1. Title

Low-Stress Bike-Route Planner for Tucson

Programming Concepts Final Project ,
Neil Pritchett, CIS 129, May 2025

2. Problem I Chose.

Tucson boasts over 1,000 mi of bikeways [2] yet Google Maps and Apple Maps routinely push riders onto high-speed arterials like Speedway and Broadway; Apple still has no cycling mode here; eight local cyclists were killed in 2023 alone .

3. Existing Software and Gaps

- Google Maps: favors shortest time; unaware of some Bike Boulevards; lacks heat-avoidance logic[5].

- Apple Maps: cycling directions limited to “select cities,” Tucson excluded [4] .

- PAG Metro Bike Map: rich data but static PDF, no turn-by-turn [2].

4. Why It Matters

- Crash data show 1,139 bicycle crashes and 44 deaths statewide in 2023 [1] .

- Safer routing lowers stress, encourages bike commutes, supports city climate goals[3].

5. Proposed Solution

A mobile app that computes **low-stress routes** by weighting every street segment for:

1. Traffic speed & volume (ADOT data).
2. Official Level-of-Traffic-Stress scores (PAG).
3. Crash hot spots [1].
4. Shade & heat index (NOAA).
5. Crowd-sourced hazard reports.

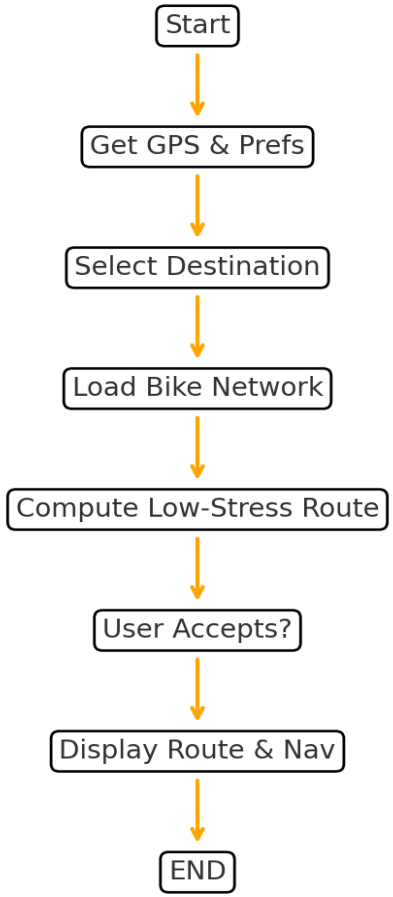
6. Data Architecture

Data Source	What We Pull	Refresh
PAG/City GeoJSON	bikeway geometry + LTS	monthly
ADOT Crash Facts API	crash hot spots	nightly
NOAA Heat Grid	temp & HI	hourly
User Reports	hazards, close calls	real-time

