B8: LANDHOPPER

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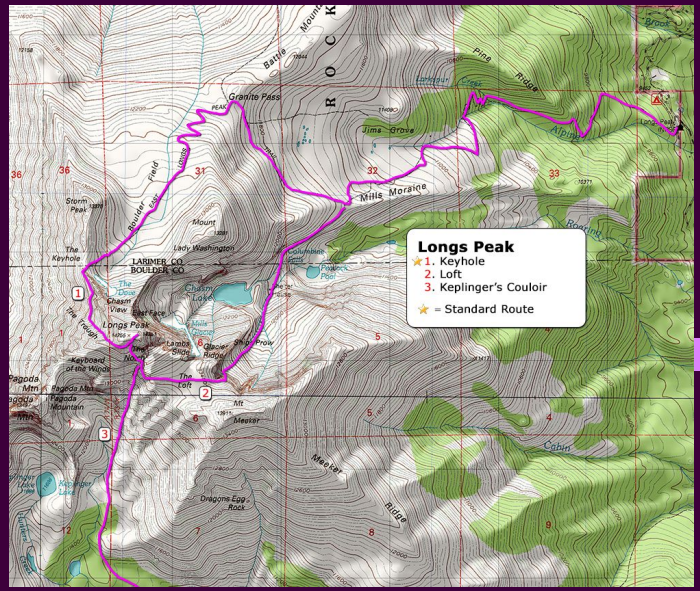
Use-case Requirements: Backpacking Trip

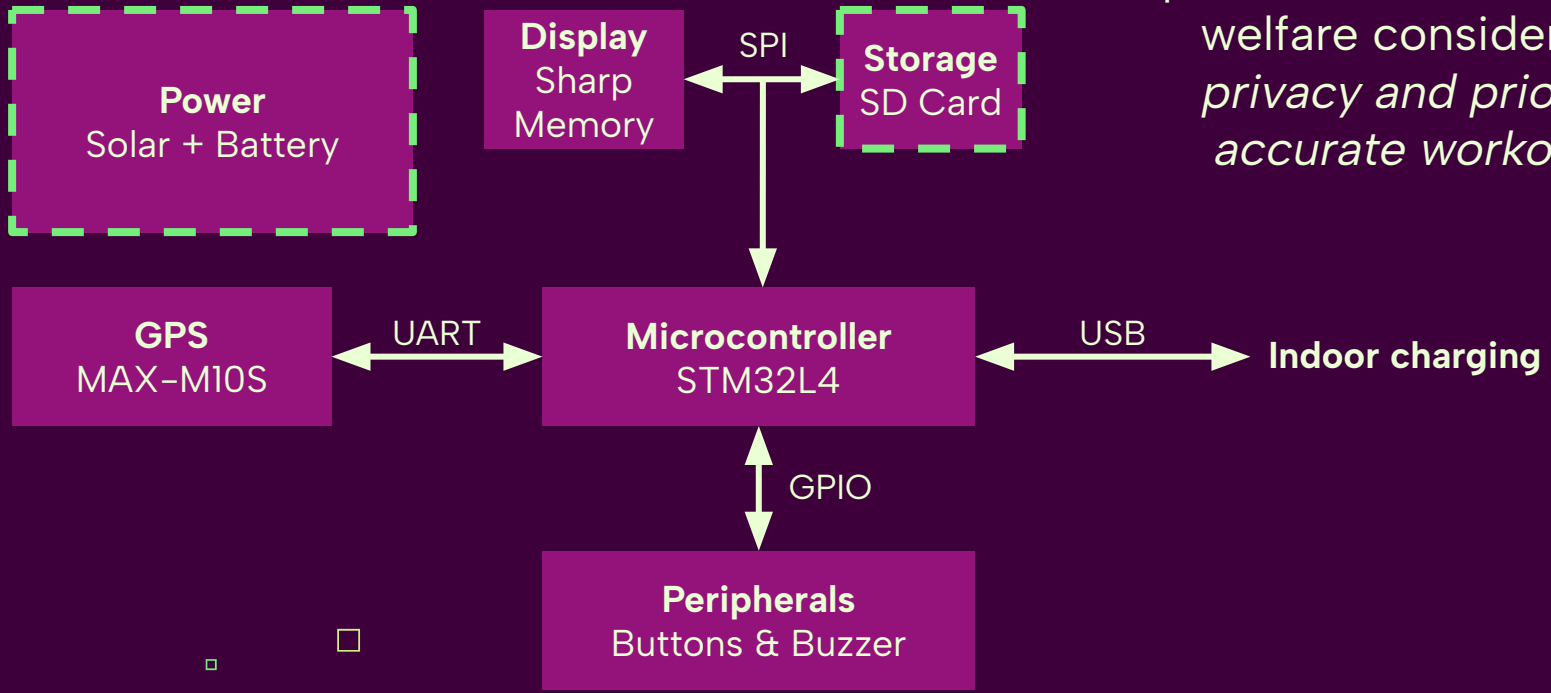
1 week without charging, 6 hours outdoors
1 week of GPS data
Total distance traveled within 10%
Comfortably wearable: ½ lb or less



