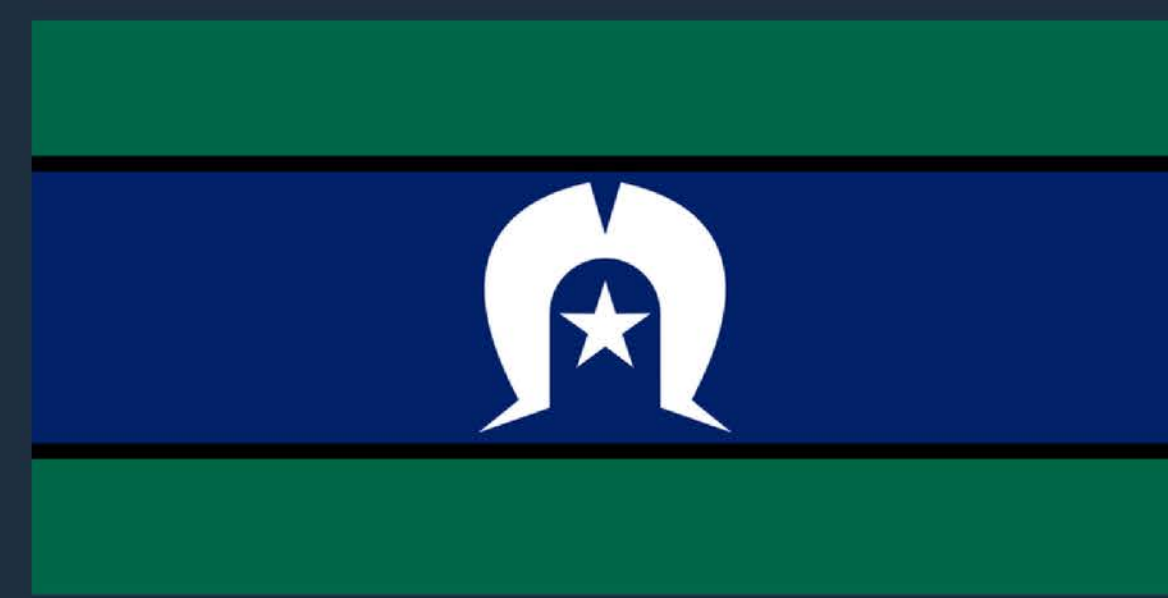




Creating a HABITAT for Healing at Banksia Gardens

Heat And Biodiversity Tracking through Automated Technologies

LILY BROMBERGER, STEPHEN FANNING, ERIC SCHUMAN & EMMANUEL VARGAS



In the spirit of reconciliation we acknowledge the Traditional Custodians of country throughout Australia and their connections to land, sea and community. We pay our respect to their Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.

We also want to pay respects to the Nipmuc Nation, the original custodians of the land that WPI resides on.

What are the biggest problems affecting Australia

Extreme Heat



Biodiversity Loss



Economic Inequalities



Banksia Gardens - Broadmeadows, VIC, AUS

*“Transforming lives,
strengthening communities,
reducing disadvantage”
-Banksia Gardens' Mission*

Climate Adaptation Garden Project

Heat Havens

Community
Gardens

Food Forests



A photograph of a community garden. In the foreground, there are several raised garden beds filled with various green plants. A wooden trellis structure stands in the middle ground. In the background, a black metal fence runs across the scene, with trees and buildings visible beyond it. The overall scene is bright and sunny.

How can we evaluate the success of the Climate Adaptation Gardens?

How do we define success?



How do we define success?

Lower Surface
Temperatures



How do we define success?

Lower Surface
Temperatures

Increased
Biodiversity



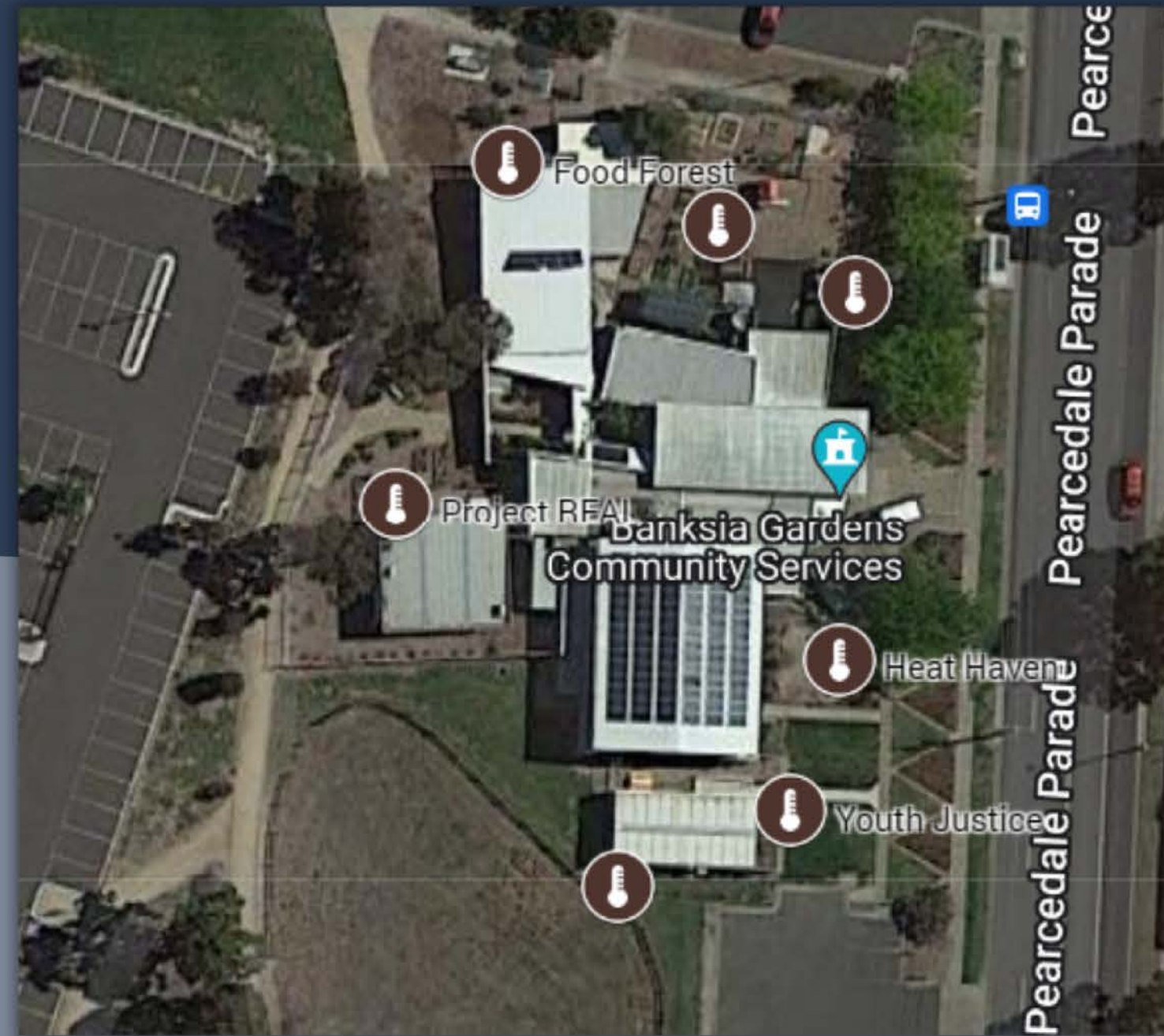
How do we define success?

