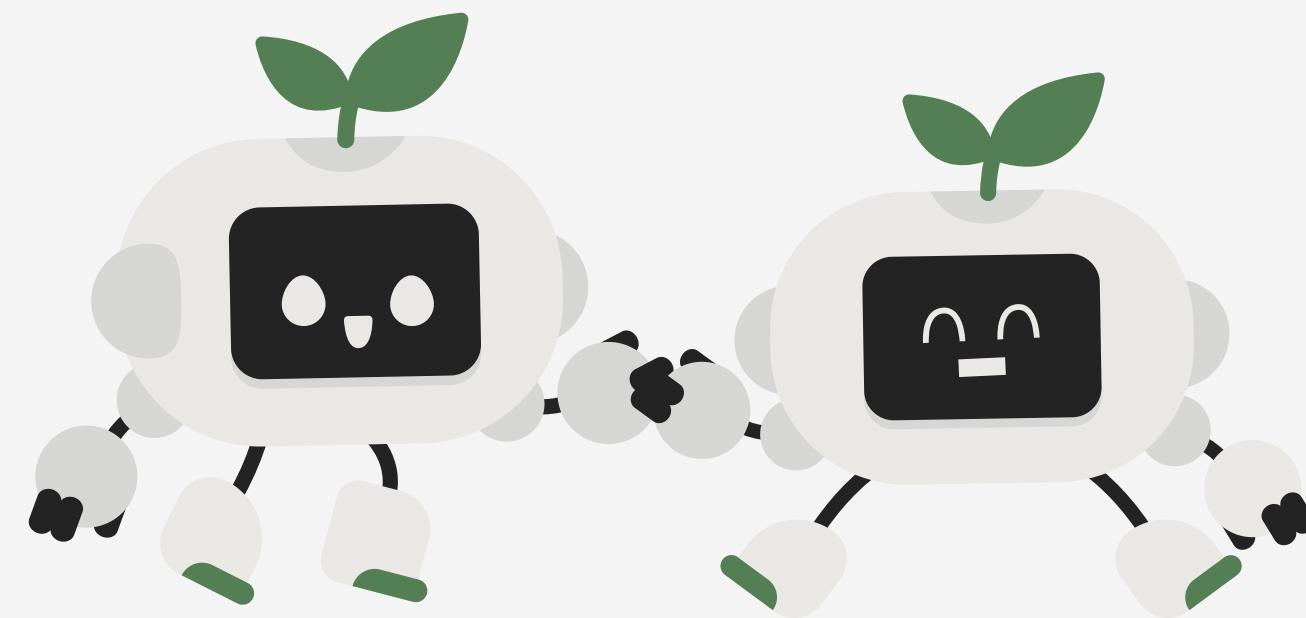


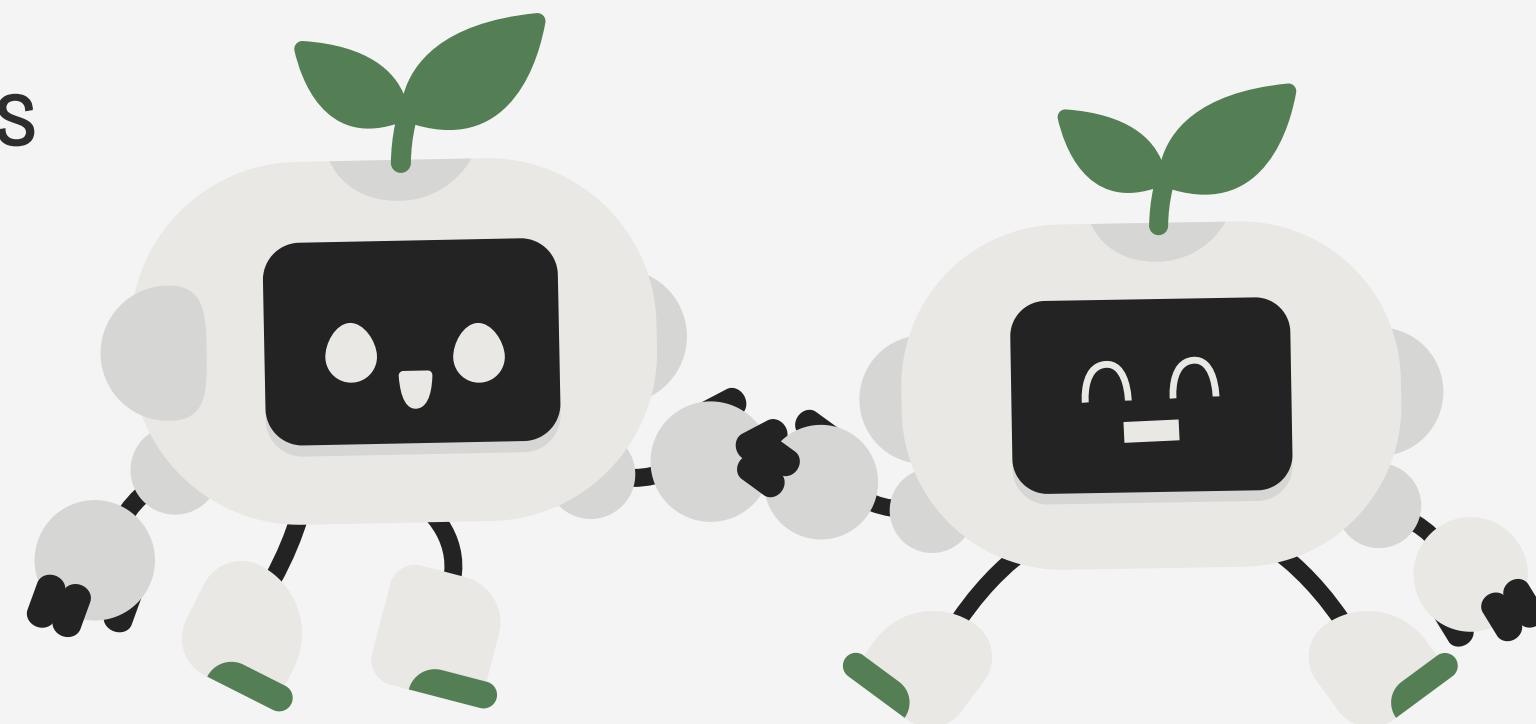
Evolving a Simple Gait for a Bipedal Robot

The **core idea** is to use a genetic algorithm within a physics simulation (Webots) to evolve a functional and efficient walking behavior for a two-legged robot.



Ideology / Concept

