Human-Robot Interaction
Hanyang University, School of Computational Intelligence

Course Information
Course #: CSE4055
Spring 2022
Thu/Tue 10:30am-12pm (Thu=lecture, Tue=lab)
FTC 5th Floor, Intelligence Computing room 4
Course Management System: https://learn.hanyang.ac.kr/

Instructor Information
Instructor: Casey Bennett
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Course Description
This course focuses on development of modern interactive devices through data-intensive approaches, including human-robot interaction (HRI) and other interactive devices (smartphones, wearables, IOT devices, etc.). In particular, we are interested in 1) how we can create more life-like interaction with robots and other devices via modeling of interaction data, as well as 2) how we can use data from such devices to monitor real world environments in order to improve people's daily life and health. The course will include a mix of lectures and lab-based activities, which will involve learning theory as well as creating your own interactive device (in groups), gathering data, and attempting to create models. Course topics will include: history of HRI, HRI design principles, IOT techniques, intro to mechatronic components, experimental methods in HRI, applications of HRI, ethical concerns, machine learning & other modeling approaches, and the intersection of Data Science & HRI. The course is an opportunity to see how data science can be applied in a world where the lines between the physical and the digital are increasingly blurring.

Course Learning Goals
At the end of the course, students should be able to:
- understand the methods behind modern HRI, both in terms of both research and applied industry
- understand how such methods can be applied more broadly for other interaction problems, such as mobile devices and IOT (internet-of-things)
- understand the history of HRI, human-computer interaction, and how human behavior often shapes modern technology (and vice versa)
- understand how to create and build their own simple interactive devices, using Arduinos and mechatronic components (sensors, actuators)
- know how to extract useful data from such devices, for data science purposes
- understand machine learning and other modeling techniques used in HRI and IOT
- develop a general knowledge of how HRI and other interactive devices can be utilized in a wide array of real-world applications, including healthcare, transportation, and environmental protection

Required Books
- *Human-Robot Interaction: An Introduction 1st Edition* by Bartneck et. Al., ISBN 978-1108735407
  - available free online: https://www.human-robot-interaction.org/
- Other readings will be assigned and provided as PDFs

Prerequisites
Students should have some basic knowledge of programming (e.g. Python) and modeling data (e.g. statistics, machine learning). Prior knowledge of how to construct devices (arduinos, soldering, actuators, sensors) is not required, and will be taught in class.

Grading
The grading scheme for the course listed below, along with descriptions of each component. The summary of the weights of each assignment for contributing to the final grade is as follows:

Assignment	Weight in final grade
Robot Movie Review	5%
Project Mission Statement	5%
Project Lit Review	10%
Project Proposal	10%
Prototype Design & Evaluation Plan	10%
Final Report & Digital Portfolio	25%
Final Presentation	15%
Lab Participation	10%
Attendance	10%

Final Grades: A: 90% - 100%
B: 80% - 90%
C: 70% - 80%
D: 60% - 70%
F: less than 60
(+/- will be given for borderline grades)

Assignments
Robot Movie Review:
You are asked to watch a movie (or 1-2 episodes of a TV series) of your choice in which **robots play a major role**. Pay close attention to *human-robot interaction* and how it is depicted in the film. Write a 1-page report, single spaced. Do not just do a summary or review of the movie itself, but focus on the HRI. Some questions to answer in your report include:

1) What **roles** do the robots have in society? What kinds of **tasks** do they perform? **Where** do they interact with people?
2) What are the methods or modalities that people use to communicate with the robots? How does their communication evolve (change over time)?
3) What methods do the robots use to communicate with people? What about with other robots?
4) What are the consequences of robots in the society? How do people react to the robots—positively, negatively, do their reactions change over time? What could be done to make negative consequences or reactions more positive?

Some examples of relevant shows: *Ex Machina, Wall-e, Westworld* (TV series), *Moon, The Iron Giant, Star Wars, Silent Running, Short Circuit, 2001: A Space Odyssey, Hitchhiker's Guide to the Galaxy, AI, Metropolis, I Robot, Ghost in the Shell, Astroboy, Frank and the Robot, Human* (TV series), *Alien Covenant*, etc.

Project Mission Statement
Here you should give your group a *group name*. Describe the general application *domain* that you are interested in (healthcare, transportation, home environments, workplaces, etc.). You do not need to know all the details at this point, but should identify the *group of users* as well as *context of use* (the types tasks the users will be doing) that you will be studying and designing for. The mission statement should describe what problem you are hoping to solve, and why, including some initial questions you hope to answer.

Project Lit Review
Each group member should **find and read 3 articles** (1 can be from popular press, but at least 2 should be scientific articles). So for example, if there are 3 group members, then 9 articles total. Write an annotation (e.g. short 5-6 sentence paragraph) for each article that briefly describes the main points and how it relates to your project topic. The group should then create a single report combining all the annotations into a single coherent document.

