

# EECS 4443

## Mobile User Interfaces

### Winter 2022

#### **--- Project ---**

**--- Due March 2 & 9 (proposal), April 18 (final report) ---**

For the 4443 project, you will design and implement a mobile user interface that includes an interesting and hopefully novel interaction technique. Then, you will do a comparative evaluation of the interface and write a report on the evaluation.

Your first step is to prepare a Proposal. The purpose of the proposal is to pick a topic, to investigate and review the topic, and to propose how the project will be carried out. The platform is Android. The topic is up to you.

4443 students → The project is done in a group of three (3) or four (4) students. So, say *hi* to your classmates and think about putting together your group for the project. Ensure the names and email addresses of all group members are at the top of the reports submitted.

5443 students → The project is done in a group of one (1). That is, each student does their own project.

#### **The Topic**

The topic should be something that interests you. Are you a regular user of a mobile device? Sure. What app do you use most? Are you an avid gamer? Do you send 50+ text messages a day? Are you hooked on social networking? Is there an app or feature you wish you had, but don't? Is there an interaction that frustrates you because it doesn't work quite how you think it should? Can you think of an improvement to this interaction? These are good starting points for choosing a topic for your 4443 project.

In picking a topic, think ahead to the evaluation. The evaluation is *comparative* because the interaction is compared with a variation of the interaction. Most likely, the variation is designed in to the interface. And there can be more than one variation. So, what sort of topic is appropriate? Again, the topic is up to you. To look for ideas, study the example projects from previous 4443 classes. See below under "Examples".

Be original. It's fine to use an existing idea as a starting point, but try to think of some new twist to the interaction that might be worth testing.

Begin by searching [Google Scholar](#) on topics of potential interest. Have a look in the research publications returned to see what the researchers did. Can you think of an interesting new twist to the research? This is a good exercise to help you decide on a topic. Within any research lies opportunities for new research – a little tweak here, a little change there. Your proposal and report require a *literature review* (see below), so the earlier you start on this, the better.

By the way, the points of comparison can be "external" to the interface, such a one-handed vs. two-handed, or sitting vs. standing vs. walking, or outside (wearing gloves) vs. inside. Of course, the points of comparison *are* the topic. Relevance to mobile interaction must be noted with related work reviewed.

Once you've decided on a topic, it's time to design, implement, and test the software. Develop the software in Android Studio as a single Android project. Name the project **Project4443**.

## The Evaluation

User study → The comparative evaluation has all the ingredients of an experiment with human participant. In the context of user interfaces, such an experiment is typically called a *user study*. The core details are in chapter 5 ("Designing HCI Experiments") in the [selected reading](#). We will discuss the mechanics of doing a user study in classroom lectures.

Independent variables → Your user study must include "points of comparison". The points of comparison are levels of an *independent variable*. Include either one independent variable with at least three levels, or two independent variables with at least two levels each.

Data collection → Your software must collect and store user performance data. Some of our 4443 demo programs do this; so, you can examine how this is done by studying these apps. Have a look, in particular, in **SoftKeyboard** and **Graffiti**. All the code needed for collecting and storing user performance data is in those demo programs.

Dependent variables → User performance data are the measurements on *dependent variables*. Include at least two dependent variables. These are measures of user performance that your software logs. The most common dependent variables relate to speed and accuracy. Speed is often logged in its reciprocal form – the time to do the task. Accuracy can be a simple record (1 or 0) of whether or not a trial was completed successfully, and is often reported as an error rate (%). Or, accuracy can reflect some other aspect of interaction, such as the number of corrective actions or the extent of deviation from perfect performance. Collecting user performance data is also explored in Lab 4.

Subjective responses → It is important to gauge the user's subjective feelings about the interaction. Subjective responses seek to capture the *user experience*. This is usually done after testing in the form of a questionnaire or interview, or both.

Participants → Engage at least eight users – probably friends or classmates – to do tasks with your UI while their performance is measured and logged. The users that assist you in this way are called *participants*.

