Stage Three Report

Team N

Drone Fleet Management System

Members

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CPSC481 F2020

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Tutorial 02

TA: Philmo Gu

Links:

Link to Portfolio: https://teamlepinee.wixsite.com/cpsc481teamn
Link to GitHub: https://github.com/stephanedorotich/TeamN.git

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1 PROJECT DESCRIPTION

Our team is designing a Drone Fleet Management System (DFMS). This will be a desktop application that allows the user to manage a fleet of delivery drones as they pick up packages and deliver them to customers. A trained operator will manage the system, overseeing all drones in a particular delivery region. For each drone, they can observe its status, position, destination, speed, battery charge and many other details pertinent to the delivery process. They monitor weather conditions, issue recall requests, and manually operate drones. The system alerts the operator about issues or possible dangers, and the operator would make the decisions of how to respond appropriately. We hope this will be used by companies such as Amazon that do drone deliveries, to allow for a simple and effective way of managing their drone deliveries.

Figure 1: An example of a delivery drone
Source: https://www.mediapost.com/publications/article/324703/golf-course-starts-drone-delivery-of-food-orders-t.html

2 TASK LIST

2.1 VERTICAL
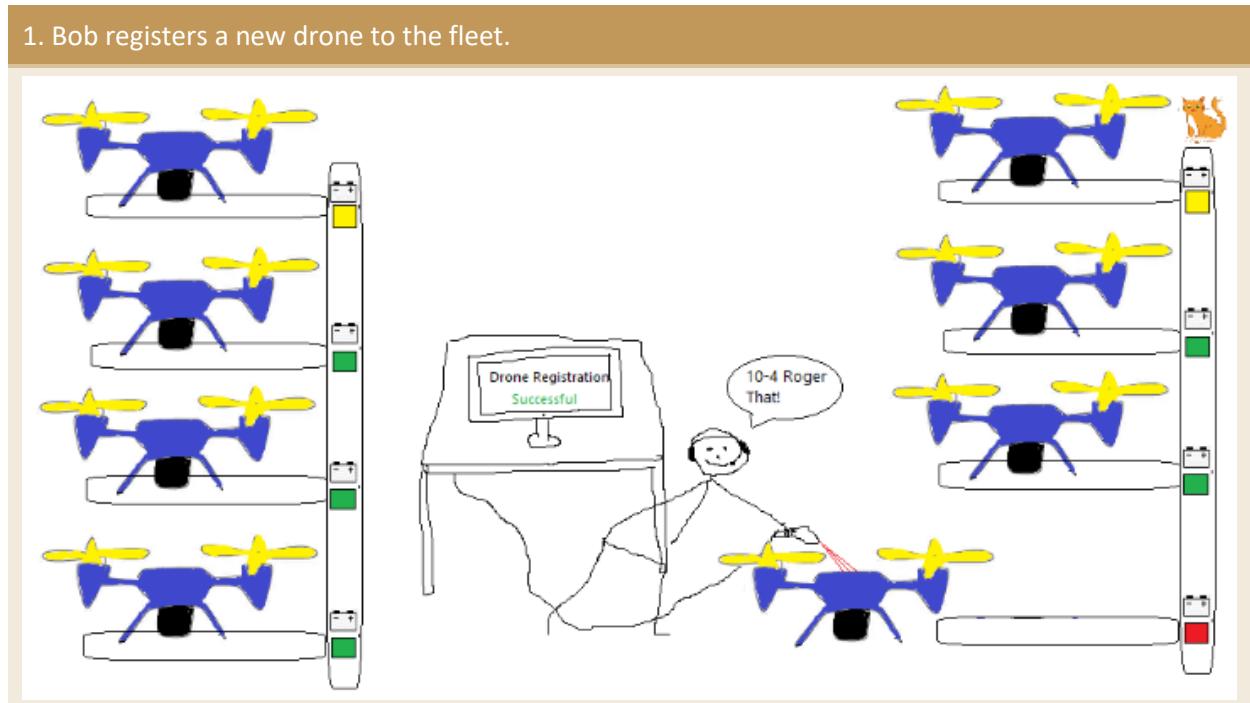
View Drone Status	Display a summary of a drone's status including its name, status keyword, battery charge, velocity, altitude, location, payload weight, and associated delivery information. Also shows it on a map.
View Map	The operator sees a map of their service area with icons representing all the active drones and their trajectories. These icons can be selected to view drone status. The map can be overlaid with a weather map.
View Drone History	The operator sees information about a specific drone. This includes statistics such as total deliveries, flight time, and distance travelled, a graph representing its "health", when it will need maintenance next, and a maintenance log to track what work has been performed on the drone and by whom.

