CS5493: TOPICS IN AUTONOMOUS DRIVING

New Syllabus Proposal

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Topics in Autonomous Driving

Subject Code
CS - Computer Science
Course Number
5493

Academic Unit
Computer Science (CS)

College/School
College of Computing (CC)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to provide students with a solid understanding of a range of topics in the field of computing systems for autonomous driving, with emphasis on the sensing techniques, perception, prediction, planning and decision algorithms based on advanced artificial intelligence, as well as the computing hardware and software system support. On completion of the course students should be able to acquire adequate understanding on the artificial intelligence driven autonomous driving systems and acquire skill to design, implement and validate appropriate algorithms for autonomous driving systems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Demonstrate a comprehensive understanding of the key components of autonomous driving systems, including sensing techniques, perception, prediction, planning, and decision-making algorithms.	20	x	x	x
2	Apply advanced artificial intelligence techniques to design and implement algorithms for perception, prediction, and decision-making in autonomous driving systems.	30	x	x	
3	Evaluate the performance of autonomous driving algorithms and systems, including their accuracy, efficiency, and robustness in real-world scenarios.	30	x	x	x
4	Analyze the hardware and software requirements for supporting autonomous driving systems, including computing platforms, real-time processing, and system integration.	20	x	x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	The lectures will focus on delivering foundational knowledge and advanced concepts in autonomous driving systems. Key topics include: Overview of sensing techniques such as LiDAR, radar, cameras, and sensor fusion, AI-based perception, path planning, motion prediction, localization, navigation and decision making algorithms. Hardware (e.g., GPUs, TPUs) and software (e.g., ROS, real-time operating systems) for autonomous driving, real-world applications, safety, and ethical considerations. Lectures will include theoretical explanations, and examples from industry and research.	1, 2, 3, 4	2 hours/ week
2	Tutorials	Students will discuss, watch demonstrations, and work with selected autonomous driving development platforms in the lab, which provide students with hands-on experience in using and configuring the tools and analysing how the related tools work. With these exercises, student will learn how to use the tools to develop, implement, test and validate autonomous driving components.	1, 2, 3, 4	1 hour/ week

3	Project	Students will be asked to conduct a substantial case study on small-scale autonomous driving tasks, in a controlled emulation or simulation environment or in-depth survey on selected topics on autonomous driving systems, such as learning-based perception, prediction, planning algorithms, datasets, software and hardware support of autonomous driving systems, development and validation tools etc.	1, 2, 3, 4	2 hours/ week for 4 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignment 1	1, 2	10	-	Yes
2	Assignment 2	2, 3, 4	10	-	Yes
3	Assignment 3	3, 4	10	-	Yes
4	Project	1, 2, 3, 4	20	-	Yes

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)

Assessment Task

Problem set, including assignments and examination

Criterion

Ability to answer fundamental concepts in autonomous driving systems.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Below Marginal

Assessment Task
Hands-on exercises

Criterion
Capacity to explore open-source autonomous driving systems development and validation frameworks and tools, perform hands-on exercises, as well as evaluate the functionality and performance of different techniques.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Below Marginal

Assessment Task
Project

Criterion
Ability to conduct a substantial case study or in-depth survey on selected topics on autonomous driving systems.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Below Marginal

Part III Other Information

Keyword Syllabus

The syllabus will evolve over time as current topics change. Current topics will be selected from following. 1) Sensing techniques such as LiDAR, radar, cameras, and sensor fusion, 2) AI-based perception path planning, motion prediction, localization, navigation and decision-making algorithms. 3) Hardware (e.g., GPUs, TPUs) and software (e.g., ROS, real-time operating systems) for autonomous driving, 4) Other topics in autonomous driving systems, such as simulation and validation environments, real-world applications, safety, public policy and ethical considerations.

Reading List

Additional Readings

	Title
1	Ishwar K. Sethi. Autonomous Vehicles and Systems A Technological and Societal Perspective. River Publishers (2023)
2	Lentin Joseph, Amit Kumar Mondal. Autonomous Driving and Advanced Driver-Assistance Systems (ADAS) Applications, Development, Legal Issues, and Testing (2022)
3	George Dimitrakopoulos, Aggelos Tsakanikas and Elias Panagiotopoulos, Autonomous Vehicles Technologies, Regulations, and Societal Impacts, Elsevier (2021)
4	Yi Lu Murphey, Ilya Kolmanovsky, Paul Watta. AI-enabled Technologies for Autonomous and Connected Vehicles, Springer (2022)
5	Fouad Sabry. Self Driving Car: Solving Full Self-driving Need Solving Real-world Artificial Intelligence (2022)
6	Bolakale Aremu. How to Build Self-Driving Cars From Scratch, AB Publisher LLC (2024)