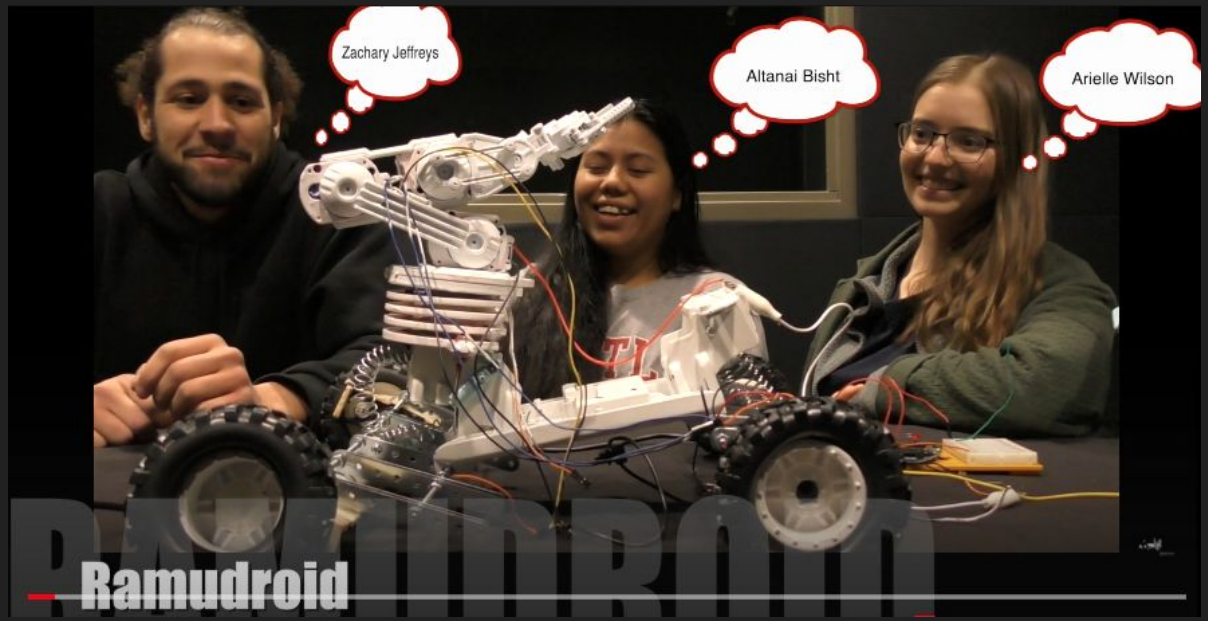
Garbage picking
Crypto mining Robot

RamuDroid v8

SEATTLE
UNIVERSITY

Presented on open Day, Apr 9 2021 at
Jim and Janet Sinegal Center for Science and Innovation

