CS 43301/S3301 SOFTWARE DEVELOPMENT FOR ROBOTICS 4 credit hours

Instructor’s Name: Jong-Hoon Kim

(Textbook Title, Author, Year)
- Introduction to Autonomous Mobile Robots, 2nd Edition
  Roland Siegwart, Illah Nourbakhsh, Davide Scaramuzza,
  - Some selected textbook sections and conference/journal articles will be assigned and read. Reading and responses to reading questions as well as discussing and reporting of the topic/papers are definitely significant parts of the course requirement to be completed.

(Other Supplemental Material)
[Recommended texts for your references]
  John J. Craig
- Robot Programming: A Guide to Controlling Autonomous Robots,
  Cameron Hughes, Tracey Hughes
- Physical Computing: Sensing and Controlling the Physical World with Computers,
  Dan O'Sullivan and Tom Igoe
- Arduino Cookbook- 2nd Edition,
  Michael Margolis,

Course Content:
(Slashed with CS 53301) Robots are being used in multiple places that are not easily accessible for humans, to support the lack of available labor, to gain extra precision, and for cost effective manufacturing processes, monitoring, space exploration, precision surgery and artificial limb support for elderly and physically challenged persons. Computer science is an integral part of robotics as it includes areas such as computer algorithms, artificial intelligence, and image processing that are essential aspects of robotics. This first course on robotics will teach the students various motions of rigid robots, mathematics and algorithms related to these motions, motion planning, obstacle avoidance, intelligent path planning including use of various sensors. This course will provide hand-on experience with lab activities and practical knowledge from semester-long projects.
Prerequisites or co-requisites: A minimum grade of C in CS 33301; and Math 12003. Required, elective, or selected elective

Goals:

Outcomes:

Students completing this course will
• learn the evolution of robotics and modern happenings in robotics technology
• understand fundamental concepts in robotics
• become familiar with terminology of robotics
• deepen the knowledge of the robots and their components
• learn the principles of operation of a robotic system
• analyze the problems and challenges on the fundamentals of the methods in robotics research
• study concepts of motion control of a mobile robot navigation
• understand how to perform secure, safe, user-friendly, and smart tasks on robots
• experience real hardware & software components such as Single Board Computer (Raspberry Pi), Embedded System (Arduino), Sensors, Actuators, etc.
• gain practical knowledge from hand-on-Experience with Robot-Operating System (ROS) with deep-learning robots and their components
• grasp an ability to collaborate in groups and teams in problem solving and in project management.

Topics to be Covered:

• Introduction to Robotics
• Basic Mechatronics (Electrical & Mechanical Basic)
• Microcontroller & Embedded System Programming
• Sensors & Actuators
• Communication
• Locomotion Concept
• Mobile Robot Kinematics
• Perception
• Localization
• SLAM
• ROS
• Motion Planning- (Local)
• Motion Planning- (Global)
• Design of a Self-Driving Car