

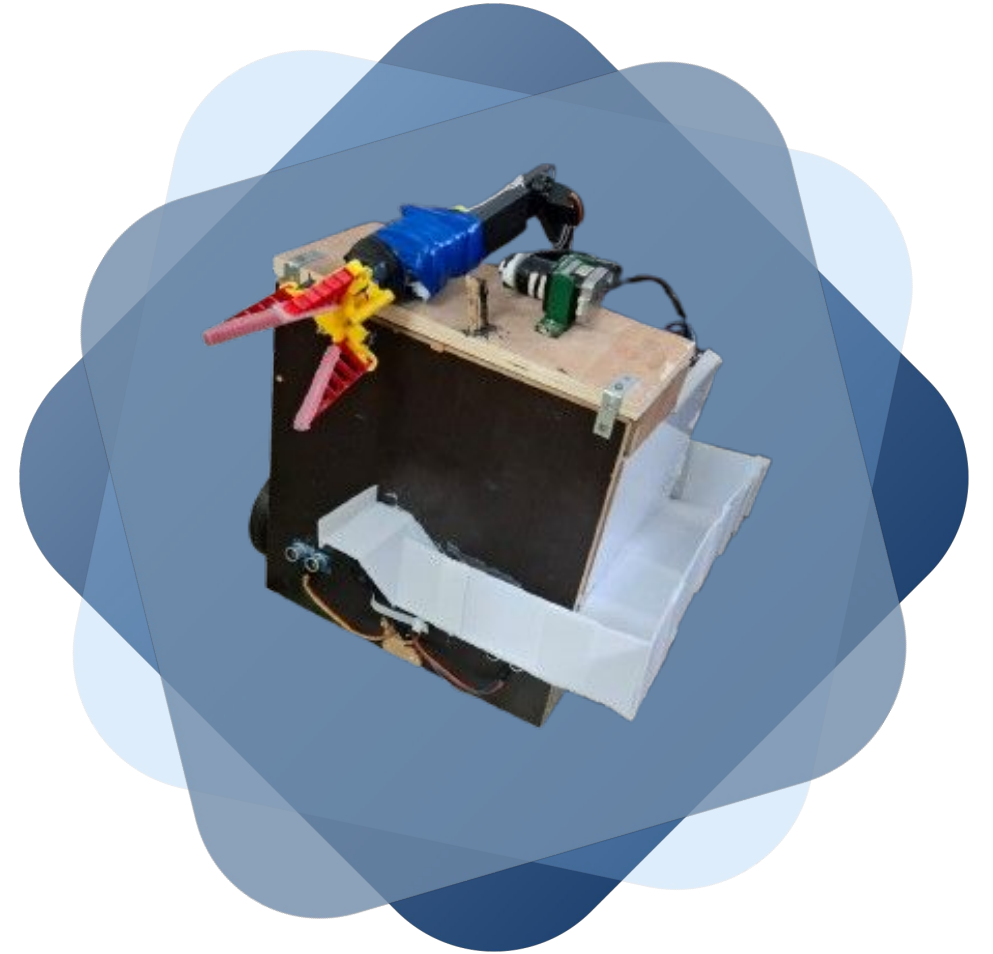


Ball-E

- Osama Dweikat
- Sohaib Arafat
- **Dr.Samer Arandi**

About Ball-E

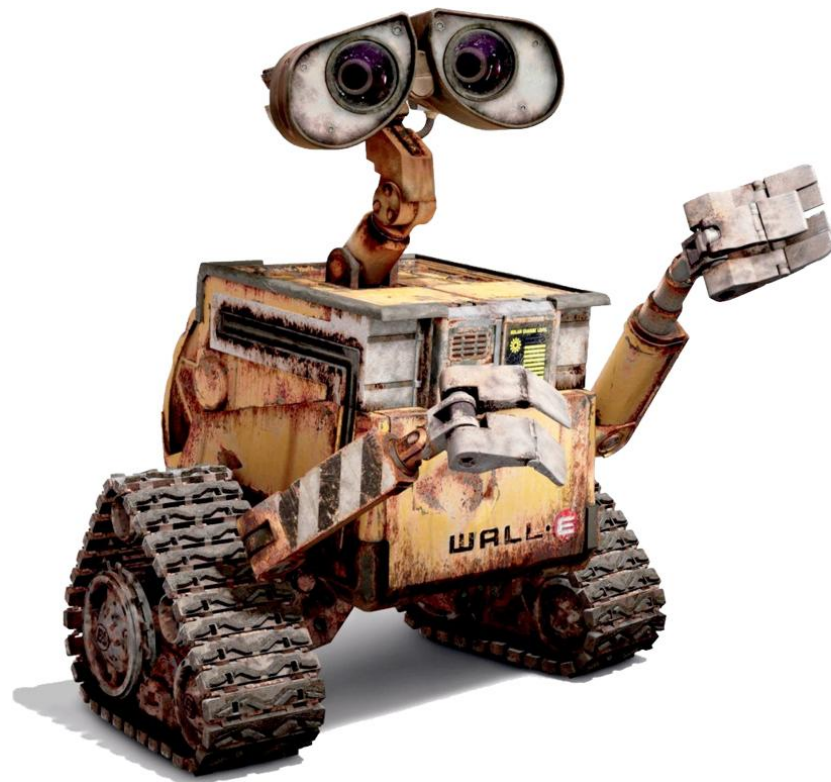
- Multiple Searching Modes.
- Object Detection Using AI model.
- Searching Patterns.
- Obstacle Avoidance.





