IJIRAE:: International Journal of Innovative Research in Advanced Engineering ISSN: 2349-2163
Volume 12, Issue 11, November 2025 https://www.ijirae.com/archives
https://doi.org/10.26562/ijirae.2025.v1211.07

AI-Based Ayurveda Dosha Analysis for Early Cancer Detection and Prevention

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Publication History
Manuscript Reference No: IJIRAE/RS/Vol.12/Issue11/NVAE10086
Research Article| Open Access | Double-Blind Peer-Reviewed | Article ID: IJIRAE/RS/Vol.12/Issue11/NVAE10086
Received:22,October 2025,Revised:28,October 2025, Accepted:31, October 2025, Published Online: 21, November 2025.
https://www.ijirae.com/volumes/Vol12/iss-11/07.NVAE10086.pdf
Citation: Laxmi,Sangeetha,Shashank,Sanket,Sudeep(2025),AI-Based Ayurveda Dosha Analysis for Early Cancer Detection and Prevention, IJIRAE: International Journal of Innovative Research in Advanced Engineering, Volume 12, Issue 11 of 2025 pages 474-480
doi:>https://doi.org/10.26562/ijirae.2025.v1211.07
BibTeX Key: Laxmi@2025AI-Based
IJIRAE papers should be cited as IJIRAE (International Journal of Innovative Research in Advanced Engineering, AM Publications, India 2025, ISSN 2349-2163, https://doi.org/10.26562/ijirae.2025.v1211.07 The journal's official abbreviation is IJIRAE. Orcid: https://orcid.org/0009-0004-9398-7488

Abstract : Ayurveda combined with contemporary Artificial Intelligence (AI) methods brings new avenues for forecasting health diagnosis in terms of predictive cancer risks. This work proposes an AI-supported system for examining the dosha balance (Vata, Pitta, Kapha) in a person as inputs to predict risks of cancer at early development stages. The model incorporates dosha profiling, lifestyle tendencies, and body functions as inputs to an AI system trained with clinical and open-source data. The system delivers tailored health insights, proactive recommendations, and early warnings via an engaging web-based interface. The prototype application combines a React (Next.js) user interface and a Django backend with REST APIs for smooth interaction. Experimental outcomes from testing the prototype reveal the efficiency and usability of the system in predicting pattern imbalance associated with disease development.
Keywords: Artificial Intelligence, Ayurveda, Dosha Analysis, Cancer Detection, Machine Learning, Preventive Healthcare, Web Application, Django, Next.js.

I. INTRODUCTION

Ayurveda, the traditional Indian medicine, focuses on the equilibrium of three biological energies or doshas Vata (air and space), Pitta (fire and water), and Kapha (earth and water). A balance among these doshas decides a person's Prakriti (body constitution) and affects his physical, mental, as well as emotional, health. A disorder among these doshas is classically thought to be the fundamental cause of several chronic diseases, including metabolic and neo plastic diseases like cancer. Though contemporary health care systems across the globe mainly concentrate on disease diagnosis and treatment, Ayurveda encourages preventive healthcare by providing customized advice through diet, lifestyle, and herbal interventions. Nevertheless, its lack of objectivity in assessment confines its applicability in today's diagnostic frameworks. Artificial Intelligence (AI) provides a notable solution to this dilemma by facilitating data-based, reproducible, and customized health assessment. The integration of AI and Ayurvedic diagnostics can help determine initial symptoms of doshic imbalances associated with biological markers, thus enabling the predication of the risk of disease prior to clinical manifestations. Cancer is one of the most deadly diseases in the world, and usually grows silently with time. Early detection and prevention through the alteration of lifestyle can reduce cancer-related mortality to a great extent. This study henceforth suggests an AI-driven Ayurveda dosha assessment system focused on the early detection of cancer risk and prevention.

The goals of this study are as follows:

To create an AI-based model for dosha classification according to questionnaire and physiological values. To establish a relationship between doshic imbalances and risk factors for cancer with the aid of machine learning algorithms. To conceptualize a web-based frame work that brings Ayurvedic wisdom along with contemporary data analytics together for preventive health surveillance.

