

# Development Plan Software Engineering

## Team 6, EcoOptimizers

Nivetha Kuruparan  
Sevhena Walker  
Tanveer Brar  
Mya Hussain  
Ayushi Amin

Table 1: Revision History

Date	Developer(s)	Change
September 18th, 2024	All	Created first draft of document
September 23rd, 2024	All	Finalized document

This document outlines the development plan for improving the energy efficiency of engineered software through refactoring. It includes details on intellectual property, team roles, workflow structure, and project scheduling. Additionally, the plan covers expected technologies, coding standards, and proof of concept demonstrations, providing a clear roadmap for the project's progression.

## 1 Confidential Information?

No confidential information to protect.

## 2 IP to Protect

The software and associated documentation files for this project are protected by copyright, outlined in the document [here](#)(referred to as "License"). The License does not grant any party the rights to modify, merge, publish, distribute, sublicense, or sell the software without explicit permission. Unauthorized use, modification, or distribution of the software is prohibited and may result in legal action.

Permission is granted on a case-by-case basis, non-transferable and non-exclusive. No rights to exploit the software commercially or otherwise are granted without prior written consent from the copyright holders.

## 3 Copyright License

LICENSE file in root of repository. [Click to Open](#)

## 4 Team Meeting Plan

The team will meet multiple times a week, once during Monday tutorial time and throughout the week as issues or concerns arise. The meetings will be conducted either online through a Teams meeting or in-person on campus. The team will hold an official meeting with the industry advisor once a week yet the time has not been decided. The meeting with the advisor will be online on Teams for the first 3 weeks, followed by in-person meetings later on. Meetings itself will be structured as follows:

1. Each member will take turns giving a short recap of work they have accomplished throughout the week.
2. Members will voice any concerns or issues they may be facing.
3. Team will form a discussion and make decisions for the project.
4. Any/all questions will be documented for the next meeting with the advisor.

The team will go ahead and use Issues on Github to add anything they may want to talk about in the next meeting as the week progresses in order to have some form of agenda for the next meeting.

## 5 Team Communication Plan

**Issues:** GitHub

**Meetings:** Microsoft Teams

**Meetings (with advisor):** Discord

**Informal Project Discussion:** WhatsApp

## 6 Team Member Roles

As a team, we will all function as developers, sharing responsibilities for creating issues, coding, testing, and documentation in the early stages. Specific roles will be defined as the project evolves, allowing for flexibility and collaboration.

During our scheduled meetings (with the supervisor, within the team, etc.), we will follow an Agile Scrum structure, incorporating additional roles such as Scrum Master and Scribe. These roles will rotate weekly, with the Scrum Master responsible for organizing and leading the meetings, and the Scribe tasked with documenting key details. This approach ensures active participation and shared responsibility amongst team members.

We have chosen not to designate a team leader, as we all possess similar skills and knowledge. Instead, we aim to work collaboratively to resolve any challenges that arise.

## 7 Workflow Plan

The repository will contain two main persistent branches (branching off main) throughout the project: **dev** and **documentation**. These branches, that we will henceforth call "epic" branches, will be used for technical software development and documentation changes respectively.

The average workflow for the project will proceed as follows:

1. Pull changes from the appropriate **epic** branch
2. Create working branch from **epic** branch with the format [main contributor name]/[descriptive related to topic of changes]
3. Create sub-working-branch from previous branch if necessary
4. Commit changes with descriptive name

5. Create **unit tests** for said changes
6. Create pull request to merge changes from sub/working branch into working/epic branch
7. Wait for all tests run with **GitHub Actions** to pass
8. Wait for 2 approvals from teammates other than the one who created the Pull request
9. Merge changes into target branch (working or epic)

**GitHub Issues** will be used to track and manage bugs, feature requests, and development tasks. Team members can report issues, propose enhancements, and assign tasks to specific individuals. Each issue will be labelled (e.g., bug, enhancement, team-meeting) for easy categorisation, linked to relevant **milestones**, and tracked through **GitHub Project** boards. Comments and code references will be exploited to allow for collaboration and discussion on potential solutions. Issues will also be integrated with pull requests, so they'll automatically close once fixes are merged.

