

Redesigning an Inclusive Digital Contact Tracing Service Systems: User-Focused Phase of Design Thinking Approach

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Abstract

The global pandemic has taken its toll in all aspects of life, economies were destabilized and shaking all the industries to their limits. Aside from implementing strict quarantine protocols, contact tracing is one of the major solutions in preventing the spread of viruses. However, the citizens are using different contact tracing applications which causes challenges including the incomplete contact identification, delays in identification and isolation of cases, updates from Local Government Units (LGUs), and data management.

This study aims to utilize the use of technology through a digital application that stores personal data of the citizens in Valenzuela City to increase responsiveness, maximize data processing, real-time identification of individuals, and to cater inclusivity to maintain the safety in the vicinity. The research will be significant to Filipino citizens residing in Valenzuela, the LGUs, the establishments in the city and the future researchers who will be carrying out similar studies.

The researchers conducted preliminary data collection through survey questionnaires in the city of interest for initial assumptions and customer journey mapping. From these results, the researchers will then conduct surveys and interviews by utilizing the online platform as the mode of data collection. To protect our respondents' safety, the researchers will exercise the provisions of the Data Privacy Act of 2012, and the researchers will utilize other issuances

of the National Privacy Commission. As for implementing the proposed digital tool, the researchers will utilize statistical methods to determine and analyze the present digital contact tracing service systems.

Keywords

COVID-19 Pandemic, Contact Tracing, Design Thinking, Service Systems

1. Introduction

In late December 2019, there was an outbreak of a virus named novel coronavirus (SARS-CoV-2) that emerged in Wuhan, China. It started with four confirmed cases on the 29th of December in 2019. After a month, the virus has spread around China and its neighboring countries. Subsequently, the World Health Organization (WHO) issued a public health emergency on the 30th of January in 2020 (Yang et al., 2020).

As of February 2021, there have been more than 110 million cases of COVID-19 worldwide including the 2 million death cases and 12% of the total cases belonging to Southeast Asia (WHO, 2021). In the Philippines, there are already more than 550 thousand COVID-19 cases reported (DOH, 2021). Due to the rapid spread of the virus, several government agencies announced a resolution regarding the management and treatment of the COVID-19 situation, which includes the suspension of classes at all levels, disallowing of mass gatherings, and a decision of having a community quarantine.

The Philippine government established a multi-sectoral response, namely Interagency Task Force (IATF) on Emerging Infectious Diseases spearheaded by the Department of Health (DOH), in containing and eradicating the COVID-19 and minimizing its impacts on the country's economy. Information regarding people's current health state and who they were in contact with is an important process of containment (Perscheid et al., 2018). Specifically, contact tracing which is defined as the identification and the monitoring of each person who has been in contact with an infected person can be useful and convenient to the public, but it also becomes challenging. It forced the world to resort to digital tools to minimize the interactions as much as possible.

According to WHO (2021), digital contact tracing's general challenges include incomplete contact identification, delays in identification and isolation of cases, notification and quarantine of contacts, and the complexity of data management requirements. The government and developers are in the rush to act quickly (Kitchi, 2020 as cited by Clavier and Ghesquiere, 2021) to make a contact tracing application; therefore, neglecting the needs of the users.

In an interview titled "Models for contact tracing and COVID-19 response in the Philippines" by the WHO (2020), it was stated that contact tracing is one of the most vital ways of fighting COVID-19. Additionally, it was added that contact tracing should be done speedily, effectively and the use of analytical tools is essential.

With this, the contact tracing must be accessible to all, including those in the minor population with physical ability challenges. According to the WHO (2016), the Philippine Eye Research Institute conducted a study on Filipino blind people. 270,000 elderly Filipinos are estimated to be blind. Therefore, if a percentage of the minor population experiences these physical ability challenges, there would be a difficulty using the contact tracing system.

