

# Nivarana: An Ayurvedic Diet Management System

A Rule-Based Personalized Dietary Recommendation System Integrating Ayurvedic Principles with Modern Computational Techniques

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## ABSTRACT

**This paper presents Nivarana**, a web-based Ayurvedic Diet Management System that bridges traditional Ayurvedic nutritional wisdom with contemporary computational methods to deliver personalized dietary guidance. Modern dietary applications predominantly rely on generic nutritional metrics and fail to capture the individualized, constitution-centric approach advocated by Ayurveda. Nivarana addresses this gap by integrating a structured Dosha (Vata, Pitta, Kapha) assessment questionnaire with a rule-based food filtering engine and health-goal alignment module to generate tailored meal plans. The system collects user-specific inputs, computes Dosha severity scores, cross-references a curated Ayurvedic food database, and produces personalized diet recommendations alongside modern nutritional metrics. The application follows a three-tier modular architecture — Presentation, Application, and Data layers — built using React.js on the frontend, Python (Flask/FastAPI) or Node.js on the backend, and MySQL as the relational database. Results demonstrate that the system consistently produces coherent, goal-aligned dietary suggestions for common health conditions including heart health, weight management, and diabetes management. This work establishes a replicable digital framework for Ayurvedic personalized nutrition and highlights the potential of knowledge-driven computing to enhance holistic healthcare accessibility.

**Keywords**— Ayurveda; Dosha Assessment; Personalized Nutrition; Diet Recommendation System; Rule-Based System; Prakriti; Web Application; Health Informatics

## I. INTRODUCTION

Diet has long been recognized as a cornerstone of preventive healthcare, and within the Ayurvedic system of medicine — one of the world's oldest holistic healing traditions — food is considered not merely a source of nourishment but a therapeutic agent capable of restoring physiological and psychological balance [1]. Ayurveda classifies every individual according to their inherent body constitution, known as Prakriti, which is determined by the relative dominance of the three fundamental bio-energies or Doshas: Vata, Pitta, and Kapha. Dietary recommendations are tailored based on this constitutional profile and the individual's current health objectives [8].

Despite the richness of Ayurvedic dietary science, its application in modern healthcare settings remains largely manual, practitioner-dependent, and inaccessible to the broader population. Existing digital diet-management applications offer calorie counters, macro-nutrient trackers, and generic meal plans, but they do not incorporate Ayurvedic intelligence or account for individualized constitutional differences [3]. This creates a significant gap: users seeking holistic, constitution-sensitive dietary guidance lack a structured digital platform that merges traditional Ayurvedic knowledge with modern technology.

This paper presents Nivarana — meaning 'remedy' or 'relief' in Sanskrit — an intelligent, web-based Ayurvedic Diet Management System designed to digitize and standardize the Ayurvedic diet planning process. The system evaluates a user's Dosha tendencies through a structured assessment questionnaire, aligns the results with chosen health goals, and

generates personalized dietary recommendations by querying a curated Ayurvedic food database through a rule-based decision engine. By integrating classical Ayurvedic principles with modern software design practices, Nivarana demonstrates how traditional health sciences can be effectively translated into scalable, user-friendly digital tools.

## II. LITERATURE REVIEW

Payyappallimana and Venkatasubramanian [1] provided a comprehensive review of Ayurvedic food knowledge, emphasizing the therapeutic role of diet in managing lifestyle diseases. Their work established a conceptual foundation for digitally modeling Ayurvedic dietary attributes alongside modern nutritional data.

Vijayakumar et al. [2] developed an Indian food composition database, one of the first efforts to systematically encode the nutritional profile of Indian foods. This work is directly relevant to building the food database required by Ayurvedic diet management systems targeting Indian populations.

Abeltino et al. [3] surveyed digital applications for diet monitoring and precision nutrition, identifying a gap in systems that integrate traditional medical frameworks with modern nutrition science. Their analysis supports the need for culturally embedded solutions like Nivarana.

