School of Engineering and Built Environment
Griffith University

1701ENG – Creative Engineering
Trimester 1, 2021

A Design Portfolio

WormBot: Solution for Apartments' Organic Waste

THIS IS AN INDIVIDUAL ASSESSMENT ITEM.

Toshimitsu Ota (s5251464)

Griffith UNIVERSITY

Organic Waste Problems in South East Queensland

76 million tones — Waste generated annually in 2019 in Australia (Australian Bureau of Statistics, 2020)

10% up — Waste increased from the previous year (Australian Bureau of Statistics, 2020)

20% of waste — was organic waste, in comparison plastics 3% and glass 2% (Australian Bureau of Statistics, 2020)

42% of — Organic waste comes from households (Australian Bureau of Statistics, 2020)

25 times — Methane is more potent than CO2. Organic waste produces methane in landfill. (Reucassel 2020)

Is lifestyle changing? Is there a particular group needs attention?

78% up — Apartment occupancy increased in the last 25 years in Australia (Australian Bureau of Statistics, 2016a)

12% population — Live in apartment buildings in Queensland (Australian Bureau of Statistics, 2016b)

For Apartment Dwellers

- No space or incentives to own a compost bin
- No convenient collection services

Point of View

Apartment residents in South East Queensland need a convenient way to dispose of organic waste. It should have a retrofitting ability to be implemented in both existing and new apartment buildings.

Aligning with United Nations

Goal 11. Sustainable Cities and Communities

SUSTAINABLE DEVELOPMENT GOALS

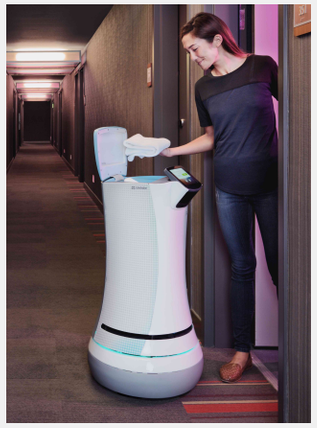
11 SUSTAINABLE CITIES AND COMMUNITIES

Inspiration

Biogas Power Plant

FoodCycler

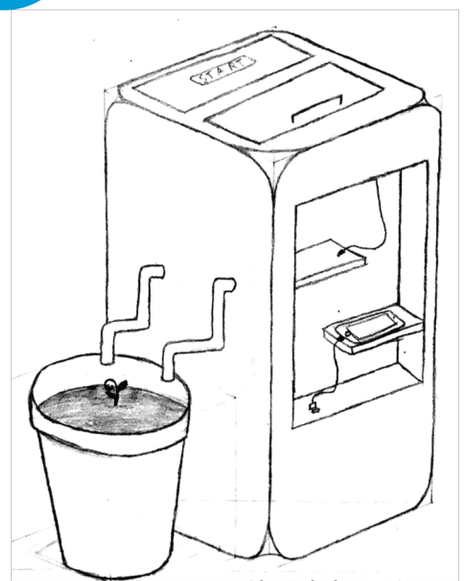
HomeBioGas



Hotel Room Service Robots

Energy Creation ..... **Composting** ..... **Gas Generator** ..... **Collection**