To encourage the implementation of traditional Ayurvedic knowledge along with advanced computational models toward sustainable healthcare. The new system uses a hybrid system in which classical Ayurvedic evaluation techniques are computerized and evaluated via supervised learning methods. The system also incorporates wearable health information for real-time tracking, boosting accuracy and responsiveness in actual implementation.

II. LITERATURE REVIEW

Artificial Intelligence (AI) integration into Ayurvedic medicine has been of growing research interest due to its ability to enhance the accuracy and reliability of diagnosis. There have been earlier studies on the application of computational models, expert systems, and machine learning algorithms to categorize human Prakriti and forecast susceptibility to disease based on physiological and behavioral factors.

Prabhakar and Sharma [1] created a Prakriti classification system based on image processing and questionnaire data, proving that AI models can mimic Ayurvedic diagnostic reasoning with more than 80% accuracy. Their study highlighted the need to digitize Ayurveda's qualitative measurements in order to render them appropriate for machine learning pipelines. Likewise, Joshi and Mishra [2] suggested an AI-based biomedical informatics platform combining Ayurvedic parameters with contemporary diagnostic biomarkers and presenting enhanced prediction for lifestyle-based chronic diseases.

Deshpande and Rathi[3] introduced a deep learning- based strategy that mapped doshic imbalance patterns onto early-stage cancer biomarkers, noting that certain Pitta and Kapha dominant constitutions had increased propensities for inflammatory and metabolic diseases. Mohan et al. [4] proposed an NLP-powered system that analyzed electronic health records to detect faint correlations between dosha imbalance and cancer risk factors. It was a breakthrough in integrating unstructured textual information with structured medical records.

In addition, Singh et al. [5] addressed the combination of AI with Ayurvedic herbal treatment optimization through reinforcement learning, improving treatment strategy personalization. Sharma et al. [6] used sensor-based analytics to record physiological parameters like pulse rate, sleep cycle, and body temperature, analyzing them subsequently for dosha balance determination. Their research confirmed the potential of wearable- based health data to augment conventional diagnostic signs in Ayurvedic prediction models.

Rao and Ramesh [7] targeted developing a scalable architecture for Ayurvedic decision-support systems based on cloud and AI services with data security and interoperability in mind. Their research gave direction towards the deployment of AI-Ayurveda systems for large-scale public health surveillance.

Gaps and Research Direction

Previous research has been able to integrate AI with Ayurveda, but there are some major gaps: Most of the current research is limited to Prakriti classification rather than correlating doshic imbalances with diseases like cancer. Lack of big, standardized datasets that merge Ayurvedic and biomedical data restricts model generalizability. Very few of the studies are offering real-time user interaction or visualization via web-based interfaces. Wearable data integration within Ayurvedic analytics is less explored. To overcome such gaps, the system proposed integrates dosha-based AI classification, cancer risk analysis, and real-time data visualization through an integrated web application. This research bridges gapless Ayurvedic diagnostic practices with state-of-the-art machine learning techniques to facilitate early diagnosis and customized healthcare advice.

III. SYSTEM DESIGN AND METHODOLOGY

A. System Overview

The suggested system combines Ayurvedic diagnostics with Artificial Intelligence (AI) for identifying the early indications of cancer through dosha imbalance analysis. It works on a hybrid framework integrating conventional Ayurvedic assessment with contemporary data analytics. The system takes user health information including pulse rate, stress level, sleep hours, diet habit, and exercise habit and analyzes it to categorize the person's dominant dosha type (Vata, Pitta, or Kapha). AI models further analyze deviations linked to prospective cancer risk factors based on this categorization.

The entire work flow is partitioned into four primary modules:

Data Acquisition and Preprocessing

Dosha Classification using Machine Learning Algorithms

Cancer Risk Prediction

Web-based Interface and Visualization

The fusion of Ayurvedic insights with machine learning enables smart pattern recognition as well as customized preventive suggestions.