## 2.2 HORIZONTAL
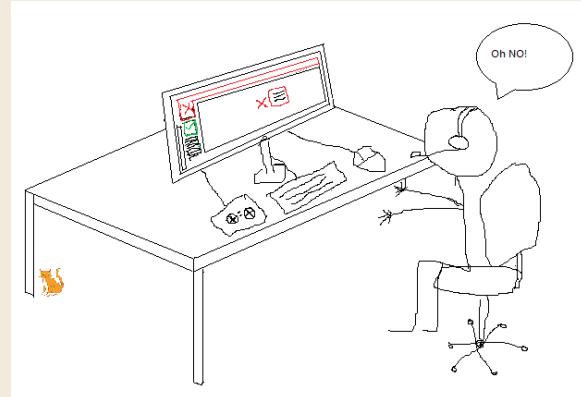
Login	Prompts the operator to login with their credentials. This allows for actions to be associated with a particular operator in case review of a decision is necessary.
Aggregate Fleet Statistics	Displays information about all drones in the fleet, including the total number of deliveries, number of active/dormant/out-of-order drones, average delivery time, average kilometers on drone, total flight time, and common errors.

|	
Issue Advisory	The operator can issue an advisory alerting customers and retailers of an expected disruption in service, updating the expected pick-up/drop-off time or cancelling the order entirely.
Register New Drone	This task adds a drone to the DFMS. The serial number is input by the operator which automatically populates information about its specifications, such as its battery type, body type, propeller type, acceleration, max payload, and windspeed/temperature limitations.
Drone Control	An operator may control any drone in the fleet. This allows them to view the drone's video feeds and assume manual control if they choose.
Issue Recovery Request	If a drone is unable to return to the flight center, the operator can send a Drone Recovery Request to the maintenance personnel so they can go recover it.

