DESIGN THINKING LAB

THEME - Digital Humanities

TOPIC-Prompt Engineering

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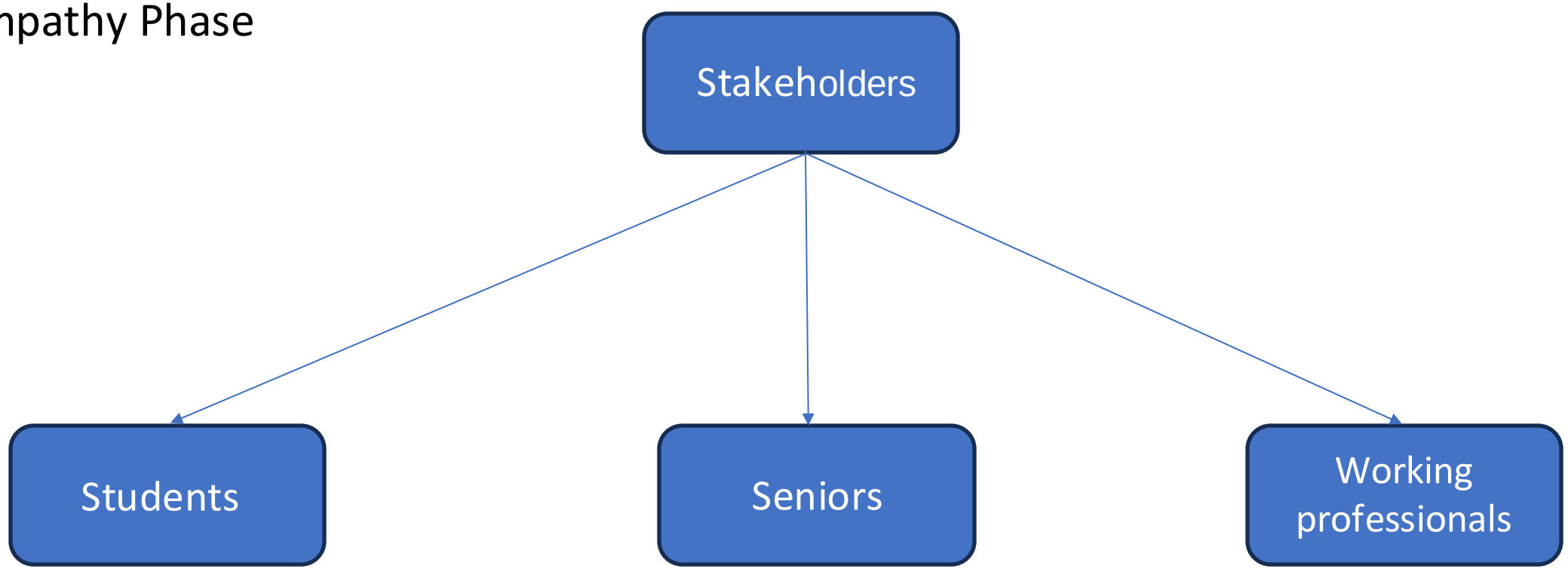
1. Empathy Phase



Stakeholders:

The primary stakeholders of our research were predominantly students, ranging from undergraduates to seniors, who contributed through surveys and physical interviews. Their involvement was crucial in shaping the direction of our study, as they represent the primary users of the outcomes we aim to achieve.

Additionally, we consulted a few industry experts who provided valuable insights from a professional standpoint. Their expertise helped bridge the gap between academic learning and real-world applications, ensuring our research remains relevant and practical.

The combination of student input and expert advice greatly enhanced the credibility and applicability of our findings.

STAKEHOLDERS

- We identified different classes of stakeholders, they were Students(including 1st, 2nd and 3rd year's) and IT Professionals.
- Our primary stakeholders were students who constitute 90% of stakeholders we approached.
- Students were also from different engineering colleges studying in 1st and 2nd year.(IIIT-Una, IIIT-Daman&Diu)
- The next dominant stakeholders were working professionals with industry experience.(GenPact)

Questions for Students :

1. Challenges faced when trying to get accurate responses from chatbots.

2. How confident are you in your ability to refine prompts to improve the chatbot's answers?

3. Do you prefer using short or detailed prompts when interacting with a chatbot?

4. What types of tasks do you struggle with the most when using a chatbot?

5. How often do you feel frustrated with a chatbot's responses because it misunderstood your intent?

6. How do you approach improving your prompts when you receive unsatisfactory responses from the chatbot?

Questions for Working Professionals-

1. Have you ever found it difficult to phrase your prompt in a way that gets useful results? Can you give an example?
2. What features or tips do you think would help you structure better prompts when interacting with a chatbot? (Open-ended question)
3. How often do you use LLM (eg - ChatGPT and Google Gemini) for help or to learn something.
4. What difficulties do you experience when the chatbot provides vague or incomplete answers?
5. In what ways do you think a practice chatbot could help you improve your prompt engineering skills?'

Empathy Map

Empathy Map for Students

Empathy Map for Working Professionals

Who is Bipin

- 3rd Year Student
- Cybersecurity Branch
- Head of Coding Club

Problems Faced

- Vague Responses
- Decreased Productivity

Proposed Solutions

- Better Prompting Techniques
- Tools for Refinement

Reasons for Problems

- Unsatisfactory Prompts
- Prompt Optimization Needed

Solutions

- Efficient Techniques
- React Method
- Chain of Thought
- Refinement Tool

Causes

- Prompt Engineering
- Tricky Nature

Role

- Business Analyst
- GenPact

Problems

- Chatbot Issues
- Prompt Clarity

1. Challenges faced when trying to get accurate responses from chatbots :

Getting accurate responses from chatbots can be tough because they may not understand the full context of a conversation or handle complex questions well. Sometimes they can misinterpret unclear language or slang, and their knowledge may be outdated if they're not connected to real-time data.

2. How often do you feel frustrated with a chatbot's responses because it misunderstood your intent:

It frustrates me sometimes when it incorrectly interprets my intent because the bot still does not understand after being clear in the question or request. I would appreciate a more intuitive understanding from the chatbot, allowing for smoother interactions and less confusion, so I could focus on finding the right answers instead of clarifying my requests repeatedly.

Astitwa Tanmay
A student at RVCE Bangalore
CS Department

1. What types of tasks do you struggle with the most when using a chatbot :

Most often, I don't know the right details and keywords for generating images using a chatbot, which makes it hard to convey my vision properly. Sometimes, what I get from the output doesn't match what I want or expect, and that's just tiring. I wish there were a more intuitive way of expressing my ideas effectively.