The study's objective is to assess the current digital contact tracing system in the City of Valenzuela using the Design Thinking Approach to identify the current user challenges by integrating inclusive designing in Project X, an ongoing project of Valenzuela City that focuses on contact tracing. It also aims to redesign improvements based on the results of the study conducted by the researchers with respect to inclusivity. This study also aims to respond to future outbreaks, improvement, and research that will benefit health and social care systems as a way to help ourselves (Calnan et al., 2018). More specifically, it aims to redesign an inclusive digital contact tracing to unify the health data of the citizens of Metro Manila for the benefit of the LGUs for an efficient and immediate contact tracing process.

This research aims to redesign an inclusive digital contract system by establishing a well-defined user-focused phase (Empathy and Define stages). The said study shall explore the current user challenges in using Project X in the City of Valenzuela, Philippines. Under these preliminary stages of Design Thinking, researchers are expected to develop the following:

1. Empathy Map
2. Personal Development
3. Customer Journey Map

The customer-focused outputs shall be used to come up with a sound problem statement for the next 3 stages of Design Thinking (Ideate, Prototype and Test).

2. Literature Review

COVID-19's history started in Wuhan, China in late December 2019 (Yang et al., 2020). The first confirmed case was on January 30, 2020 with a 38-year-old woman from Wuhan, China. (WHO, 2020). In the Philippines, the COVID-19 Alert System has been raised to Code Red sublevel 1 for the preparation of possible increase of cases (WHO, 2020). DOH promotes the practice of observing personal protective systems such as social distancing, personal hygiene, proper cough etiquette, and avoiding unnecessary travel and mass gatherings (WHO, 2020).

A study was conducted on January 1, 2020 to July 5, 2020 that 597 cities globally shows that the effect of lockdown is more significant to cities that are low income, more industrialized and with higher numbers of population. There is also a noticeable increase in premature deaths from 99, 270 to 146, 649 in the 76 countries due to the pollution in the air while in the COVID-19 pandemic (Liu et al., 2021). Globally, as of April 9, 2021, there have been more than 133 million confirmed cases of COVID-19, with almost 3 million deaths (WHO, 2021). In South-East Asia, there are almost 16 million confirmed cases. 41% of the total number of cases are from the National Capital Region (NCR). In terms of economics, tourism may be hit the hardest due to the pandemic. This is matched by job losses and mass increase in the global poverty levels and economic shocks across industries and supply chains.

Education systems have been disrupted due to the COVID-19 pandemic, and it is one of the largest in human history, affecting nearly billions in over 200 countries (Pokhrel & Chhetri, 2021). The pandemic is causing significant changes in academic institutions, forcing the country to use online platforms as a mode of learning. Instructors teach lessons synchronously through Google Classroom, WebQuest, Zoom, and other online applications. As of April 8, 2020, universities and other tertiary institutions are closed and over 200 million postsecondary students have had their studies come to a halt due to the pandemic (World Bank Group Education, 2020). For the environmental aspect, it has been indicated in the study that air quality, Greenhouse gas emissions, water, and noise pollution have significantly dropped. However, due to the COVID-19 pandemic, there is an increase in medical waste, harming the environment.

Fear of COVID-19 is prevalent among frontliners especially nurses because this may increase labor turnover in the medical industry. This fear has an effect on job stress, organizational and professional turnover intentions. According to the study of Shreffler et al. (2020), the healthcare workers' (HCWs) psychological burden and overall wellness have received heightened awareness. With these impacts on different sectors, the COVID-19 pandemic has led to the surge of digital technologies, leading firms and educational institutions have implemented work-from-home strategies (De' et al., 2020). Due to this setup, workplace monitoring, and technostress issues may be prevalent in digital surge growth. Controlling the transmission of the COVID-19 is detrimental in containing the virus, one of the ways to reduce its spreading is to implement a proper contact tracing system to immediately isolate infected individuals (Hernández-Orallo, 2020). In addition, technology can play an important role in this aspect using mobile devices such as smartphones by tracing through GPS, Bluetooth, WIFI, or other cellular networks. However, various ethical issues involving the use of contact tracing technology were present such as privacy, voluntariness, and beneficence of the data (Abuhammad S., 2020).

