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| Designing Human-Computer Interaction (6389) |
| Assignment 2 |
| Design and Implement Interaction |

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# Abstract

This paper describes the in-depth analysis and process of developing the drone delivery application, DroneDelivery. Combining techniques and tools such as creating personas and their scenarios, a PACT analysis, Object and Action analysis, application interface wireframes, a Rich Picture, storyboards for personas, and UX design principles, have ultimately contributed to the creation of an item delivery app based on catering to user needs. This paper explores the possibilities of using the DroneDelivery application, where its primary goal is to provide a user with an enjoyable and accessible experience that requires the least amount of cognitive effort.

# Personas

In this paper, number of personas were used to help design and implement interactions between different contexts of the system such as user and technology in order to allow the system to function effectively in terms of Usability and User Experience.

**Persona #1 (Steven)**

Steven is 43-year-old male, who lives North of Canberra, Australia. He has been working for an IT company as a data scientist over the past 4 years, after relocating from his previous company. His office job requires him to collect and manage the log data from the customers in preparation for usage. Steven’s wife, Carla is an English teacher in high school. They have two children, aged 16 and 13 years. Carla and her children commute to the same school.

To avoid exposing classified data, Stephan is banned from transferring data over the internet, as online delivery increases the risk of granting unwanted access of high-level data to people outside of the company.

Like everyone else, Steven’s family has been faced with some impacts regarding the novel covid-19 pandemic. Steven has been asked to work remotely between office and his home, resulting in steven to work mostly from his home for the next couple of months in order to avoid unnecessary contact with other people in the office. Steven’s wife and children are going through a similar situation.

As well as the working environment, Coivd-19 related restrictions and lockdown have affected Steven’s family time. He now spends time with his family mostly at home, doing activities such as video games and board games, as he is concerned about doing any outdoor activity with this family.

**Persona #2 (Karen)**

Karen is a 45-year-old marketing executive working five days a week while caring for two children. As a result of Covid 19, Karen now works at home in a city lockdown. However, as Karen’s workload increases, she is unable to meet the needs of her children. Covid restrictions prevent Karen from hiring a babysitter to care for her children. In her spare time, she enjoys surfing the web and searching for goods. She cannot afford to wait for the slow delivery service that the pandemic has caused, which increases her frustrations. She also used to get her food from the restaurants when she is suffering from her workload, which she cannot do anymore because of the lockdown.

Karen often goes to the shops in her suburb to do grocery shopping, she also pays special attention to the food she gets for her children. However, since people started to purchase out of panic, it is hard for Karen to get what she wants, and she is also concerned about going to public places.

**Persona #3 (Lily)**

Lily is 19-year-old second year university student; she is originally from Perth but is conducting her studies in NSW. She had been on holiday visiting her parents in Perth when covid-19 virus first emerged. As a result of Covid-19 restrictions and lockdown, Lily is unable to travel back to the Campus and must conduct her studies remotely. As a result of many other students experiencing the same dilemma as Lily, her university has overhauled the curriculum of most subjects as much as it can to accommodate for remote learning.

Lily also suffers from asthma and other medical conditions. She requires monthly doctor appointments as well as prescribed medicines that she needs to take daily. Furthermore, Covid 19 serves as a serious medical scare for her, much more so than people of her age, as a result her doctors have told her that neither herself nor her family members should interact with anyone outside of their household.

Lily likes to go for a walk with her cat in her free time, and she often goes swimming as an exercise. However, because of current situation caused by the pandemic which prevents people from going outside, she needs to find a new hobby for herself.

# Scenario implementation for personas

This section of the paper is used to propose possible interactions that can take place between each persona and the system. It also observes those interactions from more human-centred designing perspective in order to design a system interface that meets user’s demand, while adopting flawless Usability and User-Experience.

**Persona #1 (Steven)**

Steven needs to use the feature on the application that lets him order a drone and deliver an item to someone else using the drone. For him to do this he needs to use the function on the app that lets him order a drone. For this function to happen, the destination user needs to accept the delivery on the app. After the drone has arrived, Stephan needs to open a physical bay on top of the drone. When he opens, closes, places an item on the bay it will be confirmed on the app. When the bay is closed, he needs to press the “Finish” button, once this is done the drone will take off and go to its destination. When the drone arrives at the destination, the user needs to open the bay and remove the storage device. After the storage device is removed, the user needs to press “Finish” on the app.

