EEL5632 - Safe & Sec Veh Sys

Safety and Security of Vehicular Electronic Systems

EEL 5632
Class Periods: Tue 3:00-4:55pm; Thu 4:05-4:55pm
Location: CSEE118
Academic Term: Spring 2023
Class Canvas Page (with valid GatorLink account): Click [here](#)

Instructor:

- Name: Sandip Ray
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- Office Phone Number: +1 (352) 392-1605
- Office Hours: Wed 2-3pm Zoom (Link TBD)

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

Name: Rafiul Kabir
Email: kabirm@ufl.edu
Office Hours: M 3-4 pm Zoom (link TBD)

Course Description

In this course, we will study architectures of current and emergent automotive systems, and get a sense of the trend as we move towards increasingly connected autonomous vehicles. We are on the verge of the so-called 4th Industrial Revolution, ushering in a world where all things, humans, and processes, and data continuously communicate with one another enabling them to respond smartly to their environment. Autonomous, connected vehicles constitute one of the most crucial and most complex components of this connected ecosystem. Electronics and software play the central role in realizing the functionality and security needs for autonomous cars. We will explore the role of automotive systems in the context of connectivity and analyze some key challenges in making these systems robust, i.e., safe, secure, and reliable, in this context.

The course will bring together concepts from diverse areas of Computer Science and Computer Engineering, including Computer Architecture, Hardware and System Security, Real-time Systems, Machine Learning, Formal methods, Embedded system design, and Computer Networks. You will get an understanding of the cooperation, conflicts, and trade-offs among these largely disparate areas, and how to account for them the design of realistic, safety-critical applications. You will get the opportunity to have hands-on experience in design and analysis of several aspects of robust,

autonomous, automotive systems. You should take the course if one of more of the following is applicable to you:

- You want to understand what enables many of the cool features you like in a modern automobile.
- You want to understand the challenges (and approaches) to architecting the self-driving cars of the future.
- You want to understand the safety and security issues in current and emergent vehicles.
- You want to learn the behind-the-scene technologies involved in hacking a car (and how to mitigate such hacks).

Course Pre-Requisites / Co-Requisites

No specific pre-requisite. However, students are expected to have a general background on Computer Architecture and Digital Systems Design. Students should also have some familiarity with programming in C/C++, debugging, and the Linux operating system.

Course Objectives

Upon completion of the course, students should have a knowledge of the working principles of current and future automotive systems:

- Electronics and software responsible for various autonomous functionality of the vehicle
- Notions such as functional safety, security, and reliability in current and future cars
- Trade-offs and conflicts involved in automotive electronic design
- Variety of automotive standards, certifications, and regulations
- Current practices in automotive safety and security design
- Automotive software challenges

Materials and Supply Fees

None

Required Textbooks and Software

No textbook. Relevant research papers and other notes will be provided in class.

Course Contents (Tentative)

- Introduction to automotive systems and their evolution
- Challenges and characteristics of autonomous automotive systems
- Introduction to automotive robustness: safety, security, reliability
- Functional Safety: ISO26262 and Its variants
- Automotive security: How to hack a car?
- Sensors, Position, Timing, and Communication Attacks (and defenses)
- Machine Learning in Vehicular Security

- Trade-offs between security, safety, privacy, and real-time constraints
- Automotive systems and transportation infrastructure: cooperation and conflicts
- Challenges in supply chain

Course Plan (Tentative)

Content will be adjusted based on the interest of the class. Students will be encouraaged to bring up new topics for exploration.

Week	Content	Note
1	Course Overview, Introduction to Vehicular Electronics Systems	
2	Vehicular Electronics: Functional Domains	Papers on Vehicular Electronics Selected
3	Introduction to Functional Safety	
4	Paper Presentations on Vehicular Electronics (Students)	Papers on Functional Safety Selected
5	Functional Safety Standards: ISO26262	
6	Functional Safety Research Presentations (Students)	
7	Introduction to Vehicular Security	Project and Term Paper Topics suggested
8	Elements of Automotive Hacking	Papers on Vehicular Security Selected
9	Security of vehicular sensors	Project and Term Paper proposals due
10	Connected Vehicle Applications and V2X	

11	Vehicular Security Paper presentations I (Students)	
12	Machine Learning Security for Automotives	
13	Vehicular Security Paper Presentation II (Students)	
14	Transportation and Supply Chain Security	
15	Project Presentations	Project reports due on last class day

Attendance Policy, Class Expectations, and Make-Up Policy

- Attendance is required, but not monitored. Students are responsible for being up-to-date with all information communicated in class.
- The class is interactive. Feel free to interrupt and ask relevant questions.   However, questions not directly related to the topic under discussion or requiring elaborate answers may be relegated to office hours.
- Cell phones may not be used as calculators. Cell phones must be turned off at all times including lectures or presentations. lectures.
- Students are not permitted to sell or distribute notes provided for this class.
- Excused absences are consistent with university policies in the graduate catalog (http://gradcatalog.ufl.edu/content.php?catoid=11&navoid=2486#attendance Links to an external site.) and require appropriate documentation.
- Students who anticipate the necessity of being absent from class due to the observation of a major religious events must provide notice of the date(s) in writing by the second meeting.
- All late assignments receive zero credits no matter what the reason. This means students must plan to finish their work before deadline to avoid delays due to "technical difficulties". Online assignments (on Canvas) will timeout at the deadline and cannot be made up. Canvas gets very busy around common due times, such as midnight; for this reason, all assignments will be due at 4 AM. Emailed assignment will have an arrival timestamp. All emails received after the deadline will be considered late submission.
- The instructor reserves the right to interpret the class policies if confusions may occur.

Evaluation of Grades

Assignment   Percentage of Final Grade

Paper presentation   30%

Presentation review 30%

Term paper/project 40%

TOTAL   100%

Grading Policy

Percent	Grade	Grade Points
93.0 - 100	A	4.00
90.0 – 92.9	A-	3.67
87.0 – 89.9	B+	3.33
83.0 – 86.9	B	3.00
80.0 – 82.9	B-	2.67
77.0 – 79.9	C+	2.33
73.0 – 76.9	C	2.00
70.0 – 72.9	C-	1.67
67.0 – 69.9	D+	1.33
63.0 – 66.9	D	1.00
60.0 – 62.9	D-	0.67
0 – 59.9	E	0.00

The class is not curved. If everyone does well, everyone can get an A.

In order to graduate, graduate students must have an overall GPA and a major GPA of 3.0 or better (B or better). Note: A "B-" average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement.

More information on UF grading policy may be found at: http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020Links to an external site.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/ Links to an external site.. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/ Links to an external site.. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/ Links to an external site.. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/ Links to an external site..

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another

student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Conduct Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) Links to an external site.specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.htmlLinks to an external site.

Campus Resources:

Health and Wellness

Covid-19 Protocols:

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website Links to an external site.for more information.

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu Links to an external site., and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance Links to an external site.**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/ Links to an external site..

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml Links to an external site..
Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu Links to an external site..
 Library Support, http://cms.uflib.ufl.edu/ask Links to an external site.. Various ways to receive assistance with respect to using the libraries or finding resources.
 Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/ Links to an external site..
Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/ Links to an external site..
 Student Complaints Campus*:* https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/ Links to an external site.;https://care.dso.ufl.edu Links to an external site..
 On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process Links to an external site..