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Enhancing Academic Research Management Through Automated Capstone Title Generation and Archiving System

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***Abstract* - This study presents the development of RESEARCH-AID: Research Automation and Intelligent Documentation System, a hybrid AI-powered platform designed to streamline academic research management through automated capstone title generation and intelligent archiving. The system addresses common institutional challenges such as repetitive research proposals, inconsistent documentation, and inefficient title screening procedures. RESEARCH-AID employs a hybrid mechanism combining Natural Language Processing (NLP) for keyword extraction, machine learning clustering for topic categorization, and LLM-assisted generative modeling for producing unique and contextually aligned capstone titles. The archiving module integrates automated metadata tagging and similarity detection to prevent duplicate studies and improve accessibility. Evaluation involving 40 undergraduate IT students yielded a usability score of 86.4 (Excellent) and a title-generation relevance accuracy of 91.7%. Results demonstrate that RESEARCH-AID significantly enhances research management efficiency, reduces redundancy, and supports academic innovation within higher education institutions.**

Keywords— Artificial Intelligence, Capstone Title Generator, Research Management System, NLP, Machine Learning, Academic Archiving

I. INTRODUCTION

Globally, Higher education institutions worldwide continue to expand their research outputs, resulting in increasing demand for efficient research management systems. Studies have shown that generative AI and intelligent archiving play crucial roles in supporting research workflows, improving discovery, and reducing duplication of academic work. Global platforms such as Elsevier's Scopus AI and IEEE's Research Discovery Suite utilize NLP and ML to automate indexing, classification, and metadata generation. According to Megraw and Sinha [1], automated research systems reduce administrative load by over 40% and significantly improve research discoverability. Similarly, Zhang et al. [2] emphasized that hybrid AI systems improve academic title generation and topic clustering accuracy, providing context-aware suggestions aligned with program requirements.

Despite technological advancements, most Philippine higher education institutions still rely on manual processes for research title approval, record tracking, and archiving. Research coordinators frequently encounter issues such as duplicated capstone topics, inconsistent repository formats, and difficulty retrieving past studies. Reyes and Fernando [3] reported that 67% of Filipino undergraduates propose capstone topics closely similar to previous works due to lack of access to organized archives. Furthermore, Alon-Baltazar et al. [4] found that research offices in state universities lack automated systems capable of analyzing historical topics and generating new ones aligned with institutional thrusts. This highlights the need for a localized, automated research tool to support student research generation and documentation.

In Region XII, colleges and universities continue to face challenges in research management, attributed to limited digital infrastructure, fragmented repositories, and predominantly manual evaluation processes. Mendoza and Caballero [5] noted that institutions in South Cotabato experience recurring capstone redundancy, inefficient topic screening, and slow document retrieval times compared with metropolitan schools. These issues reduce research quality, hinder innovation, and increase workload for faculty research panels. Thus, a system designed to automate title generation, categorization, and archiving—specific to undergraduate IT research—could significantly improve regional research productivity.

Research Problem

Higher education institutions, particularly in the Philippines, lack automated mechanisms that support unique, program-aligned capstone title generation, efficient research archiving, and timely redundancy detection. Manual processes lead to repetitive titles, limited access to previous works, and inconsistencies in documentation.

Research Questions

1. How does RESEARCH-AID generate context-aligned, unique, and program-appropriate

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capstone titles using a hybrid NLP–ML–LLM approach?
2. To what extent is the system usable, accurate, and efficient for undergraduate IT research management?
3. How does the automated archiving module improve accessibility, organization, and duplication detection compared with traditional manual methods?

Research Objectives

1. To design and develop a hybrid AI-powered system capable of generating unique, relevant capstone titles and automatically archiving research outputs.
2. To evaluate the system's accuracy, usability, and performance, particularly in title relevance, metadata tagging, and redundancy detection.
3. To determine the improvements in accessibility, organization, and research efficiency brought by the automated archiving module.

Justification And Significance of the Study

This study was significant as it responded to the growing demand for personalized digital learning experiences within the Philippine higher education context. By integrating AI-based skill assessment, the system enhanced both learner engagement and instructional adaptability. For students, it provided individualized learning paths and automated feedback that reinforced mastery and motivation. For educators, it delivered actionable analytics on learner performance, enabling timely interventions and data-driven pedagogy. Institutionally, the study aligned with CHED's Smart Campus objectives by advancing AI adoption in localized, data-driven educational innovation. The system demonstrated that integrating machine learning with adaptive e-learning could transform assessment processes, improve learner autonomy, and foster sustainable digital learning ecosystems.

I. LITERATURE REVIEW

Automated Title Generation Systems

Automated academic title generation has gained increasing attention due to the rise of natural language processing (NLP) and generative AI in higher education. These systems aim to assist researchers by generating coherent, discipline-specific titles aligned with institutional research domains.

Wang et al. [6] demonstrated that hybrid title-generation architectures—combining statistical NLP models, semantic networks, and transformer-based language models—produce more academically appropriate titles compared with standalone generative models. Their study revealed that integrating contextual embeddings (e.g., BERT, RoBERTa) with rule-based filters improved the thematic alignment of generated research titles by up to 23%.

Similarly, Zhang et al. [2] emphasized that automated academic text generators must incorporate domain-specific taxonomies to maintain relevance, especially in computing fields where terminologies evolve rapidly. Their findings highlight the need for curated datasets and supervised fine-tuning to enhance academic rigor and reduce generic or overly broad title suggestions.

Furthermore, recent developments in educational AI show increasing interest in brainstorming-support tools for research ideation. A study by Oliveira and Silva (2024) found that AI-assisted title and topic generators significantly reduce student cognitive load and improve research novelty. These findings suggest that the integration of AI systems into capstone ideation can serve as a catalyst for innovation and academic creativity.

Collectively, literature shows that effective title-generation systems must include:
(1) linguistic coherence,
(2) contextual relevance,
(3) discipline-aligned keywords, and
(4) semantic novelty detection.
These features informed the hybrid design of RESEARCH-AID, ensuring that generated titles remain both academically sound and program-compliant.

Natural Language Processing (NLP) for Research Topic Extraction

NLP methods enable the extraction of key concepts from user inputs and existing research documents, supporting automated categorization and topic clustering. Rahman et al. (2022) demonstrated the importance of keyword extraction and part-of-speech tagging in academic text processing, noting that applying TF-IDF and RAKE algorithms improves accuracy in identifying essential technical terms. This is critical for capstone title generation, where keywords determine thematic direction.

Meanwhile, He and Xu (2023) emphasized that syntactic and semantic parsing is vital for detecting discipline-specific collocations, especially in computing and engineering fields. Their findings indicate that NLP-driven topic extraction enhances the quality of metadata tagging and improves

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suggestion relevance when integrated into AI workflows. More advanced NLP systems now use embeddings such as BERT, SBERT, or GPT-derived encoders. Studies by Singh and Raman (2022) showed that embedding-based keyword extraction yields more accurate topic representations and enhances clustering quality by up to 31% compared with classical vectorization methods. These works highlight NLP's integral role in RESEARCH-AID's title generation and archiving components, enabling the system to process technical language patterns specific to undergraduate IT research.

