WESTERN MICHIGAN UNIVERSITY

CS-5610-SP24 – Advance R for Data Science

Instructor: Wassnaa Al-Mawee

Final Project Report

"Green Expectations LLC – Convert residential houses into sustainable homes using AI"

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ABSTRACT

This project focuses on the development of a versatile chatbot for Green Expectations LLC's real estate website, aiming to guide users toward AI-driven Sustainable Homes Marketplace that prioritizes sustainability and user satisfaction. The project objectives include developing AI algorithms, the chatbot provides eco-friendly responses, troubleshoots website-related issues, and assists users. Through collaboration and iterative adjustments, the team successfully developed chatbot regarding sustainability. Thorough user experience testing and seamless integration into the existing website were prioritized to enhance the chatbot's functionality. The team addressed challenges related to AI alignment and user data privacy and collaborated with external experts to incorporate energy efficiency insights.

Future enhancements include broader troubleshooting capabilities, continuous updates, and engagement strategies such as AI-generated blogs and affiliate marketing. The project explores innovative concepts, such as chatbot using Langchain and LLM, and involving scraping sustainable housing data from multiple sources. By embracing a holistic approach, the chatbot not only provides technical solutions but also considers strategic elements, marking a significant step towards creating an interactive, user-centric, and sustainable experience. In addition to technical prowess, this project places a premium on strategic foresight. User engagement strategies, including AI-generated blogs and affiliate marketing, align with a vision to educate and empower users about sustainable living. The emphasis on user data privacy, documented in an advisory document, reflects a commitment to ethical AI practices. Collaborations with external experts, plans for continuous improvement, and a focus on marketing and monetization underscore the project's dynamic nature. The exploration of virtual personal assistants and Phase 2 initiatives amplifies the commitment to staying at the forefront of innovation. By encapsulating technical innovation, user-centric strategies, and a commitment to sustainability, this chatbot project signifies a transformative step in redefining the real estate landscape, offering users a comprehensive, interactive, and forward-thinking platform for their housing needs.

INTRODUCTION

The development of an AI-driven sustainable homes marketplace aims to convert the residential houses into sustainable homes. The project seeks to create a chatbot that facilitates sustainability and user satisfaction. The project objectives include developing AI algorithms for users to know more about sustainability, takes the information from the users and then suggest tailored response to user preferences, and implementing AI interface and experience. The report also outlines a timeline for the project, which includes conducting and preprocessing data, implementing AI interfaces, testing and validating algorithms and functionalities.

1.1 PURPOSE

The purpose of this project is to revolutionize the real estate market by introducing an AI-driven Sustainable Homes Marketplace. The ultimate goal is to solve the issue of residential buildings contributing to 20% of the total greenhouse gas emissions in the US. The chatbot is created to help the user know more about sustainability, it can be useful tool to enhance user engagement and satisfaction. The chatbot can provide personalized action plans and validation AI queries to help users make sustainable choices. Examples of such queries can be related to energy-efficient appliances, water conservation, and waste reduction. It also provides information on the sustainable materials and technologies used in building sustainable homes.

1.2 SCOPE

The report delves into the functional aspects of the AI assistant chatbot, elucidating its capabilities and features which completes the project requirements. It addresses the critical aspect of user experience design, emphasizing the importance of intuitive interfaces and personalized interactions to enhance user satisfaction. Data security and privacy emerge as paramount concerns within the scope of the report, prompting an examination of measures to safeguard user data and ensure compliance with data protection regulations.

OBJECTIVES AND DELIVERABLES

2.1 Objectives:

2.1.1 Develop a Functional Chatbot:

- Lead the design and development of the chatbot architecture, incorporating AI elements for the personalized suggestions.
- Implement troubleshooting features within the chatbot to efficiently address user issues and provide support.

2.1.2 Enhance User Experience:

- Conduct user experience testing to refine the chatbot's functionality, ensuring seamless interaction with the website.
- Gather the data from user conventions and user feedback for iterative improve the chatbot conversationalist.

