San José State University
Computer Engineering Department
CMPE 297-03: Special Topics in Autonomous Driving, Spring 2019

Course and Contact Information

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Office Hours:	See http://cmpe.sjsu.edu/content/office-hours
Class Days/Time:	Tuesday 6:00pm – 8:45pm
Classroom:	Clark Building 310
Prerequisites:	Basic understanding of Linear Algebra, Calculus, Statistics and Physics. Familiarity with Linux and a programming language (C, C++, or Java).

Course Format

Technology Intensive, Hybrid, and Online Courses

Meet students per week at classroom for teaching class materials and answering questions for students.

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on *Canvas Learning Management System course login website* at http://sjsu.instructure.com. You are responsible for regularly checking with the messaging system through *MySJSU* at http://my.sjsu.edu and Canvas to learn of any updates.

Course Description

This course is an introduction to autonomous driving and self-driving cars. It covers the basic components of autonomous driving including HD map, perception, localization, path planning, and control. The open source Apollo platform and robot operation system (ROS) will be introduced.

Course Goals

Students are required to have a comprehensive grasp and timely understanding of the current status and development of autonomous driving, master the mainstream autonomous driving methods, and implement corresponding algorithms based on the requirements of practical problems

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. Explain concepts and key modules of autonomous driving
2. Understand hardware and software requirements for autonomous driving
3. Obtain the in-depth knowledge of the state-of-the-art algorithms used in mapping, localization, perception, path planning, and control for autonomous driving

4. Become familiar with the open source Apollo platform and ROS
5. Demonstrate effective communication and teamwork skills through technical presentations and reports in course projects.

Required Texts/Readings (Required)

Textbook

Lecture notes developed by instructors.

Other Readings

1. "*ROS Robot Programming*", Yoonseok Pyo, Hancheol Cho, Leon Jung, Darby Lim, ROBOTIS, 2017
2. *Apollo GitHub repository*

Other technology requirements / equipment / material

Students should have computing resources available to prepare coding assignments and course project. Laptops or personal computers should be enough.

Course Requirements and Assignments (Required)

Homework Assignments: Students will be assigned for homework to exercise the materials taught. There are two types of assignments, concepts understanding verifications and coding implementations.

Term project: Groups of 3-4 students will be formed to work on a term-long group project related to autonomous driving. The project has deliverables throughout the semester. The quality and completeness of all the deliverables will be considered in grading the projects. All projects will be demonstrated and presented in class. Each group member is expected to participate in every phase of the project. The final grade of each member will be proportional to his/her participation in the group, as assessed by the instructor and the student's peers. Each member should be able to answer questions regarding the project, present some part of the project demo, and participate in the system implementation and the writing of the technical report.

There is a final project presentation. No makeup presentation will be given, unless the case is critical. For the exceptional cases, documented reasons (e.g. physician's statement) are required.

Pop quiz: There will be two pop quizzes during the semester. Each quiz lasts for 10 – 20 mins.

Exams: Exams will be a combination of multiple choice, true or false, short answer questions, mathematical questions, open/explanation questions and will be based on the course material covered in class.

Major exams in this class may be video recorded to ensure academic integrity. The recordings will only be viewed if there is an issue to be addressed. Under no circumstances will the recordings be publicly released.

NOTE that University policy F69-24 at http://www.sjsu.edu/senate/docs/F69-24.pdf states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading."

Students cannot take this class without fulfilling its prerequisite or obtaining instructor approval. Please note that, according to department policy, "*students who do not provide documentation of having satisfied the class prerequisite and co-requisite requirements (if any) by the second class meeting will be dropped from the class.*"

"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practice. Other course structures will have equivalent workload expectations as described in the syllabus."

Final Examination or Evaluation

This course has a comprehensive final examination at a firm schedule.

Grading Information

- The final grade will be calculated based on the following and be adjusted by the ranking of the students:

  (A+) >= 98, (A) >= 95 and <98

  (A-) >= 90 and <95, (B+) >= 85 and <90

  (B) >= 80 and <85, (B-) >= 75 and <80

  (C+)>= 70 and <75, (C) >= 65 and <70

  (C-) >= 60 and <65, (D) >= 50 and <60,

  (F) < 50

- No late assignments will be accepted. An extension will be granted only if a student has serious and compelling reasons that can be proven by an independent authority (e.g. doctor's note if the student has been sick).
- The examination dates are final.

Determination of Grades

The percentage weight assigned to class assignments is listed below. Detailed grading rubrics for homework assignment and team projects, and exact due dates for each assignment will be posted on Canvas.

- Homework 20%
- Pop quiz 10%
- Final Exam 30%
- Team Semester Project 40%

Classroom Protocol

Students are expected to arrive in time for class. Laptop/tablet/smart phone use is allowed only for activities related to the class.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/"

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Course Schedule

The schedule (and related dates/readings/assignments) is tentative and subject to change with fair notice. In case of guest lectures, the syllabus will be updated accordingly. Any changes will be announced in due time in class and on the course's web site (Canvas). The students are obliged to consult the most updated and detailed version of the reading material and syllabus, which will be posted on Canvas.

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines	Note
1	1/29	Autonomous driving overview	
2	2/5	Apollo introduction	Baidu
3	2/12	Introduction to ROS	
4	2/19	Mapping: HD map collection and data processing	
5	2/26	Localization: GPS, coordinate system	
6	3/5	Localization: Sensors, multi-sensor fusion	
7	3/12	Perception: computer vision, radar detection, Lidar perception	
8	3/19	Perception: data fusion, object detection and tracking	
9	3/26	Path planning: configuration space, modeling the environment	
Spring Recess			
10	4/8	Path planning: A* algorithm, dynamic programming	
11	4/16	Path planning: reinforcement learning based planning	
12	4/23	Control: PID control, parameter tuning	
13	4/30	Control: linear quadratic regulator, model predictive control	
14	5/7	Project presentations	
Final Exam	5/21	17:15 – 19:30	