

Chapter 1

THE PROBLEM AND ITS SETTING

Introduction

This chapter provides a comprehensive overview of the study. It introduces relevant research and development agendas from various national organizations to show where the study fits in. The chapter also presents the theoretical framework, defining key concepts and building a foundation for the research. It outlines the objectives, which focus on creating a system to meet client needs. The study's scope is defined, including its features and limitations. Moreover, this chapter emphasizes the importance of the research and provides clear explanations of key terms, serving as a useful guide for readers.

Background of the Study

Proper management and access to literature is an essential factor in research and educational progress. According to Laguador et al., (2014), archiving and disseminating the data are the important steps to ensure that the proper documentation will serve as a valuable reference for future use. Along with the development of information technology, scientific communication is also changing, and therefore it is giving more power to digital publishing models. The publishing industry is being forced to adopt a new model that is suitable for the digital age because of the explosion of information production, high subscription prices, and the need for costly storage of printed documents. The model has been in place for a number of years now (Vrana, 2011).

In addition, Laguador et al., (2014), stated that in order to solve such problems, colleges, and universities all over the world should have created digital repositories for the purpose of enhancement of accessibility and organization of academic resources. The dimension of research outputs reflects a broader trend towards digitalization in higher education. Through numerous repositories that are currently in existence which basically serve to improve basic access and management of academic literature, other features such as literature mapping are also being introduced to provide further benefits. Literature mapping can visualize and give graphical pictures of the connections among the related studies and specified research trends, along with the literature reviews and providing deep insights into the research area (Sulisworo, 2023).

At the Polytechnic University of the Philippines (PUP) - Santa Rosa Campus' Research and Extension Management Office and Campus Library, research documents have been kept in hard copy formats ever since 2008. Currently, the storage capacity limits the manual archiving system, which contains around 500 documents, making it challenging to manage. As stated by Mesa (2017), the present scenario is vastly different from that of other organizations which have successfully utilized digital repositories to address similar issues and improve the management of scholarly literature.

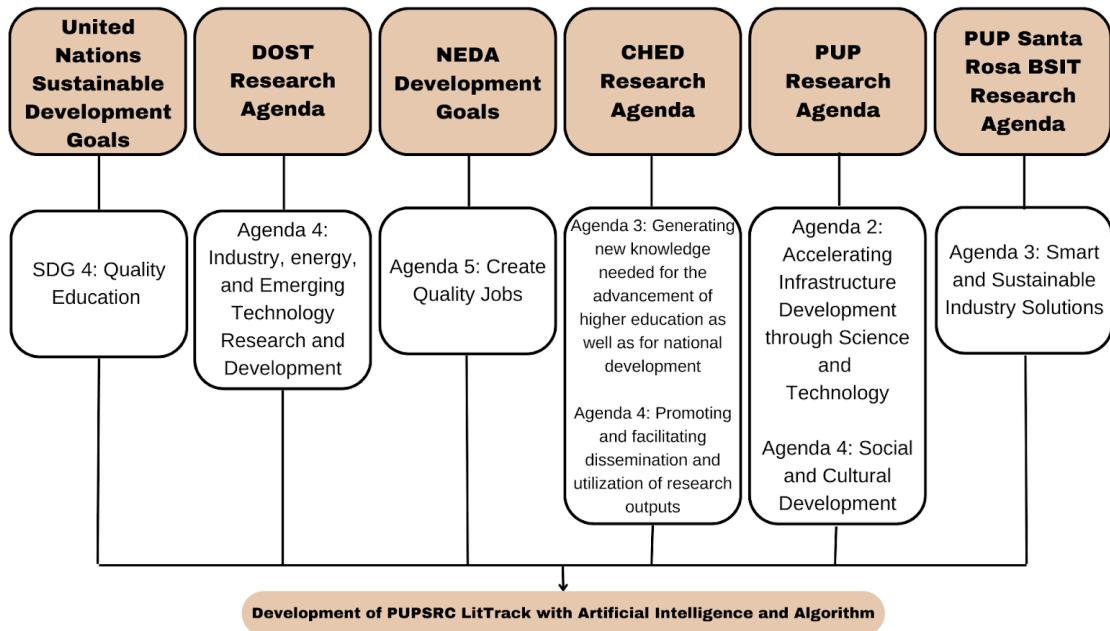
Moreover, the student researchers conducted an assessment to determine the needs of the research and extension office and campus library of the Polytechnic University of the Philippines -- Santa Rosa Campus. Based on the conducted assessment and thorough review of related literature and studies, it shows that the campus library should enhance its system for digitally storing research from various programs. This will act as a guide in creating the Research Database and Literature Mapping System with features that address the identified issues. The proposed system will be implemented on the Campus Library and Research and Extension Office.

This research has a goal to develop a system called PUPSRC LitTrack for the creation of the Research Database and Literature Mapping. With the aid of computerized intelligence algorithms and Natural Language Processing, this system is going to be used to supervise the management of research data pertaining to the Research and Extension Management Office in the Polytechnic University of the Philippines Santa Rosa Campus. The proposed system will enhance the process of uploading, reviewing, and mapping research literature, thus student researchers can upload their study which will be validated by Artificial Intelligence based on specific requirements for instance, copyright compliance. The proposed system will assist in the preparation and handling of research documents, ensuring that all relevant data is stored and easily accessible for future reference. The system's unique feature is its ability to provide literature mapping and status of the uploaded study such as the citation count and references, that will help the student researchers from different programs track the analytics. Additionally, the system will be having a search function that will help the users to access the different available literatures on the repository. Furthermore, all the files which are involved in the process of research will be stored safely and will be easily accessible from the system; it will be extremely useful in case of audits, reviewing and any other further research.

Adapting to technological advancements is crucial as research plays a more important role in higher education. The overall purpose of this study is to establish the digital repository system of the PUP Santa Rosa in order to enhance the collection of academic literature in terms of access and control. This will address current constraints of manual systems and expand research capabilities as the system shifts from manual to digital. Additionally, the understanding of literature mapping in the repository system can provide a graphical representation of links between studies and historical trend analysis that will enhance the quality of retrieved studies for students and faculty.

Research Agenda Alignment

Figure 1. Relation of the Study to the Research Agenda



This study contributes to the achievement of Sustainable Development Goal 4: Quality Education through developing the digital information system to increase the access and arrangement of academic resources in the PUP Santa Rosa community. The proposed software supports SDG 4 by promoting the quality education and innovative research direction hence is in line with the UNSDG goals. The system enables the users to learn and also to be able to interact with literature and process the information that they obtain from reading. Section 4 of the Department of Science and Technology (DOST) Research and Development Agenda, which is the Industry, Energy, and Emerging Technology Research and Development supports this study since it involves Artificial Intelligence as a component in the research. This matches with the DOST Agenda 4, which wants to encourage new technology and its use in different industries, making work better, learning more enjoyable, and helping the economy grow. Using

these advanced tools in schools is a big step towards including the newest technology in research and development. At national level, this research aligns with NEDA's agenda 5 at the national level, which aims to generate high-quality employment opportunities. Moreover, Agenda 5 supports the development of a highly skilled workforce ready for roles requiring research, data analysis, and AI technology.

This current process will be enhanced by the use of AI and algorithms in research management that is in the line of CHED's Research Agenda with the goal of improving the generation of new knowledge through Agenda 3. Furthermore, this research also attempts to enhance the availability and arrangement of educational materials to accelerate the distribution and usage of research results. The proposed study is in accordance with the PUP Research Agenda 2, which seeks to speed up the growth of infrastructure through the use of technology and science. It calls for the formulation of a complex digital information system that can aid in research management and literature mapping by using artificial intelligence and algorithms. It also aligns with Agenda 4 by focusing on equal access to quality education, the provision of inclusive academic environments, and the creation of opportunities for lifelong learning. This system will be crucial in promoting knowledge mobility, creativity, and innovation within the PUP community. Lastly, the research agenda of the course is aligned with agenda 3 of BSIT PUP Santa Rosa Campus Research Agenda: Smart and Sustainable Industry Solutions. To guarantee conformity and alignment with this agenda, the researchers will use Artificial Intelligence and advanced algorithms to enhance research management and resource accessibility. This integration supports the agenda's focus on smart technologies to improve industry practices, streamline processes, and promote sustainable development in research.

Theoretical Framework

A theoretical framework upon which such a theory may be constructed is presented, which would be useful for all the information professions. (Myburgh, Tammaro, 2013). The steps of the construction of this framework are given, including suitable epistemological approaches for this task. The Scientific Management Theory, Project Management Theory and Knowledge Management theory are used in this research.

Scientific Management Theory

As cited by Taylor in 1909, scientific management theory increases economic efficiency, especially for work productivity. Taylor believes that the use of scientific methods is to analyze and optimize workflows, standardize tasks, and improve the efficiency of workers. In this theory, research repositories and literature mapping discuss the optimization of research processes and also the use of artificial intelligence is to efficiently organize and check the status of academic papers. Scientific Management Theory helps reduce the time researchers spend on manual tasks, improves access to the relevant literature, and enhances the overall research experience, and the advancement of academic studies.

Project Management Theory and the Management of Research Projects

This theory was developed by Erik Ernø-Kjølhede in 1999. Its objective is to design strategies to enhance the process of management and often assumes that the project work takes place within the boundaries of one organization. This also entails regarding projects first and foremost as instruments with which to achieve a certain goal and a research project manager is a framework for supporting creative thinking in small subject-oriented units. Managing a research project is both about managing knowledge

workers and about managing the development of new knowledge and the sharing and dissemination of existing knowledge within the concrete setting of a joint project. In this case, Project Management Theory and the Management of Research Projects considers the structured planning and control aspects of the theory to provide a foundation for assessing our system based on ISO standards, ensuring its quality, reliability, and user-friendliness and also to manage the tasks involved in research projects. Project Management Theory helps to organize the academic literature and enhance the knowledge within the development of a research repository, ensuring that academic studies are well organized and accessible and also the integration of artificial intelligence and algorithms into the system can help the effective analysis of academic literature, catering to the specific needs of researchers. This study provides a theoretical framework for improving the arrangement and visualization of academic literature by emphasizing the effective management of knowledge workers and the knowledge they develop.

Knowledge Management Theory

In contrast, knowledge management theory, introduced by William Frobe in 2018, knowledge management includes people, content, processes, and enabling technologies needed to capture, manage, share, and find information. To enhance its performance and competitiveness, an organization shares its intellectual assets. It is based on two critical activities, capture and documentation of individual explicit and tacit knowledge, and dissemination within the organization. In these terms, the knowledge management theory emphasizes the importance of capturing and sharing knowledge to improve organizational performance and also the knowledge management theory helps the process for documenting and finding information with the integration of artificial intelligence and advanced algorithms. This theory supports the creation of a research

repository, ensuring that academic knowledge is effectively documented and made accessible. And the study seeks to enhance the organization and discovery of scholarly articles, allowing researchers to explore connections between publications more efficiently.

In essence to specify these theories, the proponents believe that the Scientific Management Theory, Project Management Theory, and Knowledge Management Theory can help manage research projects more accessible. In these theories, the system can improve the user's interaction with new technologies, keep research projects organized, and make sure important knowledge is shared effectively. This can help create an easy and more effective research process, benefiting everyone involved.

Conceptual Framework

The conceptual paradigm used in this study is the Input-Process-Output (IPO) Model, which is shown in Figure 2. In this IPO model, the workflow and activities are divided into three phases: input, process, and output. It provides an organized process that guides in developing and improving the proposed PUPSRC LitTrack System and with a feedback loop to guarantee ongoing progress.

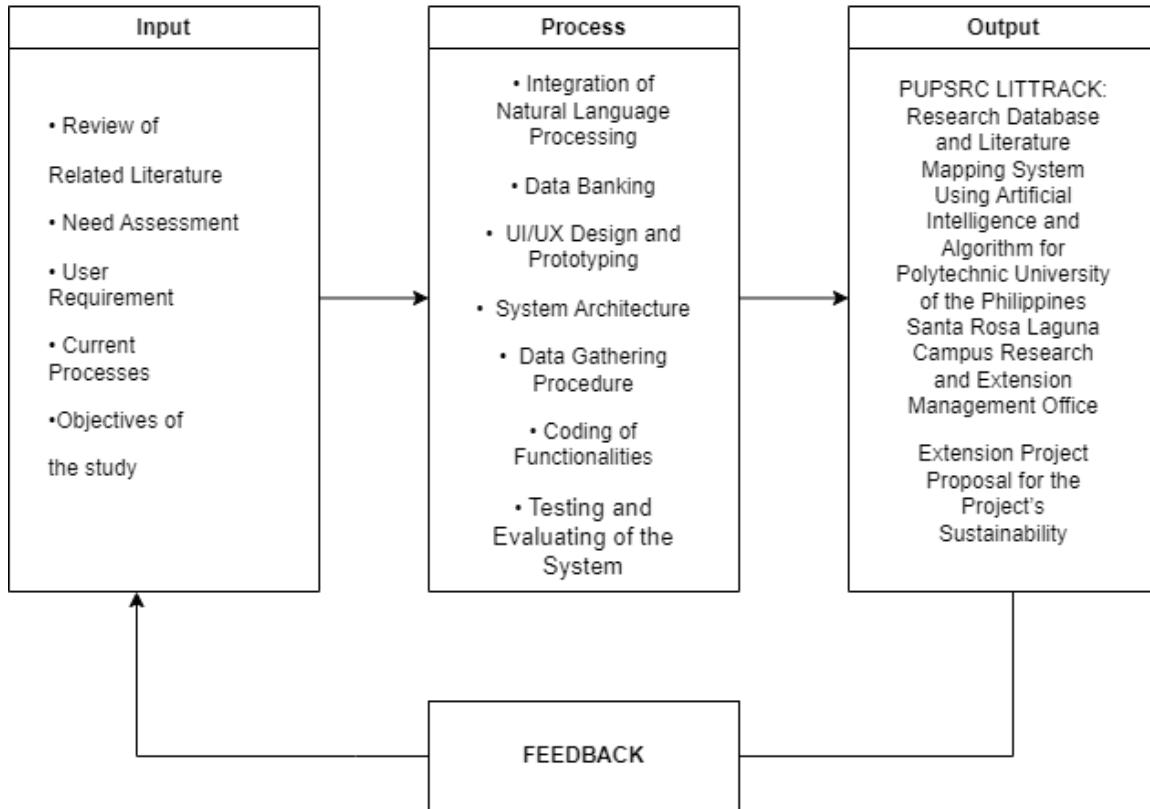


Figure 2. IPO Conceptual Framework

There are three key phases in the IPO diagram which are the input, process, and output. In the input phase, it involves gathering the information needed to develop the system. This includes review of related literature and existing studies to understand the working similarities and the challenges encountered of the system and also to serve as a guide for comparison and improvement. The current process at PUP Santa Rosa Campus is utilizing the research data that is managed and tracked, to identify any issues. A needs assessment is to determine the specific requirements of the study. This includes interacting with respondents to ensure their needs. It also provides insights to the functionality and features needs of the system.

In the process phase, the collected data in the input phase are analyzed, interpreted, and structured to guide the development of the system. This includes using artificial intelligence and literature mapping to build an engaging research database. It also includes integration of natural language processing, data banking, user interface/user experience design and prototyping that served as blueprint, designing the system architecture based on user requirements and integrating AI-driven features, and performing testing and evaluation to ensure the system performs as expected. Feedback from the initial test to make improvements and ensure it meets the standards.

