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Coursework Title: A web-based platform to measure the Sustainability level of Tourism Companies	
Deadline Date: 12th May 2024	Member of staff responsible for coursework: Mr Gayan Perera
Programme: BSc (Hons) Software engineering	

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Acknowledgement

I am deeply grateful for the guidance and support of my supervisor, Mr. Gayan Perera, whose invaluable insights, constructive feedback, and encouragement greatly influenced the successful completion of this project. His dedication and expertise have been pivotal in shaping the final product.

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To my family and friends, your unwavering support and encouragement have been my source of strength throughout this journey. Your belief in me and your patience provided the motivation needed to overcome the challenges along the way. I am deeply appreciative of your kindness and love. Thank you all for being a part of this achievement.

Abstract

This project focuses on developing a web-based platform to measure and promote the sustainability level of tourism companies. Recognizing the environmental impact of tourism in Sri Lanka, this initiative aims to address the challenges of sustainable development by providing a tool that facilitates comprehensive sustainability assessments, action planning, and reporting. The platform empowers hotels and tourism companies to evaluate and improve their sustainable practices by managing key performance indicators like water consumption, carbon footprint, waste reduction, and supply chain ethics. By implementing a standard grading system, the tool provides clear feedback on sustainability performance while assisting companies in creating actionable strategies for improvement. It also features a user-friendly interface to guide businesses in their sustainability journey. With insights from interviews with industry experts and a robust literature review, this platform aims to be an accessible and affordable solution for tourism companies committed to sustainable growth. The project successfully aligns technology with the practical needs of the industry, enabling transparent reporting and promoting Sri Lanka as a sustainable tourism destination.

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List of figures and tables

1. **Introduction**

Tourism has generally been a hyper - competitive industry in Sri Lanka. Although it has expanded, on the other hand tourism has been the cause of environmental damage as well. Therefore, I have identified that tourism should be done using a sustainable approach. Sustainability is a development that meets the needs of the present without compromising on the ability of future generations to meet their own needs.[1] When the word 'development' is mentioned, we immediately think of economic development. However, when it comes to sustainability, development means advancement in every area, including economic growth, social progress, and environmental protection.

Tourism is a field that is widespread overall the world. So, while globalization has contributed vastly to global development, it has also resulted in the damage and degradation of certain local environments and cultures as well. When it comes to tourism, many hotels are not using sustainable approaches. This has caused environmental disruption, global warming, air pollution, water pollution and many other things. Modern tourist hotels and other companies regarding the tourism field feel the need for effective sustainability management tools to accurately assist them in all management processes. Some hotels and companies are using this kind of a tool but since it's a paid one, the use has decreased.

For example, there is Travelife, which is a leading training, management and certification initiative for tourism companies committed to reaching sustainability. It costs small companies (< 25 full time employees), 200 Euro per year, medium companies (≥ 25 full time employees), 300 Euro per year, and large companies (> 100 full time employees), 400 Euro per year. Therefore, the need for effective sustainability management tools is evident to mitigate these adverse impacts. This project aims to address the challenge of promoting sustainability in the tourism sector by investigating the barriers to implementing sustainable practices, with a focus on the accessibility and affordability of sustainability management tools for hotels and tourism companies.

[1] Burton, I. (1987). Our common future: The world commission on environment and development. Environment, 29(5), 25–29.

2. Background

The tourism industry worldwide has been growing a lot. Sri Lanka is a big part of this because of its rich culture and beautiful nature. But, as more people travel, there are problems. The environment and the local way of life can be harmed. This project understands that we need to change how we do tourism. We should focus on making sure it helps the economy, but also takes care of the environment and the local communities. Sustainability, in this project, means doing things now that don't hurt the ability of future generations to do the same. It's not just about making money; it's also about helping society and protecting the environment. Even though tourism has big effects globally, there are problems like pollution and damage to the environment. Many places, like hotels, don't always do things in a way that helps.

Sustainable tourism is a way of traveling and exploring places that aims to have a positive impact on the environment, society, and local communities. It involves making choices and taking actions that support the long-term well-being of destinations, ensuring that tourism activities do not harm the natural environment, cultural heritage, or the livelihoods of local people. The United Nations World Tourism Organization defines sustainable tourism as: *"Sustainable tourism development meets the needs of present tourists and host regions while protecting and enhancing opportunities for the future. It is envisaged as leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems."* (WTO, 2001)

Globalization, which is the world becoming more connected, has helped in some ways but also made local places more at risk. Some tools, like Travelife, can help tourism companies be more sustainable. But these tools can be expensive, especially for smaller businesses. This project wants to look into why it's hard for hotels and tourism companies, especially small ones, to use these tools that help them be more sustainable.

Figure 1: Sustainable tourism

The environmental, socio-cultural, and economic pillars of sustainable tourism are interconnected and are referred to by the United Nations World Tourism Organization (UNWTO, 2019)

1) Environmental factors pertain to the utilization of various natural resources, such as the uncontaminated air, land, and water at the destination. Natural woods, mountains, and wildlife are examples of additional resources. The built environment, which includes infrastructure from towns and villages, buildings, and other structures, is also considered to be cultural heritage.
2) Socio-culture, referring to the effects that different cultures have, both good and bad, on the host community. The effects of tourism may be detrimental if the host population is not well-developed economically and socially, or if the local society and culture are not strong enough.
3) Socioeconomics considers the economic growth brought about by tourism, including the expansion of local businesses, the influx of foreign direct investment, the creation of jobs, and the influx of money. The responsible use of resources, such as biological diversity and the reduction of negative effects on the environment, culture, and society, is part of the economic side of tourism.

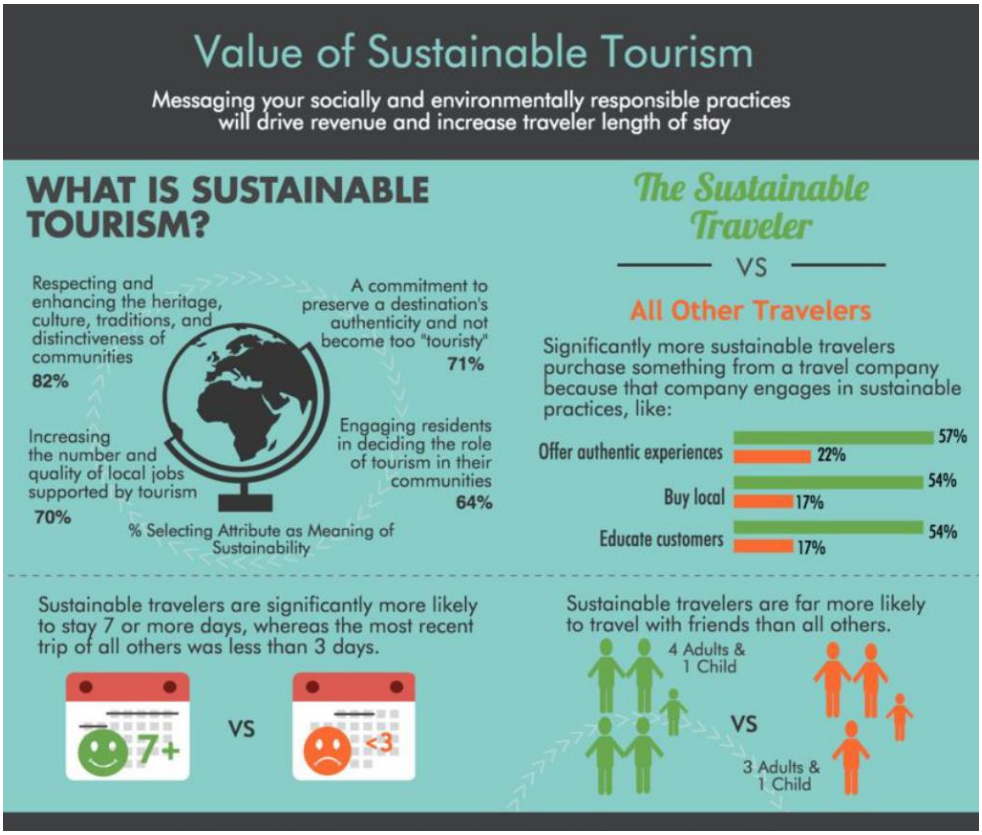

Figure 2: value of sustainable tourism

*(*https://www.destinationsustainability.com/blog/2017/8/12/wbcgwcb4enuio8zri8onkfcvh8g4hf *)*

2.1 Sustainability metrices

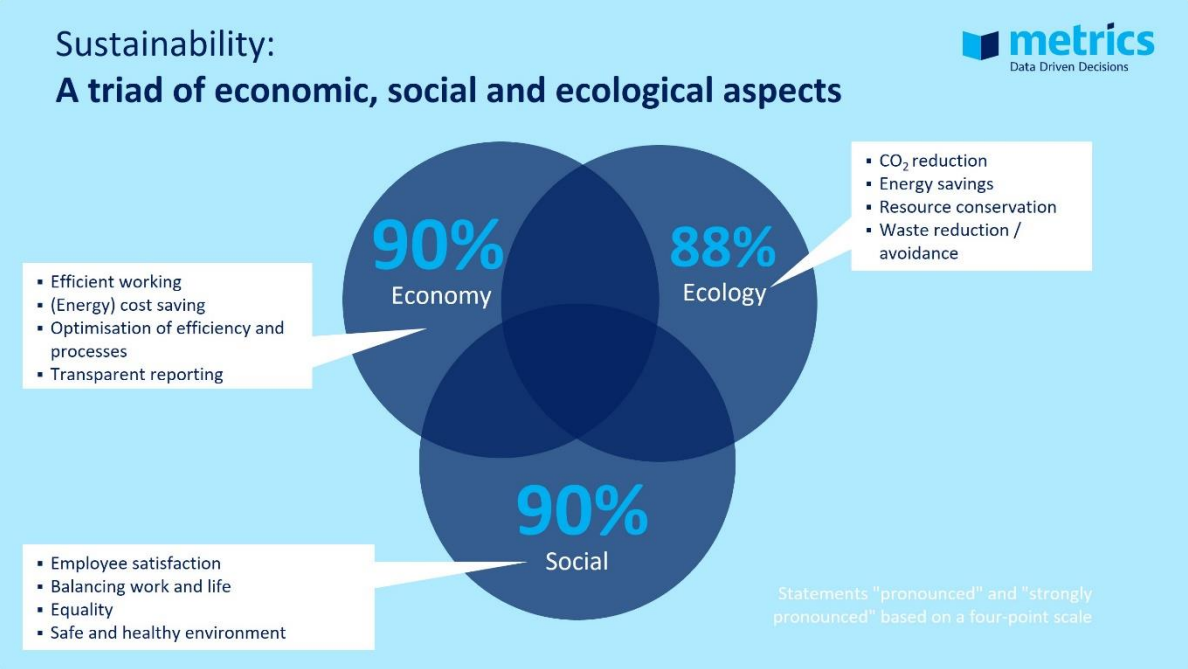

Figure 3: Sustainability metrices

For the project, below metrices have been used.

1. Water consumption
   This can be measure through the water bill.
2. Electricity consumption
   This can be measure through the electricity bill.
3. Green purchase
   users can add evidence image of the green purchase, so it will check automatically.
4. Carbon Footprint
   can be calculated through https://www.carbonfootprint.com/calculator.aspx
5. Waste recycling rate
   Users can input data on the total weight or volume of waste generated and the amount recycled.
6. Waste reduction rate
   users can provide data on the total waste generated over time. The reduction rate can be calculated by comparing the current waste generation with a previous baseline period.
7. Use of toxic materials
   Users can report the quantities of toxic materials used in their operations (e.g., cleaning chemicals or industrial solvents) and include evidence like invoices or safety data sheets.
8. employee well-being
   Gather data through employee surveys on job satisfaction, work-life balance, benefits, and safety incidents. Aggregated scores can help assess overall well-being.
9. labour practices
   Users should provide data on working conditions, such as average work hours, wages, employee training programs, and adherence to labor laws. An assessment form can help categorize and score their practices.
10. community engagement
    Ask for information on the company's community involvement, like local employment, volunteer work, or contributions to local development projects.
11. supply chain ethics

Users can upload supplier certifications or assessment data on sourcing practices, ensuring that suppliers comply with ethical sourcing guidelines.

12. Financial performance

    Include key financial metrics such as profit margins, revenue growth, or return on investment to gauge the financial sustainability of the company.

3. Objectives

1. Promoting Sustainable Tourism
    - The primary objective of this project is to promote sustainable tourism in Sri Lanka. This aims to address the environmental damage caused by tourism and emphasize the importance of sustainable development, which considers economic growth, social progress, and environmental protection.

2. Developing a Sustainability Management Tool
    - This project aims to create a sustainability management tool that can assist hotels and companies in the tourism industry to effectively manage their sustainability efforts. This tool is intended to be a web-based system.

3. Assessing Sustainable Aspects
    - The tool will enable companies to assess the sustainable aspects of their operations, including environmental, social, and economic factors. It will help them identify areas that need improvement and develop action plans for enhancement.

4. Implementation and Guidance
    - The tool will assist companies in the implementation of their sustainability action plans and provide guidance throughout the process. It will also offer suggestions to improve their sustainability practices.

5. Standard Grading System
    - The project aims to introduce a standard grading system that allows companies to assess, demonstrate, and share their sustainability accomplishments. This grading system will likely involve a one- to three-stage procedure for evaluating sustainability levels.

6. Reporting Sustainability Activities
    - The tool will enable companies to report their sustainability activities and achievements. This reporting feature will help showcase their commitment to sustainability and encourage transparency.

7. Market Sustainable Tourism
    - Develop marketing campaigns and strategies to promote Sri Lanka as a sustainable tourism destination, attracting responsible travelers who value and support sustainability initiatives.

4. Deliverables

The deliverable of this project is a web application that contains all the necessary features that are included here.

4.1 Interfaces

1. Sign up

User interface

This is the sign-up page. Here the users who wish to register on this system, can enter their company name, address, email, position, no of employees and password. Then users will be able to create an account. Here the account will be created for the company and a specific person, who will be assigned to manage this account can enter the details further.

Technology

Here the React (useState Hook) has been used. This component uses the useState hook for state management, allowing it to handle the state of the registration data, success messages, and error messages locally within the component. Also, axios for HTTP Requests. Axios is a popular promise-based HTTP client for making requests to external resources. In this component, axios is used to send the registration data to a server endpoint.

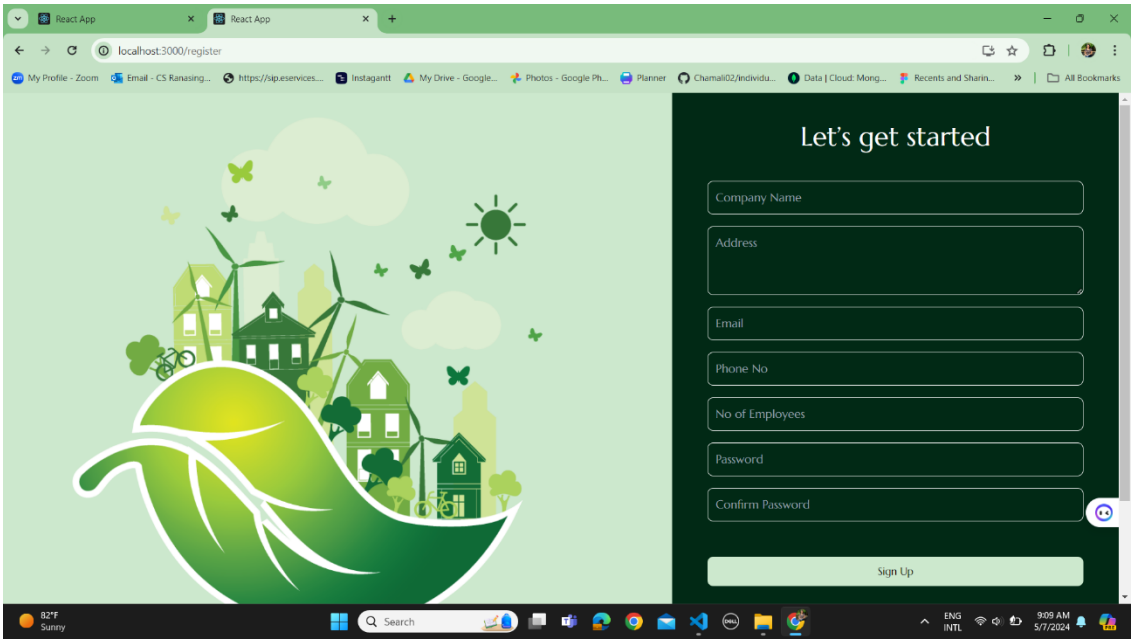

Figure 4: Sign up page

2. Login

User interface

This is the login page. Here users can simply enter their email address and password, and login to the system.

Technology

Here also has used useState and axios as register page, and the jwt-decode library is used to decode JSON Web Tokens (JWTs) received from the server. This allows the front end to extract details from the token, such as user ID or other claims that might be encoded within the token.

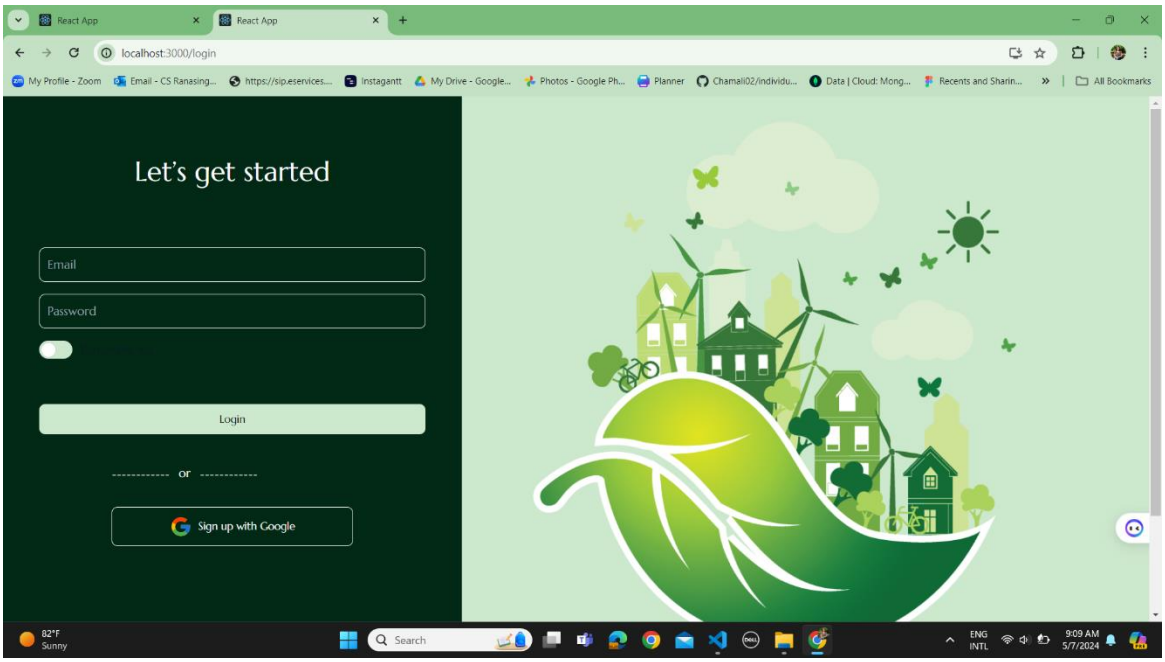

Figure 5: Login page

3. Home

User interface

This is the home page of the website. This page has divided into 4 parts as home, services, about us and FAQ. In the first part there is a showing of the companies which are already registered in the system. In the second part there are all the services that will be provided by this system. After that there are frequently asked questions like “How does the grading system work? What does the action plan included? Is there a guide through the process?, How can we share sustainability accomplishments?. And at the bottom of the page, there is all the contact information.

