WRO SOUTH AFRICA

FUTURE INNOVATORS

AGE GROUP	SENIOR

TEAM NAME

ECO INNOVATORS

South Africa

REPORT

ECO INNOVATORS

LIFE WITH NATURE'S RHYTHM

BY ECO INNVATORS

Faraz Mahomed + Siyanda Shabalala

FUTURE INNOVATORS 2023

Table Of Contents

- Front Page 1 1
- Cover Page 2
- Table Of Contents 3
- Meet The Team 4
- Summary 5
- Key Questions 6
- Timelines 7
- V2 Shipping Container 8
- V2 Vs Original Shipping Container 9
- Construction 10
- Cad Model 11
- Flow Chart 12
- Code 13-17
- Challenges And Acknowledgments 18
- Social Impact And Example 19
- Bibliography 20

Meet The Team

SIYANDA SHABALALA - 14 Years Old

- 14 Years Old
- Grade 9

ROLES

- Designer
- Robot Developer

FARAZ MAHOMED - 15 Years Old

- 15 Years Old
- Grade 9

ROLES

- Designer
- Coder
- Robot Developer

Summary

According to the **World Shipping Council** (WSC) approximately **1,382 shipping containers** are lost at sea annually covering 80% of the global vessel container capacity. Furthermore fire outbreaks occur 200 times a year on these ships.

The Topic of the 2023 WRO Competition is **Connecting The World** and the world is best connected by shipping containers, although shipping containers are in need of improvement because they have some issues. They are too heavy, expensive to maintain and cannot talk to us.

Our project **redesigns** the shipping container by making it **lighter** and **stronger** using carbon fiber and **Closed-Cell PVC Foam** as-well as **connecting it to people** across the globe by talking to us about its environment

The robot uses all kinds of **sensors** to tell us whats going on. It is able to sense **temperature**, **g-force**, **sound** levels and much more which all work together to make an **immersive** environment for our container to talk to us and the crew onboard the ship

Key Questions

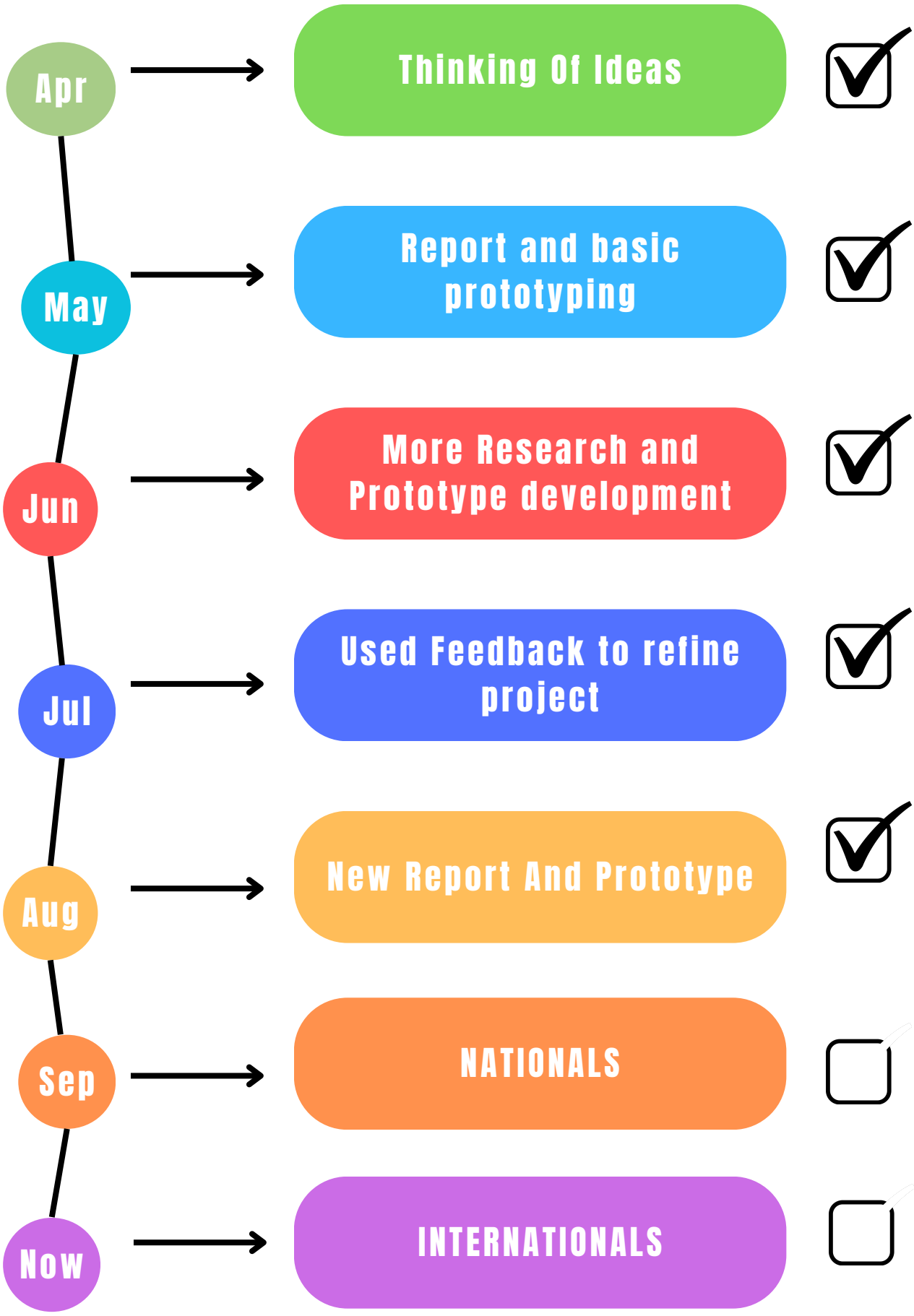
What Is The Problem Being Addressed - Our robotics project addresses key challenges in cargo shipping such as shipping containers being lost at sea.

