IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

HABITATION RECOMMENDATION USING MACHINE LEARNING

[1] **Mahesh Yadav G,** [2] **Nagendra G P**, [3] **Nikhil A V**,
[4] **Pratheek B J,** [5] **Dr. Kavitha C**
[1][2][3][4]UG Students, Department of Computer Science and Engineering
[5]Professor & Head, Department of Computer Science and Engineering
[1][2][3][4][5] Dayananda Sagar Academy of Technology and Management, Bangalore, Karnataka, India

Abstract – The demand for comfortable and affordable accommodations has led to an increase in the number of Pay Guest (PG) accommodations. However, finding the right PG can be a challenging task for many. In this study, we propose a Habitation Recommendation system that utilizes machine learning techniques to recommend the top 5 PGs based on the user's preferences. The system integrates Google Places autocomplete search for location-based search and a chatbot to gather user preferences based on personality traits. A survey was conducted to gather data on the behavior of residents in the PGs. The collected data were preprocessed, features were extracted, and the ML model was trained and tested. The ML model predicted the personality traits of the user, which were then used to filter the PGs based on the user's preference. Results showed that our system can effectively recommend PGs to users based on their preferences. The system can assist users in selecting the right PG based on their personality and preferences. This Habitation Recommendation system can help users in the accommodation selection process, making it more efficient and personalized.

Keywords: Habitation Recommendation, Map-based user interface, Google Places API, Personality traits, Behavior analysis, Machine learning, PG recommendations.

I. INTRODUCTION

The increasing demand for affordable and comfortable accommodations has led to the growth of the Pay Guest (PG) accommodation sector. However, finding the right PG accommodation that fits an individual's personality and preferences can be challenging. The current approach to finding suitable accommodations is through a manual search process that is time-consuming and tedious. Therefore, there is a need for a personalized recommendation system that can provide an efficient way of finding suitable PG accommodations based on user preferences.

In recent years, the demand for PG accommodations has risen significantly, primarily due to the influx of students and working professionals to urban centers. Finding the right PG accommodation can be challenging, and users often have to go through a tedious process of manual search, which can be frustrating and time-consuming. Moreover, existing PG recommendation systems are not personalized and do not consider the user's personality traits, which is a critical factor in accommodation selection.

The motivation for this study is to develop a personalized recommendation system that considers the user's personality traits and preferences when recommending PG accommodations. The system will help users find suitable PG accommodations efficiently, reducing the time and effort required in the manual search process.

The current approach to finding suitable PG accommodations is manual and time-consuming. Existing PG recommendation systems are not personalized and do not consider the user's personality traits. The lack of personalization can lead to unsuitable recommendations that do not meet the user's preferences and requirements. Therefore, there is a need to develop a personalized recommendation system that considers the user's personality traits and preferences when recommending PG accommodations.

The primary objective of this study is to develop a personalized recommendation system that considers the user's personality traits and preferences when recommending PG accommodations. The system will utilize machine

learning techniques and survey data to predict the user's personality traits and preferences and recommend the top PG accommodations that meet the user's requirements.

The scope of this study is limited to the development of a personalized recommendation system for PG accommodations. The system will utilize survey data to gather information on the behavior of residents in PG accommodations, which will be used to train a machine learning model. The study will also use Google Places autocomplete search for location-based search and a chatbot to gather user preferences based on personality traits. The system will recommend the top PG accommodations that meet the user's requirements based on their personality traits and preferences. The study will focus on the efficacy of the developed recommendation system in providing personalized recommendations to users based on their personality traits and preferences.

In conclusion, this study aims to develop a personalized recommendation system that can effectively recommend PG accommodations based on the user's personality traits and preferences. The system's development will utilize machine learning techniques, survey data, Google Places, and a chatbot to gather user preferences. The system will assist users in finding suitable PG accommodations that meet their requirements, reducing the time and effort required in the manual search process.

