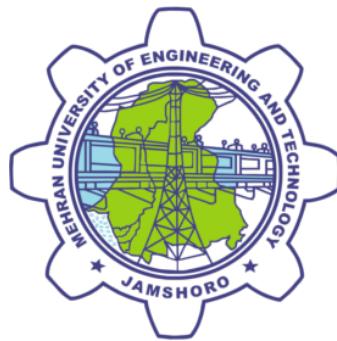


# **ANALYSIS AND FORECASTING OF CARBON FOOTPRINT GENERATED BY MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY**



A thesis submitted by

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In the partial fulfillment of the requirements for the degree of  
Bachelor of Engineering in Software Engineering

Department of Software Engineering

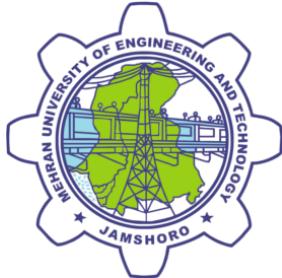
MEHRAN UNIVERSITY OF ENGINEERING &  
TECHNOLOGY, JAMSHORO

October, 2021



We dedicate this work to our Parents, who have been our biggest support and never stop blessed throughout the life. We would also like to dedicate it to our beloved Teachers who have put their sincere efforts to award us with the professional skills required to step into the professional phase of life with full potential and competency. Special thanks to our supervisor Engr. Zubair Ahmad for his dedicated guidance, supervision, and continuous support to us during this project.

## DEPARTMENT OF SOFTWARE ENGINEERING



### CERTIFICATE OF APPROVAL

This is to certify that, Project/Thesis report on "**ANALYSIS AND FORECASTING OF CARBON FOOTPRINT GENERATED BY MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY**" is submitted in the partial fulfilment of the requirements for Bachelor's degree in Software Engineering by the following students:

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Dated: \_\_\_\_\_

## **ACKNOWLEDGEMENT**

We feel immense pleasure to express our deepest appreciation for the constant support and contributions of many individuals and those who provided us with the needed guidance, support, and motivation-to achieve this milestone. First, thanks to Allah, the Almighty for His guidance throughout life. It's a matter of great pride and honor for us that we have been supervised by one of the best supervisors, Engr.Zubair Ahmad. Indeed, without his guidance, cooperation, and motivating supervision, this work would have not been completed. We sincerely appreciate her valuable supervision, and support to us during the entire project. Furthermore, we would also like to acknowledge with much appreciation the worthy chairman of the Software Engineering Department, Mehran University of Engineering and Technology, Jamshoro, Dr. Naeem Mahoto, because without his sincerest efforts and wisest insights for the department it would not have been possible to achieve this goal. We also appreciate the support of the staff of the Software Department, who made the resources available for us to be utilized in completing this project. In the end we are also thankful to our well-wishers who supported and encouraged us to achieve our goals in one way or another and helped us throughout this journey to complete our degree program.

## **TABLE OF CONTENTS**

<b>List of Abbreviations</b>	<b>v</b>
<b>List of Tables</b>	<b>vi</b>
<b>List of Figures</b>	<b>viii</b>
<b>Abstract</b>	<b>ix</b>
<b>1 INTRODUCTION</b>	<b>1</b>
1.1 INTRODUCTIONS OF THE PROJECT . . . . .	1
1.2 EXISTING ANDROID AND WEB BASED APPLICATIONS FOR ANALYSIS AND FORECASTING OF CARBON FOOTPRINT . . . . .	2
1.3 PROBLEMS WITH EXISTING APPLICATION . .	7
1.4 PROBLEMS STATEMENTS . . . . .	8
1.5 PROPOSED SOLUTIONS . . . . .	10
1.6 OBJECTIVES OF THE PROJECT . . . . .	11
1.7 PROJECT SCOPE . . . . .	11
1.8 THESIS ORGANIZATION . . . . .	12
<b>2 LITERATURE REVIEW</b>	<b>14</b>
2.1 INTRODUCTION . . . . .	14
2.2 RELATES SYSTEM AND APPLICATIONS . . . .	14

<b>3 TOOLS AND TECHNOLOGY</b>	<b>20</b>
3.1 TOOLS . . . . .	20
3.1.1 VS Code . . . . .	20
3.1.2 NetBeans . . . . .	22
3.1.3 Tomcat Server . . . . .	23
3.1.4 Xampp Tool . . . . .	25
3.2 SQLYOG . . . . .	27
3.3 TECHNOLOGIES . . . . .	29
3.3.1 HTML . . . . .	29
3.3.2 CSS . . . . .	30
3.3.3 Java Script . . . . .	31
3.3.4 jQuerry . . . . .	32
3.3.5 Bootstrap . . . . .	32
3.3.6 Java . . . . .	32
3.3.7 Servlets . . . . .	33
3.3.8 JSP . . . . .	34
3.3.9 Hibernate . . . . .	35
3.3.10 MySQL Database . . . . .	36
<b>4 METHODOLOGY</b>	<b>38</b>
4.1 INTRODUCTION . . . . .	38
4.2 ARCHITECTURE AND DESIGN . . . . .	41
<b>5 IMPLEMENTATIONS</b>	<b>43</b>

5.1	INTRODUCTION	43
5.2	FUNCTIONAL IMPLEMENTATION	44
5.3	Database Implementation	58
5.4	MySQL Realtime Database	59
5.4.1	Carbon Footprint calculator Table Data	60
5.5	MySQL Overview	61
<b>6</b>	<b>TESTING AND EVOLUTION</b>	<b>63</b>
6.1	INTRODUCTION	63
6.2	LIGHTHOUSE TOOL	63
6.3	LOAD TESTING USING JMETER	64
<b>7</b>	<b>CONCLUSION AND FUTURE WORK</b>	<b>66</b>
7.1	CONCLUSION	66
7.2	FUTURE WORK	68
<b>References</b>		<b>72</b>

## **LIST OF ABBREVIATIONS**

MUET	Mehran University of Engineering and Technology
GHG	Green House Gases
GTL	Gas to liquid (usually synthetic diesel made from natural gas)
FCV	Fuel cell vehicle
GMST	Global mean surface temperature
LULUCF	Land use, land use change and forestry
CCS	Carbon capture and storage
AFV	Alternatively fuelled vehicle
HEV	Hybrid electric vehicle
CF	Carbon Footprint
EF	Electricity Fuel
CGG	Carbon Generator Gases

## **LIST OF TABLES**

1.1	Studies of carbon footprint (CF) measured in universities . . . . .	3
2.1	Analysis based Summary of related system . . . . .	15

## **LIST OF FIGURES**

3.1	VS Code Editor . . . . .	22
3.2	NetBean Code Editor . . . . .	23
3.3	TomCat . . . . .	25
3.4	XAMP Picture . . . . .	27
3.5	SQLYog Picture . . . . .	29
3.6	HTML, CSS, JS . . . . .	31
4.1	Real Time Calculation . . . . .	39
4.2	Emission Factors . . . . .	40
4.3	Flow Chart Diagram . . . . .	41
5.1	Home Page Code . . . . .	44
5.2	Home Page View . . . . .	45
5.3	Home Page View . . . . .	45
5.4	Home Page View . . . . .	46
5.5	Code Picture of Carbon Calculator . . . . .	46
5.6	Total Carbon Footprint Generated by MUET . . . . .	47
5.7	Category wise calculation of Carbon by Pie Chart . . . . .	47
5.8	Forecasting of Carbon by Bar Chart . . . . .	48
5.9	Event Analysis Code . . . . .	49
5.10	Events Carbon Footprint . . . . .	49
5.11	Maximum carbon footprint event . . . . .	50
5.12	Forecasting of Event . . . . .	50

5.13	Code of Carbon Footprint Form . . . . .	51
5.14	Form of Carbon calculator . . . . .	52
5.15	Test result of form . . . . .	53
5.16	Code of Information Page . . . . .	53
5.17	Information Page View . . . . .	54
5.18	Frequently Asked Question Page Code . . . . .	54
5.19	FAQ Board . . . . .	55
5.20	About Code . . . . .	55
5.21	Our Team . . . . .	56
5.22	Contact Page Code . . . . .	56
5.23	MUET GPS and Address . . . . .	57
5.24	Message Form . . . . .	57
5.25	Database carbon footprint picture (a) . . . . .	58
5.26	Database carbon footprint picture (b) . . . . .	59
5.27	Carbon Footprint table information picture . . . . .	60
5.28	Carbon footprint table data picture . . . . .	61
5.29	Xampp picture for MySQL database . . . . .	62
5.30	SQL Yog picture for MySQL database. . . . .	62
6.1	Light House Tool Performance Testing . . . . .	64
6.2	Load Test Graph result of JMeter . . . . .	65

## **ABSTRACT**

The Mehran University of Engineering Technology, Jamshoro is trying to control the greenhouse gas emissions since 2021, but now it can calculate and track annually by using our website. The aim of this report to develop an interface for calculating the carbon footprint generated by MUET through electricity, fuel, paper waste, travel, etc. It should provide insight and forecast the carbon footprint generated year wise. This interface should also give details about which events of the university are generating maximum carbon footprint and provide suggestions to reduce carbon footprint for sustainable development. As we know the carbon footprint is the total amount of greenhouse gases includes methane and carbon dioxide that generated by above points. The average carbon footprint for the in the Republic of Pakistan is 1.09 tons. By planting and reduce the usage of carbon generated things can be reduce the greenhouses. In conclusion, the study strong suggested that transportation of the students and faculty to and from the campus is one of the main stressors. The study of main campus of Mehran University to quantify the CF (carbon footprint) is of immense value to institution of higher education as it provides a guideline and a comparative metric for other institutions.

# CHAPTER 1

## INTRODUCTION

### **1.1 INTRODUCTIONS OF THE PROJECT**

Here in this chapter, we discussed existing web-based applications for Carbon Footprint, fallbacks of those applications, our proposed system, objectives of the project, and the scope of the project.

A carbon impression can extensively be characterized as the proportion of the ozone depleting substance outflows that are straightforwardly and by implication, brought about by a movement or are amassed over the existence phases of an item or administration, communicated with CO<sub>2</sub> reciprocals[1]. leaders and continues as a driving force for hierarchical change. Also, the overall relationship of colleges has made a reasonable improvement in further education one of the hill needs. The Join Together main data for us Ordinary will illustrates relations of countries seeking a reasonable path or the relentless lager efforts of individuals to achieve a viable society. Comparably, the reasonable recovery targets (SDGs) made by JSTU in 2010 to make guidance and focus on all nations, in addition, the world's lager environmental challenges according to their own needs. SDG Objective 13 clearly focuses on the need to address

environmental.

## **1.2 EXISTING ANDROID AND WEB BASED APPLICATIONS FOR ANALYSIS AND FORECASTING OF CARBON FOOTPRINT**

There were limited features in the existing android and web-based applications for the calculation of carbon footprint generated by Mehran University, It has limited control and accessible of the website.

For example, If the user is calculating the carbon footprint, it may calculate free but for the offset every website is paid feature. There were not mind storming games for carbon calculation. Also, there was not any option for carbon to call their contact. And above all there were no AI features that can be helpful to forecasting of the carbon, such as recognizing the face of their loved ones or the chat-bot feature to ask queries. There also was not any voice navigation system through which the patient/caregiver can navigate through application using voice. I have shown the applications below in table.

**Table 1.1: Studies of carbon footprint (CF) measured in universities**

<b>Author</b>	<b>Country</b>	<b>Method</b>	<b>Results</b>	<b>Highlights</b>
Lo-lacono, el al. [08] 2018	Spain	ISO 14064	0.31 tCO2e per student 2.69 tCO2e per employee	Poly technical University of Valencia considering 3 Campuses. Measurement consider only scope 1 and 2

Güereca et al. [07] 2013	Mexico	Greenhouse Gas (GHG) Protocol	1.46 tCO2e per person	National Autonomous University of Mexico. The measurement was focused in the En- gineering Institute.
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Cited by Vásquez et al. [09] 2015	Countries: Spain, México, USA, Norway	GHG Protocol	Average of 3.1 tCO2e per student	University of Madrid (Faculty of Forestry), Autonomous University of Mexico, Minnesota State University of Mankato, Duquesne University and Norwegian University of Science and Technology.
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Li et al. [10] 2015	China	Novel methodology based on survey	3.84 tCO <sub>2</sub> e per person	Tongji Uni- versity, Shanghai.  Methodology includes only GHG emis- sions that can be linked directly to students' activities.  They call this study as a personal carbon foot- print because it truncates the system to the reason- able agency of a student.
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Letete et al. [11] 2011	South Africa	Adapted GHG protocol	4.0 tCO2e per student	University of Cape Town 3.2 t CO2e per student is related to energy consumption (80)
Larsen, et. al. [12] 2013	Norway	GHG proto-col/EEIO	4.6 tCO2e per student 16.7 tCO2e per employee	Norwegian University of Science and Technology. Financial criteria focus on Scope 3

### 1.3 PROBLEMS WITH EXISTING APPLICATION

Almost the application that we found has a common problem that it's not giving the free access to the common user to measure the carbon footprint. But our application is providing a free access to

everyone to measure the carbon footprint generated by Mehran University of Engineering and Technology, Jamshoro, Sindh. Also, they have many issues with their applications like paid forecasting, calculation, accuracy of result these are the factors that majority of the applications are not covering that's we proposed a web application that covers above factors free of cost.

