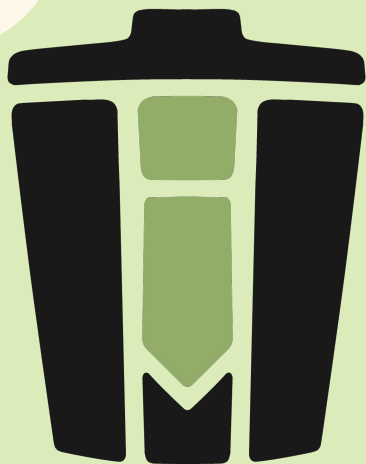




Butler Bin: Autonomous Trash Can

Gabriel Park, Mimi Chay, Nayyir Ahsan, and Jai Sharma

Our Goal

PROBLEM STATEMENT

- People with disabilities have difficulty moving around
- Hard for them to get up and throw out their trash

SOLUTION

- Design a moving trash can that will make the disposing process more streamlined



Product Features

Automatic Lid

Servo motor
PIR sensor

LED Status Screen

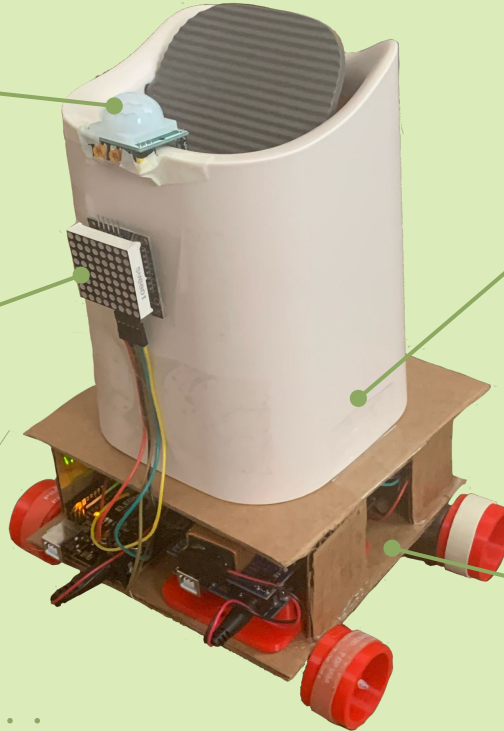
MAX7219 module

Leakage Detection

Water level sensor

Autonomous Navigation

Pathfinding via
microcontrollers





Our Design Process



01

Ideate

02

3D Modeling

03

Hardware

04

Navigation

05

Remote Control

06

**Possible
Improvements**





Brainstorming

UWB

- Very accurate
- Hardware was too expensive, not within budget
- High power consumption

AprilTags

- Limited design
- Image processing algorithms required
- Low power usage

BLE + Triangulation

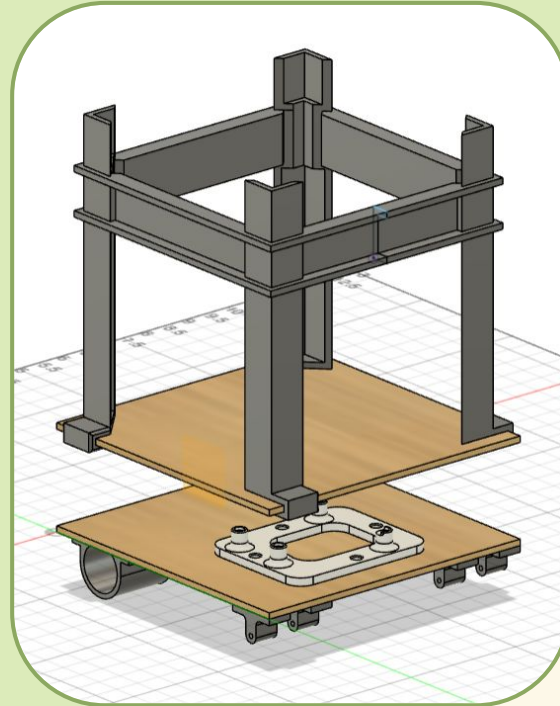
- Inexpensive
- Smartphone compatible
- Relatively accurate indoors