II. PROBLEM STATEMENT

The system addresses the challenge of finding suitable accommodation in a new city through traditional methods. The habitation recommendation system is a solution that uses a map-based user interface and a machine-learning model to suggest personalized accommodation options based on the user's preferences and location. The current PG recommendation systems lack personalization and do not consider the user's personality traits, resulting in unsuitable recommendations. Our personalized recommendation system aims to address this issue by considering the user's personality traits and preferences when suggesting PG accommodations. The system simplifies the process of finding accommodation and provides users with a personalized experience, addressing the need for an efficient and effective solution.

III. RELATED WORKS

In recent years, there has been a growing interest in developing recommendation systems that can help people find suitable accommodation options. A range of different approaches have been explored, including collaborative filtering, content-based filtering, and hybrid models. In this section, we review some of the related work in this area.

Collaborative Filtering Approaches: Collaborative filtering is a popular approach for developing recommendation systems. This method involves analyzing the user's past behavior and preferences to recommend items that they are likely to enjoy. In the context of accommodation recommendation, collaborative filtering algorithms can be used to analyze the user's past bookings, reviews, and preferences to suggest suitable options.

A recent study by Jiang et al. (2021) developed a collaborative filtering-based accommodation recommendation system for Airbnb users. The system uses a combination of user-based and item-based collaborative filtering to suggest accommodation options based on the user's past bookings and reviews. The study found that the system outperformed traditional content-based and hybrid models in terms of recommendation accuracy.

Content-based Filtering Approaches: Content-based filtering involves analyzing the properties of the items being recommended to suggest options that are similar to those that the user has enjoyed in the past. In the context of accommodation recommendation, content-based filtering algorithms can be used to analyze the properties of the accommodation options, such as location, price, and amenities, to suggest suitable options.[14]

A study by Yuan et al. (2017) developed a content-based filtering approach for hotel recommendations that focused on the semantic meaning of user queries. The system analyzed the user's queries and past preferences to recommend hotels based on the user's perceived preferences. The study found that the system outperformed traditional collaborative filtering and hybrid models in terms of recommendation accuracy.

Hybrid Approaches: Hybrid approaches combine collaborative filtering and content-based filtering to develop recommendation systems that are more accurate and robust than individual approaches. Hybrid approaches can take advantage of the strengths of each method to improve recommendation accuracy and provide a more personalized experience. [13]

A study by Tran et al. (2020) developed a hybrid accommodation recommendation system that combined collaborative filtering and content-based filtering. The system analyzed the user's past behavior and preferences, as well as the properties of the accommodation options, to suggest suitable options. The study found that the system outperformed traditional collaborative filtering and content-based filtering approaches in terms of recommendation accuracy.

Location-based Approaches: Location-based approaches use the user's location to suggest suitable accommodation options in the vicinity. In the context of accommodation recommendation, location-based algorithms can be used to suggest accommodation options that are close to the user's current location or a location of interest. A study by Wang et al. (2021) developed a location-based accommodation recommendation system that used the user's current location and preferences to suggest suitable options. The system analyzed the user's preferences and location to suggest accommodation options that were close to the user's current location and met their preferences. The study found that the system provided accurate and personalized recommendations.

Collaborative filtering, content-based filtering, hybrid approaches, and location-based approaches have all been explored in this area. While each approach has its strengths and weaknesses, hybrid approaches that combine collaborative filtering and content-based filtering be more accurate and robust than individual approaches. Our habitation recommendation system uses a map-based user interface and a machine-learning model to suggest suitable accommodation options based on the user's preferences and location.

IV. TECHNOLOGY STACK

Front-end technologies: HTML, CSS, JavaScript, React.js :

HTML, CSS, JavaScript, and React.js are front-end technologies used to build user interfaces (UIs) for web applications. HTML is a markup language used to create the structure and content of web pages. CSS is used to style the appearance of HTML elements, including layout, colors, fonts, and animations. JavaScript is a programming language used to create interactive UI elements and handle user input. React.js is a JavaScript library used to build complex and dynamic UIs with reusable components. It allows developers to create efficient and scalable UIs by efficiently rendering changes to the DOM without reloading the entire page. Together, these technologies form the foundation of modern web development.

