QuestScholar : The All-in-One Research Hub

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***Abstract*—The AI-integrated academic research platform is introduced to support students, professors, and reviewers throughout the research process. It features a real-time document editor with template support and Retrieval-Augmented Generation (RAG)-based writing assistance for formatting in styles such as IEEE, ACM, and Springer. The platform enables secure review and progress report management through institutional role-based access control. Semantic-aware capabilities include automatic content tagging, intelligent tool suggestions, multilingual support, and an AI-powered assistant for literature surveys, summarization, and title generation. A scoreboard mechanism tracks user participation and contributions. The system improves workflow efficiency and fosters academic collaboration. Future developments include a research roadmap generator, visual progress dashboard, citation manager, digital certification to support structured academic workflows and all purpose document editor.**

Index Terms - Artificial Intelligence, RAG, Research Management System, Knowledge Base, Academic Writing, Semantic Analysis

I. INTRODUCTION

Research is a systematic process aimed at generating new knowledge and developing practical solutions to real-world problems. In academic institutions, research activities form a core component of higher education, requiring structured documentation, standardized formatting, organized literature review, continuous progress monitoring, and formal evaluation. Preparation of manuscripts in established formats such as IEEE, ACM, and Springer demands strict adherence to defined structural guidelines. Ensuring uniformity and consistency in documentation across multiple users requires an integrated and structured research management environment. As the number of student projects and research outputs increases, institutions require scalable systems that can handle multiple submissions, revisions, and evaluation cycles efficiently [15].

The advancement of intelligent computing techniques has enabled the integration of automated support within academic workflows. Real-time document editors with template-based formatting allow structured manuscript preparation aligned with publication standards. Retrieval-Augmented Generation enhances writing assistance by combining contextual knowledge retrieval with content generation to improve relevance and coherence [4], [16]. Semantic-aware mechanisms such as automatic content tagging using rule-based algorithms supported by a common knowledge base assist in systematic organization of research documents [5]. Intelligent tool suggestions, multilingual support, and AI-assisted literature summarization and title generation further strengthen document development and structured knowledge processing [1], [9]. Research roadmap generation and visual progress dashboards provide systematic milestone planning and clear visualization of research progress over time [14].

The proposed framework consolidates document creation, semantic processing, review management, and progress monitoring within a centralized system architecture. Secure role-based access control ensures regulated interaction among students, professors maintaining data integrity and controlled access [5]. A unified dashboard enables supervision of submissions, evaluation reports, revision histories, and contribution metrics through a structured scoreboard mechanism.The system also supports transparent communication between stakeholders, enabling timely feedback and structured workflows.By integrating intelligent document assistance with centralized academic supervision,it enhances workflow efficiency, maintains documentation consistency, and supports organized and collaborative research management within institution [15].

A. Problem Statement

Academic research projects involve coordination primarily between students and professors, with occasional institutional oversight. However, the current research workflow in many academic settings remains fragmented and inefficient. Students often rely on multiple independent tools for drafting documents, submitting work, receiving feedback, and tracking progress. This scattered approach makes it difficult to maintain organized records and consistent documentation. Professors, in turn, face challenges in reviewing submissions systematically, monitoring student progress, and ensuring adherence to research guidelines due to the absence of a centralized platform [15].

The lack of an integrated system leads to communication gaps, delayed feedback, and difficulties in managing document versions. Students may find it hard to evaluate their academic progress over time, while professors may struggle to maintain consistency in evaluation and supervision. When research-related information is distributed across various channels, knowledge sharing becomes limited and tracking overall project development becomes time-consuming. Additionally, the use of unstructured or informal communication methods can create risks in handling sensitive research data [5].

Therefore, there is a need for a centralized, web-based research management platform that unifies document handling, progress monitoring, and feedback mechanisms within a single environment. Such a system should enable structured collaboration through role-based access control, improve transparency in supervision, and support efficient management of academic research activities from initial proposal to final submission [2], [14], [15].

