Design Week Outline

Plans and instructions for students

Contents

Key dates

- **Start of design week:** Feb 22, 2022
- **Final demo day:** Wednesday, April 12th, 2022
- **Final project documents submissions due**: Wednesday, April 12th, 2022 (final project reports & documents due 11:59pm)
- **In-class design reviews:** Scheduled during class time (see schedule on myCourses)

Background

The design week is designed to give students hands-on experience in applying the engineering design process to a technical project from start to finish. For the purposes of the design experience, we will consider **your team** as a brand new *engineering start-up*. As a start-up, you hope to deliver the best engineering solution to your first client, such that the client will recommend you to other clients in the future. At the same time, you have maximum of six members in the team, with everyone working part time and committed to working only 9 hours a week.

A large company (**your client**) has hired a number of start-ups (your team included) to deliver engineering design solutions to meet their needs outlined in the *ECSE211 – Client Needs* document. They have given each start-up a time budget of 5 weeks to deliver a design solution. The executives of the client company (**your instructors** will take on this role) have tasked their senior engineers (**your TAs**) to be the point of contact with the start-ups, working closely with you on a weekly basis to make sure the projects are headed in the right direction.

The Client's Expectations

By the time the project is completed, the client wants to be able to select the most promising designs from the start-ups and have any engineer in the company to reimplement, modify, improve upon them. They'd like this to be the case even if the start-up disbands in the future and are no longer available to answer the client's questions about their design.

This means that each team's deliverables to the client at the end of the project (i.e., due last day of classes) must be complete, with all the content anyone might need to:

a. understand how the system works,
b. know the capabilities and limitations of the system,
c. understand the rationale behind the team's key design decisions,

d. reproduce the complete system from scratch, including re-conduct tests to verify its results at various stages of its design, and

e. understand how the project was managed such that future improvements to the system can be budgeted accordingly.

The client has implemented two milestone events to assess the success of each team:

1) Throughout the design process, the executives from the client company will receive status updates from the teams and provide feedback on their design and project progress (**design review**).

2) On the last day (**final demo day**) of the project, teams will demo their final, working system to the client.

The Senior Engineer's Expectations

Each senior engineer is assigned to support a dedicated number of teams. As members of the client company, their role isn't to do the work for the teams, but to make sure that questions from the teams are answered and provide detailed feedback to help teams head in the right direction to meet the client needs on a weekly basis.

The team will meet the assigned senior engineer **every week for 30 minutes on** at an agreed-upon, regular meeting time. As such, the teams are expected to have the latest version of their documents organized in a weekly folder for review **every Wednesday morning before start of class time**. During the scheduled meeting, the senior engineer will review the submitted materials and provide feedback in-person. These documents should contain, at minimum, a set of deliverables each week as outlined in the *Weekly Minimum Deliverables* section below. The teams are welcome to have additional contents to push ahead with their design.

Teams are welcome to put together a formal presentation for the weekly meetings, but it is not required. On the other hand, the teams must prepare for the meeting in advance by having an agenda of items to be discussed as part of the weekly deliverables. Each member of the team must attend and be ready to discuss the tasks he/she has done for the week.

Weekly Meetings with the Senior Engineer

During the first design week, each team should identify the team member's availability. Then, **teams should reach out to the assigned Senior Engineer** to schedule a weekly meeting time —ideally during your team's assigned lab hours –, with **the first meeting expected to take place during the week of March 8th**.

Regular Team Meetings

Students should plan to regularly check in with each other and assess what each other is working on, where one person may be stuck, may be able to help etc. Status updates can also give each other an idea of how much each member of the team is working on tasks toward the collective goal. As you've done for the labs, have meeting agendas and keep meeting minutes. This should help keep each other accountable and become a source of reference for your team's peer evaluation.

Structure of a typical design week

In general, your schedule during the design week will have the following components:

- **Wednesdays**: Teams submit their weekly deliverables on myCourses (due start of class)
- **Wednesdays to Tuesdays**: Teams meet with the TA once a week for feedback on submitted items (regular meeting time to be scheduled between team and senior engineer in the first week, initiated by the team, ideally during their lab hours)

During the design week, **five lectures** are dedicated to student team presentations where a select number of teams will be called to present their project status to the whole class. The instructors will provide verbal feedback to the teams during the lecture time. Four of the lecture times (marked as "Teamwork time" below) are available for you to do your teamwork outside of the classroom. That means you don't need to come to the lecture hall **only** on days marked (Teamwork time), but you are expected to be present in person for all other scheduled lecture times.