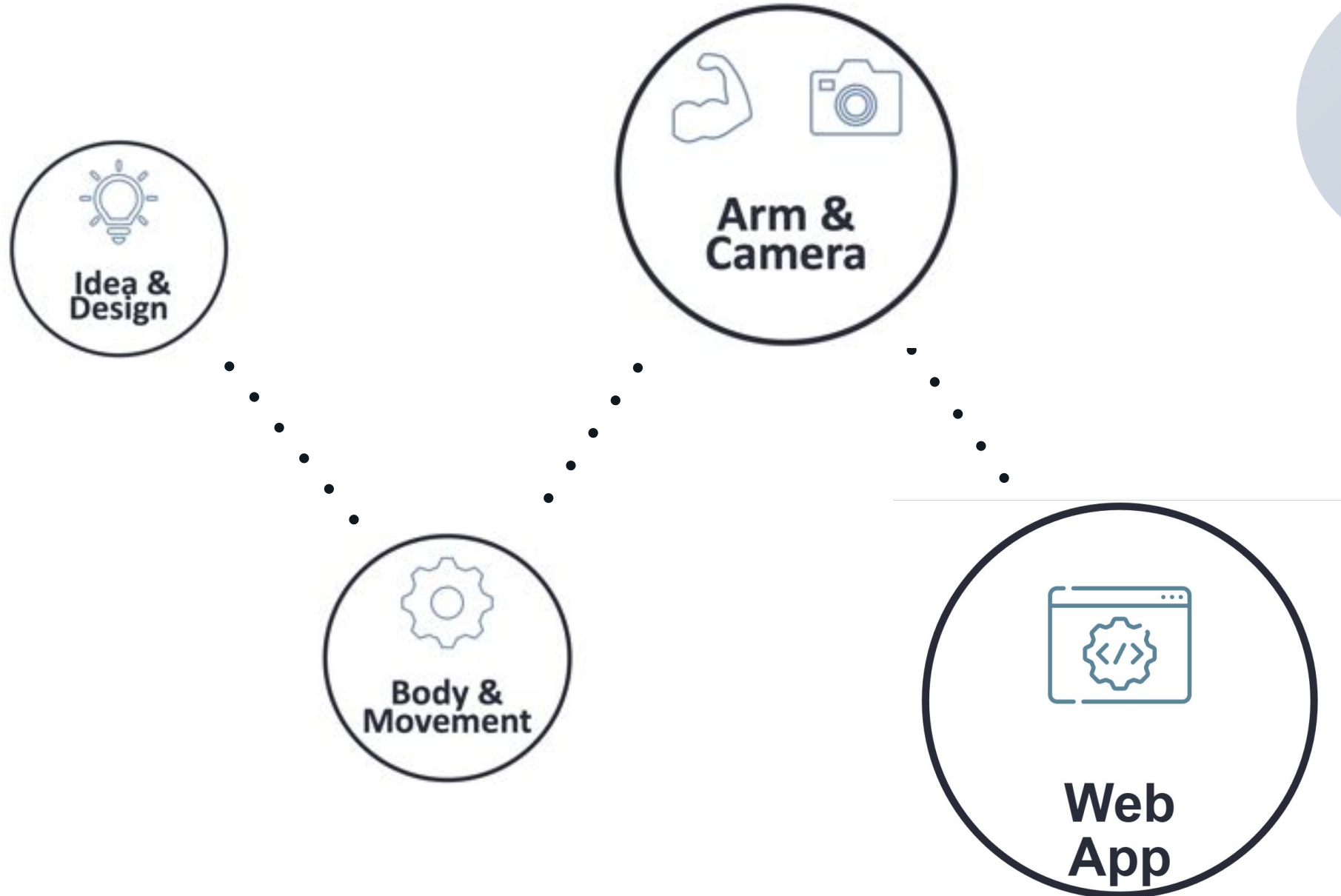
Ball-E

vs



Wall-E

Ball-E





**Idea &
Design**

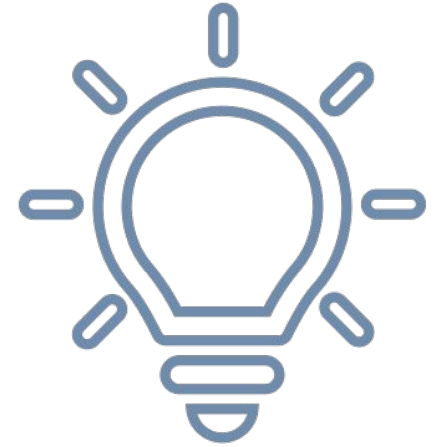
Idea & Design

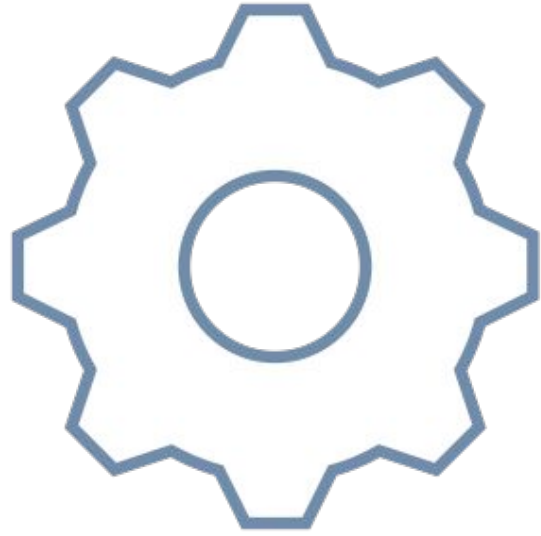


Idea & Design

Idea

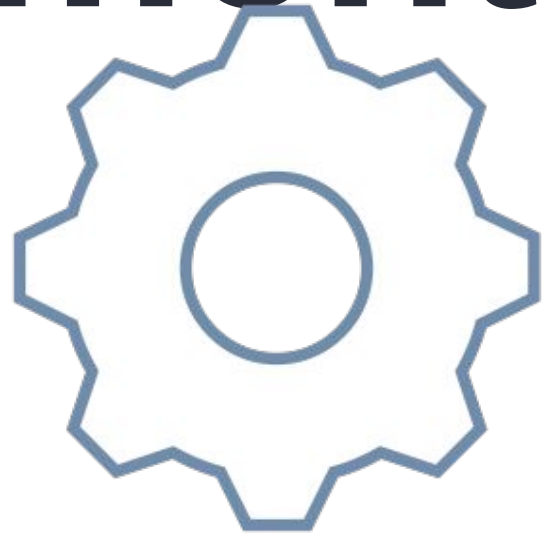
- Motivation and Initial Concept.
- The Problems That Ball-E Aims to Solve:
 - Inefficient Ball Retrieval in Sports and Games.
