“A WEB-BASED INTELLECTUAL PROPERTY DATA MANAGEMENT SYSTEM (IPDMS) IN MINDANAO STATE UNIVERSITY - MARAWI CAMPUS”

A Capstone Project

presented to the Faculty of the

College of Information and Computing Sciences in

Mindanao State University

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Chapter 1

Introduction

Data management and physical storage in library archives storing research data in a single library location have limitations, including the risk of duplication and plagiarism are what Mindanao State University did until the increasing volume of research and intellectual property assets output and the growing need for collaboration among researchers and stakeholders demanded a more efficient and secure system. According to (Alokluk, 2019) educational institutions encounter the difficulty of managing extensive amounts of information, whether in printed form or electronically. The conventional repositories designed for storing printed materials have now transitioned to digital archival and data management systems. These systems are implemented to efficiently organize and store the information gathered and utilized in universities and colleges.

The Intellectual Property Data Management System is a system that stores, protects, and manages all of MSU's intellectual property assets in one place. It is accessible to authorized users globally, it offers a variety of functionalities that enable MSU's efficient management of its intellectual property assets. Alokluk, (2019) emphasizes the purpose of digital archiving and electronic data management is to improve administrators', academics', and researchers' daily activities to contribute to the achievement of their specific goals.

As the university produces more and more research, we're facing a real need for a better way to handle all the intellectual property that's coming out of it. The collaborations we're involved in are happening all around the world, and we need a system that lets people who are allowed to access our work do so from anywhere. This shows how serious we are about encouraging

collaboration among our researchers and anyone else involved. Today's state of events emphasizes how important it is to find a solution that will enable us to manage our intellectual property assets as they increase. When it comes to managing intellectual property, the Office of Technology Innovation Center has a lot of difficulties to get through, such as the increasing volume of IP data and cases of plagiarism and duplication in academic research. The system is designed to reduce the amount of manual work required in the TIC-MSU Intellectual Property Office.

The capstone project entitled "A Web-Based Intellectual Property Data Management System (IPDMS) at Mindanao State University" aims to serves as a repository that manages Mindanao State University’s intellectual property assets including patents, trademarks, and copyrights.

According to Cruz, C. (2017) inventions are protected by patent; literary and artistic works are protected by copyright and related rights; designs are protected by industrial design; and symbols, names and images are protected by trademark. There are other forms of intellectual property like trade secrets, know-how, plant varieties and geographical indications which are also protected by the current intellectual property system. The ownership, use, distribution, and control over these kinds of intellectual property are generally referred to as the intellectual property rights (IPR).

This project aims to enhance the university's current processes by computerizing the management of intellectual property data. The project’s beneficiaries include the entire MSU community, as it provides a platform for managing their creations, works, and inventions safely and efficiently.

1.1 Project Context

The capstone project aims to address the concerns within the university, namely the risk of duplication and plagiarism of creations, works, and inventions. As we know, we are in the era of digitalization, and we have come up with a project that will protect our IP assets. The project seeks to enhance the university's existing processes by computerizing the management of these assets. The concern about the need for more efficient and protective interventions for those risks will be addressed.

The beneficiaries of this project are the university faculty members of various colleges, the researchers among those colleges, the students, and the administrative staff of various colleges who are involved in research and intellectual property activities. The project's beneficiaries encompass the entire MSU community, as it will provide an efficient platform for managing their research and intellectual property assets. Additionally, the project will involve IT professionals, system analysts, and software engineers responsible for its development.

The project was started in September 2023, to finish the paperwork, and it is projected to finish the system by the end of July 2024. The implementation of the project will occur within the premises of Mindanao State University-Main. The project arose from the need to use the advantages of technology, and how it helps the TIC-MSU IPO modernize and improve the university’s research and intellectual management processes. Therefore, the researchers propose the IPDMS to overcome the challenges and the risks that they are facing.

The development of the project will follow established software engineering techniques, ensuring that the software and hardware requirements and specifications are systematically

designed and implemented to meet the project's objectives. This approach will help create a reliable and user-friendly Intellectual Property Data Management System for Mindanao State University.

1.2 Purpose and Description

This project serves as a tool to address several challenges, like the duplication and plagiarism of inventions, creations, and works, and opportunities that have emerged over time. It seeks to enhance the existing processes in terms of intellectual property assets, including copyrights, patents, and trademarks.

The traditional way of managing these assets is by relying on physical storage in library archives. The challenges include the risk of plagiarism and duplication, as well as difficulties in tracking and retrieving information. The increasing volume of intellectual property assets needs a more efficient and secure system for organizing these assets.

The main purpose of this project is to develop a system that caters to the needs of the TIC-MSU IPO when it comes to managing the IP assets. The Intellectual Property Data Management System (IPDMS) aims to modernize the university’s research and intellectual property management processes by adapting to the trend of technology.

The project is relevant because it addresses challenges within the university’s research and intellectual property management. Modernizing the process of managing the IP assets enhances the retrieval of information and promotes collaboration because the forums, and especially MSU’s intellectual property assets, are efficiently managed and protected. By embracing technology and best practices, the IPDMS project aligns with MSU's commitment to excellence in research,

innovation, and education, positioning the university for continued growth and impact in the academic and innovation landscape.

Moreover, the capstone project is designed to manage all of MSU's IP assets, including copyrights, patents, and trademarks. The following are the beneficiaries of this project.

MSU Researchers. The MSU IPDMS provides a repository that will encourage its constituents to engage and collaborate within the system and it can help MSU researchers to publicize their works and make it known, and especially find and use existing intellectual property, and develop new intellectual property.

MSU Students. Students will be able to use the system to learn about MSU's intellectual property assets and to identify potential research topics. They will also be able to use the system to find and use existing intellectual property assets for their research projects. Also, the system will play a crucial role in the academic and research journey of undergraduate (UG), master (MA), and doctoral (Ph.D.) students.

MSU College IP Managers. College IP managers are responsible for managing the intellectual property assets of their college. They have access to approve the IP assets that will be uploaded by their students and colleagues.

IPO Administrators. Administrators can access all features provided by the system, they will be able to use the system to track the development and manage the intellectual property portfolio of the university. They can manage the user and coordinator accounts and monitor if any new IP assets have been created by researchers or inventors at the university.

1.3 Objectives

This capstone project aims to develop a Web-based Intellectual Property Data Management System that serves as a repository that manages Mindanao State University's intellectual property assets including patents, trademarks, and copyrights.

Specifically, the project aims to:

- To create an easy-to-use data management system for storing and managing research and intellectual property data, such as patents, copyrights, and trademarks, in one central location.
- To introduce dashboard for reporting and data visualization to oversee and assess the effectiveness of intellectual property assets, aiding in strategic decision-making of the MSU-Intellectual Property Office.
- To evaluate and discuss the system's overall usability through the application of the USE (Usefulness, Satisfaction, and Ease of Use Questionnaire).
- To create a database schema that holds the digital assets of MSU.
- To test the implemented system.

1.4 Scope and limitations

This capstone project is focused on developing a repository that stores and manages research and intellectual property assets within Mindanao State University - Marawi, regardless of, if it is from undergraduate (UG), master (MA), and doctoral (Ph.D.) students. This capstone can be accessed by faculty, staff, researchers, and students from a variety of disciplines.

This capstone is limited to all MSU- Marawi constituents and allows them to search, submit, view, and collaborate within the system. Also, it will be limited to published research and intellectual property assets including patents, trademarks, and copyrights. It will not include any confidential or sensitive information and is not responsible for the accuracy or completeness of the information it contains.

1.5 Significance of the Project

This study can contribute to and benefit the following groups:

Researchers. Researchers can easily access the IPDMS to get valuable information or references for their studies by accessing the different IP assets provided by the system.

Future Researchers. IPDMS will greatly assist future researchers in terms of easy access to data gathering. They can effortlessly access the works or inventions of their fellow researchers stored in the system; by doing so, they can exchange knowledge because of the system feature, forums.

Students. The project serves as a valuable and accessible resource for students, enabling them to expand their knowledge by accessing the intellectual property assets of their colleagues or fellow students through the digital repository. This platform facilitates seamless collaboration and learning opportunities among students

Teachers/Educators. The project supports teachers and educators in acquiring additional knowledge. It allows them to use works from the repository as references in their teaching or instructional activities, enhancing the quality and breadth of educational materials.

MSU IPMDS Administrators. Admins can easily manage IP assets; it can lessen their paperwork by developing the IPDMS. The repository will also provide a dashboard for them to track, study, oversee, and assess the effectiveness of intellectual property assets, aiding in strategic decision-making and innovation.

MSU Stakeholders. MSU stakeholders, including faculty, staff, managers, and community members, stand to benefit significantly from this project. By showcasing the intellectual output of MSU, the repository enhances transparency and demonstrates the institution's commitment to innovation and knowledge dissemination. Stakeholders gain insights into the breadth and depth of research conducted at MSU, fostering a sense of pride and confidence in the institution's contributions to society. Furthermore, the repository serves as a platform for collaboration between MSU and external stakeholders, facilitating partnerships and opportunities for mutual growth and development. The project strengthens the relationship between MSU and its stakeholders, positioning the institution as a leader in research, education, and innovation within the broader community.

Chapter 2

Review of Related Theories and Systems

This section focuses on the review of theories or concepts related to the proposed project.

2.1 Review of Related Theories

2.1.1 Data Management System

Data management is the practice of collecting, keeping, and using data securely, efficiently, and cost-effectively. The goal of data management is to help people, organizations, and connected things optimize the use of data within the bounds of policy and regulation so that they can make decisions and take actions that maximize the benefit to the organization. A robust data management strategy is becoming more important than ever as organizations increasingly rely on intangible assets to create value (Oracle).

Research data management systems (RDMSs) are becoming more and more necessary for publicly financed universities and research institutions (HEI) in order to guarantee the long-term use and optimal utilization of research data. Donner (2022) stated that the adoption of an RDMS will have an impact on personnel, technology, and organizational structure.

Alokluk (2019) electronic data management in institutions aims to improve administrators', academics', and researchers' daily activities to contribute to the achievement of their specific goals. Higher educational institutions rely heavily on efficient document management and archiving processes as they routinely use a variety of materials, including course and teaching materials, publications, theses and dissertations,

manuscripts, students' application forms, records, submissions, reports, regulations, policies, as well as administrative files, video, and audio files.

Today’s organizations need a data management solution that provides an efficient way to manage data across a diverse but unified data tier. Data management systems are built on data management platforms and can include; databases, data lakes and data warehouses, big data management systems, data analytics, and more. All these components work together as a “data utility” to deliver the data management capabilities an organization needs for its apps and the analytics and algorithms that use the data originated by those apps (Oracle).

2.1.2 Intellectual Property

Intellectual property is a broad categorical description for the set of intangible assets owned and legally protected by a company or individual from outside use or implementation without consent. An intangible asset is a non-physical asset that a company or person owns (Investopedia). According to Baran and Zhumabaeva (2018), intellectual property is a valuable asset for businesses, especially startups, both financially and legally. In addition to protecting the company's assets (i.e., designs, ideas, and brands), intellectual property also helps the business grow. Having one's intellectual property properly protected gives one a competitive edge, makes one recognizable, and enhances one's reputation.

Intellectual property relates to the fact that certain products of human intellect should be afforded the same protective rights that apply to physical property, which are called tangible assets. Most developed economies have legal measures in place to protect both forms of property (Investopedia). Some of the most common intellectual properties

(IPs) are patents, trademarks, and copyrights. A patent is a legally protected right used by another person or company without permission. A trademark is when an unauthorized party uses a licensed trademark or a mark resembling the licensed trademark. Copyright is when an unauthorized party recreates all or a portion of an original work, such as a work of art, music, or a novel (Investopedia).