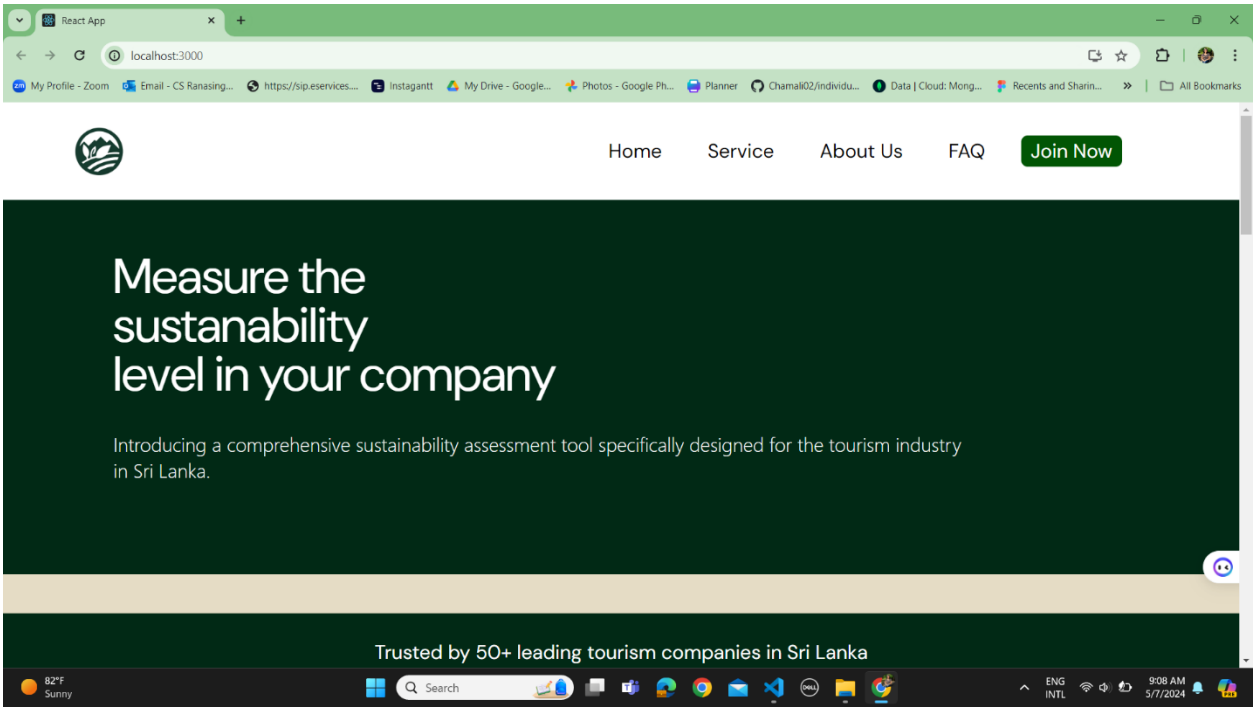

Figure 6: Home page

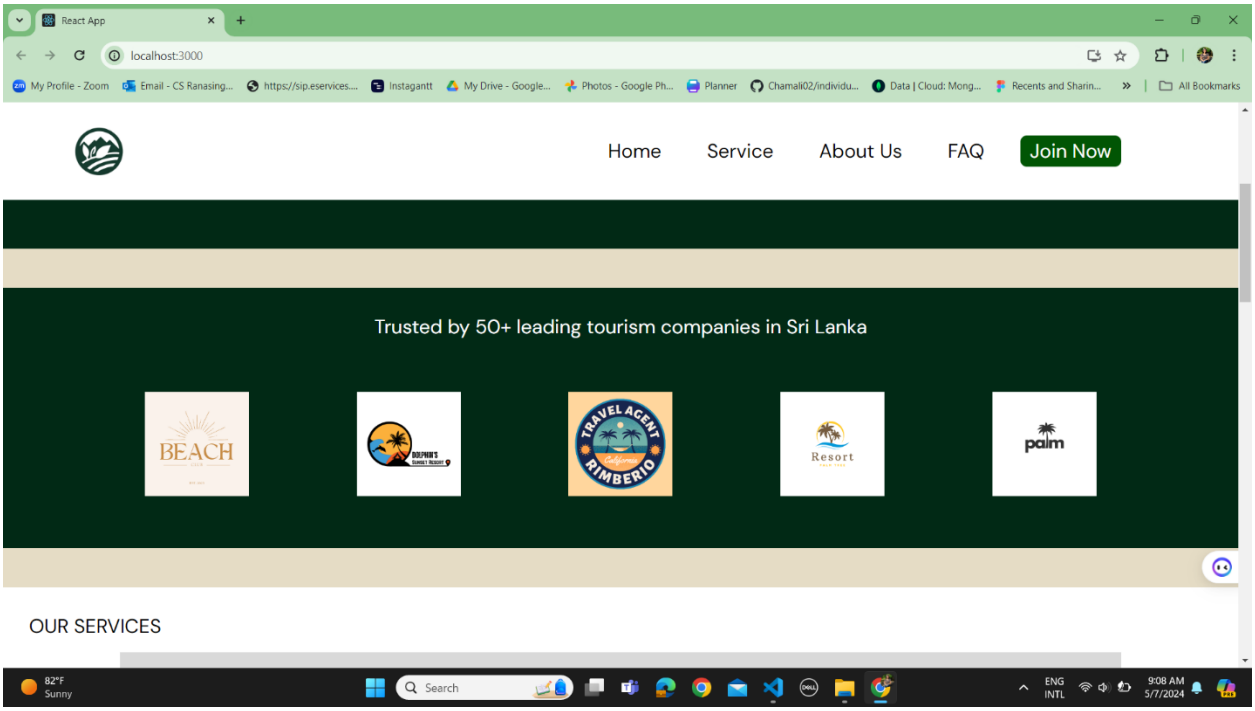

Figure 7: Home page 2

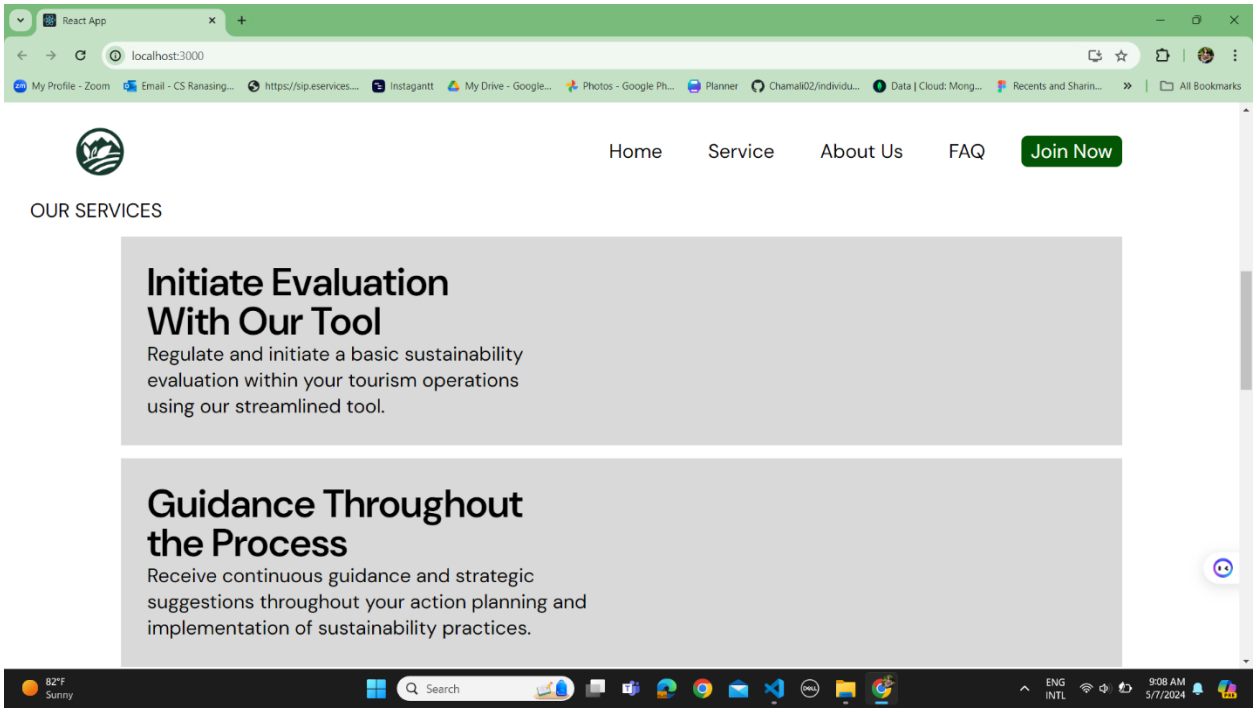

Figure 9: Home page 3 - our services

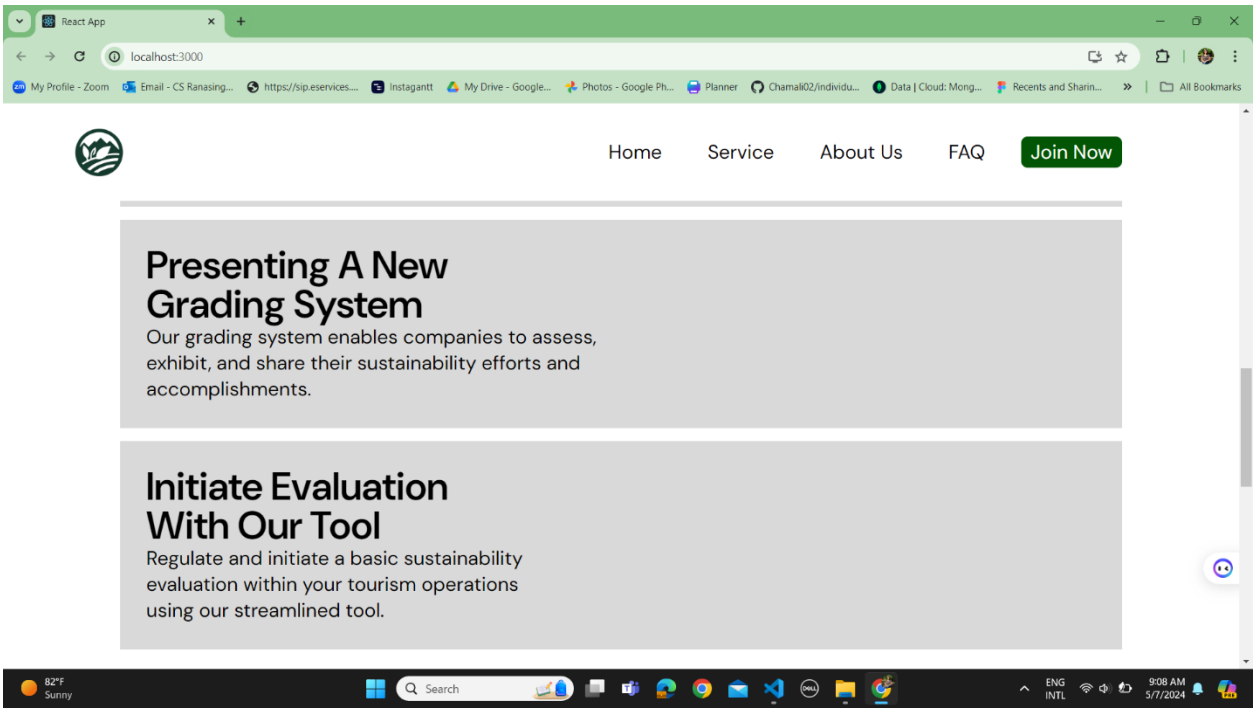

Figure 8: Home page 4 - our services

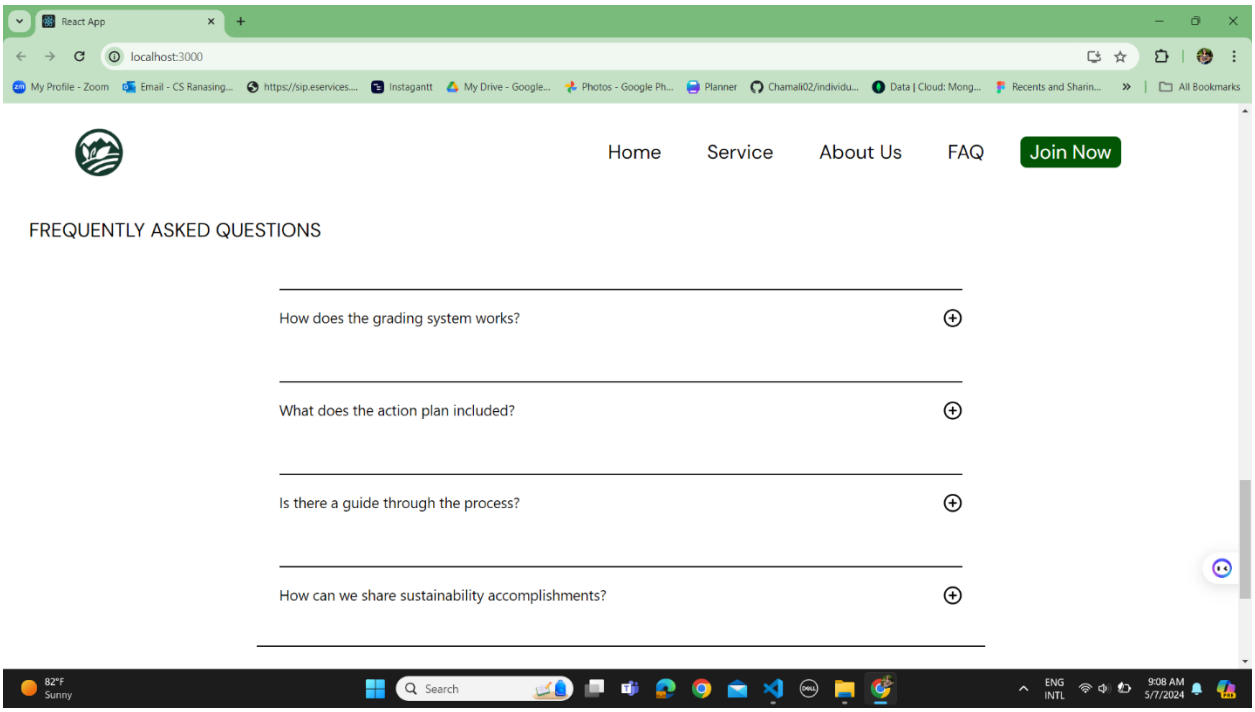

Figure 10: Home page 5 - FAQ

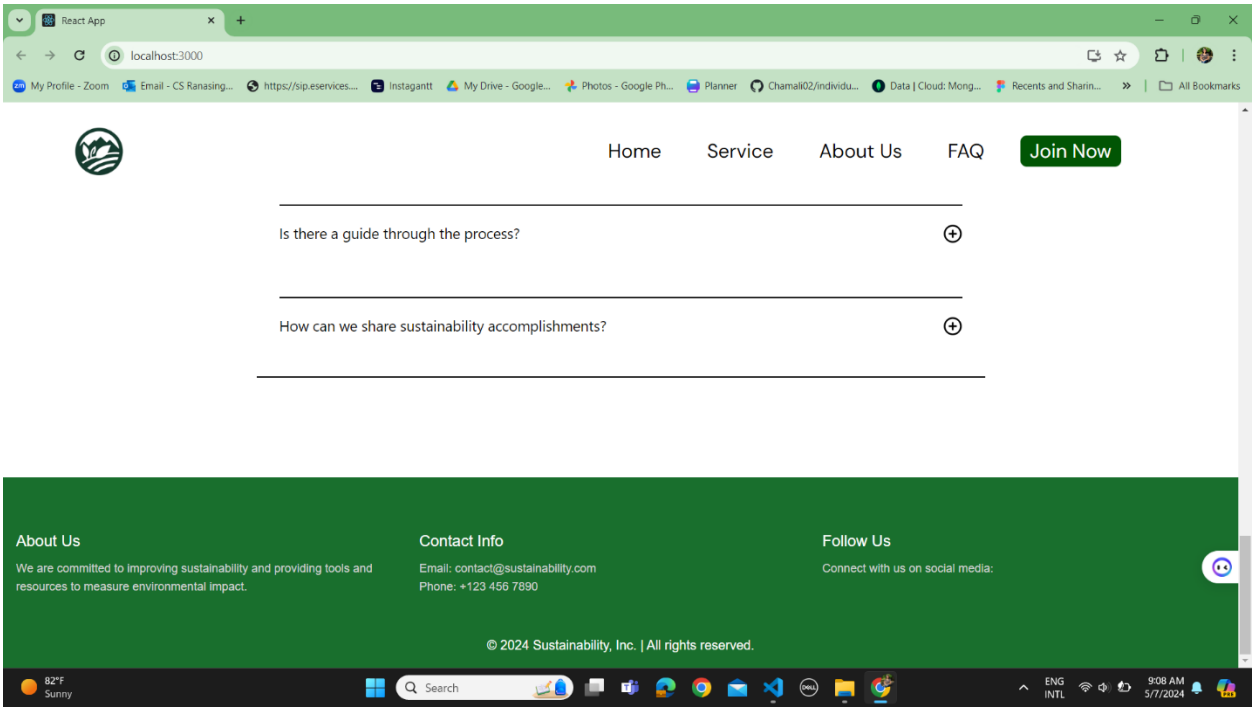

Figure 11: Home page 6 - footer

4. Dashboard

User interface

This is the dashboard and when the user logs in to the system, it will direct to this page. In this page there is a navigation bar including dashboard, form, certification, help and logout. There will be the top 5 companies which scored the highest sustainability level. Then you can download the PDF report from the below generate report button.

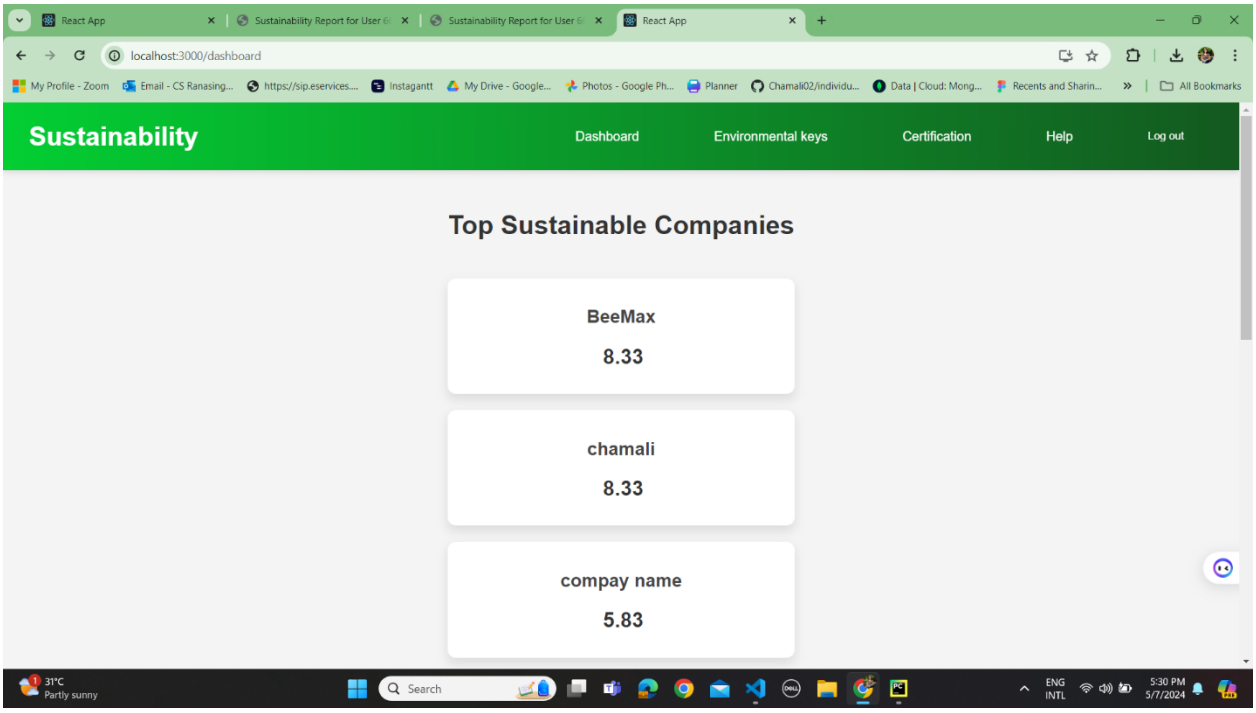

Figure 12: Dashboard

Technology

Here when the user updates the measuring keys, in the database it will update only the rate in same ID. Therefore, there will be no data redundancy.

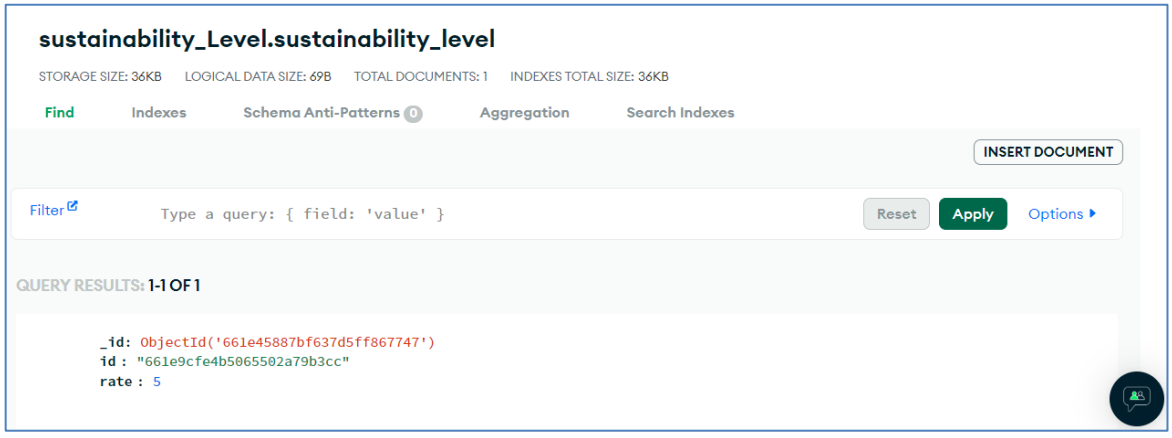

Figure 13: Dashboard database

os, scipy.constants, sklearn modules are used for general file handling and machine learning purposes. reportlab is for generating the PDF report. pandas help in handling and manipulating data. pymongo is used for accessing MongoDB. joblib is included but not currently used in the visible code.

This Flask app is designed to receive and process sustainability data, store it in MongoDB, and provide an endpoint to generate sustainability reports in PDF format for users. Additionally, it facilitates user updates and retrieves sustainability rates from the database.

5. Form

User interface

From this page users can insert their details regarding the sustainability measuring keys. There are keys as electricity consumption, Water consumption, Waste reduction rate, Carbon footprint, green purchase, and Use of toxic materials. To check the accuracy of users must submit the evidence as well. For electricity consumption, can upload the electricity bill. For the water consumption, can upload the water bill. Next for the waste reduction rate and carbon footprint there is a sperate link to a tutorial of how to calculate it. For green purchase and use of toxic materials, users can upload photos as evidence. Then it will check through AI and for further checking there will be a manual check which will be a future implementation.

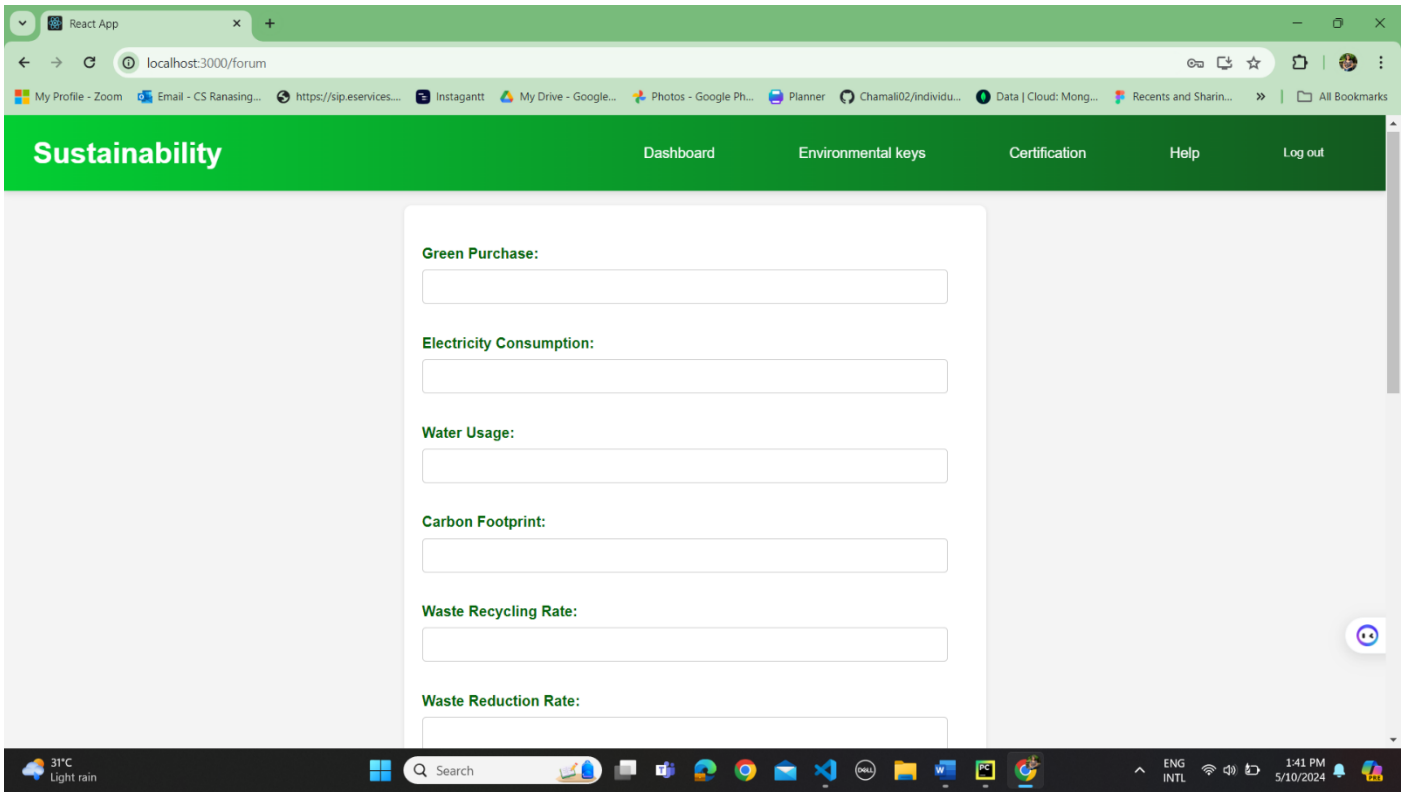

Figure 14: form 1

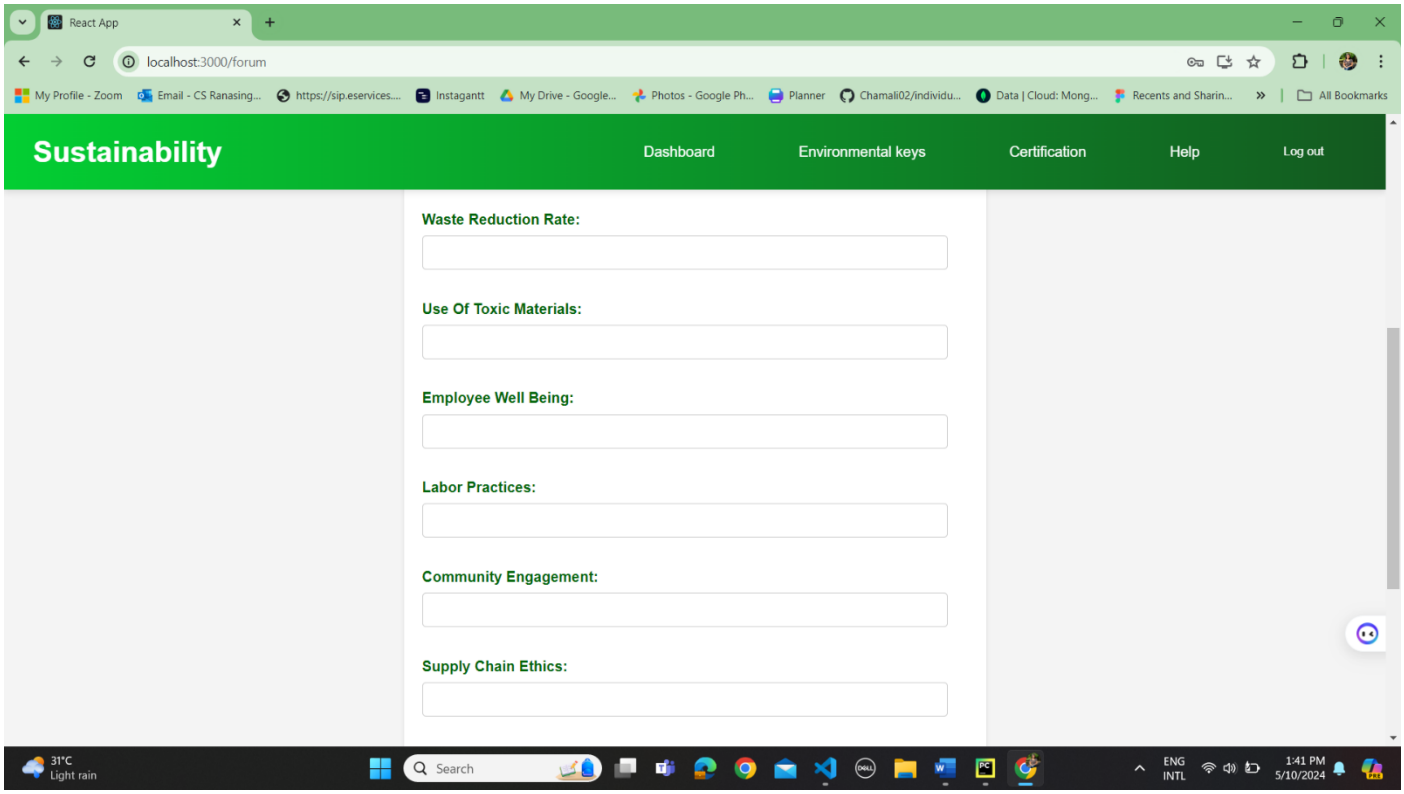

Figure 15: form 2

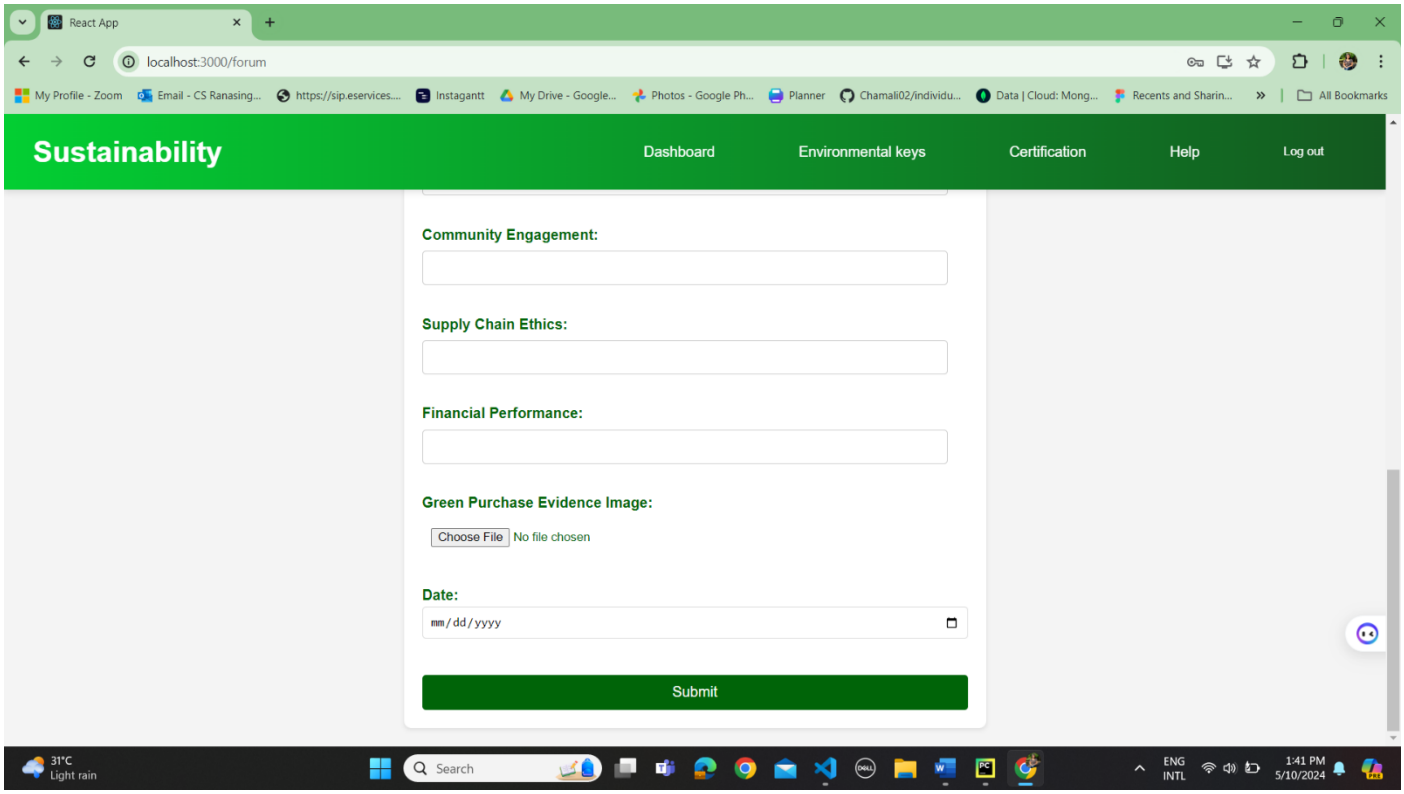

Figure 16: form 3

Technology

Here JWT has been used. JWT, or JSON Web Token, is a compact and self-contained way for securely transmitting information between parties as a JSON object. This information can be verified and trusted because it is digitally signed. JWTs can be signed using a secret (with the HMAC algorithm) or a public/private key pair using RSA or ECDSA.
Here's the breakdown.

