Group 1 (Synergetic Minds): Aashay Kadakia, Ishant Kundra, Rahaan Gandhi

Project Prototype

Main Idea:

Student Dorm Recommender, using an NLP chatbot we plan to build a system that can recommend an apartment complex or dorm that provides all the necessary features a user needs. The chatbot will interact with the user, a student, and attempt to find a dorm for the student, if there are any additional preferences such as furnished or distance from campus, then the chatbot will filter and give recommendations to the user while listing the key features that appeal to the user

Research questions:

“How can an AI-powered interactive chatbot be developed to recommend apartment complexes based on evolving user requirements dynamically, and what are the most effective methodologies for understanding user preferences and delivering personalized recommendations?”

Related works:

The concept of accommodation or housing recommender systems is not new and has seen various implementations across different platforms. Here are some common themes in existing works:

1. **Generic Housing Recommender Systems**: These platforms use user preferences like location, price range, and housing type to suggest listings. Websites like Zillow, Rightmove, and Airbnb have sophisticated algorithms to match users with properties but are not specifically tailored for college students and they don’t interact in a way of personalized communication which is what our approach does.

2. **Campus-Specific Housing Portals**: Many universities offer housing portals that list on-campus or university-affiliated housing options. These are more tailored to students but often do not include broader market listings and may lack advanced filtering options and there is no site for comparing housing as ours does.

3. **Collaborative Filtering and Machine Learning Approaches**: Research in the field has explored using collaborative filtering, a method of making automatic predictions about a user's interests by collecting preferences from many users. This technique is common in recommender systems but applying it specifically to student housing preferences is less common with personalized communication NLP chatbot.

Recent Developments in Recommender Systems: A Survey

Requirement analysis:

- Develop a responsive website that is accessible on both desktop and mobile devices. This ensures that students can access the service regardless of the device they use, with a design that adapts to different screen sizes for optimal viewing and interaction.
- The program must be a capable chatbot, able to converse with the user and pick up phrases to understand the user's requirements and present results, and apartments that fit the user's requirements. Should also allow the user to define additional requirements hence modifying search results.

Algorithm design

The developed algorithm can be defined as a Rule-Based NLP chatbot. The algorithm functions by calling sequences of if statements which are linked to SPACY matchers, that hold a list of keywords and IDs that specify how words and alternative words are matched with input. We have defined over 20 different match criteria for this small-scale project, it would well expand over millions of parameters when scaled. Each criterion has a list of words, and phrases as well as rules that define how phrases are structured for detection. This list of non-overlapping words and phrases is known as a pattern. We call a function "filter_listings", which is responsible for calling a function "parse_preferencs", this will parse user preferences based on keywords for matching using Spacy. "Filter_listings" will filter our list of data based on the keywords we parse and after running through all the necessary filters, we will obtain a list of data that matches the user's preferences. This will be sent to our stack's frontend portion to display to the user.

Interface design

The visual interface is designed with the Flask framework and uses HTML5 for the web page design. Our interface is a simple text chat webpage with user inputs in blue and the program's responses in gray. The top of the interface holds the title of the chatbot, and there is a textbox for the user to type in to communicate with the chatbot. The user can either press enter or hit a blue send button to the right of the textbox to submit their input. We use the Flask session library to host the local host session and track the liveness or the user's activity level, allowing the program to quit if the session timeout. The user will be greeted by a welcome message from the interface when they begin a session.

Code description

1. ***dataframe.py:***

   The purpose of this file is to clean the dataset collected in the first phase of our project. Our initial dataset was created to be easy to manually fill in, however, that does not make it easy for our program. First separated our bed_bath column into two distinct columns, and then we replaced all Ys and Ns with 1s and 0s respectively. We then saved the new dataset. This file is not essential for the program to work, however, it is useful for future edits to the dataset.

2. ***recommend.py:***

   The purpose of this file is the algorithm and implementation of our chatbot's decision-making. This file is capable of producing apartments when you give requirements in price, bedroom, bathroom, and many of our smaller features. The chatbot fails when the user increases the amount of requirements because of our limited dataset. Complete Functions:

   - Load_dataset - loads CSV file; complete

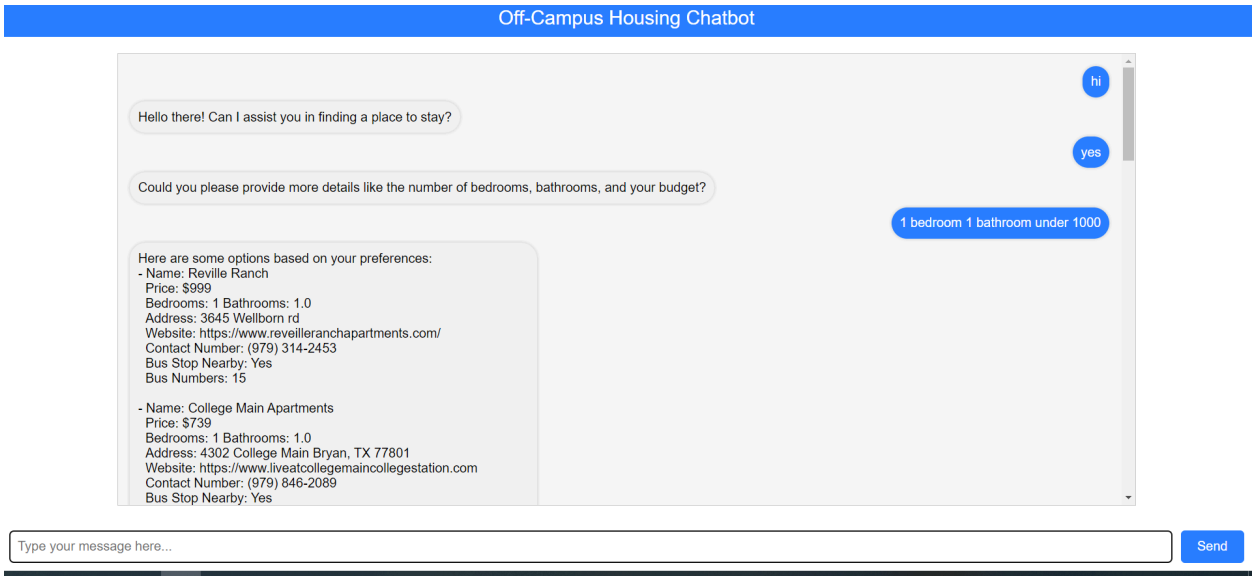
   Working functions, but can be improved:

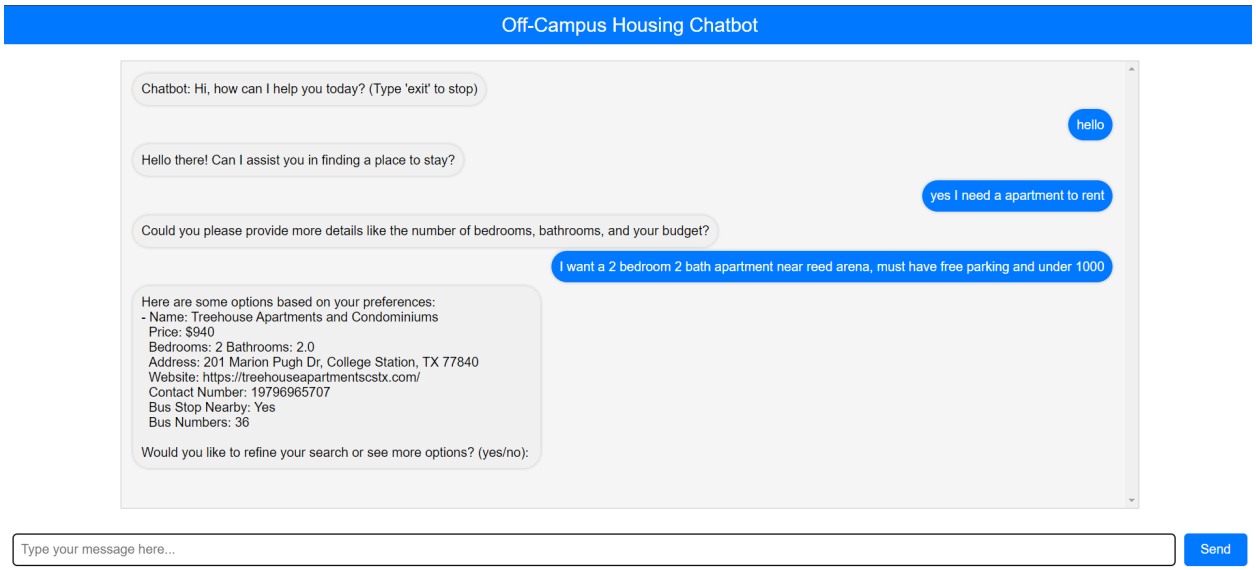
   - Parse_preferences - takes user input and parses it to extract relevant information; complete, could be improved
   - Filter_listings - filters housing based on user preferences and the dataset; complete, could be improved
   - Display listings - chatbot output based on the previous functions; complete
   - Chatbot_main - main entry point for the chatbot. It interacts with the user, processes their input, and provides appropriate responses based on their queries and preferences; complete, could be improved