As Afonso et al. (2021) emphasize, many Intellectual Property Rights instruments with different purposes and application fields have been developed. From the Industrial Revolution onward, the power to prevent others from using one's intellectual creations has been strengthened to encourage private investment in innovation activities and promote sustainable economic growth. According to RA 8293, the Intellectual Property Office (1997), the state aims to safeguard the exclusive rights of individuals with creative talents, such as scientists, inventors, and artists, over their intellectual property and creations. This protection extends, especially when such creations bring benefits to the public, for durations specified in this Act. Additionally, the government intends to simplify the administrative processes for registering patents, trademarks, and copyrights. It seeks to make the registration of technology transfers more accessible and to strengthen the enforcement of intellectual property rights in the Philippines.

Intellectual property encompasses a wide range of assets that stem from human creativity and intellect, including elements such as artwork, symbols, logos, brand names, and designs. In today's knowledge-driven economy, businesses place great emphasis on identifying and protecting their intellectual property because it holds significant value. Creating valuable intellectual property often necessitates substantial investments of time and expertise, making it a costly endeavor for both organizations and individuals. This

translates into heavy investments by organizations and individuals that should not be accessed without rights by others.

Intellectual Property Rights (IPRs) serve as an innovation vehicle that promotes labor and resource inputs for generating new ideas or innovation. Historical data analyses have demonstrated the significance of patent laws in fostering innovation, promoting creation, and fostering economic expansion (Moser, 2013; Khan, 2005; Khan and Sokoloff, 1993; Woo et al., 2015; Suominen, Deschryvere, & Narayan, 2023). A country's level of invention is measured by the quantity of patents that are filed, registered, and quoted. While the quantity of issued patents indicates the level of approaches, the number of patents indicates an amount of awareness regarding the necessity of protecting intellectual property. Maintaining intellectual property benefits the economy; patents and other types of intellectual property are sources of revenue (Baran & Zhumabaeva, 2018).

2.1.3 Technology Innovation Center

Etzkowitz and Zhou (2017) believe that Technology Innovation Centers (TICs) are crucial for fostering new technologies and promoting economic growth. These centers function as centers for innovation by bringing together scholars, entrepreneurs, and professionals from the industry to work on creative ideas. TICs promote the development and commercialization of innovative technologies by offering essential resources like funding, mentorship, and modern infrastructure. They generally serve as companies' incubators, helping them to develop and thrive in competitive marketplaces. Furthermore, via offering training programs that provide people the abilities they need to thrive in a technologically up-to-date economy, TICs promote workforce development. All things

considered, Technology Innovation Centers are essential for maintaining national competitiveness in the global economy and promoting development.

A center for innovation in science and technology is crucial for changing the direction of economic growth and boosting industrial competitiveness. Promoting the growth of innovative technology and locally oriented industries. Constructing a top-tier university and research facility, attracting top personnel, and creating a creative environment that is inclusive and open are all crucial to the development of the Science and Technology Innovation Center. Based on the idea that universities should be the center of innovation, higher education institutions should plan and construct a variety of scientific research and development, innovation, and industrialization platforms to foster the growth of a network of preeminent, globally renowned scientific and technological innovation enterprises (Zhang, 2022).

TICs are prominent members of many innovation ecosystems around the world. However, it is important to distinguish them from other centers that also play an important innovation intermediary role. Research-oriented centers, namely “competence centers,” or “centers of excellence,” bring together academic and business partners to collaborate on research projects. They tend to run multi-annual research programs in a specific field in which they receive a mix of public and private funding (ResearchGate).

As such, Technology Innovation Centers are organizations that provide firms with on-demand services and open access to technology to help them innovate and grow. It can help firms of all sizes to develop or commercialize new products and services, break into a new market, and increase their exports.

2.1.4 The Digital Library and the Archiving System for Educational Institutes

The Digital Library (DL) has become a vital component in the realm of systematic library systems, representing a relatively recent concept. Despite its significance, several existing issues need addressing, such as the organization, storage, and retrieval of relevant information. Arms (2005) defines the DL as a software-based framework with a central focus on web technology. In the online environment, electronic data can be efficiently collected and retrieved by granting appropriate privileges to access the primary data. This primary dataset primarily comprises digitally represented content, including editorials, published research materials, theses, documents, e-books, and more. Various methods, ranging from simple to complex structures, are employed for archiving and accessing digital data. The foundational architecture involves organizing entities generated by the innovative creator and storing them in a designated storage area in the appropriate format (Rahman and Fahd Al-Haidari, 2018).

2.1.5 Mindanao State University- Technology Innovation Center

In response to the limitations of traditional centralized physical storage, Mindanao State University (MSU) adapts the digital transformation journey to modernize the management of intellectual property (IP) and research assets. MSU Intellectual Property Office is committed to promoting intellectual property awareness and protects all Intellectual Property and Intellectual Property Rights by filing for protection and facilitating all assets.

Innovation and Technology Support Offices (ITSOs) were established in different universities in the country to facilitate IP creation, protection, and technology commercialization (Dellosa, 2017).

In the past, intellectual property (IP) such as patents, copyrights, and trademarks, as well as significant studies, research, theses, and data were kept in physical archives. This approach did, however, come with drawbacks, such as restricted collaboration options, data vulnerability, ineffective retrieval, and limited accessibility. The researchers have developed cloud-based storage options, an Intellectual Property Database Management System (IPDMS), and a digital repository to address these issues. These digital solutions ensure protection, scalability, and collaboration among the university community by offering easily accessible and well-organized storage for research materials and intellectual property. The researchers hope to encourage innovation and interdisciplinary collaboration while strengthening the administration of priceless research assets, raising IP awareness, and defending intellectual property rights by embracing digital technologies.

IPOPHL is the government agency mandated to administer and implement State policies on intellectual property (IP) to strengthen the protection of IP rights in the country.

Coined as the "DREAM" mandate, IPOPHL performs the following functions to protect and secure the exclusive rights of scientists, inventors, artists and other gifted citizens to their intellectual property and creations (IPOPHL).

The challenges associated with data storage and management, particularly the risks of duplication and plagiarism, have posed significant hurdles for Mindanao State

University (MSU). Over time, these problems became increasingly evident as the amount of research output increased. Researchers have realized that an extensive and modernized approach is required to successfully handle these difficulties. In this sense, the proposed system is a major advancement and a useful resource for all MSU stakeholders. Its main goal is to safeguard the research endeavors and intellectual property of the university's academics, staff, and students. By putting this mechanism in place, MSU is reducing the likelihood of plagiarism and duplication while simultaneously fostering an atmosphere that values and protects creativity and originality. It will empower all members of the MSU community to securely archive their works, thereby preserving their contributions to the university's academic heritage while upholding the principles of academic integrity and research ethics.

2.1.6 Intellectual Property Office of the Philippines- IPOPHL

IPOPHL stands at the forefront of Filipino innovation while maintaining its delicate act of balancing the interests of the creator of IP and of the public. Through proper and efficient creation, protection, utilization, and enforcement of IP, IPOPHL prides itself as a key dynamic partner in the promotion of IP as a strategic tool to influence economic growth in a creative and innovative Philippines. POPHL seeks to help bring the country to new altitudes made easier to explore with the advent of the Fourth Industrial Revolution (4IR). Moreover, being heavily involved in all innovative activities, IPOPHL reinvents itself from being a mere regulatory agency to a key dynamic partner in the promotion of IP as a strategic tool to influence economic growth in a creative and innovative Philippines. Disruption involves innovative and creative ideas—products of the intellect. To thrive, it

needs to be firmly rooted in a stable, yet flexible IP system designed to spur innovation and progress (IPOPHL).

As stated by (Dellosa, 2017) to "strengthen the institutional capacity of universities and research-related institutions to access patent information and to make use of the patent system," the Intellectual Property Office of the Philippines (IPOPHL) and the World Intellectual Property Organization (WIPO) collaborated on the ITSO project. With the creation of ITSOs and the widespread educational and awareness campaigns on intellectual property, patenting activities across several fields have been embedded in society.

The Innovation and Technology Support Offices (ITSO) were founded in the Philippines in 2010 by the Intellectual Property Office of the Philippines (IPOPHL) in collaboration with the Geneva, Switzerland-based World Intellectual Property Office (WIPO). With just two ITSOs, the inaugural ceremonial signing of a memorandum of understanding (MOA) took place on November 10, 2010**.**

2.1.7 Algorithm for Detecting Duplication or Similarities

A massive record in a database, and there are some of them seem really similar to each other, but they're not exactly the same in terms of their content. The algorithm is to figure out which ones are duplicates of each other. (A Monge and C. Elkan, 1997)

Data cleansing involves cleaning up databases by removing inaccurate or inconsistent data. It’s a challenge of identifying database records that are nearly identical duplicates, even though they're not exact matches. (A Monge and C. Elkan, 2001)

The Smith-Waterman algorithm is valuable for processing typical alphanumeric records containing fields like names, addresses, titles, dates, identification numbers, etc. In the second algorithm, the algorithm performs a similar operation but reads the data from right to left. It employs a priority queue containing sets of records associated with the most recent clusters identified. The algorithm sequentially scans the database, determining whether each scanned record belongs to a cluster in the priority queue. To establish cluster membership, it utilizes the "Find" operation discussed in the previous section. If the record is already part of a cluster in the priority queue, the algorithm proceeds to the next record. However, if the record isn't a member of any cluster in the priority queue, it is compared to representative records within the priority queue using the Smith-Waterman algorithm. The priority queue contains a fixed number of sets of records. which includes a blocking algorithm as an essential component.

Sorted-neighborhood blocking presents a complete duplicate detection framework, this algorithm, which includes a blocking algorithm as an essential component. It involves sorting the records according to a designated sorting key and then sequentially moving a fixed-size window over the sorted records. (Hernandez and Stolfo,1998)

2.2.1 Organizational Chart

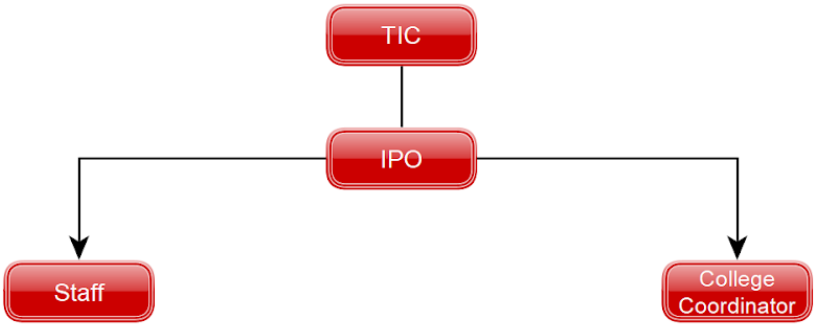

Figure 2.2.1 Organizational chart of Technology Innovation Center

Figure 2.2.1 shows the Technology Innovation Center's (TIC) organizational chart. The Director of TIC, who holds the highest order, oversees managing strategic plans. The organizational structure extends into important departments, most notably connecting to the Intellectual Property Office (IPO), which is in charge of overseeing and protecting intellectual property. The staff and college coordinators are also part of the organizational flow, which creates a strong network inside the TIC framework for effective collaboration, communication, and execution of intellectual property projects.

