



Eyes on the Water

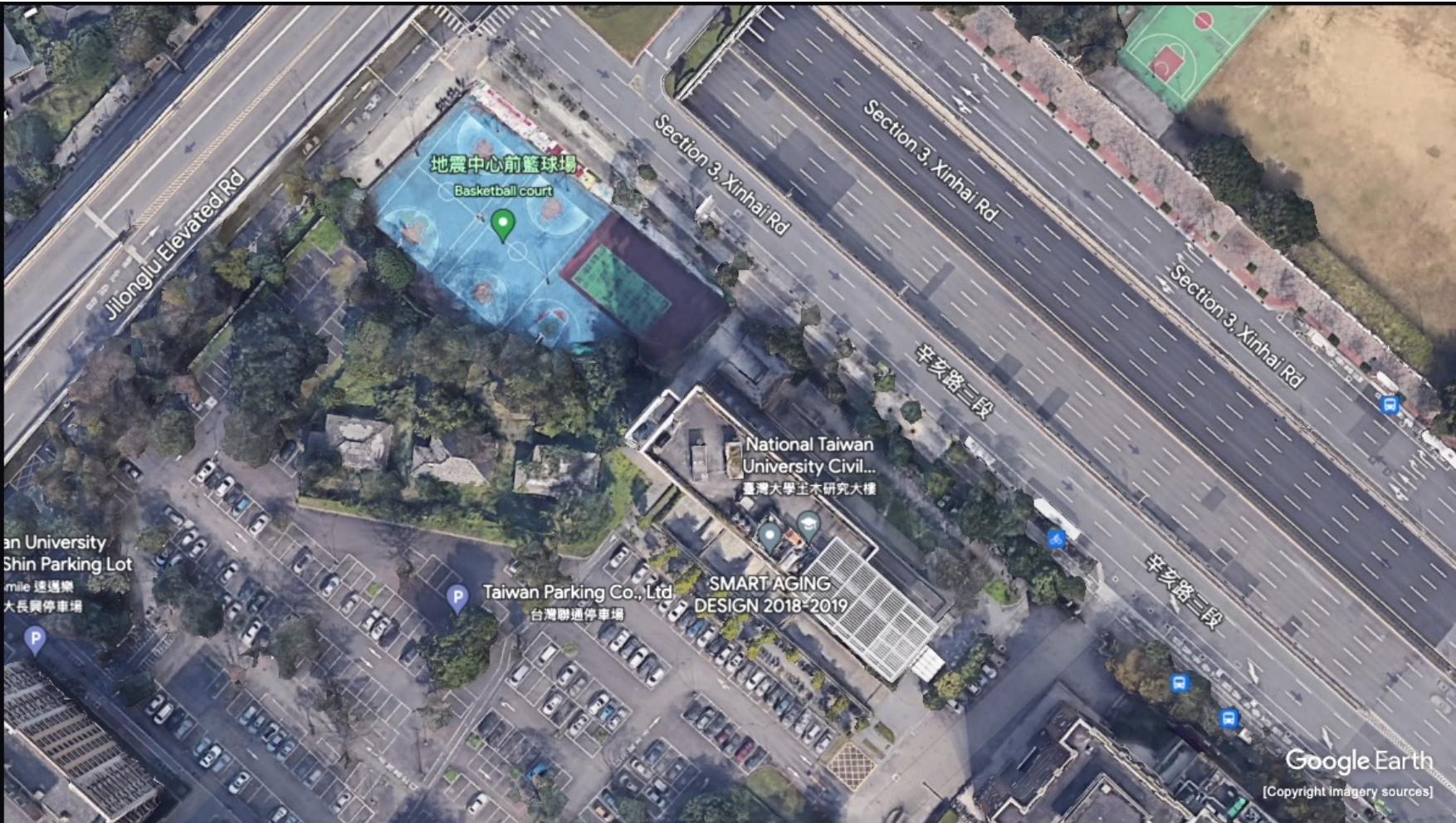
CAE Seminar - Hackathon Introduction



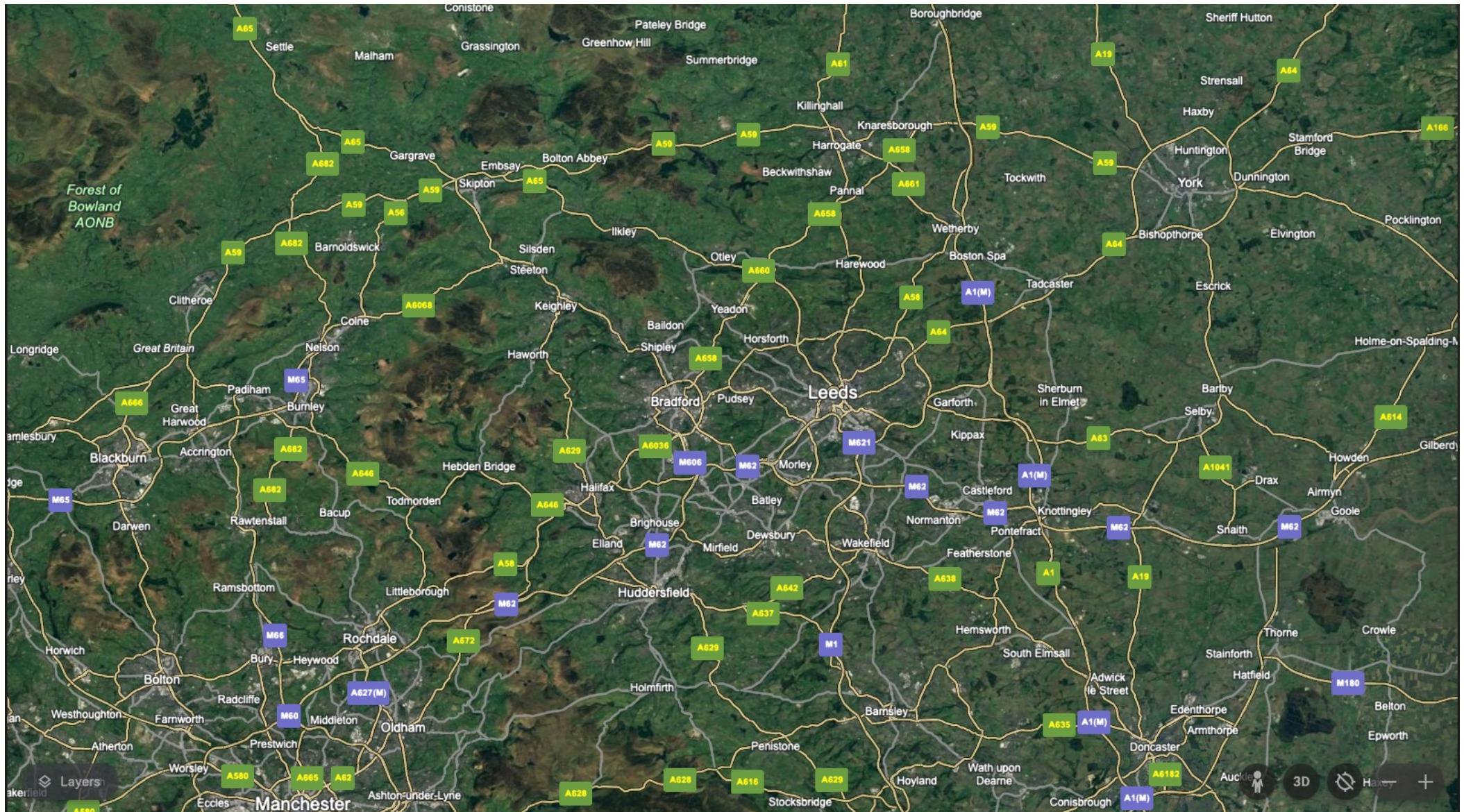
Ho Tin Hung (r12521615@ntu.edu.tw)

