Mobile Recommendation System

SHOP ASSIST AI

Project Back Ground:

In the rapidly evolving digital landscape, online shopping has become the go-to option for a majority of consumers. The convenience of browsing through a wide range of products from the comfort of one's home has revolutionized the retail industry. However, this convenience often comes with a downside: the overwhelming number of choices available online can lead to decision fatigue and confusion. This is particularly true for products like mobile phones, which come with a plethora of specifications, features, and price points. Consumers often find it challenging to sift through the options and identify the product that best suits their needs and preferences.

To address this issue, we introduce **ShopAssist AI**, a mobile shop assistant powered by Generative AI. This intelligent assistant is designed to simplify the online shopping experience by providing personalized mobile phone recommendations based on user requirements. By leveraging the capabilities of Large Language Models (LLMs) and rule-based functions, ShopAssist AI aims to bridge the gap between the vast array of choices and the consumer's specific needs, offering a more streamlined and satisfying shopping experience.

Problem Statement:

The core challenge in online mobile shopping lies in the difficulty consumers face in navigating through the extensive range of available options. With numerous brands, models, and specifications to consider, users often struggle to find a mobile phone that aligns with their specific requirements, such as budget, preferred features, and usage patterns. This problem is exacerbated by the lack of personalized assistance in most online shopping platforms, which typically rely on generic filters and recommendations that may not fully capture the user's unique needs.

To tackle this issue, we propose the development of **ShopAssist AI**, a chatbot that combines the power of LLMs with rule-based functions to provide accurate and reliable mobile phone recommendations. The chatbot will be designed to:

1. **Interact with Users:** ShopAssist AI will engage users in a conversational manner, asking relevant questions to understand their preferences, budget, and specific requirements for a mobile phone.

2. **Understand User Requirements:** The chatbot will parse user inputs to extract key information such as desired features (e.g., camera quality, battery life, storage capacity), preferred brands, and price range. It will also consider the user's usage patterns (e.g., gaming, photography, business) to tailor recommendations accordingly.

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3. **Recommend Suitable Mobiles:** Based on the user's requirements, ShopAssist AI will analyze a dataset containing detailed information about various mobile phones, including product names, specifications, descriptions, and prices. The chatbot will then recommend the most suitable options, providing a personalized shortlist that aligns with the user's needs and preferences.

Key Objectives:

- **Personalization:** To provide highly personalized mobile phone recommendations that cater to the unique needs and preferences of each user.

- **Accuracy:** To ensure that the recommendations are accurate and reliable, based on a thorough analysis of the available dataset.

- **User Engagement:** To create an interactive and engaging user experience that simplifies the decision-making process and enhances customer satisfaction.

- **Efficiency:** To streamline the online shopping experience by reducing the time and effort required to find the right mobile phone.

Expected Outcomes:

- **Enhanced Shopping Experience:** Users will benefit from a more intuitive and personalized shopping experience, leading to higher satisfaction and reduced decision fatigue.

- **Increased Sales:** By helping users find the most suitable mobile phones, ShopAssist AI can contribute to increased sales and reduced cart abandonment rates for online retailers.

- **Data-Driven Insights:** The chatbot will generate valuable insights into user preferences and behavior, which can be used to further refine the recommendation engine and improve the overall shopping experience.

Data Set:

Brand	Model	Rating	Sys	Size (i	Resolution	Refresh Rate	Processor	Capacity	Fast Charg	less Char	Camera Se	rage (GB	RAM (GB	onnectivity	Fea	Price (INR	Description (USD	Description	obile_feature
Apple	iPhone	iOS 15		6.1	1170x25	60	Apple A	3217	Yes		Triple (:	128	6	5G	Face ID	66317	The iPh	799	{'Brand' {'storage capacity': 'medium', 'camera quality': 'medium', 'performance and speed': 'medium', 'display quality': 'low', 'battery life': 'low'}
Samsun	Galaxy S	Androic		6.2	1080x24	120	Qualcor	4000	Yes		Triple (:	128	8	5G	Ultrason	66317	The Gal	799	{'Brand' {'storage capacity': 'medium', 'camera quality': 'high', 'performance and speed': 'medium', 'display quality': 'medium', 'battery life': 'medium'}
Google	Pixel 6	Androic		6.4	1080x24	90	Google	4614	Yes		Dual (50	128	8	5G	Titan M	58017	The Pixe	699	{'Brand' {'storage capacity': 'medium', 'camera quality': 'high', 'performance and speed': 'medium', 'display quality': 'medium', 'battery life': 'medium'}
OnePlu	oneplus	Androic		6.55	1080x24	120	Qualcor	4500	Yes		Triple (4	256	12	5G	In-displ	60507	The One	729	{'Brand' {'storage capacity': 'high', 'camera quality': 'high', 'performance and speed': 'high', 'display quality': 'high', 'battery life': 'medium'}
Apple	iPhone	iOS 15		6.1	1170x25	120	Apple A	3095	Yes		Triple (:	128	6	5G	Face ID	82917	The iPh	999	{'Brand' {'storage capacity': 'medium', 'camera quality': 'high', 'performance and speed': 'medium', 'battery life': 'low', 'display quality': 'low'}
Samsun	Galaxy S	Androic		6.8	1440x32	120	Qualcor	5000	Yes		Quad (1	128	12	5G	Ultrason	99517	The Gal	1199	{'Brand' {'storage capacity': 'medium', 'camera quality': 'high', 'performance and speed': 'high', 'display quality': 'high', 'battery life': 'medium'}
Google	Pixel 6	Androic		6.71	1440x31	120	Google	5003	Yes		Triple (5	128	12	5G	Titan M	74617	The Pixe	899	{'Brand' {'storage capacity': 'high', 'camera quality': 'high', 'performance and speed': 'high', 'display quality': 'medium', 'battery life': 'high'}
OnePlu	9 Pro	Androic		6.7	1440x32	120	Qualcor	4500	Yes		Quad (4	256	12	5G	In-displ	80427	The One	969	{'Brand' {'storage capacity': 'high', 'camera quality': 'high', 'performance and speed': 'high', 'display quality': 'high', 'battery life': 'medium'}
Xiaomi	Mi 11 Ul	MIUI 12		6.81	1440x32	120	Qualcor	5000	Yes		Triple (5	256	12	5G	In-displ	91217	The Mi	1099	{'Brand' {'storage capacity': 'high', 'camera quality': 'high', 'performance and speed': 'high', 'display quality': 'high', 'battery life': 'medium'}
Oppo	Find X3	ColorOS		6.7	1440x32	120	Qualcor	4500	Yes		Quad (5	256	12	5G	In-displ	87067	The Opp	1049	{'Brand' {'storage capacity': 'high', 'camera quality': 'high', 'performance and speed': 'high', 'display quality': 'high', 'battery life': 'medium'}
Vivo	X70 Pro	Funtouc		6.78	1440x32	120	Qualcor	4450	Yes		Quad (5	256	12	5G	In-displ	82917	The Viv	999	{'Brand' {'storage capacity': 'high', 'camera quality': 'high', 'performance and speed': 'high', 'display quality': 'high', 'battery life': 'medium'}
Realme	GT Mast	Realme		6.43	1080x24	120	Qualcor	4300	No		Triple (6	128	8	5G	Side-mo	33117	The Rea	399	{'Brand' {'storage capacity': 'medium', 'camera quality': 'medium', 'performance and speed': 'medium', 'display quality': 'medium', 'battery life': 'medium'}
Motoro	Edge 20	Androic		6.7	1080x24	144	Qualcor	4500	Yes		Triple (:	256	12	5G	In-displ	66317	The Mo	799	{'Brand' {'storage capacity': 'high', 'camera quality': 'high', 'performance and speed': 'high', 'battery life': 'medium', 'display quality': 'high'}
Xiaomi	Redmi N	MIUI 13		6.67	1080x24	120	Qualcor	5000	No		Quad (1	128	6	5G	Side-mo	24999	The Redmi Note	1099	{'Brand' {'storage capacity': 'medium', 'camera quality': 'high', 'performance and speed': 'medium', 'battery life': 'medium', 'display quality': 'medium'}
Realme	Narzo 5	Realme		6.78	1080x24	120	MediaT	5000	No		Triple (5	128	6	5G	Side-mo	21999	The Realme Nar	{'Brand' {'storage capacity': 'medium', 'camera quality': 'high', 'performance and speed': 'medium', 'display quality': 'medium', 'battery life': 'medium'}
Samsun	Galaxy	Androic		6.4	1080x24	90	MediaT	6000	No		Quad (6	128	6	4G	Side-mo	19999	The Samsung Ga	{'Brand' {'storage capacity': 'medium', 'camera quality': 'high', 'performance and speed': 'medium', 'battery life': 'high', 'display quality': 'medium'}
Motoro	Moto G	Androic		6.5	1080x24	90	Qualcor	5000	No		Triple (5	128	6	5G	Side-mo	22999	The Moto G71 o	{'Brand' {'storage capacity': 'medium', 'camera quality': 'medium', 'performance and speed': 'medium', 'battery life': 'medium', 'display quality': 'mediu'