Furthermore, the output phase results from the development of the PUPSRC LitTrack System. This system is designed to manage the research databases and improve literature mapping. It provides an appropriate platform that simplifies research activities for researchers and administrators. The feedback from users is to evaluate the works of the system and to identify the further improvement. This ongoing feedback helps the system adapt and enhance to meet the standard needs.

Objectives of the Study

The main objective of this study is to develop a research repository for all academic studies across programs with a literature mapping feature that aims to organize the academic literature in the campus library and to discover scholarly articles by exploring connections between publications. The study intends to improve the manual process of the Research and Extension Office through the following objectives:

- To create a database that will serve as a centralized repository for all academic studies across different programs within the campus that can

be used to ensure smooth access and efficient management of research materials.

- To develop a literature mapping feature within the system to systematically organize and visualize connections between different academic literatures, enhancing the research process and knowledge discovery.
- To integrate artificial intelligence and advanced algorithms into the system to enhance the analysis of academic literature according to specific needs.
- To assess the developed system based on ISO standards to ensure its quality, reliability, and compliance with industry best practices, providing an effective and user-friendly research management solution.

Scope and Limitations of the Study

In this study, the objectives were designed according to the concerns and issues of Polytechnic University of the Philippines (PUP) – Santa Rosa Campus library on managing and acquiring academic research materials. The primary focus of this study is on developing a research database system that will enhance the organization, retrieval, and accessibility of these materials. It will also require creating a thorough database that will not just store data, but improve the organization and accessibility of the research. This study will also employ some features such as: the search bar, file upload, artificial intelligence that will serve as a verifier for the copyright compliance and other requirements needed, and sorting mechanisms based on some parameters. Also, the feature of literature mapping will be created to show the relations between the studies and thus make it easier to define trends and gaps in the studies. The system is intended

for use by students, faculty, and researchers within the campus, providing them with advanced tools for managing and utilizing academic research materials.

However, the said study is subject to the following limitations. The proposed system will only be implemented at the Santa Rosa Campus, and it will not include connections to external databases or platforms. The research does not intend to gather additional studies outside the campus to increase the database size beyond what is currently available. The implementation of the digital repository will be dependent on the availability of adequate funding, resources, and technical expertise. Full-scale implementation may also be constrained by the availability of necessary hardware, software, and personnel. Any limitations that might be encountered will be taken into consideration in future extension projects to extend the functions of the system.

Significance of the Study

The research aims to improve the research project at the Polytechnic University of the Philippines Santa Rosa Campus. By developing a Research Database and Literature Mapping System with Artificial Intelligence, it will be easy to manage, access and verify if the research is copyrighted. Likewise, the study will benefit the following:

Research and Extension Management Office

The office will benefit from having a position to organize and store all research papers. This will also help to maintain the stability and reliability of managing the research documents and outputs.

Faculty Researchers

The faculty researchers will also benefit from the system that organizes the submission, storage, and access to research documents. This will help to protect their work from ensuring compliance with copyright laws.

Student Researchers

The student researchers will also benefit from the system to securely submitting and accessing research documents. This will guarantee that their work complies with copyright regulations.

Faculty Extensionists

The faculty extensionists will significantly benefit from the system, it supports the proper management and protection of research outputs. It provides that research projects are handled with legal compliance as academic research.

The Researchers

The researchers will also primarily benefit from this research. By developing a system with artificial intelligence, improving their research management. This research will also help them build strong capability in protecting and managing intellectual property, useful in their future academic and professional work.

Future Researchers and Developers

This study can be a reference for future research and developers, offering a study for managing and accessing a research project and to check the research documents whether they are copyrighted or not in an easier way. It also might encourage people to pursue future research and system integration in these fields.

Definition of Terms

I. Operational Terms

Research Database. A platform at Polytechnic University of the Philippines Santa Rosa Campus in which research documents are stored, archived and managed.

Research and Extension Management Office, Polytechnic University of the Philippines Santa Rosa Campus. It manages research projects, such as filing and archiving of research papers.

Document Verification. A process that will check the submitted documents whether it is copyrighted or not before it goes into the research database.

Artificial Intelligence (AI). A feature that verifies the submitted documents are not copyrighted.

Copyright Compliance. A process that all papers follow the copyright regulations and do not violate any copyright laws.

II. Technical Terms:

Information System (IS). An information system for managing and storing information. It refers to the Research Database and Literature Mapping System.

Literature Mapping System. A tool that helps users easily track the related topics and research documents.

Natural Language Processing (NLP). It helps the system process and understand human language that can assist in document analysis and content analysis within the research database.

Data Repository. A system to store, manage, and retrieve information, such as research documents.

Artificial Intelligence (AI) Algorithm. A task that typically requires human thinking, such as reviewing papers for copyright issues.

User Interface (UI). It will allow faculty, students, and researchers to connect to the database and literature mapping system to upload, search, and view their documents.

Copyright. The legal right that allows owners to manage how their work is used and to avoid others from copying it

Chapter 2

REVIEW OF RELATED LITERATURE AND STUDIES

Introduction

This chapter provides the relevant literature and studies that supports the significance of the proposed study in the field of information technology. It includes subtopics that collectively reinforce the study's claims. These reviews of literature and studies are essential in validating the study's relevance and its contribution to the field.

Research Database

Research databases are indeed a valuable resource in higher education institutions, acting as a digital library for academic studies which fosters knowledge sharing and collaboration among researchers. The proper planning and management of these databases is necessary to ensure the safety, preservation, and sharing of academic works, thus enhancing the research infrastructure of institutions. Comprehending the functionality and benefits of a database is crucial for those involved in overseeing scholarly research. Zibani, Rajkoomar, and Naicker (2021) stated that the assessment of faculty research repositories provide insights into the effectiveness of the institutions and the management of research data. The researchers performed a wide-ranging review of academic literature relating to university research repositories on different databases, including Ebscohost, Emerald Insight, Science Direct, Sage, Google Scholar, etc. The study's findings demonstrated the reasons for having these storage facilities, the help they provide, and the benefits of using them. The introduction of a research database at the personnel level has been identified as one of the key advancements in the academic research field as well as a great improvement in the sharing, analyzing, and preserving research findings.

Also, Afriliana, Bahar, and Basit (2020) examined the difficulties and solutions concerning the way the research results are to be managed in various institutions. The study of Afriliana, et.al. (2020) is taking place at Harapan Bersama Polytechnic that is suffering from problems in storing and organizing physical compact disks (CDs) that are used as research storage and job training reports by the students. The physical to digital data transfer using SIPESTA information system has led to better organization and availability of research data. The shift from classical libraries to internet libraries endorses the need for modern digital techniques to deal with the escalating volume of academic works. In addition, Rose, P., Downing, P., Asare, S., and Mitchell F (2019) also stated in their study that the African Education Research Database is a unique resource for educational development research and policy in the region.

The implementation of a thorough research database and literature mapping system such as the system being proposed, in the functions of PUP Santa Rosa Campus Research and Extension Management Office could be exceedingly advantageous in research management. The proposed system would be a centralized platform to keep, look at, and study the research outputs so as to assist the academic staff and students in their academic activities. Implementing this system is crucial for the academic development of universities, as they utilize digital tools and organized methods to enhance research capabilities and support the wider academic community.

Existing Research Repository Systems

The advent of technology has transformed the academic institutions in particular to the way they manage and retrieve research materials. Research repository systems have become indispensable tools in libraries, colleges and universities for the collection, storage, and provision of access to different types of materials. These systems offer centralized access points to the academic resources, thus, boosting the dissemination

and sharing of research outcomes. By analyzing the current research repository systems, the researchers can pinpoint the strong and weak points which in turn will assist in the designing of a custom solution for Polytechnic University of the Philippines – Santa Rosa Campus that will meet the specific requirements of the academic community and will promote the smooth administration of research.

According to Delera, G., Salao, M., and Soberano, K. (2023), a research repository system seeks to serve as a secure, efficient, and reliable data bank for thesis documents of both undergraduate and graduate students. Also in a study conducted by Somefun, T., Awosome, C., & Sika, C., (2020) discovered that creating a digital repository of research projects would give students an opportunity to enhance their academic skills, easily get access to the research projects that were done by other students, collaborate with other students that have similar research interests, and lastly to promote visibility for the companies that are interested in granting scholarships to outstanding works of students. Besides, the research also elaborated on the role of adopting the advanced technology that is going to stimulate student's participation in research. Moreover, the Mondal and Kar (2021) study examined the incorporation of a repository for the storage of the schools' publications such as literature and studies within the social networking site for the researchers, emphasizing the importance of interaction and dissemination. Their findings indicated that the growing utilization of the internet and social media platforms in the educational sector has made the website more appealing to the users. Besides, the latest studies can be easily assessed on their progress and at the same time serve as the communicative means between the scholars. The shift from traditional methods to the digital platform is clearly a showcase of the growing significance of contemporary digital tools in academic collaboration and the dissemination of research.

The reviewed studies documented that digital research repositories have a crucial function in the higher academic institutions, where students are given access to

scholarly works, collaboration among the students, and getting access to the scholarly works. The study conducted by Somefun, Awosome, and Sika (2020) introduces a digital repository which is a system that can help to develop students' scholarly capacity and visibility and it is in accordance with the objective of the system which is to increase accessibility to research. The same way, a study done by Mondal and Kar in 2019 about the incorporation of research repositories into social networks came up with the same tool which is the necessity for the collaboration and sharing of knowledge in the online setting. This finding suggests that the proposed system serves as an effective research and information platform that could improve the organization, access and sharing of educational materials at the Polytechnic University of the Philippines Santa Rosa Campus.

Literature Mapping

Recently, technology has been a dominating factor in varying fields, as for instance in education. The utilization of mobile internet, cloud computing, big data technologies, and the enhanced proficiency of artificial intelligence (AI) have given rise to e-learning and personalized learning of educational content. According to Kabudi, Pappas, and Olsen (2021) in their research work expressed that AI-powered education systems have now grown to be a smart learning system that can adapt to every student's requirements and offer a unique learning path. The thing is, there is still a lack of systems that are particularly designed to solve the problems students face.

Also, Farias-Gaytán, S., Aguaded, I., & Montoya M. (2021) used a systematic literature mapping method to investigate digital transformation in higher education. The research revealed that technology application, the shift of processes to digital formats, and the requirement for user adaptation to technological change are the factors affecting digital transformation in higher education. The findings of most studies were based on

direct observation and experimentation, employing both qualitative and quantitative methods. The systematic literature mapping method of collecting studies will enhance the researchers' understanding of the key issues and research findings of their study. Moreover, Christou E., Parmaxi A., & Zaphiris, P. (2024) stated that systematic mapping of the literature helps to find out research gaps and to provide a clearer picture of what the evidence is. The purpose of their study is to highlight the importance and benefits of mapping the literature, as well as to provide a step-by-step guide for conducting the reviews.

These reviewed studies illustrate the significance of AI, the digital transformation, and the systematic integration of mapping the literature in the improvement of education and research systems that can be aligned with the development of the proposed study for the Polytechnic University of the Philippines - Santa Rosa Campus. AI-powered educational platforms offer targeted learning activities, thus, making up for the deficiencies of existing student assistance programs. The focus of higher education on digital transformation is an indicator of the turn toward technology - driven methods thereby showing the necessity of tools such as the proposed system for proper management of academic resources. In a study by Christou, et al., it is argued that systematic literature mapping helps to find a research gap and to classify existing knowledge, which is necessary for the effective use of LitTrack's literature mapping feature. These findings together endorse the creation of a strong, AI-based research database which greatly improves the organization and availability of research in the Santa Rosa Campus.

Integration of Artificial Intelligence in Literature Mapping

One of the platforms where artificial intelligence is evolved to an up-to-date method according to Hussain (2023), it can be discussed as attached with libraries and

information science. Some academic libraries apply artificial intelligence to make their services better, work more efficiently, and provide a smoother experience for users. This study uses a bibliometric approach to review the latest research on artificial intelligence in academic libraries. By analyzing the key trends and identifying gaps, the purpose of this study is to better understand the artificial intelligence currently being used and its potential future direction. Additionally, it seeks to show that artificial intelligence could be integrated into different library functions beyond what's already being done. This approach supports the systematic management of knowledge and the development of a centralized database that optimizes the research process, contributing to the overall objectives of improving research management and accessibility.

In addition, Mardiani (2023) artificial intelligence has developed by analyzing various data and it tracks changes of artificial intelligence publications over time, examines the researchers work together, and identifies the important studies that are frequently referenced. The study also spots new trends and topics gaining traction in artificial intelligence. To make the statement easier to understand, it uses visual tools to show connections between researchers and citation patterns. The results feature the advance of artificial intelligence research, the networks between researchers and institutions, and the influence of key studies. This research also communicates the impact of artificial intelligence on society, ethical concerns, and the collaboration across different platforms. This research also provides insights that can help future work by the use of artificial intelligence, encouraging further analysis and innovation in this growing platform. By integrating these insights it facilitates a more efficient research process and also enhances the ability of connections between publications, aligning with the developing a literature mapping feature and improving research management.

Moreover, a complete knowledge map for researchers working on the

application of artificial intelligence in education. It's designed to help researchers quickly understand author collaboration characteristics, institutional collaboration characteristics, trending research topics, evolutionary trends, and research frontiers of scholars from a library informatics perspective. The bibliometric analysis software was used to analyze the retrieved literature in this study. The paper contains tables and images of the analysis results. (Chankoson et al., 2023), collaborative relationships among scholars need to be improved and collaborative research relationships among research institutions need to be more fragmented. The research progresses and trends on the application of artificial intelligence in education based on published literature and to provide a reference for further research in the future.

Natural Language Processing in Literature Mapping

The study by Garousi et al. (2020) stated that many approaches based on natural language processing have been proposed. It is important to give an overview of the state of the art in this area since many practitioners are eager to use such techniques. The aim is to summarize the state of the art in natural language processing-assisted software testing which could benefit practitioners to potentially utilize those natural language processing-based techniques. Researchers can use this to give an overview of the research landscape. In order to address the need, we conducted a survey in the form of a systematic literature mapping. The study would benefit both practitioners and researchers. The results could help practitioners utilize the existing natural language processing-based techniques, which in turn reduces the cost of testing design, and decreases the amount of human resources spent on test activities. These insights show that this review can be useful and beneficial to practitioners, after we shared it with some of our industrial collaborators. By integrating

these insights the system aims to enhance the research process, making it easier for users to determine relevant articles while ensuring the efficient management of research materials.

As cited by Mohammad in 2023, a single unified dataset created natural language processing and their meta-information by aligning information from two sources. The research describes several interactive visualizations that present different aspects of the data. Clicking on an item within a visualization or entering query terms in the search boxes will show the data in the dashboard. This allows users to search for papers based on their interests, published within specific time periods. The interactive visualization presented and the associated dataset of papers mapped to citations have additional uses as well, including understanding how the field is growing, as well as quantifying the impact of different types of papers on subsequent publications. It supports a literature mapping feature on how interactive visualizations help users easily search and explore academic papers, which aligns with organizing and visualizing connections between different studies. Adopting a natural language processing dataset also helps with integrating algorithms, it would be able to properly analyze and manage academic literature based on specific needs.

Lastly, Ahad (2020) artificial intelligence technology is used to understand, analyze and interpret human languages. Natural language processing received more recognition due to innovation in information and communication technology. It's important to understand the development of the knowledge of literature. This study aims to provide a comprehensive evaluation of the literature. The publication trends, influential journals, cited articles, influential authors, institutions, countries, key research areas, and research clusters are identified in the study. The review shows publication trends, top journals, authors, institutions, countries, and key research areas, mapping the development of natural language processing in literature. Ahad's (2020) study

supports the integrating artificial intelligence on how artificial intelligence can be used to analyze and interpret human language, and it is essential for managing and organizing academic literature in the system. Based on a literature mapping feature, evaluation of key research areas helps in visualizing connections to illustrate how knowledge has built up across different studies.

