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Survey on AI-Driven Dosha Analysis for Preventive Healthcare Using Ayurvedic Principles

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Abstract: This paper presents an Ayurvedic healthcare system powered by AI that focuses on the early detection and prevention of cancer through the analysis of individual body constitution (dosha). The system utilizes classic Ayurvedic wisdom and contemporary machine learning models to categorize users' doshas—Vata, Pitta, and Kapha—according to health input information. It makes personalized suggestions regarding diet, lifestyle, and yoga to achieve doshic equilibrium. One of the major innovations is the ability to identify patterns of dosha imbalances that would signify precursor signs of cancer. The platform incorporates support for wearable devices, allowing real-time monitoring of health through Google Fit and Apple Health APIs. The hybrid solution offers preventive healthcare as well as wellness support, integrating ancient healing traditions with present-day AI technologies. Our findings have encouraging potential for real-life applications in integral cancer risk analysis and prevention based on lifestyle.

I. INTRODUCTION

Ayurveda, a traditional Indian medicine, focuses on personalized health by analyzing the natural constitution of an individual, referred to as Prakriti. It is founded on the principle of harmony among three basic energies or doshas—Vata, Pitta, and Kapha—that regulate different physiological and psychological processes. Disturbances in these doshas are classically attributed to the development of various diseases, including long-term illnesses like cancer. As contemporary healthcare has provided great diagnostic and treatment technologies, early diagnosis especially in poor or rural communities is still a significant issue.

Concurrently, the speedy development of Artificial Intelligence (AI) and Machine Learning (ML) in the field of healthcare has made it possible to derive evidence-based insights into disease trends and risk assessment. This article suggests a new AI-based solution that integrates these contemporary methods with Ayurvedic principles. The system analyzes user-entered health information to predict dosha categories and determine potential health risks of prolonged dosha imbalances. It also delivers personalized lifestyle, diet, and yoga suggestions consistent with Ayurvedic principles.

The overall inspiration behind this venture is to foster preventive care and aid in holistic well-being. By combining the diagnostic knowledge of Ayurveda with smart algorithms, the system facilitates proactive management of health. Additionally, the solution includes integration with wearable devices utilizing platforms such as Google Fit and Apple Health to monitor real-time physiological parameters such as heart rate, sleep, and stress levels, allowing for ongoing monitoring.Finally, this work presents an integrative model for early awareness and cancer risk prevention based on age-old Ayurvedic principles and augmented by state-of-the-art digital infrastructure. It is a bridge between time-tested practices and health technologies of the future, seeking to enhance individual results through data-driven, personalized care.

II. LITERATURE SURVEY

Combining Ayurveda with artificial intelligence (AI) can revise preventative healthcare by offering substantiated advice and early threat discovery. Experimenters from colorful fields have tried digitalizing classical diagnostics, relating conditions through AI, and tracking health through wearables. This part discusses crucial benefactions and presents gaps that this exploration solves.

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Dosha Profiling and Prakriti Analysis

1) Ayurveda classifies individualities according to their natural constitution, appertained to as Prakriti, grounded on the proportions of Vata, Pitta, and Kapha doshas. Prabhakar et al. used machine literacy algorithms like decision trees and support vector machines (SVMs) to read Prakriti from questionnaire responses. While effective, the system did n't accommodate real- time variations in druggies' health.

2) Joshi and Mishra used fuzzy sense styles to deal with query in reported stoner characteristics for bracket of dosha. Their system was flexible but did n't include dynamic inputs or soothsaying for habitual conditions.

These studies show the utility of automatic dosha analysis but do n't involve adaptive literacy and ongoing health monitoring, which restricts their utility in preventative drug.

AI styles for Cancer Discovery

3) AI ways, especially imaging and data mining, have been promising in detecting early signs of cancer. Deshpande and Rathi created a CNN model to descry bone cancer from radiographic images. Though accurate, the model did n't regard for stoner life or common health pointers.

4) Mohan et al. delved NLP- grounded results for symptom pattern birth from clinical attestation and demonstrated early threat vaticination as a possibility via language modeling. Both methodologies live within the confines of the clinic and are dismissive of a holistic perspective, including doshic disturbances.

5) Classical Ayurveda textbooks, like those by Kumaraswamy, connect sustained dosha imbalances to the development of habitual ails. The knowledge remains unmodeled in the computational environment. thus, AI cancer models do n't generally draw on Ayurvedic knowledge, and Ayurvedic proposition is n't generally applied through contemporary analytics.