3 STORYBOARD

**1. Bob registers a new drone to the fleet.**
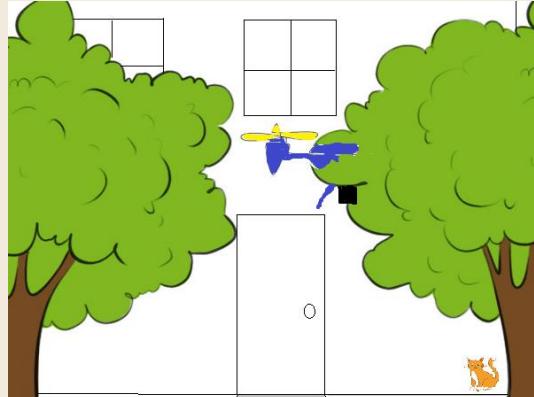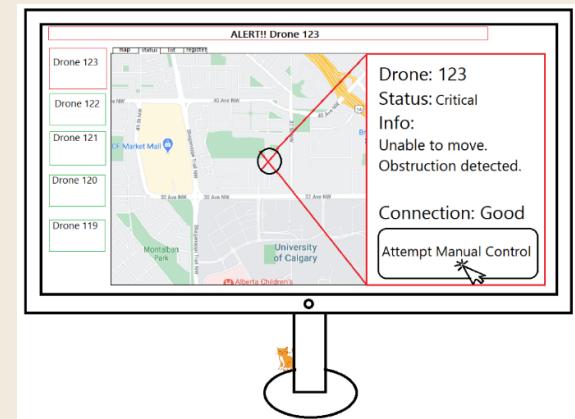
| 2. Jim, the operator, confirms the registration of the new drone. Then an alert pops up indicating that there is a problem with another drone.	3. The drone is stuck in a tree.
4. Jim attempts to manually control the drone.	5. Jim sees from the drone cameras that the drone is in a tree and that he will not be able to recover it remotely.
6. Jim issues a recovery request to the drone recovery team.	7. Sam recovers the drone from the tree.
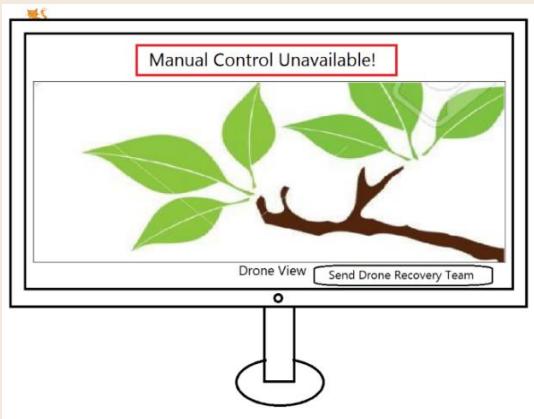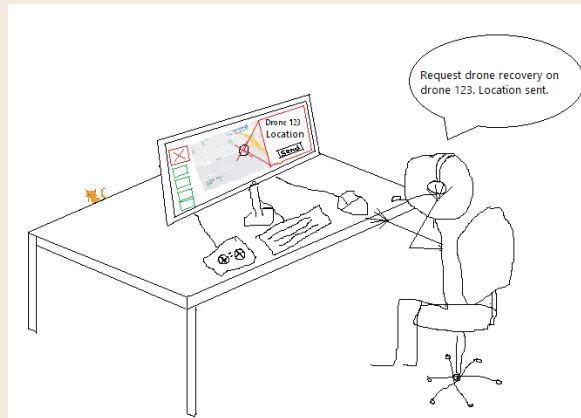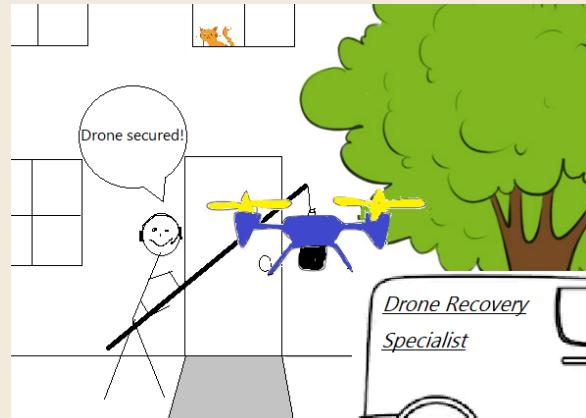
4   COGNITIVE EVALUATION

Informed by our user research, sketches, group discussions, and storyboard, we built our first low fidelity prototype. To evaluate its effectiveness and help guide our next iterations, we performed a task-centered system cognitive walkthrough. This process involves breaking down a task into individual steps with as much granularity as possible. Once decomposed, each step is evaluated, and problems are uncovered. For each step, we decided whether the user has the knowledge/training to complete the step and whether they are motivated to/would believably complete the step. We completed this for each of our three vertically implemented tasks. Instead of attempting to analyze our entire prototype, we passed through it with a fine comb.

By performing this evaluation, we learned how to improve the clarity and efficiency of our prototype. For example, when a drone is clicked on the map (and its information displayed) we found that it was not clear which drone had been clicked because there was no visual change. We fixed this by "highlighting" the drone after a click by changing its border colour. We also discovered that it was difficult to navigate to drone maintenance logs (in Drone History) because you could only click through them one at a time (so accessing an old log could require numerous clicks). We fixed this by creating a drop-down menu so maintenance logs can be browsed with convenience. Other issues like small text size, suboptimal information layouts, and ambiguous wording were addressed.

5   REFLECTION

This stage was challenging for our team, but ultimately rewarding. We have created a prototype that we are all proud of. Due to the significant number of complex steps in this stage, we had to re-evaluate how we work as a team and develop some new strategies for effective collaboration. These strategies include being explicit about how we use our meeting time and using a task list to delegate tasks. We did a great job this stage of sharing individual progress and collecting feedback; this enabled us to produce a prototype that incorporates ideas of every team member.

What was perhaps most difficult about this stage was deciding how to represent our system as an 'idea'. We drew numerous sketches, discussed each of them, and extracted their themes. However, how to translate this work into a cohesive outline for our prototype eluded us. We found ourselves stuck and made little progress for the better part of a week. It was difficult to find consensus because each of us had a different idea of how we needed to complete the steps.

