



I400/I590

Human-Robot Interaction Design Syllabus*

Indiana University School of Informatics at IUPUI
Spring 2014

Course Information: 3 credits, Lecture and Lab
Mondays, 3:00 – 5:40 p.m.
Location: ICTC, IT256
Informatics & Communications Technology Complex
535 West Michigan Street, Indianapolis, IN 46202
First Day of class: January 13, 2014
Last Day of class: May 5, 2014
On Course address/Course website:
<https://oncourse.iu.edu/portal/site/SP14-IN-INFO-I400-C76942>

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OnCourse/Messages – check box “send copy to email”
Office Hours: Mondays, 12:00 – 2:00 p.m. or by appointment
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COURSE DESCRIPTION

This will be a survey course in the field of human-robot interaction (HRI). The goal of HRI is to allow robots to successfully interact with humans. There should be computation models of social intelligence for a robot to enable them to naturally and intuitively interact with a human. This course will cover a variety of topics but will have a special emphasis on HRI design as it applies to mobile robotics. Since HRI is interdisciplinary, there may be readings from robotics, artificial intelligence, psychology, human-computer interaction, human factors, interaction design, education, drama, cognitive science, design, ethics and other relevant disciplines. This course will include a lecture and lab component in order to explore the concepts presented on an actual robot platform. Students will complete weekly readings, quizzes, labs, and projects on how to design a human-robot interaction system.

PREREQUISITES

This class is cross listed as a graduate and undergraduate elective course for students interested in HRI research. It will be an elective for HCI MS/PHD students. It will also be an elective for INFO and MAS undergraduates. Therefore, it is assumed that students will have some background in AI, HCI, robotics, or other relevant fields. All students must be proficient in using (or willing to learn autonomously) object oriented programming languages such as C and JAVA. These basic skills will not be taught in the course, but an important pre-requisite for completing the labs and projects using the mobile robot platform.



REQUIRED TEXT

There is no single textbook on Human-Robot Interaction so in this course there will be weekly readings. Readings will be distributed in hard copy in class and also posted to the course website (if an electronic version exists).

Reference Texts:

1. Rogers, Y., Sharp, H., & Preece, J., *Interaction Design: Beyond Human-Computer Interaction*, 3rd edition, Wiley & Sons Publishing, 2011, ISBN: 0-470-66576-9
2. Dautenhahn, K and Saunders, J., *New Frontiers in Human-Robot Interaction*, Advances in Interaction Studies, Benjamins Publishing, 2011, ISBN: 978-90-272-0455-4
3. Kulyukin, V.A. (ed.), *Advances in Human-Robot Interaction*, InTech, 2009, ISBN: 978-953-307-020-9
4. Prassler, E., et al., *Advances in Human-Robot Interaction*, Springer Tracts in Advanced Robotics, 2010, ISBN: 978-3-540-31509-4
5. Rahimi, M. & Karwowski, W., *Human-Robot Interaction*, Taylor & Francis, 1992, ISBN: 0-85066-809-3
6. Norman, D.A., *The Design of Future Things*, Basic Books, 2007, ISBN: 0-465-00227-7

COURSE OUTCOMES

Upon completion of this course, students should be able to

- Explain and discuss basic HRI theory, terms, and principles
- Apply HRI principles to design a robotic system
- Use practical knowledge of HRI to complete a research project and present it to an interdisciplinary audience

ATTENDANCE

Attendance is required in all class meetings. The University regulations state: “*Students are expected to be present for every meeting of the classes in which they are enrolled.*” IUPUI faculty are required to submit to the office of the Register a record of student attendance through the semester, on which they will take action if the record conveys a trend of absenteeism. As a result, ATTENDANCE WILL BE TAKEN IN ALL CLASSES. An Attendance sheet will be passed out in class for each student to sign their name. If you do not sign your name while in class you will be marked absent. Signing the attendance sheet for another student is absolutely prohibited. Any student found doing so will be in violation of university policies on ethics and/or conduct.

Class attendance entails being present for the entire duration of the class (including lecture and project meetings). Attending only part of the class is considered an absence. If you must be absence from class due to plant visits, job interviews, illness or family emergencies you must let the instructor know as soon as possible before the missed class.

GRADING

Participation	10%
Discussion	15%
Quizzes	15%
Labs	30%

Final Project	30%
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GRADE SCALE

97 – 100	A+
93 – 96	A
90 – 92	A-
87 – 89	B+
83 – 86	B

80 – 82	B-
77 – 79	C+
73 – 76	C
70 - 72	C-

67 – 69	D+
63 – 66	D
60 - 62	D-
<60	F

DESCRIPTION OF ALL ASSIGNMENTS

Participation

All students are expected to be professional in class by being focused, engaged and paying attention. The participation grade will be based upon classroom performance, peer evaluations, as well as active engagement in the classroom and OnCourse discussion for the weekly reading. Peer evaluations will be completed by using the CATME software.