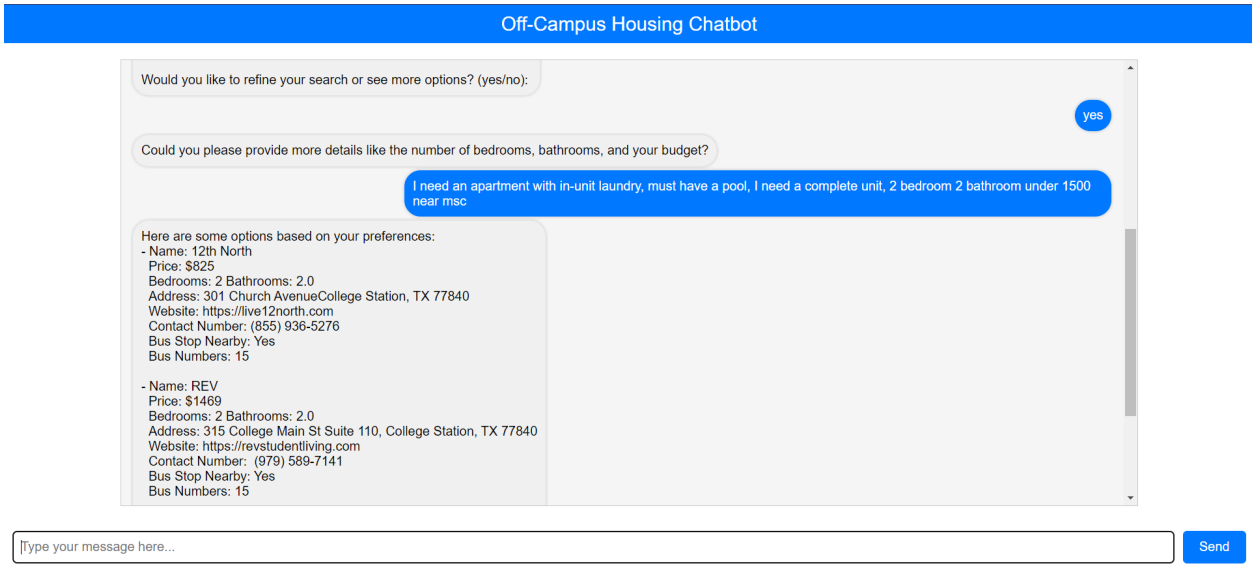
3. ***chatbot_gui.py:***

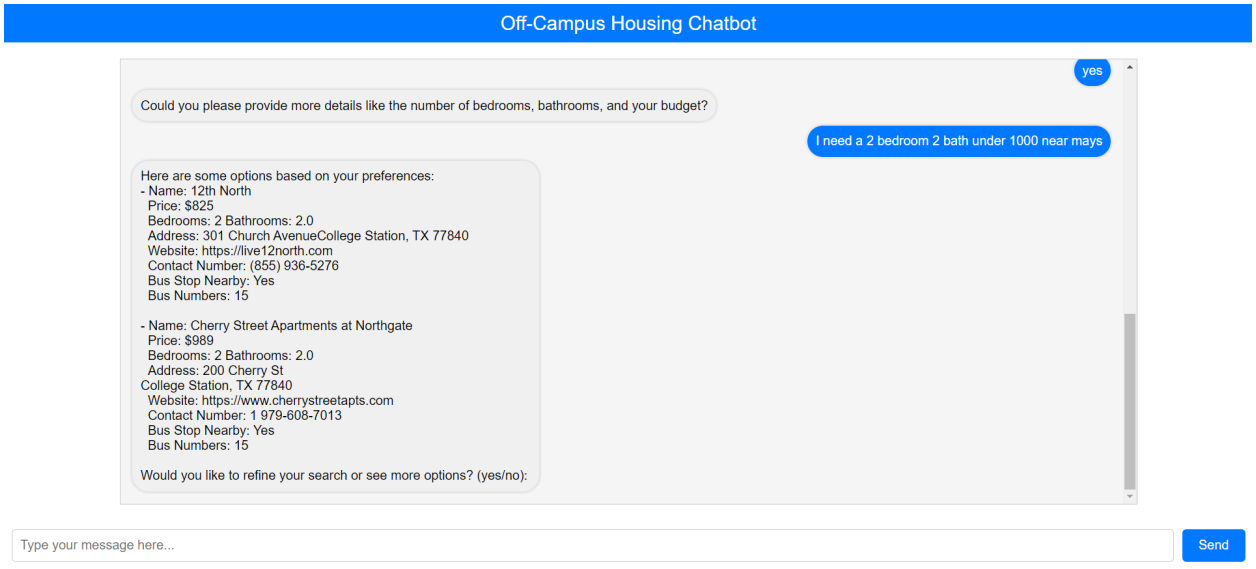
   The purpose of this file is to implement the GUI that displays the chatbot. The file works completely, however, changes to the file are expected according to our future improvements.

