



Interactive and Multi - Level Campus Navigation

Heriberto Jimenez, Guang Jin Liu, Zachary Kaiser, Cameron McDaniel

Introduction

Despite significant advancements in mapping technology, many new college students and campus visitors still get lost on university grounds. Currently, the only means of navigation available to students are obsolete paper maps. In addition, online routing software does not route to specific buildings or classrooms. There is no readily-available method of quickly locating the numerous buildings, classrooms, and offices that make up a university campus. This project aims to resolve this issue and provide university visitors with real-time navigation from their mobile devices.

Innovations

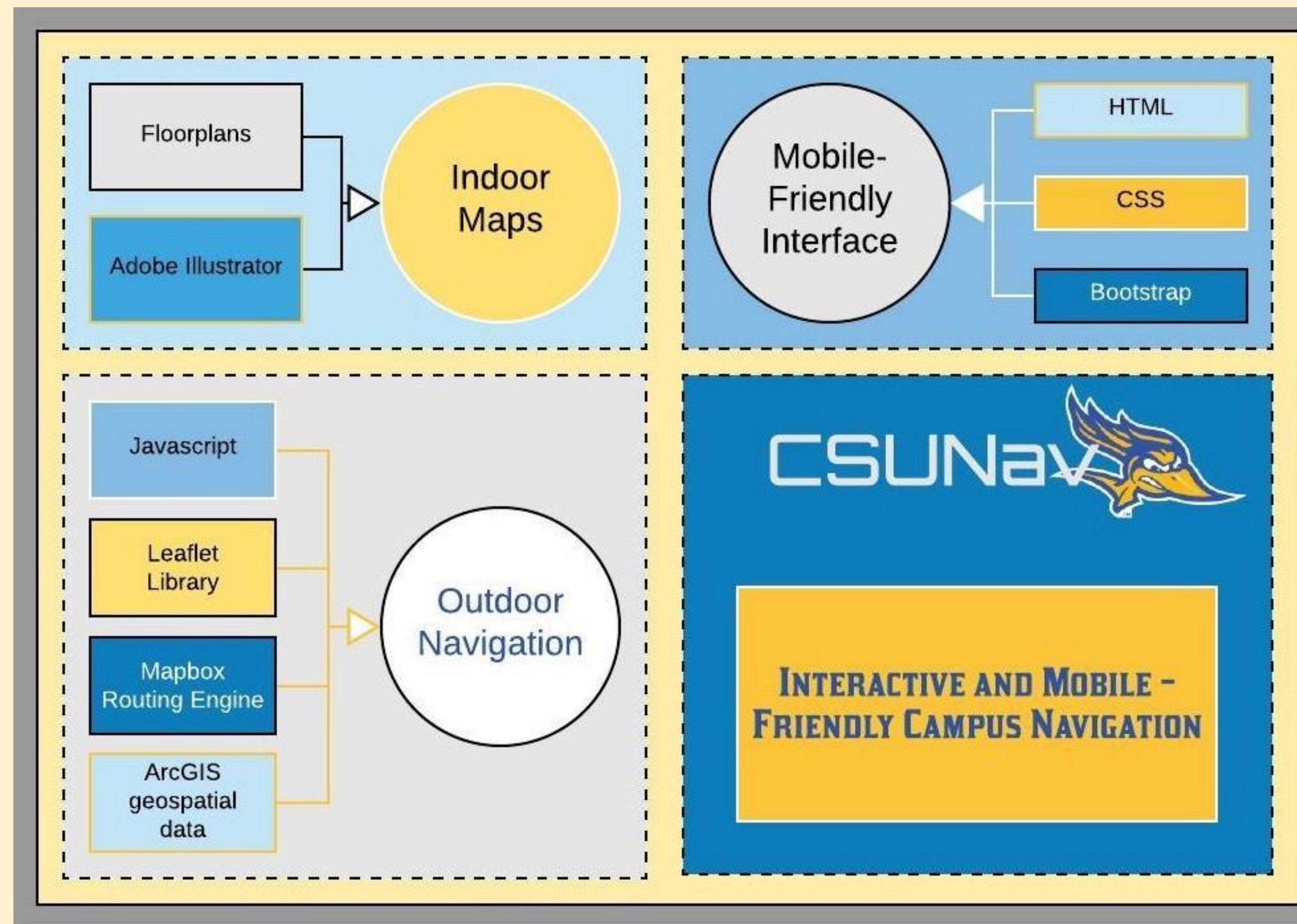
Pathfinding and navigation are nothing new, but our project is innovative due to its extension to indoor environments. After users are directed to their chosen building, they then have the ability to search for individual classrooms. The floor and position of these classrooms are then displayed to further assist users once they arrive at their desired building.

