

10. Project 2

Sustainable Software Engineering
CS4295



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1. Goal/assignment
2. Deliverables
3. Strategy
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Assignment

- **Goal:** Solve a Sustainable Software Engineering problem.
 - **Identify 1 problem** that should be fixed to help enabling sustainability in the software engineering industry/community.
 - **Propose a solution.** A tool, framework, guidelines, etc.
 - **Implementation.**
 - **Validation.** (Depending on the idea) (side note: the cancelled class was all about this)
 - **Dissemination**/social impact. (Solution should be open source, welcome contributors, post on social media? Tool website? Available in a package manager?)

Deliverables

- Paper-like **article**. (Min 4 pages, max 10)
- Online **git repo** with open source codebase and/or replication package.
- **Presentation**: 5 min + 5min Q&A

Article

- Different projects will have different expectations -> Make agreements with your coach.
 - Some projects are more technical and some projects more theoretical.
- Common requirements:
 - **Motivation**, formulation of the **problem** being addressed, etc.
 - Description of the **solution**.
 - **Validation** of the solution (if applicable -> discuss with coach)
 - **Discussion** of the solution. (Including limitations)

Strategy

- Starting next week, there are no lectures
- Steering meetings from week 5 till week 8/9 (either online or in person).
 - 1 steering meeting per week. (**3 sprints + grace period**)
- Every week, you need to plan different tasks and assignments.
- Deadline **March 28**.

Strategy

- Week 0 (today)
 - Decide project idea
 - Define and assign tasks for each week.
 - Define steering meeting schedule
- Week 1
 - Implement, implement
- Week 2
 - Implement, implement
- Week 3
 - Implement, Article, dissemination.

Project ideas

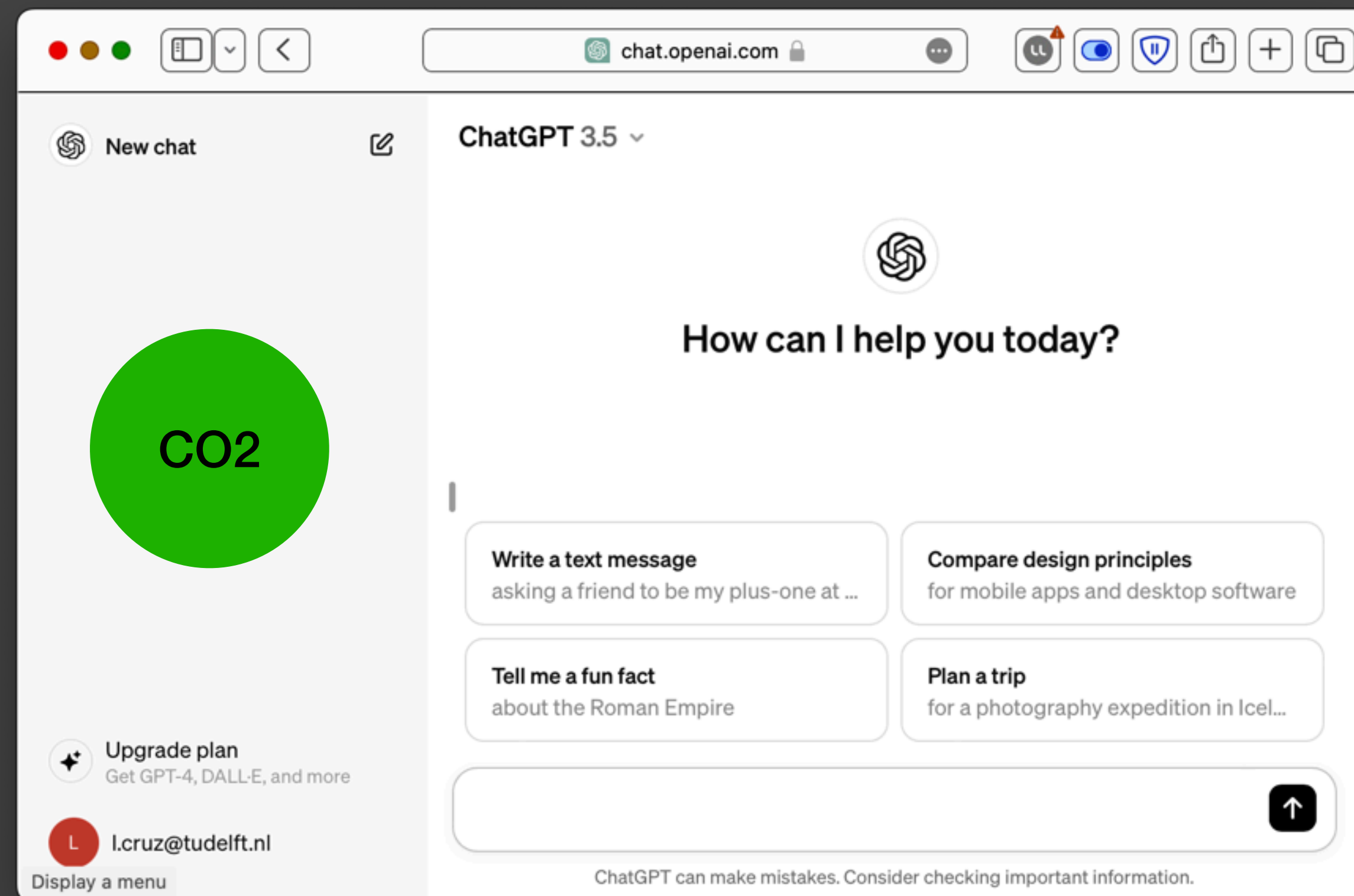
- Plugin from **EnergiBridge** (GUI, report generator, python library, etc.)
- Plugin for **ChatGPT** (carbon emissions per chat window)
- **Seamless measurements** for sklearn
- Energy **patterns** for Green AI
- Automate **Approximate Computing**
- Sustainable SW dev **gamification**
- Sustainability **auditor for AI** projects
- Energy Profiling of **screen colour filter tools** (or display settings)
- ... you can also propose yours! (Social, individual, or economical is sustainability also possible)

