OPTIMIZING FACULTY WORKLOAD: ENHANCING THE PUP TAGUIG FACULTY LOADING AND SCHEDULING SYSTEM

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CERTIFICATION OF ORIGINALITY

This is to certify that the research work presented in this capstone project, **OPTIMIZING FACULTY WORKLOAD MANAGEMENT: ENHANCING THE PUP TAGUIG FACULTY LOADING AND SCHEDULING SYSTEM** for the degree Bachelor of Science in Information Technology at the Polytechnic University of the Philippines embodies the result of original and scholarly work carried out by the undersigned. This capstone project does not contain words or ideas taken from published sources or written works that have been accepted as the basis for the award of a degree from any other higher education institution, except where proper referencing and acknowledgement were made.

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CHAPTER 1

THE PROBLEM AND ITS BACKGROUND

1. Introduction

In the ever-evolving landscape of academic institutions, the efficient management of faculty resources and course scheduling stands as a cornerstone for fostering a dynamic and effective learning environment. The Polytechnic University of the Philippines (PUP) Taguig, with its rich history and commitment to excellence, has continually sought to optimize its administrative processes to meet the growing demands of a diverse student body and changing educational paradigms.

The PUP Taguig Faculty Loading and Scheduling System is a vital component in the university's administrative machinery which traces its roots back to an era when manual processes dominated academic resource allocation. The system was conceived as a response to the burgeoning need for a more systematic approach to faculty loading, a pivotal task in ensuring that the right educators are assigned to the right courses.

Over the years, the system has been a witness to the ebb and flow of academic transformations. From the integration of new programs to shifts in pedagogical methodologies, the demands on the faculty loading and scheduling process have grown in complexity and diversity. What once sufficed as an adequate solution has found itself challenged by the accelerating pace of change in the educational landscape.

As academic programs diversified, accreditation standards evolved, and technology became an integral part of education, the limitations of the existing system became increasingly apparent. Manual entry processes, lack of adaptability to new curricula, and a user interface that struggled to meet modern usability standards have cumulatively contributed to inefficiencies in faculty resource allocation and scheduling.

The challenges faced by the PUP Faculty Loading and Scheduling System are not unique to this institution alone; they mirror a broader trend in educational institutions globally. The limitations of traditional systems in adapting to the demands of contemporary education have become a common narrative, underscoring the need for innovative solutions that blend technological advancements with the intricacies of academic administration.

This study seeks to bridge the historical foundations of the PUP Taguig Faculty Loading and Scheduling System with the current imperatives of educational administration. By understanding where the system has come from, we gain a nuanced perspective on the intricacies and nuances that have shaped its current state. The challenges posed by the past illuminate a path forward—a path of enhancement which integrates the ever-evolving curricula, new technological advancements, and user-centric design principles.

As we delve into the existing PUP Taguig Faculty Loading and Scheduling System, we do so with the intent to not just address existing deficiencies but to contribute to the enhancement and progress that propels PUP's academic administration into a future characterized by efficiency, adaptability, and a commitment to providing an optimal learning experience for both faculty and students.

