

ENSE 405 Project report-out & lessons learned.

Project name

EcoExplorers – Aryan Chandra

Project sponsor & course facilitator

Dr. Tim Maciag (ENSE 405 professor)

Business need/opportunity

Saskatchewan's educational institutions often fail to prioritize a crucial facet of learning that, though not immediately apparent, wields substantial influence over the daily lives of its inhabitants. This unattended area pertains to carbon emissions and sustainable environmental practices, wielding a profound impact on the future of our planet. As climate change escalates into an increasingly pressing concern, the glaring absence of focus on these subjects within the educational framework presents a pivotal void demanding immediate attention.

The imperative at hand is to integrate a comprehensive environmental education, encompassing carbon footprint reduction, into the Saskatchewan school curriculum. This integration stands as an essential response to the urgency of climate change, addressing the deficiencies in existing educational modules, acknowledging its global significance, acknowledging its enduring consequences, and recognizing the economic and social advantages inherent in nurturing environmental consciousness among our young generation. The proposed initiative aims to bridge this educational chasm, aiming to imbue students with the knowledge and ethos needed to emerge as conscientious custodians of our environment.

Reflections on project planning (3-5 pages)

- **State and discuss the United Nation's (UN) Sustainable Development Goals (SDGs) selected and your "why" for selecting the one(s) you did.**

The three SDGs I selected and the reasons for choosing them are:

1. **Quality Education (Goal 4):** Quality education is fundamental for sustainable development. It empowers individuals, promotes economic growth, and lays the groundwork for addressing many other societal issues. I selected this goal because education serves as a catalyst for positive change across all sectors. By focusing on education, we equip individuals with the knowledge, skills, and values necessary to promote sustainability, tackle inequality, and foster innovation.
 2. **Responsible Consumption and Production (Goal 12):** This goal targets the efficient use of resources, reduction of waste, and promotion of sustainable practices in consumption and production. I chose this goal because responsible consumption and production patterns are crucial for environmental conservation and mitigating the adverse impacts of overconsumption. By encouraging sustainable behaviors and production methods, we can minimize environmental degradation and work towards a more sustainable future.
 3. **Climate Action (Goal 13):** Climate change is one of the most pressing global challenges of our time, impacting ecosystems, economies, and livelihoods worldwide. Goal 13 emphasizes the urgent need to take action to combat climate change and its impacts. I selected this goal because addressing climate change is essential for ensuring a sustainable and habitable planet for future generations. It involves mitigating greenhouse gas emissions, adapting to changing climatic conditions, and fostering resilience in communities.
- **Discuss key findings from your community research and understanding/requirements gathering (Community characteristics and technology configuration inventory)**

The community research drew insights from diverse sources like the UN SDG website, climate action platforms, and youth climate change forums. These resources provided a comprehensive understanding of sustainability goals, real-world initiatives, and the perspectives of the youth on climate issues. Regarding the project planning processes and documentation used in the course, they provided a structured framework for requirements gathering. While they ensured clarity and organization, some rigidity in the templates occasionally

limited adaptability to changing project needs. Overall, they facilitated a systematic approach but had constraints in flexibility when faced with unexpected alterations in the project scope.

- **State selected north star & carryover customers. Why are these customers important to your project's golden circle (why, how, what)?**

Northstar Customer

For this project mine were grade 5-8 children. They represent the main users and beneficiaries of your project. Educating and engaging these children in sustainability practices aligns with the "Why" of your project, which is to instill environmental awareness, foster responsible behavior, and empower them to make informed choices.

- **Importance to the Golden Circle:**
 - **Why:** The education and engagement of these children are fundamental for building a future generation that values sustainability, understands their impact on the environment, and is motivated to act.
 - **How:** The project delivers age-appropriate and engaging content, tools, and information that resonate with this specific age group, making sustainability education accessible and relevant.
 - **What:** The app's features, content, and design are tailored to cater to the needs and interests of grade 5-8 children, providing them with the means to calculate their carbon footprint and understand the SDGs related to sustainability.

Carryover Customers:

These may include teachers, parents, or educators who facilitate and support the learning experience of the target children. They might influence, guide, or reinforce the messages and knowledge about sustainability.