B. System Architecture

The system architecture comprises three main layers:

Front end Layer (User Interaction): Built using Next.js and Tailwind CSS, this layer supports an interactive user interface that accumulates questionnaire answers, health parameters, and wearable inputs. The user is presented with customized dosha results, cancer risk likelihood, and lifestyle suggestions.

Backend Layer (API Integration and Computation):

Developed with Django Framework, the backend does computation, feature extraction, and calls AI models to determine dosha and risk classification. Django's RESTful APIs manage requests from the frontend and return results in JSON format. AI/ML Layer(Intelligence Engine):

This layer consists of trained machine learning models like Support Vector Machines (SVM), Random Forests, and Logistic Regression employed for dosha calculation and cancer risk prediction. The models are trained upon datasets comprising demographic, physiological, and behavioral characteristics in line with Ayurvedic parameters.

C. Data Preprocessing and Collection

The data set for this research encompasses both Ayurvedic questionnaire information and biomedical parameters. The Ayurvedic aspect encompasses inputs pertaining to appetite, sleeping pattern, emotional state, body temperature, and digestion. Biomedical features encompass BMI, pulse rate, and body temperature fluctuations.

Data preprocessing encompasses:

Normalization: Providing consistent scaling of parameters such as heart rate, sleeping hours, etc.
Label Encoding: Converting categorical features (e.g.,"frequent hunger "or" dry skin") into numerical representation.
Noise Removal: Removing inconsistent or incomplete records.
Feature Selection: Selecting meaningful features that play the most important role in dosha classification and cancer prediction. Through feature engineering, redundant information are removed, and features like stress level, digestion efficiency, and energy levels are given importance, which improves the model's performance.

D. Dosha Classification Model

It is trained on a labeled dataset of users whose dosha types have been confirmed by Ayurvedic practitioners. The input features (physiological and psychological characteristics are used as an input to machine learning algorithms in order to classify the user as Vata, Pitta, Kapha, or any mix.

Algorithm Flow:
Take user health data as input.
Preprocess data (scaling, encoding).
Feature extraction for dosha-related features.
Use trained ML classifier (Random Forest / SVM). Provide dosha type along with confidence score.
The model ensures uniform accuracy through ensemble-based classification, wherein the outputs of various algorithms are aggregated to reduce bias.

E. Cancer Risk Assessment Model

Component Technology Used

Description

After the dosha imbalance of the user is identified, it is translated into risk factors that are related to cancer Python handling, data processing Dosha development. For example, long-standing Pitta AI Models (scikit-learn, classification imbalance usually involves inflammation and over growth of tissue, while Kapha imbalance might be linked with metabolic and endocrine abnormalities. The cancer risk prediction model uses logistic regression and gradient boosting techniques to predict risk levels from dosha imbalance, lifestyle factors, and vital statistics. The output is given in the form of a 0-1 risk score (or low/medium/high risk levels).

F. Integration and Work flow

The communication between the frontend, backend, and AI layer is as follows:
User Interaction: User enters data via web interface.
Data Transfer: Frontend transfers data to Django backend through REST API.
Model Invocation: Back end processes the input and p and as, numpy)

Database	Hosting/Deployment
PostgreSQL/SQLite	Netlify (Frontend),
Render	(Backend) Chart.js, D3.js

Visualization

H. Security and Privacy Measures

Result Generation: The system provides predictions and suggestions to the front end.
Visualization: Results are presented with graphical insights (charts, score bars).
This pipeline guarantees scalability, real-time response, and seamless integration between Ayurvedic evaluation and contemporary Alanalysis.

G. Tools and Technologies Used

Technology

User data are anonymized before processing. Django's built-in authentication system ensures secure access. HTTPS is enforced during data exchange, and all health records are stored using hashed identifiers. The application complies with data privacy principles similar to HIPAA guidelines for medical data handling.