In a study that discusses the impact of delays in the effectiveness of contact tracing, shortening the time between the showing of symptoms and a positive test result, assuming immediate isolation, is a way to improve the contact tracing effectiveness. Digital contact tracing makes use of electronic data. It is used to detect recent infections and exposures (Kleinman & Merkel, 2020). Six core themes were identified in the study of the development and adoption of digital contact tracing applications, namely: 1) data governance; 2) role of IT giants; 3) scientific rigor; 4) voluntariness; 5) functional efficacy; 6) role of the app (Amann et al., 2021).

A study conducted by Marko-Holguin et al. (2019) utilized a design thinking approach to construct a communication tool that involves two-way interaction through SMS or text messaging. The application of mobile technology was further discussed in a research according to Petersen and Hempler (2017) in which design thinking is also applied in developing a mobile application for people diagnosed with type 2 diabetes as a form of self-management. Design thinking approach has been widely used in different industries, not just in healthcare, because of its various benefits. This is supported by a study conducted by Nakata and Hwang (2020) that in general, they were able to conclude that design thinking can significantly improve product and service performance.

The first approach is that (1) Design thinking is involved with having empathy, critical thinking and collaborative relationships with users so that innovations, products, processes and systems can further be improved. The second approach is (2) Design thinking harnesses the creative mind of the designers to be observant of the features of a product and resolve its challenges if there is any. And the last approach discussed by Matthews and Wrigley (2017) is that (3) Design thinking combines human, technology, and business together.

According to Luck (2018), observations show that when people can participate more actively in the design and meet their specific needs, this mode of engagement positively responds to several controversies in inclusive design. By focusing on the individual, this approach recognizes the unique, every day, and exceptional situations that people with varying abilities face in their lives (and reduces generalization on user stereotypes or category of disability).

Inclusive design is an approach where the goal is to create a design that includes as many people as possible. This eliminates the barrier between the user and the product which makes it more accessible to everyone. However, this does not mean that the designs are solely tailored to target a group of people. Inclusive design finds the balance between the needs of a particular group of people and the needs of the population (Heylighen, A. et al., 2017). Some examples of disabling situations, stated by Heylighen et. al, are divided into four (4) categories: Touch (one arm, arm injury, new parent), See (blind, cataracts, distracted driver), Hear (deaf, ear infection, bartender) and Speak (non-verbal, laryngitis, heavy accent).

In summary, the COVID-19 pandemic which started in China spread to numerous countries including the Philippines. This virus has affected both human health and the world economy. All industries were affected which resulted in unemployment, mass increase in global poverty levels, and economic shocks across industries and supply chains. In preventing the vast spread of virus, one way is to implement a contact tracing system to immediately isolate infected individuals through a fast and unified contact tracing system that is also accessible to minorities.

Based on studies, the creation of a digital contact tracing system has been one-sided. Only developers of this application are the ones who have control over what they think the users would need and would do. The researchers have identified a gap that would be mainly focused on the design thinking which allows the researcher to identify the pain points of the user while incorporating how to empathize with the users, define their problems with the current digital contact tracing system, ideate on possible solutions, prototyping the idea and testing on how the prototype would perform. It is vital that the end-users should be involved in the creation of the system so they can give an insight into possible bottlenecks and problems that could arise. Another gap would be inclusivity because in the creation of contact tracing tools only the general population was put into consideration. While in inclusivity, the users of the system would be provided with equal access and opportunities when collaborating on developing the system for digital contact tracing. Inclusivity would be accessible regardless of age, gender, disability with developing a system that is unique and diversified.