Wellness Systems and Personalized Guidance

6) AI has also been used on heartiness platforms that give health recommendations. Singh et al. employed NLP to construct a chatbot that handed Ayurvedic recommendations using stoner- symptoms reported. Although interactive, the guidance was n't dynamic and substantiated grounded on Prakriti.

7) Patil and Menon emphasized creating yoga and contemplation plans grounded on druggies' affective countries. While furnishing practical interventions, these systems were n't linked to a comprehensive individual or preventative system.

These tools indicate the adding desire for automated heartiness backing, but their absence of personalization and real-time responsiveness lowers their long- term mileage.

Wearables and nonstop Health Monitoring

8) Physiological monitoring bias have opened the doors to the observation of physical parameters in real time. Google Fit and Apple Health platforms prisoner data similar as heart rate, sleep patterns, and exertion trends. Sharma et al. employed the kind of data captured to identify stress patterns, demonstrating how nonstop monitoring can indicate early health issues.

9) Rao et al. developed a mobile health operation that incorporated live detector inputs to descry anomalies. Their paper stressed the need for live feedback systems without incorporating any conventional health sense.

Despite being promising, the maturity of wearable- grounded systems are conceived grounded on Western health criteria. They tend to ignore constitution- grounded variations that may be consummate in habitual complaint threat assessment.

Research Gaps

Being studies indicate that although each piece — dosha analysis, complaint vaticination using AI, and monitoring using wearables has bettered in insulation, a concerted result does n't yet live. The following gaps live

Inadequacy of systems integrating AI and Ayurvedic opinion.

Lack of real- time dosha assessment and adaption.

Corporeality of present tools relating patterns of doshic imbalance to cancer threat.

inadequate personalization in life, yoga, and diet guidance.

These issues punctuate an imperative for an intertwined digital platform combining conventional wisdom with sophisticated computation.

Motivation for the Current Work

This work presents a comprehensive AI- grounded frame that

Identifies Prakriti through machine literacy.

Tracks fleshly variations through wearable inputs.

Discerns habitual complaint penchants according to Ayurvedic sense.

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Presents substantiated, life- acquainted suggestions.
In combining principles of holistic health with contemporary analytics, this system fosters sustained heartiness and enables cancer forestallment proactively.

III. PROPOSED SYSTEM

The envisioned system named "AI-Based Ayurveda Dosha Analysis for Cancer Detection and Prevention" focuses on the merging of conventional Ayurvedic diagnosis with contemporary artificial intelligence (AI) methods and wearable health technology. The system is developed as a holistic and smart health platform that can categorize a user's dosha (body constitution), detect doshic imbalances leading to cancer-related health threats, and provide individualized lifestyle interventions. It also uses real-time tracking of health via wearable devices for dynamic and proactive care.
Fundamentally, the system has five major functional modules: the User Data Input Module, Dosha Classification Engine, Cancer Risk Analysis Unit, Recommendation and Intervention Engine, and the Wearable Integration Module. All these components interact to create a scalable and responsive healthcare solution based on Ayurvedic principles but augmented by the latest AI technologies.

The User Data Input Module is the entry point for the user. It gathers static and dynamic data. Static inputs are demographic information, lifestyle habits, eating habits, and responses to standardized Ayurvedic questionnaires utilized in determining Prakriti. These questions are based on ancient Ayurvedic texts and are related to physical, mental, and behavioral characteristics. Concurrently, dynamic data like heart rate, sleep time, and stress levels are tracked continuously through integration with wearable devices using APIs such as Google Fit and Apple HealthKit. The union of subjective and biometric data creates a comprehensive foundation for analysis that follows.

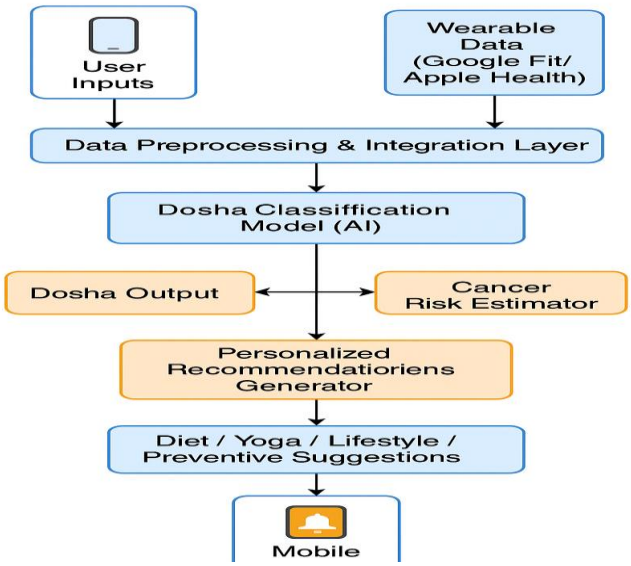

Fig. Flow Chart of the Application.