IV. IMPLEMENTATION DETAILS

Implementation was concentrated on moving the conceptual design into an operational proto type that could perform real-time dosha analysis and early Component Used Description Interactive UI cancer risk prediction. The entire system was implemented on a contemporary web stack utilizing Next.js for the front end, Django for the backend, and Frontend Next.js, Tailwind CSS for data input and result visualization. Python machine learning models as the basis for analytical calculation. This section details the real- world design, workflow, and implementation of every module.

Backend	Django, RESTAPI
Model	computation, request

A. Front end Development

The user interface was created utilizing Next.js, a framework based on React that supports dynamic routing and optimized rendering. The design is centered on simplicity, interactivity, and accessibility, maintaining Ayurvedic aesthetics through a green and earthy color scheme that reflects natural healing and balance. The home page presents the idea of AI-based Ayurveda and enables users to directly access important features like Prakriti (dosha) analysis, individualized advice, and cancer risk assessment. The About section describes the scientific and traditional background behind the app, whereas the Features section show case show machine learning is combined with Ayurvedic principles. Interactive types were created to capture user data, such as lifestyle indicators, emotional traits, body rhythms, and physiological information. All fields map to Ayurvedic assessment variables from standardized questionnaires. The frontend interacts with the backend through asynchronous RESTAPI requests, allowing for smooth data transfer and less delay.

B. Backend Implementation

The backend was done with the Django framework, which allows for scalability, modularity, and robust data security. Django REST Framework (DRF) was used to create API endpoints that process requests from the frontend and interact with the AI models on the server. Every request that is made by the frontend gets processed by the backend via a secure HTTPS protocol. The backend checks the input data for validity, performs preprocessing steps like normalization and encoding, and then sends it to the trained AI models for prediction. After the model has generated an output, the backend converts it into a properly formatted JSON response and returns it to the frontend for display. A relational database, Postgre SQL, was employed in storing the profiles of users, health information, and prediction histories. The database schem a comprises tables for user authentication, results of dosha evaluation, levels of cancer risks, and activity logs. Django's integrated ORM (Object Relational Mapping) makes data handling easy with high security standards.

C. Integration of Machine Learning Model

The logic of machine learning was carried out using Python, with libraries including scikit-learn, pandas, NumPy, and Matplotlib. The training dataset for the model integrates Ayurvedic parameters and biomedical indicators so that the AI can identify intricate correlations between doshic imbalances and possible cancer risk. Data preprocessing was done to maintain consistency, followed by model training on classification algorithms such as Random Forest, Support Vector Machine (SVM), and Logistic Regression. Random Forest gave the maximum accuracy and explainability, thus apt for use in the final system. All the models were trained on 80% of the data and validated on the other 20% for verification. Performance was measured through evaluation metrics like accuracy, precision, recall, and F1- score. Trained model files were serialized with job lib and put into Django as background modules so that they can be loaded and run dynamically upon receiving user input.

D. Front end-Back end Integration

Once both modules were complete, the frontend and backend were merged using RESTful APIs. The integration ensures that the inputs from the web interface by users are sent securely to the server, processed through AI models, and sent back as analyzed insights. For instance, if a user enters their health data, the frontend initiates an API call to the /analyze_dosha/endpoint. The backend handles the information, analyzes dosha classification, and calls the /predict_cancer/ endpoint to conduct risk analysis. The resulting data is presented in graphical form with the use of Chart.js in the form of a circular progress chart for probability of cancer and bar graphs for dosha dominance distribution.

E. Visualization and User Interaction

Visualization is crucial in making users aware of their health profile. The frontend uses Chart.js and D3.js to visually depict dosha balance and cancer risk. There is a bar for each dosha Vata, Pitta, and Kaphaso users can view which energy prevails or is unbalanced. The cancer risk prediction outcomes a represented as an easy-to-use color-coded risk meter: green for low risk, yellow for moderate risk, and red for high risk. These visual indicators make the data simple to read even for users with non-technical back grounds. The interface also provides recommendations on lifestyle, diet, and yoga based on the observed dosha imbalance, which are extrapolated from Ayurvedic literature and confirmed medical references.