2.2.2 Existing Workflow

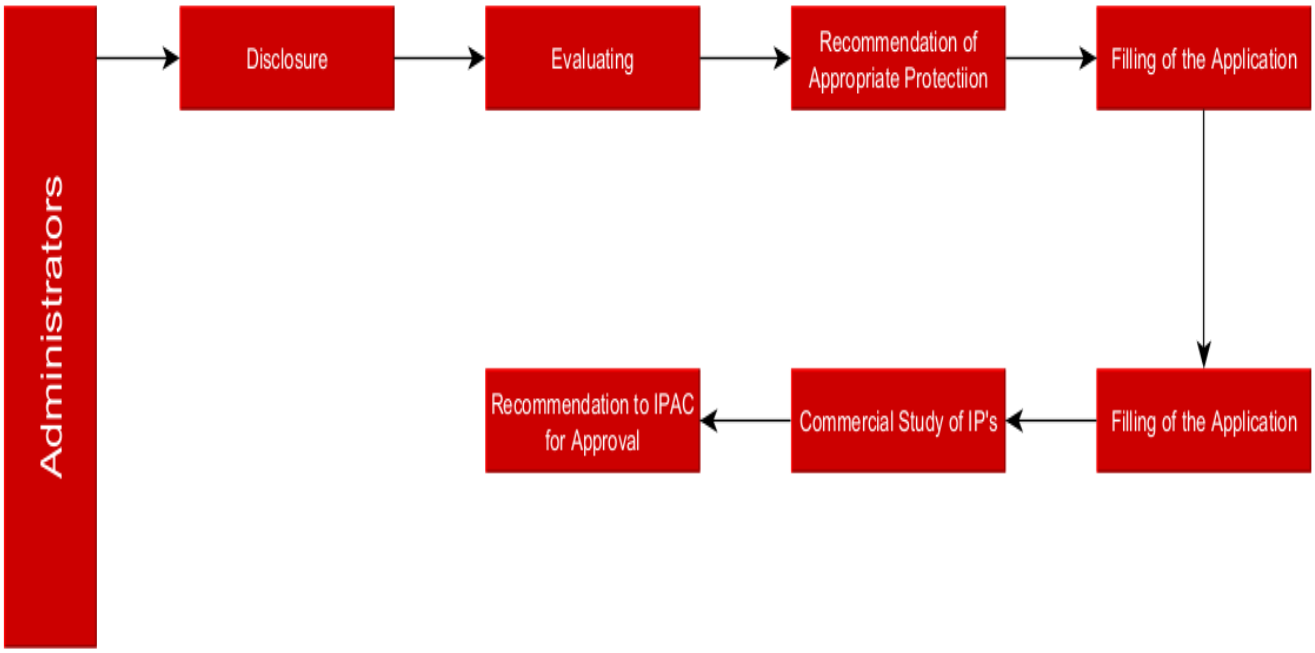

Figure 2.2.2 Existing Workflow of Intellectual Property Office

Figure 2.2.2 above shows the existing workflow of the Intellectual Property Office. First, the administrator's primary task is to accept and document these disclosures. It involves recording specifics about the invention, including its description, possible uses, and the identities of the creators. Following the disclosure stage, the assets' uniqueness is evaluated by intellectual property specialists during the evaluation process. Additionally, the office advises the creator or inventor on the best course of action for protecting their particular intellectual property. Afterwards, the application is filed, and the office starts the application procedure to determine the owner's rights to intellectual property. Simultaneously, an intellectual property commercial evaluation study is carried out, and the results will be recommended for approval to the Intellectual Property Advisory Council.

A systematic and complete approach to managing intellectual property is ensured by this extensive workflow, from disclosure to approval.

2.2.3 Proposed Workflow

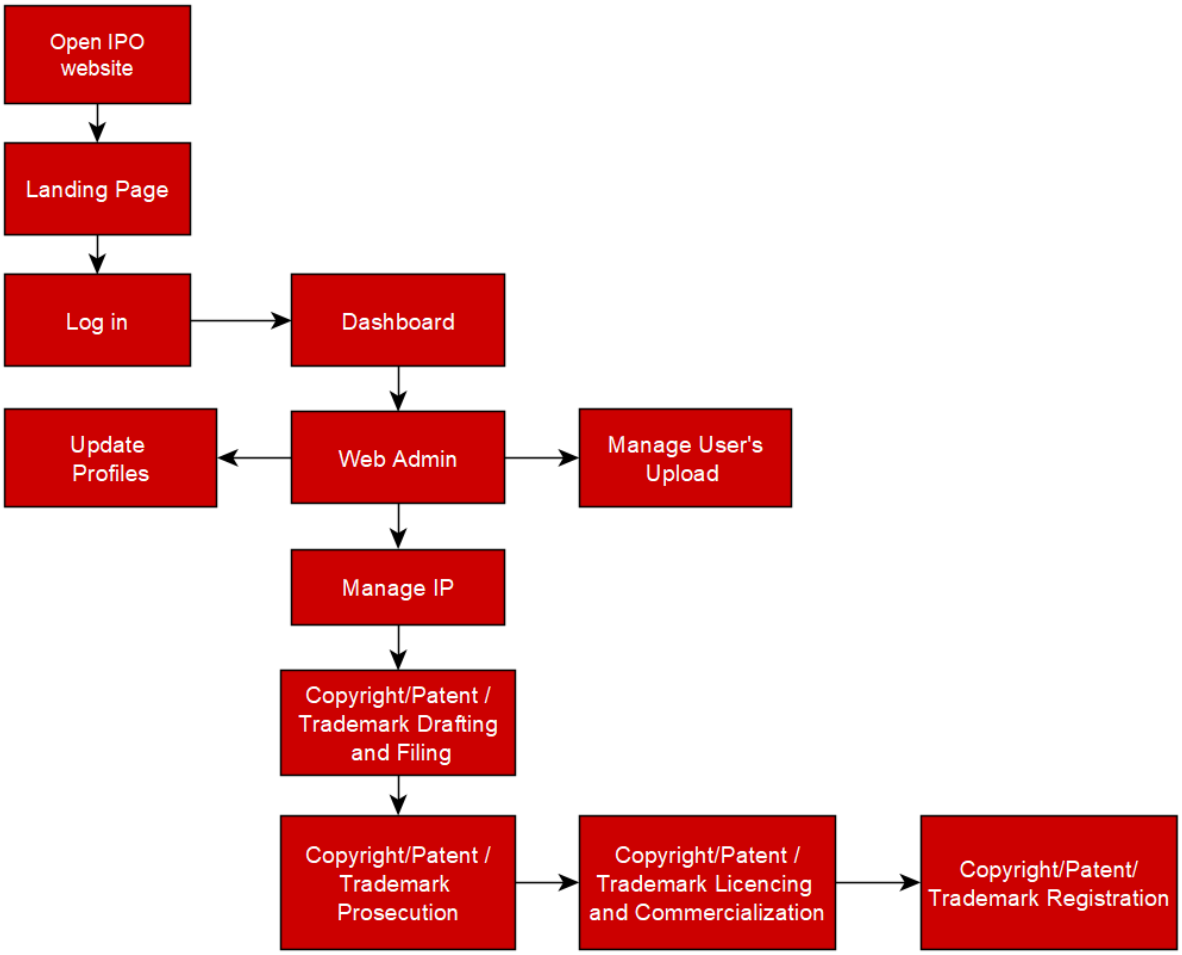

Figure 2.2.3 Proposed Workflow of the Admin

Figure 2.2.3 above shows the proposed workflow of the admin in the Intellectual Property Office. The workflow begins with visiting the IPO website and logging in. The admin can manage the whole IPO system, including managing the users upload and can update profile, and then proceeding to the internal process of the IPO.

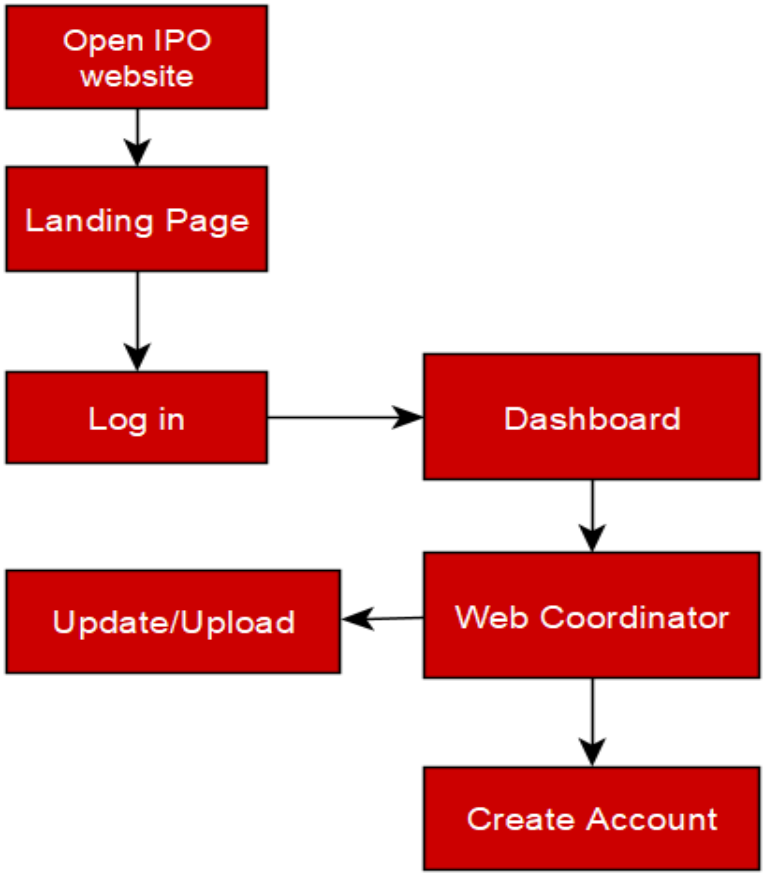

Figure 2.2.4 Proposed Workflow of the College Coordinator

Figure 2.2.4 above shows the proposed workflow of the college coordinator. It begins with the user visiting the IPO website and logging in. Then can manage the IP for their college. This includes creating accounts, validate user accounts and managing users within their college.

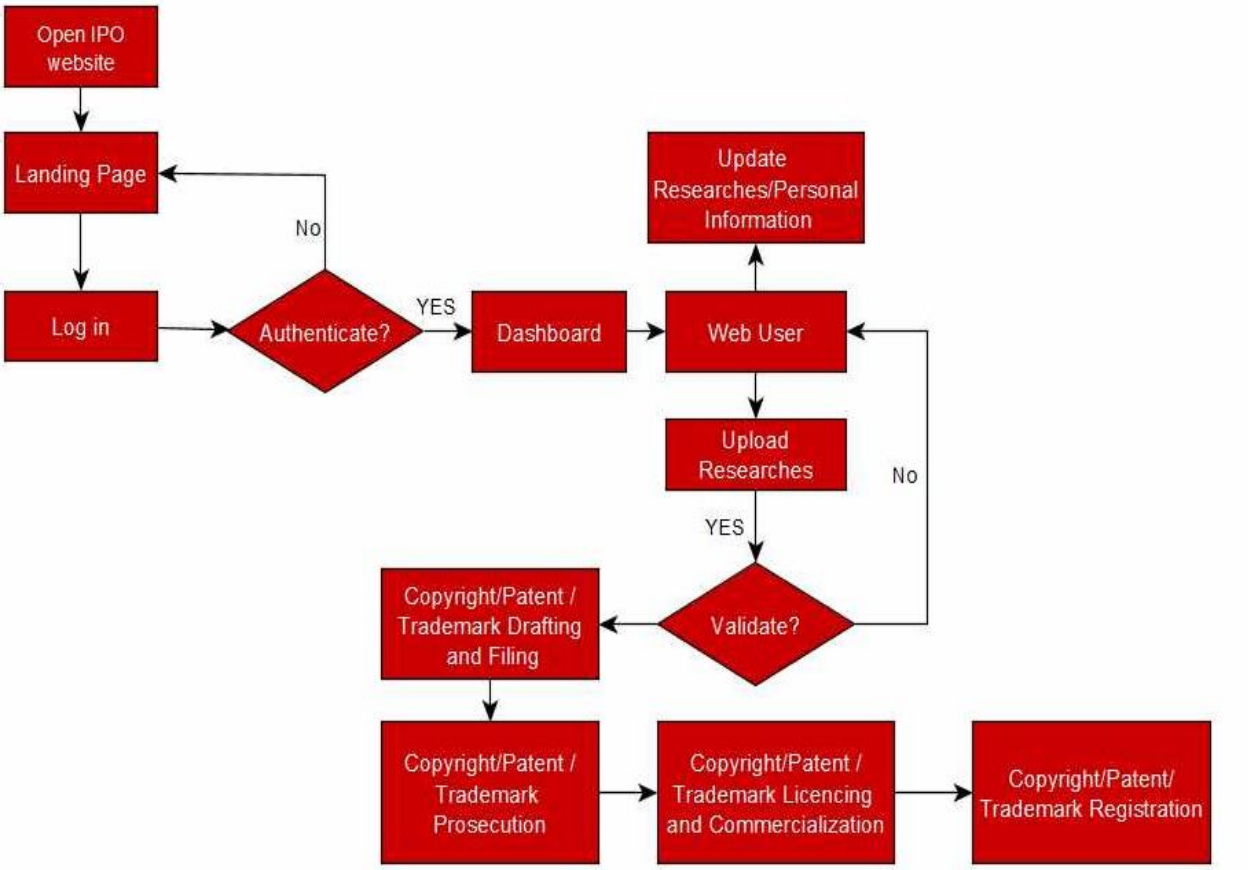

Figure 2.2.5 Proposed Workflow of the User

Figure 2.2.5 above shows the proposed workflow of the user. Begins with the user visiting the IPO website and logging in. Once the user is authenticated, they can access the dashboard to manage their intellectual property (IP). Then user can view and update their profile information, as well as their research and access resources that have been granted to them by the admin or college coordinator. This may include the ability to upload research. The college coordinator will validate the uploaded research and then the IPO process the applications. Once approved, the IP will be granted to the user.

