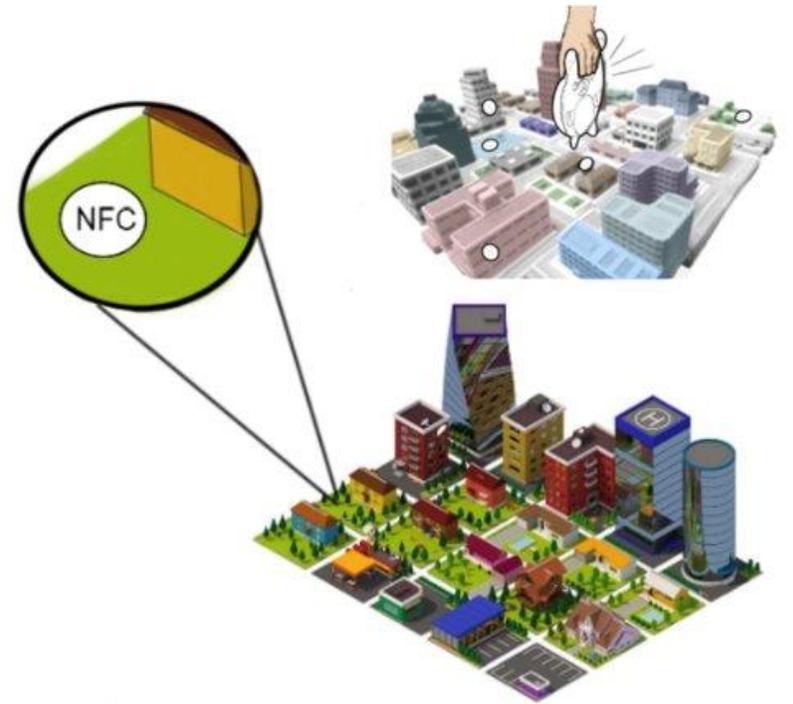
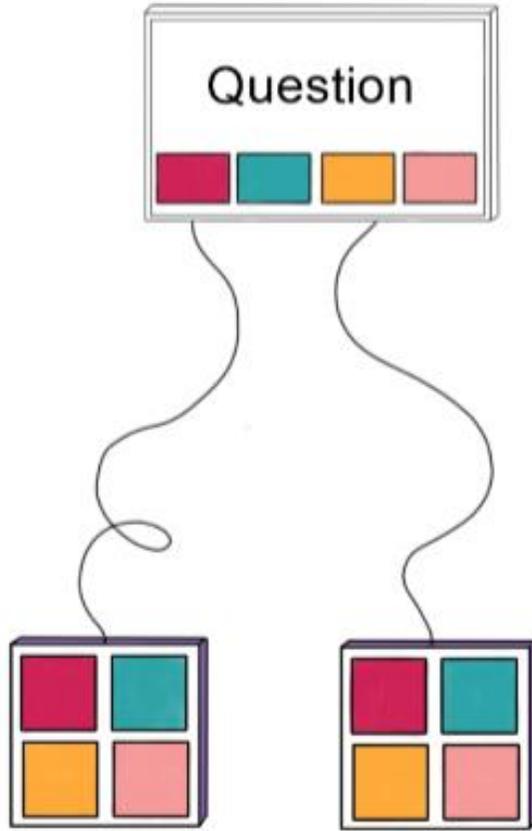
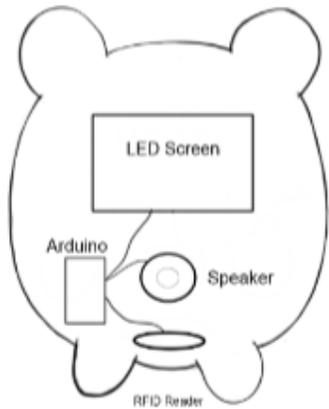
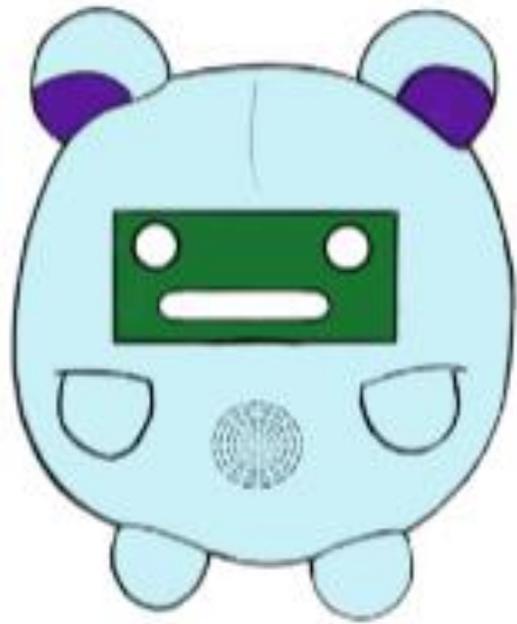


By Daniel, David, Jade & Maemi

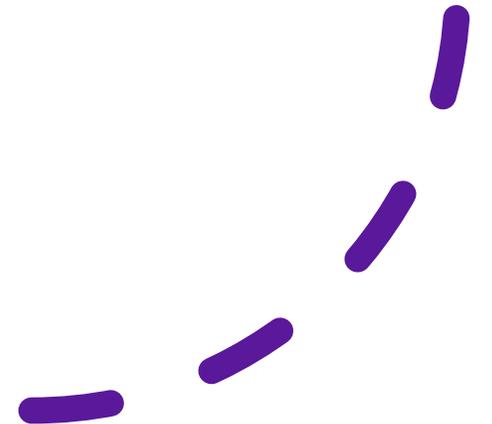




Initial concept

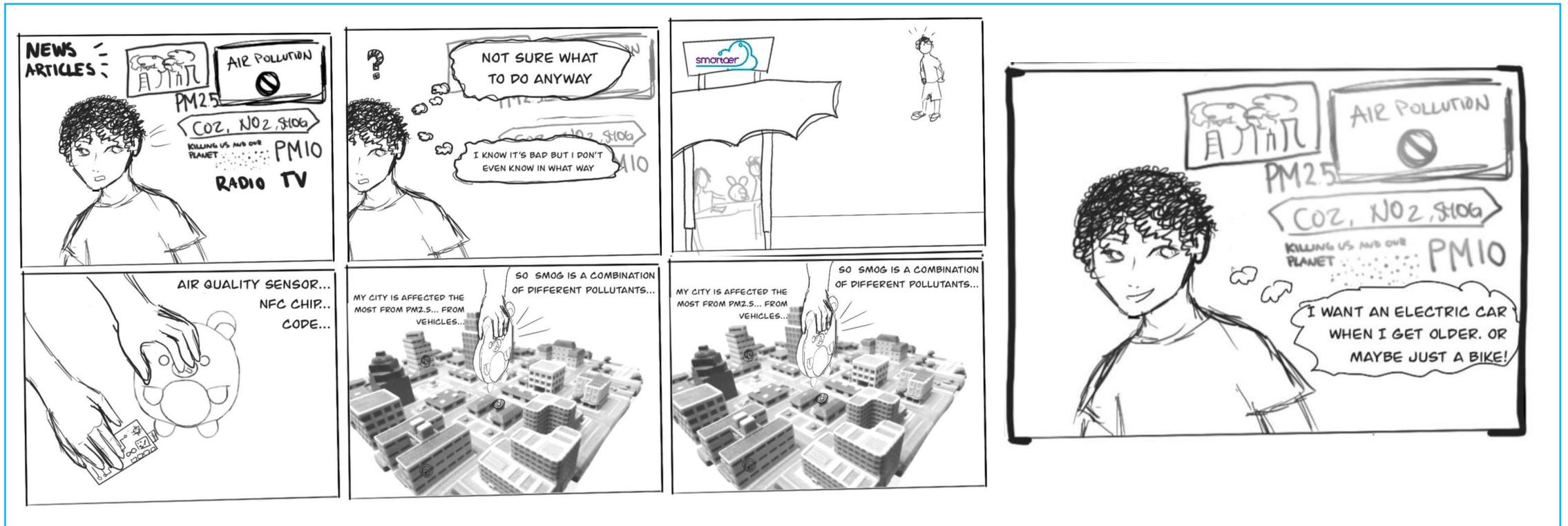
Changes Made to Our Initial Concept Using Client Feedback