II. Literature Survey

The literature survey focuses on recent advancements in artificial intelligence and semantic technologies that aim to improve academic research workflows, particularly for tasks such as literature analysis, document summarization, keyphrase extraction, and personalized learning support [1], [9]. Researchers have shown that AI can significantly enhance research productivity by automating tasks like prerequisite identification, structured content generation, and semantic tagging, which in turn reduces manual effort and improves the quality of academic outputs [2], [15]. In this section, we review research works designed to tackle similar challenges, providing insights into how semantic similarity measures, deep learning, and transformer-based models support intelligent academic assistance [6], [12]. From these studies, we selected three representative papers for the survey: [A] Prerequisite-Based Course Recommendation using Linked Open Data [2], [B] MICRank: Multi-Information Interconstraint Keyphrase Extraction [3], and [C] Enhancing Abstractive Summarization of Scientific Papers using Structure Information [1].

A. Prerequisite-Based Course Recommendation using Linked Open Data

The proposed system is structured into three interconnected phases: prerequisite identification, concept similarity calculation, and prerequisite-based course recommendation [2]. The objective is to ensure that learners receive course suggestions aligned with their existing background knowledge and intended learning goals. By integrating Linked Open Data sources with similarity-based evaluation techniques, the model systematically identifies foundational concepts and maps them to relevant course content. This structured approach enables adaptive and pedagogically consistent learning pathways.

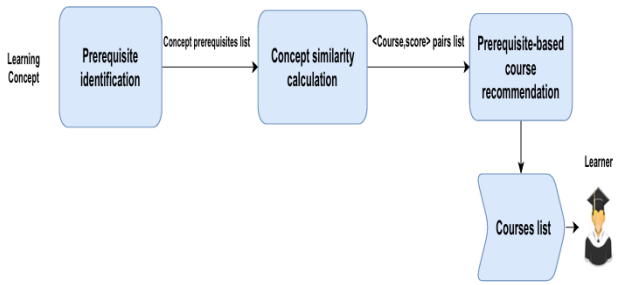

Fig. 1. System Architecture

Figure 1 illustrates the overall system architecture and the interaction among its core components. The process begins with prerequisite identification, where related concepts are extracted from Linked Open Data sources such as DBpedia and validated using a supervised machine learning classifier to ensure genuine prerequisite relationships. These identified concepts are then forwarded to the concept similarity calculation phase, where they are compared against structured course metadata—including titles, descriptions, keywords, and difficulty levels—using TF-IDF weighting and cosine similarity. Based on the computed similarity scores, the final phase generates a ranked list of recommended courses, ensuring alignment between the learner's prerequisite knowledge and the target concept. This architecture combines prerequisite extraction, semantic similarity analysis, and metadata matching to deliver personalized and well-structured course recommendations [2].

B. MICRank: Multi-Information Interconstraint Keyphrase Extraction

MICRank is an unsupervised and corpus-independent framework designed for automatic keyphrase extraction [3]. The system begins by identifying candidate phrases from an input document using part-of-speech tagging and pattern-based rules, with emphasis on concise and meaningful phrase structures. Each candidate phrase is then evaluated through three complementary scoring components: ARank, which considers structural attributes such as frequency and positional significance; GRank, which measures semantic consistency with the overall document context; and LRank, which assesses relevance within localized paragraph-level segments. These scores are systematically integrated to generate a final ranking

and identify the most representative keyphrases. In addition, MICRank incorporates a semantic evaluation mechanism that accounts for synonymous expressions and paraphrased variations, enabling a more robust and accurate assessment of keyphrase quality across diverse documents.