1.1 Overview of the Current System Process

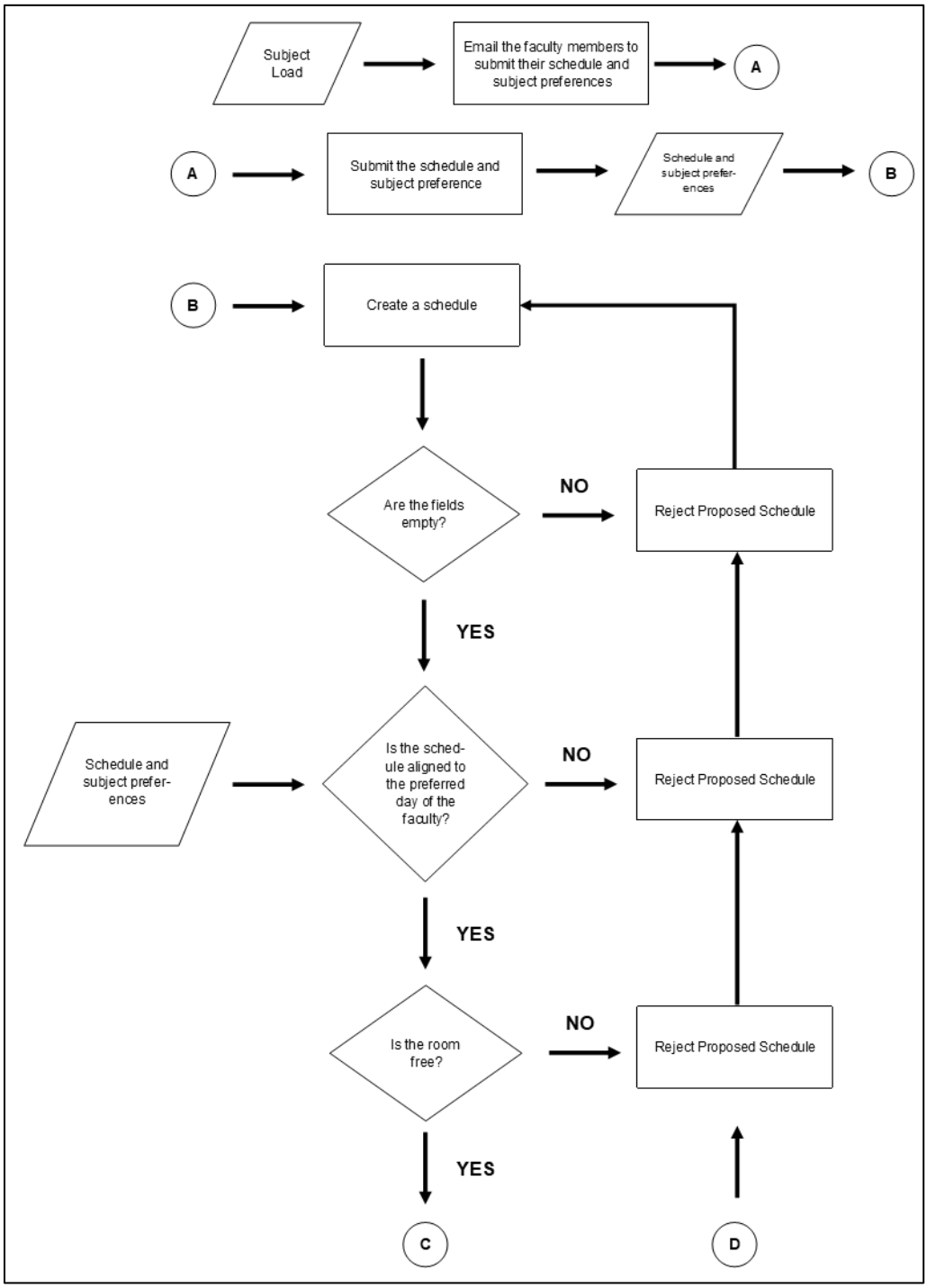


Figure 1a. The current process flow of the PUPT-FLS System

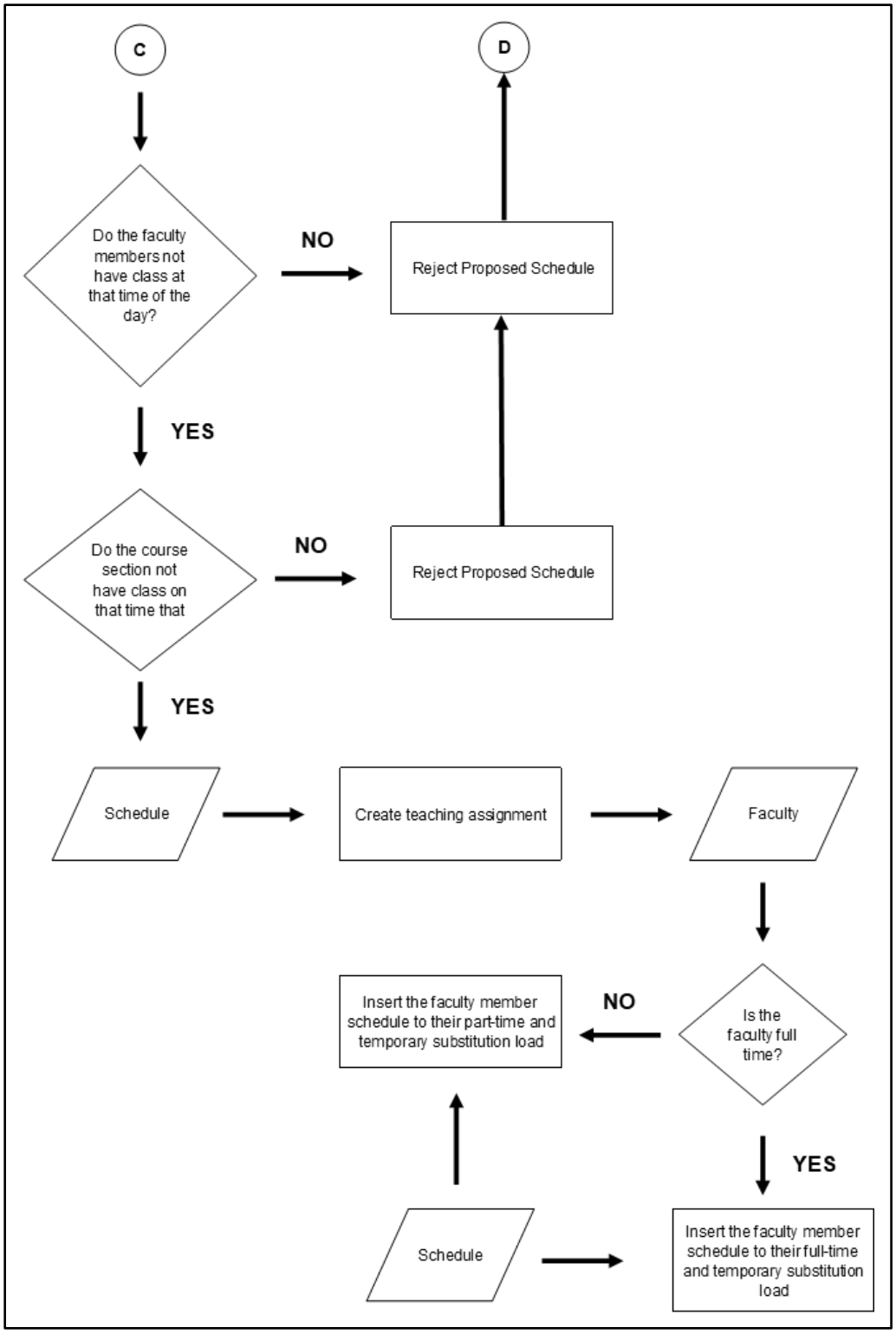


Figure 1b. The current process flow of the PUPT-FLS System

1.2 Background of the Organization

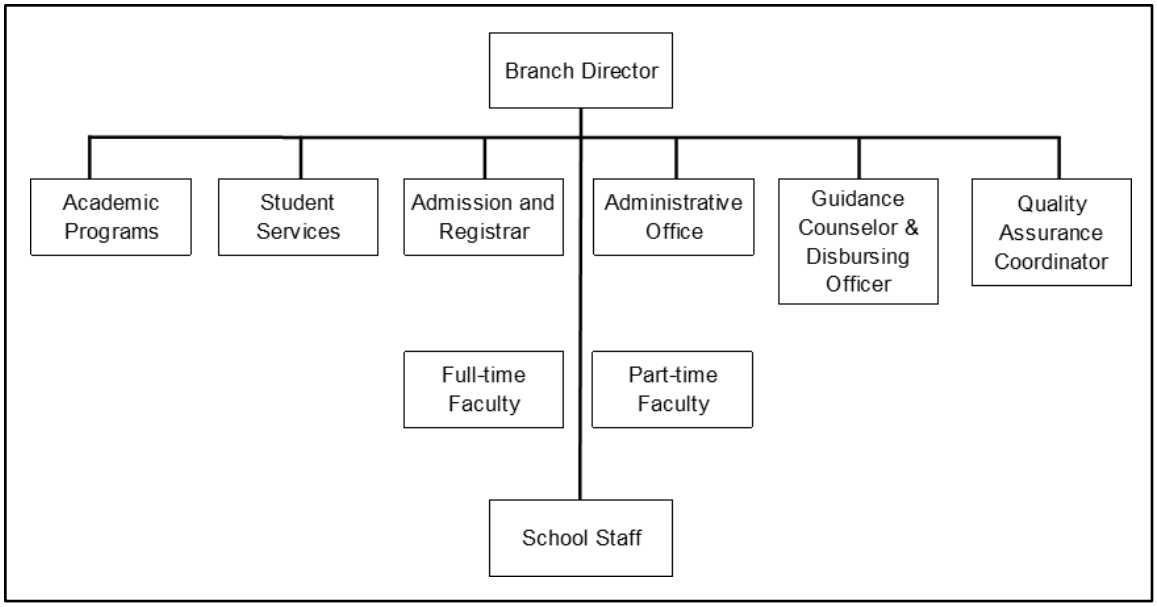


Figure 2. Organizational Hierarchy Overview at PUP Taguig

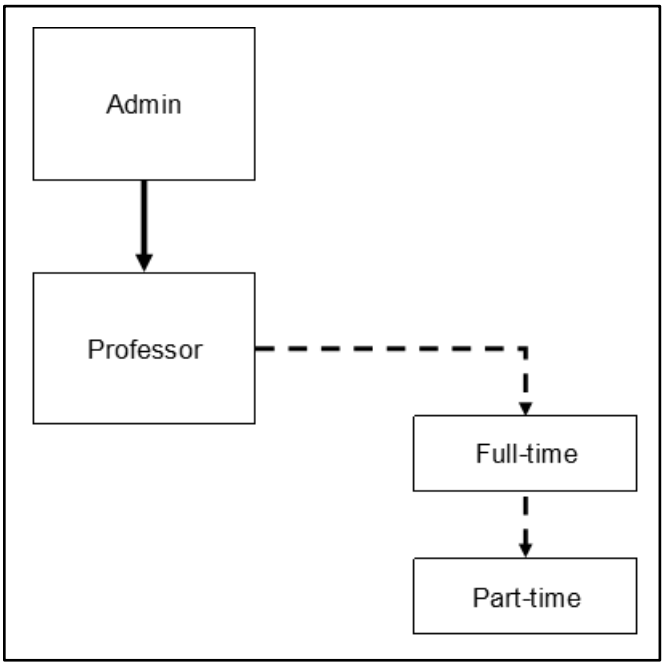


Figure 3. The Flow of Assigning Faculty Roles in PUP Taguig FLS System

1.3 Statement of the Problem

The current PUP Faculty Loading and Scheduling System face inefficiencies in adapting to the evolving educational landscape. Manual processes and limitations in system capabilities hinder the optimal allocation of faculty resources and the seamless integration of new curricula. These challenges contribute to scheduling conflicts, reduced system performance, and a less-than-optimal user experience. Addressing these issues is critical to fostering an effective and adaptive academic environment.

The specific challenges in the Faculty Loading and Scheduling project are as follows:

- *Integration of New Curricula:* The system lacks flexibility in seamlessly integrating new curricula, hindering its ability to adapt to evolving educational requirements and incorporate emerging courses efficiently;

- *Limitations in the Existing System Framework:* The current system, built on the Yii framework, requires enhancements to its architecture and technology stack to ensure optimal scalability and accommodate future advancements in educational technology.

- *Outdated User Interface:* The current user interface design is outdated, adversely impacting user experience by not meeting contemporary design standards. An overhaul is essential to create an intuitive, visually appealing interface that enhances overall system usability for both faculty members and administrators.

1.4 Theoretical Framework

The development of the enhanced PUP Taguig Faculty Loading and Scheduling System (FLSS) is grounded in theoretical concept of the study conducted by Raymundo et al. (2016) titled *Development of an Automated Faculty Loading, Room Utilization, Subject and Student Scheduling System (AFLRUS4) for Bulacan Polytechnic College* which offers insights and evidence that reinforce the key theoretical concepts underpinning the FLSS, with a particular focus on the aspects of automation, efficiency, and data management.

The findings of Raymundo et al. provide tangible evidence of the positive impact of automation on the scheduling processes within an academic institution. The AFLRUS4 system demonstrated the capability to streamline intricate scheduling tasks, showcasing a reduction in manual effort. This aligns seamlessly with the theoretical concept of efficiency embedded in the FLSS framework. The study illustrates how the implementation of an automated system not only expedites scheduling procedures but also minimizes the likelihood of errors, contributing to a more streamlined and error-free allocation of faculty resources. Furthermore, the study by Raymundo et al. highlights the practical importance of system flexibility within an FLSS. Academic environments are dynamic, subject to changes in faculty availability, student enrollment, and course requirements. The AFLRUS4 system's adaptability to such changes underscores the necessity for a flexible FLSS that can accommodate the evolving needs of an academic institution. This flexibility aligns closely with the theoretical framework's emphasis on optimizing faculty resources by ensuring that the FLSS can adjust to the dynamic nature of academic operations.

1.5 Conceptual Framework

The *Optimizing Faculty Workload Management: A Revamped Approach for PUP Taguig's Faculty Loading and Scheduling System* aims to improve the overall performance of this system for all users. This study is inspired by the Input-Process-Output (IPO) model for enhancing the Scheduling and Loading system. It enables users to add new curricula, access availability schedules, store data in the database, and experience a seamlessly user-friendly interface while using this system.

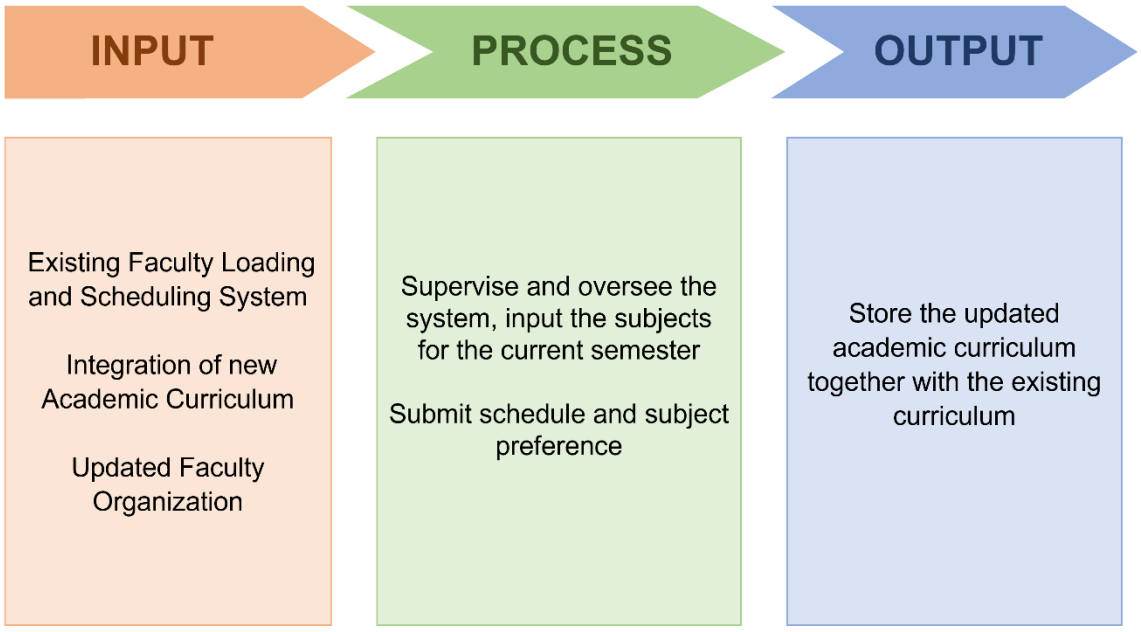


Figure 4. Input-Process-Output Model of the PUPT Faculty Loading and Scheduling System

1.6 Objectives

This study titled aims to transform the current faculty workload management and class scheduling processes at PUP Taguig. The project will introduce a comprehensive and innovative approach to address the existing challenges faced by administrators.

This revamped system will be instrumental in handling the complex task of managing teacher workloads and course scheduling. It will enhance efficiency by introducing features to track faculty members' workloads, designations, and other relevant details. Moreover, the system will facilitate the creation of printed reports summarizing faculty members' workloads, streamlining administrative tasks for each semester and summer throughout the academic year.

General Objectives:

The overarching goal of this project is to enhance the efficiency and effectiveness of faculty workload management and class scheduling at PUP Taguig. By introducing a more comprehensive and innovative approach, the enhanced system aims to provide administrators with a powerful tool to navigate the intricacies of faculty workload and scheduling.

Specific Objectives:

In pursuit of optimizing the Faculty Loading and Scheduling System, the project is set to achieve key milestones, as outlined in the following objectives:

- *Curriculum Adaptability:* To develop features that enable the system to handle both old and new curricula, ensuring adaptability to evolving academic programs. This ensures the adaptability of the system to

evolving academic programs and supports the dynamic integration of emerging courses.

- *Framework Migration and System Enhancement:* To enhance the system's capabilities by modernizing its underlying architecture while concurrently enhancing the system's overall capabilities. This involves migration from Yii PHP to LARAVEL framework, strengthening performance, security, and maintainability to meet contemporary standards.

- *User Interface Redesign:* To revamp the user interface and achieve a more intuitive, modern, and user-friendly design. Ensure adherence to accessibility standards, aiming to provide a user-centric experience for administrators using the system.

1.7 Scope and Delimitation

This study focuses on implementing specific key enhancements to the existing PUP Taguig Faculty Loading and Scheduling System. These enhancements include the integration of the new curriculum, migration to the LARAVEL framework, and a redesign of the user interface for improved usability and accessibility. Academic stakeholders such as Academic Administrators, Curriculum Developers, and Faculty Members who interact with the system will be primary involved. Their experiences and feedback are crucial for evaluating the effectiveness of the enhancements. The scope also includes the measurement and analysis of system performance metrics, such as response time, resource utilization, and overall efficiency. These metrics will provide quantitative insights into the impact of the enhancements.

On the other hand, this study is limited to the Faculty Loading and Scheduling System within PUP Taguig and does not extend to other systems or departments within PUP Taguig nor any other PUP branches; integration with external systems beyond the scope of faculty loading and scheduling process will not be addressed in this research. While security features will be implemented and evaluated in the enhanced system, the study does not involve ethical hacking or extensive security testing beyond the scope of system evaluation.

