GarbhaKalyani-Prenatal Chatbot for Pregnant women

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Abstract

Prenatal wellness is a critical period where accurate and personalized care can significantly improve maternal and fetal health outcomes. Traditional Ayurvedic practices offer a holistic approach to prenatal care, but there is a lack of accessible platforms to deliver this wisdom effectively to pregnant women. GarbhaKalyani, an AI-powered chatbot, addresses this gap by providing personalized Ayurvedic advice to support pregnant women throughout their pregnancy journey.

The motivation behind this project is to combine the depth of Ayurvedic knowledge with modern AI technology to offer holistic, accessible, and safe prenatal care. Leveraging a GPT-based model enhanced with Retrieval-Augmented Generation (RAG), GarbhaKalyani offers users tailored advice based on their pregnancy stage, health conditions, and Ayurvedic constitution (Prakriti). The chatbot covers a wide range of topics, including diet, exercise, emotional well-being, herbal remedies, and more complex subjects such as epigenetics and nutrigenomics.

Currently, the model is fully developed and is generating accurate, context-specific responses based on user inputs. Key tasks remaining include memory implementation to enable multi-session conversations and further refinement of personalized interactions across different stages of pregnancy.

Future plans include integrating memory capabilities, testing multi-conversation features, and deploying the chatbot for user testing, ensuring a seamless and engaging user experience.

CCS Concepts

• **Do Not Use This Code → Generate the Correct Terms for Your Paper**; *Generate the Correct Terms for Your Paper*; Generate the Correct Terms for Your Paper; Generate the Correct Terms for Your Paper.

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1 Introduction

Prenatal wellness is a crucial aspect of maternal healthcare, encompassing the physical, emotional, and nutritional needs of expecting mothers. Despite significant advancements in modern medical practices, there remains a gap in delivering personalized care that addresses the unique needs of each woman during pregnancy. Conventional healthcare often overlooks holistic systems like Ayurveda, which offer a more balanced view of well-being by considering not just physical but also mental and spiritual aspects. For many pregnant women, finding reliable, accessible guidance that integrates the best of traditional and modern practices for managing common issues like morning sickness, stress, and dietary requirements is a challenge.

Technology has facilitated virtual healthcare through AI-driven solutions, yet most platforms focus either on allopathic care or general lifestyle advice. The integration of AI with traditional systems like Ayurveda is limited, particularly in the context of prenatal care. This lack of a comprehensive solution that merges modern technology with Ayurvedic wisdom inspired the creation of GarbhaKalyani, a specialized chatbot designed to bridge this gap. GarbhaKalyani aims to provide personalized Ayurvedic guidance for prenatal wellness by leveraging AI, thus combining the strengths of both traditional and contemporary healthcare approaches.

The key motivation behind developing GarbhaKalyani is to empower pregnant women with easy access to personalized, holistic care that aligns with their preferences. Many women seek an integrative approach to prenatal care, combining Ayurvedic principles with modern medical practices, but often struggle to find consistent and credible advice. Ayurveda offers valuable insights into maintaining balance through diet, lifestyle, and natural remedies, which can significantly benefit pregnant women. However, accessing qualified Ayurvedic practitioners or applying these principles in a practical manner during pregnancy can be difficult. GarbhaKalyani aims to make this knowledge more accessible through a user-friendly AI-based platform.

GarbhaKalyani offers personalized advice by considering the pregnancy stage and specific needs of each user. This is achieved through the combination of a GPT-based model and a Retrieval-Augmented Generation (RAG) system, which enables the chatbot to deliver stage-specific recommendations. These recommendations incorporate traditional Ayurvedic practices alongside modern medical knowledge, thus offering users a comprehensive and culturally relevant approach to prenatal care. In addition to covering common concerns like morning sickness, stress, and nutrition, GarbhaKalyani also addresses advanced topics such as epigenetics, teratogenics, and nutrigenomics, providing a deeper understanding of how lifestyle choices can influence fetal development.

In recent years, digital health solutions have gained traction in prenatal care, with apps like Ovia Pregnancy Tracker and What to

Expect offering pregnancy-related information. These apps primarily provide general advice based on conventional medical knowledge, focusing on symptom tracking, diet, and exercise. While these platforms are useful for monitoring fetal growth and receiving weekly updates, they rely on standardized medical advice and do not cater to women seeking culturally specific or alternative practices like Ayurveda. For users interested in integrating traditional practices with modern medicine, such platforms fall short in offering personalized or holistic guidance.

