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Mobile based-Carbon Footprint Calculator and Analyzer

Prof. Balasaheb Jadhav[1], Omkar Lolage[2], Sakshi Lohote[3], Saurabh Lohar[4], Shubham Lonare[5], Aabha Lokhande[6], Lokesh Chaudhari[7]

[1]*(Guide), Assistant Professor, Department of Computer EngineeringVishwakarma Institute of Technology Bibwewadi, Pune, India*
[2, 3, 4, 5, 6, 7]*First Year Student,Department of Engineering Sciences and Humanities (DESH), Vishwakarma Institute of Technology, Bibwewadi, Pune, India*

Abstract: ***In 21st century, the percentage of anthropogenic activities is increasing. Leading to various adverse effects on environment causing problems like Climate change, global warming and many more. One of the major pollutants for these problems is CO2. Variety of factors are responsible for CO2 emissions. Several carbon footprint calculators have emerged but users are inactive. The use of such technology has to be increased for environment conscious behaviour by providing proper analysis and suggestions to users. Our application 'C- Impressions' track daily emissions and provide suggestions for improvement, its interface is very simple and easy to use making it more interestingand interactive for the user. The app not only computes carbon footprints but also offers users tailored suggestions for lowering their carbon footprint. These suggestions can be to cut back on energy use, choose for environmentally friendly modes of transportation, or cut back on food waste. The software will also enable users to monitor their development over time and assess how their carbon footprint compares to others. A crucial worldwide concern that calls for immediate and ongoing action is climate change. Promoting sustainable behaviour among people through technologies like carbon footprint apps is one way to lower greenhouse gas emissions. This study intends to evaluate how well a carbon footprint app encourages consumers to adopt sustainable behaviour.***

Keywords: C-Impressions, CO2 emissions, interactive, interesting, pollutant, **carbon footprint calculator**

I. INTRODUCTION

Every action we take every day has some sort of effect on the environment. For sustainability to continuously improve, company social responsibility and human awareness are crucial. Even if communication, sanitation, transportation, health care, and entertainment have all improved because to the internet and other technical advancements, there are still some negative aspects of technology. Think about environmental sustainability, for instance.Each online activity has a price because it generates a little amount of carbon dioxide, particularly because of the servers and data centers required to power the internet. Data centers, network infrastructures, and other large, energy-consuming devices all contribute to the carbon footprint of online services.

CO_2 emissions are causing a number of issues, including changes in weather patterns, ozone layer loss, glacier melting and more. We have noticed a change in weather pattern uncertainty during the past few years. These are all issues that the human race is facing. There are unseasonal rains leading to wasting of crops, flashfloods.These emissions are the result of several human activities that serve basic human needs including food, transportation and electricity. All of these issues must be resolved through altering behaviour to benefit the environment. To alter the behaviour these emissions must be tracked and behaviour must be changed accordingly to resolve these issues. In order to change the behaviour and address these problems, it is necessary to track these emissions. Efficient way of tracking these emissions is by using 'Carbon Footprint Calculator'. Carbon Footprints are used to quantify greenhouse gas emissions, particularly CO2 emissions. Carbon footprints calculate a person's total emissions across a range of sectors, including electricity production, transportation, heating and industries, etc. Individual carbon footprints must be measured inorder to overcome these issues. The carbon footprint calculator assists in this process by monitoring each person's daily activities and by aiding in the analysis and storage of analytical data. Additionally, it will advise individuals to lessen their contribution to CO2 emissions.

However, there is a need to increase the use of this technology. Promoting user acceptance is absolutely crucial. This paper willgo over the aspects of our tool that will help it get around the drawbacks of the current calculator. Therefore, it is necessary toadvertise this tool and make it user friendly. The necessary improvements and additional functionality have been added to our tool based on our investigation of the existing systems. Thisstudy examines how well our tool works.

II. RELATED WORKS

A carbon footprint calculator is regarded as a crucial tool that enables users to evaluate their actions. Since it is such a crucial tool, numerous studies have been done on it. According to research done in Mauritius, the 'MAU Carbon Footprint Calculator' was developed to calculate the carbon footprints of residents of Mauritius and to improve their usability [1]. One more study was conducted on 'carbon footprint analysis of student behaviour for a sustainable university campus in China'. In this study, they calculated carbon footprints of students basedon various categories like daily life, academics and transportation. They collected data in the form of survey in orderto study the emissions [2]. On basic of our study, we tried to bring improvement in existingsystem to overcome drawbacks. The successive sections of this essay are organized as follows: Related works are examined in the section that follows. The design and implementation of the suggested mobile carbon calculator are then discussed in section III. Before providing thefindings from the experiment conducted in section V, the evaluation methodology used to judge the usefulness of the suggested calculator is detailed in part IV. Before the research is concluded in section VII, section VI offers suggestions for enhancing the usability of such technologies.

