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Research Article

Ayur life-An Ayurvedic Way To Life

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ABSTRACT

This paper explores the integration of Ayurveda with modern technology, focusing on the emerging field of Ayurinformatics. The study reviews various advancements, including the use of information and communication technologies to preserve and advance Ayurvedic knowledge. Key resources such as the Traditional Knowledge Digital Library (TKDL) are evaluated for their contributions and limitations. Additionally, the research assesses methodologies for determining individual constitutions and imbalances using Ayurvedic principles and modern diagnostic tools. Machine learning approaches for predicting Ayurvedic constituent balancing are also examined. Despite promising developments, the paper identifies significant gaps, including the need for practical applications and standardized diagnostic tools, highlighting areas for future research.

Index Terms—Ayurveda, Ayurinformatics, Traditional Knowledge Digital Library, Panchamahabhuta Siddhant, Machine Learning, Prakriti, Dosha, Diagnostic Tools.

I. INTRODUCTION

Ayurveda, the Ancient Indian science of medicine, is the oldest holistic healing system in the world, that dates back more than 3000 years ago. It is founded on the principle that health and wellness depend on a fragile balance between the mind, body, and spirit. Ayurveda believes in promoting health & well-being instead of treating disease & takes a whole mind-body-spirit view using a holistic (personalized) approach which is based on individual body constitution (prakriti) & life forces (doshas). With personalized medicine gaining importance in this age of science, the tenets of Ayurveda provide tremendous guidance to personalized healthcare.

The modern technology and data science era is an unique opportunity, which could be used to amplify the domain of Ayurveda. A new interdisciplinary field - Ayurinformatics, on the integration of Ayurveda with IT and ICT is emerging. This field works on digitalisation and analysis of Ayurvedic knowledge to help live this knowledge on every day contemporary healthcare. Ayurvedic principles could be refined more precisely towards diagnostics and personalized treatment protocols with the application of recent tools like machine learning for instance.

In spite of an ancient health science, Ayurveda has profound applications in the present scenario where adaptability to new paths of holistic health that are more personalized and preventive in nature is need of the global challenges. Despite the above facts it is very difficult to merge Ayurveda with modern technologies because of various reasons. These involve the development of a digital platform for storing traditional knowledge data with advanced analytics, standardized disease diagnosis tools and techniques and usage of cutting-edge analytical methods for Ayurvedic data.

The objective of this paper is to study the combination of Ayurveda and Modern technologies through principal resources such as [1] as well as advanced techniques like Machine Learning. The potential and challenges of

Ayurinformatics are exemplified in this paper by assessing the contributions and limitations of the approaches used throughout. These gaps need to be addressed for strategically incorporating technology and promoting an redefined use of Ayurveda, with respect to its application and understanding in modern healthcare.

II. LITERATURE REVIEW

The intersection of Ayurveda and modern technology represents a burgeoning field of study aimed at preserving and advancing traditional medical knowledge. The paper [2] discusses the evolution of Ayurveda in the context of information and communication technologies, highlighting how these advancements can support the historical and ongoing development of Ayurvedic practices. The primary advantage noted is the emphasis on the importance of Ayurveda, shedding light on its historical significance and potential for integration with modern technologies. However, the paper does not provide a conclusion on digitalizing Ayurvedic processes, leaving a gap in practical applications and future directions for research.

[1] serves as a comprehensive knowledge repository of Indian traditional knowledge related to medicinal plants, ethnobotanical plants, and various other formulations used in Indian medicine systems. This repository offers a vast collection of Ayurvedic data, making traditional knowledge more accessible for research and development purposes. Nonetheless, the information is presented descriptively without interactive features or detailed insights into doshas, limiting its utility for specific research applications.
The study [3] examines how Ayurveda determines the constitution and imbalances of individuals through various modular approaches, specifically focusing on the Panchamahabhuta Siddhant. The authors utilized three different questionnaires to validate their reliability in determining prakriti levels, demonstrating a standardized methodology for investigating prakriti. However, the study's questionnaire is not widely applicable due to the influence of numerous factors affecting diagnosis, indicating the need for a more robust and universally applicable diagnostic tool.