How Will This Project Solve The Problem - Our robotics project addresses key challenges by **integrating light but strong shipping containers**; our project aims to create a more sustainable, environmentally friendly, and economically efficient shipping container.

What Is The Value Of This Project - The robotic solution offers **immense value** by **promoting** feedback, sustainable shipping practices, **protecting marine ecosystems**, **reducing pollution**, and enhancing **operational efficiency**. If implemented in real life, it would **revolutionize the cargo shipping industry.**

Why Is This Project Important - This project is important as it addresses environmental impact, **protects marine life**, **reduces pollution**, and **improves efficiency** by talking back to us and giving us important data in cargo shipping.

Timelines


Apr
Thinking Of Ideas
May
Report and basic prototyping
Jun
More Research and Prototype development
Jul
Used Feedback to refine project
Aug
New Report And Prototype
Sep
NATIONALS
Now
INTERNATIONALS

V2 Shipping Container

Introducing the **Game-Changing Shipping Container:** Redefining Efficiency, Safety, and Versatility

Efficiency is the cornerstone of our container design. Crafted from lightweight yet incredibly durable carbon fiber, our container optimizes payload capacity while minimizing weight. This means more goods transported with every trip, maximizing **efficiency** and **profitability**.

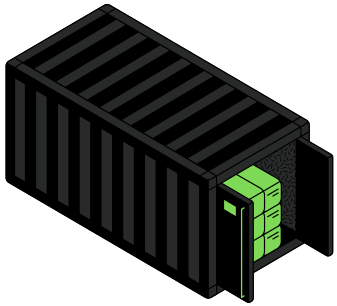
Say goodbye to wasted space and hello to a lean, agile, and cost-effective shipping solution.

Safety takes center stage in our container's innovative features being multiple sensors that collect data such as temperature, g-force, rotation, smoke detection and much more. The container is equipped with heat-sensitive fireballs and constant communication with us. It boasts an unparalleled fire prevention system that instantly activates, extinguishing potential fires and safeguarding your valuable cargo.

Rest easy knowing that your goods are protected from unforeseen risks, giving you peace of mind throughout the entire shipping process.

Versatility is our container's middle name. With a Closed-Cell PVC Foam frame, it exhibits exceptional **buoyancy**, ensuring that even if it falls into the ocean, it remains afloat and visible. This not only enhances safety and facilitates recovery but also minimizes losses and disruptions to your supply chain. Experience unmatched adaptability and efficiency in any shipping scenario.

Don't settle for ordinary shipping containers that limit your potential. Embrace the extraordinary with our game-changing shipping container.



