Course Syllabus: Robotic Caregivers, BMED 4833 ROB / 8813 ROB

Robotic Caregivers, BMED 4833 ROB / 8813 ROB, Credits: 3
Monday and Wednesday, 11 AM - 12:15 PM
Location: Whitaker, Room 260
Course website: https://sites.gatech.edu/robotic-caregivers/

Instructor Information

Instructors	Email	Office Hours
Charles C. Kemp *(Instructor of Record)* Associate Professor	charlie.kemp@bme.gatech.edu	Ad hoc on request

General Information

Description
Robotics researchers and futurists have long dreamed of robots that can serve as caregivers. In this project-based course, you'll learn about future opportunities and present realities for robots that contribute to caregiving. You'll gain hands-on experience with teleoperation, autonomy, perception, navigation, manipulation, human-robot interaction, and machine learning. You'll also learn about robot design, healthcare robotics, and entrepreneurship.

Conflict of Interest
Hello Robot produces the Stretch RE1 robot that teams will use for their projects. In addition to being an associate professor at Georgia Tech, Dr. Kemp is a co-founder and the chief technology officer (CTO) of Hello Robot Inc. where he works part time. He owns equity in Hello Robot and is an inventor of Georgia Tech intellectual property (IP) licensed by Hello Robot. Consequently, he receives royalties through Georgia Tech for sales made by Hello Robot. He also benefits from increases in the value of Hello Robot.

Pre- &/or Co-Requisites

Prior experience with the Python programming language is required.

Undergraduate requirements: Registration requires permission from the instructors. Introduction to Biomechanics (BMED 3400 or BMED 3410) is required. Students from the College of Computing are encouraged to contact the instructors.

Graduate student requirements: Permission from the instructors **is not** required.

General guidance: Students should have experience with computer programming and mechanics. Robotics experience is unnecessary, but beneficial. The course is particularly well suited to graduate students in the Robotics PhD Program and undergraduates pursuing a Minor in Robotics. In prior terms, students were primarily from the Robotics PhD Program, the School of Biomedical Engineering, and the College of Computing.

Course Goals and Learning Outcomes
The primary goal of this course is to provide students with a practical understanding of robots in the context of caregiving. Upon successful completion of this course, a student should

- Have a practical understanding of perception, action, human-robot interaction, and learning for robotic caregivers.
- Understand challenges in the design of robotic caregivers for current and future applications.

- Appreciate the design, development, and evaluation of robotic caregivers.
- Have familiarity with relevant literature and the state-of-the-art.

Attendance
This is a project-based course that requires hands-on use of real robots. Attendance is mandatory.

Digital Proctoring
This course is project-based and will not have timed written exams. Students will only be evaluated based on class participation, project presentations, and literature presentations.

Course Requirements & Grading

Assignment	Weight (percentage)
Class Participation	33%
Midterm Project	33%
Final Project	34%

Description of Graded Components

Class Participation: Students will be expected to attend classes and productively contribute to discussions in a manner that reflects familiarity with any covered content and assigned materials. Class attendance is mandatory. To reflect this, a 5% penalty will be assessed for each unexcused absence.

Participation_Grade = Max(Participation_Grade_Without_Penalty - (5% * #_of_unexcused_absences), 0%)

Midterm Project: Groups of students will be expected to work together on a project due in the middle of the term. Time during the weekly class sessions will be allotted for students to work on their projects with guidance from the instructor. Assessments of group projects will be based on in-class presentations and demonstrations. In addition to a presentation at the middle of the term upon completion of the project, groups will be expected to provide in-class updates.

Midterm_Project_Grade = (midterm_status_grade + midterm_end_grade) / 2.0

Final Project: Groups of students will be expected to work together on a project due at the end of the term. Time during the weekly class sessions will be allotted for students to work on their projects with guidance from the instructor. Assessments of group projects will be based on in-class presentations and demonstrations. In addition to a presentation at the end of the term upon completion of the project, groups will be expected to provide brief in-class updates.

