



BUSINESS
PROPOSAL

SYNERGY 2024
Software Solutions



Challenge Statement

Design an app that allows users to calculate their carbon footprint based on their daily activities, such as transportation, energy use, and food intake

eSUKAT

Carbon Footprint Calculator

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SOLUTION OVERVIEW

eSUKAT

Anchored by the United Nations' Sustainable Development Goals #11: Sustainable Cities and Communities, eSUKAT is a Flutter-based mobile application designed to empower Filipinos to measure and manage their carbon footprint with an emphasis on sustainable user retention.

eSUKAT has three main features namely:

eTala

The app focuses on users' three main consumption activities.

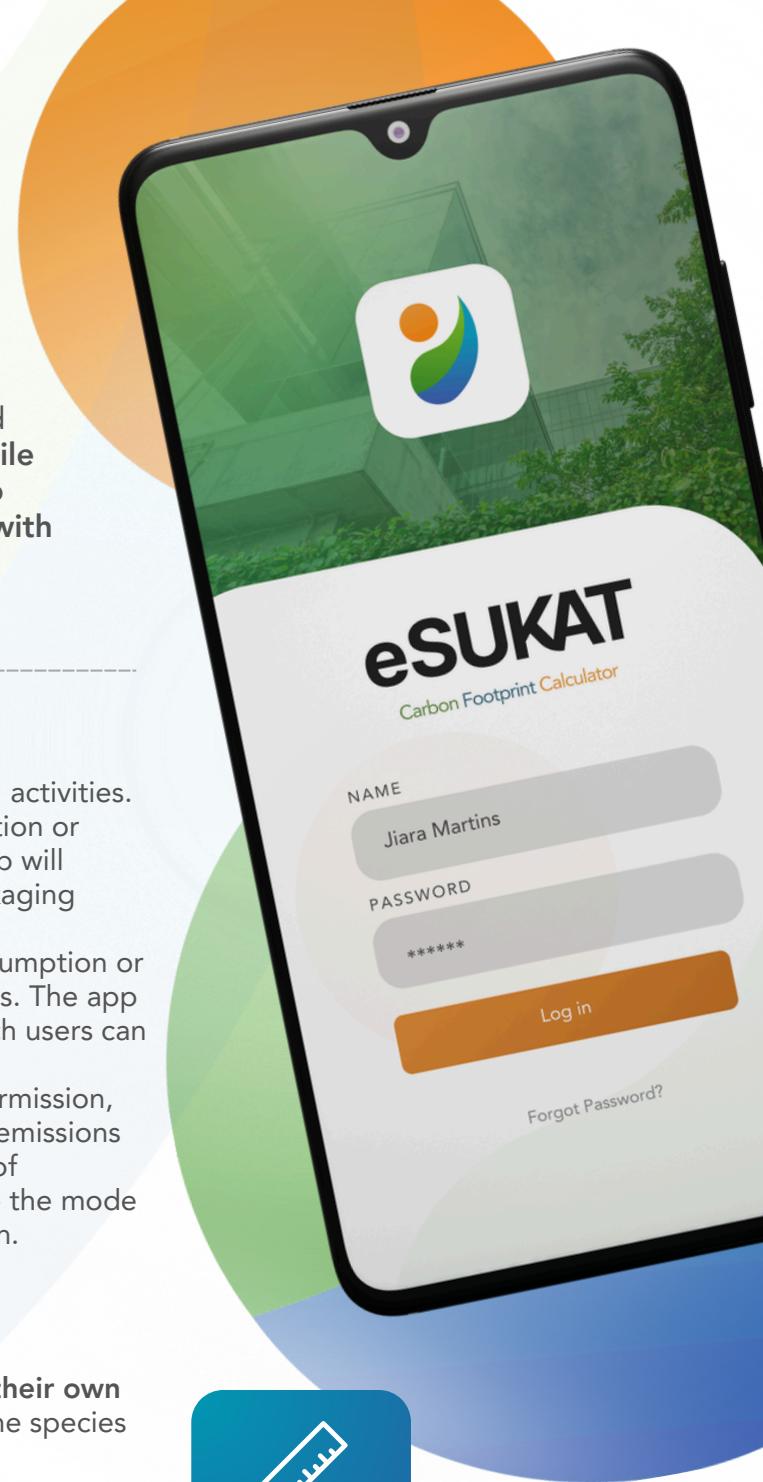
- **Food.** Users can manually input their consumption or choose to upload images of their food. The app will automatically detect the type of food and packaging using image recognition and machine learning.
- **Electricity.** Users can manually input their consumption or choose to upload images of their electricity bills. The app will use OCR to auto-fill the relevant data, which users can edit if deemed necessary.
- **Transportation.** Users' location, once given permission, will be tracked by the app to compute carbon emissions based on the distance traveled and the mode of transport. The app then attempts to determine the mode of transportation with easy manual confirmation.

eAlaga

- While recording their activities, **users nurture their own virtual companion** which are endemic Philippine species (e.g., Tarsier, Philippine Eagle, Tamaraw).
- Users can earn points through actions that reduce carbon footprint, such as sustainable food choices, which can be spent on their companions. Users can share their companions on social media platforms.
- Users can also participate in exciting weekly and monthly challenges that offer additional opportunities to earn points and enhance sustainability efforts.

