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Usability Review of Nadi Parikshan Devices

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***Abstract*— Pulse, a soft yet forceful marker of health, is crucial to both traditional and contemporary diagnostics. Nadi Parikshan, the traditional Ayurvedic practice of pulse examination, provides profound insight into the internal equilibrium of the body. There has been increasing interest in recent years in digitizing this process with the aid of biomedical sensors, artificial intelligence, and data visualization tools [1].**
This article analyzes the usability and clinical significance of Nadi Parikshan-based diagnostic instruments like Nadi Tarangini, AyuDevice, and Nadi Yantra [5][6][7]. Based on a comparative analysis of existing technologies and academic studies, it outlines major areas of inaccuracy, practitioner confidence, and interface usability. The research also suggests improvements such as sensor fusion and Ayurveda-conformant algorithms. Connecting ancient diagnostic insight with contemporary health technologies can facilitate more accessible and standardized systems for individualized care.

***Index Terms*— Nadi Parikshan, Ayurvedic Diagnostics, Pulse Diagnosis, Biomedical Sensors, Usability Evaluation, AI in Ayurveda, Digital Health, Sensor Fusion, Personalized Healthcare.**

I. INTRODUCTION

The human body is a complex system made up of interdependent physiological, biochemical, and neurological subsystems. In Ayurvedic medicine, this multifaceted nature is understood in terms of the Tridoshas—Vata, Pitta, and Kapha—each of which is controlled by the five elements or Pancha Mahabhutas: Earth, Water, Fire, Air, and Ether [1]. These doshas are thought to impact not just physical functions but also mental and emotional well-being, and their equilibrium is key to staying healthy.

Among Ayurveda's foundational diagnostic methodologies is Nadi Parikshan, or the use of pulse diagnosis, a method of gauging nuanced pulse changes through palpation in defined wrist locations. Skilled Ayurvedic clinicians read the rhythm, depth, tension, and quality of the pulse in order to establish doshic imbalances [2]. Although considered precious, it is a subjective technique that can't be easily standardized because of its dependence upon the practitioner's expertise.

To address this limitation, scientists and developers have come up with digitized Nadi Parikshan devices based on biomedical sensors, signal processing algorithms, and artificial intelligence for emulating classic pulse reading [3][4]. These devices are intended to improve diagnostic consistency, facilitate data-driven analysis, and increase access to Ayurvedic assessment.

This research synthesizes current Nadi Parikshan devices–such as Nadi Tarangini, AyuDevice, and Nadi Yantra–and evaluates their clinician usability, clinical utility, and technological restraints.

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This identifies issues including practitioner resistance, gaps in accuracy, and usability in interface, alongside suggesting design improvements based upon traditional Ayurvedic reasoning, as well as contemporary usability

II. Literature Review

Nadi Parikshan is perhaps the most respected non-invasive diagnostic method in Ayurveda. Based on classical texts such as the Charaka Samhita and Sushruta Samhita, it focuses on the analysis of pulse characteristics to determine imbalances of the Tridoshas—Vata, Pitta, and Kapha—each connected to the five elements (Pancha Mahabhutas) [1]. Ancient texts link each dosha with a specific Gati (pulse movement): Vata with snake-like movement, Pitta with frog-like beats, and Kapha with a swan-like flow [2].

Though conventionally carried out by skilled Vaidyas employing tactile perception, Nadi Parikshan has been questioned in contemporary clinical communities owing to its subjectivity and non-reproducibility [3]. In an attempt to overcome these issues, scientists have tried to digitize the practice through the use of biomedical sensors, artificial intelligence, and signal processing methods. Initial research used MEMS-based sensors to detect pressure changes in radial arteries [4], whereas newer systems employ photoplethysmography (PPG), piezoelectric sensing, and sophisticated algorithms.

Kulkarni et al. (2020) investigated AI-driven diagnostics by categorizing pulse signals based on PPG analysis and machine learning [5]. Chhangani et al. (2018) illustrated the use of digital signal processing for doshic-correlated waveform segmentation [6]. Equipment such as Nadi Tarangini employs triple-sensor arrangements to mimic three-finger palpation and enable mobile-based diagnostics [7]. In the same line, AyuDevice, developed at IIT Bombay, prioritizes tactile signal resolution and algorithmic pattern matching [8]. Nadi Yantra by S-VYASA University emphasizes hardware reduction with piezoelectric elements for affordable clinical uptake.

