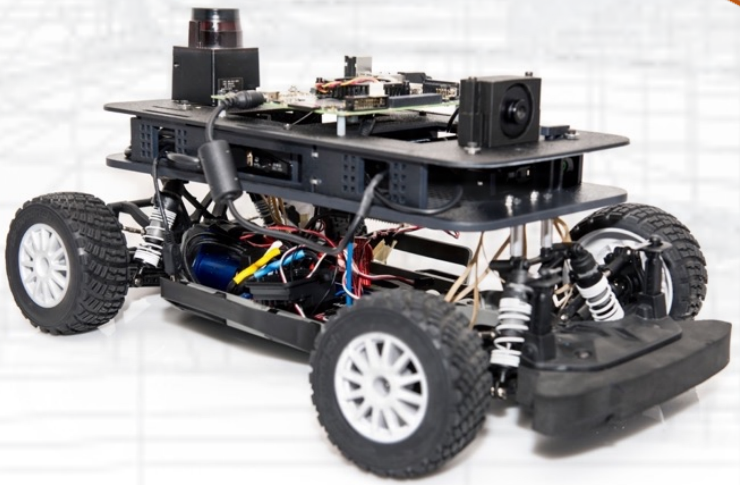
Autonomous Racing

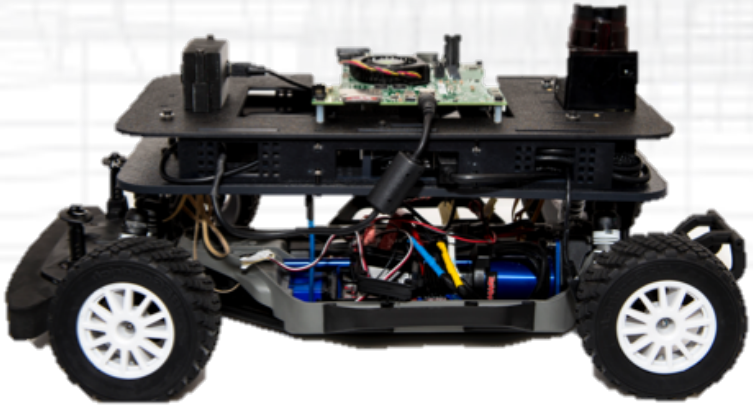


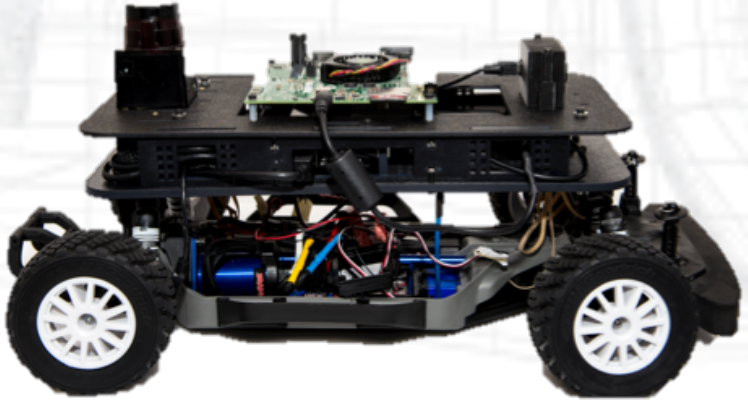
Dr. Madhur Behl
University of Pennsylvania