eSulong

- **Personal Dashboard.** The app generates an intuitive dashboard of the user's carbon footprint over time.
- Users' carbon footprint data is also converted into tangible impacts (e.g., "Your actions saved X trees").
- **Community Dashboard.** Users can also see leaderboards for users' affiliations such as academic institutions or geographic locations to provide a collective view of users' community impact.



eTala

Carbon Footprint Calculator



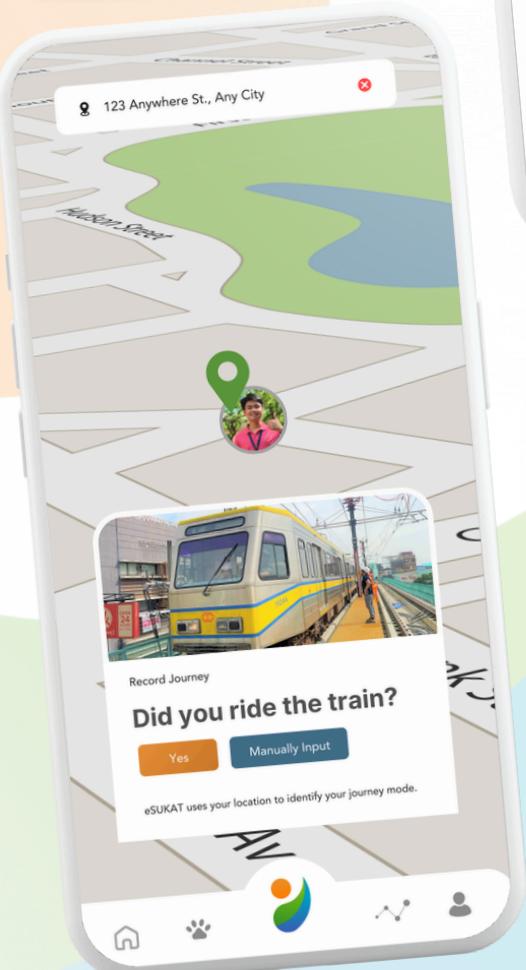
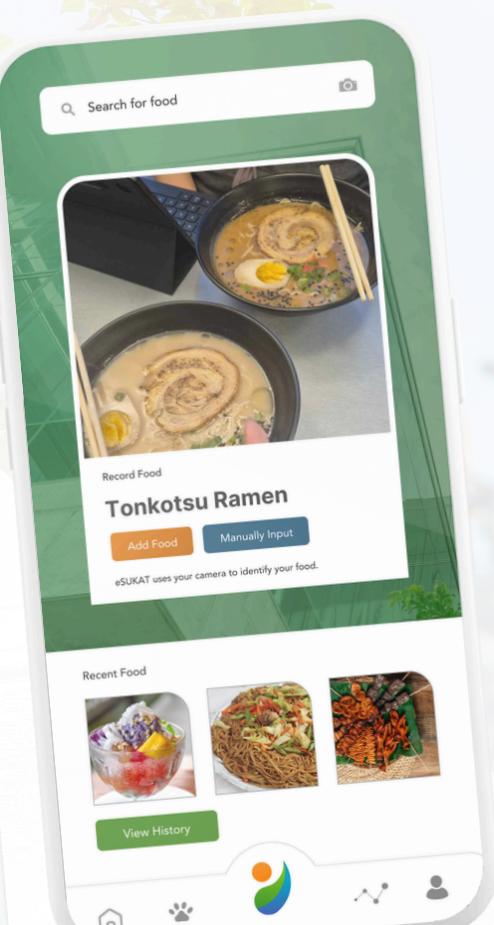
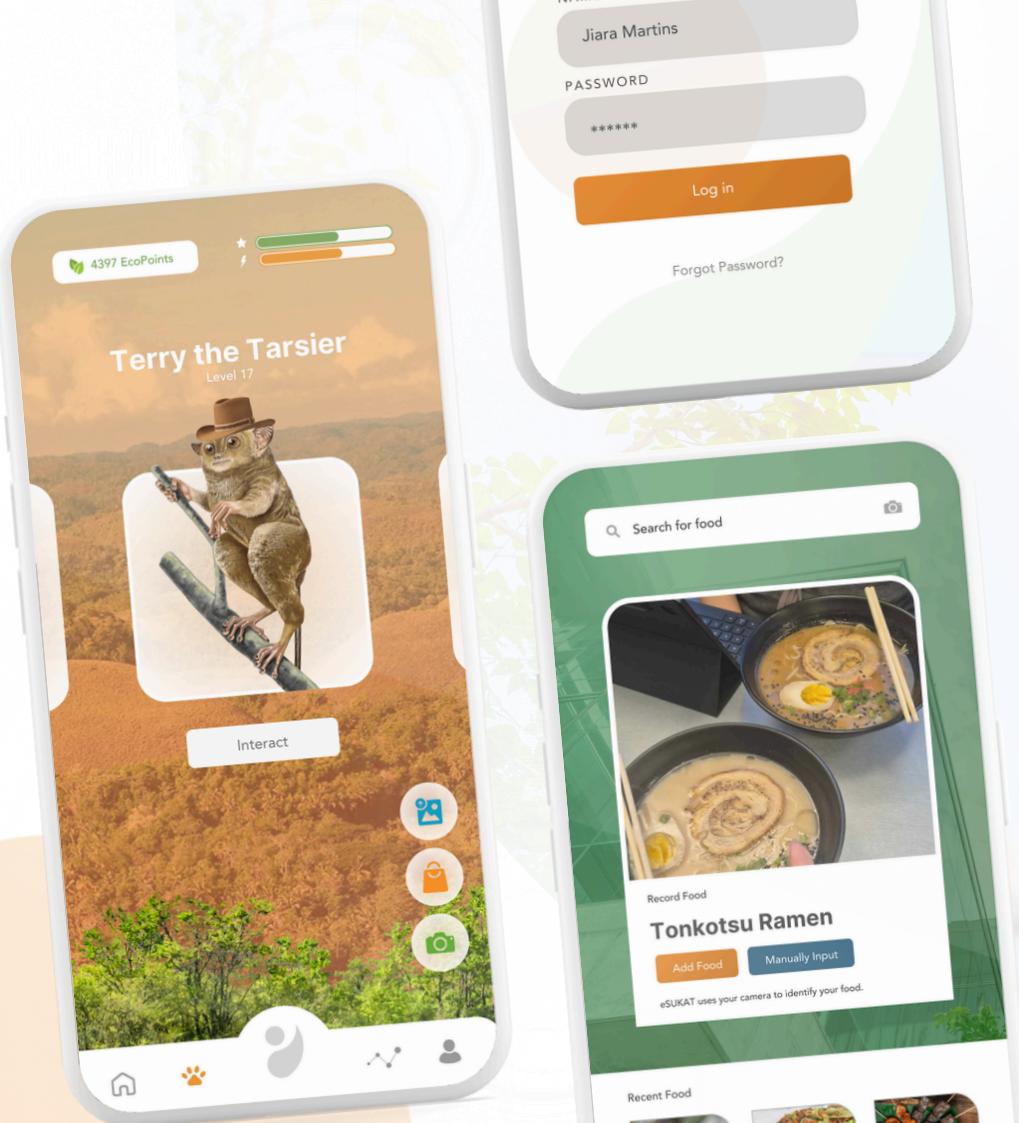
eAlaga

