WEB-BASED APPLICATION TO ASSESS THE ENVIRONMENTAL IMPACT OF CONSUMER PRODUCTS AND PROVIDE CLIMATE-CONSCIOUS RECOMMENDATIONS

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Abstract

The rising demand for textiles and clothes has led to 10% of global emissions from the textile industry. It is often not possible to check the environmental impact consumers make when they shop for fashion items. Our survey suggests that 38% of the people do not know the issue of the environmental impact of textiles. We propose a web application for e-commerce textile shoppers to check the environmental impact of their fashion items before purchasing them. The user pastes the URL of the product they wish to buy. The web application then extracts the description from the product page and highlights the materials used. The materials used are inputted into our python program which calculates the percentage of the environmental impact caused by the item which is displayed. In our survey we found that 84% of shoppers don't search for climate-friendly alternatives so we added the recommendations feature. When the fashion item is not climate-friendly the user is presented with alternatives that look similar to the fashion item inputted by the user. Statistics show a 35% increase in buying eco-friendly clothes when recommended to them directly. The chatbot contains genuine information on the environmental impact of textiles and educates the user on the importance of the issue. This allows us to get the 84% of the shoppers who do not factor in eco-friendliness while shopping for clothes understand the problem. Our application combines these functions to solve the problem of the environmental impact of the textile industry and consumerbehavior.

Keywords:climate conscious web application, consumer, e-commerce, textile industry.

I. INTRODUCTION

To allow online shoppers the climate impact of their products, we devised a climate conscious web application. We hope for online shoppers to be able to use our application to be able to checktheclimateimpactoftheclothestheywanttobuyinstantly allowing them to factor in climate-friendliness while purchasing a product. This allows for consumers to check their climate impact and make more consciousdecisions[1]. Ecologically conscious design and manufacturing (ECD&M), also known as environmental conscious design and manufacturing (ECD&M), is a manufacturing perspective that considers the social and technological aspects of the design, synthesis, processing, and use of products in continuous and discrete manufacturing industries. Safety and cleanliness in the workplace, worker protection, decreased future disposal costs, reduced environmental and health hazards and risks, increased product quality at a cheaper cost, a better public image, and greater productivity are some of the advantages of ECD&M implementation. Technological and design approaches that are sensitive to the environment will enable firms to reduce waste while also turning trash into a profit-generating product. 900 frontline service employees and their supervisors participated in a field study conducted by an international hotel chain across 14 countries in Europe, the Middle East, Africa, and Asia. The findings demonstrated measurement equivalence and suggested that, after controlling for service climate, initiative climate at the establishment level and general self-efficacy at the individual level predicted employee satisfaction. Customer service satisfaction was found to be positively and indirectly associated with initiative climate at the establishment level after controlling for service climate and collective general service performance. This was found to be true even after controlling for collective general service performance and service climate at the establishment level. These results have significant theoretical and practical ramifications, which we explore in detail[2].