Additionally, research on predicting Ayurveda-based constituent balancing using machine learning, as presented in [4] investigates the use of machine learning methods to predict constituent balancing in human bodies based on Ayurvedic principles. The experimental results indicate that the proposed model, which leverages ensemble learning methods, outperforms conventional techniques in predicting prakriti with higher accuracy. Despite the promising results, the study lacks a concrete solution for balancing prakritis and primarily offers predictive capabilities rather than practical applications.
The paper titled [5] explores the foundational concepts of Ayurveda, particularly the Tri-dosha system—Vata, Pitta, and Kapha—and its correlation with modern pharmacogenomics. This integration facilitates a deeper understanding of personalized and preventive healthcare. However, the global commercialization of traditional knowledge often sidesteps the principles of Access and Benefit Sharing (ABS) as outlined in the Convention on Biological Diversity (CBD), leading to bioprospecting and misappropriation of indigenous knowledge without proper consent. The paper advocates for a cooperative model over the monopolistic tendencies prevalent in current IPR frameworks, emphasizing the need for protecting traditional medicinal knowledge through local and international policy perspectives.

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The article [7] Investigates the reliability of self-assessment tools in determining an individual's Prakriti, or constitution, in Ayurveda. It highlights the lack of standardization in self-reported questionnaires, which results in variable reliability in diagnosing the constitutional imbalances of Vata, Pitta, and Kapha. This paper underscores the necessity for further research to develop standardized and reliable diagnostic tools in Ayurvedic practice.

In the paper [8] the authors explore machine learning models to classify Ayurvedic herbs based on their dosha balancing properties. This study emphasizes the significance of these herbs in maintaining the balance of Vata, Pitta, and Kapha, which are essential for overall health. Various classification models, including SVM, KNN, RF, DT, and XGBoost, were used, showcasing the potential of modern computational techniques in traditional medicine. This research underscores the effectiveness of ensemble learning methods in classifying Ayurvedic herbs, demonstrating significant advancements over conventional approaches and highlighting the potential of modern computational techniques in traditional medicine.

Overall, the integration of Ayurveda with modern technological advancements offers significant potential for enhancing the understanding and application of traditional knowledge. However, existing research highlights several limitations, including the need for more practical applications and standardized diagnostic tools. Addressing these gaps will be crucial for fully realizing the benefits of Ayurinformatics.

III. METHODOLOGY

A. Implementation

1) The AI Chatbot subsystem:

- The proposed AI system, as mentioned above, takes advantage of these technologies to allow LLMs to answer questions in a short, helpful way, and on the basis of previously known and verified facts only. [9]
- It also has the added benefit of limiting the scope of the chatbot that this system powers to only relevant queries, and to both prevent misuse of the system and reduce unnecessary strain on the hosting server.
- The flow of the system is as follows:
- Initially, verified facts and internal logic go through an NLP engine to be converted into the aforementioned SVO Triplets.
- These are then dynamically arranged into the Knowledge Graph (KG) structure at runtime.
- The user's query is similarly processed, and the entities in the query are extracted.
- These entities are then searched for in the KG.

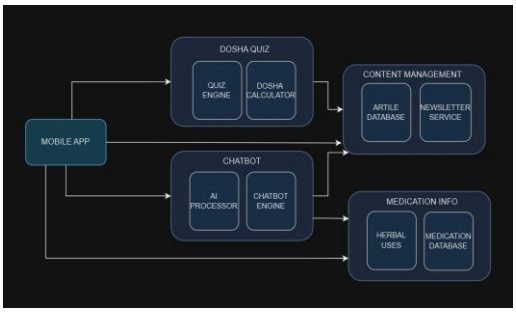

Fig. 1. System Architecture

- If they are found, the context surrounding the nodes is reconstructed, and is passed to the LLM alongside the user's query as added context.
- The response of the LLM is passed to the user.
- The LLM response is further analysed for any further information from the LLM's initial training database, and these facts are then further added to the KG.
- This process is iterated for each subsequent user query, and non-redundant knowledge is iteratively added to the network.

2) The Quiz subsystem:

- The Quiz subsystem is used to determine the user's Dosha, which further informs the previously explained LLM system.
- It stores this information for the user, and retrieves it in relevant scenarios.
- The system consists of a questionnaire with a set of questions about the user's general qualities and physical aspects.
- This information is then fed to a proprietary weighted sum algorithm to calculate the Dosha of a user.
- The calculation occurs in the form of a percentage of each of the three main dosha types [10]:
- Vata
- Pitta
- Kapha
- This gives the user information about their dominant dosha types.