Lower Surface
Temperatures

Increased
Biodiversity

Prolonged
Community
Engagement

Temperature Sensor Network



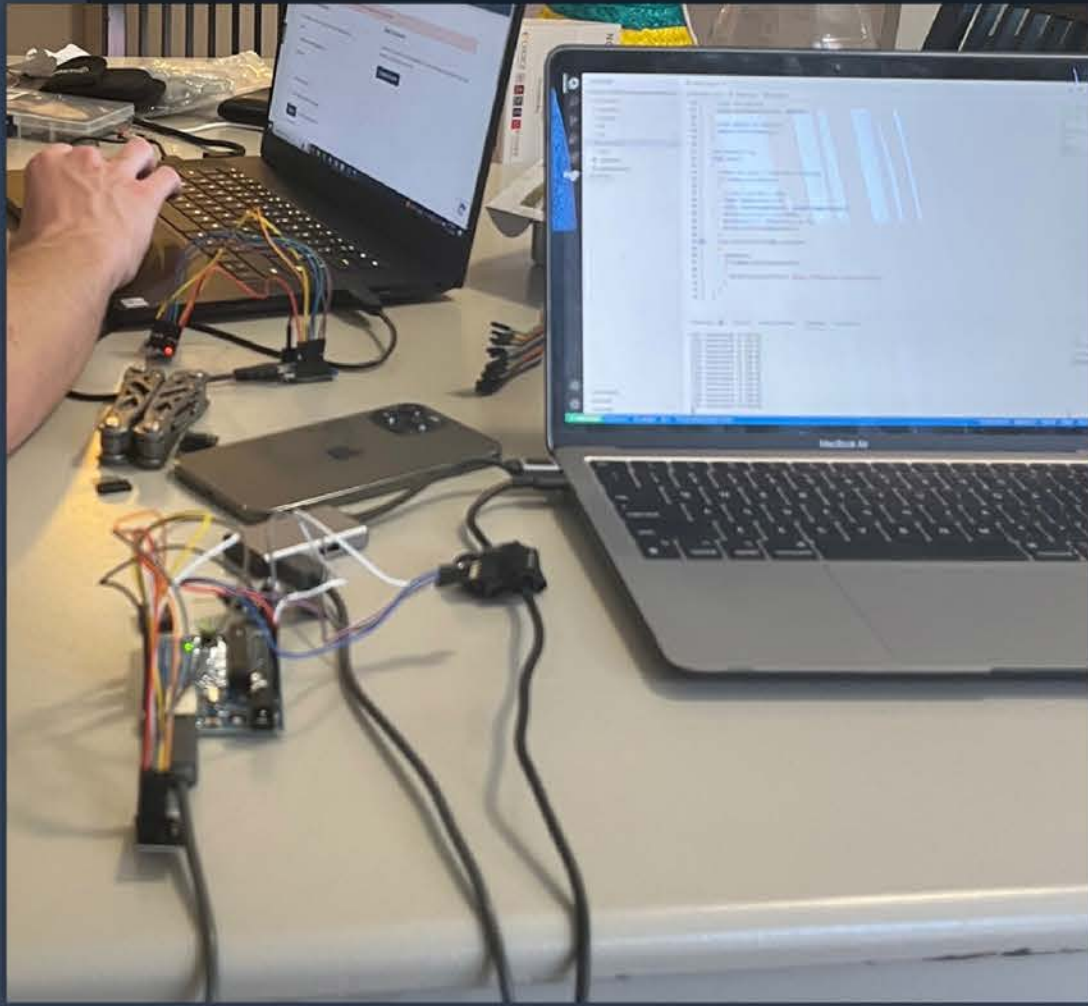
Connect to
WIFI

Get Temp.
Reading

Upload to
Database

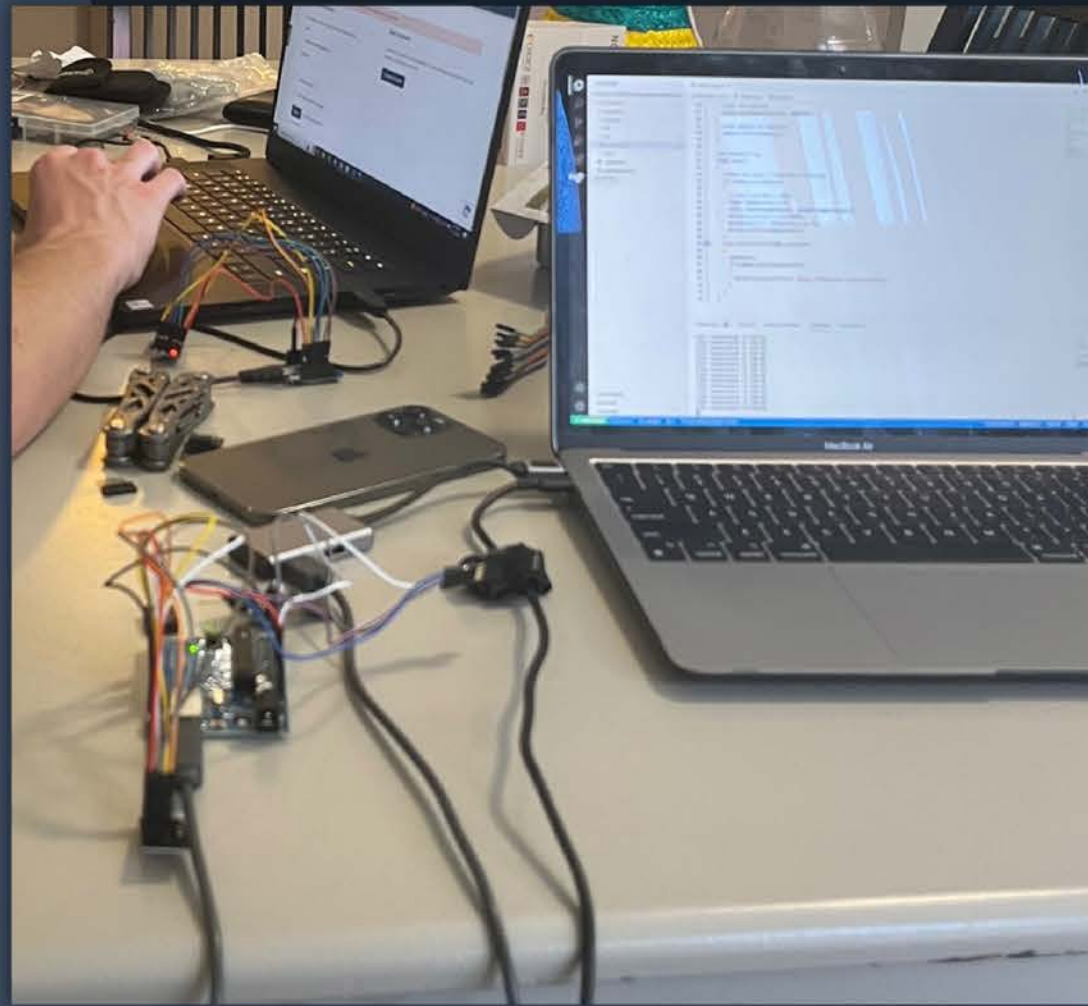
Sleep Until
Next
Reading

Designing a Temperature Sensor Network

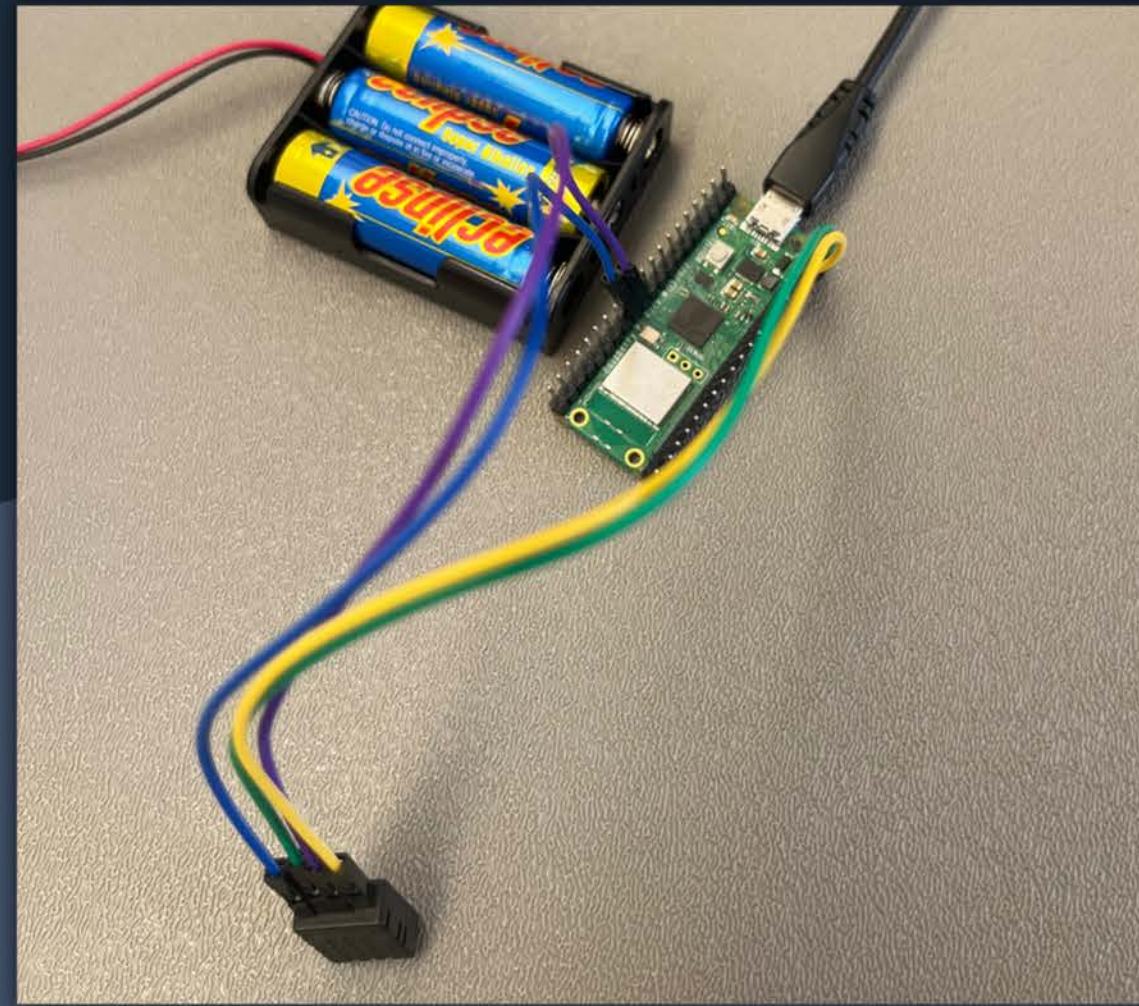


Initial Design

