Freedom Transit Real-Time GPS Feed

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CIS 400
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Executive Summary

Freedom Transit bus users needed a way to see where the busses are located in real-time so that they can plan accordingly. With the previous system, the passengers had no way of getting this information, which caused disruptions to their schedules when busses were not running on time. With the current system, riders can check if they have missed their bus or if it is running late, and make the appropriate adjustments to their schedule. In addition to the system we developed, we also gave them documentation on how to install the tracker app on their tablets, along with documentation on how to add new routes to the web application.

In order to meet these needs, we began researching possible solutions involving third-party companies that could be contracted to help if we could not develop a solution on our own. We found that Google provides all the necessary resources at a much cheaper (little to no fee) price than companies offering to build the system for us. Using Google Maps API and Google Firebase, we developed a system that retrieves geolocation data transmitted by the tablets from Firebase, and draws a map with bus markers using the API. The web application that draws this map refreshes the bus locations about every five seconds, keeping users in the loop about their bus' location. We also made sure to draft and present them with the necessary documentation that was needed to ensure that they know how to use the system correctly

Project Scope Statement

Project Name: Freedom Transit Real-Time GPS Feed
Completed By: 5/8/2018
Project Start: 2/8/2018
Duration: 3 months

PROJECT PURPOSE
Get Freedom Transit passengers a real-time GPS feed of bus locations.

DESCRIPTION
Freedom Transit bus users need a way to see in real-time where the busses are located so that they can plan accordingly. With the current system, the passengers have no way of getting this information, which can cause disruptions to their schedules in some cases. With this technology, passengers would feel less anxiety about things like missing the bus. The budget for this project is $10,000, but it is likely that expenses will be much less than this. A working prototype must be developed first before any major purchasing of GPS devices can occur. It is preferred that installation of these devices can be easily done in the years to come.

DELIVERABLES AND REQUIREMENTS
- Mobile application (either homegrown or outsourced)
  - Must provide real-time GPS information about the busses
  - Must work across both iOS and Android platforms
- Budget Breakdown
  - Must be within budget
- Installation guides and documentation
  - Must clearly demonstrate the processes required to install or remove any aspect of the system
- Prototype demonstration

COMMUNICATION NEEDS
We will communicate with each other through text messages and face-to-face meetings. We will communicate with the client through emails and face-to-face meetings. Bus rider surveys will be conducted in-person.

SUCCESS CRITERIA
User should be able to see a real-time GPS feed of where Freedom Transit busses are currently located.

CONSTRAINTS
Should be completed by the beginning of May and under the budget of $10,000. Will need approval before purchasing anything with this money. A working prototype will need to be developed before more GPS units can be purchased.

APPROVALS

Key Stakeholders	Interview Date	Approval
Dr. Hannon	2/1/18	
Joe Thomas	2/13/18	
Ian Ramsey	2/13/18	