Similarly, AI-driven healthcare solutions like virtual health assistants such as Babylon Health and Ada have made strides in providing accessible medical advice based on user input. However, these tools typically focus on allopathic medicine, lacking the capacity to incorporate traditional systems like Ayurveda into their recommendations. This is where GarbhaKalyani distinguishes itself, by offering a blend of AI-driven technology and Ayurvedic prenatal care. The platform provides a personalized, culturally aligned experience, addressing the needs of pregnant women who wish to integrate holistic wellness practices into their care routine.

The academic research surrounding AI's integration with traditional medicine, particularly Ayurveda, remains underexplored, especially in the realm of prenatal care. While some studies have investigated the potential of AI to offer personalized dietary suggestions based on Ayurvedic constitutions (Prakriti), most of these efforts focus on general health management and do not delve into the specific needs of pregnant women. GarbhaKalyani fills this gap by offering a comprehensive solution that combines the strengths of both traditional Ayurvedic principles and modern AI technologies to deliver tailored care for expectant mothers.

GarbhaKalyani's innovation lies in its use of the Retrieval-Augmented Generation (RAG) system, which allows the chatbot to retrieve contextually relevant information from both Ayurvedic texts and modern medical research. This capability ensures that users receive more accurate, tailored, and specific responses than what general pregnancy apps typically provide. By addressing advanced topics like epigenetics and nutrigenomics, GarbhaKalyani also offers pregnant women insights into how their health and lifestyle choices may affect fetal development, distinguishing itself from platforms that focus solely on mainstream medical perspectives.

From a technical standpoint, GarbhaKalyani leverages a GPT-based language model that is integrated with the RAG system, allowing it to provide precise, context-aware responses. The personalization engine tailors the chatbot's advice based on key inputs such as the user's pregnancy stage and specific health conditions, ensuring that the guidance aligns with both the traditional Ayurvedic constitution (Prakriti) and contemporary medical understanding. This level of customization allows GarbhaKalyani to offer advice that is not only accurate but also relevant to the individual's wellness journey.

Initial testing of GarbhaKalyani involved simulated interactions to refine the chatbot's ability to retrieve and provide accurate information. Following this, a prototype was tested with a small group of pregnant women and Ayurvedic practitioners. The feedback received was overwhelmingly positive, with users appreciating the personalized nature of the advice and the relevance of the Ayurvedic guidance provided. The chatbot's ability to explain complex concepts like epigenetics in accessible terms was particularly well-received, showcasing its potential to bridge knowledge gaps for expecting mothers.

However, some areas for improvement were identified. Users noted a need for clearer guidance in some recommendations, as well as further refinement of the voice-based interaction system to ensure smoother communication. These insights are guiding the next phases of development as the chatbot is refined and optimized for broader user interaction. Key improvements include fine-tuning the GPT-based responses, enhancing the RAG system's ability to retrieve information, and making the user interface more intuitive for both text and voice interactions.

As GarbhaKalyani moves toward a broader release, the focus remains on improving the user experience to ensure that the platform is both informative and engaging. Testing with a larger user base will help identify any remaining issues, ensuring that the chatbot can efficiently and effectively cater to the diverse needs of pregnant women seeking integrative, holistic care. With ongoing refinements, GarbhaKalyani is poised to become a reliable, AI-powered companion for women throughout their prenatal journey, combining the wisdom of Ayurveda with the precision of modern technology.

2 Related Works

The development of GarbhaKalyani, a specialized chatbot that offers Ayurvedic prenatal wellness advice using GPT-based models and a Retrieval-Augmented Generation (RAG) system, is set against a landscape rich with AI-driven solutions in healthcare. Numerous projects and research efforts have sought to integrate artificial intelligence, natural language processing, and machine learning to enhance care in areas like mental health, pregnancy wellness, and traditional medicine. This section reviews 12 products and research papers that are most relevant to GarbhaKalyani, examining similarities, differences, and the technologies employed. These insights highlight both the distinctiveness and the value of GarbhaKalyani's approach.

