SUBJECT OUTLINE

41019 Prototyping Physical Interaction

Course area	UTS: Information Technology
Delivery	Autumn 2021; City
Credit points	6cp
Requisite(s)	31260 Fundamentals of Interaction Design AND 48023 Programming Fundamentals
Result type	Grade and marks

Attendance: block.
Recommended studies: basic programming knowledge is helpful, but no particular language knowledge is assumed

Subject coordinator

Dr Sam Ferguson

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Questions regarding assessment or content within the subject are welcome in lectures or tutorials or alternatively post them to the discussion board in Canvas. This helps ensure that all students get the benefit of the answers given.

The Subject Coordinator may be contacted by email if you have matters of a personal nature to discuss, e.g., illness, study problems, and for issues to do with extensions, group problems or other matters of importance.

All emails sent to subject coordinators, tutors or lecturers must have a clear subject line that states the subject number followed by the subject of the email [e.g. Subject 32702, Request for Extension], and must be sent from your UTS email address.

Consultation hours: Check the Canvas Contact section for details on consultation hours. Requests for appointments outside the given consultation hours may be arranged where circumstances require, and to do so please contact the subject coordinator by email.

Teaching staff

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Subject description

This subject focuses on the design, assessment and implementation of effective and elegant interactive physical devices. Students use a human-centred design approach to create, iteratively evaluate, and refine a series of prototype devices which use a variety of sensors, actuators and display methods to facilitate rich and complex user interactions and experiences. Students learn how to obtain and process data from sensors, and design the auditory, visual and haptic feedback that the prototype provides. By conducting iterative cycles of user assessment and feedback on the evolving prototype interactive system, students iteratively refine and finalise their prototype design.

Subject learning objectives (SLOs)

Upon successful completion of this subject students should be able to:

1. Use a human-centred design process to design and develop an interactive system.
2. Model an implementation of a physical interactive system.

3. Embed sensors and process sensor data efficiently and effectively to support the user experience of a physical interactive system.
4. Implement and assess sensory feedback from the interactive prototype.
5. Communicate the capabilities of your designs and implementations effectively.
6. Assess the usability and appropriateness of an interactive system through studying use in context.

Course intended learning outcomes (CILOs)

This subject also contributes specifically to the development of the following Course Intended Learning Outcomes (CILOs):

- Socially Responsible: FEIT graduates identify, engage, interpret and analyse stakeholder needs and cultural perspectives, establish priorities and goals, and identify constraints, uncertainties and risks (social, ethical, cultural, legislative, environmental, economics etc.) to define the system requirements. (B.1)
- Design Oriented: FEIT graduates apply problem solving, design and decision-making methodologies to develop components, systems and processes to meet specified requirements. (C.1)
- Collaborative and Communicative: FEIT graduates work as an effective member or leader of diverse teams, communicating effectively and operating within cross-disciplinary and cross-cultural contexts in the workplace. (E.1)

Teaching and learning strategies

This subject will take an authentic, project-based perspective on the development and user testing of prototype interactive systems. Class time will be devoted to the exploration of both technological methods for implementation as well as practical experience of methods for obtaining design feedback from users. Collaborative exercises, design exercises and technical experimentation will be undertaken within class to develop the design and implementation skills necessary, and will. In addition, groups will collaborate to complete the central project as a team, by completing each of the individual and group assessment tasks, and within-class interaction will be the basis on which feedback on the prototypes is obtained. In week 1 and 2 there will be feedback provided on your developing project implementation model.

From time to time this subject will require preparation before attending class, including watching video lectures, doing research, developing designs and completing quizzes, so that during class time the student can engage fully in collaborative group and class exercises and discussions. Requirements for this pre-work will be posted in the appropriate sections of Canvas and will also be referenced in the program section of this subject outline.

Content (topics)

This subject covers the following content:

- Basic programming techniques for prototyping systems.
- Basic fabrication design techniques for building enclosures.
- Human-centred design and methods for evaluating prototypes.
- Analysing evaluation results.
- Analogue and digital sensors and sensor data analysis.
- Displays and audio systems Networks of prototyping systems.
- Software techniques for analysing sensor data and responding to sensor input.

Learning this content is undertaken in the context of a central prototyping project, which will involve the implementation of a prototype, a user evaluation of the prototyping, and then the refinement and completion of the prototype.

