

Beach Swarm: Phase III

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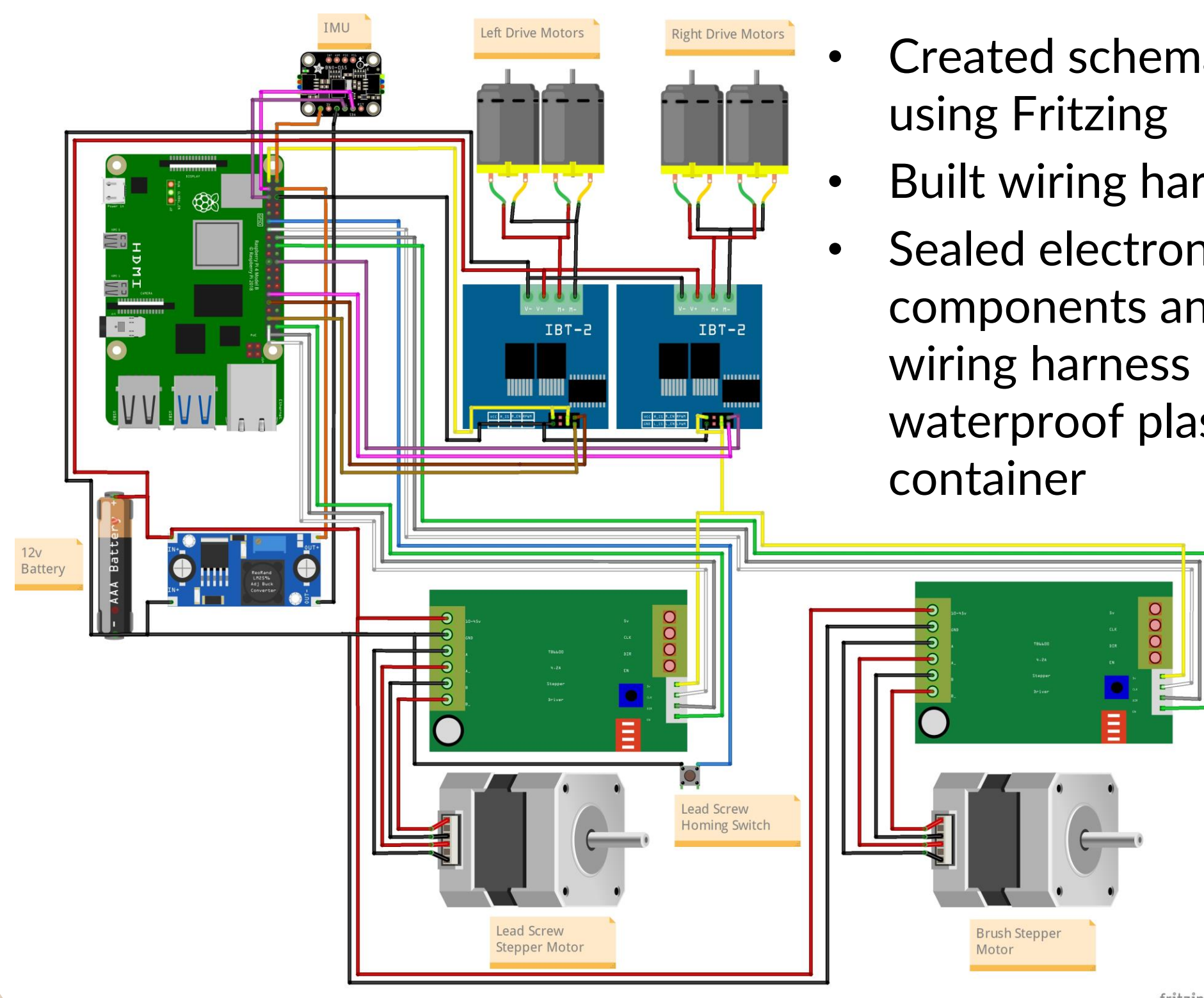
Abstract

Beach pollution is growing and negatively affects human and marine health. While there are currently several methods of beach clean-ups, many are done by hand and often overlook small litter such as cigarette butts. The goal of this project is to design and build an autonomous robot that can clear beaches of harmful litter including small litter. This robot collects a variety of trash and provides a scalable solution for future implementations of a multi-robot, swarm-like approach.

