2.09 Project H.I.K.E.
Heat Island Kartographic Environment

Our project is a portable data logger that tracks temperature, humidity, location, and time. The data is stored locally, then transferred to a cloud-based storage system and displayed on an interactive heat map for use by city planners.

Requirements

- Records temperature, humidity, time, position (GPS) locally with ease of access for uploading to cloud storage.
- 40 x 40 x 100 mm max size, 150g max weight.
- 4 hour / 48 hour battery life (operating / idle).
- Rich information display via webapp overlaid on a map

Why is it Important?

- City planners will be able to identify "hot-spots" to determine methods of integrating heat-dispersing features.
- This grows increasingly relevant, as per the EPA[1], excessive heat is responsible for increased energy consumption and decreased public health.

Cost and Budget

Original Unit Cost Requirement: $30.00/unit

Unit Cost to Date: $28.22/unit

Meet the Team

Samuel Osagie-Aruya	Leigh Cross	Jeremy Hester	Jack Hotchkiss
Power Storage & Distribution	Sensors (Temperature, Humidity, GPS)	Project Manager (Scheduler & Interactive Heat Map)	User Interface & Data Management

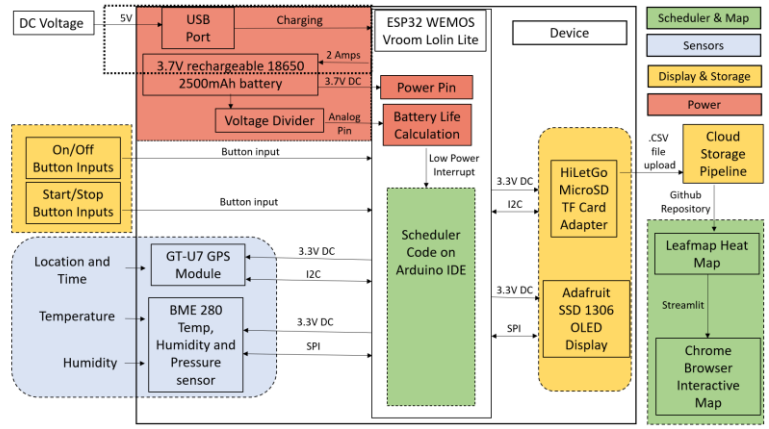
Sponsor and Faculty Advisor: Dr. Lee Hinkle

Sensors

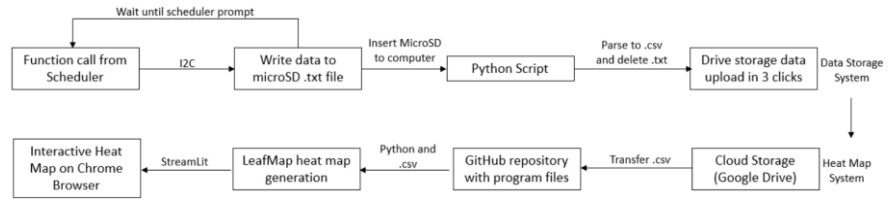
Requirements	Location	Expected Result	Actual Result (Distance from Control)
Coordinate Accuracy	Clear Sky	Within 1 meter	0.54m
	Under Tree Cover	Within 1 meter	0.62m
	Within 5m of Residential Building	Within 1 meter	0.63m
	Within 5m of Commercial Building	Within 1 meter	0.90m

Requirements	Expected Result	Actual Result	Percent Error
Temperature within Texas Historical Range	40.4°F	42.2°F	4.5%
[-23°F to 120°F]	79.6°F	82.1°F	3.1%
	101.3°F	98.7°F	2.6%
Relative Humidity within Texas Historical Range	40%	42.3%	5.8%
[25% to 95%]	80%	75.2%	6.0%

Hardware Block Diagram



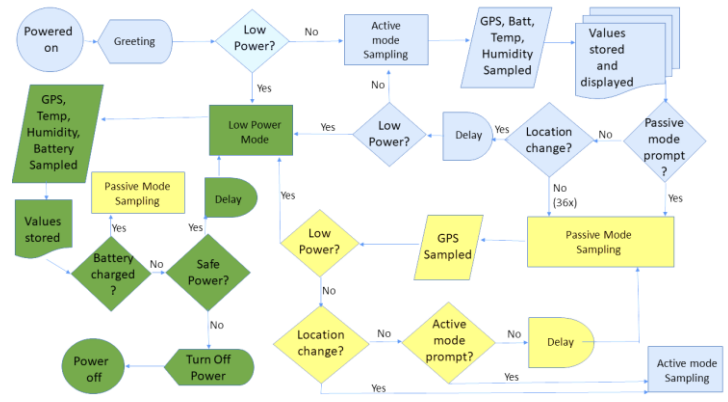
Data Storage to Interactive Map Flow Chart



Scan Here to Try!

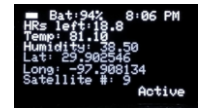
Scheduler Flow Chart

The scheduler is a state machine that regulates the timing of individual subsystems.



User Interface

Key Features		
Pixel Count: 128x64	State-Dependent Screens	MicroSD Card Slot
On/Off Switch	Mode-Change Button	USB-C Charging Port



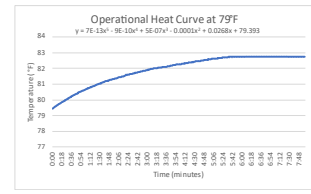
Pictured Above: Device front screen

Pictured Right: Ports on back of device

Drop Testing and Water Resistance

- Able to withstand drop of 3' onto a hard smooth concrete surface without loss of functionality.
- Rain and water resistant – able to withstand 3 full showerings without visible entry of liquid or loss of function.

Device Operational Heat Curve

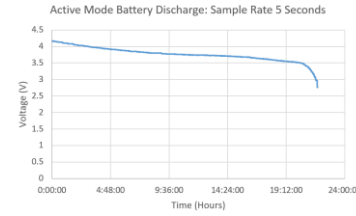


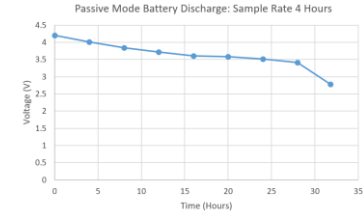
To address heat build-up within the device chassis due to the operational heat of the inner components, an operation heat curve was established and applied to the device's code to allow for higher accuracy readings.

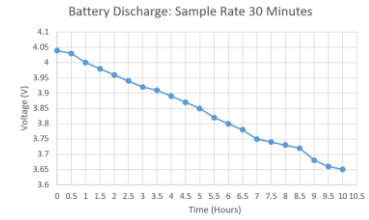
Power Budget

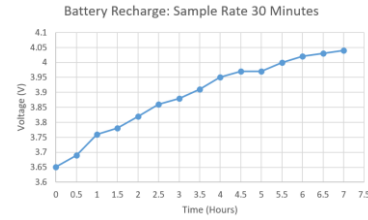
- The actual battery life lasted for 24 hours and 7 minutes on active mode, in contrast with the expected battery life of 7.7 hours on active mode.
- The actual battery life lasted for 32.8 hours on passive mode in contrast with the expected battery life of 55.5 hours on passive mode.
- Recharge circuit tests yielded a 7 hour recharge time after initially discharging the battery for 10 hours.

Device Operating Mode	Expected Current Draw	Actual Current Draw
Active Mode	325.7 mA	75.9 mA
Passive Mode	45.01 mA	62.4 mA









[1] *EPA*. [Online]. Available: https://www.epa.gov/heatislands/learn-about-heat-islands#impacts. [Accessed: 28-Sep-2022].