**Persona #2 (Karen)**

For her work Karen needs a new laptop, a desk, she also needs to order specific so she can review them. For her kids she needs toys, she also needs to order groceries every week. All these items are going to be ordered using the drone. To order the table and the laptop, she needs to find a local vender that uses DroneDelivery. For her to find one, she needs to go one the DroneDelivery. All the venders listed on the app use DroneDelivery. She cannot have items from different venders in the cart at the same time. She needs to order the furniture and computer separately. When she presses checkout on the cart, she gets taken to the payment page, then she gets taken to a page that lets her track her orders.

**Persona #3 (Lily)**

Lily is about to start her new semester. She needs to order textbooks required in her course of study. Because she is studying remotely, she wants to achieve a faster and more stable internet connection on her laptop that may help her in various ways, which requires her to order and replace her current Wi-Fi card with a new generation Wireless LAN Card. Her classes will soon commence and will need to take advantage of Drone Delivery to avoid significant delay with current courier delivery services.

Due to Lily’s medical condition, she needs to take prescribed medicine daily as well as monthly doctor’s appointment. Since the covid-19 serves as a serious medical scare to her, Lily, is now having her monthly doctor’s appointment on online instead of face-to-face. However, she still needs a way to get her prescribed medicine, which she can take advantage of Drone Delivery as they prioritise in delivery of medical equipment.

# PACT Analysis

Artefact: The artefact is a delivery service that utilises drones. The DroneDelivery system has several features that can accommodate a variety of users with their needs. The drone operates within a city. It cannot deliver from one city to another. It is most used by large companies to deliver items to people in the same city. As a result of high demand of usage for the DroneDelivery app, ‘one day’ delivery has been implemented. The second main feature of the app is the option to deliver items between customers, only if the sender and recipient both live in the same city.

This delivery system can be used by logistics and shipping companies like Australia Post, TNT, and Star Track to deliver items to customers. If an item is ordered by a customer, and the customer resides in the same city as the warehouse the item is in, the customer has the option to have the item delivered to them by one of our drones. If the item is not in the same city as the recipient, it can still be integrated into the logistics system of these companies. This is done by giving the option for the customer to have one of our drones pick up the item once the item reaches the destination city.

**People**

The DroneDelivery app is accessible to those who have access to a mobile phone and internet service (Wi-Fi or mobile data). Those with mobility impairments can still use the app as the drone will transport goods to the user and minimize movement as they can hold their mobile phone in their hands. The application will be usable by all language speakers, as there is the option to change language. Those who are eco-friendly can accept the DroneDelivery app as the drones do not function on fossil fuels and use electricity/energy instead. Ages 13 and above have access to the app, as those below 13 do not meet the minimum working age and cannot earn money/do not have the responsibility to spend money. Those with visual impairments may have difficulties using the app as there is no voice recognition for navigating through the app.

However, users with memory impairments may have difficulty navigating the app as they will need to tap various “back” buttons to return or tap other buttons to move forward to view different item categories or change account settings.

Business employees can also order items to their company buildings rather than homes, and/or in outside places.

**Activities**

**Example 1:**

An activity example could be shopping for groceries. Steven opens the app in his home, he is greeted by a home page and 4 options: Search, Favourites, Account and Settings. He taps search and is shown a list of categories to choose and search for items. Every option is large and easy to look at. He taps the category, ‘Groceries.’ local traders available from his location and finds groceries he needs to order. He needs to buy multiple sets of one item. The “+” and “-“ button next to an item show Steven that he can increase or decreased the amount of sets of an item to purchase. Steven taps the large button that is displayed when he views each item. The large bright button increases visibility for users. He quickly navigates where the button is and adds items to his cart to purchase. Steven taps on the shopping cart. The symbol is large and uniquely shaped, so he knows where to navigate to purchase his items. While reviewing his order, he quickly has his postage details (address, name, phone number) automatically filled as he registered with a DroneDelivery profile using his linked Google account. Steven is relieved as he does not need to spend a lot of time typing his details. Steven taps the large and bright “Confirm Purchase” button and is greeted by a “Purchase Confirmed” screen with a large green tick. He knows that he has paid and does not need to use strenuous effort.