Even though promising, most systems cannot integrate the complete diagnostic context of Ayurveda. Prakriti (constitutional type), seasonal impact (Ritucharya), and the mental-emotional state of the patient are infrequently integrated into device logic. In addition, metaphors of Gati-based pulses are not yet envisioned in computational models, and therefore interpretability gaps exist [9].

With digital Ayurveda making waves—supported by international integrative health programs and funding—there is an urgent need for cross-disciplinary convergence to develop tools that are technically sound and culturally relevant. This review provides the foundation for assessing such systems based on usability, acceptability, and clinical utility, and exploring avenues for refinement and further alignment with Ayurvedic fundamentals.While existing literature has explored both the traditional basis and technological evolution of Nadi Pariksha devices, very few studies have reviewed these tools through the lens of usability and practical clinical adoption. This paper aims to fill that gap by focusing not just on the sensor technologies, but on how these devices perform in real-world conditions—considering aspects such as interface design, learning curve, interpretability, and clinician trust. By evaluating these dimensions, this review contributes a new perspective to existing research and emphasizes the need for systems that are both technologically sound and practically usable in Ayurvedic healthcare.

III. Device Overview

As the effort to modernize Ayurvedic diagnostics has gained momentum, various Nadi Parikshan machines have emerged that combine sensor technology with Ayurvedic pulse analysis models. These machines seek to model the three-finger palpation method of Vaidyas through sensor arrays strung over the radial artery to detect pulse waveforms and doshic changes. Some of the front-running devices in clinical applications or research are listed below:

A. Nadi Tarangini

Atreya Innovations developed one of the commercially most viable digital Nadi Parikshan devices, Nadi Tarangini. It makes use of a triple-sensor pressure array to record radial pulse signals at Vata, Pitta, and Kapha locations. The device connects to a mobile app for visualizing pulse graphs and offering dosha-based diagnoses. It has been utilized in Ayurvedic wellness centers as well as research [7]. Major strengths are ergonomic design, rapid data acquisition, and cloud-based integration. It is, however, dependent on interpretation algorithms that do not necessarily conform to classical

B. AyuDevice

AyuDevice is an IIT Bombay research platform to examine human pulse dynamic variability through capacitive and pressure sensing. It deals with real-time signal fidelity and converts mechanical fluctuation into interpretable

digital form [8]. While Nadi Tarangini was tested exclusively in clinics and has a high-end-user-focus approach, AyuDevice primarily exists in university setups and adopts profound data analysis instead of end-user diagnostics. It incorporates calibration protocols to model doshic interpretations with Vaidya feedbacks.

C. Nadi Yantra

VYASA University has developed Nadi Yantra, which has a piezoelectric-based sensing module integrated into a specially designed wrist bracket. It records pulse patterns at the three routine diagnostic points and converts them into frequency and amplitude data for doshic classification [9]. While still constrained in clinical use, Nadi Yantra is affordable and can be trained institutionally, so it is amenable to incorporation into Ayurvedic training.

D. Comparative Insight

Although these machines differ in design, price, and technological sophistication, their common purpose is to computerize an essentially tangible and intuitive practice. Each system offers a distinctive solution to objectifying pulse information. Yet, the majority are still not well integrated with other Ayurvedic paradigms like Prakriti profiling or assessment of emotional state. In addition, their algorithms frequently work as black-box systems with scarce interpretability for classical practitioners.

IV. USABILITY EVALUATION

Assessing the usability of Nadi Parikshan devices involves examining how well they mimic conventional diagnostic methods while being accessible, interpretable, and convenient for clinical or wellness environments. This chapter compares major devices in terms of ease of use, user interface, comfort, learning curve, and clinical feedback.

A. Ease of Use

Among the examined devices, Nadi Tarangini is differentiated by its accessible user interface and smartphone connectivity. It features workflows for guided diagnostic processes and graphic outputs that de-mystify pulse reading to practitioners. AyuDevice, while research-centric, has modular calibration tools as well as free-form data collection modes. For its part, Nadi Yantra, which is economical, is more in need of hand intervention and devoid of real-time user alerts that can be the impediment towards its application within high-volume clinic settings.