The study does not extend to a long-term impact assessment of the enhanced system beyond the immediate post-implementation phase. The focus is on the initial evaluation and user feedback. Furthermore, this study also acknowledges that certain technical limitations may exist, such as hardware constraints or compatibility issues with the legacy system. These constraints may influence the implementation of certain enhancements.

1.8 Significance of the Study

A system capable of seamlessly and efficiently loading and scheduling is crucial for professors. Having such a system implemented in PUP-Taguig holds significant importance for the institution's performance and operation. Specifically, the following will benefit from the enhancement of the PUP Taguig Faculty Loading and Scheduling System:

Academic Administrators: Academic administrators will experience streamlined decision-making processes for faculty workload allocation, resulting in a balanced and optimized distribution of teaching assignments.

Curriculum Developers: Curriculum developers will benefit from an enhanced system capable of seamlessly integrating new curricula. This ensures that course offerings align with emerging academic standards, providing a more relevant and engaging learning experience for students.

Faculty Members: Faculty members will enjoy an improved user experience and increased efficiency in managing their teaching assignments. The redesigned user interface and enhanced functionalities contribute to higher satisfaction and a more user-friendly interaction with the system.

Students: Students will indirectly benefit from the optimized faculty loading and scheduling system. A well-organized and efficiently managed system contributes to a smoother academic environment, potentially reducing scheduling conflicts and ensuring a more consistent learning experience.

Accreditation Bodies: Accreditation bodies responsible for evaluating the academic quality of the institution may benefit indirectly from a system that ensures compliance with accreditation standards through efficient faculty assignment and curriculum integration.

Information Technology (IT) Personnel: IT personnel responsible for system maintenance will benefit from the migration to the LARAVEL framework, which provides a more modern, scalable, and maintainable technological infrastructure. This ensures easier maintenance and future adaptability.

Future Researchers and Developers: The findings and best practices established in this study serve as a valuable resource for future researchers and developers in the field of academic administration. The study contributes to the body of knowledge on the integration of research findings into the technological enhancement of educational systems.

1.9 Definition of Terms

PUP Faculty Loading and Scheduling System: The existing administrative platform employed by the Polytechnic University of the Philippines (PUP) for the assignment of teaching responsibilities to faculty members and the scheduling of academic courses.

Curriculum Integration: The process of seamlessly incorporating new academic programs, courses, or modifications into the existing system to ensure alignment with educational goals and accreditation standards.

LARAVEL Framework: A PHP web application framework used for the development of robust and scalable software solutions, chosen for its advanced features, security, and flexibility in enhancing the PUP Faculty Loading and Scheduling System.

User Interface Redesign: The comprehensive overhaul of the graphical user interface (GUI) of the system, aiming to improve accessibility, usability, and overall user experience for Academic Administrators, Curriculum Developers, and Faculty Members.

Conflict Detection and Resolution: The implementation of automated features within the system to identify and resolve scheduling conflicts, ensuring the efficient allocation of faculty resources without overlaps or inconsistencies.

Efficiency: In the context of this study, efficiency refers to the system's ability to streamline processes, reduce manual interventions, and optimize the allocation of faculty resources and course scheduling.

Adaptability: The system's capacity to easily incorporate changes, updates, and new requirements, allowing it to evolve and remain relevant in response to the dynamic nature of educational programs and administrative needs.

User Satisfaction: The overall contentment and positive experiences of Academic Administrators, Curriculum Developers, and Faculty Members interacting with the enhanced system, measured through surveys, feedback, and user testimonials.

System Performance Metrics: Quantitative measures used to assess the performance of the PUP Faculty Loading and Scheduling System, including but not limited to response time, resource utilization, and overall operational efficiency.

Modernization: The process of incorporating contemporary technologies, methodologies, and design principles into the system to enhance its functionality, security, and user experience.

Academic Environment: The encompassing atmosphere and conditions within the educational institution, shaped by administrative processes, resource allocation, and the interaction between faculty and students.

CHAPTER 2

REVIEW OF RELATED LITERATURE AND STUDIES

2.1 Introduction

This chapter aims to provide a comprehensive understanding of the existing relevant literature and studies related to the development and implementation of faculty loading and scheduling systems in the context of higher educational institutions. The following studies showcase the efficient distribution of faculty responsibilities, and the creation of optimal scheduling systems are essential components in fostering a conducive academic environment. This review will lay the groundwork for the rationale, theoretical framework, and methodologies employed for this study.

2.2 Faculty Workload Optimization and Scheduling Systems

The study of Abed (2021) titled *Development Of A Faculty Workload Management System Using Optimization Algorithms* addresses the prevalent concern of faculty workload imbalance in Jordan Universities by proposing a novel Faculty Workload Management System (FWMS) utilizing optimization algorithms. Recognizing the inherent efficiencies of manual scheduling, the FWMS leverages genetic algorithms to meticulously assign courses to faculty members, considering their expertise, preferences, and pre-defined workload limits. This innovative approach demonstrably reduced the number of overloaded faculty members, contributing to improved faculty well-being and potentially enhanced student learning outcomes. Abed's study emphasizes the critical roleof accurate data and user acceptance in ensuring the successful implementation and sustained efficacy of such systems within academic institutions.

In their research work titled *ClassSchedule: A Web-Based Application for School Class Scheduling with Real-Time Lazy Loading*, Nuengwong et al. (2018) introduced an innovative method to address the complexities associated with class scheduling in educational institutions. The study delves into the intricate management of resources, encompassing teachers, students, subjects, classrooms, and periods, and highlights the inherent limitations of traditional manual scheduling methods employing pens and paper. The authors underscore the insufficiencies of existing software and algorithms in meeting the diverse demands imposed by distinct departments and overarching school policies. In response to these challenges, they developed *ClassSchedule*—a sophisticated web-based application utilizing technologies such as PHP, HTML, CSS, AJAX, JavaScript, and MySQL. This advanced tool represents a departure from conventional approaches, streamlining the scheduling process and providing educators with the capability to schedule classes and access real-time data seamlessly. Key features of *ClassSchedule* include the facilitation of collaborative scheduling among multiple department representatives, allowing for simultaneous editing of scheduling data and real-time assessment of resource collisions.

Meanwhile, the Development of Online-Class Scheduling Management System Conducted by the Case Study of Department of Social Science: Faculty of Humanities and Social Sciences Suan Sunandha Rajabhat University" by Wipada Chaiwchan and Patcharee Klinhom, explores the intricacies of implementing an online-class scheduling management system. The study places a primary emphasis on enhancing the efficiency and convenience of class scheduling procedures for educators and students alike. Executed as a web-based application, the system is meticulously developed using PHP as the programming language and MySQL as the designated database management system. The research delves into the nuanced nature of class scheduling, taking into account factors such as course quantities, student volumes, and the specific

physical attributes of individual classrooms. The scholarly discourse unfolds by highlighting the transformative role of information technology in shaping educational paradigms and facilitating communication. The authors illustrate how technology, particularly online scheduling systems, streamlines class schedule management, benefiting both faculty and students. The study further investigates the application of genetic algorithms in solving complex scheduling challenges, showcasing their effectiveness in reducing complexity, saving labor time, and minimizing costs. Methodologically, the research employs a comprehensive evaluation strategy, incorporating Black-Box testing and obtaining feedback from both experts and general users. The positive outcomes of the evaluation affirm the system's high satisfaction levels among users, indicating its potential for effective implementation in authentic educational settings. In summary, the study underscores the profound significance of technologically-driven solutions, exemplified by the online-class scheduling management system, in improving educational processes and meeting user requirements.

Faculty members are at the forefront in every learning institution. They teach and nurture the minds of students. The tasks of faculty members are not only limited to teaching; they check the large volume of test papers, which add burden to their work. This is due to the reason that faculty members handle as much as fifteen teaching loads every semester. The more teaching loads, the higher the salary they received (Etcuban, 2013) This study emphasizes the pivotal role of faculty members within educational institutions. These professionals are responsible for educating and guiding students, and their duties extend beyond teaching. They also have to manage a significant volume of test papers, which contributes to their workload. This added burden is notably high because faculty members typically handle up to fifteen teaching assignments per semester. Interestingly, their compensation often correlates with the number of teaching assignments they undertake, meaning that higher teaching loads lead to increased salary, as mentioned by Etcuban (2013).

2.3 Historical Perspectives on Manual Scheduling

Miranda (2010) explained that a university, historically, subjects were scheduled its courses and assigned classrooms manually by trial and error, a slow and tedious process with average execution times that had ballooned to four weeks. In the article entitled Solving the Problem in timetabling (2010), typically, a manual solution requires expert attention and can take many weeks for large educational establishments. Moreover, because of the problem complexity, planners are not always able to make the best decisions, building schedules that are inconsistent with teaching requirements and do not satisfy all teachers' needs. Miranda's (2010) study reveals the historical reliance of universities on manual methods for scheduling courses and assigning classrooms, a slow and laborious process that involved trial and error, taking an average of four weeks for execution. This manual approach, as detailed in

"Solving the Problem in Timetabling" (2010), demanded expert attention and often consumed numerous weeks, particularly in larger educational institutions. However, due to the intricate nature of the task, planners encountered difficulties in making optimal decisions. Consequently, the resultant schedules frequently fell short in meeting teaching requirements and satisfying the diverse needs of teachers, highlighting inconsistencies and inefficiencies within the scheduling system in educational settings.

2.4 University Scheduling Challenges: A Philippine Context

Baccay & Cabahug (2019) address the multifaceted challenges of university scheduling in the Philippines. Their Class Scheduling and Faculty Loading System (CSFLS) utilizes a modified particle swarm optimization algorithm to generate efficient schedules, considering course requirements, room availability, faculty

preferences, and minimizing conflicts. The study extends its optimization scope beyond workload management to include classroom utilization, showcasing its potential for broader resource optimization within universities. While recommending further testing and user training for enhanced adoption and user satisfaction, Baccay & Cabahug's work demonstrates the effectiveness of optimization algorithms in addressing complex challenges in university scheduling.

In a study conducted by Botangen (2016), Central Luzon State University struggles with challenges in their manual scheduling system, encompassing the laborious task of organizing classes, recurrent delays in finalizing schedules, and errors leading to conflicts. Face-to-face discussions among registrars are essential for conflict resolution yet hindered by geographical distances and varying priorities among units. To tackle these hurdles, the university adopted a web-based Class-Scheduling system, integrating technologies like Apache, PHP/HTML/JavaScript, and MySQL, fostering collaboration among dispersed registrars. This innovative system operates through block, room, and faculty scheduling categories, streamlining outcomes to create a cohesive schedule. Despite challenges like delays and conflicts, the system's integration of compatible outcomes ensures a comprehensive and optimized scheduling solution.

According to Louie et al. (2018), in their paper titled "Predictive Analytics Implementing Genetic Algorithm on Class Scheduling System," concerns related to faculty course-loading and student accommodation at Trimex Colleges in Laguna, Philippines are addressed. With a notable increase in student population, there is a need for an efficient class scheduling and faculty course-loading system. The primary objective of this study is to develop a system capable of swiftly generating class schedules and faculty course-loading while predicting the demand for course sections based on data from previous terms. Their study introduces an inclusive

system that integrates predictive analytics and genetic algorithms to address challenges associated with class scheduling and faculty course loading at Trimex Colleges. The system's efficiency lies in its ability to swiftly generate class schedules and faculty course loading, resulting in substantial time and resource savings. Furthermore, the system exhibits predictive capabilities, anticipating the need for course sections by leveraging insights derived from historical data. The results of the software evaluation attest to the system's success in achieving the outlined objectives, positioning it as a valuable tool for Trimex Colleges.