- Focus on raising awareness and information
- Focus more on how the user interacts with the product than the workshop itself (resulted in us putting the question round element on the back burner)
- To not make the city too big, to keep it a manageable size

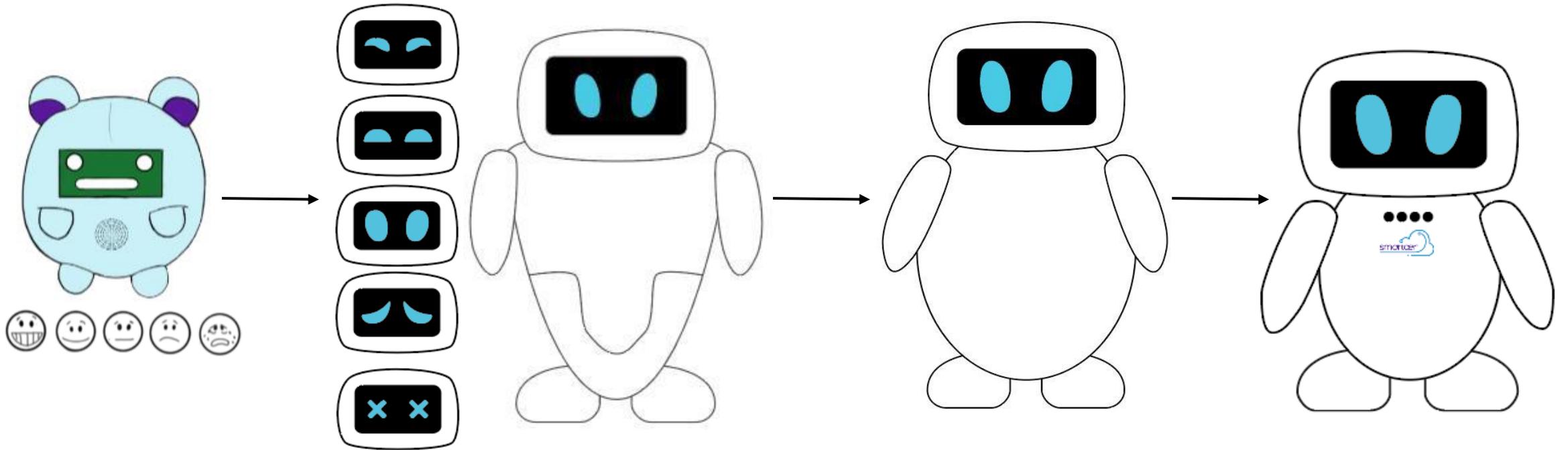


User Experience

Student



Air Buddy Development

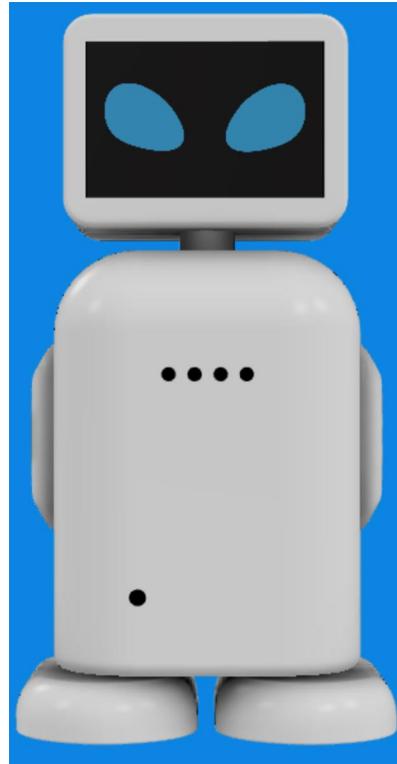


Original Inspiration:



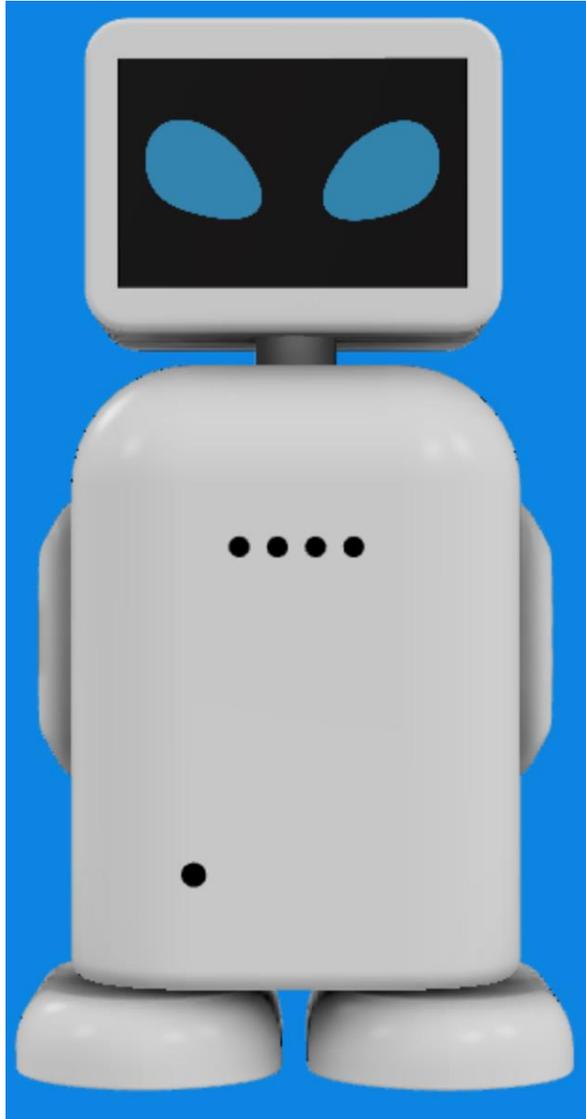
New Inspirations:





Current Concept

As we are planning on it being 3D printed, it will be made from PLA due to material and manufacturing constraints



As we are planning on it being 3D printed, it will be made from PLA

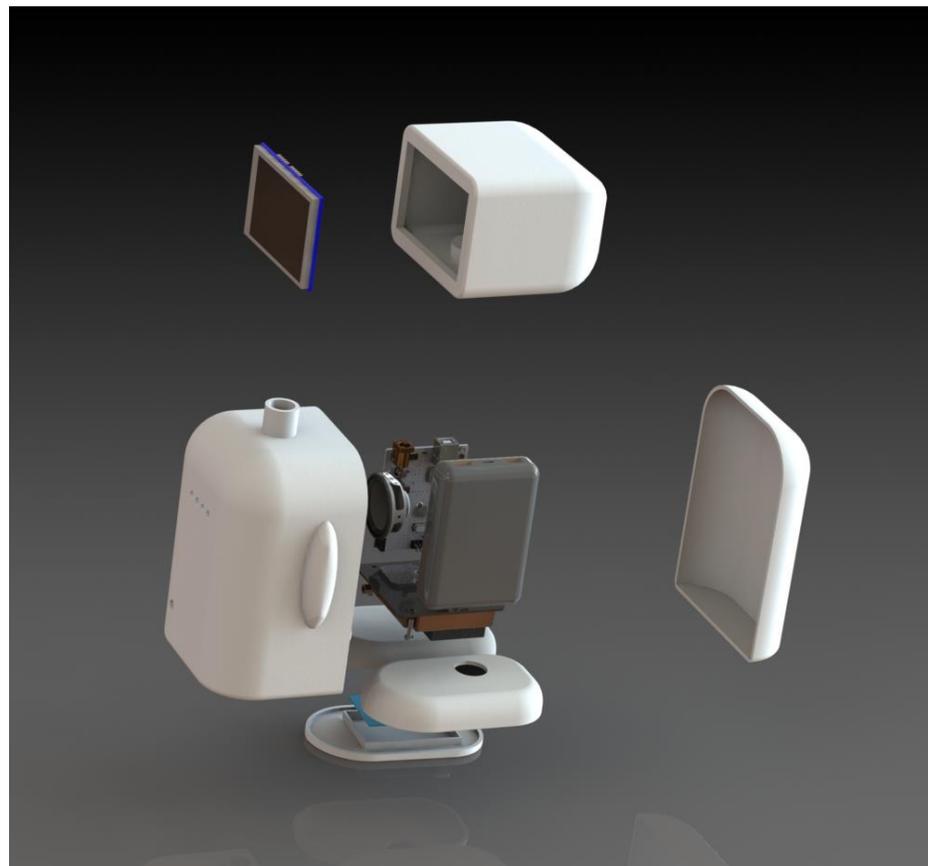
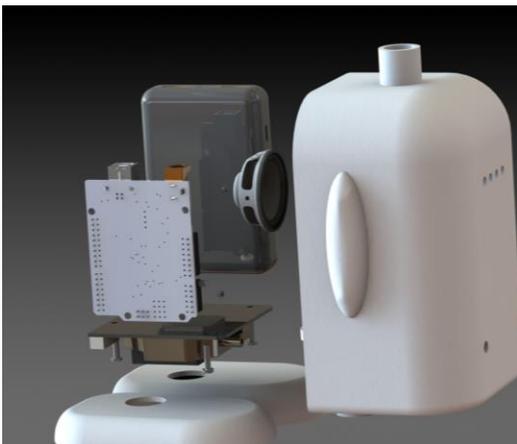
What The Air Buddy Does