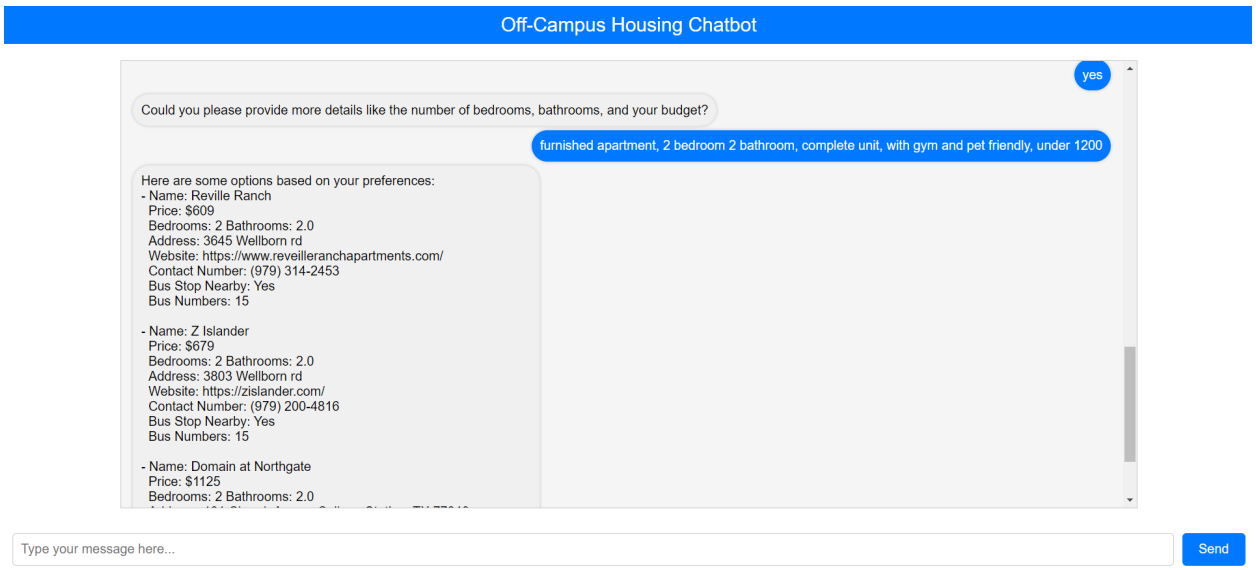
Screenshots





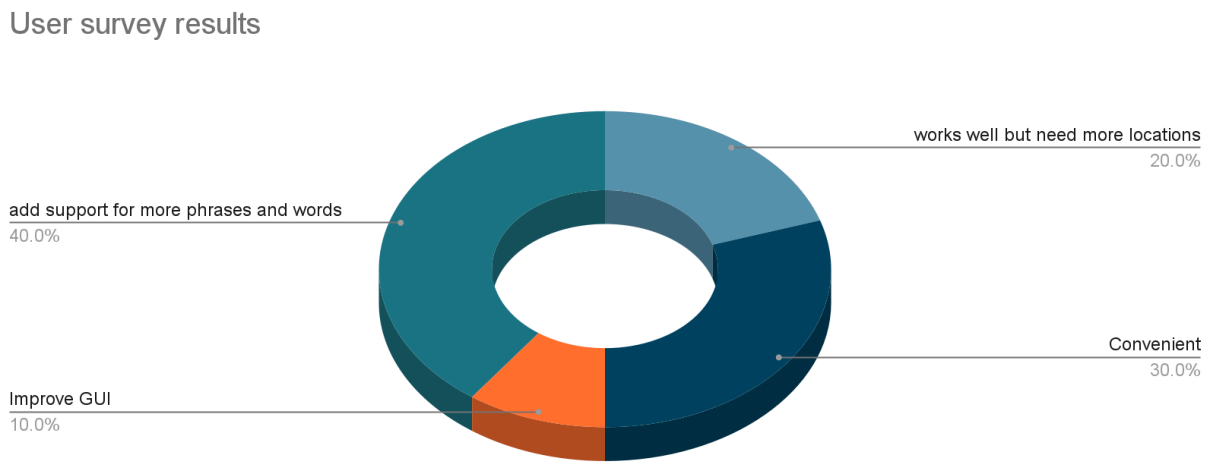

Off-Campus Housing Chatbot
Would you like to refine your search or see more options? (yes/no):
yes
Could you please provide more details like the number of bedrooms, bathrooms, and your budget?
I need an apartment with in-unit laundry, must have a pool, I need a complete unit, 2 bedroom 2 bathroom under 1500 near msc
Here are some options based on your preferences:
- Name: 12th North
Price: $825
Bedrooms: 2 Bathrooms: 2.0
Address: 301 Church AvenueCollege Station, TX 77840
Website: https://live12north.com
Contact Number: (855) 936-5276
Bus Stop Nearby: Yes
Bus Numbers: 15
- Name: REV
Price: $1469
Bedrooms: 2 Bathrooms: 2.0
Address: 315 College Main St Suite 110, College Station, TX 77840
Website: https://revstudentliving.com
Contact Number: (979) 589-7141
Bus Stop Nearby: Yes
Bus Numbers: 15
Type your message here...
Send


Off-Campus Housing Chatbot
yes
Could you please provide more details like the number of bedrooms, bathrooms, and your budget?
I need a 2 bedroom 2 bath under 1000 near mays
Here are some options based on your preferences:
- Name: 12th North
Price: $825
Bedrooms: 2 Bathrooms: 2.0
Address: 301 Church AvenueCollege Station, TX 77840
Website: https://live12north.com
Contact Number: (855) 936-5276
Bus Stop Nearby: Yes
Bus Numbers: 15
- Name: Cherry Street Apartments at Northgate
Price: $989
Bedrooms: 2 Bathrooms: 2.0
Address: 200 Cherry St
College Station, TX 77840
Website: https://www.cherrystreetapts.com
Contact Number: 1 979-608-7013
Bus Stop Nearby: Yes
Bus Numbers: 15
Would you like to refine your search or see more options? (yes/no):
Type your message here...
Send


Off-Campus Housing Chatbot
yes
Could you please provide more details like the number of bedrooms, bathrooms, and your budget?
furnished apartment, 2 bedroom 2 bathroom, complete unit, with gym and pet friendly, under 1200
Here are some options based on your preferences:
- Name: Reville Ranch
Price: $609
Bedrooms: 2 Bathrooms: 2.0
Address: 3645 Wellborn rd
Website: https://www.reveilleranchapartments.com/
Contact Number: (979) 314-2453