	Wednesday	Monday
Week 1	**Feb 22** (Teamwork time)	**Mar 6** (Teamwork time)
Week 2	**Mar 8** (Teamwork time)	**Mar 13** Team design reviews
Week 3	**Mar 15** In-class Lecture by E-IDEA	**Mar 20** Team design reviews
Week 4	**Mar 22** Team design reviews	**Mar 27** Team design reviews
Week 5	**Mar 29** Team design reviews	**Apr 3** (Teamwork time)
Week 6	**Apr 12** Final Demo Day (throughout the day, detailed schedule TBA)	

Communication and File Sharing

You will work in your respective project team's channel in MS Teams. We encourage this to be the primary means of communication between team members, because this will be the means of communication between teams and the mentor TAs.

If your team uses another communication platform, you are welcome to continue using the platform of choice. However, your team will still need to communicate with the TAs through their MS Teams channel.

Your mentor TA, and the supervising instructor have access to the MS Teams channel and its contents. Students should NOT expect the supervising professor to actively monitor the channel or to respond to messages using the platform, but rather, reach out to them via email.
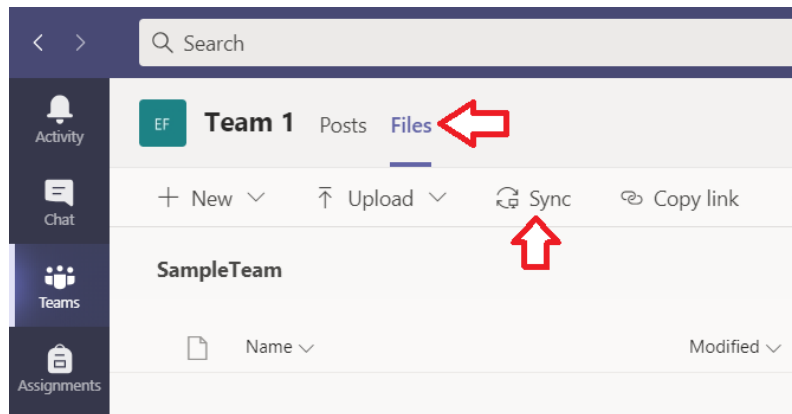

Figure 1. MS Teams environment. The Files tab allows you to create, share, and edit files collaboratively. Desktop synchronization of the files are also possible (it will trigger OneDrive/SharePoint installation).

Design Sharing: The MS Teams platform provides a cloud storage that allows teams to share files and collaboratively edit documents. During the design week, your TA and all of the instructors will have access to your design documents via your team's MS Teams channel (Files tab). However, all weekly documents, design files, and reports that are part of your team's assessment must be submitted via myCourses.

- *Design sharing between team members:* The cloud storage allows you to create reports, share files, and edit documents collaboratively. You can create any folder structure that works best for your team to exchange ideas and share design files. You are also encouraged to use GitHub to collaborate on software and to generate weekly archive of your codebase in MS Teams.

Peer Evaluation

Mid way through the design, each member of the team will be required to submit peer review of the other members of the team. Only the TAs and instructors will have the scores submitted. An aggregated score from the peer review will be shared with you individually.

TAs to be responsible for sending out the aggregated peer evaluations, checking to remove any harsh, inappropriate language etc.

In your evaluation of each other, you will be asked to provide your feedback on your teammates considering the following:

- Contribution to the team's work
- Interaction with teammates
- Motivating quality work
- Demonstrating relevant knowledge, skills, and abilities

Peer evaluation instructions will be made available on myCourses closer to the date. Students will receive grades for completing the peer evaluation by the due date, rather than the content of the feedback. Therefore, students are encouraged to be as honest in their evaluations as possible.

Weekly Minimum Deliverables

Below table provides a list of minimum deliverables that should be submitted every Monday for review by TAs. Two additional items must accompany the deliverables each week. These are:
1. *Timesheet:* The teams are expected to keep a time sheet that provides a log of the amount of time members of each team contributed to the project. This should be kept in a living document and the latest version submitted with the weekly deliverables
2. *Weekly meeting agenda/minutes:* Minutes from meetings with the TA in the prior week and

meeting agenda for the upcoming meeting should be prepared by the teams each week. The meeting agenda should highlighting what the team would like to discuss with the TA during the upcoming meeting. This will ensure that the *teams* drive the meetings to meet their team's needs, with the TAs supporting the teams accordingly. Teams are strongly encouraged to take meeting minutes during the meeting using the meeting template discussed in class.

