SY STEM 2020

SCIENCE LEARNING OUTSIDE THECLASSROOM

OBSERVATION MAPPER: DIY ELECTRONICS FOR INFORMAL SCIENCE LEARNING

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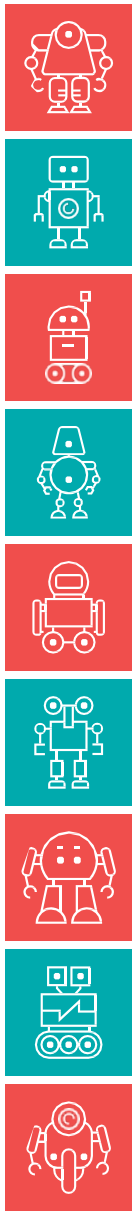
SySTEM 2020 has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 788317

Agenda

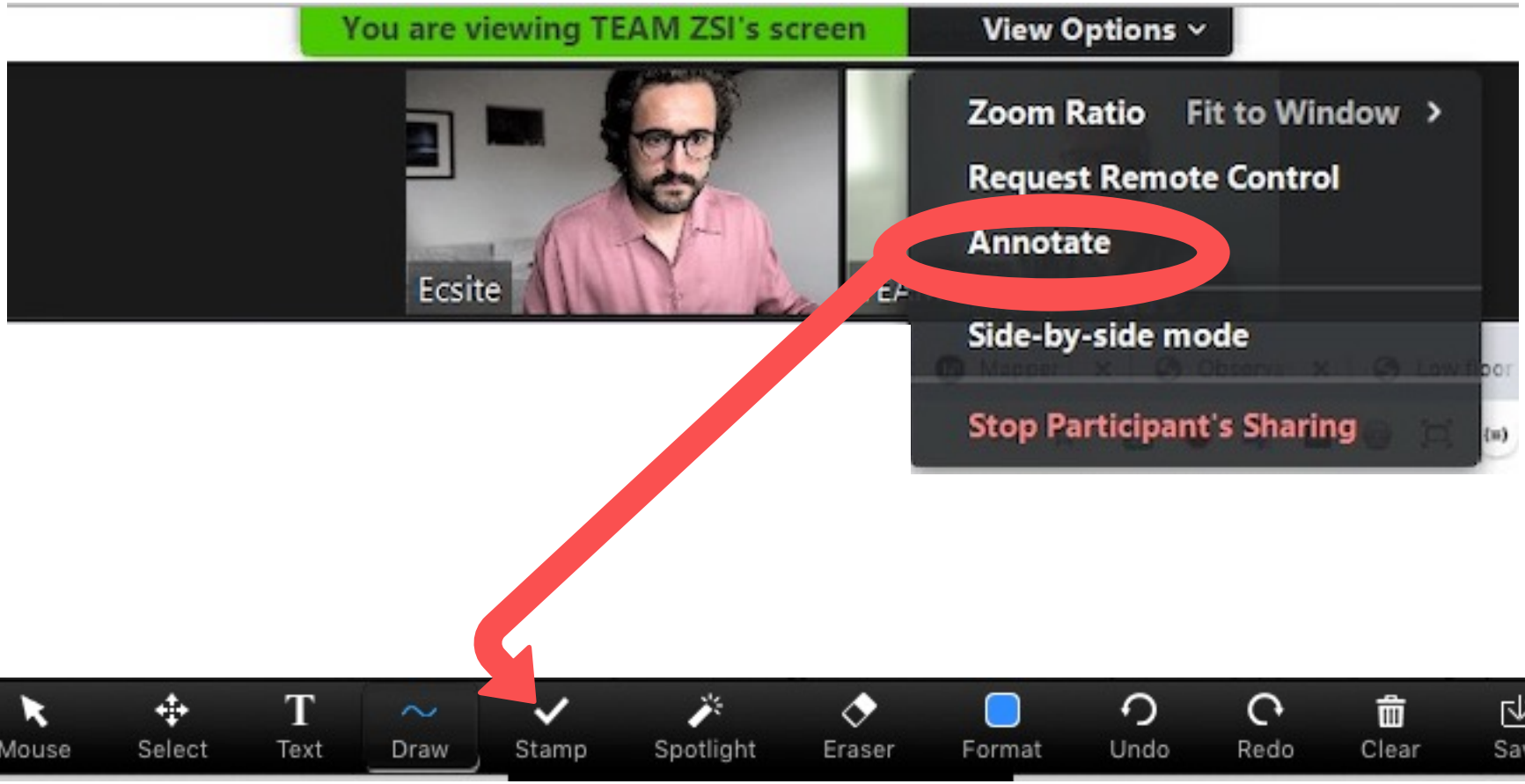
1. Project Context & the challenge of traditional science literacies
2. Creating a story and designing the data collection (Ljubljana & Dublin)
3. Building the device
4. Making sense through visualization

** questions & sharing **

after each section … feel free to use chat any time



Interacting through annotations

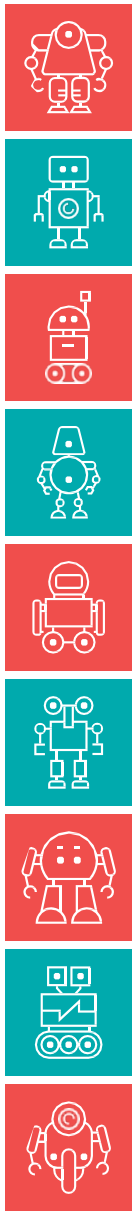


Weather today is like ....

When do you start working normally ?

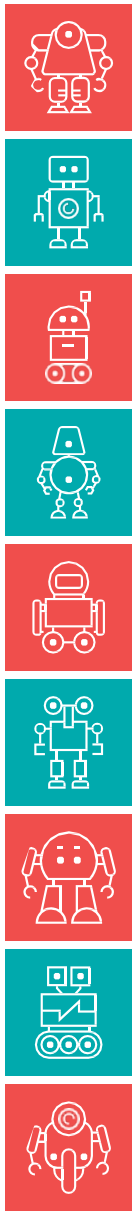
Materials

- System2020 resources https://system2020.education/resources/
- 'Observation Mapper' Report https://zenodo.org/record/4575325#.YNh2ABMzZUQ
- Programming the gadget using the Arduino IDE https://github.com/chrvoigt/observation-gadget
- Casing model for 3D Printing https://wikifactory.com/@chrvoigt/mapper-casing/files
- Visualizing the data in Python Notebooks or Streamlit Platform https://github.com/chrvoigt/observation-viz
- Blogging some personal reflections https://innodesign.io/tag/mapping/



Disclaimer

The following ideas are based on experiences from multiple projects, some I made myself and others I got to know from project partners.



