Team Rocket
Interactive Multi-level CSUB Campus Navigation

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Overview

- Current progress and future goals
- Difficulties and a Change of plans
  - This project is more ambitious than we originally thought
  - arcGIS not suitable for our needs
  - Android Studio is difficult to grasp
  - Mobile friendly web app for now
  - Leaflet and geoJSON as an alternative
- Demonstration

Timeline

First Semester:
- Beginning of Semester
  - Obtained licenses for ArcGIS, floor plans, Android Studio, and other development kits necessary
  - Familiarize ourselves with ArcGIS, Android Studio, Java, and Javascript
  - Assigned and organized workload and responsibilities
- Mid-Semester
  - Designed 2D overview map of CSUB campus
  - Started first draft design of GPS application
  - Began work on outdoor pathing
  - Strayed from ArcGIS for creating a custom map
  - Experimented with processing
- End of Semester
  - Started using leaflet library
  - Designing Web-based application for CSU-Navigation
  - Imported GPS coordinates that were obtained from ArcGIS

Second Semester:
- Beginning of Semester
  - Finish indoor navigation and floor implementations
  - Decision and application of any additional features
  - Finalize 2D or 3D map
- Mid-Semester
  - Testing/Debugging phase
- End of Semester
  - Finish Product by May
  - Presentation at Senior Expo

Android Studio & Mapbox

- ● Android Studio
  - ○ Android Studio is an Integrated Development Environment (IDE) we choose to program our application. This will serve as the coding platform for the front end of our application. The front end project is also a fail safe for our project, because it is imported with Mapbox SDK.
- ● Mapbox
  - ○ Mapbox is an open source mapping platform for custom designed maps. This SDK can track device location and simulates user travelling to destination point and it can create a pin with touch/click and shows the fastest route to destination. While user is traveling, it can also display the estimated time of arrival.
- ● Java
  - ○ Java is a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. We are using Java as our primary choice of programming language, because it is the most popular programming language for Android smartphone applications and is also among the most favored for the development of edge devices and the internet of things.

Android Studio & Mapbox Cont.

- Acquire User Location and Permission
  - We were able to acquire user permission and location by using built in android studio functions, such as:
- Location Search & Custom Locations
  - We were able to program location search by using the built-in location function from Mapbox. There is also a function to retrieve CarmenFeature, where it can auto-complete location searches. We can also input custom locations by using ".addInjectionFeature" and using Longitude and Latitude to show accurate location.


```
<uses-permission android:name="android.permission.ACCESS_FINE_LOCATION"></uses-permission>
<uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION"></uses-permission>
<uses-permission android:name="android.permission.INTERNET"></uses-permission>
```

```java
@Override
protected void onActivityResult(int requestCode, int resultCode, Intent data) {
    super.onActivityResult(requestCode, resultCode, data);
    if (resultCode == Activity.RESULT_OK && requestCode == REQUEST_CODE_AUTOCOMPLETE) {
Retrieve selected location's CarmenFeature
        CarmenFeature selectedCarmenFeature = PlaceAutocomplete.getPlace(data);
```

```java
findViewById(R.id.fab_location_search).setOnClickListener((view) → {
    Intent intent = new PlaceAutocomplete.IntentBuilder()
            .accessToken(Mapbox.getAccessToken() != null ? Mapbox.getAccessToken() : "s
            .placeOptions(PlaceOptions.builder()
                    .backgroundColor(Color.parseColor( colorString: "#EEEEEE"))
                    .limit(10)
                    .addInjectedFeature(CSUB)
                    .addInjectedFeature(SRC)
```

Android Studio & Mapbox Cont.