Program

Week/Session	Dates	Description

1	22 Feb	Understanding Physical Interaction Subject Outline and Assessments Group Expectations Audit and Concept Ideation
2	1 Mar	Human Centred Design Arduino and Happybrackets Introduction Team Formation and Sprint 1 Planning
3	8 Mar	Physical Interaction - Models and Frameworks Sensors, Analogue and Digital
4	15 Mar	Human Centred Design - Ideation and Implementation HappyBrackets Conceptually **Notes:** Sprint 1 Showcase
5	22 Mar	Interview Tools and Methods Displays, LEDs, and Actuators
6	29 Mar	Physical Interaction Frameworks Mapping Lecture **Notes:** Sprint 2 Showcase
STUVAC	5 Apr	STUVAC WEEK No Classes
7	12 Apr	Sound and Physical Interaction HappyBrackets and Physical Interaction
8	19 Apr	Design of Research Studies Physical Design and Bits and Pieces **Notes:** Sprint 3 Showcase

9	26 Apr	Gesture Recognition Techniques Hardware Hacking **Notes:** ANZAC Day Public Holiday Mon 26 Apr – No lecture or tutorials on Monday but a recording will be made available.
10	3 May	Analysis of Research Data Considering Results Inside Frameworks **Notes:** Sprint 4 Showcase
11	10 May	Media Multiplicities Urban Scale Physical Interaction
12	17 May	Presentations of Projects **Notes:** Sprint 5 Showcase

Assessment

Assessment task 1: Learning Journal

Intent: To develop familiarity with implementing sensor and display technologies and to capture learning that takes place within the collaborative sessions.

Objective(s): This assessment task addresses the following subject learning objectives (SLOs):

1, 2, 3, 4, 5 and 6

This assessment task contributes to the development of the following Course Intended Learning Outcomes (CILOs):

B.1, C.1 and E.1

Type: Journal

Groupwork: Group, group and individually assessed

Weight: 60%

Task: 1. A 2 min tutorial of two elements working together in an original way to achieve an interaction feedback loop (individual week 3, 5%)

2. An original, individual, conceptual design for the project (individual, week 5, 10%)

3. A video of an original physical interaction controlling sound with a tutorial (individual week 7, 10%)

4. A plan for a user study with the prototype system, including aims, objectives, and method (group

submission, week 9, 10%)

5. A reflection on modalities, forms, and theories of physical interaction and your experience of them in your prototype design (500 words, individual week 11, 10%)

6. A 3 min final group video demonstrating the final prototype and a post discussing the changes decided on amongst the group (1000 words total). (group submission, week 14, 15%)

Length: 1. 1 to 2-minute (maximum) video tutorial

2. A 500 word (maximum) discussion board post with at least 2 diagrams

3. 2 to 3 minute (maximum) video tutorial

4. A 1500-word (maximum) plan for the user study, including any lists of questions, ethics consent forms, procedures and processes that would need to be followed.

5. A 500-word (maximum) reflection as a discussion board post

6. A 3 minute (maximum) video and a 1000 word discussion board post.

Due: Task 1: Due 12 March 2021 11:59pm
Task 2: Due 26 March 2021 11:59pm
Task 3: Due 16 April 2021 11:59pm
Task 4: Due 30 April 2021 11:59pm
Task 5: Due 12 May 2021 11:59pm
Task 6: Due 4 June 2021 11:59pm

Further information: Refer to the assignment on the Canvas site for more specific details about this assignment. Criteria-based rubric feedback will be provided on Canvas within 2 weeks of submission.

Assessment task 2: Physical Interaction Prototype Development

Intent: **To develop a physical interaction prototype, and** to obtain and analyse user study feedback on your prototype system.

Objective(s): This assessment task addresses the following subject learning objectives (SLOs):

1, 2, 3, 4, 5 and 6

This assessment task contributes to the development of the following Course Intended Learning Outcomes (CILOs):

B.1, C.1 and E.1

Type: Report

Groupwork: Individual

Weight: 40%

Task: Build the complete interactive prototype and run a user study with the system to test your implementation and design. Analyse the feedback and make recommendations to improve your design.

1. Sprint Contribution (15%) – Document 5 Sprints of Development (concluding weeks 4, 6, 8, 10, 12) with clear evidence of individual student contribution to the completion of the design and implementation of a physical interaction prototype project– presented as a report with references to previously submitted sprint artefacts (trello boards, git commits, retrospectives submitted fortnightly at the end of each sprint).