In an article by Ortega et. al (2015) titled, *Online Class Scheduling and Faculty Loading System within a Decision Support Framework*, they discussed the challenges faced by academic department heads in creating course schedules to accommodate student enrollment needs. The study focuses on developing a class scheduling and loading system using a knowledge-based approach, heuristic functions, and rule sets within a decision support framework. The goal is to optimize available resources, such as classrooms and faculty, and enhance the efficiency of the scheduling process. The research identifies key processes in creating course schedules, including regular offerings, checking teacher availability, and allocating breaks.

Constraints, such as room availability, faculty preferences, and workload considerations, are highlighted. The study emphasizes the importance of aligning faculty members with their qualifications and preferences, contributing to the overall effectiveness of the scheduling process. The article introduces an online system prototype that allows for data entry, room availability checks, and faculty assignment validation, aiming to streamline the scheduling and loading procedures. Overall, the research concludes that the developed online system is feasible and recommends continuous improvement and maintenance for enhanced functionality and

adaptability to evolving constraints and requirements. The translated outcome of the study is an operational web system used by the University of Cebu-Banilad Campus for class scheduling and faculty loading, contributing to better resource management and overall efficiency.

2.5 Synthesis and Relevance to the Current Study

The reviewed literature and studies present a comprehensive landscape of faculty workload optimization and scheduling systems in the higher education context, each offering unique insights and approaches. Drawing upon these studies is essential to establish a foundation for the rationale, theoretical framework, and methodologies applied in the current study titled "Optimizing Faculty Workload: Enhancing the PUP Taguig Faculty Loading and Scheduling System." The synthesis of these works provides valuable perspectives on the challenges faced by academic institutions and the innovative solutions devised to address them.

In examining Abed's (2021) Faculty Workload Management System (FWMS) and Nuengwong et al.'s (2018) ClassSchedule, the integration of optimization algorithms emerges as a crucial component in achieving efficient faculty assignments and streamlined class scheduling. These studies collectively advocate for the adoption of genetic algorithms to meticulously match faculty expertise, preferences, and workload limits, resulting in improved well-being for faculty members and potentially enhanced student learning outcomes.

The exploration of technology-driven solutions by Chaiwchan and Klinhom (2014) and Ortega et al. (2015) adds another layer to the synthesis. The implementation of web-based scheduling systems showcases the transformative impact of technology on educational processes. Leveraging PHP, HTML, CSS, AJAX, JavaScript, and MySQL, these systems not only streamline class schedule

management but also provide real-time data access and collaborative scheduling features. The technological emphasis resonates with the contemporary landscape of educational technologies, aligning with the overarching goal of our study to enhance the PUP Taguig Faculty Loading and Scheduling System.

Miranda's (2010) historical perspective on manual scheduling serves as a crucial reminder of the challenges faced by universities in the past. The slow and error-prone nature of manual processes, taking weeks for execution, emphasizes the need for modern, efficient solutions. Our study acknowledges this historical context and endeavors to propel the PUP Taguig Faculty Loading and Scheduling System into a new era of effectiveness.

Addressing challenges specific to the Philippine context, Baccay & Cabahug's (2019) CSFLS, Botangen's (2016) case study on Central Luzon State University, and Louie et al.'s (2018) predictive analytics approach for Trimex Colleges underscore the multifaceted issues faced by Philippine universities. These challenges range from laborious manual scheduling systems and recurrent delays to the need for predictive analytics in accommodating a growing student population. Our study, focusing on PUP Taguig, aligns with these contextual challenges and endeavors to provide tailored solutions that consider the unique dynamics of the Philippine higher education landscape.

The synthesis of these diverse studies reinforces the significance of our research objectives in optimizing the PUP Taguig Faculty Loading and Scheduling System. By integrating optimization algorithms, adopting technology-driven solutions, acknowledging historical challenges, and addressing specific Philippine contextual issues, our study aims to enhance the existing system. The infusion of a new

curriculum, migration to a new framework, and revamping the user interface align with the evolving landscape of educational technologies and best practices identified in the literature. The insights gained from these studies will guide the implementation and evaluation phases of our proposed enhancements, ensuring a more robust and efficient faculty workload optimization and scheduling system at PUP Taguig.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter outlines the systematic approach undertaken to conduct the research, providing a comprehensive overview of the research design, data sources, construction of research instruments, data generation procedures, ethical considerations, and the proposed structure of the system under investigation.

3.1 Research Design

This study adopts a quantitative research design, focusing on the systematic collection and analysis of numerical data to assess the impact of enhancements to the Polytechnic University of the Philippines Taguig Faculty Loading and Scheduling System. The quantitative research design emphasizes objective measurement, statistical analysis, and structured data collection methods to evaluate specific metrics related to system performance, efficiency, and user satisfaction.

3.1.1 Quantitative Measures:

The research design involves the quantification of key variables through structured surveys and questionnaires. Participants, including academic administrators and faculty members, will provide numerical responses using Likert scales and closed-ended questions. The survey instruments are designed to capture quantitative data on user satisfaction, perceived system efficiency, and overall feedback on the enhanced features.

3.1.2 System Performance Metrics:

Objective metrics related to system performance, response time, and resource utilization will be automatically collected by the enhanced system. These quantitative measures aim to assess the impact of the enhancements on the technical aspects of the Faculty Loading and Scheduling System. Data generated by the system, including log files and analytics, will serve as crucial sources for quantitative analysis.

3.2 Research Instrument

In this study, the research instrument is crafted in accordance with the ISO 25010 standard, a comprehensive framework for evaluating software product quality and system performance. ISO 25010 outlines a set of quality characteristics and sub-characteristics crucial for assessing the efficiency, usability, and reliability of software systems. Specifically, the research instrument employed in this study takes the form of structured surveys and questionnaires. These instruments are designed to align with internationally recognized criteria for software quality, as outlined in the ISO standard, ensuring a systematic and rigorous evaluation of the targeted aspects of software performance.

3.2.1 ISO 25010 Quality Characteristics:

The research instrument will focus on the following ISO 25010 quality characteristics, tailored to the specific context of the enhanced Polytechnic University of the Philippines (PUP) Faculty Loading and Scheduling System:

1. **Performance Efficiency:**

- *Aspect of Focus:* Evaluation of system performance metrics, including response time and resource utilization.

- *Instrumentation:* Automated tracking of response time, system-generated metrics related to efficiency, and participant feedback on perceived system speed and responsiveness.

2. **Usability:**

- *Aspect of Focus:* Assessment of user interface design, accessibility, and overall user experience.
- *Instrumentation:* Structured surveys and questionnaires based on ISO 25010 sub-characteristics such as learnability, operability, and user satisfaction. These instruments will gather quantitative data on user perceptions of the system's usability.

3. **Reliability:**

- *Aspect of Focus:* Evaluation of system stability, accuracy, and error handling.
- *Instrumentation:* Automated collection of system-generated data on error rates and reliability. Surveys will also include questions related to users' experiences with system reliability.

3.2.2 Data Collection Methods:

The research instrument employs a combination of automated system metrics and participant responses through surveys and questionnaires. The system will automatically generate data related to performance and reliability, while structured surveys will capture user perceptions aligned with the ISO 25010 usability characteristics.

3.2.3 Structured Surveys and Questionnaires:

Structured surveys and questionnaires will be designed based on ISO 25010 guidelines to gather quantitative data from participants. These instruments will include Likert scales and closed-ended questions, enabling participants to provide numerical feedback on specific aspects of system performance, usability, and reliability.

By adopting ISO 25010 as the foundation for the research instrument, this study ensures a systematic and internationally recognized approach to assessing the enhanced PUP Faculty Loading and Scheduling System. The chosen quality characteristics guide the instrument development, facilitating a comprehensive evaluation of the software product's performance and user satisfaction.

3.3 Data Gathering Procedure

The researchers employed a comprehensive data gathering approach, primarily utilizing structured interview with key stakeholders, specifically the school director. These interview, guided by a specific protocol, explored participant past experiences, challenges, and expectations regarding to the previous faculty loading and scheduling system. In-depth interviews with the school director, the primary end-user, and the system developer provided valuable insights into user perspectives and technical aspects. Additionally, purposive sampling was applied to carefully select faculty members involved with the system, ensuring diverse perspectives. This multifaceted data collection strategy, combining structured interviews with strategic ones and purposive sampling, allowed for a thorough understanding of the faculty loading and scheduling system at PUP Taguig, informing the proposed optimized approach.

3.3.1 Sampling Method

This study employs a purposive sampling method to select participants who possess specific expertise and roles within the academic community of Polytechnic University of the Philippines (PUP). Purposive sampling is a deliberate and non-random method chosen to target individuals with in-depth knowledge and experience relevant to the faculty loading and scheduling system. In this section, we detail the rationale behind choosing purposive sampling and provide insights into the selection criteria.

3.3.1.1 Rationale for Purposive Sampling

Expertise and Experience:

The primary objective of this research is to gain insights from individuals who hold key roles in the academic administration and faculty at PUP. Academic administrators, responsible for overseeing and managing faculty resources, and faculty members, who directly engage with the faculty loading and scheduling system, possess critical expertise and experience relevant to our study. Purposive sampling allows us to intentionally target individuals with specific knowledge about the existing system and, if applicable, those who will interact with the enhanced system.

Targeted Perspectives:

By selecting participants purposefully, we aim to capture a diverse range of perspectives within the academic community. This includes individuals from different departments, varying levels of experience, and distinct roles within academic administration and faculty. The targeted perspectives contribute to a more comprehensive understanding of the faculty loading and scheduling

system, ensuring that insights are reflective of the diverse nature of the academic community at PUP.

Overall, purposive sampling serves as a strategic approach to ensure that our study benefits from the rich insights of individuals with specific roles and experiences within the academic community at PUP. While acknowledging the intentional selection process, the study aims for diversity within the chosen participant group to enhance the robustness and generalizability of our findings.

3.4 Ethical Considerations

Prior to conducting interviews, the researchers obtained explicit consent from the school director, our primary client, seeking permission to engage in the study. The consent process included a detailed explanation of the study's purpose, procedures, and the confidential nature of the information to be gathered. An agreement was established with the school director, affirming that all details obtained during the research process would be treated with the utmost confidentiality and would solely remain within the research team. This commitment aligns with the principles of ethical conduct and the requirements of the Republic Act No. 10173, known as the Data Privacy Act. Furthermore, the researchers ensured that the personal information of all participants, particularly faculty members, was handled with strict confidentiality to protect their privacy and adhere to ethical standards.

3.5 System Architecture

The system architecture serves as a conceptual framework illustrating the operational dynamics of the system. It also serves as a representation of the system. It stands as essential instrument in offering a comprehensive perspective of the overall system structure.