Department of Civil Engineering, National Taiwan University

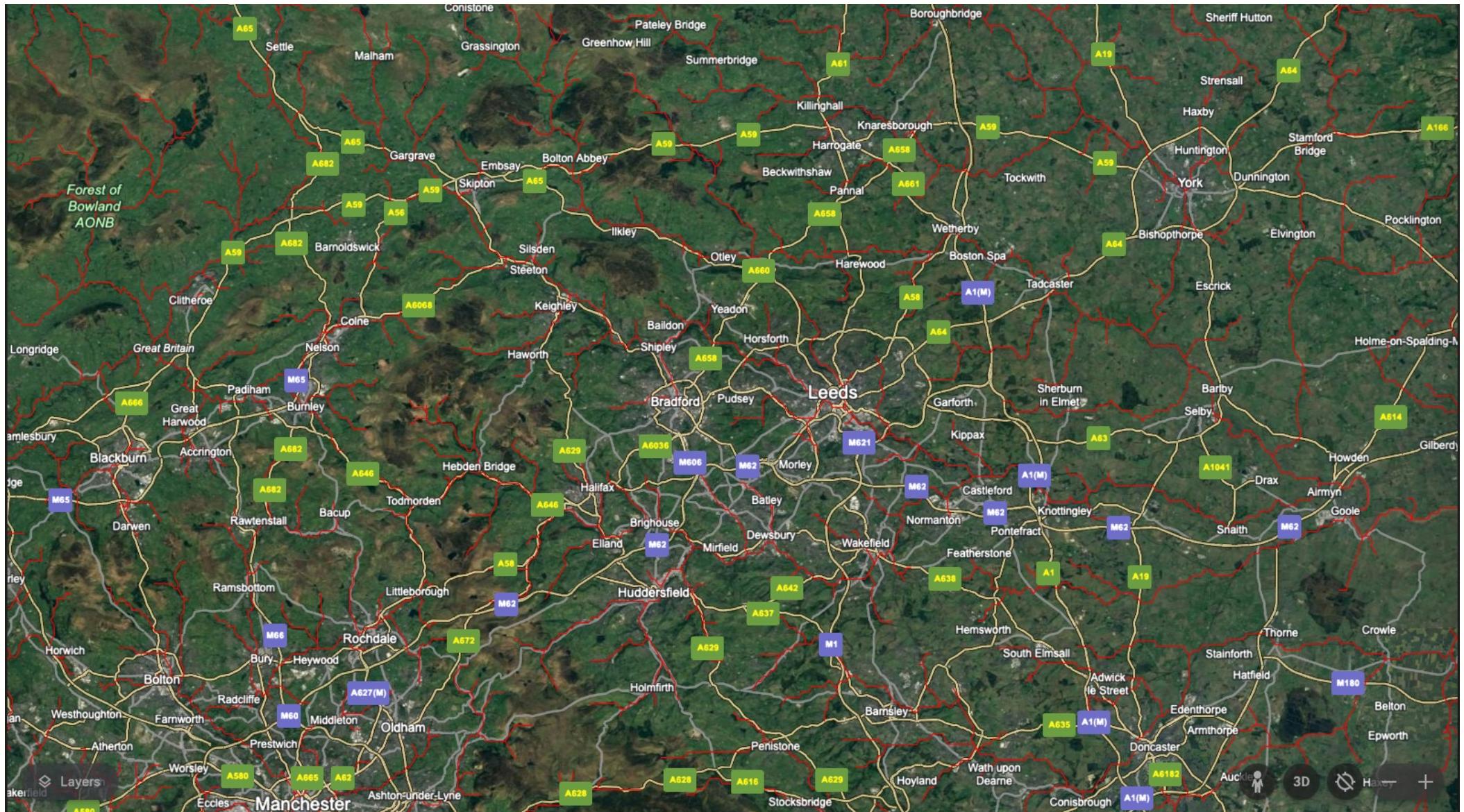
Where are we?



Where are we?



Where are we?



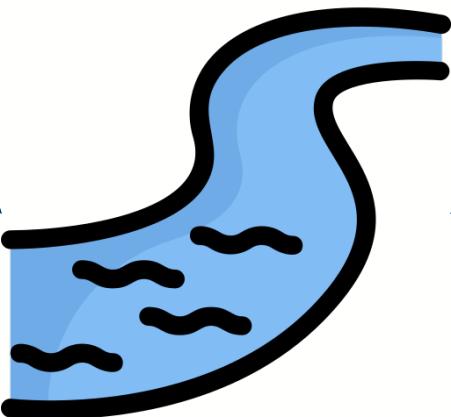
What will we do?



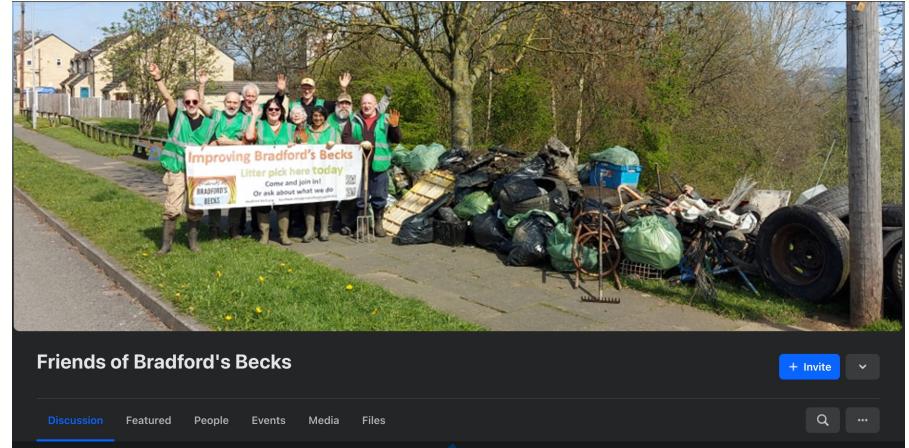
Monitor Bradford's Becks
health with **image data**