Discussion

Each week, each student will review the weekly reading and submit a typewritten discussion of the content. This should be approximately ½ a page about a summary of the paper (no more than 2 or three sentences), then discuss the pros and cons of the reading in the OnCourse forum. In addition, the discussion should list three issues or questions that the student would like to discuss about the paper. The discussion summary must be an original work and must include proper citations if external sources are used. All work should be submitted via OnCourse. Reading reflections are due by 9 am on the day of the class session.

Quizzes

Quizzes will be available only on OnCourse. They cover the reading material and they will be open one week before the scheduled class period. The quiz will close when the class period begins. Quizzes will not re-open for late completion. Quizzes will typically include multiple choice and true-false questions concerning the weekly reading.

Labs

All labs and projects will be completed by using a mobile robot platform. The robot will be checked out to a team of students and it must be returned in the same condition it was received. If it is not returned or parts are missing students will be charged a replacement or parts fee. No grade will be assigned for the student team until the fee is paid or the complete robot platform is returned in original condition. Lab Assignments will be introduced in class and there will be some time to work in class but the majority of the assignment will be completed outside of class. Demonstrations and assessments will be completed during the class meeting period. The typewritten lab memo will be due by 11:59 p.m. on the class period when the demonstration is due.

Final Project

The final project will include 3 components all equally weighted at 10% of your overall grade. It will include the demonstration/presentation, the final report and code. The project is typically a compilation of all of the concepts learned in the lecture and lab implemented on the mobile



robot platform. You will be provided with a document that provides the detail of the final project requirements.

LATE POLICY

Students are responsible for submitting all weekly assignments on time. If a student must be absent, they are responsible for submitting the assignment early and learning what was covered in class on their own. All assignment deadlines are summarized in the syllabus.

- All assignments must be submitted through OnCourse at the designated time
- All assignments submitted late will incur 20% penalty for the first day. Assignments more than one day late will not be accepted.
- Incompletes will not be issued in this course except under very extreme personal conditions that have been reviewed by the instructor and in consultation with the Dean.

GRADUATE STUDENTS

If you are a graduate student taking this course as I590, you will be required to write a research paper at the end of the semester along with completing the final project.

OTHER UNIVERSITY-WIDE POLICIES

Bringing your children to class: University Policy states that: "Children are not permitted to attend class with parents, guardians, or childcare providers. This conduct has the effect of unreasonably interfering with an individual's work or academic performance creating an offensive learning environment." "A student must not violate course rules as contained in a course syllabus, which are rationally related to the content of the course or to the enhancement of the learning process in the course." [Code of Student Rights, Responsibilities, and Conduct, page 29]

Academic Dishonesty / Integrity / Plagiarism: Using another student's work on a project or assignment, cheating on a test, or any other form of dishonesty or plagiarism will result in a grade of zero on that assignment and possibly an "F" in the course, and will be referred to the Dean of Students. All students should aspire to high standards of academic honesty. This class encourages cooperation and the exchange of ideas. For further reference, students may see: <http://life.iupui.edu/dos/code.htm>).

Values and ethics: Profanity or derogatory comments about or towards the instructor or any member of the class will NOT be tolerated. Violating this rule will result in a warning and if the offense continues, administrative action will be taken.

Code of Student Rights, Responsibilities and Conduct: All students are responsible for reading, understanding, and applying the Code of Student Rights, Responsibilities and Conduct of IUPUI. (students can access www.iupui.edu/code for further information regarding the above points)

Disabilities Policy: In compliance with the Americans with Disabilities Act (ADA), all qualified students enrolled in this course are entitled to "reasonable accommodations." Please notify the instructor during the first week of class of any accommodations needed for the course. Students with learning disabilities must provide written verification for this policy to be recognized.