Accountability Companion



eSulong

Personal and Community Dashboard



Impact of Solution

Individual Awareness & Behavior

Enhanced Environmental Accountability

Empowers individuals to track and understand their carbon footprint, making them more accountable for their environmental impact.

Increased Monitoring Accuracy and Convenience

Leverages machine learning, OCR, and GPS, eSUKAT ensures precise and user-friendly tracking of carbon footprints.

Sustained Behavioral Engagement

Keeps users motivated and engaged in maintaining eco-friendly habits through gamification elements.



Community, Society, & Government

Optimized Government Resource Management

Provides valuable data insights to government agencies for better resource management and informed urban planning.

Expanded Collective Environmental Responsibility

Supports national and global sustainability goals, including the UN's Sustainable Development Goals.

Uplifted National and Global Goals

Encourages sustainable living by providing practical insights and promoting eco-friendly behaviors.



Environment & Sustainability

Reduced Carbon Emissions

Focuses on reducing emissions through better choices in transportation, electricity, and food consumption.

Promoted Sustainable Development

Encourages sustainable living by providing practical insights and promoting eco-friendly behaviors.

Improved Environment Quality

Leads to better air quality, less waste, and efficient resource management, benefiting both current and future generations.

Solution Proper Emission Factor

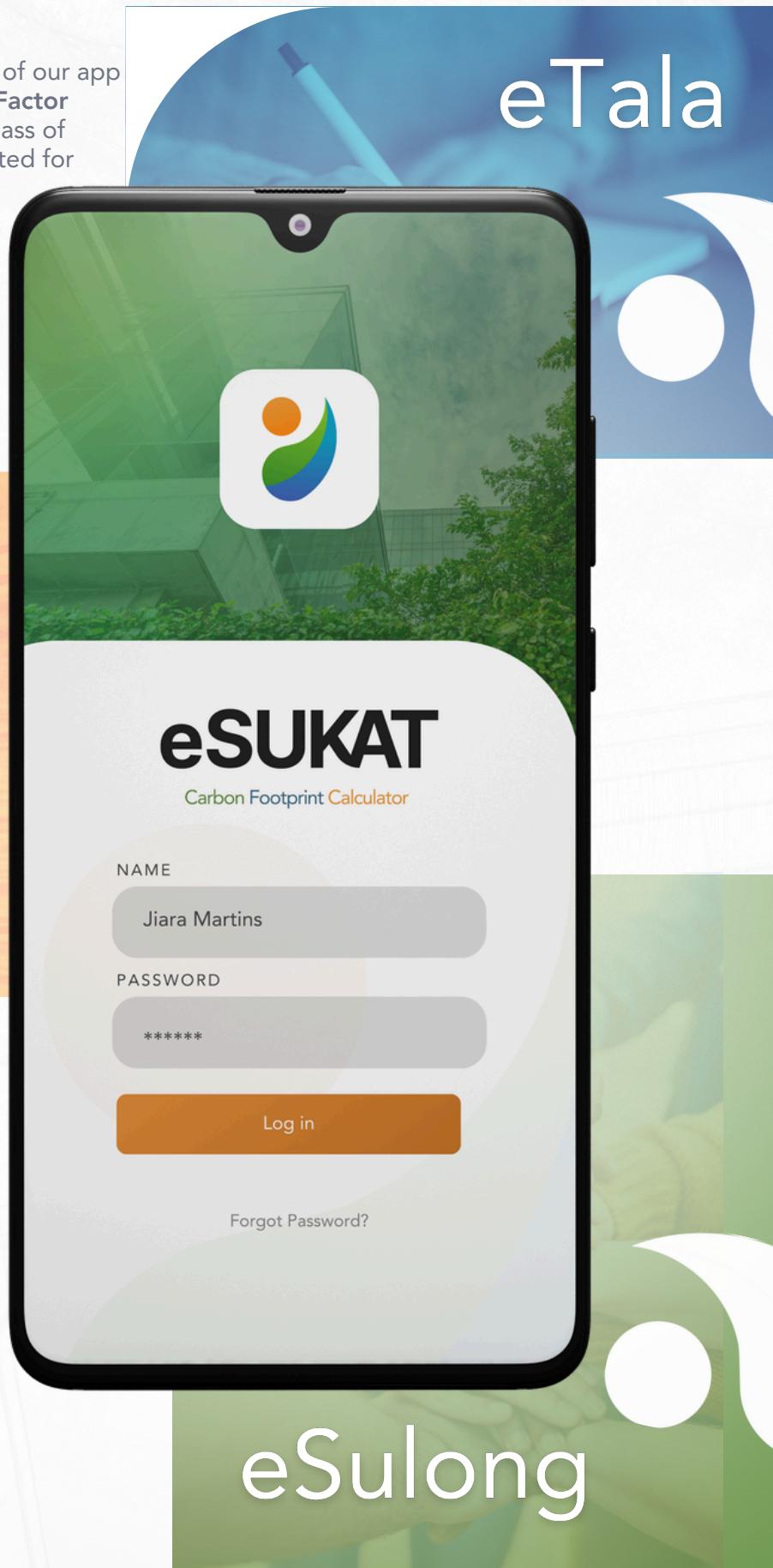
To understand how the various features of our app work, it's important to define **Emission Factor (EF)**. The EF of a human activity is the mass of carbon dioxide equivalents (CO₂e) emitted for every unit of that activity ([EPA, 2024](#)).