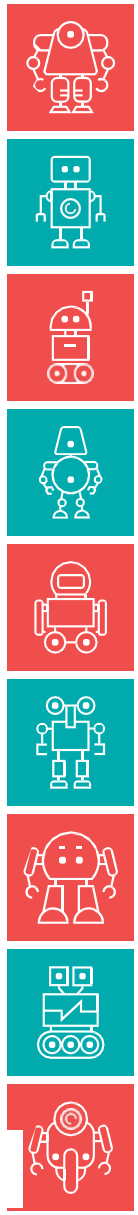
What could we gain from a mapping device?

Project Context

Objectives of the observation mapper

In the context of the System2020 project,
the observation mapper aimed to promote

- self-organised learning, retaining critical agency
- self-evaluation, detecting gaps during imlementation
- self-efficacy, confidence in own abilities

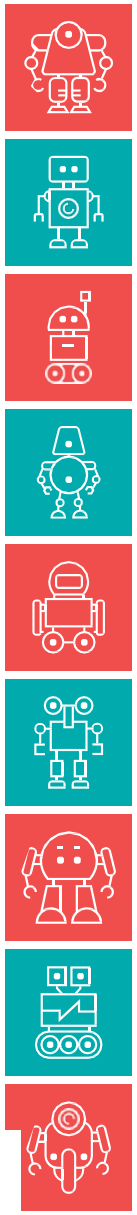


Why should we care?

Equitable science learning needs a broader set of *'science literacies'.* *

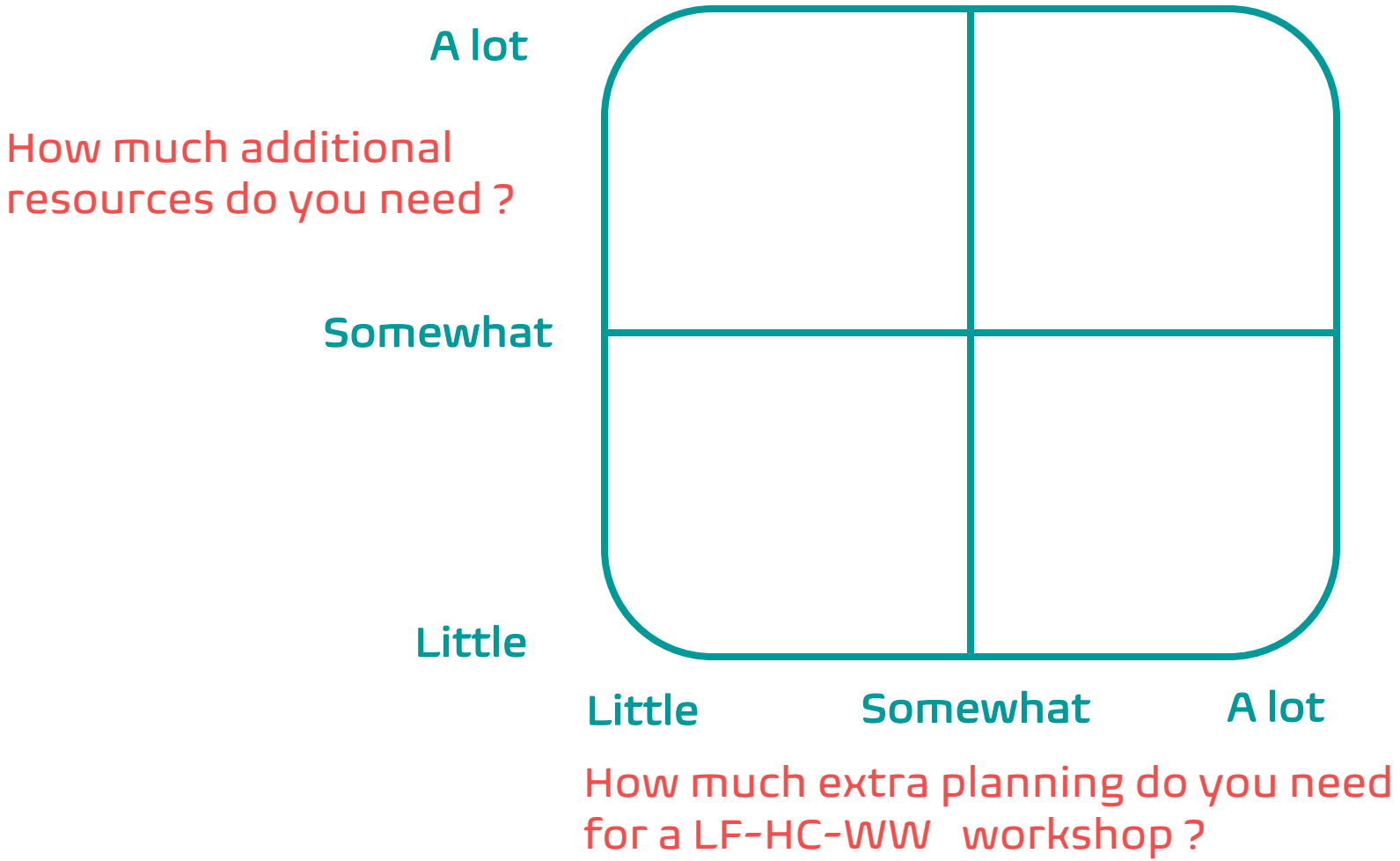
e.g.

