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BACHELOR OF SCIENCE IN COMPUTER SCIENCE

ENROLLMENT MANAGEMENT SYSTEM
WITH TREND ANALYSIS BY DEPARTMENT
USING EXTREME GRADIENT BOOSTING ALGORITHM

A Thesis Project Presented to the Faculty of College Department

Westbridge Institute of Technology, Inc.

In Partial Fulfillment of the Requirements for the Degree of

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by

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APPROVAL SHEET

In partial fulfillment of the requirements for the Degree of Bachelor of Science in Computer Science, this research entitled **ENROLLMENT MANAGEMENT SYSTEM WITH TREND ANALYSIS BY DEPARTMENT USING EXTREME GRADIENT BOOSTING ALGORITHM**, has been prepared and submitted by **JOHN LESTER B. CASTILLO** and **LOVELY J. CLAREON,** and is hereby recommended for approval as their thesis proposal.

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DEDICATION

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ABSTRACT

This thesis presents the development and implementation of an Enrollment Management System (EMS) with Trend Analysis by Department, utilizing the XGBoost algorithm, for Westbridge Institute of Technology, Inc. (WITI). The study aims to enhance existing enrollment procedures by addressing areas where manual processes may benefit from improved efficiency, accuracy, and data-driven support. The proposed EMS streamlines core administrative workflows—including student registration, payment verification, grade viewing, and enrollment evaluation—while incorporating predictive analytics to forecast enrollment trends and support academic program assessment.

By leveraging the XGBoost machine learning algorithm, the system analyzes historical enrollment data to provide timely and actionable insights for institutional planning and strategic decision-making.

System performance was assessed using ISO/IEC 25010 software quality standards, with user feedback indicating high levels of satisfaction in terms of functionality, reliability, and usability. The results suggest that the system contributes to reducing administrative workload, improving data accuracy, and strengthening the foundation for proactive and informed institutional decisions. The study highlights the value of integrating intelligent automation with responsible human oversight to support the evolving needs of educational institutions.

Keywords: *Enrollment Management, Trend Analysis, Extreme Gradient Boosting, Machine Learning, Predictive Analytics*

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CHAPTER I

INTRODUCTION

PROJECT CONTEXT

Westbridge Institute of Technology, Inc. (WITI) is open to adopting innovation and improving technological capabilities for better administrative operations. At the time of the study, enrollment management processes were manual, involving student registration, enrollment verification, payment receipt tracking, and grades viewing. These processes were all carried out using paper-based forms and recorded using Excel spreadsheets. Although these kinds of traditional methods had been functional in earlier years, as the technology continued to progress, they became increasingly inefficient and redundant as student enrollment continuously grew each year. Because of these, common issues such as difficulty locating specific records, students' repetitive form completion, and unnoticed errors—such as incorrect payment entries—contributed to delays in enrollment processes and became administrative burdens.

The institution's reliance on manual processes increased the likelihood of continuously having endless human errors, especially as the volume of student records expanded, and because of this, the administrative staff devoted substantial time to managing these records and resolving discrepancies, while the students experienced repeated steps that delayed the enrollment process. These limitations impacted the overall effectiveness of operations and demanded more required additional time and resources for correction and not able to trace those correction changes made. Given these challenges, the researchers recognized the need for WITI institutions to transition from manual processes to a technology-assisted enrollment management system that could resolve these challenges.

One significant limitation of the existing manual approach processes that the institution is practicing is the absence of a centralized and structured system for tracking specific student records and analyzing relevant data for enrollment. And because of the absence of data-driven tools, administrative decision-making has often become reactive, like in identifying at-risk academic program/s. This reactive decision-making process causes the institution to have delayed interventions and missed opportunities for early support, which, in turn, affects student retention, academic performance, and overall program effectiveness.

To resolve these existing challenges, the researchers developed an Enrollment Management System (EMS) with department-level trend analysis capabilities, which was designed to digitize enrollment processes like ensuring an organized record-keeping and establishing audit trails for payment-receipt tracking changes made. Additionally, the system integrated XGBoost-based predictive analytics to forecast enrollment trends and identify at-risk programs for proactive decision-making of the institution. Additionally, the system integrated XGBoost-based predictive analytics to forecast enrollment trends and identify at-risk programs for proactive decision-making of the institution. Additionally, the proposed system has visualization tools such as threshold analysis and at-risk monitoring for supporting data interpretation, making sure that the system is aligned with WITI's goals of institutional innovation and operational excellence.

PURPOSE AND DESCRIPTION

The purpose of this study was to design, develop, and implement an Enrollment Management System (EMS) with Trend Analysis by Department for Westbridge Institute of Technology, Inc. (WITI) to transition the institution's manual enrollment processes- student registration, enrollment verification, payment-receipt tracking, and grade viewing, into a technology-assisted system to minimize human errors, reduce administrative workloads, and improve the overall management of enrollment processes.

To resolve the challenges of the manual processes, the researchers developed the EMS to offer a structured platform for recording, managing, and verifying student data for enrollment. The system was designed to minimize repetitive tasks of the registrar, accounting, professors, and students through digitalized data entry, automated data retrieval, organized record-keeping, and automated audit trails for payment transactions. These features were intended to improve both administrative accuracy and transparency and have smoother and a more efficient processes across departments.

This study developed a system with machine learning that predicts student enrollment trends and identifies at-risk academic programs through historical data analysis. The system also provided actionable forecasts to guide the institution in planning enrollment decisions. Visualization modules such as Department Trends, Threshold Analysis, and At-Risk Student Monitoring were also integrated to present overall insights in a clear, user-friendly format, to help the stakeholders or institution to respond proactively in making academic plans.

Key Users of the System

The EMS system was designed to support a range of users: superadmin, registrar admin, accounting admin, professors, and students. These users are tied with specific roles and responsibilities involved in the enrollment process at Westbridge Institute of Technology, Inc. (WITI).

The researchers identified the following key users:

- **Superadmin** – The superadmin had full access to all system admin side functionalities. In addition, the superadmin is the only user type that can create admin user accounts and assign roles such as registrar admin, accounting admin, professor, or additional superadmin accounts. However, neither the superadmin nor any user type can create student accounts, as students are required to register and submit applications through the system independently because students’ data are crucial for enrollment processes and data analysis.
- **Registrar Admin** – The registrar admin is responsible for managing student registration, enrollment verification, grades viewing, and enrollment evaluation. This user performs all enrollment-related tasks except those involving payment.

- **Accounting Admin** – The accounting admin is responsible for handling recorded and verified payment – receipt data. The system was designed for payment-receipt tracking only and did not include any kinds of point-of-sale (POS) integration requested by the institution.
- **Professors** – The professors are responsible for uploading student grades, which are essential for enrollment evaluation because having accurate and timely grade submissions directly influenced students' eligibility for enrollment.
- **Students** – The students represent the largest group of the system users. They can access the system to complete registration, view their grades, and monitor their enrollment status throughout each academic term without needing to repeatedly go to the administrative offices.

Key Features of the System

The researchers designed the Enrollment Management System (EMS) to provide role-specific functionalities, making sure that workflow is digitally organized across different administrative offices.

The features were categorized by department as follows in the next page:

Admin Office

- User Account Creation Module – Accessed by superadmin and allows the creation of admin user accounts and the assignment of roles such as registrar admin, accounting admin, professor, or additional superadmin except student accounts.
- Settings Module – Accessed by superadmin and enables the setup of academic year, ID format, FAQ, and campus branches.
- Enrollment Setup Module – Accessed by superadmin, can manage the configuration of enrollment parameters such as program/strand, courses/subjects, curriculum, and schedule.
- Payment Setup Module – Accessed by superadmin, can assign amounts for tuition, miscellaneous fees, and other fees involving enrollment only.
- Trend Analysis by Department Module – Accessed by superadmin, can provide insights into enrollment trends by department to assist in proactive academic planning.

Registrar Office

- Registration Module – Accessed by registrar admin or superadmin, both can handle the students' registration applications, documents' checklists and overall approval of registration applications to be enrolled.

- Enrollment Module – Accessed by the registrar admin or superadmin, both can manage student enrollment processing, including clearance, document checklists, grades evaluation, and overall enrollment approval.
- Grades Viewing Module – Accessed by registrar admin or superadmin, both can control grades viewing access. Also allows professors to upload grades and students to view their grades when allowed.

Accounting Office

- Payment–Receipt Tracking Module – Accessed by accounting admin or superadmin; both can verify and record payment-receipt transactions and view receipt logs for auditing and verification purposes. Also allows students to submit receipts for tuition/s or any other enrollment-related payment-receipts.

These system module features were designed to be aligned with WITI's institutional requirements and goals of technological innovation and operational excellence. By adopting a data-driven, digitally supported approach, the EMS enhanced enrollment management, improved institutional planning, and enabled early interventions that contributed to better student outcomes.

OBJECTIVE OF THE STUDY

The researchers recognized the need of Westbridge Institute of Technology, Inc. (WITI) to transform its manual enrollment process into a modern, technology-assisted Enrollment Management System (EMS). The system was designed to simplify workflows, enhance efficiency, and enable proactive, data-informed decision-making by digitizing enrollment procedures and integrating predictive analytics.

General Objective:

The general objective of this study was to develop an Enrollment Management System (EMS) with Trend Analysis by Department for Westbridge Institute of Technology, Inc. (WITI) that digitalized existing enrollment processes and used the data for analysis to help proactive planning.

Specific Objectives:

1. **To digitize essential enrollment processes.** The EMS system is designed for student registration, enrollment verification, payment-receipt tracking, and grades viewing to remove repeated or redundant tasks, reduce human errors and detect the changes made using an audit trail, and support staff oversight like deciding whether to approve or not, which only happens when it is appropriate and needed.

2. **To build predictive models using the XGBoost algorithm.** The Trend Analysis by Department part of the system does the processing of historical enrollment data to generate predictions of future student enrollment trends across departments, which are SHS and College.
3. **To derive actionable insights from XGBoost prediction results.** The researchers analyzed the outputs of the trained XGBoost model to identify student's patterns and aggregate results to have enrollment trends and identified at-risk academic programs that can help institutional stakeholders to come up with the data-driven proactive decision-making.

To assess the overall system's functionalities and effectiveness, a live demonstration of the EMS was carried out and then the researchers' conducted surveys among IT-related students or Computer Science students or even students that have prior experience in manual enrollment. The survey system evaluation was guided by the ISO 25010 software quality model, which includes criteria such as functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, flexibility, and safety. The predictive component, powered by the XGBoost algorithm, was evaluated using metrics such as accuracy, precision, recall, and F1-score to determine its effectiveness in forecasting enrollment trends.

SCOPE AND LIMITATION

The researchers developed the Enrollment Management System (EMS) for Westbridge Institute of Technology, Inc. (WITI) with a goal in mind to modernize the institution’s enrollment processes. The researchers designed the system to improve efficiency, accuracy, and accessibility across core administrative functions while still maintaining human oversight in key validation steps like approval of enrollment and deciding when to switch on grades viewing. The EMS is composed of the following main features: student registration, enrollment verification, payment-receipt tracking, grades viewing, and trend analysis by department to identify at-risk students and provide intervention suggestions.

The EMS facilitated student registration by providing a digital platform where students could input personal information, select academic programs or Senior High School (SHS) strands, and track document submission requirements. Even though students were still required to submit physical copies of documents, the system has a feature that offered a document checklist to help the registrar in monitoring compliance. And as human intervention, authorized personnel remained responsible for verifying documents to maintain data integrity in all enrollment transactions.

As a countermeasure, the researchers wanted to ensure continuity during offline periods, so the researchers incorporated an Optical Character Recognition (OCR) feature, enabling the registrar user to capture data from physical enrollment forms using a camera so by the time an online connectivity was restored, the system could process and integrate the captured data into the central database, eliminating redundancy during enrollment cycles.

Eligibility verification was handled by comparing student-provided data against institutional criteria. While the system automated much of this process, final verification remained under staff supervision to ensure full compliance with academic and institutional requirements. The system also presented a consolidated view of student enrollment status, allowing administrators to make informed decisions more efficiently.

Payment tracking was included to confirm that students met financial requirements prior to enrollment approval. While the system supported payment verification and maintained receipt records for audit purposes, it did not perform complex financial tasks such as tax computation, point-of-sale integration, or ledger-based accounting. Its role was limited to confirming payment submissions, maintaining transparency, and assisting with payment-related inquiries.

The Grade Viewing module allowed students to access their academic records once faculty submitted and verified grades. This feature was controlled by administrative settings and could be enabled or disabled depending on institutional policy. The EMS did not compute or alter grades; all grading processes remained the responsibility of the academic department. Student access to grades was also dependent on faculty submission schedules, which could occasionally cause viewing delays.

The system’s predictive analytics component employed the XGBoost algorithm to analyze historical enrollment data by department. This enabled the identification of patterns and trends that supported strategic planning. Although XGBoost provided effective forecasting, it may have had reduced accuracy in accounting for unforeseen variables such as sudden policy shifts or global disruptions. Despite this limitation, the insights generated assisted in anticipating fluctuations in student enrollment and guiding resource allocation.

Trend analysis by department allowed WITI to identify which programs experienced consistent growth or decline. These insights supported decisions related to faculty assignment, classroom utilization, and program offerings. Moreover, the system allowed administrators to respond proactively to emerging trends by adjusting admissions strategies, enhancing curriculum offerings, or launching targeted outreach efforts

This study contributed to improving WITI's enrollment processes by addressing issues such as inefficiencies in manual data handling, document verification errors, and delays in financial confirmation. By introducing technological tools while retaining necessary human oversight, the EMS reduced administrative burdens and supported a more student-centered service model.

Strategically, the system's analytics features enhanced institutional planning by forecasting enrollment shifts, thereby informing staffing decisions, classroom capacity planning, and academic development. The centralized database also improved data accessibility and reduced dependency on paper-based workflows.

Beyond practical implementation, this study contributed to educational technology by demonstrating the effectiveness of machine learning (XGBoost) and enrollment management in digitalizing institutional operations. The researchers believed that the EMS provided a scalable model for digital transformation in enrollment systems within similar academic settings.

While the EMS did not eliminate the need for human involvement, it significantly enhanced enrollment management processes at WITI, providing a more structured, data-driven, and responsive system that benefited both staff and students.

CHAPTER II

REVIEW OF RELATED LITERATURE AND STUDIES

TECHNICAL BACKGROUND

The researchers developed an Enrollment Management System for Westbridge Institute of Technology, Inc. (WITI) to improve overall operational processes with the help of a technology-assisted solution. The EMS system part was developed using Laravel (PHP) for backend services and React for the frontend interface. Using HTML, CSS, and JavaScript ensured a responsive and user-friendly design across different devices. Where Laravel handled the data processing and the user authentication, MySQL served as the primary database system ran through localhost during system testing and development and was deployed and tested on Hostinger's cloud platform to ensure reliability, scalability, and centralized access to all branches.

To visualize enrollment patterns and trends, Chart.js was used in the frontend, enabling administrators to easily monitor department-level data and assess institutional needs. Version control and collaboration were managed through GitHub, allowing continuous development and deployment among the research team.

The predictive analytic part of the system is using the Extreme Gradient Boosting (XGBoost) algorithm, which analyzed historical enrollment data to forecast trends by department. These predictions were served through a RESTful API and visualized in real time using Chart.js, and Flask Python for the backend which handled supporting evidence-based decisions for staffing, program adjustments, and resource planning [1], [2].

In the research conducted by Patungan and Francia [1], they highlighted the value of machine learning models in predicting enrollment rates using actual applicant data and validating the feasibility of integrating such algorithms in local higher education institutions. Similarly, Sahagun [2] demonstrated how predictive analytics aided in selecting qualified engineering freshmen through the application of XGBoost, providing further justification for its use in the EMS.

To enrich the model's accuracy and interpretability, the researchers incorporated in the system the techniques for identifying feature importance within XGBoost. Supported by Goyal et al. [4] who discussed how understanding feature interactions improved model transparency and allowed the decision-makers to gain much clearer insights into the underlying factors that affect enrollment, which can help guide WITI administrators in identifying the key drivers of student interest and program popularity.

The researchers also introduced the use of OCR (Optical Character Recognition) technology to digitize and extract data from physical enrollment forms during offline periods to ensure the continuity of operations even in the absence of internet connectivity so it can be uploaded, processed, and merged easily into the MySQL database afterwards. Similar digitization efforts have proven effective in institutional workflows, as explored by De Guzman et al. [3], who implemented a low-cost analytics tool in student admissions to simplify documentation and speed up evaluation processes.

From an institutional planning perspective, predictive enrollment data played a key role in adjusting course offerings and preventing resource mismatches. As demonstrated in a recent study published in Behavioral Sciences, machine learning approaches could support administrators in forecasting and planning for future enrollment shifts [5]. Likewise, these insights do enable WITI stakeholders to remain proactive in addressing over- or under-enrollment in specific departments, ensuring sustainability and quality of academic delivery.

RELATED LITERATURE AND STUDIES

Nowadays, an enrollment management system is a crucial aspect of educational institutions because it ensures student admissions and academic planning, and they want it to be handled efficiently. In traditional methods, like paper-based applications and manual data entry, can pose challenges in terms of accuracy and timeliness. Like many other institutions seeking to enhance operational efficiency, the researchers believed that WITI also aimed to do so by adopting a technology-driven Enrollment Management System (EMS), especially as technological advancements continue to progress daily and enable the integration of predictive analytics and machine learning to support data-informed decision-making.

In the field of education, several studies have shown that XGBoost, a machine learning algorithm that is known for handling structured data and producing accurate predictions, performed really well in predicting student performance, retention rates, and course demand. It means that it could be used as the enrollment forecasting algorithm in a WITI EMS by analyzing historical data to find patterns and predict future enrollment trends which allows the institution to make proactive planning and decisions.

In this chapter, the researchers reviewed the existing literature and studies on EMS implementations, predictive analytics in education, and the application of XGBoost in various studies and research. By looking at and examining these published works, the researchers established a strong theoretical foundation for developing a technology-driven EMS at Westbridge Institute of Technology, Inc. (WITI), a good sign that the plan is taking the right path.