Mobile Recommendation System

Columns:

Here is the list of columns in the dataset for the mobile phone recommendation system:

1. **Brand**

2. **Model**

3. **Operating System**

4. **Display Size (inches)**

5. **Resolution**

6. **Refresh Rate (Hz)**

7. **Processor**

8. **Battery Capacity (mAh)**

9. **Fast Charging**

10. **Wireless Charging**

11. **Camera Setup**

12. **Storage (GB)**

13. **RAM (GB)**

14. **Connectivity**

15. **Security Features**

16. **Price (INR)**

17. **Description**

18. **Price (USD)**

19. **Description1**

20. **Mobile_Feature**

Mobile Recommendation System

Overall Approach:

The chatbot will follow a structured approach to deliver personalized mobile phone recommendations:

1. **Conversation and Information Gathering:** The chatbot will utilize language models to understand and generate natural responses. Through a conversational flow, it will ask relevant questions to gather information about the user's requirements, such as budget, preferred features, and usage patterns.

2. **Information Extraction:** Once the essential information is collected, the chatbot will use LLM's natural language understanding and rule-based reasoning to extract the top three mobile phones that best match the user's needs. The chatbot will primarily analyze the 'Description' column for each mobile phone, understanding whether the user's requirements match the phone's specifications.

3. **Personalized Recommendation:** Leveraging the extracted information, the chatbot will engage in further dialogue with the user, efficiently addressing their queries and aiding them in finding the perfect mobile phone solution.

Design Considerations:

The necessity of creating such a complex and extensive system design is driven by several key factors:

- **LLM Hallucinations:** To reduce or remove hallucinations from LLM responses, ensuring that the recommendations are accurate and reliable.

- **LLM Consistency and Reproducibility:** To ensure the output responses from the language model are reproducible, consistent, and correct for the same set of input parameters. Techniques such as JSON output parsing and seed arguments will be utilized.

- **Utilization of LLM Reasoning Capabilities:** Advanced prompt engineering techniques, such as Few-Shot prompting, Chain-of-Thought prompting, and Self-consistency prompting, will be employed to enhance the chatbot's reasoning capabilities.