Aayush Aman
A student at RVCE Bangalore ,
CS Department

2. How do you approach improving your prompts when you receive unsatisfactory responses from the chatbot:

I improve my prompts by making them clearer and more specific. I use simple language, avoid asking too many things at once, and provide more details if needed. If it misunderstands, I rephrase the question differently. I would prefer if there was a website that could help me become a better prompt engineer.

Rashtreeya Sikshana Samithi Trust

RV

INSTITUTIONS

RV College of Engineerin

Responses from Stakeholders

- We got a large number of responses from our stakeholders, including high school students, peers, seniors, juniors and industry professionals. By doing so we have collected data from a diverse group of people and tried to understand their concerns.

- We also collected data regarding – how often they face problems while creating prompts, and what tools or solutions might help them overcome the difficulties faced by them.

- We collected data from people of varying levels of expertise in Prompt Engineering, ranging from students to experts in the field. We collected data through online forms as well as offline, in-person interviews.

- We included multiple choice questions as well as open-ended questions to allow for in-depth exploration of the user's problems and enable the user to express themselves in their own words.

1. What challenges do you face when trying to get accurate responses from chatbots? Copy

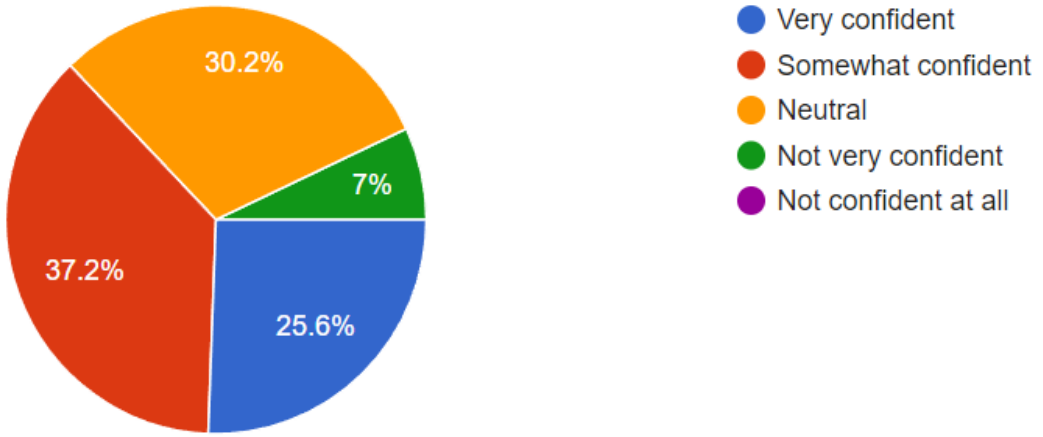
43 responses

The displayed graphs suggest that people were unable to communicate effectively using the chatbots. Common problems among them include:

- Misunderstandings or vague and nonsensical answers
- Lack of detail in answers
- Failure to phrase meaningful questions

2. How confident are you in your ability to refine prompts to improve the chatbot's answers?

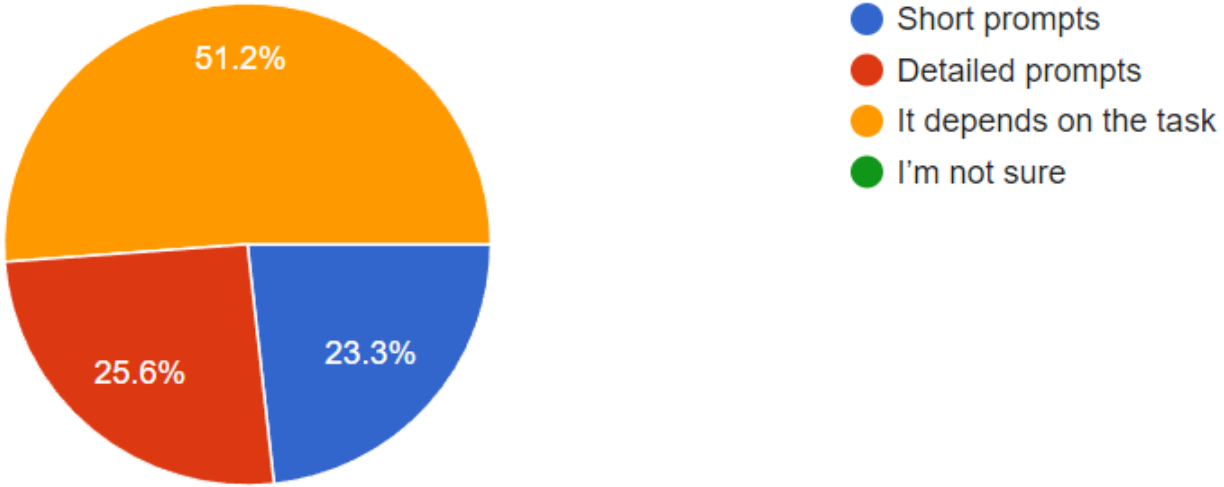
43 responses



As the survey has shown, most respondents are confident at least to some extent in fine-tuning prompts and thus better answers to questions by the chatbot. At the same time, a significant part of respondents reported themselves as being uncertain or incompetent.

3. Do you prefer using short or detailed prompts when interacting with a chatbot?

43 responses

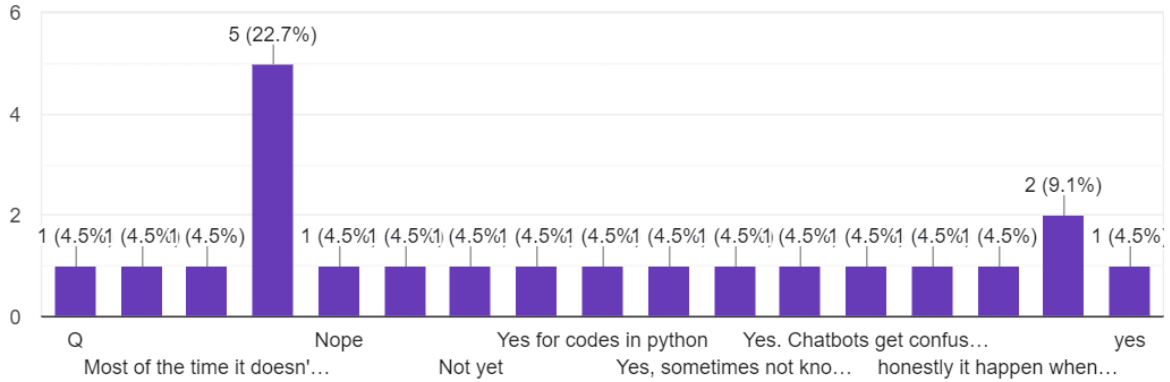


By looking at the graph we can ascertain that an overwhelming majority of the people (51.2%) modify the length and quality of their prompts depending on the task which they have at hand.
There are also some percentage of the stakeholders that prefer to use only short or detailed prompts for all tasks.