Advancements in Enrollment Management Systems

The integration of XGBoost can enhance forecasting accuracy while ensuring that human expertise remains central to enrollment management. By using this approach, it allows the institution to transition towards a more data-driven system while maintaining the necessary balance between automation and human oversight. [6]

In the study of Lagman et al., the researcher highlighted how an Online Student Registration System improves the institution’s operational efficiency by simplifying the processes and reducing occurring manual errors, and this study also followed ISO 25010 standards to assess quality attributes such as functionality, usability, and security, which ensures the robustness of the proposed enrollment system. [7]

An enrollment management system designed for private colleges utilizes a structured business logic model, integrating recruitment, admissions, and statistical analysis that simplifies data integration and enhances institutional planning capabilities. [8]

Nuevo, a researcher, also examined the efficiency of the online enrollment system at Davao del Sur State College and assessed its impact on students' experiences. The study used a descriptive approach to evaluate enrollment procedures, reliability, and system usability. It found that automated enrollment significantly reduces processing time and improves data accuracy, highlighting the necessity of technological adoption in academic institutions. [9]

Ichsan et al. developed an Android-based student registration system to improve efficiency in academic settings, to digitized registration, document submission, and ensure a smoother user experience. Their study highlighted the role of mobile applications as part of the education, emphasizing the need for accessible and real-time registration systems in schools or institutions. [10]

The automated enrollment process can register and enroll students in the proper subjects, not permit unauthorized users, and can interact with another system. Aside from this, it can also be accessed in different browsers (e.g., Internet Explorer, Google Chrome) and on other devices (e.g., laptop, smartphone). Nueva Ecija University of Science and Technology students highly praised the system for effectively serving its purpose as an online enrollment platform, surpassing the traditional physical enrollment process. [11]

An automated enrollment system is an effective tool that can save time, which is vital to the busy parent who processes the enrollment of their child. With the automated enrollment procedures implemented, they can be accessed on a desktop or computer and on a cellphone. It can ease the hustle of students and parents in terms of submitting documents for enrollment without leaving their homes. As a result, it can modernize the school in terms of enrollment procedures, which can be a massive advantage for the school's population growth. [12]

Enrollment refers to a student's official registration at an academic institution. While enrollment processing can be complex, it is crucial for both students and institutions. A proposed Web-based Enrollment System with Reservation aimed to improve accuracy in record – keeping and accommodate a higher number of enrollees simultaneously compared to manual registration. In this study, it found that most students and parents possessed devices with reliable internet access which made online enrollment an efficient and viable option for the institutions. [13]

Elizabeth et al. analyzed student records management in Kenyan universities, identifying the challenges faced in transitioning from manual to digital record systems. The study found that electronic records management adoption was only 50%, with many institutions still relying on outdated systems. [14]

Along with the development of technology implemented in the enrollment system, people no longer need to wait in long queues that spend a long-time making payments at the counter or only submitting proof of transfer. [15]

In the study of Purcia and Velarde, they explored the student records management services in private universities; they discovered the need for academic record digitization. Their findings indicated that manual record-keeping led to inefficiencies, which highlighted the necessity of transitioning the manual into an automated enrollment system. [16]

The study compared manual and system-based recording of payments in Sidoarjo. This study highlighted the capabilities of system-based methods in accurately monitoring outstanding debts and providing real-time financial insights, which was unlike how the manual recording worked that relied on handwritten documentation. System-based recording ensured more efficient, and transparent processes with reduced human error in data entry but we cannot ignore the fact that system-based approaches may occasionally face technical issues such as data loss—necessitating verification—these are still manageable and often mitigated through regular backups and system safeguards. Thus, the two methods served complementary roles rather than being interchangeable. [17]

Digital platforms have transformed school information management, improving accessibility and efficiency. Yudana and Prapitasari evaluated a website-based school information system at SMA Negeri 1 Marga Tabanan-Bali, demonstrating its effectiveness in streamlining enrollment processes. The study found that online systems improved accuracy, accessibility, and operational efficiency. [18]

Automating student admissions has become essential in modern education. Francisco proposed a Student's Entry Requirement System for high schools, transitioning from a manual to an automated application process. The system was evaluated using ISO 25010 standards, ensuring quality in functionality and efficiency. This study supported the need for digital transformation in enrollment systems, further reinforcing the use of trend analysis algorithms like XGBoost for data-driven admissions forecasting. [19]

The role of website-based information systems in education is expanding, particularly in enrollment and student records management. Asrin and Utami implemented a web-based school information system for SDN 14 Pontianak City to address inefficiencies in internal communication and student registration. The study used the Waterfall Model, ensuring a structured development process, including context diagrams, data flow diagrams (DFD), and entity relation diagrams (ERD). The implementation significantly improved accessibility to school-related information, particularly for new student registration and academic data management. [20]

Having access to school information is very crucial for having an effective enrollment and student engagement. Par et al. developed a WordPress CMS-based school website for SMA Negeri 1 Poco Ranaka, NTT, aiming to enhance information dissemination and school promotion. The study highlighted the benefits of web-based applications for areas like student registration to achieve transparency in an institution, most especially for schools that previously relied on manual processes. [21]

The evolution of enrollment management systems has transformed the educational landscape, introducing more efficient, more accurate, and more accessible ways of enrollment for students and administrators. The schools are slowly transitioning and integrating digital solutions, forming enrollment to have centralized data management resulted in too much improved processes and supported better institutional planning. As technology continued to advance, educational institutions can further optimize these systems to provide a seamless and reliable enrollment experience for all stakeholders.

The Role of Machine Learning in Enrollment Forecasting

It is important to have a good score of predicted student enrollment trends because it is essential to have good insights for future institutional planning. A study on enrollment trend analysis found that institutions utilizing statistical regression models achieved an R-squared value of 0.86, demonstrating a strong predictive capacity in forecasting student enrollment patterns over time, which means having a good model will take you to have good prediction results. [22]

Numbers of algorithms have been explored, including XGBoost algorithm to further enhance predictive accuracy. These models helped to provide the institutions with valuable insights and future student trends that led to more data-driven decision-making in enrollment management. [23]

Among these approaches, Long Short-Term Memory (LSTM) deep learning models have been particularly effective in forecasting enrollment trends. By performing training and capturing the sequential patterns in historical enrollment data, predictive models helped universities to optimize these insights and refine their strategic planning processes. [24]

Beyond predictive modeling, statistical analyses of enrollment patterns in secondary schools revealed disparities in student distribution based on geographic location. These findings showed that schools and policymakers need to use data to make smart decisions about how and when to give out resources like teachers, classrooms, and materials. [25]

A study in the UK found that when student enrollment numbers change, it affects how students move between schools and how schools make their plans. This shows how important it is for schools to have flexible enrollment plans and to use predictions so they're ready when changes happen. [26]

The growing competition among colleges, coupled with a declining national high school graduation rate, has intensified the need for advanced enrollment management solutions. Schools and universities today often face budget problems, and the institution usually did reactive planning because the number of students enrolling keeps changing over time. That's why using enrollment data and applying machine learning to predict future student numbers is becoming very important. These tools helped schools find potential students and plan better for things like hiring teachers or opening new programs. [27]

At the University of Rwanda, a study looked at how student enrollment changed over time in their School of Education. By counting how many students enrolled and looking at the percentages, researchers found that more students were enrolling each year—but there were still big differences between the number of male and female students in certain departments. There was especially a big jump in students choosing math and science, which is great news for countries that want to focus on science and technology education. [28]

All of this research showed that student enrollment is influenced by many things—like data, statistics, and outside factors like politics. By using predictive tools, schools can stop just reacting to problems and start planning ahead, leading to smarter and more sustainable enrollment decisions.

XGBoost and Its Impact on Enrollment Prediction

Predicting future trends with machine learning has become a game-changer for schools trying to make informed choices—especially in managing student enrollment. In one study, Alabdo explored how well a model called XGBoost could handle forecasting, and it turned out to outperform traditional models like Linear Regression by a good margin. By fine-tuning the model's internal settings—something known as hyperparameter tuning—they were able to get much more reliable results. This same technique can be applied to estimate how many students might enroll in different departments over the next few years, drawing on past records, which programs are popular, and how school policies shift over time. [29]

Accurately forecasting student enrollment plays a big role in how universities decide to use their budgets and resources. Another study by Zhao and Otteson used a different approach to estimate enrollment numbers at Eastern Michigan University. Their enhanced model got the predictions so close to the real numbers that the error was under 1%, showing just how powerful these forecasting tools can be. [30]

The algorithm XGBoost has gained its solid reputation in the machine learning world because it handles complex problems very well and is still able to deliver accurate results. It is fast, adaptable, and particularly good with large and messy datasets. [31]

What makes XGBoost so effective is the way it's designed because it can quickly figure out how to split data into meaningful parts, can use multiple processors at once to speed things up, and can handle memory smartly. On top of that, it doesn't just memorize the data; instead it balances the prediction accuracy with simplicity by using a combination of loss functions and regularization, which then helps the model to spot useful patterns instead of just noise and trash predictions. [32]

Machine learning is being used more and more in schools—not just to predict how many students will enroll but also to find out which students might struggle or drop out. One study by Ridwana and colleagues used XGBoost to study over 4,000 students and was able to predict with 88% accuracy which students were at risk. This showed how useful tools like XGBoost can be in helping schools take action early and support students better. [33]

The XGBoost algorithm has demonstrated significant utility in predicting, especially in identifying long-term upward and downward movements. By leveraging gradient boosting techniques, it efficiently analyzed time series data to detect trend endpoints and recognize tendencies within defined windows. [34]

XGBoost has shown strong performance when it comes to predicting future trends, even with smaller datasets. Unlike deep learning models, which usually require large amounts of data, XGBoost worked well with limited data because it included a regularization term that helps prevent the model from becoming too complex and overfitting, which made the XGBoost algorithm different and more reliable for real-world predictions. [35]

XGBoost has done a great job when it comes to predicting short-term wind power, which is outshining other methods. Just by adjusting a few settings, which are called hyperparameters, it gives more reliable predictions and reduces mistakes, so it is really flexible and great for a variety of forecasting needs. [36]

Security in online enrollment systems has become a major concern, which is why it's important to use advanced tools that can detect fraud. Meghana and Kumar studied two popular methods—Random Forest and XGBoost—to see which one is better at spotting fake enrollment websites. Their research showed that Random Forest was more accurate, catching fraudulent activity 92.63% of the time, compared to 75.55% with XGBoost. Even though their work focused on websites, it highlighted the importance of testing these tools thoroughly before using them to forecast enrollment trends. [37]

Despite this, XGBoost has shown strong results when used to analyze patterns in student enrollment like when researchers used it to study changes in student demographics in both local and international contexts and how different these factors influence the trends. Because of the XGBoost's ability to handle large amounts of data and find hidden patterns, it helps schools understand shifts in enrollment and make smarter decisions about where to focus their resources and recruitment efforts. [38]

Many studies have explored XGBoost and similar machine learning tools for predicting how many students will enroll. Compared to older prediction methods, XGBoost has often delivered better results, making it a strong choice for this kind of work. [39]

When comparing XGBoost and Random Forest, both have their strengths. Random Forest is good in many areas, but it can slow down if there are too many decision trees to process. While XGBoost algorithm used a smarter and step-by-step approach that often leads to better accuracy, especially when you need precise results. [40]

In another study, XGBoost was compared to Logistic Regression. XGBoost scored higher in accuracy, but it sometimes over-learned the training data, leading to mistakes. Logistic Regression, while not as flexible, gave more stable results with faster training times. [41]

XGBoost also outperformed Deep Neural Networks (DNN) in predicting team performance, showing reliability in both the learning and prediction stages. The study showed that XGBoost scored a perfect 100% on learning accuracy and 95.60% in predicting outcomes, while DNN had lower result scores. [42]

In terms of real-world use, the algorithm XGBoost stands out for being fast, accurate, and able to manage complex data, proven by the study of Ramdani and Furqon, which compared it with Random Forest, SVM, and ANN in classifying urban forests.

In the study, the XGBoost algorithm came out on top with the lowest error rate, proving that it's not only powerful but also efficient, making it ideal for long-term enrollment forecasting, where we can track trends by department over five years. [43]

XGBoost’s strong performance and ability to work well with messy data made it the favorite in data science exploration. It is known for delivering accurate results while still being practical to use at scale, which is why it’s widely trusted in many fields. [44]

Using XGBoost offered major benefits, especially when dealing with complicated datasets. It helped create more accurate forecasts, which can be useful not just in education but also in finance, where investors rely on it for smarter decisions. [45]

Overall, XGBoost has become a valuable tool in predicting student enrollment because it is fast, reliable, and able to uncover deep insights from complex information. Schools and universities can even use it to improve how they recruit students, manage resources, and keep students engaged. As machine learning technology keeps growing, XGBoost will likely stay at the forefront of helping schools make better decisions about the future.

SYNTHESIS AND RELEVANCE TO THE STUDY

The studies reviewed by the researchers showed that XGBoost is a powerful and reliable machine learning tool, especially when it comes to sorting data into categories and predicting future patterns over time [46], [47]. These strengths made it a great fit for predicting student enrollment [48], [49]. Compared to older models like Logistic Regression and ARIMA, XGBoost has shown better accuracy in spotting trends and identifying the key factors that affect whether students enroll or not [50], [51]. Plus, it can give predictions that include a level of uncertainty—like showing a range of possible outcomes—making it even more useful for school planning [52].

This research took things a step further by actually putting XGBoost inside an Enrollment Management System (EMS). Most EMS today just store information and help automate processes, but they don't predict future trends [53]. By adding XGBoost, this system doesn't just hold data but does more by helping the school administrators to predict what might happen next; it can also make smarter choices when it comes to recruiting students, planning budgets, or creating programs to keep students engaged [54].

What set this study apart is that it applied XGBoost in a real-world setting, specifically at Westbridge Institute of Technology, Inc. While past research has shown that XGBoost worked well with big education-related data, not many have used it in a working EMS platform [55]. This project showed how to use machine learning directly within a school's system can improve how enrollment is managed and lead to better planning for the future.

DEFINITION OF TERMS

Enrollment Management System (EMS)

An Enrollment Management System (EMS) refers to a digital platform like a website application utilized by educational institutions to transform enrollment-related processes into an automated or technologically assisted system, which includes processes like student registration, tuition payment-receipt tracking, and academic record management. [56] The researchers implemented an EMS with Trend Analysis by Department at Westbridge Institute of Technology, Inc. (WITI) to initialize the transition of enrollment manual workflows to modern technology-assisted processes with predictive analytics for enrollment trend analysis by department.

XGBoost (Extreme Gradient Boosting) Algorithm

XGBoost is an algorithm that is a scalable, ensemble-based machine learning algorithm designed for structured data and known for its superior performance in classification and regression tasks. That is why it is a popular machine learning algorithm in Kaggle. [57] The researchers applied XGBoost algorithm in trend analysis by department in EMS to analyze historical enrollment datasets and identify at-risk students and provide intervention suggestions that can help the institution in making proactive decisions.

Trend Analysis by Department

The trend analysis by department involves examining historical data to identify and predict patterns. [58] The researchers integrated this feature into the EMS to forecast enrollment changes across departments to target proactive planning.

Role-Based Access Control (RBAC)

RBAC is a security model that restricts system access based on predefined user roles, thereby protecting sensitive institutional data. [59] The researchers implemented RBAC in the EMS to differentiate access privileges for students, registrars, accountants, professors, and administrators.

Optical Character Recognition (OCR)

An OCR is a technology that converts images of printed or handwritten text into machine-readable text. [60] The researchers embedded OCR in the EMS to digitize offline enrollment forms captured via camera and synced them to the system once reconnected online.

ISO/IEC 25010 Standards

ISO/IEC 25010 defines a model for evaluating software product quality, including characteristics such as functionality, reliability, and maintainability. [61] The researchers used this standard to assess the EMS during development and quality assurance phases.

Synthetic Data

The synthetic data consists of artificially generated datasets that resemble real-world data distributions while preserving privacy. [62] The researchers generated synthetic enrollment records to train the XGBoost model without compromising student confidentiality.

Waterfall Model

The Waterfall Model is a linear approach to software development involving sequential stages such as requirement analysis, design, implementation, and testing. [63] The researchers employed this model to guide the systematic development of the EMS at WITI.

Predictive Analytics

Predictive analytics involves using statistical algorithms and machine learning techniques to analyze current and historical data to make predictions about future events. [64] The researchers used XGBoost Algorithm in performing predictive analytics within the EMS to estimate enrollment volumes for proactive planning.

Data Synchronization

Data synchronization refers to the process of ensuring consistency between data stored in different locations or systems. [65] The researchers enabled data synchronization in the EMS to allow offline enrollment records (captured via OCR) to be automatically updated in the centralized system when connectivity was restored.

CHAPTER III

METHODOLOGY

RESEARCH DESIGN

The researchers used a two-phase mixed-methods approach to design and evaluate an Enrollment Management System (EMS) with predictive trend analysis capabilities for Westbridge Institute of Technology, Inc., applying synthetic data-driven modeling with user-centric validation to ensure both technical accuracy and practical usability while adhering to data privacy regulations.

From the information gathered during the interviews about enrollment, the researchers created a fake dataset but used the realistic variables in building the data using Python's Faker library. This data included things like the number of students in each department, details about the students, and how many were expected to enroll in certain courses. Using this data, the researchers trained XGBoost algorithm model to predict future enrollment trends by aggregating the enrollment likelihood per student. The researchers fine-tuned the model using a method called grid search to make it as accurate as possible. To check how well the model worked, the researchers used different ways of measuring accuracy—some for predicting exact numbers (like RMSE and MAE), and others for predicting trends (like accuracy and F1-score). The final results were grouped by department and shown in charts over time, helping simulate situations like planning teacher hires or budgeting, all while keeping real student data private.

In the second part of the study, the researchers evaluated the Enrollment Management System (EMS) using a descriptive research method, which means they aimed to clearly describe how well the system worked. They asked 100 computer science students, who had enough technical knowledge, to test the system. The evaluation focused on important software quality standards from ISO/IEC 25010, such as whether the system worked properly, was fast, easy to use, secure, and could adapt to changes. The researchers conducted a survey to IT-related students using a 4-point Likert-scale which helped the researchers understand how users experienced the system in terms of its usefulness and reliability ensuring that the feedback received was organized and meaningful.

The researchers carefully combined the results from both parts of their study. The fake but realistic data helped improve the predictive features of the Enrollment Management System (EMS), while real feedback from users confirmed how useful the system was in practice. Throughout the study, they followed ethical guidelines—no real student data was used, and all survey responses were kept anonymous. The participants were also clearly told that the trend predictions were based on simulated data, not actual student records.

To make their work more transparent and useful to others, the researchers made their data creation tools and evaluation methods available to the public. This well-organized research approach helped connect advanced technology with real-world user needs, promoting responsible and data-driven ways to manage student enrollment in schools.

METHODOLOGY

The researchers adopted the Iterative Waterfall Model of the System Development Life Cycle (SDLC) as the guiding methodology for the development of the Enrollment Management System (EMS) with integrated predictive analytics. The researchers followed a step-by-step approach to improve the system continuously as they went along with this structured method; it helped them stay on track and manage any changes without falling behind schedule or missing important goals.