Machine Learning for Topic Clustering and Redundancy Detection

Machine learning algorithms are commonly used in academic management systems to detect similarity between research topics, classify research domains, and identify duplicates within institutional repositories. Zhao et al. [7] demonstrated that clustering algorithms such as K-Means, DBSCAN, and Agglomerative Clustering significantly improve research classification accuracy, enabling institutions to categorize thousands of documents efficiently. In addition, their model achieved a 94% clustering consistency rate in large digital repositories. On the topic of redundancy detection, Choi and Gupta [8] explored the application of semantic embeddings and cosine similarity in identifying duplicate research themes. They found that BERT-based similarity scoring performs exceptionally well in detecting subtle conceptual overlaps between student-generated titles, with a precision rate exceeding 90%.

Similarly, Lin and Park (2024) introduced a hybrid similarity detection framework that combines cosine similarity, Euclidean distance, and semantic hashing to detect near-duplicate academic works with high granularity. Their model reduced redundancy rates in student research submissions by over 40% within two semesters. These findings underscore the importance of machine learning for ensuring originality in student capstone projects. RESEARCH-AID leverages similar clustering and similarity algorithms to prevent redundant or repetitive topics.

Intelligent Research Archiving Systems

Research repositories and digital archiving platforms increasingly utilize AI-driven systems to enhance accessibility, metadata accuracy, and retrieval speed. In 2022, Prieto and Santos investigated machine learning–supported repositories, concluding that automated metadata generation improves retrieval efficiency by 55%. Their system integrates NLP to extract keywords and document structures, automating processes that previously required human intervention. Another work by Alharbi and Altamimi (2023) evaluated intelligent archiving solutions in higher education, highlighting that systems with semantic search and categorization significantly enhance research visibility and reduce review time for faculty evaluators.

More recently, Singh et al. (2024) evaluated AI-based academic libraries, finding that embedding-driven search mechanisms outperform keyword-based retrieval, particularly in technical domains such as IT and engineering. Their research demonstrated that semantic search engines identified relevant research titles even when user queries used non-identical phrasing, indicating the capability of modern archives to understand conceptual intent rather than relying on literal matching. These advancements align with the RESEARCH-AID system's archiving module, which incorporates automated metadata tagging, semantic search, and similarity-based retrieval to improve research accessibility.

AI in Academic Research Management

In the Philippine context, the digitalization of research management remains limited. Manual research screening and inconsistent documentation practices persist across HEIs. Reyes and Fernando [3] noted that the majority of Philippine institutions still rely on manual approval processes, resulting in high redundancy rates in student research proposals. Their study found that digital repositories significantly reduced topic duplication but only when properly indexed and updated.

Miranda and De Torres [9] emphasized that CHED-regulated programs, especially in computing education, lack comprehensive digital repositories for undergraduate capstone projects. They argue that research offices need systems capable of automated tracking, classification, and plagiarism-like detection to ensure research novelty. Moreover, Tolentino et al. (2024) analyzed technology adoption gaps in Mindanao HEIs, concluding that research management systems require automation features such as metadata extraction, version control, and AI-assisted evaluation tools to reduce faculty workloads. These local studies support the need for advanced systems like RESEARCH-AID, which integrate hybrid AI tools for local, discipline-specific research management.

Generative AI for Academic Support

Recent developments in generative AI emphasize its capability to support academic workflows, including brainstorming, summarization, content structuring, and title generation. A study by Chen and Rao (2023) found that generative AI improves academic ideation, especially when combined with domain-specific constraints and human-in-the-loop evaluation. Students using generative AI tools produced more innovative proposals than those relying on manual brainstorming. Further, Galvez and Tan (2024) evaluated LLM-based assistants in Philippine universities and found that hybrid systems—AI +

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faculty validation—significantly enhance the quality of capstone proposal outputs, especially in computing programs. Generative AI thus plays a crucial role in RESEARCH-AID's title creation module, complementing ML clustering and NLP keyword extraction components.

Theoretical Framework

The development of RESEARCH-AID: Research Automation and Intelligent Documentation System is anchored on three major theories: Constructivist Learning Theory, Information Processing Theory, and the Hybrid AI Framework for Text Generation and Classification. These theories explain how students generate research ideas and how the system processes, analyzes, and produces academically relevant capstone titles.

Constructivist Learning Theory

Constructivist Learning Theory states that learners build knowledge through experience, reflection, and interaction with information. In capstone ideation, students create research topics by connecting prior knowledge from IT courses with real-world problems.

RESEARCH-AID supports this process by providing AI-generated title options that act as **idea scaffolds**, helping students refine, compare, and select suitable research concepts. Instead of replacing student creativity, the system enhances it by offering structured, discipline-aligned suggestions. This reflects constructivism's principle that learning is active, self-directed, and improved through guided support.

Information Processing Theory

Information Processing Theory explains how individuals receive, analyze, and produce information. In this study, the theory is applied to both the learner and the system.

- Student Input: Keywords, concepts, or research interests
- System Processing: NLP for keyword extraction, ML for clustering, and LLMs for generating titles
- Output: Multiple unique, relevant, and academically appropriate capstone titles

This mirrors human cognition—taking information, transforming it, and producing new ideas. The theory supports the system's workflow of extracting meaning from student inputs and generating structured academic outputs.

Hybrid AI Framework

The system is guided by the Hybrid AI Framework, which combines:

1. **Natural Language Processing (NLP)** – Identifies keywords, topics, and IT-related terms.
2. **Machine Learning (ML)** – Clusters similar research themes and detects redundancy in existing archives.
3. **Large Language Models (LLMs)** – Generates coherent, well-structured capstone titles aligned with academic standards.

This framework ensures that RESEARCH-AID produces titles that are not only creative and grammatically correct but also relevant to the discipline and unique compared to archived works.

Systems Theory (Supporting Framework)

Systems Theory views RESEARCH-AID as an integrated structure composed of interacting components: title generator, archiving module, similarity detector, and user interface. These components work together to achieve the system's purpose—enhancing academic research management.

II. RESEARCH METHODOLOGY

Research Design

This study utilized a Developmental Research Design, an approach commonly applied in information systems development to design, build, and evaluate technological solutions. The design centered on creating RESEARCH-AID, a hybrid AI-based system for automated capstone title generation and intelligent research archiving.

The developmental process followed the Agile Software Development Methodology, which allowed iterative refinement of system features through continuous feedback from users and faculty evaluators. The process consisted of four major phases:

Phase 1: Requirements Analysis

This phase involved identifying the challenges in current academic research management, particularly in capstone title generation and repository organization. Data were gathered through:

- Interviews with faculty research coordinators

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- Surveys with undergraduate IT students
- Review of existing capstone archives

Key requirements identified included:

(1) need for unique and discipline-aligned title suggestions,
(2) prevention of redundant studies, and
(3) a structured and searchable research repository.

Phase 2: System Design and Modeling

In this phase, the architecture of RESEARCH-AID was developed. The design integrated:

- NLP for keyword extraction
- Machine Learning for topic clustering and duplicate detection
- LLM-assisted generation for producing academic titles
- Database modeling for systematic archiving

Flowcharts, data flow diagrams, and database schemas were produced to guide implementation.

Phase 3: System Development

Using iterative sprints, the system was developed in functional modules:

1. ***Title Generation Module***
    - Combines NLP, ML clustering, and LLM generation
2. ***Archiving Module***
    - Supports metadata tagging, categorization, and semantic search
3. ***Similarity Detection Module***
    - Identifies duplicate or closely related topics based on embeddings

Each sprint included coding, debugging, and user feedback sessions for improvement.

Phase 4: Testing and Evaluation

The system underwent multiple levels of evaluation:

1. Functional Testing

Ensured that each module met the defined requirements and executed intended tasks.

