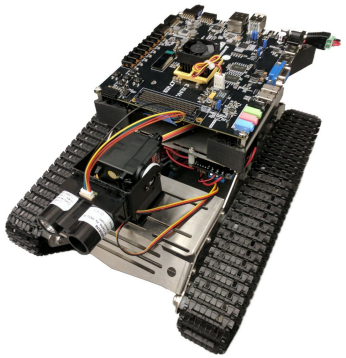
NeoN: Neuromorphic Navigation with DANNA



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NEUROMORPHIC
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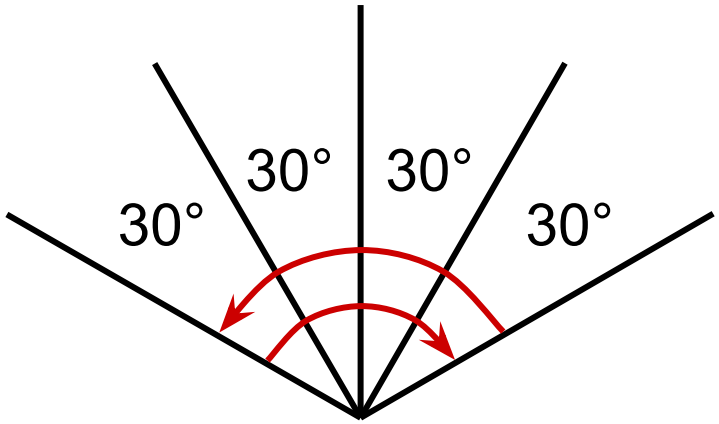
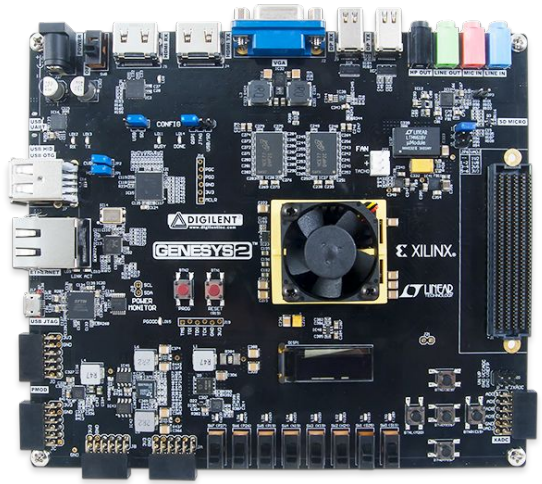
Overview

- EECS Senior Design Project
- Create roaming robot
  - Avoid obstacles
  - Avoid ledges
- Design a physical framework for deploying DANNA
- Explore robotics control as a problem domain

Robot Design

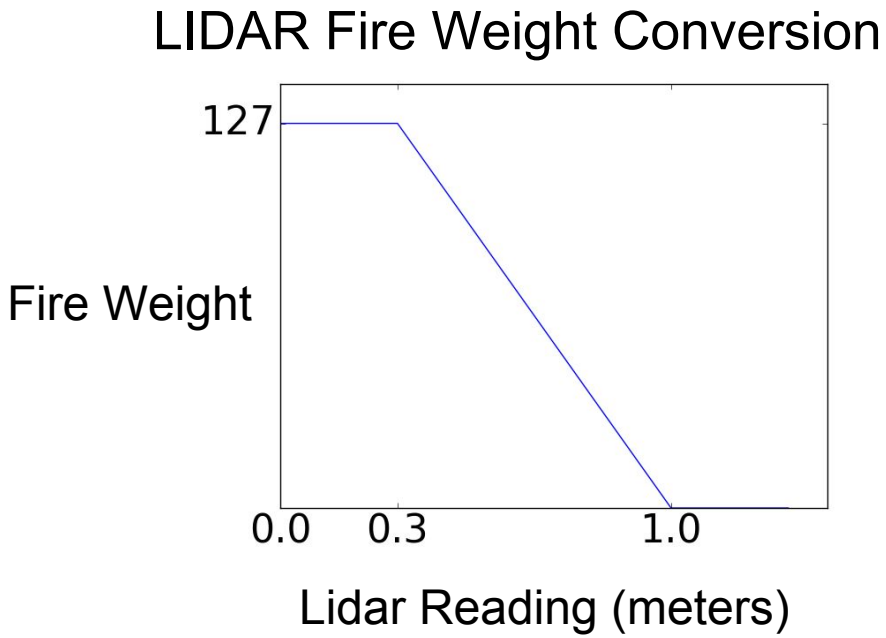


- Tank style drivetrain
- LIDAR mounted on servo
- Limit switches
- All computation through FPGA