Design Requirements

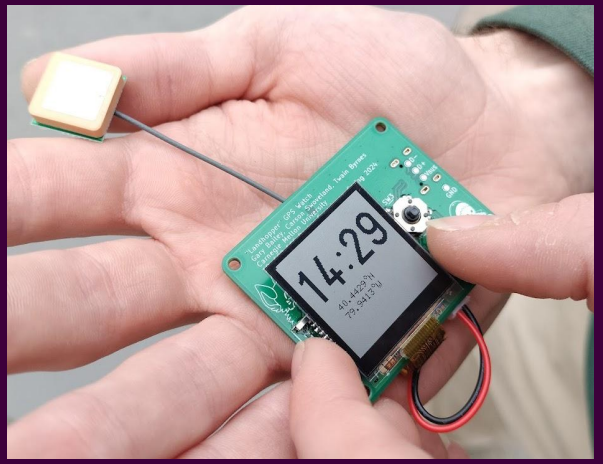
Maximum error of 150ft for one data point
Sampling at one point per minute
Space/weight: battery no larger than 1000mAh

Solution Approach

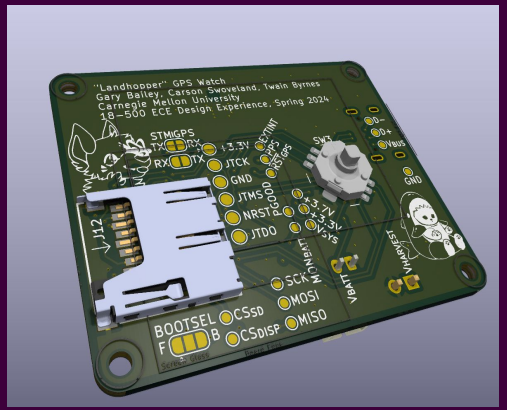


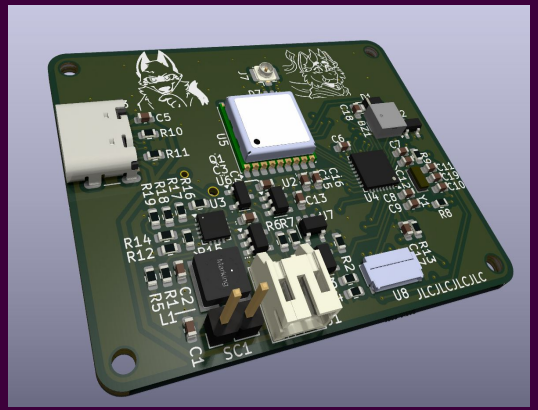
public health, safety, and welfare considerations: *privacy and prioritizing accurate workout data*