 - Handling Different Balls Types.





**Body &
Movement**

Body & Movement



Body

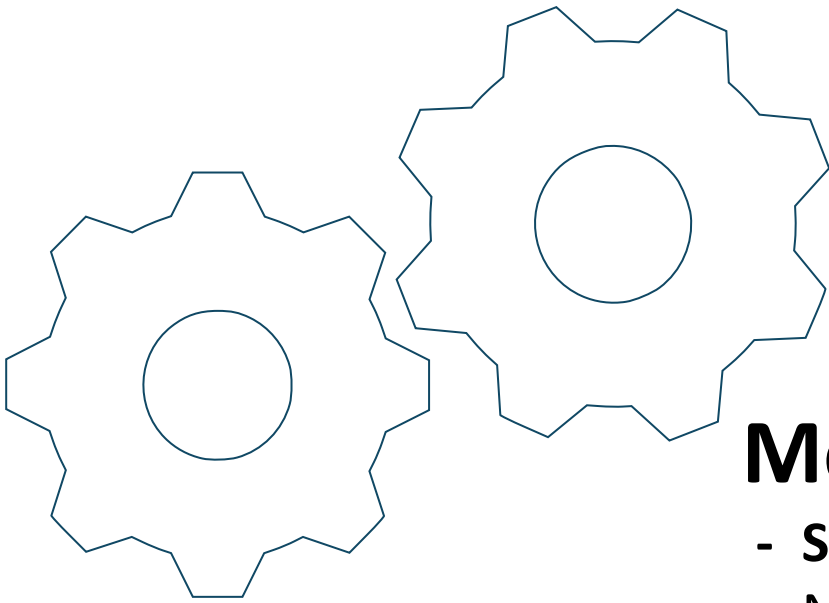
- Materials Used:
 - Wood for the base.
 - 3D printed arm and gripper and TPU for gripper fingers.
- Dimension:
 - Width: 42cm, Length: 42 cm, Height: 36 cm
 - Arm length: 28cm when it is extended (gripper not included).