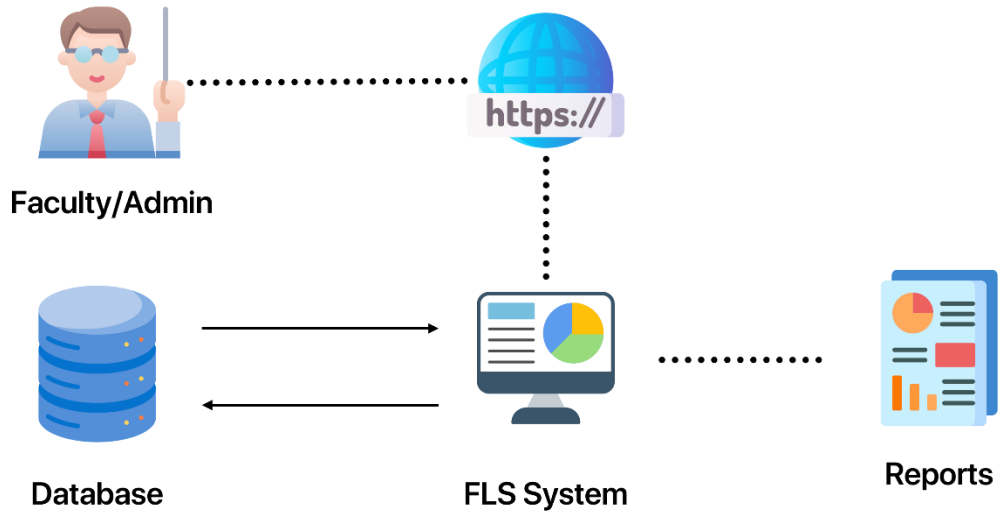
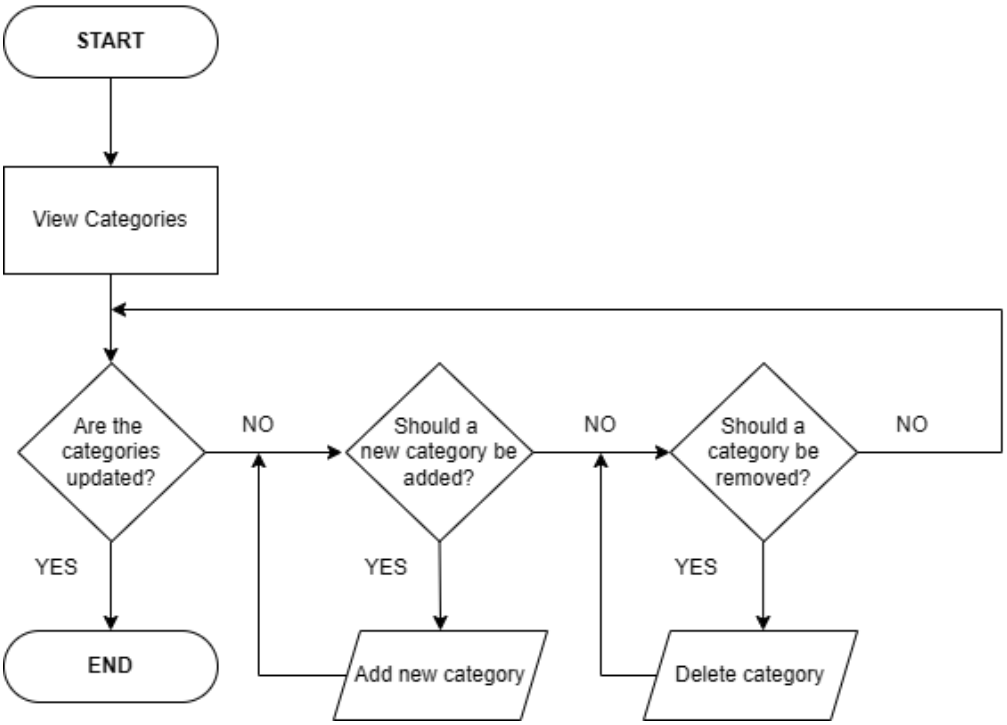


Figure 5. System Architecture

This illustration depicts the interaction between the faculty members, administrator and the Faculty Loading and Scheduling system. The administrator is responsible for overseeing the system using a computer. The system uses the raw data stored in the database server to make sure that the necessary information is properly registered. Faculty members have the ability to see important details and reports through the system.

3.5.1 System Flowchart

Figure 6. Category Management Module



This flowchart outlines the steps for managing college subjects within a system or database. It begins with viewing existing categories (subjects), then checks if they're updated. If not, it evaluates whether to add or remove subjects. The process loops back to viewing categories

Figure 7. Course Management Module

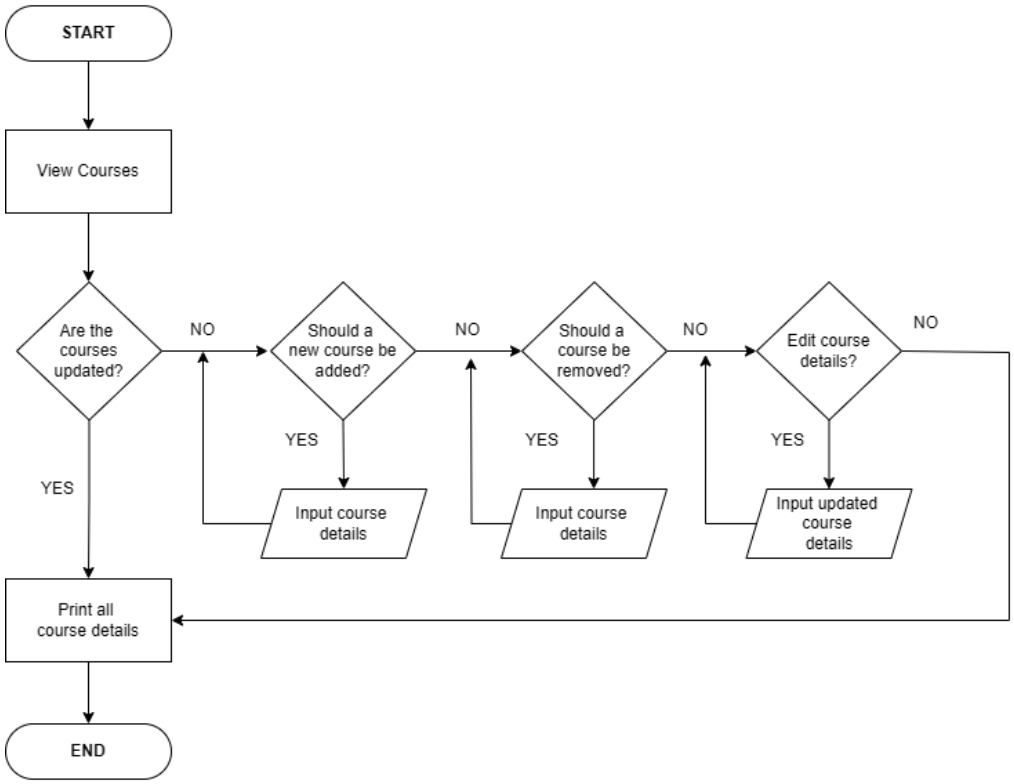


Figure 7 depicts the process for updating course details in an educational system. It starts with viewing courses, followed by decisions to add, remove, or edit course details based on their current status, with loops back to the initial step to ensure all courses are up-to-date