3) The Dataset:

The Dataset used is from Kaggle [11], and contains the details and descriptive features of a plethora of known ayurvedic plants and herbs. It works as follows:

- The system receives data about the user's Dosha makeup from the Quiz Subsystem.
- It then queries the database for the plants that the user could benefit from.
- These, along with plants to avoid, are displayed.
- The display pane includes the nature, taste, properties, and use cases of each herb.

B. Algorithm

The following algorithms were used in the proposed methodology:

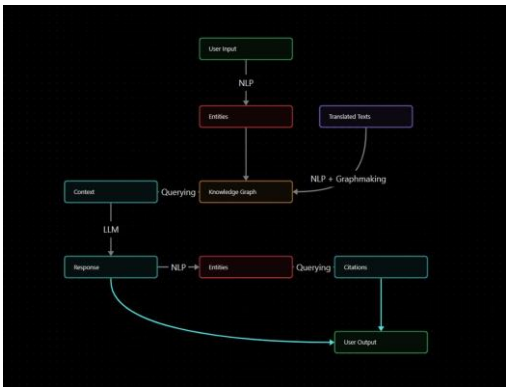

Fig. 2. Flow for Finetuned LLM

1) Knowledge Graphs:

- They are a graph-based data structure used to store semantically sorted information.
- They do so by analysing paragraphs of text, and degenerating sentences within that text into SVO (Subject Verb - Object) Triplets, and then storing them first as a Dataframe, and subsequently as a Graph. [12]
- The components of such a KG are as follows:

– **Entities:**
Anything that may be described as a noun, an acting body, or a noun phrase are termed as entities. In the graph, these are stored uniquely as a node each.

– **Relations:**
Anything that links two entities can be taken as a relationship.
In the graph, these are stored as labels on edges connecting the two entities that the relation connects.

2) LLMs:

- Large language models are artificial intelligence systems for human-like text generation and general natural language processing. They have been trained on largescale datasets of text and code to learn the patterns and relationships within language. [13]
- LLMs are used in various applications, from language translation and sentiment analysis to creative tasks for generating different forms of text.
- Large language model architectures are implemented with an architecture containing multiple layers of neural networks; commonly used ones are embedding layers, recurrent layers, feedforward layers, and attention layers. All the layers play a pivotal role in one way or another when it comes to influencing the processing of input text in the architecture of a model and creating an output prediction.
- Embedding Layer: This layer will convert each word in the input text to a high-dimensional vector, representing the semantic and syntactic information of that word. This would help the model understand the semantics and syntax of the individual words by embedding how those words were used within the context.
- The feedforward layers have nonlinear transformations of the input embeddings, which assist in the learning of higher abstractions from the input text.
- The recurrent layers process the information of the input text in a sequence. It has a hidden state that's updated through time; therefore, it can learn dependencies across words within a sentence.
- The attention mechanism allows the model to focus on specific areas of input text, thus assisting the model in concentrating on the most relevant parts of the input text and making more accurate predictions.

IV. RESULTS AND DISCUSSION

A. Results

The development and implementation of the AyurCare app have demonstrated significant potential in enhancing users' understanding and application of Ayurvedic principles. The alpha testing phase yielded several key outcomes, which can be summarized as follows:

1) Personalized Health Recommendations:

- The AI chatbot, powered by language models and supported by Knowledge Graphs demonstrated an ability to offer personalized health advice.
- The language model component excelled in customizing responses to meet the needs of users. By considering the context provided by users during its processing the system ensured that its responses were not accurate but also highly relevant and tailored.
- This adaptability of the language model allowed the application to provide individualized recommendations improving user satisfaction and trust in the apps guidance.
- The figures below demonstrate that the AI chatbot is designed to provide personalized responses based on an individual's dosha, aligning with the Ayurvedic principle of tailored healthcare. By integrating modern technology with traditional Ayurvedic knowledge, the chatbot analyzes users' doshas—Vata, Pitta, and Kapha—through a comprehensive questionnaire. This information enables the chatbot to offer customized advice and answers, reflecting the unique physiological and psychological constitution of each user. Such personalized interaction ensures that the responses are not only relevant but also aligned with the individual's inherent traits, promoting a more effective and holistic approach to health and wellness.