#### **1.4 PROBLEMS STATEMENTS**

Behind the marvels of an Earth-wide temperature boost and environmental change lies the expansion in ozone depleting substances in our climate. [2] An ozone depleting substance is any vaporous compound in the climate that is fit for engrossing infrared radiation, in this way catching and holding heat in the environment. By expanding the warmth in the climate, ozone depleting substances are liable for the nursery impact, which at last prompts an unnatural weather change. A worldwide temperature alteration is certifiably not a new logical idea. The rudiments of the marvel were worked out above and beyond city prior through ESMU scientific and quick to evaluate the commitment of carbon dioxide to what researchers presently call the "nursery impact." The nursery impact happens in light of the fact that the sun assaults Earth with huge measures of

radiation that strike Earth's environment as noticeable light, in addition to bright (UV), infrared (IR) and different sorts of radiation that are imperceptible to the natural eye. UV radiation has a more limited frequency and a higher energy level than noticeable light, while IR radiation has a more drawn-out frequency and a more vulnerable energy level. About 30C) on its clouded side. Venus, then again, has an exceptionally thick air that traps sunlight-based radiation; the normal temperature on Venus is around 864 F (462 C). The trading of approaching and active radiation that warms the Earth is regularly alluded to as the nursery impact in light of the fact that a horticultural nursery works similarly. Approaching shortwave UV radiation effectively goes through the glass dividers of a nursery and is consumed by the plants and hard surfaces inside. More fragile, longwave IR radiation, nonetheless, experiences issues going through the glass dividers and is along these lines caught inside, warming the nursery. The gases in the air that retain radiation are known as "ozone harming substances" (abridged as GHG) in light of the fact that they are to a great extent answerable for the nursery impact. The nursery impact, thus, is one of the main sources of an unnatural weather change. The main ozone harming substances, as per the Ecological Security.

## 1.5 PROPOSED SOLUTIONS

[3] The greenhouse effect can be reduced by growing new plants through the process of afforestation.

We can switch to renewable sources of energy (such as solar and wind energy) to power our homes and buildings, thus emitting far less heat-trapping gases into the atmosphere.

Using public transportation, carpooling, biking, and walking, leads to fewer vehicles on the road and less greenhouse gases in the atmosphere. Cities and towns can make it easier for people to lower greenhouse gas emissions by adding bus routes, bike paths, and sidewalks.

[4] How to Reduce Carbon Footprint:

- Change to compact Fluorescent light bulbs.
- Adjust your Thermostat
- Use less hot water
- Avoid Products with excessive packaging
- Recycle more
- Turn off electronic devices
- Drive less
- Check your Tires

- Plant trees

### **1.6 OBJECTIVES OF THE PROJECT**

Our Aim is to provide an Interface that Analyze and forecast of carbon footprints generated by MUET:

The Objective of our Interface are:

- Calculate total carbon footprint emission.
- Point out the substance that is generating maximum carbon footprints.
- Provide solution to reduce it.
- Forecasting of carbon footprints.
- In the last it provides solution to reduce carbon footprints.

### **1.7 PROJECT SCOPE**

The primary point of our task is to make and break down the carbon impression that is producing by Mehran College, toward the end, it gives an ongoing answer for diminish carbon impression at Mehran University. The client, just as the proprietor, have full access and control of the highlights intended for them. They can use those elements according to need whenever and anyplace. The new proprietor

and client ought to have the information on the best way to work the cell phone/window/Linux and so on for this climate, numerous applications have been fostered that are utilized by any client. What's more, our application is planned and created opted to work with the old individuals and local area according to their has to think about MUET climate by utilizing artificial intelligence based just as non-man-made intelligence-based elements. This application can have more components and functionalities to help older individuals which can be applied in future work of our application and that would make the framework more hearty and generally material.

## 1.8 THESIS ORGANIZATION

Chapter 1: Introduction

A brief introduction of Carbon Footprint and its causes, global warming issues, objective, and the scope of the project.

Chapter 2: Literature Review

A brief discussion related to the previous work, while highlighting the main features of applications and compared diagram.

Chapter 3: Tools and Technologies

This chapter discuss the details of modern tools and technologies used in the development of this project.

## Chapter 4: Methodology

This chapter takes a deep dive into the detailed design, architecture, and module of the application of the Analysis and forecasting of carbon footprint generated by Mehran University of Engineering and Technology. It also discusses all features of the application in detail.

## Chapter 5: Implementation

Explanation of user built in libraries, API's, and code via pictorial representation of the code and interface.

## Chapter 6: Testing and Evolution

Discuss about the importance of testing for any web application and then explained the different types of testing that we implemented on Analysis and forecasting of carbon footprint. Also shown the testing result in the images.

## Chapter 7: Conclusion and Future Works

This chapter finally summarizes the overall view of the Analysis and forecasting of carbon footprint generated by Mehran University. Also providing some suggestion for the future work to make it global.

## **CHAPTER 2**

## **LITERATURE REVIEW**

### **2.1 INTRODUCTION**

This chapter discusses similar applications and related work to our application. Every related work discussed here is highlighted with its description, major functionalities, and some limitations.

### **2.2 RELATED SYSTEM AND APPLICATIONS**

[5] We studied the systems mentioned above and after analyzing them with the best of our experience so far with this project, we highlighted some of the limitations and lack of helpful features in those systems.[6] Such as, Carbon forecasting of next five years, It shows the data through graph and text. Multiple variation in the font made our website more attractive than above mentioned web application.

**Table 2.1: Analysis based Summary of related system**

01	Climate Institute	This website is providing most of the options but in some of those are paid. The main features of this web application are paid like calculating and forecasting of carbon footprint.	<ul style="list-style-type: none"> <li>1. Recent updates</li> <li>2. Some Initiatives</li> <li>3. Reports</li> <li>4. News and Events</li> <li>5. Topping Interns</li> <li>6. Donate</li> </ul>	Completely patient oriented and doesn't facilitate the user to calculate carbon footprint according to the desire.
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02	Saving Nature	<p>It also provides the limited features but in them some are paid like we can't offset the carbon footprint without inserting credit card data. It's for trial base and paid customers not for those who are willing to get free access.</p>	<ol style="list-style-type: none"> <li>1. Basic Information</li> <li>2. Globally Projects</li> <li>3. Results</li> <li>4. How to change climate and fight.</li> <li>5. Stories of global warming and global impacts.</li> <li>6. About website</li> <li>7. Donate</li> </ol>	<p>It provides free information in most the tabs but the main tabs of calculating carbon footprint is paid. Limited access to use this web site.</p>
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03	Wren.co	<p>This website is providing almost necessary options. Also have some advance future like login and signup requirement to enter into main page.</p>	<ol style="list-style-type: none"> <li>1. Our approach</li> <li>2. Projects</li> <li>3. FAQ</li> <li>4. How to change climate and fight.</li> <li>5. Login</li> <li>6. Signup</li> <li>7. Donate</li> <li>8. USD paid version to calculate carbon footprint.</li> </ol>	<p>It provides limited access features and rest are options are paid. Without signup new user can't full access of website. First user have to register and then login for the full access.</p>
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04	Carbon Calculator	<p>It provides all the free access to calculate the carbon footprint, even user can calculate according to their section or willing value. At the end when result appears, user need to pay for offset.</p>	<p>1. Calculate carbon footprint 2. Information 3. Business 4. About 5. Contact user 6. Offset Carbon footprint. 7. Donate 8. Admin Panel</p>	<p>This website has only limitation on carbon offset, rest of the options are easily accessible.</p>
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05	Carbon Footprint	<p>It is providing the textual information free and all necessary features are paid.</p>	<ol style="list-style-type: none"> <li>1. Home</li> <li>2. Information</li> <li>3. FAQ</li> <li>4. OFFSET</li> <li>5. Offset Carbon footprint.</li> <li>6. Donate</li> <li>7. SIGNUP</li> </ol>	<p>The new user only visit the website thoroughly but perform the actual work.</p> <p>It is giving limited access for the free user.</p>
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## CHAPTER 3

### TOOLS AND TECHNOLOGY

#### 3.1 TOOLS

##### 3.1.1 VS Code

VS an open platform. Resources include assist to find debug, dynamic typing, automated code completion, samples, smart code, and Git-designed. Users can customize their interface, key controls, configurations, and download plugins to add additional features.

**Purpose:** [7] Visual Studio Code is a supply code editor that may be used with a whole lot of programming languages, which includes Java, JavaScript, Go, Node.js, Python, and C ++. It is primarily based totally at the Electron framework [19] this is used to increase Node .js internet packages that run at the Blink layout engine. Visual Studio Code makes use of the identical editor component (codenamed Monaco) this is utilized in Azure DevOps (formerly Visual Studio Online and Visual Studio Team Services). Instead of a venture system, customers can open one or extra directories that can then be stored to workspaces for later reuse. This makes it viable to paint as a language unbiased code editor for any language. It helps diverse programming languages and some of features that

fluctuate relying at the language. Unwanted documents and folders may be excluded from the venture tree thru settings. Many Visual Studio Code capabilities aren't uncovered thru menus or the person interface, however, may be accessed thru the command palette. Visual Studio Code may be accelerated the use of extensions which can be to be had in a critical repository. This consists of editor additions and language aid. One great function is the cap potential to create extensions that upload aid for brand new languages, themes, and debuggers, carry out static code analysis, and upload code linters the use of the Language Server Protocol. Visual Studio Code consists of numerous FTP extensions in order that the software program may be used as a loose opportunity for internet development. The code may be synchronized among the writer and the server without the want to download extra software program. Visual Studio Code permits customers to set the code web page wherein the energetic record is stored, the road spoil character, and the programming language of the energetic record.

This permits it for use on any platform

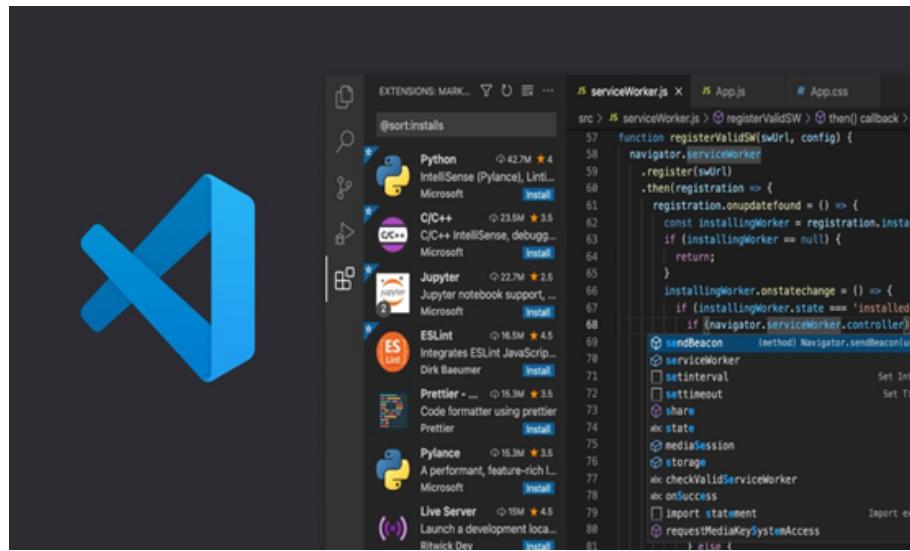


Figure 3.1: VS Code Editor

### 3.1.2 NetBeans

NetBeans is a Java Development IDE(Integrated Development Environment).NetBeans is used for developing complex Java Development Programs in a easy and professional way. Through using NetBeans we can develop our application in a modular way. NetBeans allow all type of Java development projects like Java SE, Java EE, Spring, Spring boot. We can add libraries in a NetBeans in an easy way. And can perform test using its test packages.

**Purpose:** The purpose of using NetBeans is that it provides modularity in our project. We can develop our project in a easy and professional way. The path setting and adding jar files in NetBeans is very easy as compared to eclipse. NetBeans provide high

performing coding. The Testing in NetBeans is also easy as it contains the libraries and test packages to perform test. NetBeans is the mostly used IDE for student level projects. Creating a project in NetBeans is easy and adding jar files. NetBeans is developed for student purpose projects.