2.1.3 Facilitate Property Estimations:

- Develop algorithms for guidance based on sustainable living criteria, in line with the project's objective of assisting users in converting homes into sustainable ones.
- Collaborate with real estate experts to ensure the accuracy and relevance of property estimations provided by the chatbot.

2.2 Deliverables:

2.2.1 Functional Chatbot:

- Develop and implement a fully functional chatbot capable of delivering sustainable housing advice, troubleshooting support, and property estimation guidance.
- Ensure the chatbot's compatibility with the Green Expectations LLC website.

2.2.2 Troubleshooting Assistance:

- Implement features within the chatbot to address various user issues, including login problems and navigation difficulties, offering a seamless troubleshooting experience.

2.2.3 User Data Privacy Measures:

- Implement robust measures to safeguard user information and ensure compliance with data protection standards, including advisory documents to guide users on data privacy.

2.2.4 Documentation and Training Materials:

- Prepare comprehensive training materials for users interacting with the chatbot, documenting its architecture, algorithms, and troubleshooting procedures.

2.2.5 Future Enhancements Roadmap:

- Identify areas for future enhancements based on user feedback and evolving requirements, developing a roadmap for continuous updates and improvement.

2.2.6 User Engagement Strategies Implementation:

- Implement AI-generated blogs and assist users in applying for eco-friendly incentives, loans and grant, fostering user engagement and providing comprehensive services on the website.

2.2.7 Continuous Improvement Mechanisms:

- Establish mechanisms for continuous improvement based on user feedback and technological advancements, regularly updating the chatbot with new prompts, recommendations and features to enhance user experience.

PROJECT PLAN

3.1 Requirement Analysis:

- Review and analyse the project specifications outlined in the project summary provided by Green Expectations LLC.
- Identify the key features and functionalities required for the chatbot, aligning with the project's objections of assisting users in real estate transactions and promoting sustainability.

3.2 Design and Development:

- Develop the architecture for the chatbot, incorporating sustainability-focused features to support users in converting conventional homes into sustainable ones.
- Implement AI elements, such as the AI Prompt Engine, to ensure personalized recommendations and seamless integration with the existing Green Expectations LLC website.
- Conduct regular code reviews to uphold high-quality development standards and ensure the chatbot's effectiveness and reliability.

3.3 Integration and Testing:

- Integrate the chatbot into the Green Expectations LLC website, ensuring compatibility and smooth functionality across different platforms.
- Conduct rigorous testing, including functional, usability, and security testing, to identity and address any potential issues or vulnerabilities.
- Address any issues identified during testing through iterative adjustments, prioritizing user experience and data security.

3.4 Iterative Adjustments:

- Continuously address challenges related to AI alignment, user data privacy, and troubleshooting, making iterative adjustments to enhance the chatbot's performance and effectiveness.
- Remain responsive to user feedback and evolving requirements, iterating on the chatbot's features and functionalities to better meet user needs.

3.5 Documentation:

- Prepare comprehensive training materials for users interacting with the chatbot, ensuring they understand its capabilities and how to use it effectively.
- Document the chatbot architecture, algorithms, and troubleshooting procedures to facilitate ongoing maintenance and updates.
- Create user guides and manuals to assist users in navigating the chatbot and maximizing its utility.

3.6 Future Enhancements:

- Identify areas for future enhancements based on user feedback, technological advancements, and evolving user requirements.

- Develop a roadmap for continuous updates, prioritizing enhancements that further support sustainability efforts and improve user experience.
- Explore possibilities for expanding troubleshooting capabilities and engagement strategies to better serve users.

3.7 Collaboration and Integration:

- Collaborate with energy efficiency experts to infuse relevant insights into the chatbot's recommendations, ensuring they align with sustainable living practices.
- Explore and integrate affiliate marketing initiatives to diversify revenue streams and offer users additional value-added services.
- Ensure seamless integration with external APIs for fetching diverse property information, enhancing the chatbot’s capabilities in providing comprehensive real estate listings.