Designing a Temperature Sensor Network

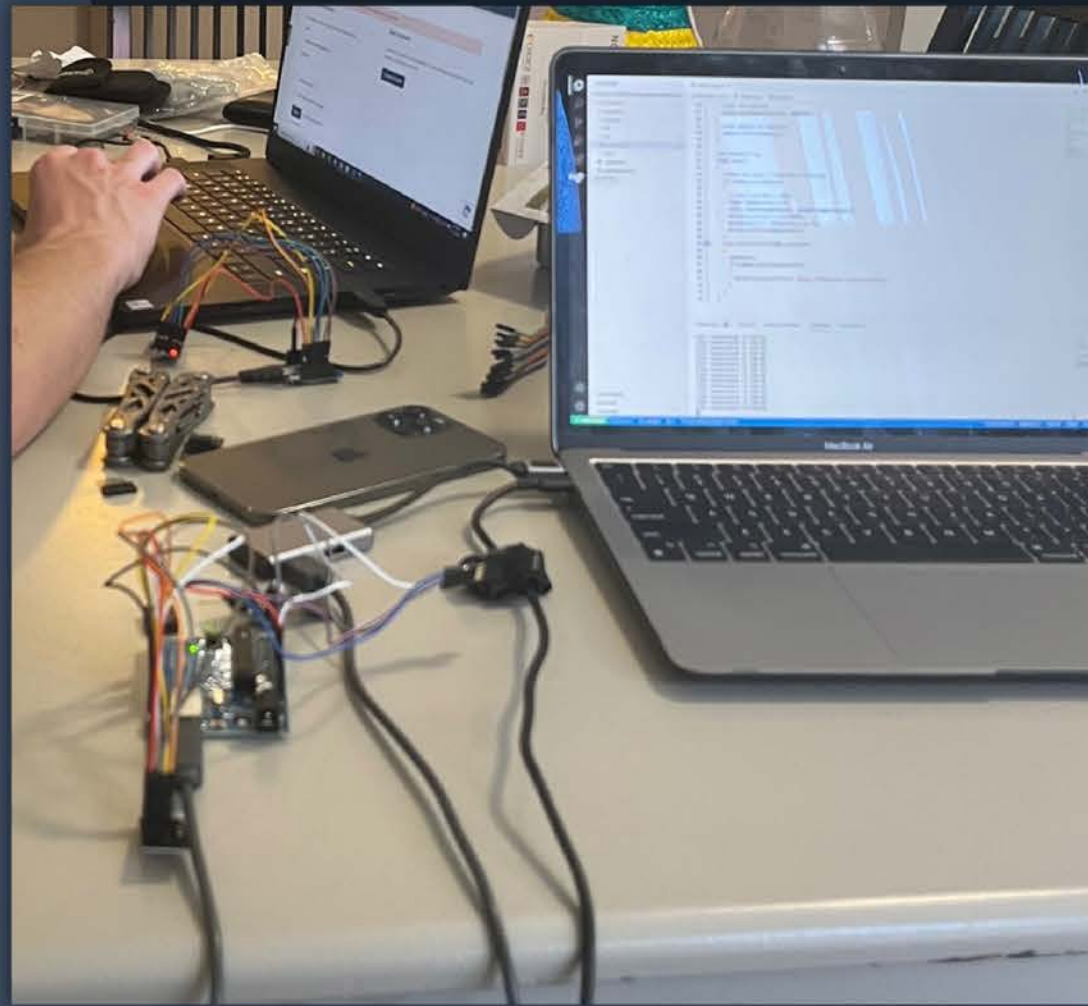


Initial Design

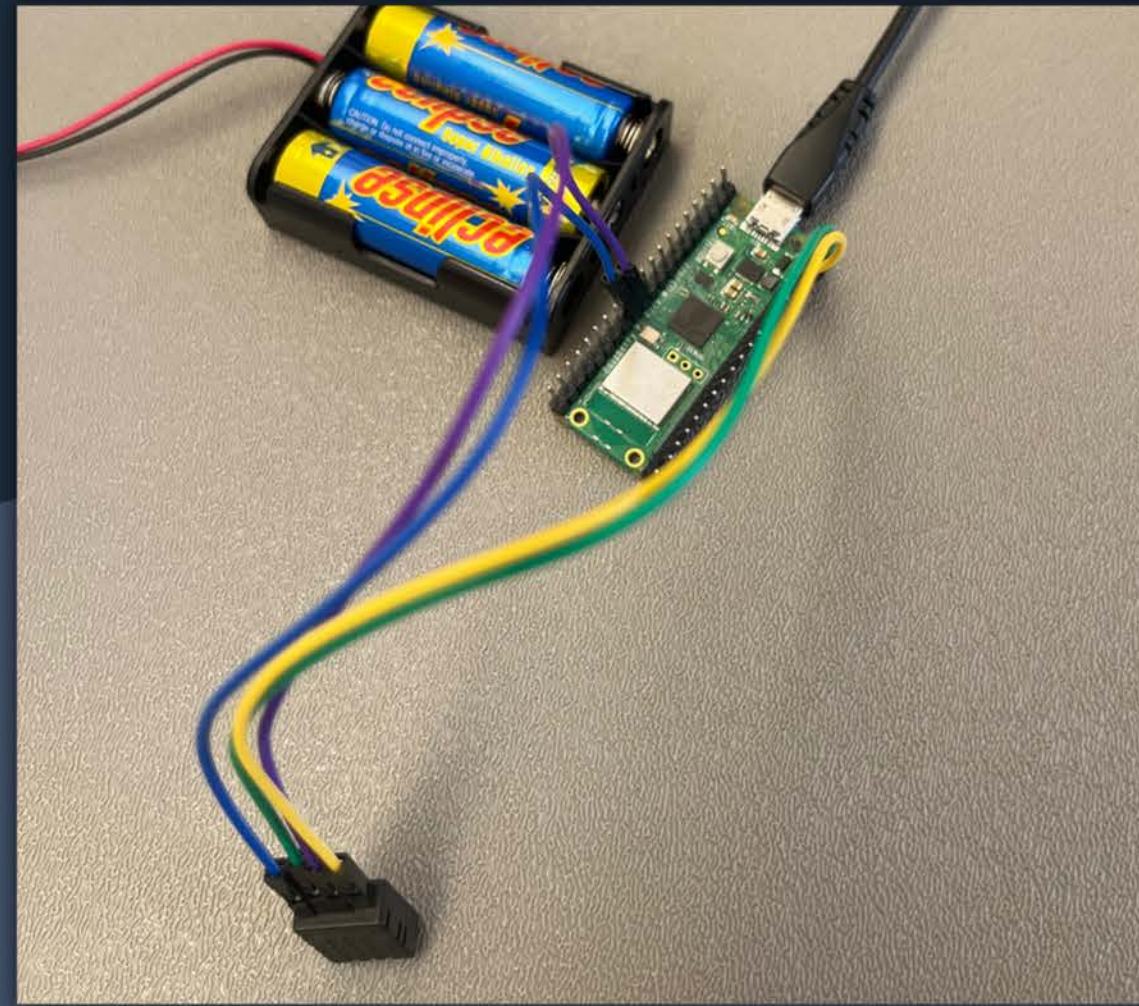


Prototyping

Designing a Temperature Sensor Network



Initial Design

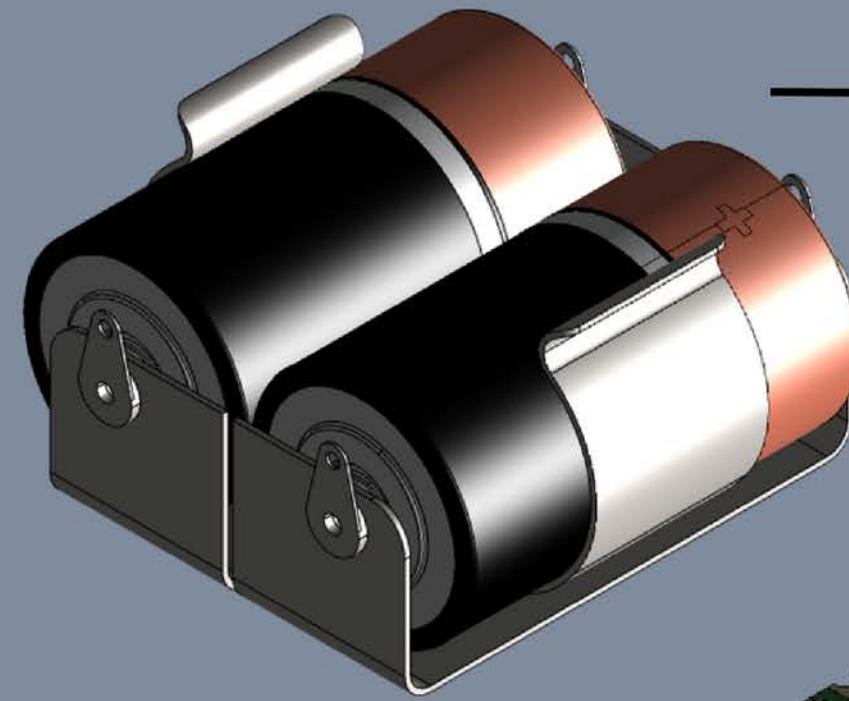


Prototyping



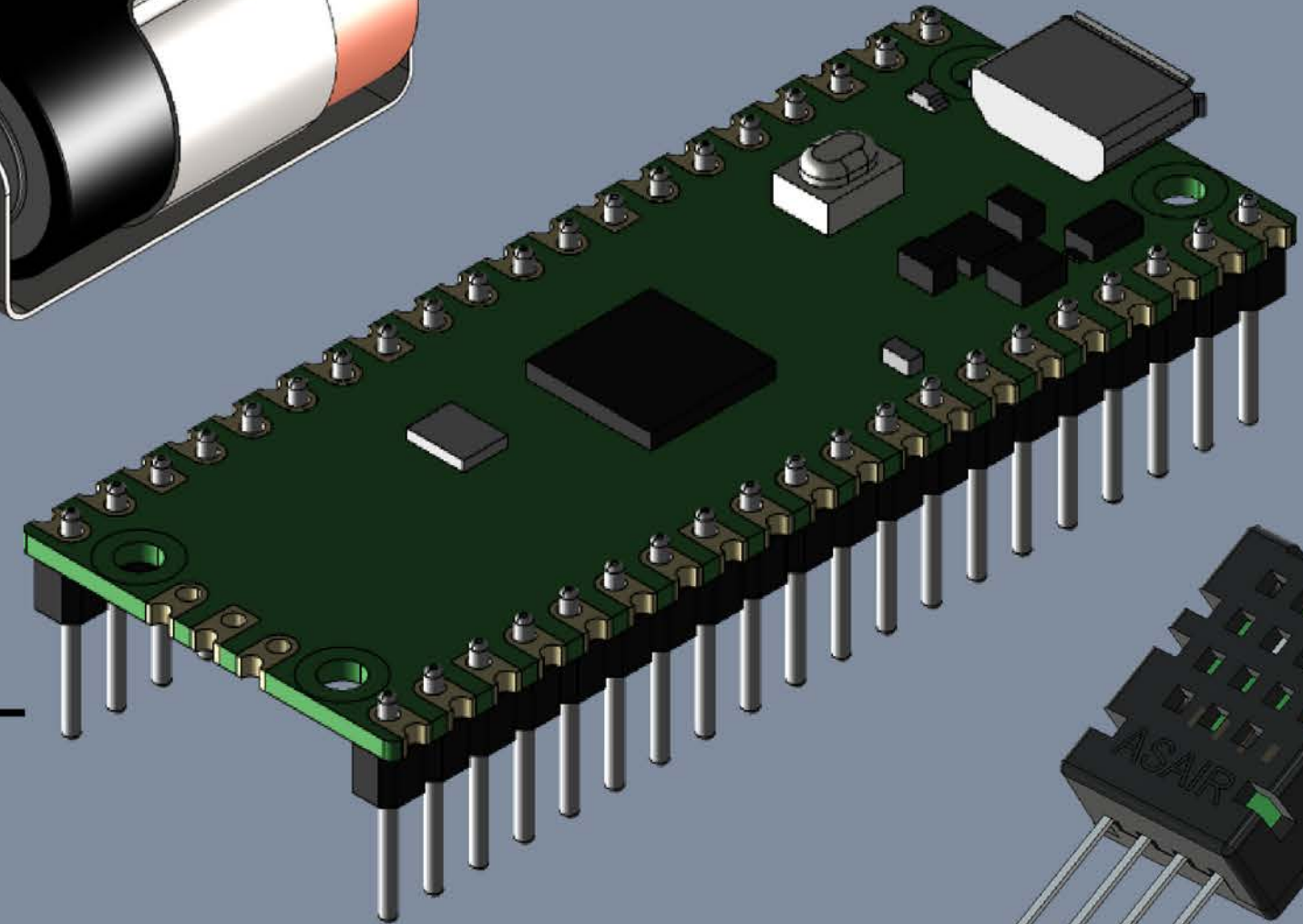
Testing

Sensor Design

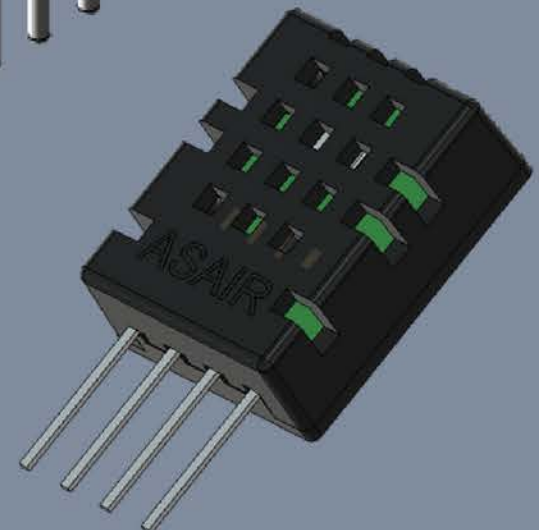


2 x D Battery Holder

