

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

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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.

- 1 Purpose
- 2 Background
 - Automower
- 3 Project
 - Simulation
 - Theory
 - Calculation
 - Implementation
- 4 Results
 - Current
 - Overlap
 - Random
 - Sprial
 - Extension
- 5 Acknowledgments
- 6 Conclusion

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- Manual labor is outdated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

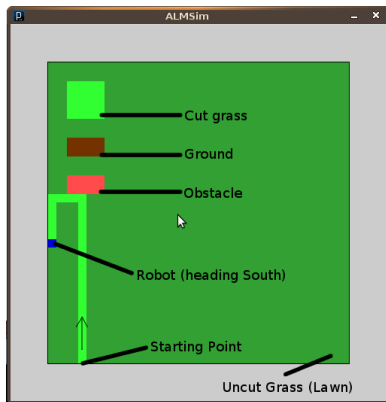
The Project

The project consists of two parts:

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

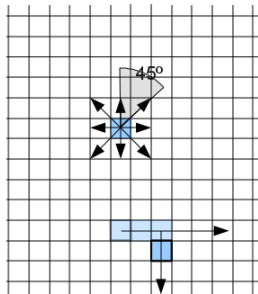
Simulation – Theory

- 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)

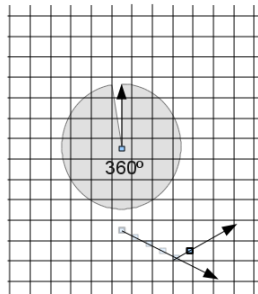


Simulation – Backbone

Pixels



Vectors



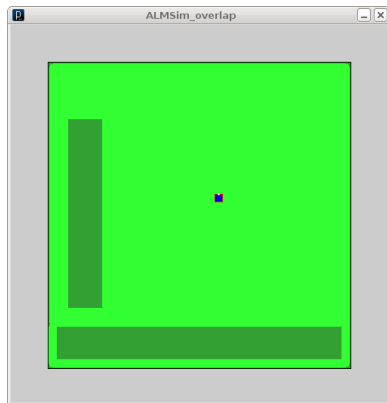
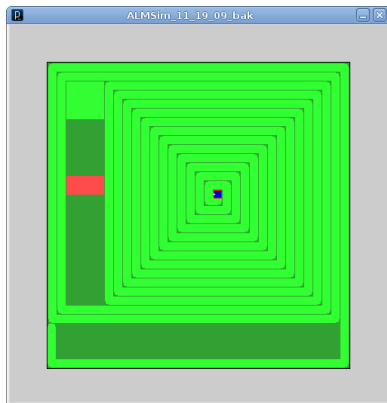
Implementation and Execution



<http://corporate.husqvarna.com/>

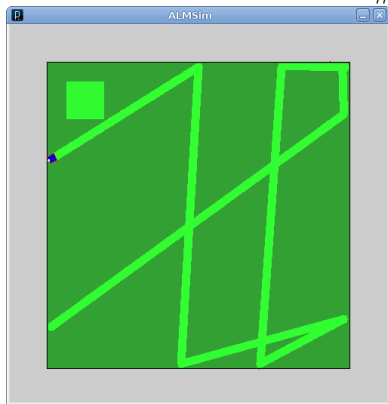
- The "eyes" of the robot:
 - US sensors
 - SLAM
- The fail-safe:
 - Bumper sensors
 - Emergency stop button

Current Results – Overlap



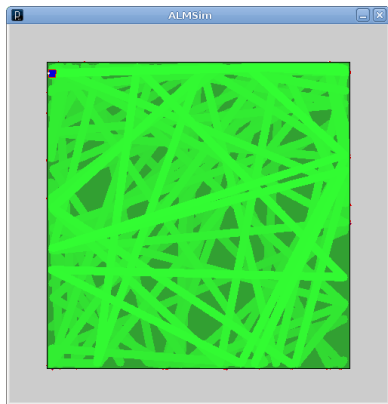
Current Results – Random

Screenshot #1 – ~10 seconds



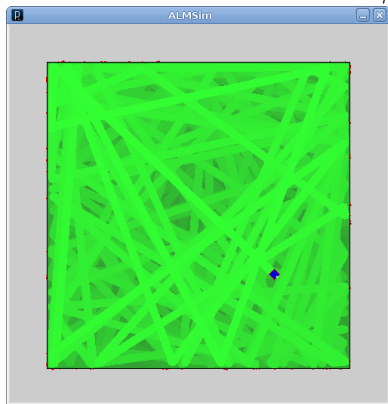
Current Results – Random

Screenshot #2 – <1 minute



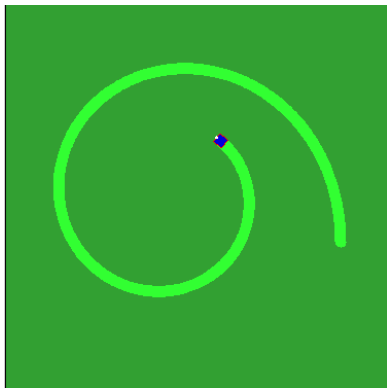
Current Results – Random

Screenshot #3 – >2 minutes



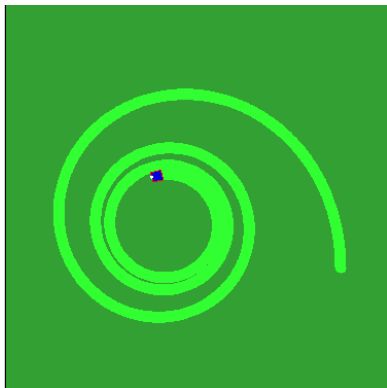
Current Results – Spiral

Screenshot #1 – 3 seconds



Current Results – Spiral

Screenshot #2 – 5 seconds



Future 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.

Acknowledgments

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- Mr. Andrew Palmer – Senior Robotics Technician and Group Partner
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- Mr. Victor Yu – Senior Energy Systems Technician and Group Partner
- Mr. Mo Yang Lu – Senior Computer Systems Technician and Lab Partner

Conclusion

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

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



In conclusion, this project turned out to be too ambitious for only one year, and hopefully another developer can make a long-term project out of it.

<http://blog.robotbase.org/>