Final_Project_Grade = (final_status_grade + final_end_grade) / 2.0

Grading Scale
Individual grades will be assigned between 0 and 100, inclusive. These grades will be used with the following equation to compute a total numeric grade:

Total_Numeric_Grade =
*33 * Participation_Grade*
*+ 33 * Midterm_Project_Grade*
*+ 34 * Final_Project_Grade*

The total numeric grade will then be converted to a letter grade using the following numeric ranges (the words in quotes are the standard Georgia Tech interpretations of letter grades from the Registrar's website):

85.0 <= Numeric_Grade	:	A (“Excellent”)
70.0 <= Numeric_Grade < 85.0	:	B (“Good”)
60.0 <= Numeric_Grade < 70.0	:	C (“Satisfactory”)
50.0 <= Numeric_Grade < 60.0	:	D (“Passing”)
Numeric_Grade < 50.0	:	F (“Failure”)

See http://registrar.gatech.edu/info/grading-system for more information about the grading system at Georgia Tech.

Course Materials

Course Text
There are no textbooks for this course. Reading materials will be provided.

Additional Materials/Resources
Each student will need to use a laptop or desktop throughout the course and use it during class sessions.

Course Website and Other Classroom Management Tools
All instructional materials will be open and available on the Internet.

Course Expectations & Guidelines

Academic Integrity
Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/. Any student suspected of cheating or plagiarizing will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities
If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter.

Attendance and/or Participation
Class participation is a critical part of the course. Attendance is required and will be tracked. As noted above, class participation will form 33% of the grade. In the event of an excused absence, a student is required to notify the instructors so that the absence will not be reflected in the student’s grade.

Please see http://www.catalog.gatech.edu/rules/4/ for more information about institute expectations and restrictions around attendance, including information about excused absences.

Collaboration & Group Work
Students are encouraged to use resources outside of the class. However, students must not take credit for the work of others. Students must provide proper attribution for their sources and properly quote materials, including text, information, code, and equations. Plagiarism is forbidden and will be considered a serious violation of academic integrity. Students must also acknowledge any help they have received from other people, whether they be students, tutors, teachers, hired consultants,

anonymous people on the Internet, or anyone else. If a student uses code written by others, the student will be expected to adhere to the license for the code.

Collaboration is encouraged. However, assessments will depend on an individual's understanding of the material, class participation and contributions to the group projects. For example, students will be expected to provide knowledgeable answers to questions posed by the instructor and others.

The midterm project and the final project will often involve group work. Students will be expected to fairly and honestly report the contributions of each group member to the group work. Reports of the contributions of the group members will influence individual grades. For example, a strong group project may not result in a high grade for a group member who failed to significantly contribute to the group project.

Extensions & Late Assignments

In general, no extensions will be given and late work will not be accepted. Late work will receive zero credit. Students are encouraged to submit incomplete projects, if necessary, since partial credit can be obtained, which would be better than no credit at all. In rare circumstances, an institute approved excuse may necessitate some form of mitigation to be determined on a case by case basis.

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectations. In the end, simple respect for knowledge, hard work, and cordial interactions will help build a positive environment.

Student Use of Mobile Devices in the Classroom

Using laptops and mobile devices as tools for learning and project productivity is encouraged. Using laptops and mobile devices as distractions from the class is discouraged.

Course Schedule

The following topics will be covered in the course:

1. Introduction to robotic caregiving
2. Common forms of assistance in healthcare
3. Perspectives on caregiving provided by guest lectures. Speakers may include caregivers, people with disabilities, clinicians, and researchers.
4. Perception: Robotic perception of the human body and human environments via vision, haptics, audition, and robot-specific modalities such as laser range finders and capacitive sensors.
5. Action: Planning, optimization, and control for robot actions.
6. Human-Robot Interaction: Interfaces, human biomechanics, and physical cooperation
7. Learning: Supervised and unsupervised machine learning from simulations and the real world.