3. Research Design and Methodology

3.1 Conceptual Framework

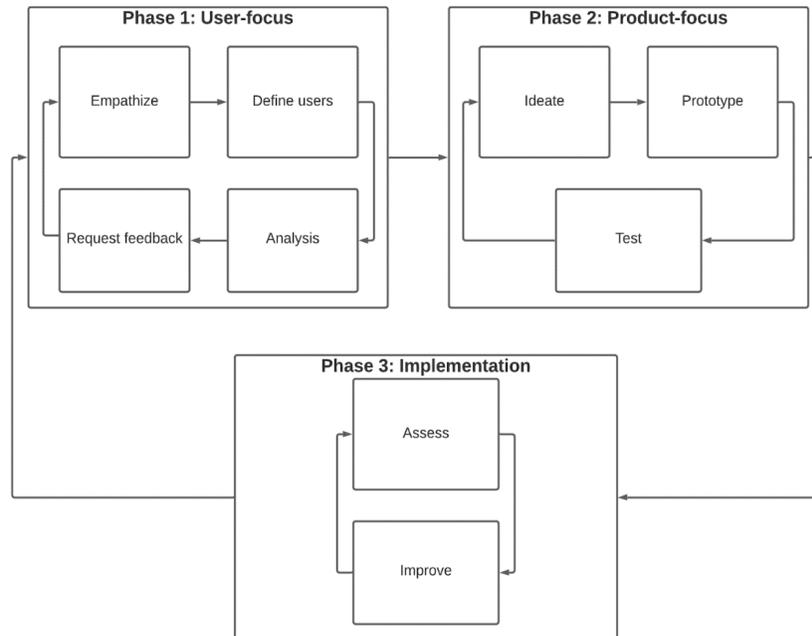


Figure 1. Three Phase Conceptual Framework

Aligned to its objectives, this research shall focus only on the first phase out of three phases as shown in Figure 1. The primary focus of the first phase is the users/consumers. It involves identifying, understanding, and empathizing with the different problems they encounter in using Project X.

- Empathize*: The researchers will be defining and understanding the problem/perspective of the users with regards to Project X in the City of Valenzuela.
- Define users*: After identifying the perspective of the users, the researchers will be able to define who will be the users of Project X and how they will manage the users efficiently.
- Analysis*: After the defining stage, the researchers will look into the user's behavior patterns and their preferences with regards to the digital contact tracing.
- Request Feedback*: Through the feedback of the users, the researchers would be able to identify the experience and possible future problems that the user might encounter in using Project X. Also, the researchers would be able to utilize the best possible solution to address these problems. This includes the exchange of information and interaction between users and designers.

3.2 Research Design

The researchers' conceptual framework will focus on three (3) phases; however, this research shall cover Phase 1 only. The first phase is called 'User-focus,' which consists of four steps: empathize, identify users, analyze, and request feedback. First, the researchers will define and understand the problem or challenges encountered by the users of Project X in Valenzuela. Then, after identifying the users' perspectives, the researchers will be able to define who are the users of Project X and how they will manage the users efficiently. Following the defining point, the researchers will look into the user's behavior patterns and preferences concerning digital contact tracing. Lastly, through the users' feedback, the researchers would be able to identify other possible problems that the user might encounter in using Project X. Also, this will aid the researchers in utilizing the best possible solution to address these problems. This includes the exchange of information and interaction between users and researchers. The researchers surveyed and interviewed 112 residents of Valenzuela City.