4. Have you ever found it difficult to phrase your prompt in a way that gets useful results? Can you give an example? (Open-ended question)

Copy

22 responses



Some Individual responses:

Yes. Chatbots get confused sometimes. Also their accuracy is subpar.

Yes. Eg - while trying to get code in python

No

Yes if I want to know something about a topic but don't know the specific details on it my prompts ends up generating more vague answers

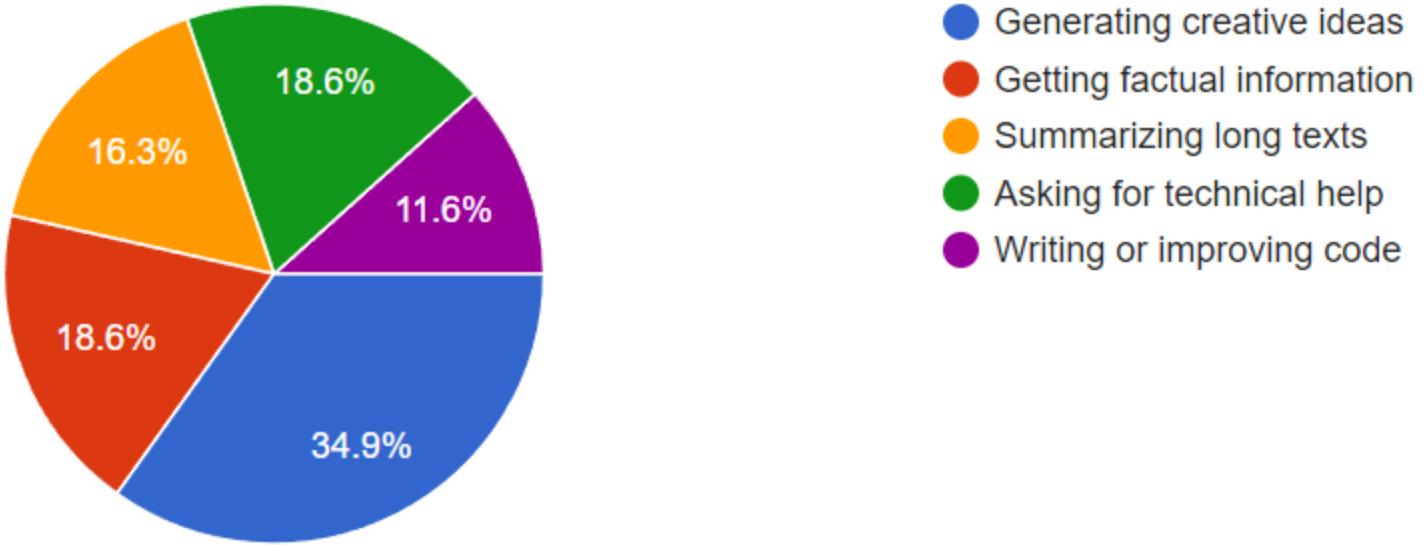
Most of the time it doesn't give expected answer to the question ,diverts from the topic

It is obvious in the open-ended question of how often respondents experience difficulties with the framing of prompts in ways that get them useful results. Most of the respondents, in fact, reported not having such problems, yet quite a few of them did. Some of these kinds of challenges include how to phrase programming tasks in prompts, how chatbots mishear or get confused, and also how the chatbots fail to give accurate responses and diverts from the topic at hand.

5. What types of tasks do you struggle with the most when using a chatbot?

Copy

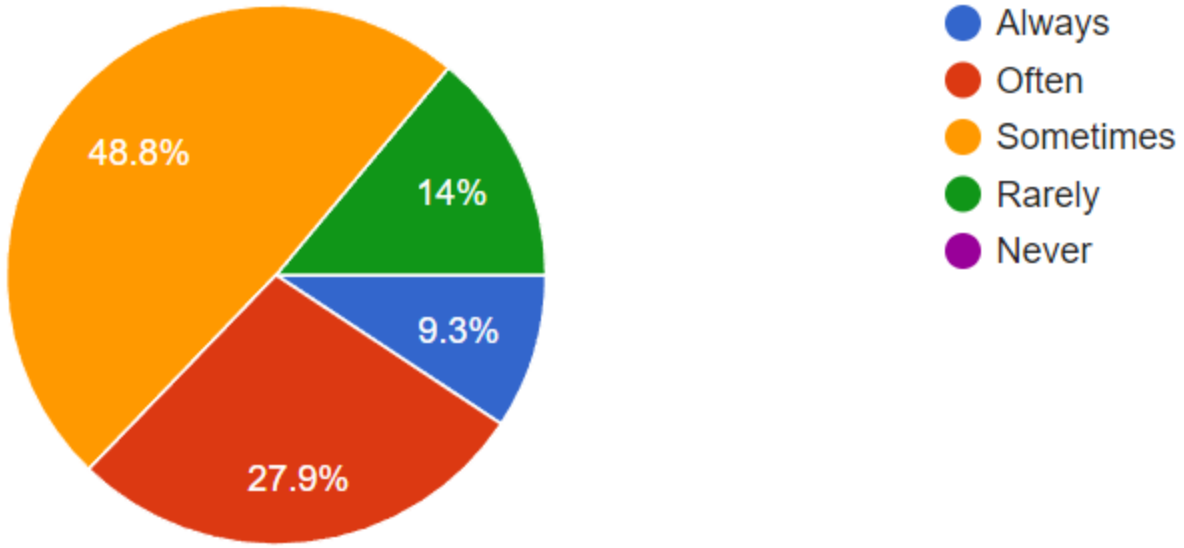
43 responses



The chart shows the result of a survey on which problems people have with using a chatbot, whether they cannot do certain things while applying it. People are probably incompetent in composing or developing their code, inventing creative ideas, and finding factual information. Other problems which people experienced in applying a chatbot included summarizing long texts and finding technical support.