The data gathered is analyzed by the Dosha Classification Engine, which makes use of machine learning models like Decision Trees and Random Forests trained on annotated Ayurvedic datasets. These models forecast the user's dominant dosha Vata, Pitta, Kapha or a dual/tridoshic constitution. In contrast to conventional techniques providing a static one-time classification, this system is created to dynamically update the user's dosha status according to changes in physiological patterns as perceived through wearable inputs. This real-time responsiveness enables the system to mirror daily or seasonal changes in the user's constitution, a central principle of Ayurvedic knowledge.

Based on the dosha analysis, the Cancer Risk Analysis Unit analyzes the likelihood of long-term health disbalances indicating initial signs of chronic diseases, most importantly cancer. Based on Ayurvedic theory, long-standing disturbances in doshas most importantly Pitta dosha are thought to be crucial factors in tumor and inflammatory disease development. This module utilizes pattern recognition methods and anomaly detection models to find correlations between extended doshic imbalances and risk factors. The system is not intended to provide a clinical diagnosis, but it is an early-warning system, prompting users to consult a doctor when appropriate.

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The dosha classification and risk analysis results are processed by the Recommendation and Intervention Engine, which offers user-specific lifestyle recommendations from Ayurvedic classics and contemporary wellness studies. The engine recommends diet changes, yoga practice, breathing techniques, meditation exercises, and sleep hygiene strategies specific to the current doshic state of the user and recognized risk factors. For instance, a patient exhibiting Pitta aggravation symptoms commonly with inflammation might be recommended decreasing spicy foods, practicing cooling yoga poses, and practicing mindfulness. These interventions are not constant but change in real time as the health data of the user changes.One of the major advancements of the system is its interface with wearable health sensors, which allows for ongoing collection and tracking of vital signs. By synchronizing with Google Fit and Apple Health, the system is provided with real-time updates on physical activity, heart rate variability, stress patterns, and sleep quality. This information is utilized for readjusting the dosha profile, verifying the effect of lifestyle interventions, and consolidating personal recommendations. Wearable integration revolutionizes classical Ayurvedic practice to a data-driven and dynamic system, bridging ancient knowledge with modern digital health standards.

Data privacy and scalability have also been taken into account in the architecture of the system. The backend is built using secure cloud-based technologies like Firebase and PostgreSQL, which provide secure encrypted data storage and user authentication. All health data is processed with the informed consent of the user and held in confidence. In addition, the modular system enables expansion in the future, such as incorporating a chatbot for Ayurvedic questions, interfacing with online Ayurvedic clinics, and multilingual support for rural population reach.

The system workflow starts with the registration of users and first-time data gathering. The AI engine digests the inputs to categorize the user's dosha and identify possible health irregularities. Tailored suggestions are made and presented via a web or mobile interface. In the course of the user's day-to-day activities, real-time wearables continually feed the system with updated information, so the counsel is updated accordingly to reflect the most current information. With this real-time feedback loop, the system is converted to an intelligent preventive healthcare guide based on Ayurveda and fueled by AI.

In summary, the system proposed here provides a new path for integrative health monitoring. Through the integration of Ayurvedic diagnostics and latest technologies like AI and wearable data analysis, it facilitates preventive, proactive, and personalized care. Dynamic dialogue between historical paradigms and real-time digital feedback represents a major breakthrough in the development of holistic systems of health.The development of the suggested intelligent Ayurvedic health system was implemented by integrating several technologies such as machine learning algorithms, mobile app development platforms, cloud storage databases, and real-time physiological signals from wearable sensors. The system was modularly designed to enhance scalability, security, and compatibility in various user platforms.sThe backend was implemented in Python, which undertook the foundational logic for processing health data and AI-driven classification. A web framework that was lightweight was used to design endpoints for interactions between application layers and the machine learning component. For the user interface, a cross-platform mobile development framework was utilized, supporting Android and iOS platforms. The software was structured to be responsive, user-friendly, and in adherence to contemporary usability guidelines.