Receive photossss from
Friends of Bradford's Becks

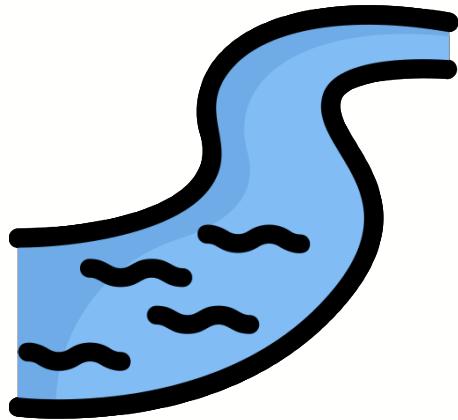
Take photosssssss



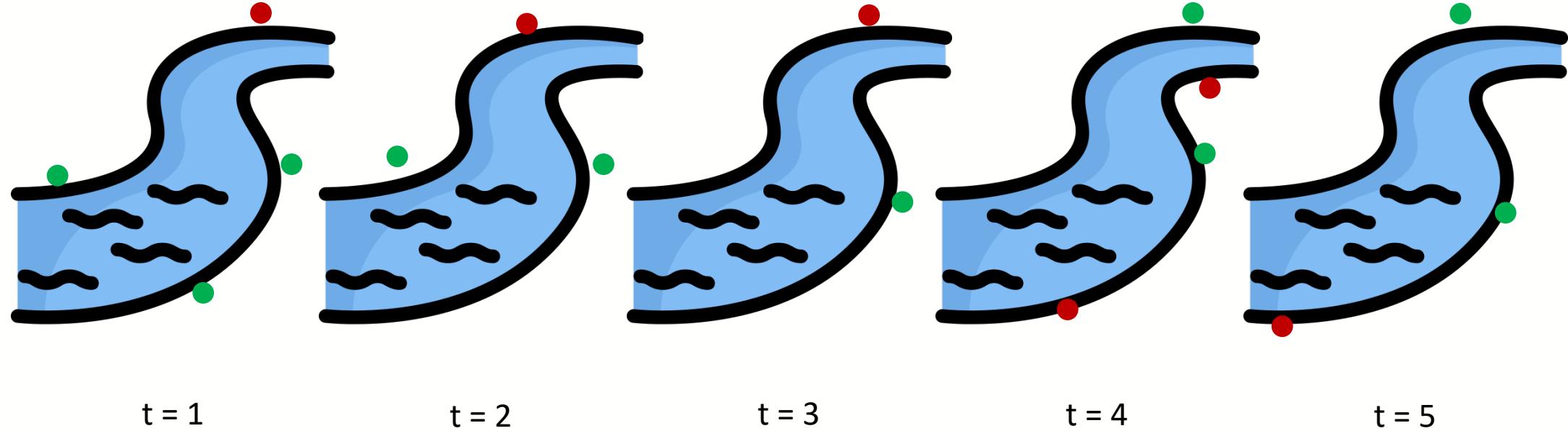
Bradford's Becks



What will we do?



What will we do?



Automatic image labelling to enable community-driven long-term river health monitoring and tracking

Images from Friends of Bradford's Becks





Eyes on the Water

Example Images



Columns 1 - 23



A Column Number	B Field	C Description
1	ImageID	Unique image ID for referencing.
2	Original_File_Name	Original image file name, found in google drive.
3	File_Path	Image file path in google drive (or wherever we share).
4	Date	Date image was taken.
5	Time	Time image was taken.
6	Latitude	Location reference.
7	Longitude	Location reference.
8	dHash	Image quality. <small>U</small>
9	Variance_of_Laplacian	Image quality.
10	Texture_Variation	Image quality.
11	Entropy	Image quality.
12	Contrast	Image quality.
13	Brightness	Image quality.
14	Colorfulness	Image quality.
15	Saturation	Image quality.
16	Hue_Variation	Image quality.
17	Width	Image quality.
18	Height	Image quality.
19	Size	Size of the image.

- Columns 1 – 23 include ‘generic’ information about the image files themselves.
- Some of the information is readily available from the image files (e.g., original filename, date, coordinates).
- Other fields need to be computed from the images (e.g., dHash).

Columns 24 onwards – features to be identified from the images



Column Number	Category	Field	Why is this of interest?
24	Outfall	Outfall	To help monitor storm overflows and highway drainage.
25	Outfall	Outfall_Spilling	To help monitor storm overflows and highway drainage.
26	Outfall	Outfall_Aeration	To help monitor storm overflows and highway drainage.
27	Outfall	Outfall_Screen	Un-screened outfalls can lead to rags entering waterbodies. Can encourage local authorities or water companies to install screens.
28	Sewage_Litter	Sewage_Litter	Indication of possible sewage pollution.
29	Rubbish	Rubbish	Trigger river clean-up.
30	Obstruction	Obstruction	Potential impact on flooding and wildlife movement.
31	Modified_Channel	Modified_Channel	Used in Water Framework Directive assessments.
32	Modified_Channel	Proportion_Modification	
33	Discolouration	Discolouration	Indicator of potential industrial pollution or sewage discharges.
34	Discolouration	Discolouration_Colour	
35	Discolouration	Discolouration_Outfall	
36	Aeration	Aeration	Potentially useful for water quality modelling.
37	Aeration	Aeration_Extent	Potentially useful for water quality modelling.
38	Wildlife	Wildlife	
39	Wildlife	Wildlife_Fish	
40	Wildlife	Wildlife_Algal	

- ◊ These are the actual labels to be automatically generated.
- ◊ The level of importance and difficulty is specified for each.



Outfall (Column 24)



◆ The presence of an outfall that would discharge (or is discharging...) into the river reach.

◆ Often a pipe, but not always.





Outfall_Spilling (Column 25)



Is there flow coming out the outfall?





Outfall_Aeration (Column 26)



Does flow from the outfall result in aeration?



14.02.16/JAN/2018



Outfall_Screen (Column 27)



Is there a 'screen' or 'grate' on the outfall?



Sewage_Litter (Column 28)



- Are sewage 'rags' present within the river reach or river banks?
- This can include rags that are caught by outfall 'screens' (see bottom right photo).



Rubbish (Column 29)



◆ The presence of general rubbish within the river reach. This could be plastics, metal, bags, trolleys, etc...

◆ Possibility to break this category down into further detail (e.g. material type, etc.)



Obstruction (Column 30)

Partial (>25%)



Full (100%)



Minor (<25%)



- ◆ A large obstruction to the river flow / river channel.
- ◆ This may be intentional (e.g. a weir) or unintentional (e.g. rubbish, etc...).



Proportion_Modified (Column 32)



Is the river channel in the image heavily modified? (i.e. man-made changes to the river channel).



