THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Autonomy in Vehicles

ECE 5553

Credit Hours:
3.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
First course on automated driving vehicles & their sub-systems; automated driving history & architectures; car following control; steering control for path tracking and lane keeping; collision mitigation & avoidance; localization & situational awareness; lower & higher level decision making including deep learning; connected vehicle technologies; evaluation of autonomous driving functions.

Prerequisites and Co-requisites:
Prereq: 3551, 5551, or 551, or Grad standing in Engineering.

Course Goals / Objectives:
- Be competent in understanding the history of connected and automated driving, autonomous vehicle architectures, problems, solution approaches and the current state-of-the-art.
- Master basic tire force modeling, autonomous vehicle dynamic modeling and path planning and tracking.
- Master speed control, car following, connected car following and cooperative driving.
- Master collision mitigation and avoidance for autonomous vehicles.
- Gain competence in localization and situational awareness based on perception sensors and sensor fusion.
- Gain competence in low-level actuator (steer/brake/throttle/shift) control and high-level decision making using rule based (state machine) control and deep learning approaches.
- Be familiar with the testing of autonomous vehicles, datasets and automated labeling, and legal and ethical issues.

Course Topics:

- Introduction and history of autonomous vehicles including challenges.
- Autonomous vehicle architectures.
- Introduction to tire and vehicle modeling for automated driving.
- Review of control system design
- Automation of longitudinal motion. Cruise Control, Adaptive Cruise Control, Cooperative Adaptive Cruise Control. Cooperative Driving.
- Automation of lateral motion. Path following control. Lane keeping.
- Collision free path planning and collision avoidance.
- Localization and situational awareness. Estimation and sensor fusion.
- Decision making. State diagrams. Deep learning.
- Testing of autonomous vehicles. Datasets and automated labeling. Legal and ethical issues.
- Connected vehicle applications. Fuel economy through connected and automated driving.

Designation:

Elective