Comparison

ORIGINAL SHIPPING CONTAINER

20 foot

2000 - 2500 KG

WEIGHT

20 foot

29 000 - 30 000 KG

PAYLOAD

Locks
Castings
Corton Steel

SAFETY

V1 SHIPPING CONTAINER

20 foot

450 - 1150 KG

WEIGHT

20 foot

29 000 - 30 000 KG

PAYLOAD

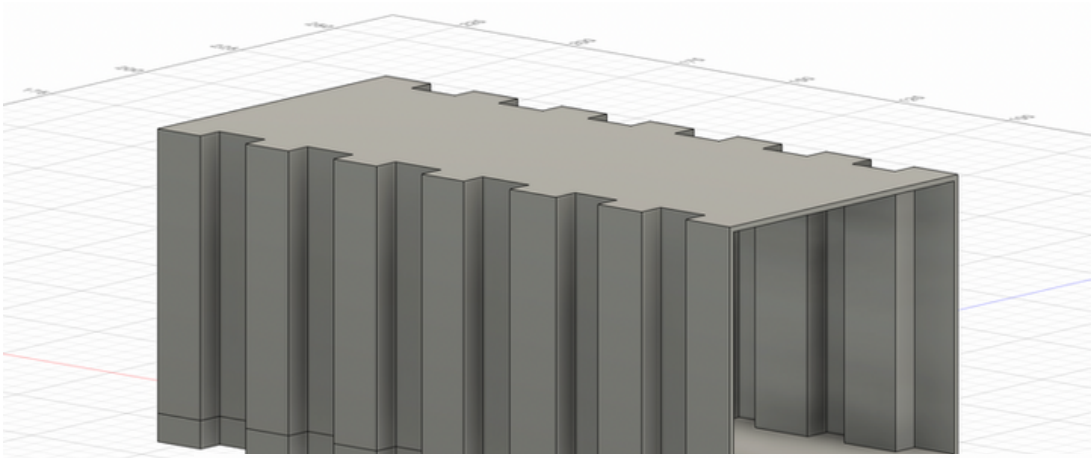
Locks
Communication
Floatation
Fire Sensors

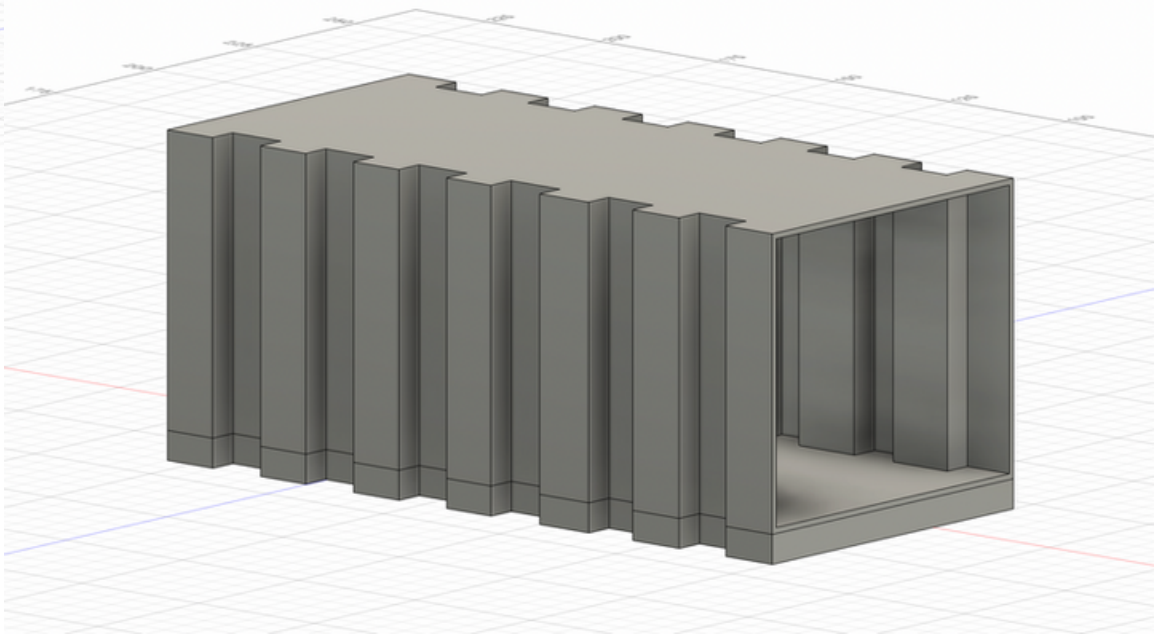
SAFETY

Construction

The V2 Shipping Container will be made using carbon fiber, closed cell PVC foam in the frame to allow buoyancy combined with sensors to sense the environment around it. Additionally it will have a fireball that will be used to eliminate risk of fire spreading in the event of an outbreak.

The **Prototype Development** is 3D Printed. Our casing uses foam to simulate the floating capabilities. We are using *micro:bits* paired with its built in sensors along with additional sensors for better accuracy. To make the fireball we are using a water-balloon filled with some air and flour to simulate our fire extinguishing powder.