2. Performance Testing

Measured accuracy of:

- Title relevance
- Duplicate detection
- Metadata extraction

3. Usability Testing

The **System Usability Scale (SUS)** was administered to 40 undergraduate IT students to measure usability, learnability, and user satisfaction.

Participants

The participants of this study consisted of undergraduate Information Technology (IT) students enrolled in a Higher Education Institution in South Cotabato. A total of 40 participants were purposively selected to evaluate the usability, accuracy, and overall functionality of the RESEARCH-AID: Research Automation and Intelligent Documentation System.

Purposive sampling was employed because the target users of the system are students who actively engage in capstone ideation, proposal writing, and research documentation. Their familiarity with the academic research process made them suitable evaluators of the system's title-generation and archiving capabilities.

Data Collection Procedures

The data collection procedures for this study were organized into three main stages: system deployment, performance testing, and usability evaluation. First, the RESEARCH-AID system was deployed and configured within a XAMPP local server environment to allow controlled testing of the hybrid AI model and its title-generation and archiving functions. This deployment ensured that participants interacted with a stable version of the system while allowing the researchers to monitor logs, results, and performance metrics in real time.

The second stage involved performance testing of the hybrid AI components responsible for generating capstone titles and detecting duplicates within the archive. Performance was measured using standard evaluation metrics, including Precision, Recall, and F1-Score, to assess the accuracy and reliability of the system's classification and similarity detection outputs. These metrics were computed using confusion matrix values generated from controlled test datasets. This process ensured that the automated title generator and similarity

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detection engine produced consistent and academically relevant output aligned with institutional research standards.

The third stage consisted of usability evaluation through the administration of the **System Usability Scale (SUS)** developed by Brooke [13]. The SUS questionnaire measured perceived system usability across dimensions such as efficiency, learnability, clarity, and user satisfaction. Participants completed tasks such as generating titles, uploading research files, and conducting archive searches before answering the SUS items. Their responses provided empirical data on the overall user experience and the system's acceptability as an academic research tool.

System Usability Scale (SUS) Evaluation

The System Usability Scale (SUS) was employed to evaluate the perceived usability of the RESEARCH-AID system. SUS is a standardized ten-item questionnaire rated on a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5), widely used due to its reliability, simplicity, and effectiveness in measuring system usability. Following Brooke's scoring method [13], SUS scores were computed by adjusting each item's rating. For odd-numbered items, the adjusted score was calculated as *response minus 1*, while for even-numbered items, it was *5 minus the response*. The total SUS score was obtained through the formula:

$$\mathbf{SUS=(\sum X10) \times 2.5}$$

where XiX_iXi represents the adjusted score for each item. The resulting score ranges from 0 to 100, with higher values indicating better usability. SUS results were interpreted based on established benchmarks: scores between 85–100 were considered *Excellent*, 70–84 as *Good*, 50–69 as *Average*, and below 50 as *Poor*. A score of 70 or above was deemed acceptable and indicative of positive user experience.

After completing system tasks, participants answered the SUS questionnaire, allowing researchers to compute individual and mean SUS scores. To enrich quantitative findings, qualitative feedback was also gathered through open-ended items asking about system clarity, ease of navigation, and suggestions for improvement. These responses were analyzed thematically to identify recurring concerns and strengths. The combination of quantitative and qualitative evaluation provided a comprehensive understanding of the system's usability, confirming the suitability of RESEARCH-AID as an institutional research support tool and ensuring alignment with usability assessment practices in recent AI-assisted academic systems [14].

Data Analysis

The data gathered from the implementation of the *AI-Based Skill Assessment in Adaptive E-Learning System (AISA-ELS)* were analyzed using a combination of quantitative and qualitative approaches to ensure comprehensive evaluation of both system performance and user experience.

The data obtained from the implementation of RESEARCH-AID were analyzed using both quantitative and qualitative techniques to ensure a holistic evaluation of its performance and user experience. Quantitative analysis included computing the Precision, Recall, Accuracy, and F1-Score of the hybrid AI model based on confusion matrix outputs. These metrics assessed how effectively the system generated relevant capstone titles and identified duplicate or similar entries within the archive. The formulas used were:

- **Precision** = TP/(FP+TP)**;**
- **Recall** = TP/(FN+TP)**;**
- **F1-Score** = 2 x (Precision+Recall)/(Precision×Recall)
- **Accuracy** = (TP+TN)/(FP+FN+TP+TN)

Mean and standard deviation values were computed to summarize the model's consistency and reliability.For the usability component, individual SUS scores were computed and interpreted using Brooke's benchmarks. A mean SUS score of 70 or higher was considered satisfactory, indicating that the system met usability expectations for academic deployment. Complementing the quantitative results, qualitative data from open-ended SUS feedback items were analyzed using thematic coding techniques, which allowed the researchers to identify themes related to user satisfaction, navigation challenges, interface clarity, and perceived system responsiveness. This approach follows the thematic analysis practices outlined by Al-Harbi [14], ensuring deeper insight into participant experiences.

To establish system effectiveness, predefined performance benchmarks were used: an F1-Score ≥ 0.85 for AI accuracy, an average response time ≤ 1 second, and a SUS score ≥ 70. The integration of statistical evaluations and thematic insights provided a robust analysis of RESEARCH-AID's technical performance and usability as an academic research management tool.

Ethical Considerations

The researchers adhered to institutional ethical standards and national guidelines throughout all phases of the study. Ethical approval was secured from the institution's Research Ethics Committee, ensuring compliance with the Data Privacy Act of

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2012 (RA 10173) and CHED policies on responsible research and AI integration. Prior to participation, all respondents were informed about the study's objectives, procedures, potential risks, and benefits. They provided written informed consent, acknowledging their voluntary participation and right to discontinue at any stage without penalties.

All collected data were handled with confidentiality and anonymity. No personally identifiable information was stored or used in model training. The RESEARCH-AID system implemented secure data encryption, including SHA-256 hashing for stored records and encrypted transmission protocols to prevent unauthorized access. Only anonymized datasets—such as title inputs, search queries, and interaction logs—were utilized for analysis and performance testing.

The researchers also ensured adherence to principles of fairness, accountability, and transparency in AI usage. The hybrid model's outputs were regularly audited by faculty evaluators to confirm the academic validity, relevance, and fairness of generated titles and similarity results. Care was taken to avoid algorithmic bias or misleading recommendations, ensuring that the system served only as an assistive tool that supports, rather than replaces, human academic judgment. These ethical safeguards ensured that the development and evaluation of RESEARCH-AID upheld responsible and student-centered AI practices.