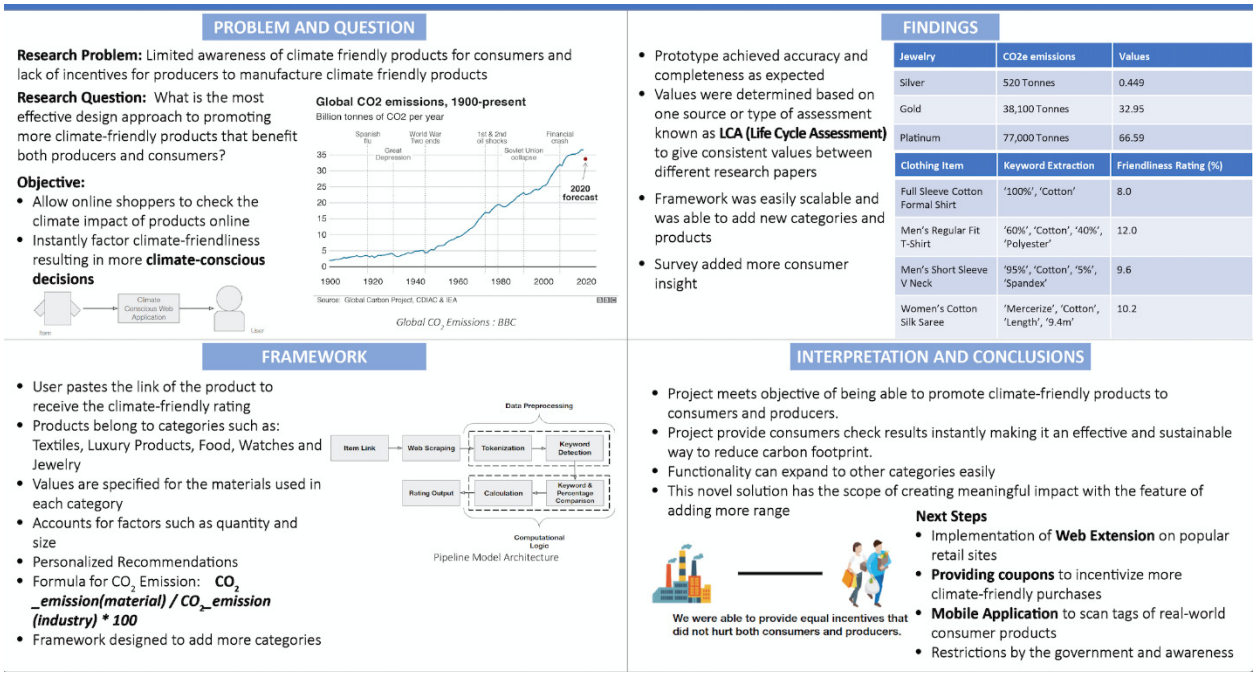

Figure 1: Climate conscious Research Quad chart

The term "life cycle assessment" refers to a technique that may be used to analyze the environmental impact of a product, process, or activity throughout the course of its life cycle. Users of life cycle assessment (LCA) nowadays include a diverse group of people with expertise in a variety of disciplines who wish to analyze their goods, processes, or activities in a life cycle perspective[3]. This research aims to provide some of the LCA studies on agricultural and industrial food products, as well as current developments in LCA and their application to food items, in an effort to provide a comprehensive overview of the subject[20]. According to the reviewed literature, agricultural production is a hotspot in the life cycle of food items, and life cycle assessment (LCA) may aid in the identification of more sustainable alternatives. Because of the recent development of LCA methods and the implementation of LCA dissemination initiatives by international and local organizations, the application of LCA in agricultural and industrial food items is quickly expanding. The LCA development process has been accelerated because to the creation of a network for information sharing and experience exchange[4].

It establishes a comprehensive and multidisciplinary definition of Climate Change Education for Sustainable Development, asserting that it must not only include relevant content knowledge on climate change, environmental and social issues, disaster risk reduction, and sustainable consumption and lifestyles, but also place a strong emphasis on the institutional environment in

which that content is learned[5]. The article presents evidence-based findings on the factors that have the greatest impact on skill, attitude, and behavior change in order to determine what works for formal and non-formal climate change education content, including environmental education, climate change and scientific literacy, and education for sustainable lifestyles and consumption, among other things[6].

II.Related Work

The Social Life Cycle Evaluation of Goods offers stakeholders involved in the assessment of the social and socio-economic effects of products throughout their product life cycle with a map, a skeleton, and a flash light. The map shows the background, the main ideas, the wider area in which tools and methods are being created, as well as the breadth of applications for those tools and approaches[7]. When conducting a social life cycle assessment, it is important to examine a number of essential components that will serve as guidelines for the objective and scope phase, inventory phase, impact assessment phase, and interpretation phase. The flash light draws attention to places that need additional investigation[19]. An increasingly popular method, Social Life Cycle Assessment (SLCA), allows us to account for tales and provide systematic information on effects that would otherwise be lost in the huge and rapidly changing sea of our contemporary world[8]. It is hoped that it would assist stakeholders in engaging effectively and efficiently to enhance the social and socio-economic conditions of production and consumption.