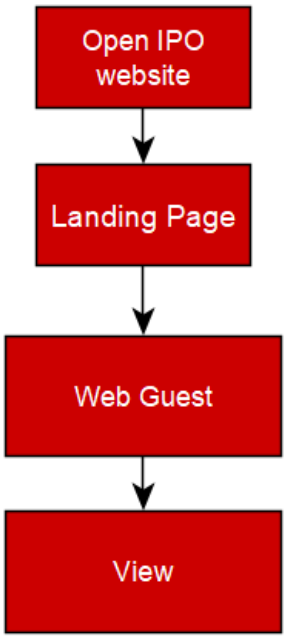

Figure 2.2.6 Proposed Workflow of the Guest

Figure 2.2.6 above shows the proposed workflow of the guest. It begins with visiting the IPO website. The guest can only view public resources. This may include information about the IPO and the IP data – only abstract.

2.2 Review of Related Systems

The following related systems gave the proponents an idea about the process of storing, protecting, and managing all of Mindanao State University's intellectual property assets including patents, trademarks, copyrights, and trade secrets through the system during the development of the system.

2.2.1 Digital Public Library of America

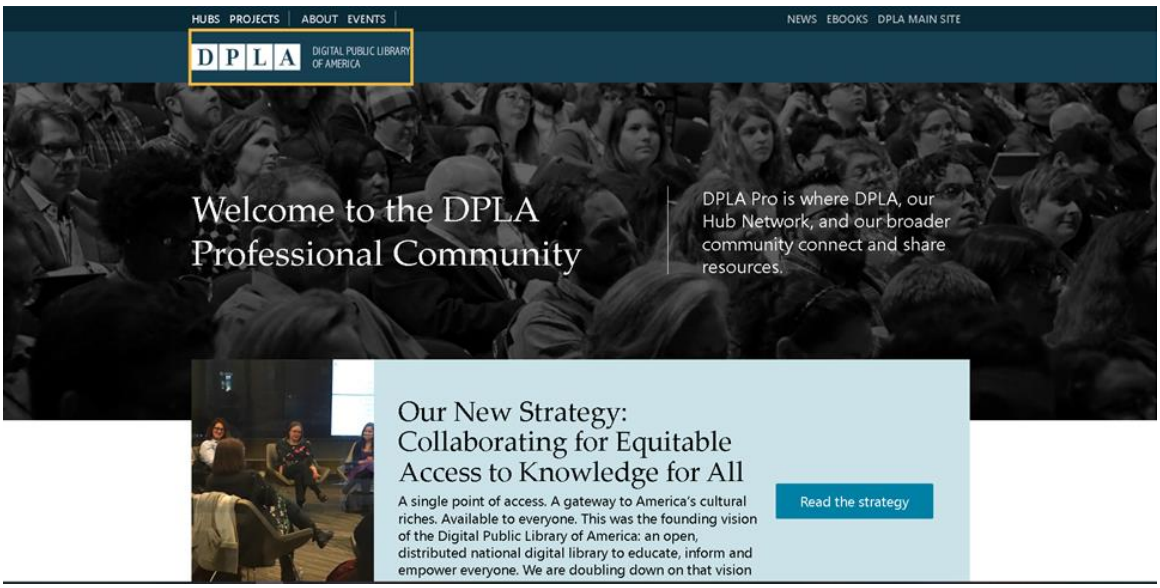

Figure 2.3.1 Digital Public Library of America Homepage

The DPLA's website provides a single access point to millions of digital items from libraries, archives, museums, and other cultural heritage institutions across the United States. The DPLA's collection includes a wide range of materials, including photographs, manuscripts, maps, books, newspapers, films, and sound recordings.

The DPLA's website offers a variety of features to help users explore and discover its collection. Users can browse by topic, search for specific items, or view curated

exhibitions and primary source sets. The DPLA also offers a variety of educational resources for students, teachers, and researchers.

The feature that we will use in the proposed project, which is like the feature of DLPA, is categorization by topic; it involves classifying content, data, or information into distinct categories or topics. Each category represents a specific subject area or theme. This metadata helps the system organize and categorize the items correctly.

2.2.2 ACM Digital Library

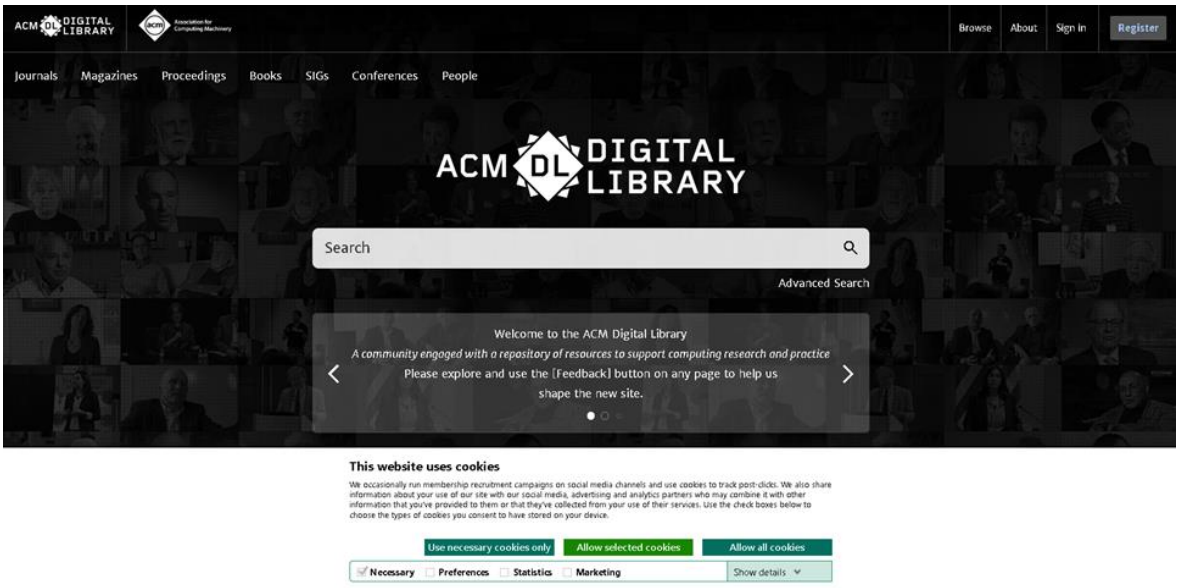

Figure 2.3.2 ACM Digital Library Homepage

The ACM Digital Library (DL) is a comprehensive digital collection of computing literature. It contains over 7 million full-text articles from ACM journals, conference proceedings, technical magazines, and books. The DL also includes the ACM Guide to Computing Literature, a bibliographic database that indexes over 6 million computing publications.

The ACM Digital Library is a valuable resource for students, researchers, and practitioners in the field of computing. It provides a single access point to a wide range of high-quality computing literature. The DL is also easy to use and navigate.

The feature that we will be adopting is similar to the web-based system of ACM digital library, the search bar, it is typically located prominently on the website's homepage or at the top of the page for easy access. Users can enter keywords, phrases, or queries related to their research interests or topics of study into this search bar. This allows them to specify additional search criteria, such as author names, publication dates, or specific publication titles, to narrow down their results.

2.2.3 University of the Philippines- Diliman Library

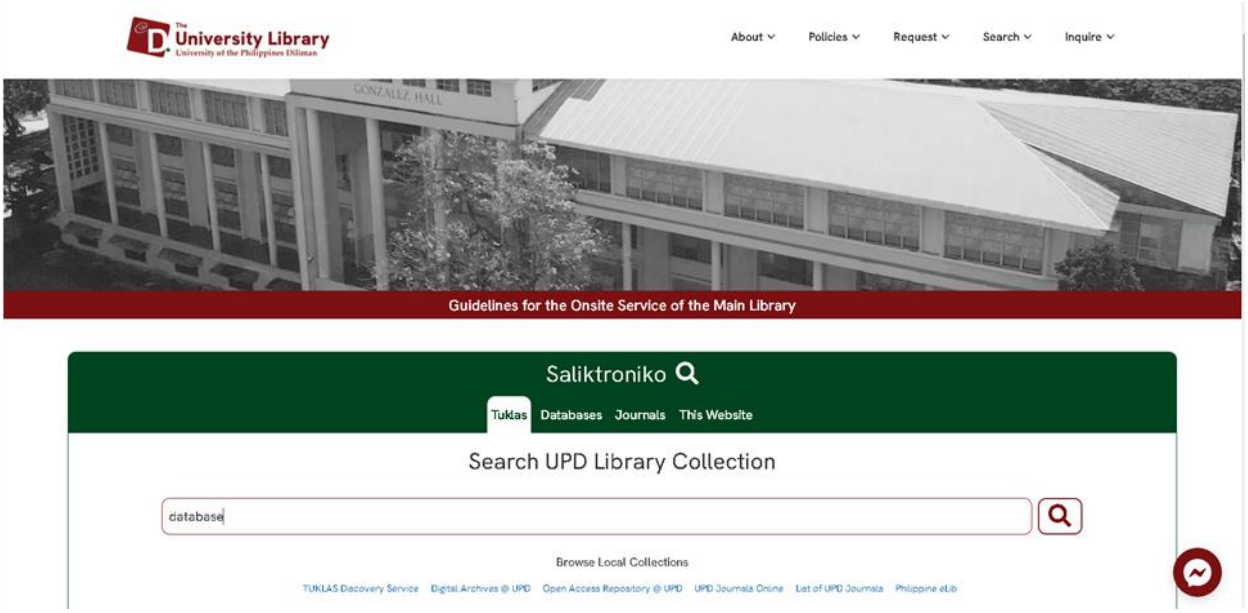

Figure 2.3.3 University of the Philippines- Diliman Library Homepage

The UP Diliman Library is a comprehensive academic library that provides access to a vast collection of print and digital resources across various disciplines. It serves as the

primary information hub for the UP Diliman campus, offering a wide range of services and resources to support teaching, learning, and research activities. And its central academic and research library that serves the University of the Philippines Diliman campus community in Quezon City, Philippines. It plays a crucial role in supporting the educational and research needs of students, faculty, and researchers.

The features that we are adapting based on the University of the Philippines-Diliman Library website is the repository of the IP assets; the website may serve as a repository or database where various types of intellectual property assets are cataloged and organized. This could include patents, research papers, copyrighted materials, and trademarks.