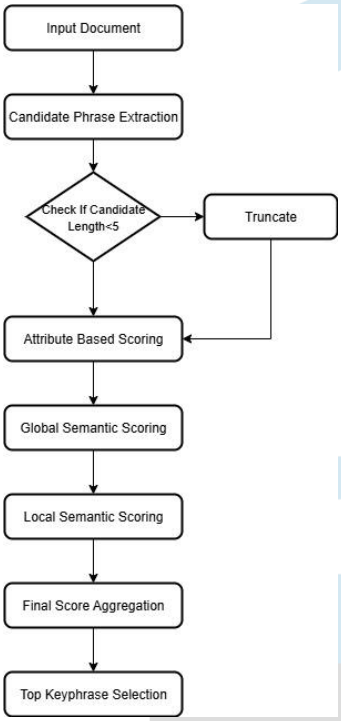

Fig. 2. Flowchart of the Proposed System

Figure 2 illustrates the detailed workflow of the MICRank framework, outlining the sequential stages from candidate phrase extraction to final keyphrase selection. The process begins with document preprocessing, where potential noun phrases are identified using linguistic rules and part-of-speech tagging. These candidate phrases are then evaluated independently through the ARank, GRank, and LRank scoring modules. ARank captures structural features such as frequency and positional importance, GRank measures semantic alignment with the overall document context, and LRank evaluates contextual relevance within local sections. The scores obtained from these modules are combined using a weighted aggregation strategy to produce a unified importance score for each phrase. Based on this final ranking, the most representative keyphrases are selected and presented as output. This design ensures a balanced consideration of both structural and semantic factors in the ranking process [3].

C. Enhancing Abstractive Summarization of Scientific Papers using Structure Information

The proposed framework enhances abstractive summarization of scientific papers by incorporating structural information into the generation process [1]. Since scientific articles follow a logical discourse pattern, recognizing structural components such as Background, Methods, Results, and Conclusions can significantly improve summary coherence and completeness. The system standardizes heterogeneous section titles into an IMRaD-style schema and constructs a supervised dataset to enable accurate structural classification. A SciBERT-based classifier is then employed to identify the functional role of each section, providing structured signals to guide summary generation. These structural annotations help the summarization model maintain balanced content representation across different sections of the paper.

Figure 3 illustrates the complete system workflow, beginning with data collection and preprocessing, where full-text scientific papers from repositories such as arXiv and PubMed are gathered and their diverse section titles are normalized into a consistent IMRaD-style format. Low-quality or incomplete documents are filtered during this stage to ensure reliability and reduce noise in subsequent processing. In the structural function recognition phase, each section is analyzed using a fine-tuned SciBERT classifier, which assigns standardized discourse roles such as Background, Methods, Results, and Conclusions. This transformation converts varied, author-defined headings into consistent structural labels that provide explicit guidance for the summarization model. Finally, the structurally annotated content is passed to a Longformer encoder–decoder architecture for abstract generation. Leveraging sparse attention to process long documents efficiently [1].

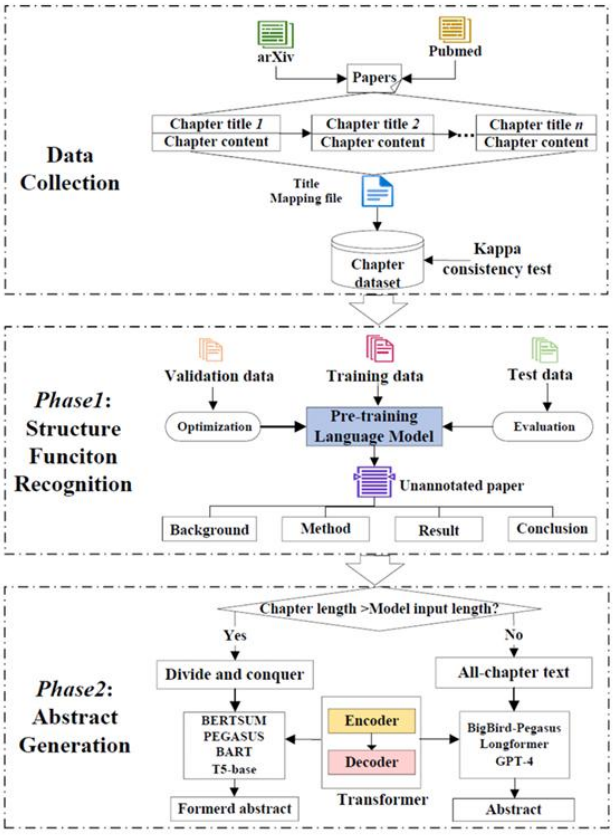

Fig. 3. Overall framework of the proposed two-stage summarization model

III. METHODODLOGY

he system offers an AI-enabled academic research platform aimed at supporting universities, professors, and students across the complete research lifecycle [15]. The process begins with a super-admin onboarding universities, where email-based verification is performed to ensure authenticated access before institutional login is permitted. Following successful registration, administrators enroll professors and students by providing essential information such as name, registration number, and email address. Each entry undergoes system-level validation, and verification links are sent via email so that only authorized users can activate and access their accounts.

