

Feasibility study for SustAIIn - An application to create awareness about sustainability

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Team Details

Thanus Kumaar A (Full stack developer)

Tharun Kumarr A (Full stack developer)

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Executive Summary

Problem Statement

The rapid adoption of AI technologies, especially Generative AI and Large Language Models (LLMs), has led to significant environmental impacts, including high energy consumption, carbon emissions, and water usage, which are exacerbated by a lack of awareness and transparency about their ecological footprint.

Background

AI technologies, especially Generative AI, Natural Language Processing (NLP), and Large Language Models (LLMs), are transforming multiple sectors, solving problems once thought impossible.

These revolutionary technologies have been widely embraced by individuals and businesses alike, with applications ranging from text and code generation to image and video creation.

- ChatGPT reached 1 million users in 5 days ([OpenAI](#))
- 73% of the Indian population surveyed is using generative AI ([Salesforce](#))
- 64% of executives want to adopt generative AI ([Google](#))
- 92% of Fortune 500 companies are using OpenAI's technology ([Financial Times](#))
- 39% of marketers in the United States use generative AI to create social media images.
- 36% of marketers also leverage AI image generators for website imagery. ([Leonardo news](#))

However, this adoption comes at an environmental cost. Most generative AI technologies rely on cloud services and data centers. These data centers require 24x7 power and should operate in cool conditions (use fresh water or air conditioning) as the processors produce a large amount of heat. So these consume vast amounts of energy and water and emit substantial greenhouse gases (GHG).

- Data centers use up to 5 million gallons of water a day ([8billiontrees](#))
- Data centers account for 2.5% to 3.7% of global GHG emissions [Higher than the aviation industry ([8billiontrees](#))
- Training a single AI model can emit over 626,000 pounds of CO₂, equivalent to the emissions of five cars over their lifetimes ([Columbia Climate School](#))
- A single request in ChatGPT can consume 100 times more energy than one Google search ([Columbia Climate School](#))

Relevance

The growing integration of AI in businesses and everyday life is undeniable,

- 9 in 10 organizations back AI to give them a competitive edge over rivals ([MIT Sloan Management](#))
- Approximately 7 in 20 organizations use AI ([Hostinger](#))
- A whopping 83% of companies claim that using AI in their business strategies is a top priority([Forbes](#))

However, the rapid adoption of AI technologies does not adequately consider their sustainability. This situation parallels the Industrial Revolution, where technological advancements brought incredible benefits but also long-term environmental damage due to unawareness of their ecological impacts.

AI could contribute significantly to global environmental challenges like climate change and resource depletion without intervention.

This project aims to address the imbalance by fostering a culture of responsible AI usage, where businesses and users can understand the environmental cost of their AI activities and make informed decisions.

Objective

- **Create Awareness:** Educate users and businesses about the environmental impact of AI technologies, particularly generative AI and LLMs, by providing accessible and relatable metrics (e.g., energy consumption equivalent to a household appliance).
- **Enable Decision Making:** Empower users and businesses with actionable insights into their energy consumption, water footprint, and CO2 emissions through browser extensions, UI components, facilitating a shift toward efficient and environmentally conscious AI usage.

Market Feasibility

Target Audience

- Individuals using AI services like chatbots or generative AI.
- Businesses adopting AI (generative AI in most cases) for their operations.
- Developer groups that use AI products (API keys, AI agents, etc.) to build applications.

Competitor Analysis

- [Cloud Carbon Footprint](#), an open-source tool that provides visibility and tooling to measure, monitor and reduce your cloud carbon emissions. (Not specific to AI)
- No specific extensions on sustainability of generative AI technologies were found.

Technical Feasibility

Key Technologies

Cloud Providers:

- Data simulation using AI/ML APIs (Vertex AI)
- Model creation, training, and Deployment.

Data Sources and APIs:

- Open-source APIs for grid emissions estimation based on area.
- Proven methodologies for simulating power consumption data of cloud platforms and data centers.
- Data simulation using true statistics and proven research papers.
- Open datasets on regional emission factors.

Development Plan

Browser Extension:

Features:

- Real-time feedback on energy consumption and emissions while using AI tools (e.g., during LLM queries).
- Lightweight UI with visualizations for energy/emission data.

Tech Stack: Chrome Extension builder, React.js, APIs for emission predictions.

Embeddable UI Component:

Features:

- Widget for integrating sustainability metrics into third-party applications (e.g., dashboards).

Tech Stack: Cross-platform development using JavaScript libraries (React.js).

Machine Learning Model for Emission Predictions:

Features:

- Predict energy usage, carbon footprint, and water consumption using input parameters (e.g., tokens, task type, cloud region).

Workflow:

Data collection → Preprocessing → Training → Validation → Deployment.

Tech Stack: TensorFlow, Scikit-learn, or PyTorch.

Data Simulation:

Generating synthetic datasets to simulate workloads based on real-world scenarios.

Tools:

- Python (Pandas, NumPy)
- Cloud-based data generators (BigQuery ML).

Sustainability Feasibility

Environmental Impact

- Contributes to reducing unnecessary AI usage and emissions.
- Encourages green cloud service adoption.

Social Impact

- Raises awareness among users and businesses.
- Promotes responsible AI usage practices.

Risk Assessment

Potential Risks

- Inaccurate prediction of sustainability metrics (energy consumption, water footprint, carbon footprint, etc.).
- Unavailability of proper data for training and incorrect simulation data.
- Resistance from developers or businesses to adopt the tool.

Mitigation Strategies

- Refining models, proper selection, and cleaning of data.
- Partner with cloud service providers to get accurate data or simulate them using well-established methodologies ([Power estimation](#)).
- Partnering with industry leaders to promote the tool.

Conclusion

The proposed application addresses the pressing need for sustainable usage of AI technologies by providing real-time insights into energy consumption, carbon emissions, and other sustainability metrics. The feasibility study demonstrates that the project is not only technically achievable but also highly relevant in today's context of environmental awareness and responsible innovation.

Despite potential risks such as data availability and prediction accuracy, these challenges can be mitigated through careful planning, reliable data sources, and iterative development.

Given its relevance, technical viability, and potential societal impact, the development of this application is a promising step toward fostering sustainable and responsible use of AI technologies. By raising awareness and encouraging optimized usage of AI, this project has the potential to influence both individual behavior and industry standards positively.