Latent Dirichlet Allocation Algorithm

This study analyzes the corpus based on the words in the documents. It also makes it easier to process data because each document contains various topics represented by different vocabulary. Latent Dirichlet Allocation is a technique to learn, cluster and summarize the data that allows us efficient management of this dataset. It is developed to categorize the data into its subjects upon word distribution. This process involves analyzing data in textual form, such as documents, to recognize the terms it contains. It can be said that text mining is a technique used to examine through different documents and derive interconnected words and patterns. (Rudiman & Rahmi, 2023). A literature mapping feature within the system is organizing datasets based on word distribution identified using Latent Dirichlet Allocation (LDA). It uses Latent Dirichlet Allocation for categorizing academic studies that makes the research process efficient and knowledge discovery good. It allows researchers to analyze those patterns and study sources. It may also function as a research support for management solutions.

In the study by Villanueva et al. (2023), they proposed a method to identify topics from text corpus and classify the terms related with the topic. This process includes document extracting and data processing, labeling and training of the data, labeling of the unseen data and evaluation of the model performance. The latent dirichlet allocation (LDA) used to analyze the subjects. The study explains how LDA can be used to categorize the topics within a text group with the assistance of literature

mapping. This study aligns with organizing academic literature and making it easier to visualize connections between different studies and enhancing the research process. This approach is to evaluate the model performance, helps ensure that the system meets ISO standards, and helps to the developing of an efficient research management solution.

Moreover, this study discusses the research trends of Latent Dirichlet Allocation based publications. And aimed to study the advance of scientific interest in LDA, to identify Authors, Institutions, and countries that refer to LDA, to identify significant topics and subject domains of the LDA based research, and to determine the publication sources, where the most articles are concentrated. In general, data for bibliometric analysis is extracted by searching the keyword in Title, Keywords, and Abstract. It holds that each text document is made up of a group of topics, and each topic is a combination of words related to it. The LDA has become a popular algorithm for topic modeling among researchers from different domains. Therefore, it is important to understand the trends of Latent Dirichlet Allocation (LDA) research (Garg & Rangra, 2023). Besides, research trend analysis and influential sources are indicated to be an important addition for integration of advanced algorithms in the system leading to updated databases time-to-time with relevant information by researchers. It also facilitates the development of a literature mapping feature utilizing LDA to characterize topics and subject domains, which aligns academic studies organization and visualization.

Research and Extension

The Research and Extension department is a central component for facilitating academics and involving the community. It manages a huge range of research projects as well as supporting initiatives that have desirable effects on both the university and the

local community. Through its research and extension services the office emerges as the main driver of innovation and societal impact. Based on the research of Sedanza (2019), the HEIs in the Philippines should prioritize the research and extension, which are important to State Universities and Colleges (SUCs). Sedanza illustrated that although faculty members demonstrated satisfactory levels of participation and performance in research and extension activities, they were highly motivated by both intrinsic and extrinsic factors. According to the respondents, the main problem that was encountered is that they did not have enough time, which means the improvement of time management might be a way of getting more involved in research and extension tasks. Addressing time constraints could significantly enhance faculty involvement, allowing their strong motivation to translate into greater participation and improved performance in research and extension activities. Addressing time constraints could significantly enhance faculty involvement, allowing their strong motivation to translate into greater participation and improved performance in research and extension activities.

Besides that, the authors of Villa, Natividad, and Thus (2021) built the system RECORDS (Research and Extension Completed and Ongoing Registered programs Database System) which is a database built for SLSU that serves to store research and extension data. The methodological assessment of the system was carried out from the different aspects of its functionality, reliability, usability, efficiency, maintainability, portability, and security, and the rating given by IT experts and stakeholders was of a favorable nature. This system illustrates the crucial importance of a digital infrastructure for the management and support of research and extension activities in tertiary level academic institutions.

The studies that were reviewed support the objectives of the proposed system, PUPSRC LitTrack: Research Database and Literature Mapping System, by emphasizing the significance of effective research and extension management in academic

institutions. Sedanza (2019) stressed the meaning of strengthening faculty's participation in executing research and extension tasks, a barrier that the system aims to bypass by making research management processes easier and automated and organized data better. Likewise, Villa, Natividad, and Tulod (2021) study reveals how strong digital infrastructures are a precondition for the successful implementation of research and extension activities. It provides a direction for the PUPSRC LitTrack system to improve accessibility, reliability, and overall research efficiency at the Polytechnic University of the Philippines Santa Rosa Campus. The proposed research is congruent with the technology road map of enhancing the relevance and responsiveness of research and extension services by infusing a technological perspective to it.

Research Management System in Institutions

In research management systems, mainly in research institutions, the proper treatment of the research information, its optimization and easy retrieval in the universities and other higher education institutions to boost the quality of research is guaranteed. As Nyirenda, M., Olugbara, O., and Moyo, S. (2019) stated, research information management plays an important role in the higher education institutions to be able to store, manage, and optimize the research findings. The procedure contains systematic output (research outputs) collection, the quality administration of these resources (research outputs) to maintain their quality and relevance, and the transparent use of the information for institutions to support their goals. The researchers demonstrate the relationship between the effective research information management systems and the increased awareness, access, and utilization of the research outputs in HEIs.

Besides, Agbede, G. and Bloodless D. (2022) stated that managing academic outputs in universities is essential for the betterment of society. The study reveals the

difficulties these entities have in research management and insists that the implementation of the proposed strategies would be a great improvement to the contributions of higher education institutions to the society. As per their study, it is evident that improving management practices to deal with these issues makes the institution's research more relevant for social and economic development. Besides, according to Donner's research in 2022, the study also asserts that organizational structure, infrastructure, work culture, and strategy have a huge effect on the delivery of Research Data Management Systems (RDMS). The research highlights that to boost overall effectiveness and ensure successful rollout, institutions need to make sure their organizational practices and resources line up with RDMS goals.

It can be seen from the synthesis of ideas of Nyirenda, Olugbara, & Moyo (2019), Agbede and Bloodless (2022), and Donner (2022) that they all share the emphasis on improving research management systems in academic institutions. Nyirenda et al. focused on having a clear organization and good management of studies to comply with institutional policies, as a part of their research on developing a complete database and literature mapping system. Agbede and Bloodless pointed to the concern about the management of academic outputs and support the application of enhanced methods to achieve the social benefits, which is consistent with the researcher's goal of using AI and algorithms to improve research management systems. Donner's research asserts that compromising organizational structure and resource inadequacy with the research management system is an obstruction to effective research management. This reinforces the strategy for successful implementation of the proposed system at PUP Santa Rosa Campus. To conclude, these perspectives stress the significance of establishing a research management system to enhance research outcomes and institutional efficiency.

Challenges in Manual Research Repository

Managing academic studies in a manual process presents significant challenges, including disorganization, difficulty in retrieval, and the risk of data loss. These issues only serve to minimize the process of research and limit the availability of every academic literature, and thus a need for more viable alternatives. As pointed out by Metha D & Wang X (2020), the transition to digital services in University libraries during the COVID-19 period exposed core issues with manual research repositories. According to the researchers themselves, the shift to online teaching and learning highlighted the deficiencies of traditional systems and the necessity for the adoption of quality digital solutions tailored to the needs of end-users during such emergencies. The pandemic is not the only reason to shift from a manual to a digital repository.

In addition, according to Kab (2021) a literature review of research on the problems of storing and retrieving information in public libraries showed that research in the 80s in Iran was mainly related to storing and retrieving documents and organizing library resources. However, according to Ullah, Usman, and Khan (2023), libraries should not be considered as mere repositories of knowledge but as active places of knowledge and cultural mix. Libraries have to adapt to society requirements, and be quite technological in nature in order to remain relevant within society.

The reviewed studies emphasize the significant need for advanced digital solutions to address the problem associated with manual research repositories. Metha D and Wang X (2020) showed that the transformation of digital services during COVID-19 was used to impart the inadequacies of traditional systems, thus, portraying the goal of PUPSRC LitTrack which is the intended enhancement of management and accessibility

of academic studies. Moreover, Kab (2021) referred to the predicaments of backing up and retrieving stored old documents, which consequently leads to the making of a stronger argument for the proposal's system's employable solution to these ancient issues. Moreover, Ullah, Usman, & Khan (2023) also emphasized that a library is not a mere storehouse of books rather it is a vibrant center for access and dissemination of information and knowledge in consonance with the proposed system developmental vision of making the repository of research a technologically active and progressive knowledge center relevant to Polytechnic University of the Philippines – Santa Rosa Campus.

Challenges in Digital Repositories

Digital repositories play a critical role in the storage, management, and provision of access to academic research and scholarly publications. However, these repositories face several challenges that could influence their efficiency, accessibility, and overall usability. Thus, the identification and resolution of these challenges are quite crucial for the successful implementation of any research repository, such as PUPSRC LitTrack.

A significant challenge faced by digital repositories pertains to the technical infrastructure necessary for the effective digitization, storage, and retrieval of extensive digital content. As the quantity of digital objects increases, it is imperative for repositories to enhance their infrastructure correspondingly, a process that can prove to be both financially burdensome and complex. Factors such as insufficient network infrastructure, restricted storage capacity, and the necessity for ongoing system upgrades can impede the performance and reliability of digital repositories (Parkoła, 2020). Addressing these challenges related to infrastructure is essential for establishing a strong technical foundation for the PUPSRC LitTrack repository, thereby ensuring seamless access and effective management of research materials.

The data management and long-term preservation challenges are multilayered. For instance, the quality and consistency of metadata, which are essential for efficient search and retrieval, vary significantly across different repositories. Good management of metadata requires careful planning and constant monitoring (Obande, 2024). Advanced algorithms and artificial intelligence integrated into the system will further improve metadata quality and provide better organization of academic literature to realize the goal of the study, which is to ensure that research materials remain usable and accessible in the long run.

Financial constraints, on the other hand, pose a great challenge in developing and maintaining digital repositories. Low budgets can inhibit technology implementation, system upgrades, and performance in general. Parkoła (2020) Budgetary constraints should, therefore, be overcome, and investment should be welcome to activities that enhance the training and develop the skills of personnel for the sustainability and efficiency of a research repository. Such considerations are essential to the PUPSRC LitTrack project in ensuring that the system is operational but also aligned with the best practices in the field.

While the integration of AI into the management system promises efficiency and improved users' experience, it introduces its challenges. According to Udo-Okon and Akpan (2024), it outlaws ethical issues relating to data privacy and bias in algorithms affecting the system's fairness and inclusiveness. The high cost of implementation and the need for updates and maintenance are also some of the major obstacles to fully integrating AI in library management systems. This review further supports the current study objectives in emphasizing that the developed research repository system be effective, efficient, and equitable, by addressing several challenges related to AI. The research benefits the purpose of integrating AI to improve literature analyses while maintaining system quality and reliability in conformity with ISO standards.

Synthesis

The reviewed literature and studies on research management systems have a common focus on making academic research more efficient, accessible, and secure. Systems like PUPSRC LitTrack, designed for the Polytechnic University of the Philippines – Santa Rosa Campus, share these goals, as they transition from manual repositories to advanced digital solutions. This transition is signified by the infusion of Artificial Intelligence (AI) and algorithmic tools like the Latent Dirichlet Allocation (LDA) algorithm, which enhances literature mapping and research database management by better organizing the data and providing more complete and coherent data organization.

However, it was evident that while the various research management systems presented in this chapter have similar objectives based on the needs of different institutions, every single system provides new features that address various institutional requirements. For example, the majority of similar systems are designed to enhance the accessibility of the system as well as data security, while PUPSRC LitTrack with the help of LDA improves the accuracy of literature categorization and search, which suits the needs of the PUP Santa Rosa Campus Research and Extension Management Office. Such specialization not only improves the quality of the research output but also aligns with the institutional academic and extension mandate by facilitating efficiency and innovation in research.

In conclusion, the proposed system's development, the researchers plan to fill in the key gaps which have been identified by the research management systems that exist currently. These gaps are a stronger AI-based literature mapping tool and the necessary integration of data mechanisms that are advanced to help meet the increasing demands of research and the extension activities. The system first aims to overcome these

challenges and thus will become a major help in the research management area by providing a flexible high-tech research management solution that is in harmony with the institutional goals of the Polytechnic University of the Philippines – Santa Rosa Campus and its commitment to academic excellence.

Technology Gaps

The review of related literature and studies shows the gaps particularly the transition from manual to digital platforms and integration of advanced technologies like artificial intelligence. According to studies by Metha D & Wang X (2020) and Kab (2021) the inefficiencies in manual systems, such as disorganization and data loss, hinder the accessibility and preservation of academic literature. Also, Somefun et al. (2020) and Mondal and Kar (2021) highlight that the existing digital repositories also fail in academic collaboration, limiting the sharing and visibility of research with the students. The study aims to organize the current research processes and to create a database for academic studies to improve accessibility and management. By optimizing and modernizing the research management processes and improving collaboration with the integrated digital tools it will address these inefficiencies and enhance the organization of research materials.

Furthermore, these literatures involve gaps which are the limited use of artificial intelligence in existing systems and the lack of research management features. Nyirenda et al. (2019), Agbede and Bloodless (2022), and Donner (2022) emphasize the need for more comprehensive systems. Additionally, Kabudi et al. (2021) and Hussain (2023) discuss an unused potential of artificial intelligence in enhancing educational platforms and literature mapping. The study seeks to improve research management, retrieval processes, and AI-enhanced research databases with the help of artificial intelligence.

Chapter 3

RESEARCH AND SOFTWARE METHODOLOGY

Introduction

This chapter introduces the different techniques and methods that the researchers used for data collection and analysis. The Development of a research design, research locale, the identification of relevant data sources, the choice and description of research instruments for data collection, the implementation of data collection procedures, ethical considerations, and the application of statistical methods for data analysis are the components involved in the development of the research design. Moreover, this chapter also introduces the system architecture along with the features that would allow the researchers to assist in system development.

Research Design

This study will utilize a descriptive-developmental research design to provide thorough examination of the current research management and literature mapping practices at Santa Rosa Campus. The descriptive research aspect will adopt surveys and structured interviews to have a more comprehensive understanding of existing practices, academic environment problems and the nature of the academic environment. In this process, methods like survey questionnaires and formal interviews shall be used to extract data from the key respondents that include faculty, researchers and students. These methods will be used in order to achieve Objective 1, where methods of information gathering relevant to creating a centralized repository are required, as well as Objective 2, where methods of information gathering related to the development of a literature mapping feature are needed. The surveys will focus on determining the current knowledge storage and retrieval system while the interviews that will be undertaken with

the academics will give more information on some of the problems encountered while carrying out the literature mapping.

For the developmental research aspect, the researchers will mainly focus on system development and testing in line with Objective 3 which entails integration of Artificial Intelligence and advanced algorithms into the system. Latent Dirichlet Allocation Algorithm specifically, will be employed to improve the literature mapping feature. Such algorithms will aid in sorting and disseminating knowledge on relevant academic articles, reducing the hustle of finding relationships. To avoid any problem in the implementation of this feature, there will be the use of prototyping and usability testing that will be done on specific participants in order to confirm that the various AI aspects of the system are fit for purpose. Tools such as functionality and usability testing will be employed, following ISO/IEC 25010 standards for system evaluation. Finally, to achieve the fourth objective of evaluating the system based on ISO standards with regards to quality, reliability, and user-friendliness of the system there will be the evaluation phase. Finally, data gathered from the users during the testing process will be collected by means of questionnaires in order to make sure that the system within the company is in compliance with the best practices of the industry and the expectations of its users.