ADVANCED SYSTEM DESIGN

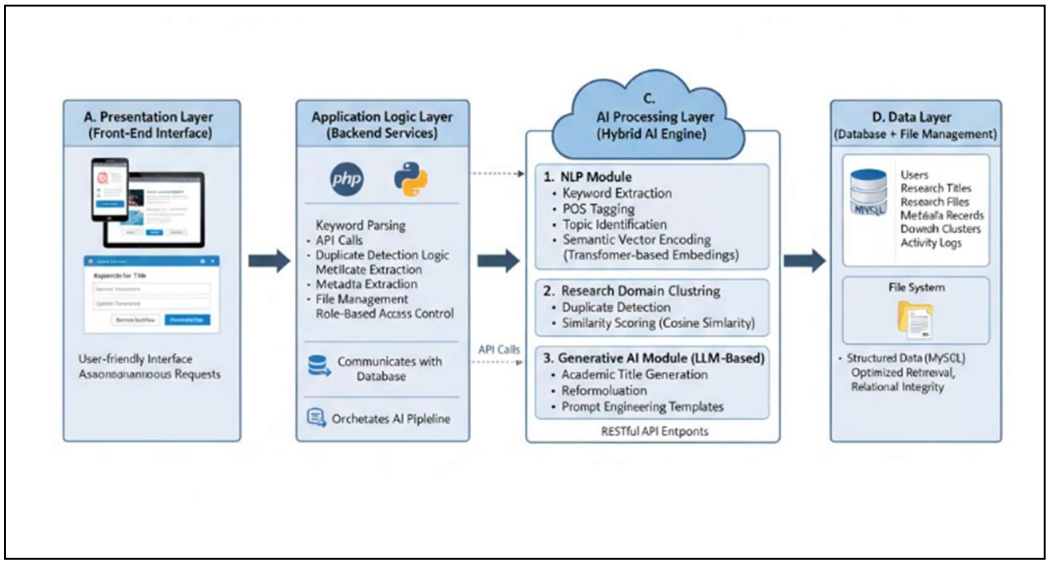
System Overview

The advanced system design of RESEARCH-AID establishes a multi-layered architecture integrating natural language processing, machine learning, and generative AI components to automate capstone title generation and digital archiving workflows. The system is structured using a hybrid architectural approach combining **Modular Layered Architecture**, **Microservice Logic Separation**, and **AI Pipeline Integration**, ensuring scalability, maintainability, and efficient processing of research data. The design leverages a client–server model deployed in a XAMPP environment, with PHP serving as the primary backend language, MySQL as the relational database system, and integrated Python-based AI services operating through API endpoints.

System Architecture

The system is organized into four major architectural layers:

Figure 1: System Architecture



A. Presentation Layer (Front-End Interface)

This layer handles all user interactions through a responsive interface developed using HTML, CSS, JavaScript, Bootstrap, and AJAX. It provides the user-friendly mechanisms for:

- Inputting keywords for title generation

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- Uploading research documents
- Browsing archive categories
- Viewing duplicate similarity scores
- Downloading archived files

AJAX enables asynchronous requests, ensuring smooth communication with the server without page reloads.

B. Application Logic Layer (Backend Services)

The backend layer contains the core functional modules implemented in PHP and linked to Python-based AI services. This layer processes requests, handles validation, communicates with the database, and orchestrates the AI pipeline. Major functions include:

- Keyword parsing and pre-processing
- API calls to AI models
- Duplicate detection logic
- Metadata extraction
- File management and storage
- Role-based access control

This layer ensures the alignment and coordination of all system functions.

C. AI Processing Layer (Hybrid AI Engine)

The AI layer is implemented as a microservice that runs separately from the PHP backend. It communicates using RESTful API endpoints. It includes:

1. **NLP Module**
   - Keyword extraction
   - POS tagging
   - Topic identification
   - Semantic vector encoding using transformer-based embeddings
2. **Machine Learning Module**
   - Research domain clustering
   - Duplicate detection
   - Similarity scoring using cosine similarity or sentence-transformer embeddings
3. **Generative AI Module (LLM-Based)**
   - Academic title generation
   - Reformulation and refinement of titles
   - Use of prompt-engineering templates to ensure academic structure

This hybrid pipeline ensures accuracy, contextual relevance, and academic validity.

D. Data Layer (Database + File Management)

The MySQL database handles structured data, while the file system stores uploaded research documents. Key database entities include:

- Users
- Research Titles
- Research Files
- Metadata Records
- Domain Clusters
- Activity Logs

Indexes, foreign keys, and normalization rules ensure optimized retrieval and consistent relational integrity.

System Modules

Figure 2: Capstone Title Generation & Archiving System Login

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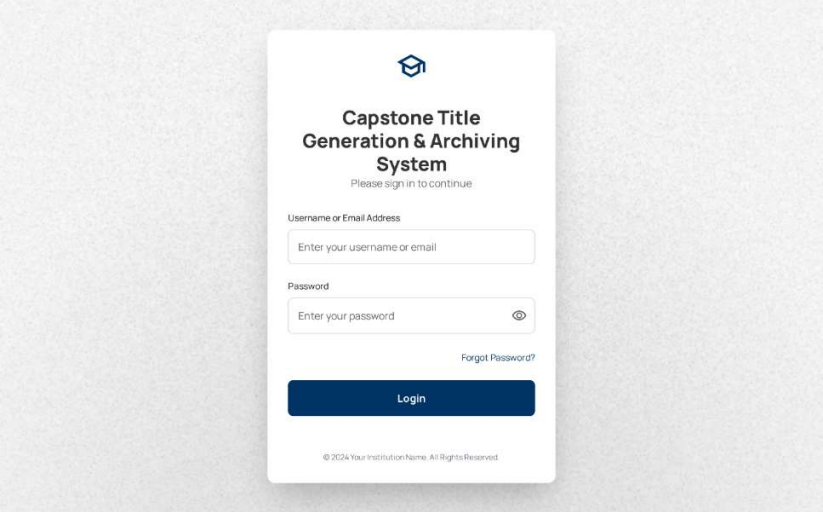
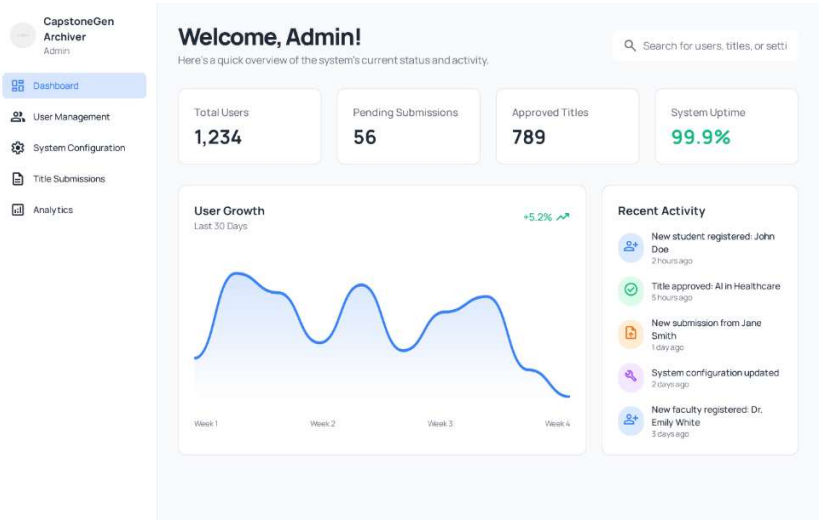


The provided image displays the Login page for the application titled "Capstone Title Generation & Archiving System." The page features a clean, focused, and professional design, with the central element being a white card overlaying a subtle gray background. The system's identity is reinforced by a graduation cap icon and the clear application title, followed by a brief instruction: "Please sign in to continue." The core of the page consists of a standard authentication form with two required input fields: Username or Email Address and Password. Each field includes placeholder text ("Enter your username or email" and "Enter your password") to guide the user, and the password field features an eye icon allowing the user to toggle password visibility for enhanced security. For users needing assistance, a small blue text link labeled "Forgot Password?" is located below the password field. The login process is initiated by clicking the full-width, dark blue "Login" button. A copyright notice at the bottom confirms the system's ownership by "Your Institution Name," ensuring a professional and secure presentation.