One of the most relevant projects in the field is ChatPsychiatrist, an AI-based solution focused on mental health support for general users. This tool utilizes large language models (LLMs) to offer early-stage mental health assistance. The most significant similarity between ChatPsychiatrist and GarbhaKalyani is their shared use of AI to deliver personalized guidance to users. However, while ChatPsychiatrist is focused on general mental health and provides preliminary support to users who may be experiencing psychological challenges, GarbhaKalyani specializes in Ayurvedic prenatal wellness. This fundamental difference in target audience and domain focus sets GarbhaKalyani apart as it caters specifically to pregnant women seeking holistic and traditional care methods.

Another related project is the Memory Support Chatbot, which is aimed specifically at pregnant women. This chatbot is designed to assist users experiencing cognitive memory issues during pregnancy, using the GPT-2 model to offer personalized support. Similar to GarbhaKalyani, this bot provides targeted care for women during pregnancy. However, the difference lies in the scope and focus: while the Memory Support Chatbot is narrowly focused on memory-related cognitive concerns, GarbhaKalyani takes a broader approach, covering a wide range of prenatal wellness topics from diet to emotional well-being, all through an Ayurvedic lens.

The Mental Health Chatbot by Thrishala, another general-purpose mental health assistant, uses a fine-tuned Llama 2 model to provide virtual therapy. Its distinguishing feature is its empathetic approach, offering virtual therapy that aims to replicate a human therapist's emotional sensitivity. While both GarbhaKalyani and this mental health bot share the goal of improving user well-being through AI-driven conversations, the latter is focused solely on mental health, and it does not address the unique physical and emotional needs of pregnant women. Moreover, GarbhaKalyani incorporates Ayurveda, a holistic approach that focuses on prevention and lifestyle management, into its design.

Products specifically tailored to pregnancy, such as HappyMama and PregBot, also offer real-time, AI-driven pregnancy advice. HappyMama is an AI-powered chatbot that provides instant answers to questions about pregnancy and labor, serving pregnant women who need immediate guidance. Similarly, PregBot uses machine learning (ML) and natural language processing (NLP) to offer comprehensive pregnancy support. Both solutions share similarities with GarbhaKalyani in their real-time guidance features and the use of AI to help pregnant women. However, neither of these products integrates traditional care methodologies such as Ayurveda, which is a key feature of GarbhaKalyani. While PregBot and HappyMama excel in providing quick, data-driven answers, GarbhaKalyani stands out by combining modern AI technologies with ancient holistic principles, thereby offering a more rounded approach to prenatal care.

Moving beyond existing products, a number of research papers have explored AI's role in healthcare, specifically in pregnancy wellness and Ayurveda. One such paper, "Artificial Intelligence and Machine Learning in Pregnancy Care," discusses how AI is being used to improve pregnancy health monitoring, particularly in diagnosing complications like preeclampsia through predictive analytics. While this research shares a common goal with GarbhaKalyani in using AI to enhance prenatal care, it focuses primarily on modern diagnostics and does not incorporate traditional wellness systems like Ayurveda. GarbhaKalyani goes beyond medical diagnostics by offering lifestyle advice grounded in both modern science and ancient wisdom.

A highly relevant paper to GarbhaKalyani is "The Use of Artificial Intelligence in Ayurveda: A Way Forward." This research highlights how AI can be used to augment Ayurvedic diagnosis and treatment planning, which aligns directly with GarbhaKalyani's objective of blending AI with traditional Ayurvedic methods for prenatal care. The paper demonstrates that AI can increase diagnostic accuracy within Ayurveda, showing how AI systems like GarbhaKalyani could potentially elevate the effectiveness of Ayurvedic advice. This fusion of ancient knowledge with cutting-edge technology is a key strength that distinguishes GarbhaKalyani from many other AI-based healthcare systems, which often rely solely on modern medical practices.

In another study, "Development of a Chatbot for Pregnant Women on a Posyandu Application in Indonesia," researchers developed a chatbot that provides health and nutritional information to pregnant women using decision trees. While this chatbot is similar to GarbhaKalyani in offering prenatal advice, it is tailored to the local context of Indonesia and is focused on general healthcare. By contrast, GarbhaKalyani provides personalized Ayurvedic wellness guidance that can be adapted to a global audience. Its use of GPT models for conversation also allows for more dynamic and responsive interactions compared to rule-based systems like decision trees.