After registration, both students and professors are provided with dedicated dashboards tailored to their roles. Students can submit research abstracts, which are processed by AI models to generate research titles using T5 [15], assign semantic tags through contextual embedding techniques [5], suggest relevant intelligent tools, and construct a structured research roadmap. For literature survey activities, students upload PDF files that are processed to extract textual data, which is then summarized using transformer-based architectures to maintain semantic consistency across AI-driven functionalities [6].

The platform also features a real-time document editor equipped with predefined templates conforming to IEEE, ACM, and Springer standards. A Retrieval-Augmented Generation (RAG) model assists students during document drafting by delivering context-aware recommendations and responses [4]. Professors are able to track student progress, review submitted research outputs, and allocate marks, which are compiled into a centralized scoreboard to ensure transparency in performance evaluation. The overall architecture incorporates a server-side backend responsible for authentication, AI model processing, knowledge base integration, and secure communication with the client interface, thereby facilitating seamless interaction and comprehensive research support [5], [15].

IV. PROPOSED SYSTEM

QuestScholar is a comprehensive academic research management platform designed to streamline the entire research lifecycle within a unified environment . It integrates AI-driven writing support, collaborative document handling, and secure role-based access control into a single system. By centralizing research documents and references, the platform delivers intelligent recommendations through transformer-based models [15], facilitates multilingual and context-aware content creation using Retrieval-Augmented Generation techniques [4], enables structured planning through semantic tagging and knowledge-based indexing mechanisms [5],and tracks research progress to enhance overall efficiency and organization.

A. Personalized Student Dashboard

TThe personalized student dashboard functions as the primary workspace, bringing together all research-related activities in a structured interface. It allows students to organize documents, monitor milestones, review scores and rankings, access AI-generated literature summaries [1], [6] and title recommendations generated using transformer-based models [15], and follow a customized research roadmap supported by semantic indexing mechanisms [5]. It offers secure storage for project code and convenient access to reviewer comments and submission deadlines, supporting systematic planning and academic supervision.

B. User Management and Role-Based Access

The user management component enforces secure access through role-based authentication mechanisms. Distinct roles, such as student and reviewer, are assigned specific permissions governing document access and editing rights. This module oversees user registration, login authentication, and account management while safeguarding data integrity and preventing unauthorized operations across the platform.

C. Real-Time Document Editor with Templates

The platform incorporates a collaborative document editor that enables users to compose and revise research papers directly within the system. It supports concurrent multi-user editing and includes predefined templates aligned with established academic standards such as IEEE, ACM, and Springer. Features such as automatic saving and built-in formatting assistance ensure consistency and reduce the risk of data loss during the writing process.

D. RAG-Based AI Writing Assistant

The Retrieval-Augmented Generation (RAG)-based writing assistant delivers context-sensitive guidance by retrieving relevant information from a shared knowledge repository and generating appropriate suggestions [4]. It supports tasks such as title formulation, abstract composition, section organization, and adherence to publication-specific formatting requirements [16]. By combining retrieval and generation mechanisms, this module enhances writing quality while minimizing the effort involved in producing academic content.

E. Semantic Tagging and Intelligent Tool Suggestions

This module applies a rule-based semantic tagging approach to automatically detect keywords, structural components, and research concepts within documents. Based on the identified semantics, the system proposes relevant tools to assist users during drafting. For instance, citation utilities are suggested when references are detected, formatting tools are recommended for methodology or results sections, and summarization functions are triggered for lengthy text segments. Integration with a centralized knowledge base improves contextual precision and ensures relevant recommendations [5].