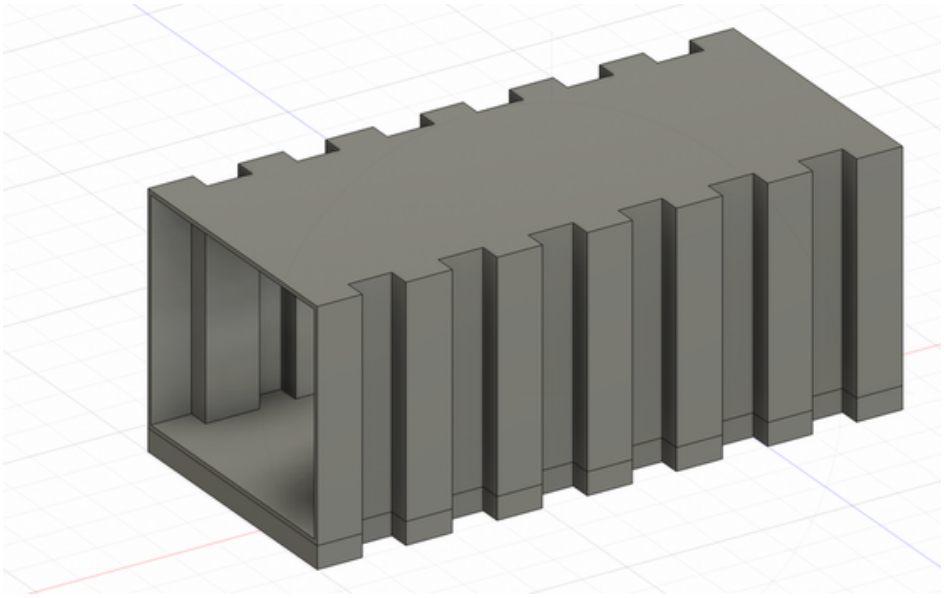


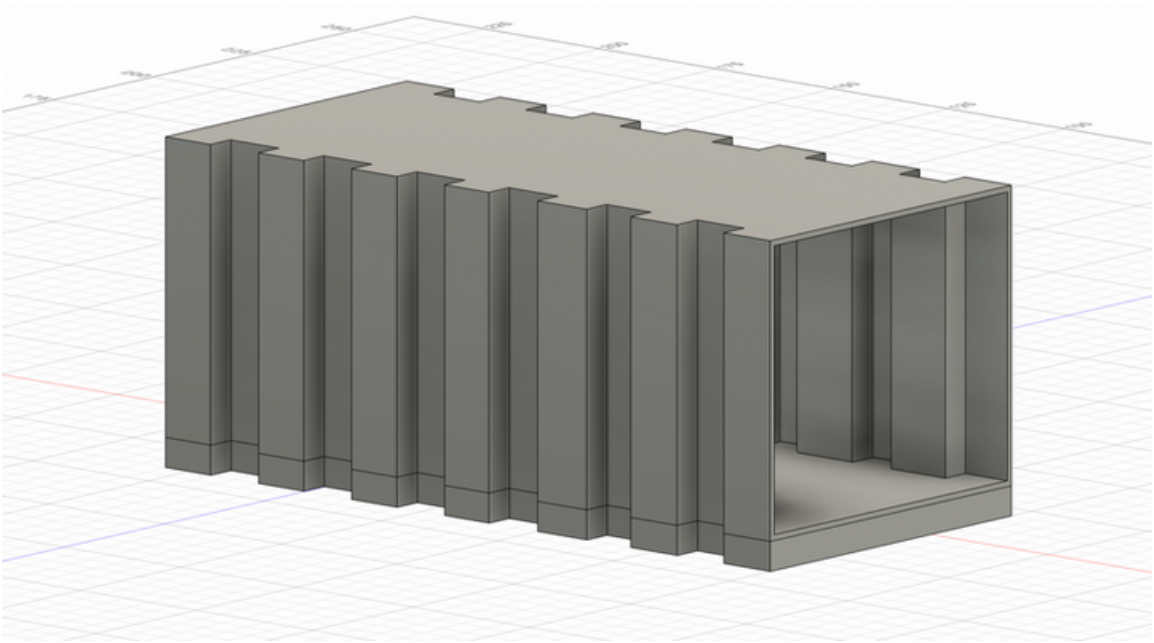


PICTURES WILL BE CHANGED TO 3D PRINTED PROTOTYPE

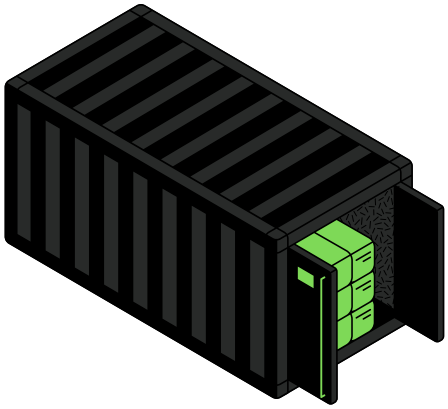
Prototype

CAD Model



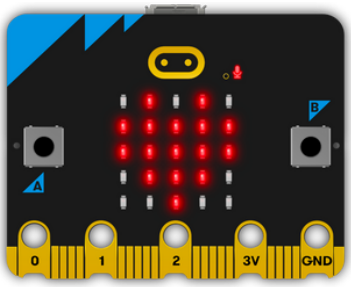


Flow Chart

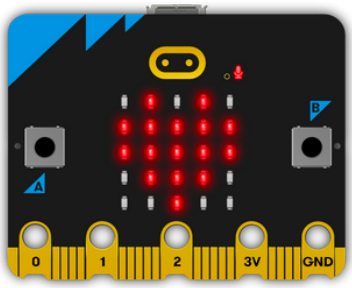


Shipping Container

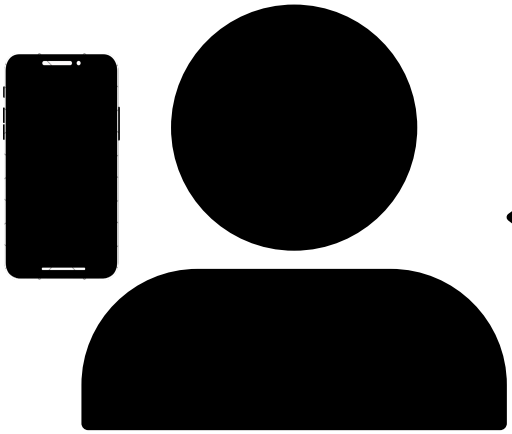
MICROBIT



- Temperature
- G-Force
- Rotation
- Pitch + Roll
- Sound Levels
- Air Quality
- Smoke Sensor