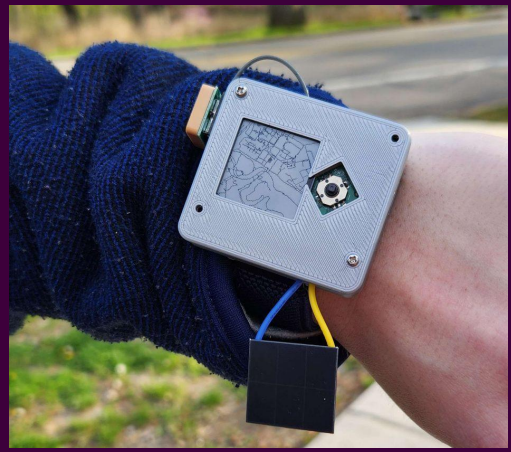
Complete Solution



Wearable watch
GPS fix (if near window)
Solar charging
Map with current and prior locations
UI with time (& time zone switching), alarms, map



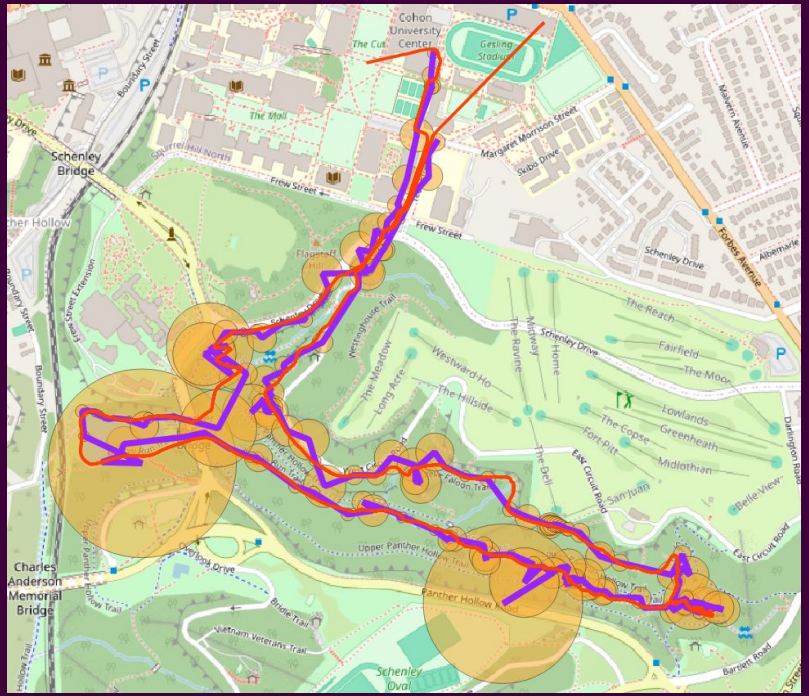




Tests and Requirements

Hike Test	1 Week	1 Week	150ft
Comfort Tests	<½ lb		User Survey

Testing + Verification: Positioning

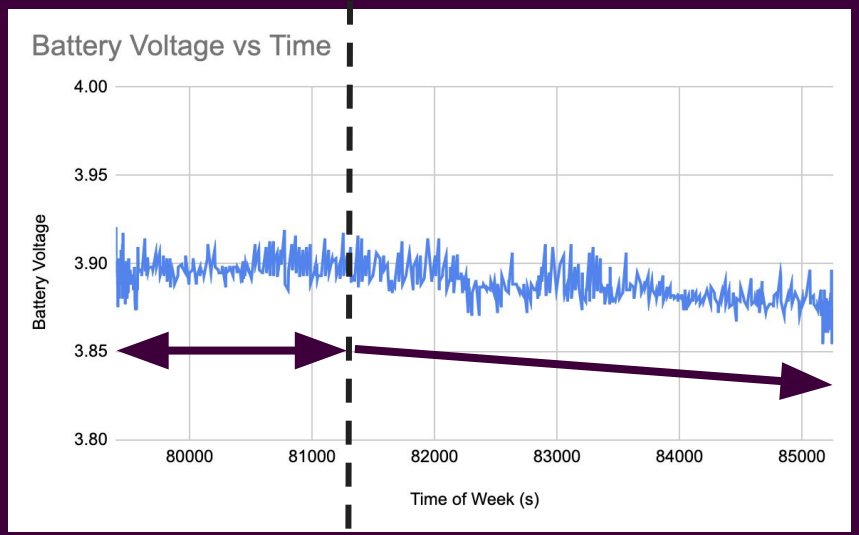


Red: Known-good position (ZED-F9P)
Purple: Landhopper's logged path
Orange circles: Error along path