In conclusion, the descriptive-developmental approach will offer insights into the existing system which shall help define the new and improved AI-based research management solution, while the surveys, interviews, and structured tests will help assess the effectiveness of the developed version anchoring on the laid down objectives and the ISO Standards.. Through the utilization of these research methods, the study supports the creation of a strong and effective research database and literature mapping system that will be established in Santa Rosa Campus as a center for continuing academic success.

Research Locale

The research will be conducted at the Polytechnic University of the Philippines – Santa Rosa Campus Research and Extension Management Office. The selection of this location was based on several factors, including its central role in overseeing research activities, the availability of relevant data, and the accessibility for both staff and students. The research included various data collection methods, such as surveys and interviews, which were conducted at the respondents' convenience. Figure 1 and 2 depicts the research location.

Figure 3: Polytechnic University of the Philippines – Santa Rosa Campus Map



Figure 4: Polytechnic University of the Philippines – Santa Rosa Campus (3D View/Google Image)



Sources of Data

The data for this study will be collected from both primary and secondary sources to ensure that the information needed to satisfy the objectives of the study will be thoroughly and meaningfully obtained. The primary data collection method of this study involves the administration of survey questionnaires among faculty members and administrators from the Polytechnic University of the Philippines - Sta. Rosa Campus, especially those involved in research and managing the Research and Extension Office and the Campus Library. These questionnaires are intended to capture firsthand information about the problems associated with the current manual process and the detailed requirements for building the centralized research repository and literature mapping system.

Secondary data will be sourced from institutional documents such as the manuals of the Research and Extension Office and Campus Library, citizen's charters,

research reports, and existing process documentation. Relevant academic studies, research articles, and databases in artificial intelligence and literature mapping systems will also be reviewed to inform system development and state-of-the-art algorithm integration. Both primary and secondary data will be used to ensure that the study meets each of its objectives by amassing the required information.

Table 1

Determining the Total Population of the Respondents

Name of Population	Total
Research and Extension Management Office	20
Campus Library	1
Total	21

Research Instrument

A research instrument can be a tool or technique used in the collection, measurement, and analysis of data relevant to the objects of the study. In this research, several research instruments will be employed to effectively gather the needed information for the development of the Research Repository System with integrated Literature Mapping features.

Documents relevant to the present research management processes will be reviewed, entailing highly focusing on the manuals, guidelines, and other materials used in the Research and Extension Office and Campus Library. This approach will provide valuable insights into the structure of the current system, thereby helping identify areas to be enhanced in the design of the database. A survey questionnaire will be prepared

for capturing input from the faculty and researchers regarding the features and functionality of the literature mapping tool. This will capture quantitative data on specific needs and expectations of the potential users to ensure the system is tailored to their needs.

Finally, in relation to assessing the performance and usability of the developed system, a standardized tool will be designed based on ISO quality standards. This will give participants a chance to evaluate the system on functionality, reliability, and user-friendliness. The resultant data from this evaluation will then be analyzed in verifying whether the system developed conforms to the required industry standards.

Data Gathering Procedure and Analysis Plan

This study will include data collection on the development and testing of the research repository system integrated with literature mapping features. Accordingly, the procedures to be adopted are those properly structured in such a way that each method has a relevance to the overall purpose of the study. The document review of the existing research management processes in the Research and Extension Office and Campus Library will be the starting point of the data gathering procedure. Through internal documents, such as guidelines and manuals, the researcher will get data on how the present system works, which will help during the designing of the database.

A questionnaire survey will also be distributed for capturing quantitative data from faculty members and researchers. The main theme of this survey will revolve around identifying the user's expectations and requirements regarding the feature of literature mapping so that the system can be designed in concert with the user preferences. Their responses will help in prioritizing the features or functionalities within the system. Upon the system development, the system evaluation will be done based on ISO. In this,

participants use a standardized assessment tool to evaluate the system's functionality, usability, and reliability. It will provide data on whether the system meets the industry standards and user requirements.

Quantitative methods will be used to analyze data from survey responses and the results of system evaluations. Descriptive statistics will be used to summarize responses that could help the research team outline key trends and patterns in the responses. Such analyses will inform necessary refinements that the system is undergoing to ensure it is in line with user and industry expectations.

Table 2

Data Analysis Plan

Answers the Following	Data Collection	Data Type	Data Level	Basis
Who are the key stakeholders involved in the management of academic literature at your institution?	Questionnaire	Qualitative	Primary	Questionnaire Items
How do departments currently access academic resources and literature?	Questionnaire	Qualitative	Primary	Questionnaire Items
What types of resources should the repository include? (e.g., journals, books, theses)	Questionnaire	Qualitative	Primary	Questionnaire Items
What is the anticipated volume	Questionnaire	Qualitative	Primary	Questionnaire Items

of literature and data that the repository needs to handle? Can you provide estimated numbers or data sizes?				
How do students submit their academic literature? What is the submission process like? Are there any existing systems in place?	Questionnaire	Qualitative	Primary	Questionnaire Items
How is each academic literature being organized?	Questionnaire	Qualitative	Primary	Questionnaire Items
What features would you find most useful in a centralized repository for academic literature?	Questionnaire	Qualitative	Primary	Questionnaire Items
What level of access control is necessary for the repository? What user roles and permissions should be considered?	Questionnaire	Qualitative	Primary	Questionnaire Items
Do you have any additional comments or suggestions to improve the repository and its services?	Questionnaire	Qualitative	Primary	Questionnaire Items

Statistical Data Analysis

The quantitative approach to data analysis that shall be obtained shall ascertain the functionality, efficiency, and satisfaction with the developed research repository

system. It is thus appropriate to use the mean and frequency distribution in statistical tools to ensure that proper evaluation is accorded to the performance of the system under development. Use of the mean will facilitate determinations of central tendencies by providing an average measure of responses to various indicators related to the effectiveness of the system, user experience, and overall usability. This statistical measure will enable researchers to measure general perceptions regarding the developed system and to draw conclusions based on aggregated feedback from the respondents.

$$WM = \frac{\sum(fx)}{n}$$

Where:

WM = Weighted mean

\sum = Summation

f = Frequency for response

x = Assigned weight

n = Total number of respondents

Frequency distribution will also be used to indicate how certain responses have occurred throughout different categories in the survey. The advantages of this will be handy in observing most frequent trends and preferences of users and, therefore, indicating strong and weak points of the system. Objectivity and quantifiability shall be ensured in the data to be produced through these methods, which will, in turn, act as a basis for assessment of the success of the system and adherence to ISO standards. The results from this analysis will go a long way in suggesting not only clear-cut signals

on functionality but also user satisfaction and shall thus form the basis for future recommendations towards optimization. This complete quantitative design means that the empirical data on which the findings of the research are based will be important in establishing the reliability and validity of any conclusion derived from the study.

Ethical Consideration

In conducting this study, the principles of the Data Privacy Act of 2012 (Republic Act No. 10173) will be followed to ensure that participants' personal information is secured. Ethical standards will be involved such as informed consent, confidentiality, and voluntary participation. The faculty members, staff, and other participants will be apprised all the details regarding aims, methods, risks, and benefits of the study. The participants have their freedom to withdraw from the study at any time with no consequences ensuring that their freedom was maintained. To protect the participants' information, all the data collected during the research were made anonymous, and extreme measures to protect the data were employed. The data collected were also kept in electronic databases, retrievable only by the members of the research group and were used exclusively for this study.

In this research study, the participant's choice will not be influenced or forced as it is mandatory for the researchers to guarantee the freedom of choice. Their decision to join or not in the study was not interfering with their roles within the university. The research was intended to give a positive impact to the academic community at Polytechnic University of the Philippines - Santa Rosa by the improvement of research management practices while serving to ethical guidelines that prioritized the welfare and rights of the participants. Through the application of these ethical principles, the study was aimed at generating useful knowledge and ideas that would enhance the university research environment.

Software Requirement Specification

Table 3

Software Requirement Specification

Software Requirement Specification	
1	Document Upload: Support for various document formats (PDF)
2	Document Management: Edit document metadata and organize documents into categories and collections.
3	User Management: Support user roles such as students, staff, and administrators with varying access levels.
4	Categorization: Allows mapping and categorizing of research documents.
5	Annotation and Tagging: Highlight text and tag documents with relevant keywords.
6	Advanced Search: Search by title, author, keywords, and full text and filter results by date, category, and document type.
7	Role-Based Access Control: Role assignments for faculty, and research office staff.
8	Submission Reports: Generates reports on document submissions and approvals.
9	Approval Process: Enables the Research Office to review and approve uploaded documents.
10	Literature Mapping: Interconnectedness of research using literature mapping and filtering count of citation and date when the research was published.
11	Scanning of Research Documents: To check if the document uploaded is copyrighted.

The following functions and features are needed for software specification, based on the needs assessment from the Polytechnic University of the Philippines, Santa Rosa Campus. Incorporating these features into the Literature Mapping Repository for Academic Studies will simplify academic research operations and help the repository achieve its aim of providing high quality research experiences.

System Architecture

Introduction

This section provides the architectural visualization of the organization and capabilities of the proposed system, articulated using various diagrams, each offering insights into different aspects of the system. It included Software Development Life Cycle (SDLC), System Flow Diagram (SFD), Data Flow Diagram (DFD), Hierarchy Input Process and Output (HIPO), and Contextual Diagram. These System Architectures coupled with explanatory outlines provide a functional and technical plan for the development of the system.

Software Development Life Cycle

Figure 5. Software Development Life Cycle for PUPSRC LitTrack



The researchers will be using agile software development to implement the proposed system. The Software Development Life Cycle (SDLC) is a methodical

process for planning, developing, testing, and maintaining software. It takes a step-by-step process through different stages, from start to finish of the project. While the system is being developed, it is focused on building a research database and literature mapping tool to improve the research process at Polytechnic University of the Philippines – Santa Rosa Campus. However, this process can run into problems when project requirements change, leading teams to consider more flexible alternatives that the teammates find out.

In addition, this agile model offers an iterative approach that the researchers are using to develop the Research Database and Literature Mapping System using Artificial Intelligence and Algorithms. This approach connects the stages of project development as follows gathering requirements, design, development, testing, deployment, and review. It emphasizes the teamwork between developers and customers, flexibility with changing needs, and delivering functional software in small, quick updates. To handle this project, the researchers analyzed the client needs and the project scope. This helps the foundation for the next stages.

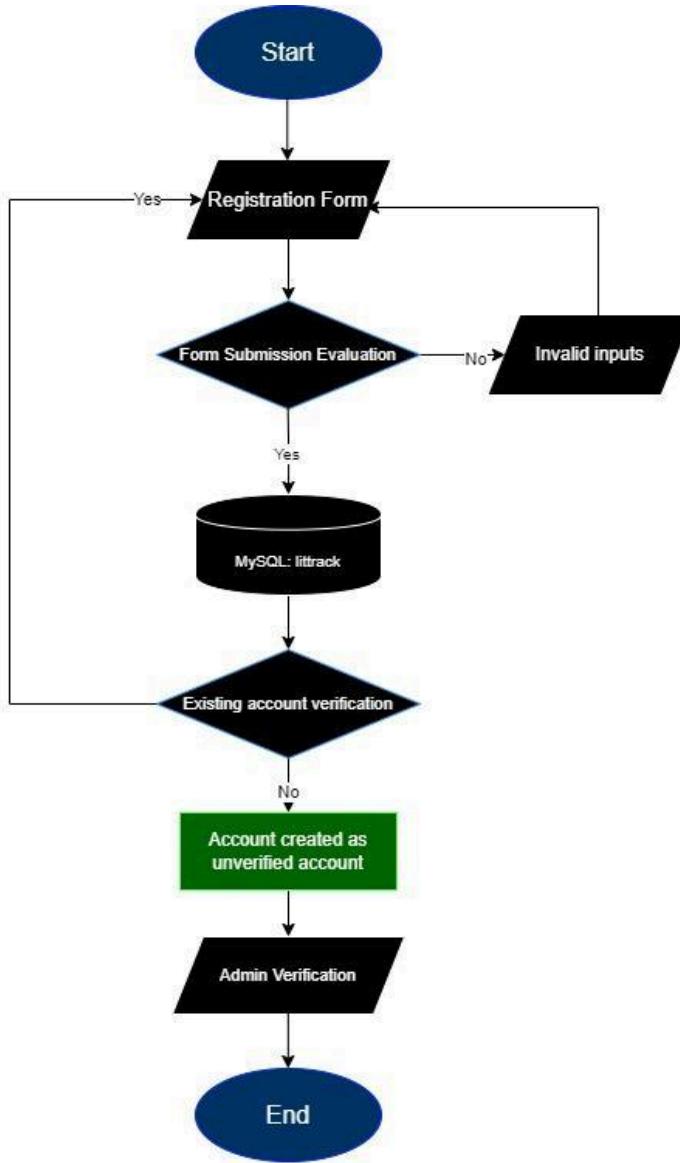
In the Agile model, in terms of design and development stages are central because it is flexible and repeatable. First, the team will be working together to create a design that matches the client's wants. Then, during development, researchers make steady progress and keep checking in with the client. In this way, researchers can easily adjust and make improvements as needed. In Agile testing the researchers created specific test cases to cover all aspects of the software functionalities and to evaluate if there were any bugs or issues. It happens throughout the whole project to make sure the software meets all the needed functions and quality. The deployment phase each time a version of the software is released, it's available for real use including the databases, code, and libraries. After that, the team reviews it, gets feedback, checks how it's performing, and makes any needed improvements. By using Agile, the researchers were

committed to being flexible and focusing on the clients needs, which will help with the specific challenges of managing the research process at Santa Rosa Campus. The researchers used the Agile model to develop a Research Database and Literature Mapping System, allowing them to adapt to changing requirements and continuously improve the software. Agile's iterative methodology made sure the system complied with requirements and quality standards. With this approach, the difficulties at PUP Santa Rosa Campus were successfully addressed and a flexible, client-focused development process was supported.

System Flow Diagram

A system flow diagram visually shows the main interactions, data flows, and processes within a system. It clearly illustrates how different parts of the system interact and how data moves from input to output. The following diagram represents some of the main processes: User Account Creation, User Account Verification, Login Authentication, Submission of Research Documents, Publishing of Research, User Literature Mapping, and Advanced Searching by User. Each of the above-mentioned processes plays a crucial role in the total functionality of the system.