Thus, the EF for **food production** refers to emissions per unit mass of food; for **electricity**, it refers to emissions per unit of energy consumed; and for **transportation**, it refers to emissions per unit distance traveled.



Most of eSUKAT's computations involve **estimating the amount of emission-creating activity** in which the user engages and then simply multiplying that by the corresponding EF to obtain the amount of emissions.

For example, multiplying a user's electricity consumption in the past month (kWh) by the EF for electricity consumed from the national grid (grams CO₂e per kWh) results in the amount of emissions (grams CO₂e).



Food Classification Model.

The user can take a photo of food they buy, and a machine learning algorithm will use the photo to determine what kind of food it is. We are currently planning to use Google's AIY food classification model which is available for free on the Kaggle website ([Google, 2020](#)).

User Response Backup.

- If the app is not certain what food is in the picture, the app will instead prompt the user to select which of the two or three most likely options matches the photo.
- The user will have the option as well to select from a list of products manually.
- The app may also prompt the user for clarification on the size of the food item.

In summary, as long as the image recognition algorithm is accurate, the user has to do only two button clicks on average when inputting food.

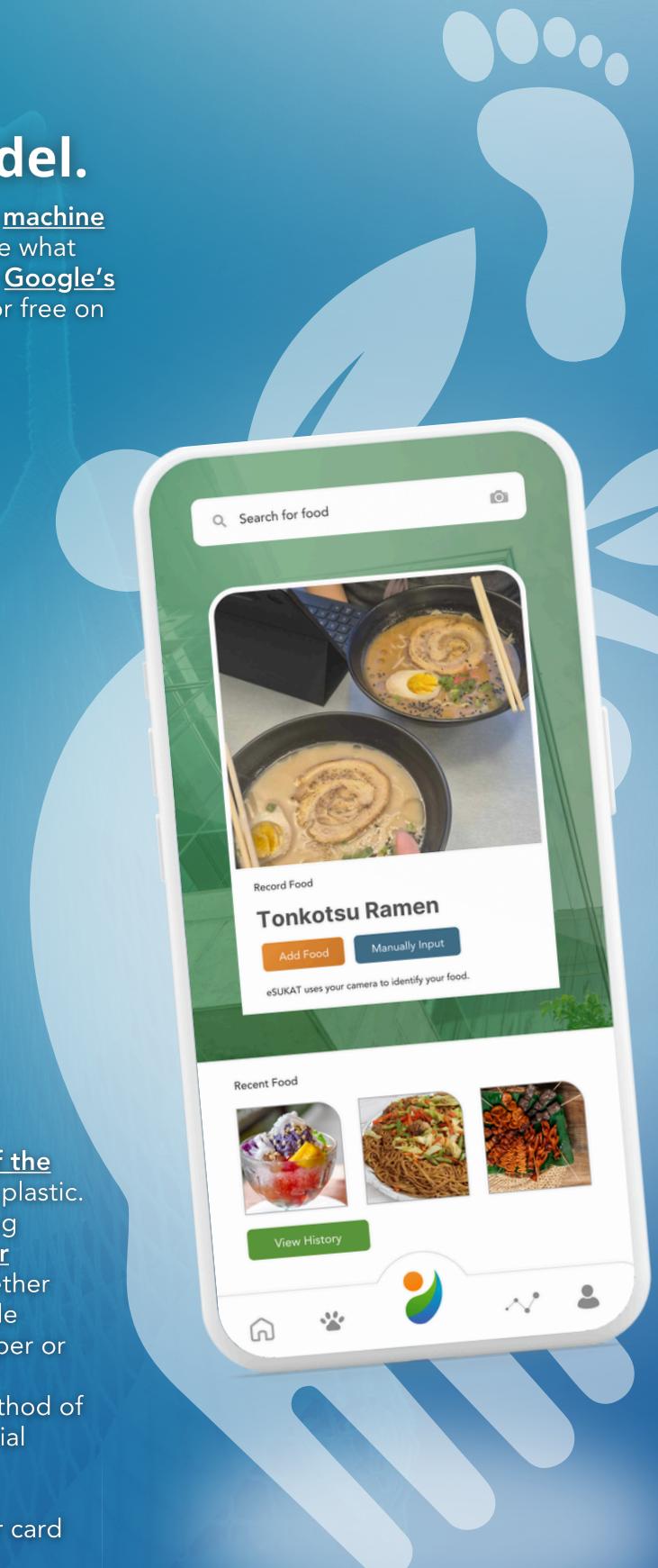
Carbon Emissions.