7. How often do you feel frustrated with a chatbot's responses because it misunderstood your intent?

43 responses

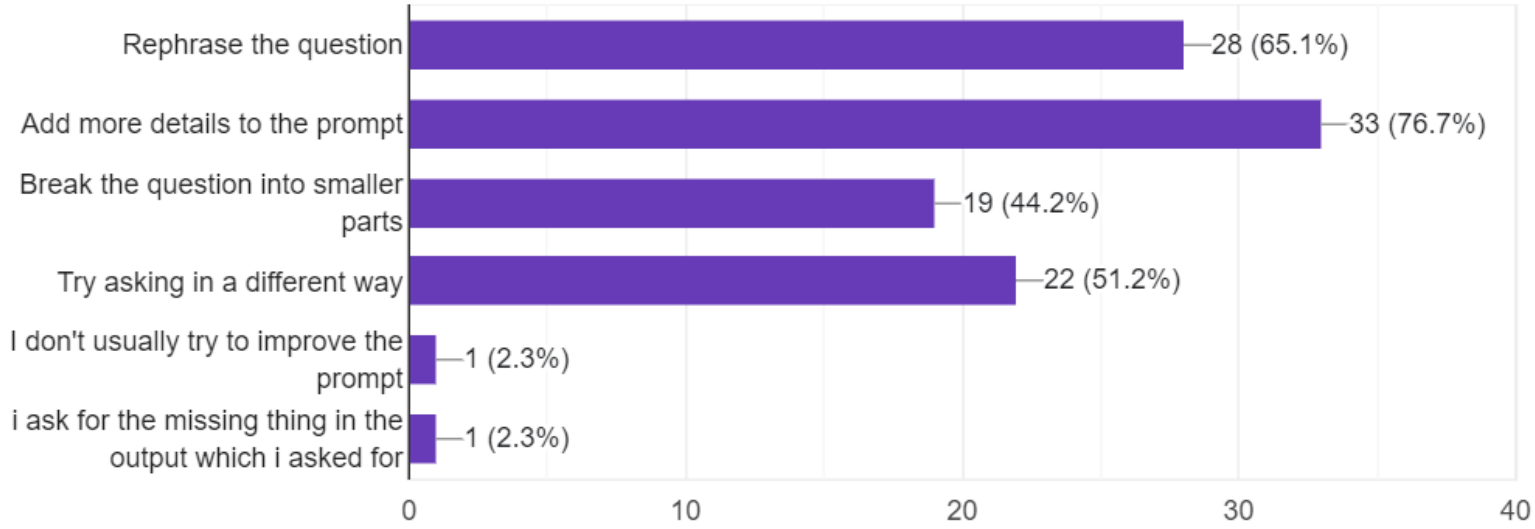


Actually, the study demonstrated a significant percentage of respondents get frustrated with chatbots which do not interpret their intent. Of course, there are respondents who rarely or never encounter the problem, but for many users, it happens rather frequently.

9. How do you approach improving your prompts when you receive unsatisfactory responses from the chatbot?
(Multiple Choice, select all that apply)

Copy

43 responses



Here we see how users reformulate their questions when the chatbot does not respond appropriately. Among these three were most prominent: reformulating the question itself, adding more context to the prompt, and asking it otherwise. Fewer respondents divided their question into little pieces, and almost no percent did nothing to enhance their prompts.

General observations from user's responses:

We can ascertain multiple things after looking at the user responses. We can notice that in the field of prompt engineering, the user faces difficulty in expressing his tasks to the chatbots and also faces challenges in optimizing their prompts in order to refine it and make it more efficient to get the desired and accurate response from the chatbot.

These challenges causes annoyances while trying to work or obtain a solution which causes waste of time and decrease in productivity.

The users feel that real-time recommendations to their prompts, which would tell them to use certain key words, rephrasing their sentences or making use of various prompting techniques, would increase the quality and accuracy of the responses received from the chatbots.

Phase 2: Problem Definition

Challenges Faced by Students

- **Difficulty in Expressing Queries**: Students often struggle to articulate their questions clearly, particularly when they lack the right keywords or details needed for effective chatbot interaction.
- **Misunderstandings and Vague Responses**: Many students experience frustration when chatbots misinterpret their intent, leading to vague or irrelevant answers that do not address their needs.
- **Confidence in Prompt Refinement**: While some students feel confident in refining their prompts, many report feeling uncertain or inadequate, which affects their ability to get satisfactory responses.
- **Complexity of Tasks**: Students find it challenging to use chatbots for complex tasks, such as generating images or summarizing texts, due to a lack of intuitive guidance on how to phrase their requests.
- **Need for Real-Time Recommendations**: There is a strong desire among students for tools or features that provide real-time suggestions on how to improve their prompts, helping them communicate more effectively with chatbots.

Challenges Faced by Working Professionals

- **Difficulty in Phrasing Prompts**: Working professionals often find it challenging to phrase their prompts in a way that yields useful results, leading to inefficiencies in their work.
- **Vague or Incomplete Answers**: Many professionals experience frustration when chatbots provide vague or incomplete responses, which can hinder their productivity and decision-making processes.
- **Need for Structured Guidance**: Professionals express a need for features or tips that help them structure better prompts, as they often lack the time to experiment with different phrasing.
- **Confidence in Using Chatbots**: While some professionals use chatbots regularly, they often feel uncertain about their ability to generate effective prompts, which can lead to reliance on traditional methods instead.
- **Desire for Skill Improvement**: There is a clear interest among working professionals in using practice chatbots to enhance their prompt engineering skills, indicating a need for training and resources in this area.

Problem Statement

- One of the key challenges faced by users when interacting with chatbots is the difficulty in clearly expressing the task or query at hand. Users often find it tough to construct well-phrased and efficient prompts that lead to meaningful, accurate, and desired responses from chatbots.
- This difficulty can result in frustration, misunderstandings, and inefficiencies, as users may need to rephrase or refine their prompts multiple times to obtain the required outcome. The challenge lies in bridging the gap between user intent and the chatbot's ability to interpret and respond accurately.
- The key challenges faced by users when interacting with chatbots is the difficulty in clearly expressing the task or query at hand. Users often find it tough to construct well-phrased and efficient prompts that lead to meaningful, accurate, and desired responses from chatbots. This difficulty can result in frustration, misunderstandings, and inefficiencies, as users may need to rephrase or refine their prompts multiple times to obtain the required outcome. The challenge lies in bridging the gap between user intent and the chatbot's ability to interpret and respond accurately.