Raspberry Pi Pico W Microcontroller



Adafruit DHT20 Temperature Sensor



Collect Information with Citizen Science



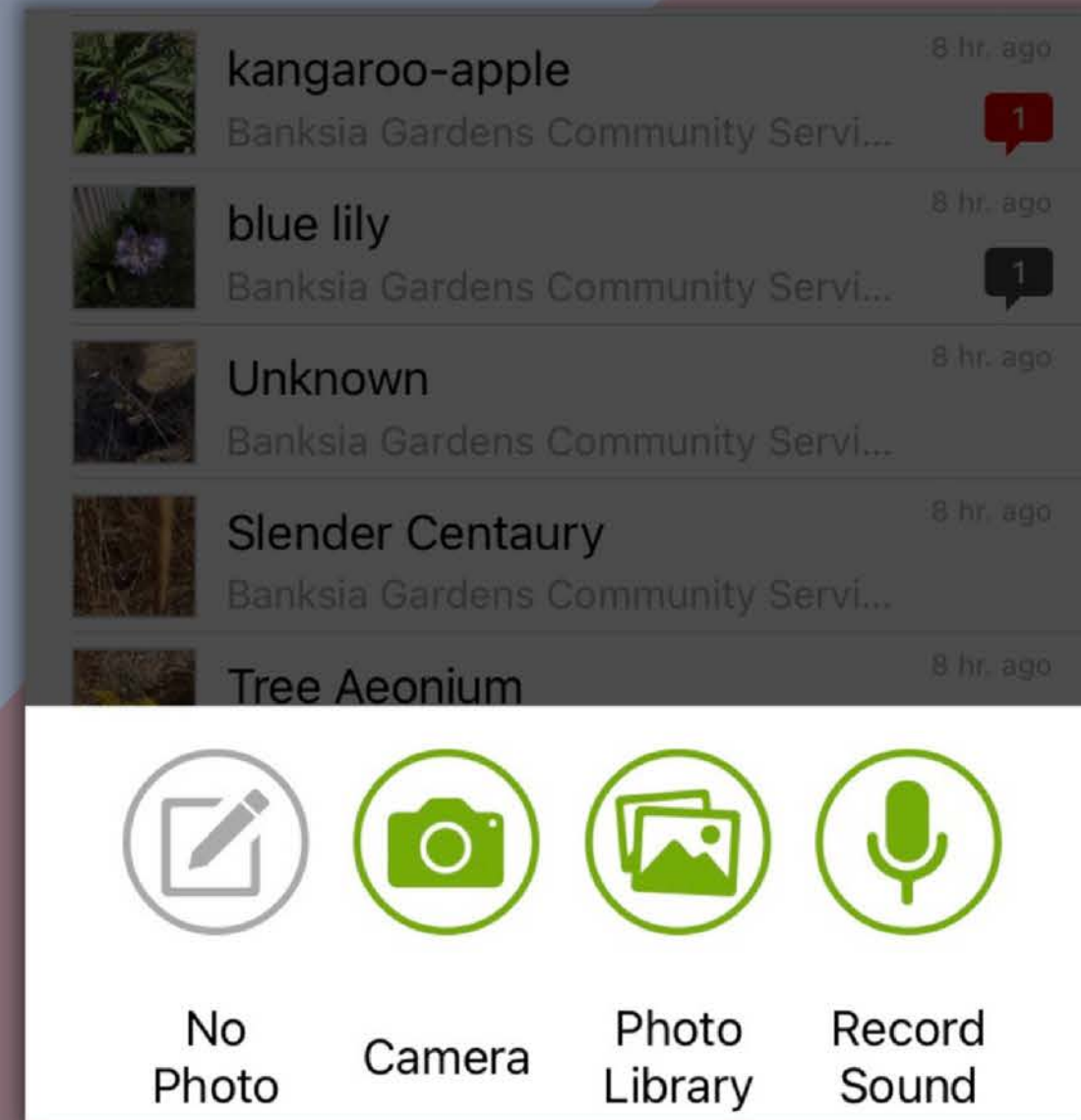
iNaturalist

Collect Information with Citizen Science



Take Photo of
Specimen

Collect Information with Citizen Science



Upload Photo to
iNaturalist

Collect Information with Citizen Science




Mobile app interface showing a list of suggestions for the flower in the photo. The list includes:

- kangaroo-apple (8 hr. ago)
- blue lily (8 hr. ago)
- Unknown (8 hr. ago)
- Slender Centaury (8 hr. ago)
- Tree Aeonium (8 hr. ago)

Below the list are four icons for data collection methods:



- No Photo
- Camera
- Photo Library
- Record Sound

WE'RE PRETTY SURE THIS IS IN THE GENUS CALENDULA.