**Example 2:**

Another example involves Karen needing to buy items for her job. She opens the app while she is at work. She is greeted by the home screen. She logs in by typing her username and password. She is shown a successful log in screen. She then taps the “Search” button. The search page appears as well as a keyboard pop-up. She begins to type in “Stationery.” Suggestions are shown underneath the search bar. They are large enough for lily to notice them and taps a suggestion. She is brought to a list of items related to that search option. She swipes up and down to scroll through the suggestions. She sees the large “add to cart” button and taps it. She taps on the shopping cart icon to look at the items she added to cart. She proceeds to tap the “Express Delivery” option. She taps “Continue.” The app smoothly prompts her to turn on her location to search for the closest drone. Karen turns on her location. The app quickly confirms her location with a screen showing “location found,” and she does not need to put extra effort in as her firm building already has a landing pad for the drone. Karen presses “continue” to the payment page, she is satisfied with the total price and taps “confirm purchase.” The app displays a “Purchase confirmed” screen and she sighs in relief. She can now get the items she needs for work.

**Contexts**

With current circumstances related to the newly emerged convid-19 pandemic, people started to purchase out of panic. This has caused a huge strain on delivery companies which in turn has caused severe delays.

To avoid interception incidents with other aircraft, the DroneDelivery application keeps in contact with Air Traffic Control (ATC). As the drones used by DroneDelivery weigh more than 250 grams, it must fly at least 5.5 kilometres away from a controlled airport, according to the Civil Aviation Safety Authority **[1]**.

Since the drone is not controlled by a person, it needs to be aware of potential dangers to itself, the environment, as well as how to deal with these dangers. The biggest danger to this drone is birds. A drone could fly into a flock of birds or it could get attacked by birds. This can damage both the drone and the birds. To prevent this, the drone will be fitted with a motion sensor that detects movement around the drone. If the drone detects movement within 10 meters of its proximity it will set a noise in a frequency that causes irritation to birds. Pets are other issues, particularly dogs. The drone is implemented with a dog and cat whistle. When the drone is in the process of taking off and landing the drone will identify human and environmental dangers. This will prevent the animals from approaching the drone and potentially hurting themselves. Since the frequency of dog and cat whistles cannot be heard by human ears, it will not be a disruption for the community.

**Technologies**

Several types of data are shared between different contexts in the system. For example, user locational data is given to the system along with their preference for the delivery and method for payment; to provide users with a seamless experience. The information is used for assigning the drone unit that is suitable for each delivery event. Information given by the customer will then be stored in the system as a part of customer detail for convenience.

To achieve enhanced security, sensitive user records are protected by segregating their information from others on the network. In doing so, it will prevent any unwanted activities from moving vertically inside the system, in case of data breach. Additionally, the users who created a DroneDelivery profile using their Google account can enable 2-step authentication feature - provided by Google to have better security **[2]**.

The app communicates with the drone system. When an order is placed, the system will send a drone to pick up the order. This information will be sent to the phone. If it is an order that involves a different delivery company such as Australia Post, the updates of the package until it gets to the Drone Delivery facility will be handled by the delivery company. Once the package gets picked up by our drone, a live GPS update will be sent to the recipient. The app will contain a payment system that includes a GPS tracking system to track dispatched drones. It has a priority delivery system that prioritises delivery from medical institutions and other essential services. It also has a system where you can order a drone to deliver items to a friend.

# Object and Action Analysis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Persona | Activity | Consists of sub-activities | Action | Object | Comments |
| Steven (#1) | Order grocery item | Go to the list of available local traders, and add items to cart | Click order confirm | User location  List of items available | User can either choose economy or express delivery service |
| Steven (#1) | Create account | click sign up option from either “create new account” or “sign up with google” | Provide details required can click “create account” | User detail required for sign up | By signing up using google account, user can enable 2-step verification feature |
| Karen (#2) | Order an item using express delivery option | Choose item needed from the list | Click on “express delivery” option and confirm order | User’s locational data for checking availability. | Express service may not be available due to the weather condition |
| Lily (#3) | Order delivery for prescribed medicine | Choose medical equipment delivery, then click prescribed medicine | Scan the barcode on prescription | Identification of medical script information | Delivery for prescribed medicine is priorities by default in system |

# Architecture and Broad Design

# **Rich Picture**

The Rich Picture below describes the system of the DroneDelivery application. Actors (customers, system owners) all interact in main activities, IoT’s for the system, as well as disruptive factors (poor weather and animals).