For situations where a certain type of issue is projected to be created at a steady frequency, templates will be created to facilitate their creation.

**Milestones** will be used to organize commits and pull requests for major deliverables. Once all working branches associated to the milestone have been merged into the appropriate epic branch, the team will go through the relevant prepared checklist to make sure that all requirements have been met. Once this is done, the epic branch will be merged into main as one pull request along with the checklist.

The **CI/CD** pipeline will be implemented via GitHub to improve automated testing as well as facilitate the feedback loop for the machine learning models used by the library. More detailed information will be added later.

## 8 Project Decomposition and Scheduling

The project is hosted on GitHub under the organization of Sustainable Systems and Methods (SSM) Lab and can be accessed at this [link](#).

The team currently has one GitHub Project setup to serve as a visual tool not only to track deadlines for all tasks but also for accountability for assigned tasks. The project can include cards for:

- Issues for course related deliverables
- Lecture and Meeting logs
- Issues for project specific tasks(such as building a certain component).

## Schedule

While the development of our system will be broken down into smaller features, the overall project will follow the following major deadlines.

Milestone	Due Date
Problem Statement, Proof of Concept and Development Plan	September 24th, 2024
Requirements Document (Revision 0)	October 9th, 2024
Hazard Analysis (Revision 0)	October 23rd, 2024
Verification & Validation Plan (Revision 0)	November 1st, 2024
Proof of Concept	November 11th-22nd
Design Document (Revision 0)	January 15th, 2025
Project Demo (Revision 0)	February 3rd-14th, 2025
Final Demonstration	March 17th-30th, 2025
Final Documentation	April 2nd, 2025
Capstone EXPO	TBD

## 9 Proof of Concept Demonstration Plan

What is the main risk, or risks, for the success of your project? What will you demonstrate during your proof of concept demonstration to convince yourself that you will be able to overcome this risk?

## 10 Expected Technology

[What programming language or languages do you expect to use? What external libraries? What frameworks? What technologies. Are there major components of the implementation that you expect you will implement, despite the existence of libraries that provide the required functionality. For projects with machine learning, will you use pre-trained models, or be training your own model? —SS]

[The implementation decisions can, and likely will, change over the course of the project. The initial documentation should be written in an abstract way; it should be agnostic of the implementation choices, unless the implementation choices are project constraints. However, recording our initial thoughts on implementation helps understand the challenge level and feasibility of a project. It may also help with early identification of areas where project members will need to augment their training. —SS]

Topics to discuss include the following:

- Specific programming language
- Specific libraries
- Pre-trained models
- Specific linter tool (if appropriate)

- Specific unit testing framework
- Investigation of code coverage measuring tools
- Specific plans for Continuous Integration (CI), or an explanation that CI is not being done
- Specific performance measuring tools (like Valgrind), if appropriate
- Tools you will likely be using?

[git, GitHub and GitHub projects should be part of your technology. —SS]

## 11 Coding Standard

[What coding standard will you adopt? —SS]

## Appendix — Reflection

[Not required for CAS 741 —SS]

The purpose of reflection questions is to give you a chance to assess your own learning and that of your group as a whole, and to find ways to improve in the future. Reflection is an important part of the learning process. Reflection is also an essential component of a successful software development process.

Reflections are most interesting and useful when they're honest, even if the stories they tell are imperfect. You will be marked based on your depth of thought and analysis, and not based on the content of the reflections themselves. Thus, for full marks we encourage you to answer openly and honestly and to avoid simply writing "what you think the evaluator wants to hear."

Please answer the following questions. Some questions can be answered on the team level, but where appropriate, each team member should write their own response:

### Mya Hussain Reflection

1. *Why is it important to create a development plan prior to starting the project?*

Development plans act as good starting points by establishing clear objectives, recourse requirements, timelines and by assigning accountability within a project. It improves overall communication and understanding between members by solidifying the intent and requirements of a project. From my experience in industry, developers who don't have a good grasp of what they're developing and why they're developing it typically deliver products that either fail to meet the primary goal or prove useless to the user. In real life, you develop products for people with various backgrounds. People of different disciplines speak in different technical tongues. Development plans are critical in syncing many people from various disciplines towards a common goal. They can also further can divide the roles and responsibilities between the developers and later aid in making development decisions that push progress towards the primary goals defined in the document.