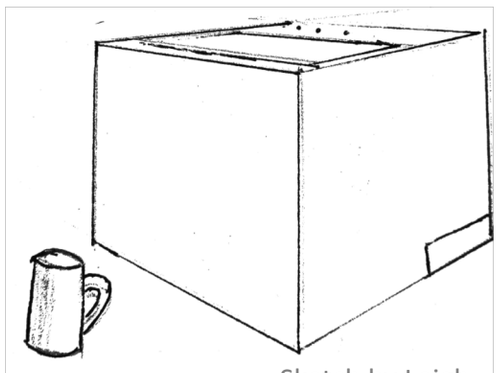
Design Concepts



Sketch by Britney

1. EcoCharge

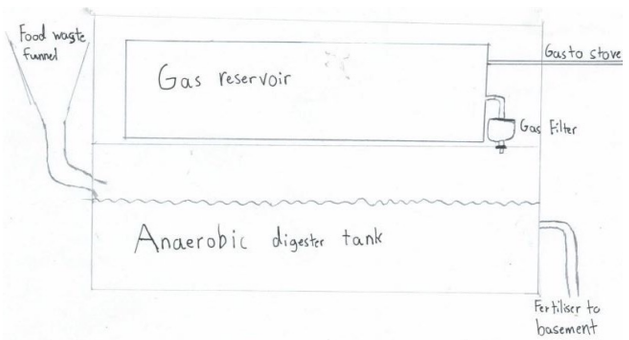
Takes food waste and coverts to energy to charge small electrical devices such as mobile phones.



Sketch by Leigh

2. QuickOrganicCycler

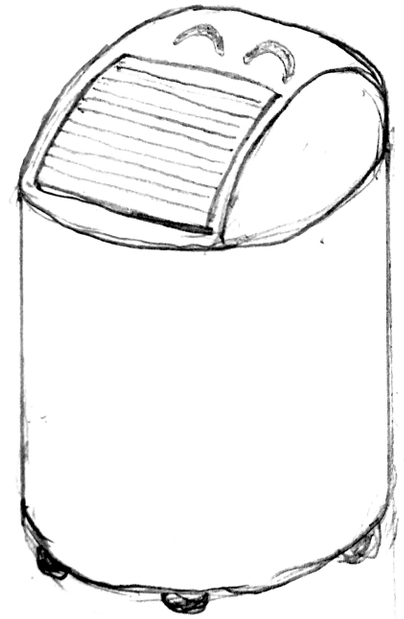
Converts organic food waste to small chips for feeding gardens. Can be placed in a kitchen.



Sketch by Nikolas

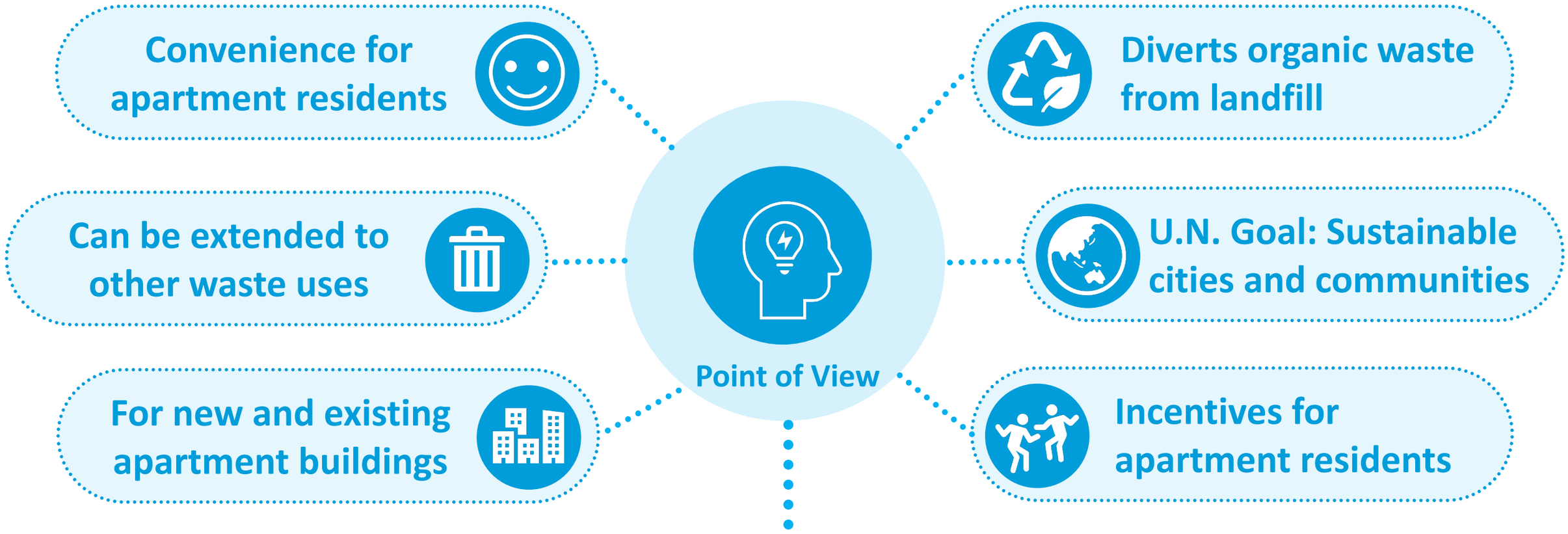
3. CompGas

Built into kitchen and turns food scraps into methane gas to be used for cooking.



