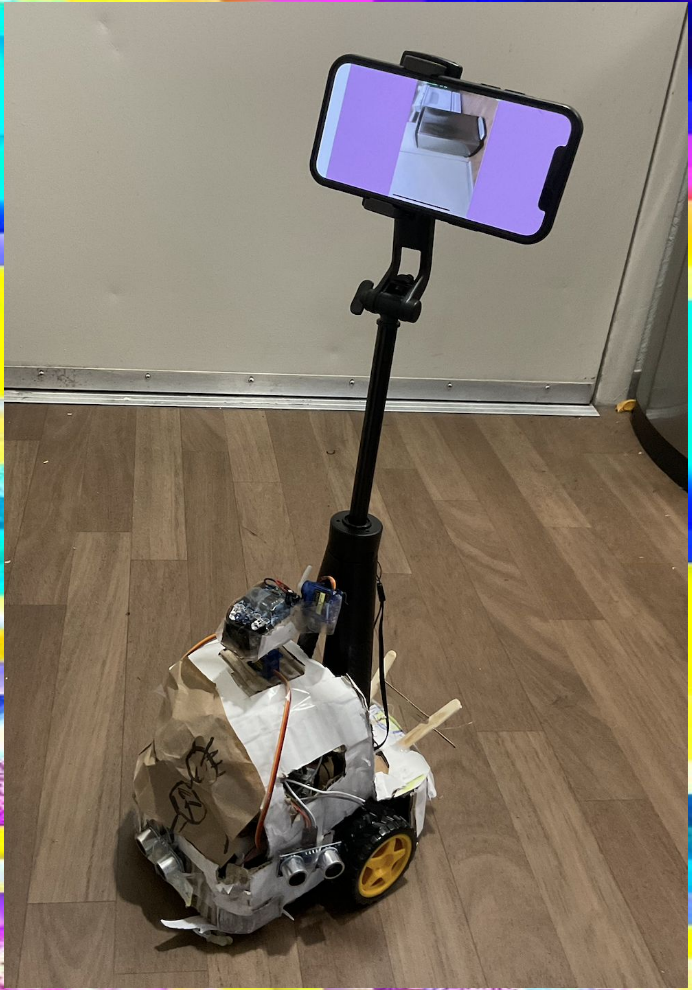
Power Saving Robot

By: Magen Mozeh



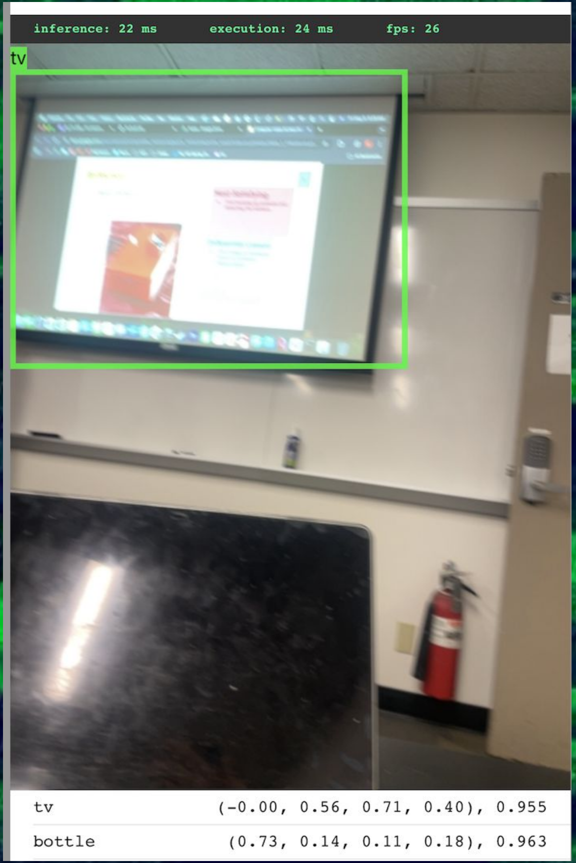
Comparison to WBS

Does exactly what WBS aimed to do:

- Occupancy detection (mmWave radar)
  - Checks every 9 seconds in case people are only just moving in-between rooms back and forth
- Infrared signal transmission (IR Blaster)
  - On top of device
- Smart behavior logic (when people return)
  - Stops moving
- Wireless communication (Bluetooth)
  - Moves around with 5V battery to turn off TVs and uses smartphone iOS Swift app `with bluetooth integration to detect TVs will turn them off when no one is in the room

- Currently in Testing Phase

IOS App To detect TV



```
inference: 22 ms        execution: 24 ms        fps: 26
```

```
tv          (-0.00, 0.56, 0.71, 0.40), 0.955
bottle      (0.73, 0.14, 0.11, 0.18), 0.963
```

- The iOS app uses a machine learning model to detect if a TV is present in the camera feed.
- Attach to Selfie Stick
- If a TV is detected, the app sends a signal to the ESP32 over Bluetooth
- The ESP32 receives the signal and immediately stops the robot’s movement.
- The robot activates two servos:
    - One rotates to align with the power button.
    - The other extends to press the button and turn off the TV.
- This process only triggers when no person is detected in the room using the mmWave sensor.