Gantt Chart

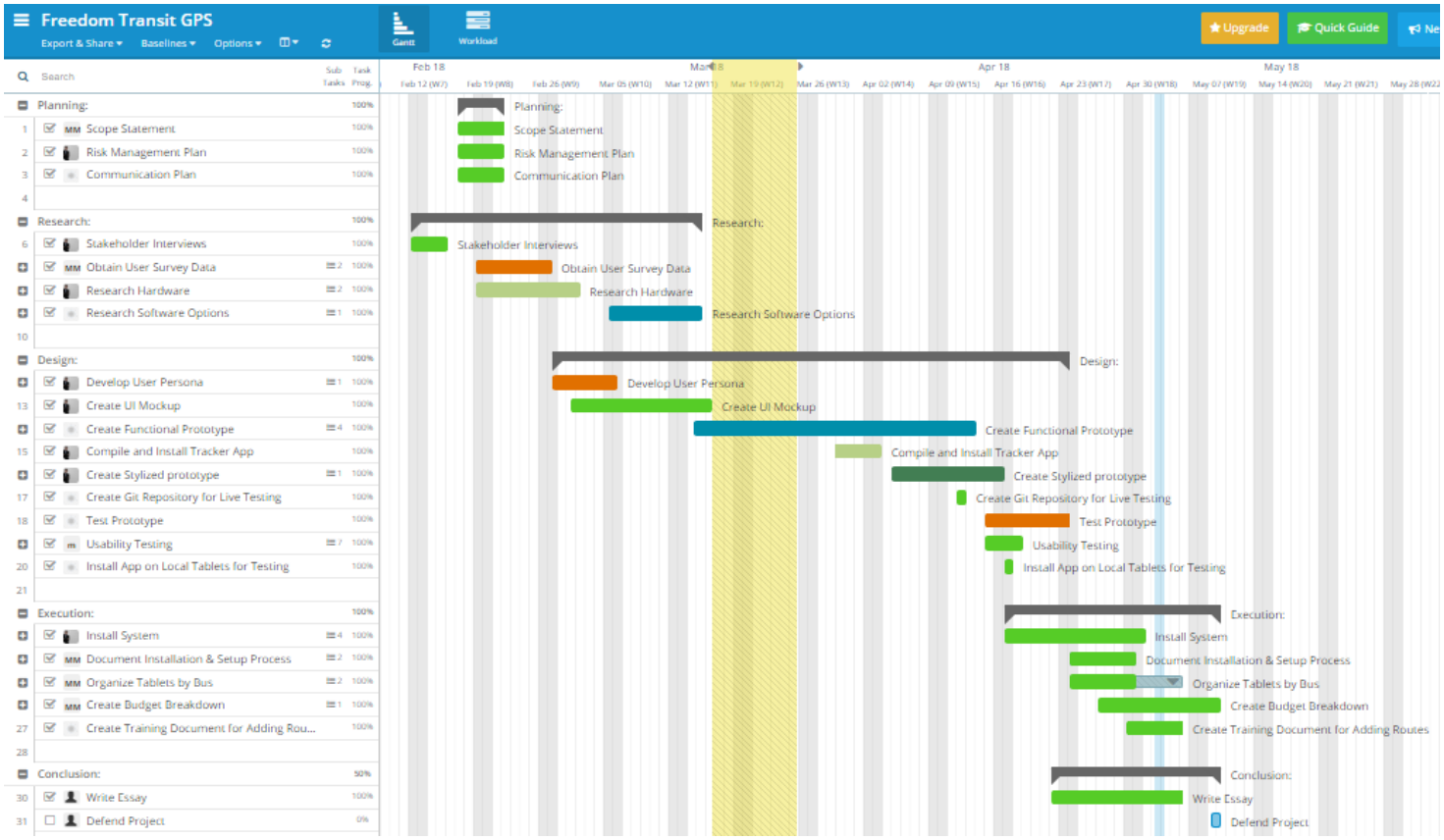


Chart Narrative

Provided above is our Gantt Chart, where we planned, revised and altered our work schedule to meet these deadlines. Over the course of the project, things have changed, moved and been altered to meet our needs. We wanted to approach our work in a sequential order beginning with planning, then research (then planning again if needed), then design, execution and later conclusion.

We put into consideration spring break as well as Ian's mini vacation nearing the end of the project into consideration. During spring break, we did not contribute greatly to the project, hence our Gantt Chart reflects this. However, during Ian's vacation, we decided to continue working on testing and adding features and designs that would not require his help. This greatly improved our ability to complete the project on time.

Looking back on our Gantt Chart, knowing the capabilities of our team, we wish we spent less time on the research portion after stumbling upon Google's Codelabs library with tracking assets that would help us greatly. However, we needed to do so in order to have a contingency plan upon potential failure in our coding process.

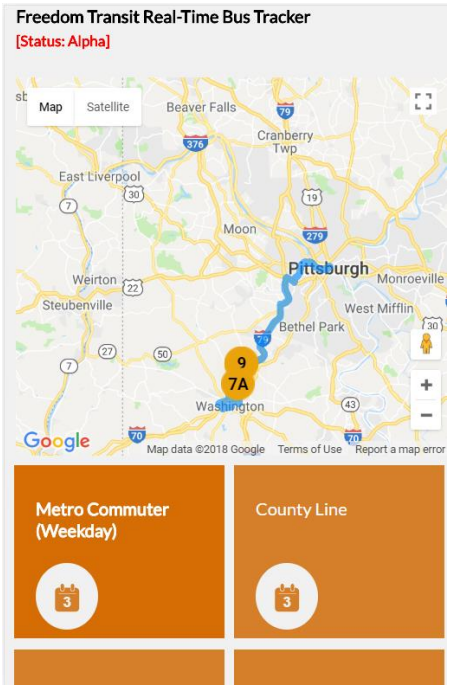
Annotated List of Deliverables

Mobile Application (Not to be confused with “Web App”)

Freedom Transit wanted their busses to be live tracking as they drive. The only way to do this is to either install a GPS system on the busses, or write an Android app in Java that allows us to send the GPS signals from the onboard tablets. We utilized the Transport Tracker app provided by Google Codelabs, and modified it to fit our needs. The most important modification was the addition of a “transport_id” that is sent with the geolocation data. This ID allows us to define which signal is coming from which bus for us to track. This also allowed us to determine which bus is running on which route based on its ID.

Web Application & Live Database

Freedom Transit wanted their busses to be visualized in a way that was universal and user friendly. Therefore, we also needed to develop a web app that communicated with a live database that pulled the data from our mobile app. The web app is great for universal platforms since it is only HTML, CSS, and JavaScript, which all modern browsers support. This allows Android, iOS, Windows, Linux, and OSX devices alike to easily view and use our user-facing web app.



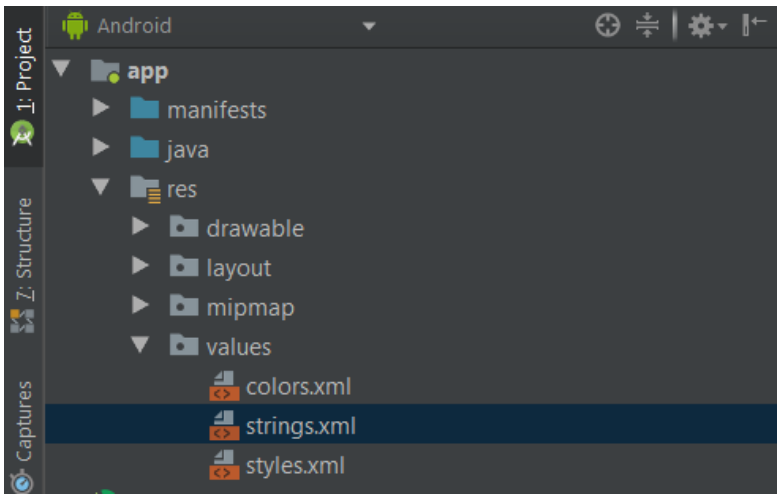
We are also passing over our live database to them which connects our mobile application data to our web application. This data provided is only latitude and longitude data that is collected by our JavaScript web app, hence why it is bundled with the web app provided.

Budget Breakdown

Freedom Transit, while currently has not spent any money, will soon possibly require a Google Firebase plan of $25/month. With a budget of $10,000, this is miniscule, and the project has shown great promise without the firebase plan even being purchased. This plan, however, will allow them to collect more data of their own busses and allow for a greater ping frequency to their busses.

Component	**Estimated Cost**	**Total Cost**
Hardware	$0.00	
Software	$0.00	
Cloud Firestore Fee	$300.00/year	
		$300.00/year

Installation Guide and Documentation



To provide a better understanding of the software we are providing to Freedom Transit, we put together an installation guide to help with the process of installing the app on the device to allow tracking. For security and customization needs, our app is not available to the public and can be saved as a ".apk" file if changes are not need. Therefore, the installation process is a little more difficult than usual. This document helps make the app installation easier to understand and execute in an incident that a tablet needs to take the place of another.