Similarly, the paper "MumCare: An Artificial Intelligence-Based Assistant" introduces a chatbot that offers personalized pregnancy care, using AI to simulate a conversation between the pregnant woman and her unborn child. This emotionally immersive design helps to create a unique bond between the user and the bot. While MumCare shares similarities with GarbhaKalyani in terms of providing personalized care, its primary focus is emotional connection rather than comprehensive wellness, which is a key component of GarbhaKalyani.

Finally, "Comprehensive Study of Virtual Assistants in Healthcare" provides a broader analysis of various healthcare chatbots and virtual assistants, focusing on their ability to improve patient interactions and healthcare decision-making. While GarbhaKalyani shares the goal of improving user interactions, it stands out due to its unique incorporation of Ayurvedic principles and its specialized focus on pregnant women.

Project/Research Paper	Target Audience	Focus	Technology	Distinguishing Feature
GarbhaKalyani	Pregnant Women	Ayurvedic Prenatal Wellness	GPT-based Model, RAG	Personalized Ayurvedic guidance; Comprehensive wellness advice
ChatPsychiatrist	General Users	Mental Health Support	LLMs	Early-stage mental health assistance
Memory Support Chatbot	Pregnant Women	Cognitive Memory Issues	GPT-2 Model	Focus on memory-related cognitive concerns during pregnancy
Mental Health Chatbot by Thrishala	General Users	Virtual Therapy	Fine-tuned Llama 2	Empathetic virtual therapy for mental health
HappyMama	Pregnant Women	Pregnancy Q&A	AI-powered Chatbot	Instant, real-time answers on pregnancy and labor
PregBot	Pregnant Women and Families	Comprehensive Pregnancy Support	ML and NLP	Real-time pregnancy and family support
AI in Pregnancy Health Monitoring	Researchers/Practitioners	Predictive Analytics	AI & ML	Focus on modern diagnostics for pregnancy complications
AI in Ayurveda	Ayurvedic Practitioners	Integrating AI into Ayurveda	AI-based Systems	Enhances diagnostic accuracy and treatment planning in Ayurveda
Posyandu Pregnancy Chatbot	Pregnant Women (Indonesia)	Health and Nutrition Support	Decision Trees	Localized pregnancy healthcare and nutrition support
MumCare	Pregnant Women	AI-based Pregnancy Assistant	Dialogflow and Firebase	Personalized conversation simulating an unborn child

Figure 1: Comparison Matrix

In conclusion, while many existing products and research efforts focus on AI-driven health advice, GarbhaKalyani distinguishes itself by blending modern AI technologies with traditional Ayurvedic care. This combination provides personalized, holistic prenatal guidance that addresses both physical and emotional well-being, offering a more comprehensive solution than many other chatbots on the market. The following comparison matrix summarizes key similarities and differences between GarbhaKalyani and other relevant products and research papers.

3 Methodology

The AI-powered conversational system developed in this project focuses on addressing Ayurvedic antenatal health questions from the perspective of pregnant women, providing accurate and contextually relevant responses. The system's architecture integrates several tools and libraries, including LangChain for conversational modeling, ChromaDB for efficient information retrieval, and LangGraph for managing dialogue state and flow. This design is underpinned by the use of advanced techniques such as retrieval-augmented generation (RAG) and agent-based behavior to ensure that responses are both accurate and contextually appropriate. The system's workflow revolves around the integration of natural language processing (NLP), memory management, and state-based dialogue flow to maintain the continuity of interactions and ensure that responses are relevant to the user's input.

The development of the system began with the installation of essential libraries such as langchain, langgraph, openai, and chromaDB, which facilitate conversational flows, memory retention, and information retrieval from a large repository of Ayurvedic data. A crucial component of the system is the MemorySaver(), which is employed to manage state information and maintain a checkpoint of conversational data. This ensures that the system can reference prior interactions, thereby enabling the generation of context-aware responses that build on previous user queries. Once the memory management system is in place, LangGraph is used to handle the dialogue flow through a graph-based approach. Each node in the graph represents a specific stage of the conversation, such as user input, document retrieval, or response generation, with different message types (SystemMessage, HumanMessage, AIMessage) controlling the conversation's progress. The graph is managed using MessagesState and StateGraph, allowing the conversation to transition smoothly between stages based on the user's input and the system's responses.