Body & Movement



Body & Movement

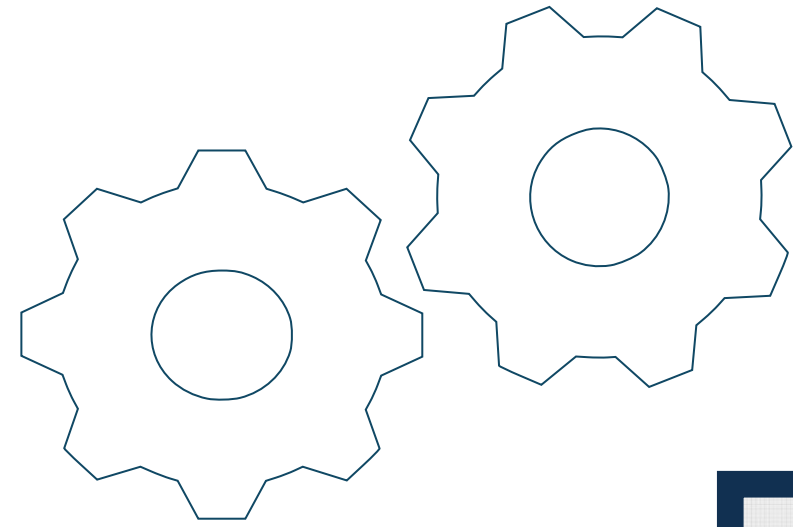
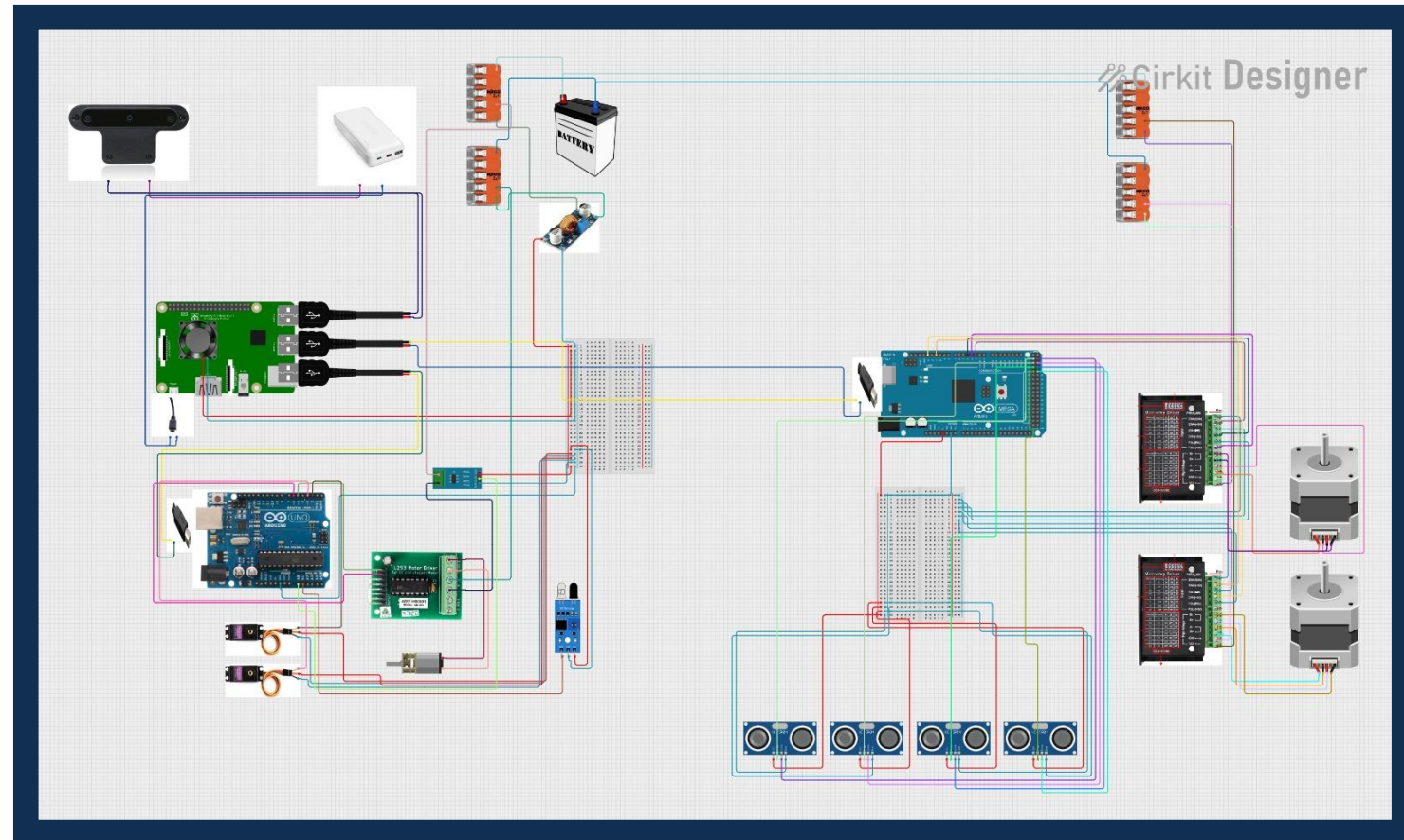