Figure 8. Curriculum Management Module

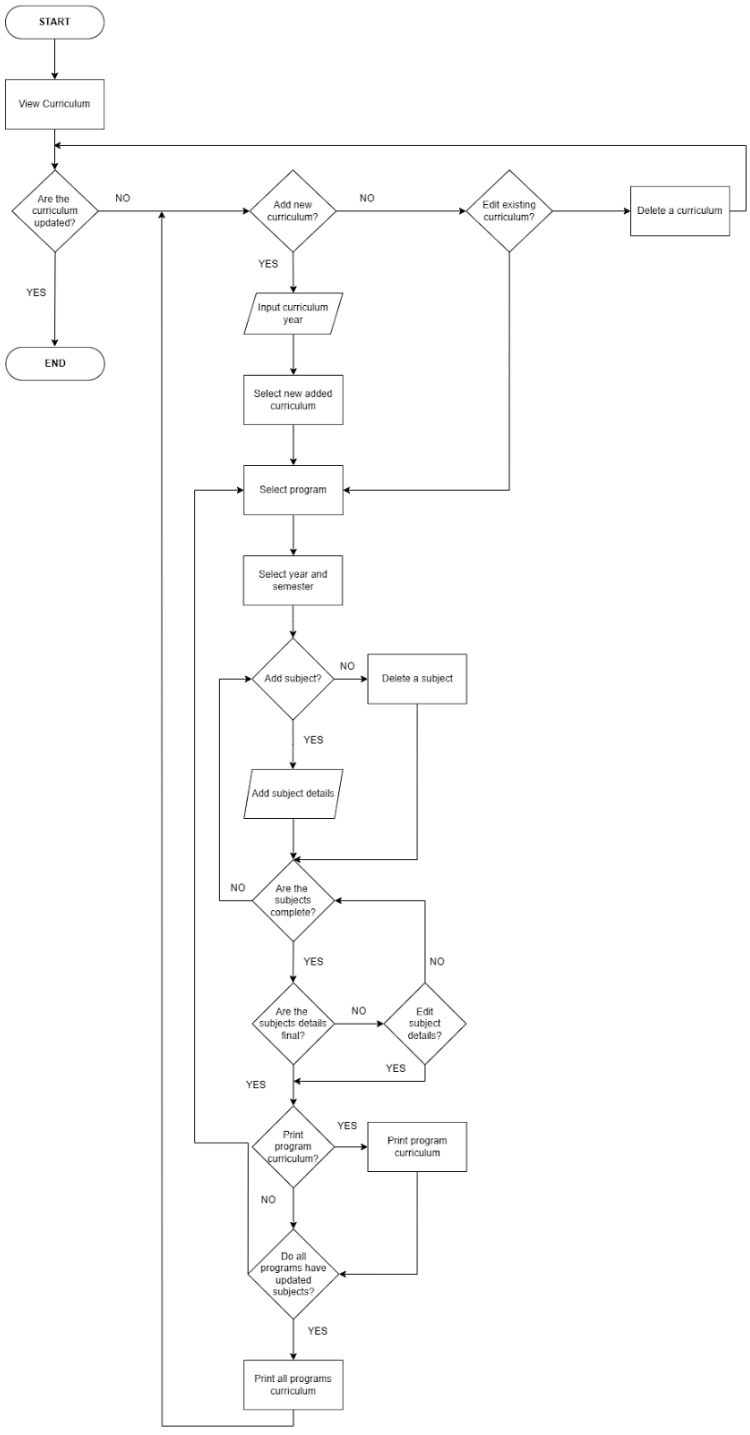


Figure 9. Colleges Management Module

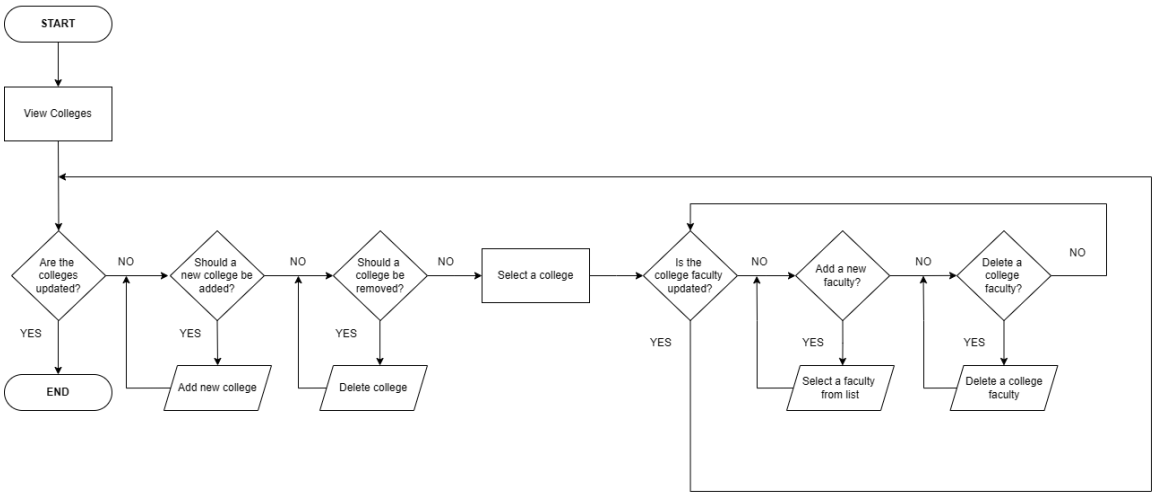
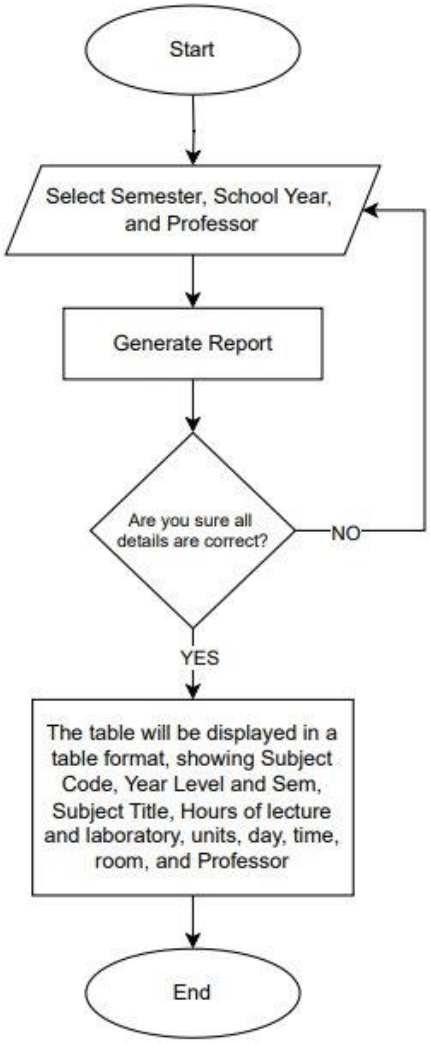


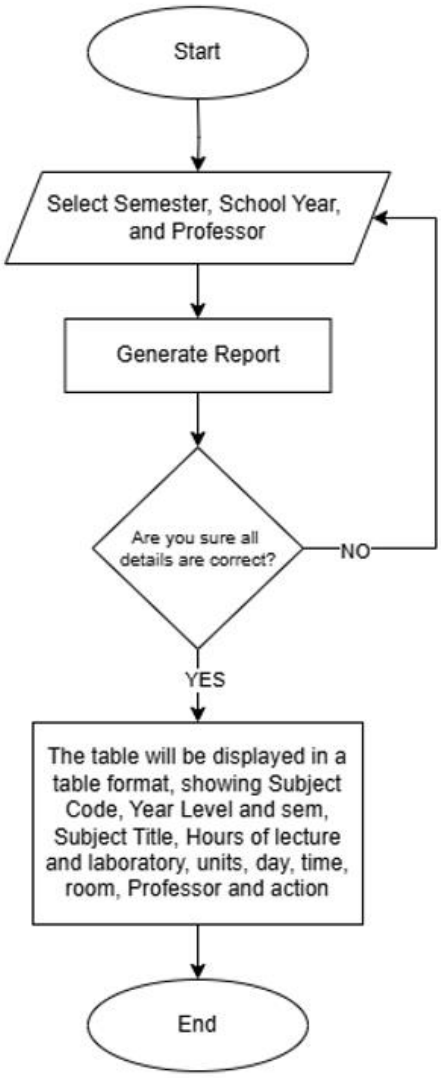
Figure 9 outlines a systematic approach to managing college data, starting with an initial review of colleges. It then guides users through a series of decisions to determine if updates, additions, or deletions are needed, and includes steps for selecting specific colleges or faculty when necessary. The process concludes once these actions are completed.

Figure 10. Faculty Daily Schedule



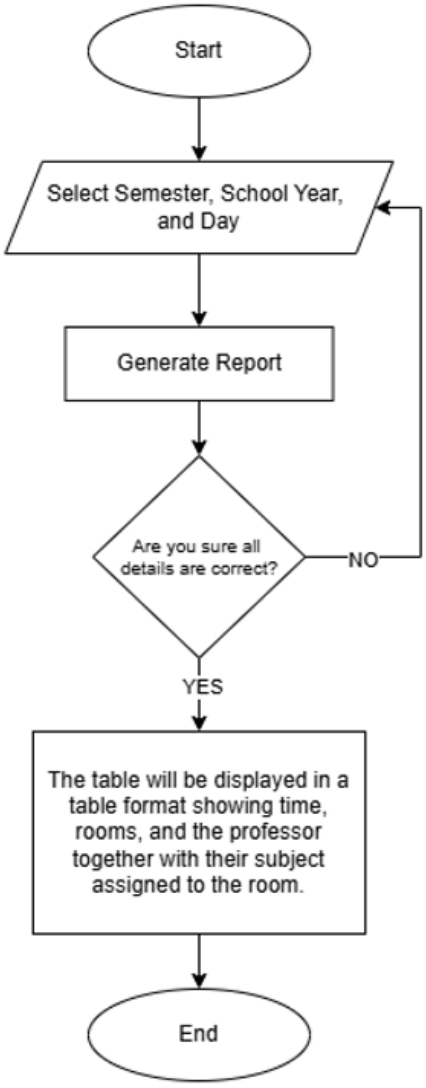
This flowchart outlines the steps for managing faculty daily schedules within a system. It begins with selecting the semester, school year, and professor. The process then generates a report and verifies if all details are correct. If not, it returns to the selection step. Once confirmed, the schedule is displayed in a table format showing subject code, year level, subject title, hours of lecture and laboratory, units, day, time, room, and professor. The process ends with the display of the table.

Figure 11. Faculty Daily Schedule



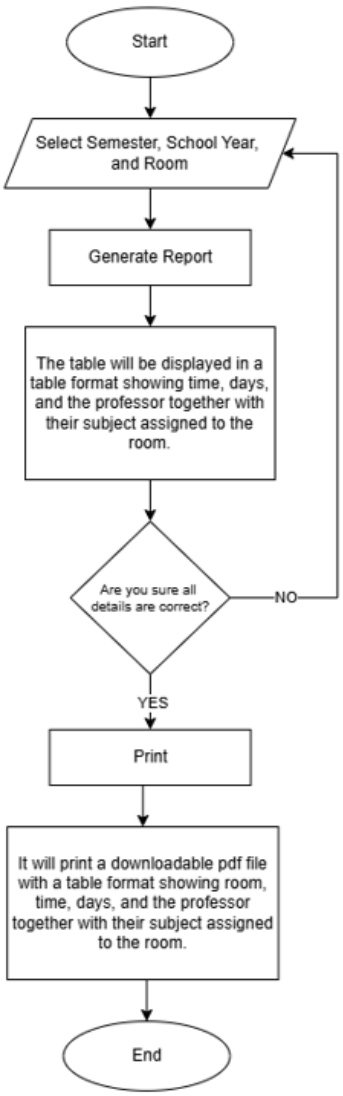
This flowchart outlines a systematic approach to managing room control. It begins with selecting the semester, school year, and day. The process then generates a report and prompts the user to verify the details. If updates are needed, it returns to the selection step. Once confirmed, the schedule is displayed in a table format showing time, rooms, professors, and their assigned subjects. The process concludes with the final display of the table.

Figure 12. Room Control



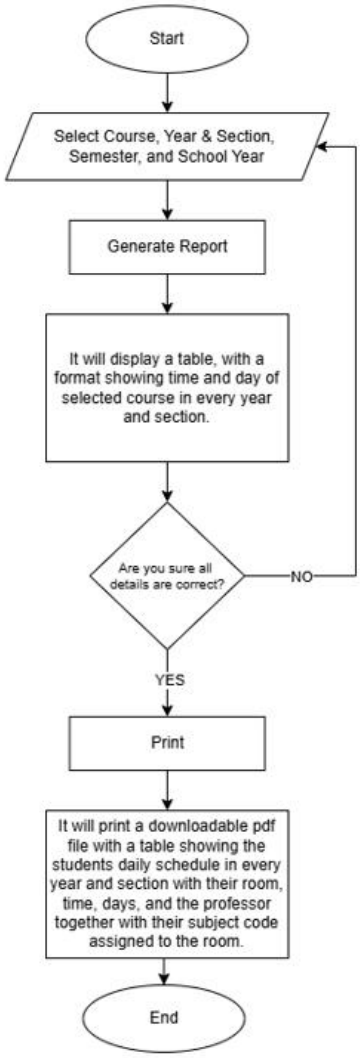
This flowchart outlines a process of managing room daily schedules. It begins with selecting the semester, school year, and room. The process then generates a report and displays the table showing time, days, and the professor with their assigned subjects. Users are prompted to confirm the details. If corrections are needed, it returns to the selection step. Once confirmed, the system prints a downloadable PDF with the detailed schedule. The process concludes with the final printout.

Figure 13. Room Daily Schedule



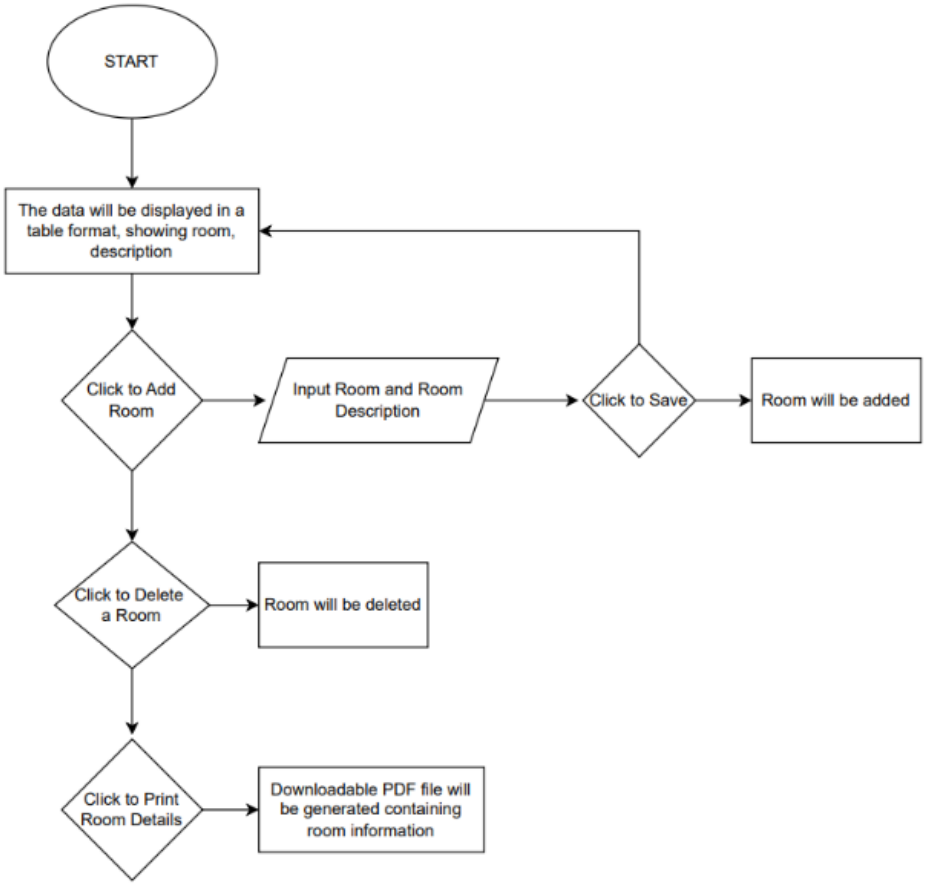
This flowchart outlines the process of managing room assignments. It begins with selecting a semester, school year, and the room. It then generates a report, and the review of the report to make sure all details are correct. If yes, it will print a downloadable pdf of the generated report with the subject assigned room and the scheduled professor.