III. C-IMPRESSIONS: A MOBILE BASED CARBONFOOTPRINT CALCULATOR

People in India are unaware of CO2 emissions. CO2 emissionsare causing a variety of environmental issues. In recent years, India has experienced numerous natural disasters such as cyclones, flashfloods, sea level rise and so on. Limiting these emissions are therefore an urgent necessity. Existing calculators do not provide daily calculations, detailed analysis ofemissions and user interface is complicated. According to recent trends 1 the term 'Carbon Footprint Calculator' searching trend inIndia is not stable.

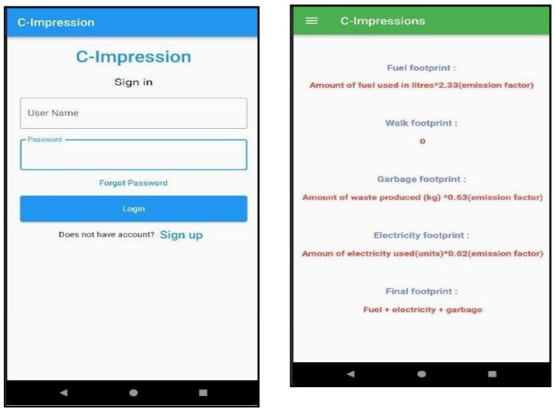
To overcome these limitations, our application named 'C- Impressions' is made. Our tool will overcome the limitations of existing calculators, and this paper will discuss these features. This tool was created to help users determine whether their activities are environmentally conscious or not, and to assist them in changing their behaviour by providing suggestions to improve their behaviour without compromising their needs. Personal carbon emissions are classified as follows: electricity consumption, transportation, food consumption, waste generation, water consumption, and soon. Electricity emissions are calculated using electricity bills and turning off appliances when not in use. If three different students' study in three different classrooms, thiswill result in more electricity usage; therefore, our tool will suggest these students to study in a common classroom, resulting in less electricity usage, which will reduce their carbon emissions and thus improve their footprints.

Transportation emissions are calculated based fuel consumption. For example, if user consumes some amount of fuel, our app suggests to use public mode of transport

This tool makes use of MySQL database to store user data and other information. When using the C-impressions for the first time, the user must first create a profile.

Steps for our application usage:

1) Make an account by entering your email address or other pertinent information after opening the app. You might also be able to sign in to app if your account already exists.
2) After registering or logging in, users are directed to our app's home page, which displays the basic information of Carbon footprints and also includes sections for the definition of carbonfootprint, the justification for computing footprints, and dash-board.
3) Including dashboard option and navigation buttons.
4) In dashboard options like home, calculate footprint, view formulae, log out ap- pears.



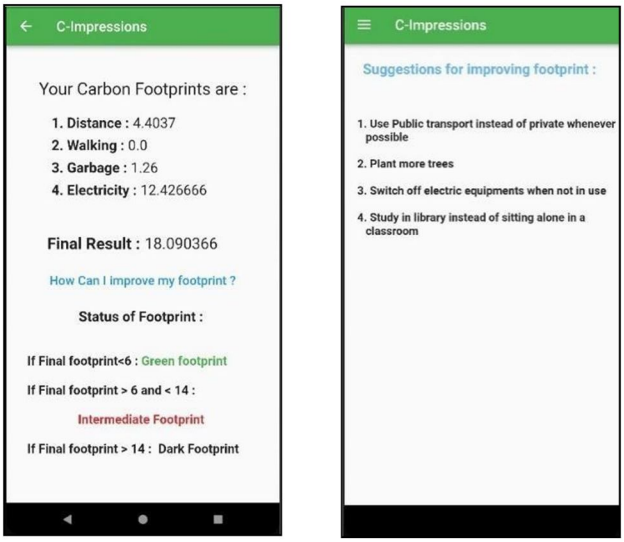


Fig1.Key screenshots of C-Impressions

Above graph shows the trend of searching for 'Carbon FootprintCalculator' in India. It is clearly visible that the trend is not stable and that is the major issue. Users need to be connected to this technology for a sustainable environment and also, they must be encouraged to contribute in the well-being of environment. Through our app we have tried to maintain user consistency through easy interface, transparency, status of footprints and suggestions.