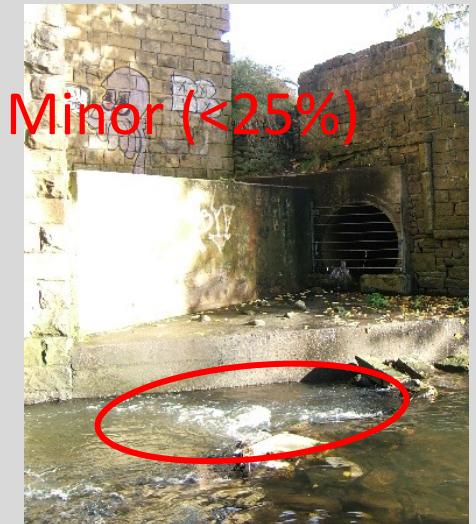


Discolouration (Column 33)



Is there discolouration of the river flow?

Aeration (Column 36)



- The presence of noticeable 'aeration' in the river reach.
- This could be in the form of 'bubbles', 'rapids', weirs, etc...
- If water level is 'flat', then aeration is not visible.



- Note – this is separate to aeration caused by an outfall. See earlier slide.



Wildlife_Fish (Column 39)



- ◆ The presence of fish in the river channel.
- ◆ Example images taken from google.



Wildlife_Algal (Column 40)



- ◆ The presence of an algal bloom.
- ◆ Example images taken from google.



Wildlife_Bird (Column 42)



The presence of birds in the river channel or surrounding environment.

All Category and subfields

	Category	Field	Description	Weight / Points / Difficulty Level
1.1	Outfall	Outfall	The presence of an outfall. Usually a pipe, but not always.	High (1)
1.2		Outfall_Spilling	Is there flow coming out of the outfall?	High (1)
1.3		Outfall_Aeration	Is there aeration caused by outfall?	Low (3)
1.4		Outfall_Screen	Is there a screen on the outfall?	High (1)
2	Sewage_Litter	Sewage_Litter	The presence of sewage 'rags'?	High (1)
3	Rubbish	Rubbish	The presence of general rubbish.	Low (3)
4	Obstruction	Obstruction	An obstruction to river flow. Full = 100% obstruction across channel, Partial >= 25%, Minor <25%, None = 0%.	Medium (2)
5.1	Modified_Channel	Modified_Channel	Is the river channel modified (i.e. man-made)?	Medium (2)
5.2		Proportion_Modification	What is the extent of river channel modification? Full = 100% change to walls and base of channel, Partial >= 25%, Minor <25%, None = 0%.	Medium (2)
			Is there discoloration in	

All Category and subfields

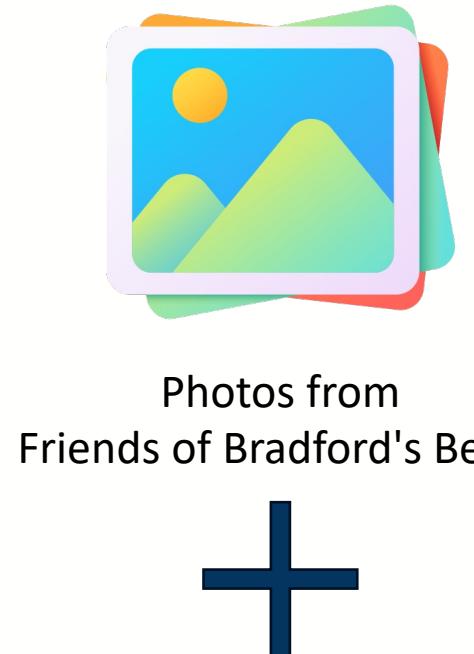
6.1	Discolouration	Discolouration	Is there discolouration in the river? Could also indicate high turbidity.	High (1)
6.2		Discolouration_Colour	What colour is the discolouration?	High (1)
6.3		Discolouration_Outfall	Is the discolouration caused by an outfall?	High (1)
7.1	Aeration	Aeration	Is there visible aeration in the river reach (e.g. bubbles, turbulence, rapids, weirs...)?	Medium (2)
7.2		Aeration_Extent	What is the extent of river flow aeration? Full = 100% of visible flow aerated (white water), Partial >= 25%, Minor <25%, None = 0%.	Medium (2)
8	Sensor	Sensor	Is there an environmental sensor installed in the image?	Low (3)
9.1	Wildlife	Wildlife	Is there wildlife present?	Medium (2)
9.2		Wildlife_Fish	Are fish species present?	Medium (2)
9.3		Wildlife_Algal	Are algal blooms present?	Medium (2)
9.4		Wildlife_Invertebrate	Are invertebrate species present?	Medium (2)
9.5		Wildlife_Birds	Are birds present?	Medium (2)
9.6		Wildlife_Other	Are other forms of wildlife present?	Medium (2)
10	Plants	Plants	Are plant species present?	Low (3)

All Category and subfields

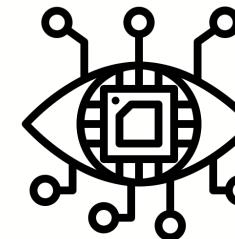
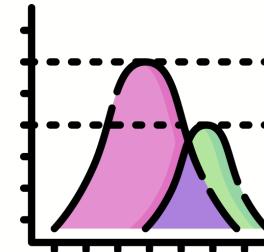
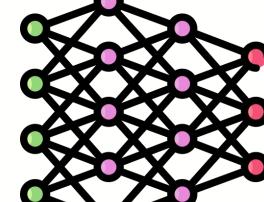
- Pick at least 2 fields
- Balance between your models and River management needs

	Category	Field	Description	Weight / Points / Difficulty Level
1.1	Outfall	Outfall	The presence of an outfall. Usually a pipe, but not always.	High (1)
1.2		Outfall_Spilling	Is there flow coming out of the outfall?	High (1)
1.3		Outfall_Aeration	Is there aeration caused by outfall?	Low (3)
1.4		Outfall_Screen	Is there a screen on the outfall?	High (1)
2	Sewage_Litter	Sewage_Litter	The presence of sewage 'rags'?	High (1)
3	Rubbish	Rubbish	The presence of general rubbish.	Low (3)
4	Obstruction	Obstruction	An obstruction to river flow. Full = 100% obstruction across channel, Partial >= 25%, Minor <25%, None = 0%.	Medium (2)
5.1	Modified_Channel	Modified_Channel	Is the river channel modified (i.e. man-made)?	Medium (2)
5.2		Proportion_Modification	What is the extent of river channel modification? Full = 100% change to walls and base of channel, Partial >= 25%, Minor <25%, None = 0%.	Medium (2)
6.1	Discolouration	Discolouration	Is there discolouration in the river? Could also indicate high turbidity.	High (1)
6.2		Discolouration_Colour	What colour is the discolouration?	High (1)
6.3		Discolouration_Outfall	Is the discolouration caused by an outfall?	High (1)
7.1	Aeration	Aeration	Is there visible aeration in the river reach (e.g. bubbles, turbulence, rapids, weirs...)?	Medium (2)
7.2		Aeration_Extent	What is the extent of river flow aeration? Full = 100% of visible flow aerated (white water), Partial >= 25%, Minor <25%, None = 0%.	Medium (2)
8	Sensor	Sensor	Is there an environmental sensor installed in the image?	Low (3)
9.1	Wildlife	Wildlife	Is there wildlife present?	Medium (2)
9.2		Wildlife_Fish	Are fish species present?	Medium (2)
9.3		Wildlife_Algal	Are algal blooms present?	Medium (2)
9.4		Wildlife_Invertebrate	Are invertebrate species present?	Medium (2)
9.5		Wildlife_Birds	Are birds present?	Medium (2)
9.6		Wildlife_Other	Are other forms of wildlife present?	Medium (2)
10	Plants	Plants	Are plant species present?	Low (3)

What to do?