- Encoding: Information like user data is encoded into a JSON object. This can include things like user ID, permissions, or any other relevant data.
- Signing: This JSON object is then securely signed to ensure that it hasn't been tampered with after it's sent.
- Transmission: Once signed, this token is transmitted between systems, like from a server to a user's browser.
- Verification: When the token is used, the receiving party checks the signature to ensure its valid and hasn't been altered.

6. Certification

User interface

In this page it will display all the certificates that achieved by the company.

Technology

This code utilizes several modern web technologies to implement a certificate generation feature within a web application. React is used to create a functional component named CertificateGenerator. It employs the useState hook to manage component state, tracking download links, errors, and the loading state during certificate generation. The axios library handles HTTP requests to a backend server, triggering the certificate creation process via a POST request. The JSON Web Token (JWT) is decoded using the jwt-decode package to extract the user ID, which is then sent to the server for certificate generation. The NavigationBar and Footer components, along with the linked CSS file, provide consistent styling and navigation. The server response determines whether a download link is provided, or an error message is displayed, making the user experience clear and responsive.

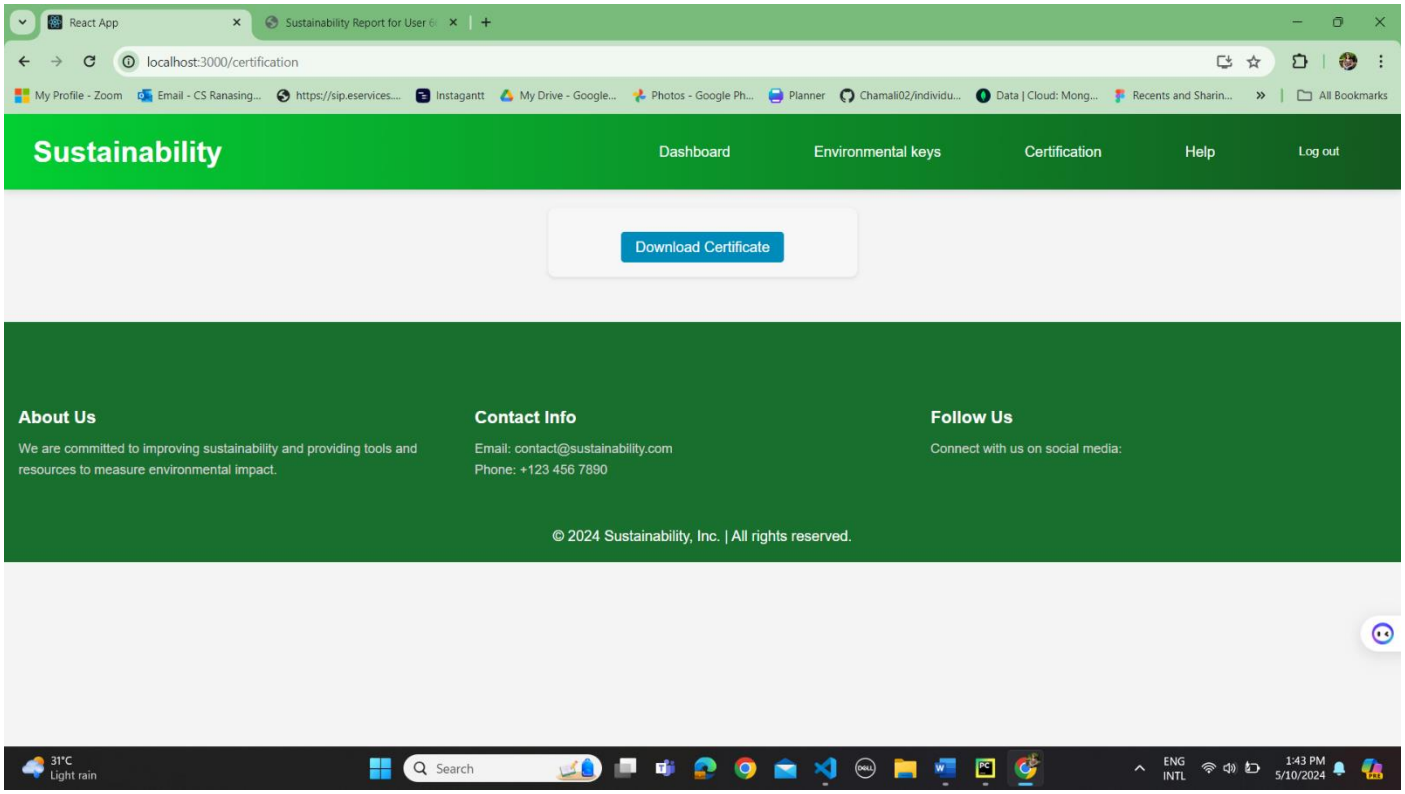

Figure 18: certificate generate

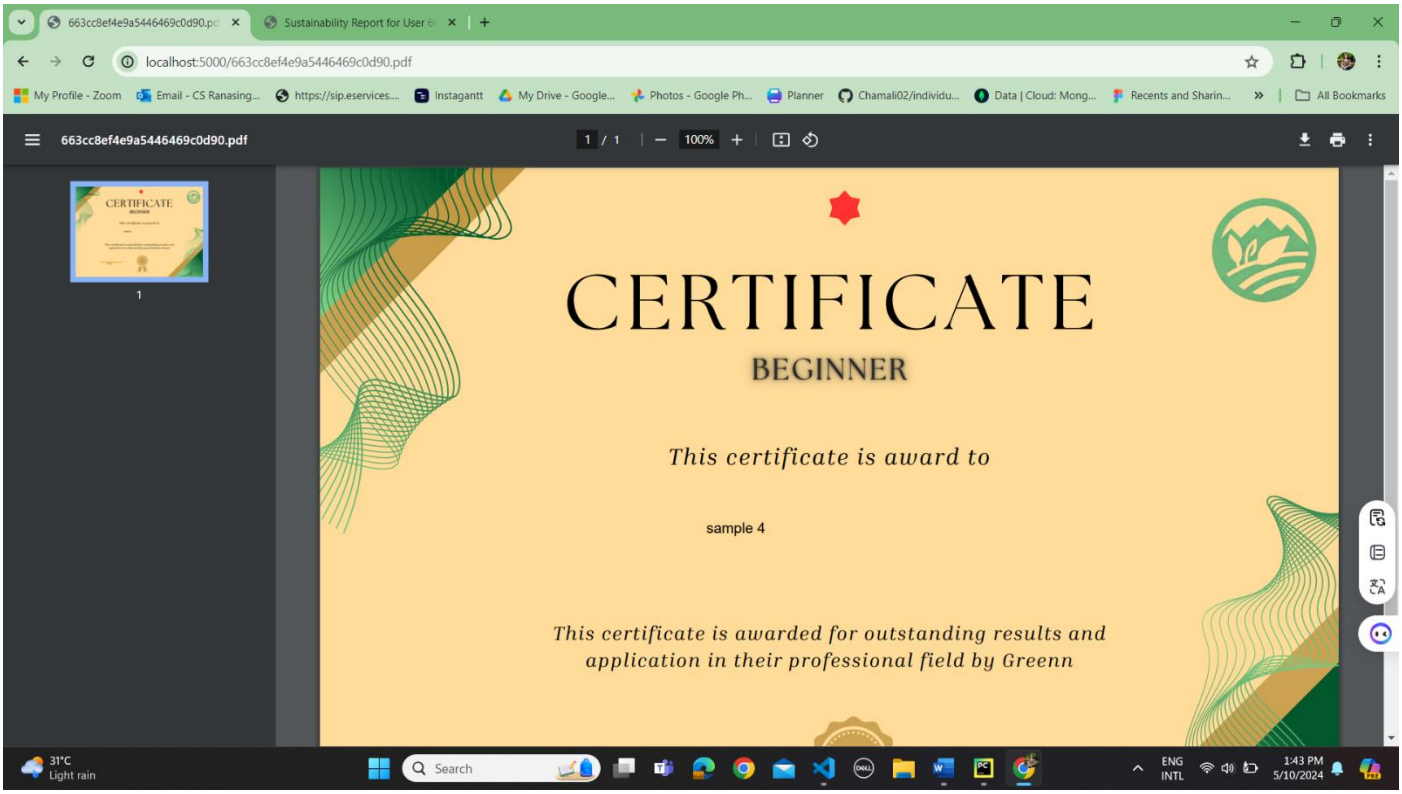

Figure 17: download certificate

7. Help

User interface

Here users can get informed guidelines on how to use the system from the beginning to the end.

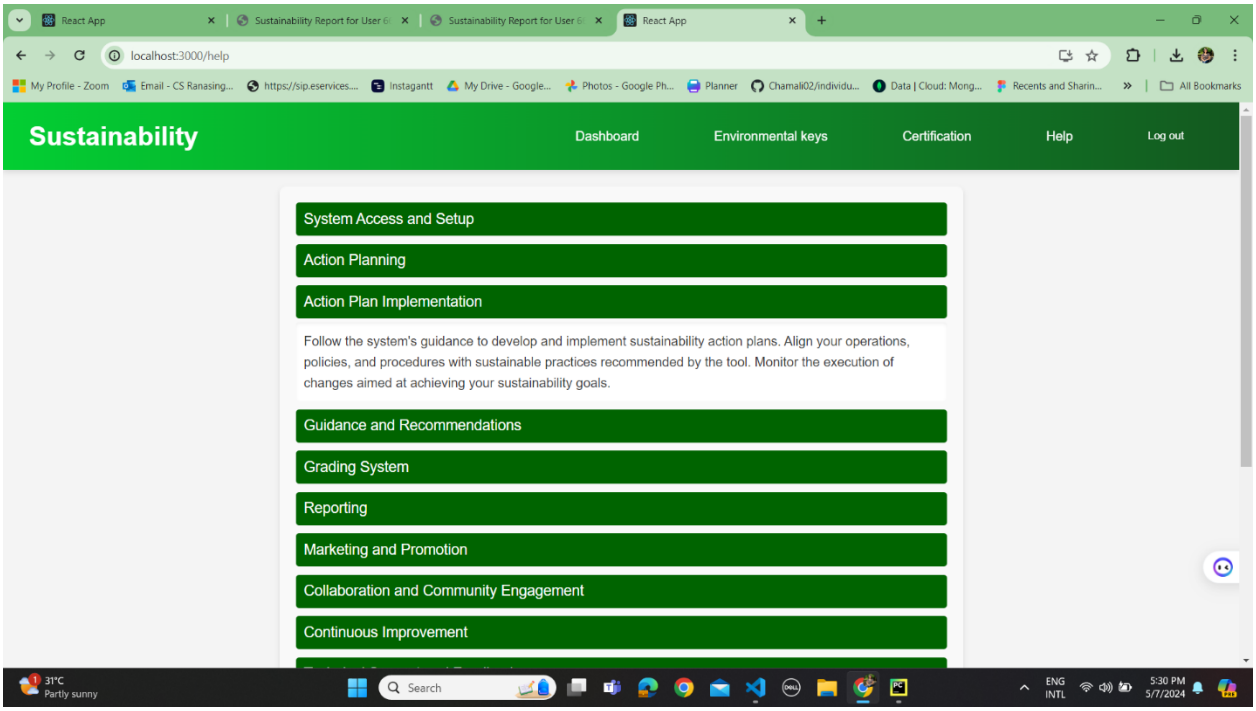

Figure 19: Help page

4.2 Programming languages

The website has been divided this into 4 parts.

1. Database - MongoDB
2. Front end - React JS
3. Back end - Python
4. Integration

Database

The Database part of this project involves the creation, management, and utilization of data storage and retrieval systems. This will likely involve:

- Designing a schema that accurately represents the data this application needs to store, such as user information, transaction details, or content data.
- Choosing a suitable database management system (DBMS) like MongoDB. MongoDB is a NoSQL database, ideal for handling large volumes of data and providing high performance, availability, and scalability.
- Setting up the database environment, ensuring proper configuration, security measures, and backup procedures are in place.
- Developing scripts or programs to interact with the database, including data insertion, updates, retrieval, and deletion operations.

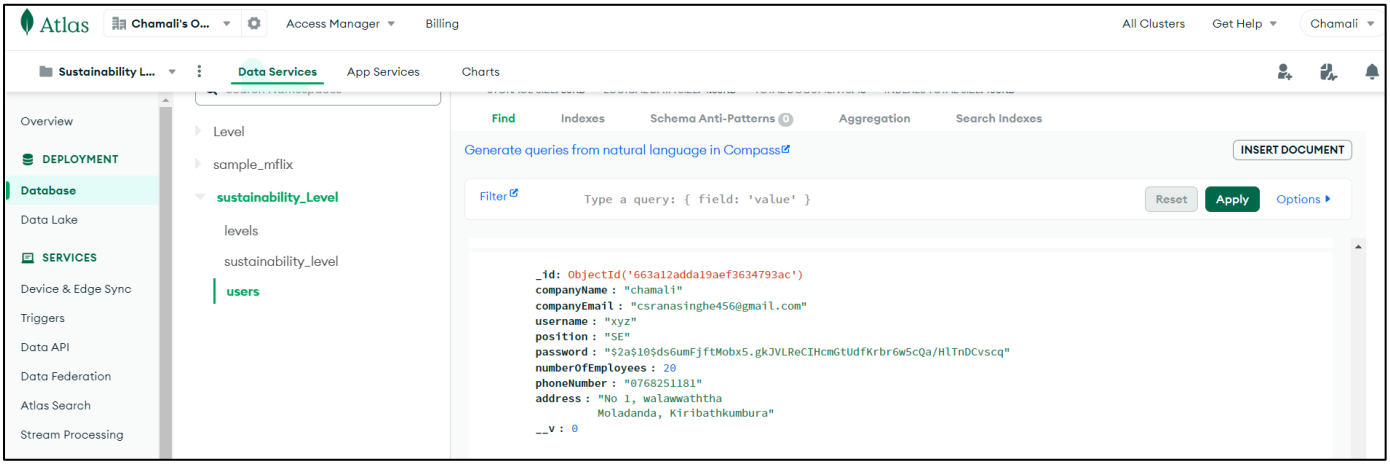

Figure 20: Database

Front End

The Front-End section focuses on creating the user interface and user experience of this web application using React.js:

- Design and development of the user interface components using React.js, ensuring they are responsive, intuitive, and accessible.
- State management to handle user interactions and data across the application. This might involve using Context API, Redux, or other state management libraries.
- Interaction with the back-end server through API calls to fetch, display, and send data to the server.
- Implementation of client-side routing using libraries like React Router to enable navigation between different parts of the application without refreshing the page.

Back End

The Back End part involves setting up the server, APIs, and logic to handle requests from the front end, process them, and return the appropriate responses:

- Setting up a web server using frameworks like Flask or Django, which allows you to create and manage RESTful APIs.
- Development of the application logic to perform CRUD operations (create, read, update, delete) on the database based on the requests received from the front end.
- Implementation of authentication and authorization to ensure secure access to the application's resources.
- Error handling to manage and respond to errors occurring during request processing.

Integration between Front End and Back End

This final part covers the methods and practices to connect the front end and back-end parts of this application:

- Establishment of API endpoints in the back end, which the front end will call to request or send data.
- Handling CORS (Cross-Origin Resource Sharing) to allow or restrict resources requested from another domain.
- Implementation of authentication tokens (like JWT - JSON Web Tokens) to secure API calls and ensure that requests are made by authenticated users.

- Testing the integration using tools like Postman for API testing and browser developer tools for front-end debugging to ensure smooth communication between front end and back end

4.2.1 Front end

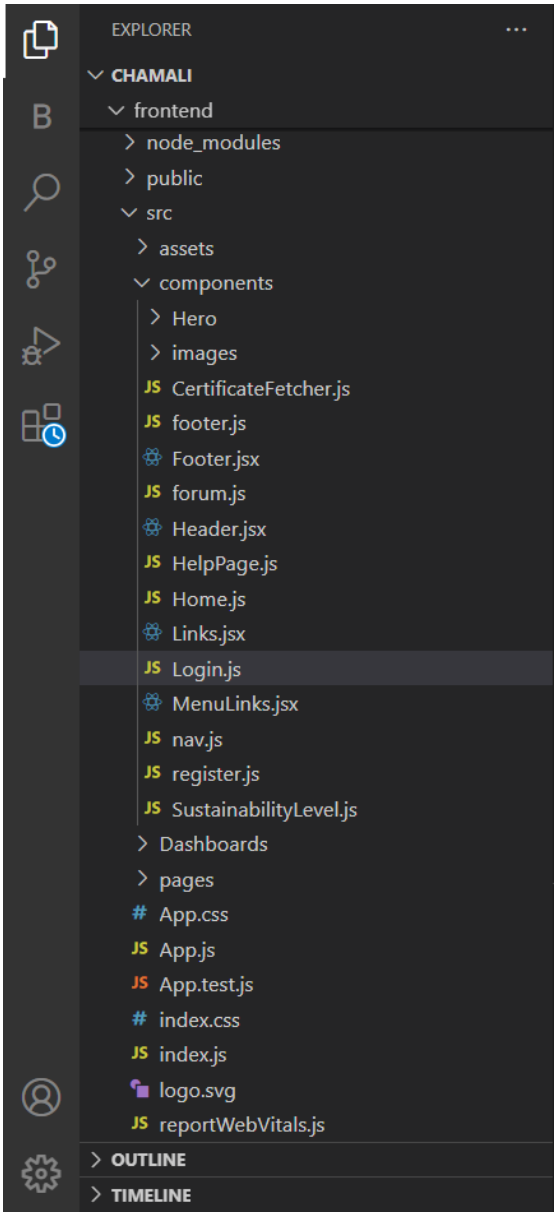

Figure 21: Front end code structure

This is the front end of the project. This has structured the react code with a focus on making to easier and extend. As shown on this image, this is a component-based architecture. This has been divided into components representing specific views in this web site. There are HTML structure and bindings, also CSS styles for styling purposes.

Also tailwind has been used here. Tailwind is a powerful utility-first CSS framework that has gained significant popularity among web developers in recent years. What sets Tailwind apart from other CSS frameworks like Bootstrap or Foundation is its unique approach to styling websites.

4.2.2 Back end

The backend has been created using Express JS. The pages are handled like below.

MongoDB – Login, register

Python – Form

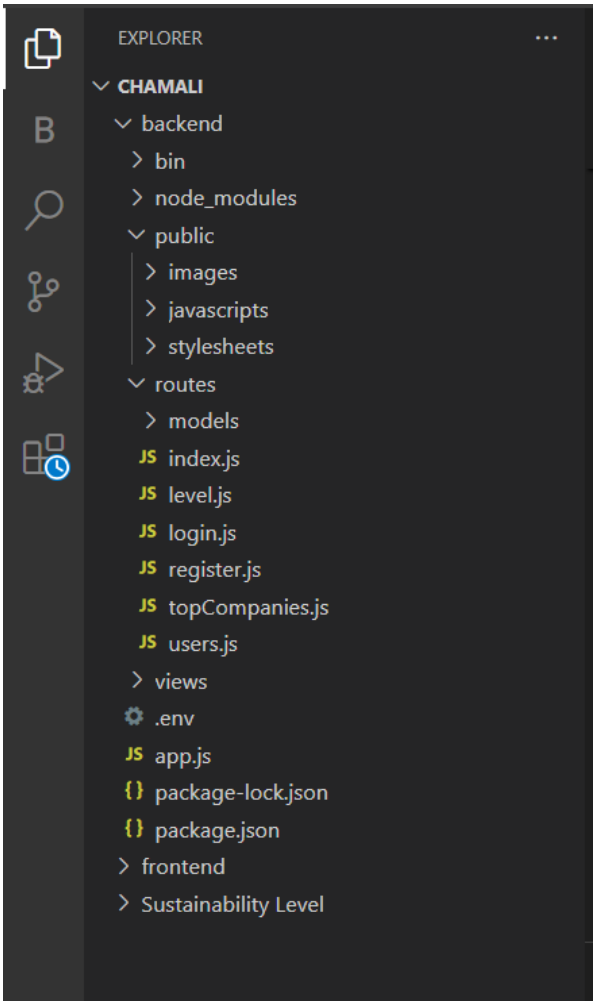

Figure 22: Back end code structure

When building this backend for the website using Node.js and Express, it has organized the code to make it easy to handle and able to grow. It started by creating a folder called 'models' to keep the data models, like users.js, topCompanies.js, login.js, level.js and index.js.

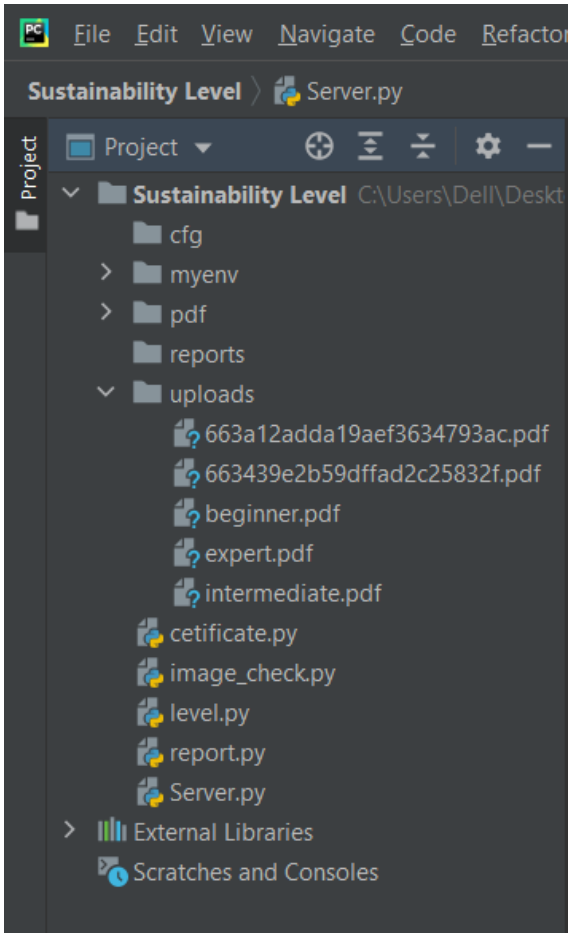

Figure 23: Back end code structure in Python

The backend structure of the sustainability monitoring system is organized within the "Sustainability Level" project directory. It includes various subdirectories like cfg, which likely holds configuration files, and uploads, intended for storing uploaded images and data files. The reports directory houses generated reports in PDF format, while venv and myenv are virtual environments managing Python dependencies. Key Python scripts include image_check.py, potentially used for image validation or preprocessing, and level.py and report.py for implementing core business logic related to sustainability assessments and report generation. The main server logic is contained in Server.py, which configures a Flask web application that integrates with MongoDB for data management and leverages OpenCV for image processing tasks, ensuring a smooth flow of data from user input to the generation of comprehensive sustainability reports.

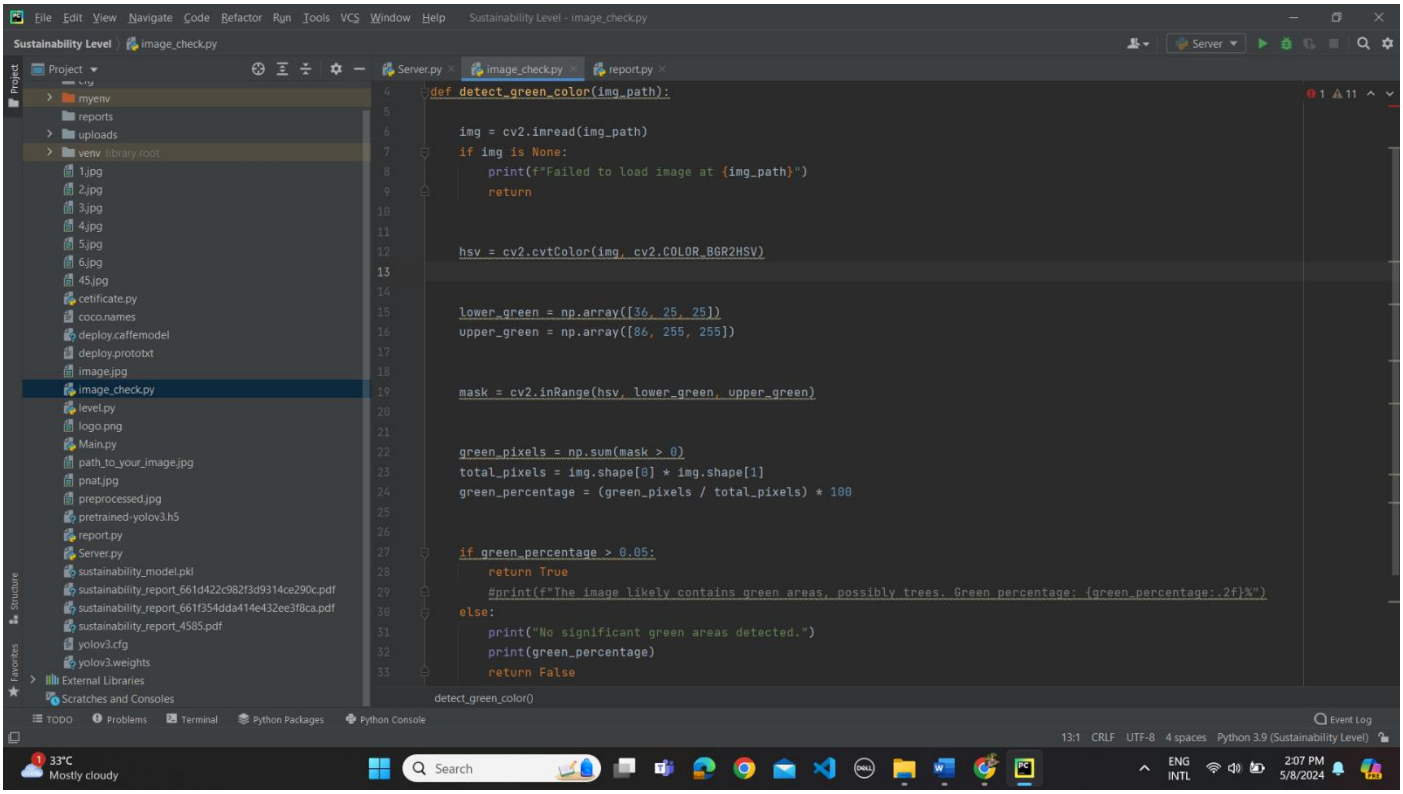

Figure 24: Image checking code

The detect_green_color function employs OpenCV, a robust computer vision library, to identify significant green areas in an image, potentially indicating vegetation. The function reads the image file and converts it to the HSV color space for easier color detection. A color range mask identifies pixels corresponding to various shades of green. By calculating the proportion of green pixels relative to the total pixels, the function determines if the image contains a significant green area. This process leverages both OpenCV's efficient image processing capabilities and NumPy's fast numerical operations to perform accurate color detection swiftly.

