Simulation and Execution of Learning Methods and Algorithms of an Automated Lawnmower

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January 26, 2010

Abstract

- Mowing of a lawn can be done more efficiently, such as when it is done manually.
- Identifying cut grass versus uncut grass, dividing the lawn into sections to be completed at separate times, and avoiding obstacles are how humans work more efficiently.
- This project uses Java in conjunction with the Processing Development Environment (in simulation) in order to evaluate the performance of an ALM as it learns its environment.

Introduction and Purpose

- Manual labor is outdated
- Roomba – same concept
- Improve the concept

http://www.aaronsdayoff.com/

Background

http://www.erobotshop.com/

- Husqvarna Automower
  - Random movements
  - Trimming
  - Wire installation

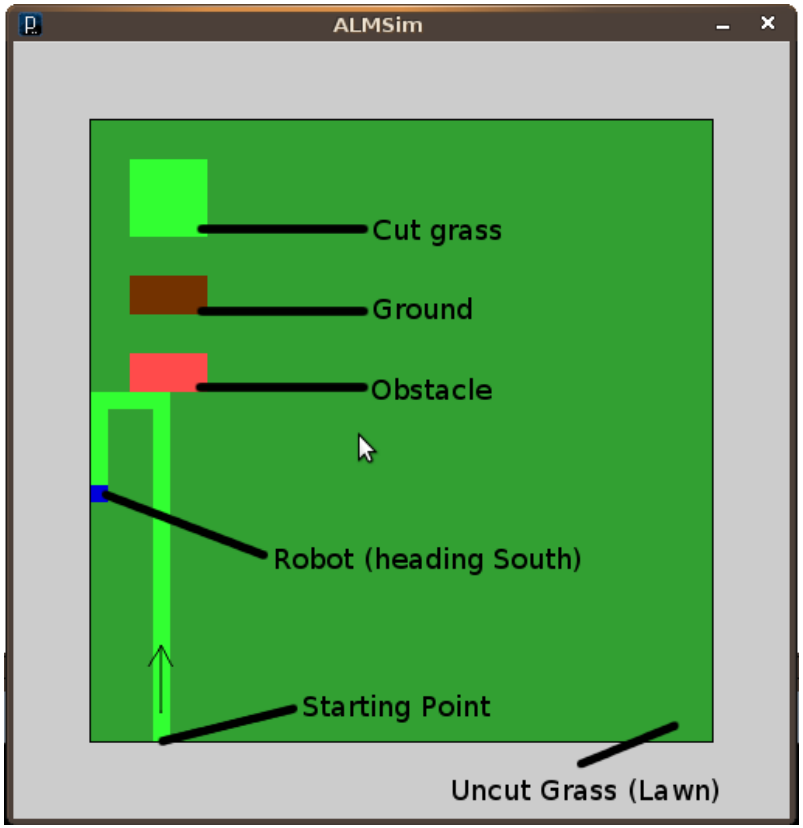
The Project

The project consists of two parts:

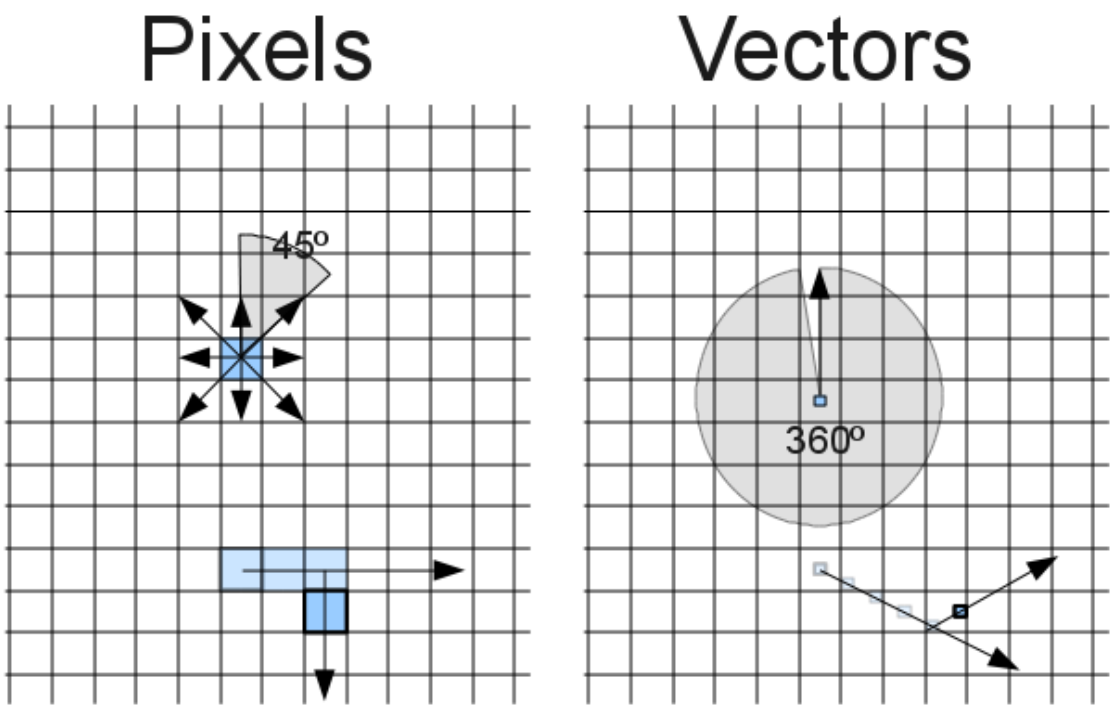
- Simulation
  - A graphical representation of the lawnmower.
- Implementation (Execution)
  - To be created in conjunction with the Robotics Lab