In retrospect, what we ought to have done, and what we will do moving forward, is decide how we can accomplish each step before performing it. Had we spent more time understanding the perspectives of our team members, we could have avoided confusion and misunderstanding and made better use of our team meetings.

APPENDIX A: COGNITIVE WALKTHROUGH

TASK: VIEW MAP & CHECK ON QUADRANT 4

Description of task step	Does user have training or knowledge to do this step?	Is it believable that they would do it?	Are they motivated?	Comments (including possible solutions)
a) Log in to program	Yes, the user should have knowledge of their username and password	Yes, to access the system the user needs to log in	Yes, it is necessary for their job	Could forget username or password. Possible solution: Option to call IT to reset their account password.
b) View Map	Yes, they should be trained in the system before being hired to use it	Map is the first tab so it should be the first thing they see	Yes, Map contains all current drones out and about	They see no drones on the map Solution: Could be on an inactive quadrant or have filters on that no active drones currently match. Change filter/quadrants
c) Click drop-down menu for sorting Quadrants	Yes, they should be trained in the system and the drop down lists all different quadrants	Yes, part of their job to maintain/ watch a quadrant of drones	Yes, to be able to see all current drones in their needed quadrant	They click the wrong drop-down menu. Solution: Label drop-down menu
d) Click Quadrant 4	Yes, they should know which quadrant they are looking for	Yes	Yes, as they wish to see all drones in quadrant 4	They could click the wrong Quadrant. Possible solution: spread the clickable quadrant options slightly farther apart so the chances of a mis-click are decreased.
e) Click on a Drone in quadrant 4	Yes, to be able to view information for a specific drone on the map	Yes, to monitor and check up on specific drones	Yes, they need to make sure all drones are functioning properly	Click on the wrong drone Solution: Show some indication of which drone they are viewing on the map (maybe highlighted)
f) Click on view Full status	Yes, should be trained to know what each button does	Yes, to see more specifics on the drone	Yes, to properly monitor and watch over all drones	Maybe name the button View full status page for more clarification
g) Click back to map Tab	Yes, tabs are common for all browsers	Yes	Yes, they want to go back to maps page	Could also click on 'view drone on map' to return to previous page.

h) Click drop down menu for Sorting by current Leg/ Battery	Yes, Interface training is a must for our operators	Yes	Yes, they may have many drones on the map and wish to see only low battery or ones on a specific leg.	They click the wrong drop-down menu. Solution: Label drop down menu
i) Select/Click Battery 0 – 19	Yes	Yes, if they wish to view low battery drones currently active	Yes, monitoring the drones to make sure they do not run out of battery while out for delivery is a part of their job	Click the wrong option on the drop-down menu. Possible solution: spread the clickable options slightly farther apart so the chances of a mis-click are decreased.
j) Notice no Drones are on the Map	Yes, should be able to realize there are no drones currently being viewed	Yes	Yes, no point in viewing an empty map	Currently notifies them in the alerts section of the map. Could have a sound as well to make it more noticeable
k) Return to viewing all drones in quadrant 4	Yes, navigating through the map interface should be part of the training	Yes	Yes, viewing an empty map does not help them manage the drones	They click the wrong drop-down menu. Solution: Label drop down menu They could click the wrong Quadrant. Possible solution: spread the clickable quadrant options slightly farther apart so the chances of a mis-click are decreased.
l) Press the Select All option for Map filters	Yes,	Yes	Yes, in case of dangerous weather conditions	If they do not wish to see all filters there is the option to view single filters.
m) View Weather version of map	Yes	Yes, checking the drones do not head into dangerous weather conditions is extremely important	Yes, if the drones are damaged, the operator is responsible because it is their job to monitor said drones	We have a legend to understand the seriousness of each weather condition. Also displays humidity and temperature. Possible issue: do not have a recall select drone on the map page so have to go to full status page then recall
n) Press the De-Select All option for Map filters	Yes	Yes	Yes, to revert to regular map	Can also deselect certain ones to view on single or a couple filters

o) Select All in drop-down menu for quadrants	Yes, they should know what selecting each option in the drop-down menus would display	Yes, if they wish to see all the quadrants	Yes, occasionally checking on all the quadrants is important for the monitoring	They click the wrong drop-down menu. Solution: Label drop-down menu. They could click the wrong Quadrant. Possible solution: spread the clickable quadrant options slightly farther apart so the chances of a mis-click are decreased.
p) View All Quadrants (cluster) Map	Yes, understanding what information is being shown should be part of the system training	Yes	Yes	Greyed out the Battery/Leg drop down menu but filtering the cluster map by it could be useful.