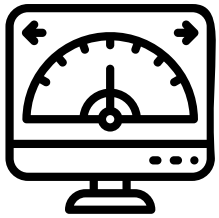


Microbit #2

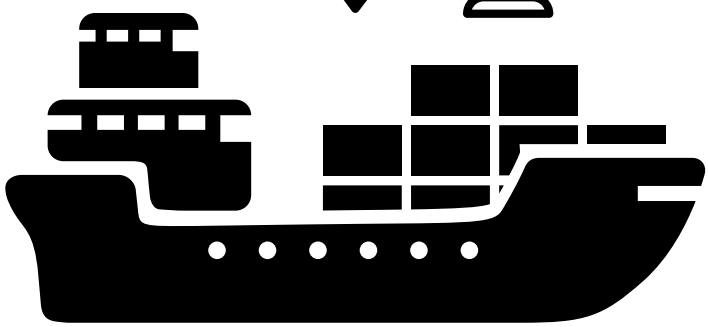


OWNER

- App Connected to Phone



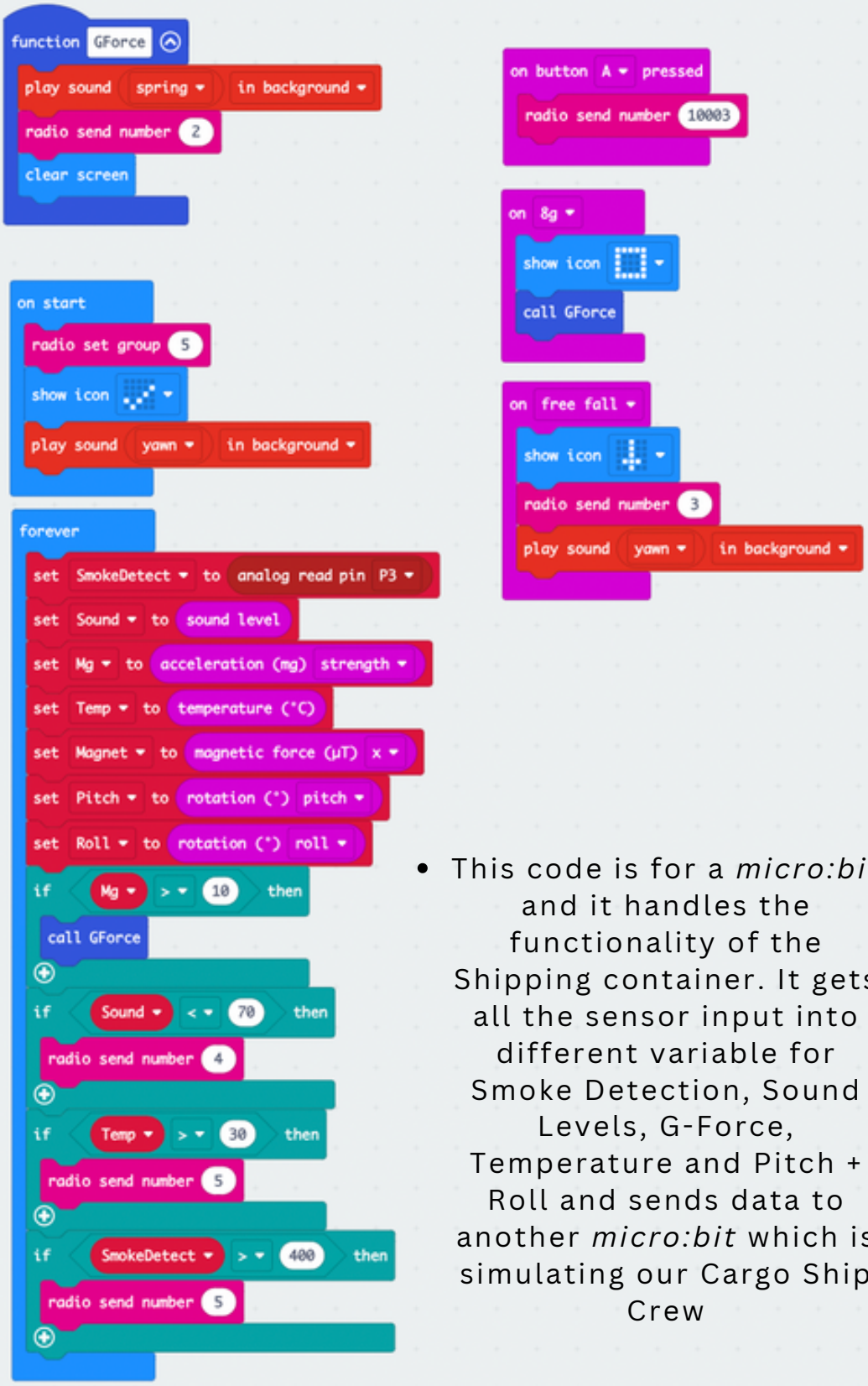
- Dashboard



CARGO SHIP CREW

Code

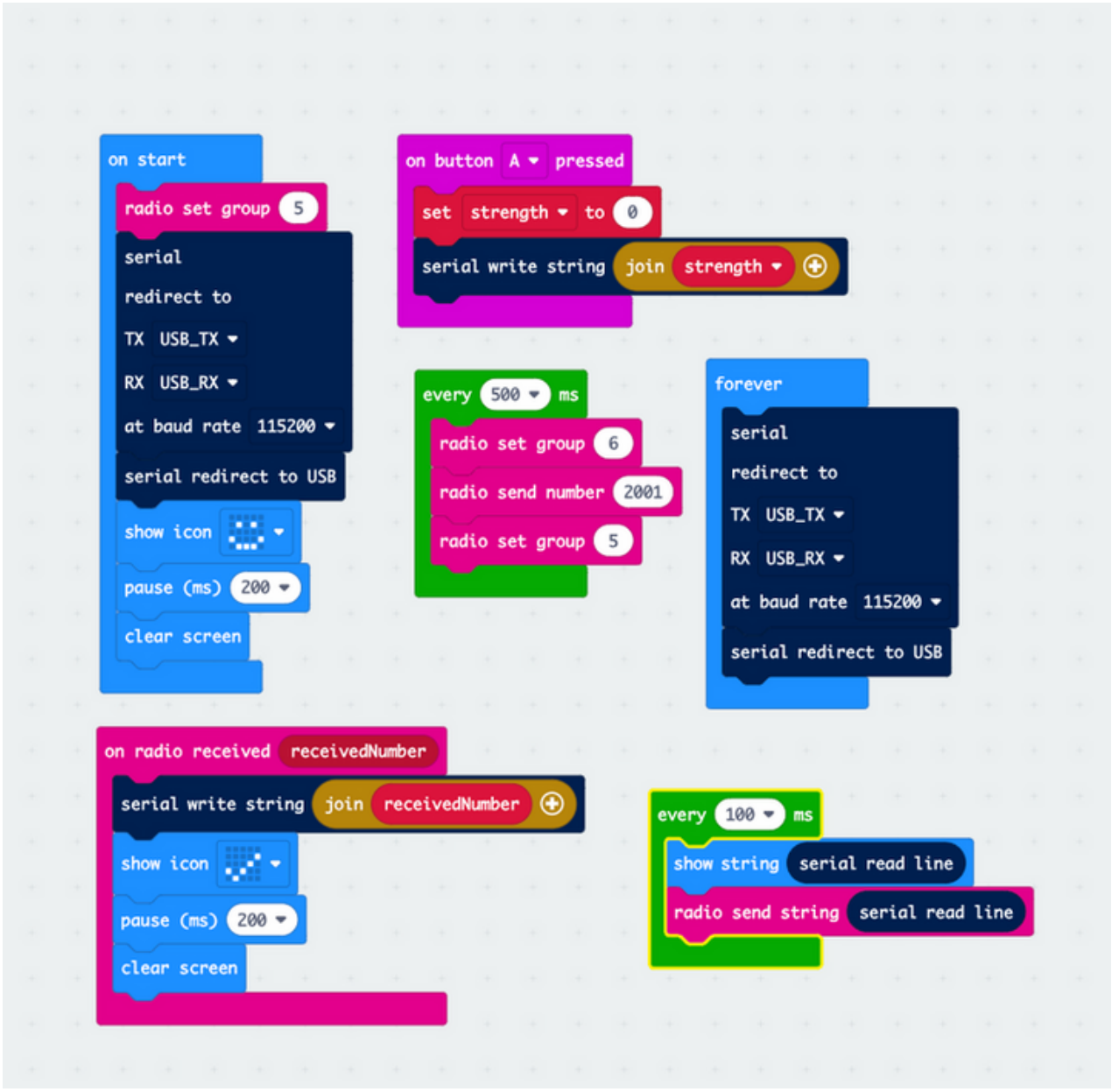
- **V1 Shipping Container**



- This code is for a *micro:bit* and it handles the functionality of the Shipping container. It gets all the sensor input into different variable for Smoke Detection, Sound Levels, G-Force, Temperature and Pitch + Roll and sends data to another *micro:bit* which is simulating our Cargo Ship Crew

Code

- **V1 Reciever**



- This code is for a *micro:bit* and it handles the functionality of the Cargo Ship crew that receives the data from the shipping container that will then send the data to the owners and the captain of the ship on an app/dashboard

Code

- **App Code**

```
ports = serial.tools.list_ports.comports()

for port in ports:
    print(port)
