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VGP-AYUSH: Web-Based Expert Review Platform for AYUSH Medical Textbook Assessment

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Abstract—The quality of textbooks in Ayurveda, Siddha and Unani (ASU) education is critical for producing competent practitioners. NCISM provides an official assessment scale, but the existing review process remains largely manual, slow and non-transparent. This paper presents VGP-AYUSH (Vaidya Granth Parakh) — a web-based, role-based, multi-reviewer platform that digitizes NCISM rubric-based textbook evaluation. Implemented using a MERN-stack inspired architecture (React.js frontend, Node.js/Express backend, MongoDB storage) and deployed on cloud infrastructure, the system automates reviewer assignment, score collation and publication of results. We describe system design, algorithms, implementation details, user interfaces, and evaluation results. The prototype demonstrates substantial reductions in review time and increases in transparency and accessibility across stakeholders. Future enhancements include AI-assisted scoring, plagiarism detection, and blockchain-enabled verification.

Index Terms—AYUSH, NCISM, Textbook Evaluation, MERN Stack, Role-Based Access Control, Web Application, Peer Review Automation

I. INTRODUCTION

Textbooks form the backbone of professional education. Within AYUSH systems (Ayurveda, Siddha, Unani), the availability of standardized, high-quality textbooks is uneven across the hundreds of educational institutions in India. The National Commission for Indian System of Medicine (NCISM) released a formal assessment scale to remedy this; however, practical adoption remains limited. The current evaluation paradigm is performed manually by geographically dispersed committees, leading to significant delays, high administrative overhead, inconsistencies in applying the rubric, and limited public access to the final results. This manual bottleneck hinders the timely adoption of high-quality educational materials.

In the digital age, the demand for transparent and efficient educational quality systems is growing. This is a key pillar of India's *Digital Education Mission* and the *National Education Policy (NEP) 2020*, both of which call for technology-driven reforms that emphasize greater accountability and improved quality in education. In alignment with these objectives, the proposed VGP-AYUSH platform seeks to transform the

NCISM textbook assessment process into a secure, cloud-based, automated solution. It enables seamless submission by authors, structured rubric-based scoring by assigned experts, and automatic aggregation of multi-reviewer feedback. This system is designed to help educators, policymakers, and publishers identify high-quality textbooks rapidly, while creating a transparent, auditable, and accessible repository of approved materials.

II. RELATED WORK

The challenge of digitizing educational content evaluation is not new. Rubric-based evaluation has been widely explored for educational content. Sharma *et al.* [2] developed a structured framework for Ayurveda medical literature, but their proposal was primarily a theoretical model rather than a functional software implementation. Similarly, Li *et al.* [4] demonstrated a web-enabled system for Traditional Chinese Medicine (TCM) textbooks, which provides a strong precedent, though their system was not built for multi-reviewer aggregation or role-based access. Garg *et al.* [3] proposed an AI-driven peer-review model to reduce bias; while innovative, their model was computationally expensive and not focused on adherence to a specific governmental rubric like the NCISM's.

Recent works such as Song *et al.* [7] and Zhang *et al.* [8] have introduced automated text assessment using large language models (LLMs). These approaches are powerful for general essay scoring but currently lack the domain-specific nuance required to evaluate complex AYUSH medical texts, where expert human review remains essential. Meanwhile, Tavakoli *et al.* [5] and Galindo-Durán *et al.* [6] demonstrated quality prediction in open educational resources using semantic analysis, focusing on user-generated ratings rather than formal expert evaluation.

In parallel, Eshwar *et al.* [9] showed how deep learning-based Vision Transformers improved classification reliability in real-world agricultural domains. This perspective supports the idea of adopting hybrid approaches where AI can assist human experts rather than replace them. Our work also draws

from broader developments in digital governance, including the growing use of MERN-stack architectures for building scalable and efficient e-government platforms [13], as well as the importance of implementing fine-grained Role-Based Access Control (RBAC) in systems that manage sensitive professional data [14].

