Robot Recycler Project

Zoha Hassan

01 Background

Recycling globally and locally

“engage students in understanding and responding to local and global environmental issues”[1]

Loyola’s Mission

Recycling in Chicago

- Chicago is one of the worst cities in the US when it comes to recycling[2]
  - Recyling rate is under 9%[2]

Recycling facility operated by Lakeshore Recycling Systems in Forest View, IL [3]

Recycling in Chicago

Recycling facility operated by Lakeshore Recycling Systems in Forest View, IL [3]

Trash Barges to China

- The US sent its recyclables in trashbarges to China
- 7 millions tons a year[4]
- 2018 - China banned all its imports of trash[4]

Trash Barge to China[5]

Shipping Plastic Waste

Waste Plastic Sorting Facility in Indonesia[6]

SORTING PLASTIC WASTE

Plastic waste being sorted by hand in Babakan, West Java, Indonesia [7]

- Countries that import US waste sort it by hand for a lack of an efficient method[7]

02 Robot Recyler

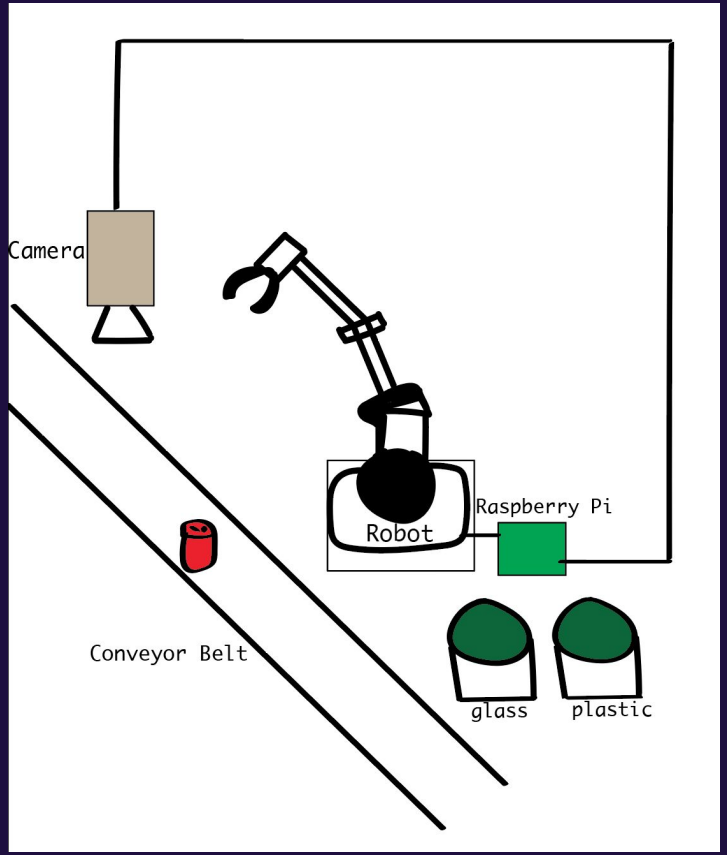
My Robot Recycler

Purpose and Function

Eliminates the need for manually sorting waste!

1. Identifies what an object is: glass, plastic, aluminum, etc.
2. Using a camera, the robot locates the size and placement of that object
3. Picks up the object from a conveyor belt to sort it in the respective category

Function - Visual Depiction



How I did it

My Raspberry Pi

- Programmed the robot using a Raspberry Pi
  - Raspberry Pi - Series of small single board computers
- The wires attached the Rasberry Pi to the robot
- Coded using Python (programming language)