Adding a New Route Guide

```
// if today is Saturday, enable Metro Commuter (Weekend) and Local (Saturday)
// if today is not Saturday, enable Metro Commuter (Weekday), County Line,
// Local A, and Local B
if(day === 6) {
   $("#metroWeekend").addClass("clickable");
   $("#localSat").addClass("clickable");
} else {
   $("#metroWeekday").addClass("clickable");
   $("#countyLine").addClass("clickable");
   $("#localA").addClass("clickable");
   $("#localB").addClass("clickable");

   // $("#newRoute").addClass("clickable");
}
```

Freedom Transit at some point may need to update or add a route to their webapp. In order to do so, we put a document together to help accomplish this. Therefore, Ian and the webmaster can help update the routes using his data he collected along with the webmaster's coding knowledge to expand Freedom Transit's route repertoire.

Additional Project Artifacts

Planning Documents

Communication Plan

Communication Plan				
Project Name: Freedom Transit Real-Time GPS Feed				
Date: 2/22			Prepared by: Chris, Michael & Jordan	
WHAT	**WHO**		**HOW**	**WHEN**
Communication Type	Initiator	Audience	Method/Channel	Time/Frequency
Progess updates	Fred	Key stakeholders	Email/In person meetings	Once a week
Team meet-ups	Project team	Project team	In person meetings	Once a week
Progess reports	Each project team member individually	Dr. Hannon	Email /In class discussion	Three times during semester

Risk Management Plan

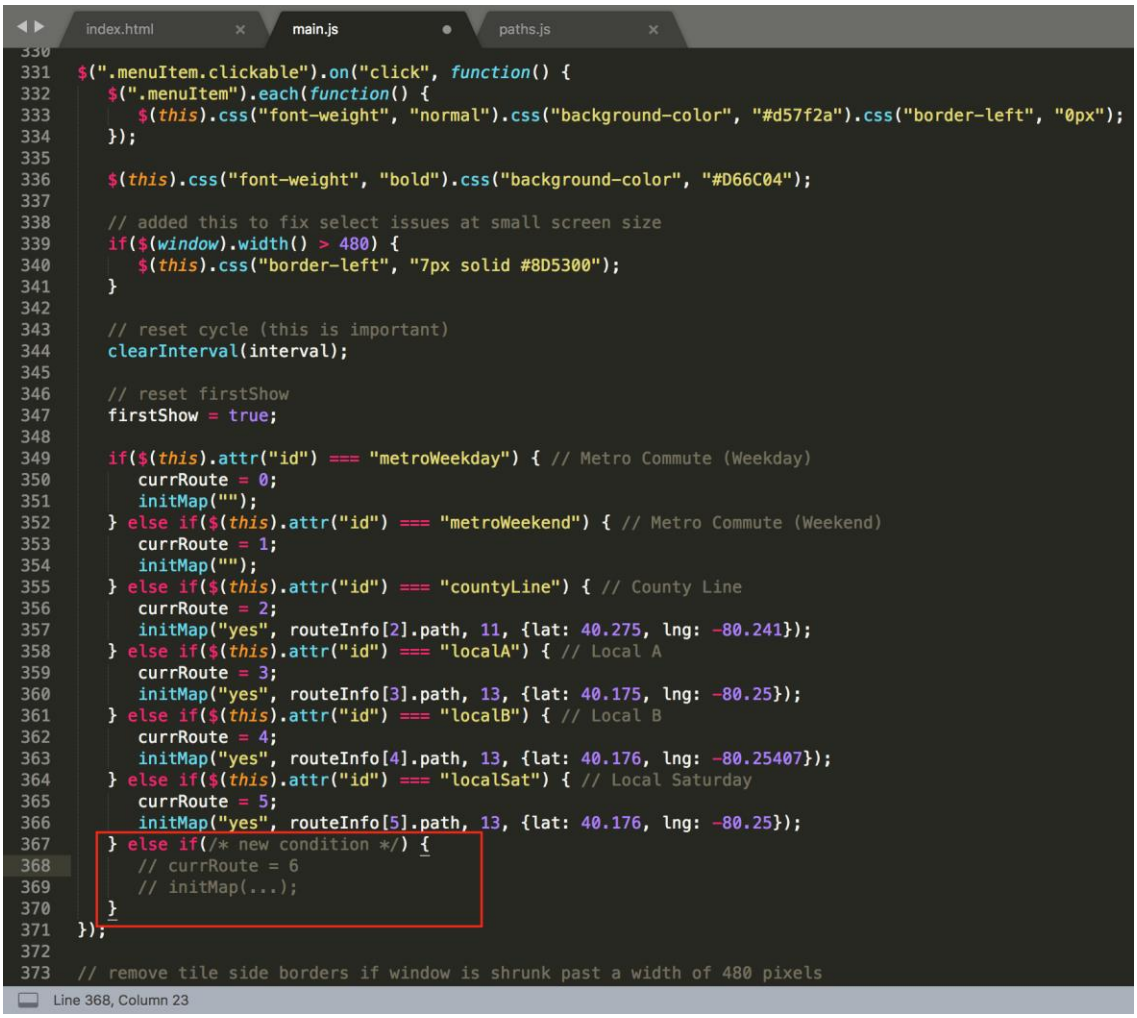
Project Name: Freedom Transit GPS		Prepared By: Michael Mann, Jordan Bechek, Christopher Frydryck			
Date: 2/21/18					
Risk	**Score**	**Strategy**	**Who**	*Risk Level*	*Probability*
Prototype fails to function as planned	12	Perform continuous tests along the way to prevent major issues and track if/when something goes wrong	Fred and Jordan	4	3
Replication of installation is more difficult than expected	6	Provide more time for installation and bus wiring	Fred and Jordan	2	3
Project cost exceeds budget	5	Keep track of costs and attempt to be under half the budget, leaving the rest for a contingency plan	Michael	5	1
Hardware and software fail to integrate together	15	Both people planning hardware and software must work together to prevent issues with integration	Fred and Jordan	5	3
Failure to communicate with stakeholders	3	Continue consistent and constant communication with stakeholders	Fred	3	1
Scope statement does not match project outcomes	9	Use scope statement as the "written law" of our project and avoid going astray	Michael	3	3
Stakeholder inputs/expectations are unachievable	6	Prevent stakeholders from reaching unachievable expectations	Freedom Transit	3	2
Post-project manual is inadequate	9	Document the installation AFTER the prototype is done with pictures and well worded instructions	Fred and Jordan	3	3
GPS systems fail to be reliable	12	Perform research on best GPS systems in regard to Pennsylvania weather conditions	Fred	4	3
GPS systems fail to be supported (not "futureproof")	12	Perfrom research on best GPS systems with modern features and software options	Fred	4	3
Unable to improve entire website	5	Work concurrently with other tasks, prioritizing the schedule pages	Jordan	1	5
Project disrupts operations	8	Install units when busses are not running for a certain period of time	Michael	4	2
Users fail to use product	6	Market and encourage users to see new GPS features for busses	Freedom Transit	2	3
Software deemed "unusable"	12	Find user friendly software that allows users to find and interact with easily	Fred and Jordan	4	3