Penn Engineering

F1/10

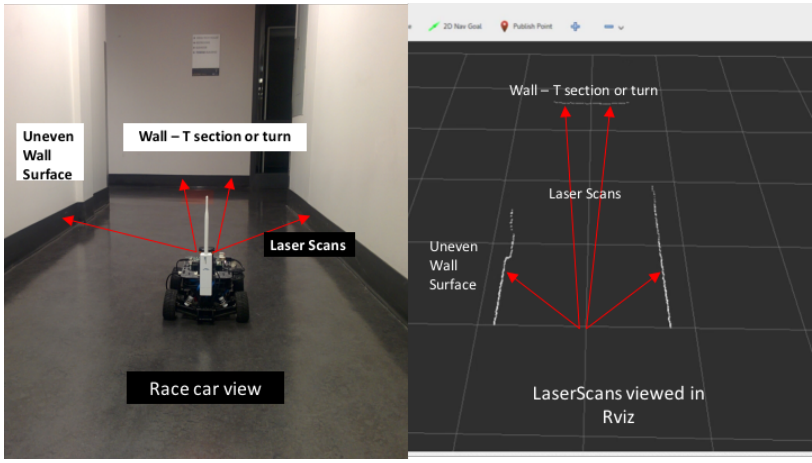
1/10th the scale. 10 times the fun!