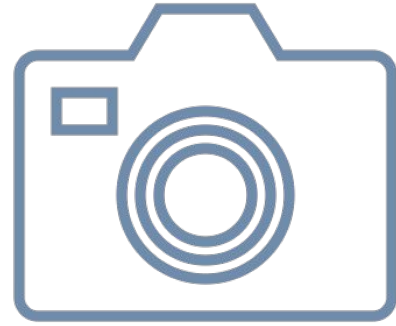
Movement System:

- **Stepper motors** are used for precise control and movement.
- Navigation System:
 - **Ultrasonic sensors** and **Camera** were implemented to avoid obstacles.
- Movement Modes:
 - **360 Sweeping**
 - **Zig Zag**
 - **Lawn Mower**

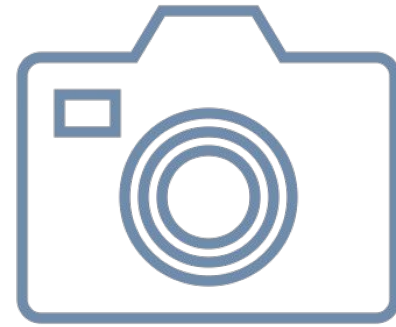
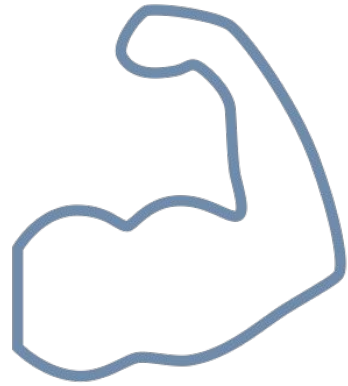
Body & Movement