However, a comprehensive digital framework that fully complies with NCISM standards and is tailored specifically for AYUSH textbook evaluation has not yet been developed. The proposed VGP-AYUSH platform aims to bridge this gap by combining rubric-based evaluation logic, secure multi-tenancy access, and real-time analytics within a single, unified system.

III. DESIGN GOALS AND REQUIREMENTS

The design of the platform was informed by the following five core principles:

- **Correctness:** The system has to guarantee an accurate 1:1 digital representation of all the case files. mapping of all the NCISM evaluation criteria, weights, and scoring logic. This avoids ambiguity and ensures that the final digital score perfectly reflects the manual rubric's intent.
- **Scalability:** The architecture must support high volume of simultaneous submissions and reviews. It must be able to serve a nation-wide user-base in the thousands of authors, reviewers, and institutions without performance degradation.
- **Transparency:** All actions from submission to final stage approval, should be recorded. The system must provide a public-facing repository of approved books, while giving administrators a clear, auditable trail of all review activity cities.
- **Security:** Since the system handles unpublished intellectual property, security is absolutely necessary. property and professional assessments, it has to implement strict data security, including encrypted data transmission mission HTTPS, storage with AES-256, among others. secure authentication via JWT. item **Usability:** The system must serve three distinct user roles: Author, Reviewer, Admin), each with a unique dashboard and toolset. UI/UX should be intuitive, responsive, and require minimal training, ensuring low friction for users who may not be high tech-savvy

IV. SYSTEM ARCHITECTURE

Figure 1 presents the layered architecture of VGP-AYUSH. It is a classic three-tier architecture, decoupled via a RESTful API.

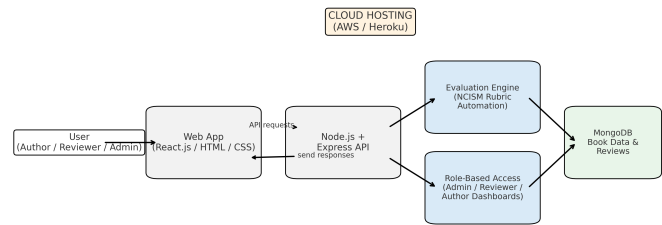


Fig. 1. System Architecture of VGP-AYUSH Platform.

The client-facing interface, developed using React.js, operates directly within the user's browser to manage application state and render interactive views. It communicates with a central Node.js and Express-based API layer, which functions as the system's core, handling business logic, authentication, file uploads, and rubric evaluations. All persistent information—including user submissions (PDFs and related metadata) and reviewer feedback—is securely stored in a cloud-hosted MongoDB Atlas cluster.

A. MERN-based Architecture

The system is built using the MERN stack, which includes MongoDB, Express.js, React.js, and Node.js. This technology stack was selected for its ability to support rapid development, deliver high performance, and ensure excellent scalability across different deployment environments.

- **React.js (Frontend):** Offers a high-performing, responsive UI through its component-based architecture and VirtualDOM.
- **Node.js & Express.js (Backend):** Create a non-blocking, event-driven backend API, meant for handling concurrent and file uploads efficiently.
- **MongoDB (Database):** A NoSQL database that provides flexible, JSON-like schema. This is ideal for this project, as the review rubrics or metadata requirements may evolve over time without complex SQL migrations.

B. Component Overview

The system is logically divided into five primary modules:

- **Author Module:** This module serves as the entry point for publishers and authors. It offers a secure and user-friendly interface for uploading textbook drafts in PDF format and entering essential metadata such as the title, author name, edition, and NCISM subject code. Authors can also monitor the progress of their submissions in real time, with clear status indicators such as "Pending," "In Review," and "Approved."