Languages and Libraries

As a web-based application, the individual elements are coded with a combination of HTML and CSS with JavaScript as our scripting language. We utilized Leaflet, an open-source JavaScript library for creating interactive and mobile-friendly maps. We chose Leaflet because it is highly customizable and allows the use of custom maps, various routing engines, and responds to CSS styling. We further used JavaScript to iterate through our geospatial data as well as select buildings based on their coordinates and also to create custom icons to display over our buildings. For further front-end styling, we incorporated bootstrap as a CSS framework because it is effective at designing mobile-friendly interface components. In addition indoor map images, coordinates, room numbers, building names, and floors were stored in a Comma Separated Value format.

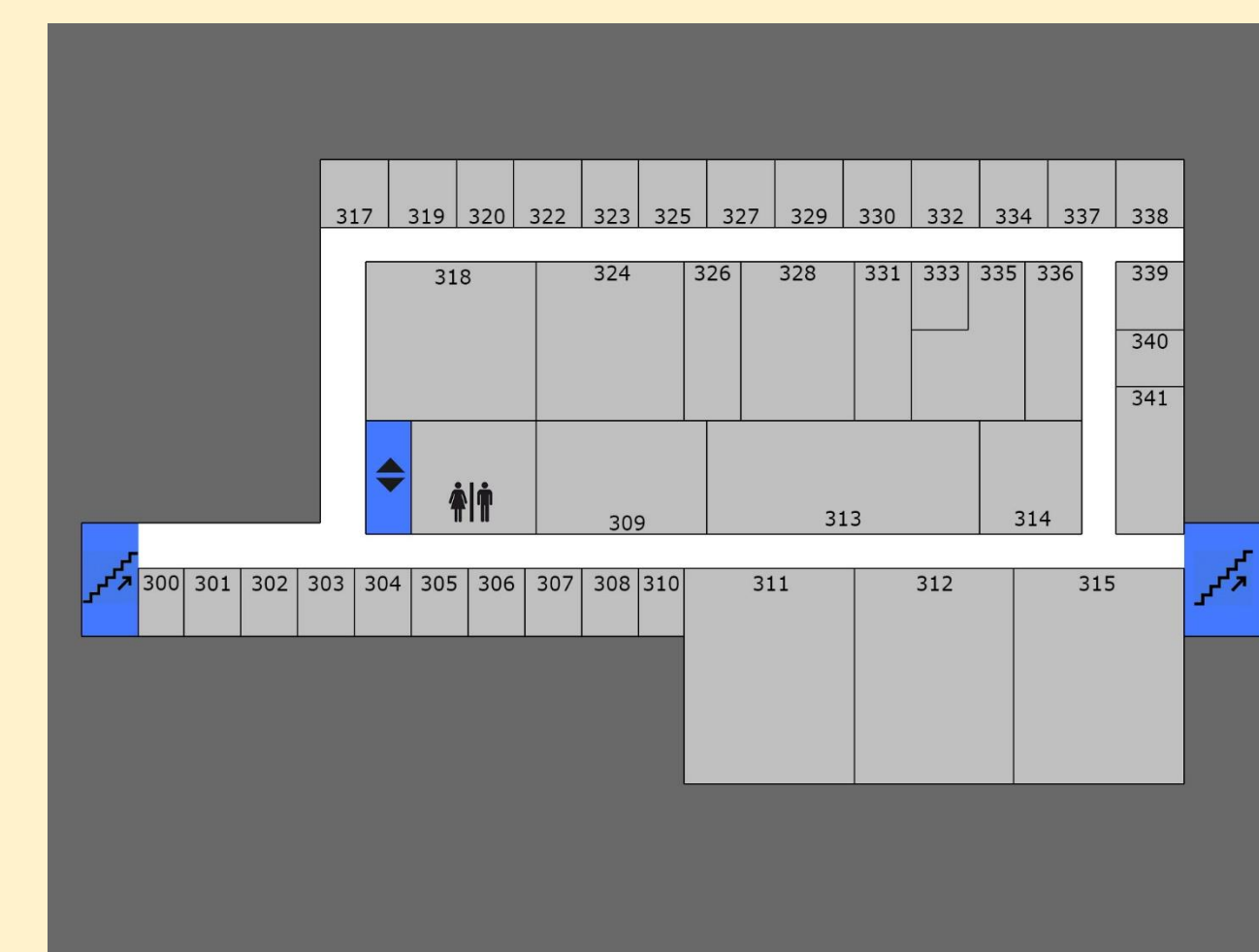
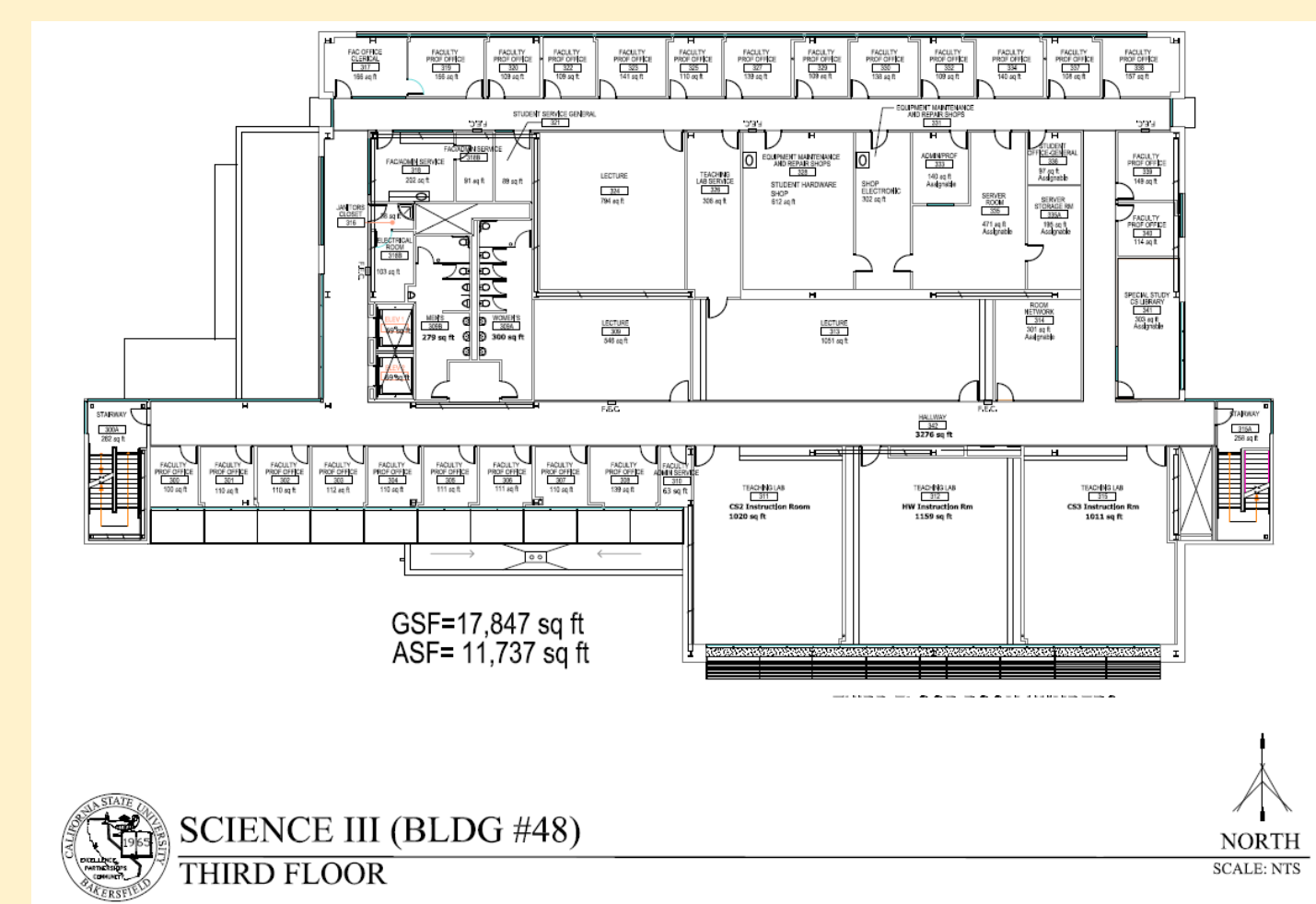
Combining Components

The result of our hard work is an interactive, mobile-friendly, and web-based application that both locates and provides directions to all of the buildings, classrooms, and offices on campus. Below is a flow chart of how our application works.