2.2.4 Digital Commons- University of South Florida

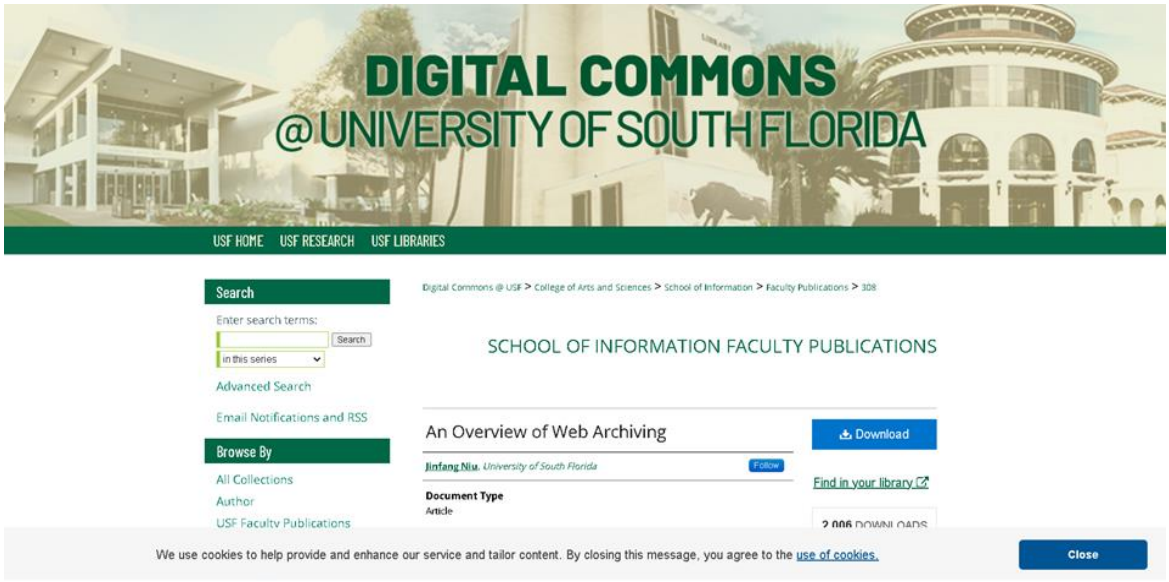

Figure 2.3.4 Digital Commons- University of South Florida Homepage

It is a digital repository that serves as a platform for preserving, showcasing, and disseminating scholarly and creative works produced by faculty, students, and researchers affiliated with the university. It provides a central location where users can access a diverse

range of materials, including research articles, theses and dissertations, conference proceedings, open-access journals, student publications, and other types of digital content.

The feature that will be adopted is forum inquiries, users can use this feature to reach out to authors for various purposes, including asking questions, seeking clarifications, requesting additional information, or expressing interest in collaboration on related research or projects.

2.2.5 Internet Archive

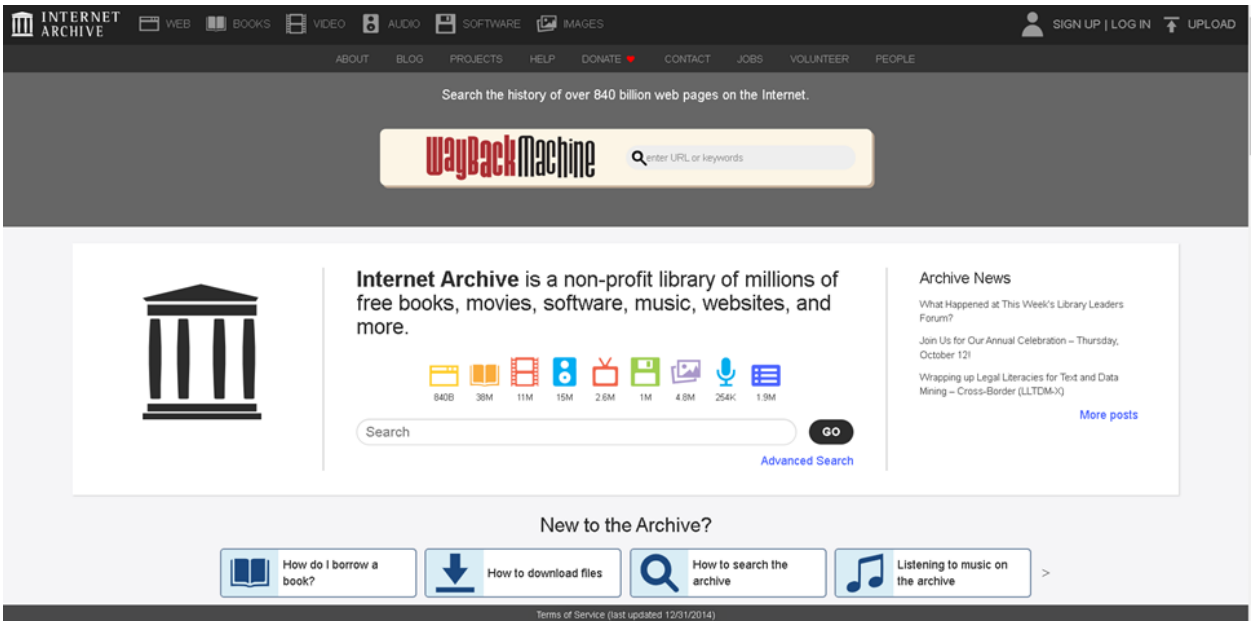

Figure 2.3.5 Internet Archive Homepage

Internet Archive is a digital library with a mission to provide "Universal Access to All Knowledge." It seeks to archive and make accessible a wide range of digital content from the internet and beyond. The Internet Archive's most well-known tool is the "Wayback Machine," which allows users to access archived versions of websites dating back to the early days of the World Wide Web. Most of the content on the Internet Archive,

including archived websites, books, audio, video, and other materials, can be freely accessed by anyone without the need for a user account.

The features that we are adapting similar to this system is, that users who wish to contribute their digital content, such as books, audio recordings, or videos, to the Internet Archive's collections may need to create accounts. This allows them to upload, manage, and describe their contributions effectively. Account holders can create and curate collections within the Internet Archive, organizing content around specific themes, subjects, or interests.

The features of login and sign-up can be useful for the proposed project.

2.3 Summary of Related Systems

Related Systems	User-friendly Interface	Document Tracking	Forum Inquiries	Reporting and Analytics	Manage IP Assets	Log in and Log out	Search IP Assets
Digital Public Library of America	✓						✓
ACM Digital Library	✓					✓	✓
University of the Philippines - Diliman Library	✓				✓		
Digital Commons- University of Florida	✓		✓				
Internet Archive	✓					✓	
IPDMS	✓	✓		✓	✓	✓	✓

Table 2.3 Summary of Related Systems

Chapter 3

Methodology

The researcher will be using the agile model as a methodology for the development and implementation of the system. Agile allows for iterative development, where requirements and solutions evolve through collaboration between self-organizing, cross-functional teams.

Figure3 Agile Methodology

3.1 Requirements Analysis

3.1.1 Data Gathering

The data for this project was gathered by conducting interviews with the office of Mindanao State University Marawi - Intellectual Property Office under the Technology and Innovation Center. The researchers utilized face-to-face interviews with the client to develop an empathy map, gathering insights into their feelings, observations, thoughts, expressions, and actions related to intellectual property data.

3.1.2 PIECES Evaluation Framework

In this section, the evaluation is conducted using the PIECES Framework, which served as the basis for identifying deficiencies in the current system. The PIECES Framework comprehensively analyzes various aspects of the system, including Performance, Information, Economy, Control, Efficiency, and Service. This structured approach facilitates a thorough examination of the system's strengths and weaknesses, shedding light on areas where improvements can be made. The identification of deficiencies using the PIECES Framework serves as a valuable foundation for subsequent enhancements and optimizations within the current system.

Performance	The system may be slow to respond to queries, making it difficult for users to find the information they need. And may crash or experience other errors, making it unavailable to users.
Information	Intellectual property assets may be lost or corrupted.
Economy	
Control/Security	The system stores sensitive intellectual property data, which could make it a target for hackers. If the system is not properly secured, it could be compromised, which could lead to data breaches and performance problems.

Efficiency	IPDMS is not regularly updated with new features and bug fixes, it could become outdated and inefficient. This could lead to performance problems and security vulnerabilities.
Services	Difficult to maintain and upgrade the system, which could lead to performance problems, or the services offered.

Table 3.1.2 PIECES Evaluation Framework

3.1.3 Cause and Effect Analysis

Based on the PIECES Evaluation Framework, an assessment of the causes and effects of the problems within the current system has been conducted. This summary outlines the identified causes and effects within the PIECES Framework and proposes corresponding solutions to address the issues. The evaluation serves as a foundation for understanding the intricacies of the system's deficiencies and provides insights into the constraints associated with implementing proposed solutions.

	Problem/Opportunity	Cause and Effect	System Objective	System Constraints
Performance	Website crash	**C-** Many users use the system simultaneously **E-** difficult to access and it	Optimizing server capacity, enhancing security protocols, and	Limitations in scalability, make it difficult to accommodate

		becomes unavailable for other uses	improving overall system resilience.	sudden spikes in traffic or increased user activity.
Information	Loss and corrupted	**C-** Failure to regularly backup and create redundant copies of intellectual property **E-** system failures, hardware malfunctions, or accidental deletions.	Identifying and addressing the root causes of data loss or corruption, whether they be due to hardware failures, software bugs, human error, or malicious activities.	Technological constraints, such as reliance on outdated hardware or software, may limit the ability to implement the latest features and encryption methods.
Economy				
Control/Security	Attack by hackers	**C-** **C**yber-attacks can	Identify and neutralize the	Human error constraints

		lead to unauthorized access, theft, or corruption of intellectual property stored digitally. **E-** Loss of sensitive information, potential misuse of IP, and damage to reputation.	security breach, regaining control and preventing unauthorized access.	often contribute to successful hacking attempts.
Efficiency	Outdated	**C- F**ailure to regularly update software, operating systems, and applications.	Improve system responsiveness, reduce downtime, and enhance user experience.	Technical constraints arise from the interoperability issues between outdated systems and

		E- Vulnerabilities to security threats, diminished performance, and compatibility issues with newer technologies.		newer applications
Services	Difficult to maintain	**C-** Insufficient knowledge or expertise to upgrade or migrate to newer technologies. **E-** Limited scalability, challenges in adapting to	Empowering the technical support team with the necessary training and resources to efficiently handle maintenance tasks.	The complexity of the system architecture can hinder efficient maintenance.

		changing needs, and potential operational inefficiencies.		