Project Objectives

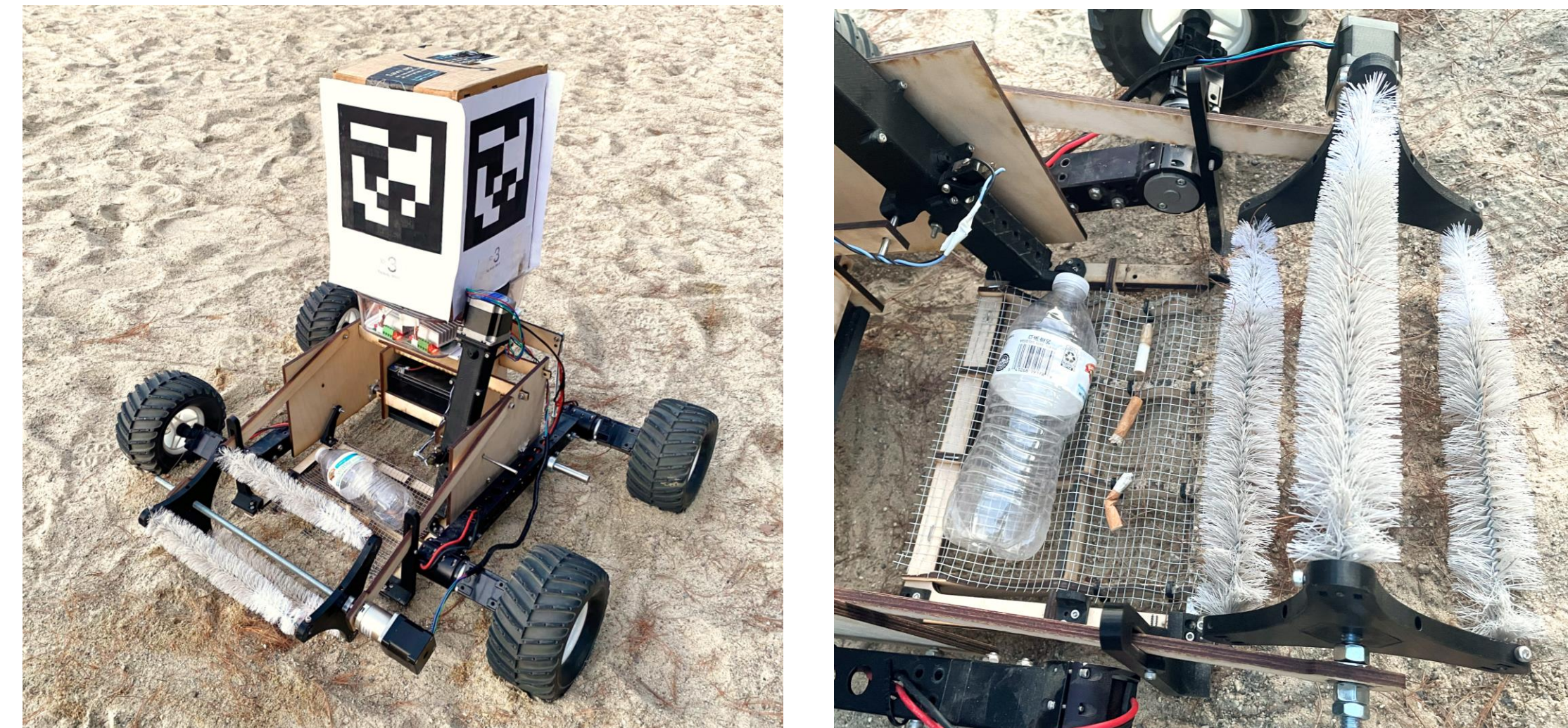
- Improve the Smallbot's mechanical design for collection of smaller forms of litter
- Waterproof the Smallbot's electrical components
- Update the previous codebase to utilize Robot Operating System (ROS)