They chose to use the Iterative Waterfall Model because it was a good fit for a project like this, which required careful planning and long-term development. The researchers thoroughly planned, built, and tested each part of the Enrollment Management System (EMS). Since the system had two big goals, one is automating the enrollment process and second is predicting future enrollment trends using a tool called XGBoost, these were satisfied by the model and gave them the structure the researchers needed. One big benefit of this method was that most of the data was collected early on, during the planning stage that helped the researchers avoid the repeated work later and focus on building the system based on the school's actual needs.

To build the management part of the enrollment system, the researchers used React to build the user interface, Laravel to handle the behind-the-scenes processes or backend, and MySQL was used to manage the data in the database. The researchers used Chart.js to display trend predictions in easy-to-understand charts, and Python (through XGBoost) was used to make those predictions. These tools made sure that each part of the system worked well, could grow over time, and responded quickly.

By using the Iterative Waterfall Model, the researchers followed a clear and organized development process that helped them meet both practical needs (like automating tasks) and technical goals (like predicting enrollment trends). This approach led to the successful creation of a system designed specifically for the needs of Westbridge Institute of Technology, Inc.

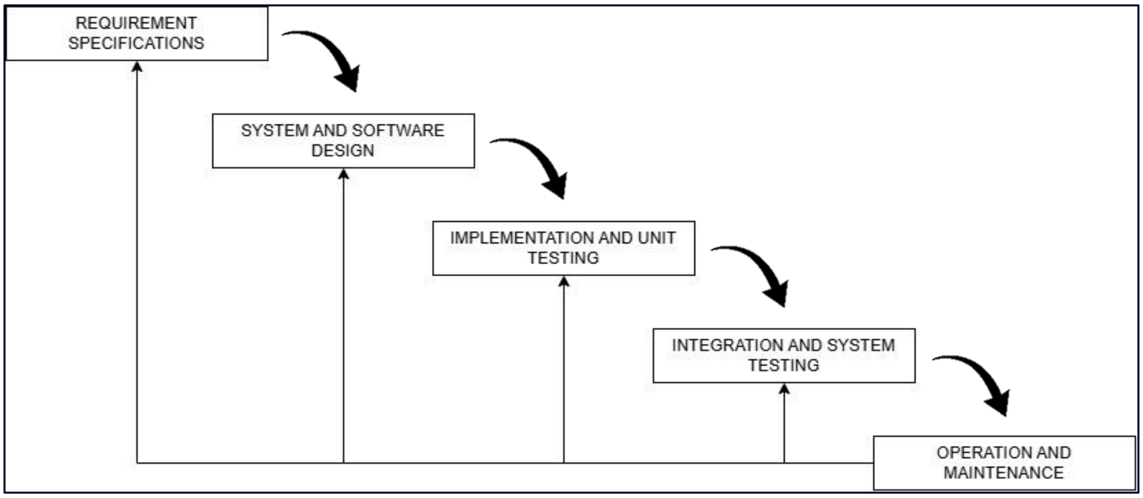


Figure 1.0 Iterative Waterfall Model

The researchers used a step-by-step method called the Iterative Waterfall Model, as shown in Figure 1.0, to guide the development of the Enrollment Management System (EMS) for Westbridge Institute of Technology, Inc., which made the researchers to carefully plan, build, and refine the system in an organized and efficient manner.

The researchers began with the requirement specification phase where the researchers identified the challenges faced by the institution's enrollment procedures and then conducted interviews with key personnel to gather insights and challenges the involved staff experienced such as redundancy of tasks, untraced payment-receipt records, lack of reporting tools, and the absence of predictive features for enrollment planning. To address these, the researchers examined existing paper forms and digital records used during enrollment. For privacy and security, they created sample forms and mock data that mimicked real scenarios without exposing any actual student information.

To enable predictive features, the researchers used synthetic data to train a machine learning model known as XGBoost. This allowed the system to forecast enrollment trends by department, which helped the institution make better decisions regarding staffing, resource allocation, and program adjustments.

In the system and software design phase, the researchers translated user requirements into a detailed system structure. They used modern technologies such as React and Laravel to develop a user-friendly, web-based interface. Python was used to implement the XGBoost algorithm, while Chart.js allowed the system to display trend graphs and predictions clearly. The researchers used MySQL as the database to securely store and manage records.

During the implementation and unit testing phase, the researchers built each part of the system based on the institutions' requirements and design suggestions which include features like student registration, enrollment verification, payment-receipt tracking, grades-viewing and trend analysis by department that were all thoroughly tested to ensure that each feature works correctly or is functional. The researchers resolved any problems or do debugging using tools like Git and to manage updates and code versions.

In the integration and system testing phase, the researchers combined all parts into one complete platform. They tested how the modules interacted with each other—such as how the forecasting feature worked with the user interface—and checked the system's performance under different conditions. The researchers made sure that the system met the institution's requirements and gathered feedback from the students - the EMS future users. The researchers used these to make adjustments and improvements.

Finally, in the operation and maintenance phase, the researchers prepared the EMS for actual deployment at the institution, pending administrative approval. The researchers built the XGBoost features where the future superadmin user can retrain the model with fresh enrollment data to keep predictions accurate. The researchers provided technical documentation to support long-term use and troubleshooting if ever the institution plans to use the proposed EMS with Trend Analysis by Department website application.

Throughout the entire process, the researchers prioritized adaptability and continuous improvement. The researchers used feedback from users to enhance the system's performance and ease of use that led the researchers to successfully develop a reliable enrollment management system with trend analysis by department that will help the Westbridge Institute of Technology, Inc., to manage enrollment more effectively and plan ahead with greater confidence.

REQUIREMENT ANALYSIS

The Enrollment Management System (EMS) with Trend Analysis was developed to combine several important features that aimed to improve how enrollment was handled at Westbridge Institute of Technology, Inc. The system was designed to help the institution operate more smoothly by turning manual tasks into digital ones, simplifying administrative work, and using forecasting tools to provide helpful insights for academic planning and decision-making.

Business Activities

Registration. The researchers observed that registration at the institution was previously done manually, where the students had to fill out paper forms and submit them directly to the registrar's office every semester. This kind of traditional method often took a lot of time and sometimes led to repeated human errors or delays, especially as the school looked to accommodate more students. To improve this process, the researchers designed the EMS to allow online registration. Students could enter their information directly into the system, which reduced paperwork, saved time, and made the process more convenient for both students and staff.

Enrollment. The enrollment process, which included checking student credentials, selecting courses, and getting approval from the registrar, had also been managed using paper forms and face-to-face communication. This setup caused repeated fill-up forms, like how the registration is being performed by the students and slowed down the entire enrollment processes. To help with these challenges, the researchers created a centralized enrollment feature within the EMS where it collected and organized student information digitally, making it easier for departments to verify enrollment quickly and accurately.

Payment-Receipt Verification Tracking. The researchers found that tracking student payments was previously done manually, which sometimes led to delays or mismatched records. To address this, the researchers added a payment-receipt tracking feature to the EMS. This module automatically recorded transactions and updated student accounts right away so the students could see their payment-receipt verification status online, and staff could manage financial records more easily and accurately, without relying on paper files or follow-up visits. Superadmin or stakeholders can also monitor the changes made by the staff the superadmin assigned.

Grades Viewing. In the past, students needed to ask their instructors or the registrar for their grades, fill-out request form and wait for the releasing data schedule, which consumed a lot of time and waiting and sometimes led to delays. To resolve these challenges, the researchers added features where students could view their grades when the registrar allowed them to view. The registrar can switch on and off the grades viewing feature for students. This helped students stay informed about their academic progress and reduced the need for back-and-forth communication with staff.

To better understand and explain the challenges in the existing processes, the researchers created several infographic diagrams (Figures 2.1 to 2.4). These diagrams showed how each process worked—such as registration, enrollment, payment tracking, and grade viewing—and pointed out areas that needed improvement. The researchers used these visuals as a guide when designing the EMS, making sure each part of the system solved a specific problem identified in the current workflow.

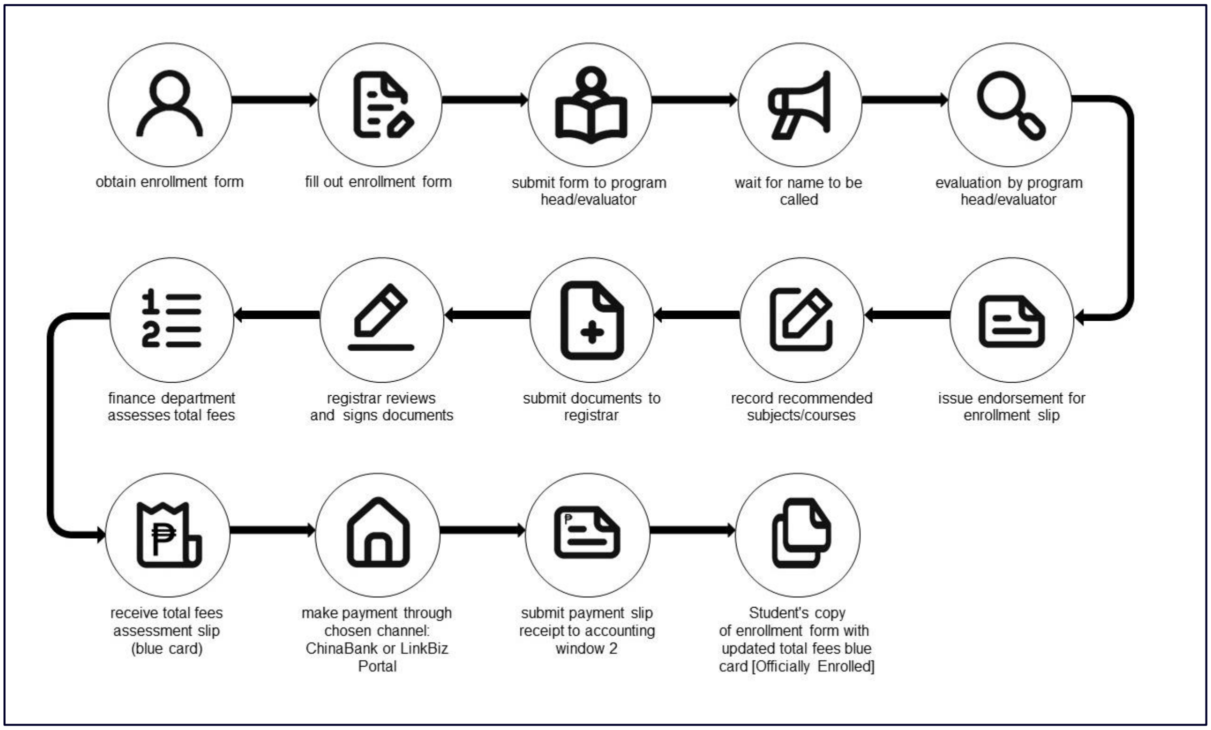


Figure 2.1 Student Registration Procedure (New/Transferees)

Figure 2.1 illustrates the manual enrollment process previously followed by new enrollees and transferees at Westbridge Institute of Technology, Inc. The process begins when the student obtains a physical enrollment form from the administrative staff stationed at Window/Table 1. The student completes the required personal and academic information and submits the filled-out form to the Program Head or Evaluator for queueing. Once queued, the student waits to be called for evaluation and then during the evaluation process, the Program Head or Evaluator reviewed the submitted information. If verified and approved, an endorsement for enrollment slip is issued. The evaluator also lists the recommended courses or subjects on the enrollment form, based on the student's academic program. Following this, the student submits the signed enrollment form and the endorsement slip to the Registrar at Window/Table 2 for additional verification and official approval then forwarded the student's documents to the Finance Department for assessment of tuition and other applicable fees. After this, the Finance Department computes the total cost, which includes the tuition fee, uniform charges, Alumni Discount Card fee, and other miscellaneous expenses. If the student is a Senior High School (SHS) enrollee with an approved DepEd voucher, the payment process is bypassed. Students without a voucher in regular enrollees and transferees proceeds to the payment stage. The student waits for their name to be called and is instructed to settle fees through the institution's designated payment channels, office site which is Chinabank or through online using LinkBiz Portal. Upon payment, the student presents the official receipt to the accounting for verification and documentation then the accounting issues a validated copy of the enrollment form along with the payment form, signaling the completion of the enrollment process making the student officially enrolled and welcomed into the Westinian academic community.

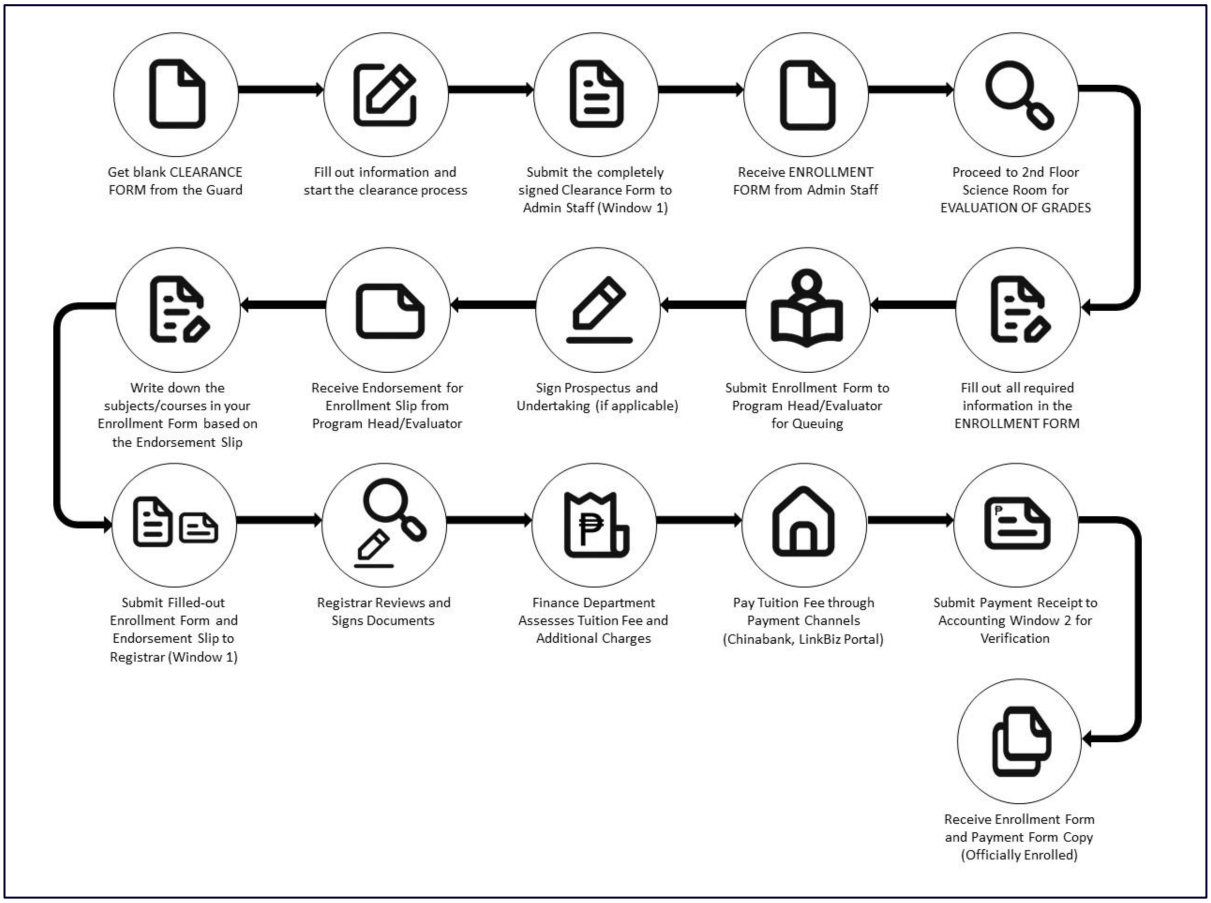


Figure 2.2 Student Enrollment Procedure (Old Students)

Figure 2.2 illustrates the manual enrollment procedure for returning students at Westbridge Institute of Technology, Inc., starts when the student obtains a clearance form from the campus security personnel. Then the student fills out the required information and proceeds through the clearance process by securing the necessary signatures from various departments. Once the form is fully completed, it is then submitted to the administrative staff at Window/Table 1. Upon submission, the student is issued an enrollment form initiating the enrollment process. Then proceeds to the evaluation phase which is located at the 2nd Floor Science Room or the designated room for evaluation. After completing the enrollment form, the student submits it to the Program Head or Evaluator for queueing. During the evaluation, the evaluator reviews the academic records, signs the student's Prospectus and Undertaking—if applicable—and endorses the enrollment by issuing an endorsement for enrollment slip then recommends courses or subjects which are listed on the form according to the student's academic standing. Subsequently, the student submits the endorsed enrollment form to the Registrar at Window/Table 2 for formal verification and signature. After verification and signature, the registrar forwards the enrollment documents to the Finance Department for the assessment of tuition fees and other related charges after the total amount due, which could include tuition, uniform fees, Alumni Discount Card fees, and other miscellaneous expenses. In cases where the student is a Senior High School (SHS) enrollee with a DepEd voucher, the tuition payment step is bypassed. Otherwise, the student is instructed to wait for their name to be called and proceed to pay the assessed fees through the approved payment channels—Chinabank or LinkBiz Portal. The final step involves presenting the official receipt to the Accounting Office for recording and verification. Once confirmed, the student receives their validated copies of both the enrollment form and the payment form (blue card), officially the student successfully completes the enrollment processes and is officially enrolled.

