The University of Texas at Tyler
Department of Electrical and Computer Engineering

EENG 4350.060: Robotic Systems and Applications

Syllabus

Catalog Description:

Python programming; Robots in monitoring frameworks; Sensing and Perception in robotics; Path planning in ground robots; Microcontroller programming and integration; Hardware/software integration. Three hours of lecture per week.

Prerequisites: EENG 4351 – IoT Systems Design; for non-engineering students, please consult with the Course instructors

Credits: 3 (3 hours lecture, 0 hours laboratory per week)

Text(s): No Textbook

Required Material : Study material provided by instructor.
Boards that can be programmed using micropython will be used. List of suggested boards are given here : https://www.adafruit.com/category/924
Additionally USB cable, Sensor bundle , motorsm actuators need to be purchased. The overall cost of the hardware prototype will be around $40 - $50.

Course Coordinator: Dr. Prabha Sundaravadivel, Assistant Professor

Topics Covered: (paragraph of topics separated by semicolons)

Introduction to Robotics Theory, Controls in robotics, Manipulators, Path planning. Software and technologies used in Robotics, Intro to ROS, Robotic Applications, Simulating Robotics, Using ROS in Python, Sensing and Perception in Robotics, Digital Twin Integration, Machine Learning, Regression and Classification, Robotics Entrepreneurship

Evaluation Methods: (only items in dark print apply):

1. Examinations/ Quizzes
2. Homework
3. Report
4. Computer Programming
5. Project
6. Presentation
7. Course Participation
8. Peer Review

Course Learning Outcomes[1]: By the end of this course ,students will be able to:

1. Analyze the key concepts of Robotics. [1,2,3]
2. Use Python language to program the microcontroller board. [4,5,6]
3. Develop microcontroller-based robotic systems as prototypes. [5]
4. Integrate path planning and control algorithms in the robots. [5,7]
5. Use Python language for data analysis. [4]
6. Analyze experimental data to generate predictive models. [4,5,6]
7. Evaluate case studies of real-world projects. [1,2,7]
8. Develop workflow models for robotics-based automation [6].

[1]*Numbers in brackets refer to method(s) used to evaluate the course learning outcome*.

Relationship to Student Outcomes (only items in dark print apply)[2]: This course supports the following Electrical Engineering Student Outcomes, which state that our students will possess:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics [1,2].
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors [4].
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. [3,5]
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives [8]
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions [7].
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. [6].

[2]*Numbers in brackets refer to course learning outcome(s) that address the Program Outcome.*

Contribution to Meeting Professional Component: (in semester hours)

Mathematics and Basic Sciences:		Hours
Engineering Sciences and Design:	3	Hours
General Education Component:		Hours

Grade Replacement:

If you are repeating this course for a grade replacement, you must file an intent to receive grade forgiveness with the registrar by the 12th day of class. Failure to file an intent to use grade forgiveness will result in both the original and repeated grade being used to calculate your overall grade point average. A student will receive grade forgiveness (grade replacement) for only three (undergraduate student) or two (graduate student) course repeats during his/her career at UT Tyler. (2006-08 Catalog, p. 35)

Prepared By: Edited By:	Prabha Sundaravadivel, Assistant Professor	Date:	11 January 2024

The University of Texas at Tyler
Department of Electrical and Computer Engineering

Course: EENG 4350.060: Robotic Systems and Applications

COURSE OUTLINE

Course Coordinator:

Dr. Prabha Sundaravadivel
Assistant Professor,
Department of Electrical and Computer Engineering
Office: RBN 2015
Email: PSundaravadivel@uttyler.edu
Office Hours: Tuesday / Thursday 10:30 AM-12 PM ,
Email, Canvas Discussion Boards,
Zoom ID: 82463769141
Passcode: Spring2024

Class Location/Time: Asynchronous online course. All the course content will be posted as recorded lecture videos.