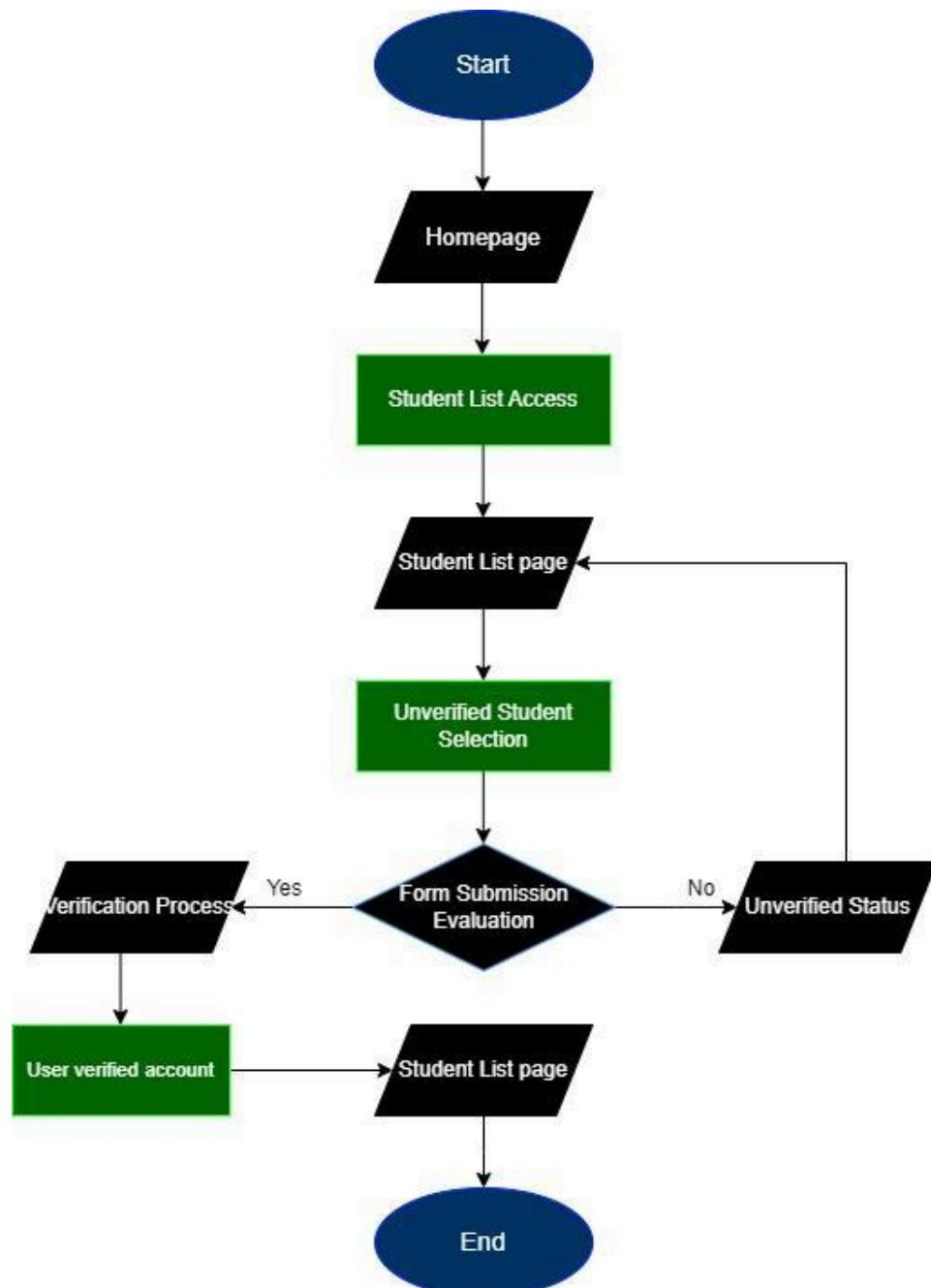
Figure 6. User Account Creation



For student registrations, the verification process starts with accessing the student list through the administrator interface. The administrator interface provides the opportunity for administrators to filter the accounts and display them, showing which of the accounts have been verified and which have not. This feature allows administrators to handle a number of accounts without any problem, making changes in the account statuses with simplicity. The administrators can remove the name of any student from the list if they want to. On successful verification of an account, it sends a confirmation mail to the

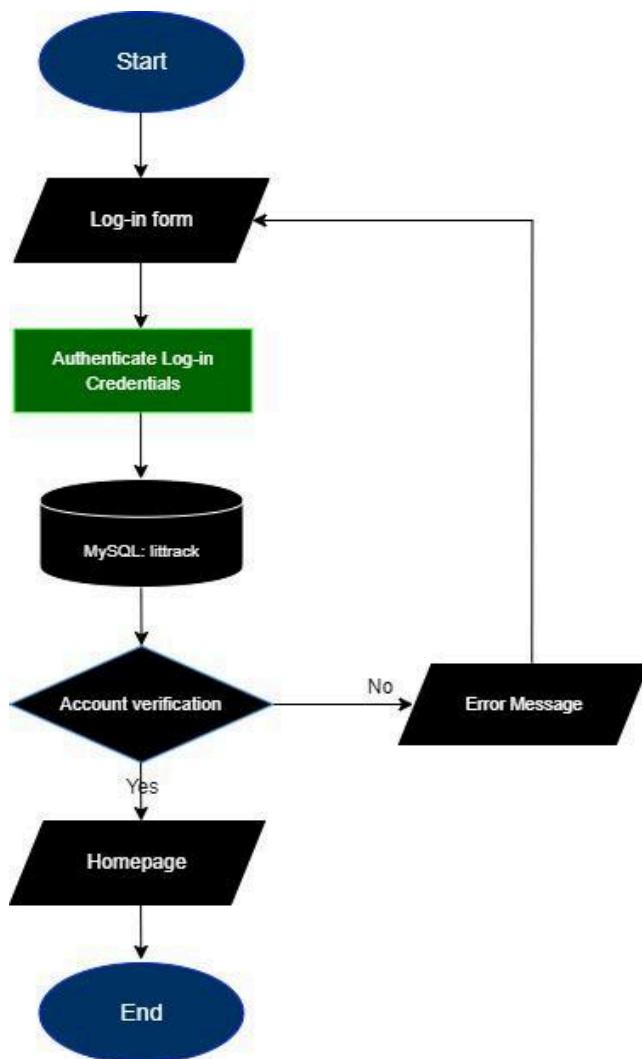
registered user confirming the said fact. This takes the form of an email telling the user that their account has been validated. The account is activated once upon confirmation. This ensures a thorough verification process and provides users with up-to-date account status information.

Figure 7. Account Verification



Account verification of student registrations is done by the system admin through accessing the student list on the admin interface. Records shown here can be filtered to see which accounts are verified and unverified. Admins will also have the option of removing student names. Once an account is verified, a confirmation email gets sent to the user who has registered, and their account gets operational and ready to use.

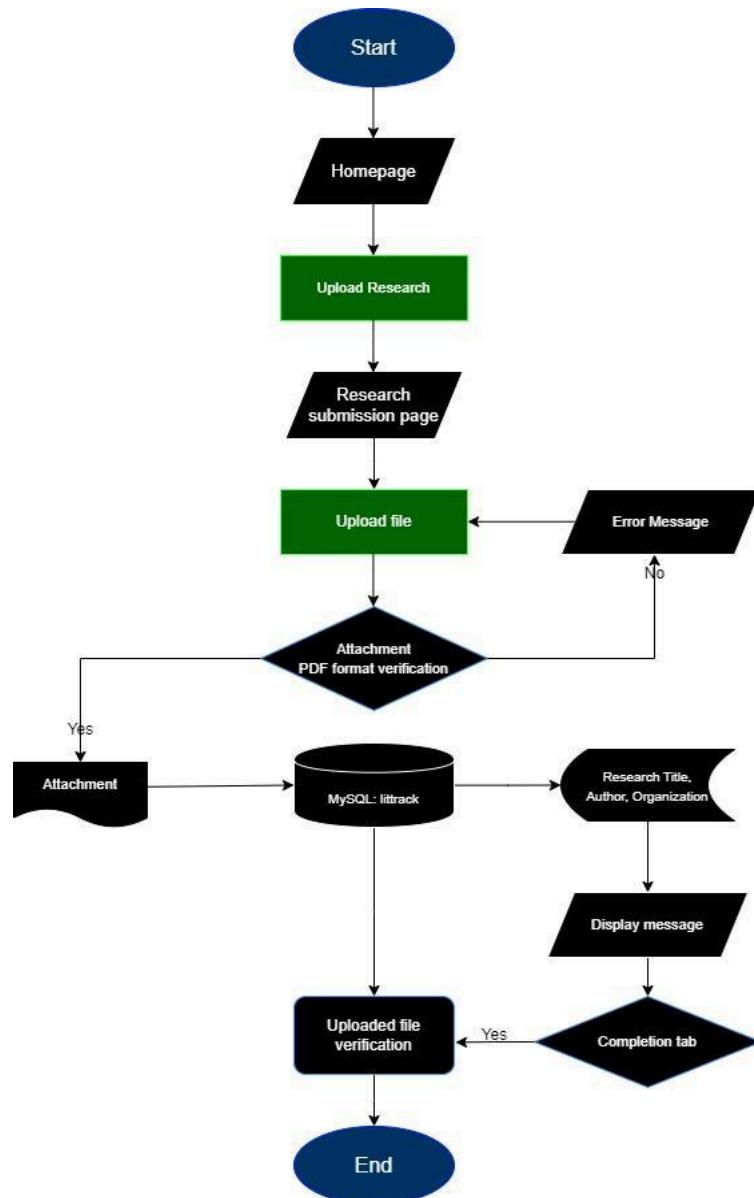
Figure 8. Login Authentication



The authentication process for both administrators and students adheres to a standardized procedure. It begins when the user inputs their login credentials, which

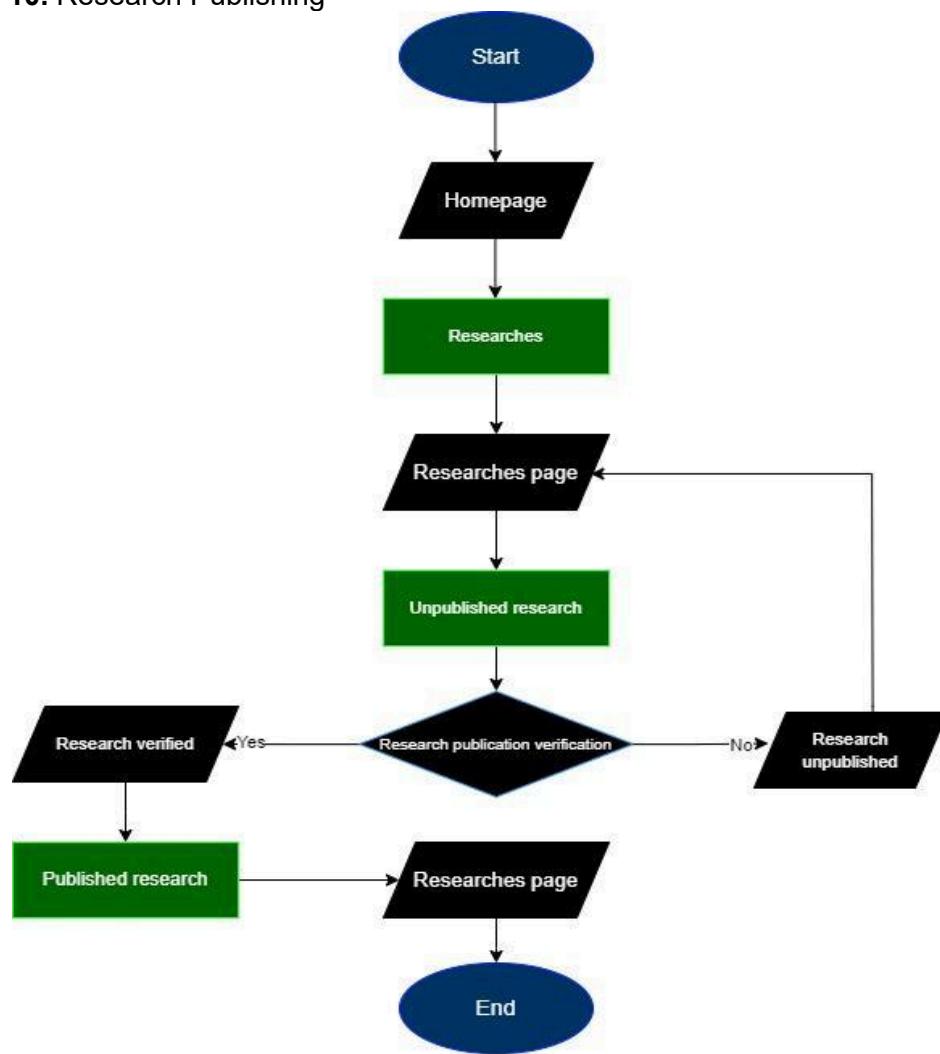
consist of username and password for the admin and email and password for the students. Upon submission by the user, the system checks it against data in the "littrack" database. When it verifies that they are correct, the system authenticates the user and forwards them to the homepage, which completes the process of user authentication. On the other hand, in case the credentials are wrong, it is going to show an error message for authentication failure and ask the user for details again.

Figure 9. Research Submission



The process begins by selecting 'Upload Research' from the homepage. The system then presents the Submission Tab, which includes a form for entering details about the research to be published. The system verifies that the attachment is in PDF format; otherwise, an error message is displayed. Accepted PDF files are stored in the "littrack" MySQLi database along with the associated details. A success message appears upon successful submission, concluding this stage. The research then undergoes an approval process by the research administrator, and can either approve or reject the document uploaded. Once approved, the research is published and displayed on the research page. the research admin which they can approve or disapprove. Once approved the research will be then published and reflected in the research page.

Figure 10. Research Publishing



The research publishing process begins by filtering pending submitted documents in the research page in the administrator interface. This opens up to the administrator a list of pending submissions, which also indicates the status of each research. Each of these submissions will be reviewed according to predefined merit criteria. If the research meets all the required standards, then the administrator approves such submission, and the research is acknowledged as approved within the system. After the approval, an email confirmation is provided to the submitting user, and the research is published and will also be shown on the research page. If it does not fit the criteria, the administrator can reject the submission by notifying its rejection to the submitting user.

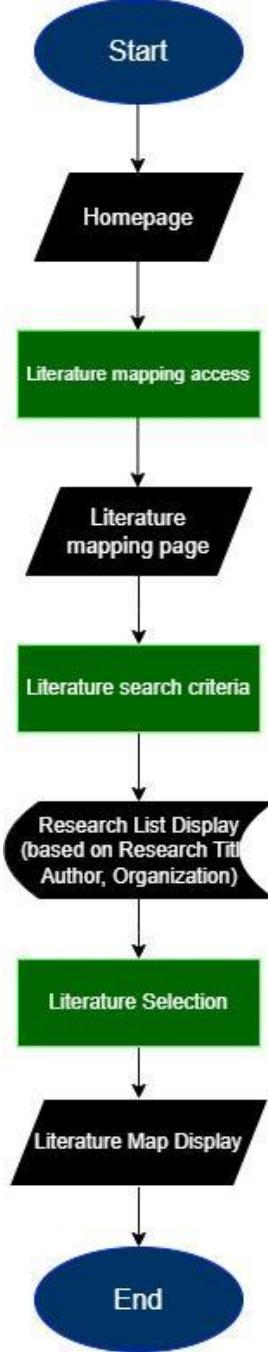
Figure 11. Advanced Search



The advanced search process begins when the user accesses the advanced search feature. The system presents the user with an advanced search filter. The system displays an advanced search filter that gives the user an opportunity to define a number of criteria, such as keywords, date of publication, author, or subject area of the publication. In this case, the user will have to fill in all the necessary search parameters

and send a prompt to the system. Afterwards, the system processes the query through filtering in the research database with the help of specified filtering criteria. It obtains relevant results and displays them, and then the option for further refinement can be done. The results are presented in a structured outline format from this, the user can read detailed information about each entry of the result. This would enable the users to conduct a more focused search such that the results are relevant to their needs.

