Team Hotwheels Self-Driving Car

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Motivation

- Roughly 100 people die in car accidents every day in America alone
- Self Driving cars have the potential to help cut emissions
- Increased mobility for people who can’t drive
  - Children and Seniors
  - Handicapped

The Platform

- Mizzou Eco Racing
- Electric Chevy S-10 Pickup
  - Small
  - Has a bed

SAE Levels of Autonomy

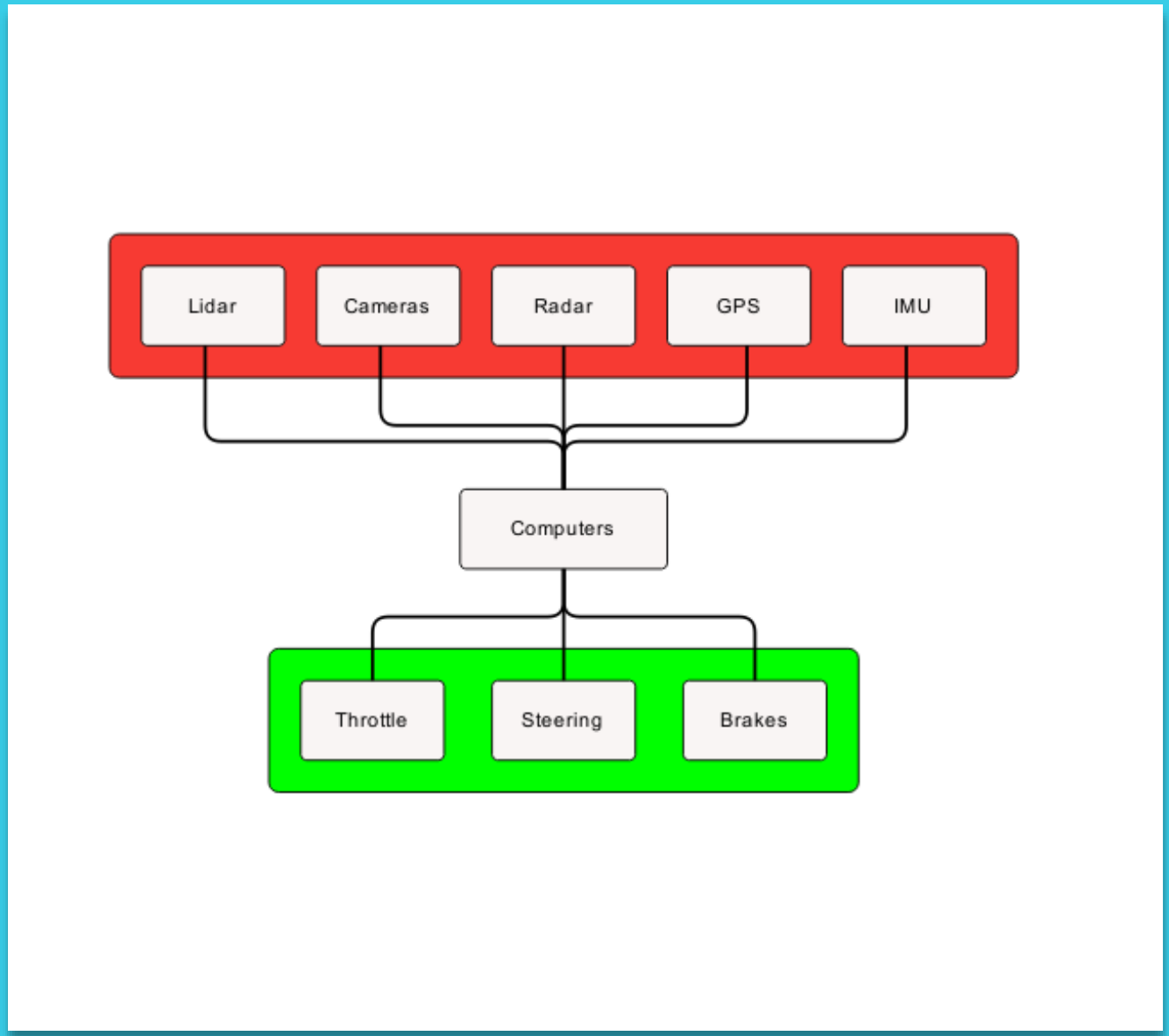
SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

Full Automation

0	1	2	3	4	5
No Automation	**Driver Assistance**	**Partial Automation**	**Conditional Automation**	**High Automation**	**Full Automation**
Zero autonomy; the driver performs all driving tasks.	Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.	Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.	Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

Implementation Overview

- Perception
  - Cameras, Lidar/Radar, Positioning
- Control
  - Computers, ROS
- Action
  - Steering, Brakes, Throttle