The app will calculate the emissions from the food's production using the food's emission factor (EF) per unit mass. We plan to obtain EFs for a wide variety of food products from Climatiq, a website and API that provides up-to-date EFs from reputable institutions

Food Packaging Considerations.

The app will also estimate the carbon footprint of the food's packaging based on whether it is paper or plastic.

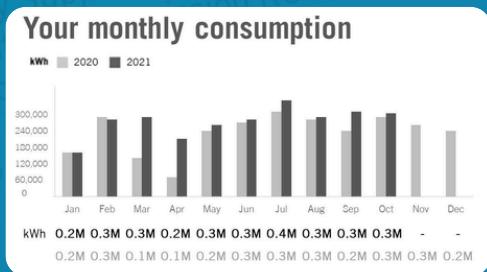
- It will start by using a separate machine learning algorithm trained using fast.ai's Vision Learner training workflow ([fast.ai, n.d.](#)) to identify whether the food in the image is contained in disposable packaging, and if so, whether this is mostly paper or plastic.
- Note that though the specific material and method of production of any given paper or plastic material affects its true EF value, these are practically impossible to ascertain from an image alone.
- Thus, we will simply use the mean EF for paper card based on Tomberlin et al. (2020).
- We will use the mean EF for PET-type plastic when the food product is a beverage, whereas the mean EF for PE-type and PP-type plastic will be used when the food product is solid, as per Kan and Miller (2022).
- We will also assume a standard mass of packaging material for beverage cups and takeout boxes.



Optical Image Recognition.

The app will also calculate the user's carbon footprint from their monthly electricity bill. [The user can upload a photo of their electricity bill](#) so that the app will read the pertinent information using Optical Character Recognition (OCR) and autofill a form. For OCR, we are planning to use [pytesseract](#), an open-source algorithm ([pytesseract, 2022](#)). To ensure accuracy of the data, this form can optionally be edited by the user and can also be manually filled up.

Initially, the app's OCR feature will apply only to Meralco bills since Meralco is the largest power distributor. The OCR algorithm will read the table in this part of the electricity bill, underneath the chart:



This table gives the monthly electricity consumption for the past 2 years. This will help the eSulong Personal Dashboard determine whether the user's current consumption is lower or higher than that in the same month last year.

Carbon Emissions.