Error statistics:
Min 0.269m, Max 122m, Mean 11.4m, StdDev 12.9m

At this log rate on a 32GB SD card:
23.5 years of storage

Testing + Verification: Power and Battery



Battery voltage maintained!
Unlimited battery life!

Average drain: ~16mA
Sampled at 100% duty cycle → **48 hours**
Sampled at 1/15th duty cycle → **10 days**

Cutoff:
Turning away from direct sunlight

Testing + Verification: Energy Source

Energy Source

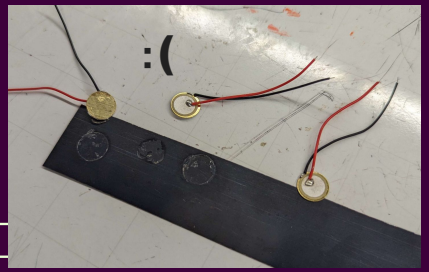
	Piezo	**Solar**	Kinetic
Can Build?	No	Yes	Yes
Power	N/A	1-10mW	1-5mW
Size	Tiny	Small	Large

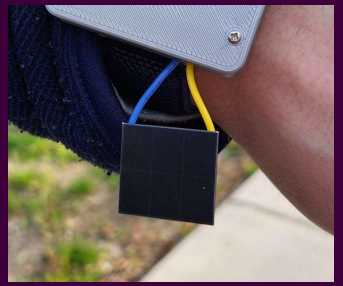