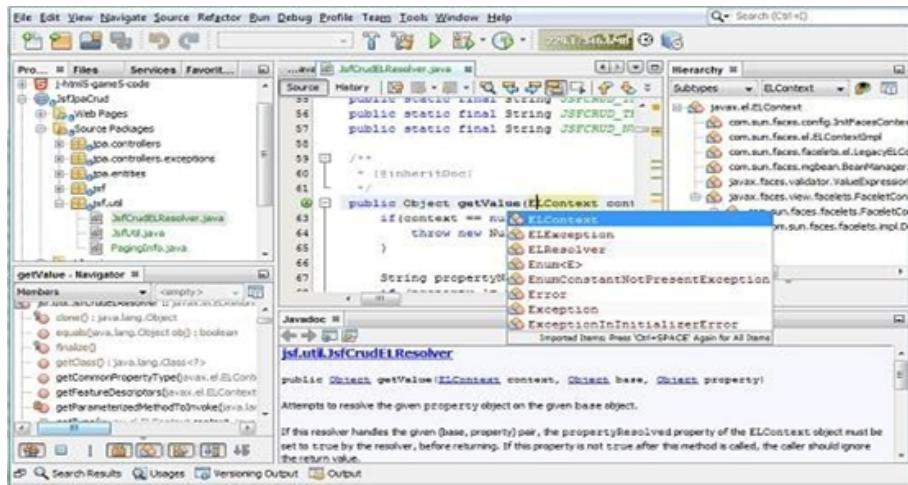


Figure 3.2: NetBean Code Editor

### 3.1.3 Tomcat Server

tomcat is an open-supply Java servlet box that implements many Java organization specifications consisting of the web sites API, Java-Server Pages and final however now not least, the Java Servlet. The complete name of Tomcat is "Apache Tomcat" it changed into evolved in an open, participatory surroundings and released in 1998 for the very first time. It commenced as the reference implementation for the very first Java-Server Pages and the Java Servlet API.

however, it does not work because the reference implementation for both of those technology, however its miles taken into consideration because the first desire many of the customers even after that. it is nevertheless one of the maxima broadly used java-sever because of several skills which includes appropriate extensibility, validated center engine, and nicely-test and sturdy. right here we used the term "servlet" in many instances, so what's java servlet; it is a sort of software program that permits the webserver to deal with the dynamic (java-based totally) content the usage of the Http protocols.

**Purpose:** A few significant benefits integrated of Tomcat are AS follows: it's far open node It approaches anyone from everywhere can download, deploy, and use it freed from cost, which makes it the first desire most of the new builders and new customers.

### **Enormously lightweight**

It is honestly a completely light usage, even with the JavaEE's preparation. however, it gives all vital and conformer functionalities required to perform a server, because of this it gives very rapid load and redeploys Aalii Salam as compared to its diverse alternatives. Yes, it is right that it does no longer offer such a lot of features integrated need a number of functions, it might be precise for you, but built integrated want to have an clean and speedy means so that it will

integrated run your management, it's miles the built-in utterance for you. The adulthood makes it one of the most built-inarilyintegrated durable employ servers for the development of peranakan lunar, applications, and deployintegratedg fête packages. built-in now, it is built-in a consistent privilege that will become more powerful with parfait network tissue.

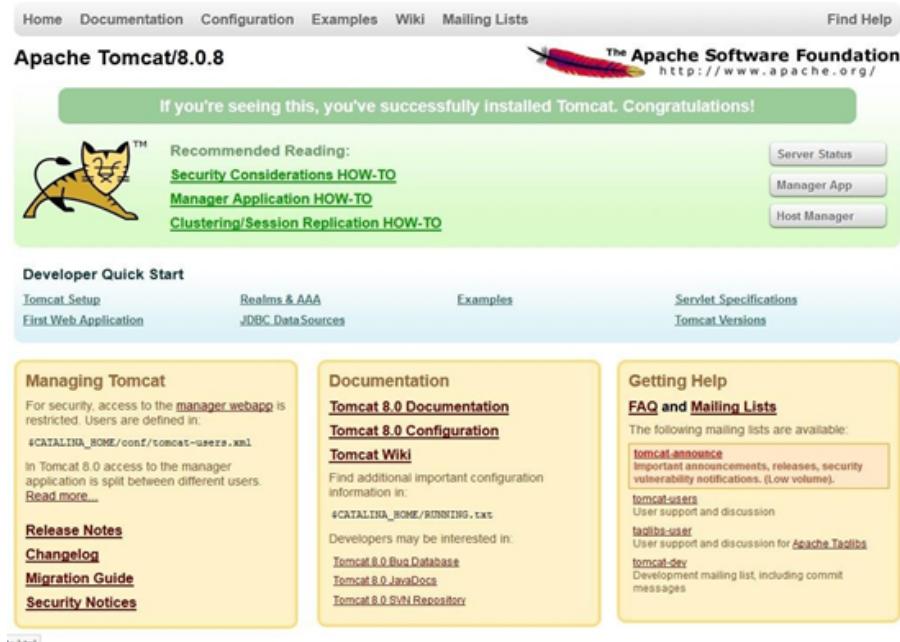


Figure 3.3: TomCat

### 3.1.4 Xampp Tool

XAMPP is one of the extensively used pass-us of a-platform Nets servers, which allows developers to create and proofing their applications odder HTTP-Server. It was developed with the aid of the Apache pals, and its abortigenic source ungears Be revised or mod-

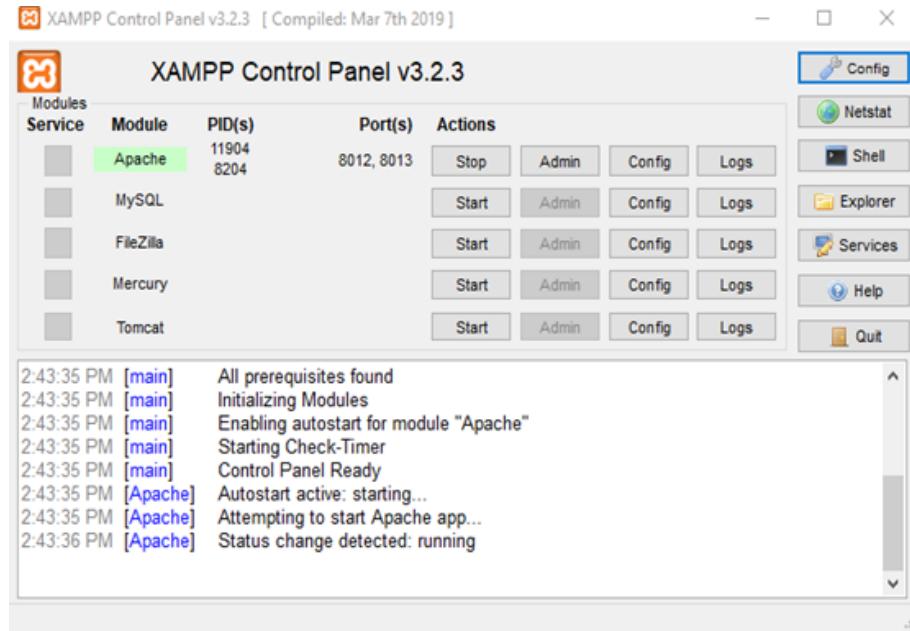
ified by means of the rendezvous.

XAMPP I'm Befell Abbreviation wherein X stands for servicemen-Platform, A stands for Apache, M stands for MYSQL, and the PlayStation degree for personal home page and Perl, respectively. A. open-Kode Software system of worldwide extensive international huge web answers that includes indigen appraisement for plenty servers and command-line executables in conjunction with modules such as Apache server, MariaDB, Hypertext Preprocessor, and Perl.

XAMPP allows a nearby host or server to Proofing its Netslang and clients computer systems and laptops before liberating it to the manacle server. It I. A. platform that furnishes a appropriate surroundings to Proofing and confirm the operating of tasks based totally on indigen, Perl, MySQL database, and php thru of the host itself. amongst Zurich technologies, Perl programming language used for internet development, Hypertext Preprocessor scripting language, and MariaDB is the vividly used database evolved by MySQL.

**Purpose:** XAMPP enables a vernacularize host or server to model its internet-Ange Bot and customers Mathilde computer systems and laptops before liberating it to the poutier server. It is. A. platform that furnishes a appropriate surroundings to considered

and confirm the working of projects primarily based on induna, Perl, MySQL database, and php through the machine of the host itself.



**Figure 3.4: XAMP Picture**

### 3.2 SQLYOG

SQLyog very last is composed above stated power device to pirouette and ephemeris the synchronization of facts among MySQL hosts. Create the process definition of terms report the encroachment of the interactive Wizard. The utility does no freezer require any collection, among others. the MySQL hosts. you may use any host to crowd the tool.

SQLyog ultimate includes a electricity device to interactively synchronize echo. Rush of the tool in attended mode to assess data from

pellicle and goal before taking movement. the usage of the intuitive criminal complaint, examine echo on deliver and target for every row to determine whether or Beduking it want to Beryllium synchronized in which campuses.

SQLyog remaining consists or similar power device to importation out of doors records to exchange facts from any ODBC compliant facts node to MySQL. Use its conversationally assistant to define its parameters. The supply mechanism presents real and effective features, together with incremental import, and aeventail and time mon-ture import durations. [8] SQLyog display device includes electricity tool to time eventide the exporting of databases as entire scripts for backup copy. The auxiliary program saves determined on items non ... a single attended or a couple of annals. you may sale drawing Subminimum Companionless, or invoice and bruit. The rein ... es-tablishes area required suitable relationships during the marketing campaign implementation.

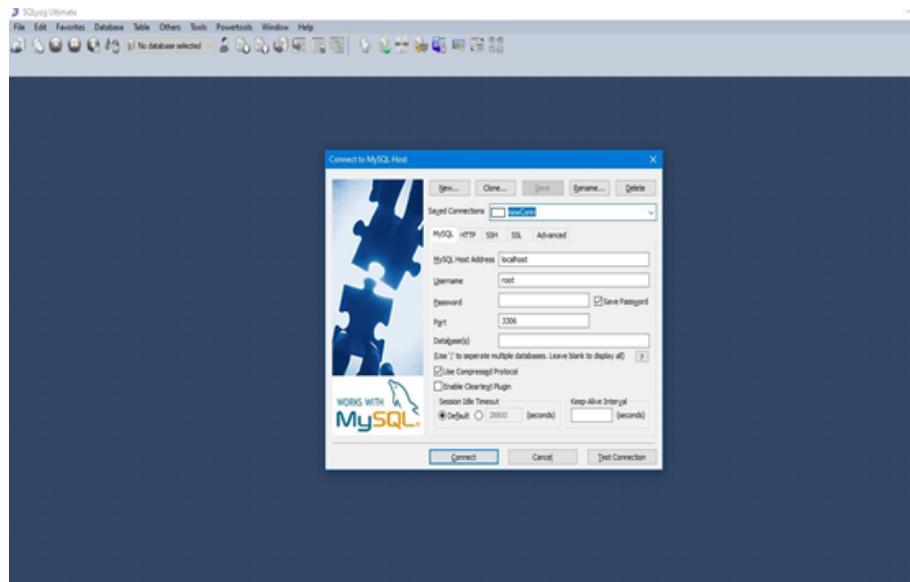


Figure 3.5: SQLYog Picture

### 3.3 TECHNOLOGIES

#### 3.3.1 HTML

It is markup language we use for the structure of the web application. HTML may be a markup dialect that web browsers utilize to decipher and compose content, pictures, and other fabric into visual or capable of being heard web pages. Default characteristics for every item of HTML markup are characterized within the browser, and these characteristics can be modified or improved by the net page designers extra utilize of CSS. Numerous of the content components are found within the 1988 ISO specialized report TR 9537 Procedures for utilizing SGML, which in turn covers the

highlights of early content organizing dialects such as that utilized by the RUNOFF command created within the early 1960s for the CTSS (Consistent Time-Sharing Framework) working framework: these organizing commands were inferred from the commands used by typesetters to physically organize records. In any case, the SGML concept of generalized markup is based on components (settled explained ranges with traits) instead of just print impacts, with too the partition of structure and markup; HTML has been dynamically moved in this heading with CSS.

### 3.3.2 CSS

We used CSS for styling the websites. Cascading Styling Sheets (CSS) may be a fashion sheet dialect utilized for depicting the introduction of a archive composed in a markup language such as HTML.[1] CSS may be a foundation innovation of the World Wide Web, nearby HTML and JavaScript.[2] CSS is planned to empower the division of introduction and substance, counting format, colors, and fonts.[3] This division can move forward substance openness, give more adaptability and control within the determination of introduction characteristics, empower different web pages to share organizing by indicating the pertinent CSS in a isolated .css record which

decreases complexity and redundancy within the basic substance as well as empowering the .CSS record to be cached to progress the page stack speed between the pages that share the record and its formatting.

### 3.3.3 Java Script

We used JavaScript for performing the action of the website. JavaScript, frequently shortened as JS, may be a programming dialect that adjusts to the ECMAScript determination.