Figure 14. Student Daily Schedule



This flowchart outlines the process of managing student daily schedules. It begins with selecting the course, year and section, semester, and school year. The process then generates a report and displays a table showing the time and day of selected courses for each year and section. Users are prompted to confirm the details. If corrections are needed, it returns to the selection step. Once confirmed, the system prints a downloadable PDF with the student's daily schedule, including room, time, days, and the professor with their assigned subject. The process concludes with the final printout.

Figure 15. Room Management



This figure depicts the process for managing rooms in a system. It starts with displaying data in a table format, followed by decisions to add, remove, or print room details. Adding a room involves inputting the room details and saving them, while removing a room will delete it from the system. Printing room details generates a downloadable PDF with the room information. The process loops back to the initial step to ensure all room data is current.

Figure 16. Set School Year and Sem

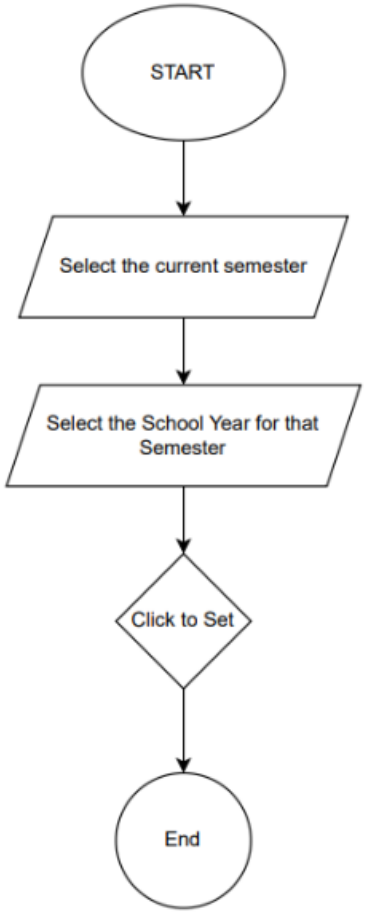


Figure 16 depicts the process for setting the school year and semester in an academic system. It starts with selecting the current semester, followed by selecting the corresponding school year for that semester. The process is completed by clicking to set these details, marking the end of the procedure.

Figure 17. Subject Management

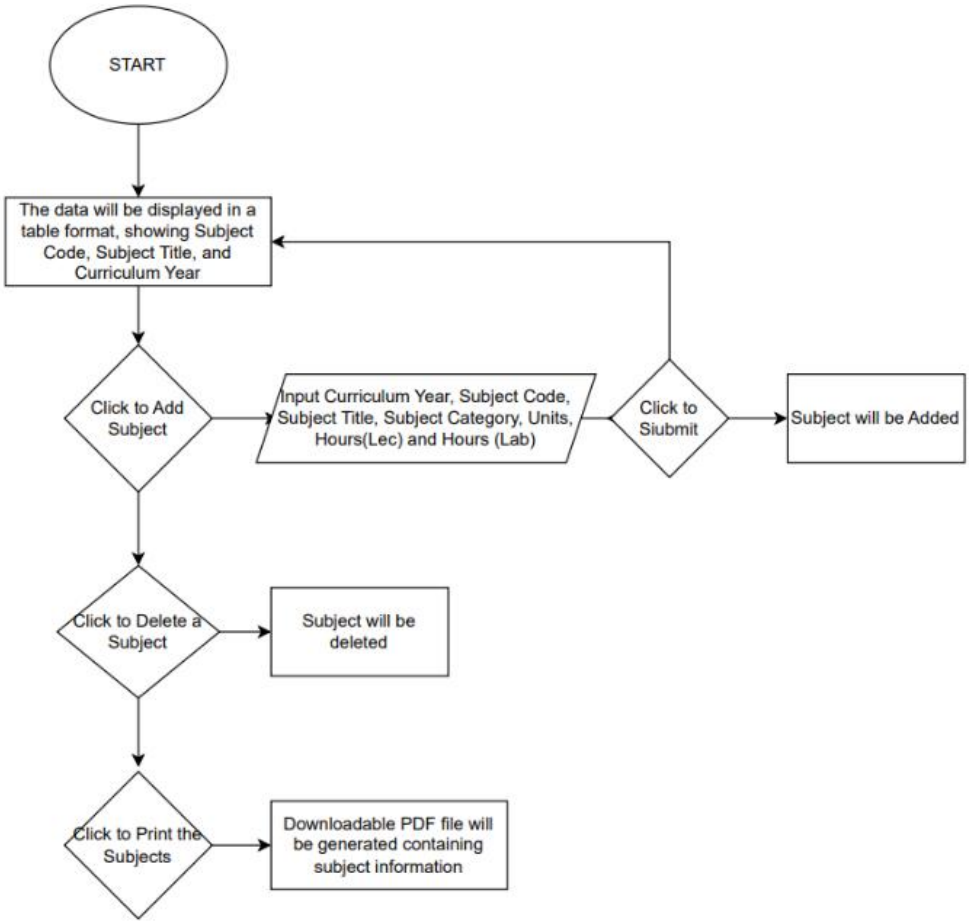


Figure 17 outlines the steps for managing subjects within a system or database. It begins with displaying data in a table format, showing Subject Code, Subject Title, and Curriculum Year. Users can then decide to add a subject, inputting details like Curriculum Year, Subject Code, Subject Title, Subject Category, Units, Lecture Hours, and Lab Hours, followed by submitting the information to add the subject. Alternatively, users can choose to delete a subject, which will remove it from the system, or print subject details, generating a downloadable PDF file with the subject information. The process loops back to displaying the updated data in the table format.

Figure 18. Teaching Assignment Units

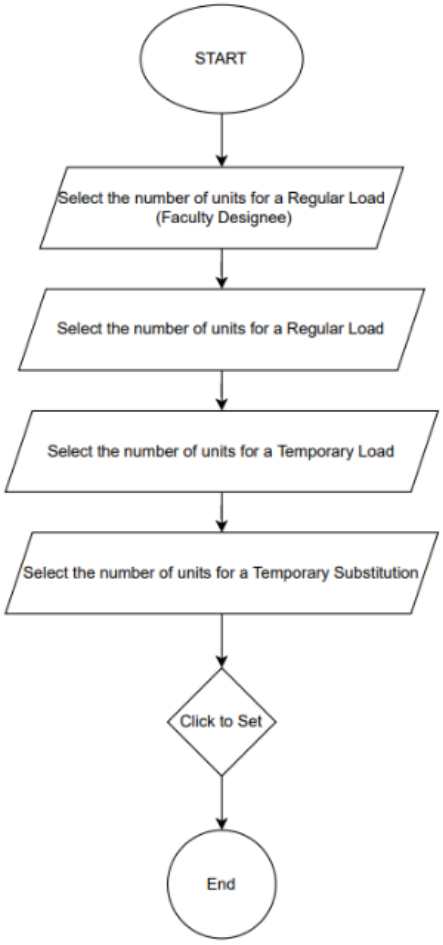


Figure 18 outlines the process for assigning teaching units within a system. It starts with selecting the number of units for a Regular Load (Faculty Designee), followed by selecting the number of units for a Regular Load, then for a Temporary Load, and finally for a Temporary Substitution. The process is completed by clicking to set these assignments, marking the end of the procedure.

3.5.2 Database Design

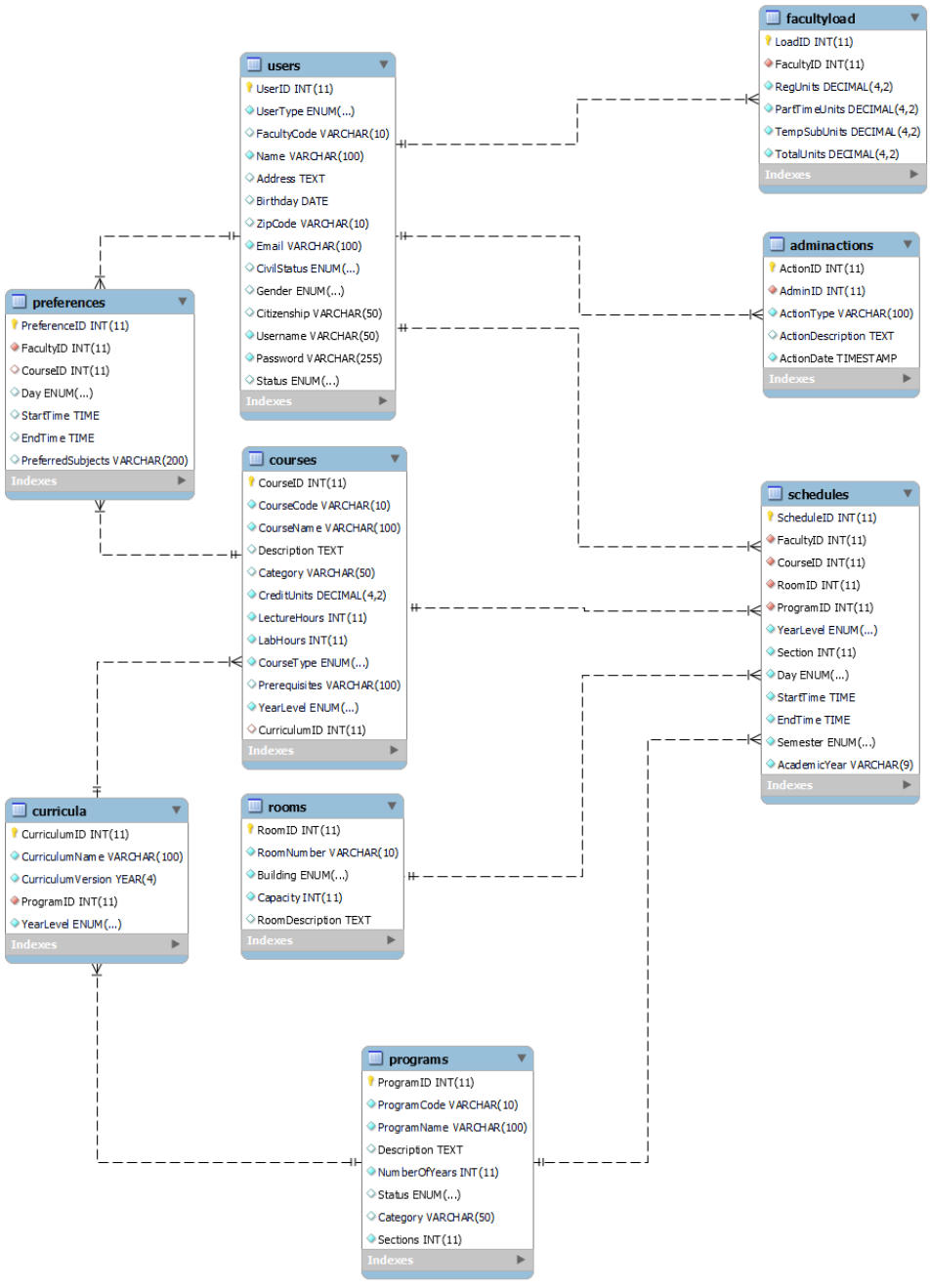


Figure 19: The new database design

3.6 Functional Specifications

This section includes the system boundaries of the proposed system which are shown through a use case diagram.