Table 3.1.2 Cause and Effect Analysis

3.1.3 Gantt Chart Development of Intellectual Property Data Management System

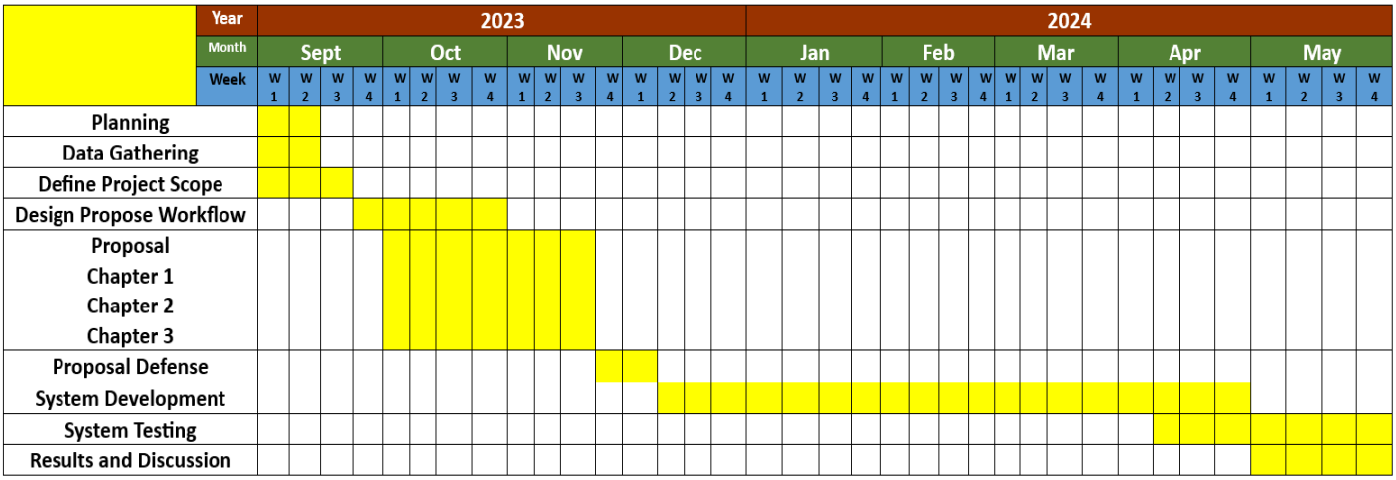

Figure 4.1.4 Gantt Chart in developing the system

Figure 3.1.3 shows the Gantt Chart development of the system. The system was proposed in mid-2023, the planning and data gathering began in the same month, followed by defining the project scope and designing the proposed workflow. Then, we proposed our chapter 1 followed by 2 and 3 in the week after to our adviser for review and revisions. And then, the potential proposal defense is scheduled for the last week of November or the first week of December. From early December 2024, the proponents began developing the system up until April 2024. The proponents started testing the system early in March while

the system was under development. The system's testing was completed in May 2024. The result and discussion of the project began in April and continued up to May.

3.2 Design

This design provides modeling tools that describe the systems and their processes including developer and user specifications and software testing plans.

3.2.1 Hierarchical Input- Process- Output

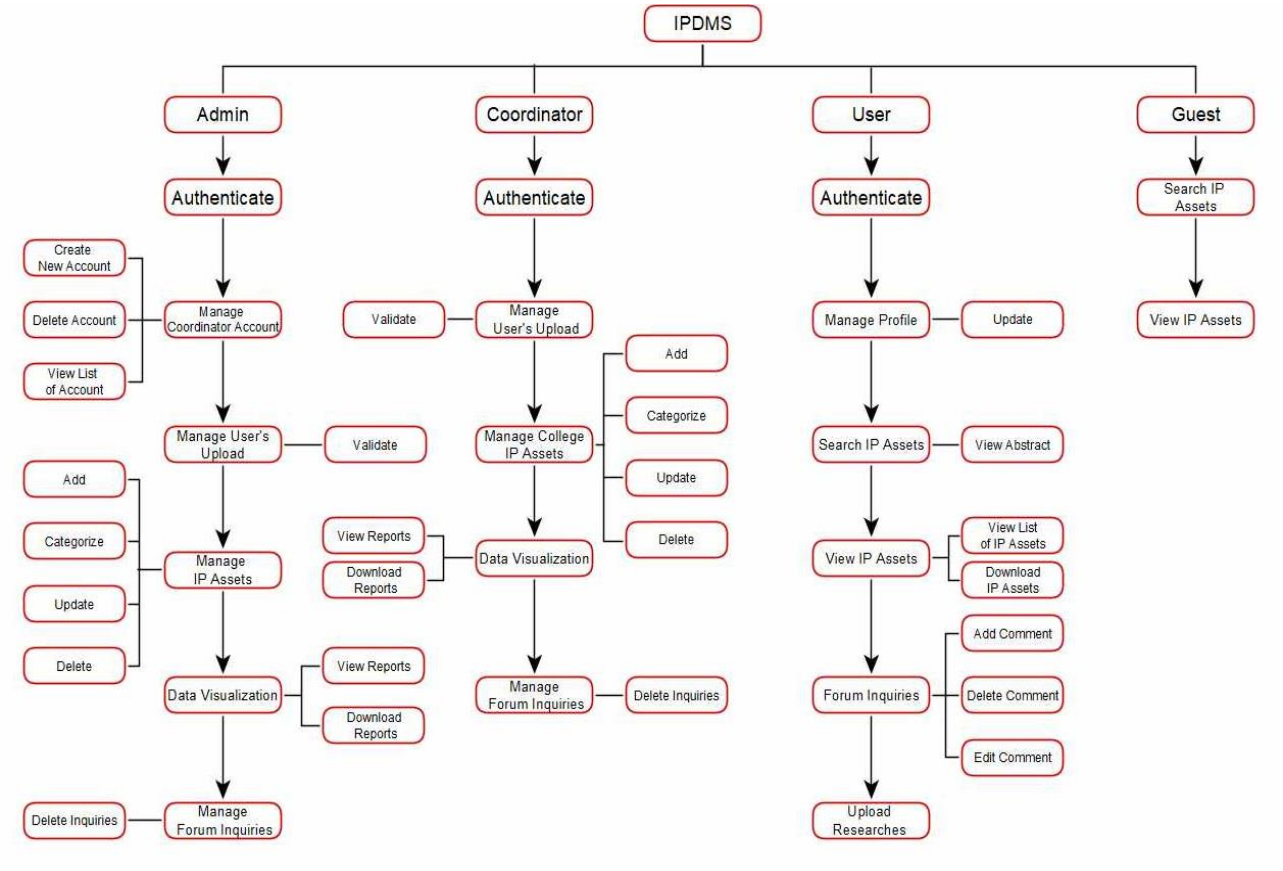

Figure 3.2.1 Hierarchical Input-Process-Output

The admin holds the responsibility for managing the accounts of coordinators and users. The admin oversees the management of IP assets, including updating and categorizing assets,

viewing data visualization reports and their downloadable features. Additionally, the admin can manage user uploads by validating the IP assets that will be put into the system, and they can also manage forum inquiries. The admin has the authority to delete inappropriate comments and oversee the update logs, which reflect the detailed specifics of assets saved within the system.

The coordinator plays a crucial role in facilitating communication and ensuring smooth system operation. Coordinators are responsible for managing User accounts, reviewing, and approving User-submitted IP assets. And also, they can view also the data visualization reports and allows them to download the reports.

The User, as the primary beneficiary of the system, actively interacts with the platform to manage their IP assets. Users can submit new IP assets for review and approval and can view their existing assets. They can also access other works by others.

The Guest, with limited access, can view publicly accessible IP assets. While unable to submit or manage IP assets, Guests contribute to the system's overall engagement and knowledge exchange.

The hierarchical input-process-output model effectively outlines the distinct roles and responsibilities of each user category within the IP management system. This structured approach ensures clear communication, efficient task allocation, and seamless system operation.

3.2.2 Input-Process-Output

3.2.2.1 Login

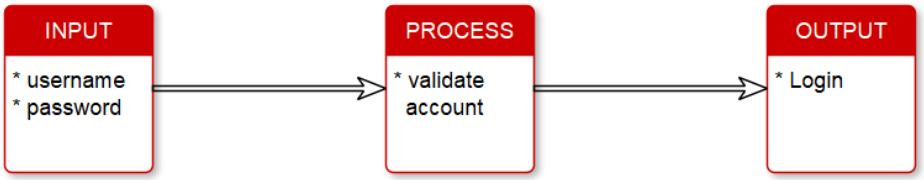

Figure 3.2.2.1 Input-Process-Output for Account login on IPDMS

Figure 3.2.2.1 above illustrates the Input-Process-Output for the account log-in process on the IPDMS web-based systems. Users are required to input their username and password. The system then authenticates the provided data. If the entered credentials exist in the system, the user is granted access to the system.

3.2.2.2 Upload IP Assets

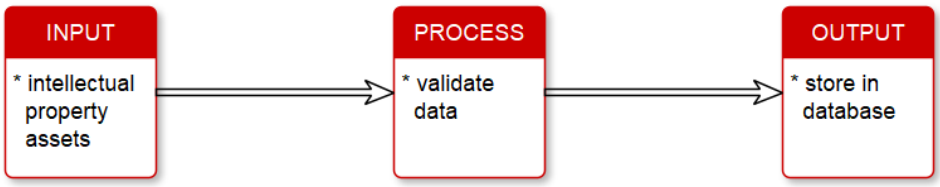

Figure 3.2.2.2 Input-Process-Output for uploading IP Assets on IPDMS

Figure 3.2.2.2 above illustrates the Input-Process-Output for uploading IP assets. Users can upload their intellectual property assets into the system. These uploads are then subject to validation by the administrator or coordinator. If the uploaded content is approved, it is automatically stored in the database.

3.2.2.3 Update IP Assets by administrator and coordinator

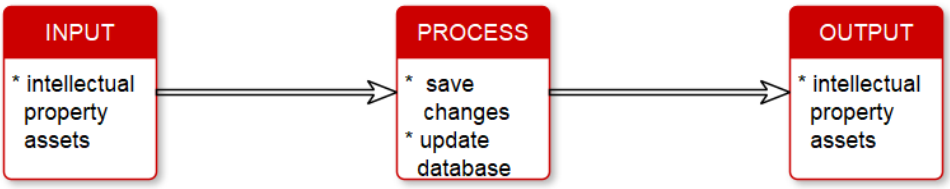

Figure 3.2.2.3 Input-Process-Output for updating IP Assets on IPDMS

Figure 3.2.2.3 above illustrates the Input-Process-Output for updating IP assets, a capability accessible to both coordinators and administrators. They can update, edit, and delete intellectual property works, and the revised information will be displayed within the system. This functionality ensures that coordinators and administrators can manage and showcase the latest versions or modifications to the intellectual property assets.

3.2.2.4 Search IP Assets

Figure 3.2.2.4 Input-Process-Output for searching IP Assets on IPDMS

Figure 3.2.2.4 above illustrates the Input-Process-Output for searching IP assets. Users can enter keywords related to what they want to search. After entering the keywords, the system will display a list of IP assets matching the search criteria. This feature enables users to easily locate and access the specific intellectual property assets they are looking for.

3.2.2.5 Manage Profile

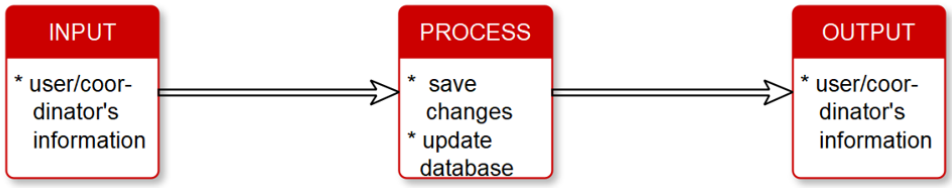

Figure 3.2.2.5 Input-Process-Output for managing profile on IPDMS

Figure 3.2.2.5 above illustrates the Input-Process-Output for managing profiles. In this system, users and coordinators can update their information, and any modifications made will be reflected automatically. This functionality ensures that individuals can easily manage and keep their profiles up to date.

3.2.2.6 Add comments by user

Figure 3.2.2.6 Input-Process-Output for adding comments.

Figure 3.2.2.6 illustrates the Input-Process-Output for adding comments. Users have the capability to input comments on various content. The process involves the user entering their comments in the provided interface. The system then processes and stores the comments, associating them with the relevant content.