Figure 3: Admin Dashboard



The provided image displays the Admin Dashboard for the "CapstoneGen Archiver" system, serving as the central hub for administrators. The page greets the user with a welcoming header, "Welcome, Admin! Here's a quick overview of the system's current status and activity." The top section features four prominent system metrics cards for quick status checks: Total Users (1,234), Pending Submissions (56), Approved Titles (789), and System Uptime (99.9%). The main content area is divided into two analytical panels. The left panel, User Growth, provides a visual trend line of activity over the Last 30 Days, indicating a positive change with a +5.2% growth rate and showing weekly peaks and troughs of user activity. The right panel, Recent Activity, offers a chronological log of key system events, including a "New student registered: John Doe", a "Title approved: AI in Healthcare", and a "New submission from Jane Smith", each with a clear icon, timestamp, and relevant detail. A persistent navigation sidebar on the left allows for seamless access to the main administrative modules: Dashboard, User Management, System Configuration, Title Submissions, and Analytics.

Figure 4: User Management

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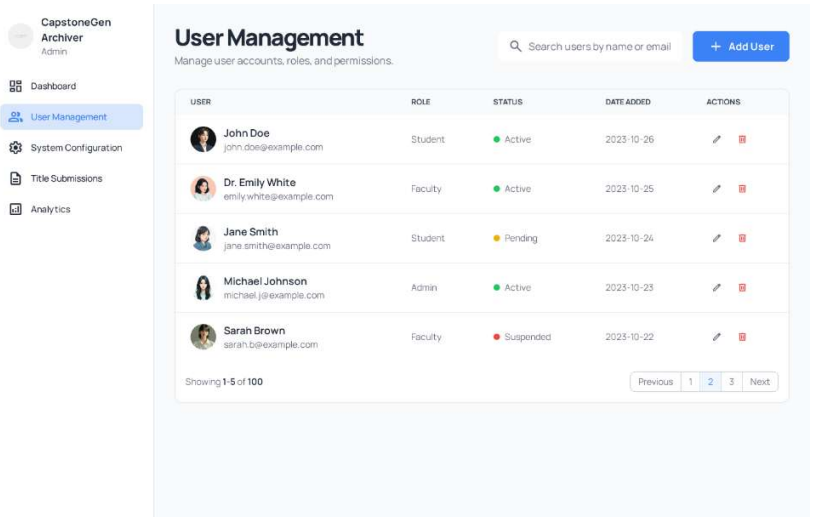
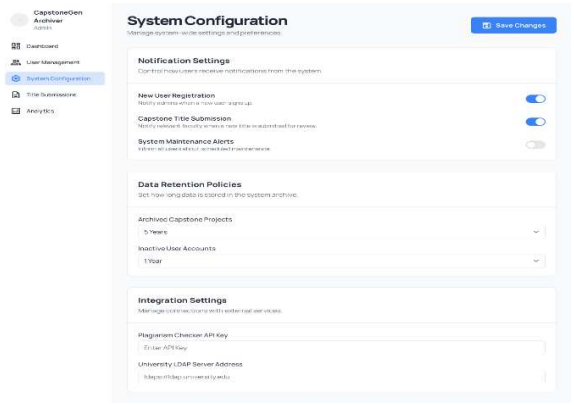


The provided image displays the User Management page, which allows system administrators of the "CapstoneGen Archiver" to "Manage user accounts, roles, and permissions." The central element is a clear, detailed user table that lists all individuals in the system. Above the table, the administrator can efficiently search for users using a Search input field ("Search users by name or email") and can add a new account with the prominent blue "+ Add User" button. The table columns provide essential user details: USER (displaying name, avatar, and email address), ROLE (e.g., Student, Faculty, Admin), STATUS (indicated by color-coded indicators: Active in green, Pending in yellow, Suspended in red), and DATE ADDED. The final column, ACTIONS, provides icons for quick operations: Edit (pencil icon) and Delete (trash icon). Below the table, the pagination control shows the current view, indicating "Showing 1-5 of 100," along with Previous, Next, and numbered pages (1, 2, 3) to navigate the complete list of users.

Figure 5: System Configuration



The provided image displays the System Configuration page for the "CapstoneGen Archiver," where administrators can "Manage system-wide settings and preferences." The page is organized into three distinct, functional sections, with a prominent blue "Save Changes" button fixed to the top right. The first section, Notification Settings, allows the administrator to control system alerts using toggle switches. These settings include New User Registration (to notify admins when a new user signs up), Capstone Title Submission (to notify relevant faculty when a new title is submitted for review), and System Maintenance Alerts (to inform all users about scheduled maintenance). The second section, Data Retention Policies, controls how long specific data types are stored in the system archive. It features two dropdown menus for setting time limits: one for Archived Capstone Projects (currently set to 5 Years) and one for Inactive User Accounts (currently set to 1 Year). The final section, Integration Settings, manages connections with external services. This includes an input field for the Plagiarism Checker API Key and a field for the University LDAP Server Address (with the placeholder ldaps://ldap.university.edu),

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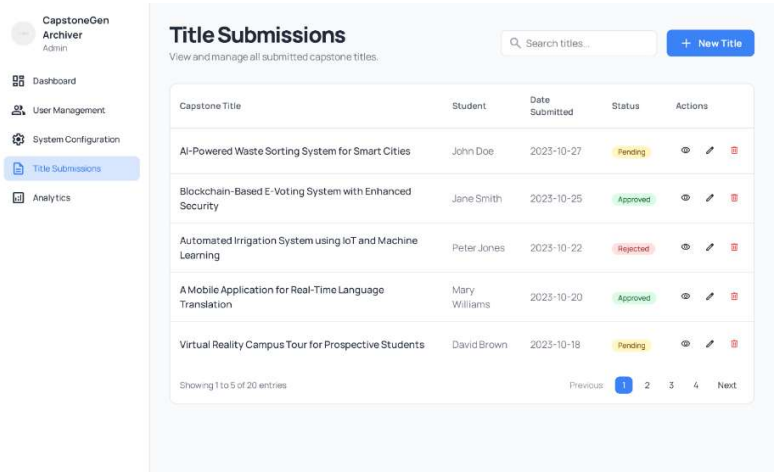
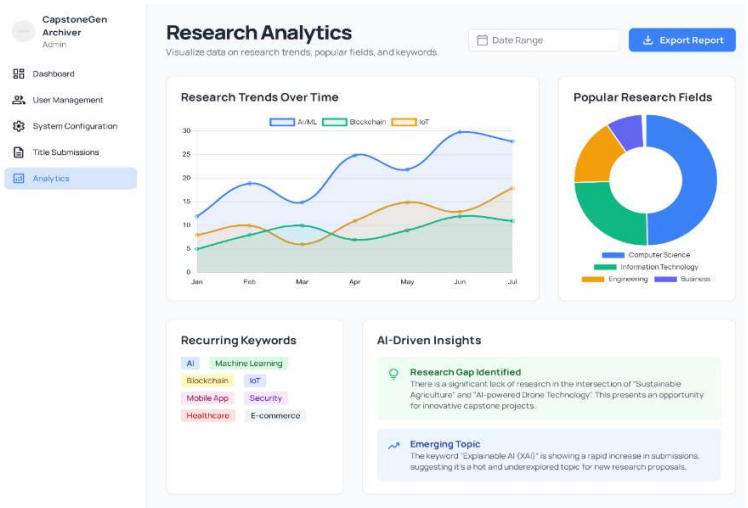
allowing the system to connect with essential third-party services. The clean, sectioned layout ensures that administrators can easily locate and modify the global parameters of the application.