- analysing my own situation,
- tinkering & dealing with uncertainty,
- communicating my needs,
- collaborating with peers



** White Paper on Equity-Focused Science Education (2020) https://system2020.education/wp-content/uploads/2021/04/13.-SySTEM-2020s-white-paper-.pdf*

Low floor, high ceiling, wide walls *



* MIT Scratch Programming (Papert, Resnick)

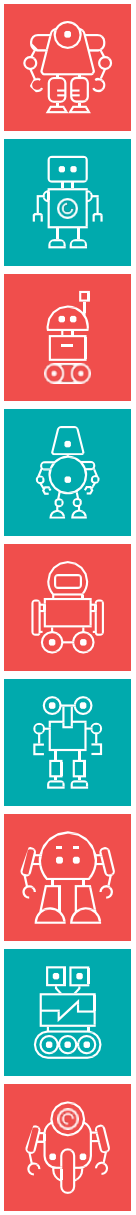
Figure: Example of knotweed (areal photo and close up)

First story

Knotweed in Ljubljana

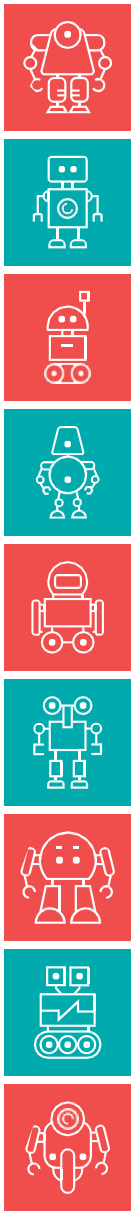
Mapping invasive plants

- **workshop concept:**
  4 workshops around the topic of transforming an invasive plant (i.e. Japanese knotweed) into paper
- **mapping idea:**
  state of plant for harvesting
- **offline** implementation under Covid19:
  facilitator plus one pair of youth collected data
- **online** implementation:
  data viz
- **offline** building the gadget



The mapping part

- mapping idea:
  state of plant for harvesting
- **offline** implementation under Covid19:
  facilitator plus one pair of youth collected data (Feb 2021)
- **online** implementation:
  data viz (Python notebooks)
- **offline** building the gadget
  (at least the first bits and pieces)