A part of the creation of the project involves the use of prompt engineering techniques to enhance response generation. These techniques were carefully evaluated using Ayurvedic antenatal health questions. Zero-shot prompting involved asking the model questions without providing any prior context, whereas few-shot prompting provided the model with several examples to guide the response. Instruction-based prompting gave explicit instructions to the model for generating more structured responses, while chain-of-thought prompting encouraged step-by-step reasoning to deliver more detailed and thoughtful answers. Context-based prompting was found to be particularly effective, where relevant documents retrieved from ChromaDB were used as contextual information to improve response accuracy. Among these techniques, context-based prompting and few-shot prompting proved to be the most effective, especially when used in conjunction with RAG techniques. These techniques were evaluated based on their relevance, completeness, and accuracy, with context-based prompting scoring highest across all metrics. LangChain integrates OpenAI's GPT models into the system, abstracting the underlying complexities of model interaction and allowing for seamless integration with ChromaDB, which serves as the repository for Ayurvedic health-related information. The retrieval-augmented generation (RAG) approach allows the system to retrieve relevant documents from ChromaDB in response to user queries. These retrieved documents or knowledge snippets are then passed as context to the GPT-based model, which synthesizes the information into a coherent response that is both informative and contextually appropriate to the user's needs. This process ensures that responses are not only based on the user's direct input but are also enriched with authoritative Ayurvedic knowledge. The flow of data and control within the system follows a structured path. When a user submits a query regarding Ayurvedic antenatal care, the system retrieves relevant documents from ChromaDB that are aligned with the user's question. This retrieval process involves filtering the database for the most pertinent information, which is then combined with the user's input to form a prompt. This prompt is passed through LangChain to the GPT model, where the system generates a response. LangGraph manages the state transitions during this process, ensuring that the conversation flows logically and that any potential overload from lengthy interactions is mitigated through summarization techniques. This structure allows the system to maintain a continuous, context-aware conversation while effectively managing large amounts of retrieved data.

An initial survey was conducted with15 participants, including pregnant women and Ayurvedic practitioners, which helped identify key areas of concern related to Ayurvedic antenatal care. The feedback from this survey played a crucial role in shaping the system's content focus, ensuring that the most relevant subject matter is prioritized during the retrieval process. The participants' responses guided the system in refining the scope of information it retrieves and processes, focusing on the most critical and frequently asked questions regarding Ayurvedic practices during pregnancy. Moreover, the importance of summarizing complex or lengthy responses was emphasized, ensuring that the system delivers concise and easily digestible information without compromising its relevance. These insights helped optimize the system's ability to provide succinct yet informative answers, improving the overall user experience by focusing on clarity and relevance.

In conclusion, the AI conversational system presents a sophisticated design capable of addressing Ayurvedic antenatal health concerns through a combination of advanced NLP techniques, memory management, and state-based dialogue control. By integrating LangChain, ChromaDB, and LangGraph, the system effectively manages conversational flow and ensures that responses are contextually enriched with relevant Ayurvedic knowledge. The system's ability to target key subject areas, as identified through user feedback, and its focus on summarization ensures that the information provided is both relevant and accessible. This design allows the system to offer a continuous, engaging, and context-aware interaction, with ongoing testing and refinements aimed at improving its accuracy, completeness, and overall user satisfaction.