B. Interface and Interpretability

An important usability aspect is the degree to which the output of the device corresponds to principles of Ayurveda. Although Nadi Tarangini tries to provide dosha-specific charts, the system does not have clear algorithmic correspondence that Vaidyas can rely upon. AyuDevice focuses on raw data examination and waveform display but needs expertise in the domain to make sense of outputs. Nadi Yantra simplifies reports but has very little interactivity or detail. This interpretability lag acts as a barrier towards wider clinical usage.

C. Training Requirements

Digital pulse analysis introduces a learning curve for both Ayurvedic practitioners and modern clinicians. Nadi Tarangini has conducted practitioner training programs and provides detailed usage manuals. AyuDevice is primarily used in research settings, often accompanied by institutional workshops. Nadi Yantra's simple construction aims to minimize training needs, though it benefits from being used in academic setups where supervision is available.

D. Patient Comfort and Workflow Integration

Patient comfort is high with all devices, particularly Nadi Tarangini, utilizing soft contact sensors and brief acquisition times. The modular sensors of AyuDevice can be placed accurately but are time-consuming to set up. Fixed brackets in Nadi Yantra might not fit all wrist anatomies equally well. Workflow integration also differs—Nadi Tarangini is most suitable for clinics, whereas AyuDevice and Nadi Yantra are more research and education focused, respectively.

E. Feedback and Iterative Improvement

Current devices lack user feedback mechanisms. The majority lack real-time feedback or adaptive learning based on practitioner input. This limits opportunities for calibration and personalization. Closed-loop systems that learn from clinician feedback could further enhance device performance and trust.

V. Challenges and Limitations

Although computerized Nadi Parikshan systems have been quite promising in integrating conventional Ayurvedic practice with modern healthcare technology, there are still some technical, clinical, and cultural issues that remain to impede their universal acceptance and effectiveness.

A. Sensor Accuracy and Signal Quality

Most devices, including Nadi Tarangini and Nadi Yantra, use pressure or piezoelectric sensors that do not necessarily measure the fine differences of pulse qualities qualitatively assessed by experienced Vaidyas. Signal noise, mounting inconsistencies, and hardware constraints can drastically contribute to diagnostic unreliability [6]. Environmental considerations like wrist structure, patient movement, and sensor calibration decrease measurement fidelity further.

B. Algorithmic Interpretability and Transparency

The computational algorithms employed for dosha classification tend to be "black boxes," yielding results without describing how the conclusions were drawn. This lack of transparency breeds mistrust among practitioners, particularly those based in Ayurvedic traditions who anticipate diagnoses to be drawn from observable and explicable events [7]. Consequently, confidence in these machines is a significant impediment to clinical integration.

C. Practitioner Adoption and Cultural Resistance

Numerous Ayurvedic practitioners see digitization as a threat to diluting the age-old art of pulse diagnosis. Fearing the loss of the touch, intuitive nature of Nadi Parikshan, there has been resistance to adopting digital devices, even with their inherent advantages. Further, the devices are perceived to be augmentative and not substitutive in nature, diminishing motivation for complete adoption [8].

D. Validation and Clinical Evidence

There is a shortage of large-scale clinical trials and longitudinal studies confirming the diagnostic results of these devices with respect to skilled practitioners. The majority of published studies are restricted to pilot schemes or educational prototypes. As there is no standardized benchmarking and regulatory approvals, credibility of these devices in conventional healthcare is limited [9].

E. Cost, Accessibility, and Infrastructure

High-end systems like Nadi Tarangini may be cost-prohibitive for small clinics or individual practitioners. In contrast, low-cost models like Nadi Yantra may lack sufficient robustness for repeated clinical use. Additionally, many devices require smartphone apps, cloud connectivity, or periodic calibration—features that may not be accessible in rural or resource-limited settings [10].