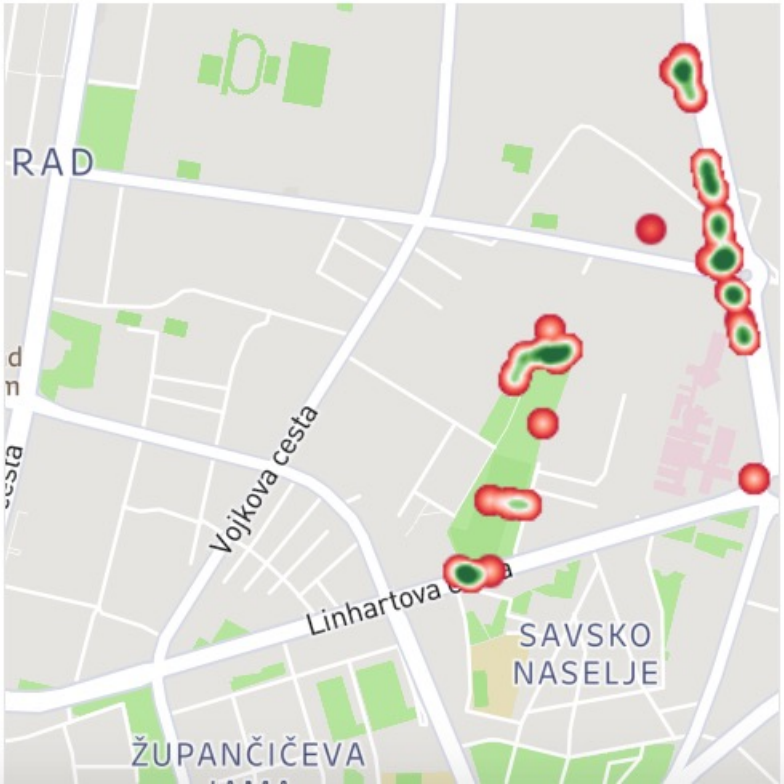


Frequency of Categories

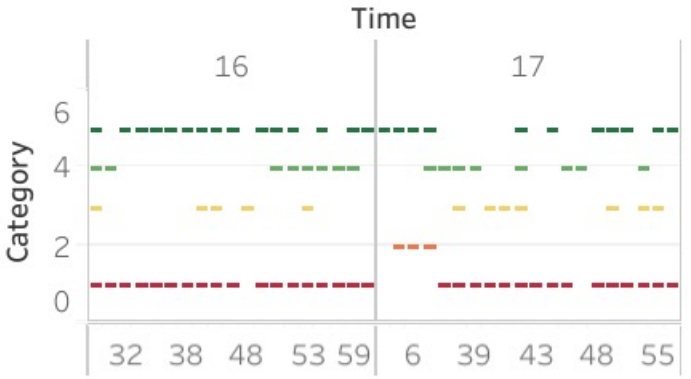
Category

Bohemian knotweed | Baby plants | Adult plants | Dying or dry plants

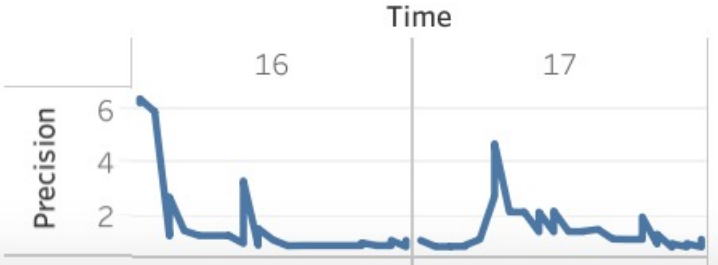
Heatmap of Categories



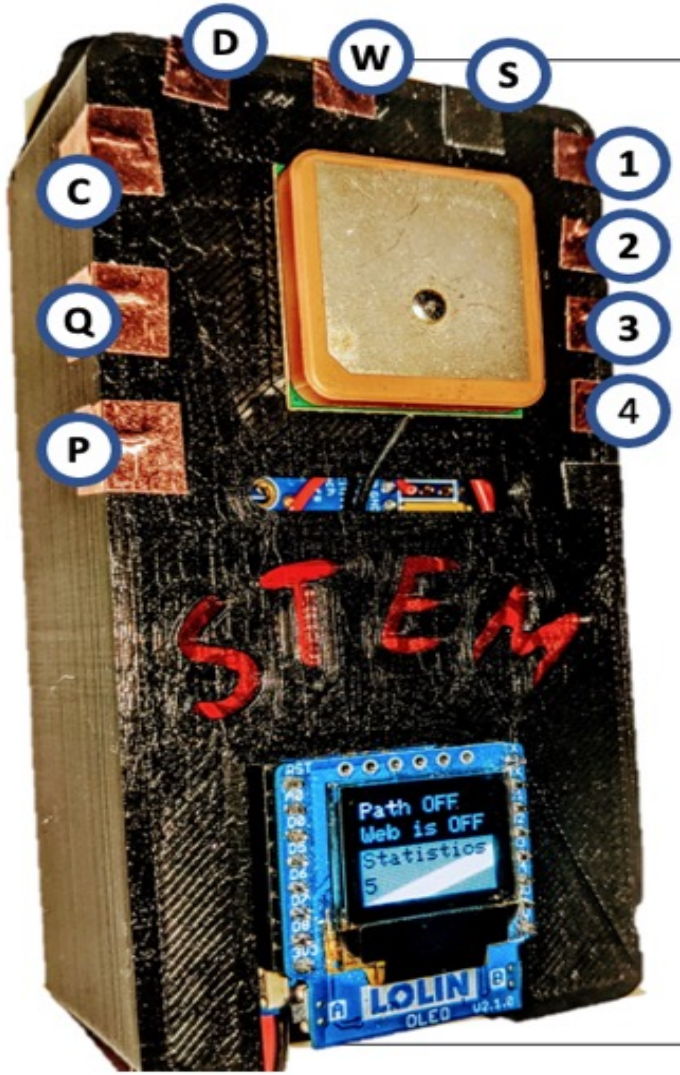
Mapping over Time



Signal Precision



The gadget



Functions:

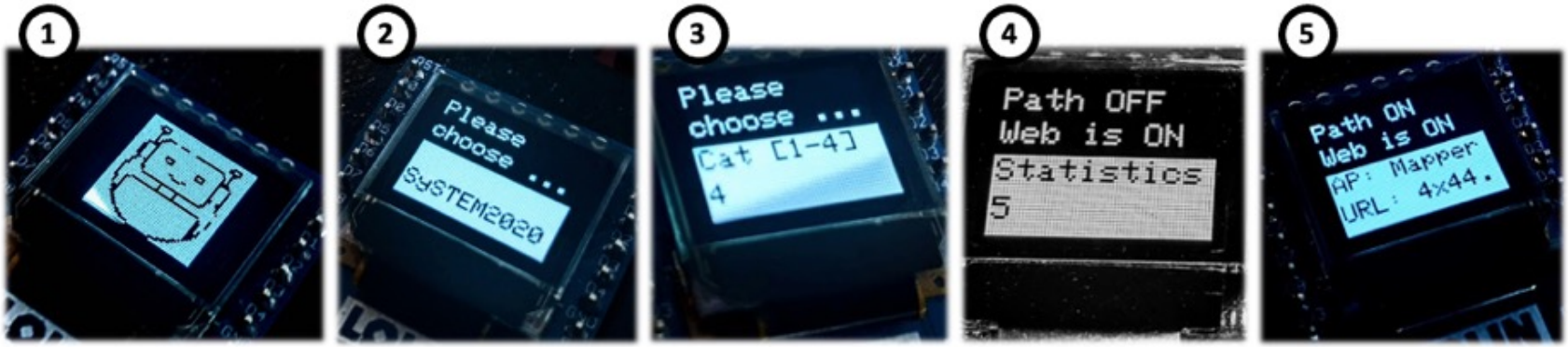
- (C) Categorizing a point
- (Q) Quality / Num. of Satellites
- (P) Path tracking (ON / OFF)

- (D) Data statistics / Points mapped
- (W) Web output (ON / OFF)
- (S) Serial output

1
2
3
4
5

... to be chosen after 'C'

Screen interaction



Second story

Dublin and Covid19 in the public space

How does Covid19 show in what you observe?