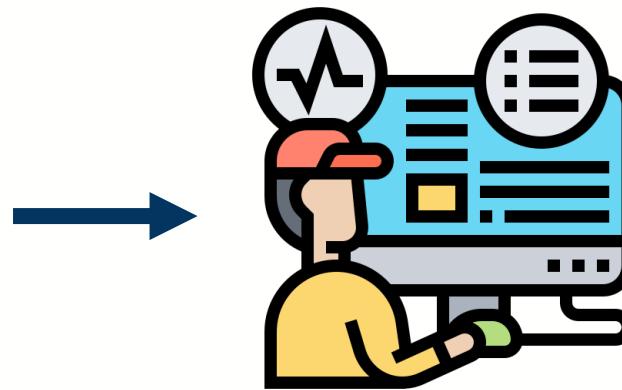
River health
monitoring needs

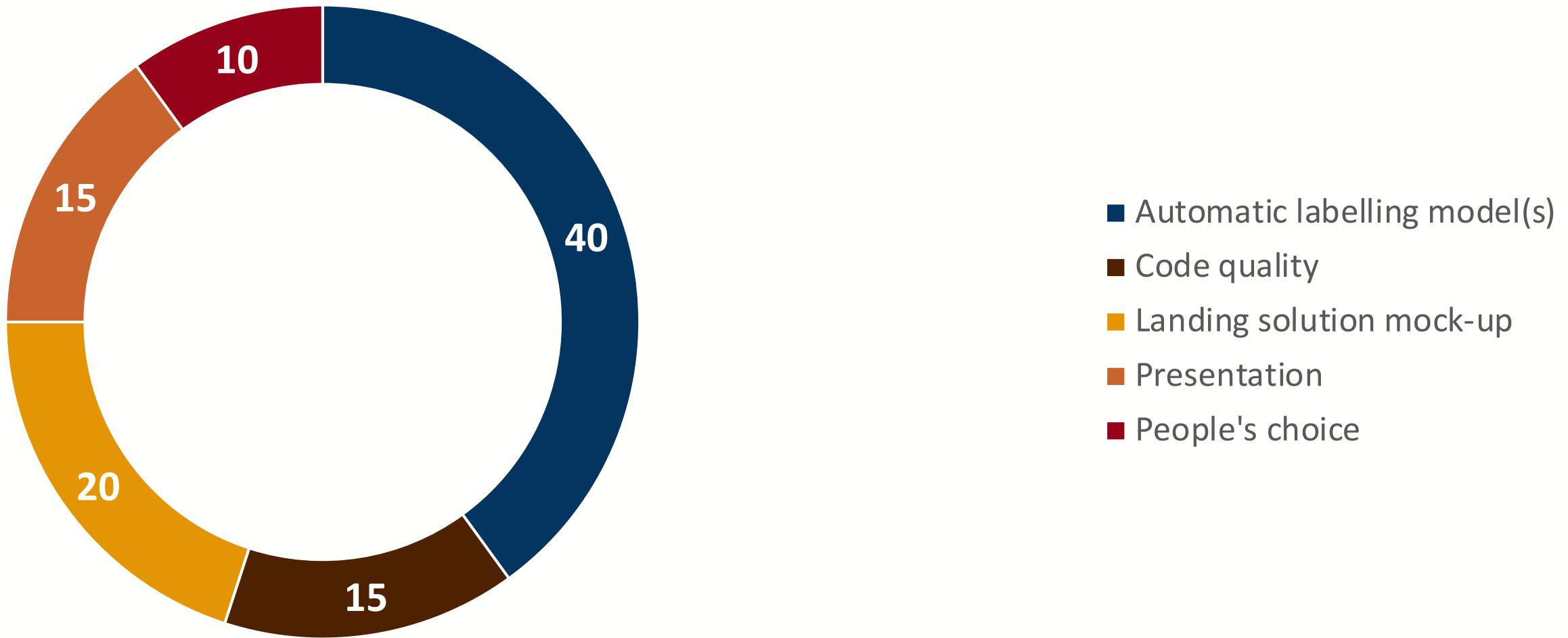


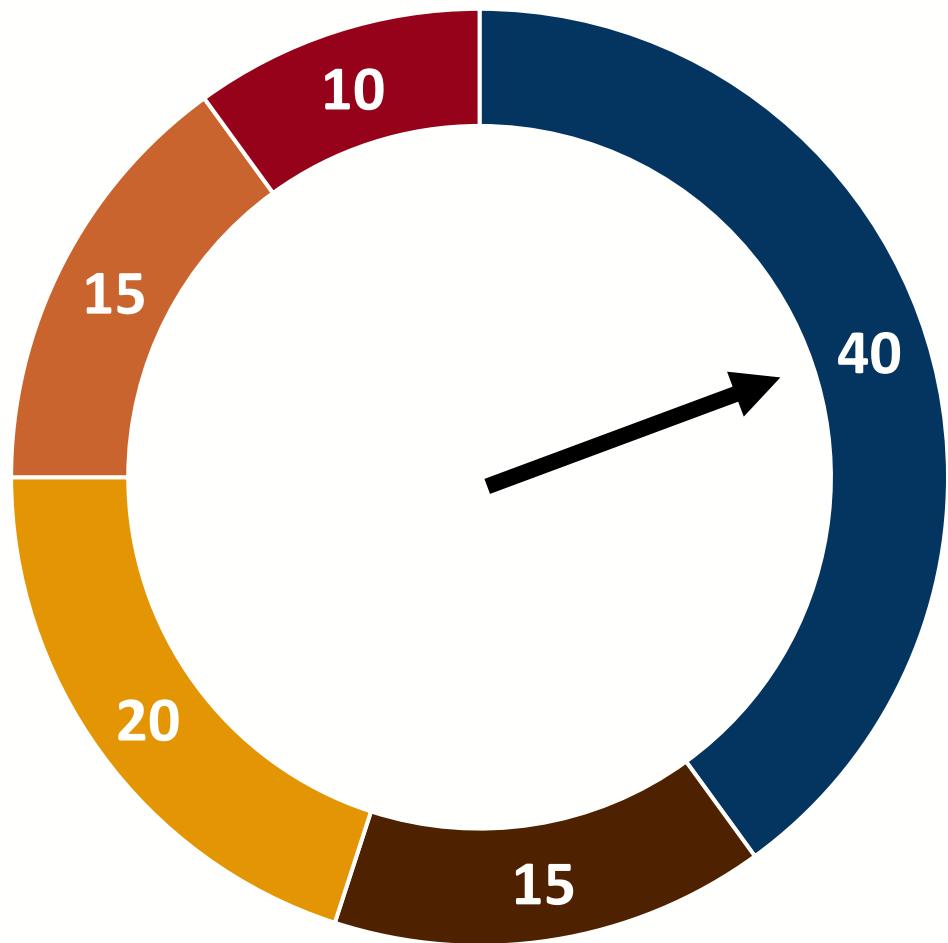
...