ports = serial.tools.list_ports.comports()
for port in ports:
    print(port)
```

- This Code gets all the **connected devices** to the computer and prints and/or displays them to the terminal window.

```
ser = serial.Serial('/dev/cu.usbmodem1102', 115200)

data = ser.read()
print(data)
```

- This Code is the **Testing** code to get the data from the Reciever m*icro:bit*

```
class MyApp(MDApp):
    def build(self):
        self.theme_cls.theme_style = "Dark"
        self.theme_cls.primary_palette = "LightGreen"
        self.theme_cls.accent_palette = "LightGreen"
        MyApp.title = "WRO 2023"
        return Builder.load_file('App.kv')
if __name__ == '__main__':
    MyApp().run()
```

- This code makes the **framework** of the App using Kivy and KivyMD and sets basic parameters for asthetics and links it to the main MD FIle

Code

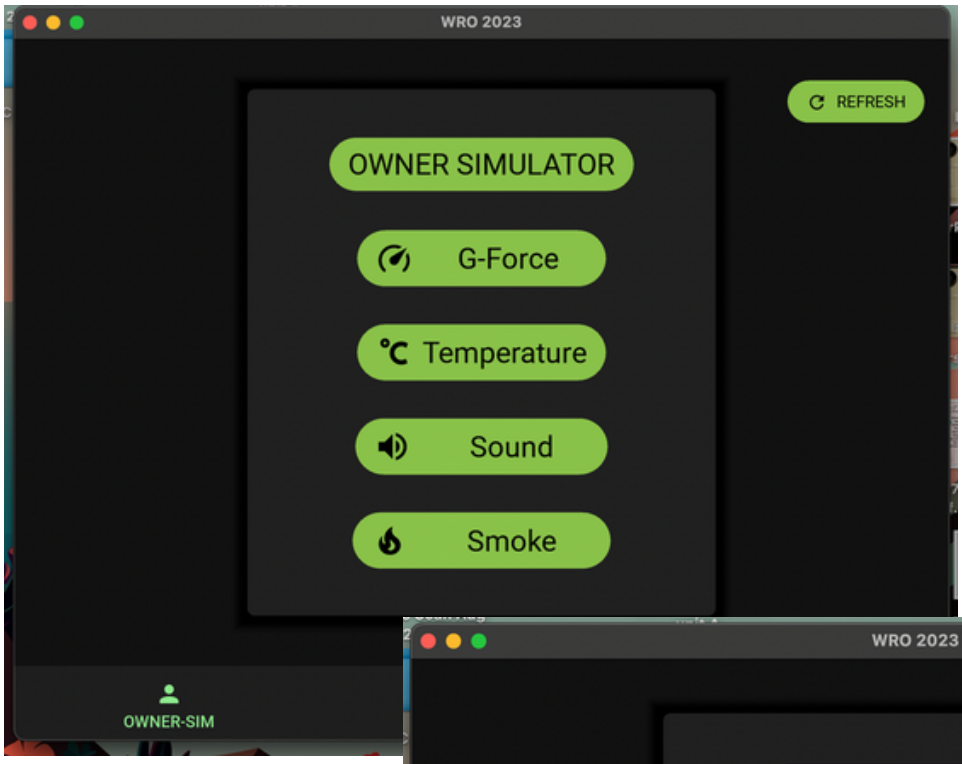
- **App MD File**

```
MDScreen:

    MDBottomNavigation:
        selected_color_background: "green"
        text_color_active: "lightgreen"

        MDBottomNavigationItem:
            name: 'screen 1'
            text: 'Owner-Sim'
            icon: 'account'


            MDCard:
                size_hint: None, None
                size: 800, 900
                pos_hint: {"center_x": 0.5, "center_y": 0.5}
                elevation: 10

            MDFillRoundFlatButton:
                text: "OWNER SIMULATOR"
                font_size: 50
                pos_hint: {"center_x": 0.5, "center_y": 0.8}

            MDFillRoundFlatIconButton:
                text: 'Temperature'
                icon: 'temperature-celsius'
                font_size: 50
                pos_hint: {"center_x": 0.5, "center_y": 0.5}

            MDFillRoundFlatIconButton:
                text: '     G-Force     '
                icon: 'speedometer'
                font_size: 50
                pos_hint: {"center_x": 0.5, "center_y": 0.65}
```