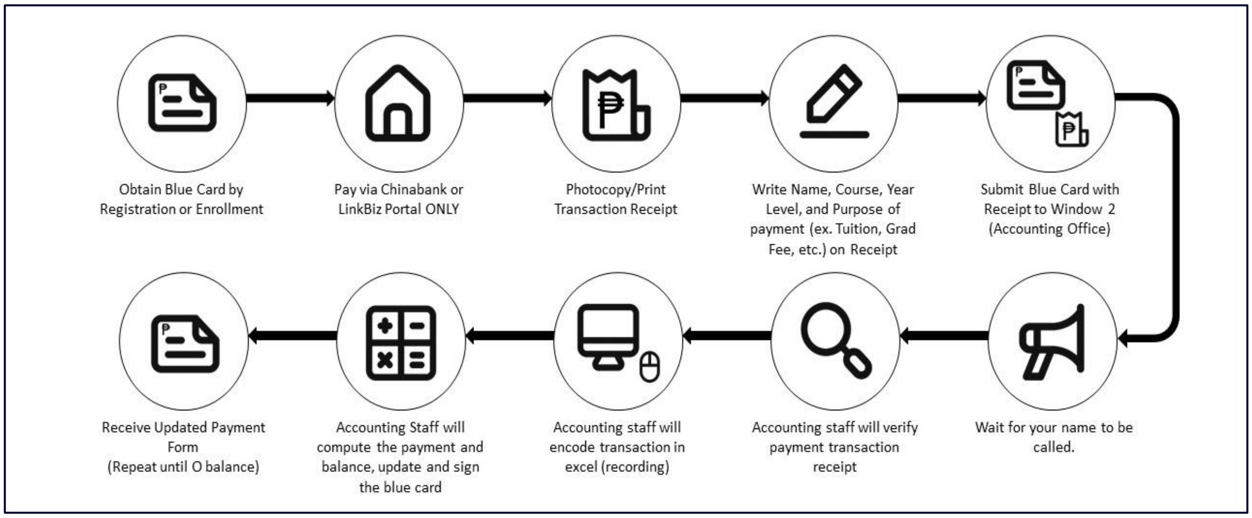


Figure 2.3 Student Payment Receipt Tracking Procedure

Figure 2.3 illustrates the payment verification procedure for Senior High School (SHS) enrollees at Westbridge Institute of Technology, Inc. If the SHS student possesses a DepEd voucher, the payment step is automatically bypassed. However, in the absence of such a voucher, the student proceeds through the standard payment procedure like other enrollees. The process commences with the student obtaining a Blue Card during registration or enrollment. The Blue Card functions as the student's official payment form, documenting all transactions and balance updates. Upon acquiring the Blue Card, the student is required to pay the assessed amount through authorized payment channels, namely Chinabank or the LinkBiz Portal, both of which provide secure and reliable transaction processing. After completing the payment, the student photocopies or prints the official transaction receipt. To ensure proper identification and matching with the institution’s financial records, the student is instructed to write their full name, course, year level, and purpose of payment (e.g., tuition or graduation fee) directly on the printed receipt. Subsequently, the student submits both the Blue Card and the annotated transaction receipt to Window 2 of the Accounting Office. The student waits for their name to be called while the accounting staff verifies the authenticity of the submitted receipt. In cases where discrepancies are detected, the document is returned for rechecking to ensure its accuracy. Once validated, the accounting staff encodes the transaction into the official Excel tracking sheet. They compute the payment amount and the remaining balance, verifying the accuracy of all entries. The updated payment information is then recorded on the student's Blue Card, which is also signed by the accounting personnel as formal confirmation of the transaction. Finally, the student receives the updated Payment Form. This cycle is repeated for every subsequent payment made until the student achieves a zero balance (O balance), signaling the complete fulfillment of their financial obligations.

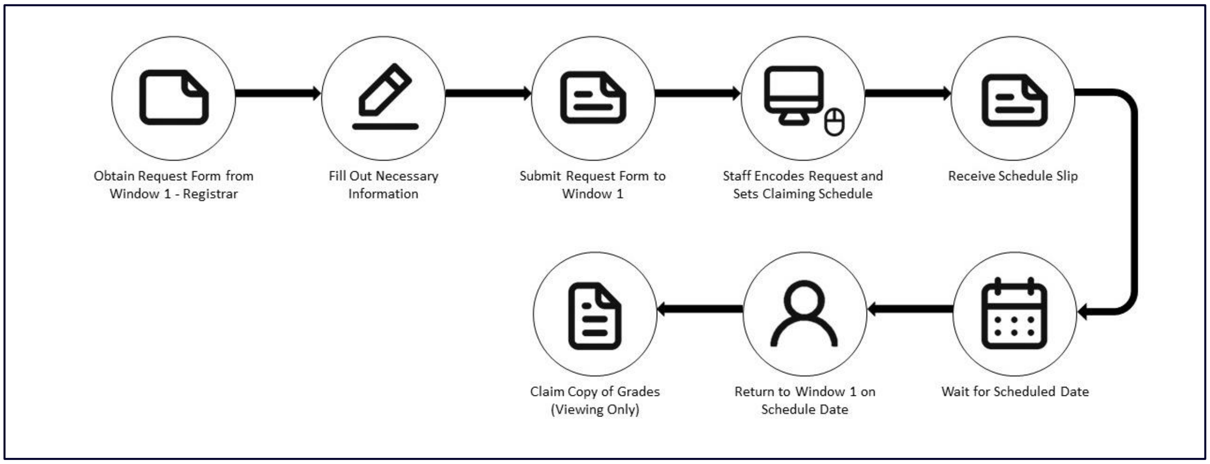


Figure 2.4 Student Grades Viewing Procedure

Figure 2.4 depicts the manual procedure for requesting a copy of grades at Westbridge Institute of Technology, Inc. The process begins with the student obtaining a request form from Window 1 at the Registrar's Office. The student is required to accurately fill out the necessary information on the form before submitting it back to the same window for processing. Upon submission, the designated administrative staff encodes the request into the record system and schedules a release date for the requested document. A schedule slip is issued to the student, indicating the specific date on which the copy of grades will be available for viewing. On the scheduled date, the student returns to Window 1 and presents the schedule slip to retrieve the document. However, the copy of grades provided through this process is for viewing purposes only and is not considered an official academic record. This manual approach highlights the limitations in accessibility and efficiency within the existing system. Understanding these procedures is essential for the researchers during the requirement analysis phase. By evaluating the current workflows, the proposed Enrollment Management System with Trend Analysis aims to streamline academic services, improve data accuracy, and enhance the overall user experience. This comprehensive and digitized approach will not only optimize administrative processes but also support data-driven insights for forecasting future enrollment trends.

REQUIREMENTS DOCUMENTATION

The purpose of the requirements documentation was to establish a comprehensive outline of the essential functionalities, features, and constraints necessary for the development of the proposed Enrollment Management System for Westbridge Institute of Technology, Inc. (WITI). This section served as a foundational blueprint for the development team, ensuring that all stakeholders possessed a shared understanding of the system’s objectives, deliverables, and performance expectations.

The documentation guided the design and implementation processes by clearly defining what the system aimed to accomplish, thereby ensuring alignment with institutional goals. It also contributed to operational improvements by addressing inefficiencies in existing enrollment procedures and proposing digitized solutions.

Furthermore, the detailed requirements enabled developers to design features that specifically addressed the institution's challenges, such as data accuracy, process automation, and enrollment forecasting. Through well-defined specifications, the documentation facilitated effective communication among stakeholders, including administrators, developers, and end-users. This clarity minimized the risk of misinterpretation and ensured that development tasks aligned with institutional expectations. Additionally, the requirements documentation served as a vital reference throughout the system development life cycle, allowing stakeholders to evaluate the project's progress and validate its outputs against predefined goals.

By establishing a structured and detailed set of requirements, the researchers ensured that the Enrollment Management System would not only meet technical standards but also deliver practical value to Westbridge Institute of Technology, Inc. in terms of enhanced service delivery, predictive insights, and administrative efficiency.

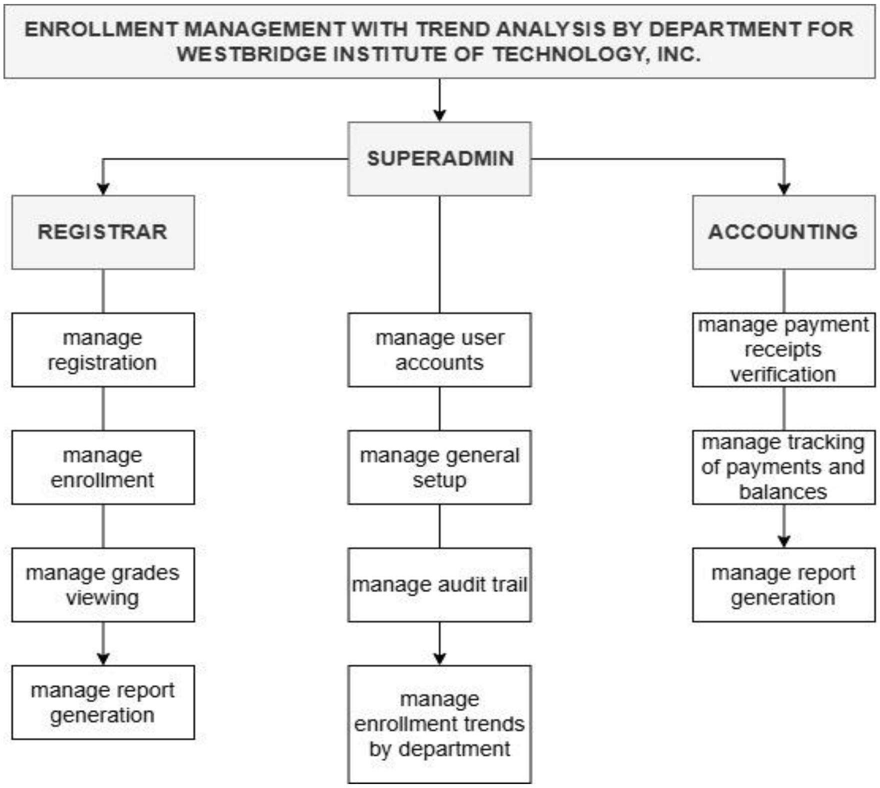


Figure 3.0 Decomposition Chart of Enrollment Management

Figure 3.0 illustrates the proposed decomposition chart for the Enrollment Management System developed for Westbridge Institute of Technology, Inc. Showing the hierarchical breakdown of the system's functional modules, it helped the researchers visualize and organize the creation of the system into smaller, more manageable subsystems. Each subsystem contributed to the fulfillment of the system’s overarching objectives, ensuring that a structured approach is applied to the development and implementation. At the top level, the system is managed by Superadmin, who assumes overall administrative control and is responsible for user management and role assignments. Superadmin also possesses oversight capabilities for system monitoring and trend analysis to help stakeholders gain insights for proactive decisions based on enrollment trends. The decomposition chart also identified critical administrative roles, including the Registrar Admin and Accounting Admin. The Registrar Admin manages student registration, maintains enrollment records, and facilitates grade viewing on and off campus, while the Accounting Admin handles the verification and processing of payment-receipt transactions associated with the enrollment processes. This top-down decomposition approach allowed the researchers to align system functionality with institutional roles, ensuring that each module addresses specific user needs while contributing to the overall goal of transforming the enrollment operations into a technology-assisted system. The chart served as a foundational tool in the design and development phases, promoting clarity and systematic progress throughout the system development life cycle.

USE-CASE DIAGRAM

The researchers prepared several use-case diagrams to describe how the different users interacted with the Enrollment Management System. A use-case diagram is a visual representation that shows the relationships between users which are also called actors and the different functions, we call it use-cases that they can perform within a system. It is a helpful tool in systems analysis and design, especially for identifying user requirements and organizing system functionalities in a way that is easy to understand.

The researchers used these diagrams to map out the specific actions that users could take, such as logging in, enrolling in subjects, uploading payment receipts, viewing grades, and generating trend analyses. Each diagram illustrated not only what each user was allowed to do but also how the system responded to those actions. These diagrams made it easier to communicate ideas among the development team and stakeholders, and they served as a blueprint during system development and testing.

The researchers believed that creating use-case diagrams was important because it ensures the development of the system would meet the expectations of its users, such as students, registrars, faculty, and administrators. It also allowed the researchers to identify and resolve any potential overlaps or missing features early in the design phase. Having use-case diagrams helped the researchers to have a structured way of understanding the system's flow which contributed to the overall clarity of the system development process.

The following pages contain five use-case diagrams that represent the major components of the Enrollment Management System:

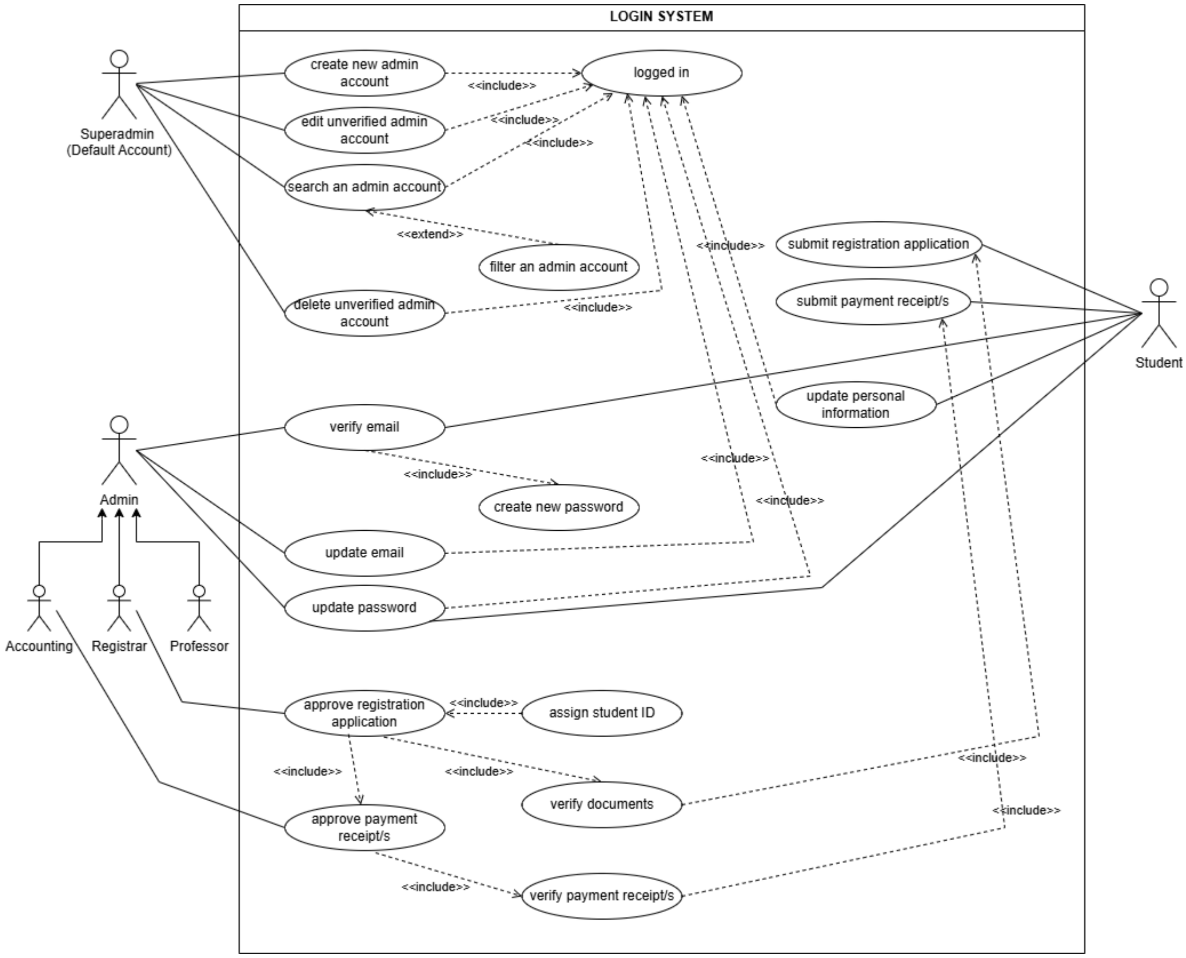


Figure 4.0 Login System Use Case Diagram

This diagram illustrates the role-based interactions within the Login System which is designed to visually represent how each user role accessed the system and what specific actions were available to them. The researchers also ensured that by clearly outlining these relationships, all mentioned actors / users will perform actions appropriate to their role, improving both system security and efficiency of Enrollment Management System.

Defined Roles and Functions:

Superadmin. The owner/stakeholder or any higher person in the institution given this access has full control over the management of the admin accounts to:

- create admin accounts
- edit unverified admin accounts
- search admin accounts, can also
- filter admin accounts, and
- delete unverified admin accounts.

Admin. Admins with elevated privileges are responsible for key verification and approval tasks.

Registrar-Admin

- approves student registration applications.
- assigns student IDs.
- verifies submitted documents

Accounting-Admin

- Verifies payment receipts

Before Login (All Users). The researchers emphasized that some actions occurred prior to logging into the system, which were essential actions for account activation and security:

- Verify Email: Users were required to confirm their email address through a verification process.

- Create New Password: After verifying their email, users needed to set up a new password before they could log in to the system.
- Email and Password Updating: The users have to update their own email and password information after logging in.

Student. Students, as the main users of the system, were responsible for submitting and managing their enrollment data:

- Submit registration applications.
- Upload payment receipts.
- Update personal information.
- Log in to access system features after completing the required pre-login steps.

The researchers also used the <<*include*>> and <<*extend*>> relationships in the diagram to show the dependencies between certain actions. Like for example, users need to verify their email and create a new password for the first time logging in; these were necessary steps included in the login process. The researchers carefully structured the flow of actions and access to ensure a secure and user-friendly login system that supported various institutional roles.

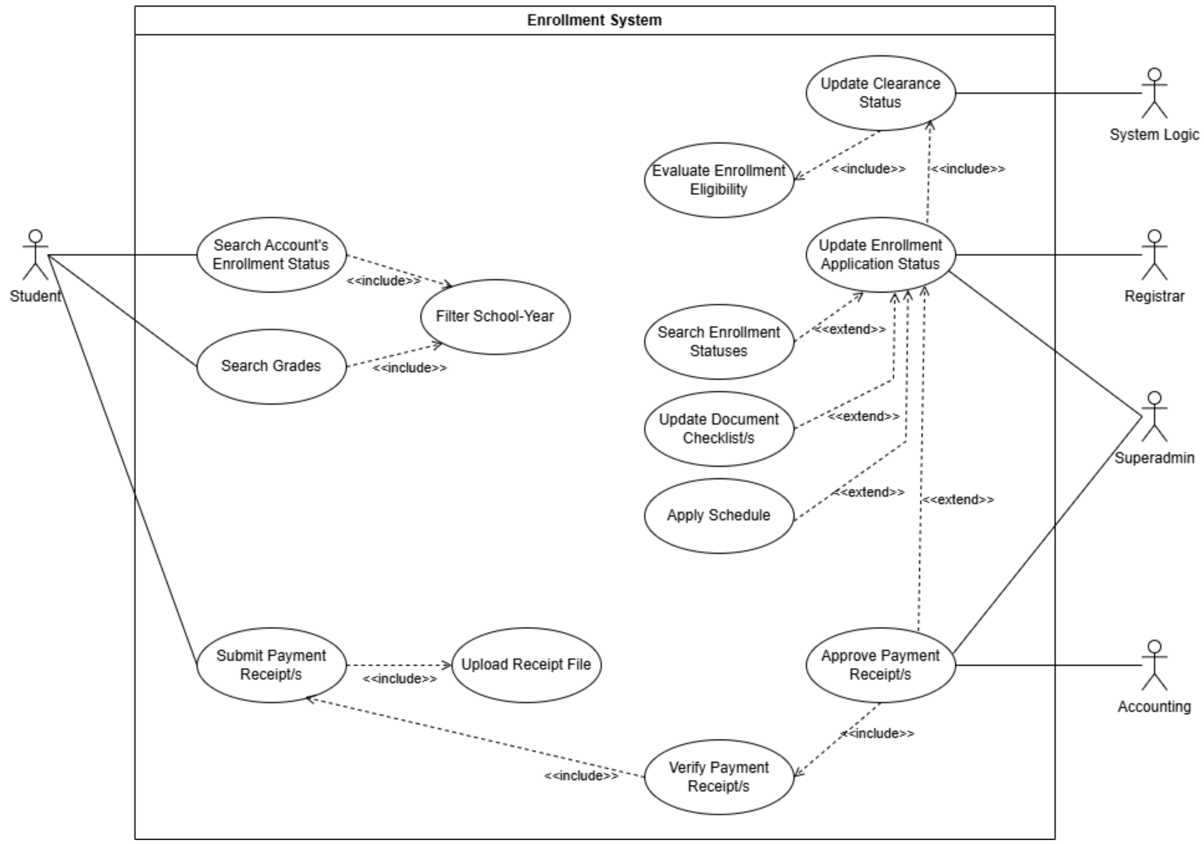


Figure 5.0 Enrollment System Use Case Diagram

Assuming that an actor or actors have already logged in, this use-case diagram explains what the specific user or actor could do and what was inside the system, depending on their roles. The researchers made sure that the system could support smooth and organized enrollment for everyone involved.