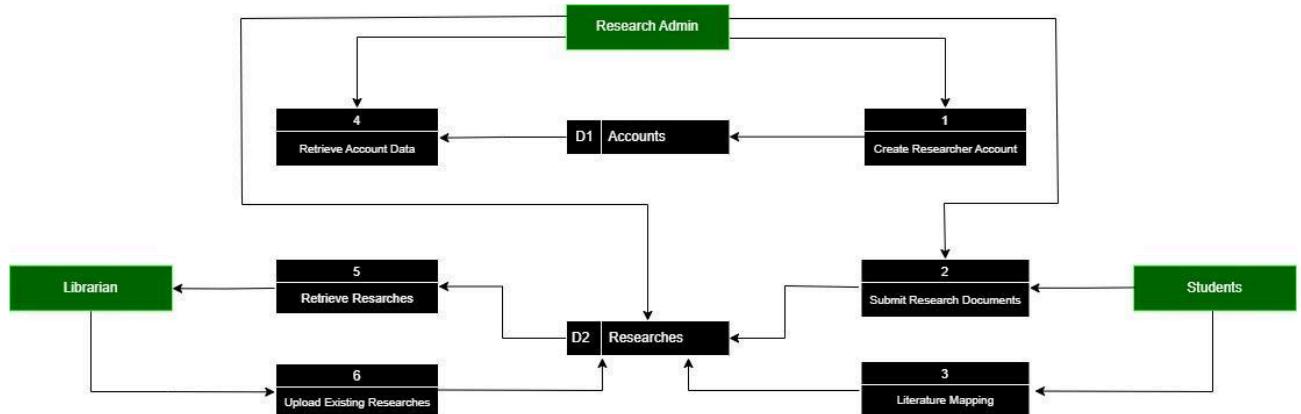
Figure 12. Literature Mapping



The literature mapping process begins with the user accessing the literature mapping feature within the system. A user would, therefore, type different research topics, keywords, or themes on provided search fields. Through the database, the system retrieves and analyzes the research articles and publications corresponding to the entered criteria. The retrieved data is analyzed for interconnectedness and patterns that exist among the research works. The system displays a visual appearance that represents the literature map, showing the various relationships from the different research studies, authors, and topics. Such a map enables the user to perceive the landscape of the research field, identify key trends, and explore how diverse studies relate to one another.

Data Flow Diagram

Figure 13. Data Flow Diagram of PUPSRC LitTrack



This diagram represents a simplified research database. Three major user roles are included: Research Admin, Librarian, and Students. The system is designed to manage research documents in literature mapping and provide focused functionalities for each kind of user.

The Research Admin fills the primary controller role in the system. This includes user management and oversight at the system level. Admin responsibilities include the creation of accounts for researchers, which falls under Process 1. This involves the administration of the accounts for the researchers, who could be students or academic staff, and keeping this in the Accounts data store D1. In addition, Research Admins can submit research documents, which means that admins can also contribute to the system by uploading important documents or assisting researchers in their submission. This process interfaces with the Researches data store, D2. Another responsibility done by the admin is to fetch data about the accounts, something very important in managing the user's details, permissions, ensuring accuracy of the system. This is achieved through Process 4, drawing from the Accounts data store D1.

Librarian: The role involves the creation and management of research content within the system. Also, the research documents stored in the data store D2 are retrieved by the Librarian through Process 5 for the purpose of order and accessibility in research materials. In addition, the Librarian uploads existing research documents in the form of Process 6 to the Researches data store to add new and established works in the database. This position is responsible for maintaining a well-organized repository in support of research.

The students, being the primary contributors and users of the system, interact with it mainly in submitting their research documents through Process 2 to the Researches data store D2, and by doing some literature mapping as per Process 3. Literature mapping permits the student to classify their research and associate it with existing literature, thus providing interconnectivity features to the database. The students will also be benefiting from the retrieval process of the Librarian-Process 5-getting a wide range of research materials.

The structured interaction of the Research Admin, Librarian, and Students hence ensures that information will flow with high efficiency and optimize the system's functioning. However, this collaborating framework has ensured not only the effectiveness of the research documents' submission, being organized and retrieved but also fostered adequate understanding of the research database system in terms of its development and functionality.

Hierarchical Input Process Output (HIPO)

Figure 14. Hierarchical Input Process Output (HIPO) Diagram

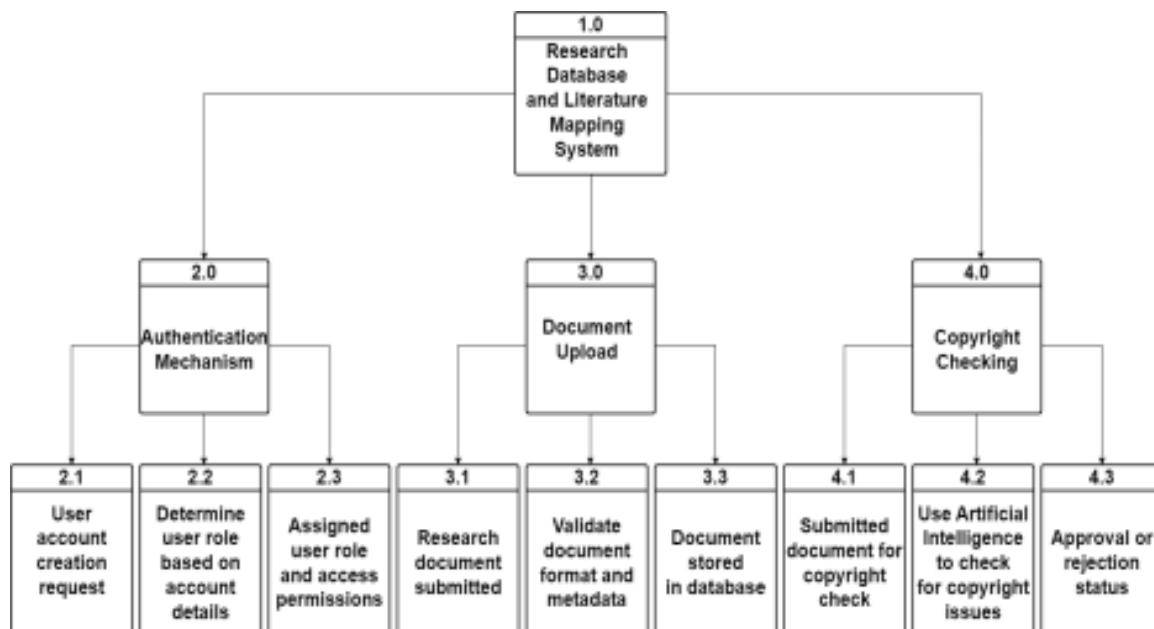
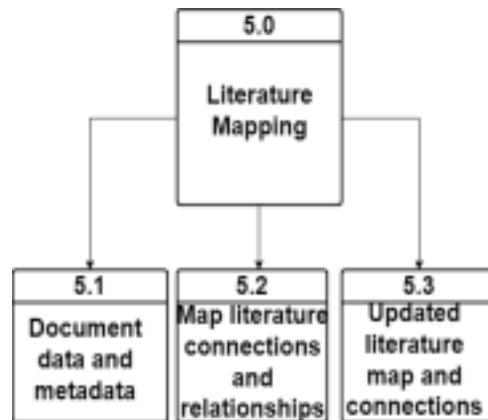


Figure 15. Continuation of Hierarchical Input Process Output (HIPO) Diagram



A Hierarchical Input Process and Output (HIPO) diagram organizes the software system modules into a hierarchy and further divides into sub-functions, using HIPO diagrams demonstrating the system functions. In this diagram, the Research Database and Literature Mapping System shows the structured hierarchy with distinct levels. At the top, the main system manages modules and functions. This system is designed to organize the research process using advanced technology. The primary functions of the Research Database and Literature Mapping System are Authentication Mechanism, Document Upload, Copyright Checking, and Literature Mapping.

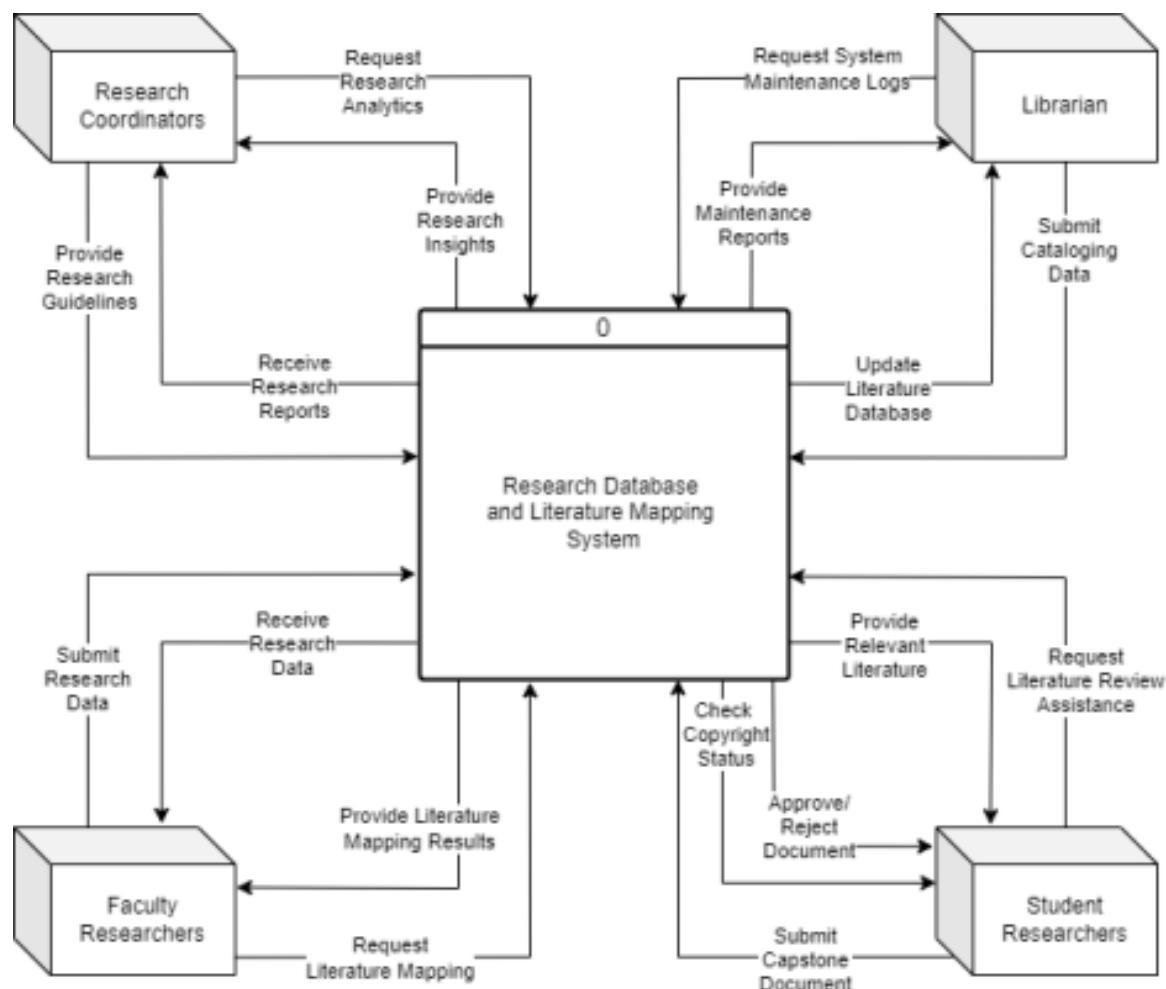
In the Authentication Mechanism function it manages user roles during creation of an account, determining whether a user is a faculty member, student, or administrator. The Document Upload module handles the submission and storage of research documents. The Copyright Checking component uses Artificial Intelligence to assess whether submitted documents are copyrighted, providing approval or rejection status. The Literature Mapping function creates connections between documents, updating the literature map based on the information processed.

The Hierarchical Input Process and Output (HIPO) diagram shows the system hierarchy and data flow. It emphasizes how the modules Authentication Mechanism,

Document Upload, Copyright Checking, and Literature Mapping interact with and contribute to the overall functionality of the Research Database and Literature Mapping System. This emphasizes the organized collaboration between modules and their responsibilities in enhancing the system efficiency.

Contextual Diagram

Figure 16. Contextual Diagram



Context diagrams show the interactions between a system and other actors

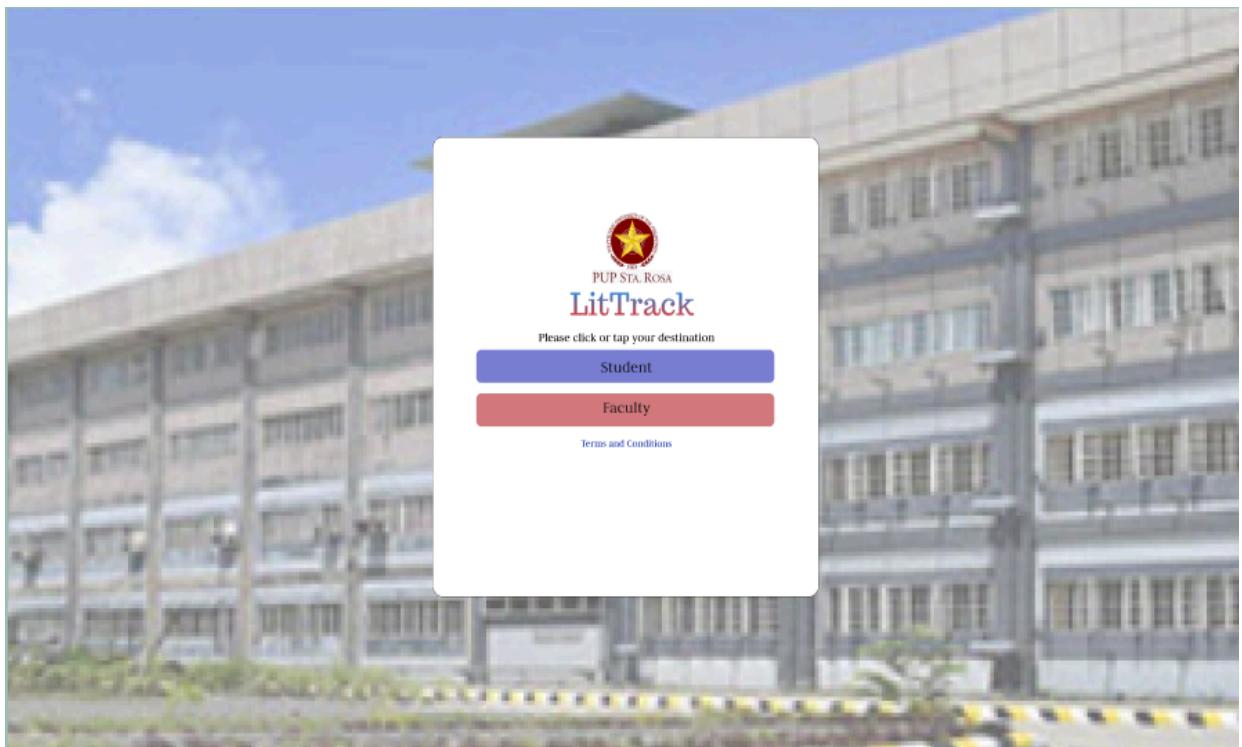
(external entities) intended to interface. Also, context diagrams help to understand the context of the system. It is used to determine the scope of a project as well as the necessary requirements. Context diagram shows the entire system as a single process. This contextual diagram shows the external entities that interacted with the proposed system, while the main functions of the Research Database and Literature Mapping System are highlighted.