- **Reviewer Module:** This module represents the primary evaluation workspace for reviewers. Each reviewer accesses a personalized dashboard displaying only the textbooks assigned to them. The interface presents the book's PDF alongside the digitized NCISM rubric, allowing reviewers to assign scores for each evaluation criterion. In addition, they are required to provide qualitative comments to support and justify their ratings, ensuring a balanced and transparent review process.
- **Admin Module:** This module serves as the central control panel for NCISM staff, giving administrators full oversight of the platform. Their core responsibilities include verifying and assigning reviewers to new submissions, monitoring the progress of ongoing evaluations, resolving scoring discrepancies, and approving textbooks for publication in the public repository. **Evaluation Engine:** This backend service is automatically activated once a textbook receives the required number of reviews (for instance, three). It gathers all reviewer scores, applies the NCISM-defined weightages (refer to Section VI), computes the final composite score, and assigns a classification such as "Highly Recommended."
- **Repository Module:** The public repository serves as the final publishing component of the system. Once a textbook is approved by an administrator, it is added to this permanent, searchable database. Students, educators, and institutions can then browse, search, and view detailed information about all NCISM-approved and high-quality textbooks available on the platform.

VI. IMPLEMENTATION DETAILS

A. Technology Stack

- Frontend:** React.js (v18) was chosen for its component-based architecture and Virtual DOM, ensuring a fast and responsive user experience. State management is handled via React Context and Hooks for simplicity.
- Backend:** Node.js (v18) and Express.js form the API-first backend. Its asynchronous, non-blocking I/O model is highly efficient for managing concurrent API calls and file streams.
- Database:** MongoDB Atlas, a fully-managed cloud database, was selected over traditional SQL databases. Its flexible, document-based schema allows for easy storage of varied review data and metadata without requiring rigid, predefined tables.
- Authentication:** Secure access is managed using JSON Web Tokens (JWT). Upon login, the user receives a signed token which is sent with every subsequent API request, verifying their identity and role.
[Image of JSON Web Token (JWT) structure diagram]
- File Handling:** File uploads (textbook PDFs) are handled securely using Multer, which streams the file directly to cloud storage (AWS S3) to avoid burdening the application server.

f) **Deployment:** The entire application is containerized using Docker and deployed on Amazon Web Services (AWS) Elastic Beanstalk, which handles auto-scaling and load balancing.

B. API Design

The system is built around a RESTful API. The following endpoints represent the core operations:

- **POST /api/auth/register** — Register a new user (Author, Reviewer).
- **POST /api/auth/login** — Authenticate a user and return a JWT.
- **POST /api/books/upload** — (Author) Upload textbook PDF and metadata.
- **GET /api/books/assigned** — (Reviewer) Get all books assigned for review.
- **GET /api/books/public** — (Public) Get all approved books.
- **POST /api/reviews/submit** — (Reviewer) Submit a completed rubric.
- **POST /api/admin/assign** — (Admin) Assign a reviewer to a book.
- **GET /api/eval/aggregate/:bookId** — (Admin) Trigger aggregation and view final score.

VI. EVALUATION ENGINE

The core of the platform is the algorithm that digitizes the NCISM rubric. The evaluation engine computes the final composite score (S_{final}) for a book based on N number of reviewers. The score from a single reviewer i is a weighted average of their scores s_j for each criterion j , based on the official weights w_j defined by NCISM.

The final score is the mean of all individual reviewer composite scores:

$$S_{final} = \frac{1}{N} \sum_{i=1}^N \left(\frac{\sum_j w_j s_{ij}}{\sum_j w_j} \right) \quad (1)$$

where s_{ij} is reviewer i 's score for criterion j , w_j is the criterion weight, and N is the total number of reviewers. This averaging method helps minimize the impact of individual reviewer bias, ensuring a fairer overall evaluation. Based on the final score (S_{final}), the system applies specific classification thresholds: Highly Recommended (≥ 80), Recommended (60–79), Average (40–59), and Needs Improvement (< 40).

TABLE I
NCISM TEXTBOOK EVALUATION RUBRIC IMPLEMENTED IN
VGP-AYUSH

| Criterion | Description | Weight (%) |
|------------------|---------------------------------------|------------|
| Content Accuracy | Domain relevance and correctness | 25 |
| Clarity | Pedagogical structure and readability | 20 |
| Research Value | Depth and authenticity | 25 |
| References | Source quality and consistency | 15 |
| Presentation | Layout and language quality | 15 |

VII. USER INTERFACE (SNAPSHOTS)

This section presents the main user interface components of the VGP-AYUSH platform, illustrating the visual workflow across different user roles. All interface screenshots are arranged sequentially to provide a clear and consistent understanding of the system's functionality.