Others

Your Solution (Prototype/ Proof of concept)



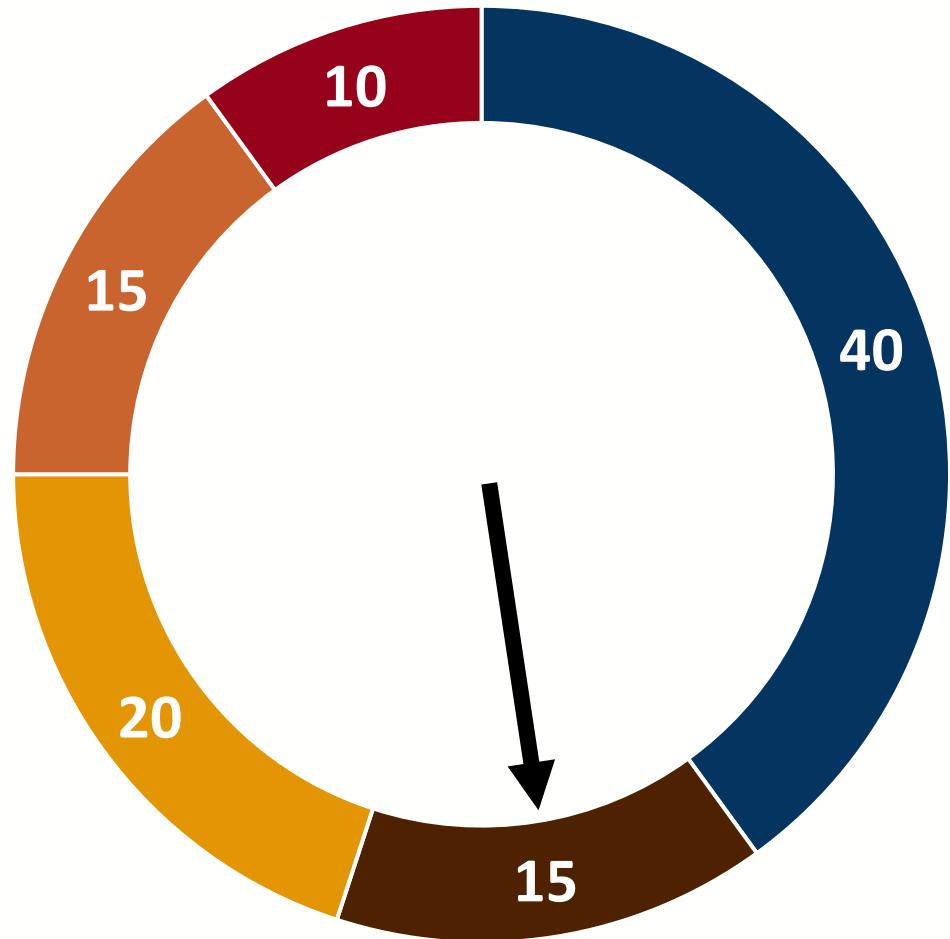




■ Automatic labelling model(s)

Objective

Based on **evaluation dataset** and with point system based on difficulty and relevance of different objects