- Implement Modern User Interface
  - For modern user interface, we need to change the layout in activity_main.xml to frame layout. There are already built in functions for float button, so the icon for search and navigation won't be rectangular and bulky.
- Restrict Map Panning
  - For restrict map panning, we have to set up the boundaries of the area. We then have the build-in function from mapbox to call the function. Currently, we want to show the restricted area, so we have applied a layer on top, which will be shown from our demo slide.



```xml
<com.google.android.material.floatingactionbutton.FloatingActionButton
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:id="@+id/button"
    android:layout_gravity="bottom|right"
    android:layout_marginRight="24dp"
    android:layout_marginBottom="24dp"
    android:background="@color/mapbox_navigation_route_layer_blue"
    android:onClick="startNavigationBtnClick"
    app:srcCompat="@android:drawable/ic_menu_directions"
    />

<com.google.android.material.floatingactionbutton.FloatingActionButton
    android:id="@+id/fab_location_search"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_gravity="end|bottom"
    android:layout_marginRight="24dp"
    android:layout_marginBottom="90dp"
    android:tint="@android:color/white"
    app:backgroundTint="@color/colorPrimary"
    app:srcCompat="@android:drawable/ic_search_category_default"
    />
```

```java
//restrict map
private static final LatLng BOUND_CORNER_NW = new LatLng( latitude: 35.3540,  longitude: -119.1098);
private static final LatLng BOUND_CORNER_SE = new LatLng( latitude: 35.3431,  longitude: -119.0968);
private static final LatLngBounds RESTRICTED_BOUNDS_AREA = new LatLngBounds.Builder()
    .include(BOUND_CORNER_NW)
    .include(BOUND_CORNER_SE)
    .build();
```
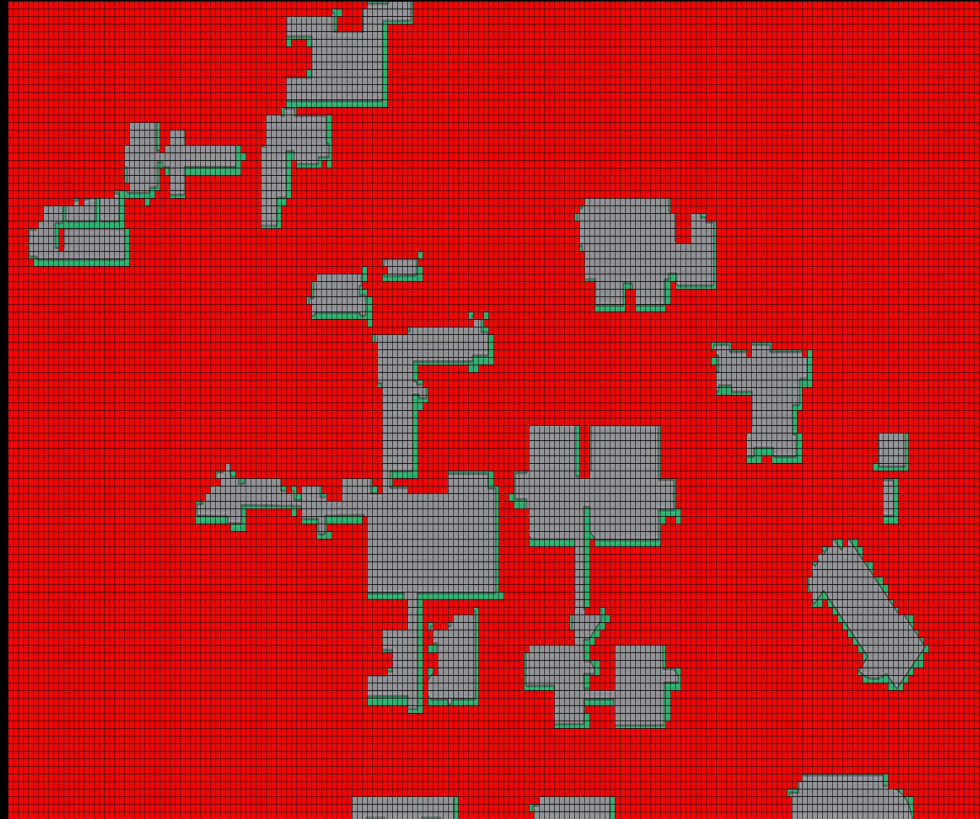
```java
//restrict
mapboxMap.setLatLngBoundsForCameraTarget(RESTRICTED_BOUNDS_AREA);
```

Demo - Front End
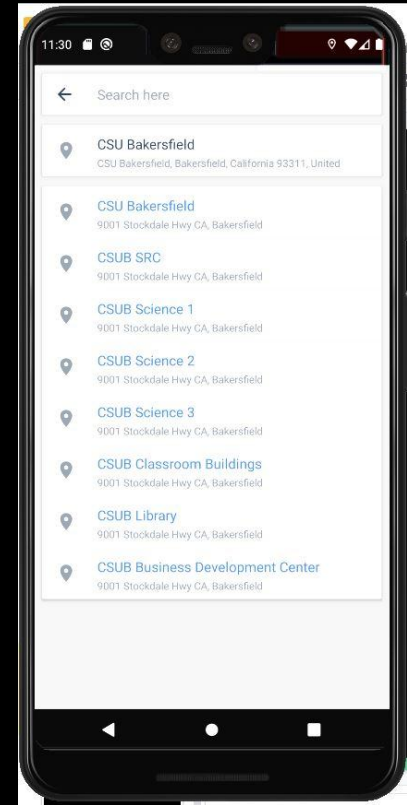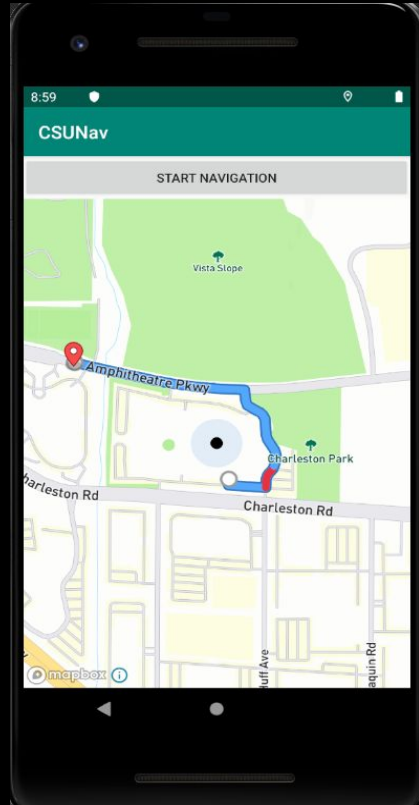
Processing and Map Design

