

Landhopper: GPS Watch

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Minimalist GPS Smartwatch

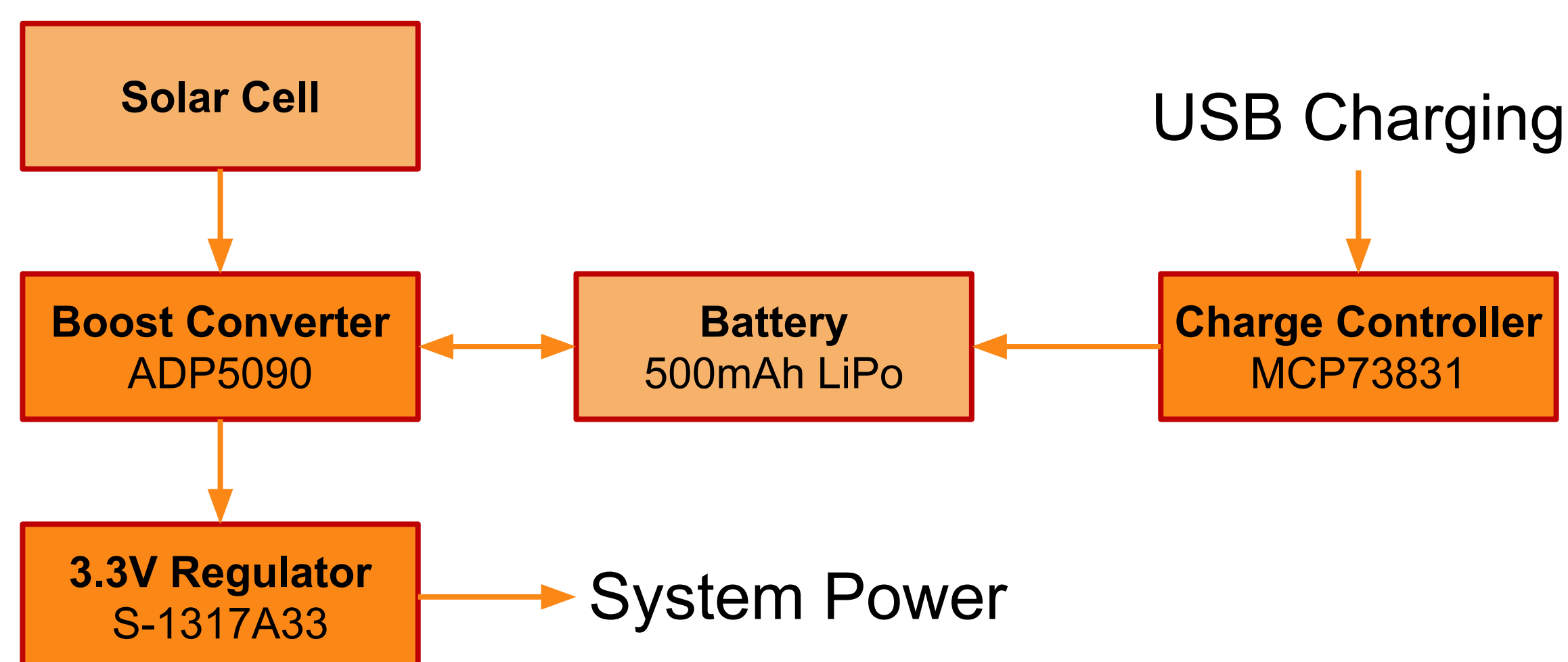
Hikers are often forced to choose between good battery life on a less functional watch, or a GPS watch that must be charged every few days. Landhopper was designed to provide location data for lengthy outdoor trips without access to power or internet connectivity.

We aimed for **1 week** of battery life and position tracking, and position measurement accuracy **< 150 feet**. Powered by solar energy, we attained **~10 days** of battery life (depending on brightness) and **38 feet** average position accuracy.