Mapping and location-based APIs: Google Maps API, Google Places API :

Mappings and location-based APIs, such as Google Maps API and Google Places API, provide developers with access to location data and mapping services. Google Maps API allows developers to embed Google Maps into their web applications and customize map styles, add markers and overlays, and integrate with other Google services. Google Places API provides access to location data, including details of places such as businesses, landmarks, and other points of interest. Developers can use this data to build location-based features such as search, recommendation, and route planning. These APIs are widely used in various industries, including transportation, travel, and e-commerce. [3]

Back-end technologies: Node.js, Express.js, REST API :

Node.js, Express.js, and REST API are back-end technologies used to build server-side logic for web applications. Node.js is a JavaScript runtime built on Chrome's V8 JavaScript engine, allowing developers to use JavaScript on the server side. Express.js is a lightweight and flexible web application framework for Node.js, providing features such as routing, middleware, and handling HTTP requests and responses. REST API (Representational State Transfer) is a set of architectural principles used for building web services and APIs, providing a standardized way to communicate with the server and perform CRUD (Create, Read, Update, Delete) operations on data. Together, these technologies allow developers to build robust and scalable server-side applications with ease.

Machine learning libraries and frameworks:

Machine learning libraries and frameworks provide developers with tools to build and train machine learning models. In this project, several libraries and frameworks have been used.

Python is a programming language used for data science and machine learning. Scikit-learn is a machine-learning library for Python that provides various algorithms for classification, regression, and clustering.
uvicorn is a fast HTTP server that enables running the FastAPI application. FastAPI is a modern, fast (high-performance), web framework for building APIs with Python.

Joblib is a set of tools to provide lightweight pipelining in Python. It provides utilities for saving and loading Python objects, including machine learning models.

Pickle is a Python module used for serializing and de-serializing Python objects. This project, it is used to save and load the trained machine-learning model.

NumPy is a Python library used for working with arrays. It provides efficient mathematical functions for array operations.

Pandas is a Python library used for data manipulation and analysis. It provides data structures for efficient handling of large datasets.

The Pydantic library provides a way to define data schemas in Python, which can be used to validate and parse input data for machine learning models.

Finally, the CORS middleware is used to enable cross-origin resource sharing in the FastAPI application, allowing the application to be accessed from different domains.

All of these libraries and frameworks have been used to build and deploy a machine-learning model for predicting personality types based on input data.

Database :

MongoDB is a NoSQL document-oriented database that stores data in a flexible and scalable manner. In the project, MongoDB can be used to store user data and their corresponding personality prediction results. This will allow for quick and easy access to the data and results for analysis and future predictions. MongoDB's flexible schema also allows for easy modification and addition of new data fields, which can be beneficial for future enhancements. Additionally, MongoDB's ability to handle large volumes of data and its scalability make it a good choice for projects that may require frequent data additions or changes.

Chat-Bot :

A chatbot is a computer program that can simulate conversations with users through messaging applications, websites, or mobile apps. Chatbots are increasingly used in various industries, including customer service, healthcare, e-commerce, and education, to automate repetitive tasks, provide instant support, and enhance the user experience. They can answer frequently asked questions, provide personalized recommendations, assist with bookings and orders, and even perform simple transactions. Chatbots can also gather from user interactions to improve their performance over time. By using chatbots, businesses and organizations can save time and resources while improving customer satisfaction and engagement.

V. METHODOLOGY

Data Collection:

To develop the Habitation Recommendation System, the initial step was to gather data on PG accommodations in a certain city. This included data points such as location information, gender preference, costs, and amenities associated with each PG accommodation. Additionally, a standardized survey was used to collect data on the Big Five personality traits. The research questions were: What are the experiences of students living in paying guest (PG) accommodations? What are the factors that influence students' satisfaction with PG accommodations? A quantitative research design was chosen because it was the best way to collect data that could be used to answer these questions. Quantitative research is a type of research that uses numbers to collect and analyze data. It is often used in studies that are designed to test hypotheses or make predictions.