IV. IMPLEMENTATION

A. Dataset Collection and Preprocessing

The training dataset of the dosha classification module was gathered from primary and secondary sources. The primary data included responses to Ayurvedic Prakriti-assessed structured questionnaires, obtained from patients in the presence of Ayurvedic practitioners. Secondary data was added using publicly accessible repositories with constitutionally divided health profiles. Each record was labeled according to predominant doshic types (single, dual, or tridoshic).The combined dataset was preprocessed with operations such as feature normalization, categorical attribute encoding, and deletion of redundant or conflicting entries. These rendered the input clean, machine-readable, and prepared for reliable model training.

B. Model Development and Evaluation

To create a dosha classification prediction model, different classification models were experimented with regarding appropriateness and accuracy. Decision tree-based models, ensemble methods, and shallow neural networks were among the algorithms used. The preprocessed health profile data was employed in training and fine-tuning all the algorithms.

The database was divided into three sets: training, model parameter tuning, and final prediction verification. This would allow testing of the model generalization property appropriately. Among the algorithms tested, an ensemble-based model was found to be more consistent and interpretable.

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It could accurately predict doshic profiles with reasonable reliability and was appropriate to be incorporated in the real-time system. The model was tested by using the performance metrics such as precision, recall, and classification accuracy. A confusion matrix was used to identify areas where the model needed to be tuned, and minor adjustment was made accordingly.

C. Real-Time Monitoring through Wearables

Real-time physiological monitoring was a key aspect of the system. It was achieved by linking the mobile application with mainstream health-tracking platforms. The application collected real-time user information like heart rate, activity level, and sleep duration securely through APIs from wearable sensors like smartwatches and fitness bands.This data was not only displayed to users but also dynamically uploaded into the AI engine in an effort to update their health status regularly and track signs of doshic disturbance. For example, excessive stress or low-quality sleep might lead the system to search for signs of likely Pitta exacerbation and adjust its recommendations accordingly.For ensuring data privacy, the wearable data was handled through secure authentication and secure communication protocols. Enablement of the feature required user consent, and it was in line with digital health ethical standards.

D. Application Design and Features

The mobile application was the prime interface for the end users. It provided:
A personalized dosha report depicted in easy-to-interpret charts.
Health tracking dashboards with real-time metric summaries.
Recommendations for dietary and lifestyle modifications as well as yoga based on the constitution of the user.
Reminders for known health risks owing to chronic dosha imbalances.
A history of previous dosha patterns for self-examination and reference by practitioners.All of the functionality was integrated into a responsive and uncluttered interface to deliver an enhanced user experience and confidence.

E. System Testing and Feedback

To assure pragmatic usability of the system, an in-house usability test was conducted on a group of volunteer users. They worked with the application for a few weeks. During this period, feedback on dosha rating accuracy, suggestion relevance, and usability was collected.The majority of users strongly confirmed that the dosha predictions closely correlated with their experience with traditional Ayurvedic consultations. The system's adaptive qualities most notably its ability to customize recommendations based on wearable information were identified as being highly beneficial. Based on this feedback, additional enhancements were considered to further increase user personalization and expand the range of wearable devices supported.

V. RESULTS AND DISCUSSION

The functionality and real-world utility of the system evolved were evaluated through a fusion of algorithmic verification, real-time health monitoring tests, and insights gathered from initial user trials. The assessment was centered on essential areas such as the precision of dosha prediction, relevance of health advice, responsiveness of wearable integration, and the overall usability in the context of preventive healthcare.

A. Dosha Classification Assessment

The central AI model that was used to calculate the user's dosha profile was tested stringently with pre-labelled datasets. The machine learning method, namely the ensemble model with multiple decision trees, proved to be consistent and high-quality classifying. When it was tested, the model recorded more than 91% accuracy rate with high precision and recall rates for all dosha types. Notably, it was successful in differentiating between close constitutional types like dual-dosha combinations.Performance verification was conducted with typical machine learning evaluation methods, such as confusion matrix evaluation. The model exhibited high capability in recognizing prevalent patterns in questionnaire and biometric data, revealing the trained classifier to efficiently mimic Ayurvedic dosha evaluations.