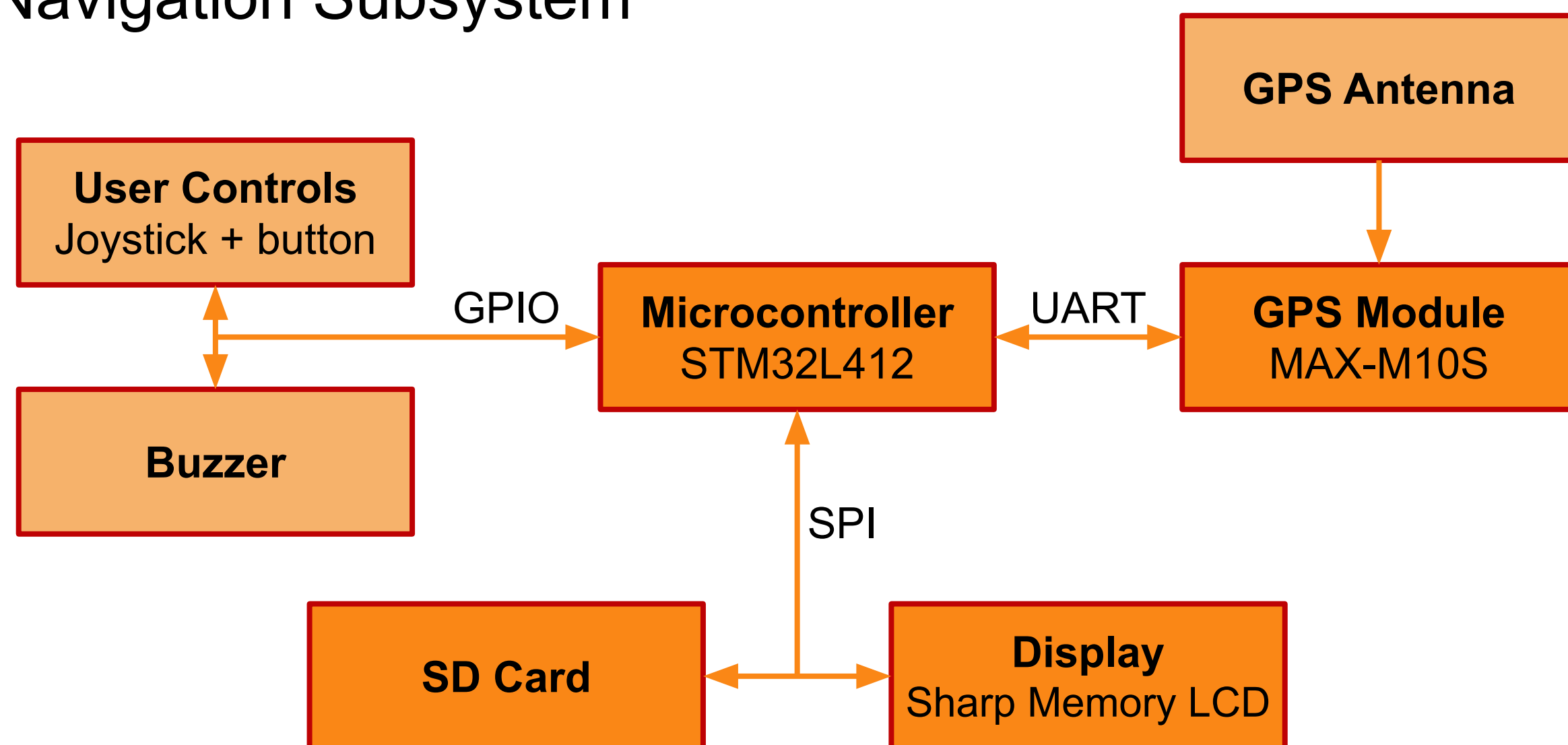
System Description

The hardware consists of two parts: the navigation subsystem and the power subsystem.