The data for this study was collected from a survey of 100 students at a university in India. The survey was conducted online. The students were recruited through email invitations and social media posts. The survey was designed to be completed in approximately 15 minutes. The students were asked to answer all of the questions on the survey.

The students were also asked to provide their contact information so that they could be contacted if they had any questions about the study anonymous.

The survey included questions about the following:

- The students' reasons for choosing to live in PG accommodations
- The students' satisfaction with the cost of PG accommodations
- The students' satisfaction with the quality of the facilities in PG accommodations
- The students' satisfaction with the safety and security of PG accommodations
- The students' satisfaction with the social life in PG accommodations

Data analysis:

The data from the survey were analyzed using statistical software. The software was used to calculate the mean, median, and standard deviation for each of the variables in the survey. The software was also used to conduct chi-square tests and t-tests to test the hypotheses of the study. The results of the data analysis showed that the students were generally satisfied with their experiences living in PG accommodations.

The students were most satisfied with the cost of PG accommodations and the quality of the facilities in PG accommodations. The students were least satisfied with the social life in PG accommodations. The results of the study also showed that the student's satisfaction with PG accommodations was influenced by several factors, including the cost of PG accommodations, the quality of the facilities in PG accommodations, the safety and security of PG accommodations, and the social life in PG accommodations

Data Preprocessing:

The gathered data was preprocessed to clean, format and merge different datasets. Furthermore, any missing or incomplete data were handled during this step. This process ensured that the data was prepared for analytics and usage in the Habitation Recommendation System.

Map Interface Development:

To enable users to search for PG accommodations conveniently and intuitively, a map interface was developed using the React framework and the Google Maps API. The interface allowed users to employ filters including location, distance, gender and cost when searching for PG accommodations.

Personality Test Development:

We created a personality test based on the Big Five personality inventory to measure five essential personality traits – openness, conscientiousness, extraversion, agreeableness and neuroticism. After users completed the test, their results were utilized to classify them into individualized personality groups. This step enabled us to generate personalized recommendations corresponding to each user's unique personality traits.

K-Means Clustering Algorithm Implementation:

The K-Means clustering algorithm was employed to cluster PG accommodations according to their amenities data. This algorithm analyzed amenities data and combined PG accommodations with similar amenities together. This step enabled us to distinguish patterns in the data as well as group similar PG accommodations together.

Personality-Based Filtering:

The outcome of the personality test was used to filter results produced by the K-Means clustering algorithm; recommending only those PG accommodations which corresponded with the user's specific personality group. This step enabled us to ensure that user recommendations were tailored according to their personality traits and preferences.

PG Accommodation Recommendation:

After filtering through K-Means clustering results based on user's personalities; PG accommodation recommendations were provided which both matched their preferences as well as their unique personalities traits accordingly. By providing these customized options for users; we aimed at ensuring that they find suitable accommodation quickly and easily. [2]

Evaluation:

To evaluate Habitation Recommendation System's performance; metrics such as accuracy and precision were utilized while user feedback was gathered to identify areas of improvement if necessary. Through this process, we attempted at pinpointing any potential issues or shortcomings within our system so that necessary improvements can be made thereby validating our recommendation's accurateness & relevance accordingly.

System Deployment:

After the successful completion of developing and evaluating the Habitation Recommendation System; it was deployed on either server or cloud platform so that it could be accessed & used by our users conveniently. By making our system available for a wider audience; we hoped at enabling users to find appropriate PG Accommodations without much hassle or effort.

