University of Glasgow | School of Computing Science

Assessed Coursework

Course Name	Mobile Human Computer Interaction (H) and (M)			
Coursework Number	1 of 1			
Deadline	**Time:**	**4:30pm**	**Date:**	11/3/24
% Contribution to final course mark	40%		**This should take this many hours:**	20-30 hrs
Solo or Group ✓	**Solo**	✓	**Group**	
Submission Instructions	Submit through Moodle			

Who Will Mark This? ✓	**Lecturer**	✓	**Tutor**		**Other**	
Feedback Type? ✓	**Written**	✓	**Oral**		**Both**	
Individual or Generic? ✓	**Generic**	✓	**Individual**		**Both**	
Other Feedback Notes						
Discussion in Class? ✓	**Yes**	✓	**No**			
Please Note: This Coursework cannot be Re-Done						

Code of Assessment Rules for Coursework Submission

Deadlines for the submission of coursework which is to be formally assessed will be published in course documentation, and work which is submitted later than the deadline will be subject to penalty as set out below. The primary grade and secondary band awarded for coursework which is submitted after the published deadline will be calculated as follows:

(i) in respect of work submitted not more than five working days after the deadline
   a. the work will be assessed in the usual way;
   b. the primary grade and secondary band so determined will then be reduced by two secondary bands for each working day (or part of a working day) the work was submitted late.

(ii) work submitted more than five working days after the deadline will be awarded Grade H.

Penalties for late submission of coursework will not be imposed if good cause is established for the late submission. You should submit documents supporting good cause via MyCampus.

Penalty for non-adherence to Submission Instructions is 2 bands

You must complete an "Own Work" form via
http://www.dcs.gla.ac.uk/socs-online for all coursework
UNLESS submitted via Moodle

Mobile HCI (H/M): Coursework Exercise

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1. Introduction

For this coursework exercise, you will be conducting a small research project that aims to develop and evaluate an alternative input technique for activating on-screen buttons on handheld or head mounted mobile devices. You will need to **design**, **implement**, and **evaluate** an input technique prototype, then produce a **written report** that describes your design and development process, and presents the findings of your evaluation. This is an individual assessment and cannot be completed as part of a group.

You are expected to produce a *functional implementation* of your input technique, so that a user can complete a range of appropriate interaction tasks on a mobile device. You cannot use design tools like Figma or Adobe XD for this assessment – we want to see some form of development that yields a working prototype of your designs. You are required to submit source code and your report needs to explain the implementation of your input technique.

We recommend using the development technologies we use in the lab exercises for this course. If you complete the lab exercises, then you will have sufficient prototyping skills to accomplish an excellent project. You are, of course, welcome to use alternative platforms (e.g., native Android or iOS development). You are also allowed to use additional frameworks and libraries to support your implementation, remembering that all third-party code should be clearly identified and referenced.

When assessing your work, our focus will be on *process* rather than *product*. Your input technique does not need to be cutting-edge or use a highly complex design that rivals the state-of-the-art in mobile human-computer interaction research. We are not just assessing your coding abilities or your abilities to produce a working implementation entirely from scratch. It is fine for your work to replicate or take inspiration from existing input techniques.

Instead, we place emphasis on going through a quality research process, e.g., a thorough design process that yields well-justified input technique designs, a robust development process that leads to high quality functional interactive prototypes, and an appropriately detailed evaluation process that gives good insight into the efficacy of your designs.

2. Input Technique

Your input technique needs to allow a mobile device user to **activate buttons** *without directly tapping on them via the touchscreen*. Users must be able to activate one button from *at least five* available buttons independently, using your input technique – so you cannot just implement a simple mechanism for activating a single button or triggering a single input event.

You can use almost any interaction modality for input recognition (e.g., motion, orientation, speech, gesture, gaze, etc). You could take inspiration from the lab exercises, and you could incorporate alternative input modalities like those considered in the lectures.

You *can* use the touchscreen for input, so long as users are not simply tapping on buttons directly to activate them like with conventional touchscreen use. Instead, you could take inspiration from existing touchscreen input techniques like marking menus [1], offset cursor techniques [2], motion correlation gestures [3], etc.