Power Subsystem

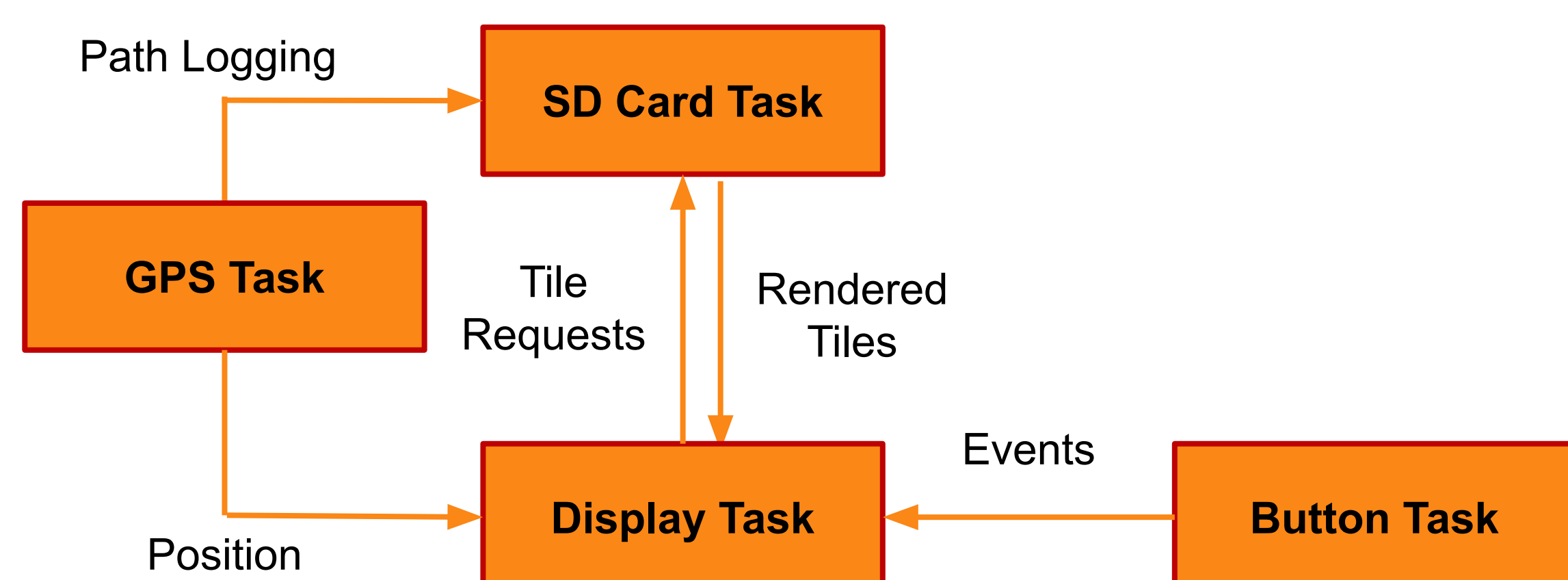


Navigation Subsystem



For the software, our tasks communicating over separate channels to log locations and load map data without making the watch unresponsive.

