EcoTrace

Methodology

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Introduction

Urban transport is one of the biggest sources of greenhouse gas emissions, but most of us do not really know how our daily travel choices affect the environment. Even though climate awareness is growing, there are still very few tools that make it easy for individuals to understand their own emissions and take action. That is exactly the gap we are trying to fill with EcoTrace.

We designed EcoTrace for younger generations, particularly Millennials and Gen Z, who are more engaged in climate issues and open to changing their habits. The application provides instant feedback on the emissions linked to personal transport choices. It considers the type of transport, fuel used and distance traveled, then turns that data into simple, visual insights. Our goal is to help users see the impact of their choices and feel motivated to move toward more sustainable habits.

The name EcoTrace reflects our mission: to let users trace their ecological footprint in a simple, visual and engaging way. But more than just a name, EcoTrace stands for a bigger idea. We are combining technology, behavioral science and clear design to make climate-conscious decisions a natural part of everyday life.

In this paper, we share how EcoTrace came to be, what makes our approach different, and why we believe it can make a real difference in the way people think about mobility and climate action.

Organization of the team

We are seven students from the Norwegian School of Economics, a mix of local and exchange students from Norway and Singapore. What brought us together was a shared drive to turn digital ideas into real, tangible solutions for sustainability. Our diverse academic and cultural backgrounds helped us approach problems from different perspectives.

Our team combines a mix of skills. Some of us have experience in Python and web development, while others bring backgrounds in economics, user experience and design. Early on, we identified our individual strengths and divided the work accordingly. This included backend development, layout design, emissions modeling and content writing. We made important decisions together through weekly meetings and open discussions, which helped us stay aligned and move forward efficiently.

We did not always agree, and that was part of what made the process valuable. Different ideas often sparked debate, for example, how to visualize the emissions data in a way that felt both clear and engaging. These kinds of discussions helped us shape a stronger product and make the most of our diverse perspectives.

EcoTrace is not just a course assignment for us. It is the result of using what each of us does best to build something meaningful and practical.

🔍 Methodology

To support our goal of promoting a more sustainable transportation system, we have chosen to start by focusing on Norway. Here, we have a good understanding of local mobility patterns, which provides a solid basis for developing the app.

We are primarily focusing on the transport modes that are most commonly used in Norway. These include cars, buses, vans, motorbikes, trains, ferries and commercial airplanes; all essential parts of Norwegian transportation. In 2023, 126.948 cars were sold, equivalent to about 2% of the Norwegian population. This marked a 27% drop from the previous year, making it the lowest car sales figure in over a decade.

Meanwhile, public transport usage such as bus and ferries rose by 33% between 2022 and 2023 (Statista, 2024), highlighting a growing shift toward greener mobility options.

In addition to the decline in car sales, the use of trains and ferries has shown positive trends toward sustainability. Train travel in Norway has steadily increased over recent years, especially in urban areas where efforts to improve rail services have made public transport a more attractive option. Similarly, ferry companies have started transitioning to electric and hybrid ferries, supporting the country's broader goal of reducing

transportation emissions. These developments illustrate a wider move across different transport modes towards greener and more sustainable mobility solutions.

This methodology explains how different forms of transportation produce varying levels of carbon emissions, measured in CO_2 per passenger-kilometer. By understanding these differences, users gain the insight they need to make more sustainable travel decisions.

Our methodology is directly linked to our business model. By using simplified yet reliable emission factors for each transport type, we provide users with quick, personalized insights into their transport emissions. This forms the foundation of our service. All users can access core features such as emissions tracking and visual feedback to better understand the environmental impact of their travel habits.

Moreover, the consistency and scalability of our calculation model allows us to offer API access to businesses in transport, tourism, and logistics, helping them quantify and communicate their emissions more transparently. In this way, our methodology is not just a technical component, it is a key enabler of both user engagement and EcoTrace's mission of turning awareness into action.

How it works

In EcoTrace, users enter their travel data by selecting a transport type and, if applicable, the type of fuel used. Once the input is submitted, the app generates a visual chart showing the user's total carbon emission. This provides an immediate and intuitive overview of the environmental impact of their travel habits.

Since we are operating on a freemium model in the beginning stages, a clean, user-friendly interface with core free features will attract a broad user base, while the ability to directly input user destinations are place behind a subscription paywall for premium users.