3.3 Research Methodology

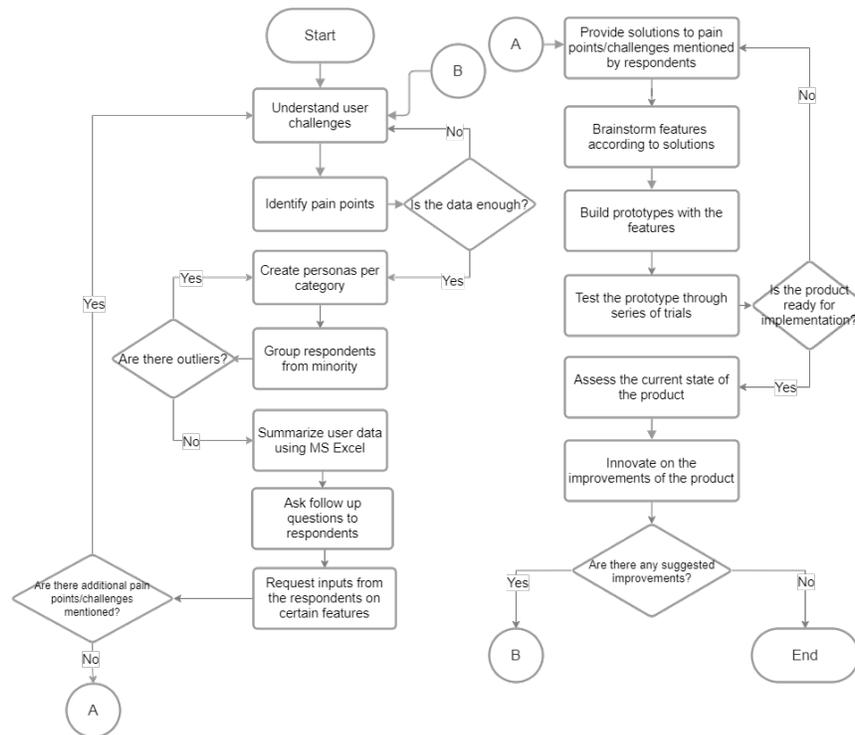


Figure 2. Design Thinking Flowchart

The design thinking method flowchart shown in Figure 2 starts with a user-focused phase in which the researchers will understand the user’s challenges to identify their pain points. After identifying the pain points, the researchers will validate the data. If the data is not enough, the researchers will gather more data from the user’s challenges. On the other hand, if the data is enough, the researchers can create personas per category. After which, the researchers will group the respondents and check if there are outliers in the data. If there are outliers, the researchers will continue to create more personas to remove the outliers. However, if no outliers appear in the data, the researchers can summarize the user’s data using MS Excel. With that, the researchers will be asked to follow up questions to the respondents and request inputs from them about specific features of Project X. If the respondents mention additional pain points/challenges, the researchers will go back in understanding the user’s challenges. However, if there are no additional pain points mentioned, the researchers will be proceeding to the product-focused phase.

3.4 Research Demographics

The researchers conduct their data collection through online platforms due to continuous quarantine protocols. The researchers will use Google Forms as the primary platform for disseminating the online survey form. Zoom sessions are used for online one-on-one interviews and focused group discussions. During the interview, respondents will be asked to explain their pain points on their digital contact tracing experience and evaluate their satisfaction. Also, the respondents that will be considered in the interview are someone with consent and awareness of details in the survey questionnaire. The categories considered in the research demographics are based on the survey form including gender, age group, minor or general population, and occupation of the respondents as seen in Table 1.

Table 1. Research Demographics

Demographic Categories	Item	Count	Percentage
Gender	Male	18	42.9%
	Female	24	57.1%
Age Group	18-24	32	76.2%
	25-34	6	16.7%
	35-44	0	0%
	45-54	1	2.4%
	55-64	2	4.8%
	65+	0	0%
Minor/General	Minor	35	83.3%
	General	7	16.7%
Occupation	Student	28	66.7%
	Employee	6	14.3%
	Merchant	2	4.8%
	Frontliner	5	11.9%