2. *What disagreements did your group have in this deliverable, if any, and how did you resolve them?*

I would be lying if I were to say that my team had disagreements during the first week of working on the project. The easy answer to this question is to make up a disagreement of low significance and say we worked through it using open democratic discussion and compromise. The truth is that it is too early in the project for us to be disagreeing with each other. We're in our "honeymoon stage" where all members are excited to work on the project and are optimistic about the possible results we could achieve. Let us be in love during week one. We have many more weeks left to disagree.

### Ayushi Amin Reflection

1. *Why is it important to create a development plan prior to starting the project?*

A development plan is important because it serves as a clear roadmap for the project and ensures that all team members understand the project scope, objectives and timeline. A clear plan helps to identify potential risks and areas of concern/challenges that can be caught at an early stage so a solution can be crafted early on. It also helps in resource allocation by ensuring that the necessary tools and budget are available when needed.

2. *What disagreements did your group have in this deliverable, if any, and how did you resolve them?*

To be quite frank, our team did not have any disagreements during the first couple weeks of working together.

### Sevhena Walker Reflection

1. *Why is it important to create a development plan prior to starting the project?*

When starting a project with a large scope, it is easy to get lost in all the features you want to implement in the project. By establish an action plan from the start, you allow yourself and your team to develop concrete goals and needs for your system. It is necessary to take a step back and analyze how exactly the components of your system are expected to interact with each other and what the end result is suppose to be.

Without this planning stage, you are essentially going in blind with only a vague understanding and what you need to do. There is no way to organize task between team members efficiently either since specific components are sparsely detailed or non-existent. The project will be in a constant state of "debugging" you could say, constantly trying to figure out how this feature will work with the next and the next and so on. It would be like trying to build a house while only ever looking at the next couple meters in front of you.

2. *What disagreements did your group have in this deliverable, if any, and how did you resolve them?* I honestly cannot say that we had any disagreements as yet. Our team tried our best to discuss what our goals for the project were and everything was well communicated so that everyone was on the same page. We are at the beginning stages of a project that will implement technology is mostly new to us. We are excited, but also somewhat ignorant to some details which makes it hard to "disagree".



## Tanveer Brar

1. *Why is it important to create a development plan prior to starting the project?*

After having created one, I believe a development plan is important as it can be useful for the project in multiple ways. For one, it is a written record of the team's expected practices related to roles, communication, etc.(which ensures that everyone is on the same page with these practices). It can also be used by instructors as the source of truth if there are any conflicts in the project team.

Secondly, with the pre-written format/prompts we were compelled to think about some logistics that we would otherwise have ignored(such as communication plan and coding standards). In short, it set a great starting note for the project so we were aware of our assumptions and were also compelled to think about less obvious aspects of project planning.

2. *What disagreements did your group have in this deliverable, if any, and how did you resolve them?*

We haven't had any disagreements in our group for this deliverable. There were multiple instances where each of us had different ideas on how to approach a particular issue. After weighing in the pros and cons of each idea together, we ended up picking one of them unanimously. It was possible since we value each other's thought process and take a non partial approach when deliberating.

## Group Answers

*In your opinion, what are the advantages and disadvantages of using CI/CD?*

CI/CD or Continuous Integration/Continuous Deployment is a two-step process where continuous integration means automatically integrating code changes from multiple contributors into a shared repository for every commit, and continuous deployment involves keeping your code base deployable at any time. Key practices in CI/CD include automated testing and frequent commits. This leads to better code quality as bugs and conflicts between users are caught early on and easily rolled back or fixed near their date of creation. Another advantage is a faster time to market as code is integrated and deployed on development allowing teams to deliver features/fixes to users quicker. It also allows for improved collaboration through feedback as features pushed to shared repositories can be easily reviewed by the team. Disadvantages include the initial setup complexity of the CI/CD pipeline as this can be time consuming and a learning curve to those new to the process. It also requires a lot of maintenance and overhead to continuously commit, push, pull, test and merge code diverging from time that could be spent developing/improving a feature.