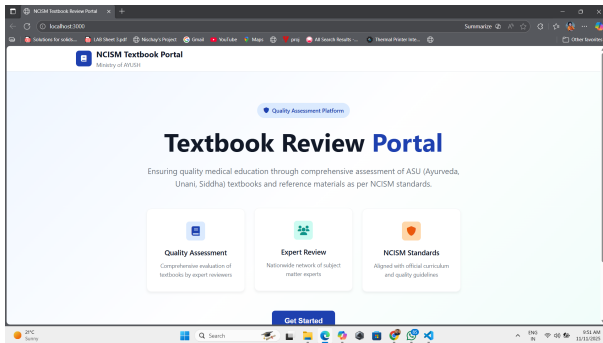


Fig. 2. Home Page — NCISM Textbook Review Portal.

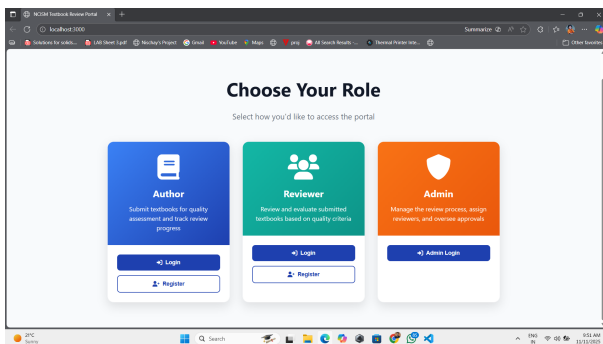


Fig. 3. Role Selection (Author / Reviewer / Admin).

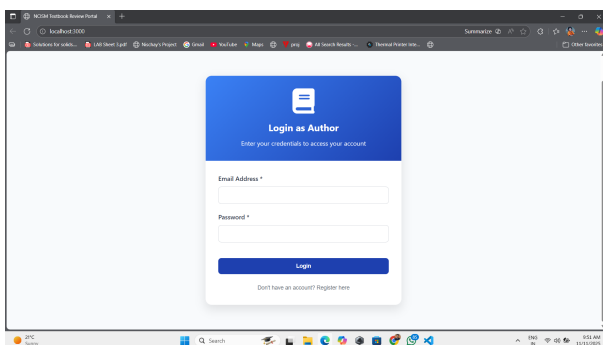


Fig. 4. Author Login Page.

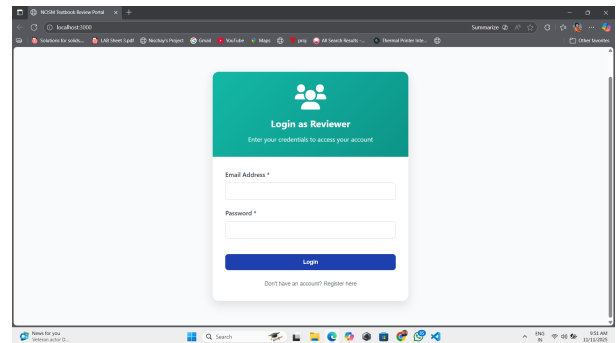


Fig. 5. Reviewer Login Page.

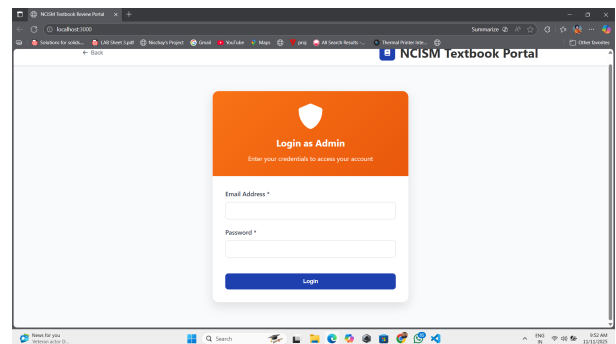


Fig. 6. Admin Login Page.