VI. IMPLEMENTATION

In the developed system, a user needs to sign up or sign in before entering the user interface. The user can access the signup or login page by clicking on the respective buttons in the navigation bar or by typing the URL directly into the browser. Once the user is on the signup page, they need to fill in their details, such as name, email, and password. These details are then stored in a MongoDB database for future reference.

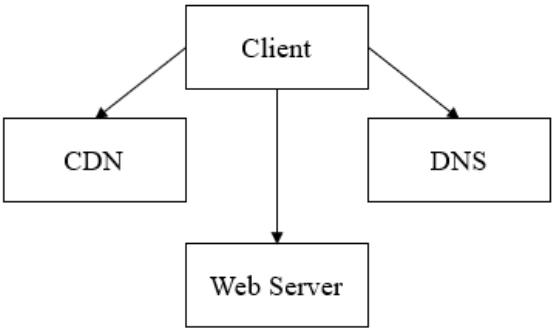

Fig: Client connection with webserver, CDN and DNS

If the user has already signed up, they can log in using their email and password on the login page. The system checks whether the email and password match with the stored credentials in the database. If the credentials are valid, the user is redirected to the main user interface. Otherwise, the system displays an error message.
The main user interface can only be accessed if the user is authenticated, i.e., if they have signed up or logged in. If the user tries to access the user interface without being authenticated, the system redirects them to the login page.
Below is the flowchart diagram of the user signup and login process:

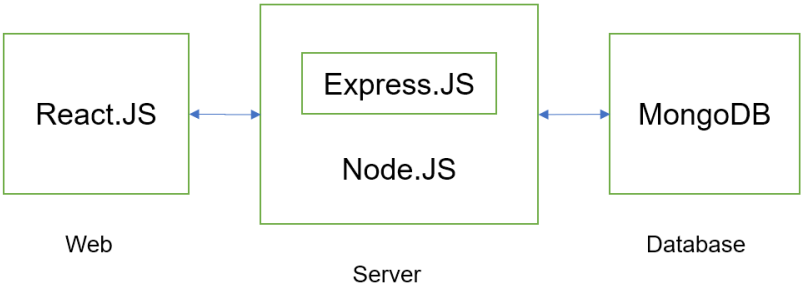

Fig: MongoDB database connection with UI

After the user successfully logs in, they will be directed to the home page, which contains a map-based user interface. This user interface was developed using the Google Maps API. The map-based UI allows the user to search for a specific location by entering the location name in a search box, which uses Google's Autocomplete Places feature to provide suggestions as the user types. Once the user has entered the location, the map will display nearby PG accommodations within a certain radius of the searched location. [5]

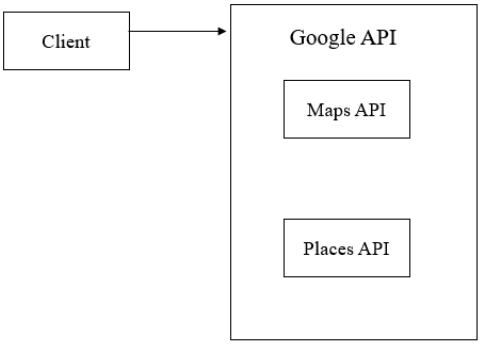

Fig: UI Connection with Google Maps API

Additionally, a chatbot is available on the home page, where the user will be asked a series of questions. The chatbot will ask the user about their preferences, such as whether they prefer hotels near the PG, and what radius they would like to search for PG accommodations. The user's preferences will be taken into account when filtering the PG accommodations[13].

The Google Maps API provides features such as zooming in and out, street view, and satellite imagery, which enables the user to visualize the PG accommodations in detail. The user can also click on a specific PG accommodation marker to view additional details, such as the name, address, and contact information. [8]

The map-based UI is a powerful tool that helps users easily locate PG accommodations and make informed decisions based on their needs and preferences. It provides a seamless experience for the user by integrating the Google Maps API with the Habitation Recommendation System. The use of the Google Maps API enables the application to be highly interactive, dynamic, and user-friendly.