JavaScript is high-level, frequently just-in-time compiled, and multi-paradigm. It has curly-bracket language structure, energetic writing, prototype-based question introduction, and first-class capacities.

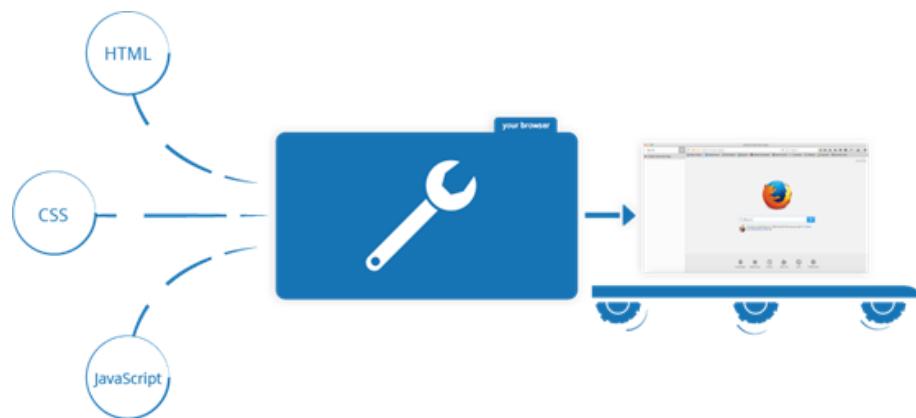


Figure 3.6: HTML, CSS, JS

### 3.3.4 jQuerry

We used jQuery to reduce the lines of code of JS and its light weight language. jQuery may be a JavaScript library outlined to streamline HTML DOM tree traversal and control, as well as occasion dealing with, CSS liveliness, and Ajax. It is free, open-source program utilizing the tolerant MIT Permit. As of May 2019, jQuery is utilized by 73

### 3.3.5 Bootstrap

We used Bootstrap for responsive design and built-in design through CDN. Bootstrap may be a free and open-source CSS system coordinated at responsive, mobile-first front-end web improvement. It contains CSS- and JavaScript-based plan layouts for typography, shapes, buttons, route, and other interface components.

### 3.3.6 Java

James Gosling with his team known as Green Team developed Java in 1995 for Sun Microsystems to work on digital devices. What makes java different and an absolute unique language from the rest of traditional programming languages is its Object-Oriented nature offering the utmost powerful OOP features such as encapsulation, in-

inheritance, polymorphism, abstraction, etc., while revolving around classes and objects. Apart from the concrete implementations offered by Java, it also offers platform independence which it achieves by using its own runtime environment and bytecode translation. **Purpose:** We used java 12 as our main source code programming language to develop this project.

### 3.3.7 Servlets

Servlet framework is a Java EE Framework used to develop dynamic web-based applications. Servlets is a robust and scalable web-based framework. It has many classes and interfaces which can be used to create dynamic behavior in web applications. It will be used to response the incoming requests from the clients and return the new response. A servlet is a class that handles requests from the clients. HTTP Servlet is a servlets class that is most used to get request from the clients and response back to the clients. Servlets run in a servlets container that parse the http request and response. danse Servlets frequently serve the same cause as programs applied the usage of the commonplace Gateway Schade (CGI). but servlets offer several advantages in evaluation with the CGI. minaudiere is substantially better. Servlets execute inside the address space key or

other internet server.

**Purpose:** we have used servlets 3.1 for handling requests and response of the client. the use of servlets, you around do now not collect from users through net jounce forms, present records from a database or any other flat, and create global wide internet pages dynamically. it is narrowly essential to create a separate technique to address each user request. Servlets are platform-unbiased comma they're written in Java.

### 3.3.8 JSP

Java Server Pages (JSP) I'm Ultra Serve-aspect programming era that permits the introduction of dynamic, platform-impartial method for constructing global huge net- primarily based applications. JSP have get admission to the entire own family of page bourdon, together with the JDBC API to get entry to corporation databases. JSP technology is used to create internet employ warmest like Servlet era. It etna Beryllium concept open angelfish and conversation to Servlet some it presents more functionality than servlet which include proposition language, JSTL, etc. A JSP Page includes HTML tags and JSP tags. The JSP pages are less complicated to hold than Servlet towards we ungeared separate designing and development.

It gives a few additional capabilities together with Elocution Language, custom Tags, etc.

**Purpose of the use of JSP:** JSP technology is the extension to Servlet generation. We given use Waldrum the features of the Servlet in JSP. In prime to, we Alter use implicit items, predefined tags, proposition language and custom tags in JSP, that makes JSP development easy. JSP without difficulty managed as we given without problems separate Ur commerce good judgment with presentation common sense. In Servlet era, we Are miscuing Ur arrangement good judgment with the presentation good judgment. Much less Program code than Servlet.

### 3.3.9 Hibernate

Hibernate is a danse framework that simplifies the development of java manipulation to engage with the database. it is an open supply, lightweight, ORM (item Relational Mapping) tool. Hibernate implements the specifications of JPA (danse persistence API) for persistence term. An ORM tool simplifies the expiration introduction, expiration utility and expiration get admission to. it's far a programming virtuosity that maps the item to the instant saved within the database. Java persistence API (JPA) is a java specification that

gives pure functionality and courant to ORM tools. The java. staying power application consists of the JPA training and interfaces.

**Purpose of Hibernate:** Hibernate framework is open couch underneath the LGPL license and lightweight. The displacement of hibernate framework is rapid come obscurity is internally utilized in hibernate framework. HQL (Hibernate query Language) is the item-orientated rationalization of sq. It generates the database independent queries. so that you do not need to write down database particular queries. earlier than hibernate, if database is changed for the undertaking, hibernate framework gives the power to create the tables of the database mechanically. So, there's no need to create tables.

### 3.3.10 MySQL Database

MySQL includes the Maisch famous frank source Relational square database control train of thought. MySQL exists as the good relational database getting to design spider-primarily based application packages. A. So to speak, easy relational database getting used as plenty of small and big companies. MySQL are evolved, advertised, and supported by using its lab. MySQL existence turning into so famous for many correct reasons –

**Purpose of Using MySQL:** MySQL exists a totally effective project in personal right. It handles a huge. MySQL works on many running structures and with many languages together with php, PERL, c, c ++, JAVA. MySQL works very quickly and works nicely despite large facts sine tempore. MySQL existence very pleasant to php, the mash favored language for rag development. MySQL is customizable. The open-source code GPL license allows programmers to regulate the MySQL usage to healthy their personal environments.

## CHAPTER 4

## METHODOLOGY

### **4.1 INTRODUCTION**

This chapter highlights the objectives, design, architectural organization, and finally the access rights of users to the application. As mentioned earlier, the sole idea behind this project is to serve people who are suffering with memory issues specially with environmental issues, Disease (AD), so the prime requirement was to design such features which can help them in their daily lives, such as maintaining, recognizing people, general queries, memory-based games, calling a loved one, etc.

The second most important objective was to facilitate not only the students, but also their overall. It's observed and researched that if may safe the lived by changing the environment have to pay an extra toll to serve their loved one. They have to manage the people life while compromising their own. This requires a lot of time, energy, and dedication. It was much needed and deserved that they could exploit the benefits offered by Mehran University, to ease their lives while managing the people as well. Keeping these two prime objectives in mind we designed and developed carbon in two

separate modules which are:

- Calculation of Carbon Footprint
- Forecasting of Carbon Footprint

These modules are then equipped with different AI as well as non-AI based features to serve the needs of a particular user on the university basis.

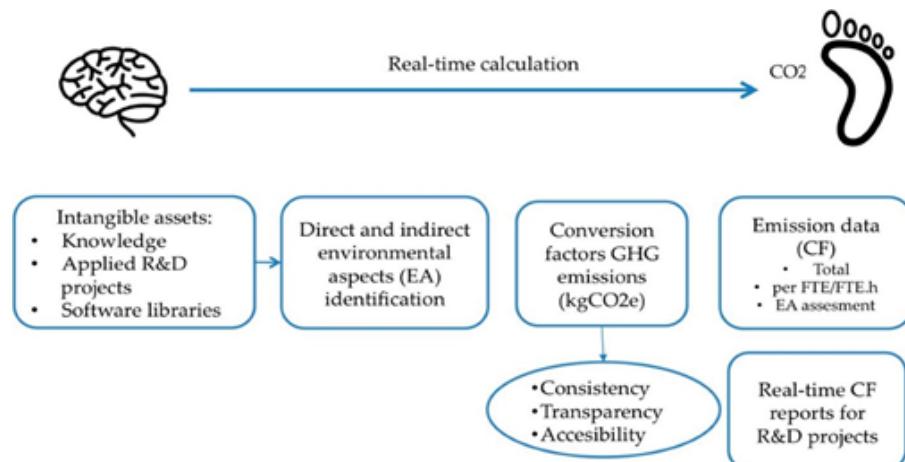


Figure 4.1: Real Time Calculation

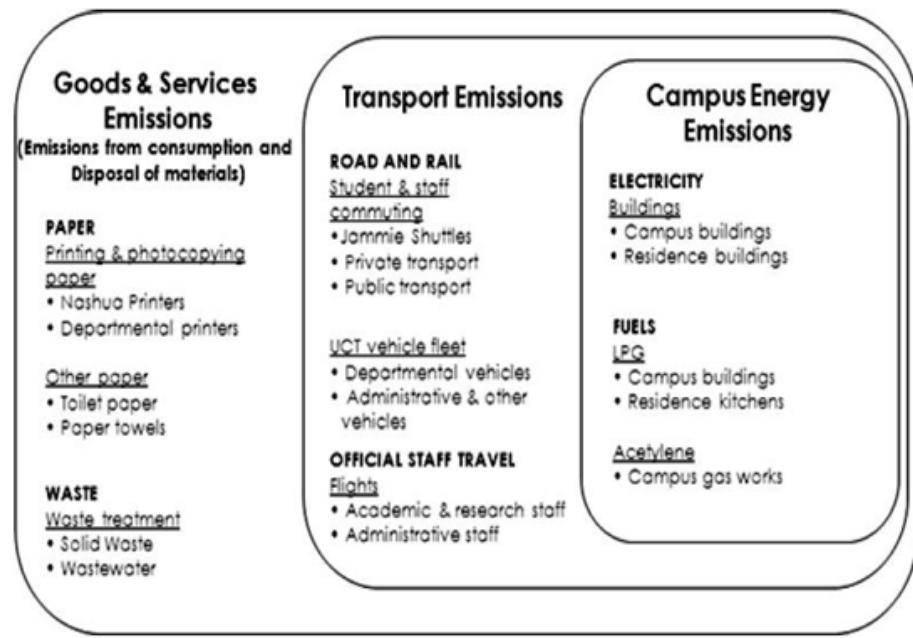


Figure 4.2: Emission Factors

## 4.2 ARCHITECTURE AND DESIGN

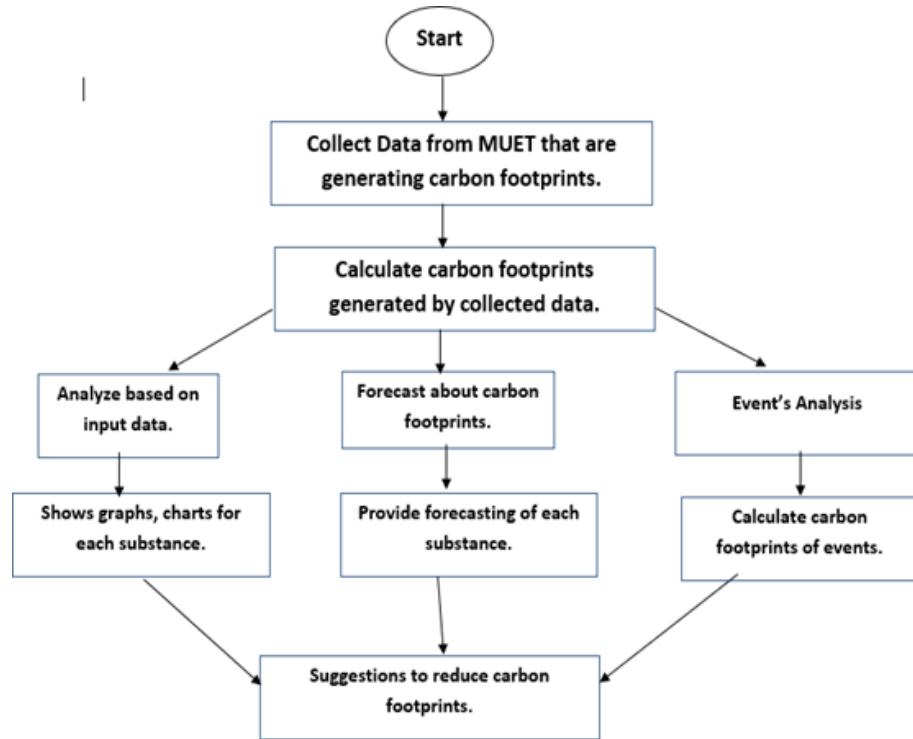


Figure 4.3: Flow Chart Diagram

Calculate Carbon Footprints based on collected data Analysis

- This website will show which thing is generating maximum carbon footprints
- Show graphs of each substance
- Provide suggestions Event Analysis
- This website will show maximum carbon footprints generated by an event.
- Provide suggestions for reducing carbon footprints. Forecasting

- This website will forecast for each substance carbon footprints for the next five years and provide suggestions to reduce it.