- **Account for LLM Limitations:** Understanding the capabilities and limitations of LLMs is crucial. Throughout this project, various prompt engineering concepts and prompt tuning will be explored to ensure optimal performance.
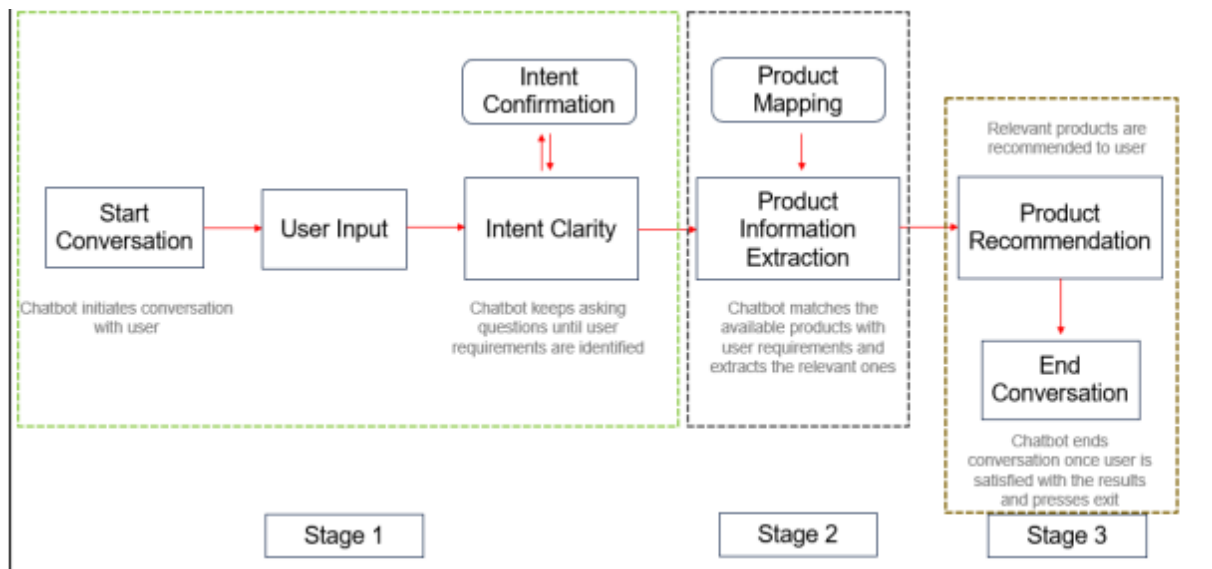
Mobile Recommendation System

The system design for the project is illustrated in the diagram

below.
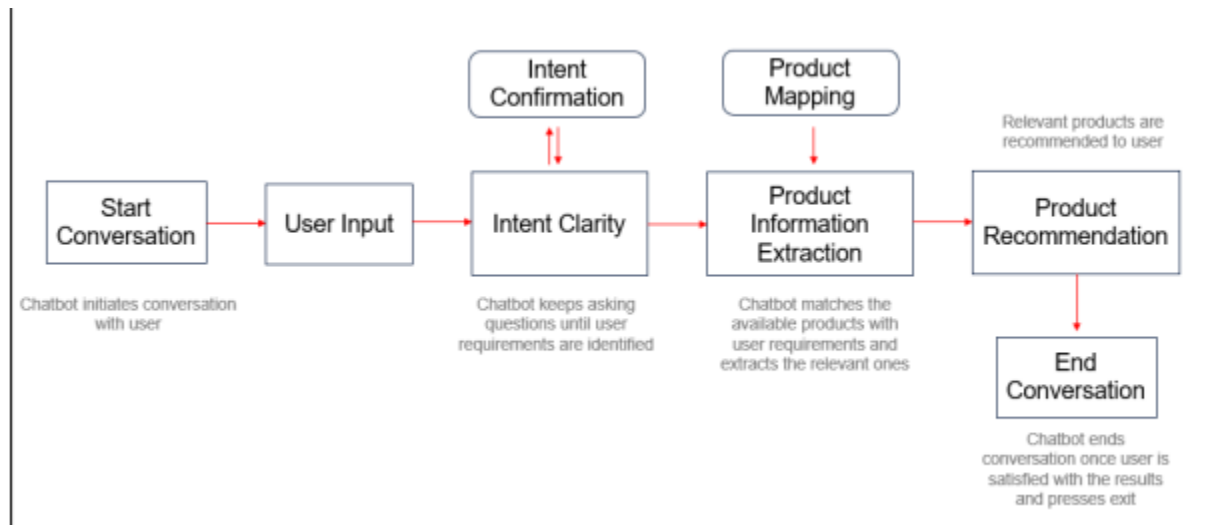
For ease, the system design has been compartmentalised into

three stages as shown in the diagram below.