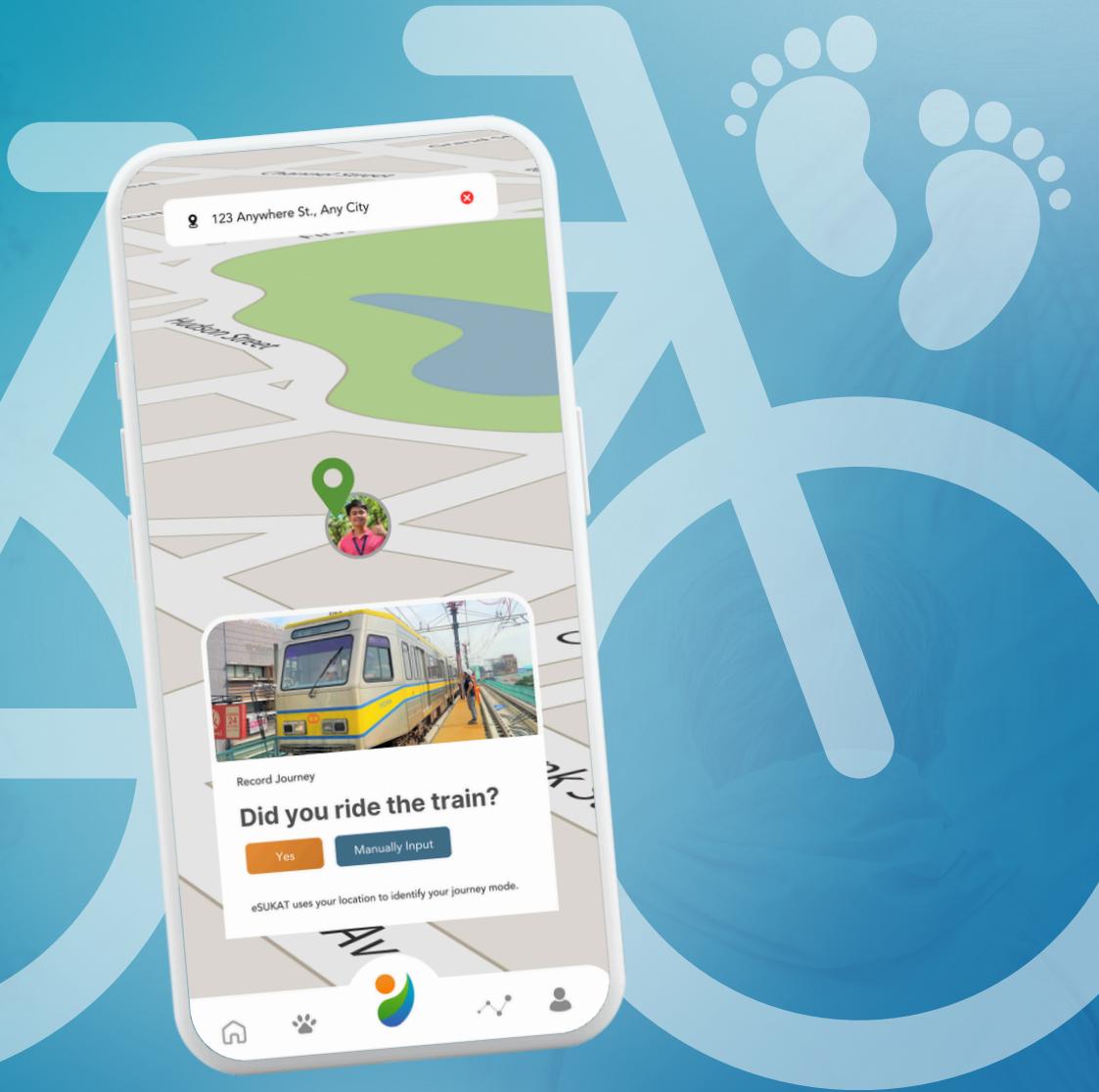
Electricity usage will be converted to GHG emissions in tons of CO₂ equivalents (CO₂e). While Meralco bills estimate emissions using the DOE's 2015-2017 national grid emission factor, this doesn't reflect the local energy mix of renewables and non-renewables in Luzon, Visayas, or Mindanao. Despite the national grid being interconnected as of 2024, household electricity is likely sourced from local plants. Thus, we will use the [DOE's latest data on power plants and energy types](#) to determine the local energy distribution and assume the user's electricity comes from this mix.

Every time the user uploads a Meralco bill, the app will [read that table and fill in the consumption data](#) for any months that haven't been recorded in the app yet. On the other hand, users with non-Meralco electricity bills will have to upload a picture of the bill and manually input their consumption data. With more uploads, we will be able to train a natural language processing (NLP) model to identify the numbers in the OCR-scanned text of a bill that represent the current monthly electricity consumption.

For example,

if a user in Luzon consumed 200 kWh this month, and 60.92% of Luzon's electricity is from coal (DOE 2022), we assume 121.84 kWh is coal-sourced.

Multiplying 121.84 kWh by the coal emission factor (1001 grams CO₂e per kWh) gives 121,961.84 grams CO₂e. We repeat this for other energy types using their respective EFs. Summing these emissions gives the total emissions for the month.



Global Positioning System (GPS).

The app will use GPS to determine how fast the user is moving. When the user appears to be using transportation, the app will determine the most likely modes of transportation based on speed, as well as proximity to a train rail. It will then ask the user to confirm which mode of transportation they are using with a button press. Apart from this on-the-go tracking feature, the user will also be able to manually input and edit what modes of transportation they used, and for how long, for any day in the past 2 weeks.

Carbon Emissions.

The app will use this to compute a conservative estimate for the distance the user travelled. By combining this with EF values for different modes of transportation obtained from Climatiq, the app will estimate the corresponding emissions in tons of CO₂ equivalents.

For example, according to Climatiq's record of UK government agency BEIS's estimates, the EF of light rail trains' fuel combustion is as low as 0.0286 kg CO₂e per passenger-km, whereas the EF of the average passenger car's fuel combustion is 0.1666 kg CO₂e per km (Emission Factor: Light rail and tram passenger train, 2023; Emission Factor: Car (average) - Passenger vehicles, 2023). We can multiply such values by the distance travelled by the user to determine the corresponding emissions.