Plugin from EnergiBridge

- Any tool that can help improve EnergiBridge feature set or UX.
- You have some freedom in terms of idea here.
 - It can be a GUI, report generator, python library, Jupyter notebook plugin, etc.

Plugin for ChatGPT

- Users seldom know how much carbon they are emitting when they interact with chat GPT.
- Let's make it transparent to the users.



Seamless measurements for sklearn

- (or other cpu-/gpu-intensive libraries)
- Study the most seamless way to report energy/power/time in model training and/or model inference?
- E.g., when training a model, you call the **fit** method. Perhaps energy data could be automatically stored.
- Apply it in existing ML projects as a use case.



Energy patterns for Green AI/(or other Software types)

- Study existing efforts to improve energy efficiency in open source AI apps. (e.g., adhoc Literature review)
- Create an online catalog of common solutions to improve energy efficiency.

Automate Approximated Computing

- Create a library to run Approximate Computing techniques
- Set of AxC techniques to define
- Tool to be made open source

Sustainable sw dev gamification

- Collect data from social coding platforms and provide a score based on actions towards Sustainable SE.
- E.g., answering a question on stackoverflow about Sustainability.



Sustainability auditor for AI projects

- Web tool that receives a pre-trained AI model and reports a sustainability report/score.
- E.g.:
 - Carbon metadata from hugging faces.
 - Is it quantised?
 - ...



Energy Profiling of screen colour filter tools (display settings)

- Colour filters are used to have a better screen readability. There is a continuous adaptation of the colours according to the time.
- What about the energy efficiency of such settings? Is there a possible trade-off between readability and energy efficiency?
- The goal is to:
 - profile the energy consumption of such colour filters / display settings
 - Create a tool to make a trade-off with regard to energy consumption

Propose your idea

- Feel free to propose something for social or individual sustainability.
- Ask for feedback! A good idea can help maximise your chances to get a high grade.

Next first steps

- Select the **topic**:
<https://docs.google.com/spreadsheets/d/1WMF1wyx8r0vXeMevjrjrye9I7e8ISq8zjEcbp-pUDwM/edit?usp=sharing>
- Ideally, **1 topic only has 1 group max.**
 - However, some topics can be **redefined** in distinct ways.
- Based on the topic, we will assign coaches (June or Luís)
 - Schedule a weekly meeting with your coach.