1) After selecting "calculate footprints," the app asks the user for information about their daily activities and way of life. They have daily waste production, energy use, fuel consumption, travel preferences, walking distances, and electricity usage.
2) After selecting formulae option user direct' s to the formulae section which consist of formulae used in our app.
3) The app calculates user's carbon footprint and shows theresult after user had entered their data. This can contain a breakdown of the various elements that go into creating user'scarbon footprint.
4) After footprint calculation user will get provided with suggestion button where user gets suggestion to reduce their carbon footprints.
5) It also shows the status of footprint as green, intermediate, or dark footprints depending on the final footprint of the user.
6) Accordingly, to user's unique situation, 'C Impression app' offer suggestions for lowering user's carbon footprint. They can include recommendations for consuming less energy, altering your transportation routine, or adopting a more sustainable diet.

1 Google trends on Carbon Footprint calculator inIndia: https://trends.google.com/trends/explore?geo=IN&q=Carbon%20Footprint%20 calculator .

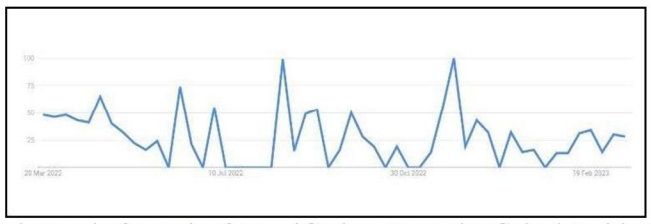


Fig.2. Google trend of search of term 'Carbon Footprint Calculator' in India.

Also, for the convenience of users, they have an option to view the user manual in which all the instructions of usage of our toolare mentioned. Users also have an option to share score through social media which makes it more interactive and will make more people to use our app. Thus, spreading more awareness tosave the environment by altering the behaviour to reduce the emissions.

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IV. FORMULAE USED FOR CALCULATION

1) Fuel footprint: user is asked to enter the daily fuel(petrol) usagein liters which is then multiplied by 2.33 as emission factor [10].
2) Garbage footprint: user is asked to enter the daily waste generated in kg which is then multiplied by 0.63 which is emission factor for waste generation [10].
3) Electricity footprint: user is asked to enter the monthly electricityusage (units) which is then divided by 30 to get daily usage which is then multiplied by 0.82 as emission factor [10].
4) Total footprint is the cumulative sum of different types of footprints.

Also, the status of footprints is displayed to the user as green orintermediate or dark.
If final footprint is less than 6 then user has green footprint. If itis between 6 to 14 it is intermediate. And it is dark for footprints greater than 14.

V. RESULTS AND DISCUSSION

By accepting inputs for crucial variables needed for calculations,our tool presents findings more precisely. Our tool is effective and simple to use because it displays results in an easy-to- understand style. Even though our app is easy to use, some usersmay find it a little confusing.
With these users in mind, we have created the user manual, which helps users to utilize our software effectively. Our app offers user instructions that include motivating details like strategies to engage and motivate the user in carbon reduction.
Users of our software have the option to view the formulaeused for the calculation, ensuring the transparency.
Our app offers the user a thorough analysis report and recommendations for reducing their carbon footprints in accordance with it. Analysis report contain the footprints calculated of various factors like fuel footprint, garbage footprint. Fuel footprint is the footprints calculated based onthe daily fuel usage of the person. Garbage foot- print is thefootprint of waste generation of the person in kg, as waste generation is also contributing to the impact on environmentso it is necessary to calculate it. Electricity footprint describes the electricity usage of a person on daily basis andbased on these factors, total footprint is generated.
Based on the final carbon footprint of the user, our app shows the state of footprint whether it is green intermediateor dark which very easy to understand and this in- creases user-engagement and ensures user consistency. Also, our application gives users the option to share their calculated carbon footprints via social media expand- ing its user baseto thousands of people. More individuals are encouraged to use our app. As a result, it ultimately causes more people to become conscious of the need to protect the environment and change their behaviour accordingly.

VI. CONCLUSION

Our app is being made with the objective to spread awareness regarding CO2 emissions and help people analyzewhether their actions are contributing to the well-being of environment or not. Our app provides user a detailed reportof his/her carbon footprint for the same.
Our app is easy to use and simple which makes it more interesting for user to maintain consistency, which makes our 'C-Impressions' different from other calculators. It willalso show users comparative data of calculated footprints with the ideal ones to alter the behaviour in accordance to improve it.
By displaying the formulas used to calculate carbon footprint, our app keeps user's interactions transparent.
Our app also provides users with user manual in case of anyconfusion. Also, end-users have option to view the formulaeused for the calculation to ensure transparency. User will begiven an option to share his/her carbon footprints through social media making it an effective way of spreading awareness.
'MAU Carbon Footprint Calculator' developed for Mauritian citizens was studied [1]. Also, the paper based on 'Carbon Footprint Analysis Behaviour for a Sustainable University Campus in China' [2] was studied for writing this paper.
In future, our app can be collaborated with the environment friendly companies which could provide the persons havinglower carbon footprint with rewards or coupons in order to encourage environment conscious behaviour.