Electrical Design



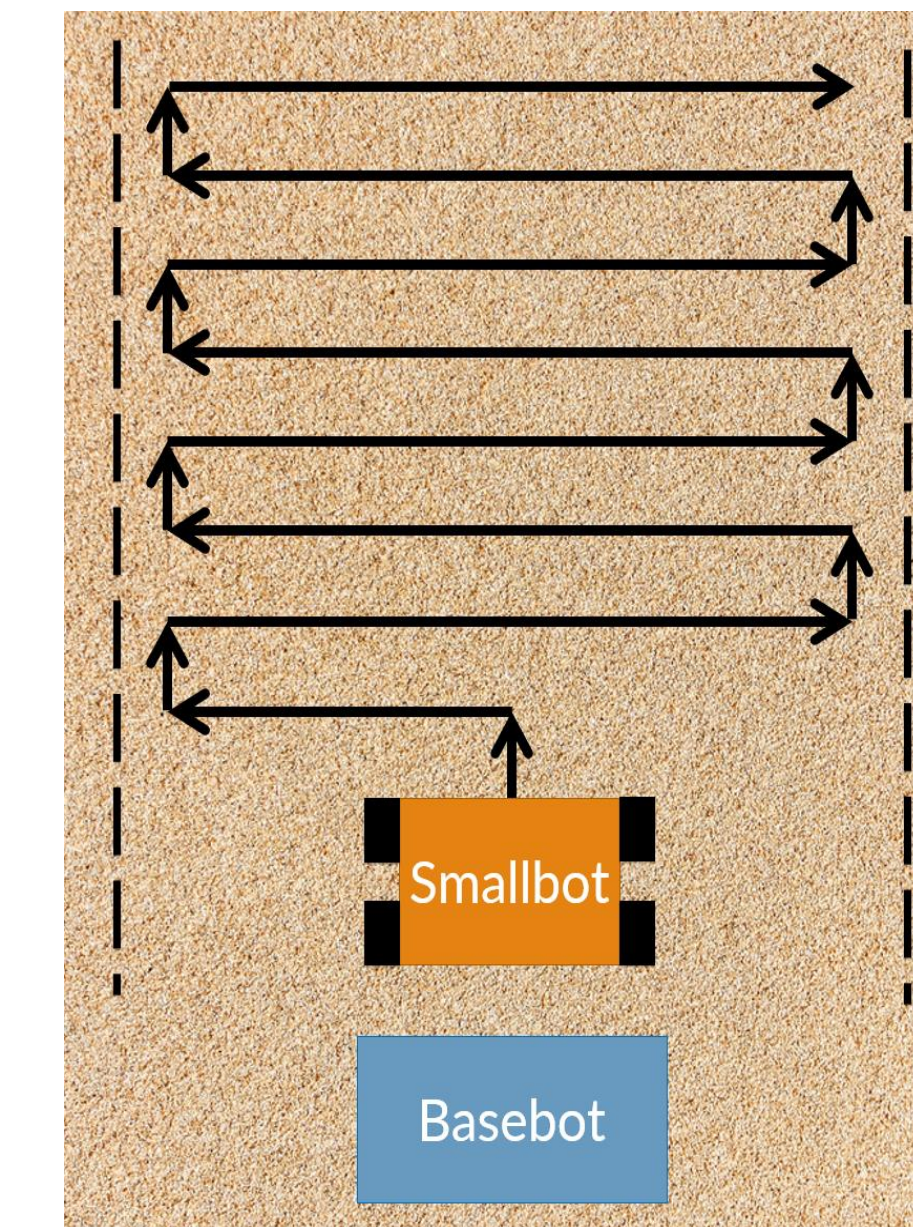
- Created schematic using Fritzing
- Built wiring harness
- Sealed electronic components and wiring harness in a waterproof plastic container

Smallbot Design



- Sifter mechanism separates litter from beach sand
- Brush mechanism helps move litter onto sifter
- Lead screw lowers and raises sifter for sifting and dumping
- IMU is used for heading control
- AprilTags are used for localization by the Basebot

System Design



Basebot

- The hub of the swarm
- Tracks and issues commands to Smallbot
- Storage for collected litter

Smallbot

- Collects litter from sand with sifter
- Deposits litter at Basebot

Testing Results

The Smallbot successfully collected both bottles and cigarette butts. The brush helped to move litter onto the sifter. The lead screw was able to move the sifter to the sifting and dumping positions.