Link:https://uttyler.zoom.us/j/82463769141?pwd=Q0hxLzN3NEs3QUx0TVFTYlNYMEdSdz09
Meeting ID: 82463769141
Passcode: Spring2024

Grading Policy:

Attendance (Course Participation)	5%	
Quizzes	15%	Total – 5
Mini Projects	40%	Total – 4
Mid-Term – Design Challenge	20%	
Final Exam	20%	
Total	**100%**	

Semester Schedule (Tentative):

Week	Start Date	Topics Covered	Exam Schedule	Mini Project
1	15- Jan	*Robotics Theory*		
2	22- Jan	*ROS – Basics, Overview*		Mini project – 1 *(Robot- software)*
3	29 – Jan	*ROS – Control library*		
4	5- Feb	*Introduction to Robotics simulation*		
5	12 – Feb	*Sensing and Actuating in Robotics. Using Alexa to actuate Robots*		Mini Project – 2 (Robot – hardware)
6	19 – Feb		**Mid- Term Exam**	
7	26- Feb	*Trajectory Planning*		
8	4 – Mar	*Introduction to Machine Learning*		

9	11 – Mar	***SPRING BREAK***		
10	18 - Mar	*Linear Regression and Logistic Regression*		Mini Project – 3 *(Data Analytics)*
11	25 - Mar	*Introduction to Advanced Machine Learning Algorithms*		
12	1 - April	*Entrepreneurship modules – MVP modeling*		Mini Project-4 *(Generate a business idea, write a business plan)*
13	8 – April	*Entrepreneurship modules – sustainable Business model canvas*		
14	15 - April	*Workflow models for Data Analytics and Robotics*		
15	22 - April	*Digital Twin modeling*		
16	29 - April		**Final exam**	

Mode of Delivery:

This course is a fully online course involving recorded lectures. Attendance will be counted by the student's course participation in Canvas discussion boards every week. Recorded lectures will be available on Canvas within their respective modules. Students must watch these lectures, review given materials, and stay updated on weekly course content. Feel free to email the instructor with concerns or feedback about the lectures.

Flexible Online Office Hours:

Students can meet with the instructor during office hours on Tuesdays /Thursdays (10:30 -12) at her office in RBN 2015 or using the class Zoom link. However, if students are unavailable during the mentioned office hours, they are strongly encouraged to schedule a meeting with the Instructor anytime.

Quiz:

There will be a total of 5 quizzes in the class that cover the theoretical concepts. The quizzes will be blended as part of the course module for each week. This is to keep the students on track with the course content. Quizzes will be conducted through Canvas.

Mini-Project:

The Mini-Project is to help students evaluate their implementation skills with respective topics. Students will be given problem statements based on which they are expected to design and evaluate robots, perform data analysis, and generate a business idea. The course will contain 4 mini-projects.

Exams:

There will be two exams in this course. The exams will be open for a week in Canvas. The exams will run a timer. Students are expected to complete the exams within the allotted time. The mid-term exam will be a programming design challenge based on ROS and Python. The final exam will be a mix of programming theory and implementation. The tentative schedule for the exams is as follows:

Mid Term Exam on 19 February 2024.

Final Exam on 29 April 2024.

Attendance Policy and Class Participation:

Students are expected to complete reviewing all the posted lectures and materials every week. By signing up for the class, it is understood that the student has checked for ANY significant recurring conflicts that might affect the completion of the course requirements. Attendance will be monitored through timely completion of the submissions and quizzes. The progressive nature of the class means that perfect attendance is recommended if a good grade is desired. Class participation is graded based on attendance and involvement of students in the class activities.

How to be successful in this course:

This course is targeted at introducing robotic systems for real-world applications. As this is a relevant topic and a high-demand job market, the course materials are designed with blended entrepreneurial components. To be successful in this course, complete all the materials on time so that any concerns or questions can be discussed with the instructor during the week. Though there are no high expectations for students to be experts in programming at the beginning of this course, active involvement in the class and taking the initiative to learn/ advance programming and robotic implementation skills beyond the scheduled classes are strongly encouraged to complete the course successfully.

Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php

Grade Replacement/Forgiveness and Census Date Policies:

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the semester's Census Date in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Please file a Grade Replacement Contract to avoid both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions that students need to be aware of. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date). Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

Disability Services

In accordance with federal law, a student requesting accommodation must provide documentation of his/her disability to the Disability Services counselor. If you have a disability, including a learning disability, for which you request an accommodation, please contact the Disability Services office in UC 3150, or call (903) 566-7079.

Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

Social Security and FERPA Statement:

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

Emergency Exits and Evacuation:

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor during class's first week. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

Happy Learning!