A DIY interactive device, which changes its facial expression depending on fictional air quality stimulus from the board and provides the user with information about air quality (consisting of particulate matter 2.5 and 10 and the pollutants nitrogen oxides and carbon dioxide) through a speaker. To do so, it has an incorporated RFID reader that gets information from different RFID chips attached to the various city board props.

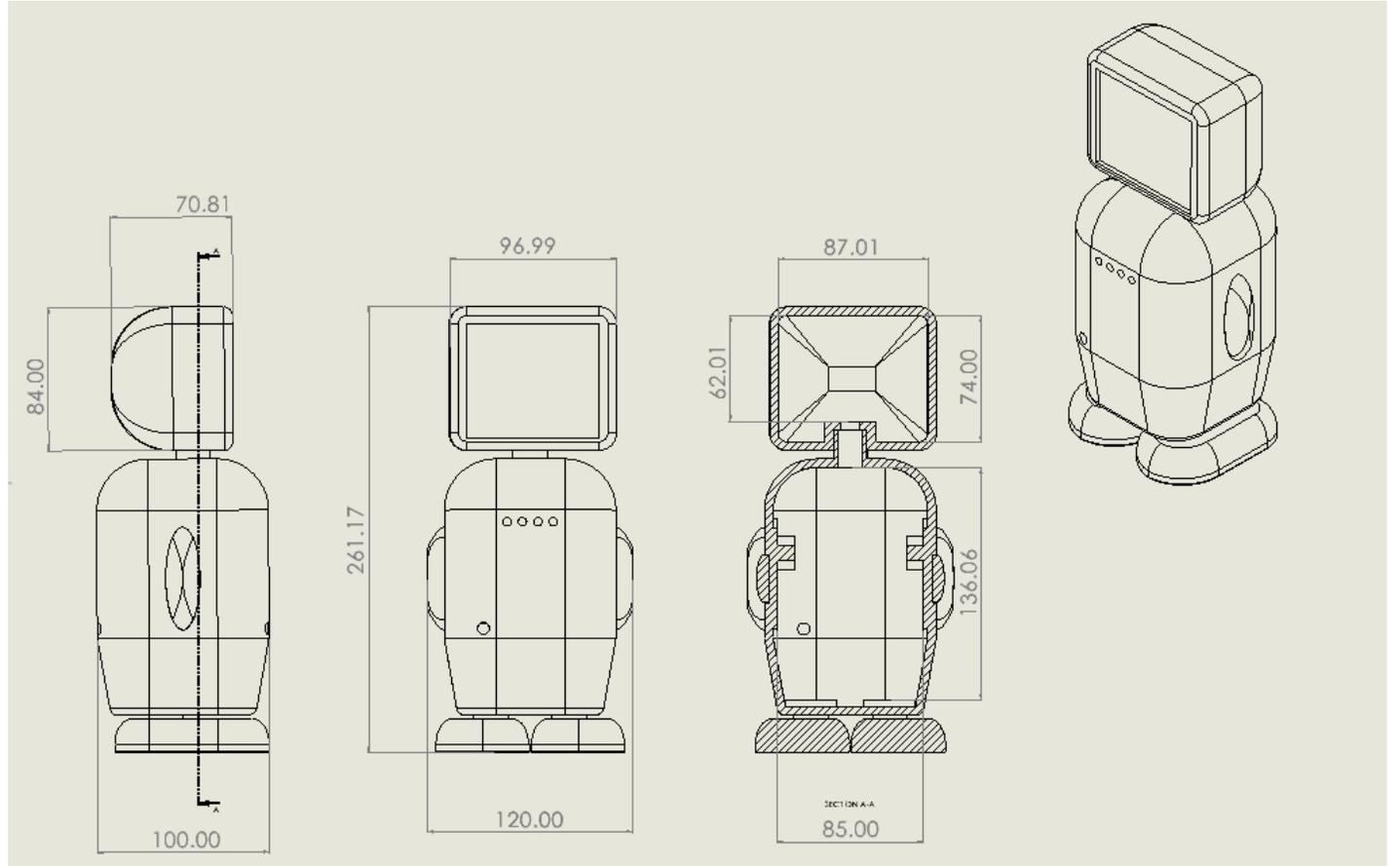
It contains an air quality sensor to detect particulate matter and pollutants, to be usable in real life situations. This addition is meant to give the Buddy a use outside of the board game for the workshops, to address air quality. The built-in LCD screen that displays the emotions, will in this case, also display the air quality values to keep the user informed.

Incorporates DIY assembly (with provided instructions) to allow users to gain hands on knowledge about basic smart technology and the components the Buddy is comprised of.

Renders



Technical Drawings

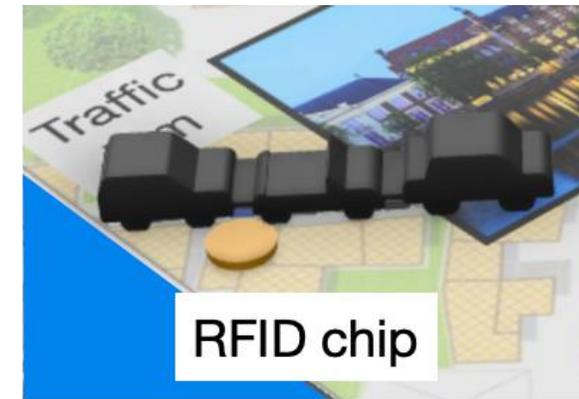


Sizes could change slightly after further prototyping and testing later on

Air Quality City Board (The Hague and its 8 districts)



Foldable, adaptable and customisable



Board comprised of 9 modular pieces

About The Board

Each modular part represents 1 of the 8 urban districts of The Hague

Each district will show 1-3 sites/buildings/landmarks



In the future, there is room for expansion, by making more boards for different cities, to be relatable to people worldwide

The octagon is a generalised city scattered with low to high air polluting sources

Each square branching off represents a different district in The Hague, to show air pollution can be anywhere

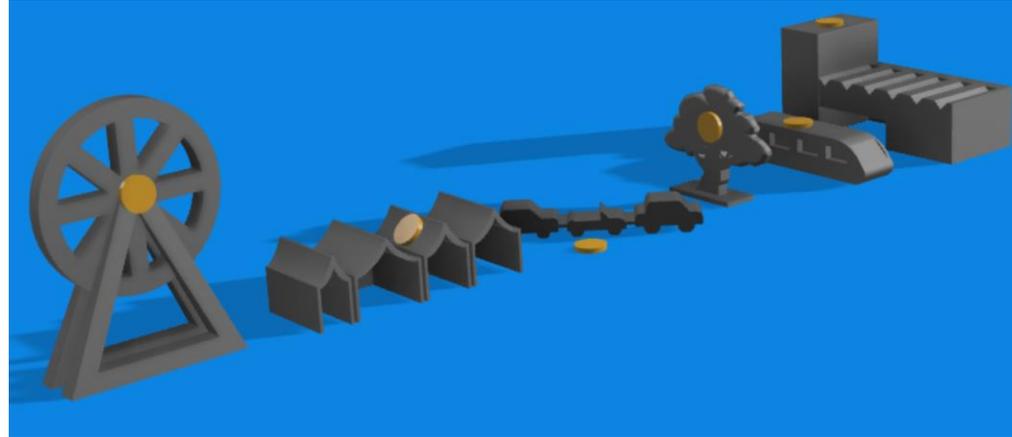
Air pollution sites range from low to high air pollution emissions (of nitrogen oxides, carbon dioxide, PM 2.5 and PM 10), to give an indication of main polluting sources.