Map

Description automatically generated

**WireFrames**

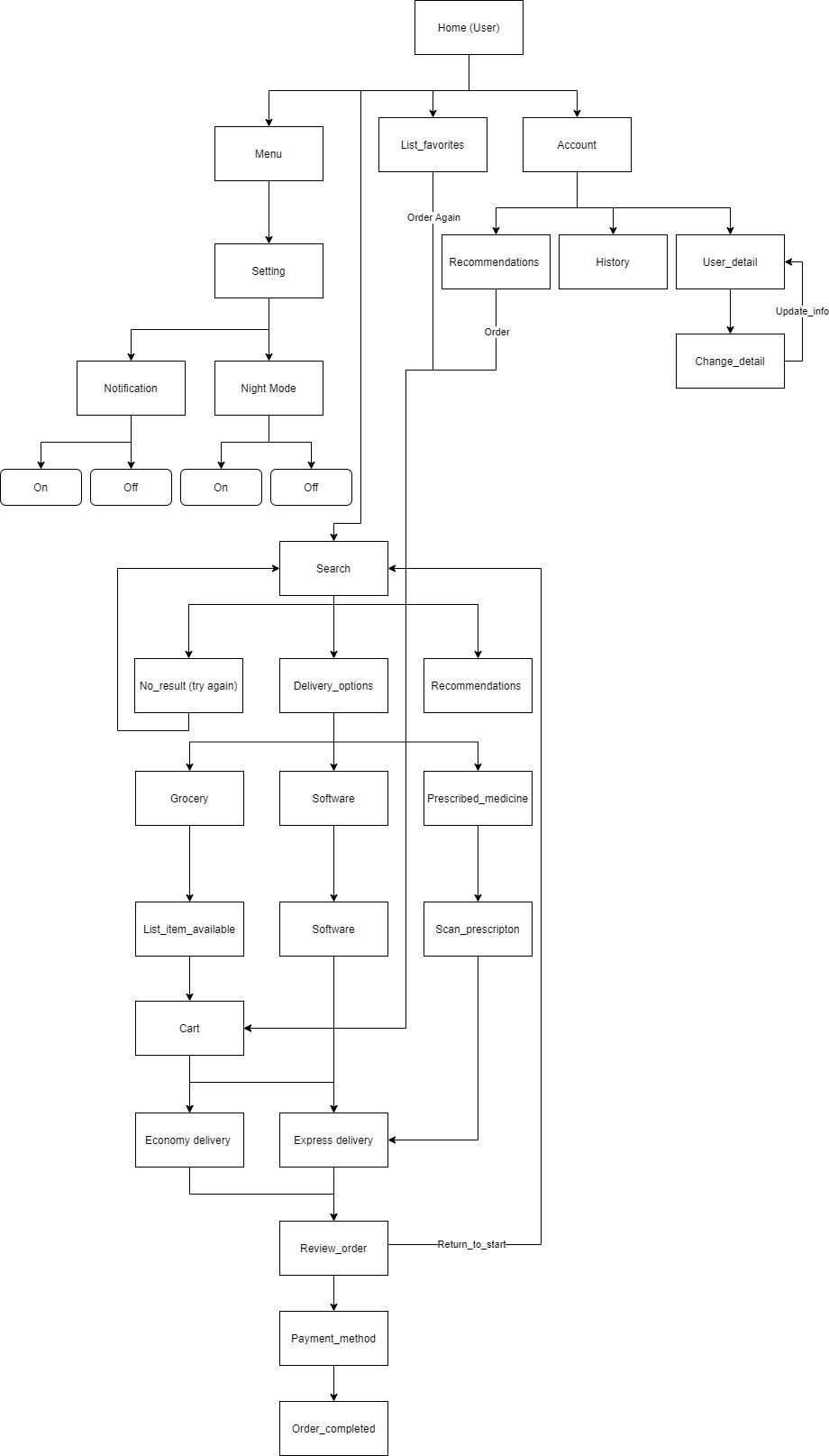
|  |  |
| --- | --- |
| **Summary:**  **The following are descriptions for parts of the wireframes that are mostly consistent within all or most of the wireframes:**  **Cart button in the top right allows the user to enter their cart to see what items have been selected.**  **The back button in the top left allows the user to go back to the previous page they entered.**  **The bottom tabs are easily accessible Buttons which include the search button, favourite list, settings, and account.**  **For each of the personas, their wireframes are associated with the items they are looking for. The difference in wireframes come from their different category type items as grocery items should be easily added to the cart and do not need much description on what it is. For Medication, similarly to groceries, the user should have an idea on what they are looking for, but due to its importance, it is more spread out to make it easier to find the desired item. Lastly for software storage, this page provides specifications of the item as these are important for those kinds of items unlike groceries or medicine.** | |
| **Legend**  = Interactable Button/input  = Non interactable image  = Interactable user choice button  = Non interactable choice button (Decided based off user’s cart items) | |
| **Home page** | **Payment Page** |
|  |  |
| **Delivery Address Page** | **Persona#3 Lily (prescription Page)** |
|  |  |
| **Persona#2 Karen (Groceries Page)** | **Persona#1 Steven (Software Page)** |
|  |  |