2) ***Knowledge Graph Implementation****:*

Using Knowledge Graphs, in the system helps store and retrieve information efficiently in a way. By converting text into SVO Triplets and organizing data into a Knowledge Graph format the application can offer responses to user inquiries. This methodical approach improves the systems capacity to handle and provide information. [14]

Question	I have a headache, what should I do?
Kapha	For a Kapha headache, try these: Apply a warm compress to your forehead and sinuses. Sip warm water with ginger and a pinch of black pepper. Do a saline nasal rinse to relieve congestion. Rest in a quiet, dark room. If it persists, see a doctor. This is not medical advice, just general tips.
Vata	Vata headaches are often described as throbbing or like a sharp, stabbing pain and can be associated with stress, anxiety, or lack of sleep. Here are a few things you can try: Warm oil massage: Gently massage your temples, scalp, and neck with warm sesame or coconut oil. Rest in a quiet environment: Turn off bright lights and electronic devices. Herbal tea: Drink calming herbal tea like chamomile or lavender. Stay warm: Wrap yourself in a blanket to stay warm and cozy. Remember, these are general suggestions, not medical advice. If you experience persistent headaches, please consult a healthcare professional.
Pitta	Pitta headaches are often intense, sharp, and burning, potentially accompanied by sensitivity to light or heat. Here are some things that might help: Cool compress: Apply a cool compress or ice pack wrapped in a towel to your forehead or the back of your neck. Stay cool and hydrated: Drink plenty of cool water or coconut water. Avoid stimulants: Stay away from caffeine and alcohol. Rest in a cool, dark room: Minimize exposure to bright lights or loud noises. This is general advice and not a replacement for personalized recommendations from an Ayurvedic practitioner. Consult a healthcare professional if your headache persists or worsens

Fig. 3. Headache Results for Vata, Pitta, and Kapha Users

Question	I have a indigestion, what should I do?
Kapha	Kapha indigestion is often characterized by slow digestion, heaviness, and mucus. Here are a few tips: Favor warm, light meals: Opt for cooked vegetables, lentil soup, or kitchari. Spice it up: Use warming spices like ginger, black pepper, and cumin. Avoid heavy, oily foods: These can aggravate Kapha. Ginger tea: Sip on ginger tea after meals to aid digestion. Stay active: Light exercise like walking can help. This is general advice; consult a healthcare professional for persistent issues.
Vata	Vata-type indigestion is often linked to irregular eating habits, stress, and gas. Try these tips: Warm drinks: Sip on warm water or ginger tea. Eat cooked, warm foods: Favor soups, stews, and well-cooked vegetables. Avoid raw & cold foods: These can be harder to digest for Vata. Regular mealtimes: Don't skip meals and try to eat at consistent times. Calm environment: Relax while you eat. This is not medical advice, just general tips. If it continues, see a healthcare professional.
Pitta	Pitta-related indigestion often involves heat and acidity. Here's what might help: Cooling foods: Favor cooling foods like cucumber, coconut water, and cilantro. Avoid spicy and greasy foods: These can aggravate Pitta. Room temperature beverages: Avoid very hot or very cold drinks. Mindful eating: Eat slowly and in a relaxed setting. Herbal tea: Try ginger tea or fennel tea for soothing relief. Remember, this is general advice, not a substitute for personalized guidance. If indigestion persists, consult a healthcare professional.