Research on technological enhancements for personalized dietary management in chronic conditions [4] has shown that rule-based and knowledge-driven systems outperform generic recommenders in adherence and patient satisfaction, validating the design choice of a rule-based engine in Nivarana.

The AYUSH digital initiatives report [5] highlighted how India's Ministry of AYUSH has been promoting technology-enabled Ayurvedic services, underscoring the policy relevance and national need for platforms like Nivarana.

Banerjee et al. [7] introduced the concept of Ayurnutrigenomics, demonstrating the scientific basis for individualized Ayurvedic nutrition rooted in genetic and constitutional differences. This supports the personalized, Dosha-based approach adopted in this system.

Collectively, the literature affirms both the scientific validity of Ayurvedic dietary science and the absence of scalable, structured digital tools that operationalize its principles for everyday users.

## III. PROBLEM STATEMENT & OBJECTIVES

### A. Problem Statement

Conventional digital diet applications are generic, nutrition-metric-centric, and fail to account for the individualized, constitution-based dietary guidance that Ayurveda offers. Ayurvedic practitioners currently create diet charts manually, a process that is time-consuming, non-standardized, and geographically constrained. There exists no widely accessible, systematically designed digital platform that operationalizes Ayurvedic dietary intelligence through a structured, rule-based approach aligned with evidence-based health goals.

### B. Project Objectives

- Design and implement a personalized Ayurvedic diet management system grounded in Dosha assessment.
- Implement a standardized questionnaire for determining individual Prakriti (body constitution).
- Generate personalized diet recommendations by combining Ayurvedic food properties with health-goal constraints.
- Integrate modern nutritional metrics (macronutrients and micronutrients) with Ayurvedic food classifications.
- Provide an interactive, responsive web interface for diet planning, food filtering, and meal visualization.
- Enable secure storage and retrieval of user profiles, dietary histories, and progress records.
- Automate meal plan generation, reducing dependency on manual practitioner effort.
- Ensure cross-device accessibility through a web-based architecture.

## IV. SYSTEM ARCHITECTURE & DESIGN

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Nivarana follows a modular, three-tier architecture that ensures separation of concerns, scalability, and maintainability.

### A. Presentation Layer (Frontend)

The frontend is built with React.js, styled using CSS, and structured with HTML5. It provides: a landing page and authentication interface (login/signup); a 15-question Dosha assessment questionnaire; a health goal selection screen; and a results page displaying the personalized meal plan and Dosha analysis. The interface is designed to be fully responsive across desktop and mobile devices.

### B. Application Layer (Backend Logic)

The backend is implemented in Python using Flask or FastAPI, or alternatively in Node.js with Express. It hosts four primary modules:

- User Management Module — handles authentication, session management, and user profile storage.
- Dosha Assessment Module — processes questionnaire responses and computes Vata, Pitta, and Kapha scores, further classifying severity as Low, Mild, Moderate, or High.
- Food Filter Engine — cross-references user Dosha scores and health goals against the food database using intersection-based rule logic.
- Meal Plan Generator — assembles filtered foods into a structured, user-readable meal plan with nutritional breakdowns.

### C. Data Layer (Knowledge Base)

The data layer uses MySQL as the relational database and stores curated, structured Ayurvedic knowledge across the following tables:

- Users — login credentials, profile data, and assessment history.
- Assessments — questionnaire responses and computed Dosha scores per session.
- Food Items — food name, category, Vata/Pitta/Kapha effect scores, and health-goal suitability tags.
- Meal Plans — generated plan records linked to users and assessment sessions.
- Meal Items — individual food entries within a meal plan with portion data.

### D. Output Layer

Post-processing, the system delivers: the final Dosha result and severity summary; a recommended food list filtered by both Dosha profile and health goal; a structured daily meal plan; and optional supporting explanations of why specific foods are recommended.