- Graphical JavaScript Library and IDE built for programming in a visual context
- Display grid and node system
- Android friendly
- No access to android libraries or GPS coordinates; cant open in Android Studio

Leaflet Library and Web Browser Application

- Leaflet - Used for navigation in web-based applications
  - Javascript Library
- Designing a web-based application to display the on-campus navigation outdoors
  - Initialize map objects
  - Create routes
  - locate device location and parse gps coordinates
  - create markers above points of interest
  - pulled arcGIS coordinates to display building locations
  - Drop-down menu to display specified coordinates and map to them from user location

- Debugging:
  - Leaflet can generate routes from point-to-point, but does not update the current user location en-route
    - Fixed by updating the current GPS position every 3 seconds and redrawing the route

ArcGIS

- Powerful for creating maps
- Was not possible to import buildings and paths through ArcGIS Online
- Map coordinates were importable through a CSV file
- Were used to implement into an html file
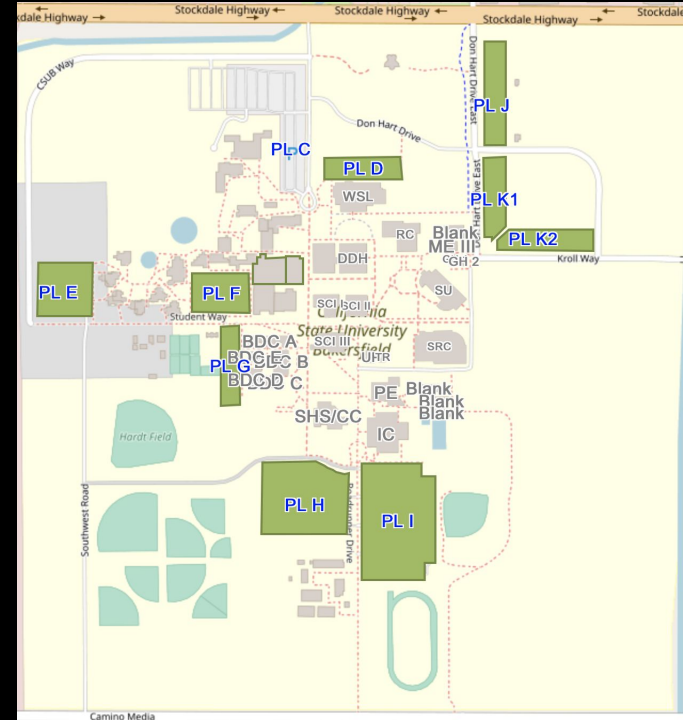
HTML

```html
<!DOCTYPE html>
<html>
<head>
<style>
table, th, td {
  border: 1px solid black;
  border-collapse: collapse;
}
th, td {
  padding: 5px;
}
th {
  text-align: left;
}
</style>
</head>
<body>

<h2>CSUB Map Coordinates</h2>
<p>Buildings and Parking Lots included.</p>

<table style="width:40%">
  <tr>
    <th>Building Name</th>
    <th>Latitude</th>
    <th>Longitude</th>
  </tr>
  <tr>
    <td>Administration</td>
    <td>35.350365</td>
    <td>-199.105509</td>
  </tr>
  <tr>
    <td>Administration East</td>
    <td>35.350689</td>
    <td>-199.105023</td>
  </tr>
  <tr>
    <td>Administration West</td>
    <td>35.350411</td>
    <td>-199.105997</td>
  </tr>
  <tr>
    <td>Amphitheatre</td>
    <td>35.353623</td>
    <td>-199.102521</td>
  </tr>
  <tr>
    <td>Business Development Center A</td>
    <td>35.349059</td>
    <td>-199.104989</td>
  </tr>
  <tr>
    <td>Business Development Center B</td>
    <td>35.348696</td>
    <td>-199.104755</td>
  </tr>
  <tr>
    <td>Business Development Center C</td>
    <td>35.348372</td>
    <td>-199.104884</td>
  </tr>
  <tr>
    <td>Business Development Center D</td>
    <td>35.348453</td>
```

```html
  </tr>
    <td>Business Development Center E</td>
    <td>35.348805</td>
    <td>-199.105281</td>
  </tr>
    <td>Central Plant Operations</td>
    <td>35.349772</td>
    <td>-199.105088</td>
  </tr>
    <td>Child Care</td>
    <td>35.349053</td>
    <td>-199.107572</td>
  </tr>
    <td>Classroom Building</td>
    <td>35.351186</td>
    <td>-199.105428</td>
  </tr>
    <td>Dore Theatre</td>
    <td>35.352188</td>
    <td>-199.105431</td>
  </tr>
    <td>Dorothy Donahoe Hall</td>
    <td>35.350394</td>
    <td>-199.103605</td>
  </tr>
    <td>Education Building</td>
    <td>35.350208</td>
    <td>-199.104479</td>
  </tr>