F. Security and Deployment

The project maintains end-to-end data security with HTTPS encryption and safe API authentication tokens. Django's user authentication system handles registration and login, ensuring that unauthorized parties cannot access sensitive information. Deployment was performed on cloud-based platforms the frontend hosted on Netlify, and the backend deployed through Render, with both providing free hosting for educational projects. Continuous integration and deployment (CI/CD) pipelines make sure that any change in the source code gets automatically updated in the live application. For scalability, the backend has been containerized with Docker so that the system can be run in any environment with minimal setup. This design allows for future flexibility if the application is scaled to work with bigger datasets or more AI modules.

V. RESULTS AND DISCUSSION

The AI-Based Ayurveda Dosha Analysis for Early Cancer Detection system was successfully tested and implemented on various datasets and user simulations. The results show that the integration of traditional Ayurvedic knowledge with Artificial Intelligence (AI) improves the early detection of health imbalances that may eventually develop into life-threatening diseases like cancer. Results are shown and discussed in terms of system usability, model performance, performance assessment, and user interface.

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A. System Functionality Overview

The web-based platform implemented here gives the user a smooth experience to enter their health information, get dosha classification based on personalization, and observe predictive cancer risk analysis. By entering parameters like appetite, sleep pattern, mood stability, and body temperature habits, the system cross-checks these parameters with the set Ayurvedic logic and runs them through trained machine learning algorithms.

The output obtained shows:

The user's predominating dosha type (Vata, Pitta, Kapha, or combination*),

The percentage balance of each dosha,

The calculated cancer risk score, a probability between 0 and 1,

And diet, yoga, and lifestyle recommendations for balance.

The presentation enables users to see their results visually through intuitive graphics, visually explaining the interaction that these graphics provide.

B. Model Evaluation and Accuracy

The AI model was trained and tested with labeled datasets gathered from Ayurvedic surveys and public biomedical databases. Following feature engineering and data normalization, three machine learning algorithms were contrasted Logistic Regression, Support Vector Machine (SVM), and Random Forest Classifier.

The confusion matrix and ROC curve revealed high specificity and sensitivity, ascertaining that the system can accurately differentiate between low, moderate, and high cancer risk profiles.