 **marigolds**
Genus Calendula

Suggestions based on observations and identifications provided by the iNaturalist community.

HERE ARE OUR TOP SUGGESTIONS:

-  **pot marigold**
Calendula officinalis
Visually Similar / Seen Nearby
-  **Golden Everlasting**
Xerochrysum bracteatum
Visually Similar / Seen Nearby

Artificial Intelligence
Suggestion

Creating a Biodiversity Database

The screenshot shows the iNaturalist project page for 'Banksia Gardens Biodiversity'. At the top, there is a banner image of a mural with children and plants, and a text box stating: 'This project aims to build an understanding of the biodiversity located on the property. We want to be able to see the impact of greenery and reducing heat on wildlife and see if there is a possibility to increase biodiversity directly in our area!' Below this, there are statistics: 98 OBSERVATIONS, 49 SPECIES, 27 IDENTIFIERS, and 7 OBSERVERS. A 'Stats' button is also visible. The 'Recent Observations' section shows four entries: 'Fortnight Lilies' (Genus *Dietes*), 'Common Agapanthus' (*Agapanthus praecox*), 'Crepe Myrtles' (Genus *Lagerstroemia*), and 'Longleaf Wattle Gall' (*Trichilogaster acaciaelong...*), each with a photo and a 'a day ago' timestamp.

Extract Data
from
iNaturalist

Filter Data

Manipulate
Data

Upload to
Database

Filter Data

quality_grade	observed_on_details.date	taxon.name	taxon.rank	geojson.coordinates	observed_time_zone	quality_metrics	location
research	2023-01-06	Fuligo septica	species	[144.919, -37.676]	Australia/Melbourne	[]	[-37.676, 144.919]
needs_id	2022-12-27	Tragopogon	genus	[144.918, -37.676]	Australia/Melbourne	[]	[-37.676, 144.918]
research	2022-12-13	Eristalinus punctulatus	species	[144.919, -37.676]	Australia/Melbourne	[]	[-37.676, 144.919]
needs_id	2022-11-16	Polistes	subgenus	[144.916, -37.677]	Australia/Melbourne	[]	[-37.677, 144.916]

```
# Columns to keep
```

```
labels_of_interest = ['quality_grade', 'observed_on_details.date', 'observed_on_details.month',  
                      'observed_on_details.year', 'observed_on_details.day', 'observed_on_details.hour',  
                      'id', 'identifications_most_agree', 'species_guess', 'identifications_most_disagree',  
                      'reviewed_by', 'description', 'updated_at', 'taxon.endemic', 'taxon.threatened',  
                      'taxon.introduced', 'taxon.native', 'taxon.name', 'taxon.rank', 'taxon.extinct', 'taxon.id',  
                      'taxon.wikipedia_url', 'taxon.default_photo.medium_url', 'taxon.iconic_taxon_name',  
                      'taxon.preferred_common_name', 'num_identification_agreements', 'comments', 'uri',  
                      'geojson.coordinates', 'user.login', 'photo_url']
```

```
column_list = df.columns
```

```
# Drop all columns we do not need
```

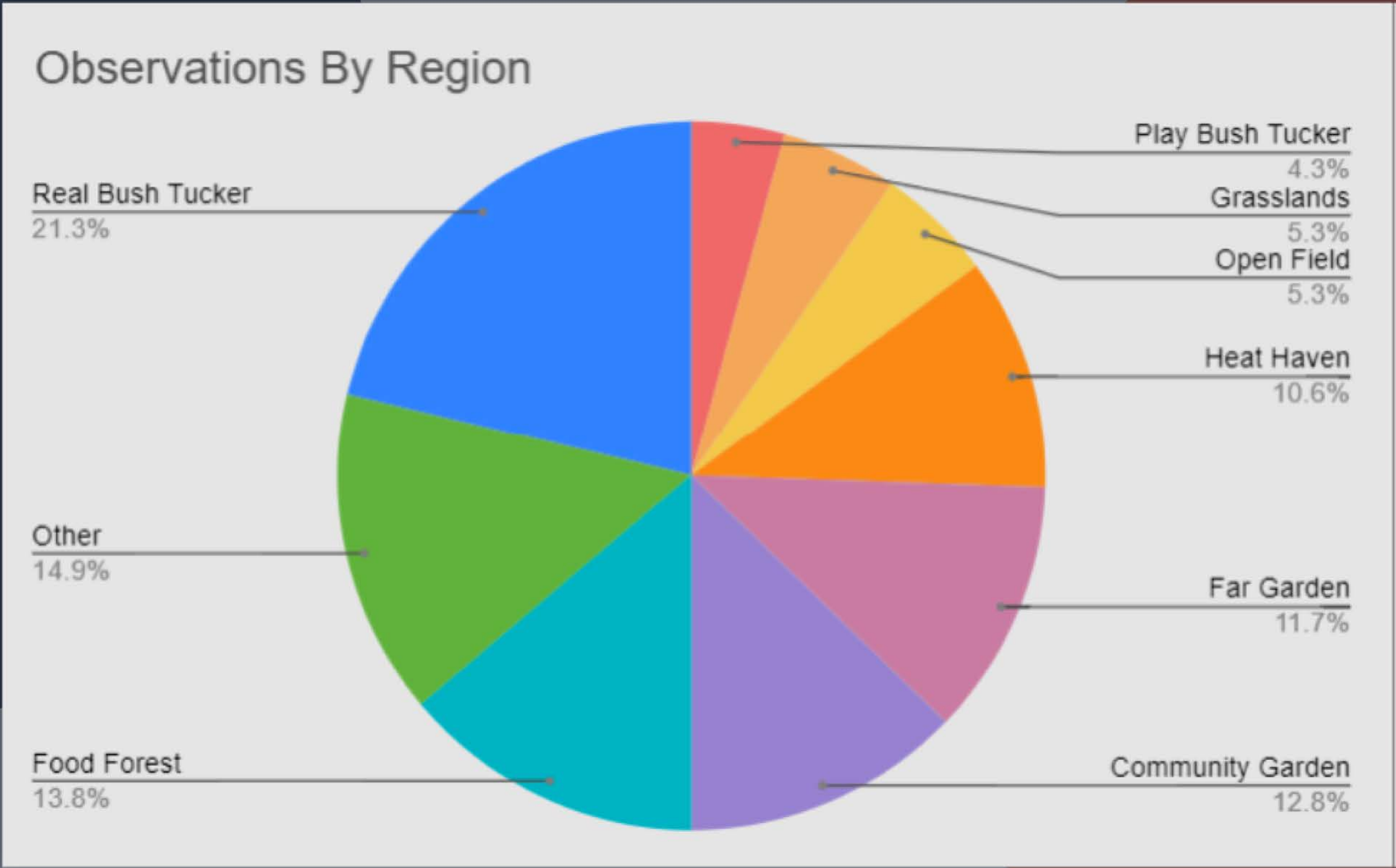
```
for label in column_list:  
    if label not in labels_of_interest:  
        df = df.drop(label, axis=1)
```