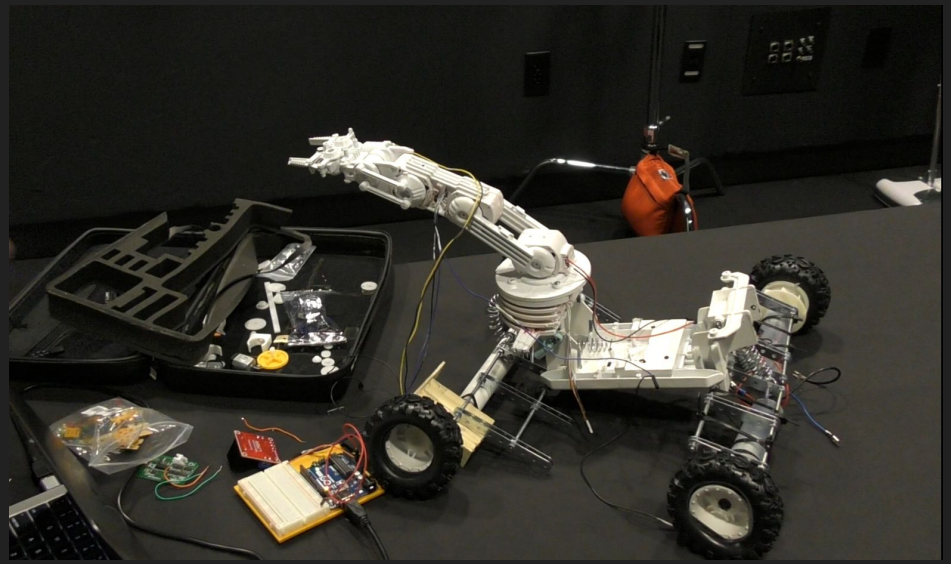
The team



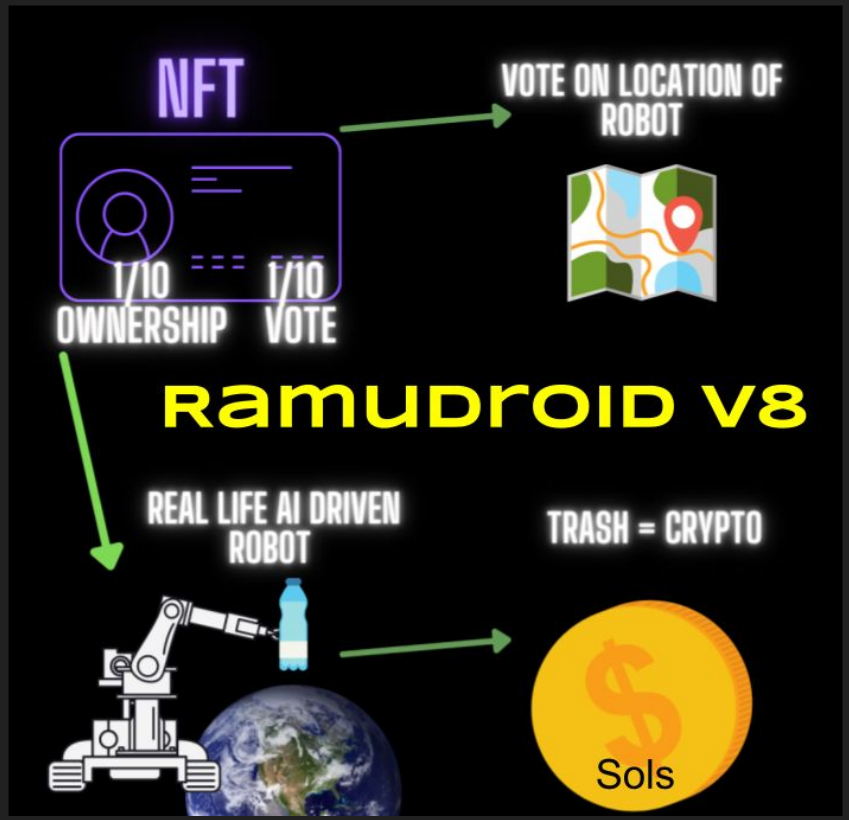
Special thanks to our faculty
- Dr. Lisa Milkowski
- Dr. Shadrock Samavi

Goal

We propose an ambitious project that combines robotics, machine learning, and blockchain. This project will reward our native cryptocurrency in exchange for helping clean up garbage around the real world.