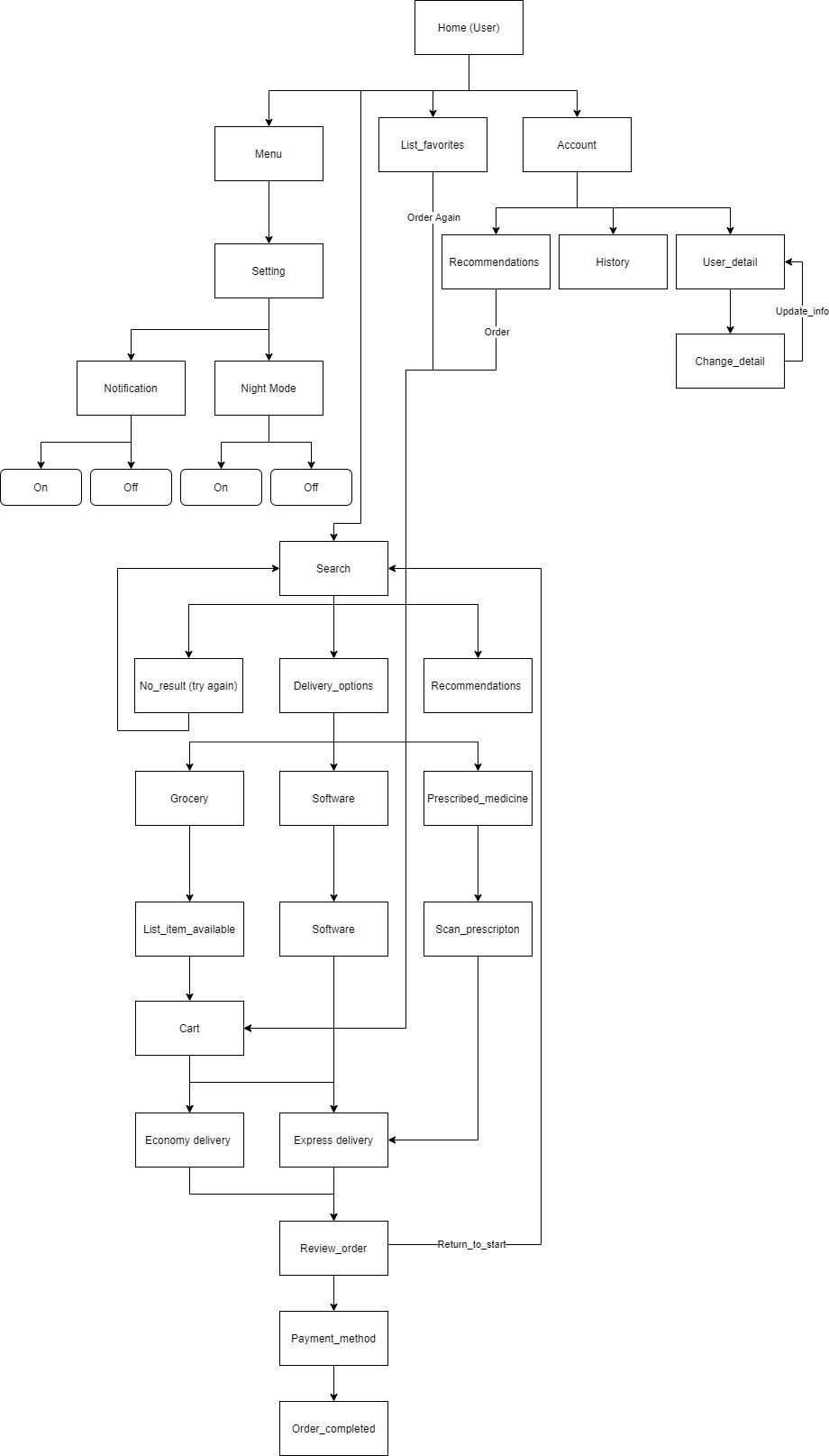
**Storyboards (based on activities)**

|  |  |
| --- | --- |
| Persona Lily Storyboard (QR code medicine + search recommendations) | |
| Diagram  Description automatically generated | Diagram  Description automatically generated |
| Persona Steven Storyboard (fail login + retry + Google login + 2-step authentication) | |
| Diagram  Description automatically generated | Diagram  Description automatically generated |
| Persona Karen Storyboard (guest log in + favourites + express) | |
| Diagram  Description automatically generated | Diagram  Description automatically generated |