Because the board and props are modular, the setup is customisable to user preference

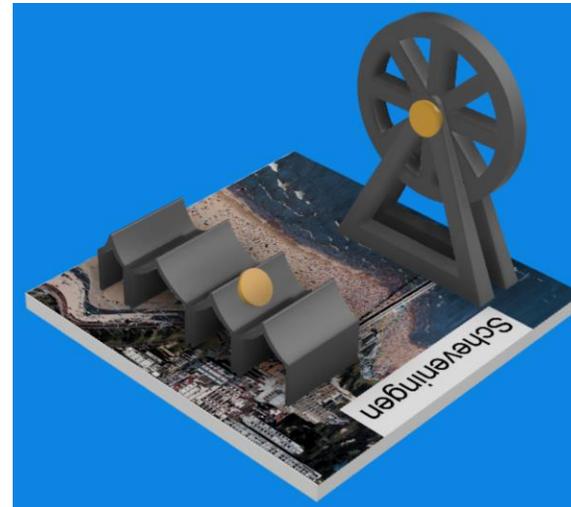
It will be made from corrugated plastic, to make it affordable, waterproof and lightweight for portability. So that it can be used either indoors or outdoors, to cater to different learning environments.

Props - Landmarks of The Hague

| Districts of The Hague | Sites/buildings/landmarks | Props to represent the site | Air pollution reading at the site |
|------------------------|---|--------------------------------|-----------------------------------|
| The Hague Centrum | Den Haag Central (train station) | Train, train station | High |
| | Peace Palace gardens | Tree | Low |
| Escamp | Zuiderpark | Tree | Low |
| | Rijswijk - railway station | Train | High |
| Haagse Hout | Haagse bos | Tree | Low |
| | Clingendael gardens | Bridge, tree | Low |
| | Eco Zonnepark 't Oor - solar power plant | Solar panel | Low |
| Laak | THUAS | Building, with roads around it | Medium |
| Leidscheveen -Ypenburg | A4 and A12 (major highways) intersect here | 2 big roads | High |
| Loosduinen | Kijkduin beach | Beach | Medium |
| | Estate (or landgoed) Ockenburgh - national park | Tree | Low |
| | Madstein park | Tree, lake | Low |
| Scheveningen | De Pier | Ferris wheel | Low |
| | Scheveningen Boulevard | Building | Medium |
| Segbroek | Uniper Stadcentrale Den Haag | Industrial looking building | High |



3D printed props used for the Scheveningen and The Hague Centrum boards

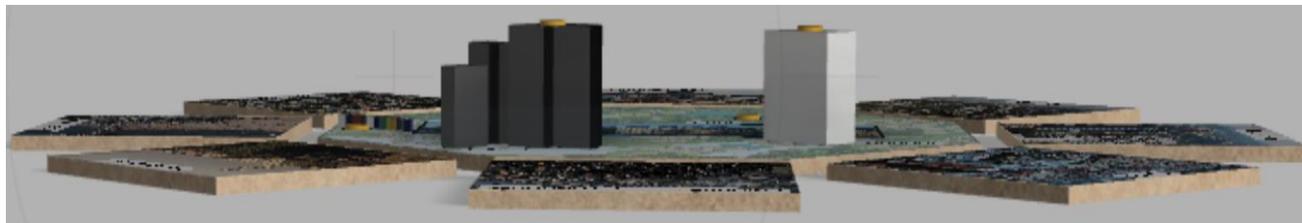


Used to establish a connection with the user

Each district board will hold 1 – 3 landmark props

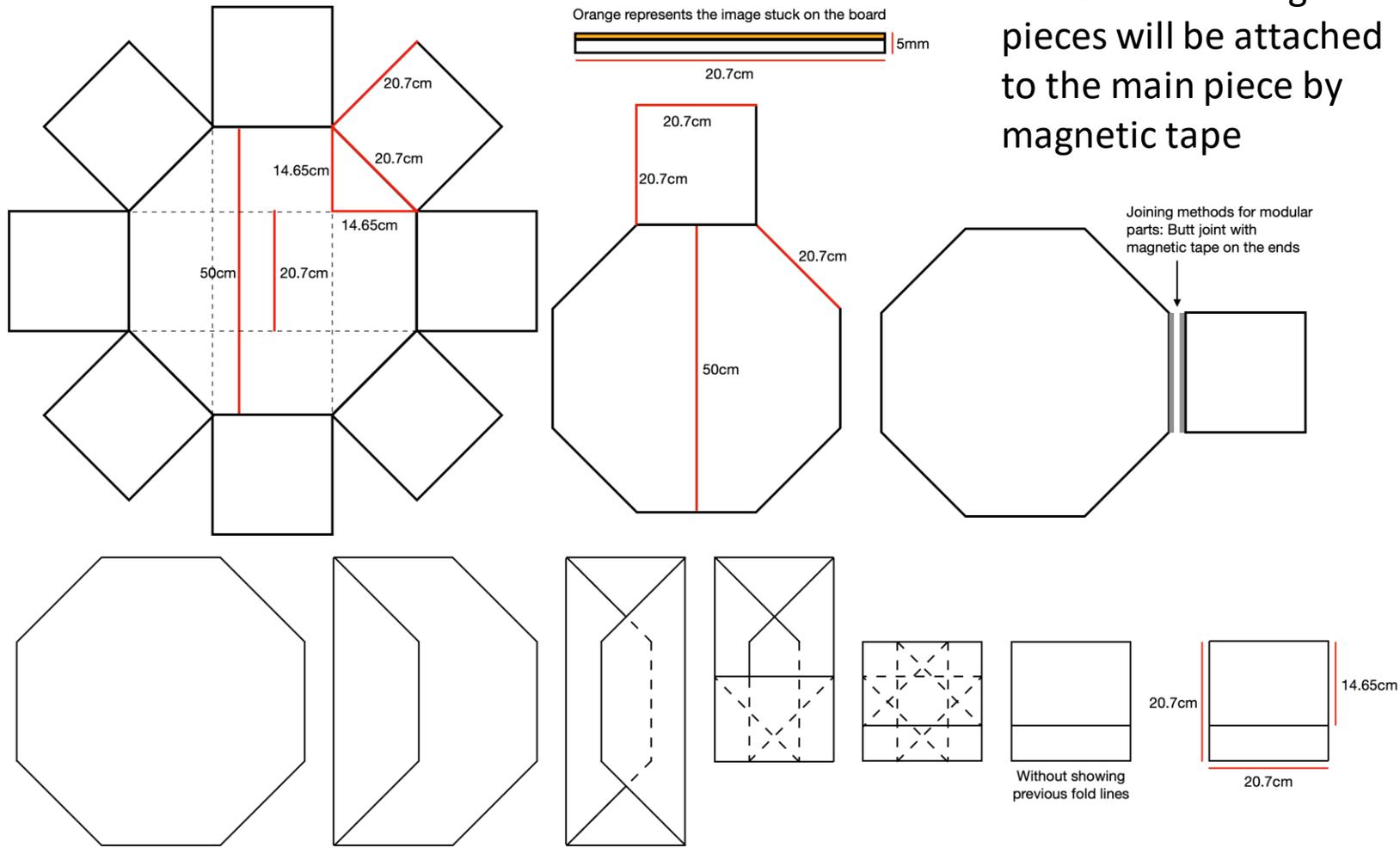
These sights will range from low to high air pollution emissions (of nitrogen oxides, carbon dioxide, PM 2.5 and PM 10)