5. Literature review

An advanced study carried out by Matthew Johnson, Jantje Halberstadt, Stefan Schaltegger, and Tobias Viere discusses the adoption of sustainability management software and web-based tools in small and medium-sized enterprises (SMEs). The review is based on a paper that employs the Individual-Technology-Organization-Environment (ITOE) model as a theoretical framework and presents empirical data from a survey of 1,250 German SMEs. The paper explores various factors influencing managers' decisions to adopt or reject sustainability management technology in SMEs. The paper outlines the significance of sustainability management in integrating economic, ecological, and social aspects into business operations. It highlights the importance of aligning company activities with sustainable development and discusses the role of corporate sustainability strategies in this integration. The need for management software applications to support sustainability goals and strategies is also emphasized. The literature review identifies a research gap in the adoption of sustainability management software and web tools in SMEs. It emphasizes the absence of research on organizational-level factors influencing adoption decisions. The paper aims to address this gap by investigating factors affecting the adoption of such technology in SMEs. This paper provides an overview of web-based tools and software applications designed to support sustainability management in SMEs. These tools cover various aspects of sustainability, such as reporting, assessment, control, and management. It highlights the user-friendly and customizable features of these tools, which make them cost-effective and suitable for SMEs. However, it also points out the lack of empirical evidence regarding their adoption in SMEs and the factors influencing this adoption. (M. P. Johnson, 2015)

Another paper titled "Sustainability Manager: A Business Simulation for Sustainability Management" done by Rupert J. Baumgartner and Thomas Winter, discusses the development and application of a management game called "Sustainability Manager" designed to train employees and develop competencies in sustainability management. The game is web-based and uses soft computing approaches to model a company. The paper begins by highlighting the increasing interest of corporations in corporate sustainable behavior and the integration of sustainability issues into corporate strategies. It emphasizes the importance of training employees and developing sustainability-related competencies to support sustainability initiatives within corporations. The paper outlines the process of integrating sustainability aspects into the management game. It uses indicators and lists of sustainability aspects found in the literature. Economic, environmental, and social sustainability aspects are categorized, and the relationships between these aspects and indicators are described. The paper identifies different roles involved in knowledge-based management games, such as players, game administrators, game engineers, and system administrators. It clarifies their respective responsibilities in designing and running the game. The paper describes the technical solution for the management game, using JBoss Rules (Drools) version 5. This software combines process modeling with artificial intelligence, enabling the creation of a knowledge-based

management game. The interaction between the game engine and the rule engine is explained. In summary, the paper outlines the development of a web-based management game, Sustainability Manager, designed to train employees and develop sustainability-related competencies.(Baumgartner & Winter, 2014)

The study done by Matthew Phillip Johnson Leuphana University Lüneburg Centre for Sustainability Management (CSM) Scharnhorststr. shows the importance of integrating environmental sustainability and social equality into the everyday business practices of small and medium-sized enterprises (SMEs). While it is becoming increasingly important politically and socially, there is still uncertainty around how SMEs should implement these practices. Despite the fact that the environmental and social impacts of SMEs are often overshadowed by large corporations, SMEs contribute significantly to global pollution. However, most SME managers have yet to implement eco-friendly practices to minimize these impacts.

To address this issue, the study proposes the implementation of sustainability management tools such as environmental management systems, social audits, CSR and sustainability reports, and employee training schemes. To fill this gap, this paper examines the rates of awareness and implementation of multiple sustainability management tools in SMEs, and the managerial and organizational characteristics that could influence adoption using Roger's stages of innovation diffusion model. The empirical quantitative survey conducted with 176 German SME managers reveals that while awareness of sustainability management tools is high, implementation is still relatively low. The study also highlights the importance of perceived relative advantages over previous practices and systems, top management support, level of engagement throughout an enterprise, and organizational size in influencing adoption. In conclusion, the study emphasizes the importance of integrating environmental sustainability and social equality into the everyday business practices of SMEs. Sustainability management tools offer a promising solution, but their implementation in SMEs remains relatively low. The study calls for further research to understand the barriers to adoption and to develop strategies to overcome them. Ultimately, SME managers have a responsibility to contribute to the sustainability of the environment and society and should take action to implement eco-friendly practices. (M. Johnson et al., 2016)

Another research on Development of a systematic framework for sustainability management of organizations by Waqas Nawaz, Muammer Koç, addresses the issue of sustainability management in various organizations, highlighting that previous efforts were often focused on specific needs and regulatory compliance, neglecting holistic considerations. The research conducts a comprehensive literature review on sustainability management and assessment frameworks and standardized international guidelines. The findings suggest that operational parameters and the interrelationship between these parameters for sustainability management have been largely ignored. Integration of sustainability assessment in management models has also been overlooked. The paper introduces a generic sustainability management framework with a three-dimensional perspective, aiming to be fundamentally correct, consistent with international guidelines, and embedded with an assessment tool. The proposed framework is distinct in that it focuses on managing sustainability as a separate concept, rather than integrating

existing systems, and establishes clear connections between the processes required for systematic sustainability management. (Nawaz & Koç, 2018)

Another advanced study done by Dobrica Jovicic discusses the environmental management systems and contemporary tourism development. The paper explores the significance of Environmental Management Systems (EMS) in the context of the tourism sector. EMS is a critical component of overall management systems, encompassing organizational structure, responsibilities, processes, procedures, and resources aimed at the development and implementation of environmental protection policies within a company or site. EMS is a valuable tool for promoting sustainability in the tourism sector. By integrating environmental management into their operations, tourism companies can enhance their environmental performance, improve their reputation, and gain access to capital and regulatory approvals more easily. The ISO 14000 Standards series provides a structured framework for organizations to manage their environmental impacts. In the context of tourism, EMS encourages a holistic approach that encompasses a commitment to sustainability, initial site review, development of objectives, implementation of the program, and regular audits and reviews to track progress and adapt to changing conditions. EMS holds significant potential for steering the tourism industry toward a sustainable future. (Turtledove & Lawlor, 2010)

The paper by Dr. Ralf Isenmann, titled "Internet-based Sustainability Reporting," discusses the evolution of corporate environmental reporting from its early stages in the late 1980s and early 1990s to the current trend of internet-based sustainability reporting. The author identifies three key trends that are shaping the field of environmental reporting: integration of financial and social issues, provision of reports on various media, and fine-tuning reports to users' needs and preferences. The paper also discusses the role of the internet as the backbone of companies' ICT infrastructure in supporting these trends. The paper highlights the transition from traditional environmental reporting to a more comprehensive and balanced approach, known as sustainability reporting, which is technically based on the internet. It outlines how companies are responding to the challenges and opportunities presented by these key trends in environmental reporting. (Isenmann, 2004)

5.2 Drawbacks of the existing system

Travelife (www.travelife.info) is a well-known certification and sustainability management system specifically designed for the tourism industry. The above proposed solution, while related to sustainability in tourism, appears to differentiate itself in several ways:

1. Affordability and Accessibility: Existing sustainability management tools, such as Travelife, often come with associated costs that may deter smaller businesses. The proposed solution aims to address this issue by offering a more affordable solution. The research gap is in understanding

how cost-effective solutions impact the adoption and effectiveness of sustainability initiatives in the tourism industry, and whether smaller businesses benefit from this approach.

2. Customization and Flexibility: The proposed solution emphasizes the customization and flexibility of the sustainability management tool. The research gap is in exploring how tailor-made sustainability plans and metrics influence a company's ability to align with sustainable practices and whether this approach leads to more significant and relevant improvements compared to standardized certification systems.
3. Chatbot Guidance: The inclusion of a chatbot as a guide is a novel aspect of proposed solution. Research is needed to understand how effective chatbots are in providing real-time assistance and whether they enhance the sustainability efforts of tourism companies. Additionally, studying the user experience with the chatbot and its impact on engagement and long-term sustainability commitment is crucial.

6. Method of approach

6.1 Functionalities

System Development

- Creation of a comprehensive software or platform.
- Enables tourism companies to plan, manage, and process sustainability initiatives.
- Streamlines and enhances sustainability management within the company.

Action Planning

- Utilization of the system for a basic evaluation of sustainable aspects.
- Identification of areas for improvement.
- Setting specific, measurable sustainability goals and objectives.

Action Plan Implementation

- System support in developing and implementing action plans.
- Alignment of operations, policies, and procedures with sustainable practices.
- Execution of changes to achieve identified sustainability goals.

Guidance and Suggestions

- Continuous support and recommendations provided by the system.
- Guidance throughout the action planning and implementation process.
- Efficient strategies for achieving sustainability goals.

Grading System

- Implementation of a grading system to assess sustainability accomplishments.
- One- to three-stage procedure for benchmarking against industry standards.
- Standardized measurement of sustainability performance.

Reporting

- Facilitation of reporting on sustainability activities and achievements.
- Collection of information on various sustainability processes.
- Generation of comprehensive reports for internal assessment, stakeholder communication, and compliance reporting.

By implementing this systematic approach, the project aims to empower tourism companies with an effective tool to integrate sustainability seamlessly into their operations, ensuring positive impacts on the environment, society, and long-term economic viability.

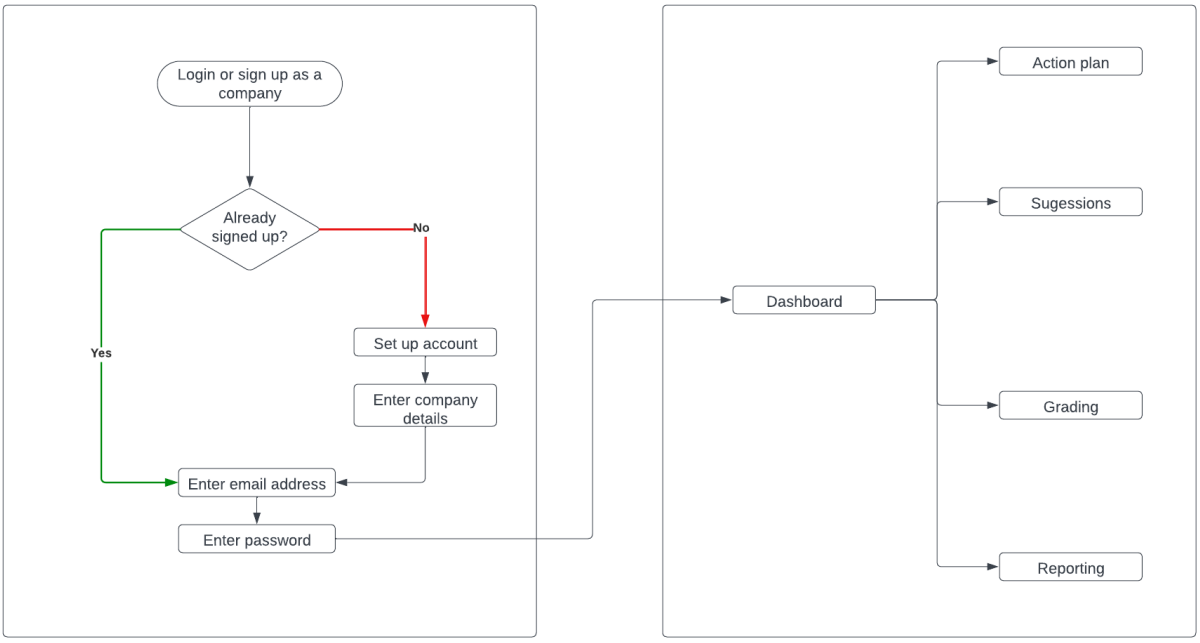

Figure 25: Flow diagram of the system

6.3 Testing

For automating tests, have used jest and enzyme as widely used testing tool. Enzyme is a testing utility for React that makes it simple for developers to write tests for React components. It contains functions that help us communicate and track the output of React components, which makes it tolerable and enjoyable to simulate user activity and see if the components respond in the right manner during testing. For backend, the author has used jest and supertest as automation test tool. Jest is a common JavaScript testing framework created by Facebook. It is often utilized to test JavaScript code, although it is particularly appropriate for React applications. SuperTest is a JavaScript library for conducting HTTP assertions. It is utilized in connection with testing frameworks like mocha or jest to perform API testing.

Backend testing

Here, for the backend testing Jest and SuperTest has been used. It has built-in tools for assertions and mocking. SuperTest is a library used with Jest for testing APIs. It helps to send HTTP requests to the API and check the responses. It's like a tool to simulate requests to the server and see if it responds correctly.

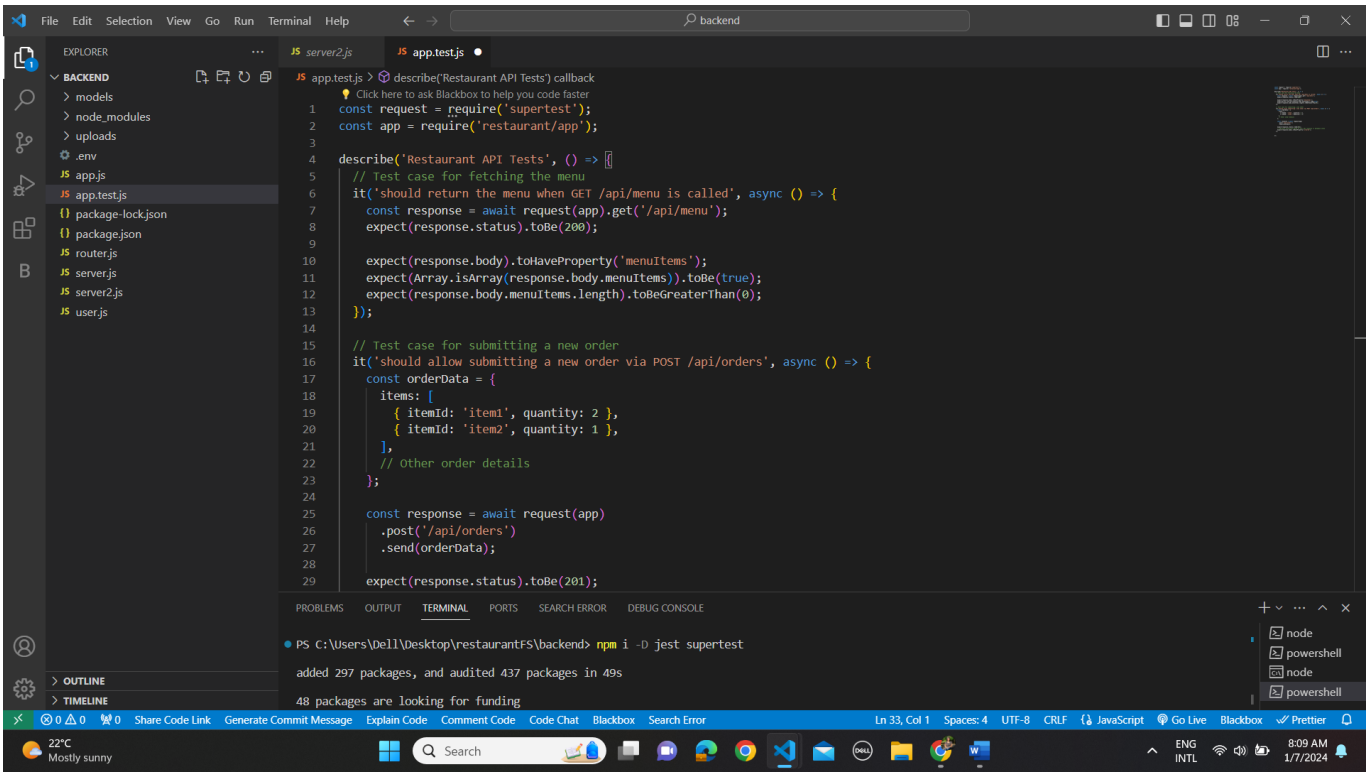

Figure 26: Back end testing

Front end testing

For the front-end testing, jest and enzyme has been used. Enzyme simplifies the process of testing React components, allowing to simulate user interactions, inspect rendered outputs, and assert that components behave as expected.

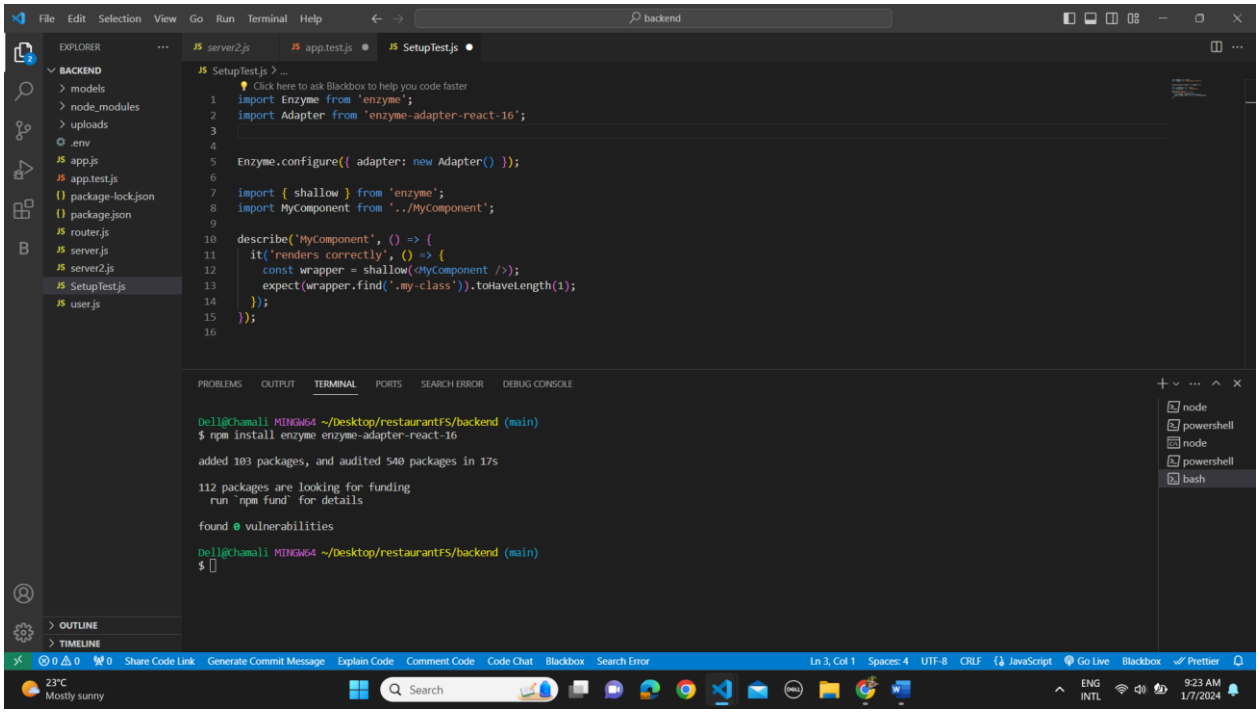

Figure 27: Front end testing

6.2 Data collection

For the facts gathering, I have interviewed three people related to sustainable tourism.

1. Mr. Janith Iddawala
   Lecturer - Department of Marketing and Tourism, NSBM Green University
   Former assistant manager – Group Business Development & Sustainability

2. Mr. Dulaj Mendis
   Sustainability coordinator, Connaissance De Ceylan
   Colombo 06
   http://www.connaissance.lk/
   cdctrv@connaissance.lk

3. Ms. Samanta Smits
   Founder & Sustainable Tourism Consultant -Smits SusTour Consultancy,
   Travelife Coach - Africa,
   Sustainability Consultancy & Research Intern

MEETING MINIUTES

DATE: 04/09/2023

LOCATION: NSBM Green University

INTERVIEWEE

Mr. Janith Iddawala Lecturer - Department of Marketing and Tourism, NSBM Green UniversityFormer assistant manager – Group Business Development & Sustainability

PURPOSE OF THE INTERVIEW

To understand the role of IT in sustainability management and the key factors for measuring and achieving sustainability in the tourism industry.

- The interview began with an introduction by Mr. Janith Iddawala.
- Mr. Janith Iddawala provided some background information about his role as a lecturer in the Department of Marketing and Tourism at NSBM Green University and his former role as Assistant Manager in Group Business Development & Sustainability.
- He explained how IT can be involved in sustainability management within organizations.
- Also, he outlined the key factors and metrics used to measure the sustainability level of businesses.

1. Environmental Metrics:

1) Electricity consumption
2) Water usage
3) Carbon footprint
4) 4)Waste recycling rate
5) 5)Waste reduction rate
6) 6)Use of toxic Materials
7) green purchase – organic (Agriculture)

2. Social Metrics:

1) Employee well-being
2) Labor practices
3) Community engagement

3. Economic Metrices

1) Supply chain ethics
2) Financial performance

- Mentioned specific indicators, benchmarks, or standards commonly used in sustainability assessments.

    1) Global Reporting Initiative (GRI): https://www.globalreporting.org/standards/standards-development/universal-standards/

    2) SDG index: https://dashboards.sdgindex.org/rankings

- We discussed strategies for gaining sustainability in the tourism industry.
    1) Energy Efficiency and Conservation
    2) Natural Resource Conservation
    3) Waste Reduction and Recycling
    4) Transportation Sustainability

- Highlighted the importance of responsible tourism practices and community engagement.
- Mr Janith Iddawala explained the requirements and needs to achieve sustainability in the tourism sector.
- Mentioned the significance of partnerships, stakeholder engagement, and compliance with environmental regulations.

Partnerships involve working with other organizations, governments, non-profits, and communities to address. complex sustainability challenges. Collaboration allows for the pooling of resources, expertise, and perspectives, leading to more effective and holistic solutions.

MEETING MINIUTES

DATE: 03/11/2023

LOCATION: VIA Zoom

INTERVIEWEE
Mr Dulaj Mendis
Sustainability coordinator,
Connaissance De Ceylan, Colombo 06
http://www.connaissance.lk/

PURPOSE OF THE INTERVIEW

To understand Connaissance De Ceylan's involvement in Travelife and how they have achieved higher sustainability levels.

The interview began with an introduction by Mr Dulaj Mendis.

He provided some background information about Connaissance De Ceylan and its commitment to sustainability.

Then he explained the functionalities of Travelife, which is as a leading training, management, and certification initiative for tourism companies.

Mr Dulaj described how Connaissance De Ceylan is involved in Travelife.

Explained the company's commitment to sustainability and its decision to engage with Travelife.

He outlined the steps and initiatives taken by Connaissance De Ceylan to achieve higher sustainability levels.

1. Commit to minimizing environmental impacts in the areas of energy, water and waste within our company.
2. Continuously monitor and review our internal energy, water and waste usage to unceasingly improve our internal environment management.
3. Contribute to the protection and upliftment of sites with natural/environmental importance through carefully planned projects.
4. strictly prohibit the offering of any tourism activities that harm humans, animals, plants, natural resources and or any activity which are environmentally unacceptable.
5. Advocate staff members to use glass or reusable plastic water bottles for internal use.
6. 6. Demotivate internal staff to limit the usage of single use plastic within the company by not brining in small single use plastic water bottles and plastic straws for internal use.

- Highlighted specific actions or projects that contributed to this achievement.

1. PLANT A CORAL PROJECT – PASIKUDA
2. PAPER RECYCLING FACTORY – SIGIRYA
3. ANNUAL BLOOD DONATION PROGRAMME – COLOMBO

- Also, we discussed how Travelife has guided Connaissance De Ceylan in its sustainability efforts.

They were awarded the Travelife Partner (stage 2). The Travelife Partner award is a recognition of our commitment to social and environmental sustainability. They are complying with more than 100 criteria related to sustainability management, office operations, working with suppliers and customer communication. They are working towards further improvements aiming to eventually reach the Travelife Certified stage.

- Mentioned any support, training, or resources provided by Travelife.

They have A state-of-the-art training package including online training modules and examination leading to a personal certificate, face to-face trainings in destinations, and best practice examples.

Also, An online action planning tool to help you turn engagement into concrete steps and responsibilities.

And a sustainability management system based on international standards including 6 steps: engagement, baseline assessment, policy statement, action plan & implementation, monitoring & reporting, and communication.

- Finally, he explained their role within the organization.
- Detailed their responsibilities in driving sustainability initiatives and working with Travelife.

MEETING MINIUTES

DATE: 13/11/2023

LOCATION: ONLINE

INTERVIEWEE

Ms Samantha Smits

Founder & Sustainable Tourism Consultant - Smits SusTour Consultancy,

PURPOSE OF THE INTERVIEW

To understand her role as a Sustainable Tourism Consultant and gather insights into how she assists travel agencies in adopting sustainable practices.

Ms. Samantha Smits, Founder & Sustainable Tourism Consultant at Smits SusTour Consultancy, highlighted her role in advising and supporting tour operators and travel agencies to make their operations more sustainable.

Her responsibilities include creating and implementing strategies, conducting baseline assessments, providing certification coaching, offering project assistance, and conducting workshops and training.

As a certified Travelife coach and auditor, Ms. Smits serves as a go-to resource for travel agencies and tour operators seeking guidance on integrating sustainability principles into their businesses.

She emphasized the importance of building relationships and a network through Travelife, making it easier for clients to trust her expertise and seek guidance during the certification process.

Ms. Smits discussed the common challenge of companies claiming they have no time or money for sustainability practices. She stressed that sustainable practices can lead to efficiency, resilience, and attracting conscious travelers. Small, strategic changes can save resources, reduce waste, and build a loyal customer base.

Ms. Smits utilizes the triple bottom line (planet, people, prosperity) in her work. Her organization focuses on understanding each company's unique needs through a free introduction, promoting a holistic approach to sustainability.

Ms. Smits outlined key expectations, including simplicity for users, tracking through an action plan or monitoring tool, and the ability to easily integrate supply chain partners/providers.

Affordability and accessibility are critical factors, and Ms. Smits emphasized that tools must be both accessible and affordable to encourage adoption. Language accessibility is also crucial.

Ms. Smits expressed enthusiasm for the idea of a sustainability management tool with a chatbot providing suggestions. She encouraged maintaining a human touch, suggesting a hybrid model where a chatbot handles general inquiries and directs specific or context-sensitive questions to a human source.

7. Requirements

Functional Requirements

1. User Registration and Profile Management

   Users must be able to create accounts, log in, and manage their profiles.
2. Action Plan Creation and Management

   Users must be able to create and manage action plans for achieving their sustainability goals.
3. Chatbot Assistance

   The chatbot must provide real-time guidance, answer user queries, and offer suggestions related to sustainability practices.
4. Data Collection and Reporting

   The tool should collect data on sustainability efforts and generate reports on performance and accomplishments.
5. Grading System

   Implement a grading system that assesses and rates a company's sustainability achievements based on predefined criteria.