- **Importance to the Golden Circle:**
 - **Why:** Engaging and educating the educators/parents reinforces the project's mission by extending the reach and impact of sustainability education beyond the direct users.
 - **How:** Providing resources, guides, or workshops for educators/parents to effectively communicate and reinforce sustainability concepts aligns with the project's objectives.

- **What:** Creating supplementary materials or resources that educators/parents can use to complement the children's learning experience, fostering an environment that supports sustainability education at home or in the classroom.

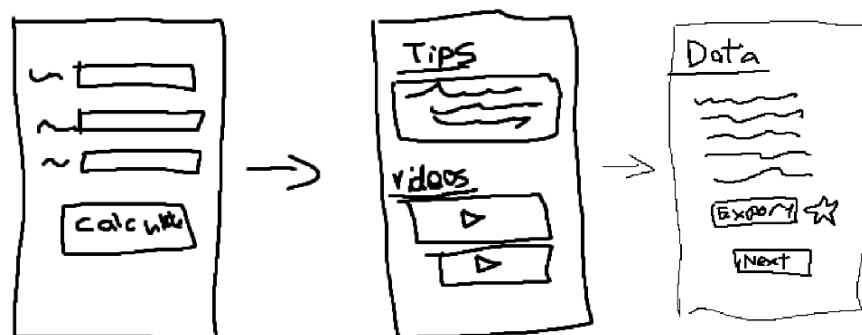
Both the North Star and Carryover customers are essential elements in amplifying the project's impact. By targeting grade 5-9 children directly and involving their educators/parents indirectly, your project aims to create a holistic learning environment that fosters a deeper understanding and integration of sustainability values into their daily lives.

- **Summarize assumptions made and constraints uncovered, re: drafting an emerging picture.**

The project's timeline constraints significantly impacted the depth of validating educational content and resources geared toward grade 5-9 children in sustainability education. Due to the limited timeframe, there was a challenge in conducting exhaustive validation processes for all educational material, leading to a reliance on pre-existing resources and assumptions about their accuracy and alignment with educational standards. As a result, the validation of educational content might not have been as thorough as desired, potentially impacting the depth and accuracy of the information provided. This constraint underscores the trade-off between time limitations and the meticulous validation necessary for ensuring educational accuracy and effectiveness, posing a challenge in fully ensuring the precision of all educational components included in the project.

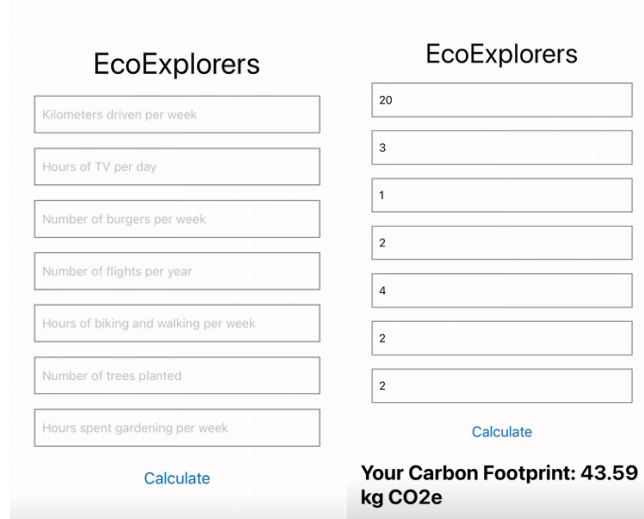
- Discuss initial & the evolution of your technology stack selection, drafted prototypes, and initial Minimum Viable Products (MVPs)

Initial Project: The initial idea that stayed the same was to create a carbon footprint calculator app for kids in the grade 5-8 range to educate by using SDG 4, then on SDG 12, and 13. The initial idea that I had for this project, the LOW-FI specifically changed a decent bit before the first SCRUM.



Before the initial SCRUM meeting, I made significant design alterations. The original plan, as depicted in the screenshot, felt overly convoluted when transitioning to the actual project design phase. Consequently, I opted to overhaul the layout, condensing it into a single-page format for better usability and coherence. Additionally, I reconsidered the inclusion of the "STAR" function intended for saving calculations. I found it redundant due to the export feature, leading me to abandon the STAR function in favor of simplifying the user experience.