City Board - 3D Model



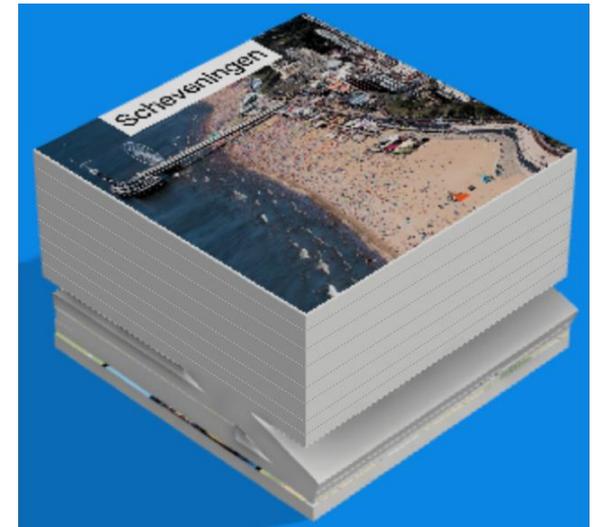
Example showing De Pier and Scheveningen Boulevard with RFID chips on props

Foldability



The 8 surrounding pieces will be attached to the main piece by magnetic tape

The octagonal piece is able to be folded into the same size as the surrounding pieces, resulting in a stackable board to be compact.



Example Information Sheet for Air Buddy

To aid users during the DIY assembly of the buddy and provide information about the workings of each component.

Also to provide users a better understanding of polluting gases, the effects of them, their sources and about particulate matter.

Information on Air Buddy Components

Arduino
Summary 

LCD screen
Summary  

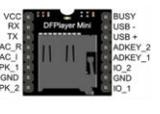
PCB board
Summary  

Speaker
Summary 

RFID chips, reader and card
Summary  

Air quality sensor
Summary  

Micro SD card
Summary 

DF player
Summary  

Information on Air Quality and Air Pollution

Particulate matter (PM)
The term for a mixture of solid particles and liquid droplets found in the air. The smaller the size, the more harmful it can be to your health and the environment. PM 10 can be found in dust and smoke. PM 2.5 is more harmful due to it being a smaller size, so therefore easier to inhale. The number refers to how many micrometers the particle is.

Carbon dioxide (CO₂)
One of the two most toxic air pollutants affecting our entire ecosystem, especially when at PM 2.5. Carbon dioxide emissions come from both natural and human sources. Natural sources such as respiration, do not negatively impact air quality, instead it is the human sources, such as deforestation and burning of fossil fuels (coal, oil and natural gas) which do harm.

Nitrogen oxides (NO_x)
Nitrogen oxides is a term that covers nitrogen oxide, nitrogen dioxide, nitrous acid and nitric acid. Nitrogen oxide is one of the two most toxic air pollutants and most detrimental to our health, causing lung, heart and brain disease, especially when at PM 2.5. NO_x pollution is emitted by automobiles, various non-road vehicles (eg construction equipment, boats, etc.) as well as industrial sources such as power plants and turbines.

Air pollution sources
Sources which use fossil fuels emit greenhouse gases and have the most harmful and negative affect on air quality. Examples of these include cars, construction sites, power plants, industries and more.