TASK: VIEW DRONE HISTORY

Description of task step	Does user have training or knowledge to do this step?	Is it believable that they would do it?	Are they motivated?	Comments (including possible solutions)
a) Log onto system	Yes, operator has username and password	Yes	Yes, it is their job	Could possibly forget their password or username. Possible solution: have a button to contact IT person.
b) Click drone list	The operator should be trained about using the interface	Yes	Yes, to see drone background	Could possibly forget history can be found in the drone list tab.
c1) Enter drone ID in search bar	Yes, operator should know the ID of the drone they are searching for	Yes	Yes	Could forget the format of drone ID. Possible solution: have example ID greyed in the search box before they type anything.
c2) Use sort dropdown menu	Yes, operator should know attributes of the drone they are looking for	Yes	Yes	Might not understand what kind of sorting the status option does. Possible solution: clearer labeling such as status (critical -> active -> dormant)
d) Find the desired drone on the list	Yes	Yes	Yes	Shows the drone list is an effective method to finding a desired drone.

e) Click history button	Yes	Yes	Yes	The history button is quite clear and is only one of two options from the drone list.
f) Look at the drone history of the desired drone	Yes, they have knowledge of the key aspects needed for a safe and effective drone	Yes	Yes	The four boxes being different sizes may cause aggravation. Possible solution: make the box sizes more similar
g) Look at drone information	Yes, the operator should have a strong idea of what are good values for distance, deliveries, failures…	Yes	Yes, but may be hindered by the clustered layout	A little overwhelming to look at so much information in one small box. Possible solution: organize information into smaller groups
h) Look at overall drone health	Debatable if the operator truly knows what drone health represents	Yes	Yes	Ambiguous, what exactly overall drone health represents. Possible solution: add a caption indicating what overall drone health represents and how it is calculated.
i) Look at next maintenance	Yes	Yes	Yes, to see how long until they need to bring the drone in	Gives a clear indication of how much time is left before drone must be brought in
j) Look at most recent maintenance	Yes	Yes	Yes	Should give a quick overview of what was done in the last maintenance.
k) Look at a maintenance prior to the last maintenance	Potentially the operator using the system should be computer competent enough to see the arrows beside	Yes	No, not if the maintenance needed to be checked is from 20 maintenances ago	Unclear what the arrows do. Possible solution: add small caption indicating "click to see previous maintenance check" Inconvenient to see maintenance checks from a long time ago, requires a lot of clicks on the arrow. Possible solution: implement a search bar to search ranges of dates for maintenances.
Error1: Enter incorrect drone ID when searching	Operator does not know they entered ID wrong and list does not show anything	OK	OK	The operator does not realize they have entered wrong ID and thinks the systems is just not working. Possible solution: create section of "did you mean …" with similar ID numbers to the one just searched. This would only pop up when no drones match the search.
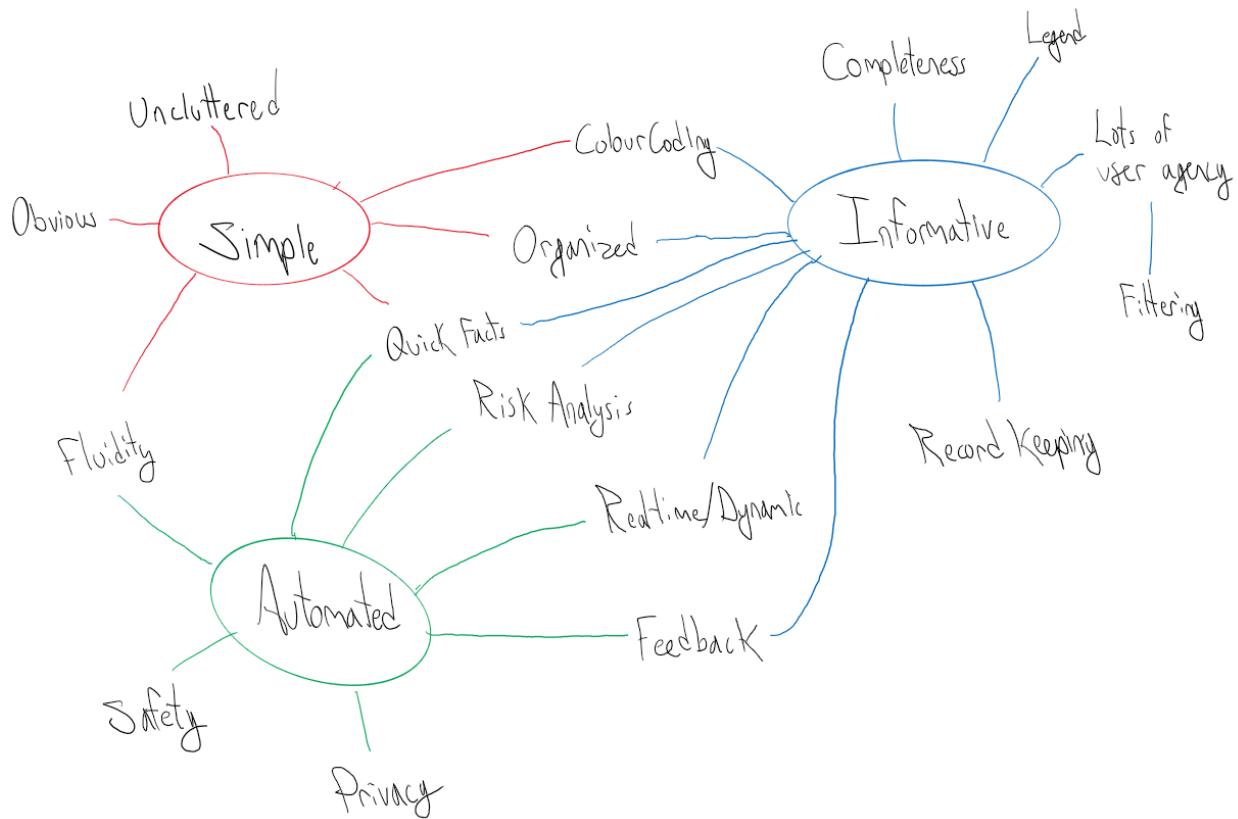
TASK: VIEW DRONE STATUS