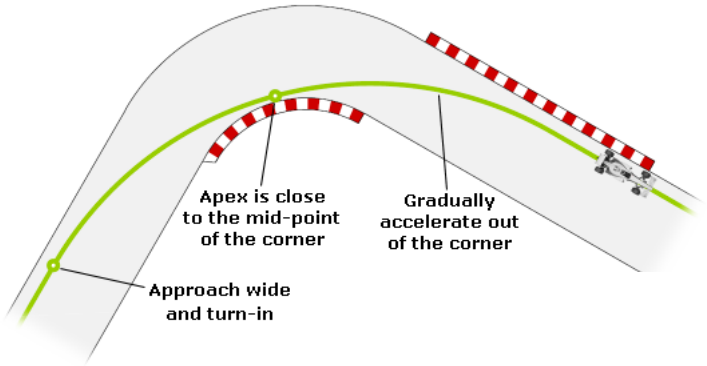




Perception. Planning. Control

Making sense of the surroundings

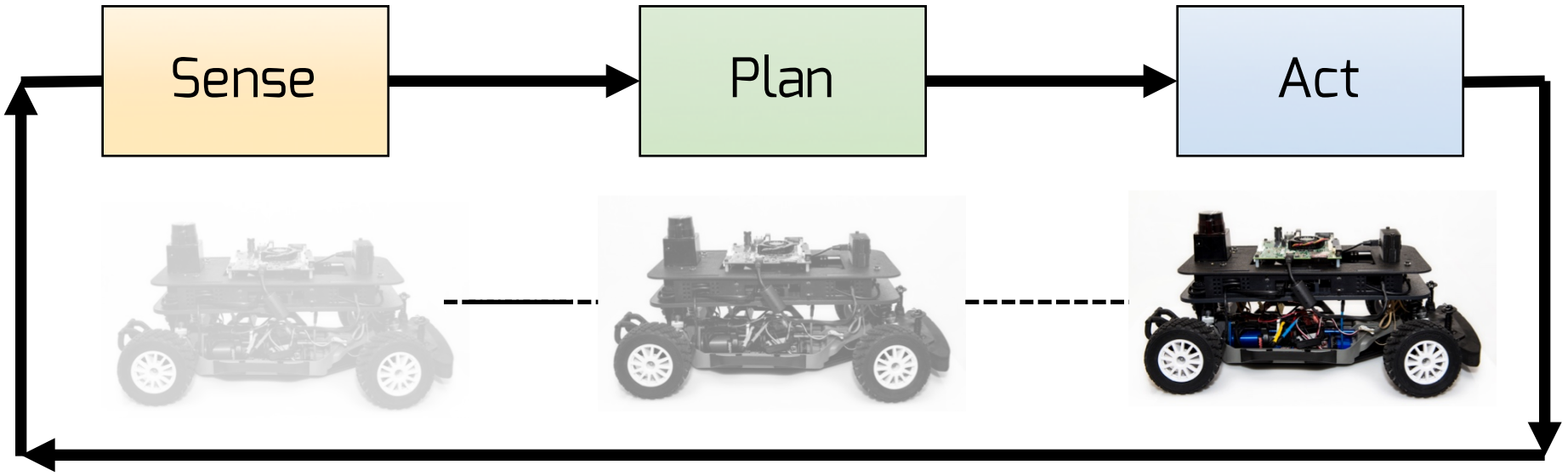




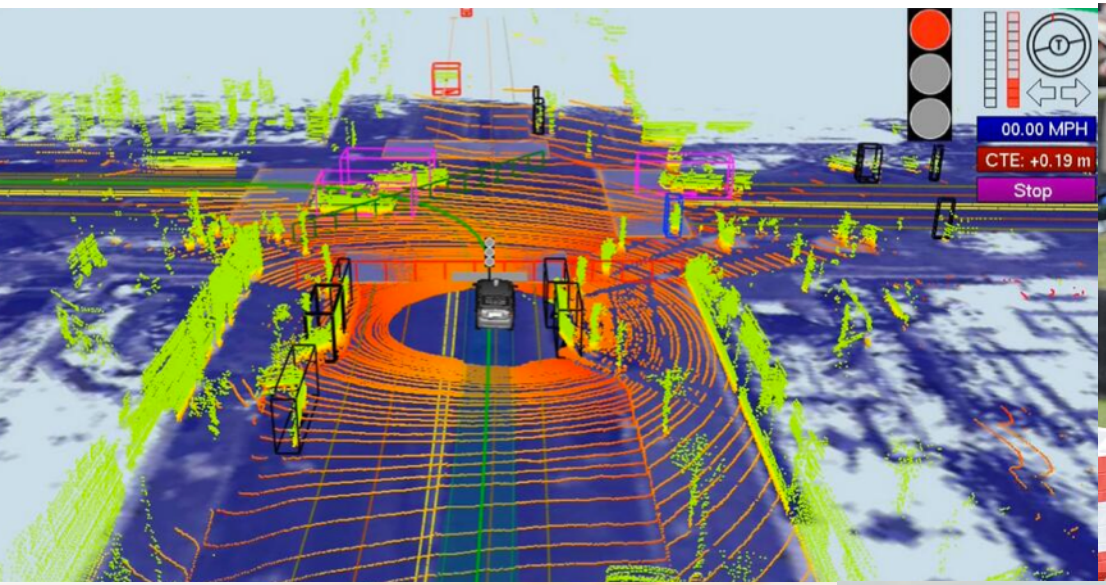
Planning the fastest racing line

Controlling the car to follow the planned path

Sense. Plan. Act. Repeat.