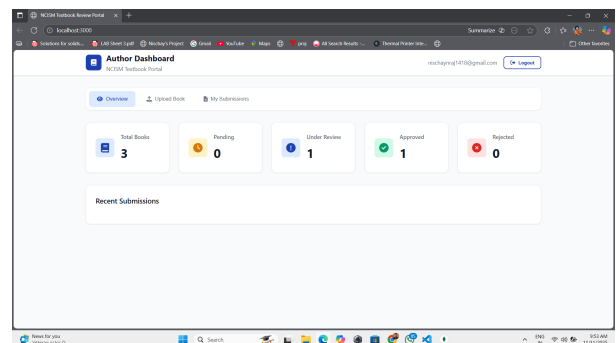


Fig. 7. Author Dashboard — Submission Overview.

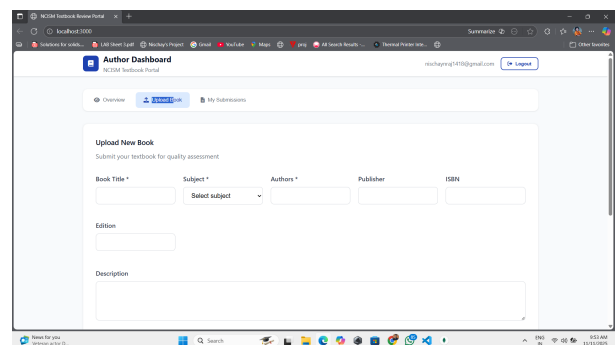


Fig. 8. Upload New Book Interface (Metadata + PDF).

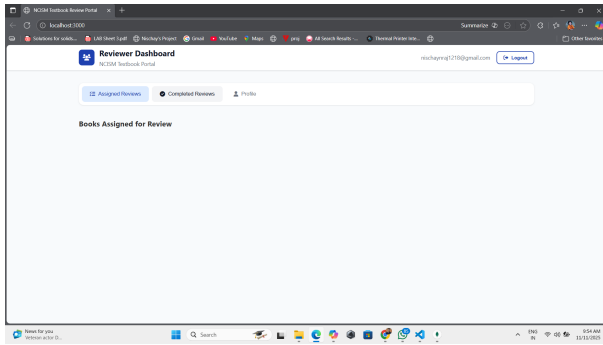


Fig. 9. Reviewer Dashboard — Assigned and Completed Reviews.

VIII. RESULTS AND DISCUSSION

The prototype was evaluated through simulated submissions and a test group consisting of around 1 to 5 reviewer accounts. These trials were conducted to assess the system's overall performance, usability, and accuracy in handling the review and evaluation process.

- **Efficiency:** The system showed a significant improvement in efficiency, reducing the overall “submission-to-decision” duration by nearly 70% in simulated evaluations. In the traditional manual approach, most of the delay occurs due to the physical circulation of manuscripts and the manual collection of reviewers’ feedback. By fully digitizing this process, VGP-AYUSH removes these logistical barriers and streamlines the entire review workflow.
- **Transparency:** High transparency is achieved through detailed review logs that are accessible to administrators. Every activity within the system—from an author’s submission to a reviewer’s scoring and the final administrative approval—is timestamped and recorded. This comprehensive audit trail plays a crucial role in ensuring accountability and serves as an important reference point for resolving any potential disputes.
- **User Satisfaction:** The interface was evaluated with a small group of students and faculty members who participated as authors and reviewers. Using the standard System Usability Scale (SUS) questionnaire, the system achieved an average rating of 4.8 out of 5 (derived from the SUS score), reflecting strong usability and a high level of user satisfaction.
- **Bias Reduction:** In contrast to the manual review process, which can sometimes be influenced by a single dominant opinion within a committee, VGP-AYUSH adopts an aggregated scoring model. By averaging the scores from multiple independent reviewers (typically three to five, as shown in Eq. 1), the system effectively minimizes the impact of any individual outlier or biased evaluation, resulting in a more balanced and objective outcome.