Software Architecture



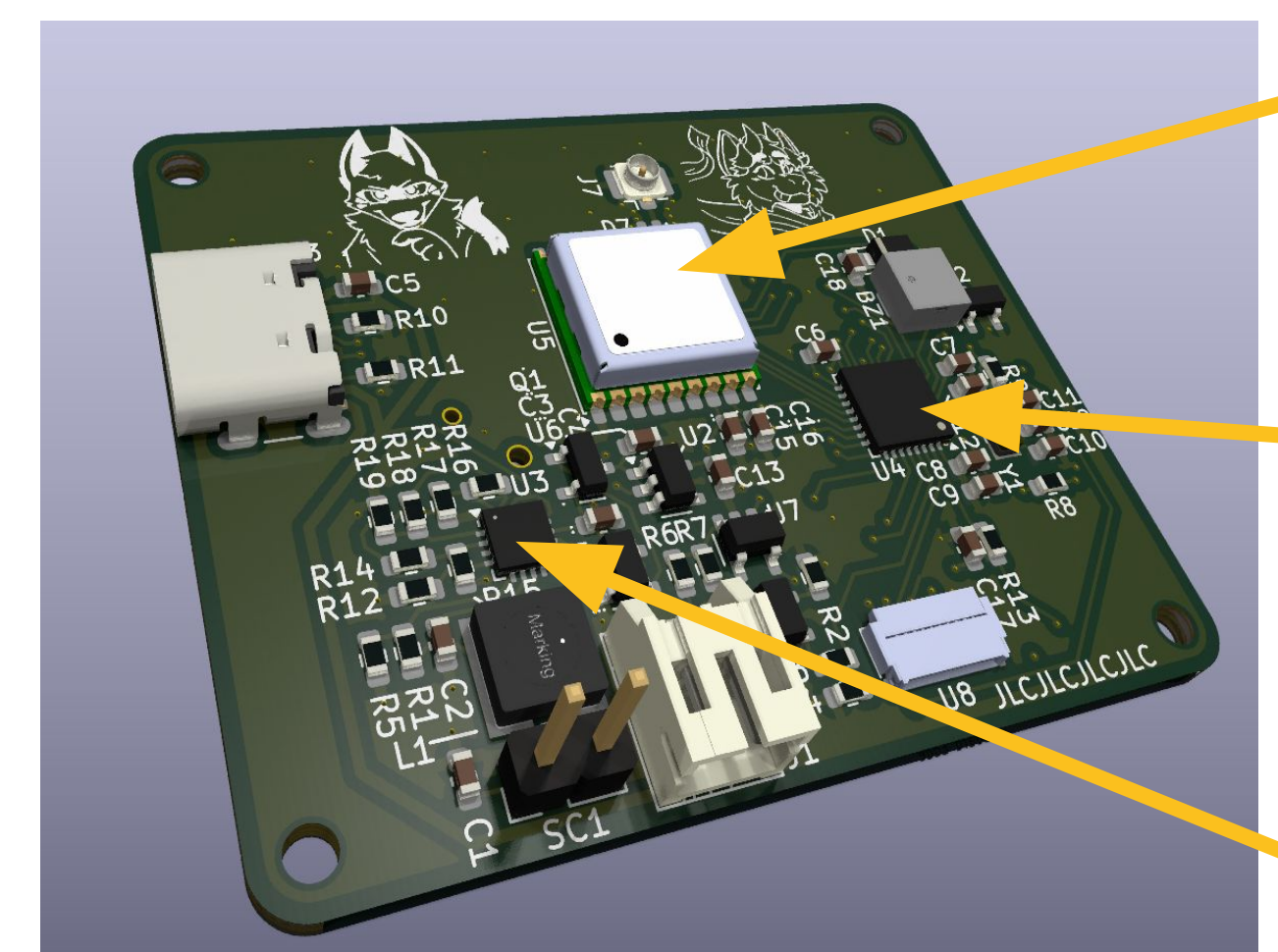
Final Design

Landhopper



Solar Cell Controller

Back Side of PCB



GPS Receiver

Micro-controller

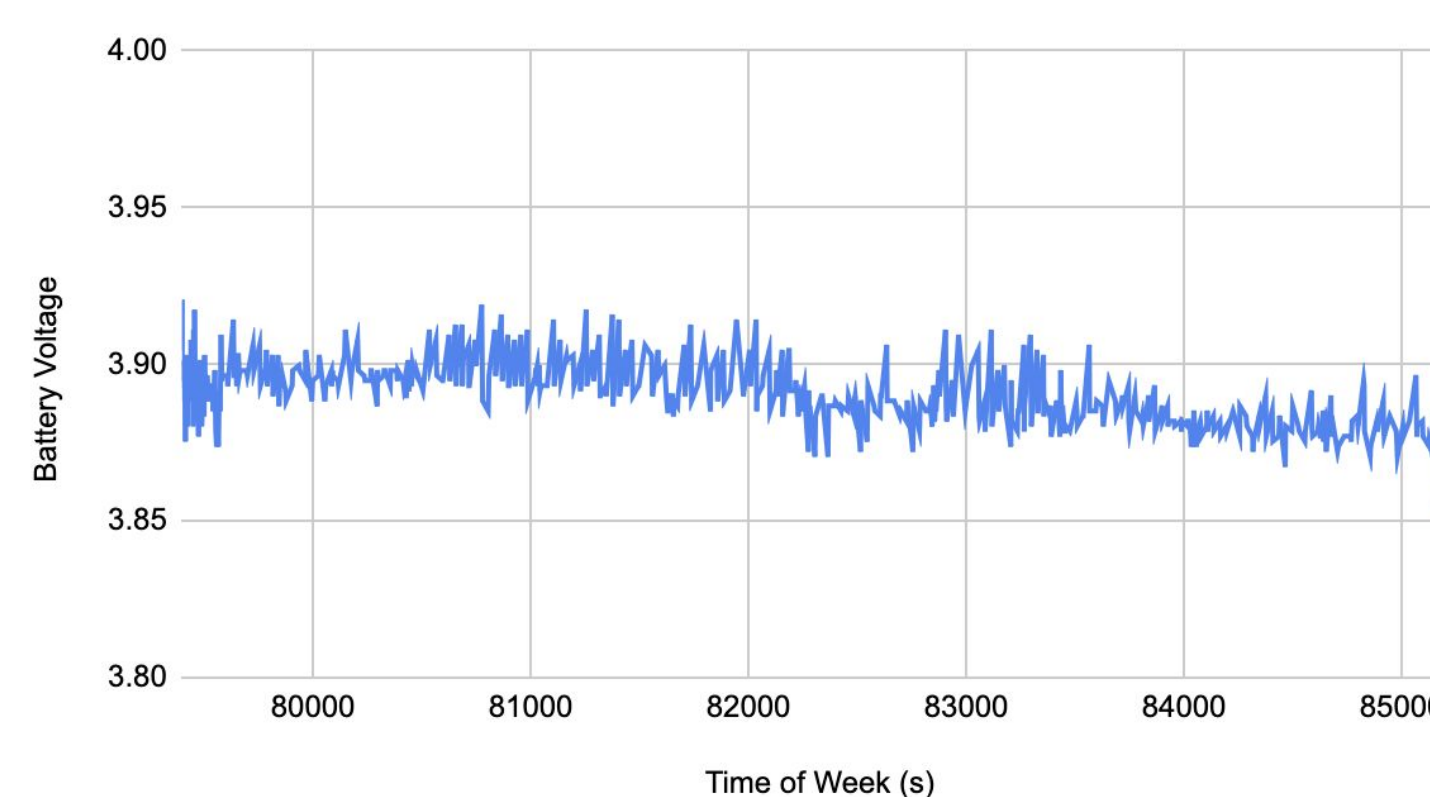
Energy Harvester

Verification and Evaluation

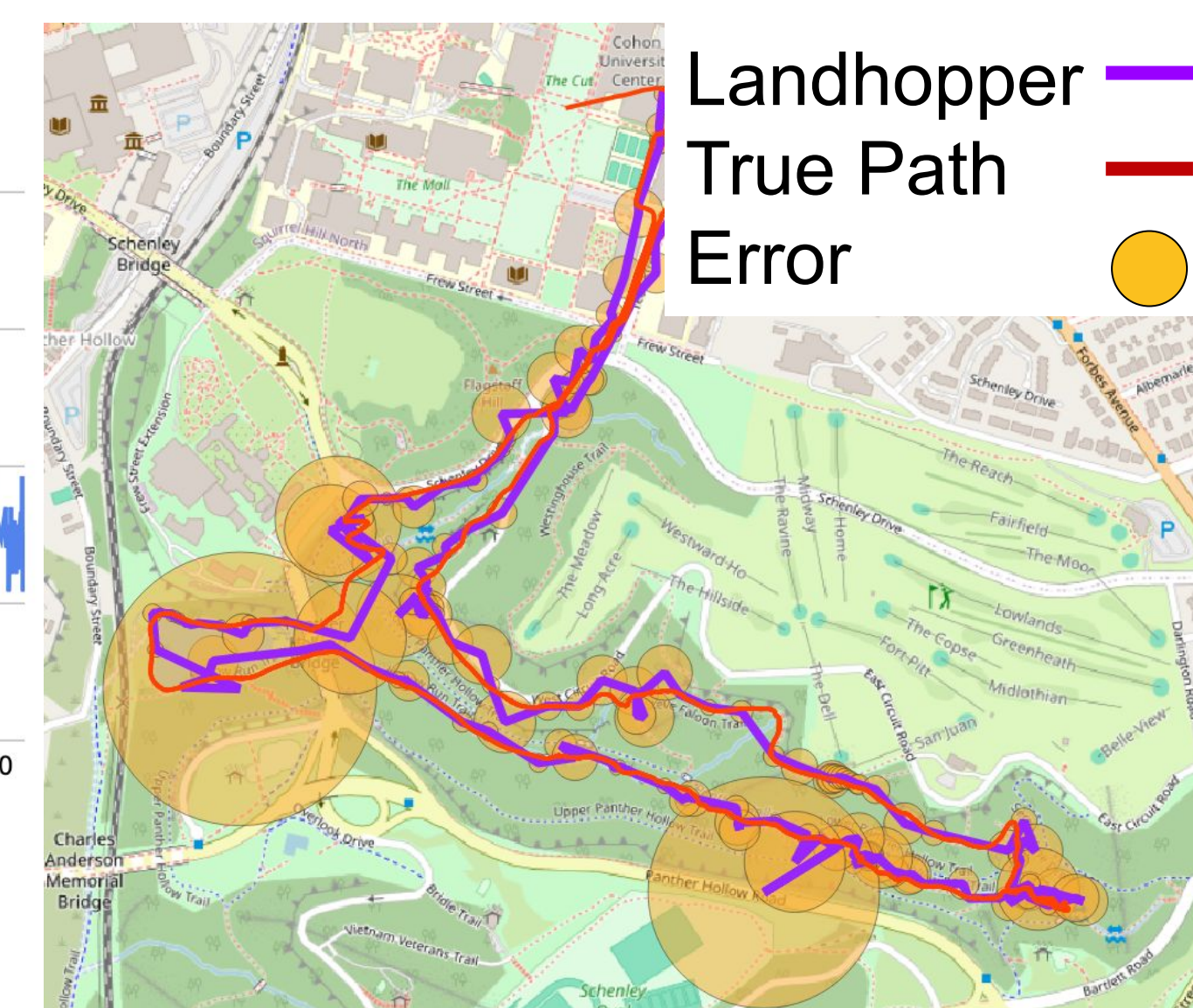
As part of the final design we compared several distinct energy harvesting methods. We chose solar due to its ease of fabrication, small size, and high average power output.

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

Battery Voltage



Location Accuracy



We tested Landhopper by taking it on a 2 hour hike through Schenley alongside a ZED-F9P RTK GPS module.

Location accuracy was **almost entirely within 150 ft** and **battery voltage was maintained** while the watch was in direct sunlight.

Conclusions & Additional Information



<http://course.ece.cmu.edu/~ece500/projects/s24-teamb8/>

Landhopper is an all-in-one **solution** to issues of location tracking over long periods of time with its solar energy harvesting.

Future work may include making the casing weather resistant and reducing the size of the watch so that it is more comfortable.