Description of task step	Does user have training or knowledge to do this step?	Is it believable that they would do it?	Are they motivated?	Comments (including possible solutions)
a) Log onto system	Yes, operator has username and password	Yes	Yes, it is their job	Could possibly forget their password or username. Possible solution: have a button to contact IT person.
b) Click drone list	The operator should be trained about using the interface	Yes	Yes, to see drone background	Could possibly forget status can be found in the drone list tab.
c1) Enter drone Id in search bar	Yes, operator should know the ID of the drone they're searching for	Yes	Yes	
c2) Use sort dropdown menu	Yes, operator should know what they are searching for	Yes	Yes	
c3) Select drone from list showing	Yes, operator should know what they are searching for	Yes	Yes	Most drones that require status checking are drones with yellow or red status. Should be sorted that way by default.
d) Click status button	Yes	Yes	Yes	Status button and History button are the only 2 options.
e) Continue searching drone list on the left	Yes	If they did not select the correct drone or wanted to check another drone's status	Yes	Nothing happens when selecting from list on the left. Could have Status and History buttons on the list.
f) Check status of next drone in the list on the left	Yes	Yes	Yes	If multiple drones require attention, then switching from one to the next must be done with ease.
g) Recall drone to base	Yes	If they needed the drone to return to base for any reason	Yes	When a recall of the drone is needed, the button is located quickly