F. Multilingual Support

The multilingual module enables users to create research content in their preferred language while offering translation support, automatic language identification, and basic grammar assistance [8]. This capability broadens accessibility for users from diverse linguistic backgrounds while preserving adherence to academic formatting conventions.

G. Review and Progress Report Management

This component centralizes the storage of research documents, reviewer remarks, and progress reports within a structured repository. It facilitates timely and organized feedback for students and allows reviewers to monitor research development efficiently [5]. Centralized documentation enhances transparency, traceability, and systematic oversight throughout the research process.

H. AI-Based Literature Survey Summarization, and Title Generation

The system supports literature review activities by summarizing research articles and extracting key themes automatically. A T5-based text generation model is employed to produce relevant and context-aware research titles [17]. By automating analytical tasks related to literature exploration, this module reduces manual workload and enables researchers to concentrate on conceptual development and innovation. It also assists in identifying prominent themes and potential research gaps across multiple studies.

I. Scoreboard

The scoreboard mechanism introduces a motivational framework by monitoring student engagement and research contributions. Points are allocated based on activities such as document revisions, participation levels, and timely submissions. The ranking feature encourages sustained involvement and consistent progress throughout the research journey [15].

J. Research Roadmap Generator and Course Recommendation

The research roadmap generator produces a structured progression plan that guides students from topic identification through final submission [13]. Leveraging the centralized knowledge base, the system also suggests relevant courses, educational resources, and reference materials aligned with the chosen research area, supporting informed learning and structured academic development.

V. Feasibility Study

A feasibility study is conducted to assess whether the proposed system can be effectively developed and deployed in a real-world setting. It examines the project's practicality, potential constraints, and overall readiness prior to full-scale implementation. For the QuestScholar platform, the analysis focuses on three primary dimensions: technical, operational, and economic feasibility.

A. Technical Feasibility

The platform relies on modern web technologies, cloud infrastructure, and AI-based language models to enable features such as real-time collaborative editing, RAG-based writing assistance, multilingual support, and automated literature summarization. Most academic institutions already possess the necessary computing resources and stable internet connectivity to support such a system. Additionally, QuestScholar is designed to integrate with existing institutional workflows, including login portals, research submission systems, and document repositories. Compatibility with standard file formats such as PDF and DOCX further ensures smooth adoption without major infrastructure changes.

B. Operational Feasibility

From an operational perspective, the platform aligns well with existing academic practices. Students, faculty, and reviewers are already accustomed to using digital editors, plagiarism detection tools, and online submission portals. By consolidating these functionalities into a unified system, QuestScholar simplifies daily research activities and reduces manual effort. Role-based authentication ensures secure access, while compliance with institutional data policies and academic integrity standards is maintained. The platform enhances workflow efficiency by enabling structured document preparation, secure feedback exchange, and systematic progress monitoring.

C. Economic Feasibility

Economically, the system is viable due to its reliance on lightweight web technologies and open-source components, which help control development and maintenance costs. Primary expenses include cloud hosting, system development, and periodic maintenance; however, these are offset by reduced dependence on multiple software subscriptions and manual administrative processes. By integrating writing, formatting, reviewing, and tracking functions into a single platform, QuestScholar lowers operational overhead and improves productivity. Over time, the improvements in efficiency, research quality, and institutional output indicate strong potential for a positive return on investment.

VI. Proposed System Design

The proposed system consists of several interconnected modules that enable an AI-supported academic research and document management environment. The platform supports three main user roles: students, professors, and administrators. Students initiate research activities by defining project context and creating documents through an integrated real-time editor. The system incorporates AI-based features such as literature survey summarization, title generation, semantic tagging, and roadmap generation to assist students during the research writing process [3] [7].

All project data and generated content are securely stored in a centralized database for efficient access and management [11]. Professors review submitted documents, provide feedback, and indicate approval or rejection decisions. Administrators manage institutional operations including university registration, user authentication, and system monitoring. The scoreboard module tracks research progress and evaluation results, enabling transparent monitoring of academic performance [10]. This architecture ensures secure access, efficient collaboration, and organized management of academic research activities.