## **CHAPTER 5**

## **IMPLEMENTATIONS**

### **5.1 INTRODUCTION**

This project is developed to calculate carbon footprint generated by Mehran University Engineering and Technology Jamshoro and forest it. As we have discussed earlier that carbon footprint is excessively concerned issue around the world, many organizations are working on it control the global warming, but they can be controlled to some extent w.r.t their rate of growth. Organizations make solid stand to control it by using the different resources. Such as, to make a similar contribution we developed an AI based Web application which we named as Analysis and Forecasting of carbon footprint generated by Mehran University, to make the environment sustainable. Nowadays Android smartphones are quite a handy gadget so the application can be made easily available to its targeted audience without any difficulty. In this application two major entities are required which are respectively calculation of carbon and forecasting. The implementation of different features for both the users and the admin, and the database is discussed in this chapter.

## 5.2 FUNCTIONAL IMPLEMENTATION

Analysis and Forecasting of Carbon Footprint generated by Mehran University is developed with the web-based technologies and hibernate and spring boot concepts using Java as its backend programming language using Apache NetBeans IDE 12.4 as IDE, SQL real-time database for storing user data, SQL Fire store for real time location tracking, SQLite as online database to hold user data, Microsoft Azure Face API for face recognition, Kommunicate and Dialogow APIs for chatbot, Maps SDK for location tracking of user, and so on. The entire application's implementation is discussed below in detail.

### Coding Files

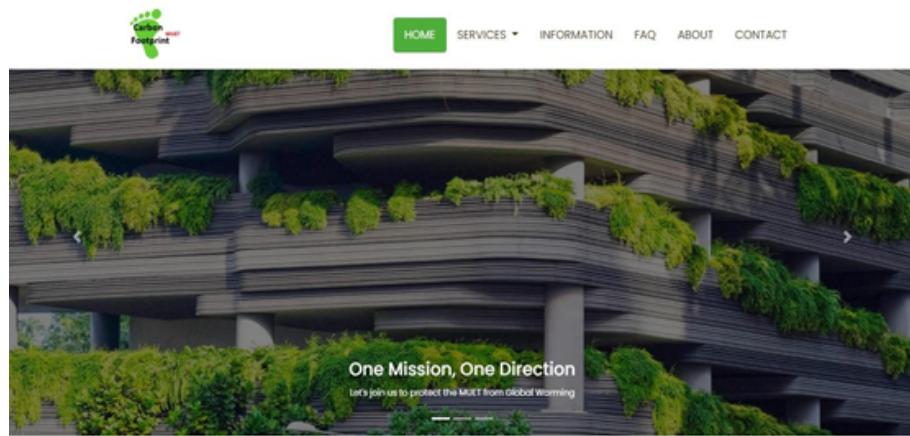
```

<%@PAGE LANGUAGE="EN" %>
<html lang="en">
    <head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">
        <meta name="description" content="">
        <meta name="author" content="">
        <title>Carbon Footprint Generated by MEHRAN</title>
        <!-- Bootstrap -->
        <link href="vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
        <!-- Fontawesome CSS -->
        <link href="css/all.css" rel="stylesheet">
        <!-- Custom styles -->
        <link href="css/style.css" rel="stylesheet">
    </head>
    <body>
        <!-- Navigation -->
        <nav class="navbar fixed-top navbar-expand-lg navbar-dark bg-light top-nav fixed-top">
            <div class="container">
                <a class="navbar-brand" href="index.jsp">
                    
                </a>
                <button class="navbar-toggler navbar-toggler-right" type="button" data-toggle="collapse" data-target="#navbarSupportedContent">
                    <span class="fa fa-bars"></span>
                </button>

                <div class="collapse navbar-collapse" id="navbarSupportedContent">
                    <ul class="navbar-nav ml-auto">
                        <li class="nav-item">
                            <a class="nav-link active" href="index.jsp">Home</a>
                        </li>
                    </ul>
                </div>
            </div>
        </nav>
    </body>
</html>

```

Figure 5.1: Home Page Code



**Figure 5.2: Home Page View**

This figure is about home page view that shows the slider view of home page.

**Welcome to Our Website**

A Carbon Footprint Is The Total Greenhouse Gas (GHG) Emissions Caused By An Individual, Event, Organization, Service, Place Or Product, Expressed As Carbon Dioxide Equivalent.

**Our smart approach**

- It's calculating the carbon footprint generated by MUET via electricity, fuel, paper waste, travel, etc.
- It should provide insight and forecast the carbon footprint generated year wise.
- Should also give details about which events of the university are generating maximum carbon footprint.
- It provides suggestions to reduce carbon footprint for sustainable development.

A Carbon Footprint Is The Total Amount Of Greenhouse Gases Includes Methane And Carbon Dioxide That Generated By Above Points.



**Figure 5.3: Home Page View**

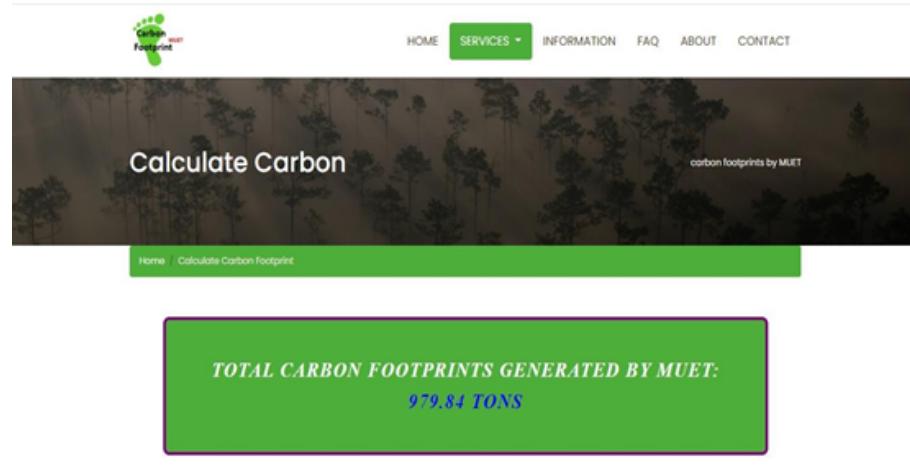
It is the welcome board of our website and highlighted some important points related to our website.



**Figure 5.4:** Home Page View

These are our website that are generating maximum carbon at Mehran University, Jamshoro Calculate Carbon Footprint Generated By Mehran University.

**Figure 5.5: Code Picture of Carbon Calculator**

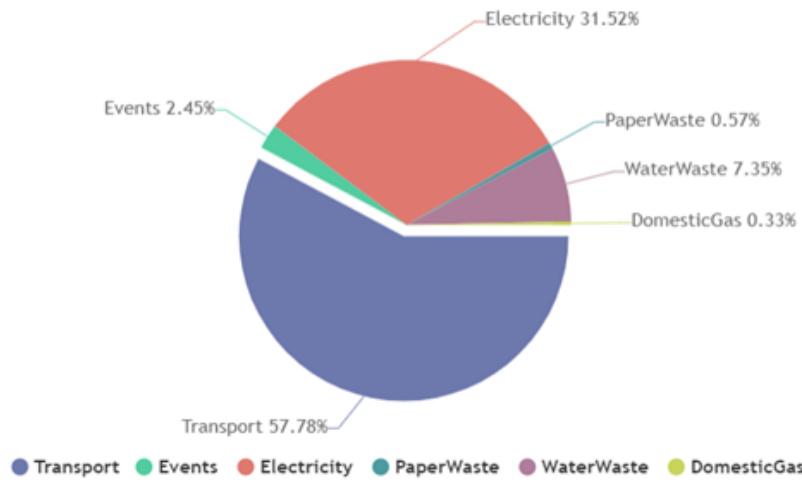


**Figure 5.6:** Total Carbon Footprint Generated by MUET

It is the total carbon footprint that are generated by Mehran University year wise. We calculate this value by given data sets.

## Emissions of Carbon Footprints

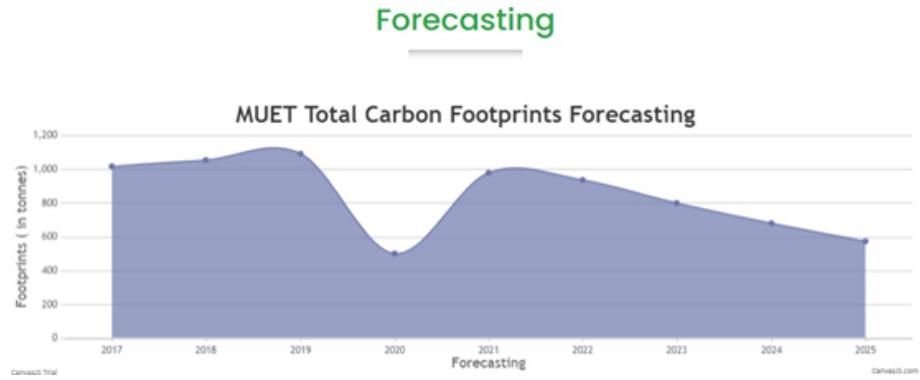
### CategoryWise divided Carbon footprints



**Figure 5.7:** Category wise calculation of Carbon by Pie Chart

Here we showed the carbon footprint category wise that are gen-

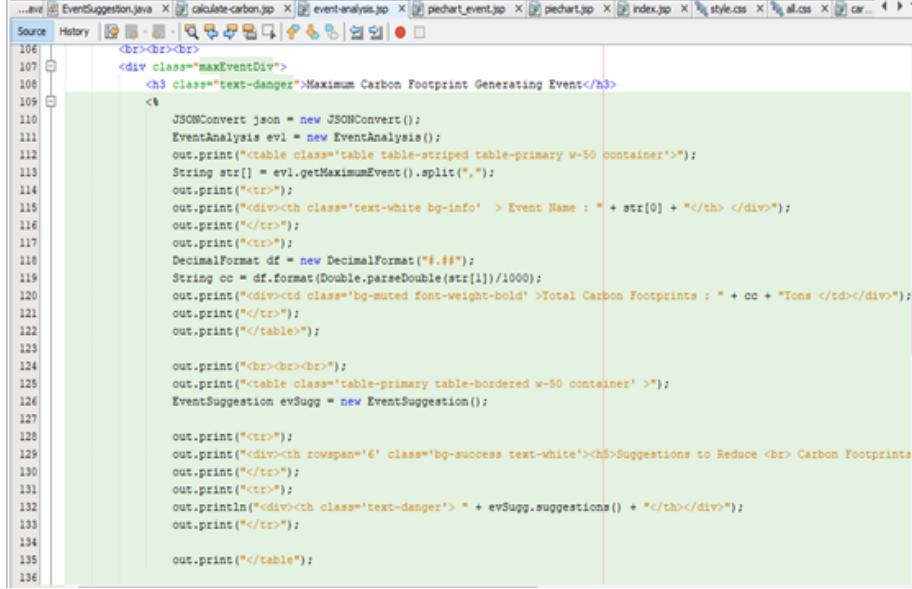
erated by Mehran University, Jamshoro. Calculated each category value and showed which factor is generating maximum carbon footprint.



**Figure 5.8: Forecasting of Carbon by Bar Chart**

Forecasting of carbon footprint according the previous 5 years data. We had forecast Carbon footprint by using linear Regression Algorithm.