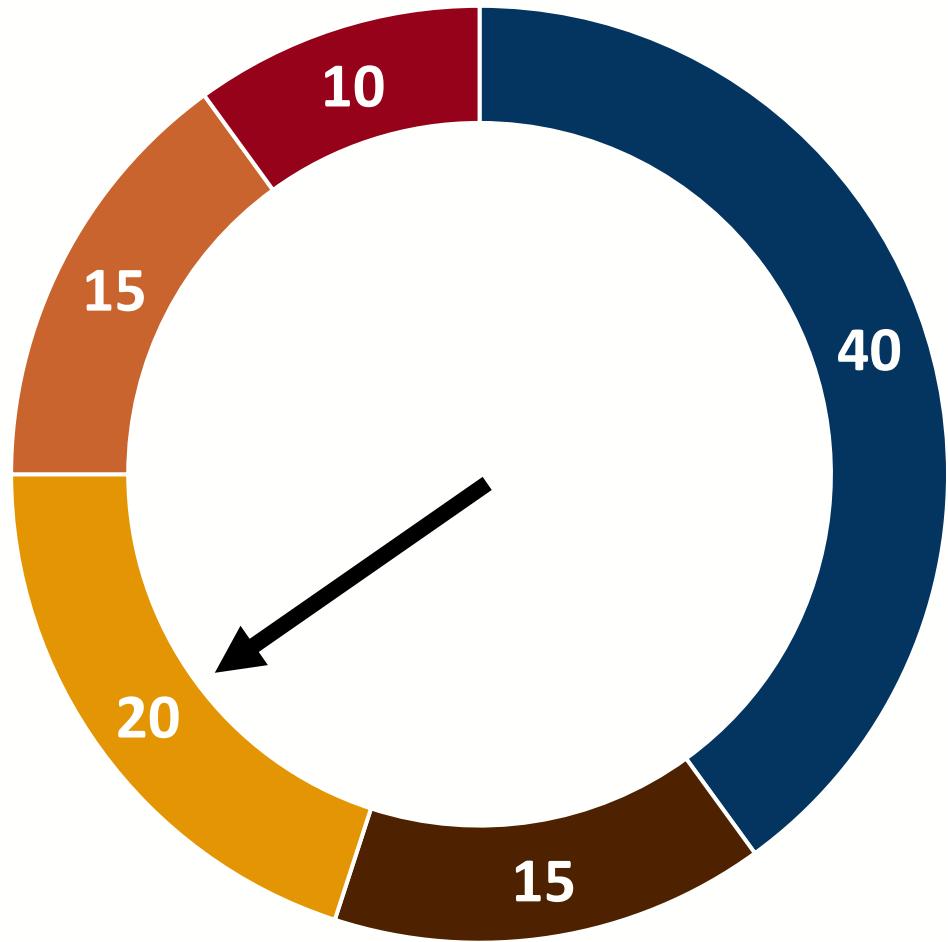


■ **Code quality**

Objective

**# Manual evaluation on Structure,
efficiency, documentation**

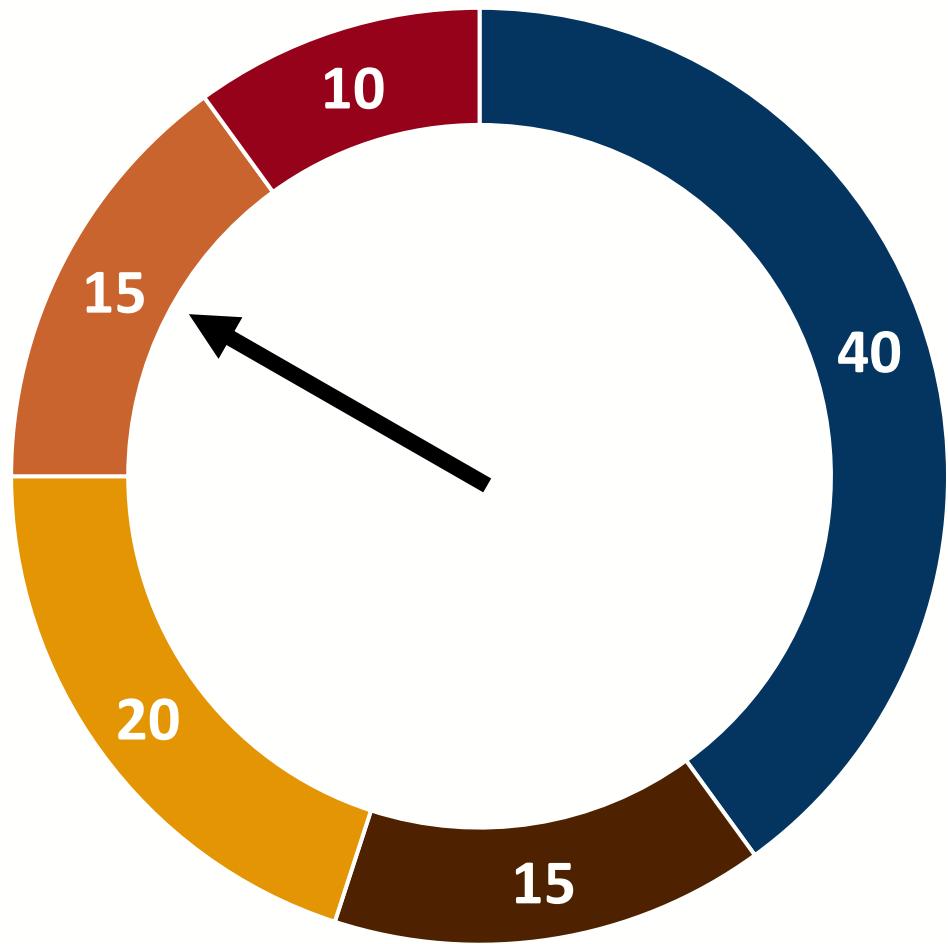
**# How easy for people with no
background to use?**



Landing solution mock-up

Jury-based

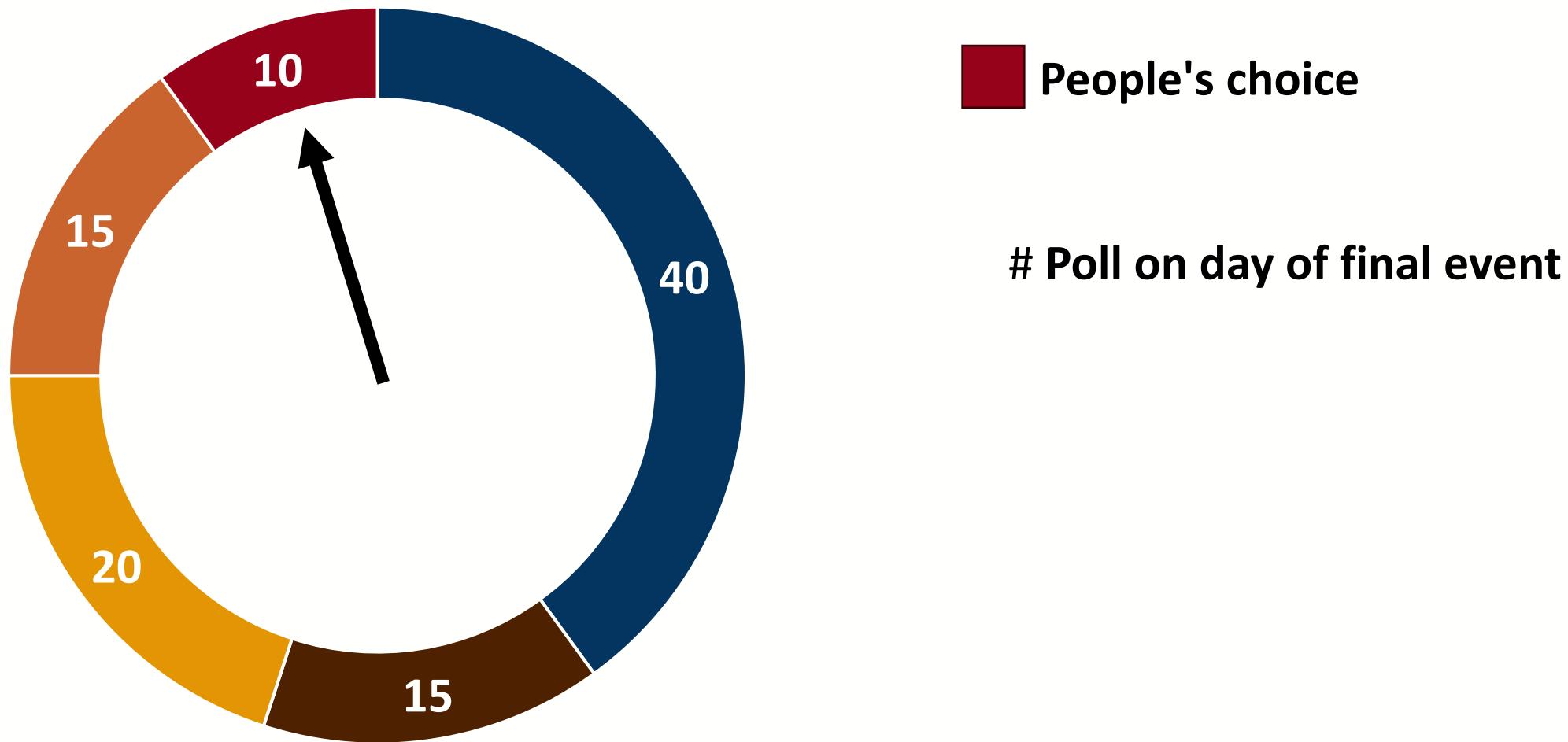
Landing solution mock-up: prototype of tool/service which incorporates labelling model and adds value to end users - these can be citizens, water companies, consultants, government agencies - possibility of integration with other datasources.