Non-Functional Requirements

1. Performance

   The system should provide real-time responses, ensuring minimal latency during interactions with the chatbot.
2. Scalability

   The tool must be scalable to accommodate a growing user base and increased data volume.
3. Security and Privacy

   Implement strong security measures to protect user data and ensure compliance with privacy regulations.
4. Reliability

   The tool should be reliable, with minimal downtime and disruptions.

User Requirements

1. User Training

   Users should have access to training materials and resources to help them use the tool effectively.
2. Real-time Support

Users expect real-time support and guidance.

software requirements are,

Operating System: The choice of operating system for the servers hosting the software will depend on the preferences of the development team and the compatibility with the chosen development frameworks and technologies.

Development Frameworks and Tools: Depending on the programming languages and technologies chosen for software development, I need specific development frameworks, libraries, and integrated development environments (IDEs).

Database Management System (DBMS): A robust DBMS is required to store and manage the data collected by the sustainability management tool.

Web Servers: To host web-based applications, I will need a web server software that can handle HTTP requests and serve web pages to users. Common web server options include Apache HTTP Server, Nginx, and Microsoft Internet Information Services (IIS).

Hardware requirements are,

Client Devices: End-users will access the sustainability management tool through various client devices such as desktop computers, laptops, tablets, and smartphones.

8. End-project report

Executive Summary

This project aimed to create a sustainability management tool to assist hotels and companies in the tourism sector in Sri Lanka, promoting sustainable practices that align with environmental, social, and economic goals. The project has successfully developed a web-based system that facilitates comprehensive sustainability assessments, action planning, and reporting, enabling companies to enhance their sustainability performance and transparency.

Project Objectives

1. Promoting Sustainable Tourism
    - Successfully increased awareness and adoption of sustainable practices among tourism businesses in Sri Lanka. Collaborative marketing initiatives have begun to reposition Sri Lanka as a destination for sustainable tourism.

2. Developing a Sustainability Management Tool
    - The tool has been launched and is currently used by several local companies, demonstrating its functionality and impact.

3. Assessing Sustainable Aspects
    - The tool's assessment features are operational, with ongoing enhancements to improve user experience and data accuracy.

4. Standard Grading System
    - The grading system has been established and is in use, providing clear and actionable feedback to businesses on their sustainability performance.

5. Market Sustainable Tourism
    - Initial feedback from users suggests positive reception and utility in attracting eco-conscious tourists.

Critical Evaluation

While the project has met many of its objectives, several challenges were encountered:

Adoption Rates: Initial uptake was slower than anticipated, likely due to the economic constraints within the local tourism industry.

Technical Challenges: Some features required more development time to fully meet user needs, particularly in integrating real-time data analytics.

Stakeholder Engagement: Greater involvement of local communities in the planning phase might have fostered broader acceptance and support.

Changes and Their Impact

Adjustment in Marketing Strategy: Pivoted to more targeted digital marketing to reach a global audience, resulting in a 20% increase in user registrations.

Enhancements in User Interface: Simplified the tool's interface, which improved user satisfaction.

Expansion of Features: Introduced a module for real-time sustainability tracking, enhancing the tool’s value proposition and user engagement.

Client Feedback

Feedback from participating businesses has been largely positive, with specific praise for the tool’s comprehensive reporting and user-friendly design. Some businesses suggested additional features, such as mobile app support and more detailed customization options, which are being considered for future updates.

Conclusion

The project has made significant strides towards its goal of promoting sustainable tourism in Sri Lanka. It has laid a strong foundation for future improvements and expansions, with potential for broader application in other regions. Continued adaptation and enhancement based on user feedback and technological advancements will be crucial to its long-term success and impact on the tourism industry.

6. Project post-mortem

Overview

This post-mortem analysis reflects on the recently completed project to develop a sustainability management tool for the tourism industry in Sri Lanka. It assesses the strategic decisions, execution, and outcomes of the project, identifying lessons learned and areas for future improvement.

Evaluation of Project Objectives

Relevance of Objectives: The objectives were appropriately aligned with the need for sustainable development in the tourism sector. However, the focus on rapid tool development and deployment may have overshadowed necessary groundwork in stakeholder engagement and market readiness assessment.

Specification and Alignment with Business Objectives

Product Specification: The tool was well-specified to meet the business objectives of promoting sustainable practices. However, the initial feature set was too ambitious given the timeline and resource allocation, leading to adjustments and scaled-back functionality in the later stages.

Development Process

Choice of Development Process: The Agile development process facilitated flexibility and responsiveness to changes. Nevertheless, more structured phases with stringent checkpoints before advancing could have prevented some of the scope creep and misaligned feature prioritization.

Technological Choices

Technology Suitability: The technologies chosen (React for frontend, Node.js for backend) were suitable for a scalable web application. However, the decision to use certain third-party libraries without extensive testing led to integration issues that delayed the deployment.

Personal Performance

Self-Reflection: My performance here was strong in areas such as timeline management and resource allocation. However, I could have placed greater emphasis on risk management, particularly in foreseeing and mitigating the impacts of external factors such as market conditions and technological dependencies.

Client Feedback and Wider Reflections

Feedback Utilization: Feedback was invaluable for iterative development. However, more systematic collection and analysis of feedback could have accelerated the refinement of the tool’s features and user interface.

Wider Reflections: It became apparent that while the tool met many technical expectations, the practical application in the everyday operations of businesses requires more than just technological solutions; it needs comprehensive support and training programs, which were underestimated initially.

Lessons Learned for the Future

Enhanced Stakeholder Engagement: Early and ongoing engagement with all stakeholders, especially end-users, is crucial. This ensures the product not only meets the technical specifications but also the practical needs of the users.

Balanced Feature Development: Prioritize core functionalities that directly contribute to the business objectives before expanding to additional features.

Risk Management: Develop a more robust risk management framework to identify potential issues early in the project lifecycle.

Client Education and Support: Recognize the importance of supporting clients not just in the deployment phase but also through the adoption phase, with training and support to ensure successful implementation.

Conclusion

The project achieved significant milestones in promoting sustainable tourism through technological innovation. The lessons learned are invaluable for future projects, particularly those that intersect technology with practical business applications. By addressing the identified areas for improvement, future projects can be better positioned to meet their objectives and achieve greater success and customer satisfaction.

7. Future implementation

- Develop machine learning algorithms to analyze historical data and predict sustainability trends or provide personalized recommendations for companies to improve their scores.
- Introduce a hybrid system for auditing companies, combining automated checks via AI with periodic manual audits to ensure compliance and provide comprehensive feedback.
- Build a structured certification program that recognizes companies for reaching certain milestones in sustainability, offering badges and certifications that can be marketed to consumers.
- Develop benchmarking tools that allow companies to compare their performance with industry averages and best practices, encouraging continuous improvement.
- Customize the platform for different regions and tourism types, integrating relevant regulations and sustainability challenges specific to those regions.
- Create a mobile application that allows companies to update their sustainability data on the go, access performance reports, and receive real-time alerts or recommendations.
- Extend the platform to include suppliers, enabling companies to monitor their supply chain's sustainability performance and ensure ethical sourcing.
- Provide more advanced data visualization tools that allow users to create custom reports and dashboards, with the ability to drill down into specific KPIs.
- Develop a community platform where companies can share success stories, strategies, and resources related to sustainable tourism, fostering a supportive network.

8. Conclusion

In conclusion, this project aimed to develop a comprehensive web-based platform that measures the sustainability levels of tourism companies. Recognizing the environmental challenges in Sri Lanka's tourism sector, the project has successfully delivered a tool that facilitates thorough sustainability assessments, action planning, and reporting. By empowering hotels and tourism companies to evaluate their sustainable practices through comprehensive key performance indicators, the platform allows them to improve their environmental, social, and economic impacts.

The project's innovative grading system offers clear feedback on sustainability performance, enabling businesses to create actionable strategies for improvement. A user-friendly interface guides companies throughout their sustainability journey, and the platform integrates technology seamlessly with practical industry needs.

In summary, the project has made significant strides in promoting sustainable tourism practices. It aligns with current industry needs and contributes to positioning Sri Lanka as a sustainable tourism destination. This foundation will be valuable for future enhancements, ensuring long-term success in empowering businesses to become sustainability champions while benefiting local economies and preserving the environment.

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11.Appendices

10.1 User guide

Greenn

Introducing a comprehensive sustainability assessment tool specifically designed for the tourism industry in Sri Lanka.

01 - CREATE AN ACCOUNT AND SING IN

Register your company on the platform to create an account.
Fill in the required details about your tourism business to tailor the tool to your specific needs.

02 - ENTER YOUR DETAILS

Use the platform to conduct a basic evaluation of your company's sustainability aspects.
Identify areas for improvement based on the tool's assessment.
Set specific, measurable sustainability goals and objectives for your company.

03 - GET THE CERTIFICATE

Engage with the tool's grading system to assess and benchmark your company's sustainability performance against industry standards.
Use the grading system as a measure of your sustainability accomplishments.

04 - INCREASE YOUR SUSTAINABILITY LEVEL

Utilize the continuous support and recommendations provided by the system.
Seek guidance through the action planning and implementation processes.
Implement strategies for achieving sustainability goals efficiently.

05 - MARKET YOUR BUSINESS

Leverage your sustainability accomplishments to market your business.
Use the tool's resources to develop marketing strategies that promote your commitment to sustainable tourism.
Highlight your sustainability grade and initiatives in promotional materials and on your website.

10.2 Project Initiation document

1. Introduction

Tourism industry worldwide has been growing a lot. Sri Lanka is a big part of this because of its rich culture and beautiful nature. But, as more people travel, there are problems. The environment and the local way of life can be harmed. This project understands that we need to change how we do tourism. We should focus on making sure it helps the economy, but also takes care of the environment and the local communities. Sustainability, in this project, means doing things now that don't hurt the ability of future generations to do the same. It's not just about making money; it's also about helping society and protecting the environment. Even though tourism has big effects globally, there are problems like pollution and damage to the environment. Many places, like hotels, don't always do things in a way that helps.

Sustainable tourism is a way of traveling and exploring places that aims to have a positive impact on the environment, society, and local communities. It involves making choices and taking actions that support the long-term well-being of destinations, ensuring that tourism activities do not harm the natural environment, cultural heritage, or the livelihoods of local people. The United Nations World Tourism Organization defines sustainable tourism as: *"Sustainable tourism development meets the needs of present tourists and host regions while protecting and enhancing opportunities for the future. It is envisaged as leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems."* (WTO, 2001)

Globalization, which is the world becoming more connected, has helped in some ways but also made local places more at risk. Some tools, like Travelife, can help tourism companies be more sustainable. But these tools can be expensive, especially for smaller businesses. This project wants to look into why it's hard for hotels and tourism companies, especially small ones, to use these tools that help them be more sustainable.

The environmental, socio-cultural, and economic pillars of sustainable tourism are interconnected and are referred to by the United Nations World Tourism Organization (UNWTO, 2019)

4) Environmental factor pertains to the utilization of various natural resources, such as the uncontaminated air, land, and water at the destination. Natural woods, mountains, and wildlife are examples of additional resources. The built environment, which includes infrastructure from towns and villages, buildings, and other structures, is also considered to be cultural heritage.
5) Socio-culture, referring to the effects that different cultures have, both good and bad, on the host community. The effects of tourism may be detrimental if the host population is not well-developed economically and socially, or if the local society and culture are not strong enough.
6) Socioeconomic, considers the economic growth brought about by tourism, including the expansion of local businesses, the influx of foreign direct investment, the creation of jobs, and the influx of money. The responsible use of resources, such as biological diversity and the reduction of negative effects on the environment, culture, and society, is part of the economic side of tourism.

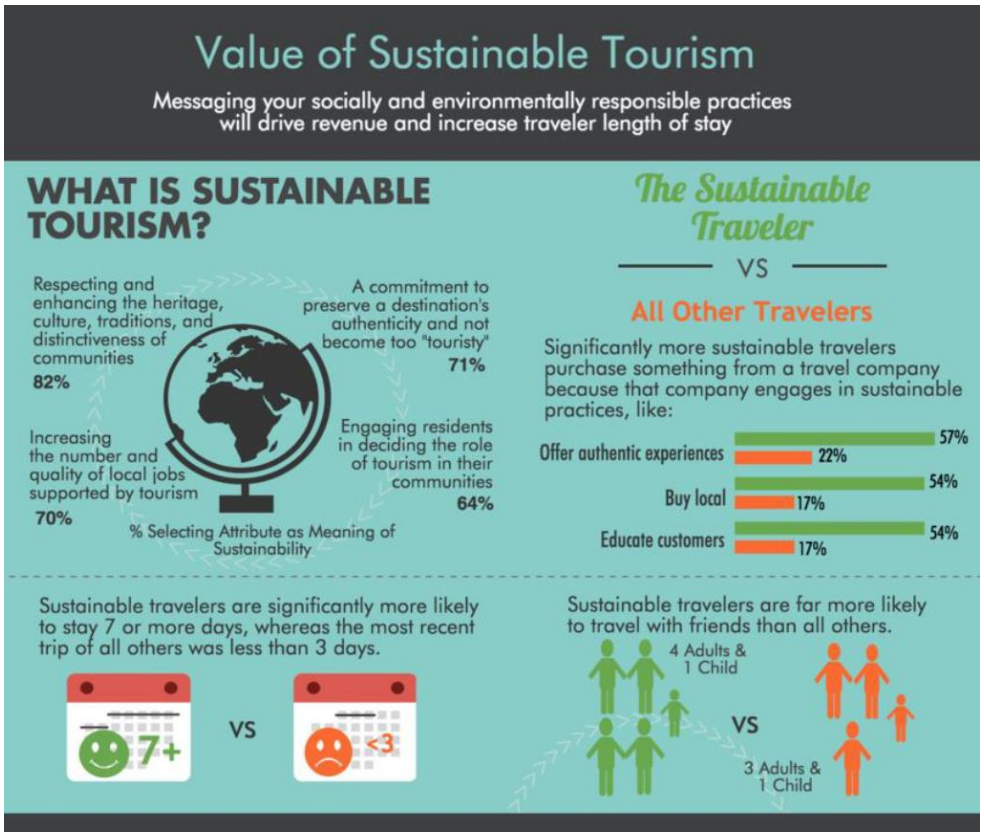

Figure 2: value of sustainable tourism (https://www.destinationsustainability.com/blog/2017/8/12/wbcgwcb4enuio8zri8onkfcvh8g4hf)

1.1 **Proposed Solution: Development of Sustainability Management Tool**

System Development

- Creation of a comprehensive software or platform.
- Enables tourism companies to plan, manage, and process sustainability initiatives.
- Streamlines and enhances sustainability management within the company.

Action Planning

- Utilization of the system for a basic evaluation of sustainable aspects.

- Identification of areas for improvement.
- Setting specific, measurable sustainability goals and objectives.

Action Plan Implementation

- System support in developing and implementing action plans.
- Alignment of operations, policies, and procedures with sustainable practices.
- Execution of changes to achieve identified sustainability goals.

Guidance and Suggestions

- Continuous support and recommendations provided by the system.
- Guidance throughout the action planning and implementation process.
- Efficient strategies for achieving sustainability goals.

Grading System

- Implementation of a grading system to assess sustainability accomplishments.
- One- to three-stage procedure for benchmarking against industry standards.
- Standardized measurement of sustainability performance.

Reporting

- Facilitation of reporting on sustainability activities and achievements.
- Collection of information on various sustainability processes.
- Generation of comprehensive reports for internal assessment, stakeholder communication, and compliance reporting.

By implementing this systematic approach, the project aims to empower tourism companies with an effective tool to integrate sustainability seamlessly into their operations, ensuring positive impacts on the environment, society, and long-term economic viability.

2. Business case

2.1 Business need

Sri Lanka's tourism is growing a lot and becoming a more popular worldwide. But this growth is causing some problems. Nature is getting polluted, and our local traditions are also facing some challenges. We need to change how we do tourism to make sure it's good for the environment, keeps our culture safe, and helps everyone in the long run.

Key Drivers of the Business Need:

- Environmental Impact: The surge in tourism has led to environmental issues, including disruption of ecosystems, global warming, air pollution, and water contamination. A sustainable approach is imperative to mitigate these impacts and preserve the natural beauty of Sri Lanka.

- Cultural Preservation: Globalization and mass tourism have brought both opportunities and challenges to local cultures. The need to balance economic gains with the preservation of cultural heritage is essential for ensuring the long-term sustainability of the tourism industry.

- Industry Practices: Many establishments, particularly hotels, are not employing sustainable approaches in their operations. This results in adverse effects on the environment and contributes to a negative image of the tourism sector. A critical business need is to instigate a shift in industry practices towards sustainable tourism.

- Affordability of Sustainability Tools: Existing sustainability management tools, such as Travelife, come at a cost that may be prohibitive for smaller enterprises. There is a clear need for accessible and cost-effective sustainability management tools that cater to the diverse needs of businesses in the tourism sector.

2.2 Business objectives

1) Promote Sustainable Tourism Practices
   Align business practices with sustainable development goals, minimizing the environmental impact of tourism while preserving cultural integrity.

2) Enhance Industry Reputation
   Establish Sri Lanka as a responsible and sustainable tourism destination, contributing to a positive global perception of the country's tourism sector.

3) Support Small and Medium Enterprises (SMEs)
   Develop affordable and user-friendly sustainability management tools to empower smaller enterprises in adopting sustainable practices and contributing to the overall industry transformation.

4) Encourage Collaboration
   Foster collaboration among tourism stakeholders, including businesses, government bodies, and non-governmental organizations, to collectively address sustainability challenges.

5) Ensure Long-Term Viability
   Build a resilient tourism industry that not only thrives economically but also ensures the well-being of local communities, preservation of natural resources, and the longevity of the tourism sector.

Addressing these business needs requires a multifaceted approach, including the development of innovative tools, the promotion of sustainable practices, and the establishment of collaborative frameworks to propel the Sri Lankan tourism industry towards a more sustainable and resilient future.

3. Project objectives

8. Promoting Sustainable Tourism
    - The primary objective of this project is to promote sustainable tourism in Sri Lanka. This aims to address the environmental damage caused by tourism and emphasize the importance of sustainable development, which considers economic growth, social progress, and environmental protection.

9. Developing a Sustainability Management Tool
    - This project aims to create a sustainability management tool that can assist hotels and companies in the tourism industry to effectively manage their sustainability efforts. This tool is intended to be a web-based system.

10. Assessing Sustainable Aspects
    - The tool will enable companies to assess the sustainable aspects of their operations, including environmental, social, and economic factors. It will help them identify areas that need improvement and develop action plans for enhancement.

11. Implementation and Guidance
    - The tool will assist companies in the implementation of their sustainability action plans and provide guidance throughout the process. It will also offer suggestions to improve their sustainability practices.

12. Standard Grading System
    - The project aims to introduce a standard grading system that allows companies to assess, demonstrate, and share their sustainability accomplishments. This grading system will likely involve a one- to three-stage procedure for evaluating sustainability levels.

13. Reporting Sustainability Activities
    - The tool will enable companies to report their sustainability activities and achievements. This reporting feature will help showcase their commitment to sustainability and encourage transparency.

14. Market Sustainable Tourism
    - Develop marketing campaigns and strategies to promote Sri Lanka as a sustainable tourism destination, attracting responsible travelers who value and support sustainability initiatives.

4. **Literature review**

An advanced study carried out by Matthew Johnson, Jantje Halberstadt, Stefan Schaltegger, and Tobias Viere discusses the adoption of sustainability management software and web-based tools in small and medium-sized enterprises (SMEs). The review is based on a paper that employs the Individual-Technology-Organization-Environment (ITOE) model as a theoretical framework and presents empirical data from a survey of 1,250 German SMEs. The paper explores various factors influencing managers' decisions to adopt or reject sustainability management technology in SMEs. The paper outlines the significance of sustainability management in integrating economic, ecological, and social aspects into business operations. It highlights the importance of aligning company activities with sustainable development and discusses the role of corporate sustainability strategies in this integration. The need for management software applications to support sustainability goals and strategies is also emphasized. The literature review identifies a research gap in the adoption of sustainability management software and web tools in SMEs. It emphasizes the absence of research on organizational-level factors influencing adoption decisions. The paper aims to address this gap by investigating factors affecting the adoption of such technology in SMEs. This paper provides an overview of web-based tools and software applications designed to support sustainability management in SMEs. These tools cover various aspects of sustainability, such as reporting, assessment, control, and management. It highlights the user-friendly and customizable features of these tools, which make them cost-effective and suitable for SMEs. However, it also points out the lack of empirical evidence regarding their adoption in SMEs and the factors influencing this adoption.(M. P. Johnson, 2015)

Another paper titled "Sustainability Manager: A Business Simulation for Sustainability Management" done by Rupert J. Baumgartner and Thomas Winter, discusses the development and application of a management game called "Sustainability Manager" designed to train employees and develop competencies in sustainability management. The game is web-based and uses soft computing approaches to model a company. The paper begins by highlighting the increasing interest of corporations in corporate sustainable behavior and the integration of sustainability issues into corporate strategies. It emphasizes the importance of training employees and developing sustainability-related competencies to support sustainability initiatives within corporations. The paper outlines the process of integrating sustainability aspects into the management game. It uses indicators and lists of sustainability aspects found in the literature. Economic, environmental, and social sustainability aspects are categorized, and the relationships between these aspects and indicators are described. The paper identifies different roles involved in knowledge-based management games, such as players, game administrators, game engineers, and system administrators. It clarifies their respective responsibilities in designing and running the game. The paper describes the technical solution for the management game, using JBoss Rules (Drools) version 5. This software combines process modeling with artificial intelligence, enabling the creation of a knowledge-based management game. The interaction between the game engine and the rule engine is explained. In summary, the paper outlines the development of a web-based management game, Sustainability Manager, designed to train employees and develop sustainability-related competencies.(Baumgartner & Winter, 2014)

The study done by Matthew Phillip Johnson Leuphana University Lüneburg Centre for Sustainability Management (CSM) Scharnhorststr. shows the importance of integrating environmental sustainability and social equality into the everyday business practices of small and medium-sized enterprises (SMEs). While it is becoming increasingly important politically and socially, there is still uncertainty around how SMEs should implement these practices. Despite the fact that the environmental and social impacts of SMEs are often overshadowed by large corporations, SMEs contribute significantly to global pollution. However, most SME managers have yet to implement eco-friendly practices to minimize these impacts.

To address this issue, the study proposes the implementation of sustainability management tools such as environmental management systems, social audits, CSR and sustainability reports, and employee training schemes. To fill this gap, this paper examines the rates of awareness and implementation of multiple

sustainability management tools in SMEs, and the managerial and organizational characteristics that could influence adoption using Roger's stages of innovation diffusion model. The empirical quantitative survey conducted with 176 German SME managers reveals that while awareness of sustainability management tools is high, implementation is still relatively low. The study also highlights the importance of perceived relative advantages over previous practices and systems, top management support, level of engagement throughout an enterprise, and organizational size in influencing adoption. In conclusion, the study emphasizes the importance of integrating environmental sustainability and social equality into the everyday business practices of SMEs. Sustainability management tools offer a promising solution, but their implementation in SMEs remains relatively low. The study calls for further research to understand the barriers to adoption and to develop strategies to overcome them. Ultimately, SME managers have a responsibility to contribute to the sustainability of the environment and society and should take action to implement eco-friendly practices. (M. Johnson et al., 2016)

Another research on Development of a systematic framework for sustainability management of organizations by Waqas Nawaz, Muammer Koç, addresses the issue of sustainability management in various organizations, highlighting that previous efforts were often focused on specific needs and regulatory compliance, neglecting holistic considerations. The research conducts a comprehensive literature review on sustainability management and assessment frameworks and standardized international guidelines. The findings suggest that operational parameters and the interrelationship between these parameters for sustainability management have been largely ignored. Integration of sustainability assessment in management models has also been overlooked. The paper introduces a generic sustainability management framework with a three-dimensional perspective, aiming to be fundamentally correct, consistent with international guidelines, and embedded with an assessment tool. The proposed framework is distinct in that it focuses on managing sustainability as a separate concept, rather than integrating existing systems, and establishes clear connections between the processes required for systematic sustainability management. (Nawaz & Koç, 2018)

Another advanced study done by Dobrica Jovicic discusses the environmental management systems and contemporary tourism development. The paper explores the significance of Environmental Management Systems (EMS) in the context of the tourism sector. EMS is a critical component of overall management systems, encompassing organizational structure, responsibilities, processes, procedures, and resources aimed at the development and implementation of environmental protection policies within a company or site. EMS is a valuable tool for promoting sustainability in the tourism sector. By integrating environmental management into their operations, tourism companies can enhance their environmental performance, improve their reputation, and gain access to capital and regulatory approvals more easily. The ISO 14000 Standards series provides a structured framework for organizations to manage their environmental impacts. In the context of tourism, EMS encourages a holistic approach that encompasses a commitment to sustainability, initial site review, development of objectives, implementation of the program, and regular audits and reviews to track progress and adapt to changing conditions. EMS holds significant potential for steering the tourism industry toward a sustainable future. (Turtledove & Lawlor, 2010)

The paper by Dr. Ralf Isenmann, titled "Internet-based Sustainability Reporting," discusses the evolution of corporate environmental reporting from its early stages in the late 1980s and early 1990s to the current trend of internet-based sustainability reporting. The author identifies three key trends that are shaping the field of environmental reporting: integration of financial and social issues, provision of reports on various media, and fine-tuning reports to users' needs and preferences. The paper also discusses the role of the internet as the backbone of companies' ICT infrastructure in supporting these trends. The paper highlights the transition from traditional environmental reporting to a more comprehensive and balanced approach, known as sustainability reporting, which is technically based on the internet. It outlines how companies are responding to the challenges and opportunities presented by these key trends in environmental reporting. (Isenmann, 2004)

5. Method of approach

5.1 Introduction

I will be implementing above mentioned solution – a sustainability management system for tourism related companies using react js because it makes it easier to create interactive and dynamic UIs. And for the database, I would like to choose firebase because it provides a real-time NoSQL database, making it well-suited for applications where data needs to be synchronized across clients in real time.

5.2 Data collection

For the data collection, I have interviewed three people related to sustainable tourism.

4. Mr. Janith Iddawala
   Lecturer - Department of Marketing and Tourism, NSBM Green University
   Former assistant manager – Group Business Development & Sustainability
5. Mr. Dulaj Mendis
   Sustainability coordinator, Connaissance De Ceylan
   Colombo 06
   http://www.connaissance.lk/
   cdctrv@connaissance.lk
6. Ms. Samanta Smits
   Founder & Sustainable Tourism Consultant -Smits SusTour Consultancy,
   Travelife Coach - Africa,
   Sustainability Consultancy & Research Intern

5.3 Functionalities

1) Action Planning

   What It Does: Uses the system to figure out where companies can do better in being sustainable.