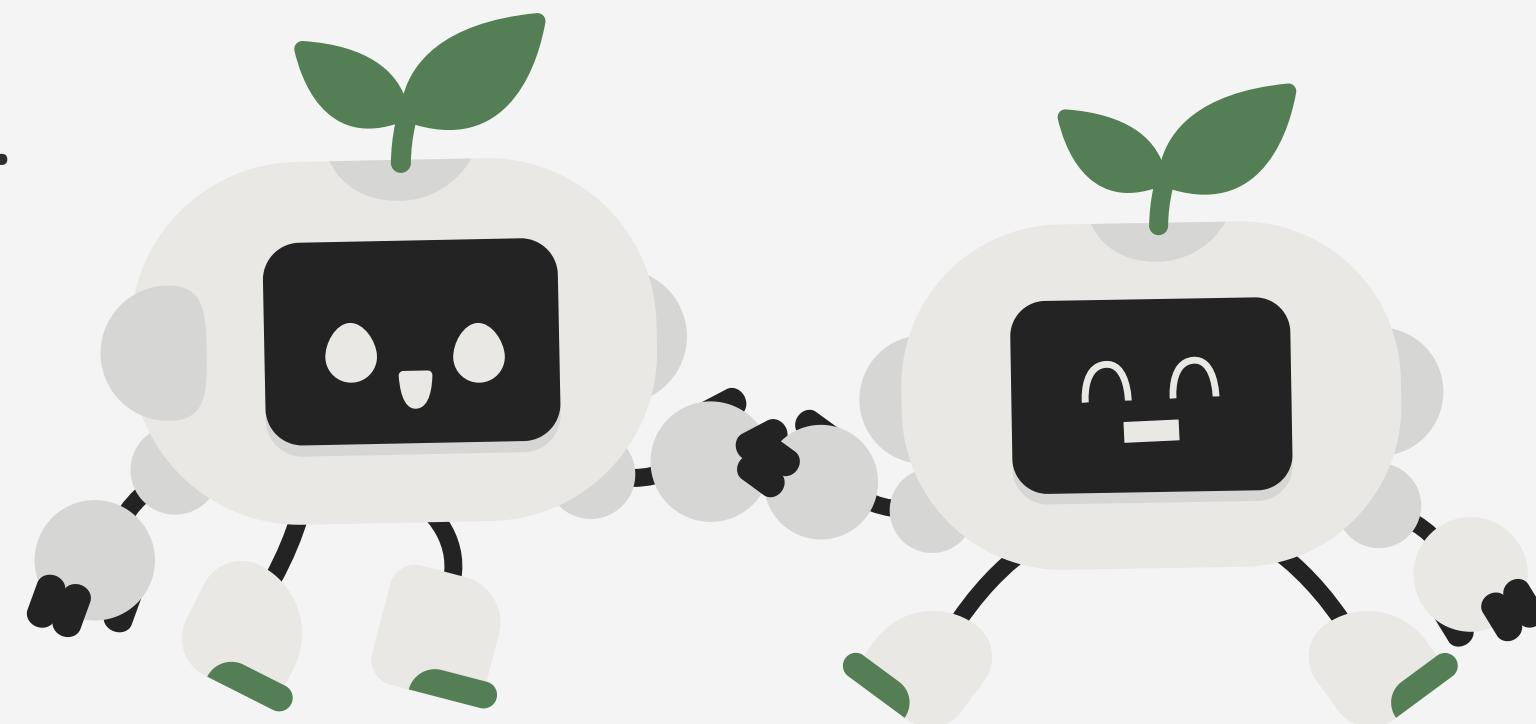
- Simulate evolutionary learning in bipedal robots.
- Robots learn, adapt, and evolve walking strategies over generations.
- Evolutionary algorithms allow self-discovery of optimal movement patterns.
- Phase 1 focuses on laying the foundation for this process.