### **Analysis and Forecasting of Carbon Footprint Generated By Mehran University Events.**



```

106
107     <br><br><br>
108     <div class="maxEventDiv">
109         <h3 class="text-danger">Maximum Carbon Footprint Generating Event</h3>
110         <table class="table table-striped table-primary w-50 container">
111             <tr>
112                 <td>JSONConvert json = new JSONConvert();</td>
113                 <td>EventAnalysis evl = new EventAnalysis();</td>
114                 <td>out.print("<table class='table table-striped table-primary w-50 container'>");</td>
115                 <td>String str[] = evl.getMaximumEvent().split(",");</td>
116                 <td>out.print("<tr>");</td>
117                 <td>out.print("<td class='text-white bg-info'> Event Name : " + str[0] + "</td>");</td>
118                 <td>out.print("</tr>");</td>
119                 <td>DecimalFormat df = new DecimalFormat("#.##");</td>
120                 <td>String cc = df.format(Double.parseDouble(str[1])/1000);</td>
121                 <td>out.print("<div><td class='bg-muted font-weight-bold'>Total Carbon Footprints : " + cc + "Tons </td></div>");</td>
122                 <td>out.print("</tr>");</td>
123                 <td>out.print("</table>");</td>
124             <tr>
125                 <td>out.print("<table class='table-primary table-bordered w-50 container'>");</td>
126                 <td>EventSuggestion evSugg = new EventSuggestion();</td>
127             <tr>
128                 <td>out.print("<tr>");</td>
129                 <td>out.print("<div><th rowspan='6' class='bg-success text-white'>Suggestions to Reduce <br> Carbon Footprints</th><td>Subheading</td></div>");</td>
130                 <td>out.print("</tr>");</td>
131                 <td>out.print("<tr>");</td>
132                 <td>out.println("<div><th class='text-danger'> " + evSugg.suggestions() + "</th></div>");</td>
133                 <td>out.print("</tr>");</td>
134             <tr>
135                 <td>out.print("</table>");</td>
136             <tr>

```

Figure 5.9: Event Analysis Code

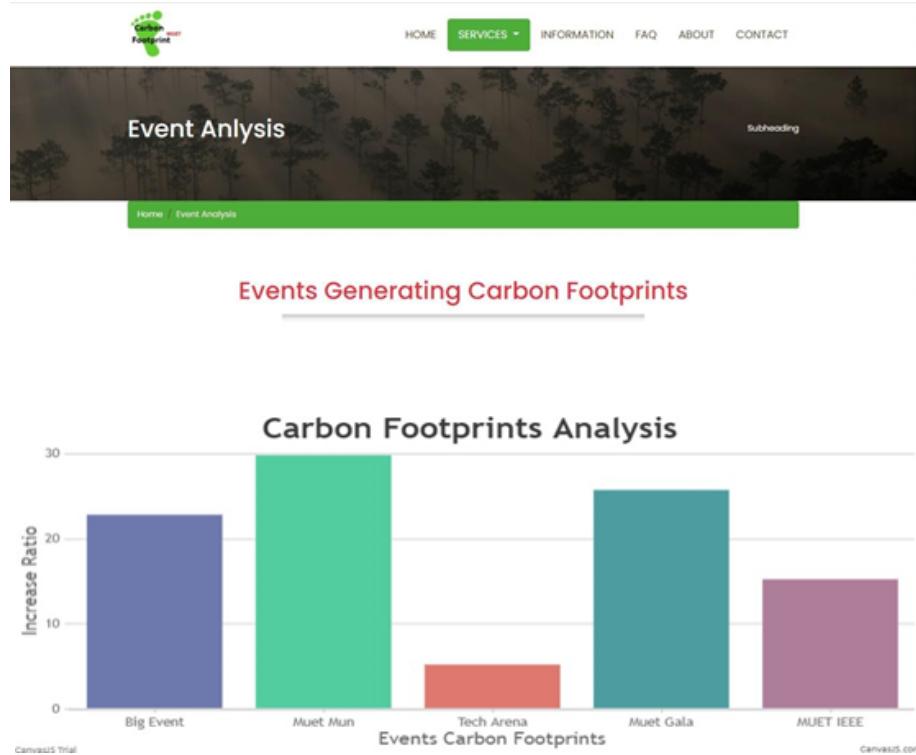


Figure 5.10: Events Carbon Footprint

Here we are calculating the carbon footprint of Events that are

generated by Mehran University and showing their values in the graph. Also we showed the maximum value generated events.



Figure 5.11: Maximum carbon footprint event

In the above image we had showed which event is generating maximum carbon footprint with the value and giving suggestions how to reduce carbon footprint generated by Mehran University. By following suggestions, we can make our university environment sustainable. And gives suggestion to reduce carbon footprint of events

## Event Forecasting

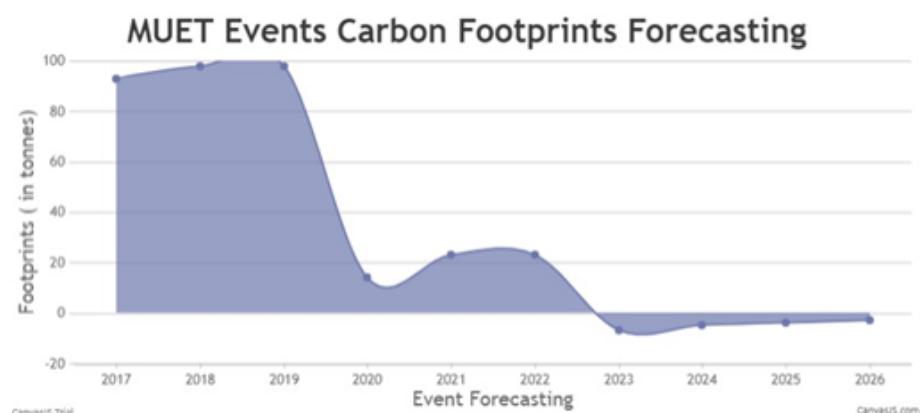
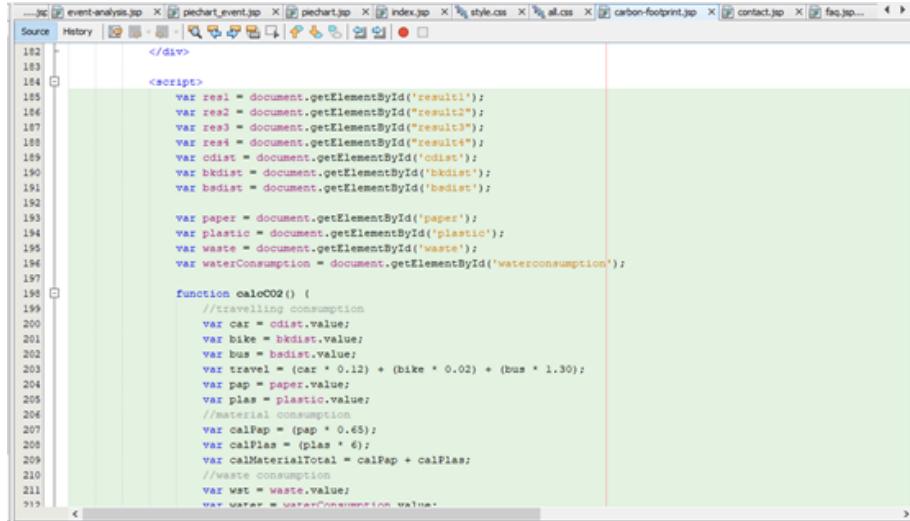


Figure 5.12: Forecasting of Event

Here we are forecasting the carbon footprint according to the

previous data. It is going down because in the last two years no any big event occur because of COVID'19 that is why its going down according to the algorithm.

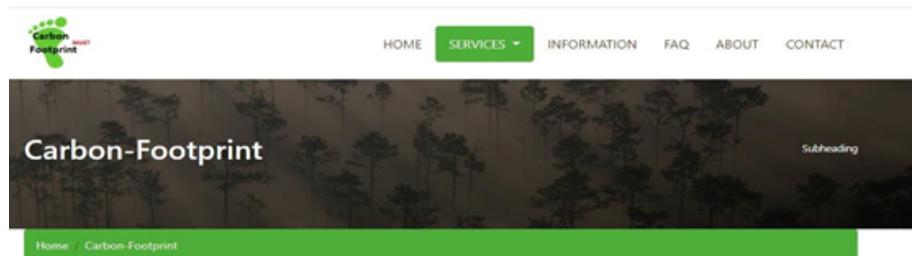


```

182 </div>
183
184 <script>
185     var res1 = document.getElementById('result1');
186     var res2 = document.getElementById('result2');
187     var res3 = document.getElementById('result3');
188     var res4 = document.getElementById('result4');
189     var odist = document.getElementById('odist');
190     var bkdist = document.getElementById('bkdist');
191     var hdist = document.getElementById('hdist');
192
193     var paper = document.getElementById('paper');
194     var plastic = document.getElementById('plastic');
195     var waste = document.getElementById('waste');
196     var waterConsumption = document.getElementById('waterconsumption');
197
198     function calcCO2() {
199         //travelling consumption
200         var car = odist.value;
201         var bike = bkdist.value;
202         var bus = hdist.value;
203         var travel = (car * 0.12) + (bike * 0.02) + (bus * 1.30);
204         var pap = paper.value;
205         var plas = plastic.value;
206         //material consumption
207         var calPap = (pap * 0.65);
208         var calPlas = (plas * 4);
209         var calMaterialTotal = calPap + calPlas;
210         //waste consumption
211         var wst = waste.value;
212         var water = waterConsumption.value;
213     }
214 
```

**Figure 5.13: Code of Carbon Footprint Form**

Here we are forecasting the carbon footprint according to the previous data. It is going down because in the last two years no any big event occur because of COVID'19 that is why its going down according to the algorithm.



**Carbon Emission Calculator**

**Section-1 (Transport)**

**Cars Avg Distance Covered daily**  
Insert Distance kilometers

**Bike Avg Distance Covered daily**  
Insert Distance kilometers

**Bus Avg Distance Covered daily**  
Insert Distance kilometers

**Section-2 (Material)**  
Leave empty if not applicable

**Printed Matter?**  
Insert Value KG

**Plastics?**  
Insert Value KG

**Section-3 (Waste)**  
Leave empty if not applicable

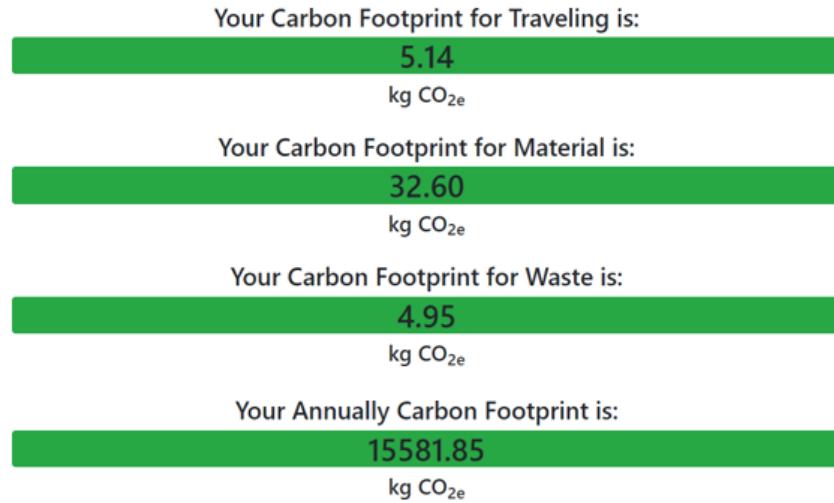
**Residual waste?**  
Insert Value KG

**Water Consumption?**  
Insert Value Liter

**Calculate Carbon Footprint**

**Figure 5.14:** Form of Carbon calculator

Here we made form to give dynamic result, if someone want to calculate their own can calculate.

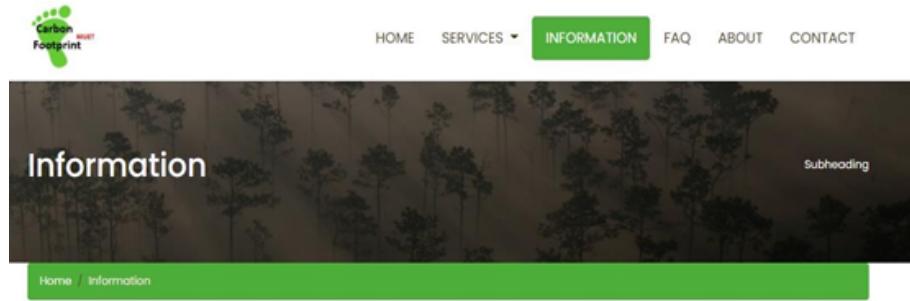


**Figure 5.15:** Test result of form

Here the demo result of the form that we input the data in form.

```
19 <div class="container">
20   <a class="navbar-brand" href="index.jsp">
21     
22   </a>
23   <button class="navbar-toggler navbar-toggler-right" type="button" data-toggle="collapse" data-target="#navbarSupportedContent" data-aos="fade-left">
24     <span class="fa fa-bars"></span>
25   </button>
26 
27   <div class="collapse navbar-collapse" id="navbarSupportedContent">
28     <ul class="navbar-nav ml-auto">
29       <li class="nav-item">
30         <a class="nav-link" href="index.jsp">Home</a>
31       </li>
32       <li class="nav-item">
33         <a class="nav-link" href="services.jsp">SERVICES</a>
34       </li>
35       <li class="nav-item dropdown">
36         <a class="nav-link dropdown-toggle" href="#" id="navbarDropdownPortfolio" data-toggle="dropdown">
37           Services
38         </a>
39         <div class="dropdown-menu dropdown-menu-right" aria-labelledby="navbarDropdownPortfolio">
40           <a class="dropdown-item" href="calculate-carbon.jsp">Calculate Carbon Footprint Generated by</a>
41           <a class="dropdown-item" href="event-analysis.jsp">Analyze & Forecast Events</a>
42           <a class="dropdown-item" href="carbon-footprint.jsp">Calculate your own Carbon Footprint</a>
43         </div>
44       </li>
45       <li class="nav-item">
46         <a class="nav-link active" href="info.jsp">Information</a>
47       </li>
48       <li class="nav-item">
49         <a class="nav-link" href="about.jsp">About Us</a>
50       </li>
51     </ul>
52   </div>
53 </div>
```

**Figure 5.16:** Code of Information Page



### What is Carbon Footprint?

A carbon footprint is the total greenhouse gas (GHO) emissions caused by an individual, event, organization, service, place or product, expressed as carbon dioxide equivalent.<sup>[1]</sup> Greenhouse gases, including the carbon-containing gases carbon dioxide and methane, can be emitted through the burning of fossil fuels, land clearance and the production and consumption of food, manufactured goods, materials, wood, roads, buildings, transportation and other services.<sup>[2]</sup> The term was popularized by a \$250 million advertising campaign by the oil and gas company BP in an attempt to move public attention away from restricting the activities of fossil fuel companies and onto individual responsibility for solving climate change.