Defined Roles and Their Actions:

Student. The student was the main user of the system. The researchers allowed students to:

- Submit clearance documents.
- View current and past enrollment records.
- See the document checklist.
- Check their grades to know if they were ready to enroll.
- Submit their payment receipts.
- Students could also download their clearance or upload files like scanned receipts.

Registrar Admin. The registrar manages and approves the enrollment of students and has the ability to:

- Approve enrollment applications.
- Update the checklist of needed documents.
- Review students' grades.
- Approve the clearances submitted by students.
- Assign class schedules after enrollment was approved.

Accounting Admin. The accounting staff made sure that students had paid the correct fees and could:

- Approve or reject the payment receipts submitted by students.

Superadmin. The Superadmin who can be in place of the registrar or accounting when absent or not available, can do:

- Everything that the registrar and accounting staff could do.
- Stepping in when needed, such as approving enrollment or reviewing payments if the regular staff were unavailable.

The researchers used this diagram to show how all these actions were connected, like when a student submitted a receipt, it included uploading the file and waiting for accounting to verify it. These kinds of connections helped the researchers in making sure that the system followed a logical process and that every user had designated clear responsibilities.

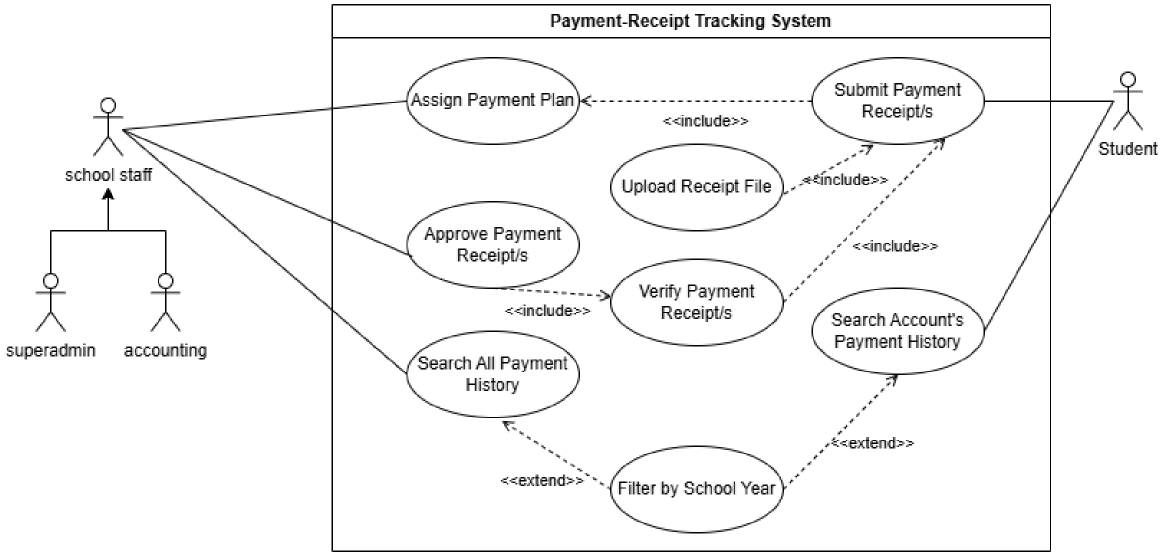


Figure 6.0 Payment-Receipt Tracking Use Case Diagram

Figure 6.0 use-case diagram shows how the Payment-Receipt Tracking System works for users or actors who are already logged in. The researchers designed this diagram to explain how enrollment payments are tracked, submitted, and verified, depending on the user's or actor's role. Use-case helped organize and simplify how payments are handled within the system, avoiding confusion or missing transactions.

Defined Roles and Their Actions:

Student. Students are responsible for making payments and keeping track of their financial records. The researchers allowed students to:

- Submit Payment Receipts: Let the school know they have paid by submitting receipt files.
- Upload Receipt File: Attach scanned copies or images of their payment receipts.
- Search Their Payment History: View a record of all past payments.
- Filter by School Year: Narrow down their payment records to a specific academic year for easier checking.

Accounting Admin. Accounting is in charge of making sure all student payments are correct and recorded. The researchers assigned the following responsibilities:

- Assign Payment Plans: Set up custom or standard payment schemes for each student.
- Approve Payment Receipts: Confirm that submitted receipts are valid and matched the records.
- Verify Payment Receipts: Double-check the information on the uploaded receipts.
- Search All Payment History: Look up payment records for any student, with the ability to filter by school year when needed.

Superadmin. The Superadmin has the same privilege as the accounting admin. The researchers made sure this role could:

- Do everything aaccounting could do, such as assigning payment plans, verifying receipts, and searching records.
- Step in to assist or take over financial tasks if needed.

The researchers used this diagram to make sure all money-related activities in the system were secure, transparent, and easy to follow. By clearly separating what each role could do, they helped prevent errors and ensured that every payment had a record.

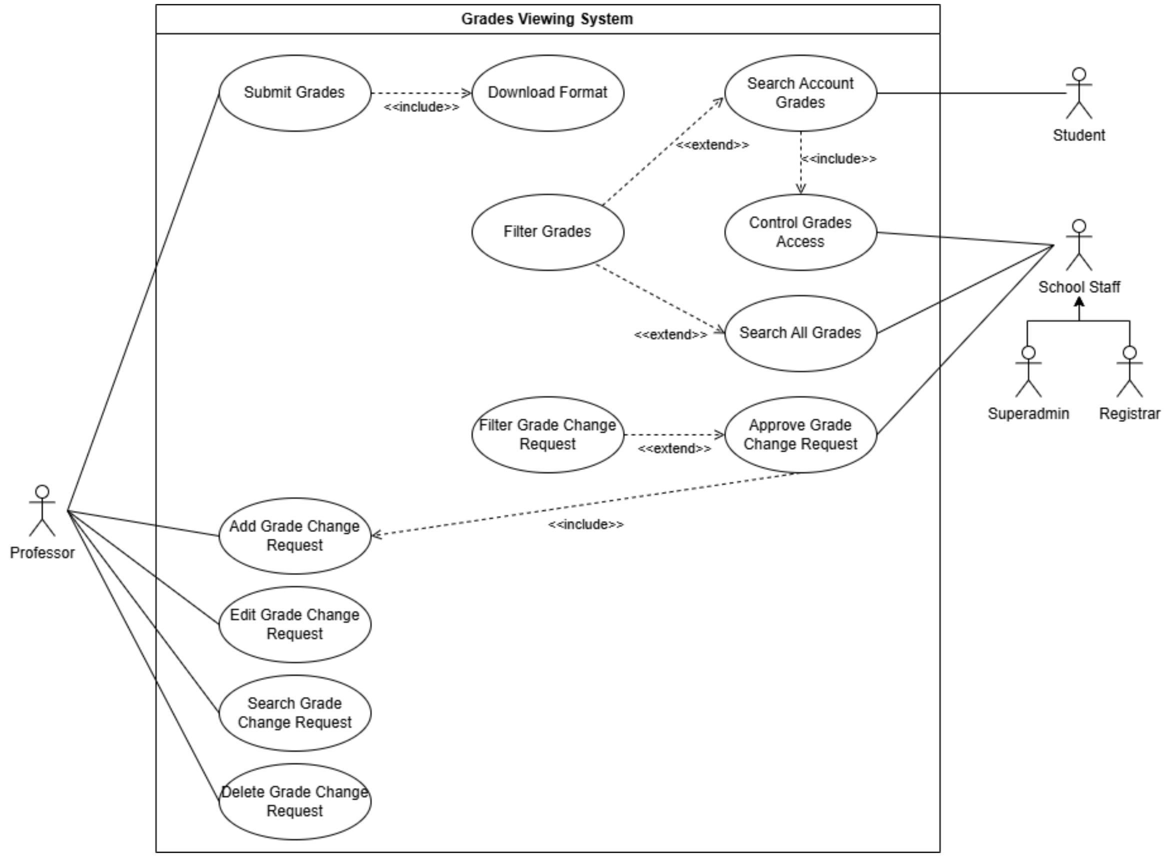


Figure 7.0 Grades Viewing Use Case Diagram

The researchers designed this use-case diagram to show how the Grades Viewing System worked for users or actors who were already logged in and explain how grades were submitted, viewed, modified, and managed depending on the user's or actor's role, helping the development of the system to have an organized and simple grade viewing workflow, avoiding confusion or unauthorized changes.

Defined Roles and Their Actions:

Student. Students are allowed to view their grades. The researchers enabled the students to:

- Search Account Grades: Let students check their own grades in the system.
- Filter Account Grades: Narrow down their grade records (e.g., by semester or subject) for easier viewing.

Professor. Professors are responsible for submitting and managing grades. The researchers allowed the professors to:

- Submit Grades: Upload grades for the students they taught.
- Download Format: Access a downloadable format for submitting grade entries.
- Add Grade Change Request: Request modifications to previously submitted grades.
- Edit Grade Change Request: Make changes to an already filed grade change request.
- Search Grade Change Request: Look for past grade change requests they submitted.
- Delete Grade Change Request: Cancel or remove a submitted grade change request.

- Filter Grade Change Request: Apply filters to narrow down specific requests (e.g., by student or subject).

Registrar. The registrar is in charge of approving any grade changes. The researchers gave the registrar the ability to:

- Approve Grade Change Request: Review and validate grade change requests submitted by professors.
- Search All Grades: Look up the grades of all students.
- Filter Grades: Apply specific filters to sort and organize or find student/s grades data.
- Approve Grade Change Request: Support the registrar in validating requests.
- Control Grades Access: Manage on/off grades viewing for the students in the system.
- Search Grade Change Request: Find and view submitted grade change requests.

Superadmin. The Superadmin had the same privilege as the registrar admin in the grades viewing system.

The researchers used this diagram to ensure that grade-related activities were clearly divided by role that had specific permissions to prevent unauthorized actions and maintain the integrity of the grade records in the enrollment management system.

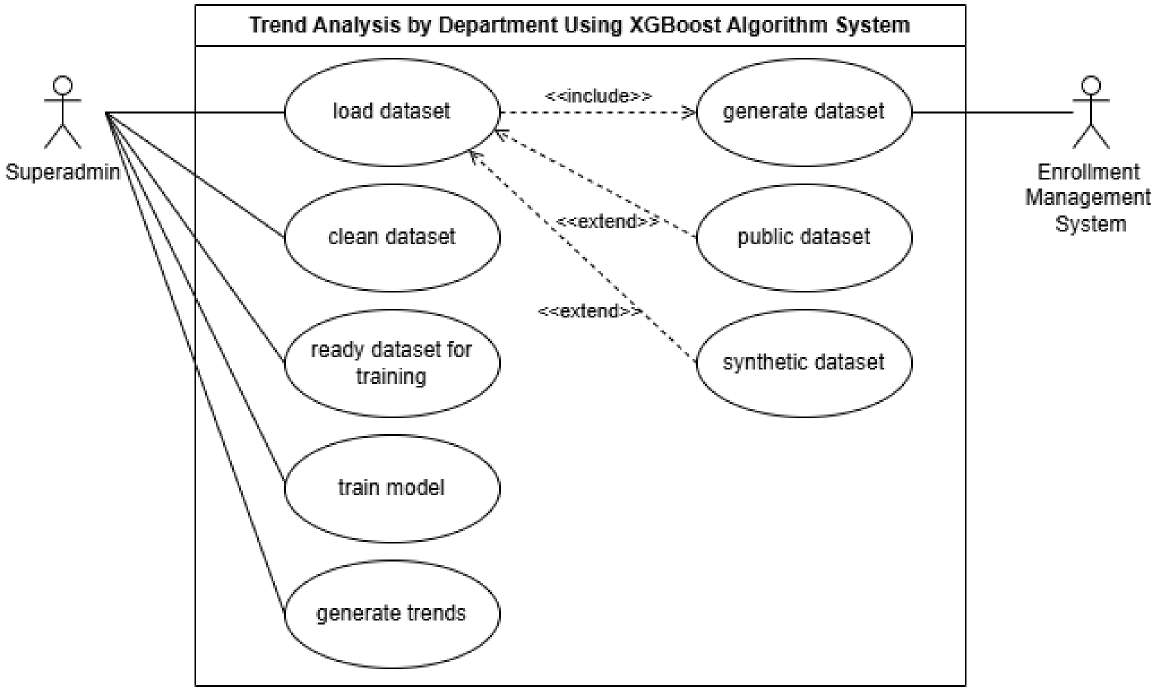


Figure 8.0 Trend Analysis by Department Use Case Diagram

The researchers designed this diagram to show how the Trend Analysis by Department Using XGBoost Algorithm System functioned for users or systems that were already logged in and to explain how datasets were managed, cleaned, and prepared for training in order to generate trends by department in the enrollment management system that will help the stakeholders for proactive planning.

Defined Roles and Their Actions:

Superadmin. The superadmin had full control of the entire trend analysis by department features and could do:

- Load Dataset: Load synthetic datasets with needed variables from student info, personal info, and guardian tables in database.
- Clean Dataset: Removing empty or null values.
- Train-Ready Dataset: Finalizing the dataset structure and format to fit the XGBoost training model's requirements, like one-hot codes - 1's and 0's.
- Train Model: Use the XGBoost algorithm to train a machine learning model based on the trained-ready data.
- Generate Trends: Analyze the trained model's results to uncover patterns and trends in departmental data.

Enrollment Management System, can do:

- Generate Dataset: Create a dataset that could later be loaded for trend analysis by department using XGBoost algorithm.

The researchers ensured that each task in the trend analysis process shown in this use-case diagram—from data preparation to model training—was clearly defined and handled by the superadmin. This clarity helped improve the accuracy of trend predictions and supported better decision-making in enrollment planning.

DESIGN OF SOFTWARE, SYSTEMS, PRODUCT, AND/OR PROCESSES

The Enrollment Management System with Trend Analysis by Department Using XGBoost Algorithm for Westbridge Institute of Technology, Inc. was designed and developed to digitalize the enrollment processes and support data-driven institutional decision-making. The researchers employed Three-Tier Architecture, which included the Presentation Layer, Business Logic Layer, and Data Layer to make sure that the system is organized and can adapt to a scalable framework.

This architectural model helped the researchers to facilitate the efficiency of handling the enrollment-related transactions while also ensuring the maintainability and future scalability of the system. The Presentation Layer as a user interface allows various users like superadmin, registrar, accountant, professors, and students—to interact with the system. Then the Business Logic Layer is responsible for handling core functionalities such as student registration, enrollment verification, payment-receipt tracking, grades viewing, and generating trend analysis by department. Meanwhile, the Data Layer is the one that managed the secure storage and organization of data which includes student records, enrollment transactions, enrollment payment-receipt/s information, and student grades. This kind of multi-tiered structure helped the researchers enhance the system performance and simplify the institutional workflows.

Additionally, the system followed a logical operational flow that ensures a structured system and user-friendly experience. The superadmin manages user roles, configured system settings, and monitors departmental enrollment trends to aid in resource planning. The registrar is responsible for managing tasks that involved student registrations, enrollment approvals, and academic records. The Accounting personnel validates payment submissions and tracks outstanding balances, thus preventing enrollment-related discrepancies and additionally the system developed an audit trail that can track any changes made by an admin. Professors submits student grades, and in turn, students could submit enrollment forms, upload proof of payment, monitor their financial status, and access academic performance online. These allows the system in exchanging necessary data needed by the other user.

Next is at the system’s core, a relational database, which organized and managed data through well-defined entities such as students, courses, payments, enrollments, and grades. Each table in database that is used for located several records included primary keys for unique record identification and foreign keys for establishing inter-table relationships. This kind of approach ensured referential integrity, it can also minimize data redundancy and allowed fast retrieval of information required by the system's processes.

The EMS has a user-friendly interface that adjusts based on each user's role, a secure login system to control who can access the system, and dashboards that designed to help users complete their specific tasks easily. The interface was built using HTML, CSS, JavaScript, and the React framework, making it work well on all types of devices and screen sizes which makes it easier to navigate and reduced the chances of users making mistakes. Another interesting feature of the system was the Trend Analysis by Department powered by XGBoost Algorithm to do predictive analysis, that uses historical enrollment data to identify growth patterns across departments. This was developed using flask python backend application.

Security was a central consideration throughout the system's development. The researchers implemented Role-Based Access Control (RBAC) that restricts the user privileges based on their role responsibilities, thus safeguarding sensitive operations. Additionally, all users' credentials were encrypted prior to storage, to safeguard and ensure data confidentiality, integrity, and availability, protecting the institutional and student records' sensitive information from being accessed by unauthorized persons.

The enrollment management system was developed using PHP that handles the server-side logic and communication with the database. And then the frontend was built using REACT along with HTML, CSS, and JavaScript to create or develop an interactive and pleasing user interface and gather satisfactory experiences. The MySQL database provided efficient data storage and query execution. The researchers used XAMPP for local development and Visual Studio Code as the primary integrated development environment. These cohesive technology stacks or applications supported a robust, scalable, and maintainable system that is very much capable of meeting the institution's operational needs.

