Floating Waste Bin

Prevent the Pollution of Waterbodies in Hamburg

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Background 1

Situation

- During the summer, people flock to the **city lakes and rivers** for various water activities.
- Unfortunately, this surge in recreational use often leads to **water pollution** due to the lack of **proper disposal bins**.
- **Plastic, glass, and packaging waste** that have been thrown into the water; harm the environment, including local flora and fauna, even oceans.

Scope

- Develop a floating waste bin to provide **waste collection points** directly on the waterbodies.
- Make the waste disposal on the waterbodies as **easy and comfortable** as possible.

Design Considerations 2

Critical Design Requirements

- **Float** in water;
- **Stable** in all weather situations;
- **Easy to empty**, particularly for SRH staff.

Buoyancy Optimization: A bin with a relatively **broader base** to generate adequate buoyant force.

Floatation: Air voids to **reduce the average density** of the bin.

Stability: Ensuring the **metacenter** stayed constantly above the centre of gravity.

Ergonomic Design

- Design a garbage container that was both **user-friendly and functional**.
- A lid opening mechanism made up of **torsional springs and rotating dampers** were part of this design, guaranteeing that the lid retracts gently.

Validation 3

- **CAD Model Validation:** Rigorous validation in **MATLAB** with fluid mechanics equations.
- **Prototyping and Testing:** Visually representing the design and validating the practicality, a 3D-printed prototype was fabricated.
- The prototype was redesigned using a **design for additive manufacturing approach** to have a minimal support structure and less material.

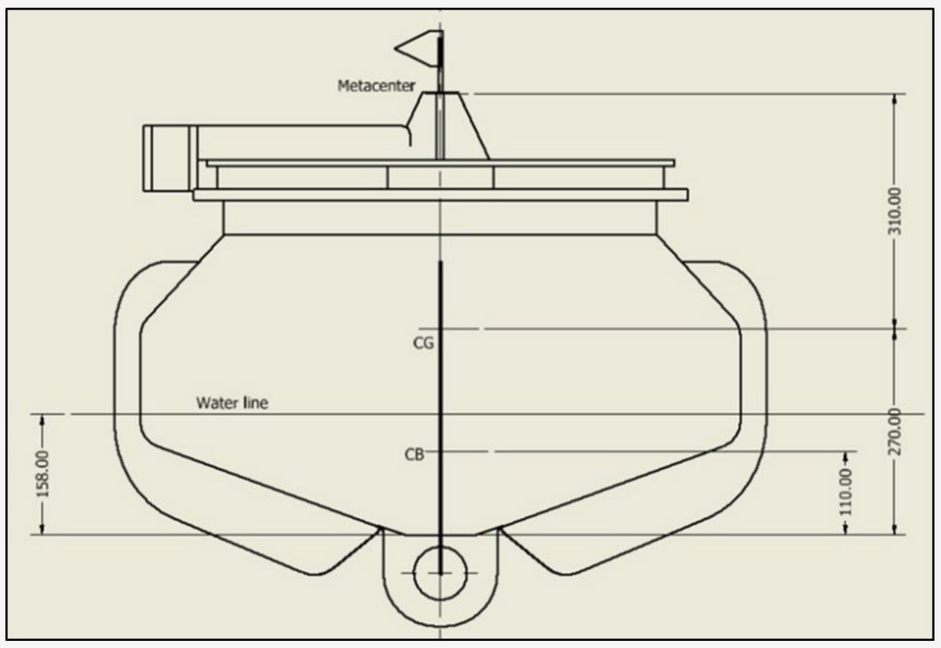


Figure 1. Centre of gravity, centre of buoyancy, metacenter and waterline of floating bin

Table 1. General specification of the bin

Specifications	
Volume of the bin (Capacity)	50 L
Total mass of the bin	25.85 kg
Mass of trash considered	15 kg