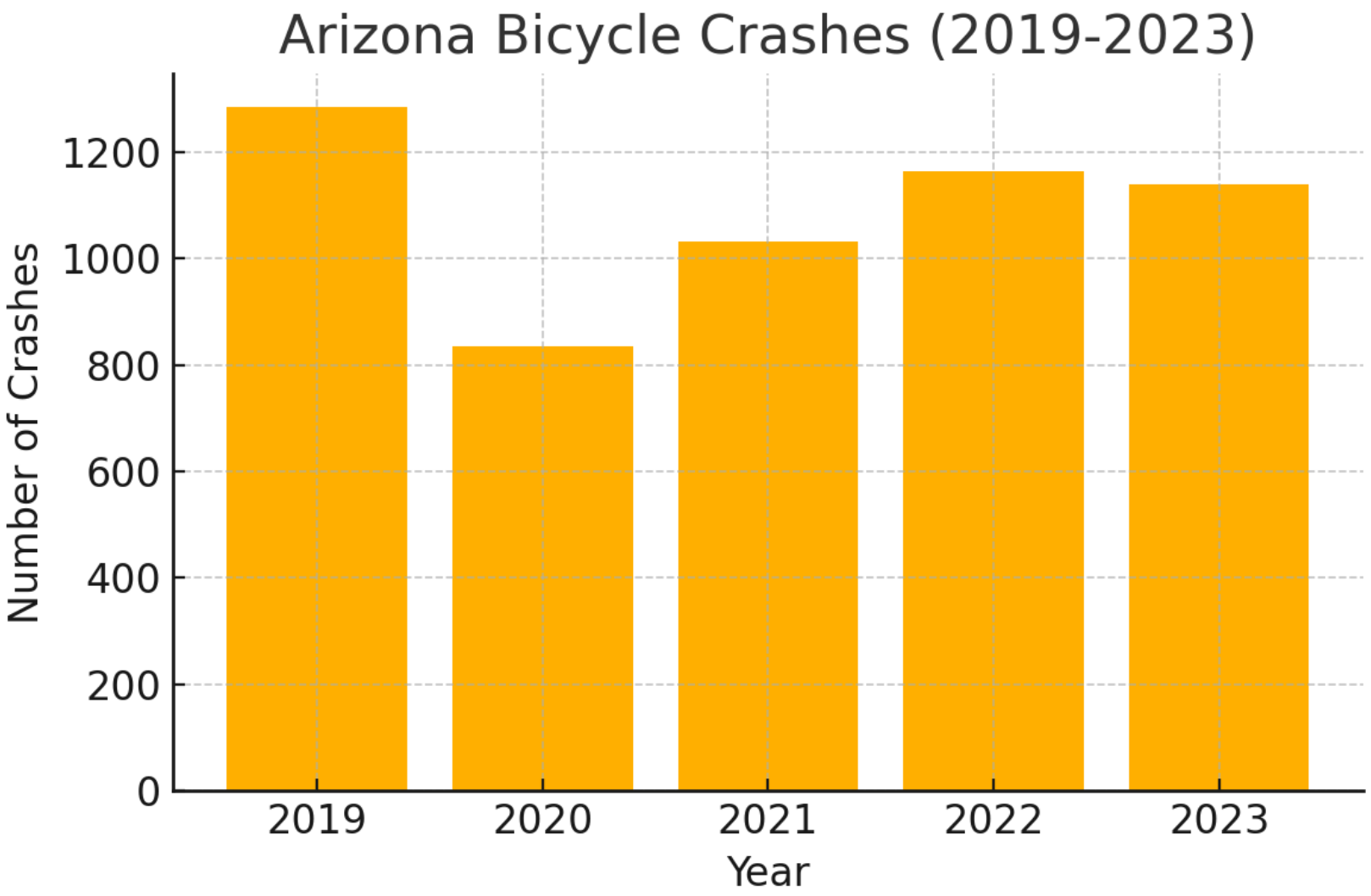
7. Pseudocode

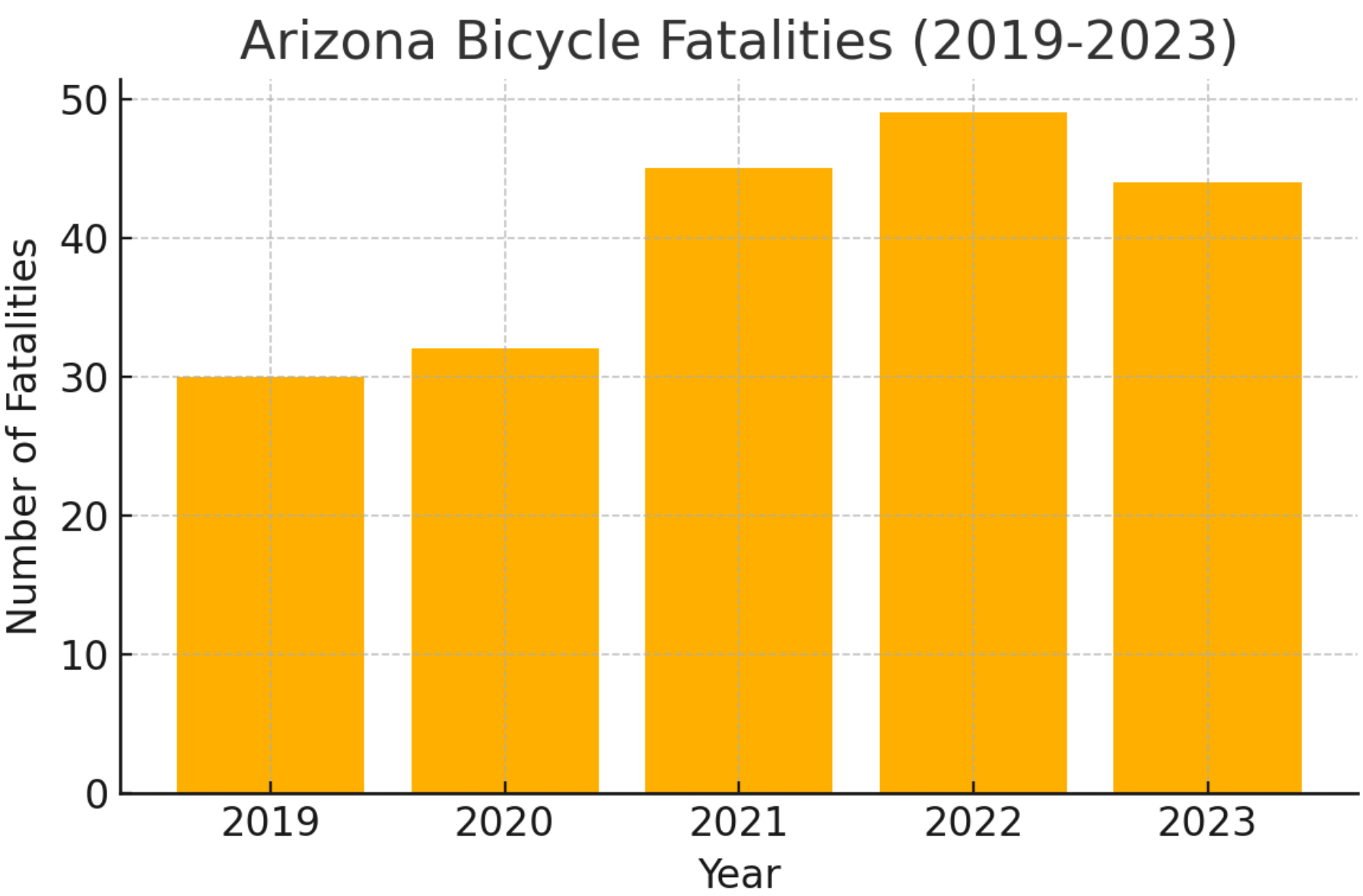
```
get_user_location()
dest = get_user_destination()
prefs = get_user_prefs()          # hills, heat, stress
net  = load_safe_network_tiles()  # bikeway graph
route_pool = dijkstra(net, origin, dest, weight=prefs)
best_route = rank_low_stress(route_pool)
display(best_route)
if user_rejects(): display(next_best)
save_feedback()
```

8. Flowchart


Start
Get GPS & Prefs
Select Destination
Load Bike Network
Compute Low-Stress Route
User Accepts?
Display Route & Nav
END

9. Trend Graphs




Arizona Bicycle Fatalities (2019-2023)
Number of Fatalities
0
10
20
30
40
50
2019
2020
2021
2022
2023
Year

10. User Experience Snapshot

- Home screen: map, search bar, quick buttons (Campus, Downtown, “The Loop”).

- Route preview: color-graded stress segments; optional **“Avoid Asphalt Heat”** toggle.

- One-tap hazard report; no audio cues (good for riders with hearing loss).

11. Open Questions

1. How granular is NOAA heat data inside Tucson neighborhoods?

2. What reward keeps crowd-source reports high-quality without turning social?

References

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3. MAP Dashboard. “Bicycling Capacity in Tucson, AZ.” Univ. of Arizona, 2024. https://mapazdashboard.arizona.edu/infrastructure/bicycling-cap

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4. Apple Support. “Get cycling directions in Maps on iPhone.” 2025. https://support.apple.com/guide/iphone/get-cycling-directions-iph431ac5856/ios

5. Klein, E. “Cyclists report a disproportionate number of errors to Google Maps.” *Vox*, Feb 28 2015. https://www.vox.com/2015/2/28/8121469/google-maps-bicycling

6. Trujillo, E. “Tucson streets can be deadly for cyclists; pros have some safety advice.” *Arizona Sonoran News*, Apr 30 2024. https://arizonasonorannews.com/37268/safety/tucson-streets-can-be-deadly-for-cyclists-pros-have-some-safety-advice/