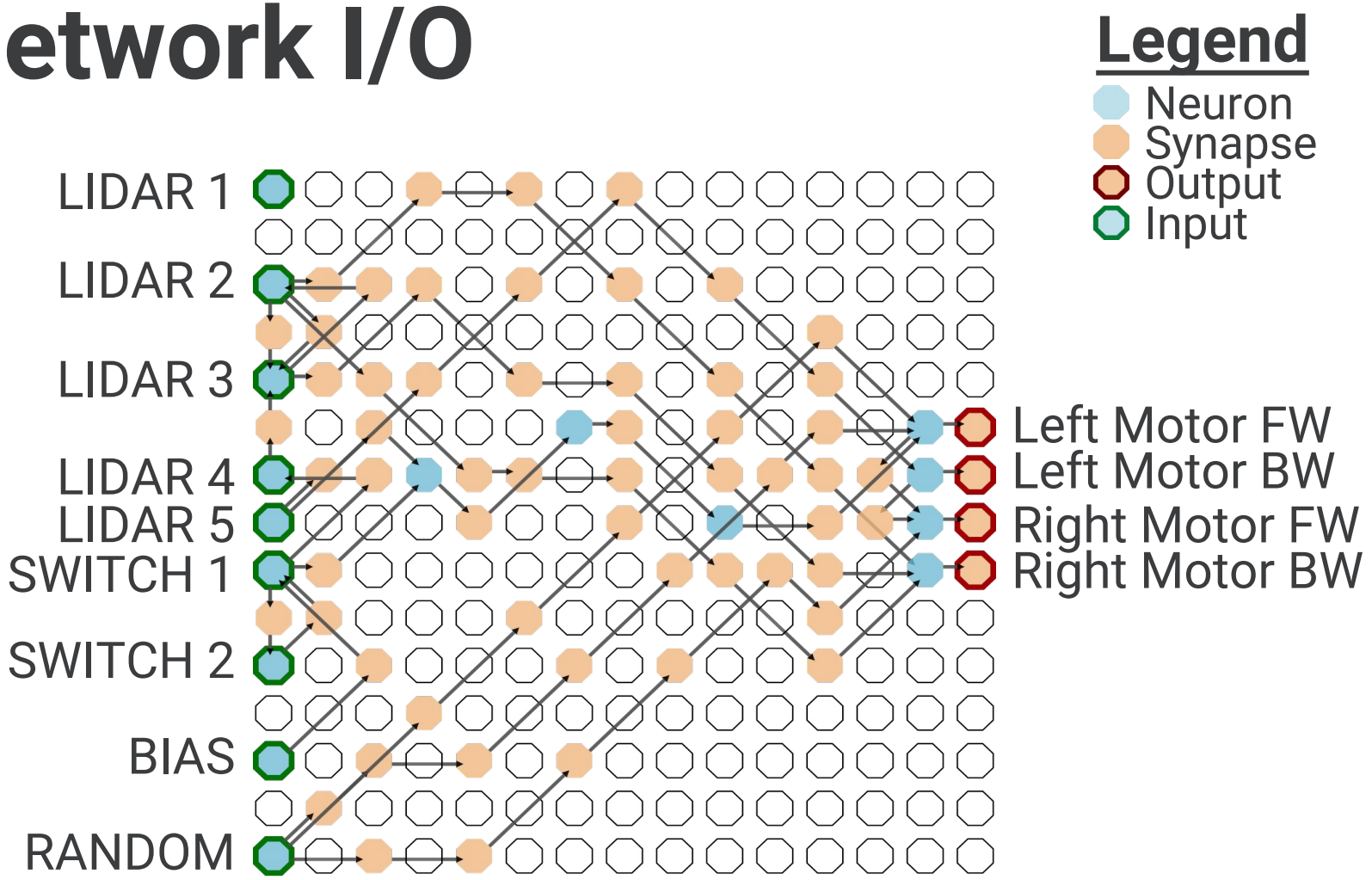


Network I/O

- 9 Inputs
  - 5 LIDAR readings
  - 2 switches
  - Bias
  - Random
- 4 Outputs
  - Left motor forward/backward
  - Right motor forward/backward