In CI/CD, there is a constant cycle of committing code to a code base, and running automated tests on that piece of code before integrating it into the

system. This constant and frequent cycle helps detect problems early leading to a more robust system. Furthermore, stress is taken away from the programmer when it comes to building and deploying software as it is all automated. The flip side to this is, of course, that the developer must initially set up the CI/CD environment. All the automated tests must first be written, and they must be written *well*. The same goes for the build and deployment workflows. This setup can be complex and lengthy and most of all, it requires the developer to know how to do it. Furthermore, it must be *maintained*. Other risks include a serious over-reliance in automation which could potentially introduce security flaws that weren't thought of before.

In other terms: Advantages:

1. Faster development since changes would be pushed constantly as testing for new/fixed features would be successful
2. Shorter delivery times
3. Improved code quality (automated testing)
4. Easier change monitoring and rollback since there are 5 members and multiple branches and changes based on the member
5. Increased efficiency and productivity

Disadvantages

1. Requires strong discipline and commitment from the entire team and may be a learning curve for the team
2. May be challenging to implement for small teams since there is only 5 members
3. Initial setup and configuration can be complex and time-consuming since the team will be setting this up from scratch

## Appendix — Team Charter

[borrows from University of Portland Team Charter —SS]

### External Goals

[What are your team’s external goals for this project? These are not the goals related to the functionality or quality of the project. These are the goals on what the team wishes to achieve with the project. Potential goals are to win a prize at the Capstone EXPO, or to have something to talk about in interviews, or to get an A+, etc. —SS]

### Attendance

#### Expectations

[What are your team’s expectations regarding meeting attendance (being on time, leaving early, missing meetings, etc.)? —SS]

#### Acceptable Excuse

[What constitutes an acceptable excuse for missing a meeting or a deadline? What types of excuses will not be considered acceptable? —SS]

### In Case of Emergency

[What process will team members follow if they have an emergency and cannot attend a team meeting or complete their individual work promised for a team deliverable? —SS]

## Accountability and Teamwork

### Quality

Our team has the following expectations regarding the quality of preparation for meetings and the deliverables brought to the team:

- **Meeting Preparation:**

- Team members are expected to arrive at meetings fully prepared, having reviewed relevant materials and completed their assigned tasks in advance.
- Each member should come ready to discuss their progress, share insights, and address any challenges they are facing.
- Members should ensure that their updates are clear and concise, allowing meetings to stay focused and productive.

- **Deliverables Quality:**

- All deliverables must meet the team’s agreed-upon standards, demonstrating a high level of accuracy, thoroughness, and attention to detail.
- Each deliverable should be carefully reviewed by each member before submission to avoid any errors or incomplete work.
- Deliverables must align with the project’s requirements and deadlines, ensuring they are both functional and meet the expected quality criteria.

- **Accountability and Feedback:**

- Team members are responsible for completing their work to a high standard, communicating any issues early if they need assistance or more time.
- Feedback on deliverables should be welcomed by all members, and revisions should be made promptly to improve the overall quality of the team’s output.

By maintaining these expectations, our team will ensure that meetings are efficient and that all deliverables reflect a professional and high-quality standard.

## Attitude

Our team has established the following **expectations** for team members’ contributions, interactions, and cooperation to ensure a productive and respectful working environment:

- **Respectful Communication:** All team members are expected to listen to each other’s ideas and provide constructive feedback. Communication should remain respectful, even in cases of disagreement.
- **Open Collaboration:** Each member is encouraged to share their ideas openly. Everyone should be willing to collaborate and help each other achieve team goals.
- **Accountability:** Team members are responsible for completing their tasks by the agreed-upon deadlines. If a member is struggling, they are expected to ask for help or communicate early.
- **Positive Attitude:** Maintaining a positive attitude, especially in challenging moments, is essential for team morale. Each member should encourage and support their teammates.
- **Commitment to Quality:** Every team member is expected to contribute to the project with their best effort, ensuring that the final product reflects high standards of quality.