h) Take manual control	Training and certification in operating a drone remotely, would be required	If the automated flying system required human intervention	Yes	When manual control of the drone is needed, the button is easy to locate
i) View drone status	Yes	Yes	Yes	Status is clearly visible and only pertinent information on the drone is shown.
j) View detailed information on status	Yes	If they needed more detailed information	Yes	If more detailed information could be required, then it should be shown immediately.
k) Send drone recovery request	Yes	If they are unable to recall or gain manual control of the drone	Yes	Send recovery request is only available if status is red.
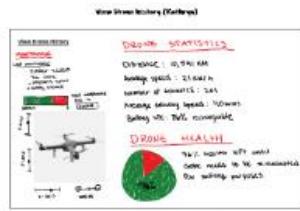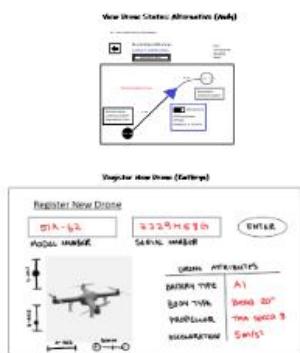
APPENDIX B: AFFINITY DIAGRAMS

THEMES DERIVED FROM SKETCHES
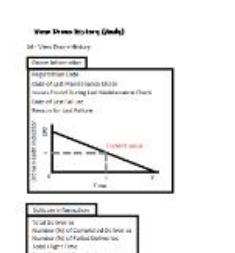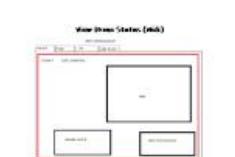
SKETCHES GROUPED BY RELEVENCE TO THEMES
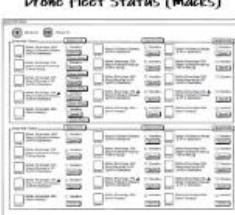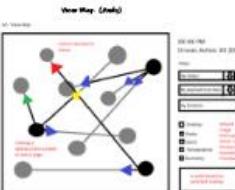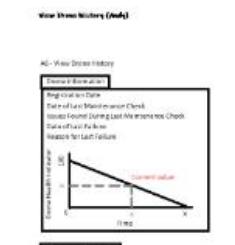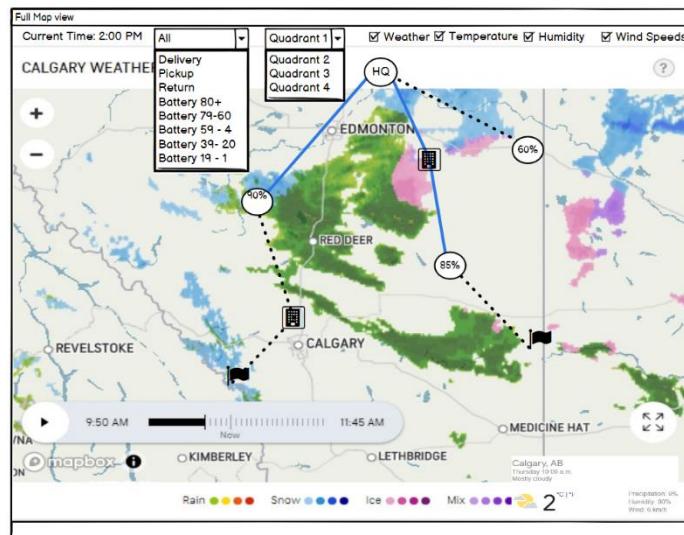
APPENDIX C: SKETCHES

FIRST ITERATION
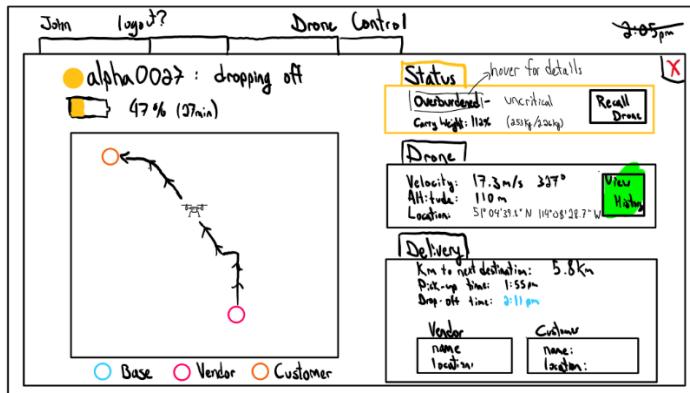
Default Page	Drone Status
Nicholas Wasilewski	Andy Ma

Drone List	Register New Drone
Macks Tam	Kathryn Lepine

SECOND ITERATION

|	
Map View Macks Tam	
Drone Status Stéphane Dorotich	
Drone History Kathryn Lepine	