3.6.1 System Boundaries

The PUP-Taguig will employ the Faculty Loading and Scheduling system, utilizing data and processes compiled by the group. This system is designed to handle administrative tasks and manage details and transactions for both administrators and professors. Use-case diagram was a vital tool in helping developers define the requirements for the system. It provides insight into how each subsystem communicates and outlines the necessary flow of transactions.

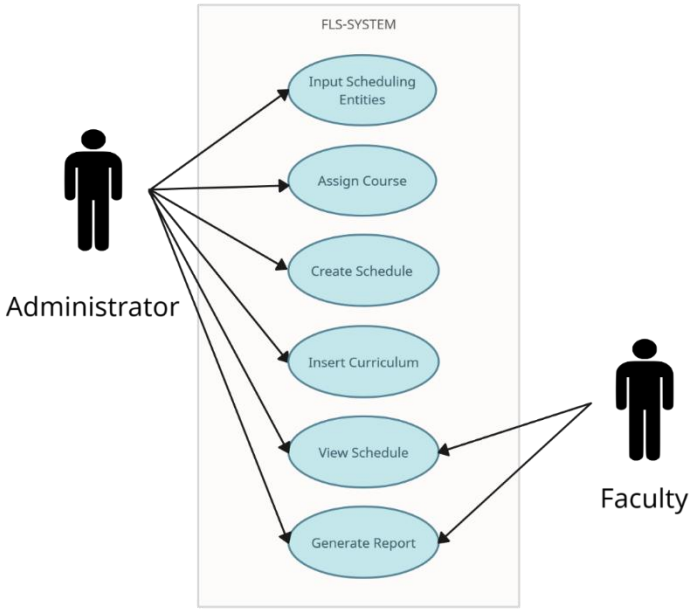


Figure 20: Use Case Diagram for Administrator and Faculty users of the enhanced PUP Taguig Faculty Loading and Scheduling System

3.7 Development Methodology

3.7.1 Process Model

With this project, researchers are using the Agile Methodology to develop the system's needs. The Agile Methodology assists the team in handling changing requirements and delivering high-quality products that meet or exceed our clients' expectations. The first step is the planning phase, during which researchers gather all the needed data related to the project, requirements from the client, and all the data and other elements necessary to start the project. The second phase involves designing, wherein researchers create plans based on the first phase. After designing, the third phase involves development based on the planning and designing phases from both previous stages. Testing occurs after the development phase and includes functional testing, user acceptance testing, and end-to-end testing. Releasing takes place after all the testing succeeds without errors or problems. During this phase, researchers implement the system and accept feedback from the client and target users, marking the beginning of the feedback phase. Using this model in developing a system helps researchers create a more effective and efficient solution for the client's main problems.

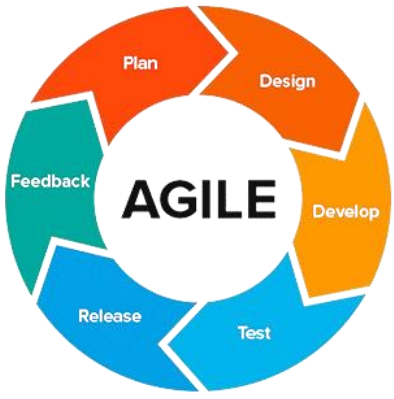


Figure 21. Process Model – Agile Development

3.7.2 Quality Plan

The objective of the quality management plan is to outline the procedures and activities required to ensure the system's quality is met and achieved. In the context of the PUPT Faculty Loading and Scheduling System project, the following steps will be taken to fulfill the client's needs and adhere to system requirements:

- *Review of Documents:* The aim is to verify if the document aligns with the system's functions and requirements. This involves reading the document, checking sources, and ensuring the accuracy of all involved data.

- *Code Review:* This step is intended to identify and rectify oversights made during the initial development phase. The purpose is to prevent the presence of unstable code that could negatively impact the system's processes, fostering continuous improvement.

- *System Testing:* Ensuring that the system meets the specified requirements outlined in the document is the focus of system testing. This step also aims to confirm that the system operates smoothly as intended. Detailed test cases will be written and executed to assess each feature of the system.

For an accurate evaluation of the system to be developed, researchers will use a survey based on ISO 25010, the International Standard for Software and Data Quality. This standard serves as a guide for creating a high-quality software product.

Below is a list of characteristics to consider when developing quality software:

- Functionality
- Reliability
- Usability
- Efficiency

- Compatibility
- Security
- Maintainability

3.8 Validity and Reliability

The success and credibility of any research study hinge on the robustness of its data, requiring a meticulous examination of both validity and reliability. In this section, we delve into the strategies and measures implemented to ensure the trustworthiness of the study outcomes.

3.8.1 Validity

Internal Validity: To ensure the internal validity of this study, rigorous measures have been implemented to accurately measure the impact of enhancements to the Polytechnic University of the Philippines (PUP) Faculty Loading and Scheduling System. The following steps have been taken:

1. **Alignment with Research Objectives:**

- All data collection instruments, including surveys and automated system metrics, have been meticulously designed to align with the specific research objectives. This ensures that the gathered data directly contributes to addressing the research questions and testing the study hypotheses.

2. **ISO 25010 Framework:**

- The research instrument, particularly the surveys, is structured based on the ISO 25010 standard to evaluate software product quality. By aligning with internationally recognized criteria for software quality, the study enhances the internal validity of the collected data.

3. **Pilot Testing:**

- Prior to full-scale implementation, the research instruments underwent pilot testing with a small group of participants. Feedback from the pilot study facilitated refinement and ensured that the instruments effectively measure the intended constructs.

3.8.2 Reliability

Consistency and Stability: Reliability measures have been implemented to ensure the consistency and stability of the research findings. Key steps taken include:

1. **Structured Surveys:**

   - The structured surveys employ established scales and standardized questions, contributing to the reliability of responses. Likert scales, for instance, offer a consistent format for participants to express their opinions.

2. **Automated System Metrics:**

   - The use of automated system metrics, such as response time and error rates, ensures objective and consistent measurements of system performance. These metrics contribute to the overall reliability of the technical assessments.

3. **Pilot Testing and Calibration:**

   - Pilot testing not only served as a validity check but also allowed for the calibration of the instruments to enhance their reliability. Adjustments were made based on the pilot study outcomes to ensure that the instruments consistently measure the intended variables.

3.8.3 Addressing Potential Bias

Mitigation Strategies: Recognizing the potential for bias in the research process, the study incorporates several strategies to minimize and address bias:

1. **Transparent Communication:**

- Participants are provided with clear and transparent communication regarding the purpose of the study, the voluntary nature of their participation, and the unbiased intent of the research.

2. **Diverse Participant Selection:**

- Purposive sampling is employed to intentionally select participants based on specific roles and expertise. However, efforts have been made to ensure diversity within the chosen group, minimizing the risk of bias in participant perspectives.

3. **Anonymous Data Collection:**

- Responses collected through surveys are anonymized to encourage honest and unbiased feedback. Participants are assured that their responses will be kept confidential, fostering an environment conducive to open and unbiased input.

4. **Continuous Monitoring:**

- Throughout the data collection process, the research team actively monitors for potential sources of bias. Any identified issues are promptly addressed to maintain the integrity of the study.

By addressing potential sources of bias and implementing measures to enhance both validity and reliability, this study aims to produce robust and

trustworthy findings that contribute meaningfully to the understanding of the enhanced PUP Faculty Loading and Scheduling System.

3.9 Development Tools and Technologies

In the pursuit of creating an effective and robust system, careful consideration was given to the selection of development tools and technologies. This section provides a general overview of the overarching technological framework employed in the creation of the PUP Taguig Faculty Loading and Scheduling System. The choices made in this realm were driven by a combination of factors, including project requirements, scalability, maintainability, and alignment with industry best practices.

3.9.1 Software Development Framework

The enhancement of the Polytechnic University of the Philippines (PUP) Faculty Loading and Scheduling System involves the adoption of the Laravel framework. Laravel, a robust and widely-used PHP framework, is chosen for its versatility, scalability, and adherence to modern software development practices. The Laravel framework provides a solid foundation for implementing the necessary upgrades and ensuring a seamless integration of the new curriculum.

3.9.2 Database Management System

The study employs MySQL as the primary database management system for storing and retrieving data related to faculty loading, scheduling, and curriculum information. MySQL is recognized for its reliability, performance, and ease of integration with Laravel, making it a suitable choice for managing the system's database.

3.9.3 Front-End Development Technologies

The user interface (UI) redesign component of the study leverages cutting-edge front-end development technologies to elevate visual aesthetics and enhance the overall user experience. The careful selection of these technologies aims to create a responsive, engaging, and intuitive interface. The key front-end development technologies employed in this study include:

1. **HTML5/CSS3:**
    - HTML5 and CSS3 form the core building blocks for structuring and styling the user interface. These technologies provide flexibility and responsiveness for a seamless experience across devices.
2. **JavaScript**
    - JavaScript is employed to implement dynamic and interactive elements within the user interface. This ensures a modern and user-friendly design.

3.9.4 Version Control and Collaboration

Git is employed as the version control system to manage the source code and facilitate collaborative development. The use of Git allows for efficient tracking of changes, collaboration among team members, and the ability to roll back to previous versions if needed.

3.9.5 Project Management

For effective project management and collaboration, the study utilizes Notion. Notion provides a comprehensive and flexible platform for project planning, task management, and collaboration, enabling the development team to organize work seamlessly and enhance communication.

3.9.6 Hosting and Deployment

Hostinger is selected as the hosting and deployment platform for the enhanced system. Hostinger offers reliable and cost-effective hosting solutions, ensuring the availability and accessibility of the system for end-users. The deployment process is streamlined through Hostinger's infrastructure, contributing to a smooth and efficient release of updates.

3.9.7 Security Measures

Security is a paramount consideration in the development process. The study incorporates industry-standard security practices and tools, including:

SSL/TLS Encryption:

- Secure Sockets Layer (SSL) and Transport Layer Security (TLS) encryption are implemented to secure data transmission between the user interface and the server.

3.9.9 Testing Tools

To maintain the quality and reliability of the enhanced system, various testing tools are employed, including PHPUnit for unit testing, Laravel Dusk for browser testing, and Postman for API testing. These tools collectively contribute to a comprehensive testing strategy that ensures the functionality and performance of the system.

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