RESULTS

4.1 High-level flow of code execution:

Execute Rshiny ():

User visits the webpage with a signup/sign-in form.

The User creds are passed to the db for verification.

Upon successful submission/verification, the user is directed to the sustainable chatbot.

Execute Streamlit():

Call the main () function.

Prepare the database by creating embeddings.

Obtain user_question input from the user.

Within the main () function:

Call user_input(user_question) function.

Inside user_input(user_question):

Generate embeddings (vector spaces) for the user_question.

Create conversational chains utilizing get_conversational_chain() based on the user_question to respond appropriately by loading the gemini-pro model.

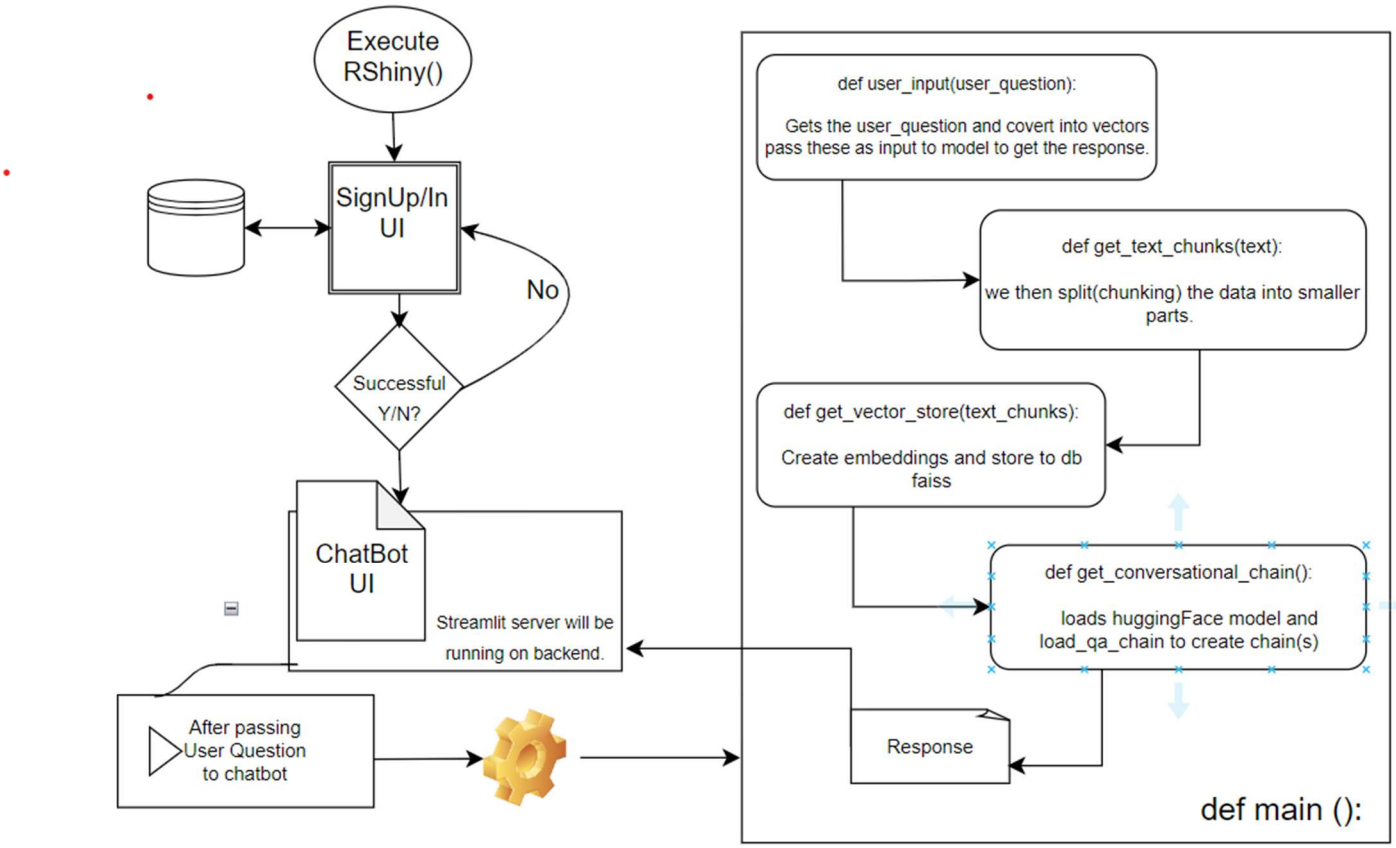
Additional steps include:

Utilize get_text_chunks() to segment the data into chunks.

Use get_vector_store() to convert text chunks into vectors (embeddings).

4.2 Flowchart:

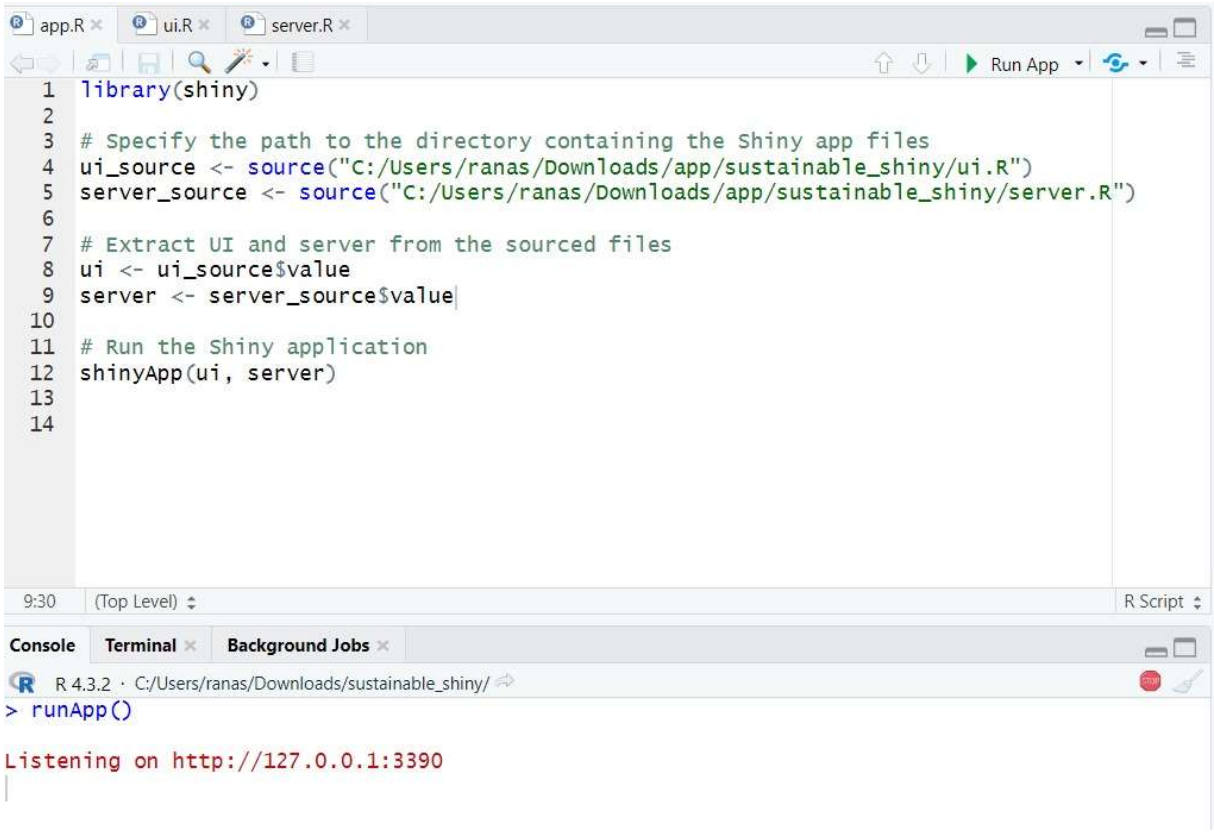
This is the complete flow of the program execution.