Training Documents

Adding a New Route Guide

To add a new route, changes must be made to both Javascript files, `main.css`, and `index.html`. Consequently, this should only be done by the webmaster or someone else who is familiar with web development.

1. Add an item to the end of the `routeInfo` array in `paths.js` following the same format as the others.
    - If this route requires subroutes, make sure that there is a `subRouteInfo` array attribute, following the format of `routeInfo[0]` and `routeInfo[2]`.
2. Add another `else if` condition to account for your new route at the bottom of `main.js`, following the format of the pre-existing conditions that are checked on any click of a `.menuItem.clickable` element.



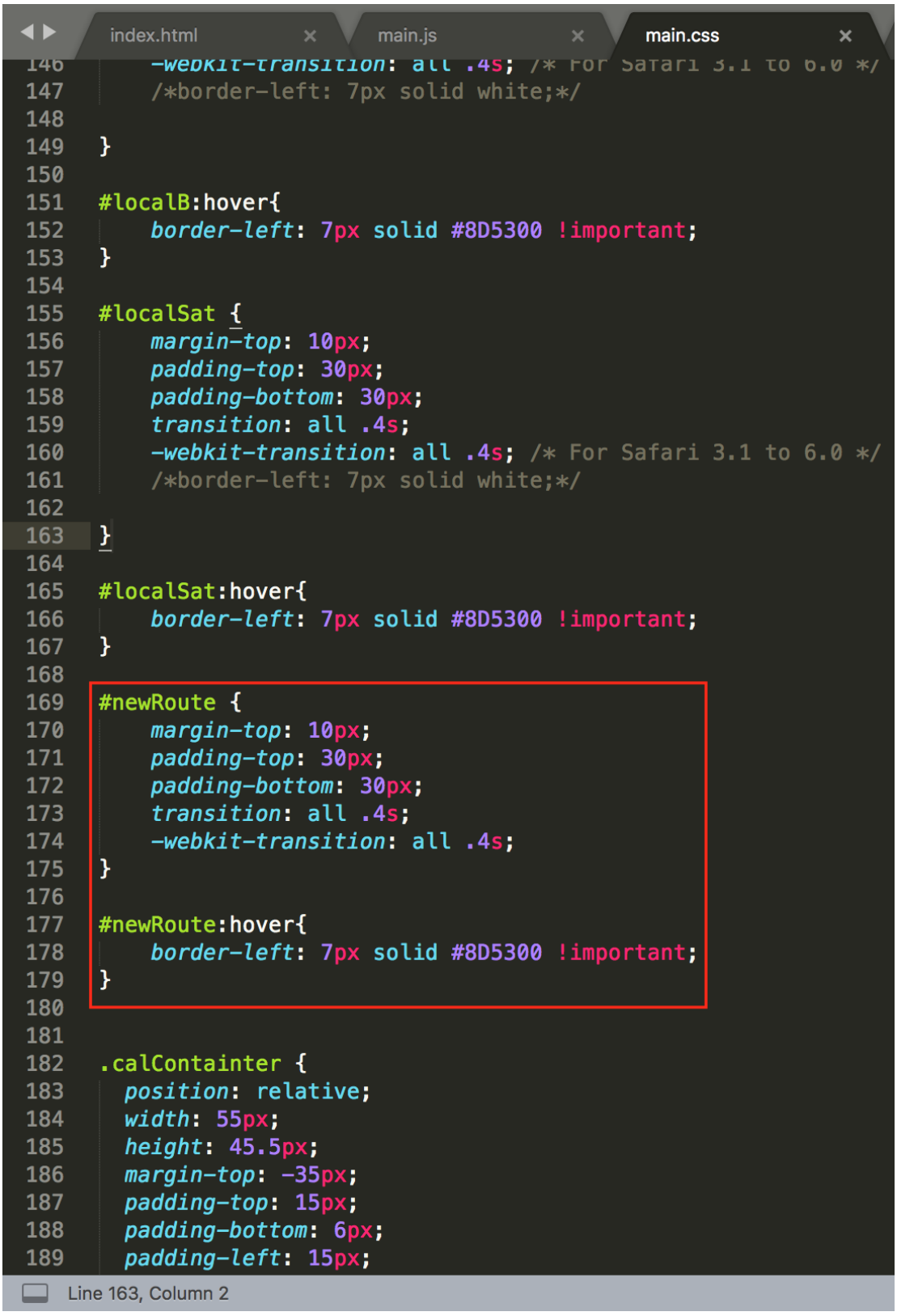
3. Add a statement to add the class `clickable` to the new button
    - If the route is available on Saturday, this should go under the `day===6` condition.
    - If the route is available on weekdays, this should go under the `else` condition.