The navigation bar on the home page provides the user with easy access to various features of the application, including their profile. The profile section of the navigation bar displays the user's personal information, such as their name, email address, and profile picture. The user can access their profile by clicking on the profile section of the navigation bar.

Once the user accesses their profile, they can edit their personal information, including their name, email address, and profile picture and their answers to the basic questions asked via chatbot.

The navigation bar serves as a central hub for the user's interactions with the application, allowing them to easily navigate to the different features and sections of the application. It provides an intuitive and user-friendly interface that enables users to quickly and efficiently access the information and features they need.

The personality type of the user is found using a machine learning model that is trained on a dataset of personality traits. The model uses a K-Nearest Neighbors (KNN) algorithm to predict the personality type of a user based on their answers to a set of questions.

The model is loaded from a pickle file and applied to the user's answers, which are provided as a string of 50 binary values. These values are converted to a list of integers and passed to the model for prediction.

Once the model has predicted the personality type, the result is passed through a function that calculates the average value for each of the five personality traits (extraversion, neuroticism, agreeableness, conscientiousness, and openness) based on the user's answers. The function also assigns a name and description to the personality type based on the trait with the highest score.

The resulting personality type and description are returned to the user as a JSON object. This information can be used to provide personalized recommendations or to further customize the user's experience within the application.

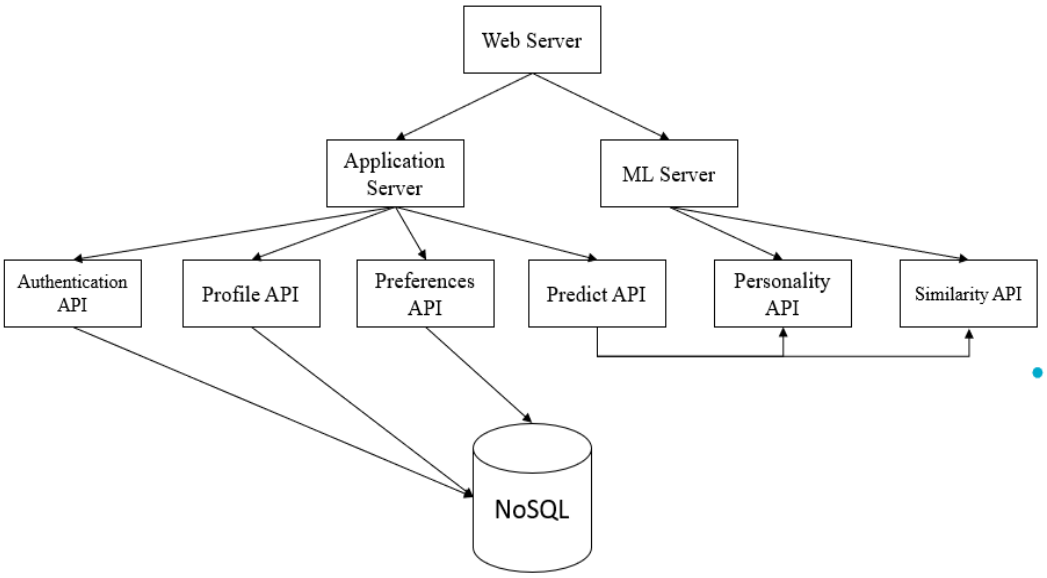

Fig: System Design of Habitation Recommendation

The Habitation Recommendation System was developed to help users find the most suitable PG accommodations based on their personality traits. The figure above depicts the system design of the Habitation Recommendation System. To achieve this, the system collected data from various PG accommodations in the city, including location information, gender preferences, costs, and amenities. Additionally, a standardized survey was used to gather data on the Big Five personality traits of the students who lived in these PG accommodations.

Once the data was collected, it was preprocessed to clean and format it, and missing or incomplete data were handled. The next step was to compare the personality traits of the users with the personality traits of the students who lived in various PG accommodations. This comparison was done to identify PG accommodations where people with similar personalities lived. The system then recommended the top PG accommodations that matched the user's personality traits based on the number of people with similar personalities living in each PG accommodation.