VI. Testing and Result

This section provides a systematic comparison of the major devices employed in digital Nadi Parikshan. This comparison draws from past research and technical reports and targets an assessment of the practical usability, interpretability, and clinical readiness of the systems. The aim is to identify the degree to which these tools correspond to the principles of Ayurvedic diagnosis and the extent to which they incorporate current technology.
While there is an increasing need for evidence-based integration of traditional medicine, a number of studies have tried to digitize Nadi Parikshan using biomedical sensors, waveform analysis, and real-time monitoring systems. These instruments are intended to record the subtle changes in pulse characteristics of the three doshas—Vata, Pitta, and Kapha—but differ greatly in their approach to design, ease of use, and accuracy of data. This research highlights the functional usability of Nadi Parikshan instruments—how they work in practice, how simple it is to interpret data, and how well they correspond to Ayurvedic principles of diagnosis. The table below summarizes important features of top-ranked systems.
The comparison brings out stark differences in usability, interpretability, and deployment readiness between the three devices. Nadi Tarangini excels in clinical integration and features, while AyuDevice and Nadi Yantra are better positioned for academic and training use. These observations underscore the importance of balanced design—integrating Ayurvedic accuracy with user-friendly technology.
While the comparative table above outlines the technical and usability features of Nadi Parikshan devices, the accompanying radar chart below visually synthesizes these parameters, providing a clear understanding of how these devices align with the biological variations they are designed to capture in practice.

TABLE I: COMPARATIVE ANALYSIS OF NADI PARIKSHAN DEVICES ACROSS USABILITY AND FUNCTIONAL PARAMETERS

Feature	Nadi Tarangini	AyuDevice	Nadi Yantra
Sensor Technology	Multi-point pressure sensors	Capacitive + tactile sensors	Piezo-based sensors
User Interface	Mobile app with charts	Desktop-based software	LED indicators
Ease of Use	High	Moderate	Low
Output Clarity	Medium (charts)	Low (raw signals)	Low (no analytics)
Training Requirement	Moderate	High	Minimal
Cost Factor	High	Medium	Low
Cloud Connectivity	Supported	Not available	Not available
Access/Distribution	Commercially available	Research settings	Institutional deployments

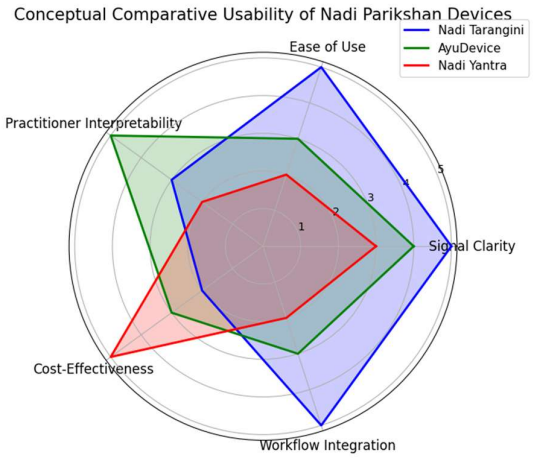

Figure 1: Radar chart visualizing the conceptual usability comparison of Nadi Parikshan devices.

The radar chart enables a holistic visualization of device strengths and limitations, allowing practitioners and researchers to quickly identify which devices align with specific clinical and educational needs in Nadi Parikshan. This graphical representation complements the tabular data by highlighting multi-parameter trade-offs in a single glance

VII. CONCLUSION AND FUTURE SCOPE

Nadi Parikshan digitization is a promising integration of ancient Ayurvedic knowledge with contemporary healthcare technology. Technologies like Nadi Tarangini, AyuDevice, and Nadi Yantra show great promise in acquiring pulse signals and decoding them by algorithmic models based on doshic concepts. Although these instruments provide gains in consistency, storage, and visualization, they also point to crucial areas that require improvement—most importantly sensor fidelity, algorithm transparency, and clinical certification.

In the future, the future generation of Nadi Parikshan devices would do well to focus on integrating multi-modal sensors (e.g., pressure, PPG, temperature), AI/ML models based on Ayurvedic reasoning, and real-time feedback mechanisms that learn from practitioner feedback. User-centric design also needs to be a priority in order to provide accessibility for both rural clinics and urban wellness centers.

In addition, joint research among Ayurvedic experts, engineers, and data analysts is the key to developing devices that not only automate the process but also maintain its holistic nature. The need also arises for the development of standardized validation procedures, ease of regulatory access, and opening up educational uses in Ayurvedic schools of learning.

With the increasing demand for integrative medicine, the use of digital Nadi Parikshan will increase—not merely as a diagnostic tool, but as a pathway from traditional practice to evidence-based digital health systems.

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