The Research Database and Literature Mapping System is the main project for managing and organizing research data that holds anything within its control. Four external entities interact with the system which are the Research Coordinators, Librarian, Faculty Researchers and Student Researchers. Faculty researchers and Student researchers are able to upload research documents and literature mapping helps them. Meanwhile, Research Coordinators manage the submission of documents, ensuring documents meet the guidelines and requesting research analysis. Librarians contribute by updating the system with new catalog data and maintaining the literature database. All these interactions help the system function effectively.

The diagram shows how Faculty Researchers and Student Researchers upload important research documents, while Research Coordinators and Librarians help to manage and assess the information. The diagram and information flows define how the Research Database and Literature Mapping System works and keeps the system running smoothly.

Software Prototype

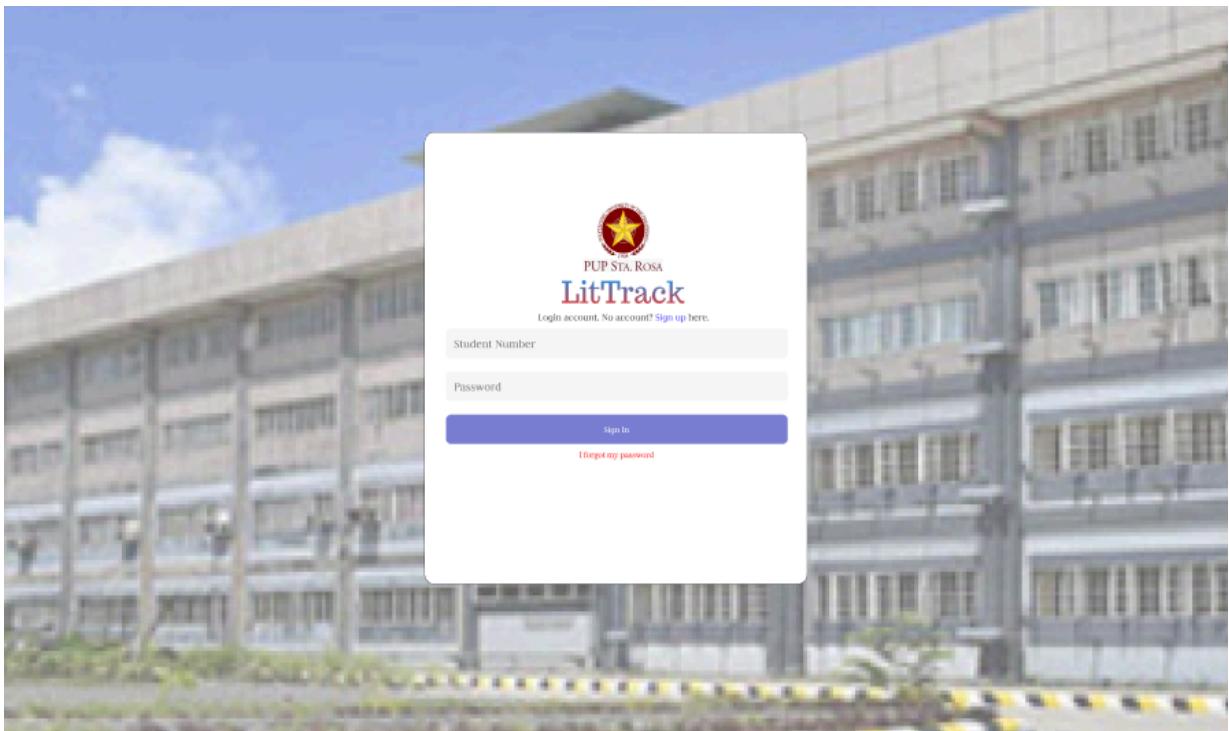
Figure 17. Pre-Login Page



Functionalities:

1. Choose if Admin or Student
2. Terms and conditions
3. Sign up button

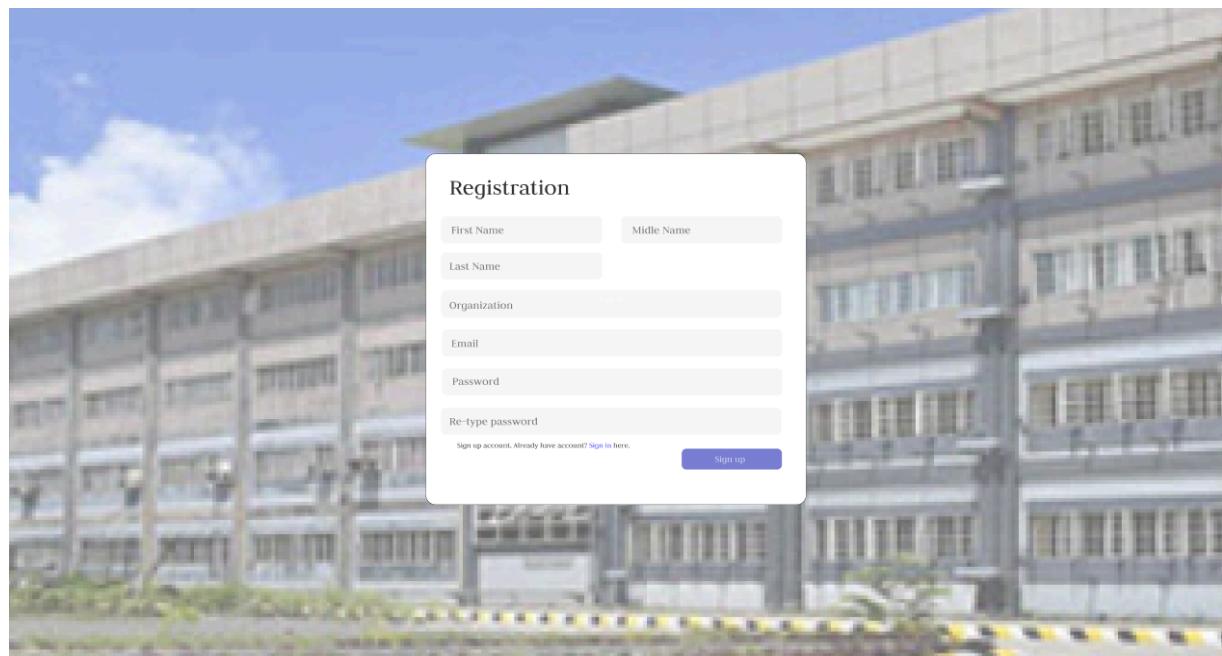
Figure 18. Login Page of Students



Functionalities:

1. Users login using email and password verified by the admin
2. Users can change their password by filling up a form, a default password should be sent to pup webmail of the student

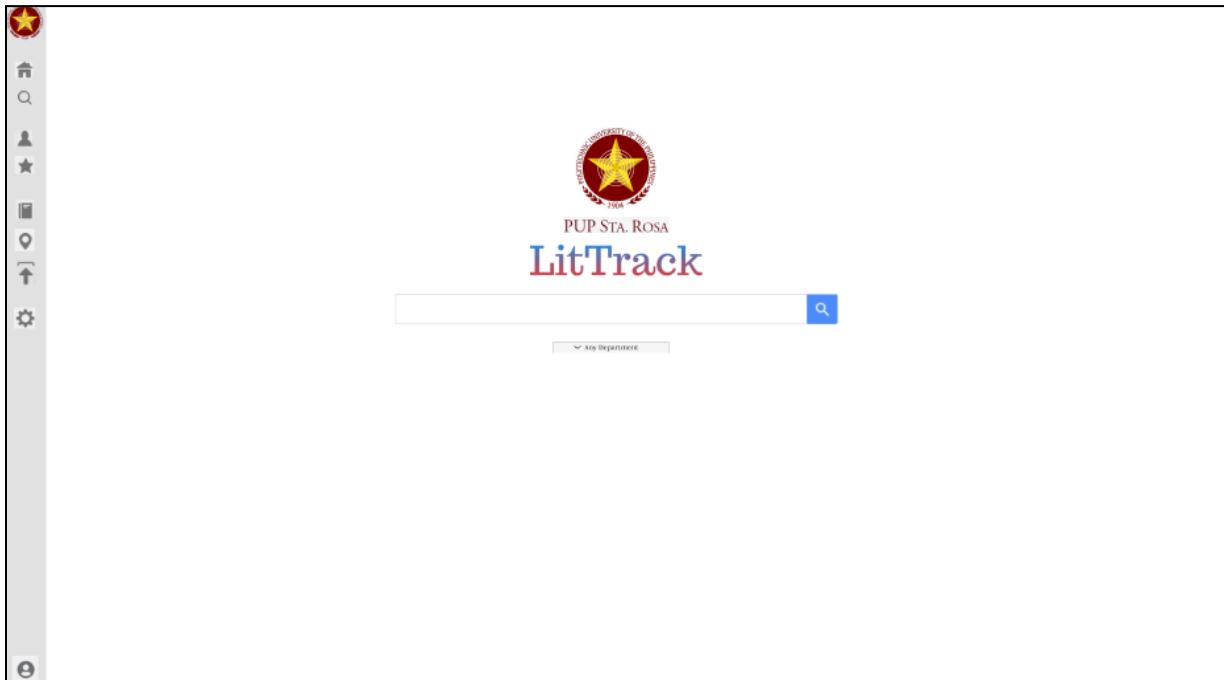
Figure 19. Sign-up Page of Students



Functionalities:

1. Sign Up unverified account

Figure 20. Home Page



Functionalities:

1. Search by title name or author
2. Once search button clicked user should be directed to Researches Page while also filtering the search input

Figure 21. Slide Bar of Students



Functionalities:

1. If the logo in the upper left corner is clicked the sidebar should expand
2. If sidebar expanded page content should be unavailable whatever page the user is in
3. Click anywhere in the content page and the sidebar should automatically close

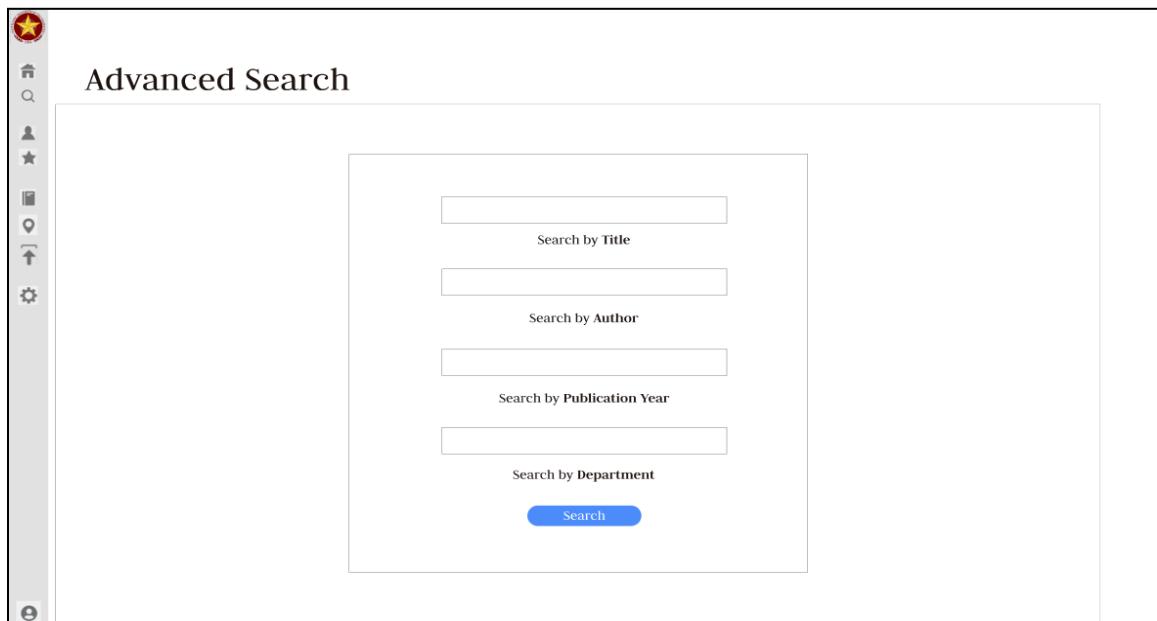
Figure 22. Researches Page of Students

 A screenshot of the "Researches" page. The sidebar on the left includes icons for Home, Advanced Search, My Profile, My Library, Researches, Literature Mapping, Upload Research, and Settings. The main content area displays three research entries:

- Research Database with Literature Mapping System**
By: Forlanda, S., Bagwisa, J.
IMAGE NOT AVAILABLE
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- Information System Strategic Plan for Bahay ni Aedriel**
By: Forlanda, S., Bagwisa, J.
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- Information System Strategic Plan for Motor ni Kim**
By: Forlanda, S., Bagwisa, J.
IMAGE NOT AVAILABLE
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Functionalities:

1. If user did not search and just clicked researches from sidebar most recent uploaded research should appear at top of the table
2. This page should have search button at the upper right of the table, if clicked a search bar should appear
3. Table filter also must be available, filter must consist (most cited, most recent, and department)
4. User can mark a research as “favorite” which should be added to user’s “My Library” page

Figure 23. Advanced Search Page

The image shows a wireframe mockup of an 'Advanced Search' page. On the left side, there is a vertical sidebar with icons for home, search, user profile, favorite (marked with a star), file, location, and settings. The main title 'Advanced Search' is centered above a large search form. The search form contains four input fields labeled 'Search by Title', 'Search by Author', 'Search by Publication Year', and 'Search by Department'. Below these fields is a blue 'Search' button.

Functionalities:

1. User can search based on title, author, publication year, and department

Figure 24. Profile Page

The screenshot shows a user profile page titled "My Profile". At the top, there is a placeholder for a user icon. Below it, the user's name "Reujen Gonzalez" is displayed in bold, followed by "Bachelor of Science in Information Technology" and the email "ruwengonzalez@gmail.com". A horizontal line separates this from a section titled "Publications". Under "Publications", there is a card for a publication titled "Research Database with Literature Mapping System" by "Forlanda, S., Bagwisa, J.". The card includes a placeholder image icon labeled "IMAGE NOT AVAILABLE", a star rating icon, and a short Lorem ipsum text snippet. Another publication card is partially visible below it.