Our ad-based revenue and customer lifetime value will improve as we continue to increase user engagement through our social media outreach, showing the benefits of the app as well as the difference, it makes.

$$CO_2 = d * ef$$

💭 Assumptions

To make our model functional and accessible for users, we have made a few simplifying assumptions. First, we use average emission factors (in grams of CO_2 per kilometer) for each mode of transport. These are based on credible sources but do not account for variations such as vehicle age or maintenance condition, which can influence actual emissions.

Second, when it comes to public transport, we assume average passenger loads. This means that emissions are evenly distributed per person based on typical occupancy rates, rather than real-time data. While this simplifies our calculations, it also reflects a realistic and general-use scenario for most users.

Thirdly, you will see in the following, some modes of transport offer electric alternatives. We acknowledge the presence of upstream emissions associated with electricity generation, however, we have chosen to exclude these from our calculations. This decision is based on the fact that, in regions such as Norway, where the electricity grid is predominantly powered by hydropower, the carbon emissions per kWh are exceptionally low. As a result, the overall environmental impact of charging electric vehicles or boats in such contexts is minimal.

Lastly, we assume a consistent travel distance. Emissions are calculated based on the user's input for kilometers traveled, assuming a direct route from point A to point B. Factors such as detours or traffic conditions are not included in the current model.

These assumptions allow us to deliver a clean and intuitive user experience while still providing reliable insights into transport emissions.

$f_{(x)}$ Formula

According to the UK's Department for Energy Security and Net Zero (2022), carbon dioxide emissions can be calculated by the following formula:

$$CO_2 = d * ef$$

Where:

d = distance travelled (in km)

ef = emission factor*

*Emission factor varies based on form of transport used

We use information from UK's Department for Energy Security and Net Zero (2022) on all the transport emissions, except train.

Cars

For cars, as they are the most common mode of transport, we will be working on the assumption that all cars emit the same amount of carbon dioxide as an average car of 1.4 to 2 litre engine size. It has the highest emission among all modes of transport.

Petrol	Diesel	Hybrid	Electric
0.17082 kg CO2e/km	0.17048 kg CO2e/km	0.12004 kg CO2e/km	0.00 kg CO2e/km

Bus

As of 2023, there was 13.6% increase of passengers using bus as their means of public transport since the previous year. This means that the carbon dioxide is being distributed by more passengers but since we are calculating for each trip, we will be using the total emission by bus.

Diesel
0.03 kg CO2e/km

Van

As of 2023, there are approximately 27 times more diesel-powered vans than petrol-powered ones. Although the number of electric vans has been growing since 2020, they still represent a relatively small share of the total. In general, Norwegians don't use vans for daily personal transport; they are primarily used for work purposes or as campervans. However, they still a significant amount carbon gas being emitted from vans.

Petrol	Diesel	Electric
0.21332 kg CO2e/km	0.23156 kg CO2e/km	0.00 kg CO2e/km

Motorbike

There has been significant growth in the motorbike market in Norway as consumers preference shift towards more eco-friendly and sustainable options. This is further aided by the large tax reduction in Norway since 2021. Motorbikes provide flexibility to navigate through narrow roads and congested city streets and rural areas, making it a convenient and popular choice of transportation. Since motorbikes are smaller than cars and vans, they produce fewer carbon emissions.

Diesel
0.11355 kg CO2e/km

🚆 Train

Train travel in the Nordic countries is remarkably eco-friendly, producing over 13 times fewer carbon emissions than diesel and three times less than the rest of Europe, thanks to the region's reliance on cleaner energy sources. As Norway is very accessible nationwide by train and to other countries, we have also included the Europe option as there can be different emission in different country (Travel and Climate, 2023). Diesel is included as the lines North of Mjøsa are not yet electrified. The following numbers come from Travel and Climate, nd.

Diesel	Electric in Europe (including Denmark)	Electric in the Nordic (Sweden, Norway & Finland)
0.091 kg CO2e/km	0.026 kg CO2e/km	0.007 kg CO2e/km

🛳 Ferry

There are more than 100 ferry connections in Norway and there has been an increase in passengers using ferry has a mode of transport since 2022. Overnight ferry services are an efficient way of travel especially since Norway are famous for their fjords.

Diesel
0.01874 kg CO2e/km

✈ Airplane

Airplanes use a single form of fuel (kerosene), so the only differentiating factor for airplane passengers is the ticket class they purchase. The emission factors (based on class) are listed below:

Economy	Business	First Class	Average
0.140625 kg CO2e/km	0.40781 kg CO2e/km	0.56251 kg CO2e/km	0.18362 kg CO2e/km

By allowing users to choose different types of ticket class, we would be able to be more accurate in calculating carbon emission as the number of passengers varies in each class.

