on the evaluation of existing interfaces, if the customer is registered to Sam's club Scan and Go feature, the subtasks are different:
1. Download the mobile application
2. Click Scan and go
3. Scan the QR code
4. Select method payment
5. Begin fueling
6. Receive the receipt by email

5 DEFINING REQUIREMENTS

During the executions of the needfinding methods, I was able to gather requirements from the customer standpoint and from the gas station's owner standpoint. To design this interface, I will mainly consider users with high level of expertise on mobile applications and digital payment methods. To make this application attractive to the owners of the gas stations, I will include functionalities to benefit their business.

5.1 From the customer standpoint:

- Implement a centralized and unique application that can be used at any gas station
- The application needs to meet accessibility standards like WCAG 2.1 AA (Web Content Accessibility Guideline) [2]
- Allow to preconfigure multiple mobile payment methods and ensure security protocols are met (e.g., PayPal, Apple Pay, Google Pay)
- Select grade of the gasoline

- Choose full tank or a predefined number of gallons
- Halt fueling at any time
- Monitor the progress of the service
- Display final cost, select payment method and complete payment transaction
- Print the receipt or send it via text or email

5.2 From the owner standpoint:

- The centralized application needs to provide API endpoints (Application Programming Interface) to integrate the vendor's pump with the service.
- Each pump needs to have a unique identifier defined by brand, store and pump number.
- The application needs to have page elements or widgets to customize the interface based on the brand and the store. For instance, placeholder for brand's name, logo, store's name and location.
- The application needs to have a placeholder to advertise specific products available inside the store. For instance, a banner to display on Wednesdays "Wednesday is your lucky day, do not forget to buy your lotto ticket today!"
- Ensure high performance and resiliency

To evaluate the success of my prototype, I will perform usability tests. I will attempt to create mocks and workflow diagrams and present them to few users. Because I will design the interface mainly for expert users, I will focus on efficiency and security. As success criteria, I will evaluate how intuitive the interface is? And how simple is the design of critical flows?

6 CONTINUED NEEDFINDING

To refine the requirements, I would like to do a modified survey. I noticed that 32% of the participants responded on question 17 that they have visited a gas stations that offers contactless solution. I would like to add question 18: If the answer to question 17 is yes, please provide the name of the gas station and the location. With this information I will try to visit the store to evaluate the interface. A question that is still pending: Is there a centralized solution with integration mechanism for different stores?

7 REFERENCES

[1] Wikipedia, "QR code," [Online]. Available: https://en.wikipedia.org/wiki/QR_code.

[2] W3C, "Web Content Accessibility Guidelines (WCAG) 2.1," [Online]. Available: https://www.w3.org/TR/WCAG21/.