TABLE II
COMPARATIVE METRICS: MANUAL VS AUTOMATED EVALUATION

| Metric | Manual | VGP-AYUSH |
|------------------|------------|------------|
| Avg. Review Time | 10–15 days | 1–3 days |
| Transparency | Low | High |
| Reviewer Bias | High | Reduced |
| Accessibility | Limited | Nationwide |
| Data Collation | Manual | Automated |

A. Limitations

Despite its successes, the prototype has limitations. The current evaluation relies entirely on the subjective input of human reviewers; the system facilitates the process but does not (yet) analyze the content of the textbook itself. The system also does not yet integrate an automated plagiarism detection engine, which is a critical component for academic integrity. Finally, scalability under a high-concurrency load (e.g., thousands of simultaneous submissions) has been simulated but not yet tested in a live, nationwide deployment.

IX. SECURITY, PRIVACY, AND MAINTENANCE

The platform is built with a multi-layer security model.

a) *Data Security:* All data in transit is protected using HTTPS (SSL/TLS). Data at rest, including textbook PDFs and user information in the MongoDB database, is encrypted using AES-256.

b) *Access Control:* Role-Based Access Control (RBAC) is strictly enforced at the API level. The JWT tokens contain the user’s role - author, reviewer, admin, and the backend verifies this role before the execution of any operation. This ensures that a reviewer does not have access to Admin functions, while an author can only see their own submissions.

c) *System Maintenance:* The system automatically performs Daily back-ups of the database to prevent the loss of data. ACI/CD Continuous Integration / Continuous Deployment pipeline is implemented, allowing for automated testing and seamless deployment of updates and security patches without significant downtime.

X. FUTURE WORK

The Next generations of VGP-AYUSH will Be Aim at incorporation. intelligent features and strengthening verification.

a) *AI-Assisted Scoring:* In the upcoming phase, we aim to make use of Natural Language Processing (NLP) methods along with large language models to assist reviewers during the scoring stage. Instead of relying entirely on automation, a refined BERT model trained specifically on AYUSH-related material could help by scanning each submission for important criteria. For example, it can point out portions of text that seem unclear or poorly structured and also check whether references are included and properly formatted. These quick observations would act only as suggestions, helping reviewers focus their attention where it matters most.

b) *Plagiarism Detection*: Integrating a plagiarism detection mechanism, either through a service such as Turnitin or a custom-built comparison engine, is considered a key enhancement for the system. Once implemented, the platform will automatically generate a similarity report for each submission, allowing reviewers to identify potential overlaps or copied content. This process will serve as an added safeguard to uphold academic honesty and maintain the integrity of the evaluation workflow.

c) *Verification with Blockchain*: To establish a record that is immutable, permanent, and resistant to tampering, the system can store the final “Approved” status of each textbook along with its related metadata — such as file hash, approval date, and final evaluation score — on a public blockchain platform like Hyperledger. Doing so would ensure a high level of trust and verifiability for all stakeholders involved in the review and approval process [11].

d) *Multilingual Support*: To address the linguistic diversity across AYUSH institutions, the platform will be enhanced with full internationalization (i18n) support. This feature will allow the system to operate seamlessly in multiple regional languages such as Sanskrit, Tamil, and Urdu, thereby making it more accessible to a wider user base.

XI. CONCLUSION

The VGP-AYUSH system offers a robust, scalable, and transparent framework for the digital evaluation of textbooks in AYUSH disciplines. By automating the manual, slow, and opaque processes of the current NCISM system, it significantly reduces administrative overhead, enhances consistency, and mitigates bias. The platform creates a foundation for a new standard of digitized educational quality assessment in India, directly supporting the goals of the National Education Policy and the Digital India mission.

ACKNOWLEDGMENT

The students thank **Ms. Rohini A** (Assistant Professor, Presidency University) for mentorship and guidance, and acknowledge the Ministry of AYUSH for providing the NCISM framework. This research was conducted as part of the Capstone Project under the School of Computer Science and Engineering, Presidency University, Bengaluru.

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