Air Buddy with City Board

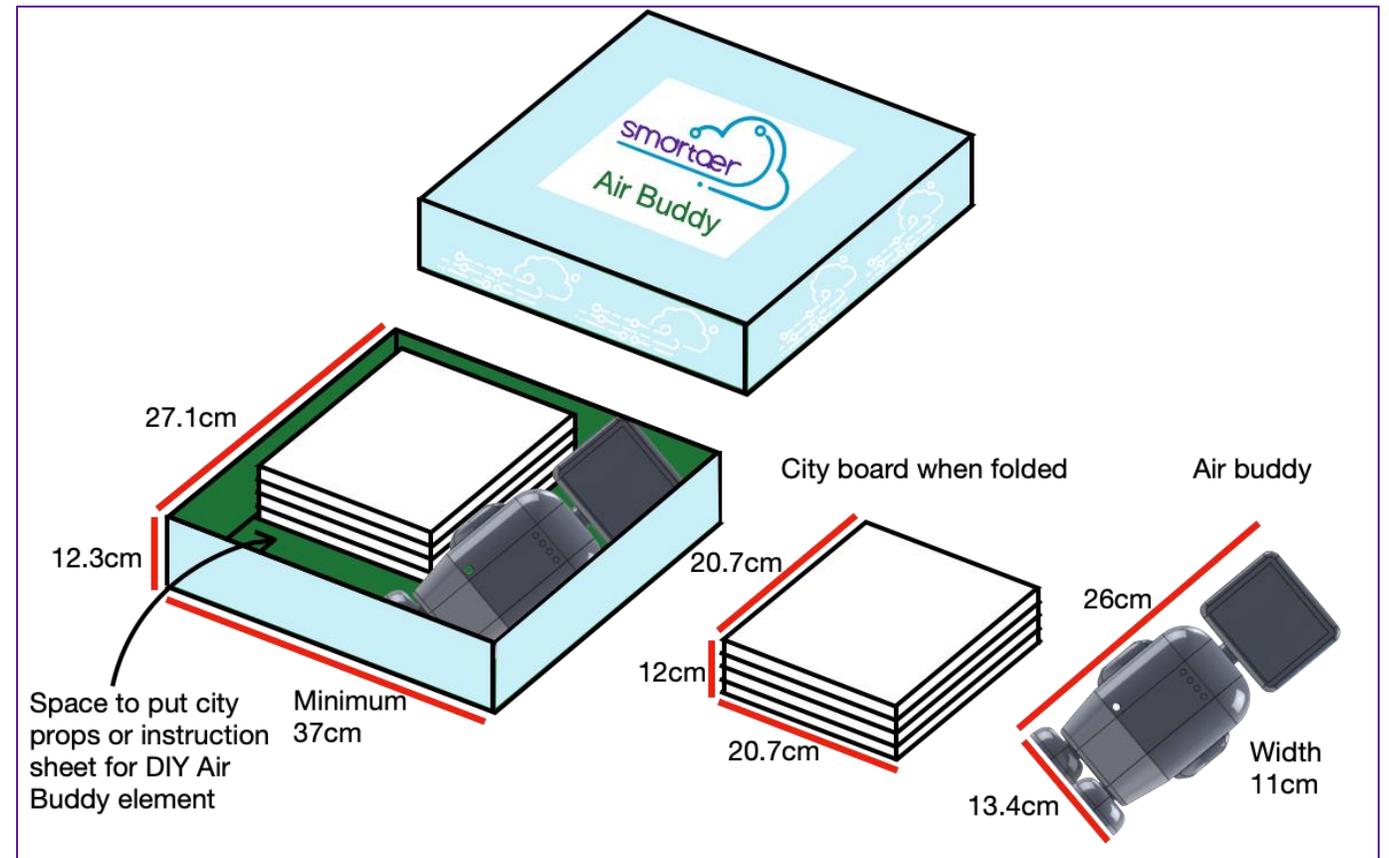


Packaging of Product

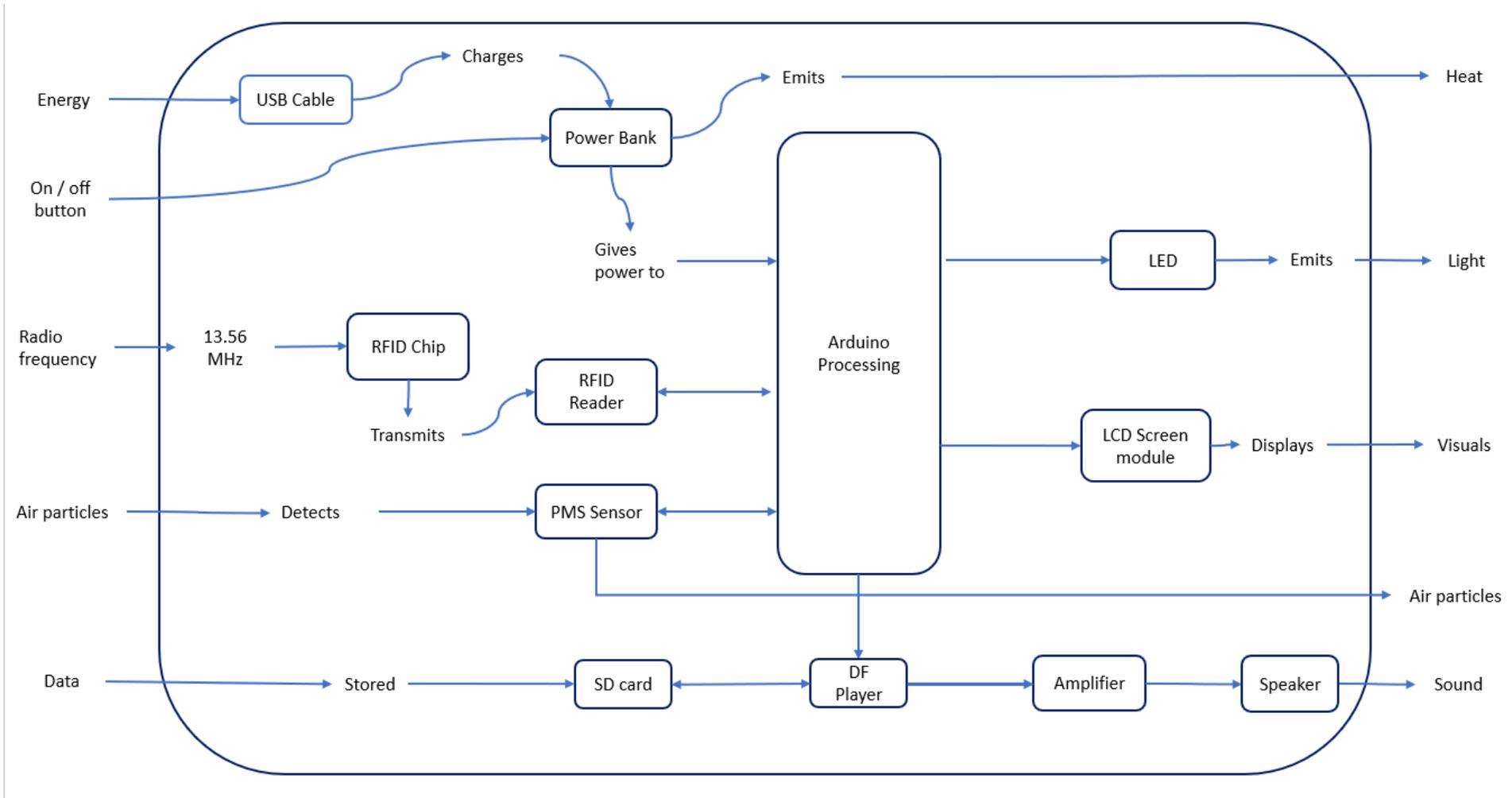


To house the Air Buddy, city board and 3D props that would be used for the city board.

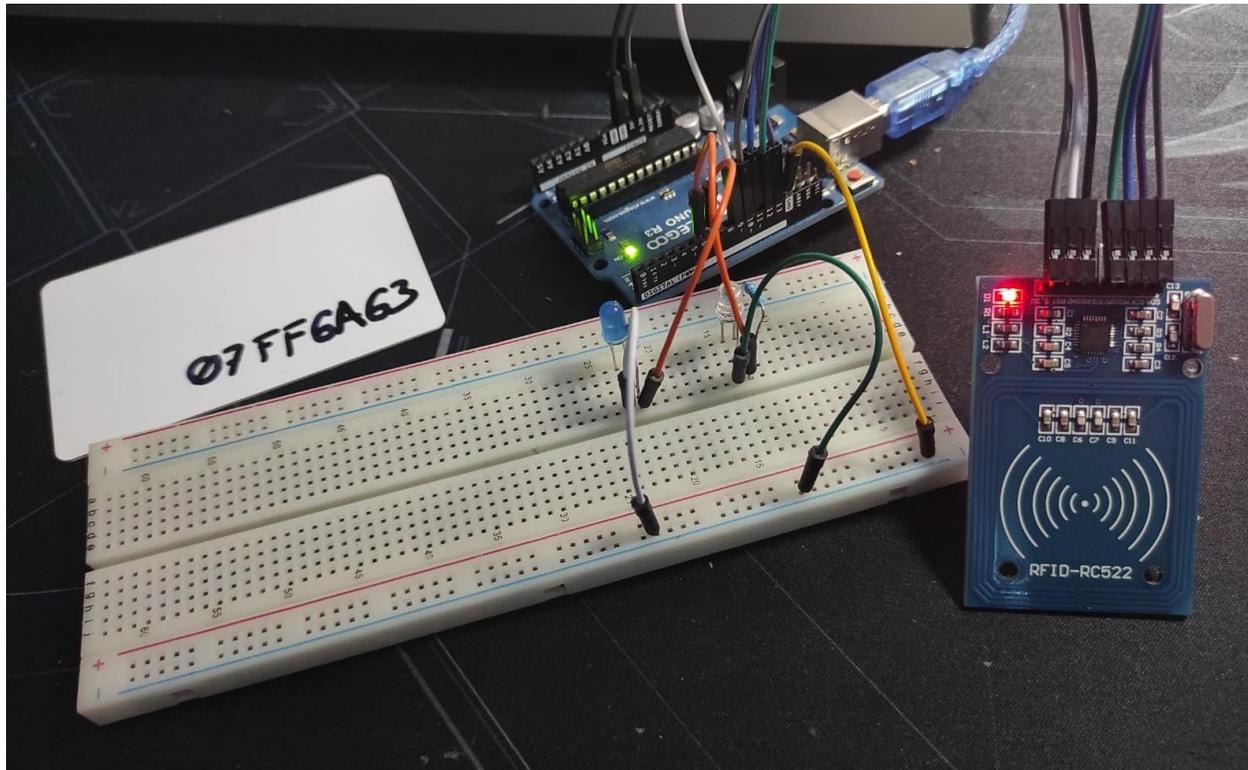
The size of this package may change later on, depending on any size changes the Air Buddy undergoes during further prototyping and testing.