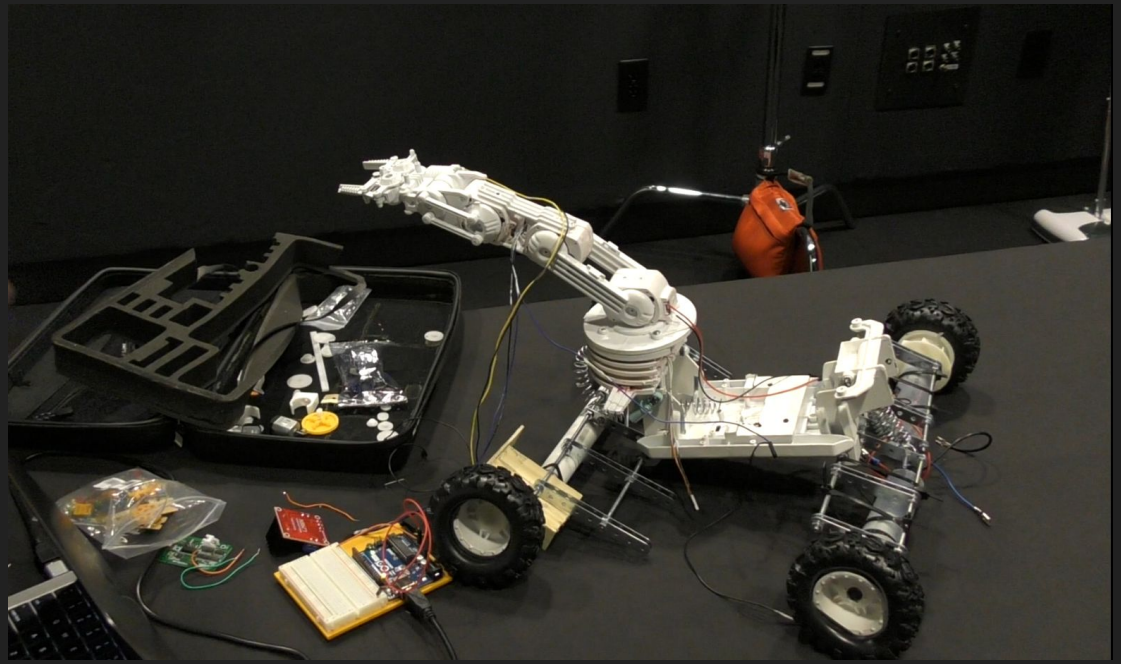


Concept



- Solana's blockchain is used to encourage shared equity in each robot in the form of NFT's.
- Community members can join together to purchase a robot to clean their community
- Owners are rewarded cryptocurrency for cleaning up trash

An open source project that cleans the world with autonomous robots that collect garbage