Wiring and Electrical Components





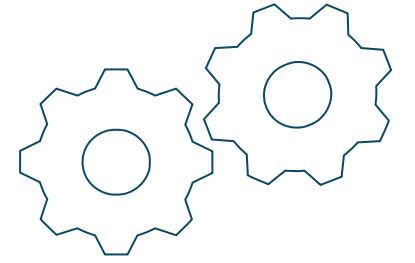
Arm & Camera



Arm & Camera



Arm, Gripper & Camera

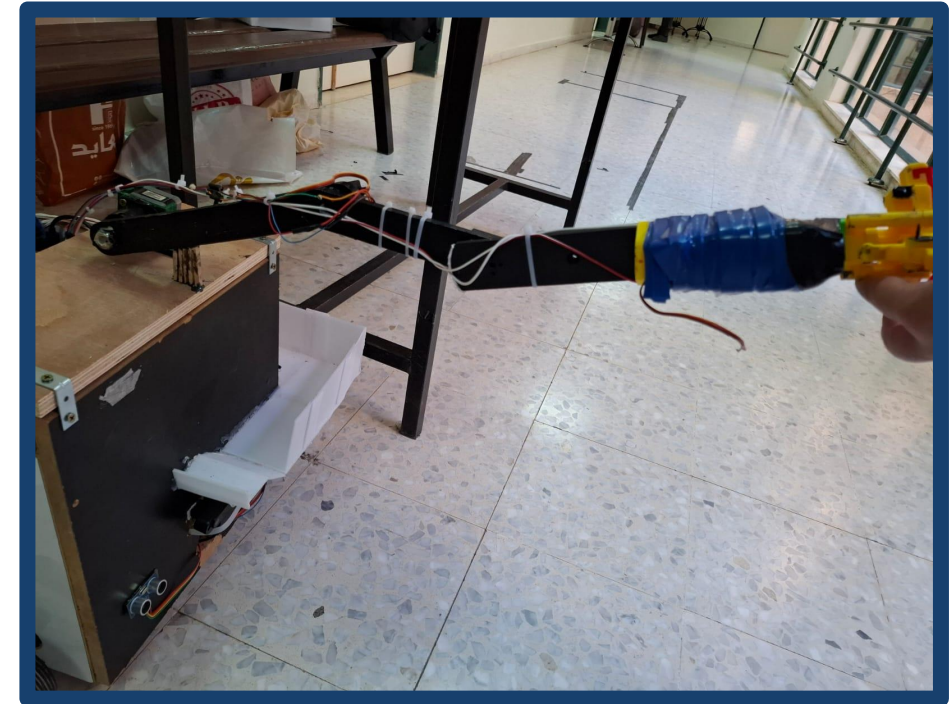
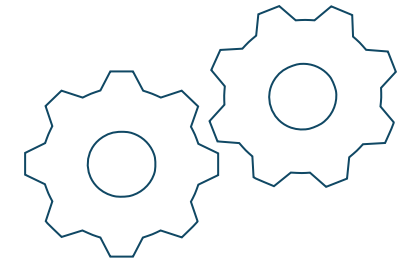


Arm & Gripper

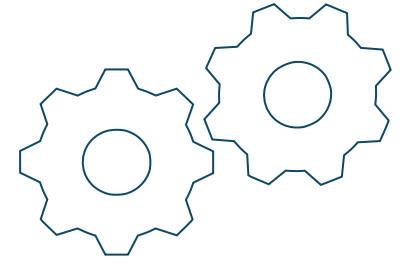
- Consist of 2 Servos -> 2 Axis and 1 DC Motor.
- Pick up Objects using a TPU griper to enhance the gripping system.
- Main body: 3D-printed .



Arm, Gripper & Camera



Arm, Gripper & Camera

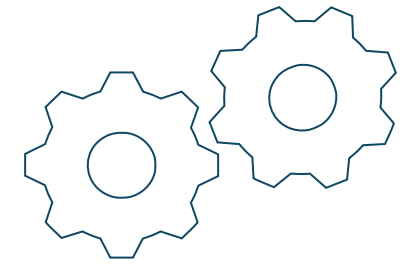


Camera

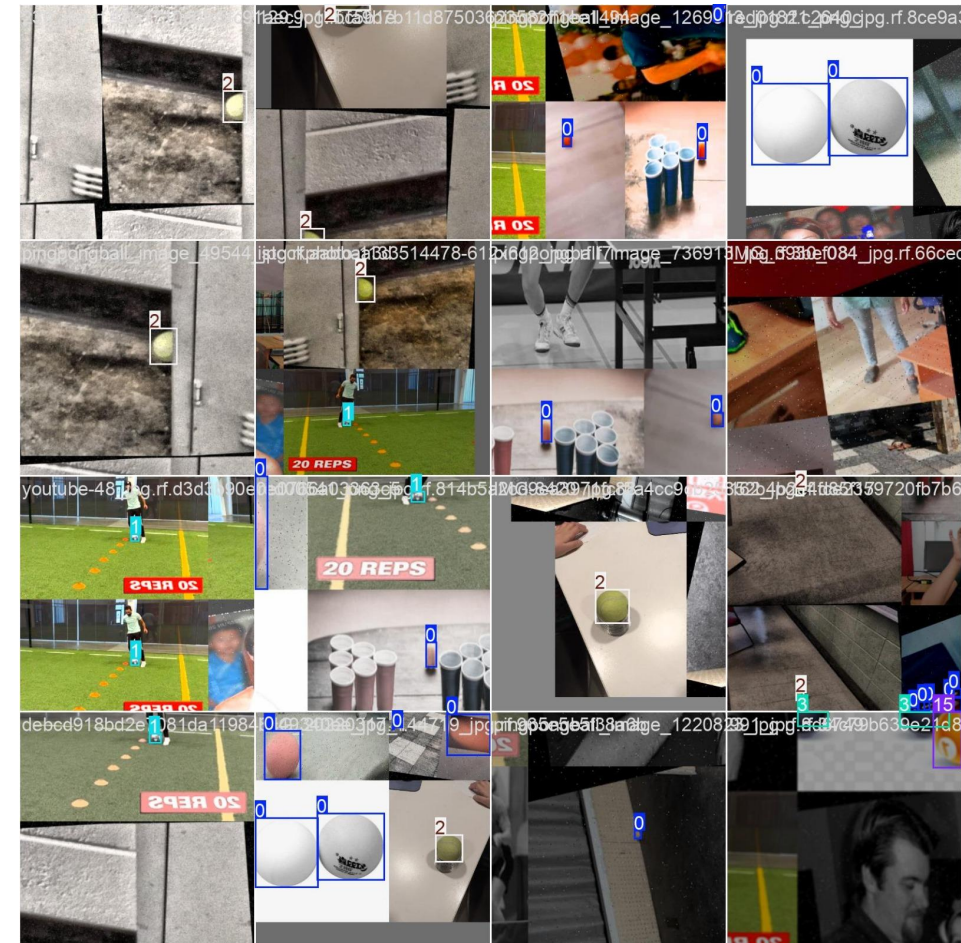
- OAK-D Full HD Camera utilized as the primary vision system for Ball-e.
- Using Yolo V8-model trained on a dataset of 30,000 samples for object classification.