index.html | main.js | paths.js

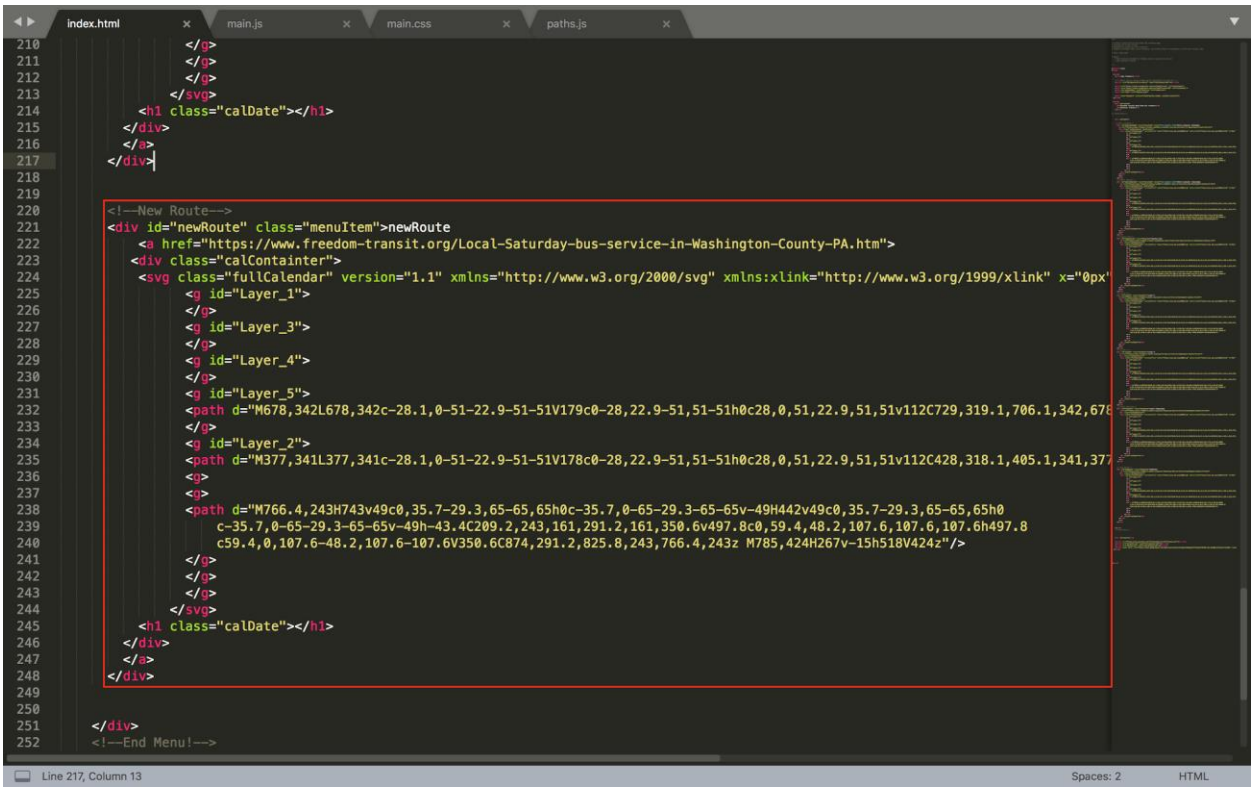
```
    $("#metroWeekday").css("background-color", "#D66C04");

    if($(window).width() > 480) {
        $("#metroWeekday").css("border-left", "7px solid #8D5300");
    }
} else if(currRoute === 1) {
    $("#metroWeekend").css("background-color", "#D66C04");

    if($(window).width() > 480) {
        $("#metroWeekend").css("border-left", "7px solid #8D5300");
    }
}

// set date on calendar icon
$(".calDate").html(date.getDate());

// if today is Saturday, enable Metro Commuter (Weekend) and Local (Saturday)
// if today is not Saturday, enable Metro Commuter (Weekday), County Line,
// Local A, and Local B
if(day === 6) {
    $("#metroWeekend").addClass("clickable");
    $("#localSat").addClass("clickable");
} else {
    $("#metroWeekday").addClass("clickable");
    $("#countyLine").addClass("clickable");
    $("#localA").addClass("clickable");
    $("#localB").addClass("clickable");

    // $("#newRoute").addClass("clickable");
}

// configuration for firebase connection
var config = {
    apiKey: "AIzaSyB2dXGVK7S9iWtwGsw_gpm7Q-DAtSMIdsE",
    authDomain: "freedom-transit-live-tracker.firebaseapp.com",
    databaseURL: "https://freedom-transit-live-tracker.firebaseio.com/",
    storageBucket: "gs://freedom-transit-live-tracker.appspot.com/",
    messagingSenderId: "224494441810"
};

// create firebase database object
firebase.initializeApp(config);
var database = firebase.database();
```