In most cases, the total carbon footprint cannot be calculated exactly because of inadequate knowledge of and data about the complex interactions between contributing processes, including the influence of natural processes that store or release carbon dioxide. For this reason, Wright, Kemp, and Williams proposed the following definition of a carbon footprint:

- A measure of the total amount of carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>) emissions of a defined population, system or activity, considering all relevant sources, sinks and storage within the spatial and temporal boundary of the population, system or activity of interest. Calculated as carbon

**Figure 5.17: Information Page View**

```

<!DOCTYPE html>
<html lang="en">
    <head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">
        <meta name="description" content="">
        <meta name="author" content="">
        <title>Welcome to Our Website </title>
        <!-- Bootstrap core -->
        <link href="vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
        <!-- Fontawesome -->
        <link href="css/all.css" rel="stylesheet">
        <!-- Custom styles for this template -->
        <link href="css/style.css" rel="stylesheet">
    </head>
    <body>
        <!-- Navigation -->
        <nav class="navbar fixed-top navbar-expand-lg navbar-dark bg-light top-nav fixed-top">
            <div class="container">
                <a class="navbar-brand" href="index.jsp">
                    
                </a>
                <button class="navbar-toggler navbar-toggler-right" type="button" data-toggle="collapse" data-target="#navbarResponsive">
                    <span class="fa fa-bars"></span>
                </button>

                <div class="collapse navbar-collapse" id="navbarResponsive">
                    <ul class="navbar-nav ml-auto">
                        <li class="nav-item">
                            <a class="nav-link" href="index.jsp">Home</a>
                        </li>
                    </ul>
                </div>
            </div>
        </nav>

```

**Figure 5.18: Frequently Asked Question Page Code**

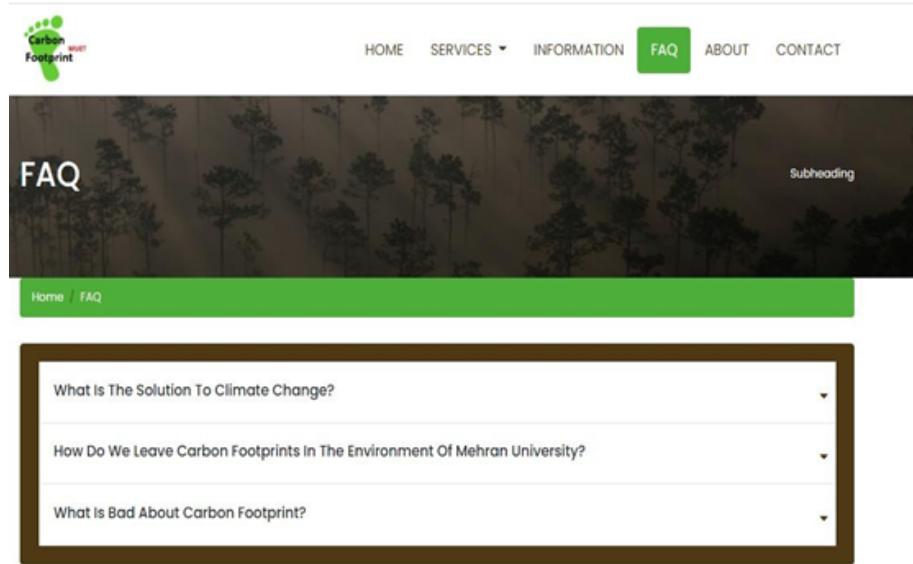


Figure 5.19: FAQ Board

Frequently ask questions that we give to clear the concept of the new users. Here we put very basics questions that could help new user to clear their queries.

```
...js pechart.jsp index.jsp style.css all.css carbon-footprint.jsp contact.jsp faq.jsp info.jsp about.jsp TotalCarbonForc... <!--  
    <ul class="nav navbar-nav ml-auto">  
        <li class="nav-item">  
            <a class="nav-link" href="index.jsp">Home</a>  
        </li>  
        <li class="nav-item">  
            <a class="nav-link" href="services.jsp">Services</a>  
        </li>-->  
        <li class="nav-item dropdown">  
            <a class="nav-link dropdown-toggle" href="#" id="navbarDropdownPortfolio" data-toggle="dropdown" aria-haspopup="true" aria-expanded="false">Services<br>  
            <div class="dropdown-menu dropdown-menu-right" aria-labelledby="navbarDropdownPortfolio">  
                <a class="dropdown-item" href="calculate-carbon.jsp">Calculate Carbon Footprint Generated by my activities</a>  
                <a class="dropdown-item" href="event-analysis.jsp">Analyze & Forecast Events</a>  
                <a class="dropdown-item" href="carbon-footprint.jsp">Calculate your own Carbon Footprint</a>  
            </div>  
        </li>  
        <li class="nav-item">  
            <a class="nav-link" href="info.jsp">Information</a>  
        </li>  
        <li class="nav-item">  
            <a class="nav-link" href="faq.jsp">FAQ</a>  
        </li>  
        <li class="nav-item">  
            <a class="nav-link active" href="about.jsp">About</a>  
        </li>  
        <li class="nav-item">  
            <a class="nav-link" href="contact.jsp">Contact</a>  
        </li>  
    </ul>
```

Figure 5.20: About Code

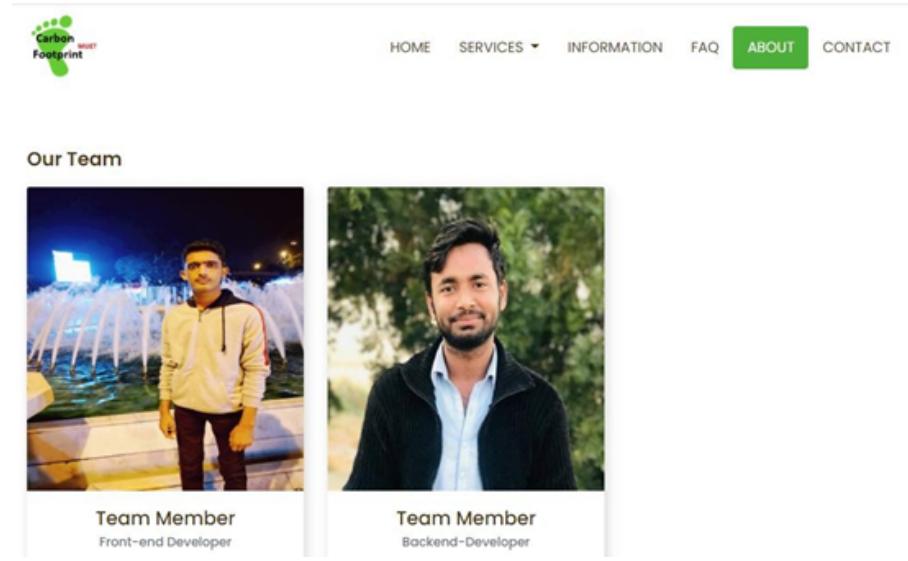


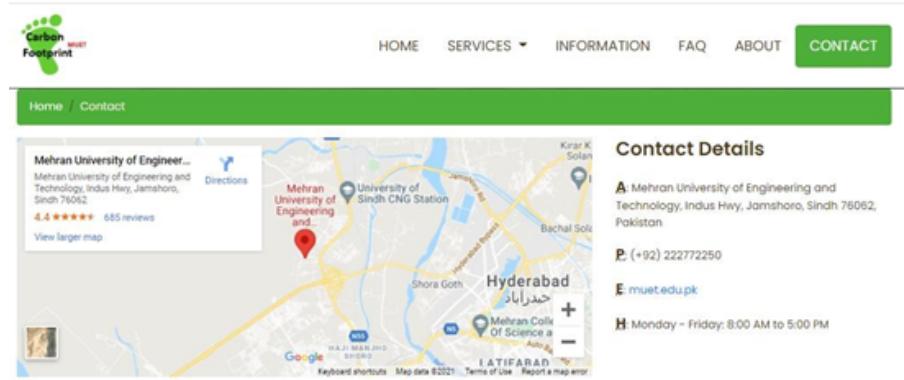
Figure 5.21: Our Team

```

97
98     <!-- Team Members -->
99     <div class="team-members-box">
100        <h2>Our Team</h2>
101        <div class="row">
102          <div class="col-lg-4 mb-4">
103            <div class="card h-100 text-center">
104              
105              <div class="card-body">
106                <h4 class="card-title">Team Member</h4>
107                <h4 class="card-subtitle mb-2 text-muted">Front-end Developer</h4>
108                <p class="card-text">Front-end web development is the practice of converting data to a graphic</p>
109            </div>
110            <div class="card-footer">
111              <ul>
112                <li><a href="https://www.facebook.com/"><i class="fab fa-facebook-f"></i></a></li>
113                <li><a href="https://twitter.com/"><i class="fab fa-twitter"></i></a></li>
114                <li><a href="https://www.google.com/"><i class="fab fa-google-plus-g"></i></a></li>
115              </ul>
116            </div>
117          </div>
118          <div class="col-lg-4 mb-4">
119            <div class="card h-100 text-center">
120              
121              <div class="card-body">
122                <h4 class="card-title">Team Member</h4>
123                <h4 class="card-subtitle mb-2 text-muted">Backend-Developer</h4>
124                <p class="card-text">A back-end web developer is responsible for server-side web application l</p>
125            </div>
126        </div>

```

Figure 5.22: Contact Page Code



**Figure 5.23:** MUET GPS and Address

Contact form that help to find the location of Mehran University through google map and given contact information.

### Send us a Message

Full Name:  
Amir Hassan

Phone Number:  
3446664632

Email Address:  
amirhassannohri8@gmail.com

Message:  
Hello Amir, I'm here facing some issues, can you resolve them?

**Send Message**

Hey Amir, Thanks for contacting! We'll be in touch with you shortly. ×

**Figure 5.24:** Message Form

If someone want to contact with admin can contact through this form that we showed in the above image with demo result.

### 5.3 DATABASE IMPLEMENTATION

The MUET carbon footprint calculator uses the relational type of database for storing the real time data generated from the Mehran University. The relational database is fast and error free that why it is used. The Database implemented in this project is MYSQL and the tool used for creating and manipulation the database is SQLYog.

Following is the Pictures of the database used.



Figure 5.25: Database carbon footprint picture (a)

Following is the Pictures of the database used.