SHARE

Observation Mapper Data_[redacted]xlsx

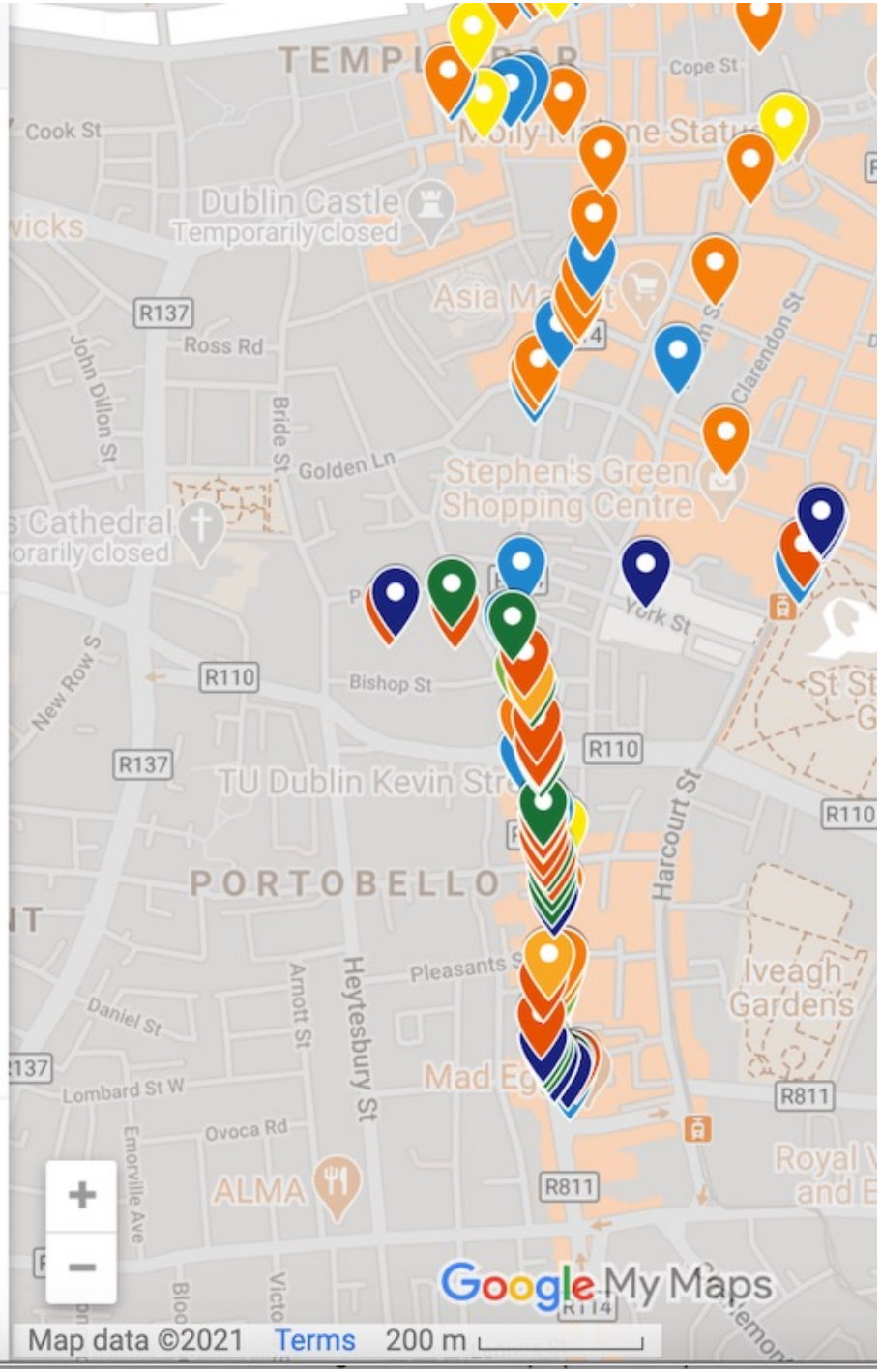
- 1 Bad
- 2 OK
- 3 Good
- 4 Excellent

Observation Mapper Data_[redacted]xlsx

- 1
- 2
- 3
- 4

https://public.tableau.com/profile/christian6183#!/vizhome/LjubljanaKnotweed/Piechartversion?publish=yes

Made with Google My Maps



Revisiting the objectives

- **Scientific literacy:**

  Scientific interpretation of data and evidence

  - the meaning of categories
  - implications of data quality
  - visualization at different levels

***

- **Self-organised learning, retaining critical agency**

  … planning your own experiment

- **Self-efficacy**:

  I made it / I programmed it / I know what it is doing

  … successful trouble shooting experiences *

- **Self-evaluation, detecting gaps**

  … how far did I get, what further skills do I need

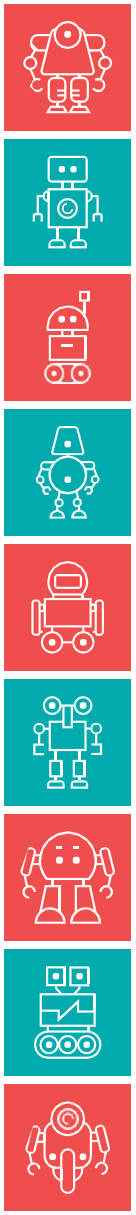
* broken charger and rescuing data from a corrupted file system

Building the ‘observation mapper’

Materials

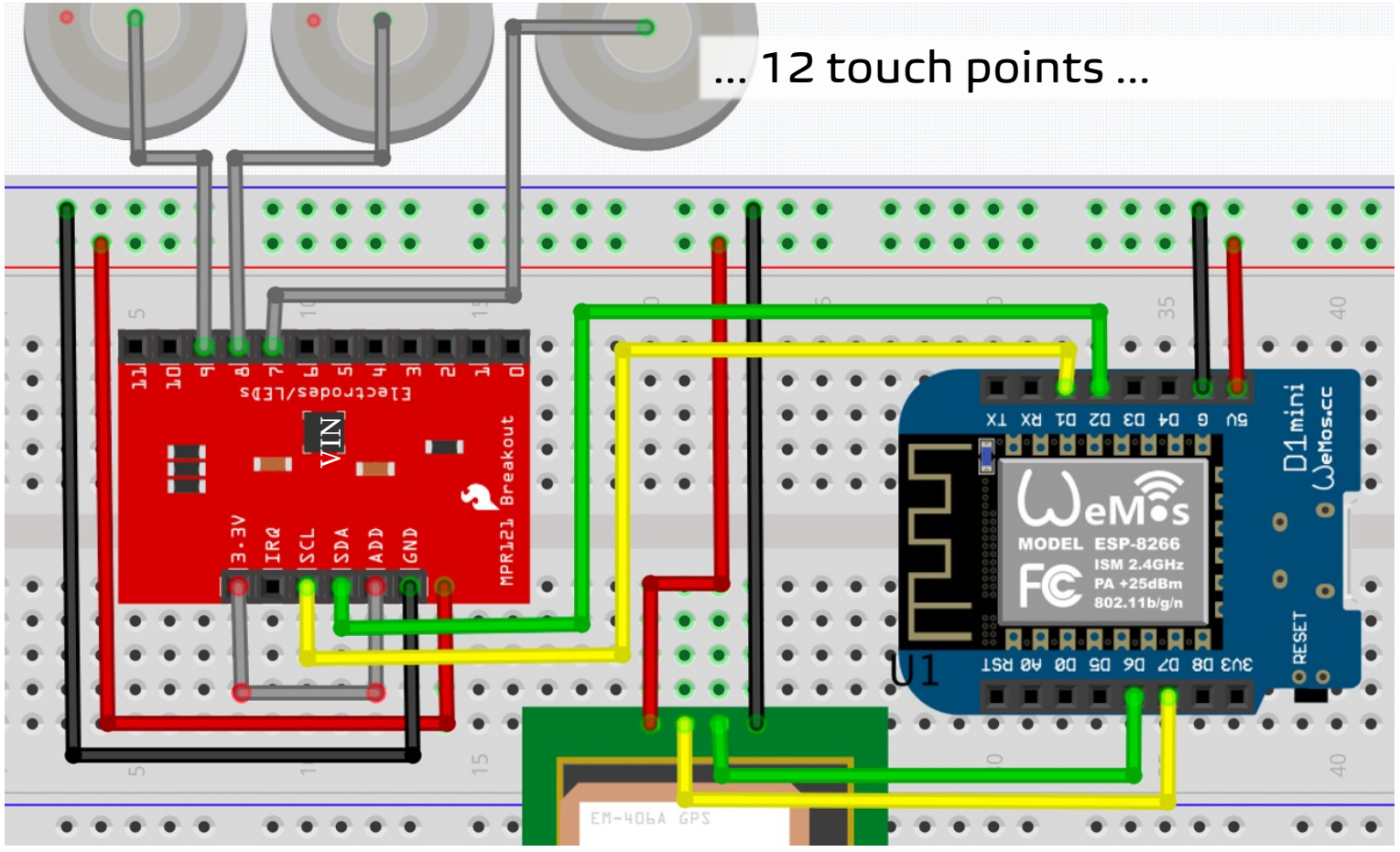
- MPR121 Capacitive Touch Sensor ≈ 3 €
- Wemos D1 (ESP8266) ≈ 5 €
- OLED Shield ≈ 5 €
- Battery charger ≈ 6 €
- PCB Prototyping shield ≈ 1 €
- NEO-6M GPS ≈ 20 €
- LiPo Battery = 5 €