We adopt the following **code of conduct** to guide behavior and interaction among team members:

- **Inclusivity:** Our team values diversity and is committed to creating an inclusive environment where everyone feels welcome and valued, regardless of background, experience, or opinion.
- **Professionalism:** Members will engage professionally, refraining from any inappropriate or offensive language or behavior. This applies to both in-person and online interactions.
- **Collaboration and Feedback:** We encourage constructive feedback and expect team members to accept and provide feedback in a way that helps everyone grow. Criticism should be focused on the work, not the individual.
- **No Tolerance for Harassment:** Harassment of any kind will not be tolerated. Any issues will be reported immediately and addressed in a structured manner.

To manage conflicts or disagreements that may arise during the project, we have a **conflict resolution plan** in place:

1. **Address the Issue Directly:** If a conflict arises, the involved members should first try to resolve the issue directly through a respectful discussion.
2. **Mediation by a Neutral Member:** If the conflict cannot be resolved, the team will appoint a neutral team member to act as a mediator to facilitate a discussion and find common ground.
3. **Escalation to Instructor/TA:** In the event that the conflict cannot be resolved within the team, the issue will be escalated to the instructor or TA for further guidance and resolution.
4. **Follow-Up and Monitoring:** After resolving the conflict, the team will continue to monitor the situation to ensure that the issue does not resurface and that team dynamics remain positive.

By adhering to these expectations, the code of conduct, and our conflict resolution plan, we aim to maintain a positive, collaborative, and respectful team environment.

### Stay on Track

To keep our team on track, we will implement the following methods:

1. **Regular Check-ins and Progress Updates:** We will hold *weekly meetings* where each member will provide an update on their tasks and progress and any concerns or troubles they faced. These updates will help us identify issues early and adjust accordingly to stay on schedule.
2. **Performance Metrics:** We will track the following key metrics:

- *Attendance* at meetings and check-ins will be documented through Issues on GitHub.
  - *Commits to the repository*, ensuring steady contributions.
  - *Task completion rates*, ensuring deadlines are met.
3. **Rewards for High Performers:** To encourage good performance, we will recognize and celebrate team members who meet or exceed expectations. Informal rewards may include public recognition during meetings or assigning leadership roles in future tasks.
  4. **Managing Under performance:** If a team member's performance is below expectations:
    - We will start with a *team conversation* to understand any obstacles and offer support.
    - If under performance continues, consequences may include *more tasks* for milestone or in severe cases, a meeting with the TA or instructor.
  5. **Consequences for Not Contributing:** If a team member does not contribute their fair share:
    - They may be assigned additional *tasks* to balance the workload.
    - In serious cases, the issue will be brought up to the TA or instructor.
  6. **Incentives for Meeting Targets Early:** Members who consistently meet or exceed their targets will be rewarded with more desirable tasks as per their wants, such as leadership roles in key project components, helping to build their leadership experience. They will get first pick on tasks for the next team milestone.

## Team Building

For team building events, the team has decided to have bi-weekly hangouts to bond and build relationships. The hangouts can attending on-campus events together, getting food or bubble tea on/off campus and more.

## Decision Making

In our group, our primary way of making decisions will be through consensus. We believe that it is important to include everyone in the decision-making process so it can lead to better outcomes and strong group work. In certain situations where consensus cannot be reached, the group will take a vote and each member will have equal say and the decision will be based on the majority rule. We will make sure all group members had a chance to voice their opinions before making the final decision through consensus or a vote.

*To Handle disagreements: The team will address each disagreement directly and respectfully.*

1. Allow all team members to express their concerns and opinions without interruption, ensuring everyone feels heard.
2. Keep the focus of the discussion on the topic at hand rather than personal feelings.
3. When necessary, we may appoint a neutral party to facilitate the discussion and help guide it to a resolution.
4. If a resolution is not found or the disagreement persists after the resolution is found, we will aim to revisit our project goals and objectives to ensure that our decisions align with our common purpose.

By following these strategies, we aim to maintain a collaborative and positive team environment while effectively managing decisions and conflicts.