4.3 Results:

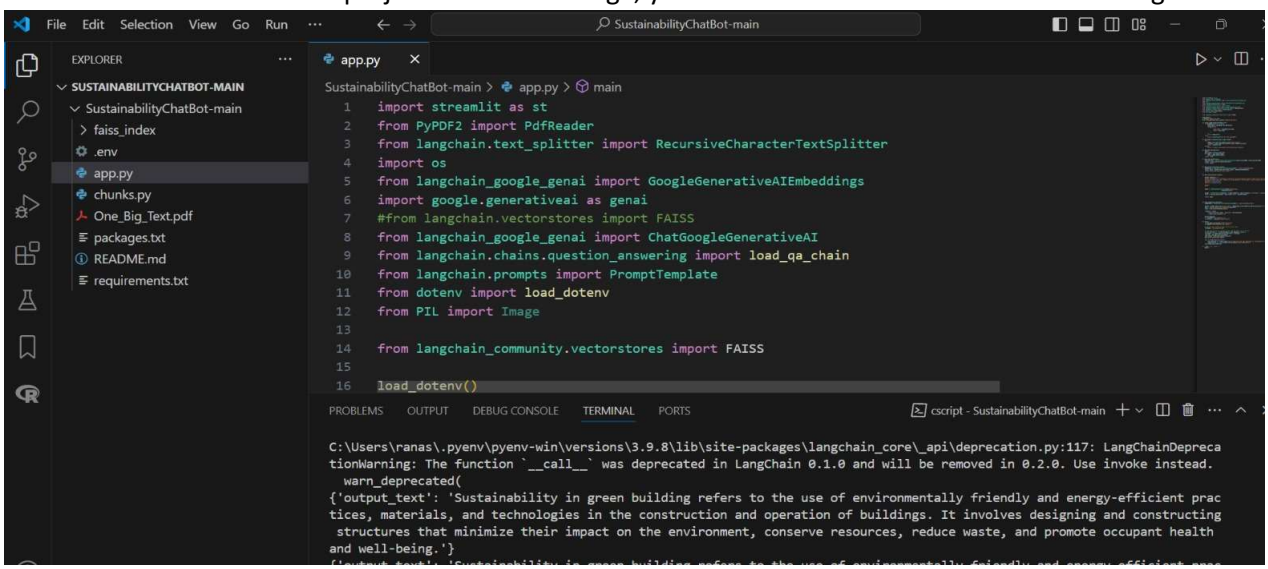
These are main screenshots in our flow.

- This is where we start the Shiny app to run over frontend.