VII. ACKNOWLEDGMENT

We want to thanks Prof. Balasaheb Jadhav for guiding us throughout this project and Prof. C.M Mahajan HOD (Department of EngineeringSciences and Humanities) for supporting us.

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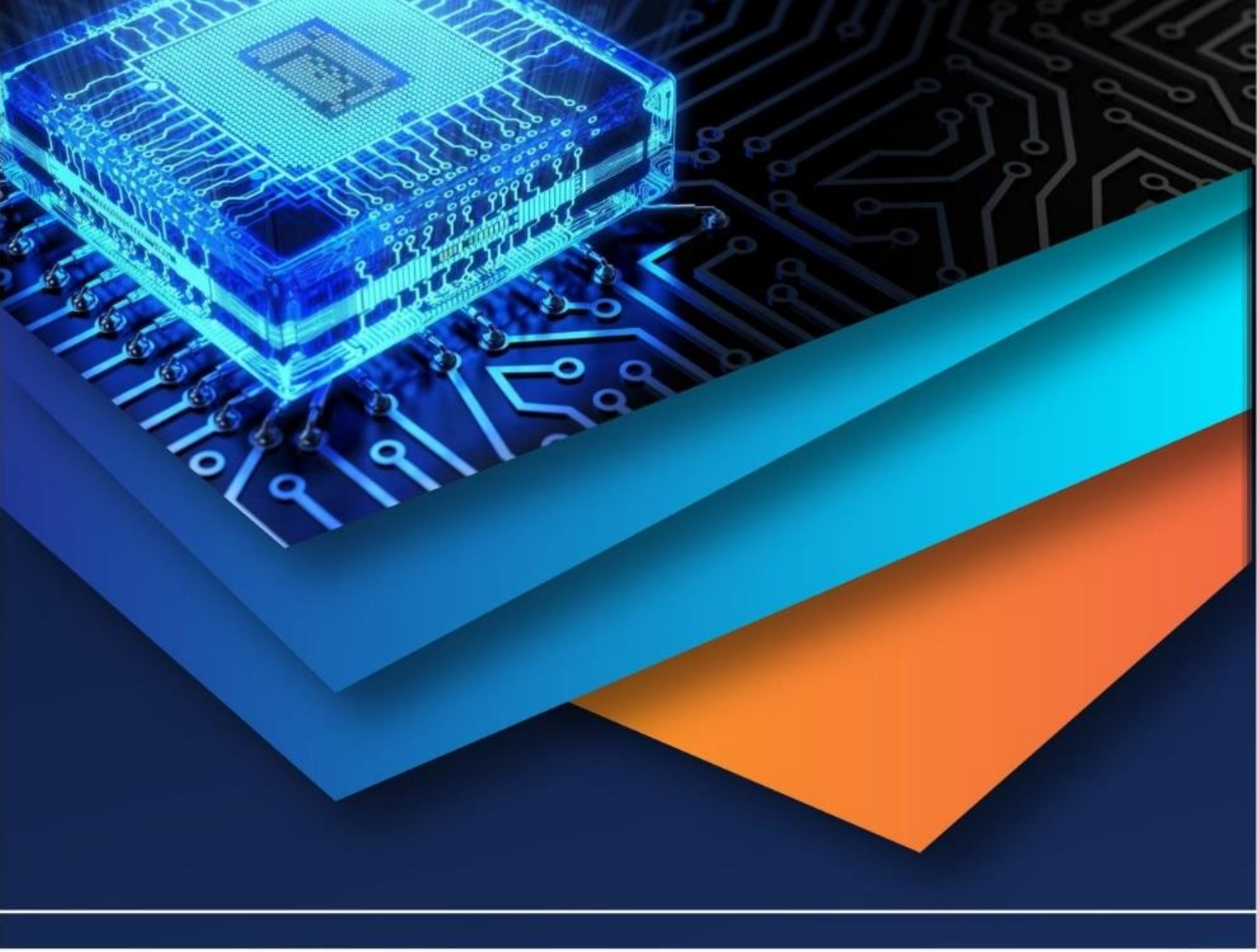

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