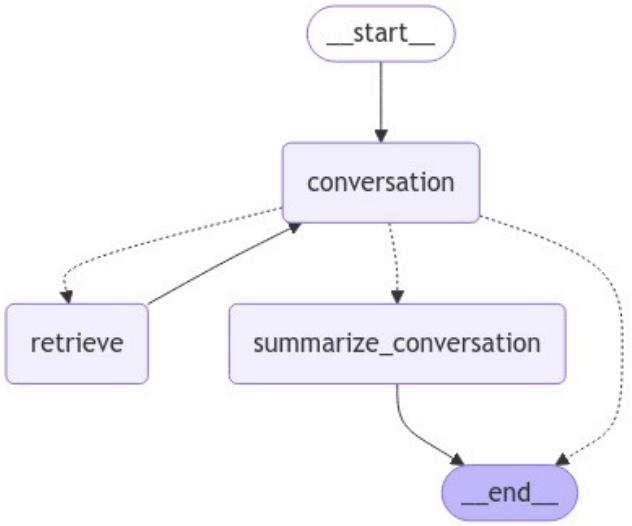

Figure 2: Lang graph

4 Future Work

As GarbhaKalyani moves toward its final stages of development, there are several system components that still need to be implemented, along with improvements and modifications that can enhance the project's capabilities, particularly with the introduction of **LangGraph** for more robust AI-driven interactions. Below is an outline of the remaining tasks and future directions.

4.1 Memory and Multi-Session Interaction

One of the key components still in development is memory integration, which will allow GarbhaKalyani to remember user inputs from previous sessions. This feature is crucial for personalized prenatal care, as it will enable the system to track the user's pregnancy progress and symptoms over time. Multi-session interaction will allow the system to provide continuity in advice, making recommendations more relevant and specific to the user's journey through different pregnancy stages. Integrating LangGraph, which excels in managing complex conversational flows, can further enhance this functionality. By using LangGraph's graph-based memory management, GarbhaKalyani can better manage long-term conversations, offering users a seamless experience where the system recalls previous interactions and evolves the advice accordingly.

4.2 Voice Interaction

Voice interaction remains an essential feature to be implemented. Many users may prefer voice-based communication, particularly those who find it more convenient during pregnancy. The LangGraph library could significantly improve this component by providing more structured, multi-turn conversations. Using LangGraph, the system could better manage diverse user intents and responses, making the voice interaction smoother and more natural. This would cater to a broader audience, especially those looking for hands-free and intuitive interaction methods.

4.3 Personalization Enhancement Using LangGraph

The system's current personalization engine provides tailored Ayurvedic guidance based on the user's *Prakriti*, pregnancy stage, and health conditions. However, LangGraph could further optimize this by enabling more nuanced, dynamic personalization. Instead of relying solely on predefined stages, LangGraph could allow for real-time adjustments to the user's Ayurvedic recommendations based on an evolving understanding of their health data, symptoms, and preferences. For example, the chatbot could dynamically adjust its advice if a user reports changes in health conditions or dietary preferences, creating a more responsive and adaptable system.

4.4 Usability Testing and Iteration

Usability testing is a critical next step for ensuring GarbhaKalyani is intuitive, accessible, and helpful for users. The plan involves gathering a diverse group of pregnant women who are interested in Ayurvedic care, conducting beta tests, and using surveys to gather feedback on various aspects such as:

- Ease of use (UI/UX evaluation)
- Quality of Ayurvedic advice
- Relevance of multi-session memory and symptom tracking
- Effectiveness of voice-based interaction

By testing the system in real-world conditions, developers can gather actionable insights into user behavior and system performance. Based on this feedback, the team will refine the user interface, improve the response quality, and adjust features to better meet user needs.

4.5 LangGraph for Better Error Handling and Flexibility

One major challenge with AI chatbots is handling user errors and ambiguous inputs. LangGraph's robust error-handling framework could allow GarbhaKalyani to gracefully manage incorrect or incomplete user inputs. By structuring conversational flows as graphs, LangGraph would allow the system to loop back or ask clarifying questions when necessary, ensuring the user gets accurate and helpful advice, even in the case of miscommunication.

4.6 Advanced Topics and External Resource Integration

To further enhance the depth of the advice provided, the system could integrate external resources to offer more advanced Ayurvedic insights on topics like *epigenetics* and *nutrigenomics*. LangGraph's structured flow could facilitate the retrieval of specific information from external Ayurvedic resources, enabling the system to answer complex queries with precision.

4.7 Final System Vision

The final version of GarbhaKalyani will feature a sophisticated AI-driven chatbot capable of delivering personalized, holistic prenatal wellness advice based on Ayurvedic principles. It will integrate memory, voice interaction, dynamic personalization, and external resource integration, powered by advanced conversational flows

through LangGraph. This version will provide a seamless, user-centric experience, guiding women through pregnancy with stage-specific and personalized wellness support.

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References

A Research Methods

A.1 Part One

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B Online Resources

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