Current Functionality

Obstacle Avoidance while traversing

- Avoids obstacles using 3 ultrasonic sensors (front, left, right)

(Burned ultrasonic sensor while soldering):)

BLE Communication:
Sends distance data; receives TV status

TV Off Action:

- Servo 1 turns to aim
- Servo 2 presses button (0° → 180°)

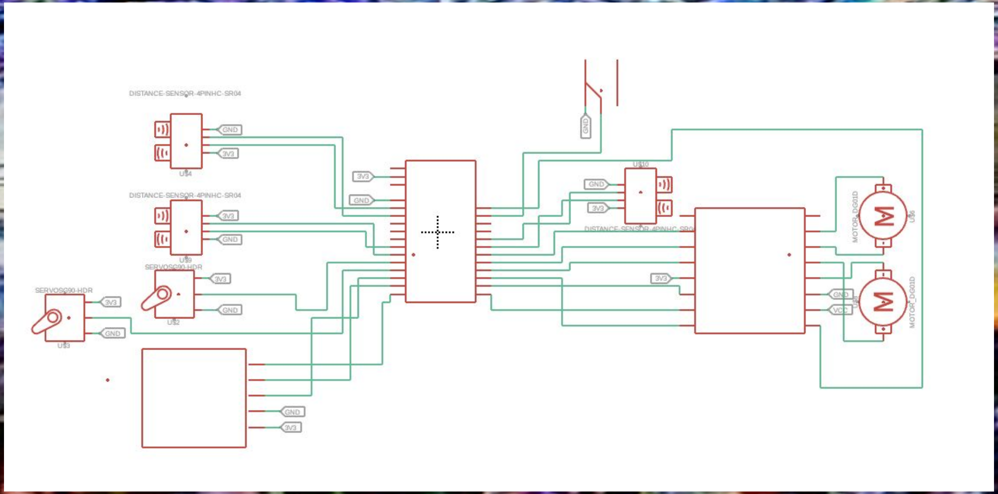
TV Detection (BLE):

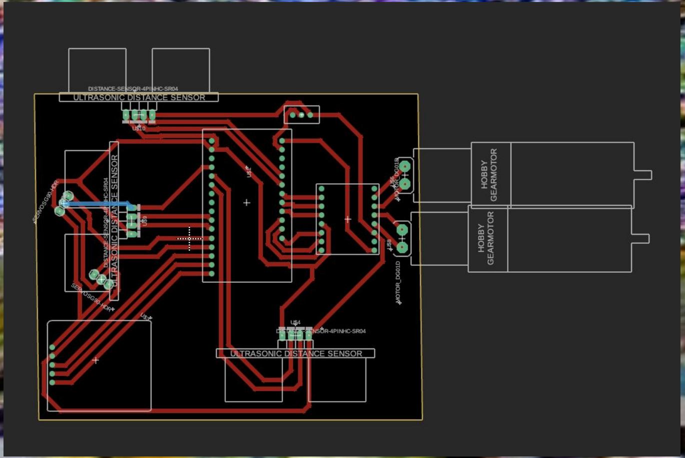
- Receives `"TV_DETECTED"` from iOS app via Bluetooth

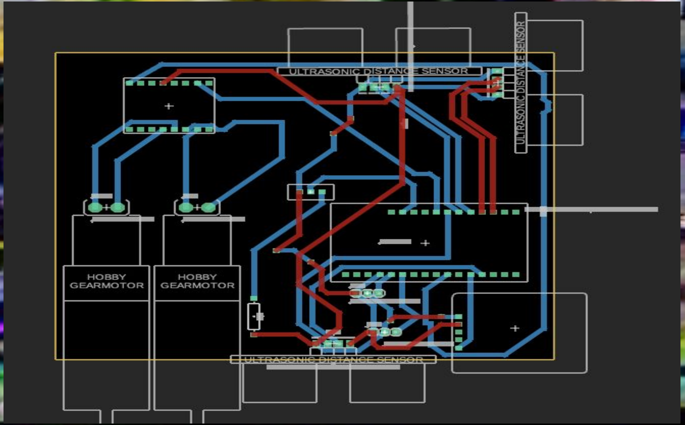
Presence Detection (mmWave):

- Stops if person is nearby; resumes after 9 seconds of no presence

Schematic(s) + PCB(s)




DISTANCE-SENSOR-4PINHC-SR04
ULTRASONIC DISTANCE SENSOR
US10
ULTRASONIC DISTANCE SENSOR
SERVOSG90-HDR
HOBBY GEARMOTOR
HOBBY GEARMOTOR
MOTOR_DG01D
DISTANCE-SENSOR-4PINHC-SR04
ULTRASONIC DISTANCE SENSOR