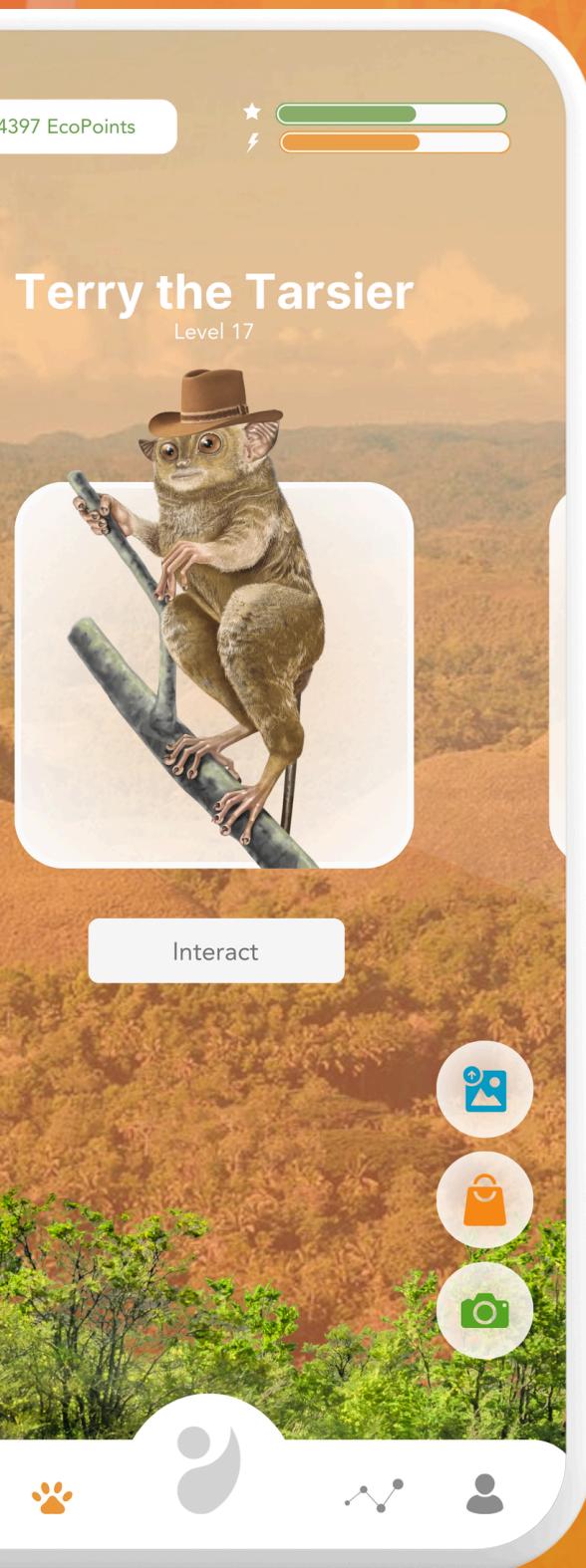
eTala
Transportation Tracker



4397 EcoPoints

Virtual Companion Selection.

During user profile creation, the user will be asked to select an endemic Philippine species to be their virtual companion. The options will show up as cards with pictures, though the user can also search for a species. After they select and name their companion, it will start as a "Level 1" companion. They can change its species only once if they would like. It will show up in the eNurture tab as an animated sprite, similar to a Pokemon.



Levelling-up.

In order to level up their companion, a user will have to earn points through actions that reduce their carbon footprint.

For example, they can earn points by buying sustainable food products. Among protein-rich foods, beef, lamb, crustaceans like shrimp, and cheese are the ones considered to have high emissions because their emissions-per-unit-mass are higher than the 10th percentile of that of ruminant meat products ([Poore and Nemecek, 2018](#)). Thus, users would earn ZERO points from purchasing these unsustainable products. On the other hand, nuts, peas, beans, tofu, eggs, chicken, fish, and pork are the protein-rich foods considered to have low emissions ([Poore and Nemecek, 2018](#)). Users would earn points for consuming these, depending on relative levels of emissions. This means users will be informed that nuts provide the highest points whereas pork provides the lowest points. Users will also earn points from other low-emission plant-based foods and dairy products.

Users will also earn points by using mass public transportation (trains, buses, PUVs, and jeeps), but not tricycles, cars, or motorcycles.

No penalties.

Note that users will not be penalized by directly removing points for making less sustainable choices, as this would disincentivize them from honestly tracking their carbon footprint. However, the impact of their less sustainable choices will be visible in the GHG emissions estimations in the eTrack section of the app.

eAlaga
Virtual Companion



Twofold Purpose.

First, earning a point permanently increases the virtual companion's experience (EXP), and certain EXP thresholds lead to level-ups. It will be much easier to level up the companion at low levels so that new users will quickly be rewarded for sustainable practices, supporting sustained usage of our app later on. Also, having a high-leveled companion indicates longtime engagement in sustainable practices. Users can flex this to their friends by sharing a picture of their companion on social media (e.g., Facebook, IG, X, Messenger, Viber, Telegram) with recent and overall statistics on their sustainable practices.

Second, every point serves as in-game currency to purchase customizations for the virtual companion, e.g., clothing and virtual furniture. More options for these become available as the companion levels up. We believe this can increase the user's sentimental attachment to their virtual companion and further incentivize engaging in sustainable practices.

Eco-Challenges.

Users will have additional opportunities to earn points through Eco-Challenges. These will be optional tasks that can last for a week up to a month, with the final number of points awarded being dependent on the user's performance.

For example:

- An Eco-Challenge can **track the user's number of Meatless Days in a week**. Each Meatless Day is verified by requiring the user to upload pictures of all three meals in a day.
- An Eco-Challenge can ask the user to **consume less electricity this month than the user did in the same month last year**. This would only be available to users who have already uploaded their electricity bill.
- An Eco-Challenge can ask the user to **request a quotation from a local solar panel company and upload documentary proof for verification**. This means the user doesn't have to actually buy or install a solar panel to complete this challenge, but at least it might help them consider doing so based on the quotation they got.



eAlaga
Virtual Companion

Detailed Summary.

The personal dashboard offers a detailed summary of the user's carbon footprint over time, this includes the following:



Visualization.

Line graphs of the user's carbon dioxide equivalents (CO₂e) emitted in tons over time, both in-total and per-category (Food, Electricity, Transportation).