Methods and techniques for measuring and comparing the environmental effects of human activities for the supply of commodities and services (both of which are described under the term "products") are required for sustainable development[9,18]. Emissions into the environment and resource consumption, as well as other interventions (for example, land use) associated with providing products, include those that occur during the extraction of resources, the production of materials, the manufacturing of products, during consumption and use of the products, and those that occur at the end of the products' life cycle (collection/sorting, reuse, recycling, and waste disposal). These emissions and consumptions have a wide range of consequences, including climate change, stratospheric ozone depletion, tropospheric ozone (smog) formation, eutrophication, acidification, toxicological stress on human health and ecosystems, resource depletion, water use, land use, and noise, to name a few examples[10,17]. As a result, there is a

clear need to be proactive and to offer complementary insights, in addition to existing regulatory procedures, in order to assist minimize the likelihood of such negative consequences[11,16].

The activities that people may take to help prevent climate change are important when considered collectively. Individual mobilization to react to climate change on a personal level must, as a result, be seen as a supplementary method to a nation's climate change plan[12,15]. It has been neglected in the United States, but altering driver behavior or style such that eco-driving becomes the standard rather than the exception is an important action item to take forward. Current evidence suggests that eco-driving may decrease fuel consumption by 10% on average and over time, resulting in a 10% reduction in CO2 emissions from driving, on average and over time. The implementation of such savings on a large scale, however, will necessitate the implementation of a sophisticated, multi-dimensional campaign that goes far beyond what has been attempted thus far. This campaign will include education (particularly the use of feedback devices), regulation, fiscal incentives, and the reinforcement of social norms[13,14].

III. METHODOLOGY

Our project is a web application which gives a percentage rating on the amount of climate impact a consumer product has by checking out the materials used in the product which is provided in the description of the product. This information is scrapped for analysis and inputted into our program.

- The rating is provided when a link of the product intended to be purchased is pasted in the application after which the percentage of its climate- friendliness is calculated. It is also based on factors such as size or the quantity of theproduct.
- It also provides recommendations when a product exceeds a certain limit for climate-friendliness. These recommendations are similar products to the link pasted that are moreclimate-friendly.

- More categories and other products can be added through the feature that was created to make it a framework.

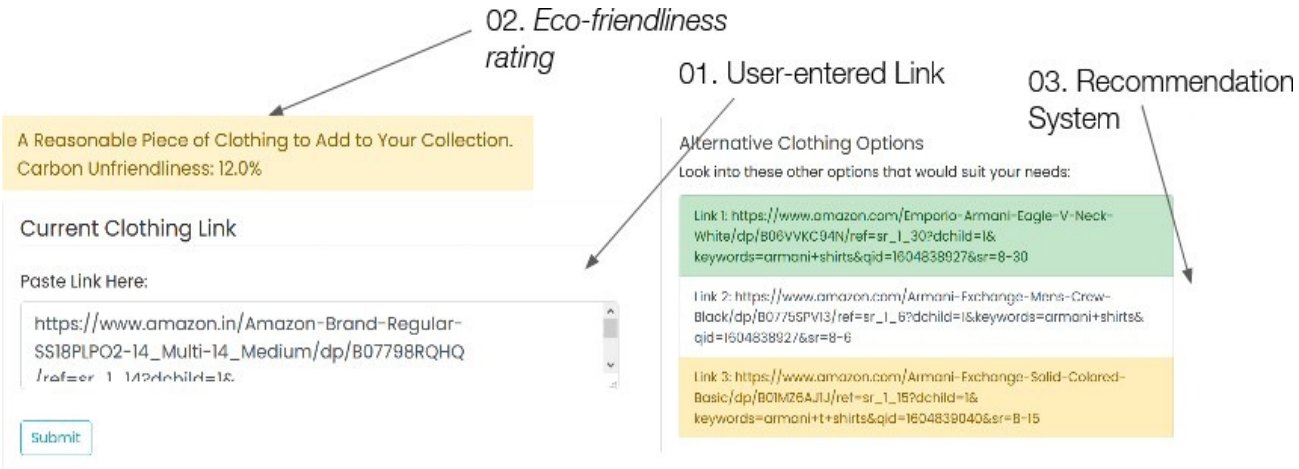

Figure 2: Framework for Proposed System

In order to make our prototype we made a demo product using python, html, css and the flask API. We designed the userinterface by recognizing the importance of having an intuitive UI so that consumers can easily navigate through the website's functions. We made the backend of the website through python. In order to do this we divided our files to contain specific functions such as one file has the calculator and another contains the code for the recommendation system.