4. WormBot

Comes to your door to collect food scraps when you book from an app. It empties when full.

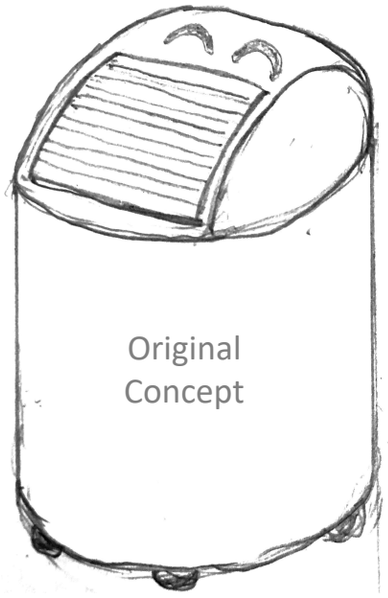


Evaluating the Concepts

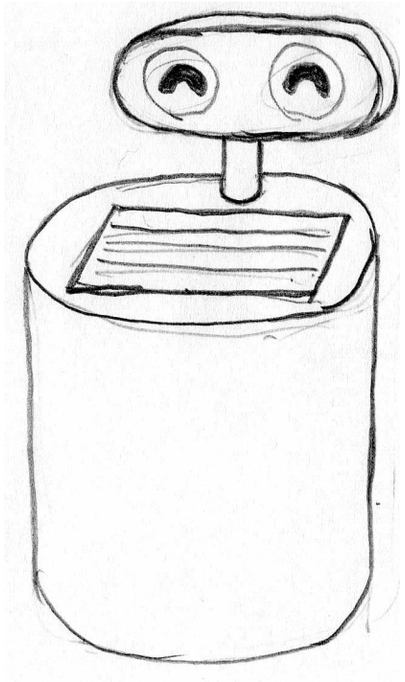
	1. EcoCharge	2. Quick Organic Cycler	3. CompGas	4. WormBot
Retrofitting	10	10	0 - Only for new buildings	10
Incentives	10 - Energy to charge small devices	5 - Compost chips for gardens	10 - Gas for cooking	10 - Fun to use and educational
Convenience	5 - No need to leave room. Loss of room space.	5 - No need to leave room. Chips need to be disposed.	5 - No need to leave room. Loss of kitchen space.	10 - No need to leave room. No loss of room space.
Versatility	0	0	0	10 - Can be used for other waste collection.
Overall Score	**25**	**20**	**15**	**40**