IR Beacons

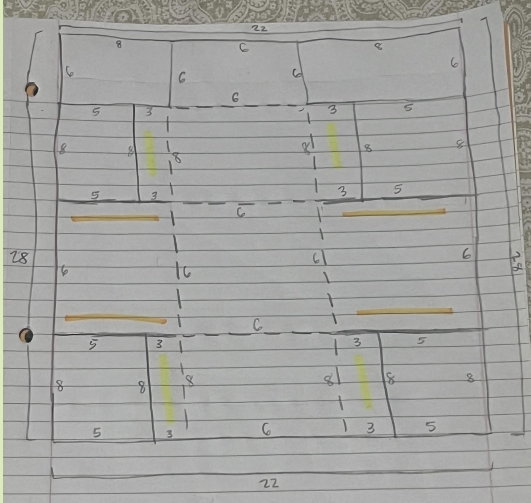
- Doesn't work with obstacles
 - Short range
 - Not accurate
- 

Structural Design

- Original idea: 3D printed frame for trash bin
- Designed parts using Fusion 360
- Mounts for hardware
 - Arduino
 - Motor Driver
- Could not print frame due to limited filament
- Parts printed using PLA
- Used cardboard & hot glue for the structure

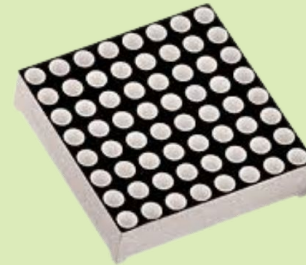
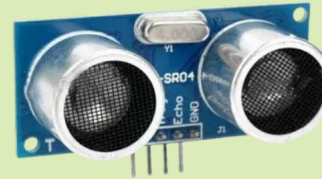


Structural Design



Additional Features

- Automatic Lid
 - Servo motor opens lid, triggered by PIR sensor
- Leak Detection
 - If water is detected through water level sensor, waterdrop is drawn
- Trash Can Level Detection
 - If ultrasonic sensor detects that trash can is full, frown is drawn
- LED Status Screen
 - Smile for standard conditions
 - Frown for full trash can
 - Waterdrop for leak





-



Navigation



Navigation: Overview

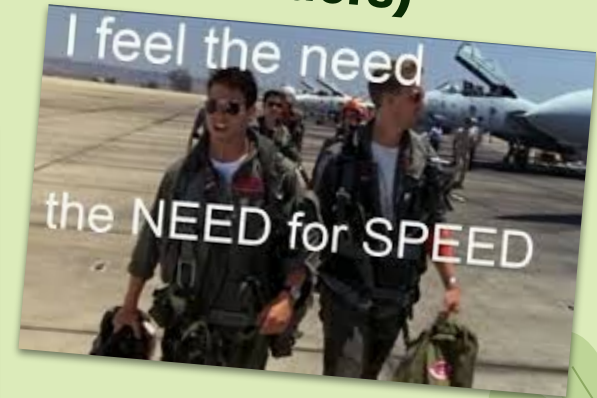
**Where am I?
(BLE)**



**Where do I need
to go? (BLE)**



**How do I get
there?
(Encoders)**



Bluetooth Low Energy (BLE)