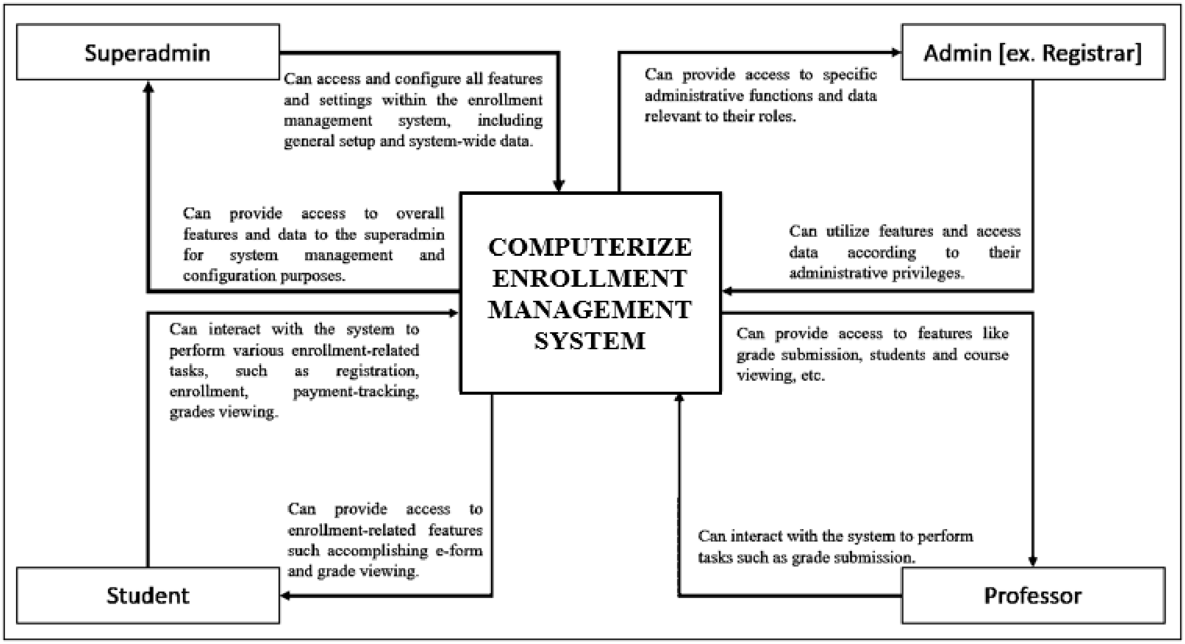


Figure 9.0 Enrollment Management Context Diagram

Figure 9.0 Enrollment Management System Context Diagram illustrates the interactions between the computerized enrollment management system and all the users involved in the system, each of them has distinct roles and access privileges within the system. For example, the Superadmin holds the highest level of access, giving them the only user that has the power to configure and manage the system's settings, features, and data. Giving the Superadmin the privilege to see the entire system’s functionalities, manage user roles permissions and make sure that all of it is running smoothly. Like for example for the admins, such as a registrar or accounting staff, they interact with the system to perform administrative tasks like managing student records, processing payments receipts verification and recording, and handling enrollment details. The system provides the specific admin with access to specific features related to their responsibilities, like viewing and updating student enrollment information if the admin user is the registrar and overseeing payment transactions if the admin user is accounting, these restrictions make sure that all administrative functions are carried out with their respective job roles and in an effective manner. While the student users can access various features related to accomplishing enrollment processes. The student users interact with the system to complete e-forms for registration and enrollment; track payments of tuitions and miscellaneous and other fees related to enrollment; and view their grades when the admin side responsible allowed it. The system enables students to monitor their enrollment-related activities, helping them by providing them with the features necessary to oversee and guide them to complete their enrollment tasks. Professors, who are responsible for managing course information and student grades, use the system to perform tasks such as submitting grades and accessing student lists. The system supports professors by offering them a platform to update grades, manage course details, and interact with student information, which is critical for maintaining accurate academic records. In this context, the system acts as the central hub connecting all the users, ensuring that each group has the appropriate access to the features relevant to their roles. The system's design ensures that each user, from superadmin to the students and professors, can efficiently perform their specific tasks, making the enrollment management process streamlined and effective.

DEVELOPMENT AND TESTING

The researchers did everything to focus on ensuring the successful development, testing, and deployment of the Enrollment Management System with Trend Analysis by Department Using XGBoost Algorithm. It entailed looking at what kind of software and hardware the system needs to run smoothly, what kind of software and hardware the system is easy to use, what kind of software and hardware the system is secured, and what kind of software and hardware the system can handle growth in the future. To meet these several goals of the researchers, the researchers built the system to handle different tasks to address and achieve those goals like predicting enrollments, digitizing enrollment forms, and processing automatic computation for payment-receipt tracking of tuition and balances. Additionally, the stakeholders can monitor changes made by their admins or staff by reviewing the feature – an audit trail. The researchers tested everything carefully to find and address these challenges, which made the system more accurate, dependable, and reliable. The researchers also checked and assured the users that the system would work well with the school's current workflow. Overall, the researchers made sure that the system could ran smoothly and could easily be improved in the future.

Category	Software/Tools
Operating Systems	Windows 7, Windows 10, or Windows 11
Development Environment	Visual Studio Code (VS Code)
Programming Languages	JavaScript, PHP, Python
Structure and Design	HTML, CSS
Database Management Systems (DBMS)	MySQL (for local development and testing), Hostinger Cloud-based Database (for scalability)
Web Servers	Google Chrome (for testing), Microsoft Edge (for testing)
Version Control	GitHub
Testing Frameworks	Live Server, Terminal
Collaboration Tools	GitHub
Documentation Tools	Python Docstrings, PHPDoc
Backend Framework	Laravel, Inertia js, Flask Python
Machine Learning Libraries	XGBoost, Pandas, NumPy, Scikit-learn, Flask (for creating RESTful APIs)
OCR Library	Tesseract.js
Frontend Libraries and Frameworks	React, Chart.js, Materialize CSS, Bootstrap

Table 1.1 Software Requirements

The software requirements offered platforms and tools for system development, testing, and deployment. The researchers optimized the development environment for efficient handling of frontend and backend sections in a responsive and scalable way. With dynamic user interfaces by React and backend operations by PHP, the researchers achieved ease of maintenance and flexibility. The machine learning component the EMS has is XGBoost-based, a Python library requirement for model and data management using Pandas and Scikit-learn for making precise predictions on enrollment patterns. For database data management, MySQL in the local development process was utilized to provide cost-effective and flexible data management. The system was subsequently hosted on a cloud database to handle more data and users without slowing down performance. To keep the development process in a clean and collaborative state, the researchers used GitHub for version control in the development of various modules of the project. Testing frameworks were also used to test frontend and backend systems thoroughly to ensure functionality, reliability, and overall system stability before deployment.

Category	Minimum	Recommended
Processor	Dual-core processor (e.g., Intel Core i3 or equivalent)	Intel Core i5 or higher
Memory (RAM)	4 GB RAM	8 GB RAM or higher
Storage	128 GB SSD or HDD	256 GB SSD or higher
Network	Stable internet connection for regular updates and collaborative work	High-speed internet connection for faster data transmission, smoother collaboration, and efficient data processing, especially during cloud deployment
Graphics Card	Integrated graphics are sufficient.	Integrated graphics should remain sufficient.
Peripheral Devices	Standard keyboard and mouse, webcam for OCR functionality, and printers for generating summary reports	Standard keyboard, mouse, webcam, and printer, with optional advanced peripheral devices as needed

Table 1.2 Hardware Requirements

Hardware specifications were so designed that the system under the proposal would work effectively in development, test, and deployment environments. Dual-core processors were seen to be adequate for development and testing, and a quad-core processor (Intel

Core i5 or higher) was seen to provide even more performance for machine learning operation and processing of bulk data. The system utilized a minimum of 8 GB of RAM to facilitate the smooth running of complex operations like training of machine learning models, simulation, and processing of data sets.

SSD storage was also proposed to provide faster read and write speeds, faster performance, and reduced loading times throughout the development cycle. A stable internet connection was deemed necessary to enable smooth collaboration using GitHub and access to cloud-based databases and services. Although a dedicated graphics card was not a priority, it would enhance performance in some machine learning tasks. Peripheral devices such as a keyboard, mouse, webcam, and printer were also necessary to enable system interaction and the generation of outputs such as reports. Adherence to these hardware specifications ensured the Enrollment Management System operated efficiently, enabled enrollment trend prediction, processed OCR data, and offered a perfect user experience. These specifications also formed a basis for a scalable, cloud-based deployment in future deployments.

IMPLEMENTATION PLAN

The plan of implementation for the thesis "Enrollment Management System with Trend Analysis by Department Using XGBoost Algorithm" was to construct a system that could predict enrollments at the departmental level. The researchers used a step-by-step process in leading the development, testing, and implementation of the system. The Enrollment Management System (EMS) was the main system by which enrollment procedures were managed, and trend data were extracted. It has a feature for data processing, handling, and forecasting to enable the identification of at-risk students and generate insights about the forecast by department results. The system used the Extreme Gradient Boosting (XGBoost) algorithm to handle the enrollment data in a manner that enables effective forecasting of future student trends.

To enable systematic implementation, the researchers divided the implementation process into stages like system design, module development, integration, and testing. The stages were designed to enable the system to meet the performance, accuracy, and usability level.

Additionally, end-user feedback dominated the process of system fine-tuning during implementation. Following preliminary deployment, EMS underwent a sequence of pilot runs involving student enrollment officials and academic staff to obtain feedback on functionality, user interface, as well as predictive accuracy. Refining was done based on the feedback so that the system is aligned with present-day enrollment processes as well as departmental forecasting requirements. Regular checking and verification of the model's performance was also included so that the XGBoost algorithm became a routine with new data coming in over time.

Implementation Plan			
Strategy	**Activities**	**Persons Involved**	**Duration**
1. Data Gathering	- Conduct comprehensive data gathering activities to collect information for system development.	- Proponents - Personnel Involved	October - November 2024
2. Design Based on Client	- Develop the system design based on client requirements, incorporating insights gathered during data gathering.	- Proponents	November 2024
3. Prototype Development	- Finalize the prototype phase, ensuring it aligns with initial project goals and user requirements.	- Proponents	December 2024
4. Coding	- Begin the coding phase, translating the system design into functional code.	- Proponents	December 2024-April 2025
5. Database Setup	- Implement the database structure and configuration based on the system design.	- Proponents	December 2024-April 2025
7. Testing & Survey Preparation	- Prepare for the upcoming testing phase, ensuring all components are ready for comprehensive testing.	- Proponents	April 2025

Table 2.0 Enrollment Management System Implementation Plan

Through the implementation of these stages, the researchers maintained timely and effective development of the Enrollment Management System. Every stage complemented the other stages in order to ensure that the system was conformant with the performance, accuracy, and usability standards of the educational institution. Utilization of the XGBoost algorithm enhanced the predictive ability of the system in the forecast of future enrollment patterns, hence enabling strategic decision-making processes.

ISO 25010 FOR SYSTEM EVALUATION FRAMEWORK

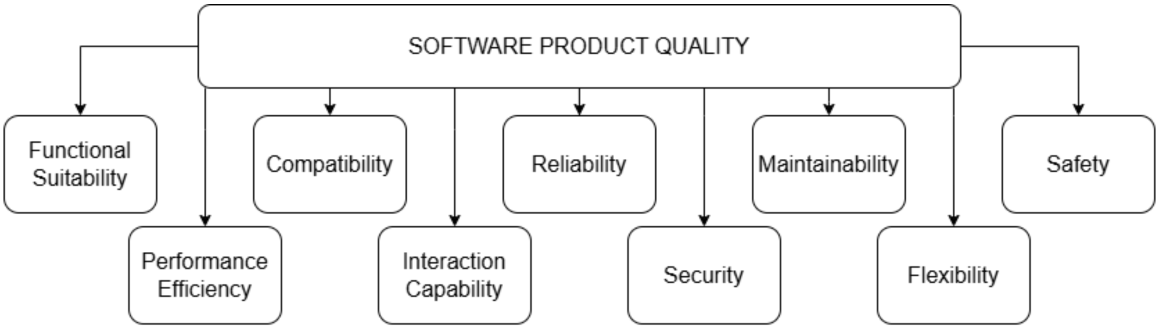


Figure 10.0 International Organization for Standardization (ISO/IEC 25010)

In Figure 10.0, the researchers introduced the ISO/IEC 25010 standard as the model to be used to measure the quality of the developed Enrollment Management System with Trend Analysis by the Department Using the XGBoost Algorithm. It is an international standard that offers a systematic model to examine software quality based on two principal viewpoints: product quality and quality in use. The product quality model comprised key characteristics, including functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, flexibility, and safety. Each of these features was then further decomposed into sub-features to allow a thorough and structured assessment of the system.

To ensure that both the Enrollment Management System and the XGBoost algorithm embedded within were properly tested, the researchers matched the system's performance criteria to the relevant ISO/IEC 25010 attributes. Under functional suitability, the researchers have measured the model performance using prediction performance metrics including accuracy, precision, recall, F1-score, AUC-ROC (in case of classification), and RMSE or MAE (in case of regression). The measurements validated the capacity of the system to make accurate predictions for departmental enrollment trends. For performance efficiency, the researchers quantified variables like inference time, training time, and system resource utilization, i.e., CPU utilization and RAM usage. These variables indicated the system's ability to perform under various data conditions.

The authors also ensured reliability by verifying the system's stability under different input datasets and situations. This included testing its fault tolerance as well as maturity, particularly in coping with incomplete or inconsistent data. In the meantime, the XGBoost model was running behind the scenes, usability was quantified based on the usability of the system—more specifically, how easily and quickly administrators and analysts would be able to use the interface to read trends and insights of data. Through the incorporation of these evaluation factors into the ISO/IEC 25010 standard, the researchers guaranteed that the Enrollment Management System was within the standards of quality software used globally. This methodical analysis further consolidated the reliability, efficiency, and general effectiveness of the system in the provision of data-driven decisions for institutions of education.

DATA ANALYSIS

LIKERT SCALE INTERPRETATION			
Scale	**Range**	**Remarks**	**Verbal Interpretation**
4	3.26 – 4.00	Strongly Agree	Very High
3	2.51 – 3.25	Agree	High
2	1.76 – 2.50	Disagree	Low
1	1.00 – 1.75	Strongly Disagree	Very Low

Table 3.0 Survey Evaluation Criteria Based on 4-point Likert Scale

Table 3.0, Survey Evaluation Criteria Based on 4-Point Likert Scale, represents the interpretation framework adhered to by researchers for rating responses obtained from the survey participants. Researchers used a 4-point Likert scale to rate users' opinions on the quality, functionality, and usability of the Enrollment Management System designed with Trend Analysis by Department Using XGBoost Algorithm. This scale excluded a neutral option to encourage respondents to express a definitive stance—either in favor of or against each item. The scale ranged from 1.00 to 4.00, with each value corresponding to a specific verbal interpretation and qualitative remark.

The score range between 3.26 and 4.00 was interpreted as "Strongly Agree," having a "Very High" rate in satisfaction. Between 2.51 and 3.25, it was marked as "Agree," indicating a "High" rate of agreement about the efficiency of the system. Values ranging from 1.76 to 2.50 were labeled as "Disagree," showing a "Low" acceptance level, and scores from 1.00 to 1.75 translated to "Strongly Disagree," representing a "Very Low" rating. This framework for interpretation gave the researchers a systematic method of measuring and analyzing user feedback, enabling them to impartially evaluate the performance of the system and user experience. By doing so, the researchers were able to translate stakeholder feedback into something valuable for system validation and incremental enhancement.

For providing the overall quality measurements, the authors used ISO/IEC 25010 as the primary model for evaluation. The international standard was tailored to measure software systems using both product quality and quality in Use models. Unlike ISO/IEC 12207, which focuses on software life cycle processes, or ISO/IEC 9126, the previous precursor to ISO/IEC 25010 with a narrow focus, the ISO/IEC 25010 standard offered a revised and more detailed model. It evaluated major attributes like functionality, performance efficiency, usability, reliability, and maintainability—making it extremely suitable for measuring the performance of the proposed system.

To obtain empirical data against this standard, the researchers employed a survey methodology, which provided a convenient and efficient method of gathering direct feedback from end users. Surveys were particularly well-suited to the measurement of subjective variables such as usability, user satisfaction, and perceived reliability—key elements of the ISO/IEC 25010 model. Using a 4-point Likert scale without a central point, researchers encouraged more precise responses, reduced ambiguity, and enhanced the interpretability of results. Consequently, feedback collected could be mapped precisely onto the system quality attributes according to the ISO/IEC 25010 standard, offering a robust and legitimate assessment process.

RESEARCH INSTRUMENTS

For the collection of empirical information from the users, the researchers created a controlled questionnaire based on the ISO/IEC 25010 assessment framework. The questionnaire included items categorized based on major quality characteristics like functional suitability, performance efficiency, compatibility, interaction capability, reliability, security, maintainability, flexibility, and safety. Rating for each item was done using a 4-point Likert scale and with careful phrasing to capture actual user experiences about the system. The questionnaire was used as the main research tool in determining user satisfaction and system effectiveness based on the views of system evaluators.

VALIDATION OF RESEARCH INSTRUMENTS

To ensure that the research tool was valid and reliable, the researchers had their draft questionnaire read and commented upon by the professor. An expert in system assessment and educational management systems. The feedback was used to make the questionnaire items clearer, relevant, and in relation to the objectives of the study. This validation process strengthened the instrument's credibility and minimized potential measurement errors.

RESPONDENTS OF THE STUDY

The respondents of the study consisted of students involved in the enrollment process at Westbridge Institute of Technology, Inc. (WITI). This group included students in IT-related strands and programs both in SHS and college. These participants were chosen purposively since they are the ones dealing directly with the enrollment system and are capable of providing informed responses on the usability and effectiveness of the system. The system was tested by 100 respondents. Their comments provided useful information about the performance of the system within an actual education environment.

DATA GATHERING PROCEDURE

The researchers used a methodical approach to gathering data from the respondents. Following the acquisition of the relevant approvals from the institution, the researchers sent out paper and electronic forms of the already validated questionnaire. Respondents were explained in a clear manner the intent of the study and the way they would complete the form.

Data collection was conducted over one week in April 2025. The researchers ensured availability to clarify any queries raised by the participants during the evaluation period. After collection, responses were tabulated, encoded, and analyzed using statistical tools to compute mean scores for each item.

ETHICAL CONSIDERATIONS

Based on research ethics, the researchers made sure that the participants were adequately informed about the nature and purpose of the study. Consent was obtained prior to participation through the use of a written informed consent. The respondents were assured of confidentiality and anonymity in their response and were informed that participation was voluntary and could be withdrawn at any time.

