2 Project Plan

2.1 Task Decomposition

The deliverable statement for this project is as follows:

> **"Create teaching materials and post them to a new 5G Site for the purpose of teaching how to implement ARA-specific resources, such as software defined radios (SDRs) and OpenAirInterface (OAI)."**

In context of this deliverable statement, our deliverable should do the following (functional requirements):

1. **Use step-by-step laboratory experiments to help get learners familiar with ARA-specific resources relating to SDRs and OAI**
    a. **Task 0**: Setup and learn how to edit the "new" 5G Site
        i. Subtask 1: GitHub / ReadTheDocs connection
        ii. Subtask 2: Editing with ReadTheDocs (Sphinx)
        iii. Subtask 3: Accessibility to ARA equipment/software
    b. **Task 1**: Write the labs
        i. Subtask 1: Content (lab and wiki page) planning
            1. SDRs
            2. OAI
        ii. Subtask 2: Lab writing
            1. SDRs
            2. OAI
2. **Use wiki pages as exposition material for the laboratory experiments to further elaborate and explain the concepts**
    a. **Task 2**: Write the wiki pages, targeting and providing exposition on SDR and OAI material
        i. Subtask 1: Content (lab and wiki page) planning – *same as above*
        ii. Subtask 2: Wiki page writing
            1. SDRs
            2. OAI
3. **Be easily understandable by people *with* previous knowledge of the topics**
    a. **Task 3**: Alpha testing
        i. Subtask 1: Group 1 checks Group 2, Group 2 checks Group 1
        ii. Subtask 2: Make improvements, edit materials as needed
4. **Be easily understandable by people *without* previous knowledge of the topics**
    a. **Task 4**: Beta testing
        i. Subtask 1: Conduct usability study with at least 2 people not on the team and know nothing about 5G
        ii. Subtask 2: Make improvements, edit materials as needed

2.2 Project Management/Tracking Procedures

Our group will use the Agile project management style. The main reason for this is because we need the adaptation aspect of Agile. We will do one sprint for a short time, then we will gather together and see what changes we need to make for the following sprint. We have a lot of material to learn, and it needs to be done as a group. Moreover, the time it takes to learn 5G and other necessary materials before the end of this semester varies for each 5G topic. Therefore, checking in frequently with everyone will be crucial if the group is to stay together.

For tracking procedures, we will use the Microsoft Teams group that our advisor provided to us, specifically the NextG Exploration "F23-Sp24 Tasks", which is similar to the GitHub Issues board.

2.3 Project Proposed Milestones, Metrics, and Evaluation Criteria

Members will be split into the following groups for efficiency, however due to the overlap between SDRs and OAI, large group meetings for sprint retrospectives will still be very common:

GROUP 1: SDRs

1. Chris
2. Josh
3. Varun

GROUP 2: OAI

1. Jared
2. Lukas
3. Zach

Our milestones for the entire academic year are as follows:

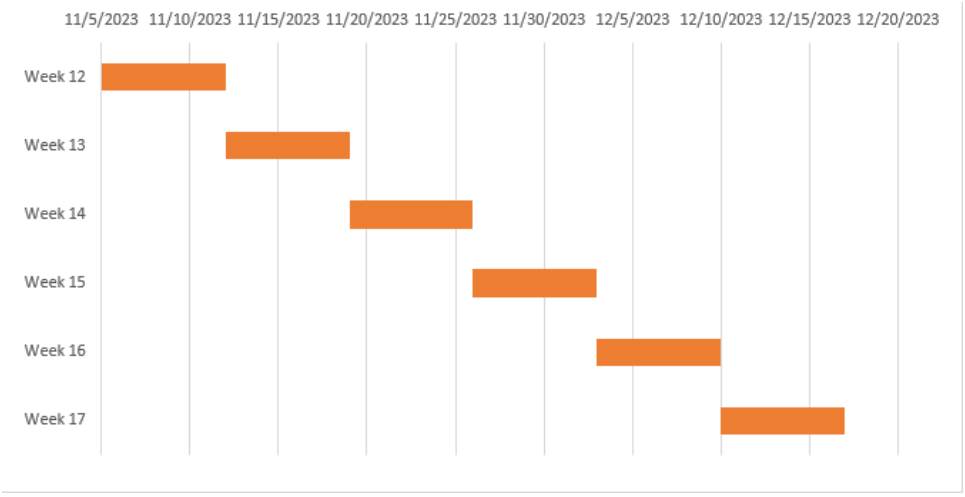
1. **Phase 1: Learn/prepare for spring semester and the fall board meeting**
    a. **Milestone 0:** *Setup* and learn how to edit the "new" 5G Site
    b. Milestone 1: *Learn/Plan* content for labs
        i. We will know when we are done with Milestone 1 when each groups' work has been checked by the other group (checks & balances idea)
        ii. Alpha testing
2. **Phase 2: Spring semester**
    a. Milestone 2: *Write* lab content and *create* wiki pages on "new" 5G Site
        i. We will know when we are done with Milestone 2 when we have conducted a **short usability study** in which we provide our "new" 5G Site to at least 2 other students not in our senior design group
        ii. Beta testing

2.4 Project Timeline/Schedule

A breakdown of our current schedule to complete all the above subtasks, tasks, and achieve the functional requirements is below:

	Week #	Start Date	Task List
FALL	Week 12	11/5/2023	- *Project direction reevaluation* - **BEGIN** task 0, subtask 1
	Week 13	11/12/2023	- **BEGIN** task 0, subtask 3
	Week 14 (**BREAK**)	11/19/2023	- **BEGIN** task 1, subtask 1 - **BEGIN** task 2, subtask 1
	Week 15	11/26/2023	- **FINISH** task 0, subtask 1 - **FINISH** task 0, subtask 3 - **BEGIN** task 0, subtask 2
	Week 16	12/3/2023	- 7 Dec: Board Presentation @ 3pm
	Week 17 (**FINALS**)	12/10/2023	**FINALS**
WINTER BREAK	Week 1	12/17/2023	
	Week 2	12/24/2023	- **FINISH** task 0, subtask 2
	Week 3	12/31/2023	
	Week 4	1/7/2024	- **FINISH** task 1, subtask 1 - **FINISH** task 2, subtask 1
SPRING	Week 1	1/14/2024	- **BEGIN** task 1, subtask 2
	Week 2	1/21/2024	- **BEGIN** task 2, subtask 2
	Week 3	1/28/2024	- **FINISH** task 1, subtask
	Week 4	2/4/2024	- **FINISH** task 2, subtask 2
	Week 5	2/11/2024	- **BEGIN** task 3, subtask 1
	Week 6	2/18/2024	- **FINISH** task 3, subtask 1
	Week 7	2/25/2024	- **BEGIN** task 3, subtask 2
	Week 8	3/3/2024	- **FINISH** task 3, subtask 2

	Week 9 (**BREAK**)	3/10/2024	
	Week 10	3/17/2024	- **BEGIN** task 4, subtask 1
	Week 11	3/24/2024	
	Week 12	3/31/2024	- **FINISH** task 4, subtask 1
	Week 13	4/7/2024	- **BEGIN** task 4, subtask 2
	Week 14	4/14/2024	
	Week 15	4/21/2024	- **FINISH** task 4, subtask 2
	Week 16	4/28/2024	
	Week 17 (**FINALS**)	5/5/2024	FINALS



2.5 Risks And Risk Management/Mitigation

- **For task 1, there are risks of:**
  - GitHub conflicts
  - Lack of Sphinx experience
  - Privilege oversights with ARA software
- **For task 2, there is a risk of:**
  - Writing unclear explanations to all audiences
- **For task 3 and 4, there are risks of:**
  - People falling behind and being unable to keep up with the rest of the group
  - People failing to check each other's work thoroughly
  - Scheduling problems when conducing the usability test
- **For the group work aspect, there are risks of:**
  - Members of the group failing to be in attendance at meetings
  - Members of the group failing to communicate

- **All of these risks lead to an incomplete and substandard product, specifically:**
  - A product that does not thoroughly walk through how to use SDR and OAI
  - Not enough labs with quality content to test user knowledge
  - Users are left confused about the relevant material needed to understand ARA and its applications
- **Therefore, mitigation of all these requirements strongly depends on the following:**
  - Staying together as a group throughout the process by checking in frequently with each other, especially at each weekly meeting
  - Asking questions to our advisor as soon as possible
  - Keep finetuning the ideas we are planning to implement (think about ways we can improve on the method used to deliver the material)

2.6 Personnel Effort Requirements

Task Performed	Explanation	Hours Required
Attend assigned weekly meetings	Every week the group has scheduled meetings at Sunday 2pm via Teams that help with issues that may arise and to ensure the project is getting completed according to the Agile framework	There are three meetings that occur in a week which should account for ~3 hours a week.
TA and Client Meetings	We have meetings bi-weekly with our client on Fridays at 5pm. And we meet with our TA every week but alternates between Wednesday at 5:30 and Friday at 5:30. We are required to attend these meetings so we can get more on track as a	Each meeting is about 30 minutes. Hours required could be 1 hour minimum with one of our

	team as what needs to be done for the project.	meetings being staggered.
Complete small group tasks	Every week the assigned small groups are scheduled certain tasks that are required to be completed by everyone. Once an individual completes this task, they should log the completion in the Meetings tab within Microsoft Teams so our client can see what we have done	This can vary week to week however should require at least ~6

2.7 Other Resource Requirements

5G document website to learn and to expand the contents on the website. We will use powder(sample packets with 5G RAN's), GitLab, ARA Software and Hardware and more. Here is a list of information and some of the books that we are allowed to share with others.

Resources Provided:

5G Site Documentation

- https://5gsitedocumentation.readthedocs.io/en/latest/

5G Mobile Networks: A System Approach

- https://5g.systemsapproach.org/

Computer Networks

- https://book.systemsapproach.org/

USC cellular Scheduling Information

- https://www.ece.iastate.edu/~hongwei/group/publications/UCS.pdf

LPD real-time Scheduling

- https://arxiv.org/abs/2101.01768

Sphinx

- https://sphinx-tutorial.readthedocs.io/

BubbleRan

- https://bubbleran.com/

ARA sandbox

- https://arawireless.readthedocs.io/en/latest/ara_technical_manual/sandbox_service.html

OAI

- https://www.openairinterface.org/