    <td>Engineering Modulars</td>
    <td>35.34795</td>
    <td>-199.104696</td>
  </tr>
    <td>Facilities</td>
    <td>35.345029</td>
    <td>-199.103575</td>
  </tr>
    <td>Greenhouse 1</td>
    <td>35.350413</td>
    <td>-199.101252</td>
  </tr>
    <td>Greenhouse 2</td>
    <td>35.35037</td>
    <td>-199.101086</td>
  </tr>
    <td>Humanities Complex</td>
    <td>35.351908</td>
    <td>-199.106834</td>
  </tr>
    <td>Icardo Center</td>
    <td>35.347541</td>
    <td>-199.102631</td>
  </tr>
```

```html
  <tr>
    <td>J. Antonio Sports Center</td>
    <td>35.348283</td>
    <td>-199.101773</td>
  </tr>
    <td>J.R. Hillman Aquatic Center</td>
    <td>35.347887</td>
    <td>-199.101496</td>
  </tr>
    <td>Modular East III</td>
    <td>35.350617</td>
    <td>-199.101311</td>
  </tr>
    <td>Modular West</td>
    <td>35.349101</td>
    <td>-199.107158</td>
  </tr>
    <td>Music Building</td>
    <td>35.351881</td>
    <td>-199.105831</td>
  </tr>
    <td>Parking Lot A</td>
    <td>35.353192</td>
    <td>-199.105788</td>
  </tr>
    <td>Parking Lot B</td>
    <td>35.353139</td>
    <td>-199.104546</td>
  </tr>
    <td>Parking Lot C</td>
    <td>35.352196</td>
    <td>-199.104562</td>
  </tr>
    <td>Parking Lot D</td>
    <td>35.351894</td>
    <td>-199.103087</td>
  </tr>
    <td>Parking Lot E</td>
    <td>35.349893</td>
    <td>-199.109071</td>
  </tr>
    <td>Parking Lot F</td>
    <td>35.349847</td>
    <td>-199.105935</td>
  </tr>
    <td>Parking Lot G</td>
    <td>35.348674</td>
    <td>-199.105761</td>
  </tr>
    <td>Parking Lot H</td>
    <td>35.346458</td>
    <td>-199.10423</td>
  </tr>
```

Building Name	Latitude	Longitude
Administration	35.350365	-199.105509
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Building Name	Latitude	Longitude
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Parking Lot E	35.349893	-199.109071
Parking Lot F	35.349847	-199.105935
Parking Lot G	35.348674	-199.105761
Parking Lot H	35.346458	-199.10423
Parking Lot I	35.346165	-199.102387
Parking Lot J	35.35313	-199.100432
Parking Lot K1	35.351477	-199.100437
Parking Lot K2	35.350707	-199.099359
Parking Lot K3	35.351297	-199.099745
Parking Lot L	35.350711	-199.097739
Performing Arts	35.351006	-199.104683
Physical Education	35.348237	-199.102671
Romberg Nursing Center	35.349716	-199.104664
Runner Cafe	35.350805	-199.102247
Satellite Plant	35.349197	-199.108309
Science I	35.349674	-199.103771
Science II	35.349643	-199.103221
Science III	35.349059	-199.103715
Student Health Services	35.347847	-199.103808
Student Housing Northeast	35.35154	-199.097752
Student Recreation Center	35.348954	-199.101529
Student Services	35.350208	-199.104967
Student Union	35.349926	-199.101495
Testing Room	35.348799	-199.102714
University Advancement	35.350378	-199.10634
University Police	35.34881	-199.102947
Visual Arts	35.351527	-199.107325
Walter Stiern Library	35.351444	-199.103216
Well Core Repository	35.344627	-199.10383

Demo

Questions?