Database: carbonfootprintdata																	
Tables (1)																	
<a href="#">Find Redundant Indexes</a>																	
Find the redundant indexes of each table in the database. <a href="#">Read more</a>																	
<table border="1"> <thead> <tr><th>Name</th><th>Engine</th><th>Rows</th><th>Data Size</th><th>Index Size</th><th>Total Size</th></tr> </thead> <tbody> <tr><td>carbonfootprint</td><td>InnoDB</td><td>70</td><td>16K</td><td>0</td><td>16K</td></tr> </tbody> </table>						Name	Engine	Rows	Data Size	Index Size	Total Size	carbonfootprint	InnoDB	70	16K	0	16K
Name	Engine	Rows	Data Size	Index Size	Total Size												
carbonfootprint	InnoDB	70	16K	0	16K												
Views (0)																	
<table border="1"> <thead> <tr><th>View_name</th><th>Is_updatable</th><th>Definer</th><th>Security_type</th><th></th><th></th></tr> </thead> </table>						View_name	Is_updatable	Definer	Security_type								
View_name	Is_updatable	Definer	Security_type														
Procedures (0)																	
<table border="1"> <thead> <tr><th>Name</th><th>Definer</th><th>Security_type</th><th></th><th>Comment</th><th></th></tr> </thead> </table>						Name	Definer	Security_type		Comment							
Name	Definer	Security_type		Comment													
Functions (0)																	
<table border="1"> <thead> <tr><th>Name</th><th>Definer</th><th>Security_type</th><th></th><th>Comment</th><th></th></tr> </thead> </table>						Name	Definer	Security_type		Comment							
Name	Definer	Security_type		Comment													
Triggers (0)																	
<table border="1"> <thead> <tr><th>Trigger</th><th>Event</th><th>Table</th><th>Timing</th><th>sql_mode</th><th>Definer</th></tr> </thead> </table>						Trigger	Event	Table	Timing	sql_mode	Definer						
Trigger	Event	Table	Timing	sql_mode	Definer												
Events (0)																	
<table border="1"> <thead> <tr><th>Event_name</th><th>Definer</th><th>Event_type</th><th>Execute_at</th><th>Interval_value</th><th>Interval_field</th><th>Starts</th><th>Ends</th><th>Status</th></tr> </thead> </table>									Event_name	Definer	Event_type	Execute_at	Interval_value	Interval_field	Starts	Ends	Status
Event_name	Definer	Event_type	Execute_at	Interval_value	Interval_field	Starts	Ends	Status									

Figure 5.26: Database carbon footprint picture (b)

## 5.4 MYSQL REALTIME DATABASE

Following is the Realtime database table of the carbonfootprint calculator. This table has all the values stored for the carbon footprints generated by the MUET.

Here is the picture of the table which contains all the creational table informations.

Table: carbonfootprint		
Columns (5)		
<a href="#">Calculate Optimal Datatypes</a>		
Find the optimal datatypes for this table by reading existing data. <a href="#">Read more</a>		
Field	Type	Comment
Name	varchar(255) NOT NULL	
category	varchar(255) NOT NULL	
carbon_amount	double(19,2) NOT NULL	
emission_rate	double(19,2) NOT NULL	
year	varchar(255) NOT NULL	

Indexes (0)		
<a href="#">Find Redundant Indexes</a>		
Find the redundant indexes of this table. <a href="#">Read more</a>		
Indexes	Columns	Index Type

DDL Information		
<a href="#">Create Table</a>		
<pre>CREATE TABLE `carbonfootprint` (   `Name` varchar(255) NOT NULL,   `category` varchar(255) NOT NULL,   `carbon_amount` double(19,2) NOT NULL,   `emission_rate` double(19,2) NOT NULL,   `year` varchar(255) NOT NULL ) ENGINE=InnoDB DEFAULT CHARSET=latin1</pre>		

Figure 5.27: Carbon Footprint table information picture

#### 5.4.1 Carbon Footprint calculator Table Data

The table carbon footprint contains all the data related to each category which is contributing for generating the maximum carbon footprints in the MUET. Each category has the name, category Name, its emission rate and value. The tables data is in tabular form so that's why it is easy to get the data and understand it. The data stored in the database is the average data calculated.

Car	Transport	1300.00	0.12	2021
Bike	Transport	8000.00	0.02	2021
Bus	Transport	800.00	1.30	2021
Rikshaw	Transport	1300.00	0.10	2021
Ac	Electricity	3800.00	0.30	2021
Refrigerator	Electricity	700.00	0.21	2021
paper consumption	PaperWaste	35.00	0.65	2021
water consumption	WaterWaste	1500.00	0.20	2021
Domestic Gas	Methane	3.50	2.80	2021
Big Event	Event	700.00	0.39	2021
Muet Mun	Event	1200.00	0.39	2021
Tech Arena	Event	400.00	0.39	2021
Muet Gala	Event	1000.00	0.39	2021
MIET TFFF	Event	700.00	0.39	2021

Figure 5.28: Carbon footprint table data picture

## 5.5 MYSQL OVERVIEW

MySQL database is the relational database, and it contains the data in the tabular form. And we can get all the data from database using the JDBC Library of the Java and SQL queries. As MySQL is efficient database so that's why it is used.[9] We are using the SQLYog and Xampp server for using the MySQL database. Both are mandatory for using the database. SQLYog is the visual tool for showing the data into the database. And xampp server contains the data of the MySQL.

Here is the picture of the xampp and SQLYog.



Figure 5.29: Xampp picture for MySQL database

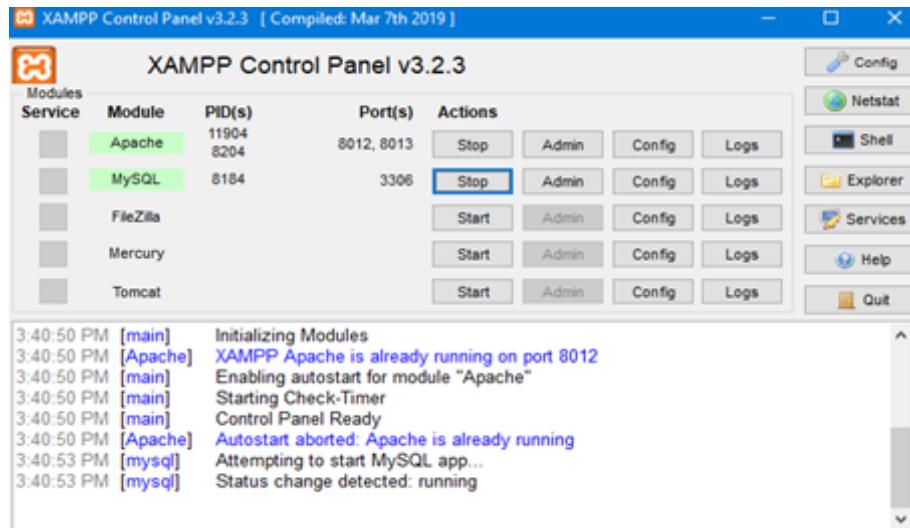


Figure 5.30: SQL Yog picture for MySQL database.

## **CHAPTER 6**

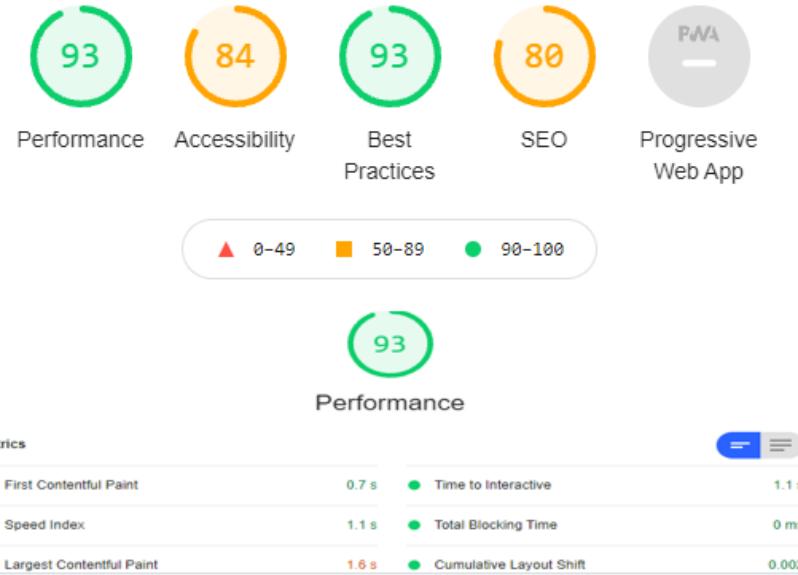
### **TESTING AND EVOLUTION**

#### **6.1 INTRODUCTION**

Testing is the final phase for any system or application and indeed is the most crucial and sensitive one too. It decides whether the application you have been investing in is potential enough to be used in a real-life environment or not. To serve the same purpose, we tested our application MUET carbon footprint calculator main tests Performance Testing. This chapter is focused on what these tests do and what are the results or interpretations we obtained from them for our application.

#### **6.2 LIGHTHOUSE TOOL**

Light house tools are basically used for analyzing the performance of any web application. [10]This tool is an open-source automated web testing performance tool. It can run on any web page and generate the report of that page with its performance, accessibility, best practices and SEO. The MUET carbon footprint calculator has a very good performance calculated by using the Light house tool. The carbon footprint calculator has 93



**Figure 6.1: Light House Tool Performance Testing**

### 6.3 LOAD TESTING USING JMETER

The Load Testing is the measurement of the load of the MUET carbon footprint calculator.[11] Using JMeter we can perform the number of operations. JMeter is the Java Testing framework. JMeter is the desktop app for testing the load of the applications. We can use number of resources using JMeter. JMeter use static resource and dynamic resource. JMeter Graph result is used for testing the Carbon calculator.

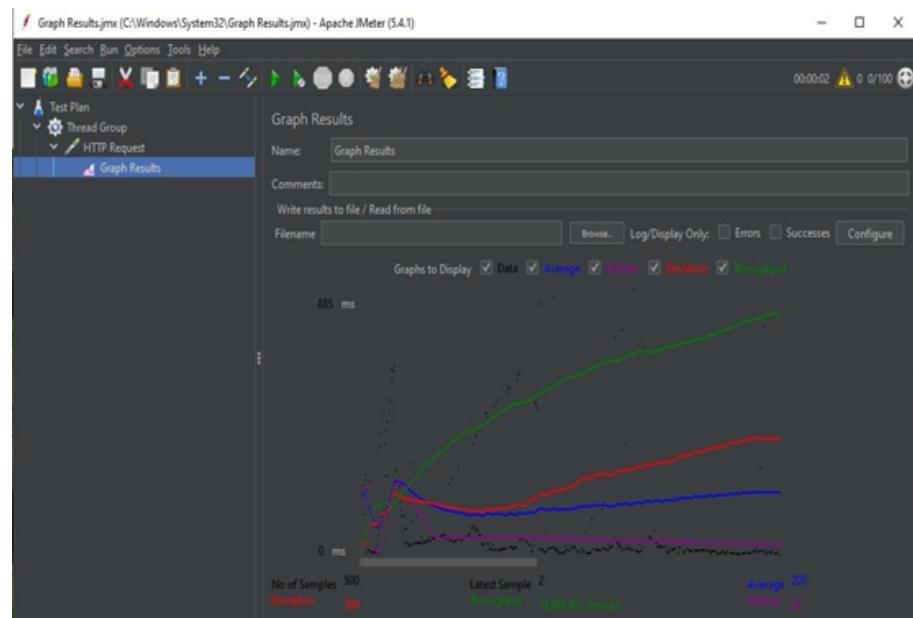


Figure 6.2: Load Test Graph result of JMeter

## **CHAPTER 7**

### **CONCLUSION AND FUTURE WORK**

#### **7.1 CONCLUSION**

This thesis represents the development of an AI based web application for elderly dealing with Analysis and Forecasting of Carbon Footprint Generated by Mehran University. In our project we have presented an application namely Carbon Footprint which is used to calculate the carbon footprint and forecast of it.

The application will also be very useful for Mehran University environment to make it sustainable and use to prevent diseases and control the temperature of MUET. This project was proposed as a Web based application responsive site because in the modern world web is very sustainable, probable and accessible as compared to other options. Cherry on the top in this application is added because of AI features as artificial intelligence is also taking over the world and is being integrated in every device so by merging web with AI provides the best solution for forecasting according to the previous data. Moreover, this application also gives the opportunity to maintain communication between both user and admin from any type of web based responsive design from any corner of the world and

at any time. The user and admin can communicate by exchange of data over the network using mobile phone/ laptop or any operating system. This application will be helpful in maintaining a large organization of the environment and it could be helpful for them to prevent the global warming. The discussed related work and literature is discussed according to the needs and requests required in the application. This thesis also contains the tools and technologies used in web application's development.

The diagrams and flowcharts mentioned in the thesis defines the structure, plan, and methodology of the application and how the application would work. The thesis also includes the implementation and development of the application in detail. Different testing techniques were applied to evaluate and check the issues related to application and to address them proper steps were taken in different phases. The application is also tested for its performance in order to provide reliability and safety for the users from any threat of the data and provide real time solutions that could be implemented on any community.

## 7.2 FUTURE WORK

The system is designed for the calculation of carbon footprint generated by Mehran University of Engineering and Technology Jamshoro as well as Forecasting and they can use its features easily that are helpful in their daily life activities.[12] We have integrated non- AI like calculate your own carbon footprint, contact form directly and indirectly, information, well as AI features like forecasting according to the given data. Alongside these features other useful features of different types will also be incorporated in this application in the future that can be helpful for Mehran University as well as global warming. A few of such features can be, adding a gallery in the user module along with forecasting in which the registered can directly be saved in that gallery so that user can open them up and see any time. Other than that, another feature like adding the FAQ option which can be useful to answer the basic queries of the new user. The application can also have the global warming history option which will be helpful in case if the admin of the application is changed due to any reason. The option of seeking software assistance can also be incorporated which would be helpful for MUET students to know about the environment of it, and other staff. This system can also be implemented on the android application or different hardware

devices, such as wrist watches or digital home system.

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