- This is the **MD File** that is responsible for the **visual aspects** of the app that will be linked to the backend of the app.

Code

- **DASHBOARD APP**



- In these pictures you can see the design for the **Dashboard app** where the sensor **data** will be **displayed**

PICTURES WILL BE CHANGED TO LATEST PROTOTYPE

CHALLENGES

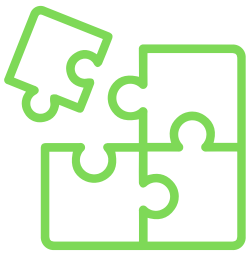
During our project, we faced several challenges that put our determination to the test.

- **Load shedding** caused frequent interruptions during 3D printing, hindering the progress of our prototype development.

- **Delays** in parts delivery from the stores further delayed us, leaving us with limited time to work on our project.

- **School**; The added stress of exams, Projects and the heavy workload from school made it challenging to balance our commitments.

Despite these obstacles, we had dedication to the project. Our resilience and teamwork allowed us to navigate through these challenges, finding creative solutions and pushing forward with our innovative cargo ship design but most importantly having fun and learning new things along the way



ACKNOLEDGEMENTS

Despite us having challenges we also have alot to be thankful for such as...

- our families, coaches and peers for the constant support and motivation.

- W.R.O for giving us an opportunity to compete and share our visions and the opportunity to learn from others around us

- And the amazing members on this team who made it possible and allowed for the project to be fun and exciting at all times

Impact On Society

Our project creates a significant impact on society by promoting **environmental sustainability** and marine conservation. Through our shipping container that is equipped with systems to keep it floating if it falls overboard as-well as systems to warn and alert us about whats going on in the ships environment. Contibuting to a greener future, we promote living life with natures rhythm .

Example

Example: Our cargo ship project can be used in real-life scenarios for transporting goods between major ports in the Pacific Ocean, connecting continents and regions with high shipping volumes. For example the trade route between Asia and North America, which experiences substantial traffic. Here are the following senarios.

In the event of high g-force the system is able to warn the owners and crew of something being wrong so they can look into the situation and check the container for faults or damages.

In the event of high temperature and smoke detection the system is able to deploy, warn the owners and crew about a possible fire as well as deploying a fireball to aid in eliminating the risk at hand.

The systems can be used in multiple ways all working with one another to create an immersive environment for feedback to the container owner and crew

BIBLIOGRAPHY

Marine Insight, Available at: https://www.marineinsight.com/
Accessed Date: 10 June 2023

Ship Technology, Available at: https://www.ship-technology.com/
Accessed Date: 10 June 2023

Composite Materials Handbook. Available at: carbonfiber.com
Accessed Date: 20 June 2023

Containerization International, Available at: https://container-mag.com/
Accessed Date: 22 June 2023

Images Availible At:
Canva.com
Accessed date: 10 July - 31 August 2023

SOFTWARE

BLENDER: BLENDER.ORG - 3D MODELS
CANVA: CANVA.COM - VISUALS AND REPORT DESIGN
CIRCUIT DIAGRAM: CIRCUITDIAGRAMS.ORG - CIRCUITS
ARDUINO IDE: ARDUINO.CC - CODING HARDWARE
PYCHARM: JETBRAINS.ORG - CODING SOFTWARE
MICROBIT IDE: MICROSOFT.COM - CODING SOFTWARE
FUSION360: AUTODESK.COM - CAD MODELS
KIVYMD: KIVY.ORG - APP FRAMEWORK

PEOPLE

MR MELUSI SHEZI

MR BRADLEY MALOPE

MR FARADH MAHOMED