Course Syllabus

Course Information

Course Number/Section	CS 6301.001
Course Title	Special Topics in Computer Science: Introduction to Robot Manipulation and Navigation
Term	Fall 2022
Class Level	Graduate
Activity Type	Lecture
Days & Times	Monday & Wednesday 1:00 PM – 2:15 PM
Location	ECSW 3.210
Course Modality	Face-to-Face
Credit Hours	3

Professor Information

Instructor	Prof. Yu Xiang, Ph.D.
Office Phone	(972) 883-3891
Email Address	yu.xiang@utdallas.edu
Office Location	ECSS 4.702
Office Hours	Monday & Wednesday 3:30PM – 4:30PM

Teaching Assistant Information

Teaching Assistant	Ninad Khargonkar
Email Address	ninadarun.khargonkar@utdallas.edu
Office Location	ECSS 3.618
Office Hours	Tuesday 1:00PM – 2:00PM

Course Pre-requisites, Co-requisites, and/or Other Restrictions

MATH 2418 Linear algebra, MATH 2413 Differential Calculus or MATH 2417 Calculus I, CS 2336 Computer Science II, CS 5343 Algorithm Analysis and Data Structures

Course Description

Theory and practice of robotics. Provides in-depth overview of robot manipulation and robot navigation, including kinematics, statics, and dynamics of robot manipulators, motion planning, state estimation, environment mapping and robot control.

Student Learning Objectives/Outcomes

- Ability to understand the design of robot manipulators and wheeled robots.
- Ability to understand kinematics, statics, and dynamics in robot manipulation
- Ability to solve motion planning problems in manipulation and navigation
- Ability to understand state estimation with filtering techniques in robot navigation
- Ability to perform environment mapping for robot navigation
- Ability to understand robot control for manipulation and navigation

Required Textbooks and Materials
Kevin M. Lynch and Frank C. Park. Modern Robotics: Mechanics, Planning, and Control. 1st Edition.
ISBN-13: 978-1107156302
ISBN-10: 1107156300
http://hades.mech.northwestern.edu/images/7/7f/MR.pdf

Textbooks and some other bookstore materials can be ordered online or purchased at the UT Dallas Bookstore.

Technical Requirements
In addition to a confident level of computer and Internet literacy, certain minimum technical requirements must be met to enable a successful learning experience. Please review the important technical requirements on the Getting Started with eLearning webpage.

Course Access and Navigation
This course can be accessed using your UT Dallas NetID account on the eLearning website. Please see the course access and navigation section of the Getting Started with eLearning webpage for more information.

To become familiar with the eLearning tool, please see the Student eLearning Tutorials webpage. UT Dallas provides eLearning technical support 24 hours a day, 7 days a week. The eLearning Support Center includes a toll-free telephone number for immediate assistance (1-866-588-3192), email request service, and an online chat service.

Communication
This course utilizes online tools for interaction and communication. Some external communication tools such as regular email and a web conferencing tool may also be used during the semester. For more details, please visit the Student eLearning Tutorials webpage for video demonstrations on eLearning tools.

Distance Learning Student Resources
Online students have access to resources including the McDermott Library, Academic Advising, The Office of Student AccessAbility, and many others. Please see the eLearning Current Students webpage for more information.

Server Unavailability or Other Technical Difficulties
The University is committed to providing a reliable learning management system to all users. However, in the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will provide an appropriate accommodation based on the situation. Students should immediately report any problems to the instructor and also contact the online eLearning Help Desk. The instructor and the eLearning Help Desk will work with the student to resolve any issues at the earliest possible time.

Grading Policy

Credit Distribution

- Homework (50%)
  - (10%) Homework #1
  - (10%) Homework #2
  - (10%) Homework #3
  - (10%) Homework #4
  - (10%) Homework #5
- Team Project (45%)
  - (5%) Project proposal
  - (10%) Project mid-term report
  - (15%) Project presentation
  - (15%) Project final report
- In-Class Activity (5%)

Grading Scale

- A 93 or above
- A- 90-93
- B+ 87-90
- B 83-87
- B- 80-83
- C+ 77-80
- C 70-77
- F 70 or below

Course Policies

- eLearning is the official information portal for this course. Course announcements, homework, lecture slides, assignments, and grades will be communicated via eLearning
- Final course grade will be posted in Galaxy by the Records Office
- Attendance:
  - Required for mandatory class sessions. There will be 1-point deduction for each mandatory class absence in Team Project participation score (5%). There will be zero point for class participation if the number of absences is three or more.
- If you decide to stop attending class, be sure to drop or withdraw from the course. Otherwise, you risk receiving an 'F' or 'NF' for the course.
- No additional individual assignments can be assigned for extra credit. Only assignments that are available to the entire class may count toward the course grade.

UT Dallas Syllabus Policies and Procedures

Please visit http://go.utdalls.edu/syllabus-policies for other policies

Schedule

Week	Monday	Wednesday	Deadlines
1	8/22 Introduction to Robotics	8/24 Configuration Space	
2	8/29 Task Space, Workspace, Introduction to ROS	8/31 2D Rigid-Body Motions and Rotation Matrices	
3	9/5 Labor Day	9/7 Course Project Description	HW1 release on 9/5, due 9/12 at 11:59PM CT
4	9/12 Angular Velocities and Exponential Coordinates of Rotations	9/14 Matrix Logarithm of Rotations and Homogeneous Transformation Matrices	Project description release on 9/12, proposal due 9/19 at 11:59PM CT
5	9/19 Twists and Screw Axes	9/21 Exponential Coordinates of Rigid-Body Motions and Wrenches	HW2 release on 9/21, due 9/28 at 11:59PM CT
6	9/26 Forward Kinematics and Denavit-Hartenberg Parameters	9/28 Forward Kinematics and Product of Exponentials Formula	
7	10/3 Velocity Kinematics	10/5 Inverse Kinematics	HW3 release on 10/5, due 10/12 at 11:59PM CT
8	10/10 Dynamics I	10/12 Dynamics II	
9	10/17 Dynamics III	10/19 Robot Control I	Project mid-term report due 10/26 at 11:59PM CT
10	10/24 Robot Control II	10/26 Robot Control III	HW4 release on 10/26, due 11/2 at 11:59PM CT
11	10/31 Motion Planning I	11/2 Motion Planning II	
12	11/7 Wheeled Mobile Robots	11/9 Grasp Planning	HW5 release on 11/9, due 11/16 at 11:59PM CT
13	11/14 Reinforcement Learning I	11/16 Reinforcement Learning II	
14	11/21 Fall Break	11/23 Fall Break	
15	11/28 IRVL Visit	11/30 Guest Lecture: Dr. David Held	
16	12/5 Project Presentation I	12/7 Project Presentation II	Project final report due 12/14 at 11:59PM CT

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.