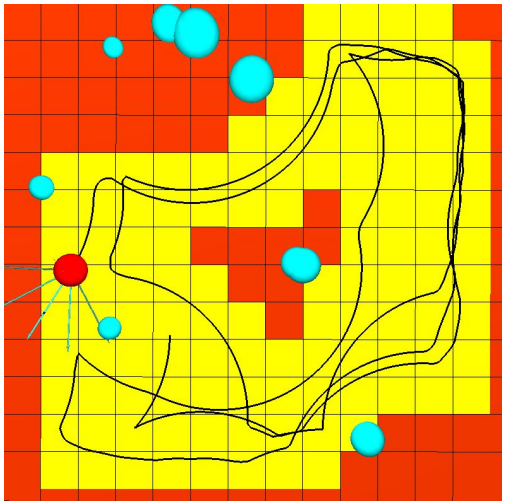
Network I/O



Example 15x15 DANNA Network

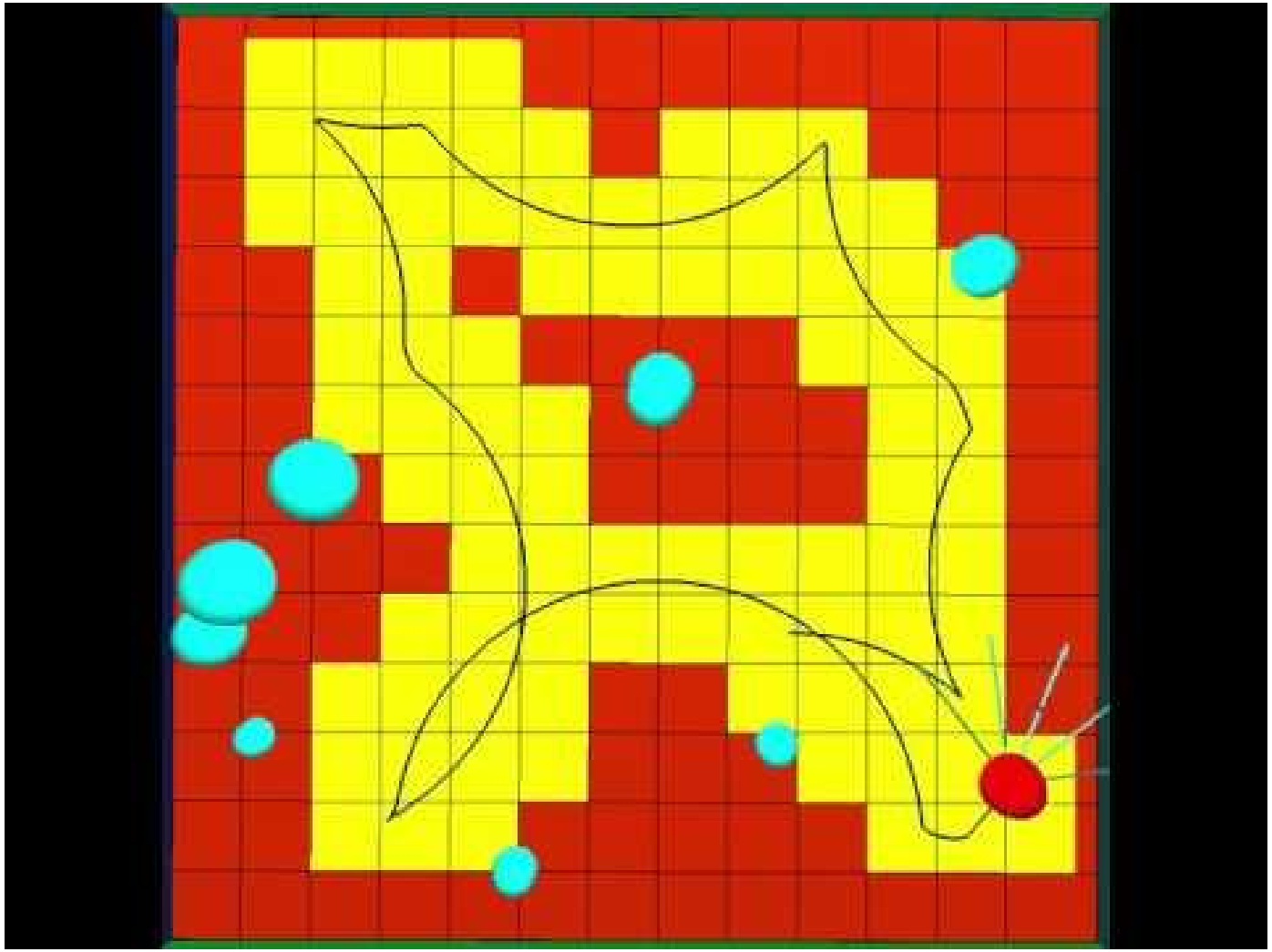
Training

- Train using evolutionary optimization (EO)
- Simulate in an empty room, room with obstacles, and table with obstacles
- Score based on grid coverage
- Penalize for critical failures
  - Hitting an obstacle
  - Falling off ledge



Grid Coverage Example

Simulation Video



Future Work

- DANNA with leaky IAF neurons
- Nonsquare networks, input spacing
- Optimized FPGA logic
- Harder task
  - Target tracking
  - Autonomous flying drone
- Implementation with mrDANNA

Any Questions?

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