CE 597: Intelligent Transportation Systems (Fall 2023)

[Information] Hampton Hall of Civil Engineering (HAMP) 2108, Fridays 11:30am-2:20pm.

[Instructor] Prof. Ziran Wang, office: Hampton Hall G133, office hours: by appointment, email address: ziran@purdue.edu.

[Description] Intelligent Transportation Systems (ITS) is an interdisciplinary field that leverages technologies from transportation engineering, electrical engineering, computer science, and many other areas to improve the safety, efficiency, and sustainability of transportation systems. This course provides an introduction to the fundamental concepts, technologies, and applications of ITS, where students will learn interesting topics like connected and automated vehicles, autonomous driving systems and advanced driver-assistance systems, vehicle-to-everything communications, internet of things and cyber-physical systems in transportation, machine learning and big data in transportation, and more.

[Prerequisites] This course is intended for both **graduate students and undergraduate students in all engineering disciplines**.

[Topics] This course is planned to cover the following topics:

- **Fundamentals of traffic flow theory and transportation engineering**
- **Internet of things (IoT) and cyber-physical systems (CPS) in transportation**
- **Machine learning and big data in transportation**
- **Sustainable transportation technologies**
- **Connected and automated vehicles (CAV)**
- **Autonomous driving systems (ADS) and advanced driver-assistance systems (ADAS)**
- **Vehicle-to-everything (V2X) communications**
- **Advanced simulation tools for vehicles and traffic**
- **Mobility as a service**
- **Invited talks from industry**

[Grading] The grading of this course is made up with the following parts:

A. (30%) Homework Assignment

Three homework sets (10% each).

- Homework Set I: TBD
- Homework Set II: TBD
- Homework Set III: TBD

B. (30%) Midterm Exam

- Open book
- No discussion allowed
- The Student Code of Honor applies

C. (40%) Course Project (Independent)

There are two parts for the Course Project:

- 1-page Proposal: TBD (10%)

- Final presentation: TBD (30%)

Final letter grade will be based on the following rule:

A: Scores ≥ 90
B: Scores < 90 & ≥ 80
C: Scores < 80 & ≥ 70
D: Scores < 70 & ≥ 60
F: Scores < 60

Late submissions of any assignment will be handled based on the following rule, where X represents the number of days elapsed after the due date:

$$Score_{late} = \begin{cases} Score_{graded} \times (100 - X \times 10)\% & 1 \le X \le 3 \\ Score_{graded} \times (70 - (X-3) \times 5)\% & 4 \le X \le 7 \\ \max\{0,\ Score_{graded} \times (50 - (X-7) \times 2)\%\} & X \ge 8 \end{cases}$$

[Project] The course project aims to introduce the students to ITS, and to encourage the students to conduct **independent** research with one of the following project options:

- **Options:**
  1. **In-Depth Reimplementation of a Research Paper**
     a. Goal: Students are expected to get in-depth understanding of a particular research paper by reimplementing its methods and reproducing its results.
     b. Evaluation Matrix:
        i. Implementation details
        ii. In-depth insights of pros and cons of the implemented methods compared to other methods on this topic
        iii. Discussions of potential solutions to further improve the paper

  2. **Survey of Multiple Papers on a Topic**
     a. Goal: Students are expected to become proficient on one research topic by conducting a literature review of multiple relevant papers.
     b. Evaluation Matrix:
        i. No less than 5 references
        ii. In-depth insights with summary of pros and cons of each paper
        iii. Discussions regarding open challenges on this research topic in general

  3. **Development of a New Research Idea**
     a. Goal: Students are expected to propose a new research idea by developing methods in theory and evaluating results in experiment.
     b. Evaluation Matrix:
        i. Novelty of the proposed idea
        ii. Technical contributions of the proposed idea
        iii. Soundness of the experiment results