	TA-Team Meeting Date	Overview of minimum deliverables prior to the meeting date (see detailed descriptions/expectations in the respective sections below)
First meeting	Week of Mar. 8	Translation of client needs into requirements, constraints, specifications; Outline of the brainstormed ideas and priority order of idea implementation; Team coordination plan, project management plan, budget update; System description of the candidate designs.
Second meeting	Week of Mar. 15	Project and budget status update, updates/changes to the project plans/tasks; Outline of the initial prototype in the system, hardware, and software design documents; Reports from tests conducted.
Third meeting	Week of Mar. 22	Project and budget status update, updates/changes to the project plans/tasks; Evidence of reflections after conducting integration test(s) and modifications made to refine the system, hardware, software in the respective design documents; Reports of tests conducted.
Fourth meeting	Week of Mar. 29	Project and budget status update, updates/changes to the project plans/tasks; Near final documentation of system, hardware, and software designs; Reports of final set of tests; Draft presentations for the final demo.

First meeting

This week's submissions (i.e., items your team submitted prior to your first meeting with the TA) should have contents akin to Lab 1 (lab 1 report). Teams should prepare the following contents written/documented in MS Teams for senior engineers to review:

- No TA-team meeting minutes this week, as this is the first meeting with the team.
- Meeting agenda
    - Teams should have a clear agenda of things to discuss, and drive the meeting. There should also be a designated member of the team taking minutes from the meeting.
- Translation of client needs into requirements, constraints, specifications;
    - Make sure the requirements & specifications are not a simple copy-paste of the client needs document.
    - Clearly write down any assumptions you might be making about the problem you are solving or design requirements/constraints, so that you can confirm/address them in the upcoming weeks.
    - Expression of specifications should be connected to preliminary system design (if your system design isn't complete, your specs are likely not going to be complete. This is fine, but teams should have some candidate sys design already and started to eliminate some candidates.
    - Make sure project constraints are clearly outlined including the following:
        - Team member availability
        - Time & $ budget: 5 people team should reflect the reduced # of hours avail. to them accordingly.
        - Teams should have a clear idea of how much time is budgeted for each type of tasks. Use the time it took you to do similar tasks in the labs to come up with a reasonable estimate.

- ▪ Human resources (i.e., member capabilities)
- Outline of the brainstormed ideas and priority order of idea implementation, and system description of the candidate designs
  - o Teams should have drawings, system descriptions etc. that the senior engineer can read to understand how the system might roughly work, if implemented.
  - o There should be at least three different ideas that are not simple modifications of the same idea.
  - o Description of pros & cons of each system design so that you are keeping track of what design ideas have been considered and what design decisions are made for what reason.
  - o If you are having brainstorming sessions, there should be meeting minutes, drawings, or other forms of documentation of the ideas discussed and conclusions made (even if the conclusion was "to be decided at the next meeting").
- Team coordination plan, project management plan, budget update;
  - o Teams should have individual roles identified & assigned to the members (a clear project manager, a clear lead positions for hardware, software, testing, or subsystems etc). All members should have a clear role
  - o Teams should have a team contract and shared goals written for all members agree to abide by (similar to Lab 1).
  - o The project management plan should include a Gantt chart, if they are using an agile approach, they should still have a clear idea of their upcoming sprints and provide a Gantt chart. The Gantt chart should also identify project milestones.
- Timesheet
  - o The timesheet should be up to date to include a full week's worth of work. If your team have not spent all the budgeted time this week, and plan to spend more time next week, your Gantt chart or other parts of the project management should reflect this accordingly.
  - o Not all members need to have used all 9 hours per person every week (it's ok for a member to budget more hours for the upcoming week than the past week etc). But it is not ok to leave unreasonable amount of work until last minute while other members of the team do the work. E.g., no one who takes at least two courses in the semester can spend 0 hours one week, and 18 hours the next week.