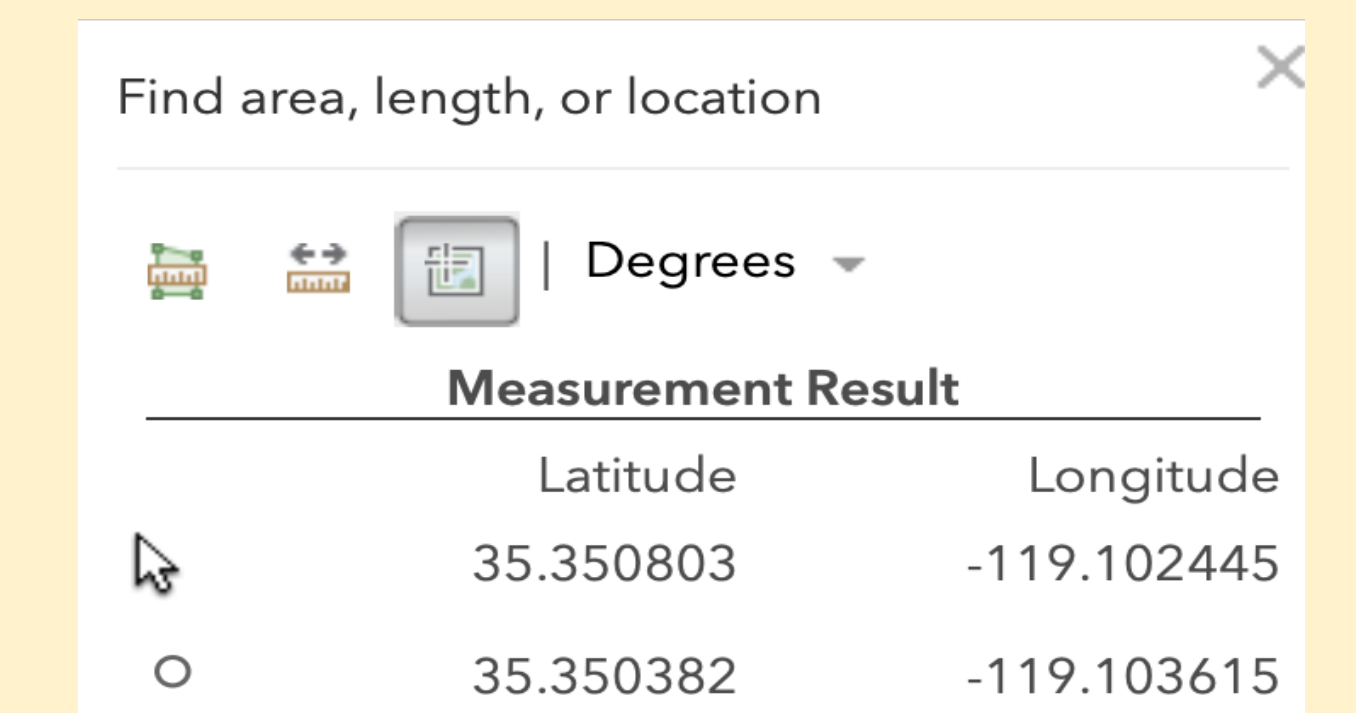
Floorplan Creation

We started by obtaining actual building floorplans from the CSUB Facilities Management Department. We simplified these plans into readable and user-friendly indoor maps using Adobe Illustrator. Points of interest like restrooms, stairs, elevators, and exits are easily found. Classroom numbers are displayed but further guidance is provided with a marker displayed above the desired room for convenience.



Gathering Geospatial Data

Defining the coordinates of buildings, structures, and parking lots on campus required gathering very precise GPS coordinates for each of these locations. To accomplish this task, we employed ArcGIS - a geographic information system maintained by the Environmental Systems Research Institute.



ArcGIS allowed us to export the latitude and longitude of any location for later reference within our web-based application.

Routing Machine

Once we had the coordinates, we needed a way to traverse between our waypoints. A routing machine takes the latitude and longitude of two points and uses predefined paths to show the most direct path. We chose the Mapbox Routing Machine which accepts sidewalks as traversable routes. Constantly changing the routing machine input as the user location updates allowed us to redraw the paths and give the experience of real-time tracking.

Custom Tile Set

Every instance of a leaflet map requires the use of a tile set, which is a base map over which layers and elements can be built. While many stock tile sets are available, they were missing some campus buildings. To update our maps, we edited an existing tile set to include our buildings and extruded them to give a 3-D appearance. This was then passed as Leaflet's tile layer when we instantiated the map. The result is an updated map with easily identifiable buildings over which our icons, images, and routing can be displayed.