Line 64, Column 1

4. In `main.css`, add a block for the new route following the format of the pre-existing blocks.



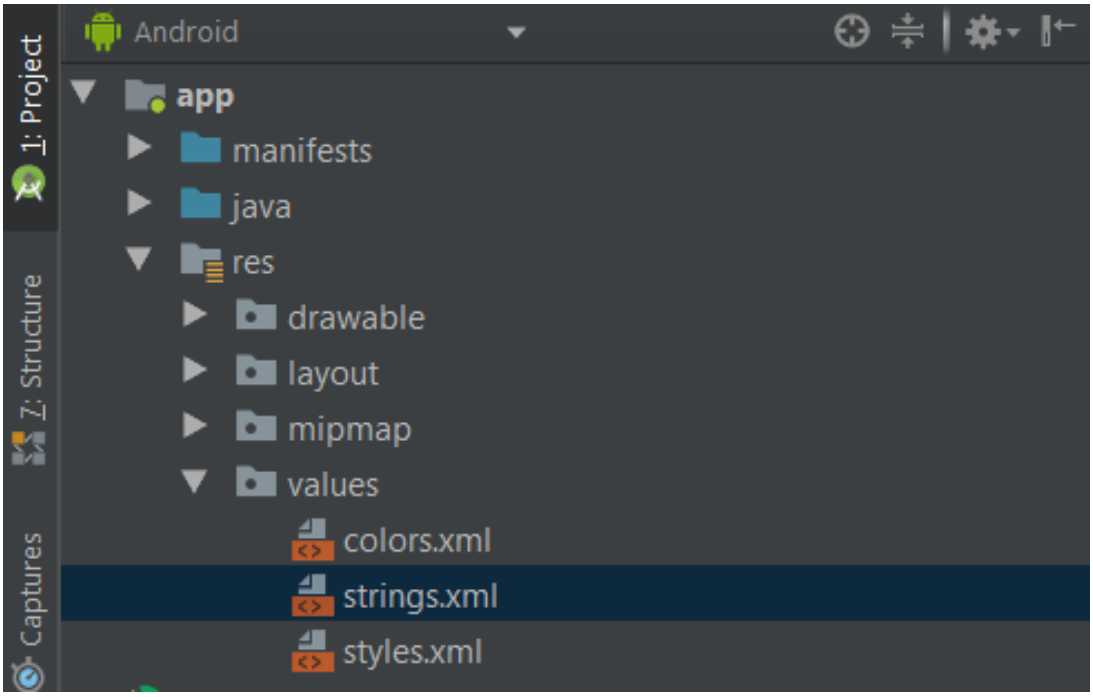
5. Finally, add a `div` for the new route button following the format of the others. This is essentially a copy and paste, with the exception of changing the ID and label.



Installation Guide

1. If the Transport Tracker app is installed on the tablet, delete it
2. Open settings on the tablet
3. Scroll down to and tap on “about tablet”
4. Find “build number” and tap it 7 times to enable developer options
5. Tap on “developer options”, which should now appear at the bottom of your settings tab
6. Enable “USB debugging”
7. Tap on “location” in the settings tab
8. Make sure location is on and set to “high accuracy”
9. Ensure that the computer you will be using has Android Studio installed
    - Go to https://developer.android.com/studio/ to download Android Studio
10. Plug tablet into computer
11. Open Android Studio on the computer

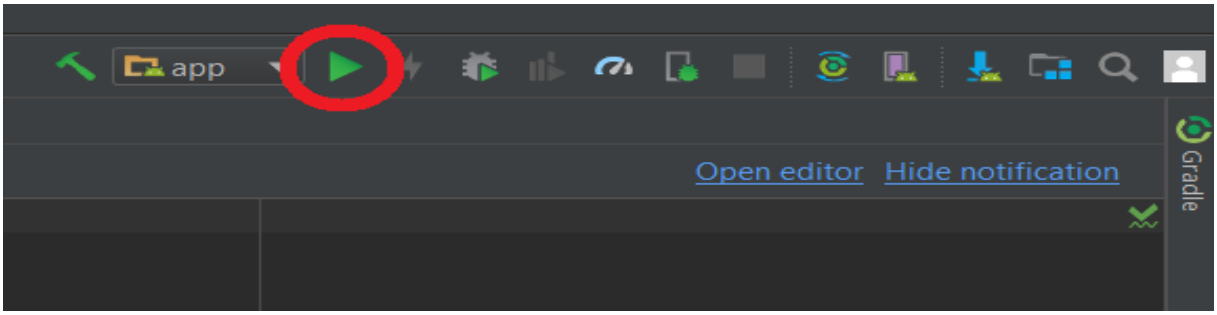
12. In Android Studio, click on file → open → then find and click on TransitTrackerFreedom
13. Click the arrow next to “app” near the top left corner
14. Click the arrow next to “res” when it comes up
15. Click the arrow next to “values” when it comes up
16. Double click on strings.xml to open it



(Figure 1: Refer to this figure for steps 13-16)

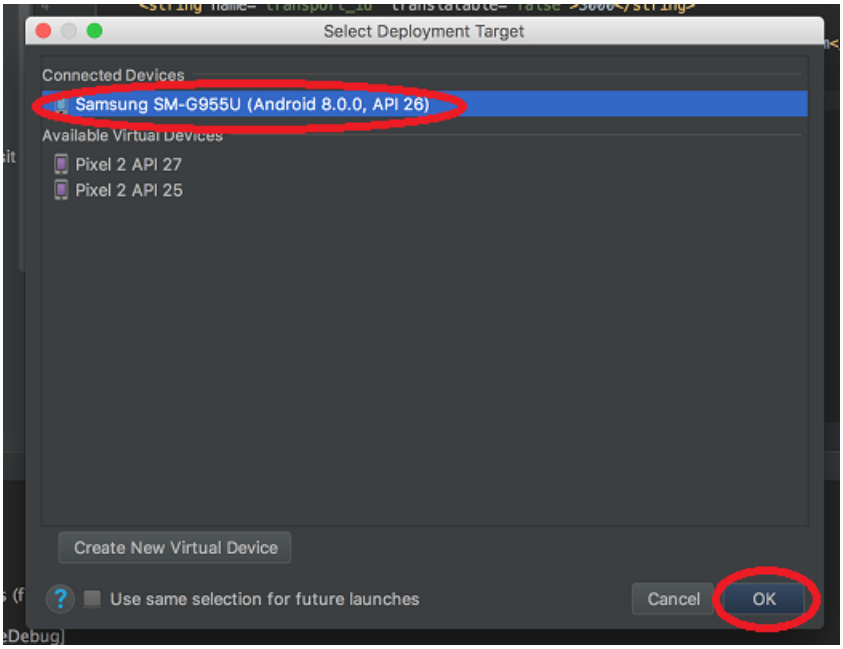
17. Find and edit the number contained in the row with “string name = transport_id” to the corresponding route number
    - Local A: 4XXX (Current Local A is labeled 4000)
    - Local B: 5XXX (Current Local B is labeled 5000)
    - Local Saturday: 6XXX (Current Local Saturday is labeled 6000)
    - Metro Saturday: 2XXX (Current Saturday is labeled 2000)
    - Metro Weekday:
        - Subroute 0: 10XX (Current Subroute 0 is labeled 1000)
        - Subroute 1: 11XX (Current Subroute 1 is labeled 1100)
        - Subroute 2: 12XX (Current Subroute 2 is labeled 1200)
    - County Line:
        - Subroute 0: 30XX (Current Subroute 0 is labeled 3000)
        - Subroute 1: 31XX (Current Subroute 1 is labeled 3100)