Task → It is important to have a simple and well-defined *task*. There are two properties of a good task for a comparative evaluation. A good task must *represent* and *discriminate*. The task must be representative of the sorts of things users typically do. At the same time, the task must have the ability to reveal differences in the points of comparison.

Trial → Each presentation of the task is a *trial*. If the task is simple and takes just a few seconds, include many trials in your evaluation. In this case, you can analyse the participants' improvement over the trial iterations. You might even build a regression model for the *power law of learning*. These possibilities will be elaborated during classroom lectures.

Analysis → After your evaluation is complete, the data are examined and analyzed, with results presented and discussed in the report. The points of comparison are the *test conditions*. Which test condition performed best? Was it better for both dependent variables? How much better? Why was it better? What is the best way to present the results? In a table? In a chart? A line chart or a bar chart? Did participants like the interfaces or interaction methods compared? Did they like one better than the other? Why? Did the participants have useful comments or suggestions for improvements?

## Video Required

Prepare a short video (a minute or so) demonstrating and explaining your UI or interaction technique. Some examples of videos will be shown during classroom lectures. There are also videos in the links below to example projects.

## The Proposal (due March 2 & March 9)

The proposal is an early draft of the report. Begin by downloading the template file in the Project section of eClass. Make a copy of the template file and name it **proposal.docx**. Read the template and follow the instructions, re organization, formatting, citing, referencing, writing style, etc. Edit directly in the renamed template using a word processor such as Microsoft *Word* or The Document Foundation's *LibreOffice*. Use the template file's styles for headings, paragraphs, figures, etc. Do not change any of the fonts, font sizes, paragraph spacing, and so on.

If you prefer, you can use *latex* or *Overleaf*. If you do, make sure you use the ACM conference template file. It is important your submitted report is in the standard two-column format for ACM conference submissions. The template file is an example.

The main parts of the proposal are the Introduction and the Method sections. The Introduction can include additional sections or sub-sections as you see fit.

Begin the Introduction with high-level observations on mobile computing and mobile user interfaces. Then, introduce the topic. Make broad comments about the importance and relevance of the topic to mobile computing. Present and discuss different examples of current practice. Include figures containing images or screen snaps to describe and distinguish them. All figures must include a caption and must be referred to in the body of the proposal. See the template file for examples and details.

Describe the topic, then narrow in on the issue you are investigating. Important interaction issues are presented and compared. Related work is reviewed. Then, get to your idea – an improved *such-and-such* method for *such-and-such* interaction. Describe it in detail, perhaps in a dedicated section or sub-section. Use figures and other visual aides to help guide the discussion.

The point above that "related work is reviewed" refers to a *literature review*. Include this in a section called Related Work. Search using [Google Scholar](#) to find publications on your topic, or similar topics. Summarize what was done and the results obtained. Cite and reference! Review at least four (4) publications.

After the Introduction (and literature review) comes the Method section. Here, you describe what you plan to do and how you propose to do it. Organize the Method section using the customary sub-sections (see template). Since the evaluation is not yet conducted, write the Method section in the future tense (e.g., "Eight participants will be recruited from..."). The goal is to tell the reader what you plan to do. Use figures or other visual aides to help guide the discussion.

The proposal includes a References section. Include at least four (4) publications. The references should be published papers, not web sites. Make sure all references are cited in the body of the proposal.

Tip: Take the time to properly format the citations and references. Consult the template for details and examples.

The template file also includes sections called Abstract, Results and Discussion, and Conclusions. Leave the headings in your proposal, but just note "To be added later."

One final tip: **Read the template file!**

Proposal length: 3-4 pages (formatted as per the template).

When finished, make a PDF copy of the proposal. Follow the submission instructions below.

### **Contribution of Group Members**

For 4443, it is important that the contribution of each group member is approximately equal. In most cases, the groups work quite well as a team. However, occasionally things don't work out as planned and irreconcilable problems emerge within a group. A requirement of the proposal, then, is (a) to confirm that the contribution of each group member was approximately equal, or (b) to provide a rationale on why things didn't quite work out as planned.

If all is well concerning the contribution of group members, download **proposal\_contributions.docx** from eClass. Complete the form by adding the names and signatures of all group members. Make a PDF copy of the form and upload it with your proposal. Digital signatures are fine.