The collected data were handled with confidentiality and in the interest of academic relevance to the assessment and improvement of the Enrollment Management System. The research was by the ethical requirements needed by the institution and dealt with respect for the welfare and human rights of all who were involved.

CHAPTER IV

SOFTWARE PRODUCT DEVELOPMENT

SYSTEM OVERVIEW

The process of enrollment at Westbridge Institute of Technology, Inc. is simplified and updated to present standards through automation and modernization, which ease the limitations placed on employees, students, and administrators. The system is online-based, and users are provided with the feature to handle enrollment information through individual devices, mitigating the need for physical access. The core features include registration management to make document submissions, evaluation, and enrollment management to register only valid students, Payment Tracking for tracking money matters, and enrollment trends and insights for resource and planning support. The software presents an efficient and convenient mechanism to deal with such operations. The user interface is built using React, HTML, CSS, and JavaScript for an interactive user interface. Back-end processing is taken care of by PHP Laravel, with data storage and retrieval handled via MySQL. The combination of Python and Chart.js provides visual insight into enrollment numbers. The platform also utilizes the application of XGBoost algorithms in forecasting enrollments, and administrators are provided with essential decision-support tools.

SYSTEM ARCHITECTURE

The architecture is client-server. Students, staff, and faculty on the client side use personal computers to interact with the system. The server processes requests, maintains data, and provides real-time communication with the client side through HTTP protocols. For scalability and reliability, the system is run on cloud hosts like Hostinger. Such sensitive data is kept secure by measures such as encryption, token-based authentication, and role-based access control, while safe access by permitted users is provided.

Server-side is designed to integrate with third-party applications like OCR APIs that render it easy to scan past enrollment forms and update records after maintenance a breeze. PHP Laravel and Python integrated; the app utilizes both programming languages to provide smooth operation for all back-end functions. PHP Laravel is best utilized to handle core app logic, manage user authentication, and integrate with MySQL to ensure that data continues to run smoothly. Python, on the other hand, is suited best for operations like predictive analytics and data visualization using libraries like Pandas, NumPy, and Matplotlib. Both back-end modules communicate with each other through clean APIs, without which integration is not possible even though they are written in different languages. For example, Python can operate on data or gain insights and then transfer the outcomes to PHP Laravel through RESTful API endpoints. This module-based approach allows each language to focus on tasks it can perform best without compromising compatibility and speed. By organizing the back end in this manner, the system achieves flexibility and scalability without any conflict between the two languages. It also makes future updates available to be executed independently for each module so that the system remains adaptable to changing requirements.

This enrollment system offers a flexible, secure, and user-friendly platform that is responsive to the needs of the institution. It enables data-driven decision-making, enhances administrative effectiveness, and increases the student and staff experience.

DATA FLOW AND INTERACTION

In the Westbridge Institute of Technology, Inc. enrollment system, data flow, and user interaction both play a major role in institutional effectiveness. It is initiated by students who feed their personal and academic information to the system and administrative staff verify the inputs for accuracy and completeness. Through validation, the system stores and processes information securely to support processes such as charging fees, document validation, and final enrollment approval. All points of contact are designed to minimize errors and delays simplify the process and make it easy to use. The formal process not only supports data integrity but also enhances the ability of the institution to process enrollment efficiently and address student needs on time.

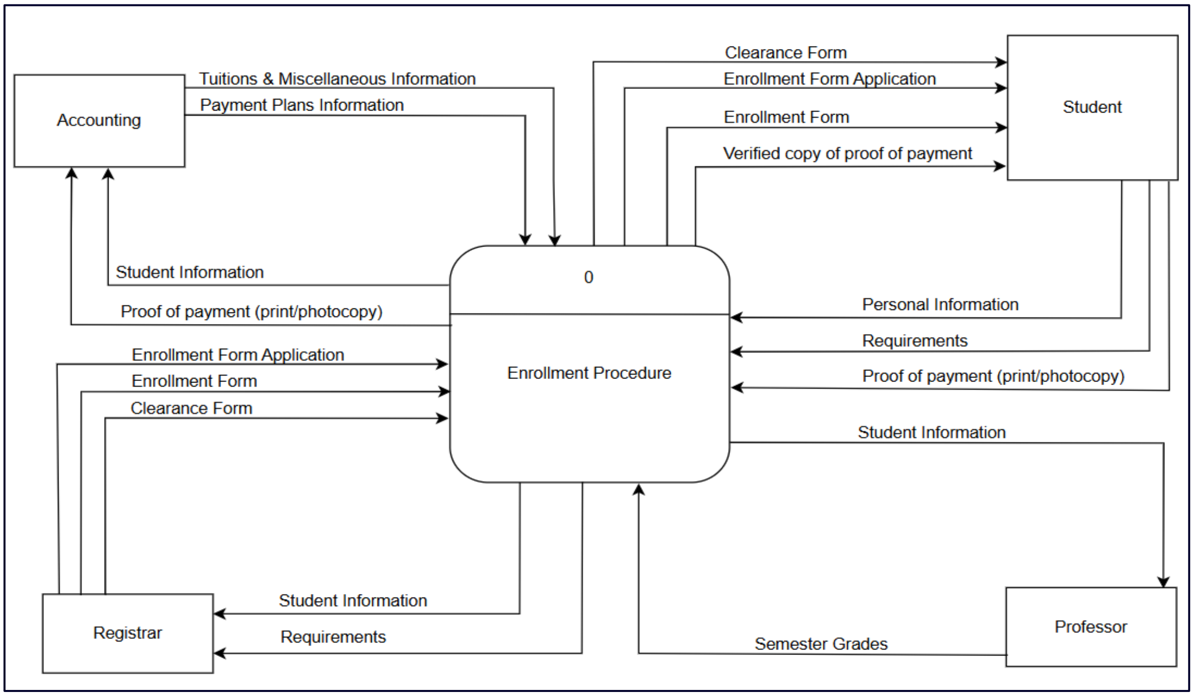


Figure 11.0 Current Traditional Enrollment Context Diagram

The figure illustrates the present enrollment process of Westbridge Institute of Technology, Inc., identifying the interaction of key stakeholders such as students, administrative staff, and the enrollment system. It follows the data flow concerning key activities—registration, enrollment, payment receipt, and grade submission—while identifying segments that continue to use manual processes. This graphical illustration is the starting point for analyzing the existing system and identifying whether the integration to EMS with Trend Analysis by the Department Utilizing the XGBoost algorithm can improve operational efficiency, bring some improved changes, and meet user satisfaction.

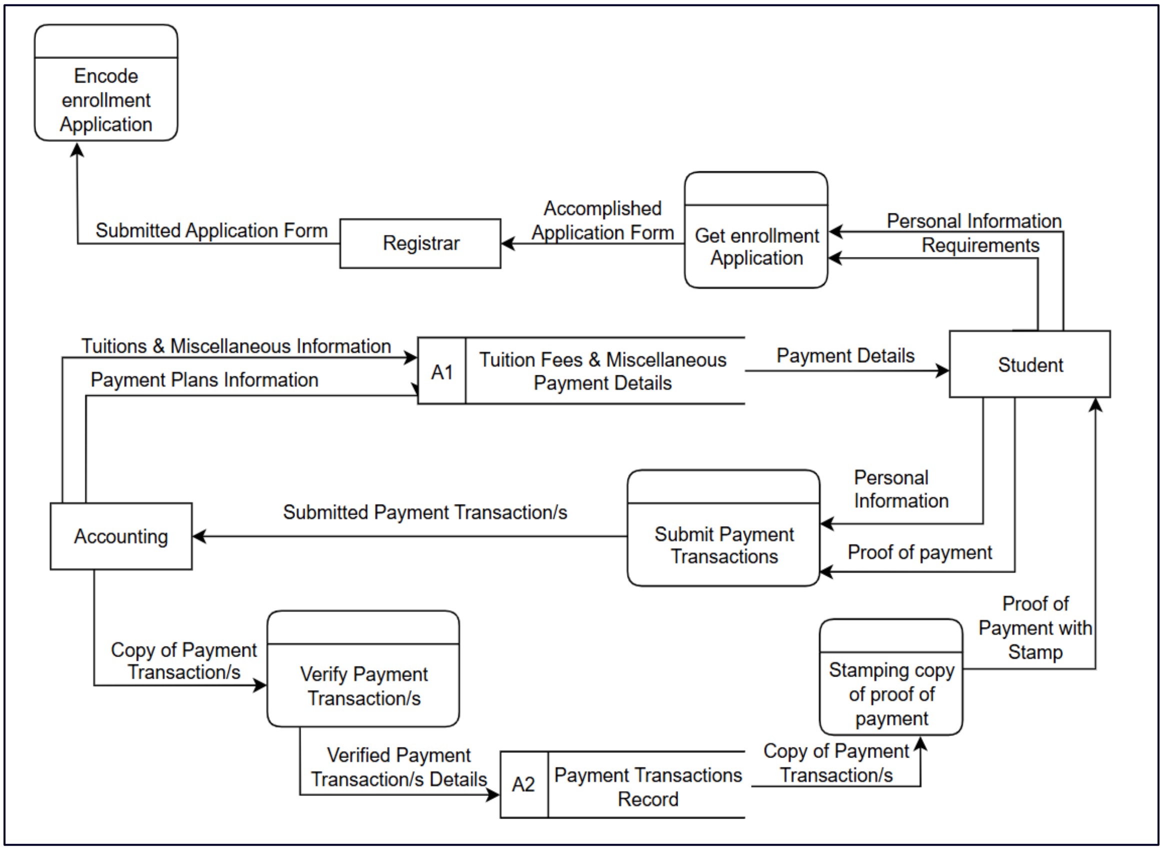


Figure 12.0 Current Traditional Enrollment Data Flow Diagram

This diagram illustrates the manual handling of data in the present enrollment process at Westbridge Institute of Technology, Inc. It depicts how students and administrative staff exchange information, mapping out steps like document submission, verification, and record-keeping. The diagram is a learning tool for discovering bottlenecks and inefficiencies in the current workflow, providing valuable insights into system redesign and digital transformation.

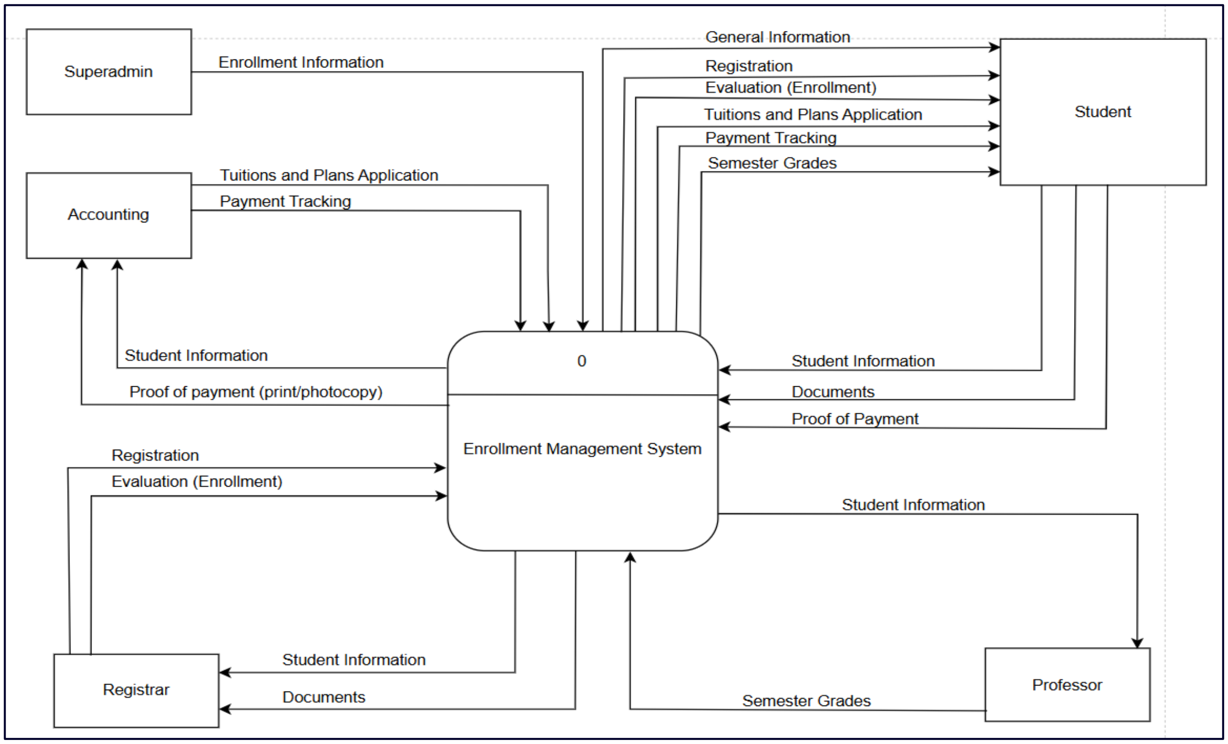


Figure 13.0 Enrollment Management System Context Diagram

The System Context Diagram illustrates a general overview of the proposed digital enrollment system, indicating the interaction between users—students, staff, and administrators—and the system. Students provide inputs like registration data and payment confirmations, while staff conduct verification and approval processes. The system then uses these inputs to generate outputs like enrollment status updates and transaction reports, demonstrating how automation increases the accuracy of data and simplifies the enrollment process.

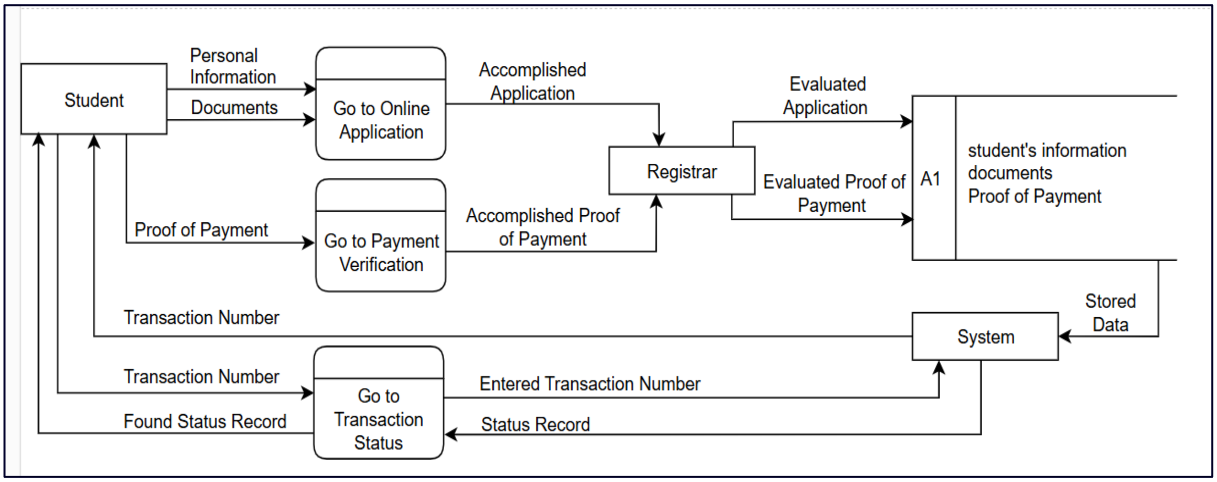


Figure 14.1 Registration System Data Flow Diagram

The diagram is centered on the systematized registration process, highlighting how students upload mandatory documents and details via the platform. The system allows staff to validate and confirm the data, after which it is stored securely. The system then provides feedback to students in the form of confirmation messages or status messages, ensuring transparency and ease of registration.

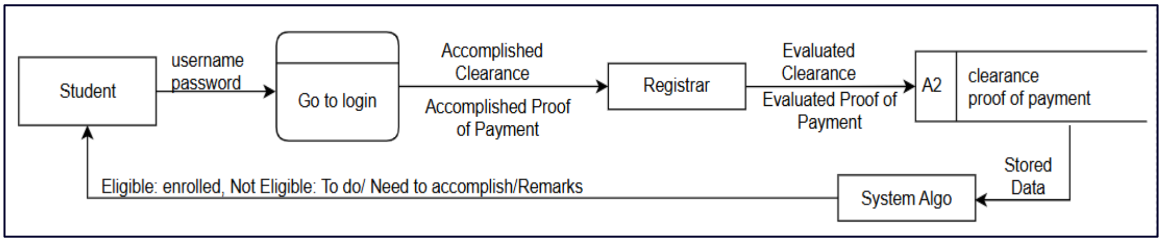


Figure 14.2 Enrollment System Data Flow Diagram

Figure 14.2 diagram details the enrollment process, in which the system uses validated registration information and enables eligibility verification by registrar and accounting staff. Once verification is successful, the system completes the enrollment, updates student status, and records financial transactions. It ensures all required steps—academic and financial—are monitored efficiently, eliminating delays and enhancing institutional control.

ACTIVITY DIAGRAM

Enrollment Management System with Department-wise Trend Analysis using XGBoost Algorithm is a unified online platform designed to revolutionize and automate the core academic functions in schools. Its prime function is to enhance the efficiency, transparency, and decision-making capacities of administrative staff as well as students.

This system combines traditional academic processes—course registration, tuition payment-receipt tracking, and viewing grades—with sophisticated data analysis to facilitate strategic planning. The most impressive component is the Trend Analysis module, which utilizes the XGBoost algorithm for machine learning to track past enrollment trends and forecast future trends by department. These statistics allow department chairs and academic planners to make data-driven decisions regarding course offerings, resource utilization, and student service support.

Key aspects of the system are:

- **Secure Login System:** Authenticates administrators or students before providing access to personalized dashboards.
- **Enrollment Module:** Enables students to view listed courses, confirm requirements, and enroll in subjects for the next semester.
- **Payment-Receipt Tracking:** Enables tracking of receipts.
- **Grades Viewing:** Enables students' access and viewing of their performance in a completed course in a secure manner.
- **Trend Analysis with XGBoost:** Provides historical trends of student enrollment by department and term in graphical charts and forecasts for strategic academic planning.

By integrating forecasting analytics with the spirit of the academic process, this platform not only optimizes the user experience but also provides an aspect of expectation that allows institutions to plan and prepare themselves for growth and student activity.

Authentication & Setup

The researchers designed the setup and authentication module to allow users to access the system securely. This was in the form of such features as logging on, email address verification, and new password creation.