Fig. 4. Indigestion Results for Vata, Pitta, and Kapha Users

Question	I am feeling bloated, what should I do?
Kapha	Bloating is a common problem that can be caused by a vanety of factors. including eating too much. eating too quickly. eating qasoroducinq foods, and dnnkinq carbonated beverages. Here are some tips to help reduce bloating Eat smaller meals more frequently throughout the day. Eat slowly and chew your food thorouqhty. Avoid gas-producing foods. such as beans. broccoli. and cabbage. Donk plenty of water throughout the day. Avoid carbonated beverages. Exercise regularty to help move gas through your digestive system. It you have persistent bloating. see your doctor to rule out any underlying medical conditions. If you have a Kepha body type. you may be more prone to bloating. In addition to the tips above. you may also want to: Avoid cold and heavy foods. Eat warm and light foods. such as soups and stews. Drink ginger tea to help improve digestion. Consider taking a Kapha.balancing herbal supplement.
Vata	Bloating is a common digestive complaint that can be caused by a variety of factors, including indigestion, gas, and constipation. According to Ayurveda, bloating is often caused by an imbalance of the vata dosha, which is responsible for movement and circulation. To reduce bloating, Ayurveda recommends: Eating a diet that is easy to digest and avoids gas-producing foods such as beans, lentils, and cruciferous vegetables. Drinking plenty of warm water throughout the day Massaging the abdomen with warm oil. Taking herbal supplements such as triphala or ginger tea. Getting regular exercise to help move gas through the digestive tract.
Pitta	To reduce bloating, try: Avoiding gas producing foods like beans, lentils, and cruciferous vegetables. Eating smaller meals more frequently. - Drinking plenty of water Exercising regularly. Reducing stress.

Fig. 5. Bloating Results for Vata, Pitta, and Kapha Users

3) Dosha Determination Accuracy:

- The Quiz section, which aims to determine an individual's dosha based on their answers to a variety of questions worked well. Since doshas are not fixed quantifiable parameters, the systems accuracy was confirmed by comparing it to evaluations done by experienced experts.
- The application achieved a matching rate of 92% when comparing its assessments with those of practitioners. This high success rate demonstrates the systems strength and dependability, in evaluating doshas establishing a basis, for tailored health suggestions.

4) Dataset Utilization:

- The AyurCare app leverages a comprehensive dataset sourced from [11], encompassing detailed and descriptive features of numerous Ayurvedic plants and herbs.
- Upon determining the user's dosha makeup, the system queries the database for Ayurvedic plants and herbs that align with the user's specific needs, providing a list of beneficial plants as well as those to avoid.
- For each herb listed, the display pane provides detailed information, including the nature, taste, properties, and use cases, helping users make informed decisions about which herbs to incorporate into their daily routines.

5) User Engagement:

• The AyurCare apps interactive elements like the prakruti assessment quiz and the Ayurvedic chatbot play a role, in engaging users by encouraging involvement and providing personalized guidance. Through the quiz users gain insights into their dosha composition empowering them to better understand their individual health requirements.

• Moreover, the AI driven chatbot delivers customized health tips and ongoing assistance to ensure users feel supported and engaged in practices. These features also serve a purpose by making learning about Ayurveda interesting fostering a deeper connection with holistic wellbeing principles and promoting adherence, to Ayurvedic advice.

V. CONCLUSION

The AyurCare application has displayed potential, in improving users' comprehension and utilization of concepts as seen in the results of the initial testing period. The Quiz feature, within the app exhibited a precision rate of 92% in identifying doshas confirming its efficiency and dependability when compared to evaluations conducted by seasoned Ayurvedic experts. This solid groundwork enables the application to offer tailored health suggestions with assurance.

The chatbot powered by AI, with the help of language models and Knowledge Graphs proved to be quite successful, in delivering health advice that was tailored to the specific context. This feature not guaranteed information but also built trust and increased user interaction. By utilizing Knowledge Graphs, the app was able to store and retrieve data efficiently allowing it to offer well organized responses to user questions.

Moreover, the extensive collection of plants and herbs obtained from [11] was extremely beneficial. By matching users dosha composition, with the herbs the application offered in depth details regarding each herb's characteristics, flavour, attributes and applications. This functionality assisted users in making informed choices, about their wellbeing.

Moreover, the engaging functionalities of the application, like the prakruti evaluation quiz and the assistant, greatly enhanced user interaction. These features encouraged hands on involvement and tailored advice nurturing a bond, with Ayurvedic ideologies and overall health principles.

In summary the AyurCare application effectively combines knowledge with modern technology to provide users with a trustworthy, informative and tailored health partner. Continuous updates and improvements, guided by user feedback and emerging Ayurvedic research, will be essential to maintain and enhance the app's relevance and accuracy, ensuring it remains an effective tool for promoting holistic health and well-being.

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