2. User Study Report (25%) – an analysis of the results of the user study of the prototype system and a description of the changes that should therefore be made to the prototype to achieve the final, resolved design. This should include the (previously marked) plan for the user study as text to outline the study aims, objectives and method. The results summary, analysis, and design recommendations are individually developed and presented in this report, and no group collaboration should take place.

Note – the implementation and study of an original physical interaction prototype system is a requirement for this assignment.

Length:	1 collated sprint contribution report of a maximum of 1000 words. Use the previously submitted sprint artefacts to demonstrate your contribution – but they do not contribute to the word count. 1 analysis report (3000 words) This report should also include the group's submission from Assignment 1 Task 4 which does not contribute to the word limit, as well as including any raw data or transcripts which also does not contribute to the word limit.
Due:	Both components are due 11.59pm Friday 21 May 2021
Further information:	Refer to the assignments document for more specific details about this assignment. Criteria-based rubric feedback will be provided on Canvas within 2 weeks of submission.

Use of plagiarism detection software

Turnitin Software will be used for all written assignment submissions.

Moderation of marks

All students will receive the same mark for the group p0 assignment 1 unless at least half of the team requests a Peer Assessment. Using Peer Assessment the mark of each member will be weighted according to their individual contribution as assessed by their peers in the team using the peer assessment form, and the tutor and subject co-ordinator. The Peer Assessment form is in the Assignments folder on Canvas and must be completed by each student in any team experiencing problems and handed to your workshop lecturer or tutor individually at the time of assignment submission. Peer Assessment is optional and should only be considered where other methods of solving group problems have been exhausted. If you have trouble with the operation of your team, ask your tutor for advice as soon as problems arise, a quick discussion can usually produce a solution in the early stages, but it is much harder to solve when the assignment is in its final stages. No complaints or concerns about the group assignment will be considered after the assignment has been submitted.

Assessment feedback

Assessment feedback will be provided 2-3 weeks after each assignment has been submitted in full. In addition, the studio-based learning environment will be used to provide formative feedback on your process throughout the semester.

Minimum requirements

In order to pass the subject, a student must achieve an overall mark of 50% or more.

Recommended texts

IDEO, 2015, *The Field Guide to Human-centred Design,* IDEO, Canada. (Free e-book)

References

Banzi, M. 2009, *Getting Started with Arduino*, O'Reilly Media, Sebastopol, CA, USA.

Monk, S. 2014, *Raspberry Pi Cookbook*, O'Reilly Media, Sebastopol, CA, USA.

Margolis, M. 2011. *Arduino Cookbook,* O'Reilly Media, Sebastopol, CA, USA.

Igoe, T., 2007. *Making Things Talk: Practical Methods for Connecting Physical Objects*. Make, Sebastopol, CA, USA.

Moggridge, B., 2007. *Designing Interactions*. MIT Press, Cambridge, USA.

Norman, D. A. 2003. *Emotional Design – Why We Love Everyday Things*. Basic Books, NY.

Norman, D. A. 1990. *The Design of Everyday Things.* Bantam Doubleday Dell Publishing Group, NY.

Graduate attribute development

For a full list of the faculty's graduate attributes refer to the FEIT Graduate Attributes webpage.

For the contribution of subjects taken in the Bachelor of Engineering (Honours) or Master of Professional Engineering to the Engineers Australia Stage 1 Competencies, see the faculty's Graduate Attributes and the Engineers Australia Stage 1 Competencies webpage.

Assessment: faculty procedures and advice

Marking criteria

Marking criteria for each assessment task will be available on the Learning Management System: Canvas.

Extensions

When, due to extenuating circumstances, you are unable to submit or present an assessment task on time, please contact your subject coordinator before the assessment task is due to discuss an extension. Extensions may be granted up to a maximum of 5 days (120 hours). In all cases you should have extensions confirmed in writing.

Special consideration

If you believe your performance in an assessment item or exam has been adversely affected by circumstances beyond your control, such as a serious illness, loss or bereavement, hardship, trauma, or exceptional employment demands, you may be eligible to apply for Special Consideration.

Late penalty

For Graded subjects:

Work submitted late without an approved extension is subject to a late penalty of 10 per cent of the total available marks deducted per calendar day that the assessment is overdue (e.g. if an assignment is out of 40 marks, and is submitted (up to) 24 hours after the deadline without an extension, the student will have four marks deducted from their awarded mark). Work submitted after five calendar days is not accepted and a mark of zero is awarded.