Functionalities:

1. User information from sign up
2. Publications of the user

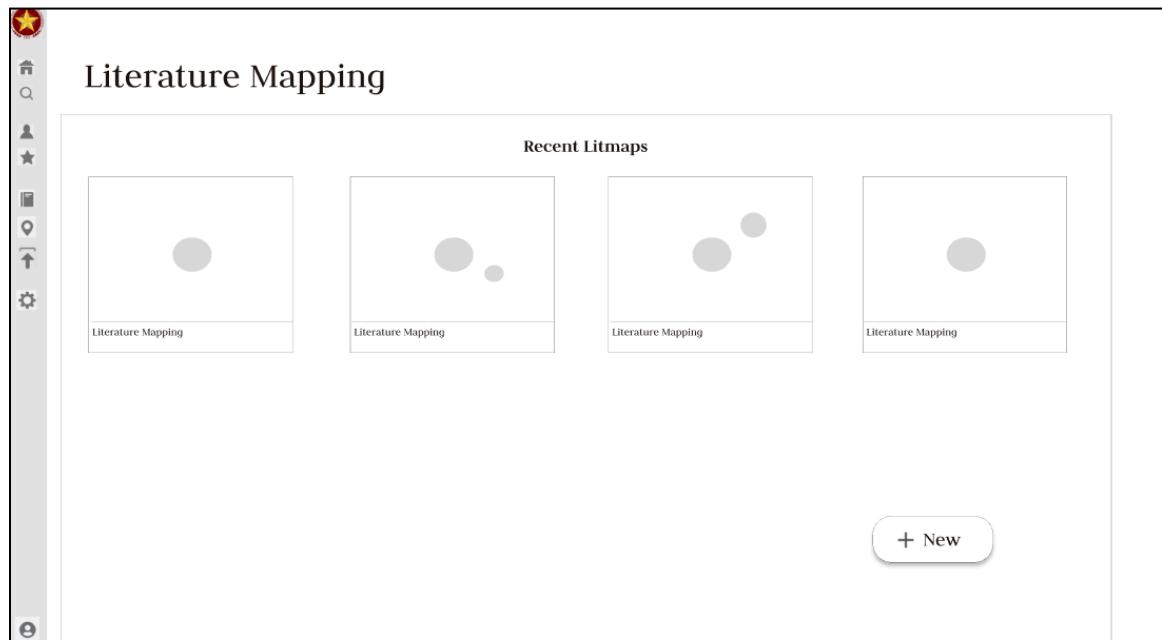
Figure 25. Researches Page

The screenshot shows a page titled "My Library" listing three publications. Each publication is represented by a card with a placeholder image icon labeled "IMAGE NOT AVAILABLE", a title, the author(s), a star rating icon, and a short Lorem ipsum text snippet. The publications listed are "Research Database with Literature Mapping System" by "Forlanda, S., Bagwisa, J.", "Information System Strategic Plan for Bahay ni Aedriel" by "Forlanda, S., Bagwisa, J.", and "Information System Strategic Plan for Motor ni Kim" by "Forlanda, S., Bagwisa, J.".

Functionalities:

1. User's marked favorites from researches page

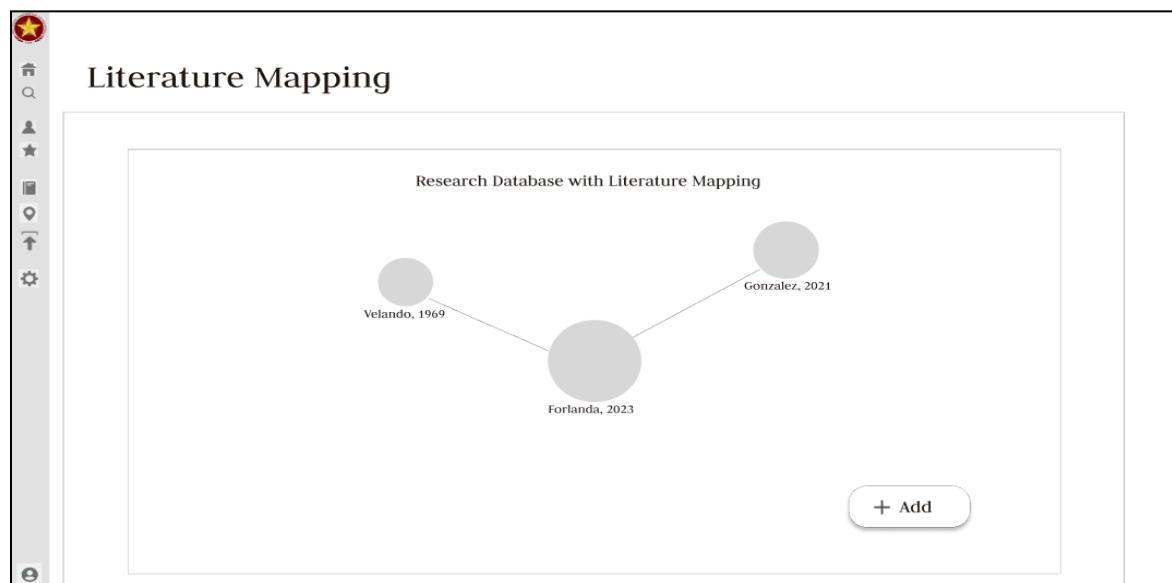
Figure 26. Literature Mapping Page



Functionalities:

1. Library of created litmaps
2. User can click on recent edits to continue editing

Figure 27. Creating Litmap



Functionalities:

1. Create literature mapping by adding existing researches from the database

Figure 28. Uploading Page

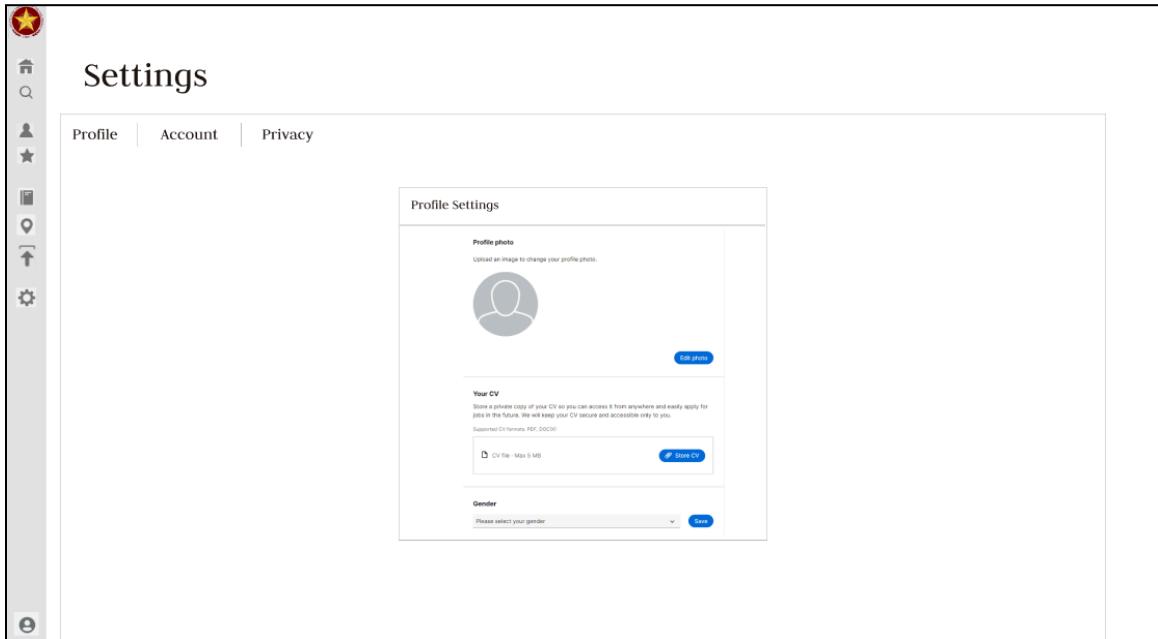
The screenshot shows a web-based application interface titled "Upload Research". On the left, there is a vertical sidebar with icons for home, search, user profile, star, document, location, upload, and settings. The main area has a light gray background and contains the following fields:

- A large input field for the "Title".
- A large input field for "Author/s".
- A large input field for "Abstract".
- A "Choose File" button followed by the placeholder "Research Document (PDF)".
- A "Choose File" button followed by the placeholder "Project Image (PNG)".
- A blue "Submit" button at the bottom right.

Functionalities:

1. Upload a research by filling up a form
2. The uploaded file will be directed to the admin side which should be approved before posting in the researches page

Figure 29. Settings Page



Functionalities:

1. Profile settings consist of adding account picture, CV of user, and gender
2. Account settings consist changing of password
3. Privacy settings (planning)

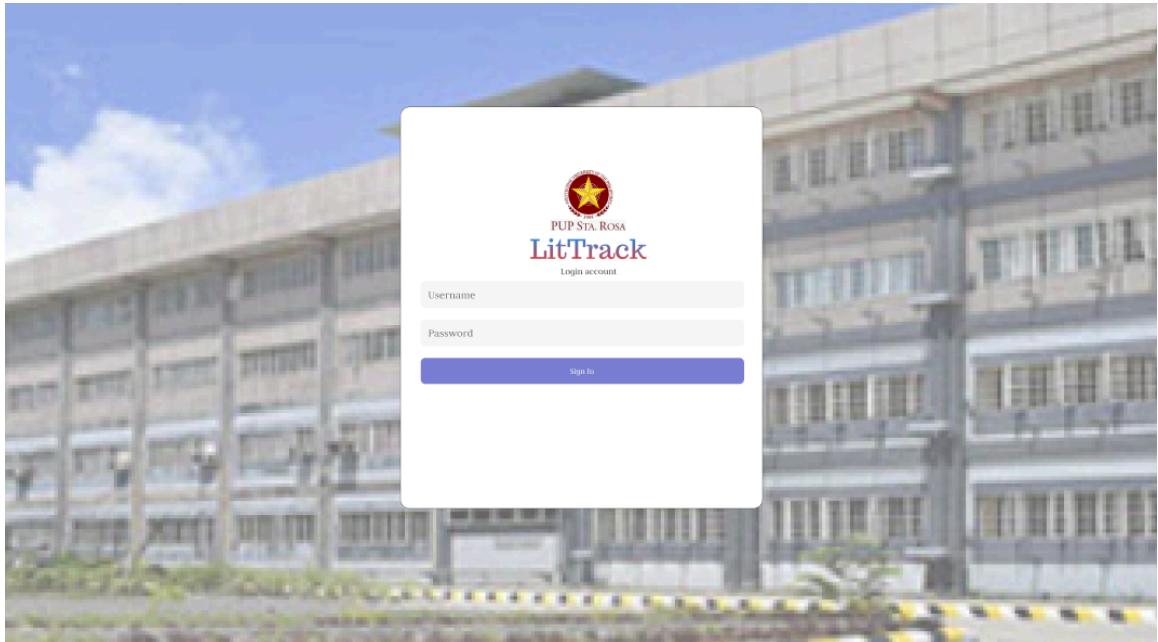
Figure 30. Pre-login Page of Faculty



Functionalities:

1. Choose if Admin or Student
2. Terms and conditions

Figure 31. Login Page of Faculty



Functionalities:

1. Users login using default username and password provided by the faculty only
2. No Sign up page
3. No forgot password

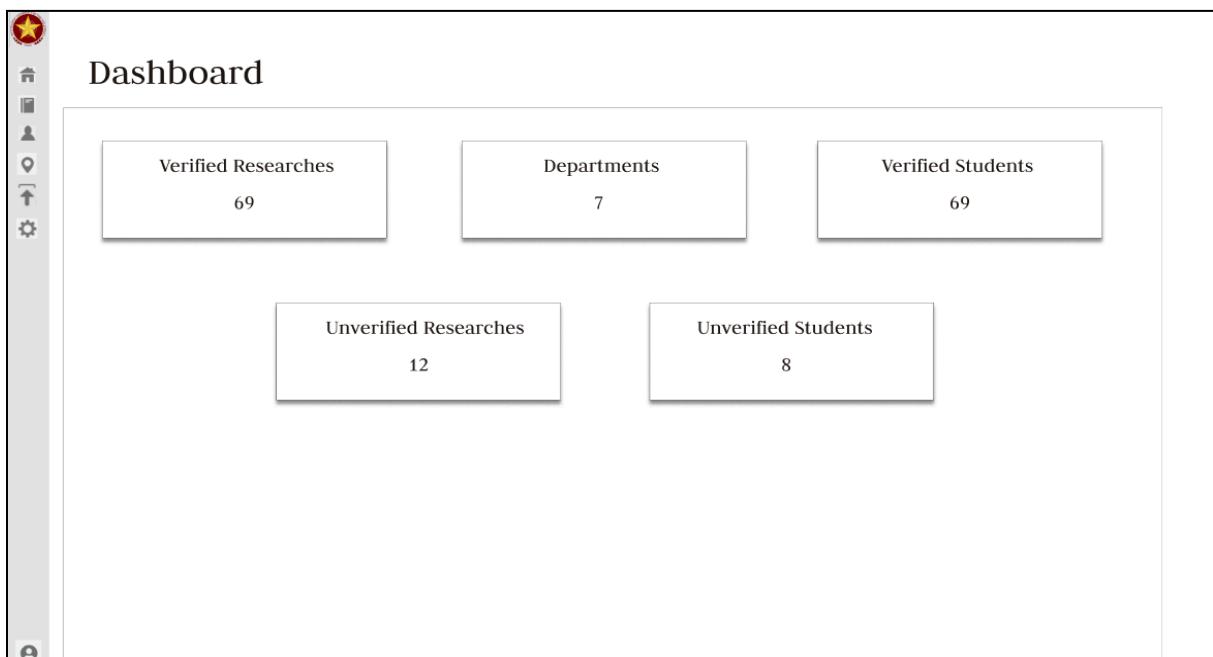
Figure 32. Side Bar of Faculty



Functionalities:

1. If the logo in the upper left corner is clicked the sidebar should expand
2. If sidebar expanded page content should be unavailable whatever page the user is in
3. Click anywhere in the content page and the sidebar should automatically close

Figure 33. Dashboard of Faculty



Functionalities:

1. Consist of number of departments, also researches and students (verified/unverified)

Figure 34. Researches Page of Faculty

#	Date Created	Research Code	Research Title	Curriculum	Status	Action
1	01/01/01	01010101	Research Database w/ Literature Mapping	BSIT	Published	<button>Action</button>
2	01/01/01	01010101	Research Database w/ Literature Mapping	BSA	Pending	<button>Action</button>
3	01/01/01	01010101	Research Database w/ Literature Mapping	BSIT	Published	<button>Action</button>

Functionalities:

1. Consist of information about uploaded researches
2. Action for publishing uploaded researches

Figure 35. Student List Page

Functionalities:

1. Consist of information about signed up account of students
 2. Action for verifying/deleting accounts

Figure 36. Curriculum List Page

Functionalities:

1. Consist of information about curriculums
2. Action for setting active/inactive curriculums

Figure 37. Uploading Page of Faculty

The screenshot shows a web-based application interface titled "Upload Research". On the left side, there is a vertical sidebar containing icons for navigation: a house (Home), a magnifying glass (Search), a user profile (User), a star (Favorites), a document (Curriculum), a location pin (Location), an upward arrow (Upload), and a gear (Settings). The main content area has a light gray background. At the top, it says "Upload Research". Below that is a large input field divided into three horizontal sections: "Title", "Author/s", and "Abstract". Underneath these sections are two "Choose File" buttons: one for "Research Document (PDF)" and another for "Project Image (PNG)". At the bottom right of the input field is a blue "Submit" button.

Functionalities:

1. Same in the student side, uploading of research

Project Implementation Plan

Table 4

Project Implementation Plan

PHASE	2024-2025		
	3rd	4th	1st
Project Initiation and Planning			
- Developing the project charter			
- Distribution of Roles per Member			
- Identifying the stakeholders			
- Defining Initial Project Scope			
- Detailed System Planning			
Analysis			
- Analysis			
- Creating Mock-up UI/UX			
- Approval of Mock-ups			
Development			
- Chapter 1 to 5			
- PUPSRC LitTrack			
Testing			
- Quality Assurance			
- User Acceptance Testing			
- Bug Fixing and Re-testing			
Deployment			
- Installment of the PUPSRC			

LitTrack System			
Maintenance			

The main conclusion of the research is that the Polytechnic University of the Philippines – Santa Rosa Campus could be a beneficiary of the study known as PUPSRC LitTrack. It is argued that the Research and Extension department will be more productive if it will be proactive in taking advantage of current opportunities and planning for future threats. The PUPSRC LitTrack is proposed after analyzing the needs and the views of the stakeholders. When it is put into practice and accepted by the Campus, it can be a great way to improve the service quality and the operational efficiency, which in turn will be a benefit to the students, faculties, research and extension office, and the library in Santa Rosa Campus.

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