First SCRUM: The first SCRUM was very basic and all it contained was the simple calculation of carbon footprint, which is exactly what I had envisioned for my MVP1. After this SCRUM the one major feedback that I was given by Dr. Tim was to add a feature where it tells the user what kgCO₂e means. This was a good suggestion, so I went ahead and made this first up.



The image displays two versions of the 'EcoExplorers' carbon footprint calculator. The left version is a multi-page form with input fields for: Kilometers driven per week, Hours of TV per day, Number of burgers per week, Number of flights per year, Hours of biking and walking per week, Number of trees planted, and Hours spent gardening per week. The right version is a single-page format with the same inputs, but with pre-filled values: 20, 3, 1, 2, 4, 2, and 2. Both versions feature a 'Calculate' button. The right version shows the result: 'Your Carbon Footprint: 43.59 kg CO₂e'.

Second SCRUM: In preparation for this SCRUM, my vision encompassed integrating visual enhancements like a logo, background colors, and other design elements. I also incorporated educational content, such as tailored tips linked to different levels of carbon footprint (low, medium, or high), aimed at guiding, and informing the user. The colour of the total carbon footprint would also change colour from RED, YELLOW, or GREEN depending on how their calculation. Additionally, I integrated concise, educational YouTube videos at the page's bottom, supplementing the user experience with short, instructive visual aids. After the presentation of this SCRUM I was given feedback for adding checks for inputs, for example, how much TV can you watch in a day? Obviously, you can't get over 24 hours. So this was added right after.

Final: For the final presentation, the first two MVPs were done which just left the last one, which was the export data feature. A lot of tinkering was done on how I would want to do this, I originally thought maybe exporting as an image, but there were some issues. After some more researching I learnt that there was a "Share" library



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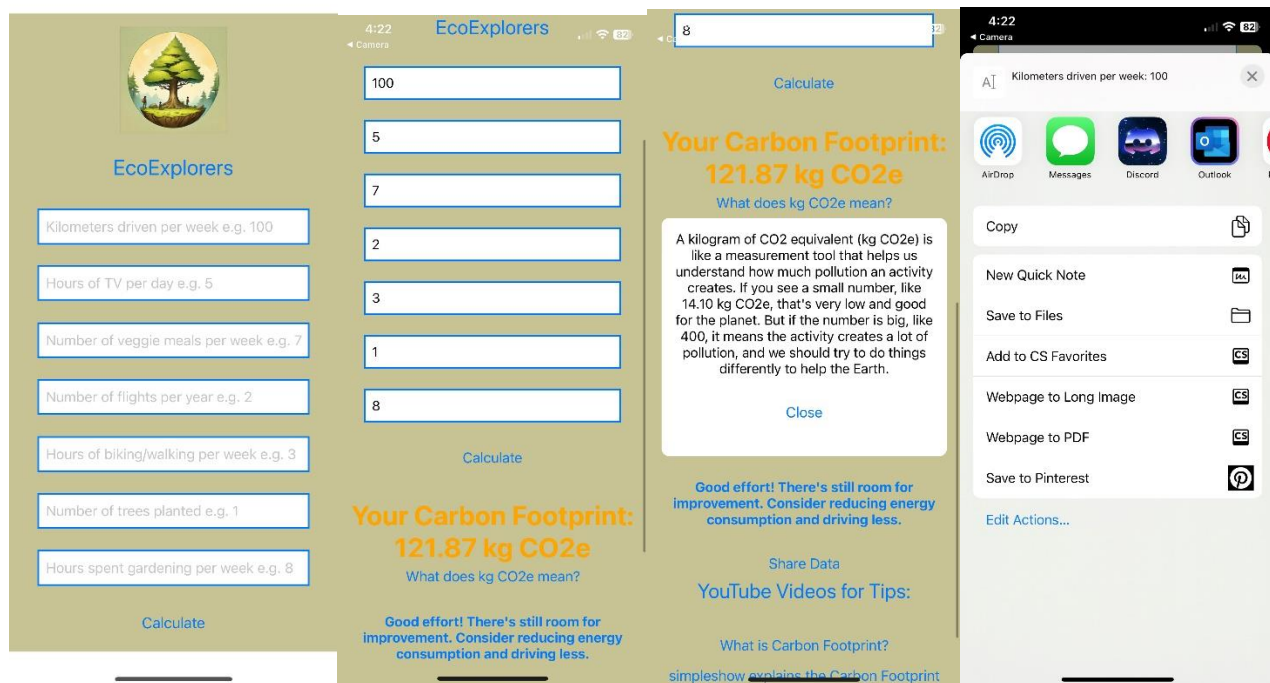
in React Native which came really in handy. I used this to alter how the JSON text looked and made the exported data readable which would allow the children to understand well.