Refinements: Head needed to change to avoid manufacturing issues

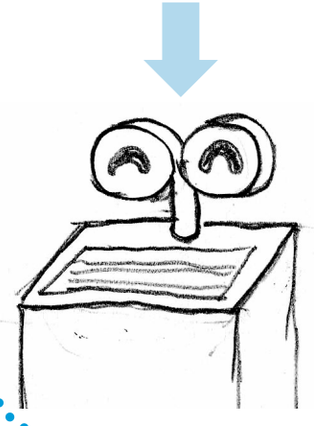
Complex head shape

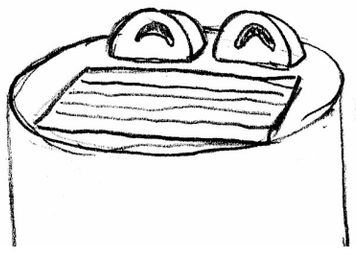


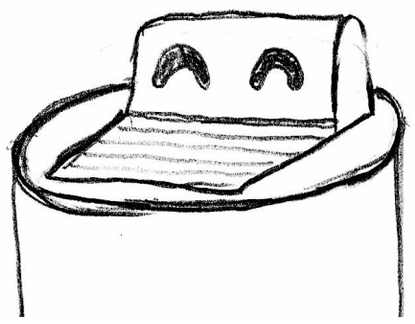
Original Concept



Simplified head design

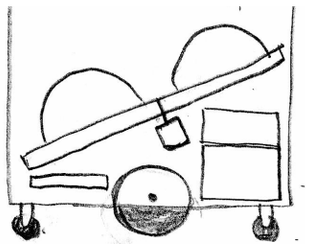






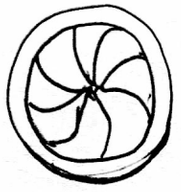
Added: Motorised tumbling blades to compact content inside for efficiency

Inspired by Washing machines



Store more, emptying less frequent

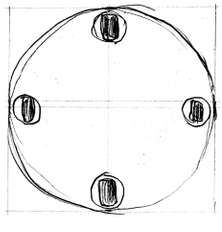
Refinements: Waste ejecting closure changed to minimize leakage



Iris Mechanism

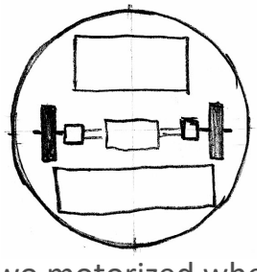
Inspired by submarine hatch

Refinements: Improved wheels to support the body weight and better movements



Four small wheels

Inspired by Roomba



Two motorized wheels for better movements

Ball shape wheels are not suitable for heavy weight

Casters can support heavy weight

WormBot

A robot that comes to your door and collects organic waste in an apartment building. Automatically empties when it gets full.

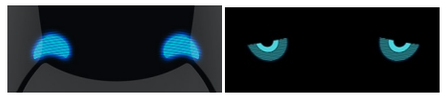
Network connectivity
Through network it controls elevators and receives waste collection requests from residents via a phone app.

Automatic Roller door
Mortors open and close the door. Users don't need to touch the door.

Body height
90 cm height. Same as standard kitchen bench height. Easy to tip waste without bending over.

Tumbling blades
Motorised tumbles content to air and compact for saving space.

OLED display
Outputs statuses. Eyes change according to users' actions to interact. E.g. Sad eyes for inserting wrong items.



Behind screen cameras
Detects what objects users putting into the storage. Also used for navigations and automations.

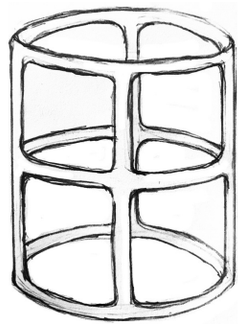
Ejection door
Silicon gasket seals tight to prevent leakage.

Wheels
Two motorized wheels with two casters enable WormBot to move any directions.

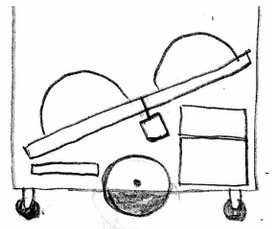
Material Selection

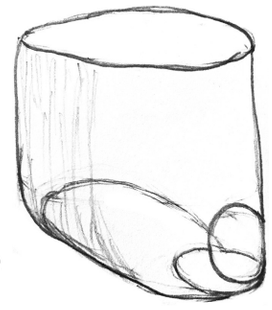
Aluminium
Strong, lightweight and rust resistant. Easily recycled using low energy (Aluminum Association, 2021).

Used for the body chassis.



Stainless Steel
Strong, rust resistant, hygienic and affordable. Easy to clean. 100% recyclable (ASSDA, 2020).





Used for interior storage and tumbling blades.

ABS Plastics
High rigidity, impact resistant and easy to manufacture. Recyclable. (Omnexus, 2017)

Used for the body shell and the head.

Silicon Rubber
Used for the gasket of ejection door to prevent odor and leakages.

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