Ideation

- During the empathy phase, we gathered valuable feedback from students and industry experts, which highlighted the common difficulties users face when trying to communicate effectively with chatbots. These challenges include unclear responses, misunderstandings of user intent, and the struggle to formulate precise prompts. As we move into the ideation phase, our goal is to brainstorm and develop potential solutions that address these issues, ultimately improving user experiences and outcomes.
- In this phase, we will encourage open-mindedness and creativity, allowing for a wide range of ideas without immediate judgment. We will explore various strategies, tools, and features that could assist users in crafting better prompts, such as real-time recommendations, intuitive interfaces, and educational resources. By fostering collaboration and leveraging diverse perspectives, we aim to generate a robust set of ideas that can be further refined and tested in subsequent phases of our project.

The ideation phase will not only focus on generating solutions but also on prioritizing them based on feasibility, impact, and alignment with user needs. the ideation phase is an opportunity to transform the challenges identified in the problem definition phase into actionable solutions. By harnessing the collective creativity of our team and the insights from our stakeholders.

Brainstorming and Storyboarding

- There are a variety of ideation techniques that can be used for generation of ideas. Ideation techniques help in creative flow, and help in generation of a variety of ideas. Not all of these ideas may be good, but every idea in turn could lead to a better idea, and hence none of them can be neglected. During our brainstorming sessions, we focused on generating a variety of innovative ideas aimed at improving interactions between users and chatbots.

- **1. Educating Users on Prompting Techniques**
- **Idea**: Create a web app that provides blog tutorials on how users can improve their prompting skills.
- **Drawbacks**:
  - **Not Interactive**: This approach lacks direct interaction, making it less engaging for users who might benefit from hands-on practice.
  - **No Real-Time Teachings**: The absence of real-time feedback limits the opportunity for users to learn and adapt their prompting techniques immediately.
  - **Reason for Not Choosing:** We recognized that while educational resources are valuable, users benefit more from interactive, practical experiences that allow for immediate application of what they learn.

2. Prompt Score System

- **Idea**: Develop a website that scores users' prompts based on their effectiveness.
- **Drawbacks**:
  - **Simply a Scoring System**: This idea risks being overly simplistic, as it may not provide users with deeper insights or actionable feedback.
  - **Does Not Improve the Prompt**: Without guidance on how to enhance the prompts, users may remain stuck with ineffective phrasing.
- **Reason for Not Choosing:** Although providing a score could offer some feedback, the lack of actionable advice rendered this idea less useful for fostering real improvement in prompt engineering**.**

3. Keyword Suggestion Bot

- **Idea:** Create a chatbot that identifies key topics in the user's prompt and suggests additional keywords to make prompts more comprehensive.
- **Drawbacks:**
  - Doesn't Provide Guidance for Improvement: While it may assist in expanding keywords, the bot wouldn't help users understand the nuances of effective prompting.
  - Limited to Keyword Expansion: This concept is focused primarily on keyword suggestions and fails to address other critical aspects of prompt formulation.
- **Reason for Not Choosing:** The limited scope of this idea would not comprehensively meet user needs. We sought solutions that could improve overall communication effectiveness, not just keyword relevance.

- **Final Solution: PromptForge - Prompt Refining Bot:**
- After an extensive brainstorming phase and careful consideration of various ideas, we developed our final solution: **PromptForge**, a Prompt Refining Bot designed to enhance user interactions with chatbots. This tool aims to address the common challenges faced by both students and working professionals when formulating prompts.

- **Key Features of PromptForge**

  1. Real-Time Assistance:
  - **Dynamic Feedback and Suggestions**: PromptForge will provide users with immediate feedback as they formulate their prompts, helping them refine their questions on the spot.

  2. Suggestions for Improvement:
  - **Adding Specific Context or Details**: The bot will guide users on how to enrich their prompts by incorporating relevant details, ensuring clearer communication with chatbots.
- **Examples and Comparisons**:
  - **Side-by-Side Examples of "Before" and "After" Prompts**: Users will see practical examples demonstrating the difference between their original prompts and improved versions, reinforcing effective prompt formulation.
- **Customizable Guidance**:
  - **Level of Detail and Type of Feedback**: Users can select how much detail they want in the feedback, allowing for a tailored learning experience that meets their specific needs

StoryBoarding

Prototyping and Testing

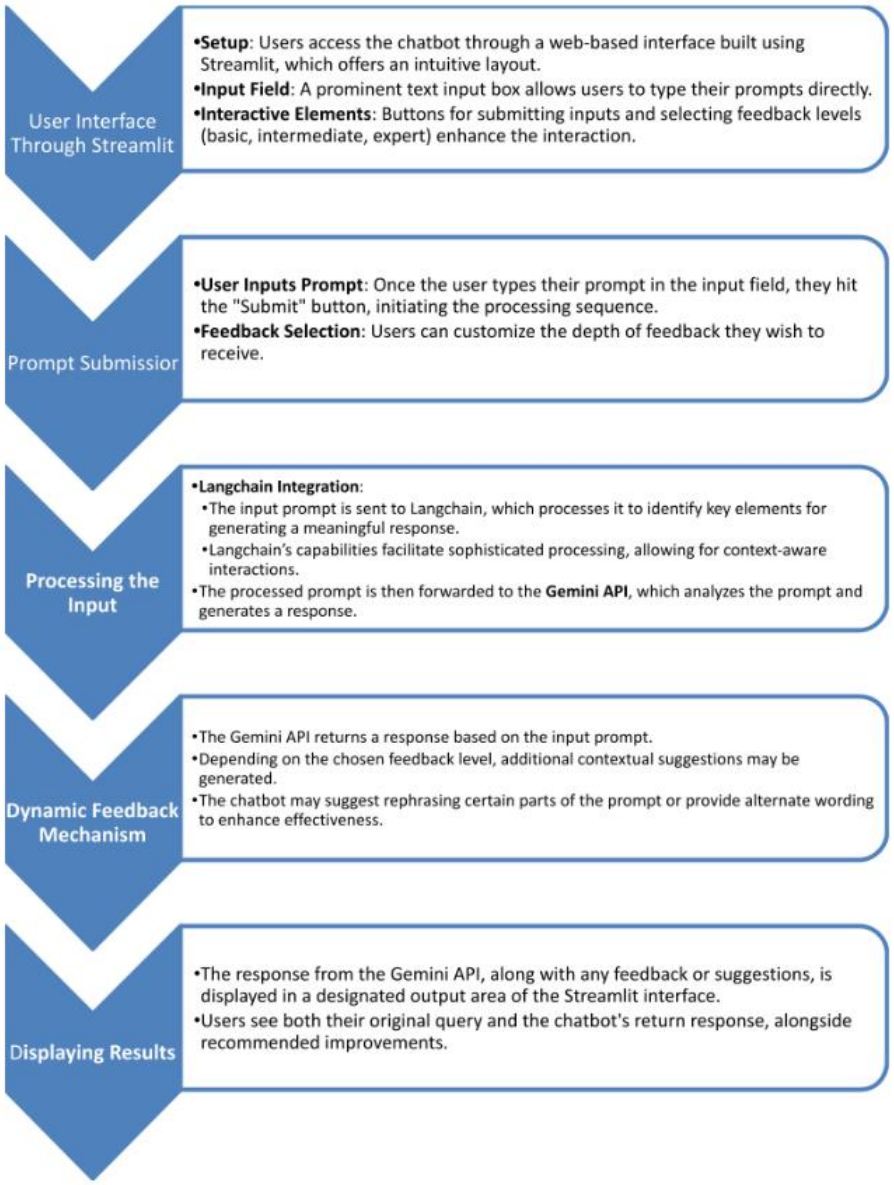
- Prototyping is an essential part of the Design Thinking process. It is the culmination of all the techniques and ideas that have been implemented so far.
- In the prototype phase of **PromptForge**, we developed multiple iterations of the chatbot to enhance its functionality and user experience. Each version built upon the previous one, incorporating feedback and improvements based on our research and stakeholder input. Here's a detailed explanation of each prototype version:
  1. First Prototype:
- **Overview**: The initial version of the chatbot utilized the Gemini API to generate responses, which were displayed directly in the terminal.
- **Functionality**:
  - **Basic Interaction**: Users could input prompts directly into the terminal, and the chatbot would return responses based on the input.
  - **Simplicity**: This version focused on establishing a foundational understanding of how the Gemini API processes prompts and generates responses.
- **Limitations**:
  - **User Experience**: The terminal interface was not user-friendly, lacking visual elements that could enhance user engagement and understanding.
  - **Limited Feedback**: Users received responses without any contextual guidance or suggestions for improving their prompts, which did not address the challenges identified during the empathy phase.