   Why It's Important: Sets clear goals for companies to be more environmentally friendly and helpful to local communities.

2) Action Plan Implementation

   What It Does: The system helps companies make real changes in how they operate to reach their sustainability goals.

   Why It's Important: Supports companies in making their rules and procedures more in line with sustainable practices.

3) Guidance and Suggestions:

   What It Does: The system gives continuous advice and smart strategies to help companies stay on track in their sustainability journey.

   Why It's Important: Acts like a helpful friend, guiding companies on the path to being more sustainable.

4) Grading System:

   What It Does: Introduces a grading system like a report card to show how well companies are doing in sustainability.

Why It's Important: Recognizes and celebrates companies' efforts to be more sustainable.

5) Reporting:

What It Does: The system helps companies collect information on their sustainable practices and creates reports.

Why It's Important: Allows companies to see how they're doing, share their efforts with others, and follow the rules.

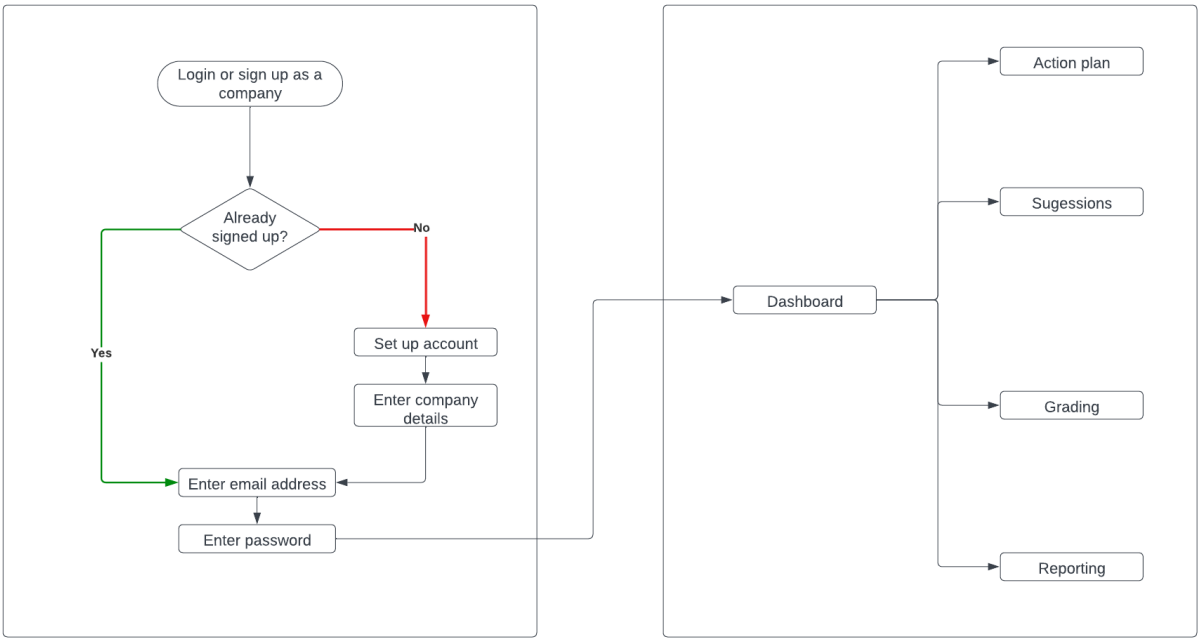

Figure 3: Flow diagram of the system

5.4 **Stakeholders**

Tourism Companies - The businesses involved in tourism, like hotels, travel agencies, and tour operators. They want to understand and use the sustainability tool to make their operations better and more environmentally friendly.

Tourists - The people traveling to different places for leisure. They might be interested in supporting sustainable tourism and experiencing destinations that are mindful of the environment and local communities.

Local Communities - The people living in the areas where tourism happens. They are concerned about how tourism affects their environment, culture, and daily lives.

6. Initial project plan

Stage	Deadline	Deliverable
Project Introduction	09/10/2023	Supervisor Meetups, Proposal preparation
Proposal submission	21/11/2023	Project Proposal
PID submission	10/12/2023	Project initiation document
Interim I submission	Not mentioned	Interim report I
Interim II submission	Not mentioned	Interim report II
Final submission	21/04/2024	Final product and the report
Defense	21/04/2024 onwards	Demonstration

7. Risk analysis

Risk	Management strategy
Lack of expertise or skilled resources	Collecting more data if needed
Lack of knowledge of AI ML	Develop simple application using AI to learn the technologies
Losing data	Getting regular backups in every stage and store them and having multiple backups
Legal risks	Conduct a thorough legal review of the laws and regulations relevant to sustainability practices

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Isenmann, R. (2004). Internet-based sustainability reporting. In *International Journal of Environment and Sustainable Development* (Vol. 3, Issue 2, pp. 145–167). Inderscience Publishers. https://doi.org/10.1504/IJESD.2004.004700

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1. Introduction

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Globalization, which is the world becoming more connected, has helped in some ways but also made local places more at risk. Some tools, like Travelife, can help tourism companies be more sustainable. But these tools can be expensive, especially for smaller businesses. This project wants to look into why it's hard for hotels and tourism companies, especially small ones, to use these tools that help them be more sustainable.

The environmental, socio-cultural, and economic pillars of sustainable tourism are interconnected and are referred to by the United Nations World Tourism Organization (UNWTO, 2019)

Figure 1: sustainable tourism

7) Environmental factors pertain to the utilization of various natural resources, such as the uncontaminated air, land, and water at the destination. Natural woods, mountains, and wildlife are examples of additional resources. The built environment, which includes infrastructure from towns and villages, buildings, and other structures, is also considered to be cultural heritage.
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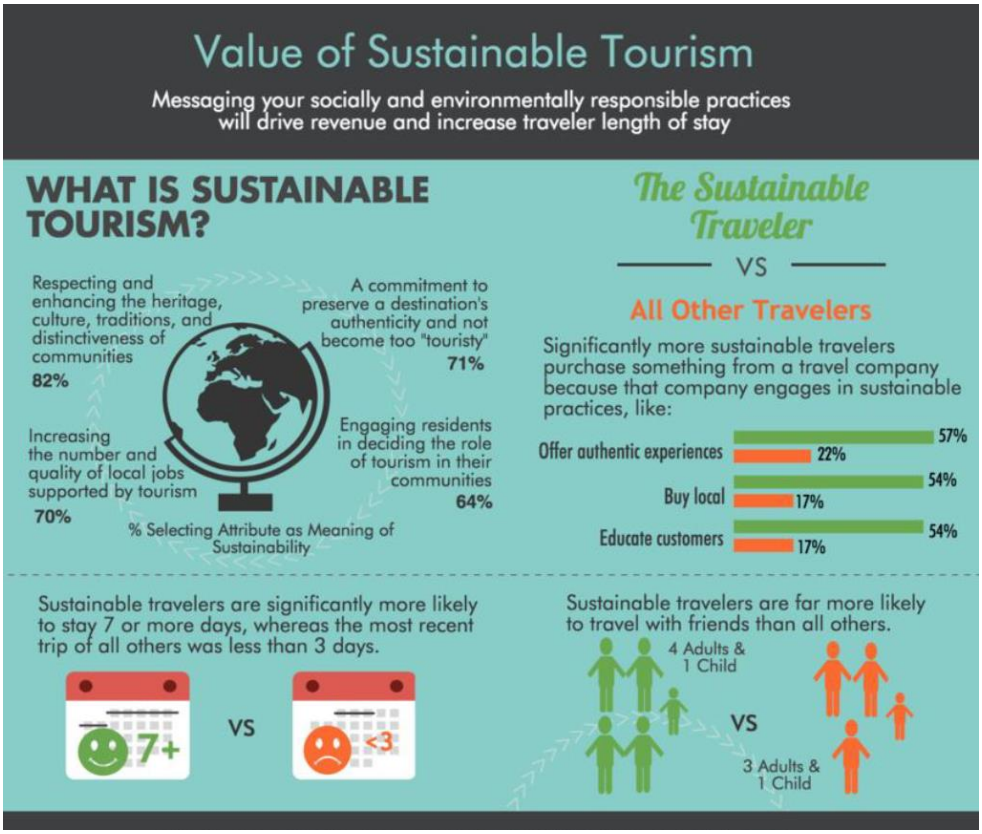

Figure 2: value of sustainable tourism (https://www.destinationsustainability.com/blog/2017/8/12/wbcgwcb4enuio8zri8onkfcvh8g4hf)

1.2 problem definition

Tourism has generally been a hyper - competitive industry in Sri Lanka. Although it has expanded, on the other hand tourism has been the cause of environmental damage as well. Therefore, I have identified that tourism should be done using a sustainable approach. Sustainability is a development that meets the needs of the present without compromising on the ability of future generations to meet their own needs.[2] When the word 'development' is mentioned, we immediately think of economic development. However, when it comes to sustainability, development means advancement in every area, including economic growth, social progress, and environmental protection.

Tourism is a field that is widespread overall the world. So, while globalization has contributed vastly to global development, it has also resulted in the damage and degradation of certain local environments and cultures as well. When it comes to tourism, many hotels are not using sustainable approaches. This has caused environmental disruption, global warming, air pollution, water pollution and many other things. Modern tourist hotels and other companies regarding the tourism field feel the need for effective sustainability management tools to accurately assist them in all management processes. Some hotels and companies are using this kind of a tool but since it's a paid one, the use has decreased.

For example, there is Travelife, which is a leading training, management and certification initiative for tourism companies committed to reaching sustainability. It costs small companies (< 25 full time employees), 200 Euro per year, medium companies (≥ 25 full time employees), 300 Euro per year, and large companies (> 100 full time employees), 400 Euro per year. Therefore, the need for effective sustainability management tools is evident to mitigate these adverse impacts. This project aims to address the challenge of promoting sustainability in the tourism sector by investigating the barriers to implementing sustainable practices, with a focus on the accessibility and affordability of sustainability management tools for hotels and tourism companies.

[2] Burton, I. (1987). Our common future: The world commission on environment and development. Environment, 29(5), 25–29.

1.3 project objectives

15. Promoting Sustainable Tourism

- The primary objective of this project is to promote sustainable tourism in Sri Lanka. This aims to address the environmental damage caused by tourism and emphasize the importance of sustainable development, which considers economic growth, social progress, and environmental protection.

16. Developing a Sustainability Management Tool

- This project aims to create a sustainability management tool that can assist hotels and companies in the tourism industry to effectively manage their sustainability efforts. This tool is intended to be a web-based system.

17. Assessing Sustainable Aspects

- The tool will enable companies to assess the sustainable aspects of their operations, including environmental, social, and economic factors. It will help them identify areas that need improvement and develop action plans for enhancement.

18. Implementation and Guidance

- The tool will assist companies in the implementation of their sustainability action plans and provide guidance throughout the process. It will also offer suggestions to improve their sustainability practices.

19. Standard Grading System

- The project aims to introduce a standard grading system that allows companies to assess, demonstrate, and share their sustainability accomplishments. This grading system will likely involve a one- to three-stage procedure for evaluating sustainability levels.

20. Reporting Sustainability Activities

- The tool will enable companies to report their sustainability activities and achievements. This reporting feature will help showcase their commitment to sustainability and encourage transparency.

21. Market Sustainable Tourism

Develop marketing campaigns and strategies to promote Sri Lanka as a sustainable tourism destination, attracting responsible travelers who value and support sustainability initiatives.

2. System analysis

2.1 facts gathering techniques

For the facts gathering, I have interviewed three people related to sustainable tourism.

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2.2 existing system

The study done by Matthew Phillip Johnson Leuphana University Lüneburg Centre for Sustainability Management (CSM) Scharnhorststr. shows the importance of integrating environmental sustainability and social equality into the everyday business practices of small and medium-sized enterprises (SMEs). While it is becoming increasingly important politically and socially, there is still uncertainty around how SMEs should implement these practices. Despite the fact that the environmental and social impacts of SMEs are often overshadowed by large corporations, SMEs contribute significantly to global pollution. However, most SME managers have yet to implement eco-friendly practices to minimize these impacts.

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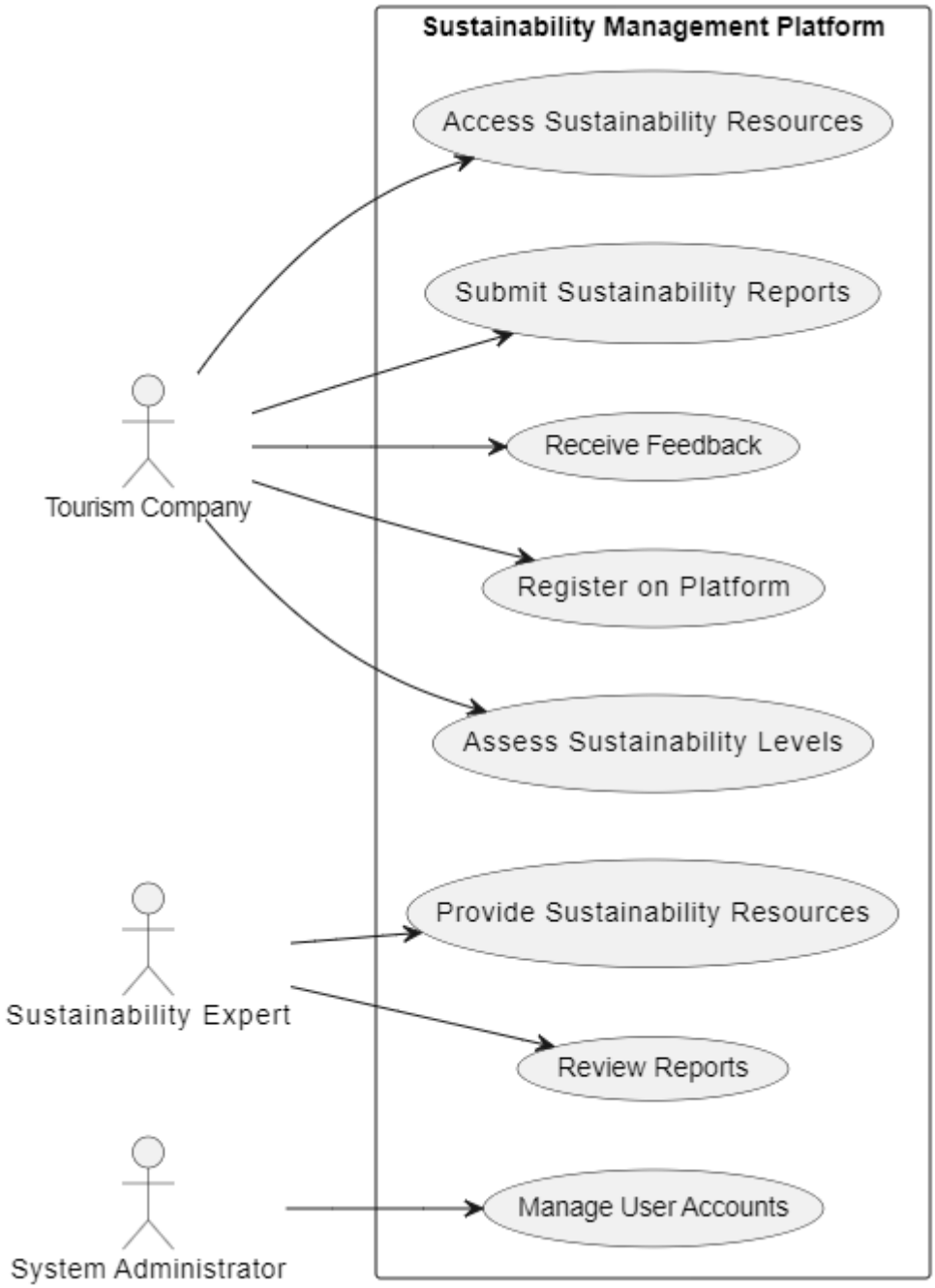
2.3 use case diagram



2.4 drawbacks of the existing system

Travelife (www.travelife.info) is a well-known certification and sustainability management system specifically designed for the tourism industry. The above proposed solution, while related to sustainability in tourism, appears to differentiate itself in several ways:

4. Affordability and Accessibility: Existing sustainability management tools, such as Travelife, often come with associated costs that may deter smaller businesses. The proposed solution aims to address this issue by offering a more affordable solution. The research gap is in understanding how cost-effective solutions impact the adoption and effectiveness of sustainability initiatives in the tourism industry, and whether smaller businesses benefit from this approach.
5. Customization and Flexibility: The proposed solution emphasizes the customization and flexibility of the sustainability management tool. The research gap is in exploring how tailor-made sustainability plans and metrics influence a company's ability to align with sustainable practices and whether this approach leads to more significant and relevant improvements compared to standardized certification systems.
6. Chatbot Guidance: The inclusion of a chatbot as a guide is a novel aspect of proposed solution. Research is needed to understand how effective chatbots are in providing real-time assistance and whether they enhance the sustainability efforts of tourism companies. Additionally, studying the user experience with the chatbot and its impact on engagement and long-term sustainability commitment is crucial.

3. Requirements specification

3.1 functional requirements

6. User Registration and Profile Management

   Users must be able to create accounts, log in, and manage their profiles.

7. Action Plan Creation and Management

   Users must be able to create and manage action plans for achieving their sustainability goals.

8. Chatbot Assistance

   The chatbot must provide real-time guidance, answer user queries, and offer suggestions related to sustainability practices.

9. Data Collection and Reporting

   The tool should collect data on sustainability efforts and generate reports on performance and accomplishments.

10. Grading System

    Implement a grading system that assesses and rates a company's sustainability achievements based on predefined criteria.

3.2 non-functional requirements

5. Performance

   The system should provide real-time responses, ensuring minimal latency during interactions with the chatbot.

6. Scalability

   The tool must be scalable to accommodate a growing user base and increased data volume.

7. Security and Privacy

   Implement strong security measures to protect user data and ensure compliance with privacy regulations.

8. Reliability

   The tool should be reliable, with minimal downtime and disruptions.

9.3hardware / software requirements

software requirements are,

Operating System: The choice of operating system for the servers hosting the software will depend on the preferences of the development team and the compatibility with the chosen development frameworks and technologies.

Development Frameworks and Tools: Depending on the programming languages and technologies chosen for software development, I need specific development frameworks, libraries, and integrated development environments (IDEs).

Database Management System (DBMS): A robust DBMS is required to store and manage the data collected by the sustainability management tool.

Web Servers: To host web-based applications, I will need a web server software that can handle HTTP requests and serve web pages to users. Common web server options include Apache HTTP Server, Nginx, and Microsoft Internet Information Services (IIS).

Hardware requirements are,

Client Devices: End-users will access the sustainability management tool through various client devices such as desktop computers, laptops, tablets, and smartphones.

10. Feasibility study

4.1 operational feasibility

Compatibility with Existing Systems: The feasibility of integrating the sustainability management tool with existing systems and processes within hotels and tourism companies is crucial. This includes compatibility with existing software applications, data management systems, and operational workflows. Any potential disruptions or conflicts with current operations need to be carefully addressed to ensure smooth integration and minimal downtime.

User Acceptance and Training Needs: The successful adoption of the sustainability management tool depends on the willingness of users within hotels and tourism companies to embrace the new system. Assessing the readiness of staff to learn and use the tool, as well as identifying any potential resistance to change, is essential. Adequate training and support mechanisms must be in place to facilitate user onboarding and address any challenges or concerns that may arise during the implementation process.

Scalability and Flexibility: The operational feasibility of the sustainability management tool also depends on its scalability and flexibility to accommodate the diverse needs and requirements of different types and sizes of tourism businesses. The tool should be capable of scaling up to meet the growing demands of larger enterprises while remaining adaptable enough to cater to the unique characteristics and operational complexities of smaller establishments.

Regulatory Compliance and Industry Standards: Ensuring compliance with relevant regulatory requirements and industry standards is essential for the operational viability of the sustainability management tool. This includes adherence to data privacy regulations, environmental regulations, and industry best practices related to sustainability reporting and certification. Failure to comply with regulatory mandates could result in legal penalties and reputational damage.

4.2 technical feasibility

Software Development: The development of the sustainability management tool will require expertise in software development, including programming languages, databases, and development frameworks.

Data Integration and Management: The tool will need to integrate with various data sources within hotels and tourism companies to collect information on sustainability practices and performance metrics. Ensuring compatibility with existing data management systems and establishing secure data exchange protocols are crucial for technical feasibility.

Scalability: The tool should be designed to scale up to accommodate the growing volume of data and users as more hotels and tourism companies adopt it. Scalability considerations include the ability to handle large datasets, support concurrent users, and maintain performance under increased workload.

Compatibility and Interoperability: Compatibility with different operating systems, web browsers, and devices is essential to ensure widespread adoption of the sustainability management tool. Interoperability with other software applications commonly used in the tourism industry, such as booking systems and customer relationship management (CRM) platforms, should also be considered.

Security: Protecting sensitive data and ensuring the security of the sustainability management tool are paramount. Implementing robust authentication mechanisms, encryption protocols, and access controls to safeguard data against unauthorized access, data breaches, and cyber-attacks is crucial for technical feasibility.

User Interface and Experience: The user interface (UI) and user experience (UX) of the sustainability management tool play a significant role in its adoption and usability. Designing an intuitive and user-friendly interface that provides easy access to relevant features and functionalities is essential for technical feasibility.

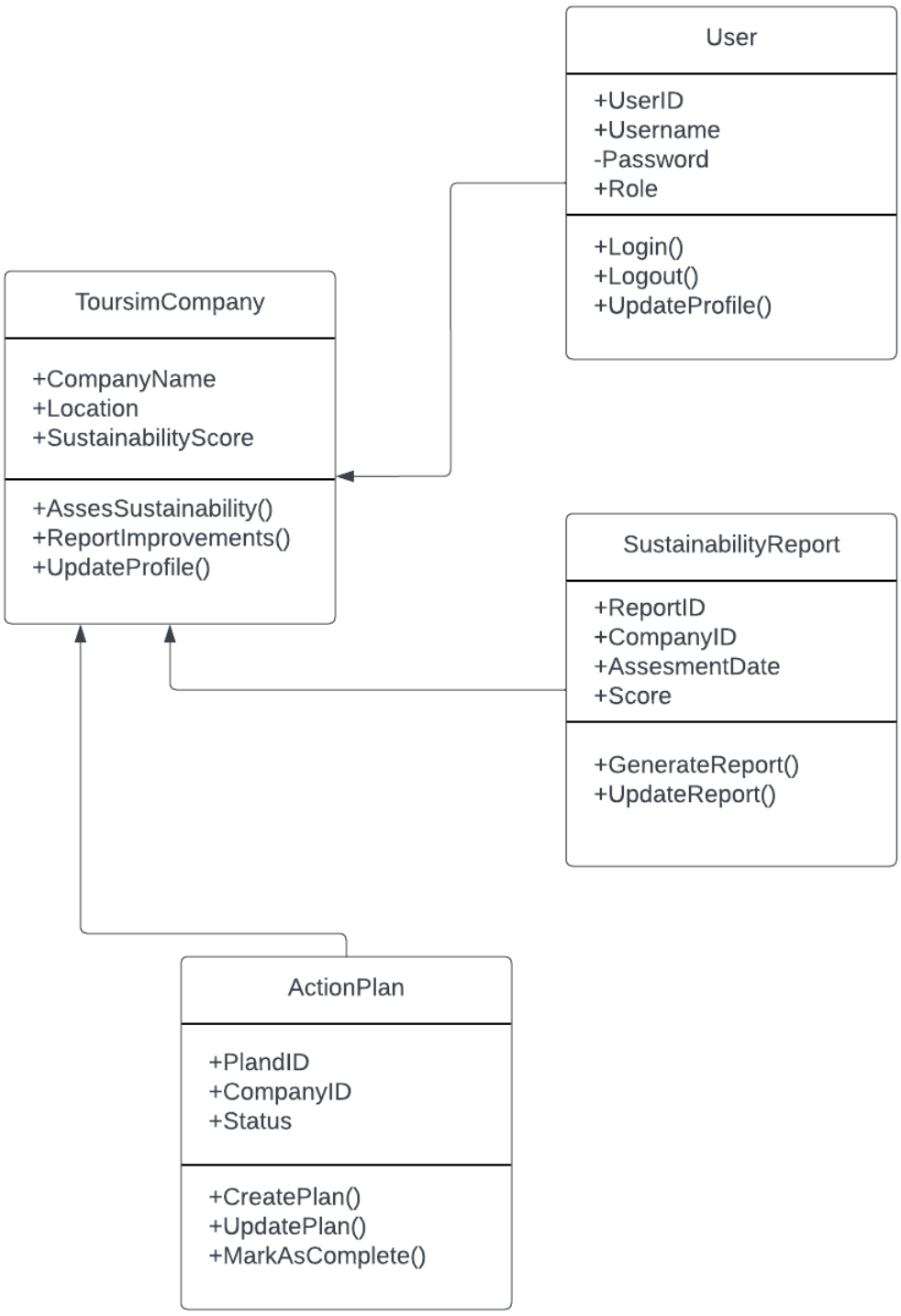
Maintenance and Support: Ongoing maintenance and support are critical for ensuring the technical viability of the sustainability management tool. This includes regular updates, bug fixes, and technical assistance to address any issues or concerns that may arise post-implementation.