Phase 1 Goals & Project Structure

Goals:

- Build the bipedal robot prototype (legs, joints, sensors, motors).
- Set up the evolutionary supervisor for multiple robots and generations.
- Define fitness criteria like distance and balance.
- Organize the project structure for modular development.



Phase 1 Goals & Project Structure

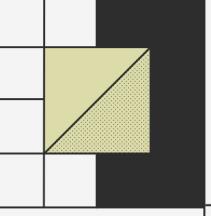
Project Structure

```
bipedal_evolution_project/
├── worlds/
│   └── evolution_world.wbt      # Main Webots world file
├── controllers/
│   ├── evolutionary_supervisor/    # Evolution management
│   │   ├── evolutionary_supervisor.py
│   │   ├── genome.py
│   │   ├── population.py
│   │   └── environment.py
│   └── bipedal_robot/            # Individual robot controller
        └── bipedal_robot.py
```

Phase 2 - World File

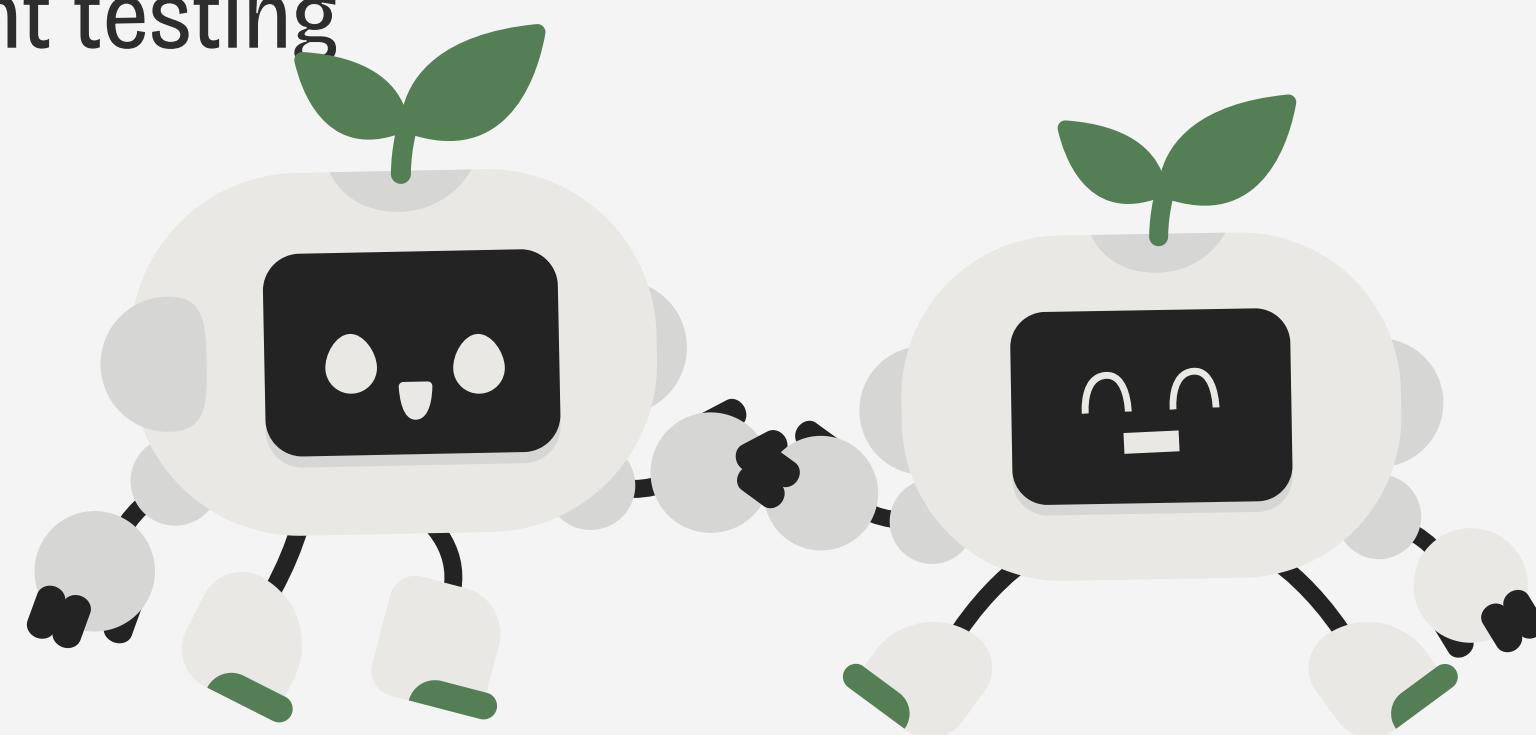


The world is derived from the Humanoid Robot Marathon, which serves as an example environment provided by Webots.