Technology Stack: Initially, choosing the technology stack for the mobile application was a challenge as it was my first time in mobile app development. After some discussions and research, I ultimately opted for React Native as the primary framework. Alongside React Native, I decided to go with Expo and Expo Go for their comprehensive set of tools and functionalities. This choice was influenced by Expo's ease of use, extensive libraries, and streamlined development environment, offering an efficient and accessible platform for mobile app creation.

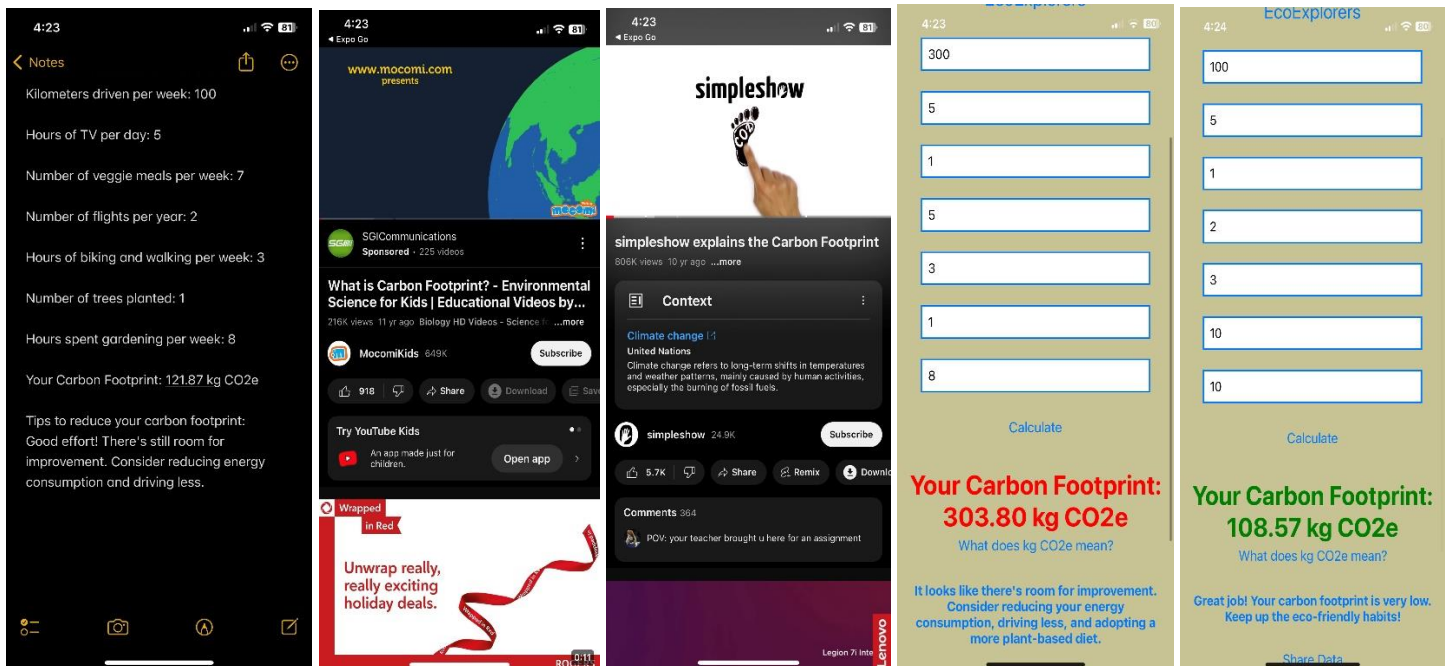
Reflections on project results (4-5 pages)

- Discuss what you created. Provide key images/screenshots illustrating core functionality.