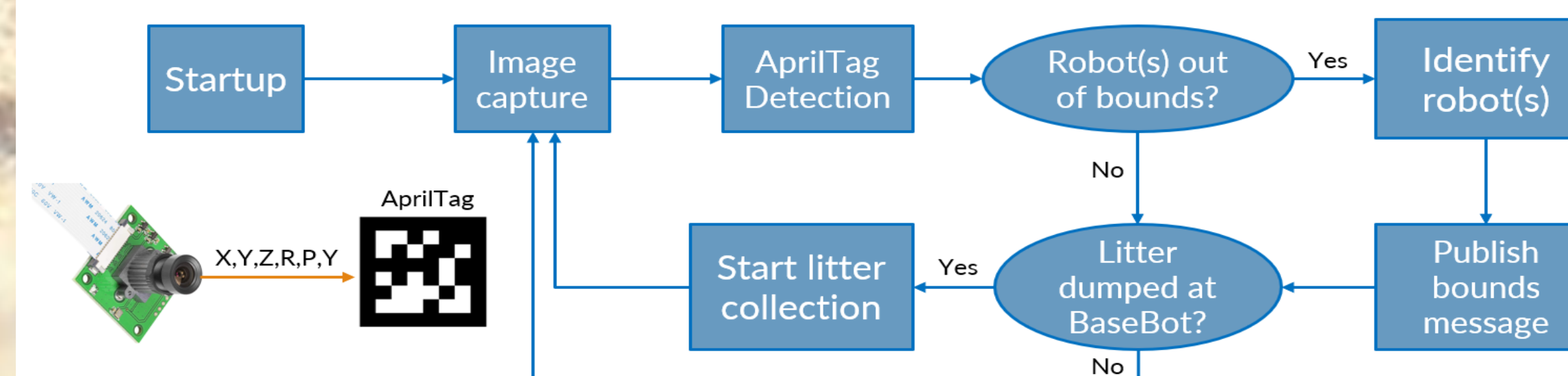
The Basebot successfully tracked the Smallbot using AprilTags and issued commands for driving and turning.

Demo videos can be accessed through the QR Code:

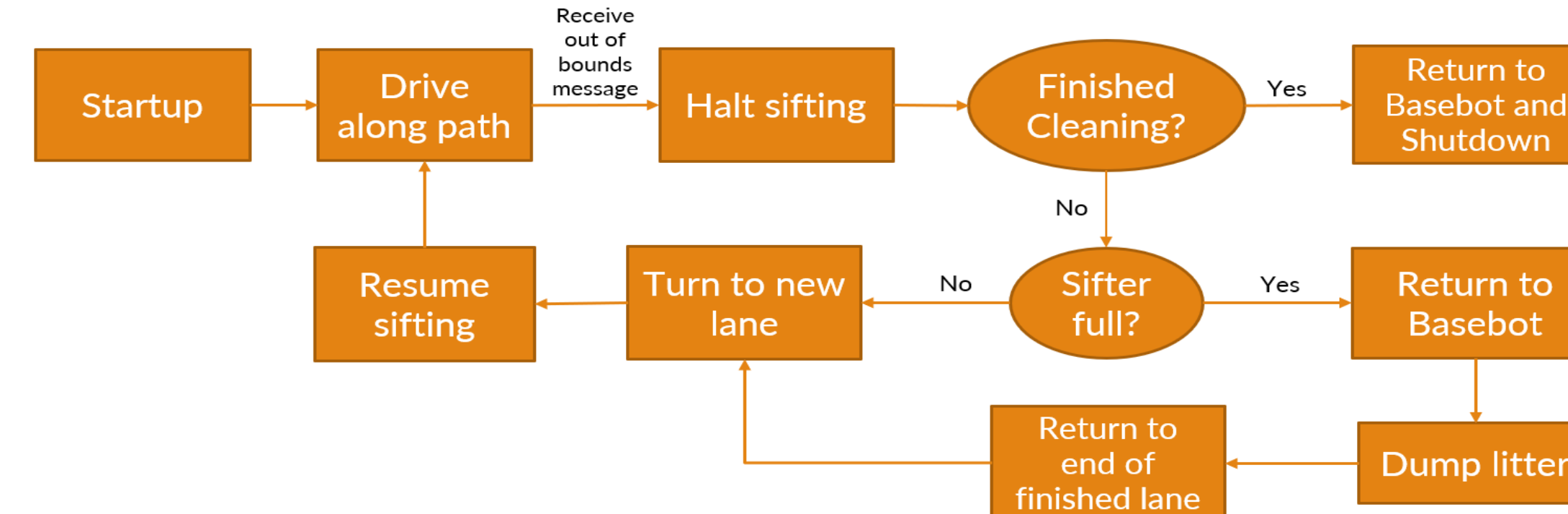


Software Design

Basebot State Machine



Smallbot State Machine



Future Implementations

- Expand on Basebot functionality by implementing Smallbot swarm to clean larger areas of beach
- Implement sifter functionality on more robust chassis

Acknowledgements

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