ULTRASONIC DISTANCE SENSOR
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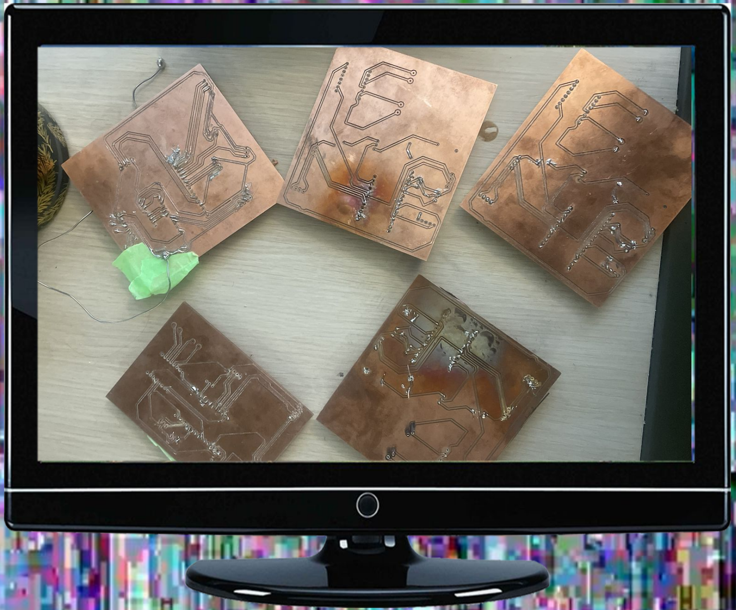
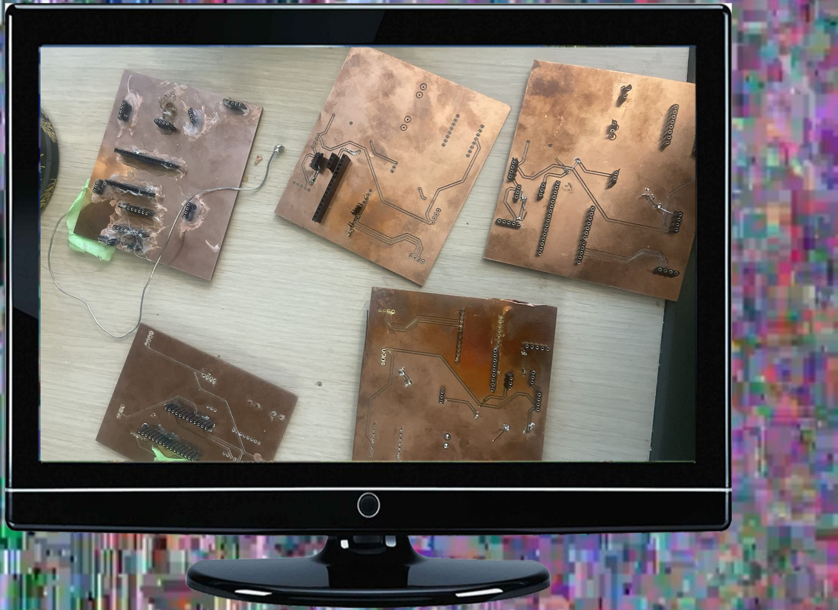
ULTRASONIC DISTANCE SENSOR

Assembly of Fabricated PCBs

Front



Back



💡 Desired Functionality (Not Yet Included) 💡

→ TV State Detection

Determine if the TV is *actually* on or off (e.g., via IR signal feedback or power sensing)

Room Mapping

Navigate room intelligently using path planning.

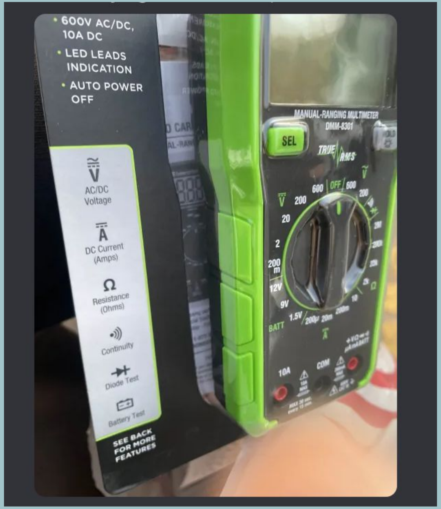
Reflection

Biggest Challenge: Soldering was the hardest part — I had to redo it multiple times and couldn’t use front-and-back traces easily. I almost got a fully working PCB as a result. Stayed in the FabLab for multiple days to learn from peers.

Most Satisfying to Overcome: Troubleshooting my PCB with a multimeter from Home Depot (field trip!) and finally getting solid connections; very passionate about this to buy my own multimeter.

Most Valuable Lesson: I learned how to solder and assemble a working PCB — the hands-on skill I hoped to gain from this course.

- Using a fume extractor, learning to solder the right amount without bridging connections, tracing and debugging with a multimeter, and understanding single-sided routing.



Thank You!

Github Repo:

https://github.com/mozeh0001/ITP388Final