Simulation – Theory

- Created with the Processing Development Environment (PDE)
- Knows nothing of its whereabouts until it "bumps" into them
- Base state for actual robot (similar to Automower)



Simulation – Backbone

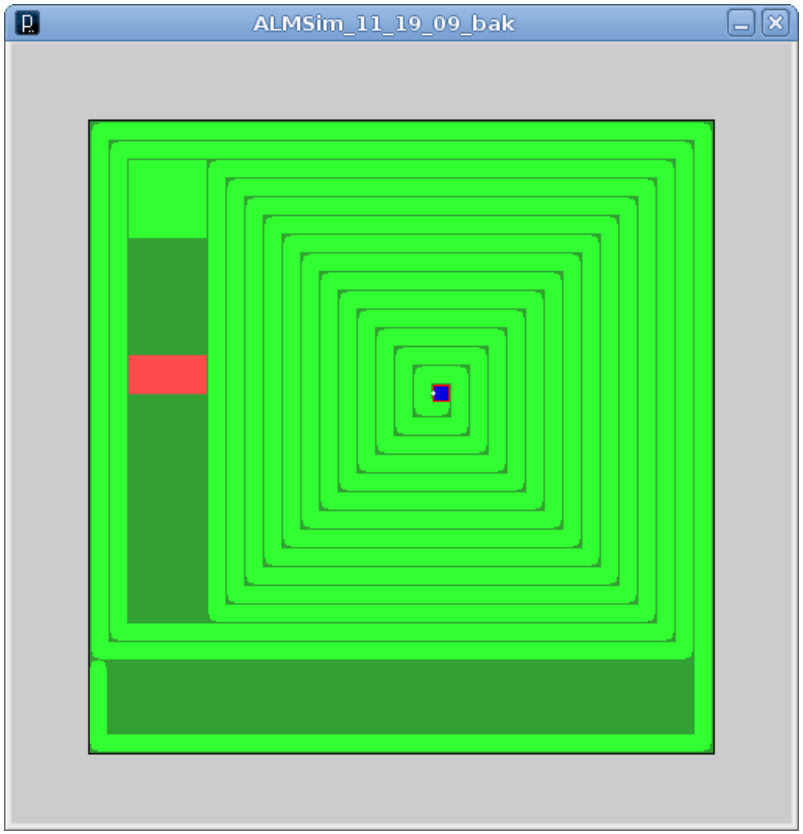


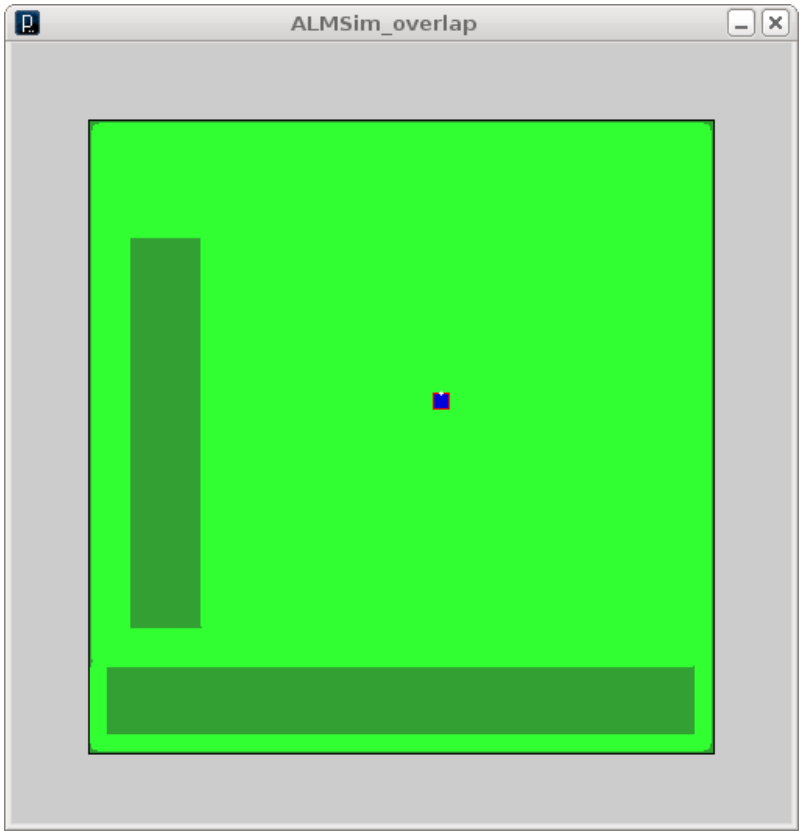
Implementation and Execution

http://corporate.husqvarna.com/

- The "eyes" of the robot:
  - US sesnsors
  - SLAM
- The fail-safe:
  - Bumper sensors
  - Emergency stop button