## V. METHODOLOGY

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### A. Dosha Assessment

The Dosha assessment consists of 15 structured questions covering physical constitution, temperament, digestion, sleep patterns, and lifestyle tendencies. Each question carries a weighted response mapped to one of the three Doshas. Upon submission, the system computes aggregate Vata, Pitta, and Kapha scores and classifies them into four severity bands. The dominant Dosha or combination is identified as the user's current imbalance profile.

### B. Rule-Based Food Filtering Engine

The food database encodes each food item with numerical effect scores for each Dosha (pacifying or aggravating) and binary suitability tags for supported health goals (e.g., Heart Health, Weight Loss, Diabetes Management, Digestive Health). The filtering engine uses an intersection-based logic: it first filters foods that pacify or are neutral to the dominant Dosha, then intersects this set with foods suitable for the selected health goal. In cases of Dosha conflict, severity scores are used as tie-breakers to resolve contradictions. The result is a curated list of recommended foods organized by meal type (breakfast, lunch, dinner, snacks).

### C. Meal Plan Generation

The Meal Plan Generator takes the filtered food list and assembles a structured daily meal plan. It distributes foods across meal slots, suggests portion sizes, and computes aggregate nutritional metrics (calories, carbohydrates, proteins, fats, fiber) for the generated plan. The output is rendered in a clear, patient-friendly format with Ayurvedic categorization labels.

### D. System Workflow

The end-to-end workflow proceeds as follows: (1) User registers or logs in; (2) User completes the Dosha assessment questionnaire; (3) The backend computes and stores Dosha scores; (4) User selects a health goal; (5) The Food Filter Engine queries the food database and generates recommendations; (6) The Meal Plan Generator assembles the final plan; (7) The frontend renders the personalized meal plan; (8) User may opt for reassessment or goal change, restarting the process.

## VI. IMPLEMENTATION

### A. Technology Stack

| Layer / Component | Technology                                                      |
|-------------------|-----------------------------------------------------------------|
| Frontend          | React.js, HTML5, CSS3, JavaScript                               |
| Backend           | Python (Flask / FastAPI) or Node.js with Express                |
| Database          | MySQL / PostgreSQL                                              |
| Rule Engine       | Custom rule-based logic (Dosha scoring, intersection filtering) |
| Development Tools | VS Code, Git, Google Colab                                      |
| Hosting           | Free-tier cloud / Local server                                  |

Table I: Technology Stack of Nivarana

### B. Dataset Preparation

A curated food database was compiled from trusted Ayurvedic textual sources, encoding each food item with: (a) Dosha effect scores for Vata, Pitta, and Kapha; (b) health-goal suitability flags for all supported conditions; and (c) standard nutritional values (calories, macronutrients) aligned with ICMR NIN data [6]. All entries were validated for consistency and structured into relational database tables to enable efficient querying.

### C. Development Phases

Development proceeded through seven sequential phases: Literature study and requirement gathering; System and database schema design; Dataset compilation and validation; Frontend UI development (login, assessment, results screens); Backend logic and rule engine implementation; Frontend-backend integration; and System testing and validation. Each phase involved peer review within the three-member team to ensure quality and correctness.

## VII. RESULTS & DISCUSSION

The implemented system successfully accepts user inputs through the Dosha assessment questionnaire, computes Dosha severity classifications, and generates personalized meal plans. Across test scenarios covering users with dominant Vata, Pitta, and Kapha profiles combined with health goals such as heart health, weight loss, and diabetes management, the system consistently produced coherent, rule-compliant food recommendations.

The rule-based approach proved effective for the defined set of health goals and Dosha profiles. The intersection logic correctly excluded foods aggravating the dominant Dosha while simultaneously satisfying health-goal constraints in all tested configurations. Nutritional metrics computed for the generated plans fell within recommended daily intake ranges for the respective health conditions.

The modular architecture facilitated independent testing of each component: the Dosha scoring engine, the food filter, and the meal plan generator were validated separately before end-to-end integration testing. The web-based interface rendered correctly across desktop and Android mobile browsers, confirming cross-device accessibility.