Battery Size

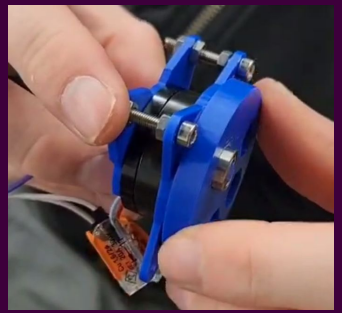
Need <40x50mm

2mA average draw * 1 week = 330mAh

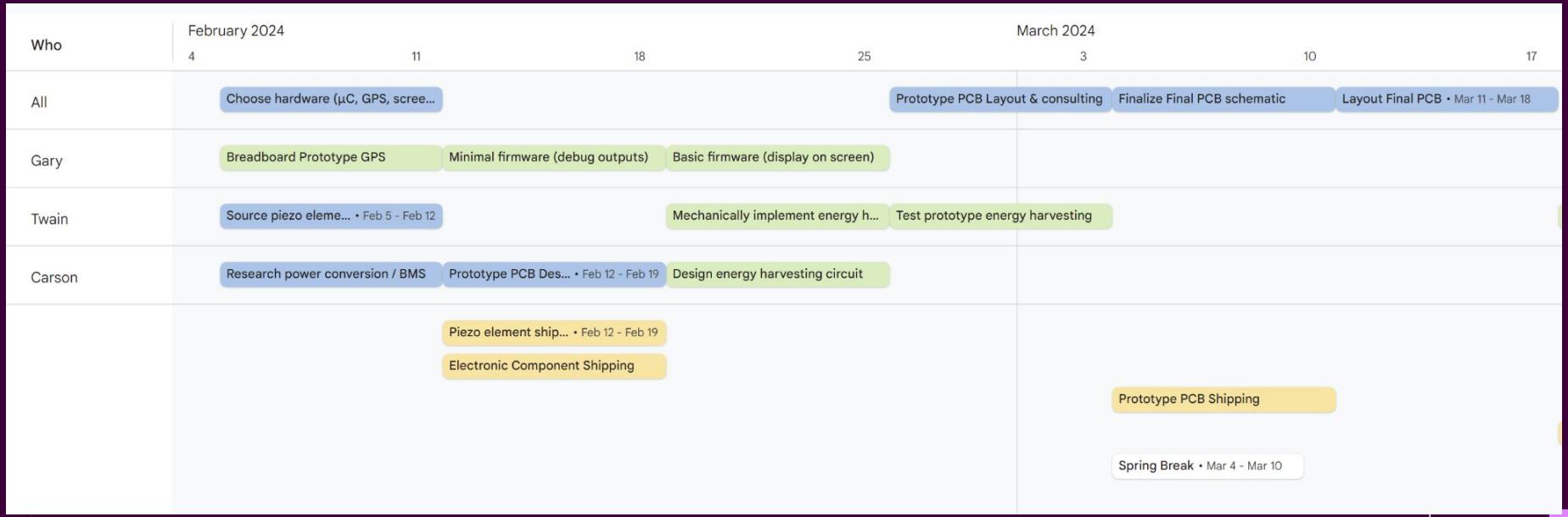
Largest possible capacity: **500mAh**







Project Management



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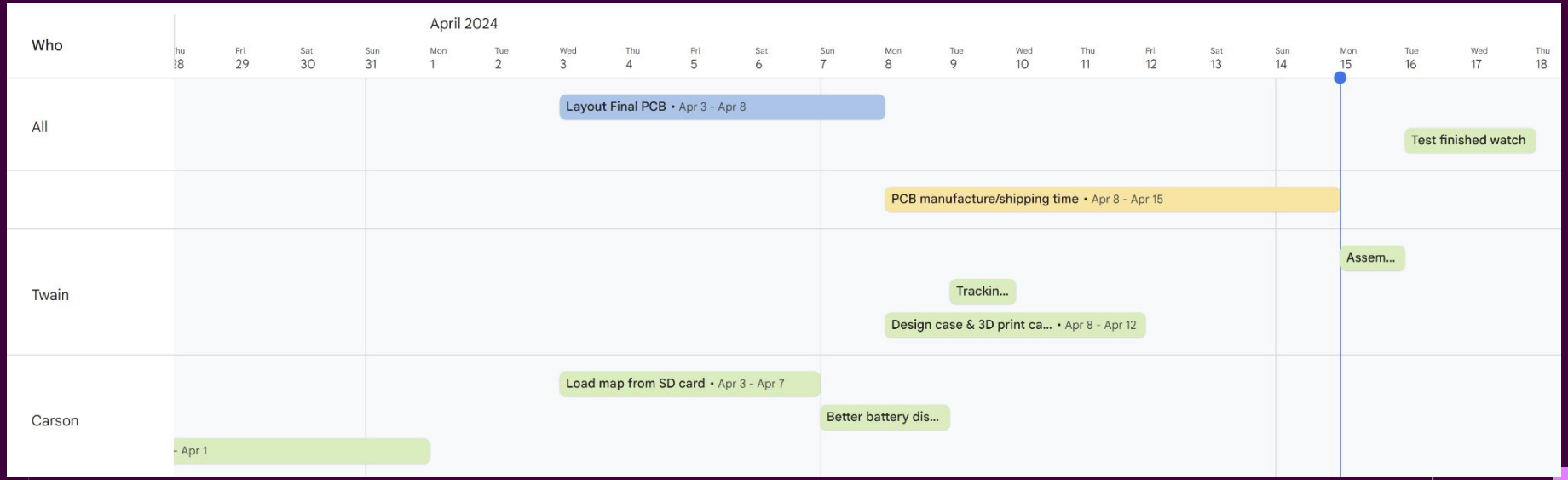

Takeaways

- Further investigation of **kinetic energy harvesting**
- Improvements to case design/user interface
- You can never have enough test points
- Don’t buy GCT SD card slots

Landhopper is **effective** at filling its **designed use case**,
but still has plenty of room for improvement.