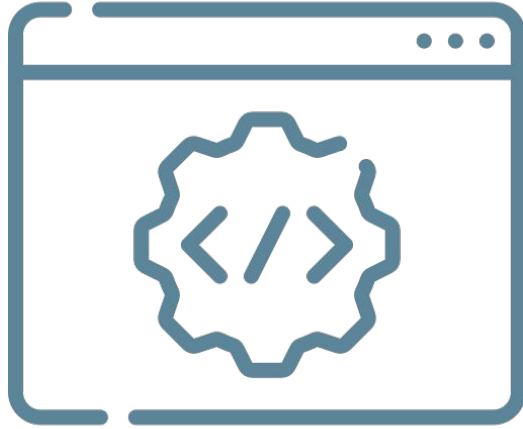


Arm, Gripper & Camera



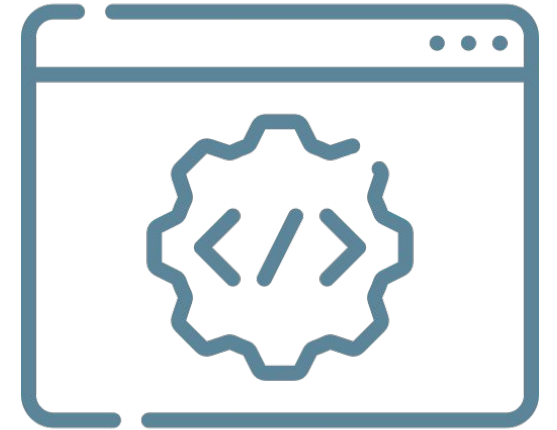
Sample Model Output





**Web
App**

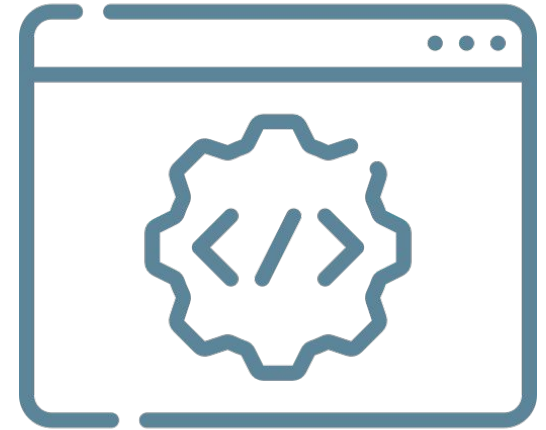
Web App



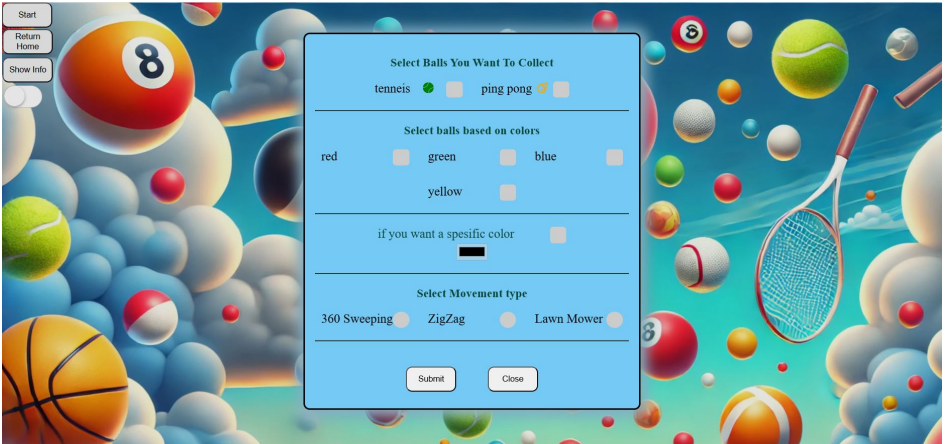
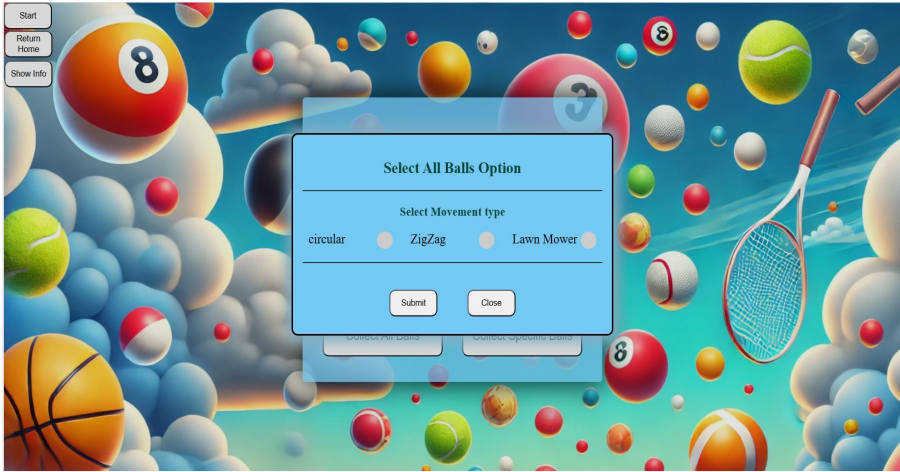
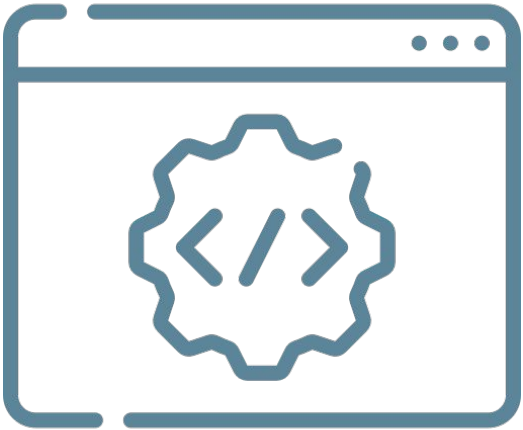
Web App

React Web Application.

- Mainly, 2 sections:
 - Select Balls, Mode and Movement
 - Manual control.
- There is an API acting as a middleman between the Web Application and the Raspberry Pi.