3.2.3. Use Case Diagram

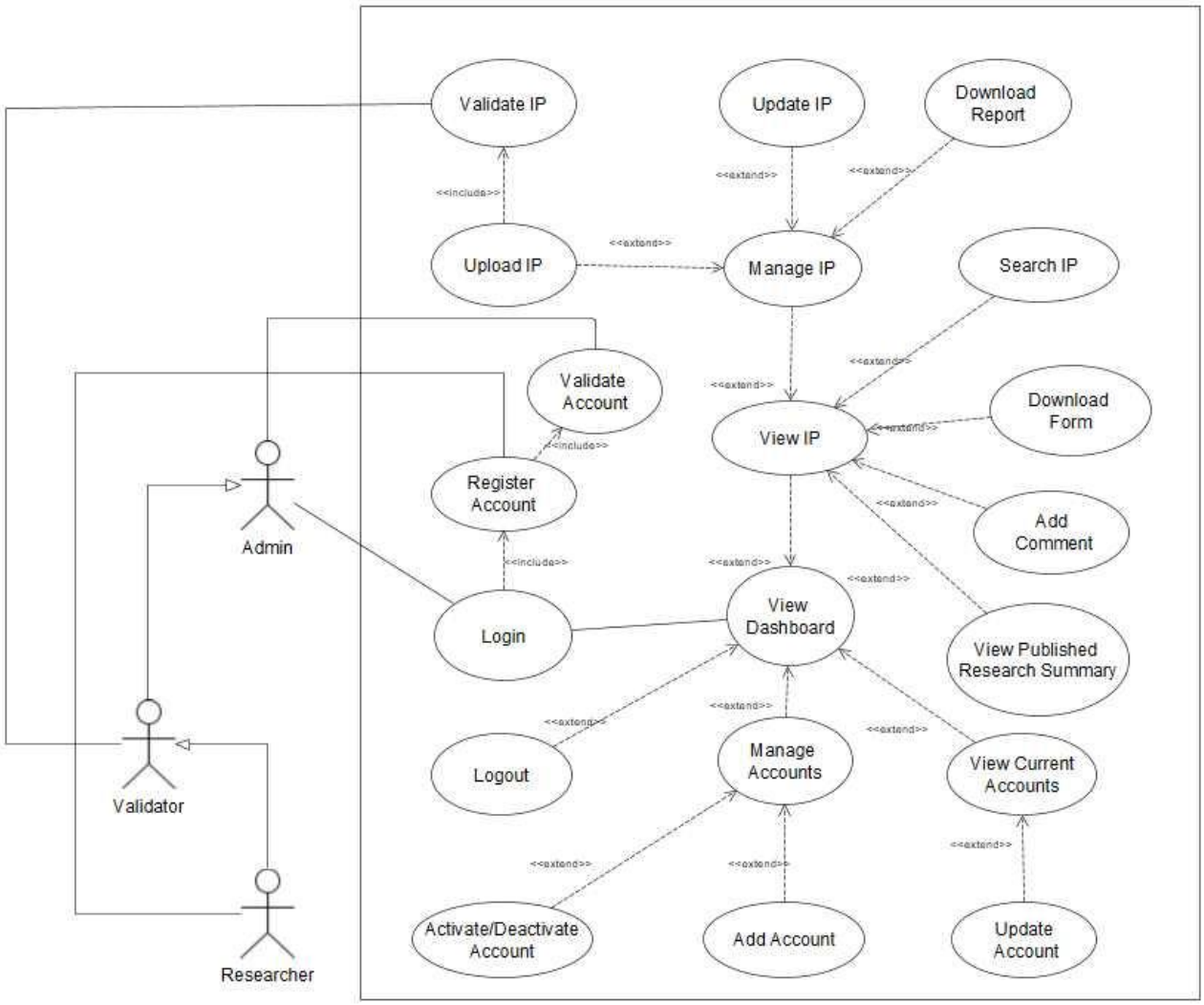

Figure 3.2.3 Use Case Diagram

This figure illustrates the use case diagram of the IPDMS. The admin features include managing accounts, managing IP assets, the admin can add, update, delete, and categorize the intellectual property assets that are added to the system. This comprehensive functionality empowers the admin to not only facilitate the inclusion of new assets but also to ensure that the existing assets are kept up-to-date and appropriately categorized for efficient organization and

retrieval within the system. And can manage forum inquiries, in managing forum inquiries, the admin has the authority to delete comments that are not conducive to a positive environment for everyone. The forum serves as a collaborative space for users and researchers, fostering interaction and knowledge exchange. The admin's ability to moderate and remove inappropriate comments ensures a conducive and respectful platform for productive collaboration within the community. The upload logs feature serves as a historical record of when and where assets are added to the system, along with detailed information about each upload. This functionality allows administrators and coordinators to track the progression of asset uploads, providing transparency into the system's activity. And, they can access the data visualization reports at the same time they can download the reports. Administrators can review the timeline and specific assets added, and the feature also contributes a comprehensive understanding of the system's history and facilitates effective management and analysis of intellectual property assets. The validator, like the admin, can manage user accounts, handle IP assets, manage forum inquiries, and upload logs. Users can manage their profiles, search for IP assets for viewing, add, edit, and delete content in the forum section. Additionally, users can upload assets, but approval is required from the validator or administrator. And the users can download the forms like the non-disclosure agreement and different forms that are needed to fill out. This comprehensive use case diagram outlines the functionalities and interactions among admins, validators, and users within the IPDMS.

3.2.4. Entity-Relationship Diagram

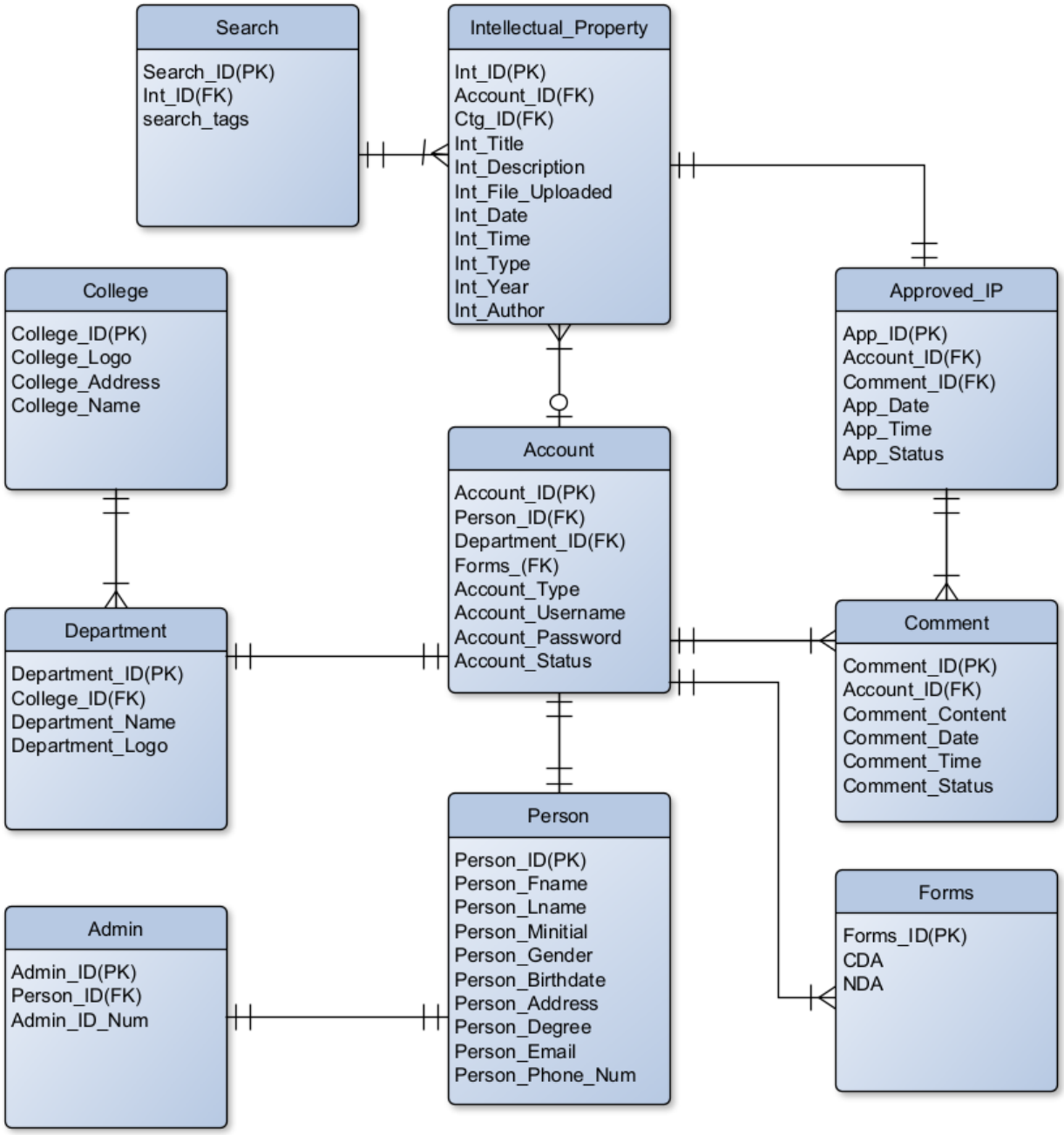

Figure 3.2.4 Entity-Relationship Diagram

The ERD diagram for the Intellectual Property Database Management System (IPDMS) at Mindanao State University comprises entities such as Intellectual Property types (Copyright,

Patent, Trademark), Admin, Person, Department, Account, Comment, Approved IP, Forms, Search and College. Intellectual Property encapsulates submitted works, each associated with a specific Intellectual Property type. Admin, with overarching authority, manages Coordinators, Users, Intellectual Property, and Comments. Users, the regular contributors, engage in asset submissions and forum discussions. Comment or Forums serve as collaborative spaces. This ERD captures the detailed relationships and interactions, illustrating the dynamic flow of information and collaboration within the IPDMS ecosystem.

3.2.5. Architectural Design

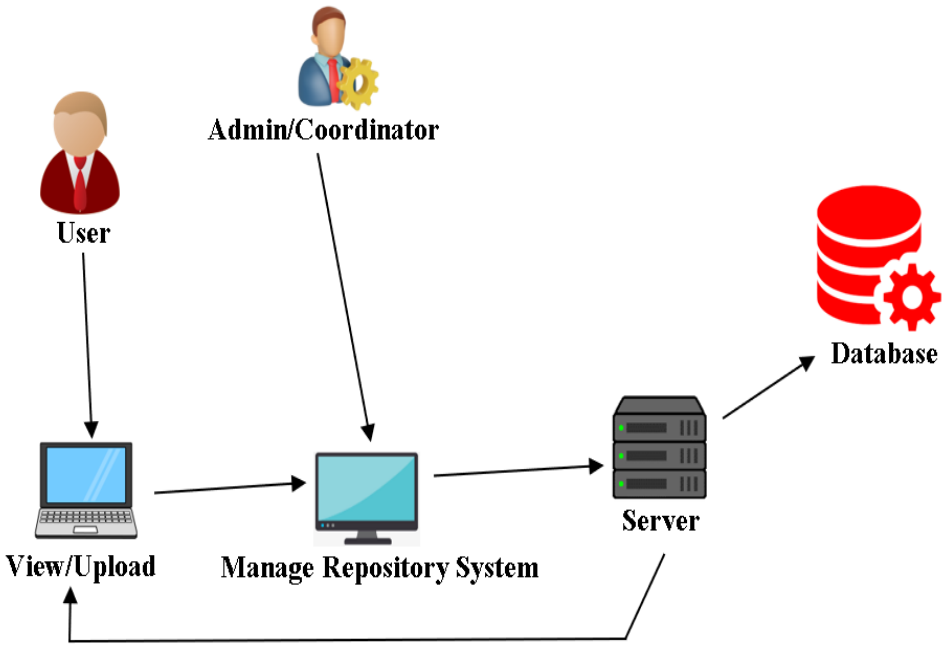

Figure 3.2.5 Architectural Design of IPDMS

Figure 3.2.5 illustrates the Admin/Coordinator and User/Researcher architecture. All the users have access to the database when storing and querying data. The Admin/Coordinator is responsible for managing the repository system, which includes creating and managing users, uploading, and deleting IP assets, and managing the database. The User/Researcher can view and upload research to the repository system.