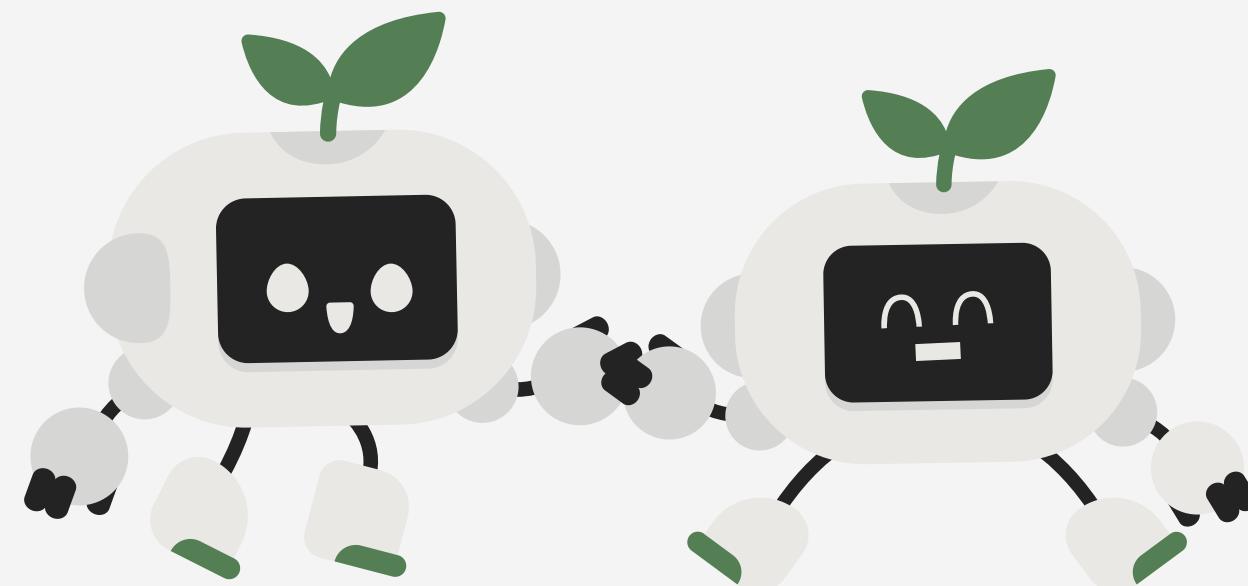
Phase 3 - World Re-Design

- Modified and refined the simulation world to better suit project requirements.
- Removed unnecessary elements and simplified the environment.
- Adjusted layout and coordinates for stable robot placement.
- Ensured the redesigned world provides consistent testing conditions.



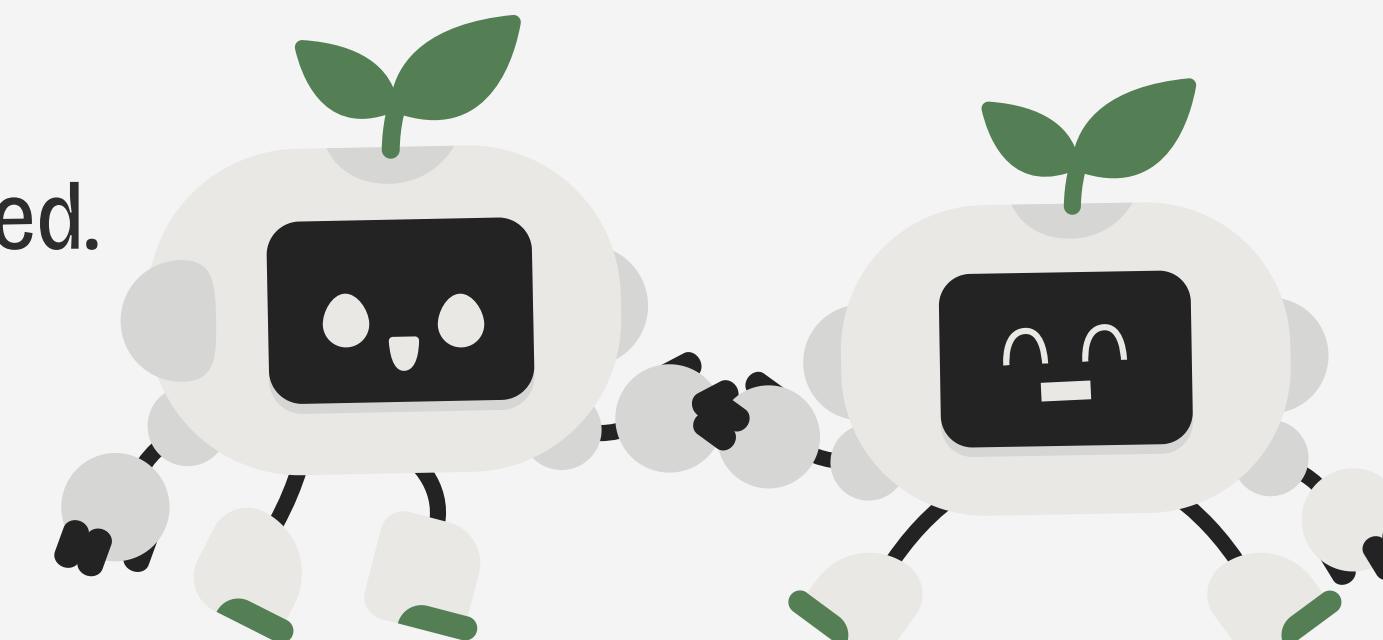
Phase 3 - World Re-Design

- Modified and refined the simulation world to better suit project requirements.
- Removed unnecessary elements and simplified the environment.
- Adjusted layout and coordinates for stable robot placement.
- Ensured the redesigned world provides consistent testing conditions.



Phase 3 - Robot and Controller Design

- Began creating the bipedal robot from scratch within Webots.
- Initially attempted placement in the modified world, but encountered coordinate alignment issues.
- Shifted to a simpler rectangular arena for easier debugging and control setup.
- Used fundamental Webots components like HingeJoint, Solid, Shape, and Physics for robot construction.
- Around 70% of the robot structure has been completed.



Phase 3 - Robot Implementation