Floating Bin Sketch Map 4

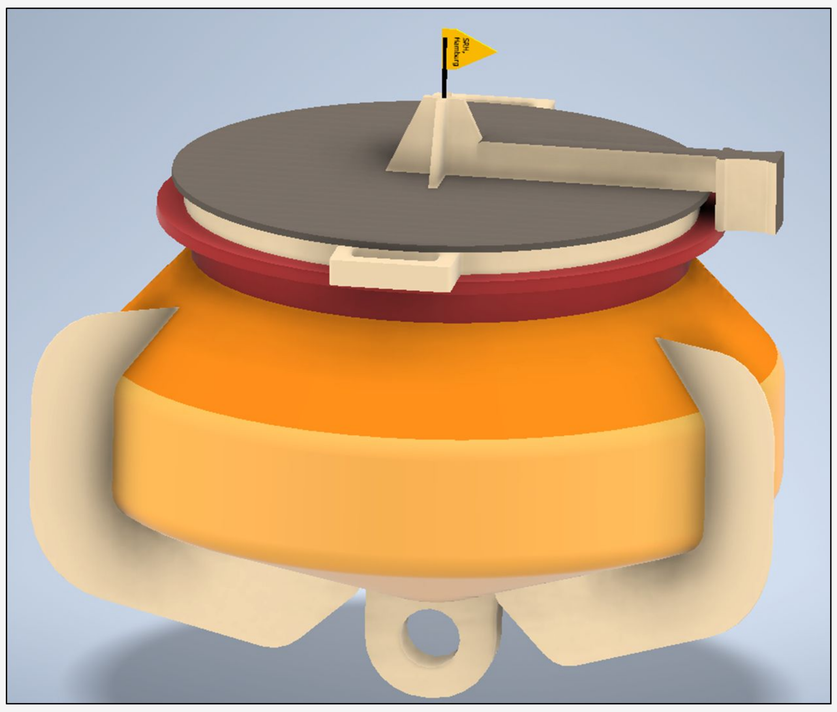


Figure 2. 3D model of floating bin

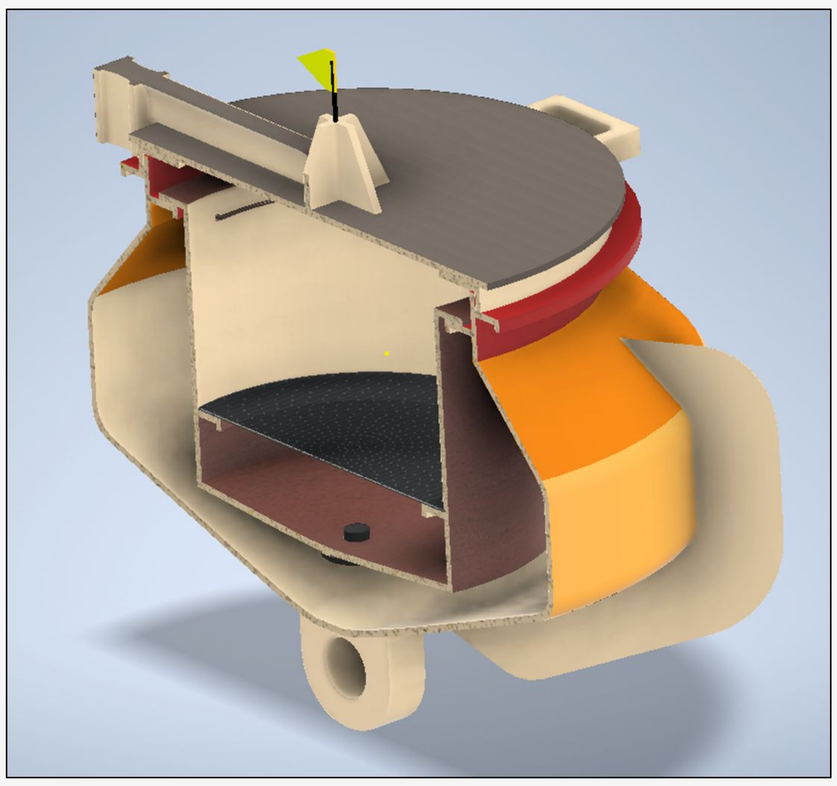
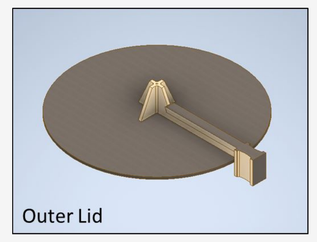
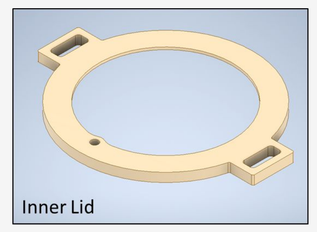
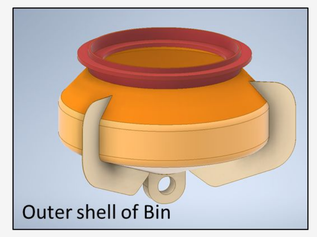
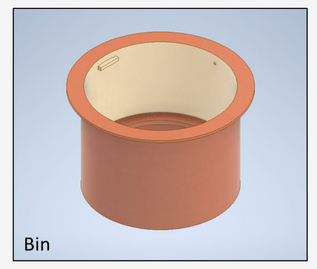


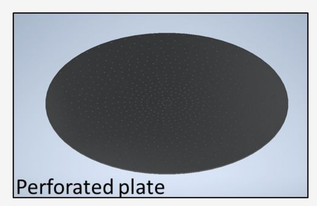
Figure 3. Cross-sectional view of floating bin

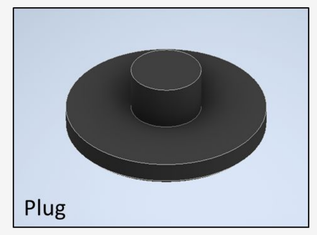


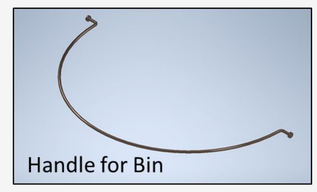












Materials 5

Material Selection: The **durability and waterproof** quality of the bin were significantly influenced by the materials. Two types of main materials, **high-density polyethylene**(HDPE) and **stainless steel** were selected.

Table 2. Materials used in each part with mass

Part	Description	Mass (kg)	Material
Outer Shell of Bin	Outer shell of the Bin with Fins	12.5	High Density Polyethylene
Bin	Collect trash	5.4	High Density Polyethylene
Handle for Bin	Facilitate in lifting the Bin	0.112	Stainless Steel
Plug	To drain out the water from the bin	0.056	Rubber
Perforated Plate	To separate dry and wet waste	3.2	Stainless steel
Lid assembly	To open and close the Bin	4.4	High Density Polyethylene

Conclusion and Outlook 6

- A meticulously **designed floating waste bin** is presented as a solution to encounter water pollution of the waterbodies in Hamburg.
- The bin excels in **buoyancy and stability,** which makes it a practical tool for collecting waste **straight off water surface**.
- An advanced floating bin concept can be implemented by optimsing the design with enhanced functions such as **autonomous control, filling sensors** .