Feb 2021, Total ≈ 45 €



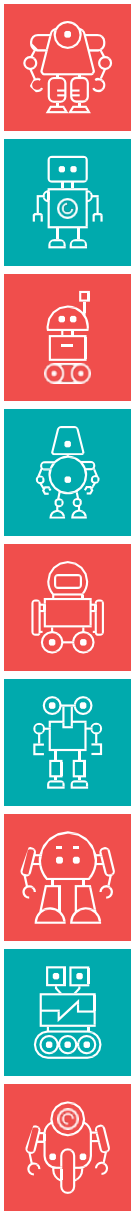
Fritzing

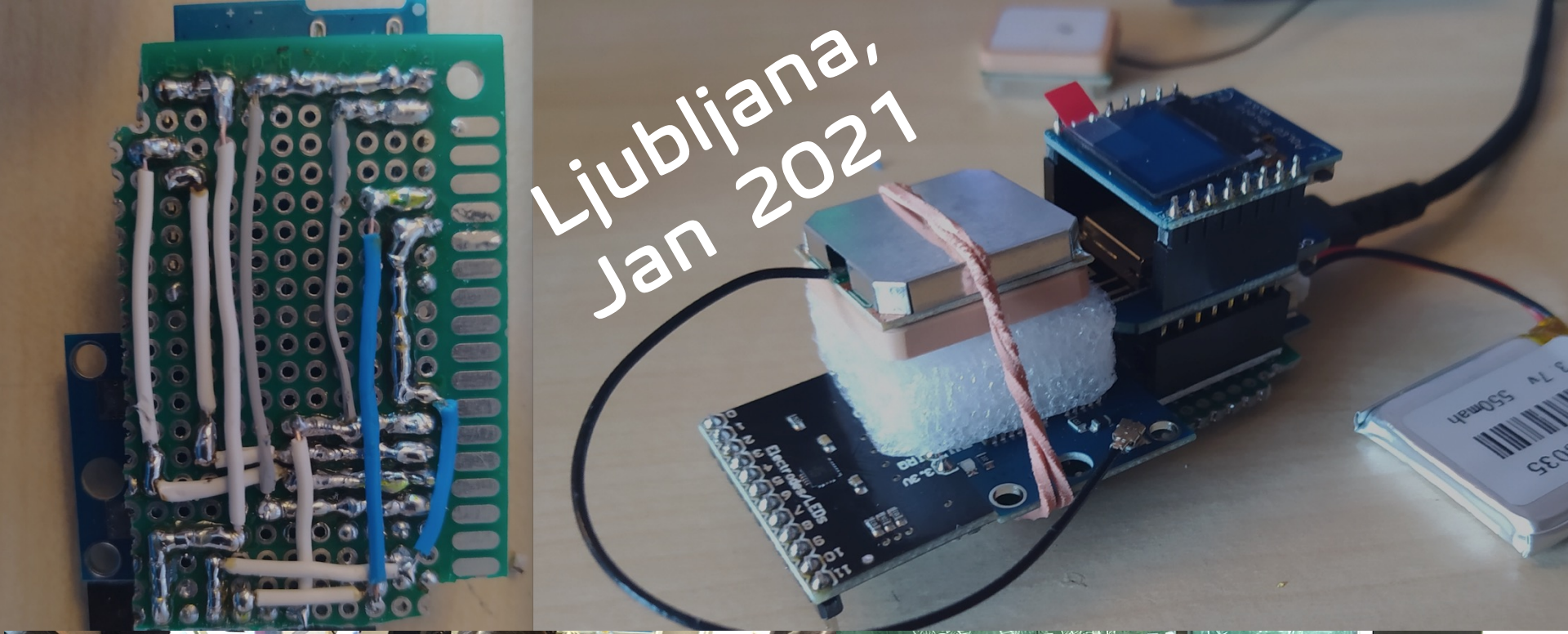
- Designing electronic systems:
  2 x 4 connections