As you can see in this image, there are three stages of the
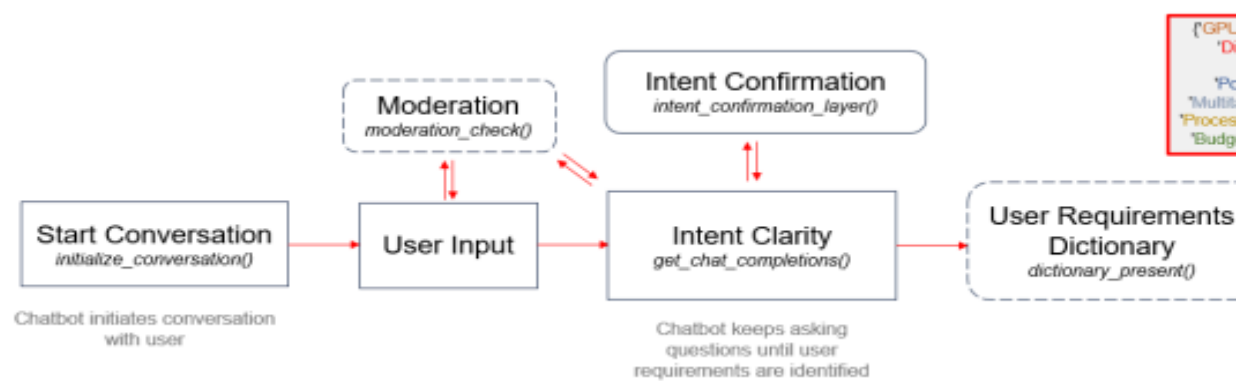
Mobile Recommendation System

chatbot, which are as follows:

● Stage 1: Intent Clarity and Intent Confirmation

● Stage 2: Product Extraction and Product Mapping

● Stage 3: Product Recommendation

Stage 1 - Intent Clarity and Intent Confirmation

The first stage involves a conversation between the user and the AI system. Python functions such as **initialize_conversation()** trigger the conversation, and functions like **get_chat_completions()** allow the conversation to continue via LLM (Large Language Model) calls. This stage also includes an additional layer called **moderation_check()** to flag and discontinue conversations that contain unsafe or sensitive content.

The output of this stage is a **User Requirements Dictionary** that captures all the user's needs in key-value pairs (JSON format). The JSON format is chosen for output parsing convenience, as the AI system aims to collect user requirements and store them in a Python dictionary for further processing. Since LLMs primarily produce string outputs, a Python function called **dictionary_present()** is used to convert the LLM output (which might resemble a dictionary in string format) into an actual Python dictionary.

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Functioning of the Chatbot in Stage 1:

1. **Initializing Conversation and Chat Model Completion:**

   o The conversation starts with the **initialize_conversation()** function, where the AI system introduces itself and asks for the user's requirements.

   o Subsequent messages from the user and the AI system are handled by the **chat_model_completion()** function, which uses OpenAI's chat completion API to continue the conversation until all user requirements are identified.

2. **Intent Confirmation:**

   o The AI system uses an **Intent Confirmation Layer** (**intent_confirmation_layer()**) to confirm whether all user requirements have been captured. This layer acts as a flag (yes or no).

   o If the system receives a "no," it understands that further questions are needed to capture all requirements.

3. **User Requirements Dictionary:**

   o Once the Intent Confirmation Layer confirms that all requirements have been captured (i.e., a "yes" flag), it passes the requirements to the **dictionary_present()** function.

   o This function converts the requirements into a dictionary-like object and stores it in the **user_req** variable.