3.3 Development and Testing

This section discusses the test plan, the software, and the hardware specifications that are used in the development and testing of the system.

3.3.1. Software Specification

Name	Description
Operating System (OS)	Windows 10
Programming Language	C#, JavaScript, CSS, HTML, PHP
SQL Database	MySQL
Web Server	XAMPP
System Type	64bit
Editor	Notepad++, Sublime, VS Code
Web Browser	Google Chrome, Microsoft Edge

Table 3.3.1 Developer's Software Requirement

Table 3.3.1.a shows the software specification for the developer and user. It also shows the minimum software requirement for the end user.

Name	Description
Operating System (OS)	Windows 7
System Type	32bit or 64bit
Web Browser	Google Chrome/Microsoft Edge

Table 3.3.1.b User's Software Requirements

Table 3.3.1.b shows the user's software requirement. The user must have at least a Windows 7 operating system, a system type of either 32bit or 64bit, and a browser preferably, Google Chrome browser.

3.3.2. Hardware Specification

Name	Description
Processor	2.60 GHz
Memory (RAM)	4 GB
Storage	128 GB
Data Connectivity	Local Area Network

Table 3.3.2.a Developer's Hardware Requirements

Table 3.3.2.a shows the hardware specifications of the laptop for the developer.

Name	Description
Processor	Intel Core i3 or better
Memory (RAM)	3GB or better
Storage	500 GB or higher
Data Connectivity	Local Area Network

Table 3.3.2.b User's Hardware Requirements

Table 3.3.2.b shows the user's hardware requirement. The user must comply with the recommended requirements to experience better usage of the project.

3.3.3. Deployment Diagram

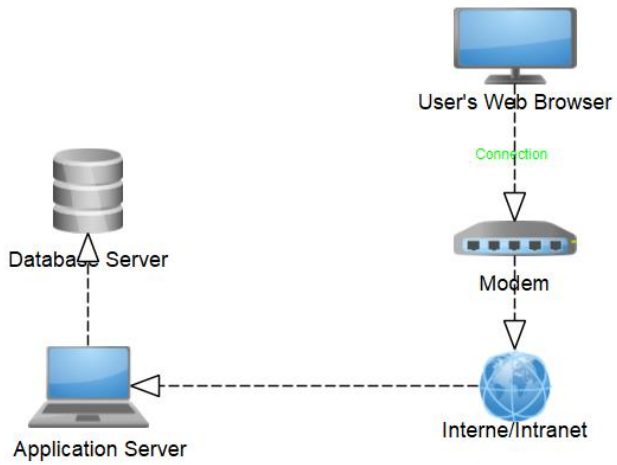

Figure 3.3.5 Deployment Diagram

In Figure 3.3.5, the deployment diagram illustrates the cohesive interaction among various components within the Intellectual Property and Data Management System (IPDMS) architecture. The user's browser serves as the primary interface, facilitating user

interactions with the system, allowing access to intellectual property assets, and enabling the submission of inquiries. The modem acts as the intermediary, ensuring a smooth data transfer between the user's browser and the broader network, whether it be the internet or an intranet. The internet/intranet, representing the network infrastructure, functions as the communication medium, facilitating data exchange between the user's browser, the application server, and the database server.

The application server, a pivotal component, hosts and executes the functionalities of the IPDMS. It processes user requests, manages data retrieval and storage, and oversees the overall system functionality. Simultaneously, the database server, a critical repository, stores and manages intellectual property assets, user data, and other relevant information, contributing to data persistence and retrieval. The seamless flow of functions involves users interacting with the system through their browsers, with data transmission via the modem to the internet/intranet. The application server processes user requests, communicates with the database server for data retrieval or storage, and sends relevant information back to the user's browser. This integrated architecture ensures efficient user access, management, and contribution to intellectual property assets within the IPDMS.

3.3.4. Test Plan

In this section, demonstrates the test plan for conducting a usability test concerning the Web-Based Intellectual Property Data Management System in Mindanao State University - Marawi Campus. The usability testing of the system is required to access the usefulness, satisfaction and efficiency based on the user’s data.

3.3.4.1 Usefulness, Satisfaction and Ease of Use- USE

The USE questionnaire, developed by Lund in 2001, is designed to assess the subjective usability of a product or system. This survey consists of 30 items and evaluates four key dimensions of usability: usefulness, ease of use, ease of learning, and satisfaction.

For this project, we'll create a USE questionnaire to gauge users' perceptions regarding usefulness, satisfaction, and ease of use. These factors are important as they influence the system's performance.

3.3.4.2 USE Questionnaire – Based on Lund, A.M. (2001) Measuring Usability with the USE Questionnaire

USEFULNESS		1	2	3	4	5	6	7		NA
1. It helps me be more effective.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
2. It helps me be more productive.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
3. It is useful.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
4. It gives me more control over the activities in my life.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
5. It makes the things I want to accomplish easier to get done.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
6. It saves me time when I use it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
7. It meets my needs.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
8. It does everything I would expect it to do.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
EASE OF USE		**1**	**2**	**3**	**4**	**5**	**6**	**7**		**NA**
9. It is easy to use.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
10. It is simple to use.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
11. It is user friendly.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
12. It requires the fewest steps possible to accomplish what I want to do with it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
13. It is flexible.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
14. Using it is effortless.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
15. I can use it without written instructions.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
16. I don't notice any inconsistencies as I use it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
17. Both occasional and regular users would like it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
18. I can recover from mistakes quickly and easily.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
19. I can use it successfully every time.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○

Figure A 3.3.6.2 USE Questionnaire

EASE OF LEARNING		1	2	3	4	5	6	7		NA
20. I learned to use it quickly.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
21. I easily remember how to use it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
22. It is easy to learn to use it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
23. I quickly became skillful with it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
SATISFACTION		**1**	**2**	**3**	**4**	**5**	**6**	**7**		**NA**
24. I am satisfied with it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
25. I would recommend it to a friend.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
26. It is fun to use.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
27. It works the way I want it to work.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
28. It is wonderful.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
29. I feel I need to have it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
30. It is pleasant to use.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
		1	**2**	**3**	**4**	**5**	**6**	**7**		**NA**

List the most **negative** aspect(s):

1.
2.
3.

List the most **positive** aspect(s):

1.
2.
3.

Figure B 3.3.6.2 USE Questionnaire

Figure A and Figure B shows the 30 items questions that evaluates the system performance by determining the usefulness, ease of use, ease of learning and satisfaction.

3.3.4.3 Usefulness, Satisfaction and Ease of Use- USE Evaluation

The USE (Usefulness, Satisfaction, Ease of Use) method for evaluating usability is different from other testing approaches because it doesn't generate a single numerical score. Instead, it looks at various aspects like usefulness, satisfaction, and efficiency to assess the usability. This method might include qualitative analysis of user's feedback, such as surveys and interviews. By using the USE method, designers and researchers can really understand how usable the system is and figure out how to make it better for users.

CHAPTER 4

DEFINITION OF TERMS:

- **Intellectual Property (IP)** – refers to creations of the mind, such as inventions, literary and artistic works, designs, symbols, names, and images used in commerce. It is protected by law through patents, copyrights, trademarks, and trade secrets.
- **Data Management** – involves the process of organizing, storing, and handling data throughout its lifecycle. It includes practices related to data quality, retrieval, and overall efficient use.
- **Trademark** – a recognizable sign, design, expression, or symbol that identifies products or services of a particular source, distinguishing them from others in the market.
- **Copyright** – is a legal right that grants the creator of an original work exclusive rights to its use and distribution, usually for a limited time, to enable the creator to receive compensation for their intellectual investment.
- **Patent** – an exclusive right granted for an invention, providing the inventor with the right to exclude others from making, using, selling, or importing the patented invention for a limited period.
- **Web-Based** – refers to systems, applications, or services that are accessible and operated through a web browser over the internet, allowing users to access them remotely.
- **IPDMS (Intellectual Property Data Management System)** – refers to a specialized system designed to centralize, store, and manage intellectual property assets, such as patents, trademarks, copyrights, and trade secrets.

- **Mindanao State University - Marawi Campus** – refers to the specific campus location of Mindanao State University, emphasizing the geographical context of the project.

REFERENCES:

1. AE Monge and CP Elkan, "An adaptive and efficient algorithm for detecting approximately duplicate database records", Proc of the Sigmod., vol. 2001, no. 03.
2. A Monge and C. Elkan, "An efficient domain independent algorithm for detecting approximately. duplicate database records", Proc. of the SIGMOD Workshop on Data Mining and Knowledge. Discovery, 1997.
3. Alokluk, J. (2019). Archiving and Document Management at Taibah University: A Case Study. Computer and Information Science, 12(4), 11.
4. Baran, A., & Zhumabaeva, A. (2018). Intellectual property management in startups — problematic issues. *Engineering Management in Production and Services, 10*(2), 66–74.
5. Cruz, C. (2017). Arts and Culture: Heritage, Practices and Futures Intellectual Property of Indigenous Peoples (IP of IP): Challenges in Protecting Traditional Knowledge in the Philippines.
6. Dellosa, J. T. (2017). The impact of the innovation and Technology Support Offices (ITSOs) on innovation, intellectual property (IP) protection and entrepreneurship in Philippine engineering education. In IEEE Global Engineering Education Conference, EDUCON (pp. 762–770). IEEE Computer Society. https://doi.org/10.1109/EDUCON.2017.7942933
7. Donner, E. K. (2022). Research data management systems and the organization of universities and research institutes: A systematic literature review. *Journal of Librarianship and Information Science, 55*(2), 261–281.

8. Etzkowitz, H., & Zhou, C. (2017). The Triple Helix: University-Industry-Government Innovation and Entrepreneurship. *Routledge*. https://doi.org/10.4324/9781315620183
9. "History | IPOPHL," *Ipophil.gov.ph*, 2023. https://www.ipophil.gov.ph/history/.
10. Jost Zetzsche. (2019). Freelance translators' perspectives. Routledge EBooks, 166–182.
11. Lund, A. M. (2001). Measuring Usability with the USE Questionnaire. Usability Interface, 8(2), 3-6.
12. M. A. Hernandez and S. J. Stolfo. Real-world data is dirty: Data cleansing and the merge/purge problem. Data Mining and Knowledge Discovery, 2(1):9–37, 1998.
13. "Mandate & Function | IPOPHL," *Ipophil.gov.ph*, 2023. https://www.ipophil.gov.ph/mandate-function/.
14. Republic Act No. 8293 | GOVPH. (1997, June 6). Retrieved December 2, 2023, from Official Gazette of the Republic of the Philippines website.
15. The link between intellectual property rights, innovation, and growth: A meta-analysis. Economic Modelling, 97, 196–209 | 10.1016/j.econmod.2021.01.019. (2021).
16. The Importance of Archive Management Systems in Digital Era. (2017). from Google Books website.
17. What is Data Management? (2020), from Oracle.com website.
18. What Is Intellectual Property, and What Are Some Types? (2023), from Investopedia website.
19. Sci-Hub | Psychometric Evaluation of the USE (Usefulness, Satisfaction, and Ease of use) Questionnaire for Reliability and Validity. Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 62(1), 1414–1418 | 10.1177/154193121862132"

20. Suominen, A., Deschryvere, M., & Narayan, R. (2023). Uncovering value through exploration of barriers - A perspective on intellectual property rights in a national innovation system. *Technovation, 123*, 102719–102719.
21. USE Questionnaire: Usefulness, Satisfaction, and Ease of use," *Garyperlman.com*, 2024.
22. Zhang, W. (2022). Layout and Suggestions on China's Science and Technology Innovation Centers at Different Levels. Bulletin of Chinese Academy of Sciences, 37(12), 1745–1756. https://doi.org/10.16418/j.issn.1000-3045.20220925002
23.