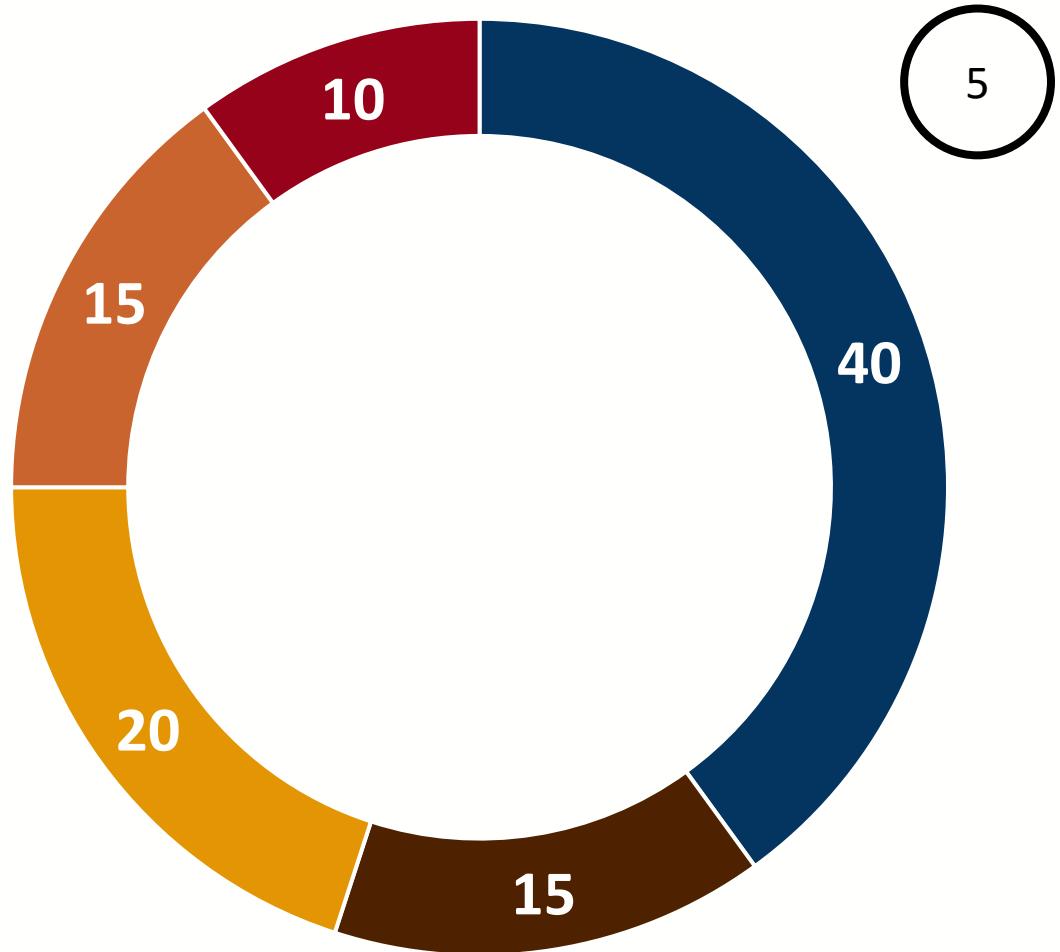
█ Presentation

Jury-based

10 + 2 minutes



Scoring – Bonus



5

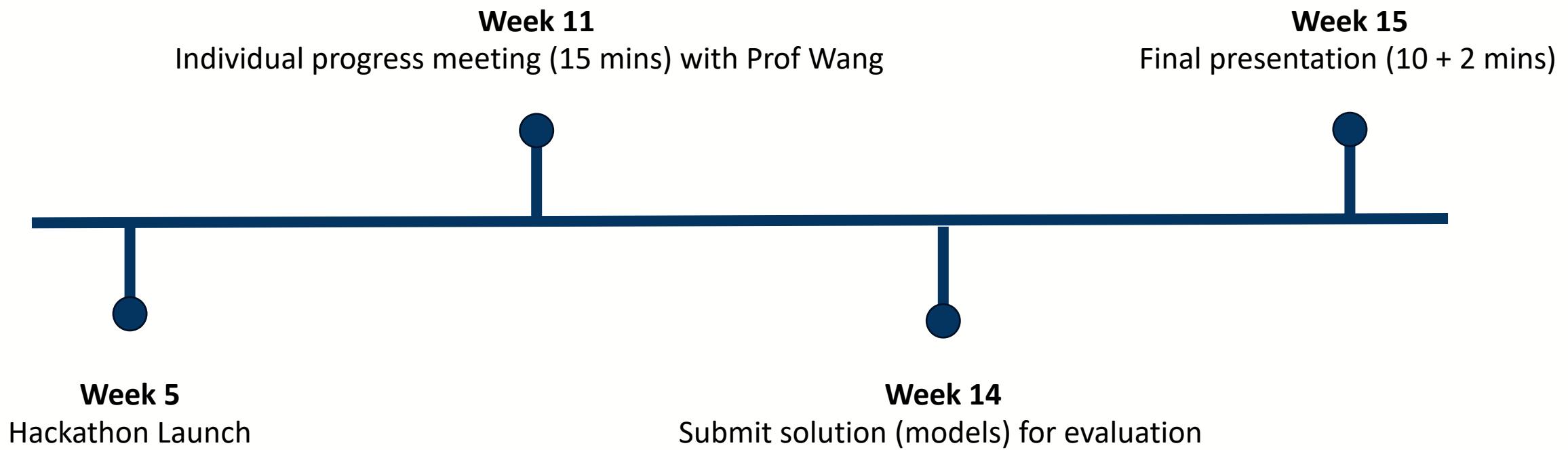
Tackle Unique Category

+5 If you are the only team tackle the one of the problems

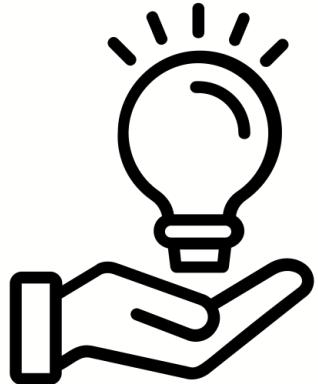
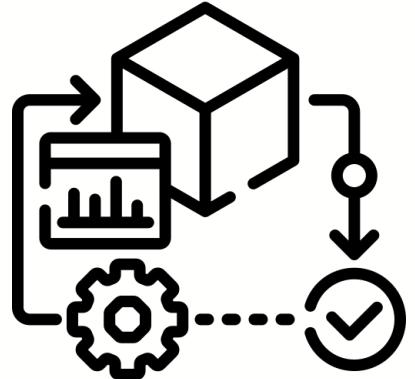
+4 If you are the only 2 teams tackle the one of the problems

...

Timeline



Hackathon Cash Prizes



Best model
NTD 12500

Best solution
NTD 12500

Best overall
NTD 20000

People's choice
NTD 5000

Total NTD 50000

Group rules

- All students who are **NOT** going to graduate next semester are required to join
- Other students feel free to join
- ~ 4-5 groups @ 4-6 people/ group