4.3 outline budget

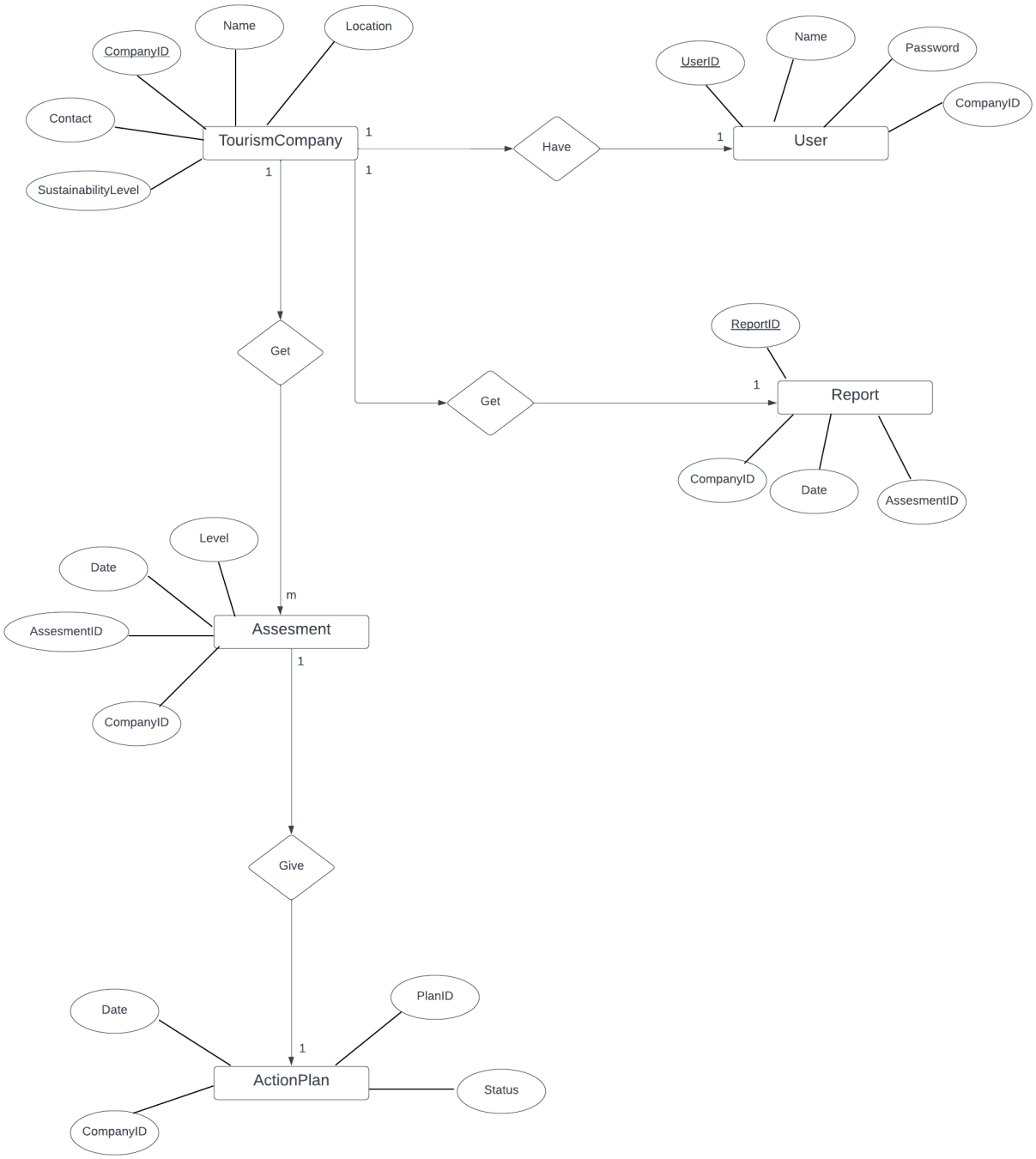
For this project outline budget will be domain and hosting charges only.

11. System architecture

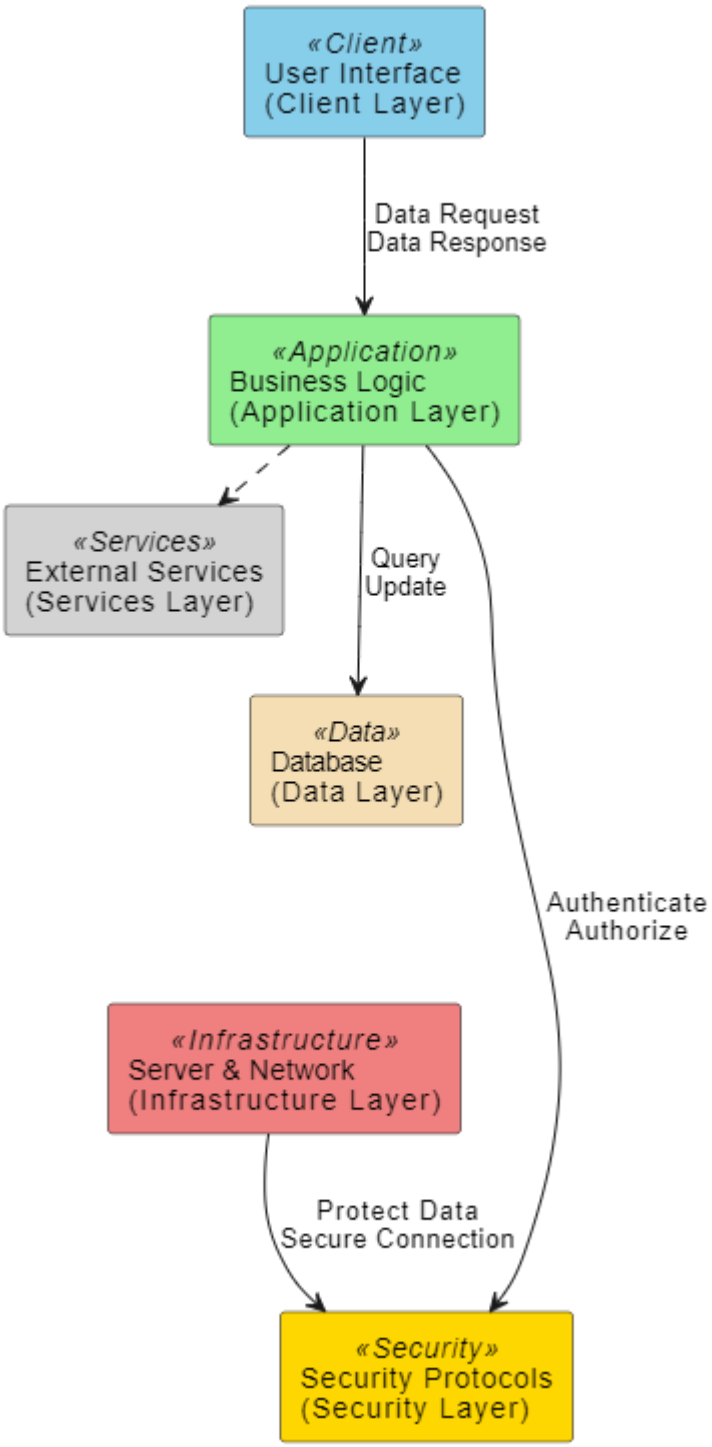
5.1 class diagram



5.2 ER diagram



5.3 High-level architecture diagram



12. Development tools and technologies

6.1 development methodology

This project will adopt an Agile development methodology to ensure flexibility, rapid iteration, and continuous stakeholder feedback. Agile methodology is especially suitable for projects with dynamic requirements and a need for quick adaptability, as often found in the sustainability and tourism sectors.

1. System Development: The very first step is to create a system that enables companies in the tourism industry to plan, manage, and process their sustainability initiatives. This system is essentially a software or platform designed to streamline and enhance sustainability management within the company.
2. Action Planning: Once the system is in place, it allows companies to initiate a basic evaluation of sustainable aspects within their operations. This involves identifying areas where sustainability can be improved. The system can help in setting specific goals and objectives related to sustainability.
3. Action Plan Implementation: The system also aids in developing and implementing an action plan. It helps the company achieve the identified sustainability goals and put them into practice. This could involve making changes to operations, policies, or procedures to align with sustainable practices.
4. Guidance and Suggestions: The system offers guidance and suggestions throughout the action planning and implementation process. It can provide recommendations on how to achieve sustainability goals more effectively and efficiently.
5. Grading System: The proposed solution includes a grading system that allows the company to assess, demonstrate, and share their sustainability accomplishments. This grading system can help benchmark their sustainability efforts and compare them with industry standards. It is designed as a one- to three-stage procedure, offering a clear and standardized way to measure sustainability performance.
6. Reporting: The sustainability management tool facilitates reporting on a company's own sustainability activities and achievements. This involves collecting information on various sustainability-related processes within the company and generating comprehensive reports. These reports can be used for internal assessment, communication with stakeholders, and compliance reporting.

6.2 programming languages and tools

I'm dividing this into 4 parts.

5. Database - MongoDB
6. Front end - React JS
7. Back end - Python
8. Integration

Database

The Database part of this project involves the creation, management, and utilization of data storage and retrieval systems. This will likely involve:

- Designing a schema that accurately represents the data this application needs to store, such as user information, transaction details, or content data.
- Choosing a suitable database management system (DBMS) like MongoDB. MongoDB is a NoSQL database, ideal for handling large volumes of data and providing high performance, availability, and scalability.
- Setting up the database environment, ensuring proper configuration, security measures, and backup procedures are in place.
- Developing scripts or programs to interact with the database, including data insertion, updates, retrieval, and deletion operations.

Front End

The Front-End section focuses on creating the user interface and user experience of this web application using React.js:

- Design and development of the user interface components using React.js, ensuring they are responsive, intuitive, and accessible.
- State management to handle user interactions and data across the application. This might involve using Context API, Redux, or other state management libraries.
- Interaction with the back-end server through API calls to fetch, display, and send data to the server.
- Implementation of client-side routing using libraries like React Router to enable navigation between different parts of the application without refreshing the page.

Back End

The Back End part involves setting up the server, APIs, and logic to handle requests from the front end, process them, and return the appropriate responses:

- Setting up a web server using frameworks like Flask or Django, which allows you to create and manage RESTful APIs.
- Development of the application logic to perform CRUD operations (create, read, update, delete) on the database based on the requests received from the front end.
- Implementation of authentication and authorization to ensure secure access to the application's resources.
- Error handling to manage and respond to errors occurring during request processing.

Integration between Front End and Back End

This final part covers the methods and practices to connect the front end and back-end parts of this application:

- Establishment of API endpoints in the back end, which the front end will call to request or send data.
- Handling CORS (Cross-Origin Resource Sharing) to allow or restrict resources requested from another domain.
- Implementation of authentication tokens (like JWT - JSON Web Tokens) to secure API calls and ensure that requests are made by authenticated users.
- Testing the integration using tools like Postman for API testing and browser developer tools for front-end debugging to ensure smooth communication between front end and back end.

6.3 third party components and libraries

UI Frameworks/Libraries: These libraries provide pre-designed UI components and styles to speed up front-end development. Examples include Bootstrap, Material-UI, Semantic UI, and Ant Design.

Form Handling Libraries: Libraries like Formik or React Hook Form simplify form handling and validation in React applications.

HTTP Client Libraries: Axios or Fetch API wrappers simplify making HTTP requests to backend APIs from the front end.

Testing Libraries: Jest, Mocha, and Chai are examples of testing libraries that help automate testing processes, ensuring the reliability and robustness of the application.

Deployment and Hosting Services: Platforms like Heroku, AWS, or Netlify provide services for deploying and hosting web applications, often offering integration with the MERN stack components for seamless deployment workflows.

6.4 algorithms

Sustainability Scoring and Evaluation:

Multi-Criteria Decision Analysis (MCDA) or AHP (Analytic Hierarchy Process) algorithms could be used to develop a grading system that evaluates and scores hotels and tourism companies based on their sustainability efforts and achievements.

Data Analysis and Pattern Recognition:

Algorithms like K-Means Clustering, Principal Component Analysis (PCA), and Support Vector Machines (SVM) can be used to analyze and interpret large datasets related to tourism sustainability, such as visitor patterns, environmental impact assessments, and resource utilization rates.

13. discussion

Overview of the Interim Report:

The report covers the increasing importance of sustainable tourism, especially in Sri Lanka, due to its significant cultural and natural resources. It emphasizes the need for a sustainable approach to mitigate the adverse impacts of tourism like pollution and environmental degradation.

Summary of the Report:

The main focus is on promoting sustainable tourism in Sri Lanka, addressing environmental damages, and fostering economic and social progress. It highlights the development of a web-based sustainability management tool to assist hotels and companies in the tourism industry.

Challenges Faced:

The report identifies challenges such as the high competition within the tourism industry, the environmental damage caused by unsustainable practices, and the difficulties small businesses face in adopting sustainable management tools due to high costs.

Future / Upcoming Work:

Plans include enhancing the sustainability management tool, implementing a grading system for sustainability efforts, and developing marketing strategies to promote Sri Lanka as a sustainable tourism destination. Additionally, there is a focus on overcoming barriers to sustainable practice adoption by making tools more accessible and affordable.

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Records of supervisor meetings

UNIVERSITY OF PLYMOUTH

NSBM GREEN UNIVERSITY TOWN

PUSL3190 Computing Individual Project
Student Progression Report
[Student Copy]

01. Student Name ..... Chamali Ranasinghe .....
02. Plymouth Index Number ..... 10819555 .....
03. Degree Program ..... Software Engineering .....
04. Supervisor Name ..... Mr. Gayan Perera .....
05. Project Title ..... Sustainability management System .....

Meeting Number	Meeting 01	Meeting 02	Meeting 03	Meeting 04	Meeting 05	Meeting 06	Meeting 07
Date	03/11/2023	09/11/2023	28/11/2023	05/12/2023	19/03/2024		
Student Signature	Chamali	Chamali	Chamali	Chamali	Chamali		
Supervisor Signature							

Meeting Number	Meeting 08	Meeting 09	Meeting 10	Meeting 11	Meeting 12	Meeting 13	Meeting 14
Date							
Student Signature							
Supervisor Signature							

UNIVERSITY OF PLYMOUTH | NSBM GREEN UNIVERSITY TOWN

Final Year Project – Supervisory meeting minutes

Meeting No: 01

Date : 03/11/2023

Project Title : Sustainability management system

Name of the Student : Chamali Ranasinghe

Students ID : 10819555

Name of the Supervisor : Mr. Gayan Perera

Items discussed:

In the meeting, the following key topics were discussed :

1. The implementation of cloud database.
2. The development of chatbots for company guidance and suggestions.
3. The significance of data analysis.

Items to be completed before the next supervisory meeting:

1. Conduct interviews with people involved in the tourism field & sustainability management.
2. Write a literature review on the topic of sustainability management in tourism field.

3/11/2023

Supervisor (Signature & Date)

Instructions to the supervisor: Do not sign if the above boxes are blank.

UNIVERSITY OF PLYMOUTH | NSBM GREEN UNIVERSITY TOWN

Final Year Project – Supervisory meeting minutes

Meeting No: 02

Date : 09/11/2023

Project Title : Sustainability Management System

Name of the Student : Chamali Rangsinghe

Students ID : 10819555

Name of the Supervisor : Mr. Gayan Perera

Items discussed:

* Checked the literature review and pointed out the things that needs to change.
* Checked the meeting miniutes document.

Items to be completed before the next supervisory meeting:

1. Conduct another interview.
2. Make a chart including all the functionalities & other relevant stuff.
3. Add more points to meeting miniutes.

9/11/23

Supervisor (Signature & Date)

Instructions to the supervisor: Do not sign if the above boxes are blank.

UNIVERSITY OF PLYMOUTH | NSBM GREEN UNIVERSITY TOWN

Final Year Project – Supervisory meeting minutes

Meeting No: 03

Date : 28/11/2023

Project Title : Sustainability Management System

Name of the Student : Chamali Ranasinghe

Students ID : 10819555

Name of the Supervisor : Mr. Gayan Perera

Items discussed:

* What are the features that should be include in the system
* How to draw the system diagram.

Items to be completed before the next supervisory meeting:

* Continue the literature review.
* Define the measuring keys and how to measure them. What are the indicators.

28/11/2023

Supervisor (Signature & Date)

Instructions to the supervisor: **Do not sign** if the above boxes are blank.

UNIVERSITY OF PLYMOUTH | NSBM GREEN UNIVERSITY TOWN

Final Year Project – Supervisory meeting minutes

Meeting No: 04

Date : 05/12/2023

Project Title : Sustainability Management System

Name of the Student : Chamali Ranasinghe

Students ID : 10819555

Name of the Supervisor : Mr. Gayan Perera

Items discussed:

* In the meeting we discussed about,
  how to draw diagrams for the system
  Collect more data
  About the back end

Items to be completed before the next supervisory meeting:

Draw the diagrams
Complete PID & Interim documents.

7/12/23

Supervisor (Signature & Date)

Instructions to the supervisor: **Do not sign** if the above boxes are blank.

UNIVERSITY OF PLYMOUTH | NSBM GREEN UNIVERSITY TOWN

Final Year Project – Supervisory meeting minutes

Meeting No: 05

Date : 19/03/2024

Project Title : Sustainability Management System

Name of the Student : Chamali Ranasinghe

Students ID : 10819555

Name of the Supervisor : Mr. Gayan Perera

Items discussed:

* Formatting of the documents. Checked the Interim document.
* How to do the evaluation part & testing.
* How to compare the existing systems.

Items to be completed before the next supervisory meeting:

* Complete the front end.

19/3/24

Supervisor (Signature & Date)

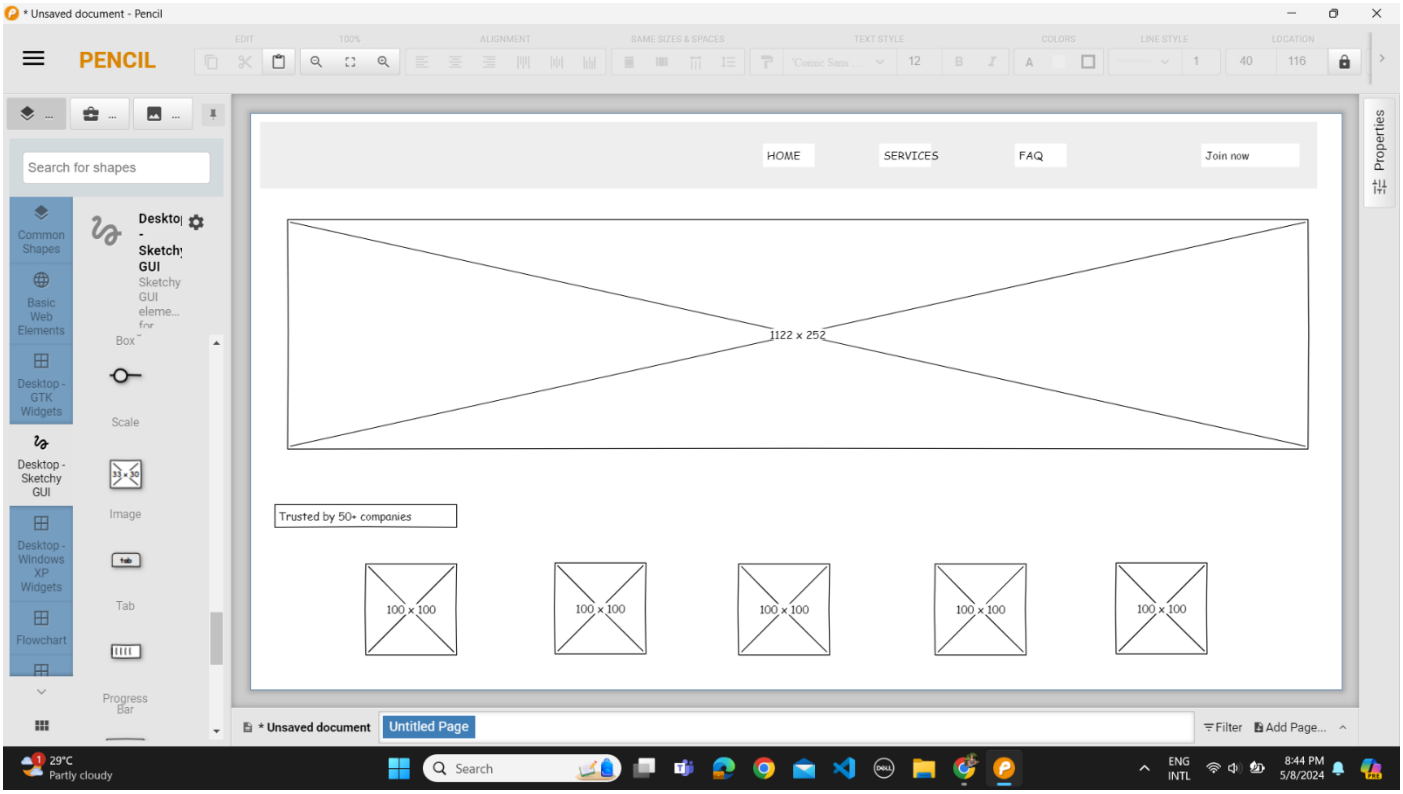
Instructions to the supervisor: **Do not sign** if the above boxes are blank.

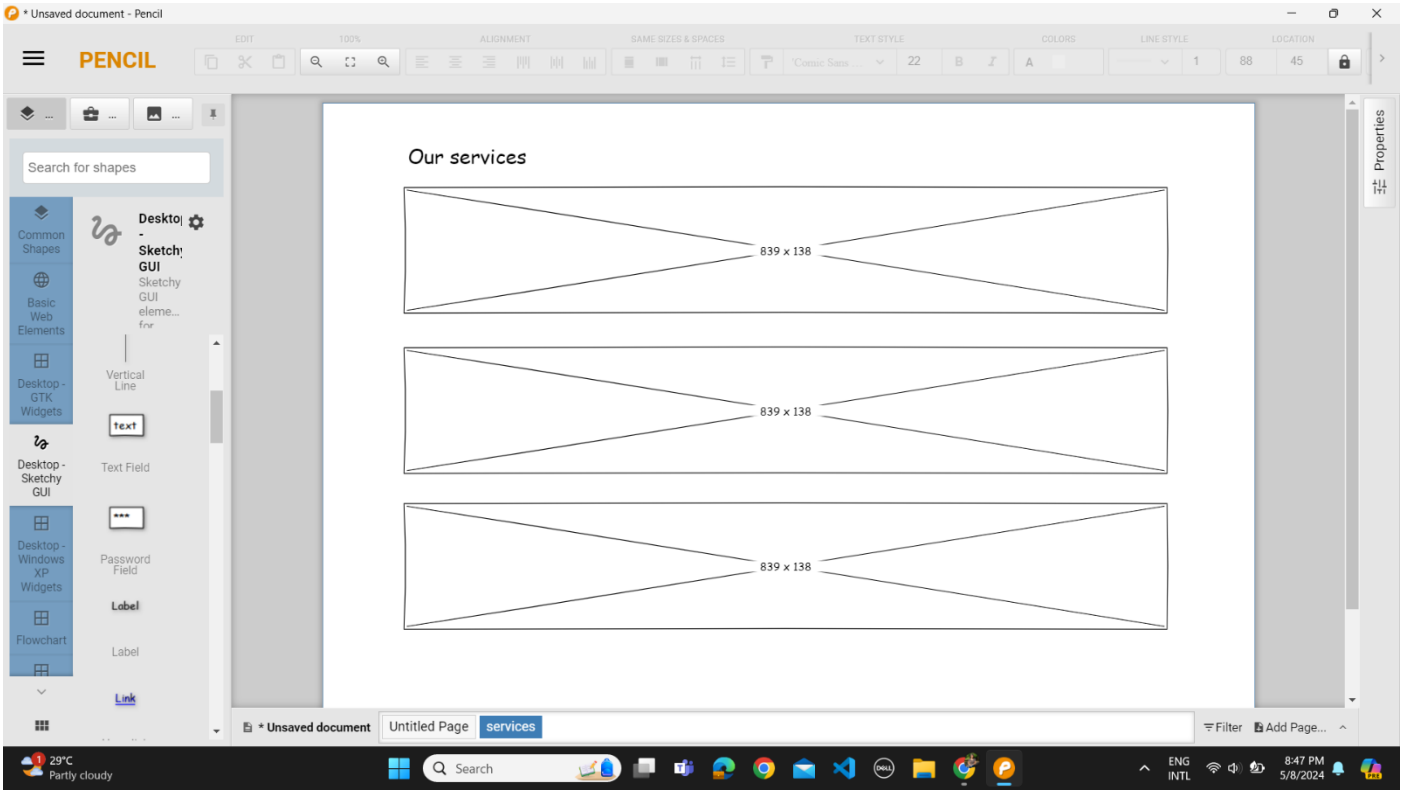
Designs

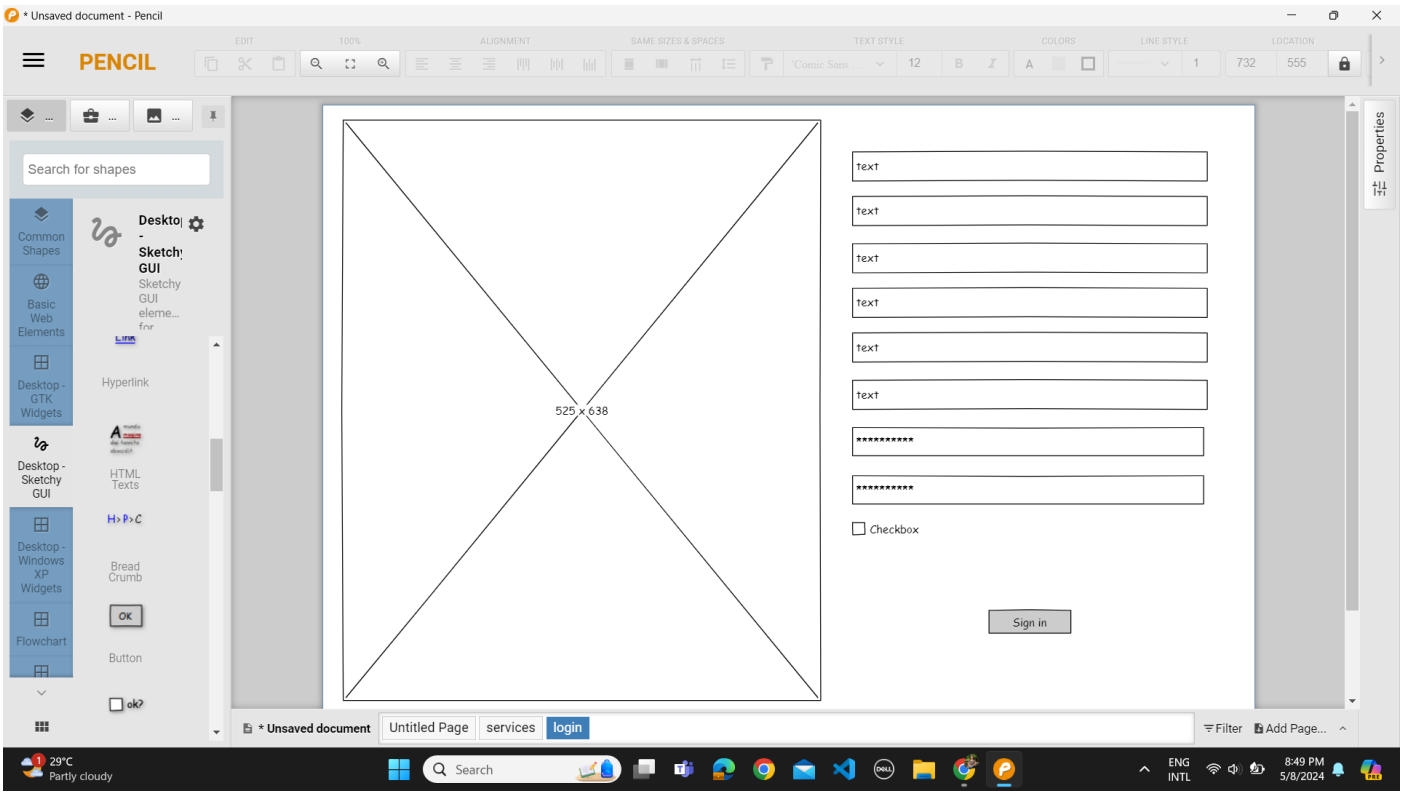
Figma design

https://www.figma.com/file/lfr2ZjoB4zrUDep6QMjO4K/CIP?type=design&node-id=0-1&mode=design&t=e7SoTBSSvYmo4JGj-0