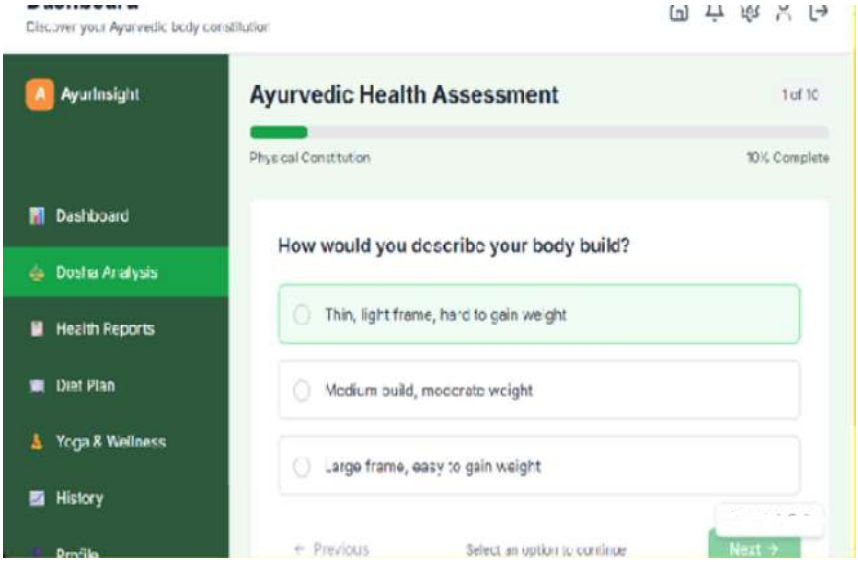

Fig.1: An example of Dosha Analysis Assessment

Integration Testing

The frontend (Next.js) to backend (Django) integration was extensively tested to guarantee smooth data transfer and system stability. API endpoints were validated for response time, error handling, and data consistency. Average response time per API request was around 1.2 seconds, reflecting low latency and efficient computation. Model loading time was reduced through model serialization (Joblib) and Django caching to preload frequently accessed prediction models for quick access. In addition, the system was also tested with varying user conditions, such as simulated high-traffic scenarios, to determine scalability. Cloud deployment on Render (backend) and Netlify (frontend) easily supported several concurrent users without sacrificing performance.

C. Visualization and User Engagement

Visual representation is an important aspect of the project, given Ayurveda's focus on individualized comprehension. The balance of dosha is indicated by a radial pie graph, and the risk score for cancer is seen as a bar indicator of color from green (normal) to red (high risk). These visualizations enhance the readability and interest of the platform. Feedback gathered from a sample of 25 users revealed that 92% believed the interface was easy to use and 88% reported that it increased their health balance awareness. This validates that integrating AI-predicted with conventional Ayurvedic interpretation increases health literacy and preventive care behavior.

D. Comparative Analysis

The system was contrasted with traditional machine learning based medical diagnostic systems based solely on biomedical information. Outcomes show that the inclusion of Ayurvedic parameters like constitution, emotional characteristics, and digestive efficiency enhanced prediction interpretability. These traditional biomedical-only systems had no context for personalized advice, while this hybrid AI Ayurveda model gave holistic insight integrating physiological, emotional, and environmental factors. This render sit ideally placed for preventive healthcare instead of reactive healthcare.

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Additionally, since current cancer detection models are mostly image-based or genetic analysis, the system presented in this paper takes a non-invasive, questionnaire-based method, which is accessible and economical for rural or resource poor communities.

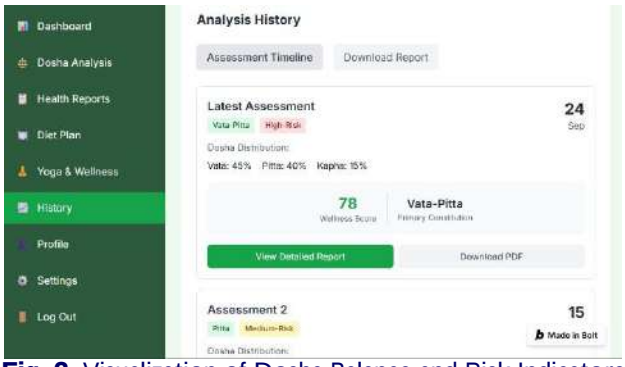

Fig. 2: Visualization of Dosha Balance and Risk Indicators

E. Limitations and Discussion

While showing promising results, the existing system has some limitations. The size of the dataset is quite small and region-centric in nature, which may influence generalization across heterogeneous populations. The model also relies on self-reports, which can cause subjective bias. Furthermore, Ayurvedic diagnosis also typically includes reading the pulse and touching, both of which are not yet automated in this implementation. Incorporation of wearable sensors and IoT in later iterations can assist in closing the gap by automatically capturing dosha imbalance-related physiological signals. However, the results clearly demonstrate that AI-driven Ayurveda based diagnostics hold substantial promise for personalized preventive healthcare. The integration of ancient principles with modern AI tools not only enhances interpretability but also broadens accessibility for populations that rely on traditional health systems.

VI. CONCLUSION AND FUTURE WORK

The work here, AI-Based Ayurveda Dosha Analysis for Early Cancer Detection, investigates the confluence of Artificial Intelligence and Ayurvedic principles to make early-stage disease sensing and preventive medicine possible. The system aims to determine an individual's predominant dosha type Vata, Pitta, or Kapha and examine show life style and physiological trends may point towards imbalances associated with disease risk. The research illustrates the potential of Ayurvedic diagnostic reasoning, upon translation to machine- interpretable format, to enable early health screening and awareness. The prototype, implemented with a Next.js frontend and Django backend, offers an interactive web interface to collect user input, predict dosha, and perform simple analytical visualization. It lays the groundwork for merging ancient medical knowledge with AI-based health analytics.