18. Click run (green play button at the top of the screen)



(Figure 3: Refer to this figure for step 18)

19. Click the name of the tablet when the box pops up (may automatically be selected)



(Figure 4: Refer to this figure for steps 19-20)

20. Click “Ok”
21. On the tablet, click “allow” when prompted “Allow transport tracker to access this device’s location?”
22. On the tablet, move the Transport Tracker app to the home screen
23. To close the Transport Tracker app, swipe down to reveal the status bar and tap on transport tracker
24. Put a label at the top left and on the upper-center of the back of the tablet case with the name of the route that it will be used for

Usability Documents

User Persona

Freedom Transit Persona: Sheryl Mayfield

"I want transportation to be less waiting and interpreting a schedule, and more focused on efficiency."

Age: 46
Work: Managerial Role
Family: Married, kids..
Location: Washington, PA
Character: Type

Freedom Rating

Unsafe — Safe

Dissatisfied — Satisfied

Difficult — Usable

Driven | Independent | Observant | Satisfied

Goals

- Successfully commute to work or run errands seamlessly
- Cut down on wait time for busses

Frustrations

- Lack of frequency in weekend service
- Bus stops are not comfortable/safe
- Website is not easily navigable
- Bus seats are not comfortable
- Bus schedule is not easily understood.

Bio

Sheryl is a middle aged mother who lives in Washington (15301) and is employed in the Washington County area as a manager of a business office. She is a frequent rider with Freedom Transit and has been riding with the company for nearly three years.

She uses the busses at most five days a week and is generally pleased with the experience with Freedom Transit in the Washington area.

Personality

Tech Savvyness

Experience

Loyalty

Internet Usage

Social

Preferred Channels

Traditional Ads

Online & Social Media

Referral

Guerrilla Efforts & PR

Background Questionnaire

Participant #:

Please select an age range (circle one):

15-25 26-39 40-59 60+

How often do you use public transportation (circle one)?

MORE THAN TWICE A WEEK
TWICE A WEEK
ONCE A WEEK
ONCE A MONTH
ONCE EVERY FEW MONTHS
ONCE A YEAR +

Would you say you are good with technology (circle one)?

YES NO IN BETWEEN

Have you ever used a vehicle tracking app (circle one)?

YES NO

Orientation Script

Hello, and thank you for participating in our usability testing. You will be presented with three tasks that you will be asked to complete using our new bus tracking system. Please keep in mind that we are testing a prototype, so if something goes wrong, it is likely the fault of the prototype, not you. Please say what you are thinking aloud while completing the tasks. If you have any questions, or need me to repeat anything, please ask before we start.

Task List

1. You are in Washington, PA and need to take the County Line to Houston, PA. It is five minutes after the bus was supposed to arrive and you would like to see where the bus is along its route so you know if it is almost there or if it broke down and you need to make other arrangements.
2. You need to take the Local A back to Washington & Jefferson College and you are curious about how far away the bus is because it is cold outside.
3. You need to take the Local B to Walmart, but only if the bus is going to be on time because you have a meeting later. Because of this, you need to see where the bus is on the route.

Observation Documentation

Participant # 1	Date: 4/18/18	Time: 8:14 PM	
Task #	Time to Completion	"Think Aloud"	Observations
1	15 seconds	Said he was confused about where he was on the map	Saw county line immidately, had no trouble finding it
2	10 seconds	Said he was confused about where he was on the map	Saw the local A immediately, had no trouble finding it
3	6 seconds	Said he was confused about where he was on the map	Saw local B immediately, had no trouble finding it

Participant # 2	Date: 4/18/18	Time: 9:08 PM	
Task #	Time to Completion	"Think Aloud"	Observations
1	5 seconds	Said nothing because it was completed so quickly	Found immediately, had no trouble
2	5 seconds	Said nothing because it was completed so quickly	Found immediately, had no trouble
3	5 seconds	Said nothing because it was completed so quickly	Found immediately, had no trouble

Participant # 3	Date: 4/18/18	Time: 10:54 PM	

Task #	Time to Completion	"Think Aloud"	Observations
1	20 seconds	Asked me to clarify the scenario	Had trouble at first, but once he understood the scenario he figured out what to do very quickly
2	5 seconds	Said nothing because it was completed so quickly	Immediately knew where to go
3	5 seconds	Said nothing because it was completed so quickly	Immediately knew where to go

Percentage that completed task 1 successfully: 100%
Number of task 1 errors: 1
Average time to completion for task 1: 13.33 seconds

Percentage that completed task 2 successfully: 100%
Number of task 2 errors: 0
Average time to completion for task 2: 6.66 seconds

Percentage that completed task 3 successfully: 100%
Number of task 3 errors: 0
Average time to completion for task 3: 5.33 seconds

	Did they know to scroll through routes by touching the route panels rather than the map?	Did they accidentally hit the schedule button when selecting different routes?	Did they prefer that the schedule opens a new tab or opens within the same tab?
Participant #			
1	Yes	Very close but did not accidentally hit the schedule	Same tab
2	Yes	Very close but did not accidentally hit the schedule	Same tab
3	Yes	Very close but did not accidentally hit the schedule	New tab
4	Yes	Very close but did not accidentally hit the schedule. Said he thought the schedule icon was the date not a link to a schedule	Same tab
5	Yes	No	Same tab
6	Yes	Very close but did not accidentally hit the schedule	Same tab
7	Yes	Very close but did not accidentally hit the schedule	Same tab
8	Yes	Yes	Same tab