Stage 2 - Product Mapping and Information Extraction

The second stage of the system is the **Product Mapping and Information Extraction** stage. This stage filters mobile phones based on the **User Requirements Dictionary** captured in Stage 1 and presents the top three mobile phone recommendations to the user.
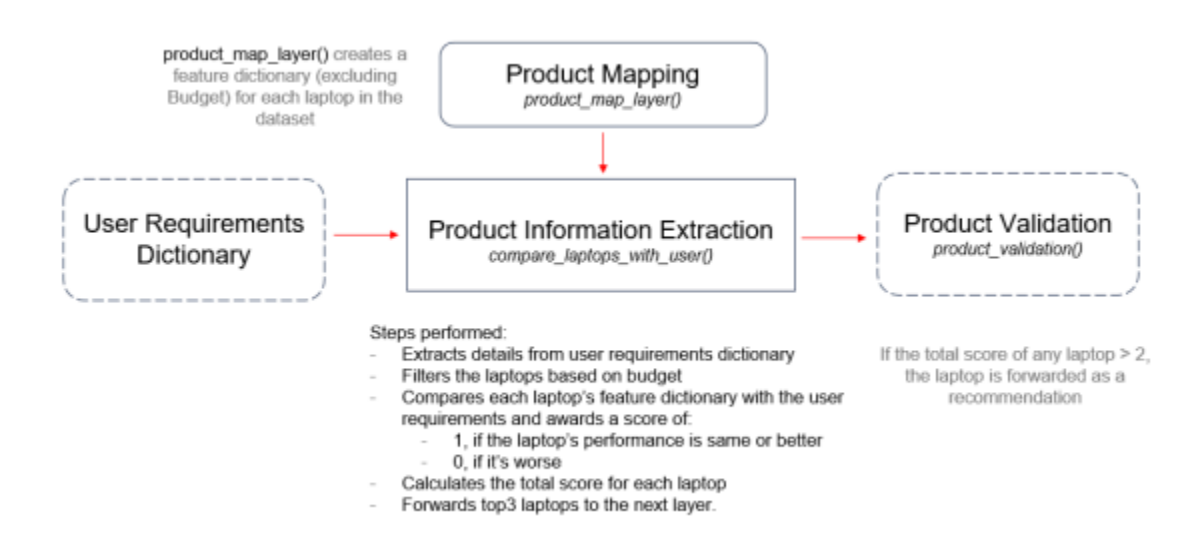
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Process in Stage 2:

The mobile phone filtering process in Stage 2 is divided into two parts:

1. **Part 1 (Product Mapping):**

   o A **feature dictionary** is created for each mobile phone using the **product_map_layer()** function. This function extracts key features and criteria from the mobile phone descriptions.

   o The function extracts primary mobile phone features from the detailed description (e.g., camera quality, battery life, display quality, processing speed, etc.). These features are stored as key-value pairs in a dictionary called **mobile_spec**.

   o The extracted values are mapped with appropriate classification values (low, medium, or high) based on predefined rules.

   o This operation is independent of user input and is executed once for all mobile phones in the dataset.

2. **Part 2 (Information Extraction):**

   o At this stage, two dictionaries are available: **mobile_spec** (mobile phone features) and **user_req** (user requirements).

   o Before comparing these dictionaries, they are converted from string format to actual dictionaries using the **dictionary_present()** function.

   o The dictionaries are then passed to a rule-based function called **compare_mobiles_with_user()**.

      ▪ For each feature, a score of **1** is assigned if the feature meets or exceeds the user's requirement. Otherwise, a score of **0** is assigned.

      ▪ The scoring is performed iteratively for all mobile phones. Once completed, the scores are used to rank and identify the top three mobile phones as recommendations.

      ▪ The scoring system is flexible and can be modified based on specific use cases.