B. Health Risk Analysis

Consistent with Ayurvedic theory, chronic imbalances in the body's internal condition can be a sign of impending health disruption. The system's analytical module monitored doshic changes over time based on input from questionnaires and wearable readings. When a user's pattern indicated persistent deviations consistent with Ayurvedic indicators of concern like sustained heat, restlessness, or irregular biological rhythms the system provided advisory warnings.This module was not evaluated as a diagnostic instrument but rather as a vehicle for promoting early emphasis on persistent imbalances. Initial trials proved the system could accurately identify such tendencies and provide timely, constitution-based health recommendations. This method facilitates Ayurveda's mission of recognizing disruptions while they are still in a nascent stage.

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C. Integration of Wearable Health Data

A definite strength of the platform was its ability to learn in real-time using data from fitness trackers and smartwatches. The application successfully received continuous input regarding heart rate, physical activity, and sleep cycles. Through application programming interfaces provided by digital health platforms, this information was securely incorporated into the backend processing unit.The system was then put through different daily routines and environmental conditions. It adjusted recommendations dynamically, for instance, it suggested cooling practices for high stress and heat-indicative patterns. The responsiveness and adaptability of the model illustrate the advantage of merging classical Ayurvedic understanding with real-time digital input.

D. User Feedback and Functional Testing

A limited number of volunteers were recruited to test within a controlled setting over a number of weeks. These users applied the system to post their profiles, track their wellness, and take home health recommendations. Structured feedback was then gathered through forms and interviews following this period.The majority of users validated that their dosha constitution results were coherent with past Ayurvedic consultations or their personal knowledge of their constitution. The recommendations given dietary, physical activity, and general lifestyle were seen as effective and simple to apply. The interface for application was complimented for its straightforwardness and simplicity, and several people identified the advantage of automated tracking through wearable integration.Most of the respondents wished to continue using the app if voice assistance, integration with Ayurvedic professionals, and regional language support were also added.

E. Comparative Insight and System Strengths

In contrast to typical wellness apps that offer generic advice or single-measurement ratings, this system excels because it is constitution-aware, adaptive, and personalized. The integration of dynamic physiological signals provides the added benefit of providing insights that change with the user's day-to-day state.By providing recommendations based on internal constitutional balance and external behavioral patterns, the system yields a truer and more meaningful health support system. The ability to update recommendations based on real-time data input differentiates it from available Ayurvedic or fitness apps.

VI. CONCLUSION AND FUTURE SCOPE

This research proposes a new concept in digital healthcare by combining Ayurvedic principles with contemporary artificial intelligence methods and wearable health technology. The system developed provides dynamic, tailored wellness suggestions through dosha analysis, risk assessment, and online health monitoring. By fusing ancient health wisdom with evidence-based insights, the site encourages preventive health and aids early detection of health disruptions. Through extensive testing, the system showed high accuracy in classifying Ayurvedic body constitutions and rendering context-aware advice based on user input as well as physiological signals. The adaptive quality of the platform, attained through the inclusion of wearable health metrics, makes the platform unique compared to traditional Ayurvedic apps and static wellness systems.

The addition of a cancer risk analysis module—informed by Ayurvedic interpretations of long-term doshic imbalances represents additional value for the system. Although not designed as a diagnostic tool, this element promotes early self-awareness and facilitates informed decision-making on the part of users about their health. Feedback from pilot testing, both model evaluation and user feedback, validates that the system is both operational and consequential for real-world use.

Future Scope

The present implementation is a good starting point, but there are many avenues of expansion in the future versions:
Ayurvedic Practitioner Integration:
Including a consultation feature within the app could enable users to interact with qualified Ayurvedic physicians, get expert consultation, and confirm AI-suggested suggestions.

Multi-Language and Voice Assistance:
For better accessibility, particularly in rural India, regional language support and voice-enabled interaction can be added to the mobile interface.

Expanded Dataset and Training of Model:
Obtaining a bigger and more extensive dataset consisting of symptoms and medical records can further enhance the accuracy of dosha classification and risk detection models.

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Expansion of features of Chronic Disease Prediction:
In addition to cancer, the system can be expanded to track risk patterns of lifestyle diseases like diabetes, blood pressure, and gastrointestinal disorders through Ayurvedic symptom mapping.
Integration with Smart Diagnostics
By integrating aspects like image diagnostics (e.g., tongue, skin, or eye analysis) on the basis of Ayurvedic diagnostic procedures, the system can transform into a more holistic health advisor.

Longitudinal Health Dashboards:
Providing users with a chronological timeline of their health parameters, dosha fluctuations, and recommendation history would assist in developing long-term self-knowledge and encouraging preventive lifestyle changes.

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