Manipulate Data

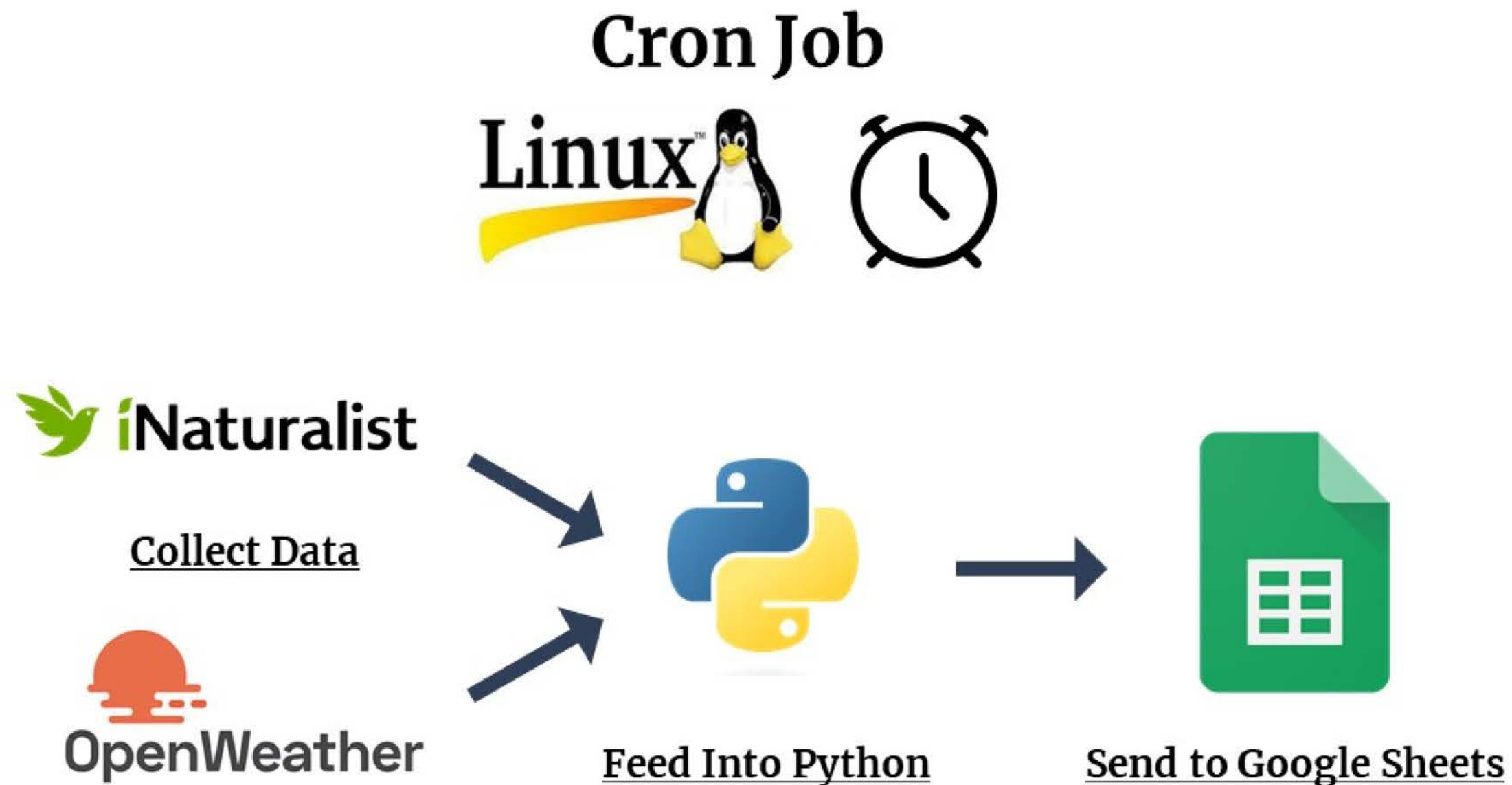
geojson.coordinates	region	on_property?
[144.9193416667, -37.6765216667]	Heat Haven	TRUE
[144.91925, -37.6766466667]	Heat Haven	TRUE
[144.9192966667, -37.6767166667]	Heat Haven	TRUE
[144.9192666667, -37.6767283333]	Heat Haven	TRUE
[144.918625, -37.6770633333]	None	TRUE
[144.9189616667, -37.67707]	Grasslands	TRUE
[144.9190833333, -37.6767783333]	Grasslands	TRUE
[144.9189, -37.67662]	Real Bush Tucker	TRUE
[144.9188216667, -37.676605]	Real Bush Tucker	TRUE
[144.9187783333, -37.676605]	Real Bush Tucker	TRUE
[144.9184116667, -37.6760666667]	Open Field	TRUE
[144.9182583333, -37.6761166667]	Open Field	FALSE
[144.9182133333, -37.6758583333]	Open Field	TRUE
[144.9182583333, -37.6756583333]	Open Field	TRUE
[144.9183666667, -37.6747333333]	Far Garden	TRUE
[144.9185333333, -37.674695]	Far Garden	TRUE
[144.918625, -37.674725]	Far Garden	TRUE
[144.9186866667, -37.67472]	Far Garden	TRUE