Your implemented prototype should allow users to complete button activation tasks – e.g., present several buttons from which one must be activated. The prototype should be sufficiently functional to allow an evaluation to take place.

You can use any form of button design and button layout you like, so long as users can activate one button from five or more available targets. Buttons do not need to always be visible – e.g., they may not appear until the user initiates some interaction, or you may choose to design an entirely non-visual interaction technique. Buttons do not need to provide any functionality and there is no specific application context – you may choose to just label buttons from Button 1 to Button N, or you could alternatively base this on an example interaction context (e.g., buttons for controlling music playback).

3. Project Outline

For this coursework project, you are expected to **design**, **implement**, and **evaluate** a prototype for a novel input technique. You will then submit a written report that discusses your work throughout the full research process.

In this section, we give an outline of what we would like to see in the report – this will let you see what we expect from the project and should give guidance about what to include in your report.

You should read through this section (and the rest of the handout) in its entirety before you begin the project work. This will hopefully avoid any unexpected surprises – e.g., coming up with design ideas that you cannot implement or evaluate.

3.1. Interaction Technique Design

You should design one input technique – i.e., a series of actions that a user can take to intentionally activate a particular button in an arbitrary user interface layout.

Consider available input modalities (e.g., device motion, device orientation, touch, speech, mid-air gesture, pressure). What modalities are available for the device that you are going to use? What modalities could feasibly be incorporated into an interactive prototype? We recommend choosing one or two input modalities only (e.g., using motion only, or combining motion and speech); avoid overly complex multimodal designs as this likely exceeds the time available for this assessment.

Having identified your potential input modalities, you should consider the actions necessary for button activation – i.e., what do users need to *do* to target and activate a button, and how could you recognise those actions? Can you clearly define conditions or criteria for recognising that those actions have taken place – i.e., how do you know the user intended to activate *that* button? How can you tell the difference between an intentional and unintentional action? Are there any constraints or implications for user interface layout – i.e., do buttons need to be arranged in a particular way, placed in a particular position, have a certain appearance, etc? Are there any limitations of your design – e.g., maximum number of available buttons? Engage with these questions to help you come up with a more formal definition of your input technique. Be creative.

Once you have a better idea of your input technique behaviour and functionality, you should think about how your technique can be incorporated into a usable user interface design. There are two key things to think about at this stage: what kinds of *feedback* do users need, and how should buttons be *arranged* and presented on the device?

In terms of *feedback*, consider what your users need to know to understand the current state of the input technique. How do they know they are interacting correctly? How do they recognise if their actions are causing an effect on the system? How do they know if a button has been targeted? How do they know if the desired button was activated correctly? Think about how you can provide information and feedback to your users so that they can form a better understanding about how your input technique works.

In terms of *button layout*, consider how you might arrange buttons in your interactive prototype. The goal is not to exhaustively identify the range of potential user interface layouts or designs, but to encourage you to come up with *at least one* button layout that you will incorporate into your prototype – because your users need to activate *something*.

As an outcome from this phase of the project, you should have a design specification for your input technique. This specification should describe the actions taken by a user to target and activate a button and should identify how the user interface changes in response to user input. You should consider trying to formalise this as a state diagram for a finite state machine – e.g., what are the possible states of your input technique, what conditions cause a transition from one state to another, and how does the user interface react to changes in state?

Your report should describe the design and rationale of your input technique. Discuss why your chosen approach was selected and why you think it is appropriate for your chosen mobile device or interaction context. What are the potential strengths and weaknesses of your design? What made you choose this design? You may wish to discuss similar existing input techniques, e.g., from consumer technology or research papers. You could also discuss alternative ideas that you considered and discarded, as this gives better insight into your interaction design process. Use diagrams or sketches to illustrate and communicate your input technique's intended behaviour.

A thorough design process will make implementation more straightforward – e.g., by forcing you to think about how your system will function – so don't rush ahead to begin development.