System Diagrams & Components

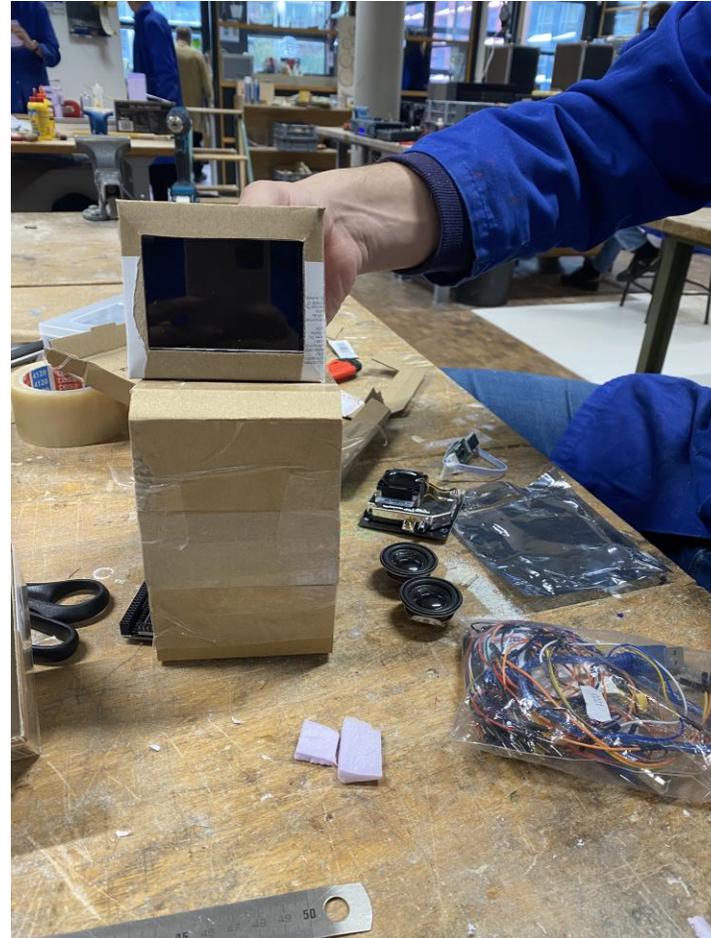
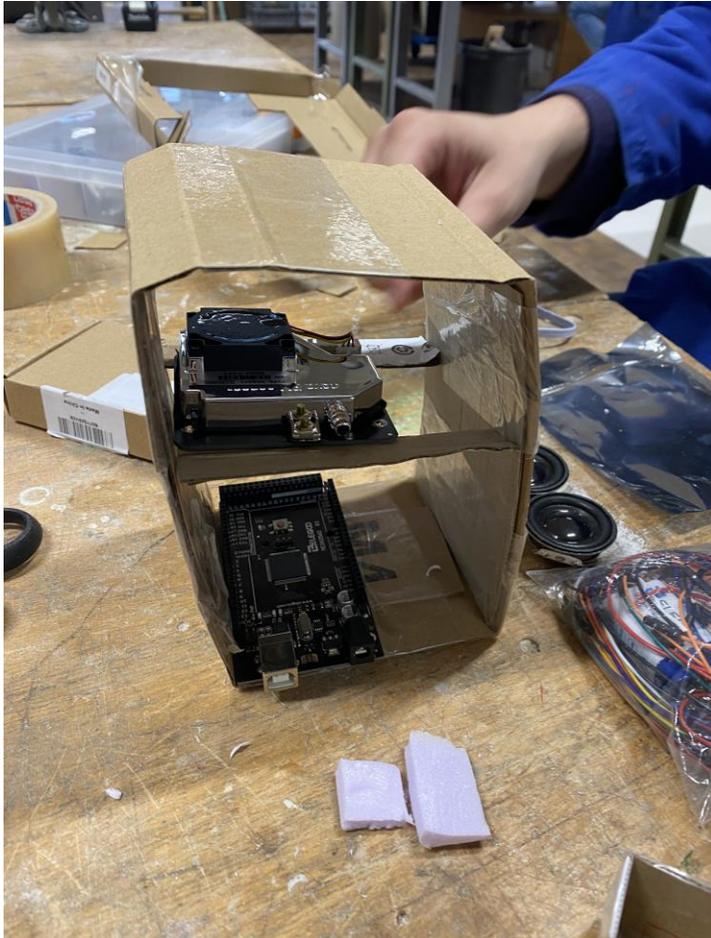


Coding Prototyping



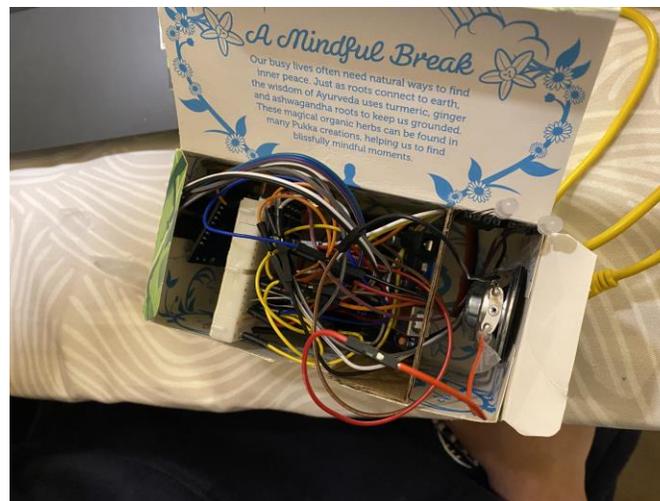
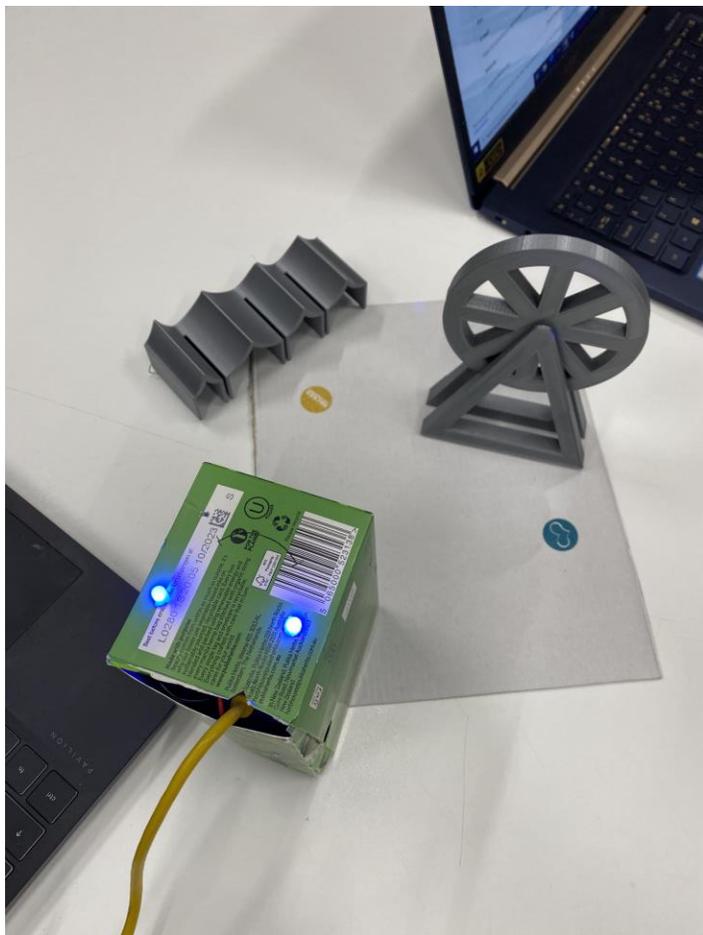
- Testing each component on individual codes and merge them together later into the final version

Prototyping For The Air Buddy



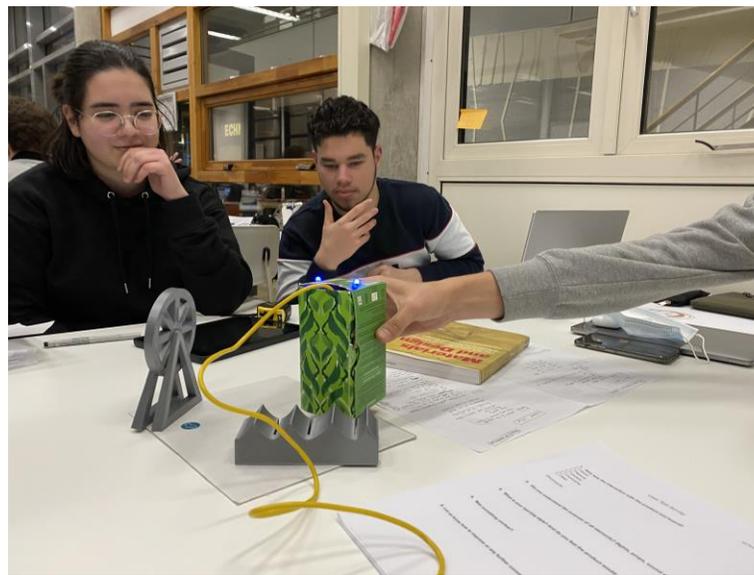
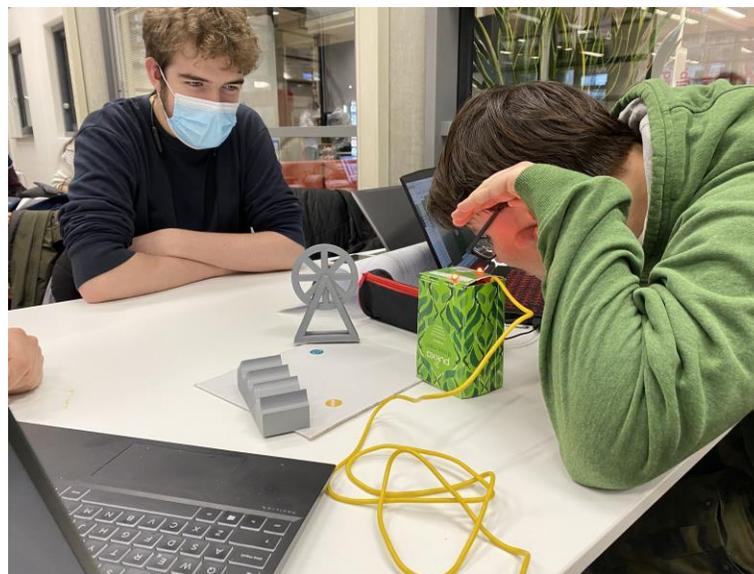
- Cardboard prototyping done to:
- Determine minimum size it can be whilst containing all the necessary components
- Test stability