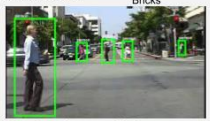
RamuDroid v8

Garbage picking Crypto mining Robot

Edge/ ondevice Object Detection


Stones , pebbles


Bricks


Pedestrian, vehicles

Path Obstruction

Behaviour based robotics
Autonomous Driving

Motor Controller

Camera stream from robot

SRTP

Wifi / LTE network

json

Reinforcement Learning

Bin Sensor

Mechanical Arm to pick up the object

ROS

NFT reward from Blockchain mining

Web 3.0

Decentralized blockchain network

Record garbage collected
Analyze readings

WebRTC media stream
+
Datachannel json

Tensorflow Neural Network
Model based garbage detection

Remote Object Detection


plastic


Can / tin Metal


Bottles Plastic


e-waste


Paper / cardboard

Recyclable Garbage


leaves

wood

Non Recyclable Garbage Object Detection

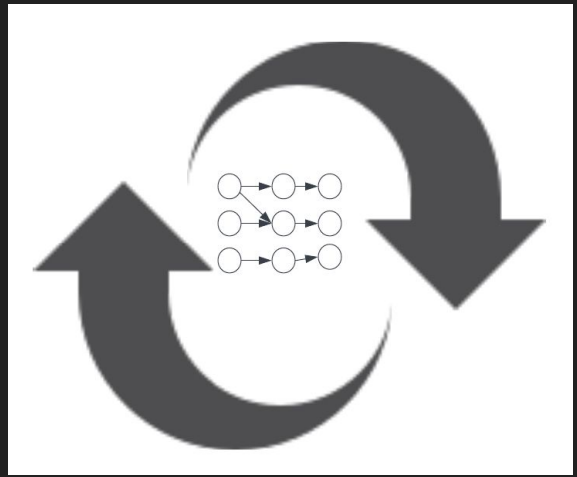

Masks


Syringe

Bio Hazard Garbage

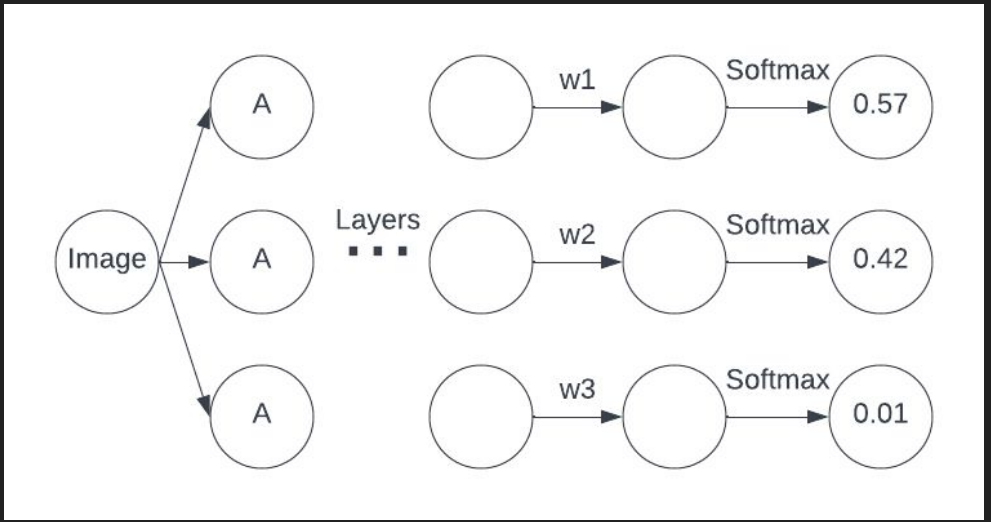
How the Model Learns to Find Trash

1) Generate trash types, or classes, from photo folders e.x. “plastic”.
2) Training happens in epochs. An epoch has
   one feed forward and one back propagation.



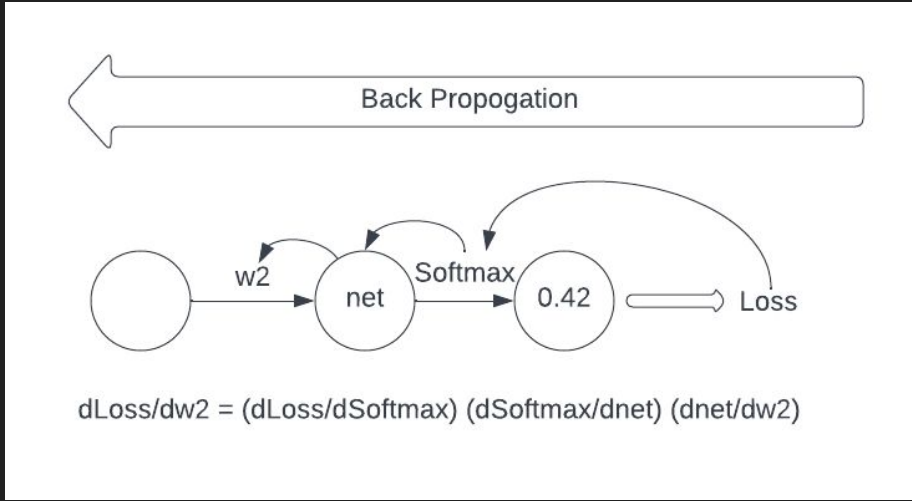
Feed Forward

- An image is fed to the network.
- In the final layer, probabilities of this image belonging to all classes are generated using a Softmax activation function.
- Softmax converts output to probability.



Back Propagation

- Predicted probabilities are compared to the actual image class.
- The network tries to generate a high probability of an image belonging to the correct class, but it is not perfect.
- SGD, a gradient descent algorithm, is used to optimize weights and improve accuracy.
- A weight is changed based on its gradient with respect to the loss.