System architecture represents the conceptual structure that defines how the components of a system are organized and how they interact to perform coordinated operations. It provides a structured view of system modules, data flows, and communication mechanisms between components. The architecture of the proposed platform integrates user interfaces, AI-based processing modules, authentication mechanisms, and a centralized database within a unified framework [4] [16]. As illustrated in Figure 4, the system supports collaborative research and document authoring through clearly defined roles and controlled interactions. By organizing functional modules in a centralized structure, the architecture ensures scalability, secure access management, and efficient coordination of academic research activities.

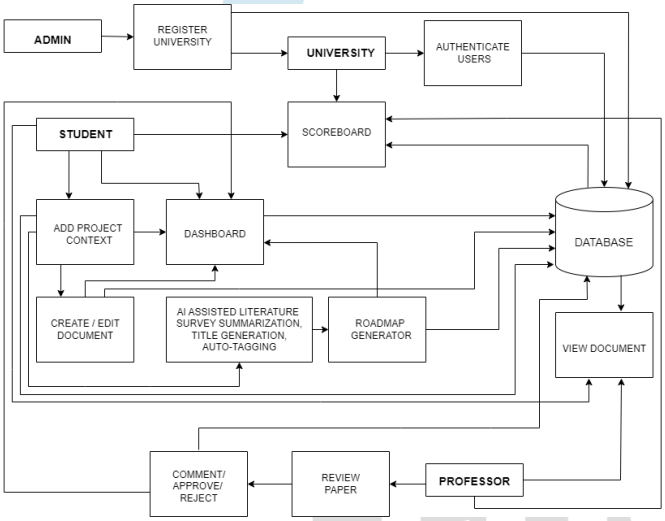

Fig. 4. Architecture Daigram

Figure 4 presents the architecture diagram of the QuestScholar platform, which functions as a collaborative research and document authoring environment designed for students, professors, and administrators. The major components of the system are described as follows:

1) **Student**– The primary user responsible for initiating and managing research projects. Students define project context, create and edit documents, and utilize AI-supported tools for literature survey summarization, title generation, and semantic tagging.
2) **Add Project Context** – Captures essential research details that act as the input for document creation and AI-based processing.
3) **Create / Edit Document**– Allows students to compose and modify research documents using the integrated real-time document editor.
4) **AI-Assisted Literature Survey Summarization, Title Generation, and Auto-Tagging**– Uses AI techniques to generate literature summaries, suggest research titles, and automatically assign semantic tags to documents [9] [1].
5) **Roadmap Generator**– Produces a structured research roadmap outlining milestones and suggested research steps based on the project context [2] [14].
6) **Dashboard**– Serves as the central workspace where students manage projects, access AI-generated outputs, and track research progress.
7) **Professor** – Responsible for reviewing submitted research documents and evaluating student work.
8) **Review Paper**– Enables professors to access and analyze submitted research documents within the system.
9) **Comment / Approve / Reject**– Stores reviewer feedback and evaluation results which are communicated back to the student dashboard.
10) **Admin**– Oversees the overall system operation, manages platform activities, and ensures secure functioning of the system.
11) **Register University**– Allows the administrator to register universities in the platform by adding institutional details. This enables proper organization and management of users belonging to different universities.
12) **University** – Represents the institutional entity that manages students and professors associated with the platform.
13) **Authenticate Users**– Handles user login verification and role-based access control to ensure secure access to the system [11].
14) **Scoreboard**– Displays research progress and evaluation results, allowing users to track performance and project status.
15) **View Document**– Provides access to stored research documents, feedback records, and AI-generated outputs.
16) **Database** – Serves as the central storage system for user credentials, project data, research documents, AI-generated content, and evaluation records.

The architecture of the QuestScholar system integrates user management, AI-assisted research support, document authoring, and evaluation workflows within a unified platform. This design ensures efficient collaboration between students and professors while maintaining secure data management and structured research development throughout the academic process.