|  |
| --- |
| Persona Steven Storyboard (Sending items to others + Google login) |
| Diagram  Description automatically generated |

**Navigation Map**

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# Summary of Techniques Involved

# The processes involved in designing the prototype of the drone delivery system includes understanding, envisionment, design, and evaluation. In each process, there were multiple techniques used to improve the overall design of the drone delivery system.

# Understanding

Within the DroneDelivery system prototype, an understanding of the different users who would experience the system was required. Through utilising techniques such as the PACT analysis and personas with their scenarios, this can improve the user experience of the system.

PACT provides a clearer understanding on the overall drone delivery system and establishes how the system will adjust to different users and goals.

Personas and their scenarios create the opportunity to understand different user needs, experiences, and interaction within the drone delivery system. UX designers can use the envisioned Personas by stepping into their shoes and seeing how to cater to the DroneDelivery’s target audience, as well as how it could be further improved. Designers can use the information and apply it to the improvement of usability and efficiency in the application towards users using less cognitive effort. The personas and scenarios also set the requirements for the design principles as these addresses the needs of human behaviour.

# Envisionment

When creating a prototype, it is important to understand how practical ideas can be. With envisionment, these ideas can become reality using different techniques to visually represent them. These techniques used in the envisionment process of the drone delivery system include storyboards, wireframes, and a navigation map.

Storyboards focus on the interactions between the user and the system, which improves the understanding for others on how it will take place. For the prototype, the storyboards provide images based of each persona and their scenarios with the system to create further clarification on the interactions between the personas and system. The storyboards assist in developing the effectiveness and learnability design principle as the storyboard focuses on the familiarity and navigation of the system.

In terms of the prototype, the wireframes outlined the structure of the main pages of the drone delivery system for each persona. The wireframe provides the prototype with a vivid image on the structure of the system and incorporates the functionalities. In terms of design principles, the wireframes improve the learnability and effectiveness of the system towards users as it explores the navigations, controls, consistency, and visibility of the pages.

In the drone delivery system, the navigation map gives guidance of each of the different features of the system and an idea on what the user should expect when interacting with a specific page. Similarly, to the other techniques, this assists in the effectiveness design principle as there is clarification on the navigation and controls.

# Design

The design process can be split into two main distinct categories being the conceptual design and physical design. As this is a prototype of the drone delivery system, the conceptual design is the main design for it as within designing the prototype, the techniques used were the object and action analysis, and the human activity system diagram also known as the rich picture.

The rich picture’s purpose to demonstrate the main relationships between users, stakeholders, and outside entities with system. It also brings attention towards the issues of the system and the potential solutions. As for the drone delivery system prototype, the rich picture expands on the system’s interactions with its users, showing the process and potential risks with the delivery system.

Though in the envisionment process there are multiple techniques that visually represent the interface and pages of the system, there is little detail on how each interactable button works. The object and action analysis provides detail to those interactions through describing the objects and the actions associated, it also assists in developing and planning the system’s functionalities. The learnability of the system is improved as the object action analysis provides familiarity to the functionalities and controls of the system.

# Planning

For stage two and three of prototype assignment, the focus is on the design and evaluation processes. For design, the techniques include dataflow and entity relationship diagrams, which focus on a more detail design of how the user would interact with the system. For these future stages, the design techniques will introduce more depth in the understanding of the system which will be the final steps of planning the prototype before it is built.

## Evaluation

This process was only briefly introduced in stage 1 through the development of personas and their scenarios as they introduce different users and their interactions with the system. However, in stage two and three, there will be techniques used to access the evaluation of the system through testing the user’s interactions with the system and observing their reaction to the system. This is done using techniques such as a Cognitive Walkthrough and User Journey Maps which puts the creators in the user’s role to understand the user’s experience.

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