Prototyping For User Testing



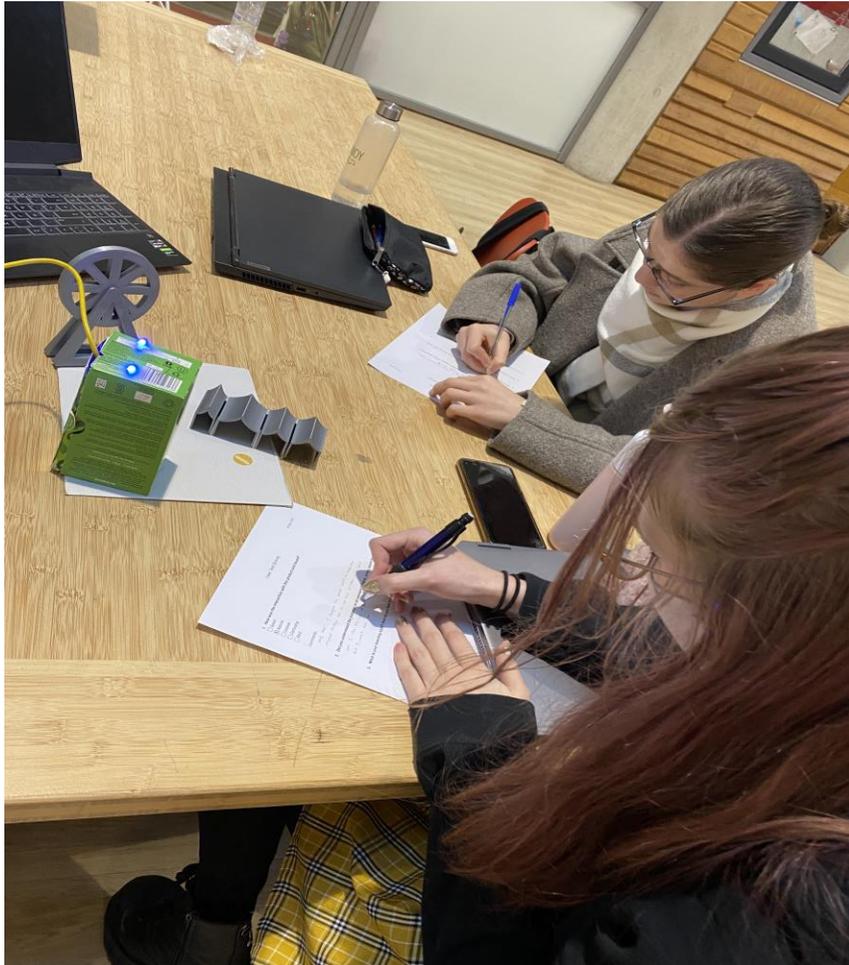
- Functional prototype for user testing
- Took out the AQ sensor and the screen to see how the user navigates through different props with the buddy
- Screen replaced by 2 RGB LEDs that also simulate emotions

User testing



- Tested on nearly 20 subjects
- Test aimed for students near our target group's age range
- Test aimed to
 - Observe interactivity with the prototype and board
 - Test RFID chips and reader together with props, board and audio
 - Test the understanding of the product as a whole
- Students were provided with a survey after the testing in order to get feedback

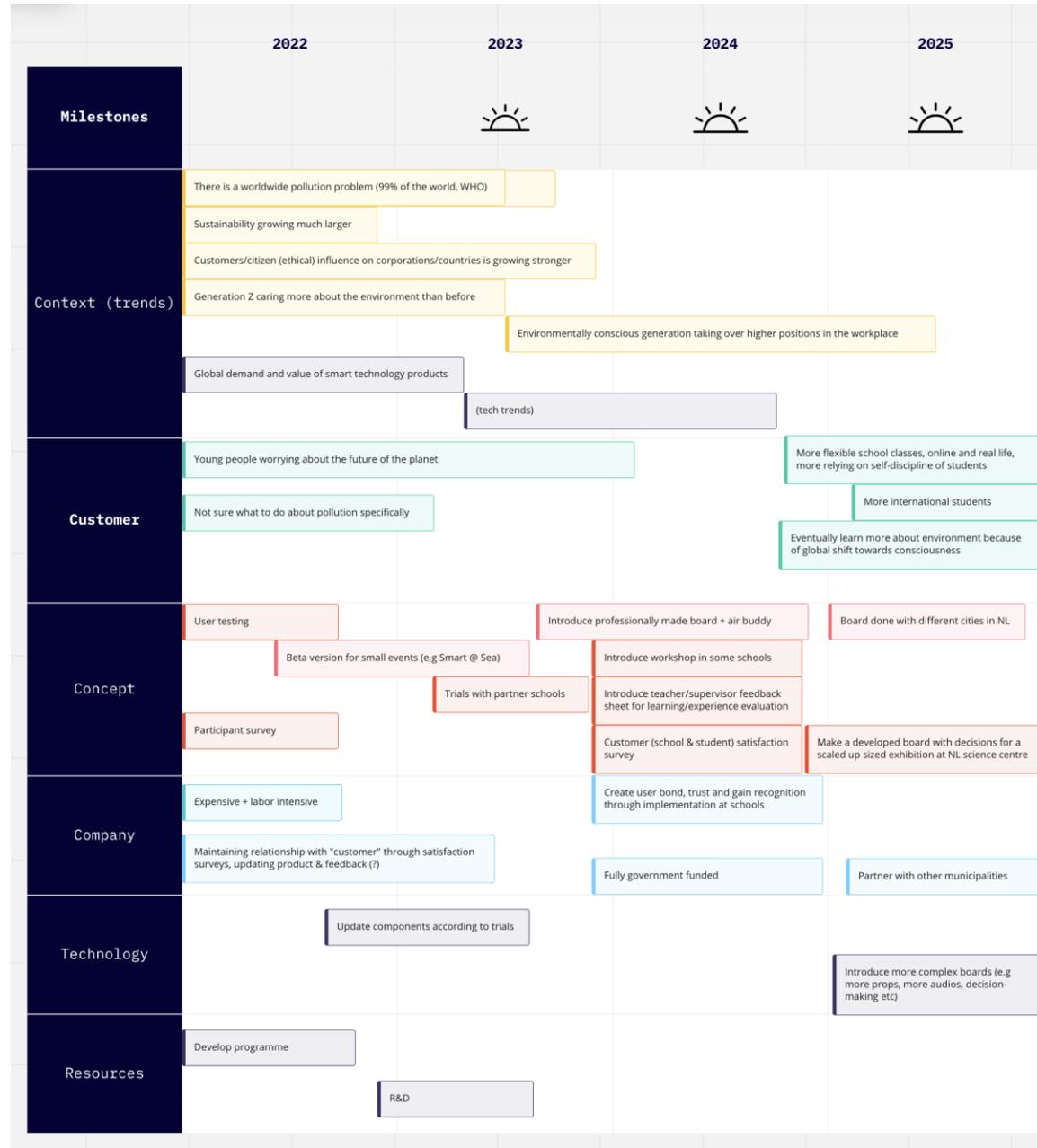
User testing outcomes



Things we could improve on based on feedback:

- The sound
- Sensor placement could be changed to inside or on the props rather than be in the board, to give more purpose to the props
- Think about how to make it more interesting than just "picking it up and moving it"
- Explain how the buddy "knows the place it is in" in the information sheets
- Include a reset button for the buddy or the code
- See if the buddy size can be reduced

Roadmap



Thank you