VII. RESULTS AND DISCUSSION

The implemented QuestScholar platform was evaluated based on its ability to assist students throughout the academic research workflow while providing effective supervision tools for professors. The system integrates several artificial intelligence modules for document analysis, literature survey summarization, semantic tagging, title generation, and structured document preparation [17] using standardized academic templates.

By combining these functionalities within a single platform, QuestScholar simplifies research management, improves document organization, and supports efficient literature review and research planning. The following subsections present the major functional outcomes of the implemented system.

A. Student Dashboard Interface

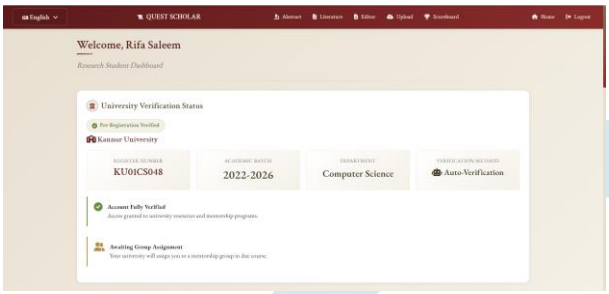

Fig. 5. Student Dashboard Interface

Figure 5 illustrates the main dashboard interface of the QuestScholar platform. The dashboard acts as the central control panel where students can manage research activities, upload documents, and access AI-generated outputs. It displays important information such as uploaded research papers, generated summaries, semantic tags, and project progress indicators. By providing a centralized interface, the dashboard simplifies research management and allows students to track their academic work within a single integrated environment.

B. Semantic Tagging, Title Generation and Tool Suggestion

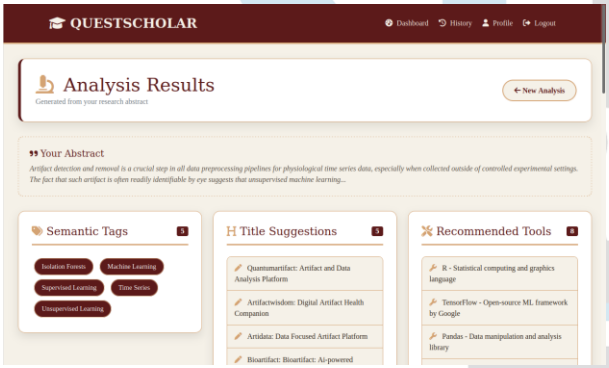

Fig. 6. Semantic Tagging, Title Generation and Tool Suggestion

Figure 6 shows the output of the semantic analysis module. When a research document is uploaded, the system automatically analyzes the textual content and extracts key concepts using natural language processing techniques [3]. These concepts are used to generate semantic tags that represent the main topics of the research paper [5].The system provides suggested research titles and relevant development tools related to the identified research domain. This functionality helps students better organize their research content and identify suitable directions for further development.

C. AI-Based Literature Survey Summarization

Figure 7 presents the literature survey summarization feature of the platform. After uploading a research document, the system automatically processes the text using transformer-based natural language processing models to generate a concise summary [8]. The generated summary highlights key information such as research objectives, methodology, and major findings. This feature enables students to quickly understand related research work and significantly reduces the time required for manual literature review.