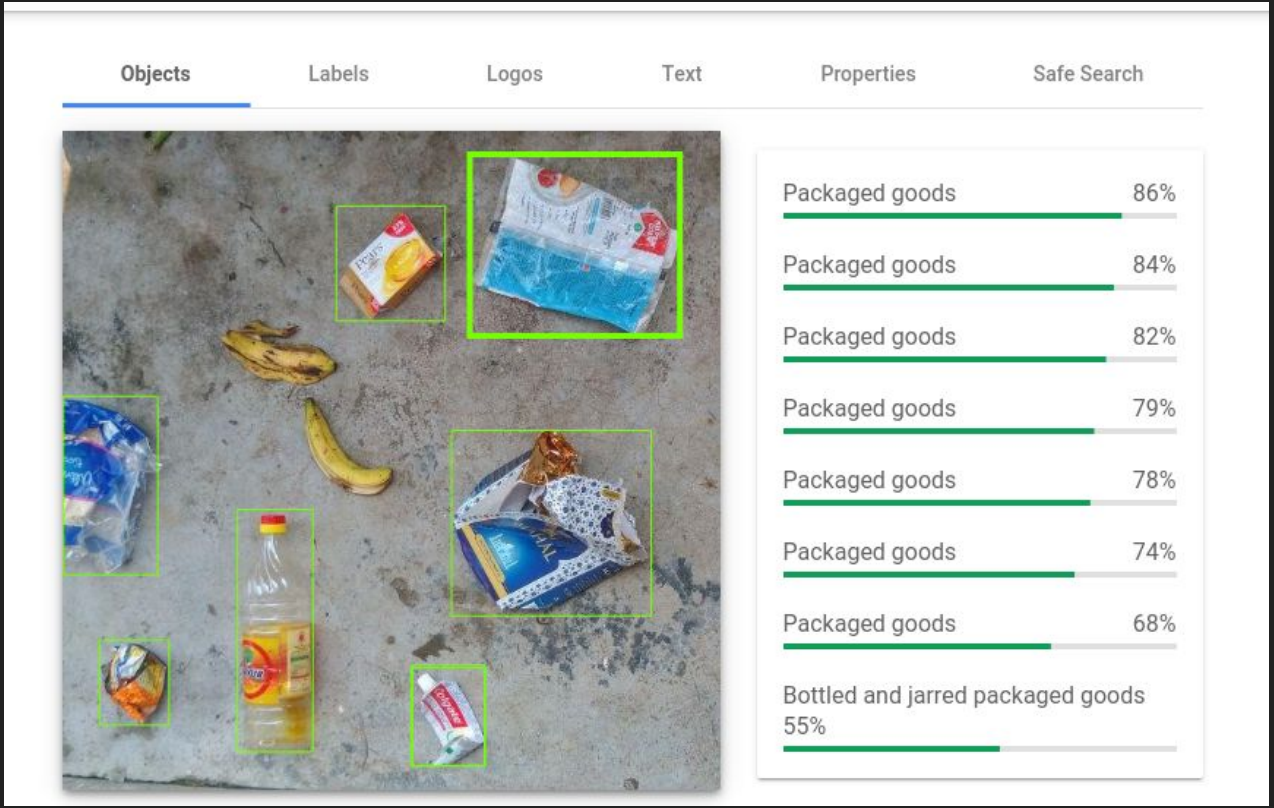
Garbage Segregation by Probability

leaf: 0.00
plastic: 0.86
polythenebag: 0.00
paper: 0.00
glass: 0.00
metal: 0.13
cardboard: 0.01
wrappers: 0.00

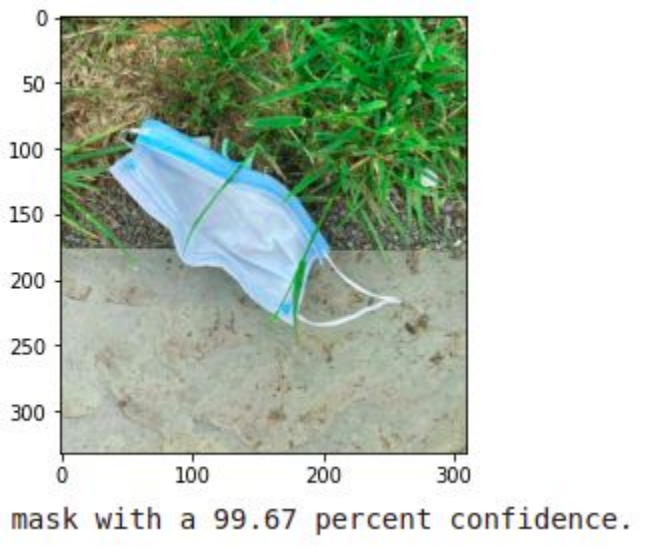
leaf: 0.01
plastic: 0.89
polythenebag: 0.00
paper: 0.00
glass: 0.00
metal: 0.01
cardboard: 0.07
wrappers: 0.01

