

Interactive Pedestrian Routing Web Map for CSULB's Upper Campus

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Introduction

The goal of this project was to develop a web application that people will use to find the shortest walking path from point A to point B on CSULB's upper campus. Digital routing is an important resource in today's world because we do not know where everything is located, and can benefit from on-demand directions to help us navigate to new locations. While driving directions can be provided in the form of text based navigational instructions, walking directions are in some ways more difficult to generate because, unlike streets, most walking paths are not named. Thus, when providing walking directions in a digital routing application, a map interface is crucial for giving spatial context that the user can utilize for navigation.

CSULB is located in southern California within Los Angeles County. It is near the edge of Los Angeles County and Orange County. It has almost 38,000 students (Figure 1).

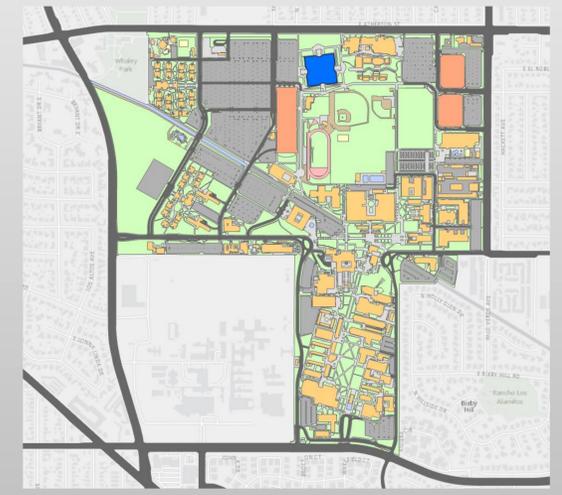


Figure 1. This is a screenshot of the study area, CSULB.

Data and Data Sources

I received campus structure data, campus boundary data, and 2014 aerial imagery from the CSULB Geography Department. Those datasets were all saved in a file geodatabase. I field collected CSULB upper campus walking paths and building entrances. Those datasets were saved in a feature dataset within the file geodatabase (Table 1).

Table 1. List of data and data sources used in the project

Dataset	Source
CSULB campus structures	CSULB Geography Department
CSULB campus boundary	CSULB Geography Department
2014 aerial imagery	LARIAC
CSULB upper campus walking paths	Personally collected
CSULB upper campus Building entrances	Personally collected

Methodology

I digitized all of the CSULB's upper campus walking paths using ArcMap 10.5's editor toolbar. These were digitized by referring to the TIFF aerial imagery created in 2014 and the vector campus outline data both owned by the CSULB Geography Department. I also referred to the CSULB Geography Department's building structures layer to accurately digitize and connect the walking paths with the building entrances. I collected the building entrance and walking path data that I could not see just by looking at the aerial imagery by going out into the field and ground-truthing. I did this by printing out around 12 maps of the aerial imagery that covered the entire CSULB upper campus. This process took me two weekends and four full days out in the field. Once the digitization process was completed I created the network using ArcMap's Network Analyst extension. Once the network was built it was provided to the CSULB GIS Lab Manager, Mr. Michael Shensky, who placed the network on the CSULB enterprise GIS and published the network as a service using the CSULB ArcGIS Server. I was then able to reference the service when creating the web application. I used the ArcGIS API for JavaScript's Route Task to build routing functionality into my web map and altered some of its aspects to fit the goal of the project (See Figure 2).

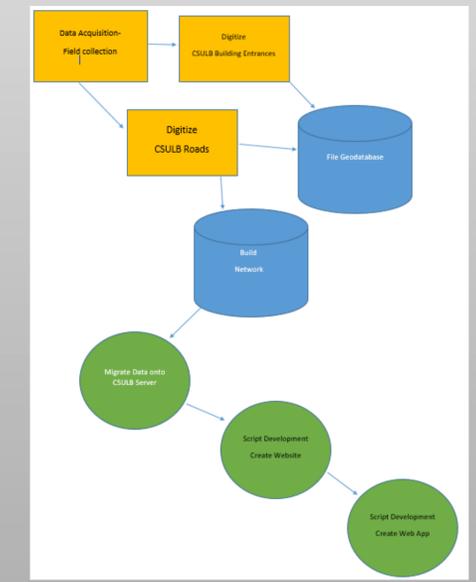


Figure 2. This figure shows a workflow of my project. The orange squares symbolize field work and data creation. The blue cylinders symbolize geodatabase management and network construction.

Timeline

Step	Dates
Field work- Plotting building entrance locations and plotting walking paths	May 12, 13, 19, 20, 21.
Data Processing- Digitize the field work.	May 12, 13, 19, 20, 21.
Create the network.	May 21
HTML, CSS, and JavaScript online training.	May 22- May 28
HTML, CSS, and JavaScript web app work.	May 29-June 30

Results

The results of this project include the feature classes generated from data collected in the field, the network created in ArcMap using the Network Analyst extension, and the relevant code that enables user interactivity in the web application. The cumulative result is a web routing application that allows a user to find the shortest path from one CSULB upper campus location to another by clicking at the desired origin point and clicking to define the desired destination point(s) (please see figures 3-6).



Figure 3. This figure shows the CSULB walking paths represented as a red line and the CSULB building entrances as a black circle



Figure 4. This is an image of the built network.

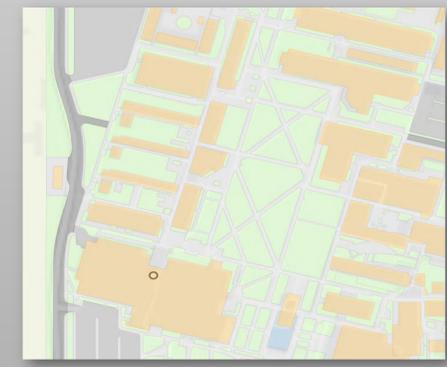


Figure 5. This is a screenshot showing the first click or stop.



Figure 6. This is a screenshot of a completed route.

Discussion

Field data collected for this project could have been collected more efficiently using Collector for ArcGIS, ArcGIS Pro, and ArcGIS Online. I would set up the basemap and feature classes in ArcGIS Pro. I would then push this map on to ArcGIS Online and connect it to Collector for ArcGIS.

This web application is significant because the network was created with more walking path detail than currently available. I digitized more walking paths and created a more robust network than Google Maps. I compared routes of some of the smaller walking paths both in Google Maps and in my application. The Google Map route went around some walking paths instead of using a more direct route. My application used a more direct route.

The web application's functionality and applicability was evaluated through a quality control check. I randomly created 10 routes distributed through the network to see if there was anything wrong with connectivity. Each of those routes were successfully completed by the web routing application. I also field checked the generated walking paths and building entrances to ensure they were valid paths.

Conclusion

My results include a walking paths and building entrances; a network; and an interactive web application. I would improve this project by creating a CSULB-wide walking network. By doing this, the web application would serve the entire CSULB population. CSULB could possibly use and host this application because of its routing capabilities. CSULB could attach this functionality to an interactive web map with other map layers, giving more information to the user. Some of CSULB's other relevant layers include: shuttle stops, Long Beach Transit stops, parking, bike racks, and bike routes. These layers would pair well with a routing network because they are all related to transportation.

Additional future work to improve the product would be an increased focus on ADA accessibility. I would find all the steps on the CSULB campus and create a steps layer as a polygon barrier within my network. This application would be able to serve more of the pedestrian population. I would also conduct an elevation study in order to create routes that would avoid hills. While there are ways to improve the application I developed through my work on this project, overall I was successful in creating a working routing web map prototype for the campus.

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