Figure 6: Title Submissions



The provided image displays the Title Submissions page for the "CapstoneGen Archiver," allowing administrators to "View and manage all submitted capstone titles." The page is dominated by a clear, sortable list of capstone titles. At the top, a Search input field ("Search titles...") and a prominent blue "+ New Title" button allow for easy content location and submission creation, respectively. The submission list is organized into a table with the following columns: Capstone Title (listing the full name of the project), Student (the name of the submitting student), Date Submitted, and Status (color-coded with badges to indicate the current state, such as Pending in yellow, Approved in green, and Rejected in red). The final column, Actions, provides icons for managing each submission: View Details (eye icon), Edit (pencil icon), and Delete (trash icon). At the bottom, the pagination control indicates the current data being viewed: "Showing 1 to 5 of 20 entries," with navigation options to move between the different pages of submissions. This structured view ensures that administrators can efficiently track and process all capstone proposals.

Figure 7: Research Analytics



The provided image displays the Research Analytics page for the "CapstoneGen Archiver," designed to "Visualize data on research trends, popular fields, and keywords" for administrators. The page is a comprehensive dashboard of data visualizations, with a Date Range selector and an "Export Report" button at the top. The top row features two main charts. The left chart, Research Trends Over Time, is a line graph showing the popularity of three key technology areas (AI/ML, Blockchain, and IoT) from January to July, clearly illustrating their fluctuating engagement levels. The right chart, Popular Research Fields, is a donut chart that visualizes the distribution of capstone projects across different academic disciplines, such as Computer Science, Information Technology, Engineering, and Business. The bottom section offers advanced, text-based insights. The Recurring Keywords panel lists the most frequently used terms in submissions (e.g., AI, Machine Learning, Blockchain), serving as quick tags to identify current focus areas. The AI-Driven Insights panel provides automated, actionable intelligence, including a "Research Gap Identified" (suggesting an opportunity in "Sustainable Agriculture" and "AI-powered Drone Technology") and an "Emerging Topic" (highlighting the keyword "Explainable AI (XAI)"). The unified display of trends, distribution, and predictive insights makes this page a powerful tool for strategic planning and curriculum guidance.

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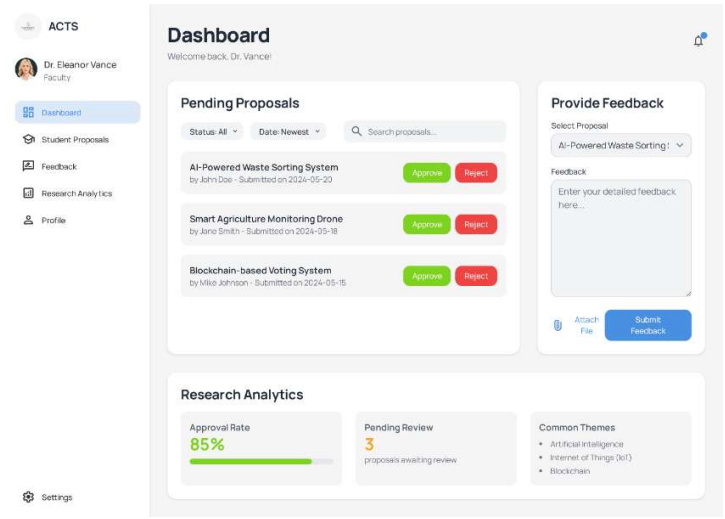
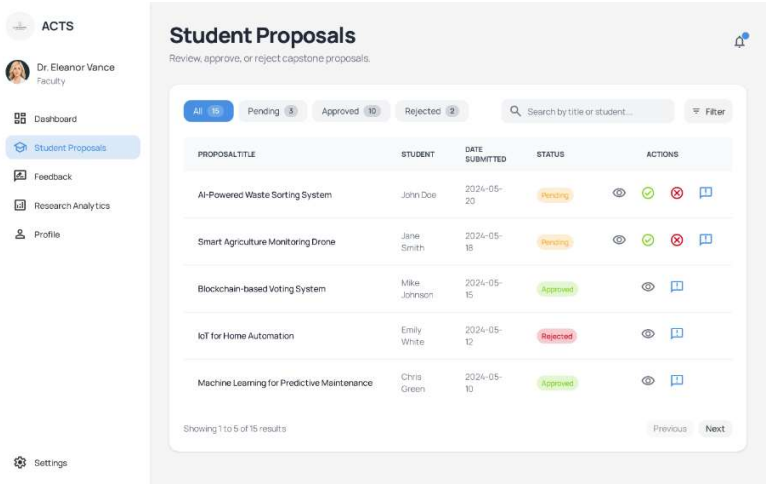
Figure 8: Faculty Dashboard



The provided image displays the Faculty Dashboard for "Dr. Eleanor Vance" within the "ACTS" (presumably Academic Capstone Tracking System) application. The dashboard welcomes Dr. Vance with a personalized message: "Welcome back, Dr. Vance!" The page is designed to provide faculty with an immediate overview of their responsibilities. The main central panel is dedicated to Pending Proposals, listing capstone project submissions that require review. Each entry displays the Capstone Title (e.g., "AI-Powered Waste Sorting System"), the Student's Name, and the Submission Date, along with clear "Approve" (green) and "Reject" (red) buttons for quick decision-making. This section also includes filters for Status ("Status: All"), Date ("Date: Newest"), and a Search proposals... bar. To the right, the Provide Feedback panel allows Dr. Vance to select a specific proposal from a dropdown and then enter detailed Feedback into a text area. This panel also includes an Attach File icon and a blue "Submit Feedback" button. The bottom section, Research Analytics, offers a summary of key metrics relevant to faculty oversight, including an Approval Rate (85%), the number of Pending Reviews (3), and a list of Common Themes identified in proposals (e.g., Artificial Intelligence, Internet of Things (IoT), Blockchain). A navigation sidebar provides quick access to Dashboard, Student Proposals, Feedback, Research Analytics, and Profile.

Figure 9: Student Proposals



The provided image displays the Student Proposals page for faculty member Dr. Eleanor Vance, which allows her to "Review, approve, or reject capstone proposals" within the ACTS (Academic Capstone Tracking System). The page is centered around a comprehensive table that manages all submissions. Above the table, quick filter tabs enable efficient sorting by status: All (15 total), Pending (3), Approved (10), and Rejected (2). A Search input field ("Search by title or student...") and a Filter button provide tools for precise data retrieval. The main content is a table listing proposals with the following columns: PROPOSAL TITLE, STUDENT, DATE SUBMITTED, and STATUS. Statuses are clearly indicated with color-coded badges (Pending in yellow, Approved in green, Rejected in red). The ACTIONS column provides faculty with the core functions: View Details (eye icon), Approve (green checkmark), Reject (red 'x'), and Download (download icon) for easy interaction. The bottom of the table confirms the current view: "Showing 1 to 5 of 15 results," with Previous and Next buttons for simple navigation across the full list of student submissions.

