ECE5995 Syllabus, Spring/Summer 2018

ECE5995: Cooperative Connected Vehicles

Session 0001, 4 Credit Hours, Spring/Summer2018

Proposed WSU Catalog Description:
Junior standing or above. Fundamentals of vehicle network services and architectures, DSRC, IEEE 802.11, IEEE 1609.X, and SAE J2735 protocols, media access control, wireless access, network programming, and other topics. Programming assignments give students hands-on experience.

Course Coordinator: Syed Masud Mahmud, Associate Professor of Electrical and Computer Eng.
Course Instructor: Radovan Miucic, Adjunct Professor of Electrical and Computer Eng.
Office Hours: After Class
Course Meeting Time and Location: M W 06:00PM - 08:00 PM, 0174 MAIN

Phone: NA, **Email:**radovan@wayne.edu

Goals:
To develop understanding of the underlying concepts and technologies of Intelligent Transportation Systems (ITS). To develop skills for the future connected vehicles research and development through in depth study of wireless protocols, namely Dedicated Short Range Communications (DSRC), for vehicle to vehicle and vehicle to infrastructure networking applications for vehicular safety, mobility and environment. To prepare students for practical automotive and communications work environments where the DSRC will become the cornerstone of ITS developments.

Learning Objectives: At the end of this course, students will be able to:
1. understand the definition and services of the application, transport, network, link and physical layers of the DSRC.
2. understand the architecture and implementation of vehicle network applications and in particular using real world programming examples.
3. develop a detail understanding of how vehicle communicate to other vehicles and to infrastructure over DSRC.
4. know services, limitations and remaining issues of DSRC in particular security, privacy, and localization.
5. Design a realistic solution for cooperative vehicular application: e.g. warning system for intersection collision

Textbook:
- Luca Delgrossi, Tao Zhang, “Vehicle Safety Communications: Protocols, Security, and Privacy”, John Wiley & Sons Ltd1st Edition 2012.

Optional Textbook:
- Hannes Hartenstein and Kenneth P. Labarteaux, “VANET: Vehicular Applications and Inter-Networking Technologies”, John Wiley & Sons Ltd., 1st Edition 2010.

Reference Text:

- DSRC Implementation Guide
- ITS related research articles
- Standards: IEEE 802.11-2012, IEEE 1609.X, and SAE J2735

Prerequisites: Basic knowledge of programming in C/C++, Python or Java, or consent of instructor.

Topics:
Lecture 1: Introduction to VANET
Lecture 2: Introduction to DSRC and BSM
Lecture 3: Vehicle Safety Comm. - Apps (VSC-A)
Lecture 4: Python 1
Lecture 5: Python 2
Lecture 6: Vehicle to Pedestrian Application
Lecture 7: Automotive Safety Evolution
Lecture 8: Vehicle Architecture
Lecture 9: Connected Vehicles& Connected Autonomous Vehicles
Lecture 10: Dedicated Short Range Communication
Lecture 11: WAVE Physical Layer
Lecture 12: WAVE MAC Layer
Lecture 13: WAVE Upper Layer
Lecture 14: Vehicle to Infrastructure Safety Applications
Lecture 15: DSRC Scalability
Lecture 16: Security and Privacy
Computer Resources: need to have access to a computer for programming assignments

Course Policy:
- It is your responsibility to visit the course website at http://ccv.eng.wayne.edu/to keep you up to date;
- Late submission of homework, programming assignments, and project reports is not accepted.
- Any questions regarding your scores of assignments and tests should be resolved within 3 days after the scores are released.
- Adherence to the University's Code of Ethics will be strictly monitored and enforced. This will be applicable to assignments, projects and examinations.

Cheating Policy and Penalty for Cheating: Cheating is defined by the University as "intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise." This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment/exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure Academic Integrity, will also result in downgrading for the course. Students who cheat on any assignment or during any examination will be assigned a failing grade for the course. Any work submitted for a grade must include the following statement and be signed and dated. If this is missing or not signed and dated, the work will be returned ungraded.

I have neither given nor received unauthorized assistance on this work.