3. **Product Validation Layer:**

   o Once the top three mobile phones are identified, the list is sent to the **Product Validation Layer**, which ensures that only relevant products are recommended.

   o The purpose of this layer is to ensure that only mobile phones with a score of **3 or above** are recommended to the user. The threshold of 3 is arbitrary but ensures that at least three features meet or exceed the user's requirements.

   o If a mobile phone's total score is greater than 2 (indicating it meets or exceeds the user's requirements in at least two features), it is considered a recommendation.

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Stage 3 - Product Recommendation

The final stage is the **Product Recommendation Layer**, which takes the output from the **compare_mobiles_with_user()** function and provides recommendations to the user.

Process in Stage 3:

1. **Product Validation Layer Output:**

   o The Product Validation Layer recommends a maximum of three mobile phones to the user. This ensures that the user is presented with a manageable number of options.

   o If no mobile phones meet the score threshold of 3, the Product Validation Layer feeds **"None"** or **"No mobiles matched"** to the Product Recommendation Layer.

   o In such cases, the AI system is instructed to connect the user to a human expert for further assistance.

2. **Final Recommendations:**

   o The top three mobile phones are presented to the user with detailed descriptions, features, and pricing.

   o The user can ask follow-up questions or request additional details about the recommended mobile phones.

Key Design Considerations:

1. **LLM Hallucinations:**

   o Measures are taken to reduce or eliminate hallucinations in LLM responses, ensuring accurate and reliable recommendations.
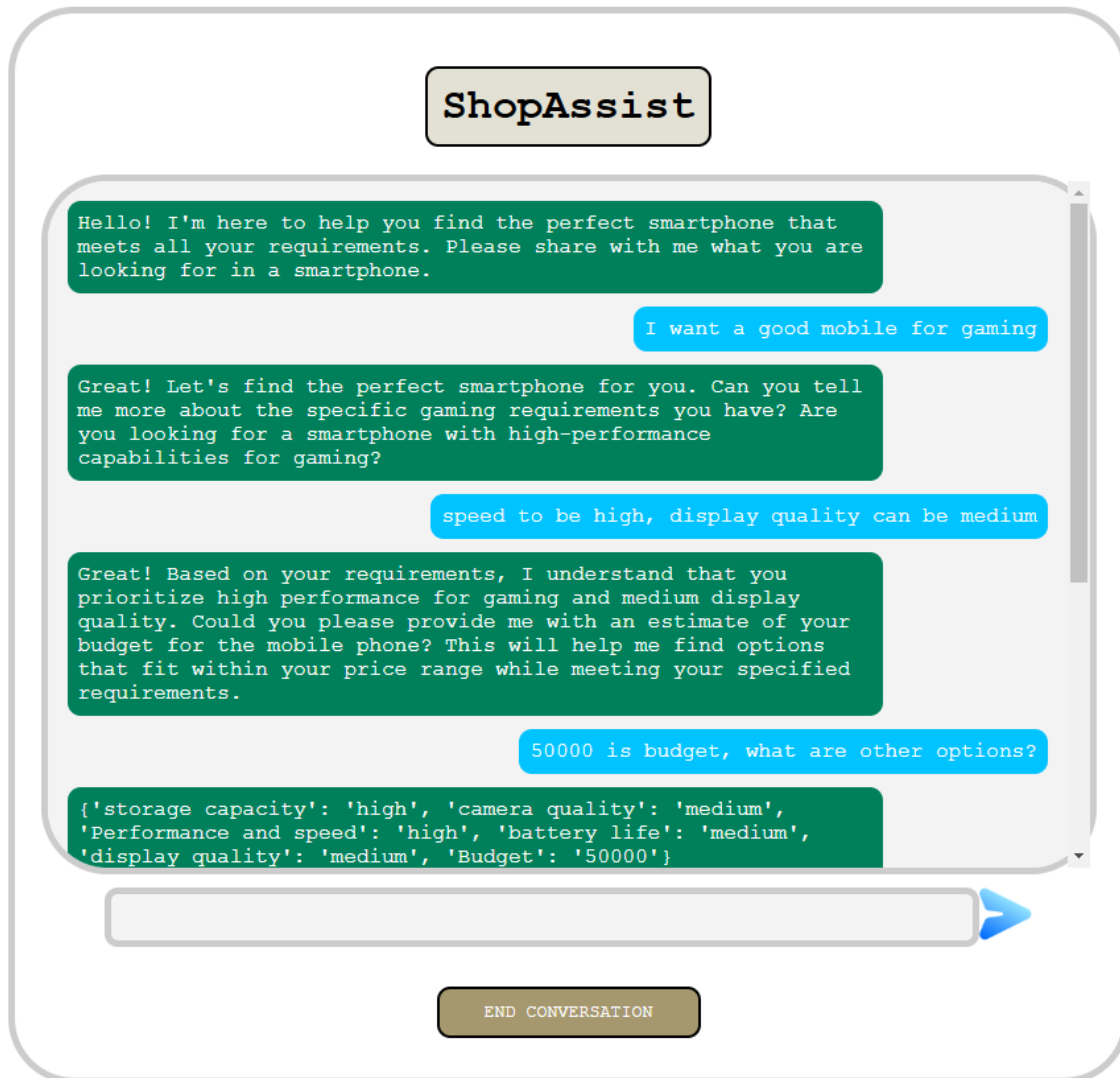
2. **LLM Consistency and Reproducibility:**