How I did it

- Became intimately familiar with the robot and its movements
- Began by hardcoding many of the movements of the robot
  - Chose specific angles and speeds in different combinations
- Movement examples:
  - putDownRight()
  - setAngle()

```
def putDownRight():
    posInDegrees(1, 200)
    time.sleep(1)
    posInDegrees(3, 900)
    time.sleep(1)
    posInDegrees(5, -600)
    time.sleep(1)
    posInDegrees(3, 300)
    time.sleep(1)
    posInDegrees(1, 800)

def putDownLeft():
    posInDegrees(1, 1500)
    time.sleep(1)
    posInDegrees(3, 900)
    time.sleep(1)
    posInDegrees(5, -600)
    time.sleep(1)
    posInDegrees(3, 300)
    time.sleep(1)
    posInDegrees(1, 800)

def mainLeft():
    pickUp()
    time.sleep(1)
    putDownLeft()

def main():
    pickUp()
    time.sleep(1)
    putDownRight()

def mainTwice():
    main()
    time.sleep(1)
    main()

def mainBoth():
    main()
    time.sleep(1)
    pickUp()
    time.sleep(1)
    putDownLeft()

#os.system

if __name__ == "__main__":
    main()
```

```
import os
import serial
import time

def setAngle(number, angle):
    f = serial.Serial("/dev/ttyUSB0",115200)    #opening the serial port and setting baudrate
    f.write(f"#{number}MD{angle}\r".encode())   #writing to the file
    f.close()


def posInDegrees(number, angle):
    f = serial.Serial("/dev/ttyUSB0", 115200)
    f.write(f"#{number}D{angle}\r".encode())
    f.close()


def wheelModeDegrees(number, angle):    #sets servo to wheel mode where it rotates in that direction
    f = serial.Serial("/dev/ttyUSB0", 115200)
    f.write(f"#{number}WD{angle}\r".encode())
    f.close()

def halt(number):
    f = serial.Serial("/dev/ttyUSB0", 115200)
    f.write(f"#{number}H\r".encode())
    f.close()

def firstPos(number):                   #initially goes limp when turning on
    f = serial.Serial("/dev/ttyUSB0", 115200)
    f.write(f"#{number}CFD\r".encode())
    f.close()

for x in range(6):
    firstPos(x)

#Reset command
def reset(number):
    f = serial.Serial("/dev/ttyUSB0", 115200)
    f.write(f"#{number}RESET\r".encode())
    f.close()

def resetAll():
    time.sleep(1)
    for x in range(6):
        reset(x)
```

Robot Demo

https://youtu.be/Ck55z4vyvi4

Robot Demo

https://youtu.be/N6igR0m3iFQ

03 Next Steps

Next Steps

- Ability for camera to distinguish materials
- Locate the coordinates of object and pick it up using relative angles instead of hardcoded ones

Sources

[1] “Environmental Justice: Loyola University Chicago.” *Loyola University Chicago - School of Environmental Sustainability*, https://www.luc.edu/sustainability/about/ourmission/.

[2] “While Chicago Recycling Rate Remains Stubbornly Low, Advocates and Officials Eye Improvements.” *WTTW News*, https://news.wttw.com/2022/10/03/while-chicago-recycling-rate-remains-stubbornly-low-advocates-and-officials-eye.

[3] “Where Does Chicago's Recycling Go?” *WTTW News*, https://news.wttw.com/2017/06/27/where-does-chicago-s-recycling-go.

[4] Joyce, Christopher. “Where Will Your Plastic Trash Go Now That China Doesn't Want It?” *NPR*, NPR, 13 Mar. 2019, https://www.npr.org/sections/goatsandsoda/2019/03/13/702501726/where-will-your-plastic-trash-go-now-that-china-doesnt-want-it.

[5] LLC, George Argeroplos / Newsday. “The Tugboat Break of Dawn with Garbage Barge Is Anchored in New York...” *Getty Images*, https://www.gettyimages.com/detail/news-photo/the-tugboat-break-of-dawn-with-garbage-barge-is-anchored-in-news-photo/1031473174?adppopup=true.

[6] Admppc. “157,000 Shipping Containers of U.S. Plastic Waste Exported to Countries with Poor Waste Management in 2018.” *Plastic Pollution Coalition*, 8 July 2022, https://www.plasticpollutioncoalition.org/blog/2019/3/6/157000-shipping-containers-of-us-plastic-waste-exported-to-countries-with-poor-waste-management-in-2018.

[7] “UK Exporting 67% of Plastic Waste amid 'Illegal Practices' Warnings.” *The Ecologist*, 17 Nov. 2017, https://theecologist.org/2017/mar/13/uk-exporting-67-plastic-waste-amid-illegal-practices-warnings.

THANK YOU!