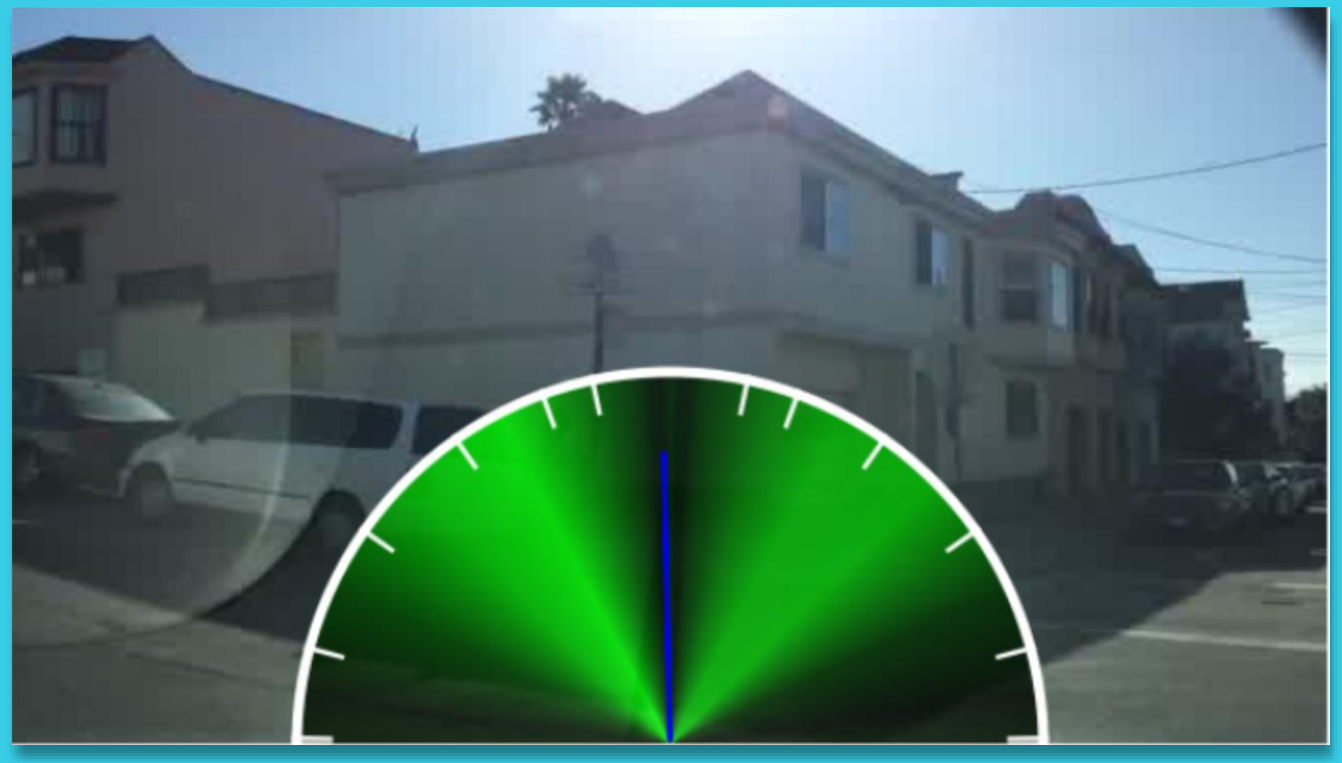


Perception

Cameras	• Object detection and path planning
Lidar	• Object detection and distance detection
Radar	• Emergency braking
GPS/IMU	• Path planning and localization

Path Planning

- GPS mapping for general path
- Cameras and deep learning model to find drivable area along that general path
  - Berkley Deep Drive dataset
  - End to End model based on Berkley and Nvidia models
- Model makes a decision, we adjust with other information



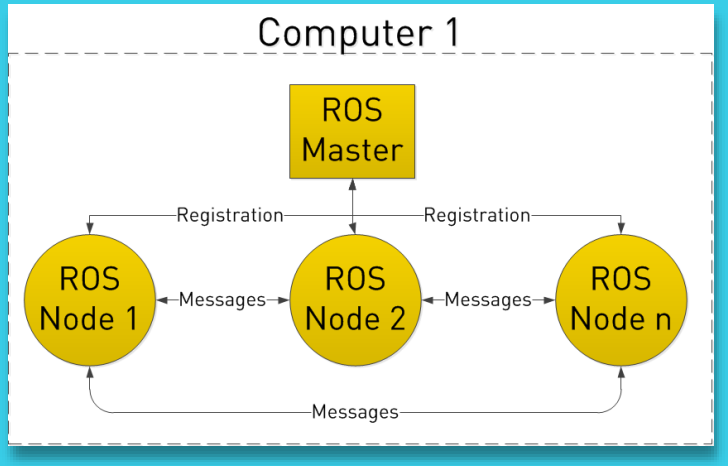
Software Stack

- Python 3.5, C, C++
- Tensorflow
  - Neural Network library from Google
- CUDA
  - Parallel computing library from Nvidia
  - Used in training, but most likely will not be used on board
- OpenCV
  - Open source Computer Vision library
- Robot Operating System
  - Asynchronous message passing

Control

- Robot Operating System
  - Publisher subscriber model
  - Node for each sensor and perception service

- Computers
  - 2 or 3 computers onboard depending on sensor load
    - 24 GB of ram
    - 2.9GHz i7 processor
    - Solid State Hard drive
  - Training models on High Performance Computing cluster
  - Models are slow to train, but fast at prediction time



Action

- Actuators on steering column, throttle, and brakes
- Actuation systems designed by mechanical engineering students
  - Kyle Messick
  - Teddy Perkins

Last Resort

- Still self driving but only stops on impact and NO control
  of steering. Wear a seatbelt….or two.

- Technological due to the laptop pressing the accelerator
  instead of a brick.

Questions?