For some assessment tasks a late penalty may not be appropriate – these are clearly indicated in the subject outline. Such assessments receive a mark of zero if not completed by/on the specified date. Examples include:

a. weekly online tests or laboratory work worth a small proportion of the subject mark, or
b. online quizzes where answers are released to students on completion, or
c. professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
d. take-home papers that are assessed during a defined time period, or
e. pass/fail assessment tasks.

For Pass/Fail subjects:

Work submitted late without an approved extension will only be assessed at the subject coordinator's discretion. Students who do not submit assessment tasks by the due dates may be referred to the Responsible Academic Officer under Student Rule 3.8.2, and a fail result may be recorded for the subject.

Querying results

If you believe an error may have been made in the calculation of your result in an assessment task or the final result for the subject, it is possible to query the result with the Subject Coordinator within five (5) working days of the date of release of the result.

Academic liaison officer

Academic liaison officers (ALOs) are academic staff in each faculty who assist students experiencing difficulties in their studies due to: disability and/or an ongoing health condition; carer responsibilities (e.g. being a primary carer for

small children or a family member with a disability); and pregnancy.

ALOs are responsible for approving adjustments to assessment arrangements for students in these categories. Students who require adjustments due to disability and/or an ongoing health condition are requested to discuss their situation with an accessibility consultant at the Accessibility Service before speaking to the relevant ALO.

Statement about assessment procedures and advice

This subject outline must be read in conjunction with the Coursework Assessments policy and procedures.

Statement on copyright

Teaching materials and resources provided to you at UTS are protected by copyright. You are not permitted to re-use these for commercial purposes (including in kind benefit or gain) without permission of the copyright owner. Improper or illegal use of teaching materials may lead to prosecution for copyright infringement.

Statement on plagiarism

Plagiarism and academic integrity

At UTS, plagiarism is defined in Rule 16.2.1(4) as: 'taking and using someone else's ideas or manner of expressing them and passing them off as ... [their] own by failing to give appropriate acknowledgement of the source to seek to gain an advantage by unfair means'.

The definition infers that if a source is appropriately referenced, the student's work will meet the required academic standard. Plagiarism is a literary or an intellectual theft and is unacceptable both academically and professionally. It can take a number of forms including but not limited to:

- copying any section of text, no matter how brief, from a book, journal, article or other written source without duly acknowledging the source
- copying any map, diagram, table or figure without duly acknowledging the source
- paraphrasing or otherwise using the ideas of another author without duly acknowledging the source
- re-using sections of verbatim text without using quote marks to indicate the text was copied from the source (even if a reference is given).

Other breaches of academic integrity that constitute cheating include but are not limited to:

- submitting work that is not a student's own, copying from another student, recycling another student's work, recycling previously submitted work, and working with another student in the same cohort in a manner that exceeds the boundaries of legitimate cooperation
- purchasing an assignment from a website and submitting it as original work
- requesting or paying someone else to write original work, such as an assignment, essay or computer program, and submitting it as original work.

Students who condone plagiarism and other breaches of academic integrity by allowing their work to be copied are also subject to student misconduct Rules.

Where proven, plagiarism and other breaches of misconduct are penalised in accordance with UTS Student Rules Section 16 – Student misconduct and appeals.

Avoiding plagiarism is one of the main reasons why the Faculty of Engineering and IT is insistent on the thorough and appropriate referencing of all written work. Students may seek assistance regarding appropriate referencing through UTS: HELPS.

Work submitted electronically may be subject to similarity detection software. Student work must be submitted in a format able to be assessed by the software (e.g. doc, pdf (text files), rtf, html).

Further information about avoiding plagiarism at UTS is available.

Retention of student work

The University reserves the right to retain the original or one copy of any work executed and/or submitted by a student as part of the course including, but not limited to, drawings, models, designs, plans and specifications, essays, programs, reports and theses, for any of the purposes designated in Student Rule 3.9.2. Such retention is not to affect any copyright or other intellectual property right that may exist in the student's work. Copies of student work may be retained for a period of up to five years for course accreditation purposes. Students are advised to contact their subject coordinator if they do not consent to the University retaining a copy of their work.

Statement on UTS email account

Email from the University to a student will only be sent to the student's UTS email address. Email sent from a student to the University must be sent from the student's UTS email address. University staff will not respond to email from any other email accounts for currently enrolled students.