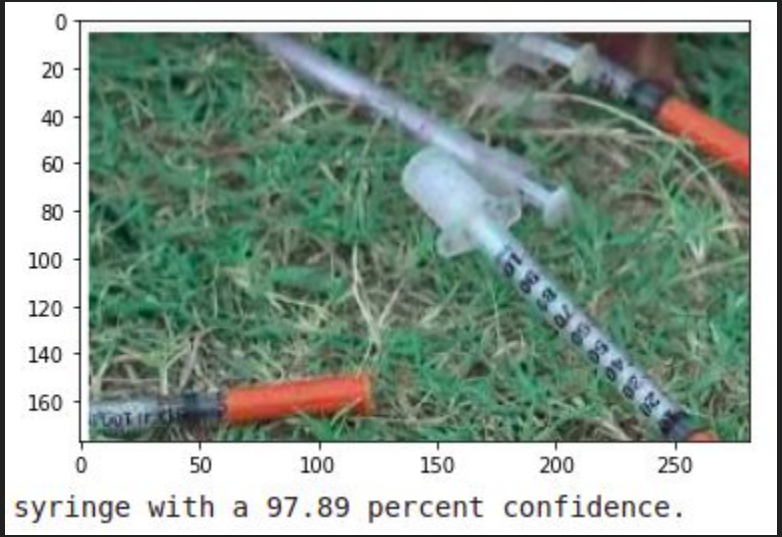
leaf: 0.00
plastic: 0.01
polythenebag: 0.00
paper: 0.01
glass: 0.26
metal: 0.00
cardboard: 0.67
wrappers: 0.06

Test Run


Objects
Labels
Logos
Text
Properties
Safe Search
Packaged goods 86%
Packaged goods 84%
Packaged goods 82%
Packaged goods 79%
Packaged goods 78%
Packaged goods 74%
Packaged goods 68%
Bottled and jarred packaged goods 55%

Biohazardous waste detection

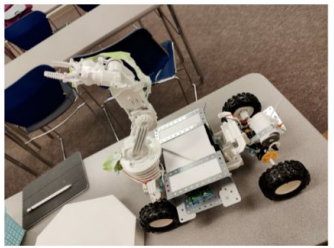




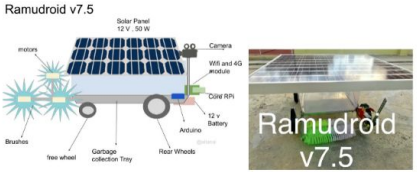
History of RamuDroid

Ramudroid v2 (2016)
Simple assembly, battery-powered that detected garbage but needed manual input to confirm to pickup with the front assembly of brushes. Built by Altanai Bisht

Ramudroid v8 (2022)
Ramudroid v8 is an ambitious project that merges robotics, its machine learning model for trash identification, Web 3.0, and Blockchain. The highlight of this project is awarding Cryptocurrency for successfully picking up trash using the robot. This open-source project will help promote innovative usage of technology to solve real-world problems. The robot has a mechanical arm for better control. Built by Altanai Bisht, Zachary Jeffreys, and Arielle Wilson



Ramudorid v7 (2019)
Powered by solar energy, it uses the camera's media stream to identify target garbage type and 3 brush designs to lift up small objects like plastic cups, wrappers, leaves etc. The autonomous droid also provides a real-time camera stream and detects obstruction to reroute itself. It can communicate over 4G, WiFi and BLE and uses edge computation to collect and analyze data on garbage spotted and collected. Built by Altanai Bisht