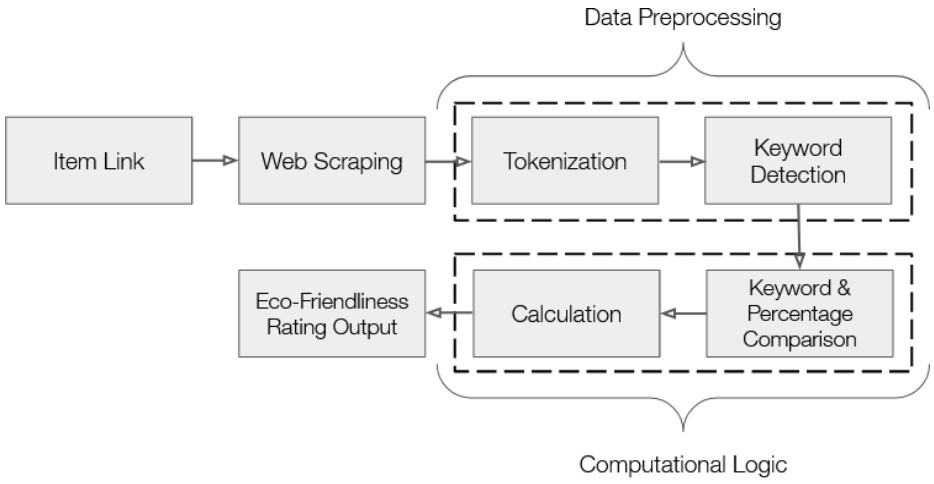

Figure 3: Data Preprocessing Techniques with Computational Logic

Using the local host service we were able to test and make changes to our web application. We checked all of the functions of the program, made changes whenever we noticed any glitches and problems. Algorithm 1 utilizes Beautiful Soup (a python library used for web scraping) in conjunction with a Tokenizer model to extract material-related keywords of products from e-commerce webpages. Compares extracted keywords and percentages with stored database values and calculates climate-friendliness rating (arbitrary unit).

As the urgency of addressing climate change grows, industrial sectors are putting out efforts to decrease their carbon emissions to meet the challenge. When it comes to climate change, fashion plays a significant role. According to a McKinsey study, the industry was responsible for about 2.1 billion metric tonnes of greenhouse gas (GHG) emissions in 2018, accounting for approximately 4% of world total emissions. Consider this: the fashion business produces about the same amount of greenhouse gases each year as the combined economies of France, Germany, the United Kingdom and the rest of the world put together.

No matter how hard the sector tries to cut emissions, it is on a road that will take it beyond the 1.5-degree route to climate change mitigation established by the Intergovernmental Panel on Climate Change (IPCC) and approved in the 2015 Paris accord. In order to achieve this goal, the fashion industry would have to reduce its greenhouse gas emissions to 1.1 billion metric tonnes of CO2 equivalent by 2030. However, our growth projections, which have been modified to account for the probable effect of COVID-19, indicate that the sector is on track to exceed its goal by almost twice, with emissions of 2.1 billion metric tonnes of CO2 equivalent in 2030 unless it takes further abatement measures.

Proposed Algorithm 1 for Keyword Detection Model:

match 0

current state=idle

match id=0

string= get (input packet) as ASCII

for (i=1; i <= strlen(string); i++)

```
        if (match id) break
        if table[current state, string(i)]
        {current state, match id}= table[current state, string(i)]
        else
            {current state, match ic1)= {idle,0}
    end for
    return match id
end
```

Algorithm 2 suggests similar products with higher climate-friendliness from the same e-commerce website by scraping information of related webpages to that product and iterating the climate-friendliness rating calculation (using the Keyword Detection Model).