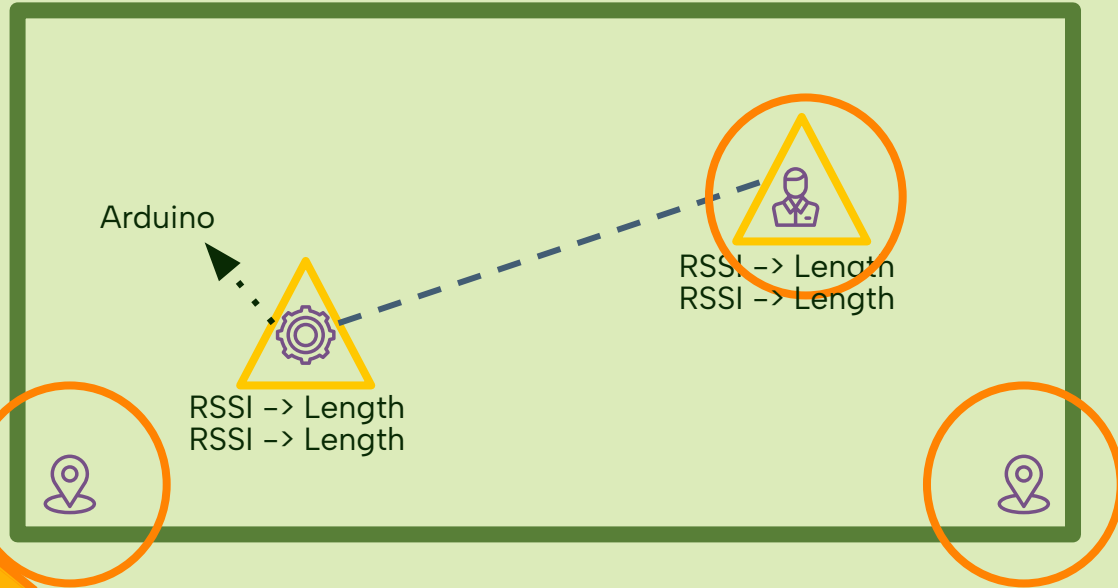
Servers



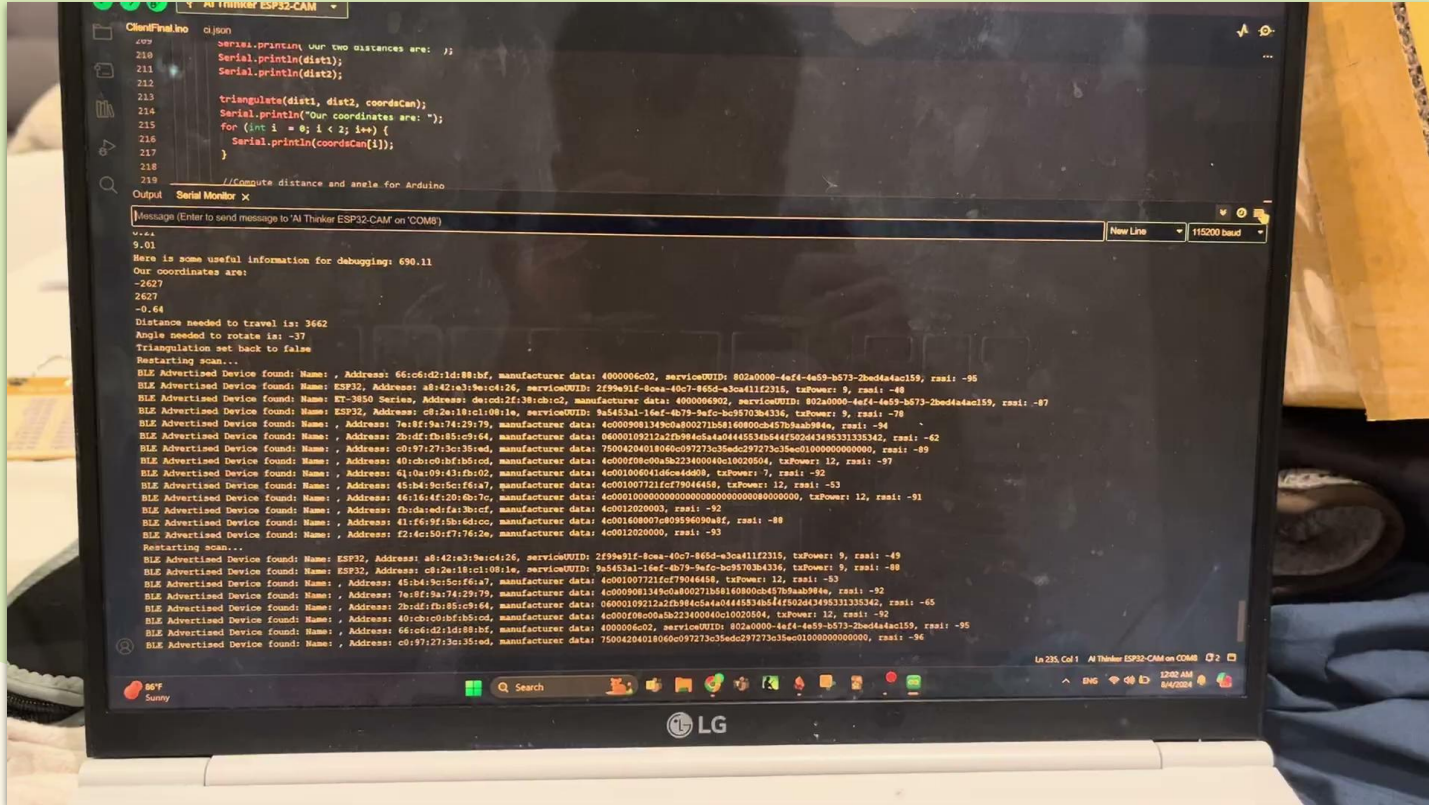
Trash Can



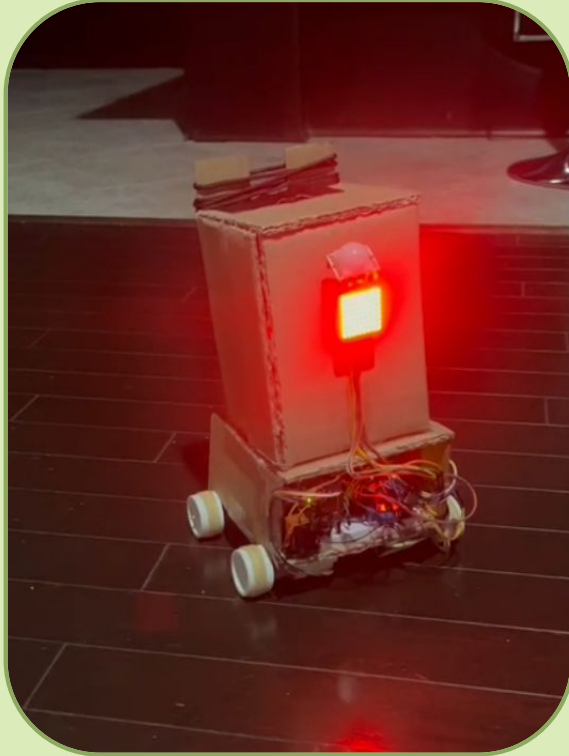
Person



BLE Demo



How do I get there?



- Multiple functions to control wheels via encoders
 - Spin motors forwards or backwards
 - Turn wheels to set angles
 - Turn wheels for a set number of revolutions
 - Angle & distance calculated
- 1) Wait for signal
 - 2) Coordinates from ESP32
 - 3) Calculate angle & turn to angle
 - 4) Coordinates from ESP32
 - 5) Calculate & travel distance
 - 6) Wait for signal



Challenges we faced

- Encoders
- MIT App Inventor Limitations
- ESP32 microcontrollers
- ESP Orientation
- Shipping Issues
- And many more...



Possible Improvements

- Reducing error in path finding
- Autonomous navigation in natural environments
- Notification system
- Obstacle avoidance
- Larger trash can
- Addition of gyroscope and PID control
- More powerful batteries
- And many more...

The background is a light green gradient. In the top left, there are stylized green leaves. In the top right, there is a yellow and orange water bottle with a black strap, and a yellow and orange striped bag. In the bottom right, there are green hills with white contour lines, and two stylized trees with green foliage and brown trunks. There are also several small green leaves scattered around. The text "Thanks!" is in a large, bold, dark green font. Below it, "Do you have any questions?" is in a smaller, bold, dark green font. Further down, "Special thanks to:" is in a regular dark green font, followed by a bulleted list of names. The list includes "Dr. Zhang", "Atharva Wani, Patrick Kanan Darmawi-Iskandar, Jenny Lee, Samarth Modh, Frankie Cicmil", and "BWSI staff and classmates :)".

Thanks!

Do you have any questions?

Special thanks to:

- Dr. Zhang
- Atharva Wani, Patrick Kanan Darmawi-Iskandar, Jenny Lee, Samarth Modh, Frankie Cicmil
- BWSI staff and classmates :)