5. Results and Discussion

5.1 Empathy Map

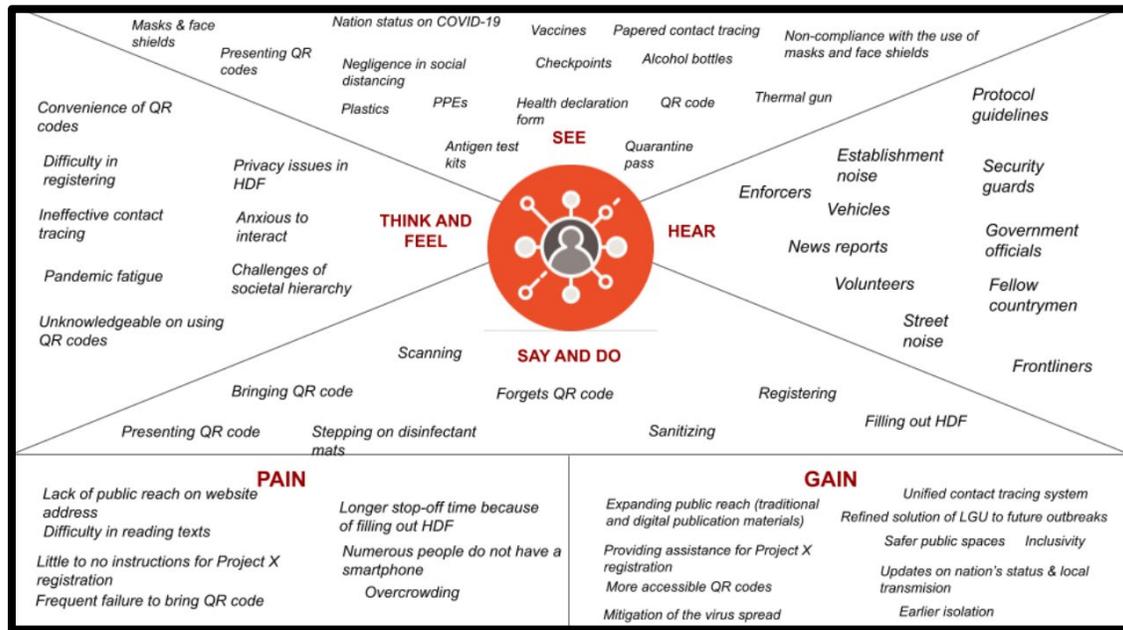


Figure 3. Empathy Map

Based on the survey and interview done by the researchers. They were able to develop an Empathy Map as shown in Figure 3. The Empathy highlights the pain and gain of the 112 respondents of the study which are essentials in coming up with the personas.

5.2 Persona Development

Upon generating the Empathy Map, using the Thematic Analysis, the researchers were able to develop the 7 personas of the study. They are Lucy, Cecil, Gabriela, Grace, Bertha, Leonard and Chico. These personas are fictitious characters generated from the empathy map. Each of the personas represents a certain type of respondent of the study. Each persona's characteristics and user story are shown in Table 2.

Table 2. Persona Development

Name	Characteristics	User-story
Lucy	Homebody; Female student; Rarely-to-seldom goes out	She is anxious about going outside when the case is high. She does not feel safe entering establishments when there's a lot of people. She hopes to improve the Project X system, such as tutorial or voice assistant for PWDs.
Cecil	Forgetful and technology illiterate; Female housewife in her 40's; Frequently goes out	She frequently goes out because of her family's need to buy essentials but usually forgets her QR code. She hopes that improvement on ease of use will be implemented to use it efficiently.
Gabriela	Prepared; Female medical frontliner in her 20's; Frequently goes out	She helps people who still do not have a QR code from Project X. Moreover, its accessibility in terms of web address will be improved. She also wishes for Project X to have additional features for vaccines, telemedicine, text updates, and a help desk for Project X.
Grace	Techy; Female citizen in her 20s; Rarely to seldom goes out	She is mainly concerned about Project X being accessible to every citizen, especially to people who are not from Valenzuela. Even though she rarely goes out, she experiences repetitive scanning of QR code when entering every establishment.
Bertha	Humble; Housewife in her 50's; Rarely goes out	She used to go out every day before her leg was amputated. She had a hard time registering for herself, so she asked her son to do it for her. She hopes that there could be a help desk or any assistance to be provided.
Leonard	Confident-Knowledgeable; Male employee in his 30's; Seldom goes out	He is highly satisfied with Project X's current stature but also wants improvements that can maybe improve the usage of the system.
Chico	Enthusiastic; Male citizen in his 20s; Rarely goes out	He is anxious because whenever he manually fills out a health declaration form with a crowd, the virus may spread easily. He is hopeful that improvements like unity of DCT and HDF can improve the current system.