Prototyping and Testing

2. Second Prototype:

- **Overview**: The second iteration integrated Langchain with the Gemini API to improve the quality of responses and enhance the interaction process.
- **Functionality**:
  - **Enhanced Processing**: Langchain allowed for better handling of user inputs, enabling the chatbot to analyze prompts more effectively and generate more relevant responses.
  - **Contextual Understanding**: This version aimed to provide a more nuanced understanding of user queries, addressing some of the misunderstandings reported by stakeholders.
- **Improvements**:
  - **R1. First Prototype:**
- **Overview**: The initial version of the chatbot utilized the Gemini API to generate responses, which were displayed directly in the terminal.
- **Functionality**:
  - **Basic Interaction**: Users could input prompts directly into the terminal, and the chatbot would return responses based on the input.
  - **Simplicity**: This version focused on establishing a foundational understanding of how the Gemini API processes prompts and generates responses.
- **Limitations**:
  - **User Experience**: The terminal interface was not user-friendly, lacking visual elements that could enhance user engagement and understanding.
  - **Limited Feedback**: Users received responses without any contextual guidance or suggestions for improving their prompts, which did not address the challenges identified during the empathy phase.
- **Response Quality**: The integration led to more accurate and contextually appropriate responses, reducing the frequency of vague or nonsensical answers.
- **Feedback Mechanism**: Although still limited, this version began to incorporate basic feedback on user prompts, helping users understand how to refine their queries.

Working


User Interface Through Streamlit
•Setup: Users access the chatbot through a web-based interface built using Streamlit, which offers an intuitive layout.
•Input Field: A prominent text input box allows users to type their prompts directly.
•Interactive Elements: Buttons for submitting inputs and selecting feedback levels (basic, intermediate, expert) enhance the interaction.
Prompt Submissior
•User Inputs Prompt: Once the user types their prompt in the input field, they hit the "Submit" button, initiating the processing sequence.
•Feedback Selection: Users can customize the depth of feedback they wish to receive.
Processing the Input
•Langchain Integration:
•The input prompt is sent to Langchain, which processes it to identify key elements for generating a meaningful response.
•Langchain's capabilities facilitate sophisticated processing, allowing for context-aware interactions.
•The processed prompt is then forwarded to the Gemini API, which analyzes the prompt and generates a response.
Dynamic Feedback Mechanism
•The Gemini API returns a response based on the input prompt.
•Depending on the chosen feedback level, additional contextual suggestions may be generated.
•The chatbot may suggest rephrasing certain parts of the prompt or provide alternate wording to enhance effectiveness.
Displaying Results
•The response from the Gemini API, along with any feedback or suggestions, is displayed in a designated output area of the Streamlit interface.
•Users see both their original query and the chatbot's return response, alongside recommended improvements.

Validation and Iterative Improvement

We tested our innovative chatbot, designed to enhance user prompts dynamically, with two distinct user groups: **students** and **industry professionals**. The insights from these tests provided valuable feedback for refining our solution.

1. **Student User**: Students, including undergraduates and seniors, provided feedback based on their academic and personal experiences with conversational AI:

1. **Provide Examples of Effective Prompts**: Students expressed a need for the chatbot to display sample prompts for specific tasks, helping them understand the structure of an ideal query.
2. **Offer Contextual Tips**: Many users recommended real-time suggestions tailored to their input, such as guiding phrases to clarify intent.
3. **Intuitive Learning Features**: A request for tooltips or hover-over descriptions of advanced features to facilitate onboarding.
4. **Integration with Academic Tasks**: Students preferred options for automating repetitive academic interactions, such as summarizing research or generating structured essay outlines
5. **Accessible Knowledge Base**: Students desired a repository of frequently asked questions and related topics to enhance learning.

Validation and Iterative Improvement

- **Industry experts:** Industry professionals shared viewpoints founded on their utilization of chatbots for professional and business use:

- **Personalized Feedback:** Professionals emphasized the need for tailored prompt refinement based on domain-specific language, such as technical or business jargon.
- **Advanced Debugging Features**: They asked for a way to detect and clarify ambiguities in prompts that could trip up AI.
- **Batch Processing Capability**: Users suggested enabling multiple queries to be optimized simultaneously for workflow efficiency.
- **Performance Metrics**: A feature to analyze the effectiveness of crafted prompts over time, helping users improve their interaction quality.
- **Enhanced Context Sensitivity**: Experts have pointed out the need to make the chatbot respond dynamically to varied user intents, not giving generic or irrelevant responses.