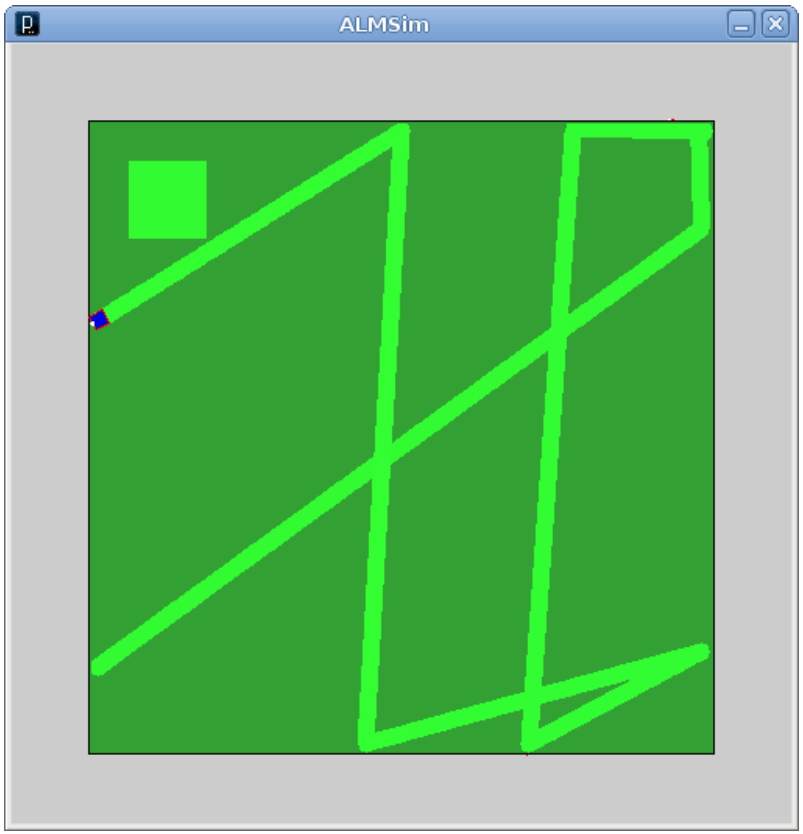
Current Results – Overlap





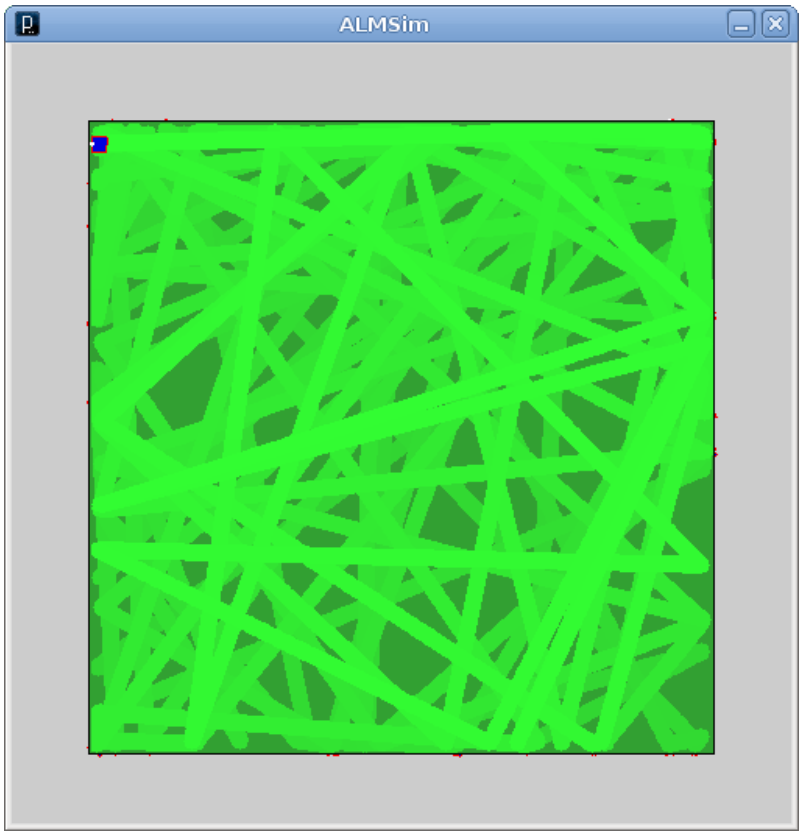
Current Results – Random

Screenshot #1 – ∼10 seconds



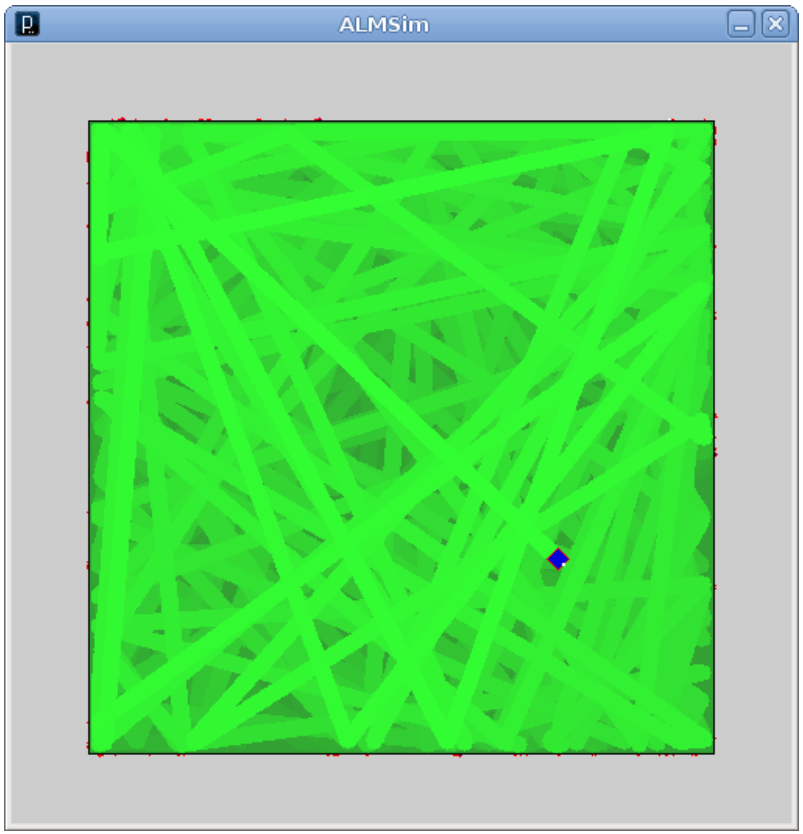
Current Results – Random

Screenshot #2 – <1 minute



Current Results – Random

Screenshot #3 – >2 minutes



Expected Results

The robot should begin by working as it does now, making random cuts. It then progresses as it learns its environment through SLAM, avoiding obstacles more often. The robot should eventually be able to notice when it would be best to just finish an entire section rather than continue running around the entire lawn.

Conclusion

For an automated lawnmower to be feasible, it must be:

- Low-cost/Cost-effective
- Efficient
- Quiet/Customizable
- Safe

Our designs for this project cover 3 of the 4 bases, as the parts are somewhat expensive.

http://blog.robotbase.org/