Signed: **Date:**

Distribution of Points:

- 10% Homework Assignments
- 30% 1 Paper Presentation and 2 Programming Labs
- 30% 2 Midterm Tests with 15% each
- 30% Final Exam

Grading Scale:
A:94-100; A-:88-93; B+:82-87;B:76-81;B-:70-75;C+:65-69;C:60-64;C-:55-59;E/F:0-54.

Attendance: You are expected to attend lectures in entirety. Do not schedule other classes or commitment that conflict with any part of the lecture time.

Schedule: see course structure in the course homepage for details. The last day to drop any class with a tuition refund is the end of the second week of classes. Any withdraw afterwards will be assigned “withdrawal passing (WP)” or “withdrawal failing (WP)” on the transcript.

Make-up Exams: There is no make-up exam policy.

Outcome Coverage:
(a) an ability to apply math, science and engineering knowledge. The homework and exams require students to solve problems in area such as communication delays and error checking.

(b) an ability to design and conduct experiments, as well as to analyze and interpret data. The homework and project assignment require student to design and implement cooperative safety applications such as intersection collision avoidance, blind spot and control loss warning.

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. The design in the project must be checked against real world operating limits.

(e) an ability to identify, formulate and solve engineering problems. Students must be able to identify and model the architecture of network applications and their performance under practical limits.

(f) an understanding of professional and ethical responsibility. Students will learn how to use vehicle network simulation tools and how not to misuse or abuse such knowledge.

(g) an ability to communicate effectively. Students are required to write a comprehensive report on the project.

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. The course details the design of the vehicle to vehicle and vehicle to infrastructure communications and how engineering solutions evolved to meet global, economic, environmental, and societal needs.

(j) a knowledge of contemporary issues. The students will learn about the design and issues with vehicle communications that is going to be used by millions of people and what issues are being addressed.

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Students taking the course will learn how to use software programming languages such as Python to build vehicle network applications.

Policy on deferred grades:
A grade of "I" can only be assigned if all of the following criteria are met:

1. you are not currently failing the class and,
2. there is not a substantial quantity of work yet to be completed,
3. there is no extra work required of the instructor beyond the normal duties of grading the paper/exam,
4. there is no need for you to attend the class in subsequent terms.

The final decision to assign an incomplete grade rests with the instructor.
An "I" grade must be made up within one year of assignment of the grade.

Examination policy:
The final examination schedule was listed above. If you have any conflicts with the examination date, please notify the instructor as soon as possible. The following documentation is required for rescheduling of an examination:

[Medical Excuse:] A signed letter from a physician from the day of the examination indicating that the student had a valid medical reason for missing school. This letter must be on the physician's letterhead and the name and phone number of the physician must be legible. (Note: for cases of extended medical treatment, the letter can be dated prior to the examination, if the physician's recommendation for leave extends beyond the examination date.) Students with flu symptoms who decide to self-isolate and not attend the examination are required to notify the instructor by email prior to the examination.

[Employment Conflict:] A signed letter from the student's direct supervisor indicating that an absence from the Detroit-area is required for the student's employment for the dates surrounding the examination.

[Death in the Family or Family Illness:] A copy of the death certificate or obituary for the family member who has died. For illness of a family member for whom a student is the primary care-giver, a signed letter from the family member's physician for the day of the examination.

[Transportation Problem:] In the event that you are prevented from arriving on campus due to a transportation delay, the following should be provided:

1. A copy of the police report concerning a traffic accident
2. A copy of the receipt for towing from a towing service
3. A signed letter from the Customs and Immigrations Officials at the Detroit/Windsor border indicating that a student was delayed for questioning

The final determination of the validity of an excuse is the jurisdiction of the faculty member. In all of the above instances, all reasonable attempts must be made to contact the faculty member to notify them of the problem BEFORE the examination. This can be done via email. If notice is not provided before the examination, no documentation will be accepted.
If a makeup exam is approved, the grade will be reduced by a factor of 0.90 (e.g. maximum points that a student can get from a 100-point exam will be 90 points)