- The API is hosted on Google Cloud and communicates with the Raspberry Pi using Google Cloud Pub/Sub.



Home page



Manual Control

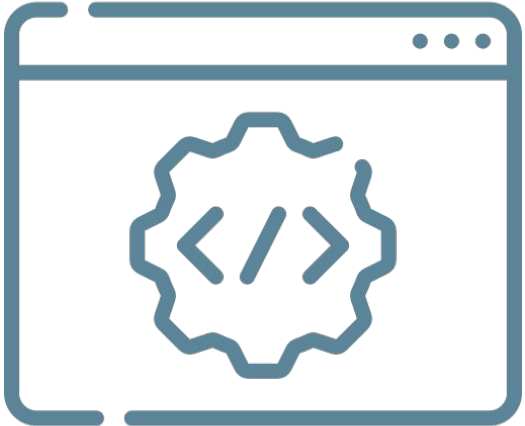
Start
Return Home
Show Info

Manual Controller

Ball Collector

Small	<input checked="" type="checkbox"/>	Medium	<input type="checkbox"/>	Large	<input type="checkbox"/>
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Stop Moving



Constraints

- A lot of things related to size(power).
- Gripper broke down



Future Work

- Several ball types detection for camera.
- Integrate other movement modes.
- Live streaming.
- Detailed statistics.