Wireframe designs



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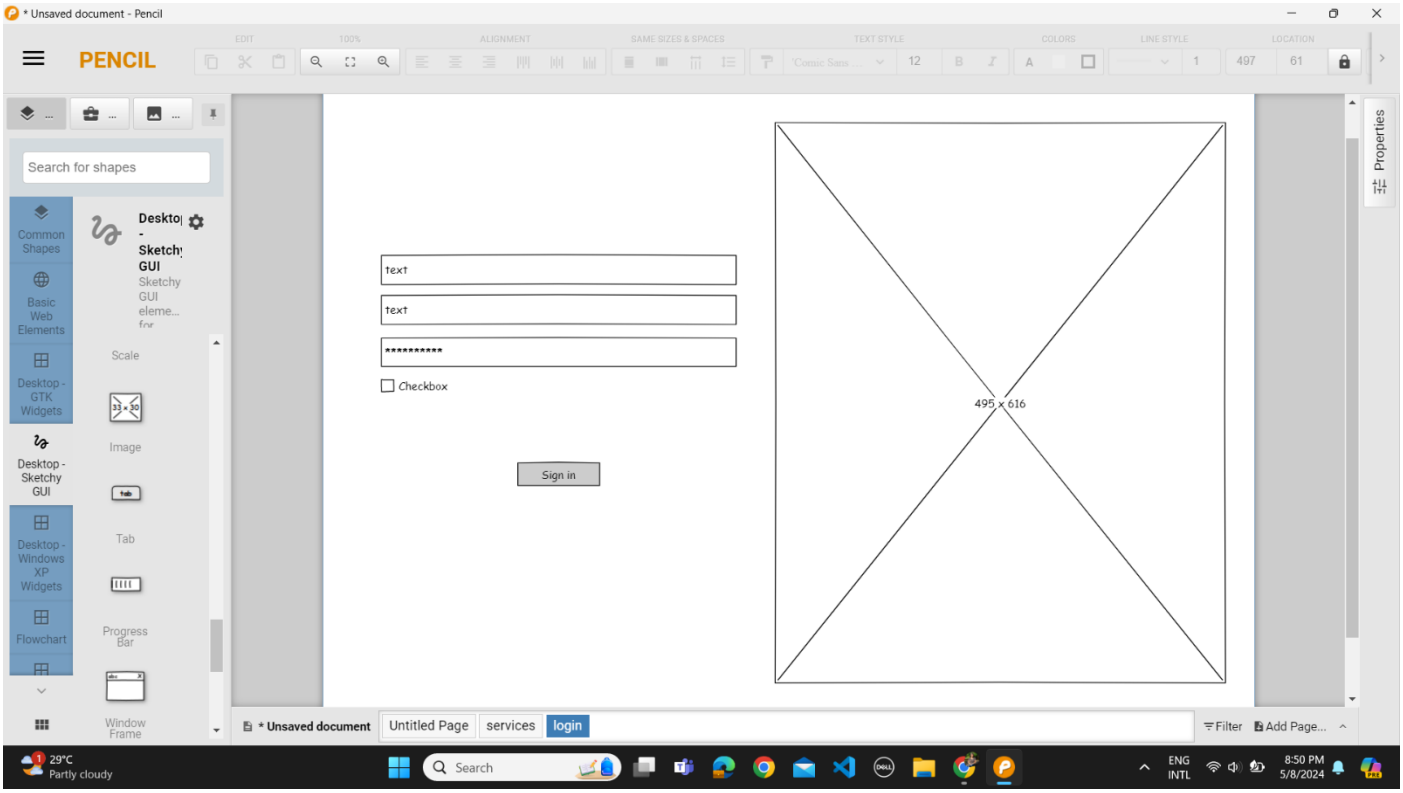
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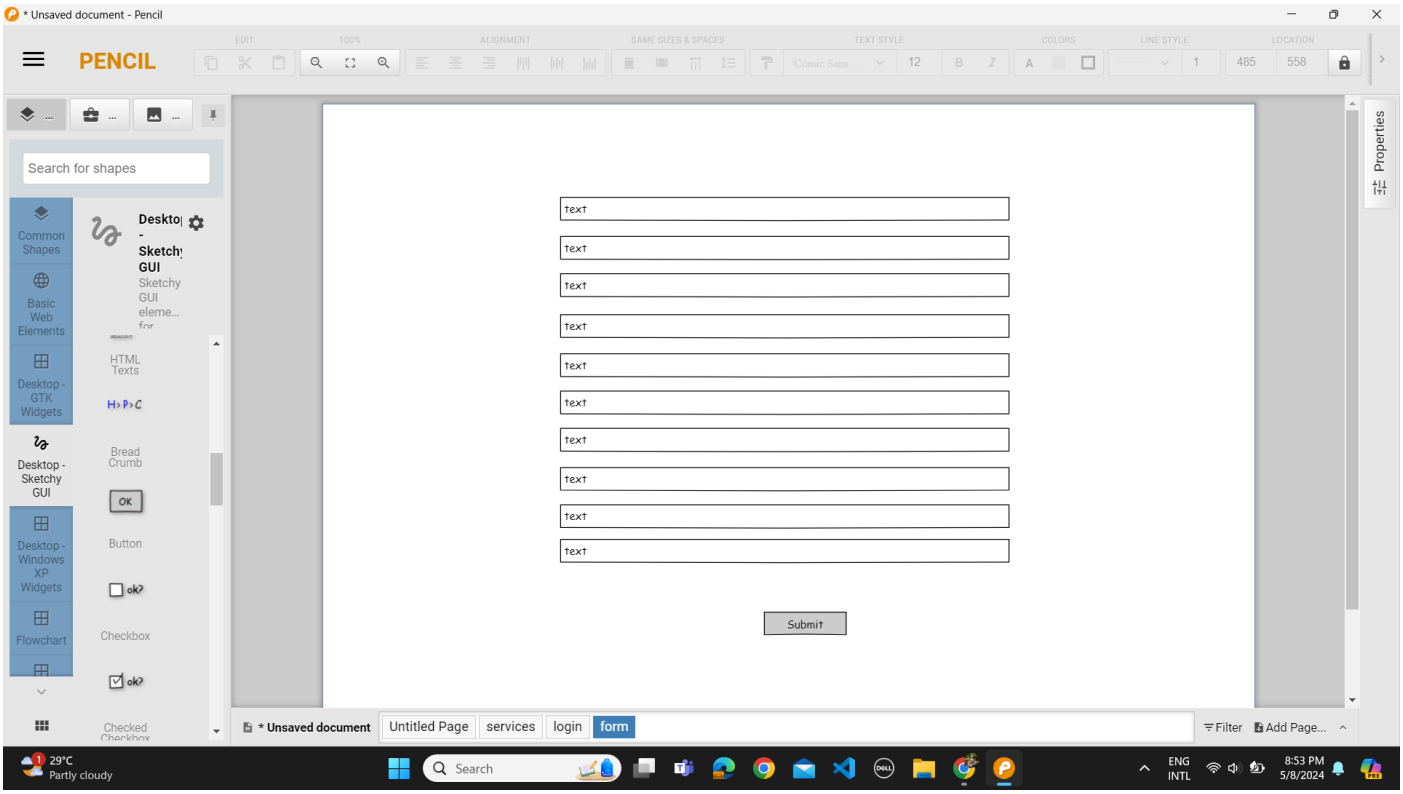
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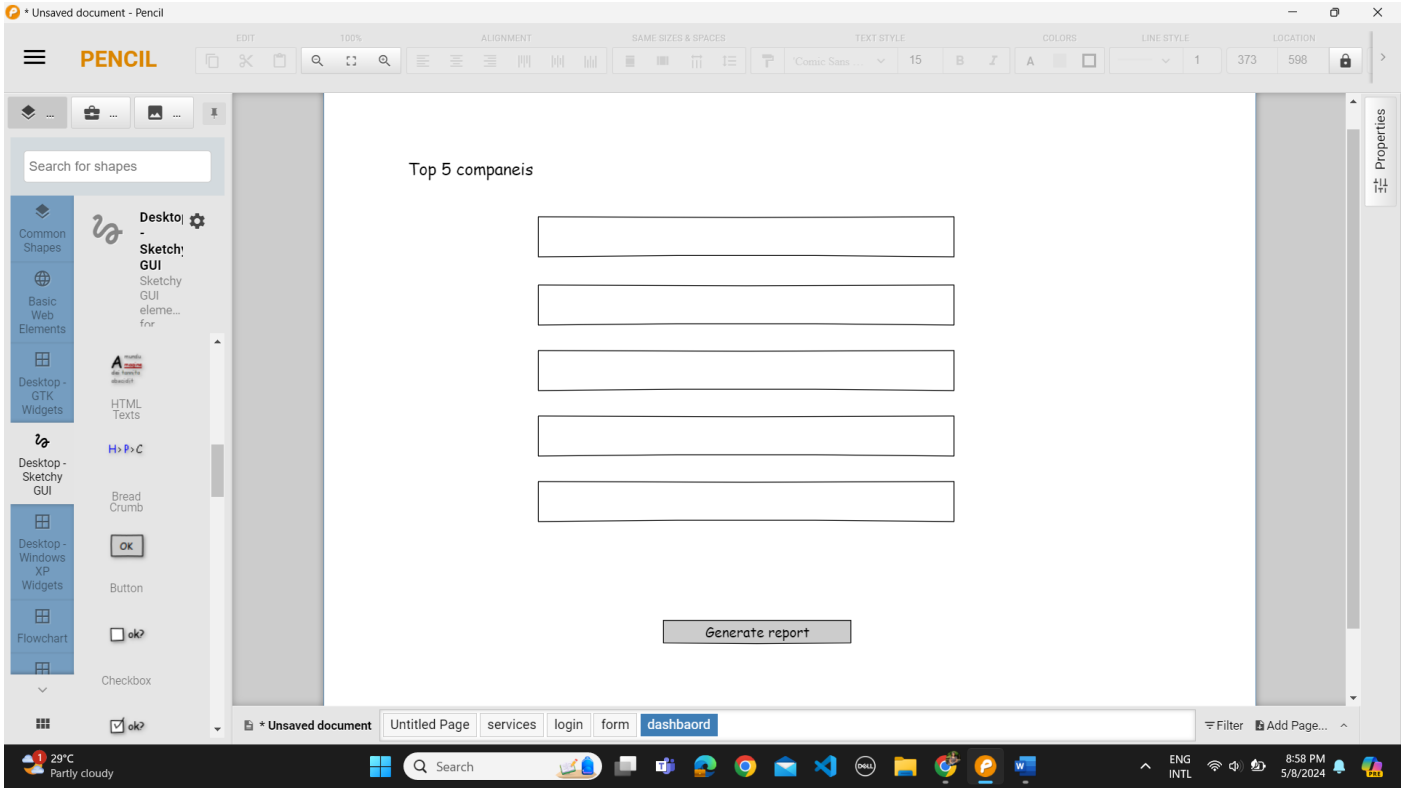
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Certificate designs

Test results

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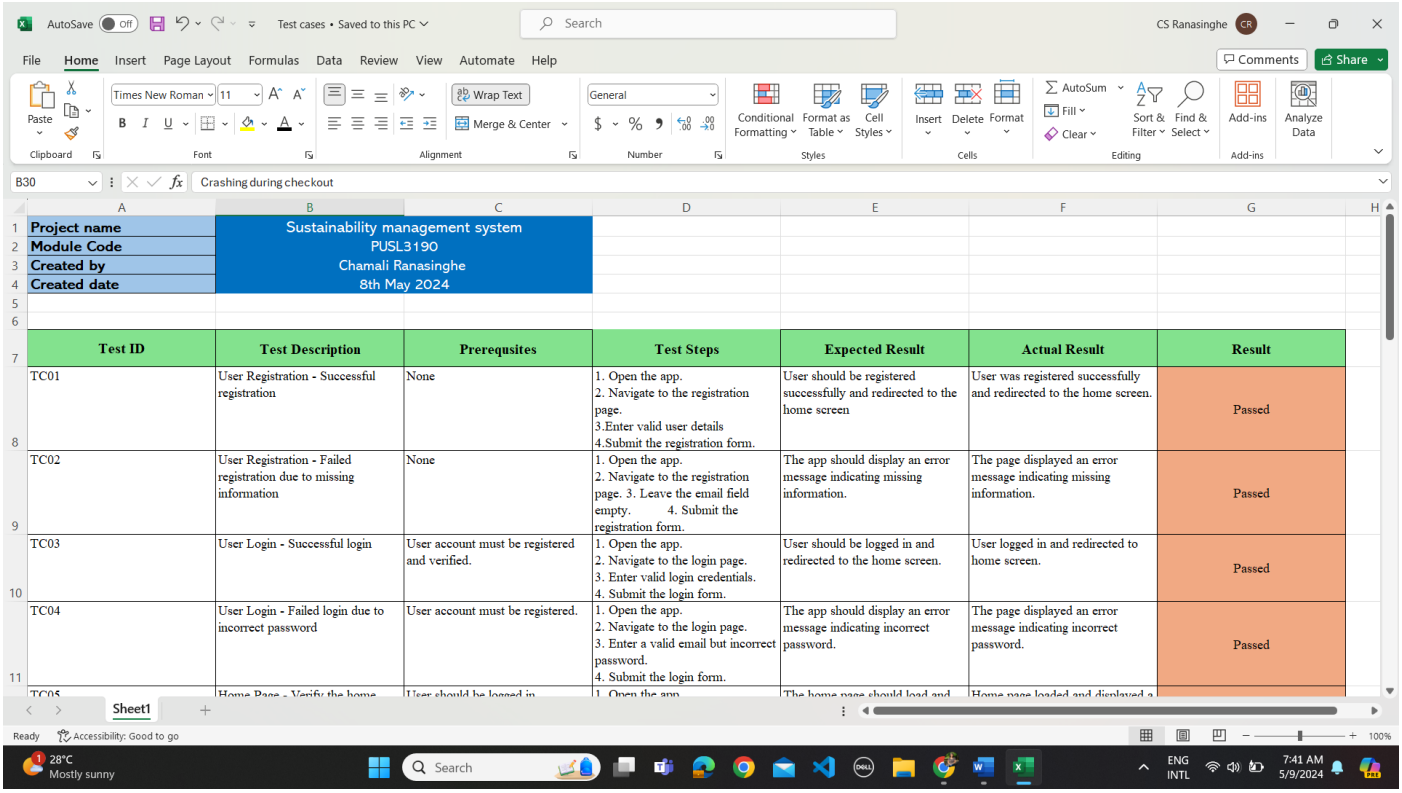
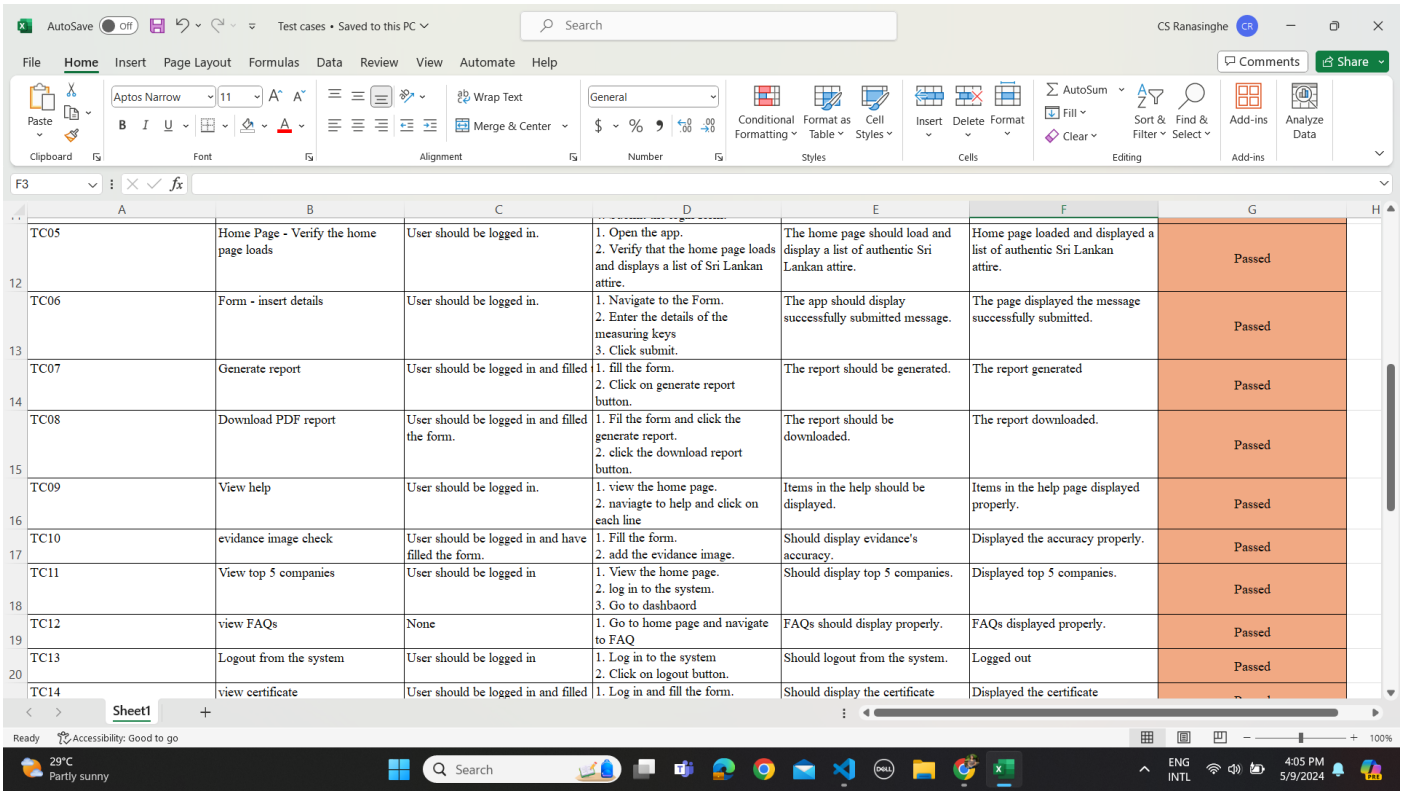
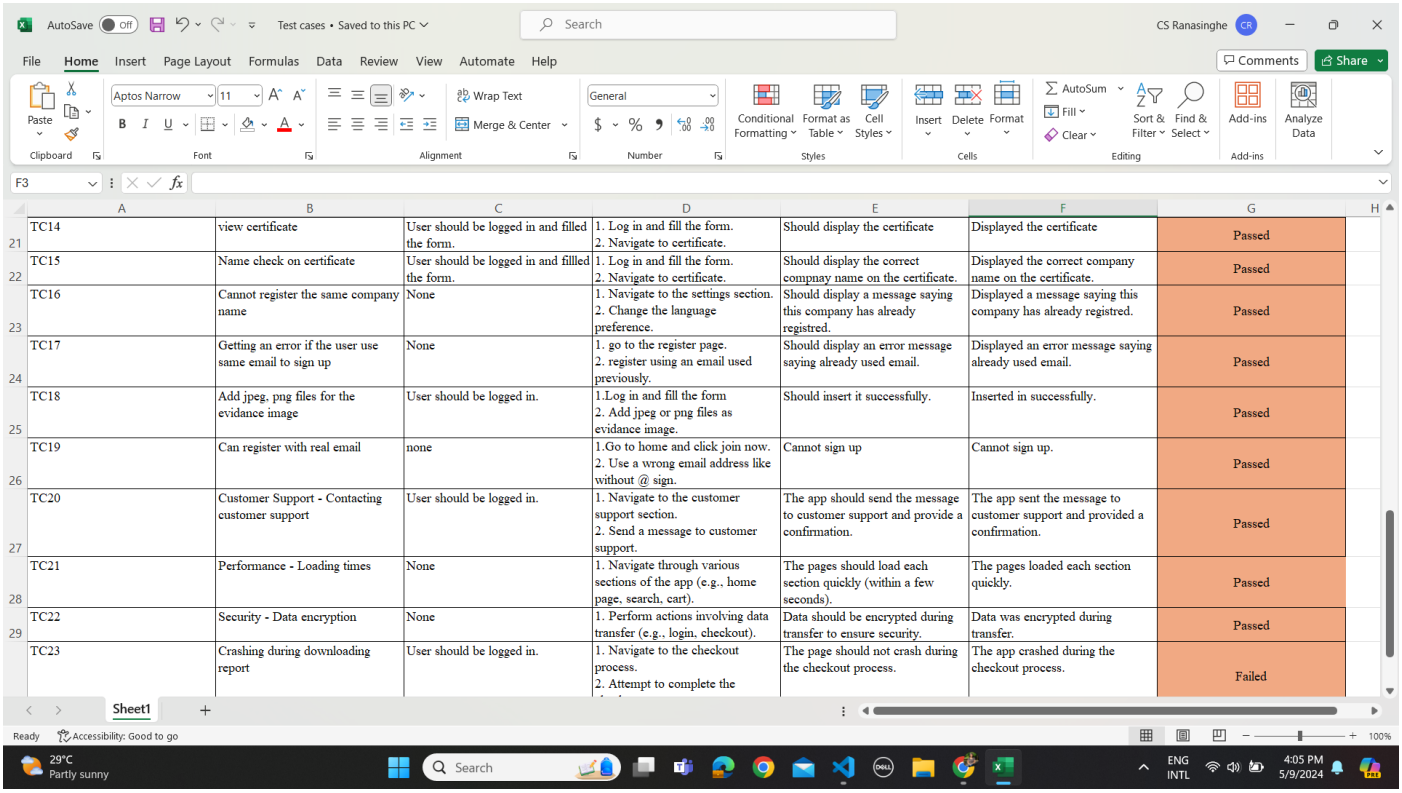


Project name	Sustainability management system
Module Code	PUSL3190
Created by	Chamali Ranasinghe
Created date	8th May 2024

Test ID	Test Description	Prerequsites	Test Steps	Expected Result	Actual Result	Result
TC01	User Registration - Successful registration	None	1. Open the app. 2. Navigate to the registration page. 3.Enter valid user details 4.Submit the registration form.	User should be registered successfully and redirected to the home screen	User was registered successfully and redirected to the home screen.	Passed
TC02	User Registration - Failed registration due to missing information	None	1. Open the app. 2. Navigate to the registration page. 3. Leave the email field empty. 4. Submit the registration form.	The app should display an error message indicating missing information.	The page displayed an error message indicating missing information.	Passed
TC03	User Login - Successful login	User account must be registered and verified.	1. Open the app. 2. Navigate to the login page. 3. Enter valid login credentials. 4. Submit the login form.	User should be logged in and redirected to the home screen.	User logged in and redirected to home screen.	Passed
TC04	User Login - Failed login due to incorrect password	User account must be registered.	1. Open the app. 2. Navigate to the login page. 3. Enter a valid email but incorrect password. 4. Submit the login form.	The app should display an error message indicating incorrect password.	The page displayed an error message indicating incorrect password.	Passed



TC05	Home Page - Verify the home page loads	User should be logged in.	1. Open the app. 2. Verify that the home page loads and displays a list of Sri Lankan attire.	The home page should load and display a list of authentic Sri Lankan attire.	Home page loaded and displayed a list of authentic Sri Lankan attire.	Passed
TC06	Form - insert details	User should be logged in.	1. Navigate to the Form. 2. Enter the details of the measuring keys 3. Click submit.	The app should display successfully submitted message.	The page displayed the message successfully submitted.	Passed
TC07	Generate report	User should be logged in and filled	1. fill the form. 2. Click on generate report button.	The report should be generated.	The report generated	Passed
TC08	Download PDF report	User should be logged in and filled the form.	1. Fil the form and click the generate report. 2. click the download report button.	The report should be downloaded.	The report downloaded.	Passed
TC09	View help	User should be logged in.	1. view the home page. 2. naviagte to help and click on each line	Items in the help should be displayed.	Items in the help page displayed properly.	Passed
TC10	evidance image check	User should be logged in and have filled the form.	1. Fill the form. 2. add the evidance image.	Should display evidance's accuracy.	Displayed the accuracy properly.	Passed
TC11	View top 5 companies	User should be logged in	1. View the home page. 2. log in to the system. 3. Go to dashbaord	Should display top 5 companies.	Displayed top 5 companies.	Passed
TC12	view FAQs	None	1. Go to home page and navigate to FAQ	FAQs should display properly.	FAQs displayed properly.	Passed
TC13	Logout from the system	User should be logged in	1. Log in to the system 2. Click on logout button.	Should logout from the system.	Logged out	Passed
TC14	view certificate	User should be logged in and filled	1. Log in and fill the form.	Should display the certificate	Displayed the certificate	



21	TC14	view certificate	User should be logged in and filled the form.	1. Log in and fill the form. 2. Navigate to certificate.	Should display the certificate	Displayed the certificate	Passed
22	TC15	Name check on certificate	User should be logged in and fillled the form.	1. Log in and fill the form. 2. Navigate to certificate.	Should display the correct compnay name on the certificate.	Displayed the correct company name on the certificate.	Passed
23	TC16	Cannot register the same company name	None	1. Navigate to the settings section. 2. Change the language preference.	Should display a message saying this company has already registred.	Displayed a message saying this company has already registred.	Passed
24	TC17	Getting an error if the user use same email to sign up	None	1. go to the register page. 2. register using an email used previously.	Should display an error message saying already used email.	Displayed an error message saying already used email.	Passed
25	TC18	Add jpeg, png files for the evidance image	User should be logged in.	1.Log in and fill the form 2. Add jpeg or png files as evidance image.	Should insert it successfully.	Inserted in successfully.	Passed
26	TC19	Can register with real email	none	1.Go to home and click join now. 2. Use a wrong email address like without @ sign.	Cannot sign up	Cannot sign up.	Passed
27	TC20	Customer Support - Contacting customer support	User should be logged in.	1. Navigate to the customer support section. 2. Send a message to customer support.	The app should send the message to customer support and provide a confirmation.	The app sent the message to customer support and provided a confirmation.	Passed
28	TC21	Performance - Loading times	None	1. Navigate through various sections of the app (e.g., home page, search, cart).	The pages should load each section quickly (within a few seconds).	The pages loaded each section quickly.	Passed
29	TC22	Security - Data encryption	None	1. Perform actions involving data transfer (e.g., login, checkout).	Data should be encrypted during transfer to ensure security.	Data was encrypted during transfer.	Passed
	TC23	Crashing during downloading report	User should be logged in.	1. Navigate to the checkout process. 2. Attempt to complete the	The page should not crash during the checkout process.	The app crashed during the checkout process.	Failed