If all is not well, do not upload the form. Instead, each group member should separately upload a file called "my\_rationale" (or something similar). In this file, state your rationale for what you consider to be the relative contributions of yourself and the other group members. Provide any other information you wish.

### **What to submit for Part 1 – the Proposal**

By March 2, upload to eClass the names of the groups members for your group. Provide the full names and email addresses. Only one group member needs to do this. Upload one file:

- [groupmembers.txt](#) (4443 students only)

By March 9, upload to eClass the proposal and the statement of contribution of group members. Only one group member needs to do this. Make sure the names of all group members are at the top of the proposal. Upload two files:

- [proposal.pdf](#)
- [proposal\\_contributions.pdf](#) (4443 students only)

### **The Report (due April 18)**

After you submit the proposal, make a copy of the file and name it **project.docx**. Edit directly in this document to prepare the final project report.

The complete details on preparing and organizing the report are elaborated in the template file. See, as well, chapter 8 ("Writing and Publishing a Research Paper") in the [selected reading](#), and the example reports from previous students in 4443.

The first section of the report is the Abstract. The abstract is a summary of the report. The goal of the abstract is to tell the reader "what you did" and "what you found". Write the abstract last. The abstract is short – a single paragraph of about 150 words.

Make changes as necessary to the Introduction and Method sections. Since you are now describing what you have done, not what you propose to do, change the writing style in the Method section to use the past tense (e.g., "Eight participants were recruited to...").

The report will include sections for Results and Discussion and Conclusions. For details on what to include and tips on writing style, and so on, see (i) the template file, (ii) chapter 8 in the [selected reading](#), and (iii) the example reports from previous students in 4443.

Report length: 5-6 pages (formatted as per the template).

When finished, make a PDF copy of the project report. Follow the submission instructions below.

For the Android code, zip the files for the Android project into **Project4443.zip**.

## What to submit for Part 2 – The Project

By April 18, submit the files for your project. Only one group members needs to do this. Make sure the names of all group members are at the top of the project report. Upload three files:

- [project.pdf](#) – the report
- [name\\_of\\_video\\_file](#) – the video file
- [Project4443.zip](#) – the Android project source files

## Example Projects

Five particularly good projects from past offerings of 4443 were published in the proceedings of an HCI conference. See below. For each, there was some post-4443 polishing-up before submitting to the conference. Note, as well, that the format in these reports does *not* follow the required format for your proposal and project report.

- Farhad, M., & MacKenzie, I. S. (2018). [Evaluating tap-and-drag: A single-handed zooming method](#). *Proceedings of 20th International Conference on Human-Computer Interaction - HCII 2018 (LNCS 10903)*, pp. 233-246. Berlin: Springer.
- Varghese Jacob, S., & MacKenzie, I. S. (2018). [Comparison of feedback modes for the visually impaired: Vibration vs. audio](#). *Proceedings of 20th International Conference on Human-Computer Interaction - HCII 2018 (LNCS 10907)*, pp. 420-432. Berlin: Springer.
- Constantin, C. I., & MacKenzie, I. S. (2014). [Tilt-controlled mobile games: Velocity-control vs. position-control](#). *Proceedings of the 6th IEEE Consumer Electronics Society Games, Entertainment, Media Conference - IEEE-GEM 2014*, pp. 24-30. New York: IEEE.
- Cuaresma, J., & MacKenzie, I. S. (2014). [A comparison between tilt-input and facial tracking as input methods for mobile games](#). *Proceedings of the 6th IEEE Consumer Electronics Society Games, Entertainment, Media Conference - IEEE-GEM 2014*, pp. 70-76. New York: IEEE.
- Medryk, S., & MacKenzie, I. S. (2013). [A comparison of accelerometer and touch-based input for mobile gaming](#). *Proceedings of the International Conference on Multimedia and Human-Computer Interaction - MHCI 2013*, pp. 117.1-117.8. Ottawa, Canada: International ASET, Inc.

The reports above all include example videos. The links to the videos are at the top of the HTML documents.

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