The total development cost of the system remained under INR 1,600, demonstrating that meaningful healthcare-adjacent digital tools can be built at minimal cost using freely available open-source technologies — an important consideration for student-level academic projects targeting societal impact.

## VIII. ADVANTAGES & LIMITATIONS

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### A. Advantages

- Automates personalized Ayurvedic diet chart generation, eliminating manual practitioner effort for common health goals.
- Integrates modern nutritional metrics (macronutrients, micronutrients) with Ayurvedic food properties for a holistic output.
- Patient-centric design captures comprehensive lifestyle and constitutional data to produce genuinely individualized recommendations.
- Web-based architecture ensures platform-independent accessibility for both users and practitioners.
- Systematic patient record storage enables longitudinal dietary tracking and continuity of care.
- Modular and scalable design allows future expansion with minimal architectural rework.

### B. Limitations

- The food database covers a curated set of items and may not include all regional, seasonal, or packaged food products.
- Recommendations are based solely on self-reported questionnaire responses; the system does not incorporate clinical test results or real-time physiological data.
- The system follows a generalized interpretation of Ayurvedic principles, which may not align with every regional tradition or expert practitioner's approach.
- The rule-based engine is optimized for common health goals and may not adequately handle users with multiple comorbidities or rare dietary restrictions.
- The fixed 15-question questionnaire may not capture nuanced Prakriti factors such as seasonal effects, mental state, or long-term habit patterns.
- The system is intended as a supplementary guidance tool and is not a substitute for consultation with a certified Ayurvedic physician or clinical nutritionist.

## IX. APPLICATIONS

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- Personalized dietary guidance for individuals seeking Ayurvedic-aligned lifestyle management.
- Supplementary digital tool for Ayurvedic clinics to standardize and accelerate diet chart generation.
- Educational platform for students and beginners learning the application of Ayurveda in nutrition.
- Digital reference for Ayurvedic food categorization and Dosha-property mapping.
- Foundational module for broader Ayurvedic wellness applications incorporating yoga, mindfulness, and Dinacharya (daily routines).

## X. FUTURE SCOPE

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The current system establishes a solid foundation for several significant enhancements:

- Integration of wearable health-tracking data (activity levels, sleep quality, stress indicators) for real-time adaptive diet plans.
- Advanced Prakriti profiling incorporating Vikriti (current imbalance state), digestive strength (Agni) analysis, and seasonal dietary adjustments (Ritucharya).

- Expansion of the food database to include regional ingredients, traditional Indian recipes, and preparation methods aligned with Dosha-balancing principles.
- Incorporation of machine learning models to detect patterns in user responses and progressively improve recommendation accuracy.
- Multi-language support to reach regional populations across India.
- Integration with Ayurvedic practitioners for teleconsultation, enabling a hybrid digital-human care model.
- Comprehensive wellness ecosystem expansion including yoga routine recommendations, habit coaching, and mindfulness modules.

## XI. CONCLUSION

This paper presented Nivarana, an Ayurvedic Diet Management System that successfully demonstrates how classical Ayurvedic dietary principles can be operationalized within a structured, user-friendly digital application. By combining a Dosha assessment module, a rule-based food filtering engine, and a personalized meal plan generator within a modern three-tier web architecture, the system delivers coherent, constitution-aligned dietary recommendations for a range of health goals.

The project validates a replicable digital framework for Ayurvedic personalized nutrition, highlighting the compatibility of traditional health knowledge with modern software engineering. While current limitations exist around database coverage and clinical integration, the system provides a meaningful step toward making Ayurvedic dietary guidance accessible, standardized, and scalable in a contemporary digital format.

Nivarana demonstrates that traditional wellness principles, when encoded through well-designed computational frameworks, can deliver practical, personalized health guidance to the broader population — contributing to the growing intersection of ancient knowledge systems and modern health informatics.

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