8 APENDIX

8.1 Survey demographic results

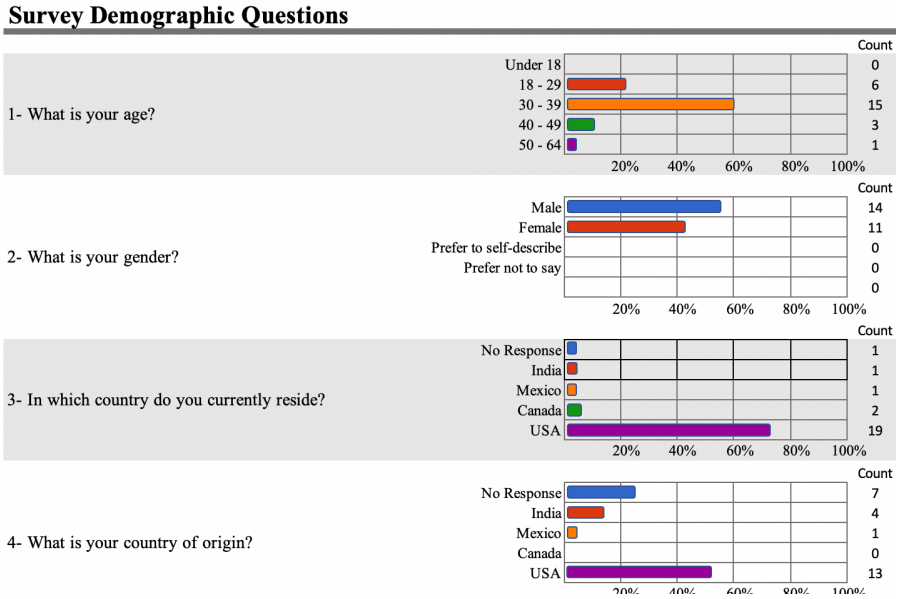

Figure 1 — Screenshot shows the results of the survey demographic questions

8.2 Second part of the survey results

Table 1 — Survey questions from 5 to 17 designed to gather information.

No.	Question	Results
5	How familiar are you with mobile applications?	0% Not at all familiar; 0% Slightly familiar; 4% Somewhat familiar; 40% Moderately familiar; 56% Extremely familiar
6	How familiar are you with digital payment methods?	0% Not at all familiar; 0% Slightly familiar; 12% Somewhat familiar; 44% Moderately familiar; 44% Extremely familiar
7	How frequently do you fill your car's tank with gas?	4% More than twice a week; 24% Once a week; 44% Once every other week; 28% Once a month; 0% Never
8	I feel comfortable using the physical pump interface	4% Strongly disagree; 20% Disagree; 32% Neutral; 24% Agree; 20% Strongly agree
9	I see the benefit in using contactless solutions to fill my car's tank	0% Strongly disagree; 8% Disagree; 12% Neutral; 44% Agree; 36% Strongly agree

10	**I feel comfortable using a contactless solution to fill my car's tank**	**0% Strongly disagree; 4% Disagree; 16% Neutral; 56% Agree; 24% Strongly agree**
11	**I feel comfortable downloading the mobile application of my most visited gas station**	**4% Strongly disagree; 16% Disagree; 12% Neutral; 60% Agree; 8% Strongly agree**
12	**I feel comfortable using digital payment methods**	**4% Strongly disagree; 0% Disagree; 8% Neutral; 68% Agree; 20% Strongly agree**
13	**I have privacy and security concerns related to digital payment methods**	**12% Strongly disagree; 32% Disagree; 16% Neutral; 36% Agree; 4% Strongly agree**
14	**Digital payment methods are difficult to setup**	**20% Strongly disagree; 72% Disagree; 8% Neutral; 0% Agree; 0% Strongly agree**
15	**There are often technical difficulties with digital payment methods**	**12% Strongly disagree; 64% Disagree; 20% Neutral; 4% Agree; 0% Strongly agree**
16	**If the contactless solution is more complex than the traditional method, will you still be willing to use it?**	**64% No; 36% Yes**
17	**Have you visited a gas station that offers contactless experience for filling the car's tank?**	**68% No; 32% Yes**

8.3 Interview script

Table 2 — Interview script designed with basic questions, specific questions for consumers and specific questions for gas station's owners.

No.	**Basic Questions**
1	How are you doing today?
2	Do you feel comfortable talking about the covid-19 pandemic? If yes, go to question 3, 4, and 5. If not, I will move to the second part of the interview.
3	Have you been exposed to covid-19?
4	If yes, How?
5	What do you do to avoid getting infected?
No.	**Specific questions for consumers**
1	How is your experience at a gas station?
2	Describe the tasks and the sub-tasks you perform while filling the tank
3	What type of changes would you suggest improving for purchasing and servicing gasoline?

4	Walk the participant through the contactless solution at a high level and ask for feedback. Describe the QR code [1], mobile interface, payment methods, feedback to the user, etc.
5	If you are not familiar with mobile application neither with contactless payment solutions. Would you use a contactless solution for gas stations? Why?
No.	**Specific questions for gas station's owner**
1	Who is the owner of the pumps at the gas station?
2	Who is the owner of the cashier system?
3	Who is the vendor supplier for gloves?
4	If you own different brands' gas stations. Do you use the same cashier system or a different system per brand?
5	What do you what to see in the contactless solution to improve your business?