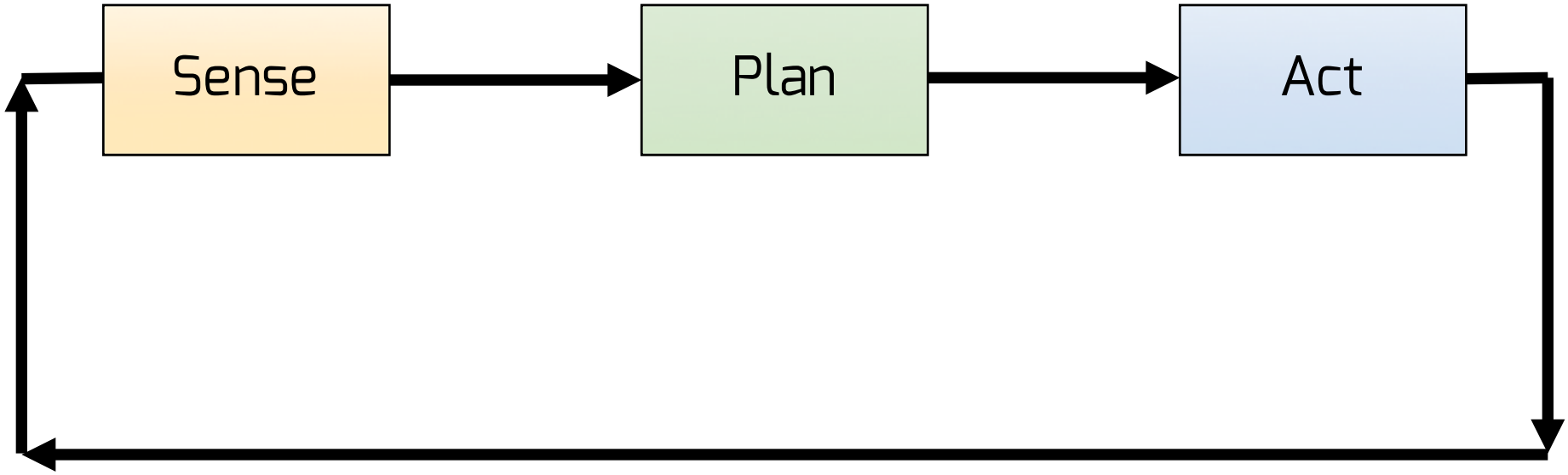


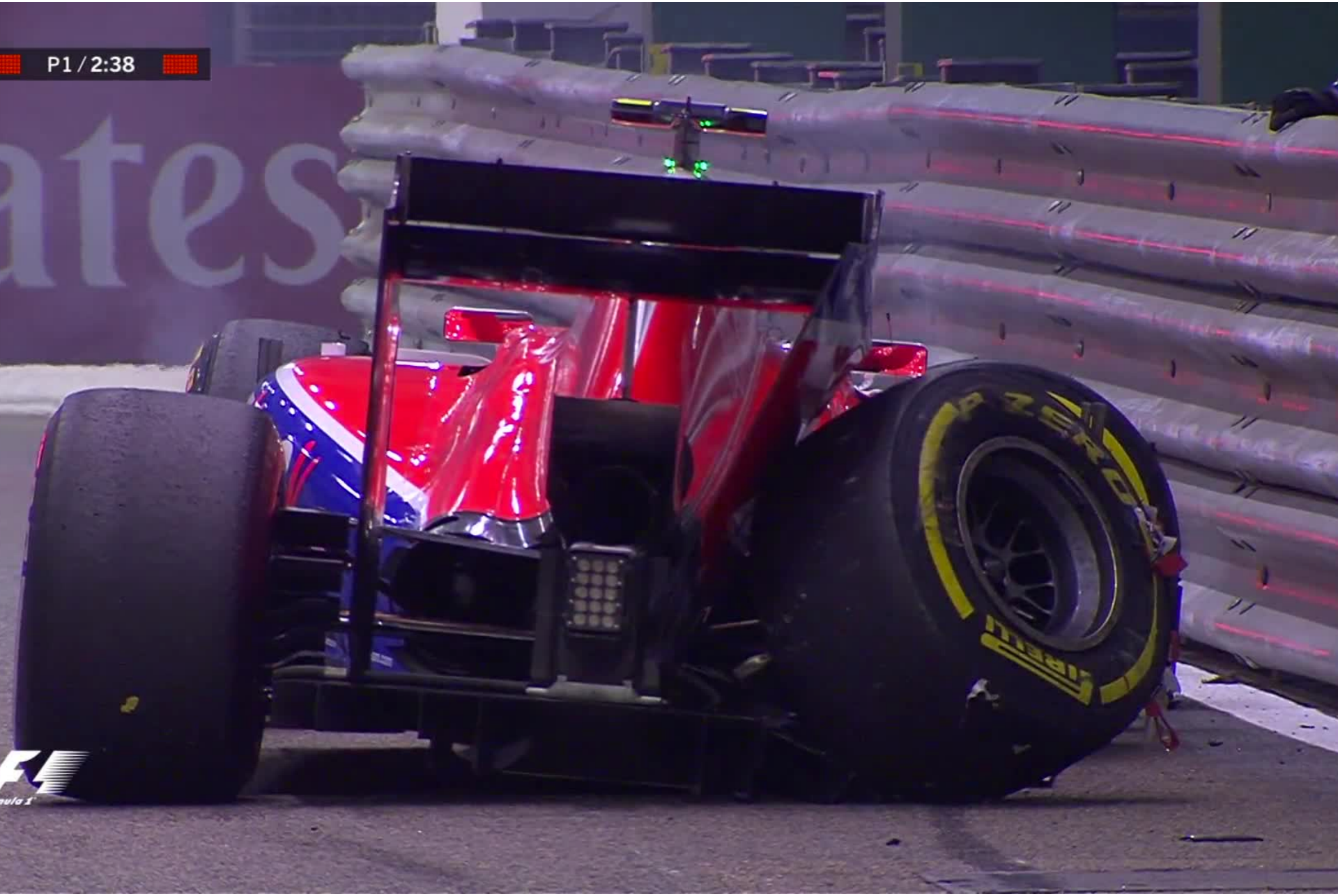
Self driving cars: Safety and Comfort




“If everything seems under control,
you're not going fast enough.”

Closing the loop FAST




P1 / 2:38
PIRELLI


ROBORACE

0 to 100mph and back to 0 in 4 seconds.
Approximately 80,000 components per car.
F1 drivers experience up to 5G under braking and cornering.