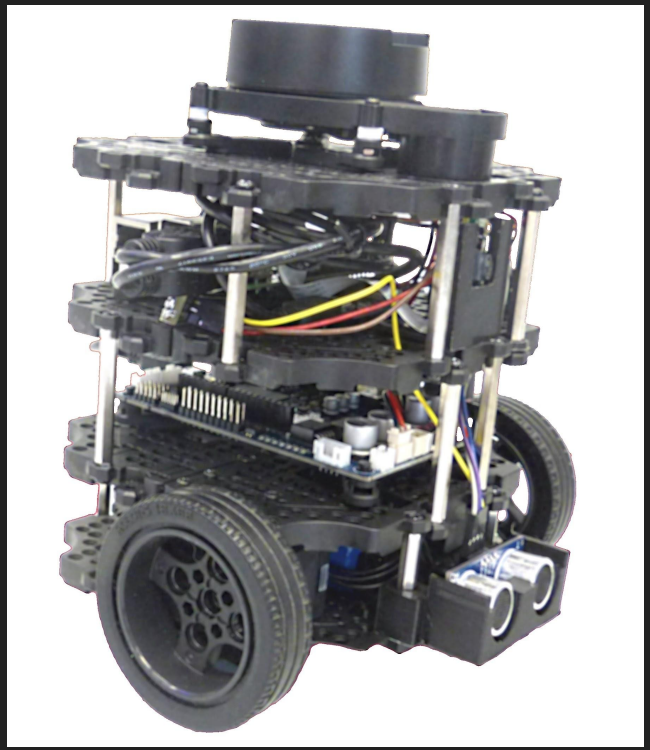


Next Steps


RAMUDROID
PARTNERED WITH
BETTER WORLD
ROBOT # 1
This robot uses crane like legs to naviage more difficult terrains. Two large crab like arms are used to find and transport the garbage to robot 2.
TWO LARGE VERSATILE ARMS
LEGS RAISE FOR CLEARANCE
ROBOT #2
This robot stores categorized trash into bins. The Robot 1 will pick up and drop garbage into the correct bin. Once robot 2 if at capacity, it will transport the garbage to one of our garbage centers.
SEPERATES GARBAGE INTO CATEGORIES
COMING SOON...
GLOVES TO CONTROL REMOTELY
DRONE TO IDENTIFY TRASH & BATTERY REPLACEMENT
SOLAR CHARGING STATIONS
DEPOSIT CENTERS

1) Better Equipment to overcome hardware Limitations

- Our self-driving program is on the Raspberry Pi, but our model is hosted remotely.
- We want a TensorFlow Lite version of the model to live on the rpi to eliminate WIFI connection delays.
- We need more RAM and computational power