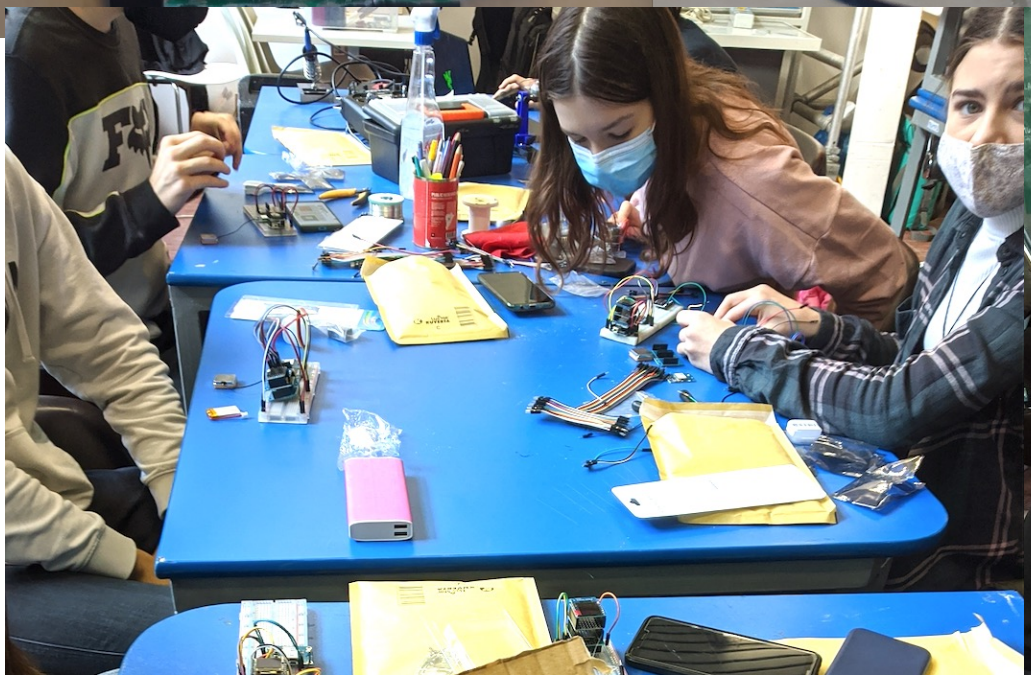


Extensibility

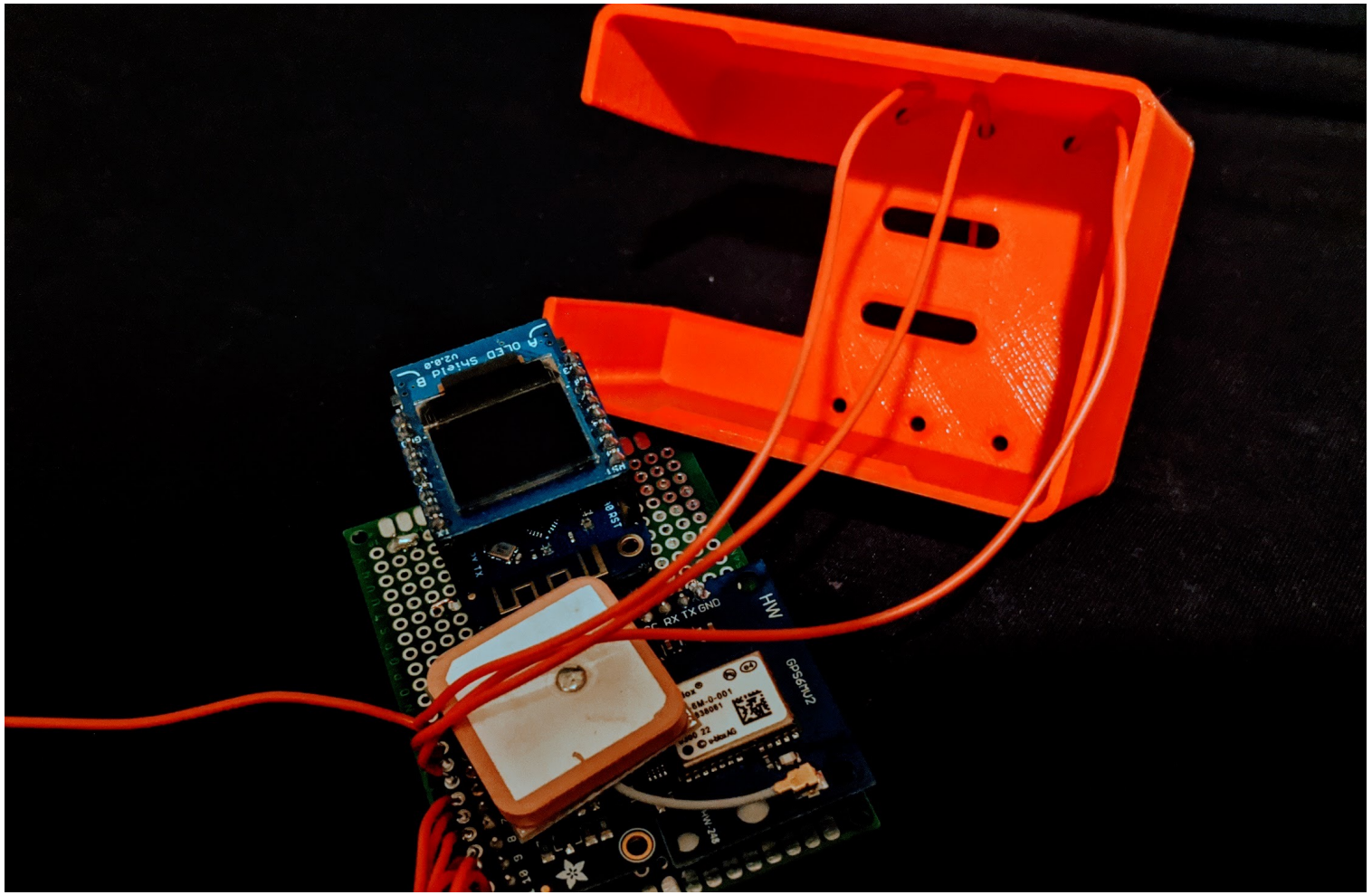
Label on Wemos D1 (ESP 8266)	Used for ...	GPIO Number
TX, RX	Linked to Serial Commun.	1, 3
A0	Analogue Sensors	
D0	Not recommend **	16
D1	OLED	5
D2	OLED	4
D3	Sensors *	0
D4	Sensors *	2
D5	Sensors *	14
D6	GPS	12
D7	GPS	13
D8	Not recommend **	15




Ljubljana,
Jan 2021



Wrapping it up ...



Making Sense through visualizing

Direct access through Laptop or Smartphone

SCIENCE LEARNING OUTSIDE THECLASSROOM

Learning paths outside the classroom: Explore and download your da
on your mapper

Paths you walked

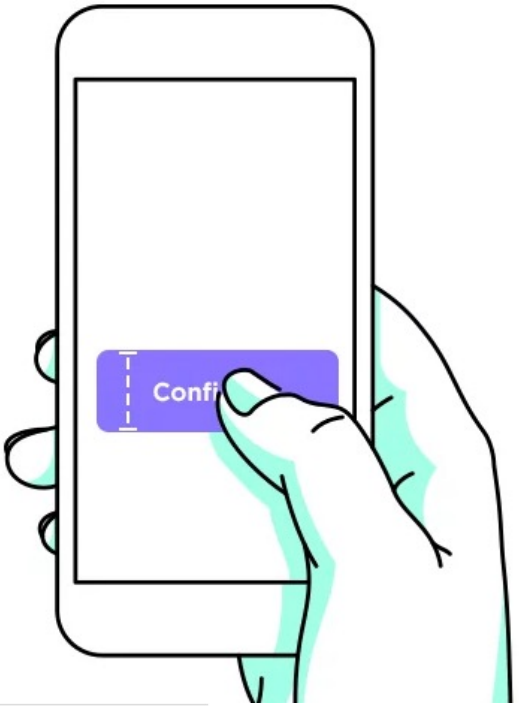
Show 10 entries Search

Date	CET Time	Raw Time	Latitude	Longitude	Altitude	Num of Sats	S
121020	07:36:34	6363400	48.232141	16.371889	179.40	8	5.
121020	07:36:37	6363700	48.232097	16.371891	180.10	8	4.
121020	07:36:40	6364000	48.232055	16.371895	180.90	8	3.
121020	07:36:43	6364300	48.232020	16.371905	181.80	8	3.
121020	07:36:46	6364600	48.231981	16.371911	184.20	8	4.
121020	07:36:49	6364900	48.231958	16.371917	184.60	8	1.
121020	07:36:52	6365200	48.231948	16.371916	185.00	8	0.
121020	07:36:53	6365300	48.231945	16.371917	185.70	8	0.5000 1.20
121020	07:36:53	6365300	48.231945	16.371917	185.70	8	0.5000 1.20
121020	07:36:53	6365300	48.231945	16.371917	185.70	8	0.5000 1.20