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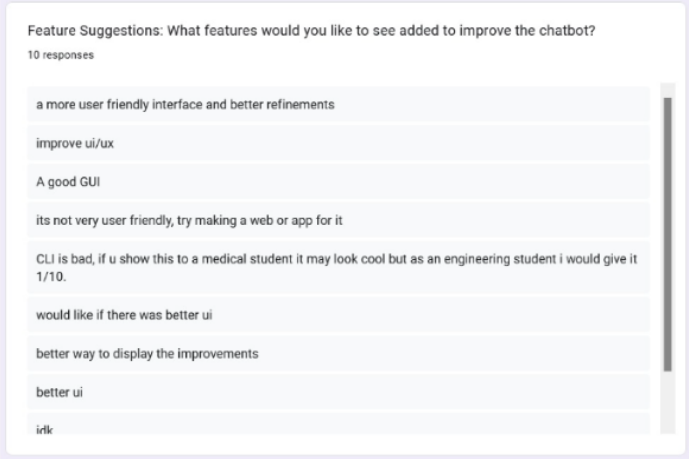
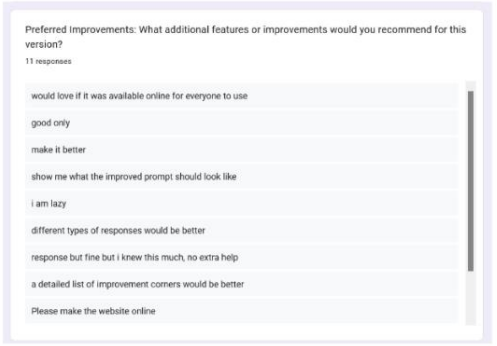
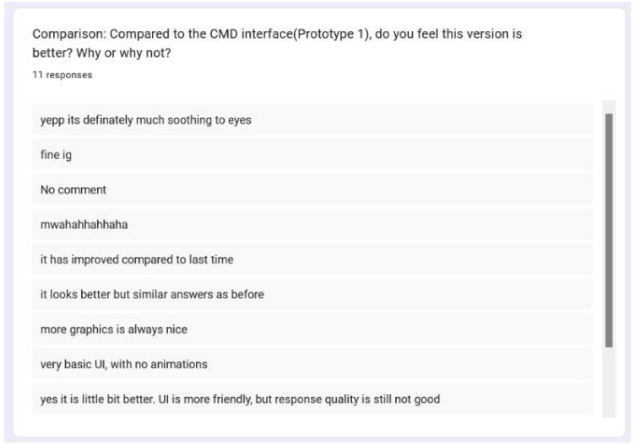
Prototype 1



Summary of the Feedback: Average rating of the prototype by users in terms of usability and response quality was 1-2 stars.
Major Concerns : Lack of GUI: The interface was considered old-fashioned and clunky. **Response Quality**: Responses from the chatbot were not clear or irrelevant.
Action Taken: We worked on the feedback received and made a GUI-based version of the chatbot, which made it more user-friendly.We also began experimenting with different methods to make the chatbot's responses better and more relevant.

Prototype 2



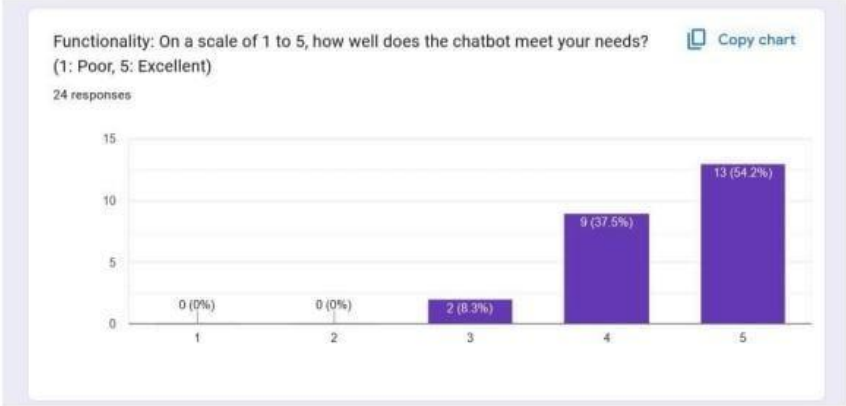


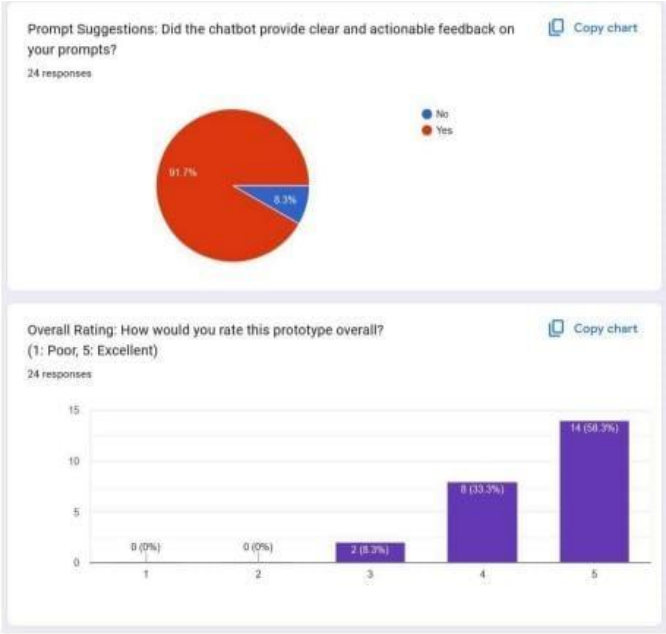
Feedback Summary: Users rated the prototype with an average of 3 stars.

Improvements noted:
GUI Added: Users appreciated having a GUI (Streamlit) and found the use of the chatbot more convenient.
Local-only Access: The users mentioned that they had to run it on localhost, and it was not available at any online host.
Response Quality: Slightly better than Prototype 1 but still not reaching user expectations.

Action Taken:
We addressed the quality of responses by incorporating the LangChain framework to better manage prompts and enhance the content generated by the AI. We initiated planning for prospective online hosting solutions in subsequent iterations to improve accessibility.

Prototype 3: LangChain-Integrated Chatbot





Summary of Feedback: Users gave the prototype an average rating of 4-5 stars, meaning they were highly satisfied.
Improvements:Better Response Quality: The LangChain integration made the chatbot much better at understanding and responding to the question with relevance.**GUI Improvements:** The user interface became much more polished and intuitive, making interactions smoother.**Prompt Analysis Feature**: The intelligent prompt refinement feature, through LangChain and Gemini, added value and utility.
Action Taken: Given the overwhelmingly positive feedback, we decided that this version could be a foundational model for further enhancements, such as deploying online, incorporating multilingual support, or introducing voice-based interaction.

