

Harvard Extension School

CSCI E-78 Wearable Technologies and the Internet of Things

Teaching Staff:

Instructor:

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Course Description

Wearable technologies field has been experiencing explosive growth with exciting applications in the fields of medicine, sports, fitness, entertainment, as well as new ways for people to interact, communicate, and experience the environment around them. Internet of Things (IoT) works with sensors and software in wearable technologies to provide a communications network that allows data collection and information exchange for wearable devices. The applications of this exciting new field range from helping manage chronic diseases to experiencing entertainment, sports and games in a virtual-reality setting. Enterprise Architecture for systems is being expanded and augmented to use Internet of Things communication network and aggregate data from wearable devices into Big Data collection and analytics frameworks. In this course we review aspects of wearable technologies, including the software, architecture, UX design, communication networks, and data analytics. We review current and proposed uses of this emerging technology.

Textbooks

- Edward Sazonov, Michael R. Neuman (editors), Wearable Sensors: Fundamentals, Implementation and Applications, 2014, Academic Press/Elsevier, ISBN 978-0124186620
- Honbo Zhou, Internet of Things in the Cloud – A Middleware Perspective, 2012, CRC Press, ISBN 978-1439892992
- Claire Rowland, Elizabeth Goodman, Martin Chaliar, Ann Light, Alfred Lui, Designing Connected Products: UX for the Consumer Internet of Things, 2015, O'Reilly Media, Inc, ISBN 978-1449372569

Course Objectives

The course is intended to provide students with an understanding of:

- Wearable Technology Devices
- Application of Wearable Device Technology, such as Medicine, Sports, Fitness, Entertainment, Communication, Connected Homes, Connected Cars
- User Experience Design for Wearable Technology
- Internet of Things – Architecture and Middleware
- Internet of Things – Networking and Communication

- Internet of Things – Data
- Internet of Things – Cloud and Mobile Computing

Assignments and Grading

- Homework 1: Wearable Technology Applications
- Project 1: Wearable Technology Design and Architecture
- Homework 2: Internet of Things – Architecture and Networking
- Project 2: Internet of Things Design and Architecture
- Team Presentation: Case Study - students are grouped into teams for case discussions and each team presents one case study analysis
- Weekly Discussions: Students will participate in weekly online forum discussions with topics based on course material for each week

Grade Weight	Assignment
15%	Homework 1
20%	Project 1
15%	Homework 2
20%	Project 2
10%	Team Presentation: Case Study
20%	Weekly Discussions

Week 1: 1/22-1/28/2018	Fundamentals of Wearable Technologies. User Experience Design for Internet of Things <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 1.1 • Rowland et al.: Ch. 1 <u>Assignments:</u> • Week 1 Discussions
Week 2: 1/29-2/4	Social Aspects of Wearability. Internet of Things - Applications <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 1.2, 1.3 • Zhou: Ch. 2 (pp. 29-53) <u>Assignments:</u> • Homework 1 Assigned • Week 2 Discussions

Week 3: 2/5-2/11	Wearable Chemical and Biochemical Sensors. Technology of Connected Devices – Device Types, Sensors, Actuators. Internet of Things – Devices, Objects, Transducers, Controllers <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 2.1 • Rowland et al.: Ch. 2 (pp. 29-52) • Zhou: Ch. 3 <u>Assignments:</u> • Homework 1 Is Due 2/11 • Week 3 Discussions
Week 4: 2/12-2/18	Medical Applications of Wearable Technologies. Internet of Things - Connectivity <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 2.3 • Zhou: Ch. 4 <u>Assignments:</u> • Project 1 Assigned • Week 4 Discussions
Week 5: 2/19-2/25	Wearable Technologies - Energy Expenditure and Energy Harvesting. Technology of Connected Devices – Energy Considerations <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 2.4, 4.1, 4.2 • Rowland et al.: Ch. 2 (pp. 53-56) <u>Assignments:</u> • Project 1 Continued • Week 5 Discussions
Week 6: 2/26-3/4	Flexible Electronics and Textiles for Wearable Technologies. Connected Product Design. Internet of Things - Middleware <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 3.1, 3.2, 3.3 • Rowland et al.: Ch. 5 • Zhou: Ch. 5 <u>Assignments:</u> • Project 1 Due 3/4 • Week 6 Discussions