The group should also **find at least 3 existing robots** or other interactive devices in your domain of choice, then show photos and describe the functions and characteristics of those robots/devices. You can still change your mind about the focus of your project, based on this review.

Project Proposal:
Midway through the semester, each student group team will have to propose 1) a robot or interactive device they wish to build, 2) questions they need to answer to design it, 3) a rough "research plan" for evaluating it and collecting data, 4) a plan to analyze/model that data. Should also detail the "division of labor", i.e. which team member will work on what? Proposals will be graded based on creativity and thoroughness. Collecting data by having a prototype interact with a few human participants is encouraged.

Past projects have included smart wearable devices, furry owl robots for educational purposes, and simple mobile robots. At least one past project in a previous class led to technology that was later patented by the student team in the USA. So be creative … the sky is the limit here.

Prototype Design & Evaluation Plan:
Following the results of your background research & project proposal, group members will work together to develop a **series of potential designs** for their prototype concept, including drawings/sketches, components needed to build it, and a weekly work plan needed to complete it. Based on these designs and the original proposal, you should also then include a detailed *final evaluation plan* for evaluating whether their design is successful or not.

Final Project:
Each group team of students will be required to submit a **final report**. This should include details about 1) the design and construction process of your interactive device or robot, 2) the experimental data collection, 3) an analysis and/or modeling of the data, and 4) final conclusion based on your results (including future potential). Students are encouraged to be creative, to include pictures or photos of their work (or even videos of real interaction). However, they should also make sure the written report fully explains in-text what they did and what the results were.

Students will be required to submit a **digital portfolio** along with the final report. This can be submitted as a PDF file, or even better as an online website. It should include photos, drawings, and/or models of your

design process for your interactive device. If you do this well, you can use it as part of your resume later for applying for jobs, graduate school, student design competions, etc.

Students will also be required to give a brief 6-minute presentation the final week of class, detailing what they did and their results. This should include a *live demonstration* showing off their interactive device or robot for the rest of the class.

Participation
Students will also be graded based on their participation in in-class lab activities and regular attendance. There will be a number of in-class hands-on lab sessions, on a weekly basis. So come prepared to get your hands dirty.

Software
The use of Python will be a component of the class, and some prior knowledge is a prerequisite for the course. Outside of that, we will be using the Arduino software (which is based on C++), but that will be taught in class.

Course Schedule
The course schedule will be maintained on the course website on LMS website.

Attendance
It is expected that you will attend every class and remain for the duration; it is the single most important action you can take in mastering the course objectives. Coming 5 minutes late or leaving 5 minutes constitutes an absence for the student. You are responsible for all material covered, assignments delivered or received, and announcements made in class sessions that you miss. For distance learning students, this means viewing the classes in a timely manner, participate in the discussion forum, and being sure to email or call in any questions that you have.

Email
Email is the primary means of communication between faculty and students enrolled in this course outside of class time. Students should be sure their email listed in Hanyang's system is correct.

Attitude
A professional and academic attitude is expected throughout this course. Measurable examples of nonacademic or unprofessional attitude include but are not limited to: talking to others when the instructor is speaking, mocking another's opinion, cell phones ringing, emailing, texting or using the internet whether on a phone or computer. If any issues arise a student may be asked to leave the classroom. The professor will work with the Office of Student Affairs to navigate such student issues.

Civil Discourse
Hanyang University is a community that thrives on open discourse that challenges students, both intellectually and personally. It is the expectation that all dialogue in this course is civil and respectful of the dignity of each student to become leaders. Any instances of disrespect or hostility can jeopardize a student's ability to be successful in the course

Cell Phones/On Call
If you bring a cell phone to class, it must be off or set to a silent mode. Should you need to answer a call during class, students must leave the room in an undisruptive manner. Out of respect to fellow students

and the professor, texting is never allowable in class. If you are required to be on call as part of your job, please advise me at the start of the course.

Course Policies

Changes to Syllabus
This syllabus is subject to change as necessary during the quarter. If a change occurs, it will be thoroughly addressed during class, and an announcement will be posted on Blackboard and sent via email.

Academic Integrity and Plagiarism
This course will be subject to the university's academic integrity policy. More information can be found at the Office of Academic Affairs: https://academic.hanyang.ac.kr/home

Academic Policies
All students are required to manage their class schedules each term in accordance with the deadlines for enrolling and withdrawing as indicated in the University Academic Calendar. Information on enrollment, withdrawal, grading and incompletes can be found at More information can be found at the Office of Academic Affairs: https://academic.hanyang.ac.kr/home

Incomplete Grades
An incomplete grade is a special, temporary grade that may be assigned by an instructor when unforeseeable circumstances prevent a student from completing course requirements by the end of the term and when otherwise the student had a record of satisfactory progress in the course. All incomplete requests must be approved by the instructor of the course and the Associate Dean. Only exceptions cases will receive such approval. More information can be found at the Office of Academic Affairs: https://academic.hanyang.ac.kr/home