3.2. Prototype Implementation

You should begin implementing an interactive prototype of your input technique. This prototype should present multiple buttons to the user and allow them to activate those buttons by using your input technique. The buttons do not need to *do anything* when activated – i.e., no features or functionality need to be provided. However, it should be clear to the user that the selection is complete, e.g., through appropriate feedback. You may wish to implement multiple button layout prototypes for a more comprehensive evaluation in the next phase of the project – e.g., to give insight into how your technique performs with different button layout parameters.

During development, consider the robustness of your implementation. What are the edge cases for your input recognition? Do you need to take steps to mitigate false-positive or false-negative recognition? Are there any undefined state transitions? Is there anything that might be unclear to the user about how the system is behaving?

Using existing libraries and frameworks is fine, although we expect there to be some level of technical complexity in your project – e.g., a project that simply instantiates a marking menu using an existing library may not score as highly as one that implements the marking menu interactions itself. You *can* use the lab exercises as the basis of your implementation, but we would like to see improvements or adaptations to the design and implementation of those input techniques – i.e., you cannot just conduct an evaluation of the lab exercise solutions without substantial change.

As an outcome from this phase of the project, you should have an implemented prototype that demonstrates your interaction technique. Your implemented prototype may differ from your initial design – that's fine.

Your report should discuss the development and implementation of your prototype. Explain how you implemented your input technique and discuss any additional design decisions made during implementation. You likely encountered many challenges about how best to implement something – e.g., choosing appropriate sensor thresholds, choosing appropriate button layouts, choosing the 'best' way to present feedback, etc.

If you want to incorporate novel interaction modalities (e.g., hand tracking, eye tracking) feel free to ask us for advice about how to get started.

3.3. Evaluation

Now you should have a functional prototype that you can evaluate with other people. There are two aims for the evaluation: (i) to evaluate the efficacy of your input technique; and (ii) to provide empirically supported design recommendations about how to use the technique successfully (e.g., about how to design usable and effective button layouts).

There are many evaluation methodologies you could use, and we are quite open minded about how you do this. However, your chosen evaluation methodology needs to involve *users interacting with your prototype*. You cannot, for example, use surveys with screenshots or videos that illustrate interaction. Instead, you need to choose an evaluation approach that involves users interacting with your prototype, e.g., to complete a series of button activation tasks.

For a stronger evaluation, you may wish to compare your own input technique to conventional touchscreen activation as a baseline condition – although this is not required.

In terms of evaluating efficacy, think about what evaluation data you can collect to enable you to reflect on the strengths and weaknesses of your input technique design. For example, can you measure things like task completion time, button activation success rate, etc? You may also use survey and qualitative data to give further insight, e.g., through standard usability surveys, design heuristics, and interview questions.

In terms of providing design recommendations, think about how your design can be used to help interaction designers use your designs successfully. For example, can you design your evaluation with different button sizes, button layouts, feedback types, etc, to determine how effective different options are? Rather than a simple evaluation that concludes 'it works', we want to see your evaluation try to identify *when* 'it works' (or when it might not).

As an outcome of this phase of the project, you should have data and feedback which you can use to evaluate your input technique. Reflect on what worked well and what did not. Think about potential areas for improvement or future research. Consider how your results can be used to present design guidelines or recommendations for others.

Be honest and open to critique when analysing your evaluation results. We don't expect things to be perfect, so don't avoid talking about things that did not work as well as expected – otherwise you won't have much to talk about and are potentially missing out on extra marks! Remember, the emphasis is on *process* not *product* – we don't care if your results show it was amazing, we're more interested in the evaluation process that you go through.

Your report should describe your evaluation design and justify why you chose to evaluate your prototype in that way. You should also present and discuss the findings from the evaluation. Finally, you should discuss what you would do as future work if you had more time to continue to refine your design – e.g., would you implement your interaction technique differently, or would you choose entirely new interactions instead?

When considering evaluation for your project, be conscious of the School of Computing Science ethics procedures for student projects. Avoid evaluation tasks that expose your participants to potential risks. In the interests of time, we recommend avoiding any evaluation designs that would require further ethics approval. Chat to us about this if you're unsure.