Algorithm 2: General outline of neighborhood algorithms(AI Recommendation System)

Input: Number of items to be recommended *N EN,*
Number of neighbors used for ranking *k EN,*
User to recommend items to u,
List of all items *Items,*
User-Item matrix of ratings *R*

output:*N* items to be recommended

```
for each item E Items do
 if item ¢ u. then
item.rank r rank_according_to_nearest_neighbors(k, u, item)
```

Algorithm 3 trained using Natural Language Processing (NLP) algorithms and articles on the respective categories of products, allowing users to request additional information regarding climate-friendly goods and alternatives. This allows e-commerce websites to trust our extension as a reliable tool to circulate customers towards more climate-friendly products.

Algorithm 3: Conversational AI

Initialization. Select the set of neighborhood structures 94,

for k =that willbe used in the search; find an initial solution lc;

choose a stopping condition;

Repeat the following sequence until the stopping condition is met

(I)Setk<-1;

(2) Repeat the following steps until k =

(a)Shaking. Generate a point x' at random from the kth neighborhood of x E 94(x)); (b) Move or not. If this point is better than the incumbent, move there (x x'), and continue the search with 9,6 (k t— I); otherwise, set k r k+ 1;

Consumption of products and the generation of greenhouse gases from the economy have been rising. Because customers have little motivation to live more sustainably, manufacturers aren't making the switch to a greener economy. Prior to making a purchase, customers will be able to verify the climate effect of a product using our web app, which we developed. The consumer enters the URL of the product they want to purchase. Afterwards, the web programme takes the product page's description and emphasizes the materials used. Our python software uses the materials to compute the item's climate effect, which is then presented as a rating. The rating is based on numerical values assigned to various materials within a product category. These numbers are derived from the LCA (Life Cycle Assessment) of the materials or goods, which takes into consideration emissions throughout the course of the material's or product's lifetime. Users who want to purchase a climate-unfriendly product may get customized suggestions for climate-friendly alternatives that are comparable to the one they're considering buying.

It is suggested that these items be used. According to research, people are 35 percent more likely to purchase environmentally friendly clothing if it is suggested to them personally. There is a structure in place to enable for expansion to new product categories and the updating of data scalability. Our software

combines these features to address the issue of encouraging people to live more sustainably. Customers while simultaneously increasing the demand for more environmentally friendly goods without having an impact on the manufacturers' bottom line.

We also had other people test and give us feedback which we later used to improve the UI and other functions. We also tested consumer knowledge and shopping habits through a survey and finalized our results so that we can develop our features based on the needs and the behavior of consumers. We conducted the survey using the googleform.

IV. RESULTS

Prototype met with testing accuracy and completeness as expected. Values were determined based on one source or type of assessment known as LCA to give consistent values between different research papers. Framework was easily scalable and had functionality to add more categories and products easily. Survey provided more applications and insight to consumer purchase patterns.As the program is web based it is easily scalable and has a wide audience of consumers.The consumers are incentivized to buy more climate friendly products when provided with recommendations.

Producers are provided with:

Demand for more sustainable products. Aid in shifting to a greener economy. Unbiased recommendations that do not incentivize any particular brand. Incentive from consumers thatis not radical and is based on their preferences. No privacy concern as the data taken by the program is publicly available.

TABLE I: SAMPLE ITEMS INPUTTED IN PROGRAM

Clothing Item	Keyword Extraction	Eco-Friendliness Rating (%)
Full Sleeve Cotton Formal Shirt	'100%', 'Cotton'	8.0
Men's Regular Fit T-Shirt	'60%', 'Cotton', '40%', 'Polyester'	12.0
Men's Short Sleeve V Neck	'95%', 'Cotton', '5%', 'Spandex'	9.6
Women's Cotton Silk Blend Indian Saree	'Mercerize', 'Cotton', 'Length', '9.4m'	10.2

TABLE 2: SAMPLE OFVALUES

Jewellery	**CO2e emissions**	**Values**
Silver	52 tonnes	0.449
Gold	38 tonnes	32.95
Platinum	77 tonnes	66.59