I created a mobile app targeting grade 5-9 children, focusing on sustainability education and carbon footprint awareness. The app enables users to calculate their carbon footprint by inputting data on transportation, energy use, diet, air travel, walking/biking, tree planting, and gardening habits. It offers instant results and provides educational content aligned with UN Sustainable Development Goals (SDGs). The app includes tips and videos based on users' carbon footprint levels, aiming to raise awareness and encourage sustainable actions among children. The design prioritises user-friendliness and educational value, catering specifically to this age group's learning needs while promoting practical steps for reducing environmental impact.



Clicking 'Share Data' button lets you copy paste results anywhere.



- Review your initial “Planning and initialization” video created for the first deliverable. How close did you come to realizing the solution/product you initially envisioned?

Compared to the first deliverable done, I would say that I managed to stay true and very close to what I had envisioned. The only idea that had been changed and as mentioned before, is the “STAR” (save calculation) feature, as while moving forward, I had realised how redundant it would be for what I am trying to achieve in the given amount of time.

- Summarize software design activities and findings. Ensure you discuss how you/your team either linked or envision links to design ideas back to topics discussed in class lectures.

In creating the mobile app tailored for grade 5-9 children, focusing on sustainability and carbon footprint awareness, I think I managed to connect two class topics. Gamification and Knowledge Management. Using this, and leveraging gamification principles, I aimed to make learning about sustainability engaging for children through interactive elements. KM concepts on the other hands influences the app’s content curation, such as the tips and videos provided after the calculation. I tried to make sure that this information had aligned with the UN SDGs.

Some of the software design activities however were the following:

Business Case: Formulated a robust rationale, outlining the app's purpose, its alignment with the UN SDGs, and its potential impact on educating children about sustainability.

Community Orientation: Understanding the target users (grade 5-9 children) guided my design decisions, ensuring the app catered to their learning capacities and engagement preferences.

Technology Inventory: This involved assessing available tech tools and frameworks, allowing me to select the most suitable technology stack for app development.

Stakeholder Analysis: Identifying stakeholders helped me understand diverse perspectives and interests, aligning the app's features and content with their needs.

Low-Fi: Creating low-fidelity prototypes facilitated early-stage visualization and user feedback, refining the app's functionality and design before investing heavily in development.

Drafting an Emerging Picture: This step involved piecing together initial ideas and insights, providing a preliminary understanding of how the app would address sustainability education for children.

- **Summarize how you felt about this project (likes/dislikes), from your experiences with the technology stack selected, translating prototypes into real solutions, and the creation/realization of your MVPs.**

I really liked the idea of being able to choose your own tech stack, this gave me a great opportunity to work more closely with React Native, and something that I've wanted to do for a long time, which is make a mobile app. I don't think I really had any dislikes besides from the time constraint, everything went pretty smoothly for me. Overall, this was fun.

- **Summarize what went well during the project. / What would you do the same on future projects?**

My time management and initial scope. I created a scope that wasn't completely impossible, but also something that would be way too easy. I was always in the green and managed to have my MVPs completed before the SCRUM dates, so I'm quite proud of that. I hope to continue to do the same for future projects.

- **Summarize what not went well during the project. / What would you do differently on future projects?**

Although low-fi is meant to be a very low type of diagram, I wish I had done it better/differently, and created a high-fi. Purely so I had a better idea of how I wanted the app to look. Other than that the only other thing I wish I had done would be to add a testing plan, since currently there were none. Only checking for possible bugs while using the app.



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- **Discuss opportunities and design ideas for future work.**

I had two things in mind which I think would be cool to add. An assessment system such as quizzes that could be progressed into a point system and maybe even achievements. This could possibly be displayed on a leaderboard, adding more to the gamification topic, which I think is a really simple and great way to educate kids on topics. Asides from that, I don't think there are any other future work/designs planned.

General reflections on the class & project experience (3-5 pages)

- **Before taking ENSE 405, were you aware of the UN SDGs?**

Before ENSE 405, my understanding of the UN Sustainable Development Goals (SDGs) was limited. While I had a general understanding of concepts related to climate action and sustainability, I wasn't aware that these ideas were categorised under the umbrella of the SDGs. Growing up in Australia, schools frequently emphasised climate action and sustainability, which shaped my understanding of environmental issues. However, I hadn't specifically associated these teachings with the broader framework of the UN SDGs until encountering ENSE 405.