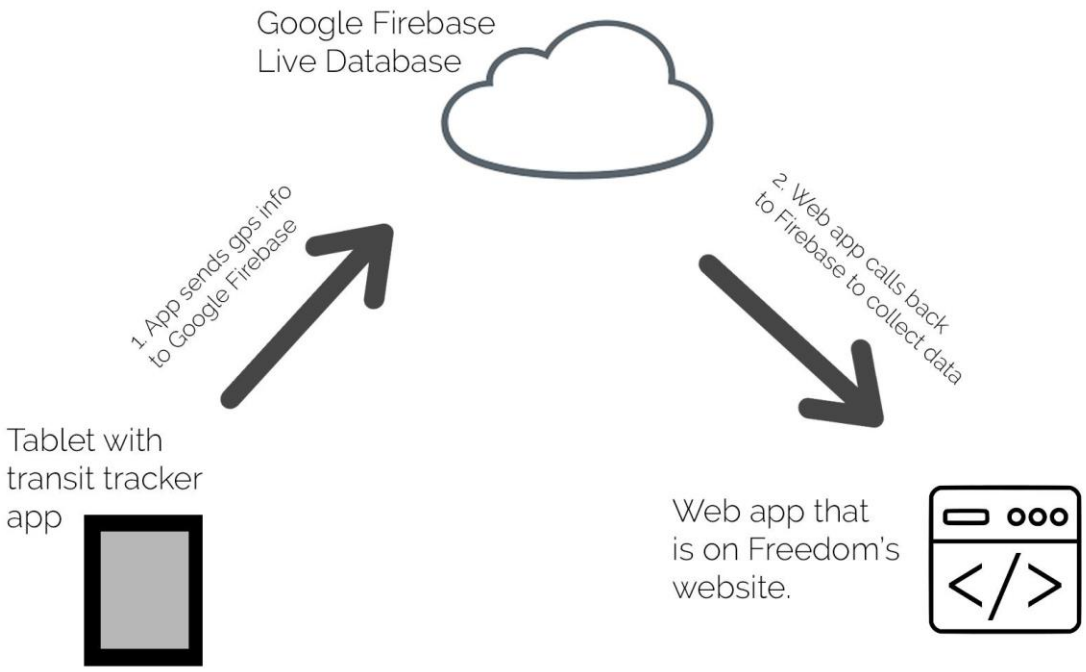
Percentage that scrolled correctly: 100%

Percentage that selected routes correctly: 87.5%

Percentage that want same tab: 87.5%
Percentage that want new tab: 12.5%

Visualization Documents

Software Interaction Visualization



Transition Document

Project Name: Freedom Transit Real-Time GPS Feed **Document Author(s)**: Jordan Bechek, Chris Frydryck, Michael Mann	**Date**: 5/7/2018

WHAT WAS THE PURPOSE OF THIS PROJECT?
To track Freedom Transit's buses so that their customers could have a real-time GPS feed of where the buses are at at any given time.
WHAT ARE THE MAIN ELEMENTS OF THE PROJECT (DELIVERABLES) THAT THE CLIENT WILL NEED TO MAINTAIN OR USE REGULARLY?
The client will need to maintain the web app as part of their website. Any website-wide changes would need to be applied to the tracker page as well. The bus drivers will use the Tracker app daily, and must remember to start the app before driving, and to cancel the app when finished driving. They must also maintain the Firebase database, though there shouldn't be a frequent need for change there.
WHAT LOGIN INFORMATION, PASSWORDS, FEE PAYMENT INFORMATION, ETC., FOR NEW SYSTEMS OR DELIVERABLES MUST THE CLIENT BE AWARE OF? WHERE IS THIS INFORMATION LOCATED?
The client must be aware of their email and password that was used for all software under their Google and github accounts. They must be aware that Cloud Firestore may cost up to $25 per month depending on the amount of writes to the database per day. The password to their Google and github accounts are already in their possession. They can find the cost information by logging into Firebase through their Google account and checking there.
WHAT SECURITY AND BACKUP MEASURES DO YOU RECOMMEND THE CLIENT IMPLEMENT TO SAFEGUARD SYSTEM INFORMATION?
The app should never be pushed to the actual market due to the fact that it keeps their information in plain text, rather than encrypting it. Making backups of all the code would be advised as well so that if they somehow lose it they still have a working copy of it.
IN WHAT FORM HAVE YOU DELIVERED TRAINING DOCUMENTS FOR CLIENT ACTIVITIES? WHERE IS THIS MATERIAL? WHICH STAFF MEMBERS WERE TRAINED

IN EACH NEW SYSTEM?
We delivered these documents in the form of actual printouts and emailed PDFs of these documents. The webmaster will be “trained” on how to add new bus routes and install the software on new tablets if needed.
HOW OFTEN SHOULD THE CLIENT UPDATE OR OTHERWISE INTERACT WITH EACH DELIVERED SYSTEM (POSTS, PAYMENTS, SOFTWARE UPDATES, ETC)?
The client should only need to interact with the code when integrating our web application with their website, or when they want to add a route or use a new tablet for tracking. This means that they may go months without even touching the code. They should also make sure that they are checking the amount of writes to the database per day they are getting every two weeks or so, and keeping up with their monthly payments if payment for the month is necessary.
WHAT RISKS TO THE DELIVERED SYSTEMS SHOULD THE CLIENT BE MADE AWARE OF?
The client should never push the app to the actual market due to the fact that it keeps their information in plain text, rather than encrypting it. They should also keep backups of the code at all times in case their version somehow becomes unusable. If a tablet will not show up in Android Studio, it is likely a problem with the tablet itself or the tablet needs a software update. If it still does not show up after the software update, the tablet should not be used.
SIGNATURES: PLEASE HAVE CLIENTS SIGN BELOW ATTESTING THAT YOU DISCUSSED THIS DOCUMENT WITH THEM.
Ian Ramsey: Joe Thomas:

Lessons Learned

Jordan Bechek

Christopher Frydryck

Michael Mann