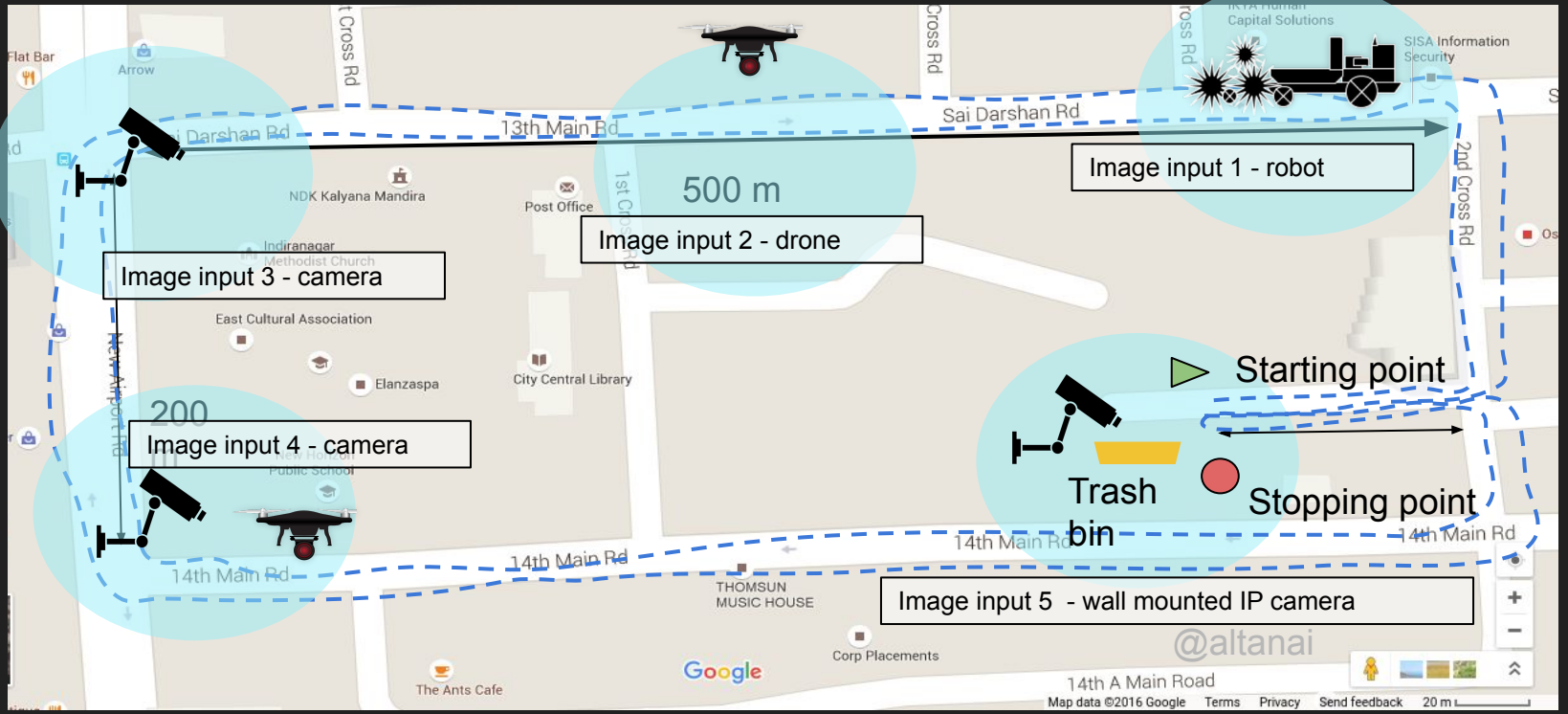
2) Gazebo Simulation Software and ROS

- Use Gazebo simulation software to design our robot, test our algorithms, and train our AI system in complex outdoor environments.
- Use The Robot Operating System (ROS), a set of software libraries and tools,to build out our application.

3. Robot and Bin Dual Robot System to pick and carry the garbage

Image credit https://www1.cimtecautomation.com/ and https://www.robot-advance.com/EN/art-wowwee-mip-white-robot-1281.htm

4. Swarm of Robot and Quadcopters to Scan and Clean the area



Ramudroid in news

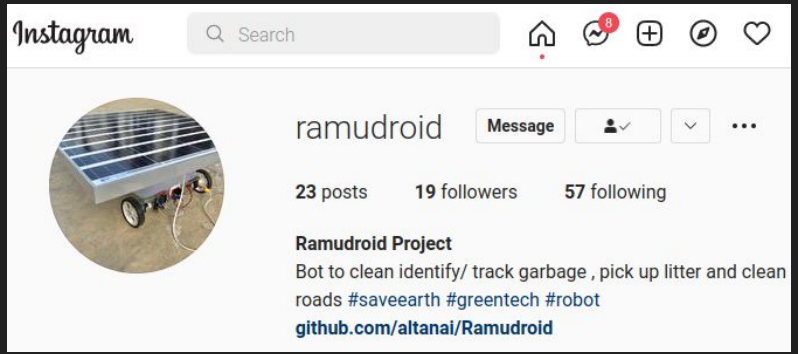
https://seattlespectator.com/2022/03/12/seattle-u-graduate-students-are-building-a-droid-that-collects-trash/#

Reach us at our discord server discord.gg/TxwvwhVgcE

More Info

https://medium.com/ramudroid

https://www.instagram.com/ramudroid/



https://github.com/Ramudroid