5.3 Customer Journey Map

The information included in Table 3 are the main points of their goals, expectations, opportunities, ideas to improve, and the current challenges they face in the City of Valenzuela's digital contact tracing process. Upon reviewing the Customer Journey Map of each persona, the researchers have observed that most of them have trouble accessing, Scanning, Registration, and filling out the Health Declaration Form (HDF). For Accessing, concerns arise such as internet connectivity issues and Project X not being accessible to everyone. For Scanning, repetitive Scanning of QR codes due to unresponsiveness of the equipment, possible loss of QR code that may lead to identity theft and forgetfulness in bringing the QR code. One of the common problems in Registration is that the website's text is difficult to read, password complexity requirement, and absence of tutorial or video guide on how to register. As for the Filling Out of the HDF, there are time delays and repetitive filling out of health declaration forms in every establishment.

Table 3. Customer Journey Map Summary

	Scenario	Goals & Expectations	Opportunities & Ideas to Improve	Contact Tracing Existing Process							
				Accessing	Registration	Saving	Scanning	Checking	Accessing (HDF)	Filling Out (HDF)	
Lucy	Generation Z Female student; rarely to seldom goes out	- Cases would drop down as it allows her to go out without being anxious	- Faster WiFi system - Provide assistance to PWDs (tutorial guide and voice assistance) - Immediate response in reading QR code - Mandatory scanning of QR code and HDF in every establishments	✓			✓				
Cecil	40-yr old housewife who goes out every day to buy needs of family; Only one in the family that could go out	- Project X system would be stricter so that cases could lessen with a better contact tracing system.	- Make Project X accessible to everyone or at least easy to understand - Bigger font size and direct to the point instructions	✓	✓		✓				
Gabriela	28-yr old female frontliner who assists in vaccination sites; assists citizens in the registration on Project X	- Contact tracing system should be unified with added features: vaccination, telemedicine, inclusivity and text updates.	- Improve public materials for announcements to reach all users	✓							
Grace	Female tech-savvy citizen in her 20s; Rarely to seldom goes out	- DCT can be improved and used in the right way - DCT should be accessible to every Filipino, not only to the privileged ones.	- Make Project X accessible to everyone or at least easy to understand - Input vaccination feature - Physical QR code - Implement RFID/Tap System - Unified DCT	✓	✓		✓				✓
Bertha	Widow PWD in her 50s; Rarely goes out	- Guides for end-users on how to access the Project X website and how to create an account - A unified system - Text updates regarding the nation's status on COVID-19	- Provide a help desk or assistance for Project X	✓							
Leonard	Male employee in his 30s; Seldom goes out	- Observes physical distancing to avoid being exposed - Usage of face mask, face shield, and proper sanitation	- Accessibility of the website to download QR code - Implementation of Project X as National ID								
Chico	Male student in his 20s; Rarely goes out	- Avoid queue lines in filling out HDF that may possibly cause the spread of the virus	- Messenger integration because of its free access - Avoid manual HDF because sharing of pens might help contract the virus - HDF should be all-in-one form in sync with DCT	✓			✓				✓

6. Conclusion

In this first phase of Design Thinking, the researchers were able to define seven personas based on identifying the user challenges of Project X, namely: Lucy, Cecil, Gabriela, Grace, Bertha, Leonard, and Chico. Their pain points in using the said project were divided into three main categories: Accessibility, Registration, and Scanning. Lucy, Cecil, Gabriela, Grace, and Chico are having difficulties in the accessibility of Project X for reasons such as lack of internet connectivity, not all citizens of the Valenzuela are tech-savvy, difficulty in finding the web address for Project X, and hassle in accessing QR code. Cecil, Gabriela, Grace, and Bertha were struggling in registering for Project X because the website's text is difficult to read, and the password complexity requirement. Lastly, Lucy, Cecil, and Grace are having trouble with scanning the QR codes because of repetitive scanning due to unresponsiveness of the equipment, possible loss of QR code that may lead to identity theft, and forgetfulness in bringing the QR code.

Furthermore, some concerns outside these main categories are repetitive filling out of health declaration forms in every establishment, time delays/bugs in saving QR codes, and time delays in filling out health declaration forms. Indeed, the researchers' objectives were met. The results from the Empathy and Define stages (User-Focused Phase) will be used to ideate solutions, to design, and to test the prototype.

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