MOBILE ROBOTS

COURSE: CENG 5437-01  SPRING 2020
Monday 1PM-3:50 PM

INSTRUCTOR: Dr. Thomas L. Harman  harman@uhcl.edu

OFFICE: D104  Phone: 283-3774

OFFICE HOURS: After 4PM M, T Evenings (Check office or lab D125).

PREREQUISITES: N/A

DESCRIPTION: The course presents a study of techniques applied to the study of mobile robots. The purpose is to introduce the students to the use of robots and the techniques necessary to design and develop or specify hardware and software for applications.

WEBSITE: http://sceweb.sce.uhcl.edu/harman /

COURSE FORMAT: The course format will consist of lectures with homework and examinations. In addition to regular homework and examinations, a project report will be due at the end of the semester.


GRADING: The grade will be divided as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Exams and Quizzes</td>
<td>50%</td>
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<tr>
<td>Homework</td>
<td>25%</td>
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<tr>
<td>Project and presentation</td>
<td>25%</td>
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The project will consist of a design with documentation for a complete robotic system serving some useful purpose. The presentation will consist of a brief lecture and report on the project at the end of the semester.
MOBILE ROBOTS Spring 2019
CENG 5437 Mobile Robots Course Outline
(Tentative – Changes with interest of the Instructor and the students)

Material to be covered

1. Introduction to the Course
   To the videos – History, Cars, Applications. ROS robots

2. Physics, Inertia, URDF models

3. Selecting Motors for Wheeled Robots

4. PID control of Wheeled Robots

5. Wheeled Robots and Differential Drive Steering
   Basic Kinematics and Math
   Basic Physics of Wheeled Robots

6. SENSORS
   Classes of Sensors
   Characterization of Sensors
   Types of Errors – Statistical and Random

7. Specific Sensors
   Position- Absolute and Relative
   Range

8. Connect Sensors to the Computer – A2D converters, etc.

9. Control Theory PID and Digital Control of Robots

MIDTERM EXAMINATION

DUE: BRIEF ORAL AND WRITTEN SUMMARY OF PROJECT.

10. Software for Navigation
    The Robot Operation System will be used as an example
    Gazebo and MATLAB for Simulation

11. Systems View of Robots
    Sensing, data acquisition, control, and navigation
12. Localization, Sensor Noise and Aliasing, Path Planning and Navigation

13. How Autonomous Cars Drive –
   Localization GNSS, Perception and Deep Learning, Prediction and Routing, Control, Cloud Data, Testing

Other Possible Topics  Flying Robots, Underwater Robots, Safety, Regulations, New Trends

DUE: Night of Final PROJECT DEMONSTRATIONS AND REPORTS.
HOMEWORK RULES and Honesty

HOMEWORK IS DUE ON DATE GIVEN IN THE ASSIGNMENT UNLESS CHANGED IN CLASS

ONLY VALID EXCUSES ARE ACCEPTED FOR LATE WORK

EACH DAY LATE -10 POINTS

A WEEK LATE 30 POINTS MAXIMUM IS YOUR SCORE

Honesty

Academic Honesty

The Academic Honesty Policy at UHCL (found in the university of Houston-Clear Lake Catalog) states: Academic honesty is the cornerstone of the academic integrity of the university.

It is the foundation upon which the student builds personal integrity and establishes a standard of personal behavior.

Because honesty and integrity are such important factors in the professional community, you should be aware that failure to perform within the bounds of these ethical standards is sufficient grounds to receive a grade of "F" in this course and be recommended for suspension from UHCL.

The Honesty Code of UHCL states "I will be honest in all my academic activities and will not tolerate dishonesty."

- Academic Honesty Code – A suggested statement: The Academic Honesty Code states “I will be honest in all my academic activities and will not tolerate dishonesty” and is detailed on pages 77-80 of the 2008-2009 Catalog. Online at: http://www.uhcl.edu/XDR/Render/catalog/06/#A0213
Learning Outcomes CENG 5437 Mobile Robots

Understand the various types and capabilities of mobile robots.

Understand how a robot's component parts are used in applications for mobility and navigation.

Understand and apply the mathematics used to coordinate a robot’s movement.

Describe the mechanical parts of a mobile robot and their characteristics.

Understand how a robotic system is controlled and how the control parameters are measured or acquired using sensors.

Describe the sensors of a mobile robot and their characteristics for various applications. Consider sensor errors and correction techniques.

Understand the types of software used to guide a mobile robot

Be able to design a project to use a robot in an application.

Be able to design a computer system architecture to apply to a robotic system.

Write a project report according to the directions and give presentations in class.

Accommodations (as specified by the Americans with Disabilities Act) – Suggested statement: If you will require special academic accommodations, please contact the Disability Services Office at 281-283-2627.

Academic Honesty Code: see section 2.1.4 in this handbook for the UHCL Academic Honesty Code.