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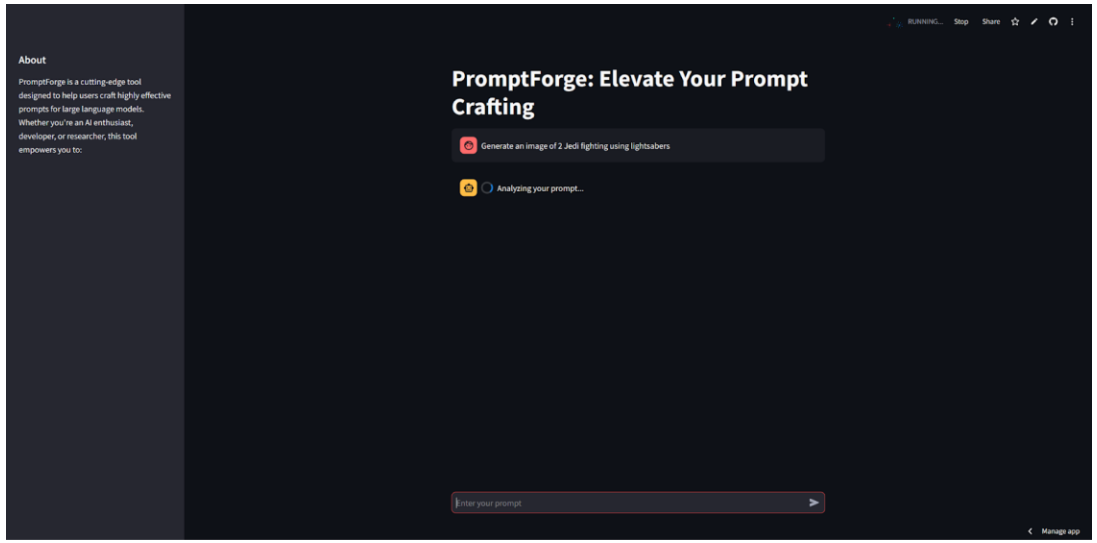
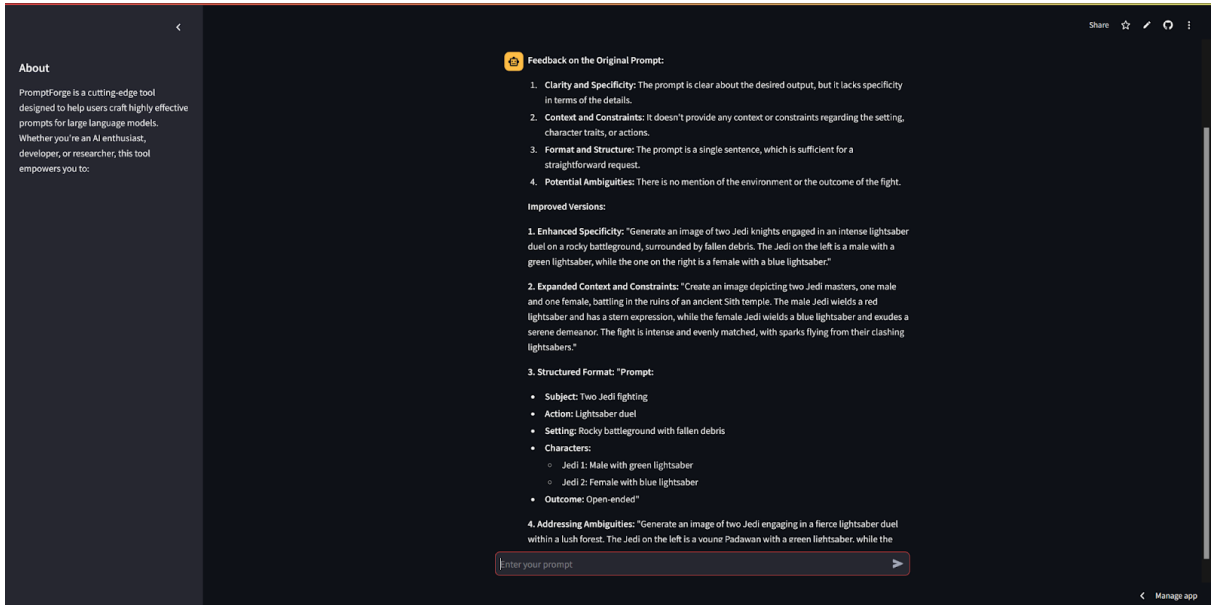
Prototype 3: LangChain-Integrated Chatbot



Through user validation, we transformed the chatbot from a basic command-line tool into a feature-rich, GUI-based application powered by advanced AI techniques. The iterative improvements highlight the importance of user feedback in creating a solution that meets real-world needs effectively.



Conclusion and Reflection

The **PromptForge** project has successfully created a powerful chatbot tool aimed at improving how users interact with artificial intelligence by helping them formulate effective prompts. By using advanced technologies such as **Langchain**, the **Gemini API**, and the **Streamlit** framework, we developed a prototype that meets the specific needs of students and professionals alike. This final version of the prototype not only offers users immediate feedback but also provides thoughtful suggestions that enhance their prompt quality. This innovation helps bridge the gap between what users intend to ask and how well the chatbot understands their queries, ultimately leading to more productive interactions.

By following the design thinking approach, we fostered a team environment that encouraged collaboration and open communication. We learned from the users, which sparked innovation and led us to solutions that were both functional and easy to use. As a result, we are proud to present a tool that not only enhances how people interact with AI but also sets a standard for future developments in prompt refinement.

Reflection

The development of the **PromptForge** project has been an invaluable learning experience that highlighted the importance of understanding user needs in creating effective technological solutions. Engaging with students and professionals revealed their specific challenges when interacting with chatbot.

Collaboration was another key aspect of our success in this project. Working closely within a diverse team allowed for a rich exchange of ideas and perspectives, fostering creativity and innovation in our approach. The iterative design process not only enhanced our problem-solving skills but also reinforced the need for flexibility in adapting to feedback and refining our solutions. This experience has expanded my technical skills, particularly in using tools like **Langchain**, the **Gemini API**, and **Streamlit**. Overall, the insights gained from this project will greatly influence my future endeavors in technology development, emphasizing the importance of user-centered design and collaboration in creating impactful solutions.

Thank you