If the user's emissions last month have been lower than their monthly average, or lower than their emissions in the same month last year, then the user will see a message quantifying the equivalent number of trees saved to the reduction in their carbon emissions. The equivalent number of trees will be calculated using the Asian Forest Cooperation Organization's (AFoCO) estimates of the number of trees of each species that would be required to offset each 1 kg of CO₂, as indicated in the [Methodology document](#) of the AFoCO Carbon Tree Calculator (2023). We will use the values provided for tree species that are naturally found in the Philippines.

eSulong
Personal Dashboard



Aggregated Summary.

Organizations like schools and companies can partner with us, for a fee, to be able to track the aggregated emissions of their community members. We will generate custom links for their members to open, which will result in their members being marked as affiliated with the organization. Then the same kinds of graphs and metrics available in the Personal Dashboard will be displayed to the organization, using the sum of members' emissions instead of their individual data. Furthermore, we will give them the option to categorize their community members (for example, students as opposed to faculty in a school) to analyze different categories separately.



eSulong
Community Dashboard

Login

Cost of Implementation

Prototype Development.

The cost for developing a working prototype is zero. We use open-source datasets, perform our own carbon emission calculations, and rely on free backend services to power eSukat version 1.

Business Model for Commercialization.

To commercialize eSukat, we will employ a combination of strategic partnerships and a freemium app model. This approach ensures multiple revenue streams while enhancing the app's value proposition to users and partners alike.

Partnerships. eSukat will collaborate with sustainable, low-carbon businesses to feature them as partners on the app. Our partners will benefit from targeted advertising and increased visibility, while users will be rewarded with points by purchasing from them using our referral code. Moreover, eSukat will provide each partner business with data on the daily number of successful purchases achieved through our app to help them improve their marketing strategies.

Freemium Model. The app's core functionalities — eTala, eAlaga, and eSulong— will be available for free to all users. Advanced features, such as detailed analytics, will be available through a premium monthly or yearly subscription. Corporate and educational institutions can subscribe to enterprise-level plans, enabling them to track and manage the carbon emissions data of their employees or students. This feature will help organizations promote sustainability within their communities and achieve their environmental goals.

To maximize reach and user acquisition, eSukat will be available on both the Android and Apple App Stores. Sustained marketing efforts will be done through a combination of digital advertising and strategic partnerships.



Cost of Implementation

Scaling Costs.

The following table provides an overview of the estimated costs for scaling the solution.

Item	Estimated Costs (₱/mo)	Notes
Development costs		
Developers	$60,000 \times 3 = 150,000$	c/o Jobstreet
UI/UX designers	$60,000 \times 2 = 90,000$	c/o Jobstreet
Operational costs		
Backend infrastructure	2,725 10,446 (one-time)	*
Customer support	$20,000 \times 3 = 60,000$	c/o Jobstreet
Distribution and marketing costs		
Distribution channels	Apple App Store: 479 Google Play Store: 1450 (one-time)	**
Marketing and Partnerships	Marketing: 20,000 Partnerships: 15,000	c/o Spiralytics
Legal costs	5,000 40,000 (one-time)	c/o Triple i consulting
Total	₱403,204/mo + ₱51,896 (one-time)	

*Includes cloud hosting, NoSQL database based on AWS pricing; AWS t2.medium: \$17/mo; AWS DynamoDB: \$30/mo + \$180 upfront

**Apple charges a yearly fee of \$99, while Google charges a one-time fee of \$25 (Eslabrat, n.d.).

Further Development

Three-Year Development Plan.

To ensure eSukat stays relevant and helpful in the future, we propose the development of several advanced features aimed at enhancing user experience, increasing engagement, and improving the app's core functionalities. Over the next three years following product launch, the following outlines our yearly timeline for the next development stages.

Comprehensive Integration

Integration of Ride-Hailing Apps and Payment Methods (Month 25–30)

- **Rationale:** Increase convenience as many Filipinos use these services.
- **Description:** Detect users' use of ride-hailing apps (e.g., Grab, Angkas, JoyRide, etc.) and other payment methods (e.g., Beep Card) to automate data input and increase accuracy.
- **Feasibility:** Integrate APIs and assess notification data from these apps.

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Predictive Analytics

Expansion to Inferential Statistics (Month 31–36)

- **Rationale:** Shift from a responsive to a proactive approach in minimizing carbon footprint.
- **Description:** Proactively suggest carbon-minimal actions to users based on their daily activities.
- **Feasibility:** Integrate machine learning to provide personalized, proactive suggestions.

Advanced Functionalities

Carbon Offset Purchasing (Month 13–18)

- **Rationale:** Provide users with options to mitigate their carbon emissions.
- **Description:** Enable users to offset their carbon emissions by purchasing carbon credits on the app.
- **Feasibility:** Requires partnerships with verified carbon offset sellers.

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Waste Management Tracking (Month 19–24)

- **Rationale:** Improve overall accuracy.
- **Description:** Track an individual's waste production.
- **Feasibility:** Implement AI to track waste production.

Initial Enhancements

Voice Input Implementation (Month 7–12)

- **Rationale:** Simplify data input for users.
- **Description:** Allow users to input data via voice commands to improve accessibility & convenience.
- **Feasibility:** Needs virtual assistants like Siri.

1

Real-Time Data Integration (Month 1–6)

- **Rationale:** Simplify data input for users.
- **Description:** Integrate eSukat with wearable devices to automatically track transportation and food consumption data, and with smart home devices to refine electricity consumption data.
- **Feasibility:** Requires agreements with device developers for data sharing.

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