Second meeting

This week, all teams should have started to prototype and experiment with their conceptual designs and started testing. Students should have the following contents written/documented in MS Teams for senior engineers to review:

- Meeting agenda
  - o As was the case the previous week, the teams should come to the TA with a clear agenda of things to discuss and drive the meeting.
  - o Completed meeting minutes from the last TA-Team meeting (from the previous week) should also be included, such that everyone can review what was discussed/concluded in the last meeting before starting to discuss this week's agenda items.
- Timesheets
  - o Make sure their timesheet is up to date. If members (on average) haven't done 9 hours of work per member there should be clear plans as to how to make up for the hours lost.
- Project budget update
  - o Teams should have a budget for the rest of the project figured out by now. Realistically, this should have changed because some tasks from previous week may have taken longer/shorter. The time budget and the list of remaining tasks should now be look very

specific: i.e., how many hours will they spend on which subsystem testing, software implementation, etc.

- Updates/plans to the upcoming week(s) including specific tasks (assigned to specific people) that needs to be done
- Hardware/software design documents
  - Based on the system design the team has selected, the teams should have some documentation of their current hardware and software designs.
  - H/W can be in the form of photos of the prototypes, sketches, 3D models. S/W can be in the form of class diagrams, flowcharts, list of functions, objects, python code (submitted as a file or documented on github).
  - There should be a model or a system description, outlining how the system is divided, and how each member of the team is tackling parts of the system design asynchronously. The S/W leads should have a clear understanding of how the software is to be designed (architecture-level discussion) and who is working on which part of the code. The H/W lead should have a clear idea of who is building which part of the H/W subsystem, who is prototyping what. Everyone in the team should have an idea of subsystem and system-level specifications – these are specifications specific to the system being designed (e.g., how large should component X in subsystem Y be?)
- Reports from tests
  - Test leads should have a plan on what tests should be conducted when, and by whom. In particular, they should plan to have at least one integration test conducted before the upcoming week, and another integration test prior to the final demo. They should also have plans to test their subsystems and key components the system may depend on.
  - See if any of the things that are tested or planned to be tested are related to the system's specifications. Tests should help determine whether the specs are being met. If the specifications were vague/ambiguous in the previous week, the team members should be updating the specs according to the system they've chosen together.
  - A good test should have test procedures, success criteria, results etc. written (akin to the Lab 2 report).

Third meeting

This week's submissions should be an extension of the items expected in the previous week. Project budget and status should be updated accordingly, and the H/W, S/W docs should be updated as well. By now, you should have integrated your system and have tested it.

During your third meeting, you should be prepared to **demonstrate your working prototype** to the TA. This demonstration will be evaluated as part of the weekly deliverable.

- In addition to the last week's list of items, each team should have conducted at least one integration test, and have some reflections based on test results. For instance, based on what went well or didn't go well in integration testing, and students should reflect how their current design needs to change their subsystems, H/W (if their hardware design contributed to failures during testing; for instance, many teams involving mobile robots with four wheels had drift issues due to imbalance of weights), and/or S/W.
  - There should be other tests planned/conducted to confirm that they've fixed the issues they've identified during the integration test(s).
- Project budget and task allocation:
  - In addition to updated tasks and plans for the rest of the project, the teams should have some time allocated to preparing the final design report, getting their design submissions ready, and preparing for their final demo.

Fourth meeting

This is the final meeting with the senior engineer. Apart from updates to the previous week's deliverables, teams should have:

- near final set of tests conducted,
- most of the budget having been spent,
- the final design report coming together in submission-friendly form (if the teams have been working on many separate documents, they should be working on the one final design report to be submitted)
  - take a look at the final report outline and make sure that it's easy for readers to find relevant information (what tests were conducted, where can project management information be found, where can we find the final system design information, evolution of design toward the final system design, review of the resources uses used such as bill of materials and time).

Design Reviews (During Lecture Time)

Design reviews for **a selected set of teams (max. 5 teams per lecture)** will take place as per schedule outlined above. The teams selected to present will be announced beforehand on myCourses. Each team will be given 10 minutes to give an overview of the team's project status, designs considered/made so far, or to demo working parts of their system. This will be followed by ~5 minutes of instructor feedback. All members of the team are expected to be present for the design reviews.

Naturally, some teams will have design reviews much earlier in the design process than other teams. The expected amount of work completed for each week will be aligned according to the weekly submissions outlined above. That is, you won't be penalized for not having a working system if you happen to be one of the first groups selected to present.

Your presentation will be evaluated on effective communication (verbal, visual, other), quality of the content presented, quality of response to questions, and appeal to the client.

Detailed rubric for the design reviews is available on myCourses.