Bus Stop Nearby: Yes
Bus Numbers: 15
- Name: Z Islander
Price: $679
Bedrooms: 2 Bathrooms: 2.0
Address: 3803 Wellborn rd
Website: https://zislander.com/
Contact Number: (979) 200-4816
Bus Stop Nearby: Yes
Bus Numbers: 15
- Name: Domain at Northgate
Price: $1125
Bedrooms: 2 Bathrooms: 2.0
Type your message here...
Send

Evaluation:

We gathered feedback from 20 friends about our chatbot. They were tasked with using the chatbot to help find different apartments based on a variety of different qualifications. All of our users recognized the tool as extremely useful, and it seemed to appeal mainly to students unfamiliar with the surrounding area. Despite the positive reviews, our feedback indicated that there were some common criticisms.8 of the users indicated that adjusting the boundaries of their qualifications was difficult, and more often than not these users would choose to simply restart the bot instead of trying to change features, their feedback suggested adding support for a wider library of NLP phrases. A few users suggested improvements in the UI and interface to make it look cleaner and make the printed output more dynamic. Another concern for some users was the system's limited ability to process certain phrases like abbreviations, slang, non-English words, and mixed-language phrases. 20% of the test users felt there could be more support for various locations across campus, such as Kyle Field and the A&M airport.



Future Improvements

- Implement a sorting function for various features, such as price and number of bedrooms/bathrooms.
- Allow the chat to update features if prompted.
- Implement a sliding bar to adjust boundaries.
- Improve the replies the chatbot makes, and make them seem more natural.
- Able to pick up a wider variety of words and phrase matches in long sentences to make filtering possible for a wider variety of the NLP library.
- Improve the UI past the current basic text chat format.
- Diversify our dataset

Group member work allocations:

Member	Percentage contribution
Aashay Kadakia	33.3%
Arunkumar Tamilselvan	0.1%
Ishant Kundra	33.3%
Rahaan Gandhi	33.3%