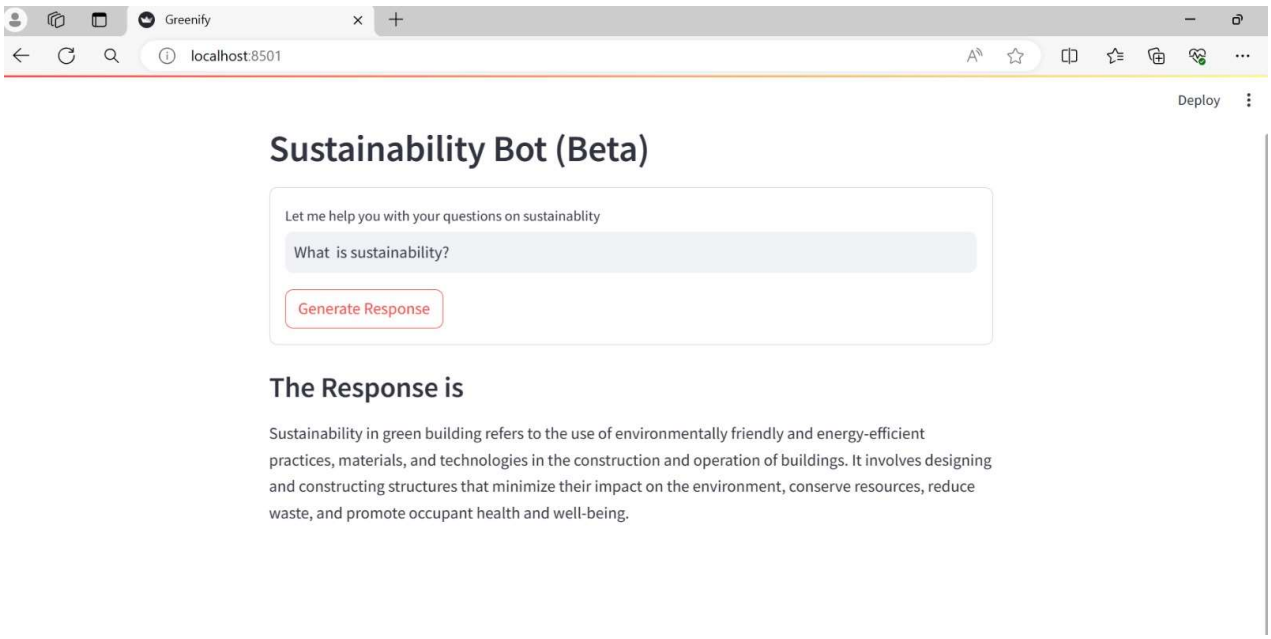


- Start-Up UI: The First page where users' lands !

- This the backend side of the project and in the image, you can see the list of libraries we are using.



- This is interface of the Chatbot (**this is still in beta version!**)



CONCLUSION

The development and integration of the AI assistant chatbot within the Green Expectations LLC real estate project signify a strategic investment towards revolutionizing the real estate industry landscape. Throughout the various stages of requirement analysis, design, development, integration, and testing, meticulous attention has been paid to aligning the chatbot's functionalities with the overarching objectives of the project.

The comprehensive requirement analysis has allowed for a deep understanding of user needs and project specifications, ensuring that the chatbot's features are precisely tailored to meet these requirements. By identifying key functionalities such as personalized recommendations, troubleshooting assistance, and property estimation guidance, the chatbot has been equipped to serve as a valuable resource for users navigating the complexities of real estate transactions.

In the design and development phase, a robust architecture has been crafted to support the chatbot's operations, with particular emphasis on incorporating sustainability-focused features. Integration of AI elements, including the AI Prompt Engine, has further augmented the chatbot's capabilities, enabling it to deliver personalized recommendations based on user preferences and sustainability criteria. Regular code reviews have upheld stringent development standards, ensuring the chatbot's reliability and effectiveness in real-world scenarios.

The integration and testing phase has been marked by meticulous efforts to seamlessly integrate the chatbot into the Green Expectations LLC website while prioritizing compatibility and user experience. Rigorous testing, encompassing functional, usability, and security testing, has been conducted to identify and address any potential issues or vulnerabilities. Through iterative adjustments, these issues have been resolved, resulting in a robust and user-friendly chatbot interface.

Looking forward, the roadmap for future enhancements underscores a commitment to continuous improvement, with a focus on incorporating user feedback, leveraging technological advancements, and adapting to evolving sustainability practices. Collaboration with external experts and integration of affiliate marketing initiatives represent strategic initiatives to enrich the chatbot's offerings and provide users with comprehensive real estate solutions.

In summary, the AI assistant chatbot represents a transformative addition to the Green Expectations LLC ecosystem, poised to redefine the real estate industry's paradigm by promoting sustainability, enhancing user engagement, and facilitating seamless real estate transactions. With its innovative features and strategic roadmap for future growth, the chatbot stands as a testament to Green Expectations LLC's commitment to innovation and sustainability in the real estate sector.

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