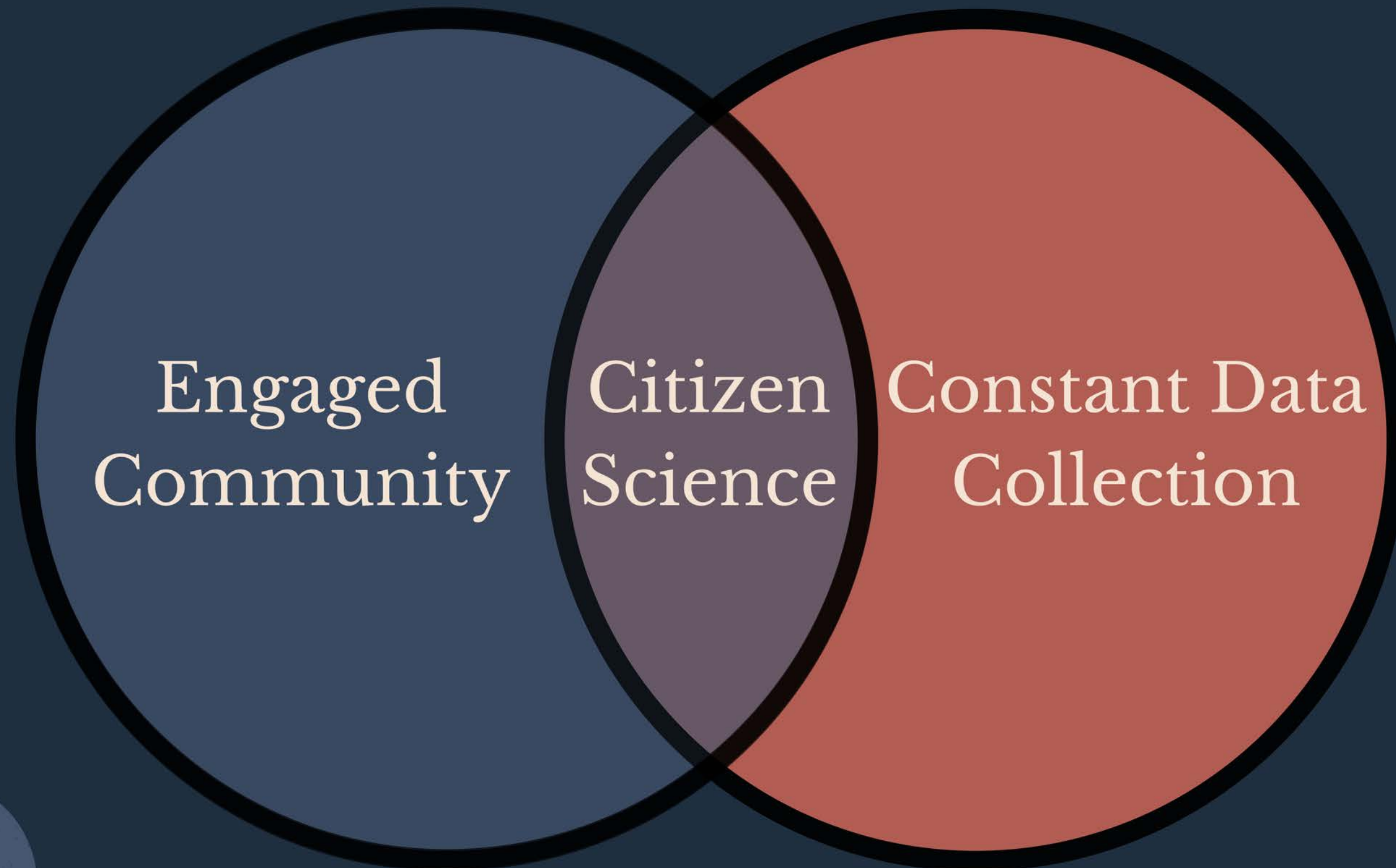
Visualizations



Data Processing is Automated



The role of Citizen Science



Citizen Science Activities



After-School
Activities



Community
Days



BioBlitzes

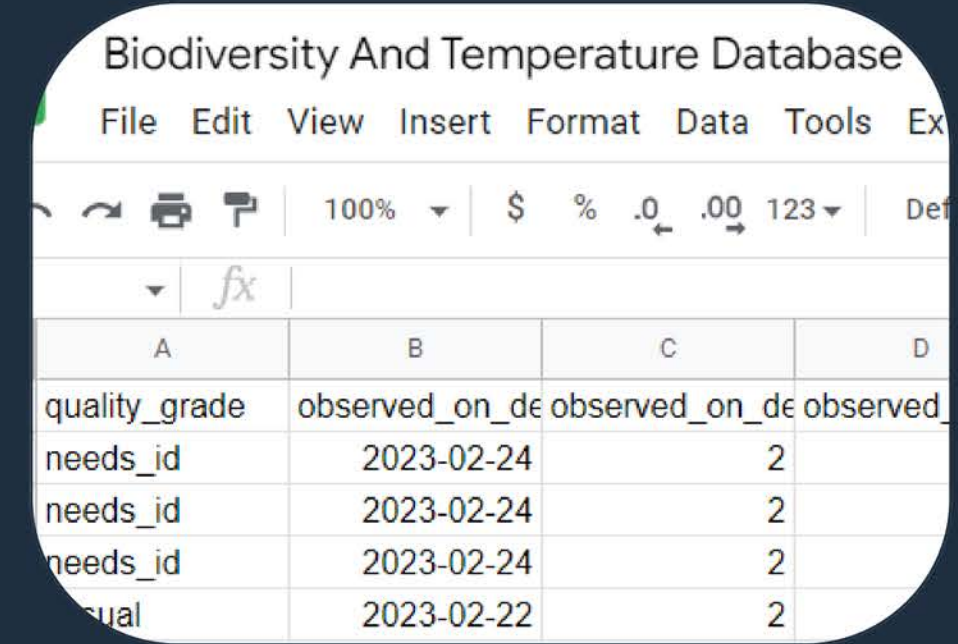
Deliverables



Recommended
Activities & Resources



Network of Heat
Sensors



Database



Heat Sensor and
Biodiversity Manuals



Supplementary
YouTube Videos



Centralized
Website



Impacts



Thank you!



Banksia Gardens
Community Services

Citations:

Land Acknowledgement:

Australian Government. (n.d.). Welcome to Country or Acknowledgement of Country. Retrieved February 26, 2023, from https://www.indigenous.gov.au/welcome_acknowledgement-

Images:

Bernard Namok. (1992). Torres Strait Islander flags [Torres Strait and headdress]. Wikimedia Commons. https://commons.wikimedia.org/Torres_Strait_Islander_flags

Geoffery Kehrig. (2012). Colour Flower Sketch [crayon drawing]. Flickr. https://www.flickr.com/photos/looking_and_learning/6909421496

Google. (2020). Google Sheets logo (2014-2020) [Google Developers logo]. <https://developers.google.com/>

Greg P. (2022). DHT20 [Cad drawing of a DHT20]. Grabcad Community. <https://grabcad.com/library/dht20-1>

Harold Thomas. (1971). Australian Aboriginal Flag [Australian Aboriginal flag using the official on-screen display colours]. Wikimedia Commons.

https://commons.wikimedia.org/wiki/File:Australian_Aboriginal_Flag.svg#filelinks.

iNaturalist (California Academy of Sciences & National Geographic). iNaturalist text logo [The logo of iNaturalist - citizen science project and website]. <https://www.inaturalist.org/>

It's No Game. (2021). Fox caught on the trail camera [black and white photo of a fox] Flickr. <https://www.flickr.com/photos/duncanhl/51387399204>

Lycopene579. (2020). Alarm clock. [Alarm clock icon]. Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Alarm_clock.png

Map showing location of Broadmeadows. Google Earth. <https://earth.google.com/web/>

Meca Project. (2021). Raspberry Pi Pico w/pins [Cad drawing of a Raspberry Pi Pico]. Grabcad Community. <https://grabcad.com/library/raspberry-pi-pico-w-pins-1>

Openweather. OpenWeather-Master-Logo RGB [Openweather logo]. <https://openweathermap.org/>

Philip Bouchard. (2019). Boodie and Bilby [black and white photo of two animals] Flickr. <https://www.flickr.com/photos/pbouchard/49201802378>

Python. Python-logo-notext. [Python logo]. www.python.org.

Roezma. (2016). Boarded up building in downtown Springfield Massachusetts. Wikimedia Commons. File:Boarded up building in downtown Springfield Massachusetts (MA) 2.jpg -

Wikimedia Commons, File:Boarded up building in downtown Springfield Massachusetts (MA) 2.jpg - Wikimedia Commons.

ThalassaLib. (2019). Intertidal transect quadrat sampling [Researchers collect observational data on an intertidal transect line on the central California coast]. Wikimedia Commons.

https://commons.wikimedia.org/wiki/File:Intertidal_transect_quadrat_sampling.jpg

TproOfficial. (2021). Linux Logo. Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Linux_Logo.jpg

Xasartha. (2014). Flag of the Nipmuc Nation [Flag of the Nipmuc Nation]. Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Flag_of_the_Nipmuc_Nation.PNG