Showing 1 to 10 of 500 entries

Previous 1 2 3 4 5 … 50 Next

Download as CSV



Careful planning

Available time

Participant / facilitator ratio

Existing knowledge (participant & facilitators)

Heterogeneity of group

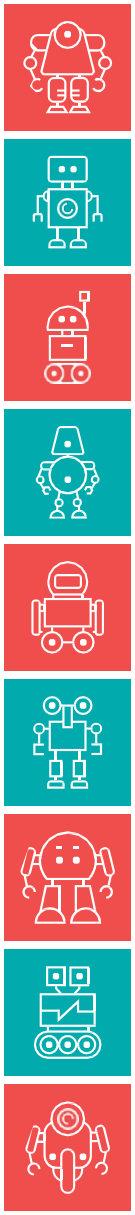
Robustness of tools

Tools

- Excel
- Google Maps
- Individual notebooks / Google Collab (mapping through IPyLeaflet, or Kepler.gl)*

Platforming the result …

https://streamlit.io/ or https://www.heroku.com/



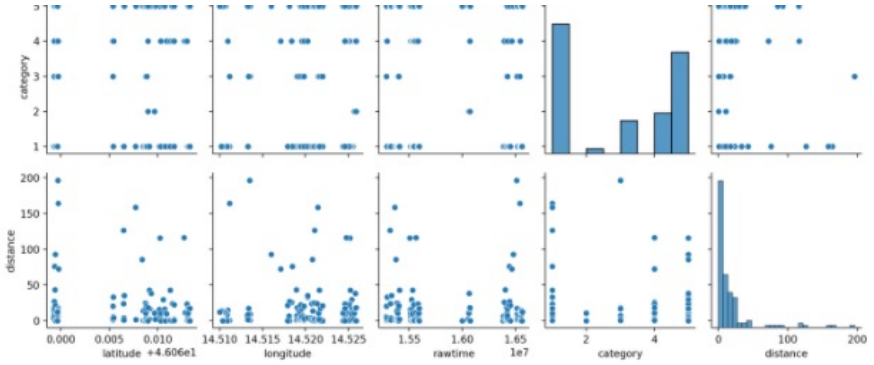
* both tools are described on https://innodesign.io/tag/mapping/

Platform example

Observation Mapping

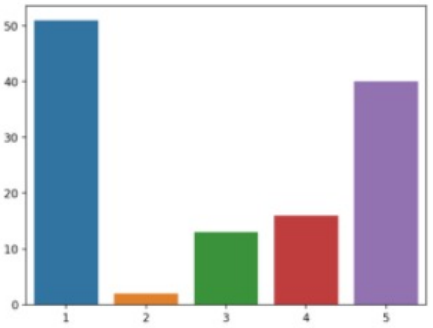
Go to

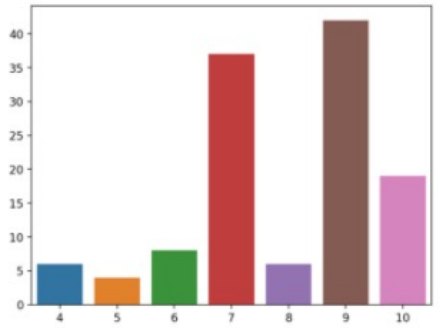
- ○ Data Exploration
- ◉ Ljubljana Example
- ○ About



This bar chart shows the usage frequency per category.

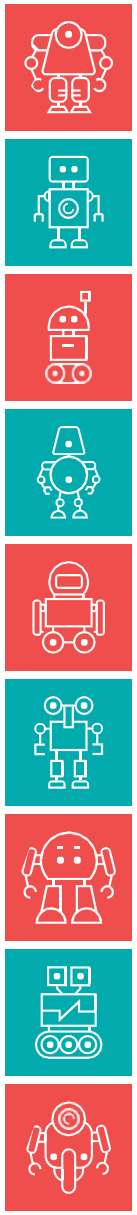
This bar chart indicates the quality of your GPS coordinates. 5+ is good.





http://mapper.innodesign.education/

Facilitating programming



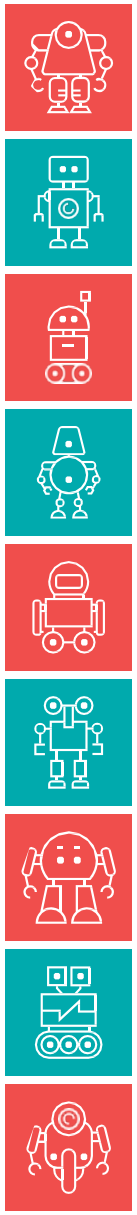
The PRIMM* model:

- **Predict** what code will do
- **Run** the code to test predictions
- **Investigate** the structure of code
- **Modify** the code to add functionality
- **Make** a new program using the same/modified structures.

* Sentance, S., Waite, J., & Kallia, M. (2019). Teachers' Experiences of using PRIMM to Teach Programming in School. *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*, 476–482.

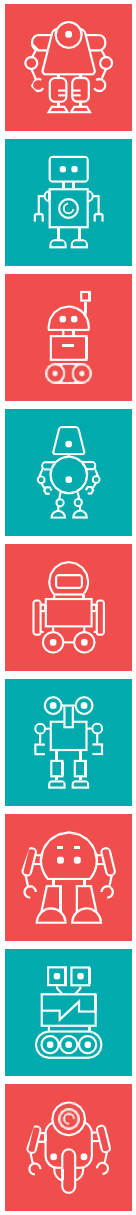
Which part would you like to try ?

Design your own data collection	Build your own mapper	Visualize your data	Try out DIY electronics



Thanks

- **Kersnikova**: Ana Smerdu, Lovrenc Košenina, Urska Spitzer
- **Science Gallery Dublin**: Sophie Perry, Róisín McGannon, Shaun Ussher, Grace D'Arcy
- **ECSITE**: Andrew Whittington
- **DOIT Project**: Tamer Aslan ...



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