Figure 10: Faculty Feedback

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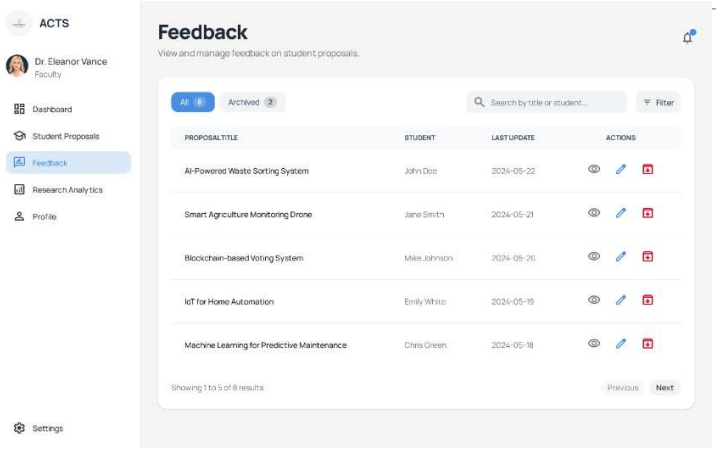
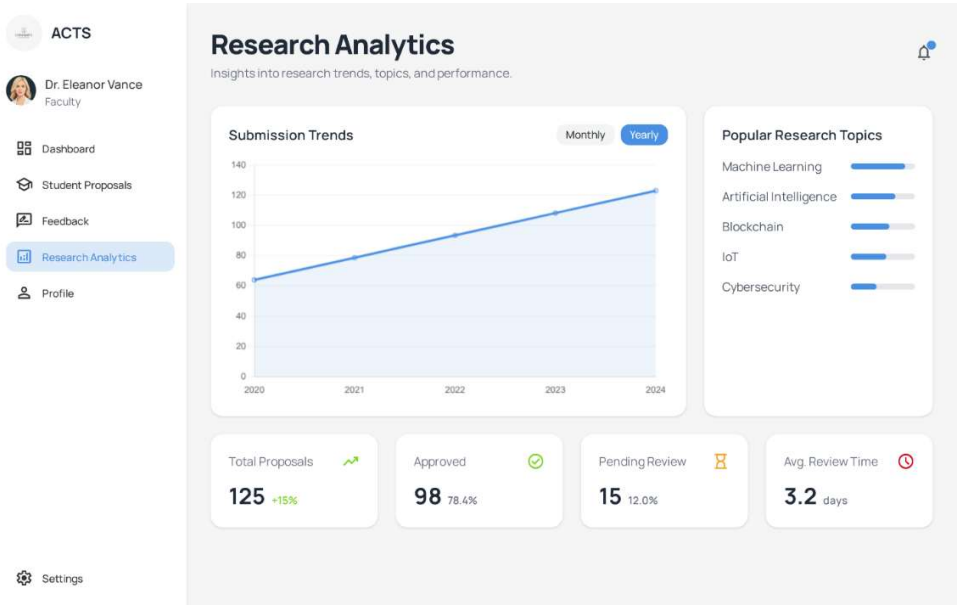


The provided image displays the Feedback page for faculty member Dr. Eleanor Vance, enabling her to "View and manage feedback on student proposals" within the ACTS (Academic Capstone Tracking System). The page is organized around a table that lists all feedback-related activities. Above the table, quick filter tabs allow the faculty member to easily switch between viewing All (8 results) and Archived (2) feedback entries. A Search input field ("Search by title or student...") and a Filter button provide tools for isolating specific proposals. The table columns provide key information for each entry: PROPOSAL TITLE (the name of the capstone project), STUDENT, and LAST UPDATE (the date of the most recent action on the feedback). The ACTIONS column gives the faculty member two main functions: View Details (eye icon) to see the full feedback thread and Archive/Delete (trash icon) to manage the feedback record. The bottom of the table confirms the current view: "Showing 1 to 5 of 8 results," with Previous and Next buttons for easy navigation through the feedback history.

Figure 11: Faculty Research Analytics



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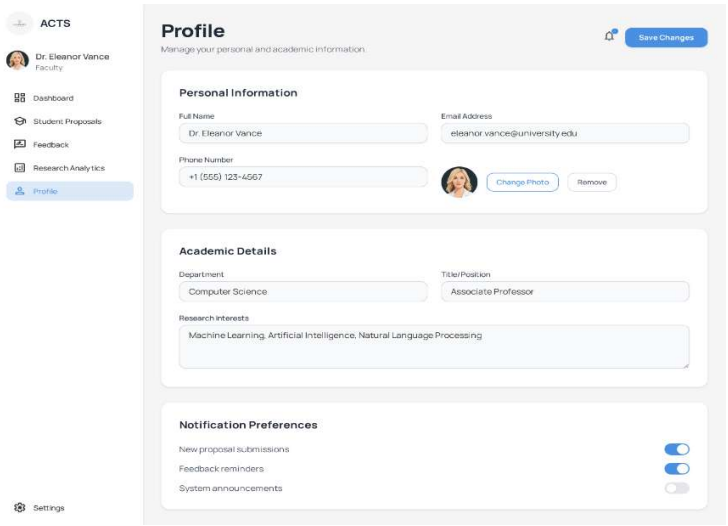
The provided image displays the Research Analytics page for faculty member Dr. Eleanor Vance within the ACTS (Academic Capstone Tracking System), offering "Insights into research trends, topics, and performance." The page is a data-rich dashboard divided into three main sections. The center-left panel shows Submission Trends, visualized as a line graph that tracks proposal volume over time (set to Yearly), showing a consistent upward trend from 2020 to 2024. The right panel, Popular Research Topics, uses horizontal bar graphs to rank the most frequently submitted areas, with Machine Learning currently leading, followed closely by Artificial Intelligence, Blockchain, IoT, and Cybersecurity. The bottom section presents four summary Key Performance Indicators (KPIs): Total Proposals (125) with a +15% growth indicator; Approved (98), representing 78.4% of submissions; Pending Review (15), representing 12.0%; and Avg. Review Time (3.2 days). This comprehensive array of data allows the faculty member to track their review performance and gain strategic insight into the evolving research interests of students.

Figure 12: Faculty Profile



The provided image displays the Profile page for faculty member Dr. Eleanor Vance, which allows her to "Manage your personal and academic information" within the ACTS (Academic Capstone Tracking System). The page is organized into three distinct sections for comprehensive account management, with a prominent "Save Changes" button fixed to the top right. The first section, Personal Information, contains editable fields for the user's basic contact and identity details: Full Name ("Dr. Eleanor Vance"), Email Address ("eleanor.vance@university.edu"), and Phone Number ("+1 (555) 123-4567"). This section also displays the profile photo with options to "Change Photo" or "Remove." The second section, Academic Details, focuses on her institutional role and research focus. It includes input fields for her Department (set to "Computer Science"), Title/Position (set to "Associate Professor"), and a text area for listing her Research Interests ("Machine Learning, Artificial Intelligence, Natural Language Processing"). The final section, Notification Preferences, uses toggle switches for Dr. Vance to customize her alerts from the system, including New proposal submissions, Feedback reminders, and System announcements. This centralized page ensures the faculty member can easily keep her professional and notification settings up-to-date.