11 teams – 2 cars each.
20 races around the globe each season

Typical F1 GP weekend
Practice Sessions. Qualifying Session. Race Day.

F1/10 Course overview

Practice Session 1:

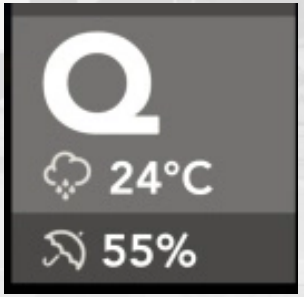
Setting up the Car

Practice Session 2:

Driving straight

Qualifying Session:

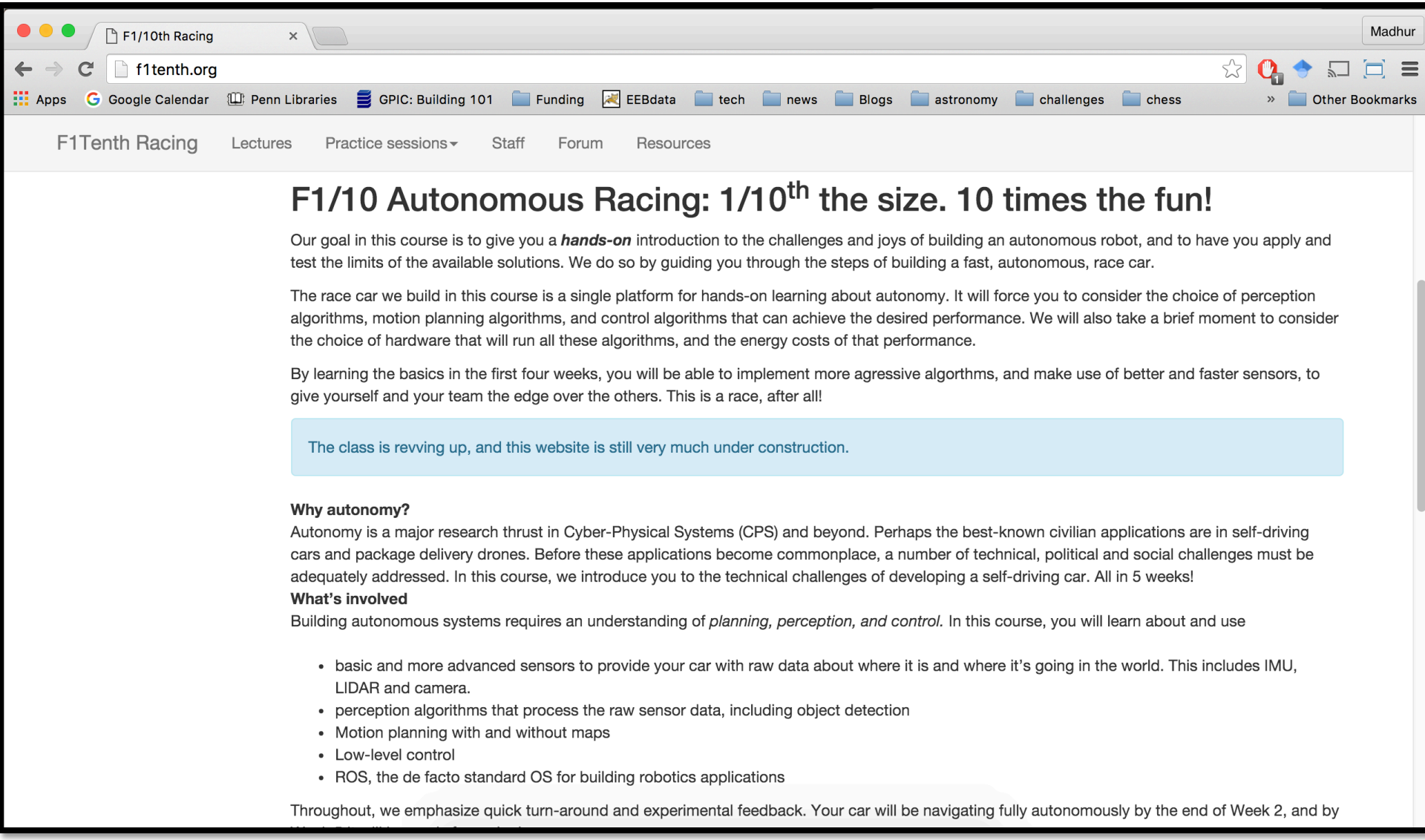
Driving in a loop.