REFERENCE READINGS (Preliminary List)*

Adams, Julie A. "Critical considerations for human-robot interface development." <i>Proceedings of 2002 AAAI Fall Symposium</i> . 2002.
Atherton, J.A. and Goodrich, M.A., "Perception by Proxy: Humans helping robots to see in a manipulation task", <i>Proceedings of the ACM/IEEE international conference on Human-robot interaction</i> . ACM, 2011.
Casper, Jennifer, and Robin R. Murphy. "Human-robot interactions during the robot-assisted urban search and rescue response at the world trade center." <i>Systems, Man, and Cybernetics, Part B: Cybernetics, IEEE Transactions on</i> 33(3), pp. 367-385, 2003.
Crandall, Jacob W., and Mary L. Cummings. "Identifying predictive metrics for supervisory control of multiple robots." <i>Robotics, IEEE Transactions on</i> , 23(5), pp. 942-951, 2007.
Dautenhahn, Kerstin. "Methodology and themes of human-robot interaction: a growing research field." <i>International Journal of Advanced Robotic Systems</i> , 2007.
Fong, Terrence, Illah Nourbakhsh, and Kerstin Dautenhahn. "A survey of socially interactive robots." <i>Robotics and autonomous systems</i> , 42(3), pp. 143-166, 2003.
Goodrich, Michael A., et al. "Experiments in adjustable autonomy." <i>Proceedings of IJCAI Workshop on Autonomy, Delegation and Control: Interacting with Intelligent Agents</i> , 2001.
Groom, Victoria, and Clifford Nass. "Can robots be teammates? benchmarks in humanrobot teams." <i>Interaction Studies</i> , 8(3), pp. 483-500 2007.
Johnson, C.A., Koku, A.B., Kawamura, K. and R.A. Peters II, "Enhancing a Human-Robot Interface using Sensory EgoSphere", <i>Proceedings of the 2002 IEEE International Conference on Robotics and Automation (ICRA)</i> , May 11-15, 2002, Washington, DC, pp.4132-4137, 2002.
Johnson, Carlotta A., Julie A. Adams, and Kazuhiko Kawamura. "Evaluation of an enhanced human-robot interface." <i>Systems, Man and Cybernetics, 2003. IEEE International Conference on</i> . Vol. 1. IEEE, 2003.
Keyes, B. et al, "Improving Human-Robot Interaction through Interface Evolution", <i>Human-Robot Interaction</i> , Chugo Daisuke (ed.), InTech, February 2010, pp. 288.
Lee, Woohun, et al. "Design guidelines for map-based human-robot interfaces: A collocated workspace perspective." <i>International journal of industrial ergonomics</i> , 37(7), pp. 589-604, 2007.
McLurkin, James, et al. "Speaking Swarmish: Human-Robot Interface Design for Large Swarms of Autonomous Mobile Robots." <i>AAAI Spring Symposium: To Boldly Go Where No Human-Robot Team Has Gone Before</i> . 2006.
Murphy, Robin Roberson. "Human-robot interaction in rescue robotics." <i>Systems, Man, and Cybernetics, Part C: Applications and Reviews, IEEE Transactions on</i> , 34(2), pp.138-153, 2004.
Nourbakhsh, Illah, et al. "The design of a highly reliable robot for unmediated museum interaction." <i>Robotics and Automation, 2005. ICRA 2005. Proceedings of the 2005 IEEE International Conference on</i> . IEEE, 2005.
Nourbakhsh, Illah, et al. "The Personal Exploration Rover: Educational assessment of a robotic exhibit for informal learning venues." <i>International Journal of Engineering Education</i> 22(4), pp.777-791, 2006.
Olsen, Dan R., and Michael A. Goodrich. "Metrics for evaluating human-robot interactions." <i>Proceedings of PERMIS</i> . Vol. 2003. 2003.
Pina, P. et al. "Identifying Generalizable Metric Classes to Evaluate Human-Robot Teams", <i>Proceedings of the ACM/IEEE International Conference on Human-Robot Interaction, March 2008</i> , pp.13 – 20.
Scholtz, Jean. "Theory and evaluation of human robot interactions." <i>System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on</i> . IEEE, 2003.
Steinfeld, A. et al. "Common metrics for human-robot interaction." <i>Proceedings of the ACM/IEEE international conference on Human-robot interaction</i> . ACM, 2006.
Steinfeld, Aaron. "Interface lessons for fully and semi-autonomous mobile robots." <i>Robotics and Automation, 2004. Proceedings. ICRA'04. 2004 IEEE International Conference on</i> . Vol. 3. IEEE, 2004.
Yanco, Holly A., and Jill Drury. "Classifying human-robot interaction: an updated taxonomy." <i>Systems, Man and Cybernetics, 2004 IEEE International Conference on</i> . Vol. 3. IEEE, 2004.
Yanco, Holly A., Jill L. Drury, and Jean Scholtz. "Beyond usability evaluation: Analysis of human-robot interaction at a major robotics competition." <i>Human-Computer Interaction</i> , 19.1-2, pp.117-149, 2004.
Young, James E., et al. "Evaluating human-robot interaction." <i>International Journal of Social Robotics</i> 3.1 (2011): 53-67.



WEEKLY OVERVIEW*

Week 1 – Introduction to Robotics & HRI	Week 9 – Final Project Overview
Week 2 – Classifying HRI	Week 10 – Final Project
Week 3 – Evaluating HRI	Week 11 – Final Project
Week 4 – Autonomy and Perception	Week 12 – Final Project
Week 5 – HRI Interfaces	Week 13 – Final Project
Week 6 – Enhancing HRI Interfaces	Week 14 – Final Project
Week 7 – Robot Teams	Week 15 – Final Project Presentation
Week 8 – Museum Robots/Urban Search & Rescue	Week 16 – Final Project Report and Code Due

*This is a new course so the syllabus, calendar and readings may change as deemed necessary by the instructor. Please be flexible and patient about these changes as we explore this topic together.