🏷 How we create value in EcoTrace
🧍 Who We Build For

EcoTrace is designed for younger generations, primarily Millennials and Gen Z (ages 18–40), who are actively engaged with climate issues and open to adopting new habits that support sustainable living. This group is digitally fluent and often seeks tools that align with their values and lifestyle.

According to Cardiff University (2023), these generations show a higher level of engagement in environmental issues compared to older age groups. By focusing on this audience, we aim to empower a generation already inclined to lead change, providing them with the tools to take meaningful, everyday action.

☀ What We Offer

EcoTrace gives users a simple way to understand the climate impact of their travel. By entering details like distance, transport type and fuel, the app provides immediate feedback on carbon emissions. It is quick, clear and easy to use.

What sets EcoTrace apart is how personal and interactive the experience is. The application adapts to user behavior, tracks progress over time and includes features like ticket class emissions for flights. To keep users engaged, we have added elements like badges, challenges and comparisons that make sustainable choices more rewarding. EcoTrace is not just a calculator. It is a tool that helps people reflect on their habits, stay motivated and take action in their everyday lives.

👫 How We Make It Work

EcoTrace runs on real data and a simple, functional system. Emissions are calculated using factors from trusted Norwegian sources such as Statistics Norway. Users enter basic travel details like distance, transport mode and fuel type, and receive instant, reliable feedback on their carbon emissions.

The app is designed to be clear, personal and easy to use. A clean interface delivers immediate results, and a login system allows users to track their activity over time. This makes it possible to follow progress, compare trips and reflect on habits.

To make the experience more engaging, we are developing gamification features such as badges, progress tracking and community challenges. These are tailored to our target group, digitally fluent and climate conscious users, who are motivated by personal insights, social comparisons and visible progress over time.

We also plan to integrate with travel tools like Skyss and VY to make the app more connected and useful in daily life. For example, a user planning a trip in the Skyss app could see the estimated carbon emissions for different travel options and be encouraged to choose a lower-emission alternative.

How We Keep It Sustainable

Our business model is designed to support both scalability and long-term impact. EcoTrace uses a freemium model: the basic features are free, while premium users can access more advanced analytics, smart travel tips and integrations with tools like Google Maps

We also offer something for businesses. Through our API (Application Programming Interface), companies in transport, tourism or logistics can connect their own systems to EcoTrace. For example, a travel agency could show the emissions of a trip during booking, or a company could track emissions from employee travel. This helps businesses take responsibility for their climate impact while spreading the use of our platform.

In addition, we look for partnerships with sustainable brands for ethical in-app advertising, and we apply for funding from public programs and environmental organizations. This helps us stay independent, grow responsibly and stay focused on our mission.

Where We Are Going

While our current focus is on transport emissions, EcoTrace is built with a broader vision. In future updates, we aim to expand into other high-impact lifestyle areas such as consumption, food and energy use. This will give our users a more complete view of their everyday climate impact.

We also plan to offer more personalized guidance. For example, if a user regularly drives short distances, the app could suggest alternatives like biking or public transport. These insights will be shared through prompts, challenges and other interactive features that make climate-friendly choices easier to follow.

Community is another important focus. Users will be able to join groups, take part in challenges and compare progress, whether between friends, schools or workplaces. We believe shared goals and friendly competition can turn awareness into action.

To make this possible, we will continue building partnerships for better data, strengthen our API integrations and launch the app on mobile platforms.

As EcoTrace evolves, we remain committed to our mission: turning carbon awareness into meaningful action and helping individuals take ownership of their environmental impact in a way that is personal, practical and lasting.

Summary

EcoTrace is a digital tool that helps users track and visualize their transport-related carbon emissions. It is designed for young individuals who are open to adopting new habits and using technology to support more sustainable lifestyles.

We offer an intuitive and accessible app that calculates emissions based on transport choices, turning complex data into clear, personalized insights. The app is built with a modern tech stack and supported by partnerships with key Norwegian organizations that provide essential data and local expertise.

Our freemium model ensures accessibility while allowing for future growth through premium features. Looking ahead, we aim to expand EcoTrace into other lifestyle areas, introduce behavior-based guidance, and strengthen community features. Throughout this development, we will stay true to our mission of making sustainability part of everyday life.

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