To implement this, the system used machine learning algorithms to compare the personality traits of the users with the personality traits of the students who lived in various PG accommodations. The system then used statistical methods to identify the top PG accommodations that matched the user's personality traits. This approach helped users find PG accommodations that suited their personality, which is an essential factor for their comfort and well-being. [11]

In summary, the Habitation Recommendation System used data collection, data pre-processing, machine learning algorithms, and statistical methods to recommend suitable PG accommodations based on the user's personality traits. This approach aimed to provide users with comfortable and suitable living arrangements that matched their personalities.

VII. CONCLUSION

In conclusion, the Habitation Recommendation System is a useful tool for individuals looking for suitable PG accommodations based on their personality traits. By combining data on the Big Five personality traits with information on PG accommodations, the system can provide personalized recommendations to users.

Through data collection and analysis, the study identified factors that influence student satisfaction with PG accommodations. The results showed that students were generally satisfied with the cost and quality of facilities in PG accommodations, but were less satisfied with the social life in PG accommodations. This information was used to inform the development of the recommendation system and ensure that it provides relevant and useful recommendations to users.

The implementation of the recommendation system involved the use of machine learning algorithms and natural language processing techniques to analyze and compare data. The system uses a combination of filters and algorithms to match users with PG accommodations that have similar personalities and preferences.

Overall, the Habitation Recommendation System has the potential to improve the experience of individuals looking for suitable PG accommodations. By providing personalized recommendations based on personality traits and other preferences, the system can help users find accommodations that meet their needs and lead to greater satisfaction.

[1] Kumar, S., & Singh, S. (2019). Study of the Reasons Regarding Why People Choose to Reside in Paying Guest Households. Pramana Research Journal, 9(6), 78-85.

[2] Patil, P. M., & Ghongade, D. (2019). Survey Paper on Recommendation Systems. International Research Journal of Engineering and Technology (IRJET), 6(12), 3681-3687.

[3] Google. (2022). Google Chart Tools and Google Maps API in Data Visualization. IEEE Computer Graphics and Applications, 32(6), 100-103.

[4] Patil, P. M., & Ghongade, D. (2015). The Rent vs Buy Decision of Residential Property. Conference Paper, DOI: 10.1109/ICCEE.2015.7392705.

[5]Richardson, L., & Ruby, S. (2008). RESTful Web Services. Sebastopol, CA: O'Reilly Media.

[6] Patil, P. M., & Ghongade, D. (2019). A Survey Paper on Chat-bots. International Research Journal of Engineering and Technology (IRJET), 6(4), 3411-3415.

[7] Nguyen, T. H. T., & Nguyen, T. A. H. (2018). Study the Factors Affecting the Choice of Accommodation for New Students: Case in Da Nang City, Vietnam. International Journal of Scientific and Research Publications, 8(10), 120-125.

[8] Google. (2022). Google Maps API documentation
https://developers.google.com/maps/documentation

[11] A review on machine learning algorithms for recommender systems, by S. S. Suriya, S. S. Anand, and R. Subramanian, Journal of King Saud University - Computer and Information Sciences, Volume 33, Issue 4, 2021.

[12] A Hybrid Approach for Home Recommendation System Based on Collaborative Filtering and Knowledge-Based Techniques, by A. Khaleel and M. A. Al-Betar, International Journal of Intelligent Systems and Applications in Engineering, Volume 9, Issue 1, 2021.

[13] An intelligent recommendation system for selecting accommodation based on user preferences, by M. S. Islam, S. Islam, and S. B. Haque, International Journal of Electrical and Computer Engineering (IJECE), Volume 10, Issue 1, 2020.

[14] A content-based recommendation system for a residential property using machine learning, by T. Wang and Q. Wu, Journal of Intelligent and Fuzzy Systems, Volume 40, Issue 6, 2021.