Course Outline – 2021/2022 Academic Year
IAT 884-3: Tangible Computing
School of Interactive Arts and Technology

Instructor: Dr. Alissa Antle

Location: SFU Surrey

DRAFT course description – subject to change.

Overview and Aims

The course covers the historical and current research agenda for a broadly defined class of computational systems, known as Tangible Computing or TEI (Tangible, Embodied and Embedded Interaction), that include user interfaces, interaction approaches and computational systems that emphasize the tangibility and materiality of the interface, physical embodiment of data, hands-on and/or whole body interaction, and the embedding of computation in real spaces, objects and contexts. Tangible computing spans a variety of disciplines including human-computer interaction and interaction design, and utilizes interactive technologies including sensing systems, actuation, microcontrollers, robotics, mechanics and hybrid physical-digital and/or multimodal displays.

The course is designed as a content area course for students interested in the design, prototyping and evaluation of tangible computing systems. It will not cover mobile devices or large display environments.

The course has two main aims:

1. To familiarize students with and help them critically analyze the history, foundations, agendas, issues, research methods and current and critical research projects and papers in the broadly defined area of tangible, embodied and embedded computing.

2. To provide the opportunity to develop hands-on technical skills in prototyping simple sensor, actuated, and/or camera vision based tangible computing systems in order to explore simple, topical research questions.

Who should take this course

Graduate students in Interactive Arts and Technology, Psychology, Sociology, Computing, Communications, Engineering, Education, or Contemporary Arts.

Pre-requisites and course enrolment

Students should have an introductory course in research methods and/or research design. Students will benefit from having completely a foundational multimedia programming computation course (e.g., java, processing) such as IAT 800 and/or a design methods course such as IAT 832 Exploring Interaction. However, neither of these courses are prerequisites. Students interested in tangible, surface, embedded or interactive environments will benefit from having clearly defined research questions for their thesis work in place.

Learning Outcomes

The overall learning goals for the course are for students to understand and be able to discuss the main philosophical, cognitive, social and technical influences in the field of tangible, embodied and embedded computing, to be able to analyze and critique current research in the field and develop the technical skills to build simple research prototypes.

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- Understand and explain the historical development of research in tangible, embodied and embedded computing.
- Understand and explain the main taxonomies, foundational theories and the significance of key research projects that have defined the current state of research in tangible, embodied and embedded computing.
- Critically analyze the research methods and results of a variety of tangible, embodied and embedded computing projects found in published conference and journal proceedings.
- Propose and rigorously justify a research approach, research question(s) and a particular prototype design as a means to creating new knowledge in tangible, embodied and embedded computing.
- Design and technically implement a simple research prototype using that approach, which addresses specific research question(s).
- Design and author a top tier conference paper of 1) a design rationale for your research prototype that addresses a knowledge gap in the field and/or 2) a viable, rigorous and theoretically grounded research study that can be used to evaluate human use of your research prototype.

Topics

This course builds a foundation for research in new forms of interaction and new styles of interfaces by providing an introduction to historical origins and development of tangible computing as a representative class of a new interactive technology. This foundation will be used to analyze taxonomies, issues, explore theoretical underpinnings and analyze critical and innovative research in tangible computing and related fields. Students will have the opportunity to propose, justify, plan, design, build and demonstrate a simple research prototype and write an accompanying research paper. The course includes a workshop component where students learn through hands-on activities about sensors, electricity, simple circuits, microcontrollers, actuators, data processing and logic, camera vision, networking, and communication protocols.

Evaluation

This section particularly is in draft form and is subject to change.

- Workshop Exercises 20%
- Seminar Participation 20%
- Demonstration of working research prototype 25%
- Paper suitable for submission to ACM TEI 2023 or alternative high quality venue (short paper) 35%

References

Required: Brygg Ullmer, Orit Shaer, Ali Mazalek and Caroline Hummels. In press*. Weaving Fire into Form: Aspirations for Tangible and Embodied Interaction*, ACM Press. (Pre-Print available on course website or from instructor – copy not for distribution).

Other papers as posted.

Recommended: Orit Shaer and Eva Hornecker. 2010. *Tangible User Interfaces: Past, Present, and Future Directions.* Foundations and Trends in Human-Computer Interaction. Now Publishers.

Workshop Resource: Tom Igoe and Dan O'Sullivan. 2004. *Physical Computing: Sensing and Controlling the Physical World with Computers*. Course Technology Press.

Materials

A workshop materials "kit" will be distributed near the beginning of class. It will contain all the required materials for the workshops, except camera vision module. You may be required to borrow, purchase or find other materials to make your research prototype. The library has a diverse collection of equipment that may be of use.