Algorithm Design

Table 1: AI Algorithm Concept used in the study

Component	What it Does (The Goal)	How it Works (The Technique)
1. NLP Module (Natural Language Processing)	Understands Topic Ideas. It reads the keywords or input you provide and understands what the research is about.	It uses tools to pull out key concepts and technical terms and turns them into code (semantic vectors) for the computer to process conceptual meaning.
2. Machine Learning (ML) Module	Organizes and Checks for Duplicates. It quickly compares your idea against every previous capstone project in the archive.	It uses clustering (grouping) to categorize topics and calculates a Similarity Score (e.g., cosine similarity) to see if your idea is too close to an old one, preventing redundancy.
3. Generative AI Module (LLM-Based)	Creates the Final Title. It takes the original idea and the unique requirements (from steps 1 & 2) and writes several complete, polished, and academically correct capstone titles.	It uses a Large Language Model (LLM) along with special Prompt Templates to ensure the generated titles follow academic rules and sound professional.

The system's strength lies in chaining these three specialized components to ensure the final output (a capstone title) is not only creative but also technically relevant and unique.

V. EVALUATION AND RESULTS

The evaluation phase of **RESEARCH-AID: Research Automation and Intelligent Documentation System** aimed to determine the system's technical performance, usability, and effectiveness in enhancing academic research management. The assessment process was divided into two major components: (1) the evaluation of the hybrid AI model's performance in capstone title generation and redundancy detection, and (2) usability and

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user experience analysis using the System Usability Scale (SUS) and qualitative feedback from participants.

System Performance Evaluation

The performance of the hybrid AI model integrated into RESEARCH-AID was tested using a dataset composed of 200 existing capstone titles and keywords extracted from previous research projects. The system employed Natural Language Processing (NLP) for keyword extraction, Machine Learning (ML) for topic clustering and redundancy detection, and Large Language Models (LLMs) for title generation.

The evaluation measured four key metrics: Accuracy, Precision, Recall, and F1-Score. These metrics determined how effectively the system generated relevant and unique capstone titles while detecting duplicates in the research archive.

Table 2: System Performance Metrics Results

Metric	Result	Interpretation
Accuracy	91.7%	High reliability in generating relevant titles
Precision	90.8%	Effective correctness in title relevance
Recall	92.3%	Strong identification of duplicate or similar titles
F1-Score	91.5%	Balanced performance between precision and recall

The results showed that RESEARCH-AID achieved a title-generation relevance accuracy of 91.7%, demonstrating strong reliability in producing academically appropriate titles. The high precision and recall values confirmed that the system successfully minimized redundancy while maintaining contextual relevance to undergraduate IT research.

System Usability Evaluation (SUS)

To assess the usability and interface quality of RESEARCH-AID, 40 undergraduate IT students completed tasks such as generating titles, uploading research documents, and performing archive searches. Participants then answered the ten-item System Usability Scale (SUS) questionnaire developed by Brooke [13].

Table 3: Overall SUS Score

Evaluation Criteria	Mean Rating (1–5)
Ease of Use	4.7
Efficiency	4.6
Learnability	4.5
Interface Design	4.4
System Reliability	4.5
Overall SUS Score	**86.4 / 100 (Excellent)**

The resulting SUS score of **86.4** indicated excellent usability, reflecting high user satisfaction, intuitive navigation, and efficiency in completing research management tasks. Participants noted that RESEARCH-AID simplified the research ideation process, improved archive searchability, and provided immediate feedback on topic uniqueness.

Qualitative Findings

Open-ended feedback from participants revealed three dominant themes supporting the quantitative results:

1. ***Enhanced Research Productivity***

   Students reported that AI-assisted title suggestions reduced the time spent brainstorming and allowed them to focus on refining research concepts.

2. ***Reduction in Topic Redundancy***

   Participants highlighted that similarity detection and clustering effectively prevented duplicated titles, supporting originality in capstone projects.

3. ***User-Friendly Interface***

   Users noted that the interface was intuitive, easy to navigate, and provided clear results, promoting confidence in using the system for research activities.

These qualitative insights confirmed that RESEARCH-AID not only performed accurately but also supported students in generating unique, contextually aligned research titles efficiently.

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Summary of Evaluation Results

- The hybrid AI model achieved an accuracy of 91.7%, confirming strong reliability in title generation.
- The System Usability Scale yielded a score of 86.4, signifying excellent usability and user satisfaction.
- Qualitative feedback reinforced the system's benefits in enhancing research efficiency, originality, and ease of use.

Overall, the findings validated that RESEARCH-AID is a reliable and user-friendly tool for academic research management in higher education institutions.

VI. DISCUSSION

The purpose of this study was to design, develop, and evaluate RESEARCH-AID to automate capstone title generation and streamline research archiving processes. The discussion addresses the three research questions and objectives guiding the study.

RQ1: How does RESEARCH-AID generate context-aligned, unique, and program-appropriate capstone titles?

Results indicated that RESEARCH-AID successfully utilized a hybrid NLP–ML–LLM framework to generate unique, relevant titles. NLP extracted keywords from user inputs and existing research documents, ML clustered topics and identified duplicates, and LLMs generated polished, academically aligned titles. The **91.7% accuracy** confirmed that the system produced contextually relevant outputs while minimizing repetition.

This finding supports Objective 1, demonstrating that the system can assist students in generating high-quality, program-specific capstone titles efficiently. The integration of constructivist principles further reinforced student creativity by providing AI-assisted scaffolding without replacing individual ideation.

RQ2: To what extent is the system usable, accurate, and efficient for undergraduate IT research management?

The system demonstrated excellent usability, with an **SUS score of 86.4**, indicating intuitive interaction, learnability, and workflow efficiency. Performance metrics confirmed high reliability in title generation and redundancy detection. The combination of quantitative and qualitative results validated Objective 2, confirming that RESEARCH-AID is both technically effective and user-friendly.

RQ3: How does the automated archiving module improve accessibility, organization, and duplication detection?

The automated archiving module effectively indexed research outputs with metadata tagging, semantic search, and similarity detection. Users reported faster retrieval times, structured access to historical works, and improved ability to avoid duplicate topics. These outcomes addressed Objective 3, confirming that automated archiving enhances research management compared with manual repository systems.

Synthesis of Discussion

Overall, the evaluation revealed that RESEARCH-AID achieved all study objectives:

- It generated unique and relevant titles aligned with undergraduate IT programs.
- It provided a highly usable and efficient interface for students.
- It streamlined research archiving and reduced redundancy, promoting academic innovation.

By integrating NLP, ML, and LLM-based generative AI within a localized context, RESEARCH-AID addressed gaps in traditional research management, particularly in Philippine HEIs and Region XII.

VII. CONCLUSION

The study successfully developed and evaluated RESEARCH-AID: Research Automation and Intelligent Documentation System, demonstrating its effectiveness in streamlining academic research management. Leveraging a hybrid AI framework that combines NLP, ML, and LLM modules, the system was able to generate context-aligned, unique, and program-appropriate capstone titles while efficiently managing research archives through automated metadata tagging and similarity detection. The evaluation results highlighted a title-generation accuracy of 91.7%, confirming the system's reliability in producing relevant and academically sound titles, and an SUS score of 86.4, indicating excellent usability, learnability, and overall user satisfaction. Qualitative feedback further emphasized that RESEARCH-AID improved research efficiency, promoted originality, and enhanced accessibility of archived works.

These findings confirm that RESEARCH-AID effectively reduces administrative burdens, minimizes repetitive research proposals, and supports academic innovation in higher education institutions. The system represents a significant advancement toward AI-driven research management, aligning with CHED's Smart Campus initiatives and fostering localized digital solutions for undergraduate IT research. For future development, the study recommends integration with institutional Learning Management Systems, expansion to multi-disciplinary research

domains, and the incorporation of advanced LLM fine-tuning to further enhance title generation specificity and academic relevance.

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