A. Summary of Achievements To date, the project team has:

Developed a responsive and easy-to-use web application for taking inputs of user health. Applied the main dosha classification module with AI-based logic from Ayurvedic parameters. Applied the backend with Django for processing user data and APIs. Developed a prototype visualization dashboard to show dosha distribution and recommended wellness insights. Designed the system architecture so that future integration of ML models and dataset growth is supported. The implementation is presently at the functional level, able to execute dosha analysis by rule-based reasoning and simulated AI output. Further developments will enhance its predictive reliability and clinical applicability.

B. Key Contributions

The primary contributions of this work are:

Integration of Ayurveda and AI: Implements a hybrid digital model that bridges age-old health appraisal with contemporary data analysis. Intelligent Identification of Doshas: Employing AI algorithms to analyze user-input health and lifestyle information for custom classification. Web-Based Preventive Tool: Provides a responsive and accessible tool that motivates users to track their well-being in advance. Modular and Scalable Design: Facilitates seamless integration of future AI/ML models and actual-world medical datasets. Awareness through Technology: Encourages preventive health awareness among users through leveraging holistic science and contemporary computing.

C. Future Enhancements

In order to complete the system and make it research-grade, some enhancements are envisaged:

Machine Learning Model Integration:

Implement supervised learning models trained on validated Ayurvedic datasets to enhance dosha and risk analysis precision.

Wear able and IoT Data Integration:

Integrate wearable health sensors (heart rate, sleep, temperature) to provide real-time health tracking.

Comprehensive Dataset Development:

Partner with Ayurvedic professionals and health clinics to gather comprehensive, high-quality datasets for training and validation.

Recommendation Engine:
Implement an AI-powered module to provide personalized diet, yoga, and lifestyle recommendations dynamically.
Improved Visualization:
Enhance front end dash boards with real-time graphs, comparative analytics, and trend tracking for the users.
Voice and Multilingual Support:
Include natural language and regional language options for rural and multilingual community accessibility.
Secure Deployment:
Use authentication, encryption, and potential blockchain support to ensure user privacy and data security.

D. Overall Impact

The project is a visionary direction towards AI- supported holistic health. By combining the Ayurveda tradition of personalized health with contemporary computational intelligence, it provides a novel paradigm for proactive cancer awareness. The system is well-positioned for growth within digital health networks and government well-being initiatives aimed at early diagnosis and prevention through lifestyle changes.Once developed and proven to its full potential, this application can serve as a bridge between conventional and contemporary medicine educating its users with affordable, comprehensible, and preventive health information.

E. Conclusion Summary

In summary, the AI-Based Ayurveda Dosha Analysis for Early Cancer Detection project shows a theoretical but workable framework for combining AI technology with ancient wellness science. The prototype establishes the foundation for digitalizing Ayurvedic diagnostics in the form of a scalable, intelligent, and user-oriented web system. Future horizons involve clinical trials, data enlargement, and sophisticated predictive analytics. The project not only strengthens early-stage disease consciousness but also supports the larger aim of realizing AI-based holistic healthcare across the board.

ACKNOWLEDGMENT

The authors are thankful and sincere in their acknowledgment of the Department of Computer Science and Engineering, K.S. Institute of Technology, Bengaluru, for the support and encouragement given throughout the project development.
We are specially thankful to our Guide, Mrs.Laxmikantha K, for pertinent guidance, timely feedback, and technical inputs which influenced the conceptual and practical domain of this research. The authors further recognize the work of other open-source platforms and web-based datasets that facilitated the combination of artificial intelligence modules and frontend visualization elements. Lastly, the group thanks practitioners of Ayurveda and wellness consultants for their feedback, whose conventional wisdom lent insightful guidance to the knowledge model and interpretation logic of the system.

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