Week 7: 3/5-3/10, 3/18 (Spring Break: 3/11-3/17)	Wearable Algorithms. Web of Things – Architecture Standardization <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 5.1 • Zhou: Ch. 7 <u>Assignments:</u> • Homework 2 Assigned • Week 7 Discussions
Week 8: 3/19-3/25	Data Mining for Body Sensor Network. Internet of Things – Embedded Device UX Design <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 5.2 • Rowland et al.: Ch. 7 <u>Assignments:</u> • Homework 2 is Due 3/25 • Week 8 Discussions
Week 9: 3/26-4/1	Physical Activity Modeling and Behavior Change. Internet of Things – Interface and Interaction Design <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 5.3 • Rowland et al.: Ch. 8 <u>Assignments:</u> • Project 2 Assigned • Week 9 Discussions
Week 10: 4/2-4/8	Human Body Communication for a Data Rate Sensor Network. Internet of Things – Networking <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 6.1, 6.2 • Rowland et al.: Ch. 3 <u>Assignments:</u> • Project 2 Continued • Week 10 Discussions
Week 11: 4/9-4/15	Wireless Body Area Networks. Internet of Things – Cloud Computing <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 6.3, 6.4 • Zhou: Ch. 8

	<u>Assignments:</u> • Project 2 Continued • Week 11 Discussions
Week 12: 4/16-4/22	Wearable Sensors for Monitoring of Physical and Physiological Changes and for Early Detection of Diseases. Cloud of Things – Mobile Computing, Cloud Architecture <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 7.1, 7.2 • Zhou: Ch. 9 <u>Assignments:</u> • Project 2 Is Due 4/22 • Week 12 Discussions
Week 13: 4/23-4/29	Wearable and Non-Invasive Assistive Technologies. Internet of Things - Cross-Platform UX, Interoperability, Interusability <u>Readings:</u> • Sazanov, Neuman, Wearable Sensors: Ch. 7.3 • Rowland et al.: Ch. 9, 10 <u>Assignments:</u> • Week 13 Discussions
Week 14: 4/30-5/6	Team Presentation: Case Study 1 (Team 1) – Digital Health Team Presentation: Case Study 2 (Team 2) – Connected Home Team Presentation: Case Study 3 (Team 3) – Connected Car Team Presentation: Case Study 4 (Team 4) – Smart Cities <u>Readings:</u> • Rowland et al.: Case Study – Proteus Digital Health • Rowland et al.: Case Study – Connected Home • Rowland et al.: Case Study – Connected Car <u>Assignments:</u> • Team Presentations due for teams 1, 2, 3, 4. Teams record presentations and submit on 4/30. Presentations will be available on Canvas for student viewing • Week 14 Discussions
Week 15: 5/7-5/12	Team Presentation: Case Study 5 (Team 5) – Wearables and IoT in Entertainment and Gaming Team Presentation: Case Study 6 (Team 6) – Wearables in Sports and Fitness Team Presentation: Case Study 7 (Team 7) – IoT in Retail Industry

	<u>Readings:</u> - Articles <u>Assignments:</u> - Team Presentations due for teams 5, 6, 7. Teams record presentations and submit on 5/6. Presentations will be available on Canvas for student viewing - Students taking the course for undergraduate credit submit feedback on a selected case study presentation (due 5/12) - Week 15 Discussions
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Course Policies

Learning Disabilities

The Extension School is committed to providing an accessible academic community. The Disability Services Office offers a variety of accommodations and services to students with documented disabilities. Please visit www.extension.harvard.edu/resources-policies/resources/disability-services-accessibility for more information.

Academic Integrity

You are responsible for understanding Harvard Extension School policies on academic integrity (www.extension.harvard.edu/resources-policies/student-conduct/academic-integrity) and how to use sources responsibly. Not knowing the rules, misunderstanding the rules, running out of time, submitting "the wrong draft", or being overwhelmed with multiple demands are not acceptable excuses. There are no excuses for failure to uphold academic integrity. To support your learning about academic citation rules, please visit the Harvard Extension School Tips to Avoid Plagiarism (www.extension.harvard.edu/resources-policies/resources/tips-avoid-plagiarism), where you'll find links to the Harvard Guide to Using Sources and two, free, online 15-minute tutorials to test your knowledge of academic citation policy. The tutorials are anonymous open-learning tools.

Assignment Late Policy

All course assignments are expected to be submitted by the assignment deadline. Any extenuating circumstances that prevent a student from submitting an assignment on time need to be discussed with the instructor.