3.4. Advice on Project Planning

In this section of the handout, we have given you quite detailed suggestions about what you should do during the coursework project. We have presented the project in terms of three key phases with clear outcomes from each phase. We recommend using this structure to create a rough plan for your project. You should anticipate spending most of your time on implementation and evaluation, so make sure you start the project early to give yourself plenty of time for these. The earlier you start on design, the more time you will have to ask questions and get feedback.

Towards the end of the semester, there will be no lab exercises; instead, lab sessions will be left free for you to work on this coursework. These lab sessions are the ideal time to run your project evaluations because you're all going to be in the lab at the same time. Please be willing to take part in other students' evaluations and, in return, ask them to take part in yours.

4. Submission

You should submit a written report, the source code for your interactive prototypes, and any data gathered during the evaluation process. The tentative submission deadline is **Monday 11 March** at **16:30** and everything should be submitted via Moodle.

4.1. Report

Your report should use the template provided on Moodle and should describe all aspects of work completed during the project. There is no expected structure, but the project outline in this handout should give you a good idea about what we would like to be included in the report. Your report should be a **maximum of 6 pages** and should be submitted as a **pdf**. References and appendices do not count towards the page limit, so cite as many papers as you like!

4.2. Source Code

You need to submit the full project source code of your final interactive prototype. If you do not submit this, your project may not be marked. You should submit a zip archive containing the full project source (in a state where the markers can deploy or run it), or alternatively should provide a link to publicly accessible source code (e.g., an accessible Glitch project or GitHub repository).

Remember that the aim of this coursework exercise is to develop and evaluate an interactive prototype, so that you can test your interaction designs. It does not need to be a fully functional system and it does not need to be perfectly engineered. We are not assessing code quality; we are mainly interested in seeing *how* you implemented your prototype.

4.3. Evaluation Data

You need to submit any data collected as part of the evaluation process, ensuring that no personal data is included (in compliance with the ethics process for student evaluations). This may include quantitative measures of task performance, survey data, interview data, etc. You should submit a zip archive containing all data, separate from your source code. If you do not submit this, your project may not be marked.

5. Grade Descriptors

A1-A5 **Excellent**	Excellent design process leading to a highly innovative and well-justified input technique design. Excellent technical prototype that provides a robust and thorough implementation. Excellent evaluation involving a variety of input tasks, shows great attention to detail, and gives very good insight into the usability of the input technique. An excellent report that clearly describes the research process and shows excellent reflection on evaluation results.
B1-B3 **Very Good**	Very good design process leading to an innovative and well-justified input technique design. Strong technical prototype that provides a robust and thorough implementation. Very good evaluation involving a variety of input tasks, shows good attention to detail, and gives good insight into the usability of the input technique. A very good report that clearly describes the research process and shows very good reflection on evaluation results.
C1-C3 **Good**	Good design process leading to a well-justified input technique design. Strong technical prototype that provides a mostly working implementation. Good evaluation with some appropriate input tasks, shows good attention to detail, and gives good insight into the usability of the input technique. A good report that describes the research process and shows good reflection on evaluation results, though may lack critical insight.
D1-D3 **Adequate**	Satisfactory design process leading to a mostly well-justified input technique design. Adequate technical prototype that provides a mostly working implementation. Good evaluation with some appropriate input tasks and gives some insight into the usability of the input technique. A satisfactory report that describes the research process and shows some limited reflection on evaluation results, though may lack critical insight.
E1-E3 **Weak**	Weak design process leading to a poorly justified input technique design. Satisfactory technical prototype that provides a mostly working implementation. Weak evaluation with a limited range of input tasks and gives limited insight into the usability of the input technique. A poorly written report that describes the research process in limited detail.
F1-F3 **Poor**	Poor design process leading to a barely justified input technique design. Poor technical prototype that offers an unreliable implementation. Poor evaluation with a limited range of input tasks and gives poor insight into the usability of the input technique. A poorly written report that describes the research process in limited detail.
G1-G2 **Very Poor**	Very poor design process that does not adequately justify the input technique design. Barely functional technical prototype. Poor, or no, evaluation that gives very poor insight into the usability of the input technique. A very poorly written report that describes the research process in limited detail.
H	No significant attempt.