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o Techniques such as JSON output parsing and seed arguments are used to ensure consistent and reproducible outputs from the LLM.

3. **Utilization of LLM Reasoning Capabilities:**

   o Advanced prompt engineering techniques, such as Few-Shot prompting, Chain-of-Thought prompting, and Self-consistency prompting, are employed to enhance the chatbot's reasoning capabilities.

4. **Rule-Based Logic:**

   o A heuristic/rule-based logic is used to assign scores to mobile phones based on user requirements. This ensures that recommendations are not solely dependent on LLM outputs but also on a structured scoring system.

5. **Handling LLM Limitations:**

   o The system accounts for the limitations of LLMs by incorporating prompt engineering and prompt tuning to optimize performance.

Mobile Recommendation System

Conversation flow of Shop Assist AI- Mobile Recommendation System:

ShopAssist

Hello! I'm here to help you find the perfect smartphone that meets all your requirements. Please share with me what you are looking for in a smartphone.

> I want a good mobile for gaming

Great! Let's find the perfect smartphone for you. Can you tell me more about the specific gaming requirements you have? Are you looking for a smartphone with high-performance capabilities for gaming?

> speed to be high, display quality can be medium

Great! Based on your requirements, I understand that you prioritize high performance for gaming and medium display quality. Could you please provide me with an estimate of your budget for the mobile phone? This will help me find options that fit within your price range while meeting your specified requirements.

> 50000 is budget, what are other options?

{'storage capacity': 'high', 'camera quality': 'medium', 'Performance and speed': 'high', 'battery life': 'medium', 'display quality': 'medium', 'Budget': '50000'}

END CONVERSATION

Mobile Recommendation System

ShopAssist

budget for the mobile phone? This will help me find options that fit within your price range while meeting your specified requirements.

50000 is budget, what are other options?

{'storage capacity': 'high', 'camera quality': 'medium', 'Performance and speed': 'high', 'battery life': 'medium', 'display quality': 'medium', 'Budget': '50000'}

yes suggest good mobiles with above features

Based on your requirements of high performance and speed, medium display quality, and a budget of 50000 INR, here are some mobile options that you may consider: 1. OnePlus Nord 2 2. Xiaomi Poco X3 Pro 3. Realme GT Master Edition 4. Samsung Galaxy M52 5G These smartphones offer a good balance of performance, display quality, and features within your specified budget. You can explore these options further to find the one that best suits your needs.

thank you so much

You're welcome! If you have any more questions or need further assistance in the future, feel free to ask. Enjoy your new mobile phone for gaming!

END CONVERSATION