- **Typically, before taking this class, when you engineered software solutions, were you concerned with areas encompassing the UN SDGs?**

No, specifically I hadn't used the UN SDGs to guide any software solutions. However, for one instance in the class project for ENSE 375 where we had to design a Howitzer Simulator so this can be related to the SDGs. Elements of that project could be related to the SDGs indirectly. Although it wasn't the primary focus, aspects of sustainability, particularly related to military practices' environmental impact, could have potential connections to certain SDGs, highlighting an incidental intersection between the project and sustainability principles.

- **Did learning about the UN SDG(s) help you understand better your role and responsibility as an engineer to society?**

Yes definitely. For me, it provided a structured framework that shows how engineering efforts merge together with broader societal goals, focusing on the importance of addressing global challenges. The SDGs can be served as a "compass" almost into guiding to consider the broader implication of the work and how engineering solutions can contribute to addressing societal and environmental issues. This learning process not only expanded my perspective but also reinforced the idea that as an engineer, we hold a responsibility to create solutions that align with these global goals, making sure a positive impact on society and the environment is made.

- **What was your experience(s) in engineering your specific software solution to address the UN SDG(s) selected?**

My experience in engineering a software solution to address the selected UN Sustainable Development Goals was rather entirely new. Making a mobile app aimed at educating grade 5-9 children about sustainability



and carbon footprint awareness was a decent “journey” if you will for me. It involved learning about the nuances of these goals and finding ways to translate them into an engaging and comprehensible format for a young audience. Creating something that is targeted towards the UN SDGs is something I haven’t done before so it was new.

- **As a future engineer, what are your thoughts on the UN SDGs as a whole? Do you think they can help or hinder our work as software engineers?**

As a future engineer, I view the UN Sustainable Development Goals (SDGs) as a critical blueprint for guiding global efforts towards a more sustainable and equitable future. These goals offer a comprehensive framework that addresses pressing global challenges, spanning areas such as climate action, education, health, and poverty eradication. It would be interesting however to see how other people in the workforce think about this while making a software solution. Especially in regard to when some people having different views in what SDGs should be used and what not.

- **Should we use the UN SDGs to guide our work or is our work dependent on customer requests, regardless of the UN SDGs?**

Balancing between the UN SDGs and customer requests is really important in software engineering. The SDGs offer a broad framework guiding us toward societal and environmental goals. Meanwhile, customer requests reflect immediate needs and preferences. The ideal approach is integrating both: using the SDGs as guiding principles while tailoring solutions to meet customer needs. This balance allows us to create impactful solutions aligned with global objectives and satisfying user requirements.

- **Will you use your understanding of the UN SDGs in engineering solutions in the future?**

Absolutely, my understanding of the UN Sustainable Development Goals (SDGs) will definitely influence my approach to engineering solutions in the future. These goals provide a framework for addressing global challenges, offering a path to create solutions that align with broader societal and environmental objectives.

In my future endeavors as an engineer, I aim to use this understanding to make solutions that not only meet specific requirements but also contribute positively to societal well-being and environmental sustainability. Whether it's designing applications, systems, or platforms, I aim to integrate aspects of the SDGs, ensuring that my work aligns with global objectives and makes a meaningful impact.

I do still think it would have to be a balance between what needs to be done and what SDGs says to do, but yes definitely it will provide a solid path to look towards in how to make a good impact towards the environment.

- **Will your experience learning about the UN SDGs inform your career path decisions in the future?**

Maybe, I'm not too sure. I am still thinking about how it might directly influence my career path decisions in the future. I can see that the importance and relevance of these global goals are there, but I'm also considering different factors and opportunities that could shape my career trajectory. I'm still learning and growing so the best answer I think I can give right now is I'll see where the future leads.

- **Provide any other comments on the project.**

It was a good course in my opinion. I really really liked the idea of being able to choose your tech stack. This gave so many people, including me, to be able to learn something new. The workload sometimes felt like a lot, but I think that's only because I am taking 4 other classes, and this is a 4xx level course, so this is to be expected. Other than that, I had no issues.