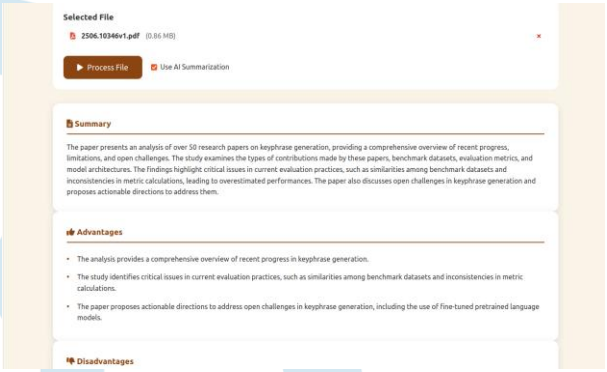

Fig. 7. Literature Survey Summarization

D. Real-Time Document Editor

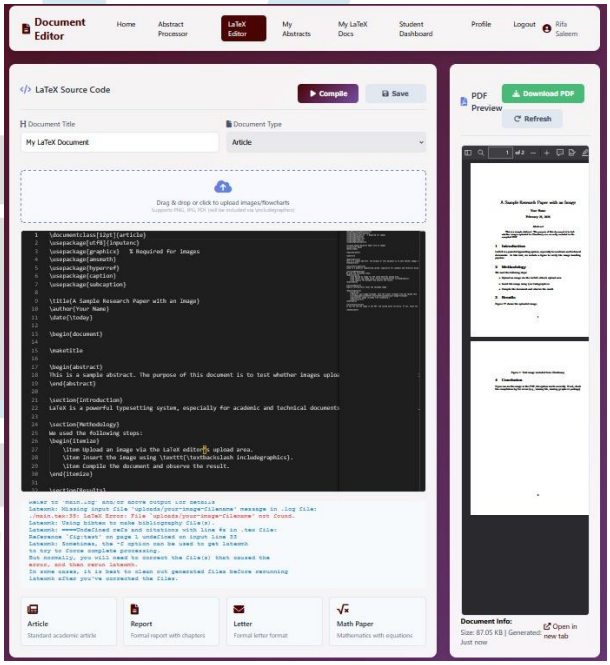

Fig. 8. Real-Time Document Editor with Templates

Figure 8 demonstrates the real-time document editor integrated within the QuestScholar platform. The editor allows students to write and edit research papers directly within the system using predefined academic templates such as IEEE, ACM, and Springer formats [15]. The editor supports structured formatting, automatic saving, and collaborative editing capabilities. By providing built-in document preparation tools, the system eliminates the need for external editors and ensures that research documents follow standardized academic formatting guidelines.

E. Document Review and Approval Interface

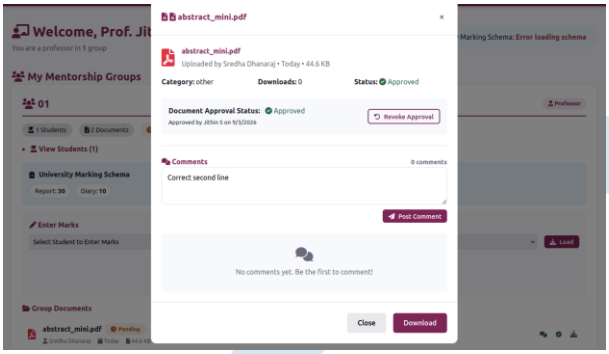

Fig. 9. Document Review and Approval

Figure 9 demonstrates the document review interface of the QuestScholar platform where a research document titled abstract mini pdf is displayed. The interface provides details such as the document uploader, file , category, download count, and approval status. It also allows professors to approve or revoke approval and provide feedback through the comments section. This feature supports academic document management by enabling mentors to review, comment on, and manage research submissions within the platform [10].

VIII. CONCLUSION

QuestScholar presents a centralized and AI-enabled academic research management platform designed to streamline the complete research lifecycle within institutional environments. By integrating real-time collaborative editing, structured template support, Retrieval-Augmented Generation-based writing assistance, semantic tagging, literature summarization, and intelligent recommendation mechanisms [4] [9], the system addresses fragmentation in traditional research workflows. The architecture enables secure role-based access control, ensuring controlled interaction among students, professors, and administrators while maintaining data integrity and transparency. This integrated approach enables institutions to manage research activities more efficiently within a single digital ecosystem.

The platform enhances research efficiency by consolidating document preparation, review management, progress monitoring, and performance tracking into a unified framework. Features such as roadmap generation, multilingual support, and a structured scoreboard mechanism promote organized supervision and measurable academic development [6] [14]. Through centralized coordination and AI-assisted guidance, QuestScholar supports systematic research progression from initial topic formulation to final submission. The proposed framework establishes a scalable foundation for intelligent academic collaboration and structured research management in higher education institutions. These capabilities help create a more structured, transparent, and collaborative research environment for academic communities.

ACKNOWLEDGMENT

We would like to express our sincere gratitude to St. Thomas College of Engineering and Technology for the continuous academic support and encouragement provided throughout the course of this research work.

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