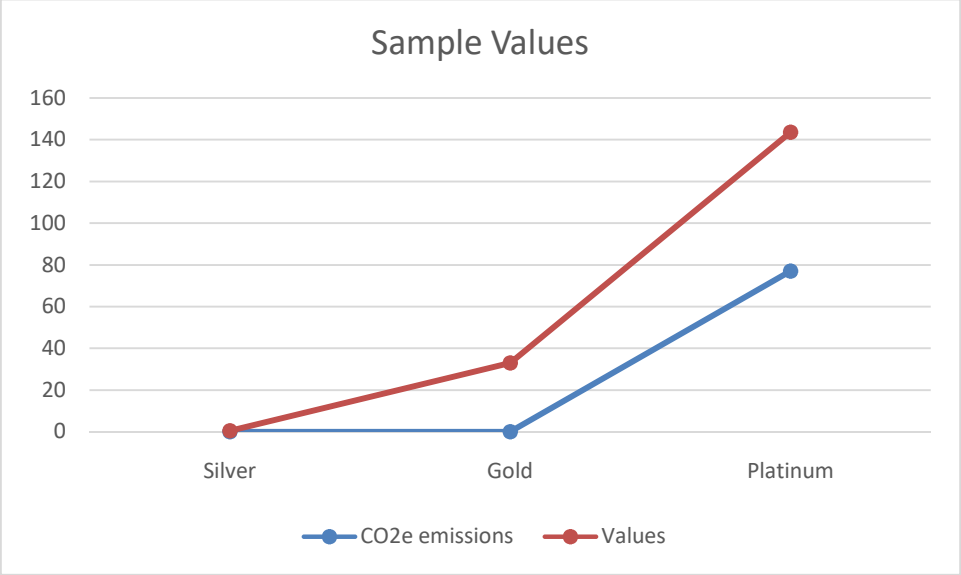

Figure 4: Sample Values for different jewels

V. CONCLUSION

- Inourresultswewereabletojustifythatourprocess wasabletopromotemoreclimate-friendlyproducts to consumers andproducers.
- Ratingsareprovidedinstantlyandaccuratelyfrom values that were consistent based on the best researchmethods.
- Functionalitytoexpandtoothercategorieseasily.
- This novel solution has the scope of creating meaningfulimpactwiththefeatureofaddingmore range.

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AUTHOR PROFILE

Mr. Anish Krishnan Ganesh is an International Baccalaureate Program student and a Research Scholar at Lumiere Education (USA). He is the Founder and CEO of Conquerly (https://conquerly.io/), nationally recognized AI Educational platform completely free for students across the globe with a mission to educate the world on the unlimited possibilities of AI and make a positive impact on society through innovations. He was headlined in Edex, The New Indian Express, India's National Education paper along with his interviews at The Hindu, Dinamalar, Edex Live and few other media outlets for his educational innovations.

He has done extensive research on Artificial Intelligence under the guidance of Harvard University and New York University mentors to find out whether training conversational AI with sentiment-based rewards exhibit meaningful semantic variation. His research paper has been submitted to prestigious Springer Journal of Grid Computing.

He has Interned at Microsoft Corporation and has worked as a Data Science Intern for 2+ years and has immense experience working with Machine Learning, Deep Learning using Python, TensorFlow, and PyTorch. He has solved real-world problems by developing AI products in the fields of healthcare, education, music, finance, and reducing waste. He has designed a framework, EcoShop which has been registered for Copyright/Patent under Intellectual Property by Government of India.

He was the World Topper in IGCSE Mathematics, Grand Award Winner at IRIS National Fair and his project, Conscious Clothing is selected as Finalist at International Science and Engineering Fair (ISEF) 2021, received a Diploma by the Royal Swedish Academy of Engineering Sciences. He has completed a Java programming course from John Hopkins University, three IBM AI Engineering courses, and advanced Python programming courses from Datacamp. From a very young age, he has love for all things AI and lived his life with the words never giving up flowing through his very being.