Race Day:

Obstacle avoidance and race

f1tenth.org


F1/10th Racing
Madhur
f1tenth.org
Apps
Google Calendar
Penn Libraries
GPIC: Building 101
Funding
EEBdata
tech
news
Blogs
astronomy
challenges
chess
Other Bookmarks
F1Tenth Racing
Lectures
Practice sessions
Staff
Forum
Resources
F1/10 Autonomous Racing: 1/10th the size. 10 times the fun!
Our goal in this course is to give you a hands-on introduction to the challenges and joys of building an autonomous robot, and to have you apply and test the limits of the available solutions. We do so by guiding you through the steps of building a fast, autonomous, race car.
The race car we build in this course is a single platform for hands-on learning about autonomy. It will force you to consider the choice of perception algorithms, motion planning algorithms, and control algorithms that can achieve the desired performance. We will also take a brief moment to consider the choice of hardware that will run all these algorithms, and the energy costs of that performance.
By learning the basics in the first four weeks, you will be able to implement more agressive algorthms, and make use of better and faster sensors, to give yourself and your team the edge over the others. This is a race, after all!
The class is revving up, and this website is still very much under construction.
Why autonomy?
Autonomy is a major research thrust in Cyber-Physical Systems (CPS) and beyond. Perhaps the best-known civilian applications are in self-driving cars and package delivery drones. Before these applications become commonplace, a number of technical, political and social challenges must be adequately addressed. In this course, we introduce you to the technical challenges of developing a self-driving car. All in 5 weeks!
What's involved
Building autonomous systems requires an understanding of planning, perception, and control. In this course, you will learn about and use
basic and more advanced sensors to provide your car with raw data about where it is and where it's going in the world. This includes IMU, LIDAR and camera.
perception algorithms that process the raw sensor data, including object detection
Motion planning with and without maps
Low-level control
ROS, the de facto standard OS for building robotics applications
Throughout, we emphasize quick turn-around and experimental feedback. Your car will be navigating fully autonomously by the end of Week 2, and by

Autonomous race cars ?

"That's a terrible idea, because I want to have a job."

Lewis Hamilton

[Current and 3 time Formula One World Champion]