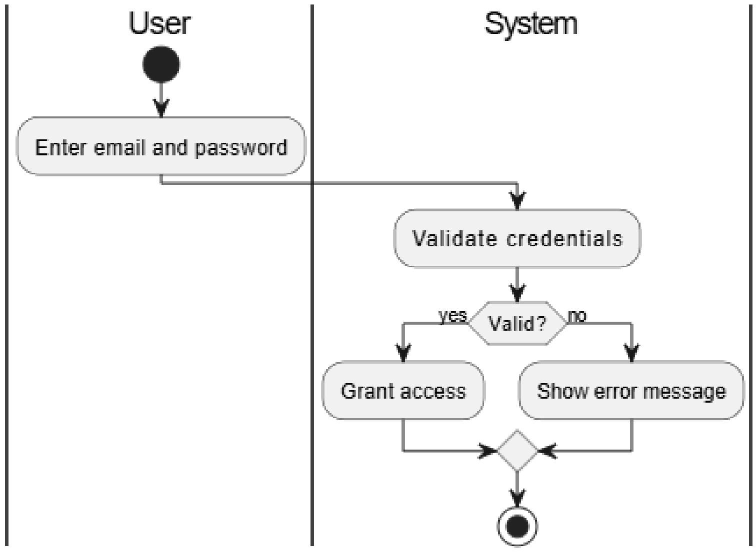


Figure 15.1 Login Activity Diagram

Figure 15.1 activity diagram explains how the users enter their login information, and the system verifies the correctness of the data before allowing or denying access.

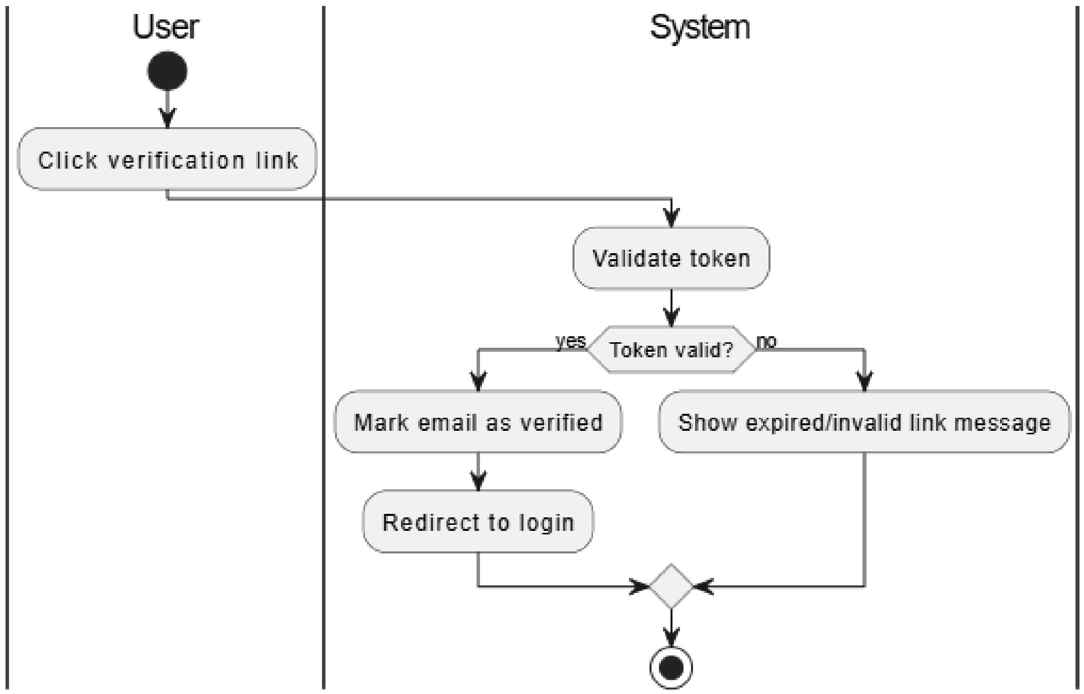


Figure 15.2 Verify Email Activity Diagram

Figure 15.2 activity diagram explains how the users confirmed their email addresses through a verification link, which helped to authenticate the account in EMS.

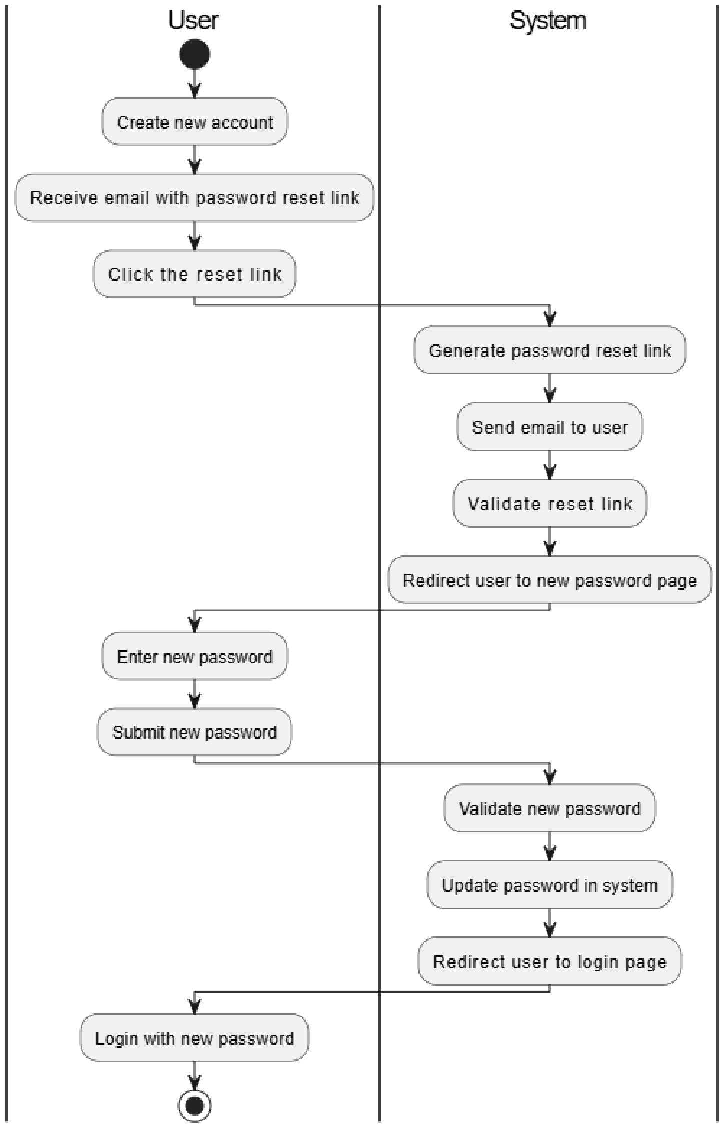


Figure 15.3 Create New Password Activity Diagram

Figure 15.3 activity diagram explains how the users are able to set a new password upon verification, which is usually used when restoring lost credentials.

Admin Management

The researchers incorporated admin management features so that a superadmin could handle and oversee the access of all the other system administrators. This included the creation, modification, and searching of admin accounts.

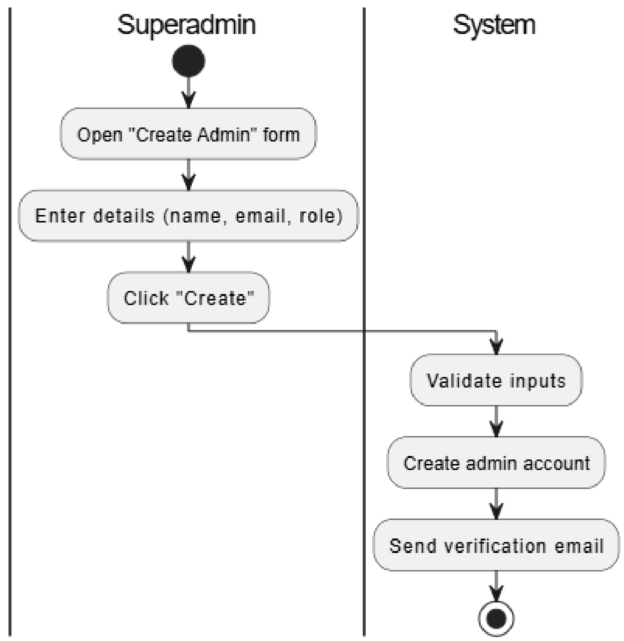


Figure 16.1 Create New Admin Account Activity Diagram

Figure 16.1 activity diagram explains how a superadmin can create a new admin by filling out a registration form. The system stored the information and set the account pending verification.

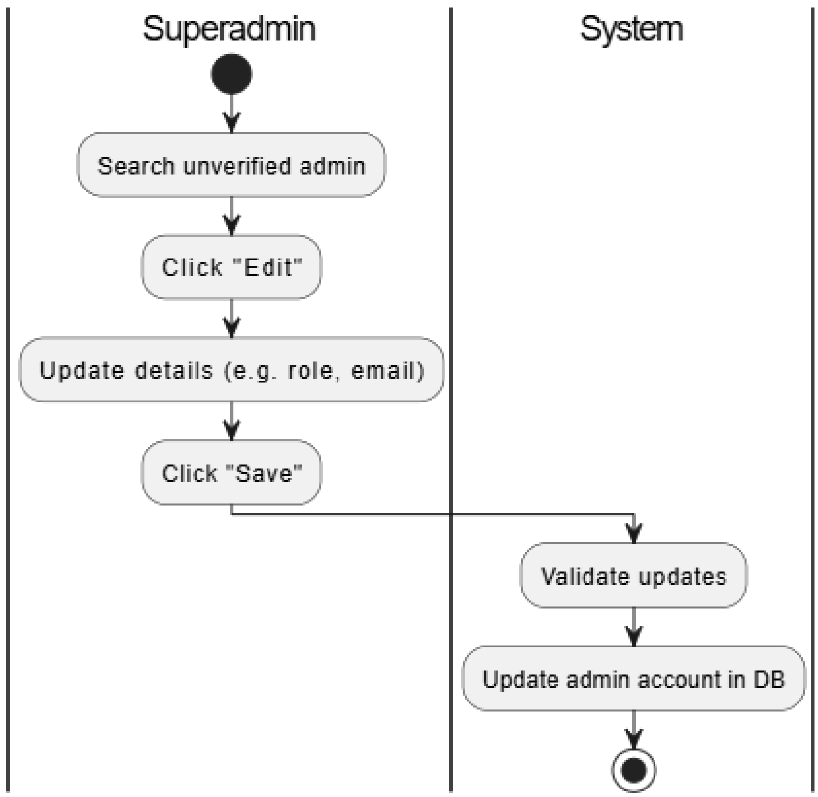


Figure 16.2 Edit Unverified Admin Account Activity Diagram

Figure 16.2 activity diagram explains how the superadmin will use an edit feature to alter the data of admin accounts that are yet to be verified in an attempt to rectify errors or modify data.

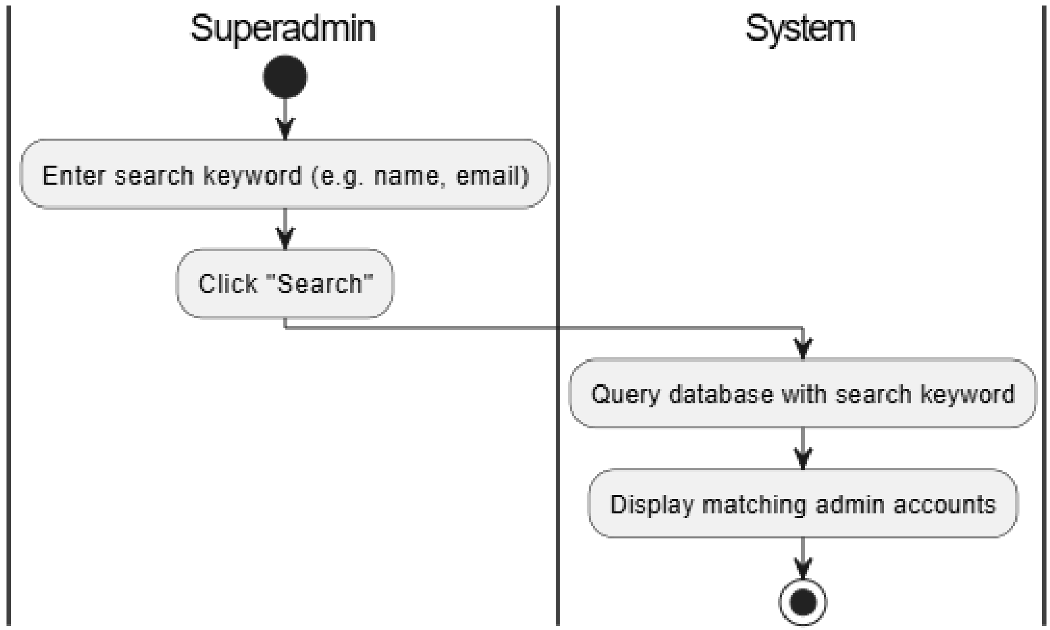


Figure 16.3 Search Admin Account Activity Diagram

Figure 16.3 activity diagram explains how a superadmin has the capability of searching admin accounts by keyword for easy retrieval of certain user records.

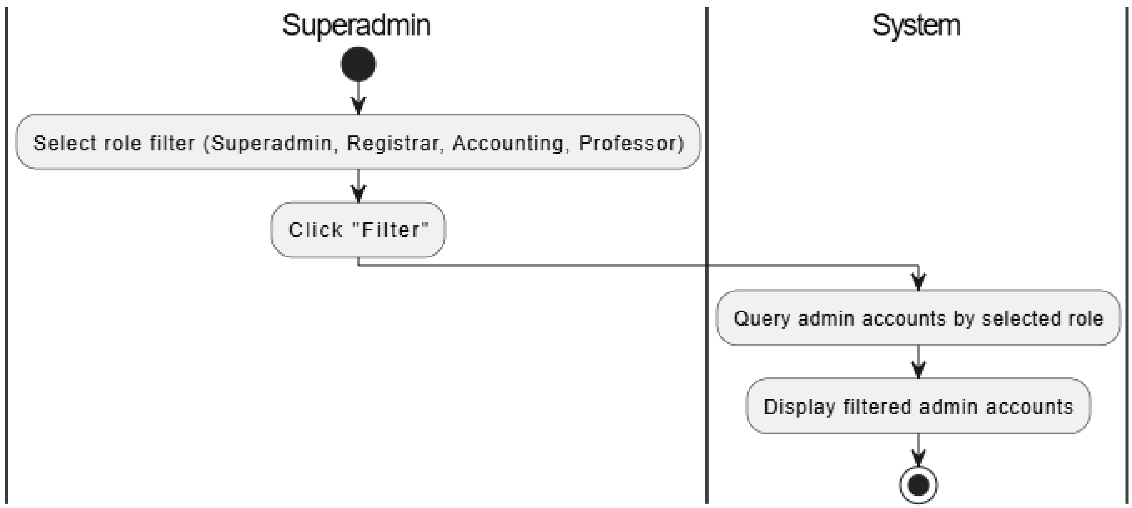


Figure 16.4 Filter Admin Account Activity Diagram

Figure 16.4 activity diagram explains how the system accommodates filtering admin accounts by roles such as the superadmin, registrar, accounting staff, or professor to ease management.

Registration Workflow

The researchers designed the registration process to manage the way students submitted, monitored, and completed their registration, including document verification and assigning student IDs.

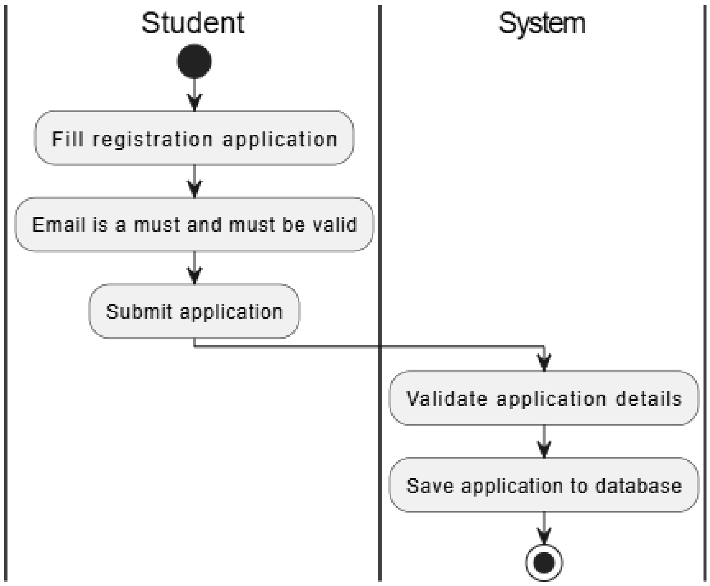


Figure 17.1 Submit Registration Application Activity Diagram

Figure 17.1 activity diagram explains how the students fill out and submit their registration forms, which are kept by the system for administrative review.

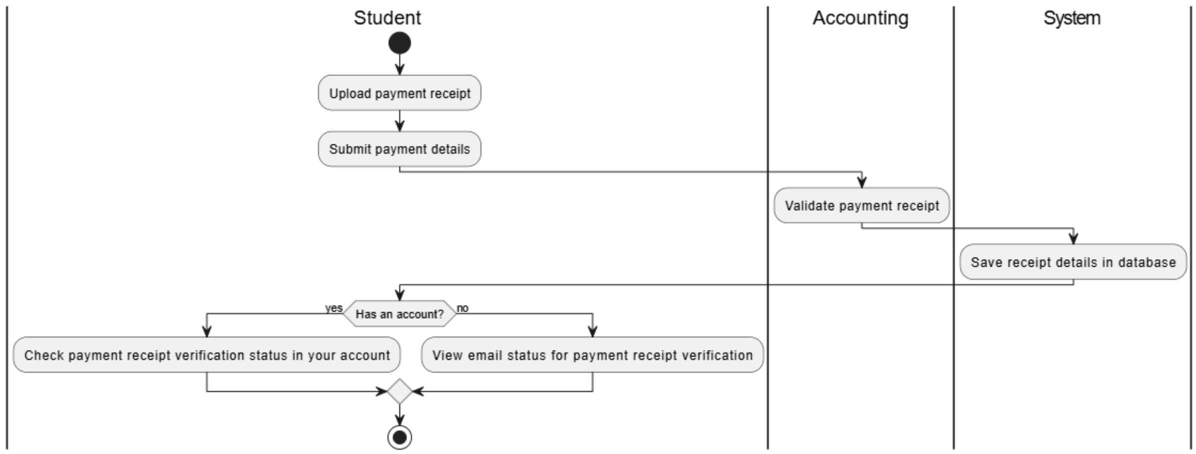


Figure 17.2 Submit Payment Receipt/s Activity Diagram

Figure 17.2 activity diagram explains how students present evidence of payment, which is then accessible to the accounting staff to verify and authorize.

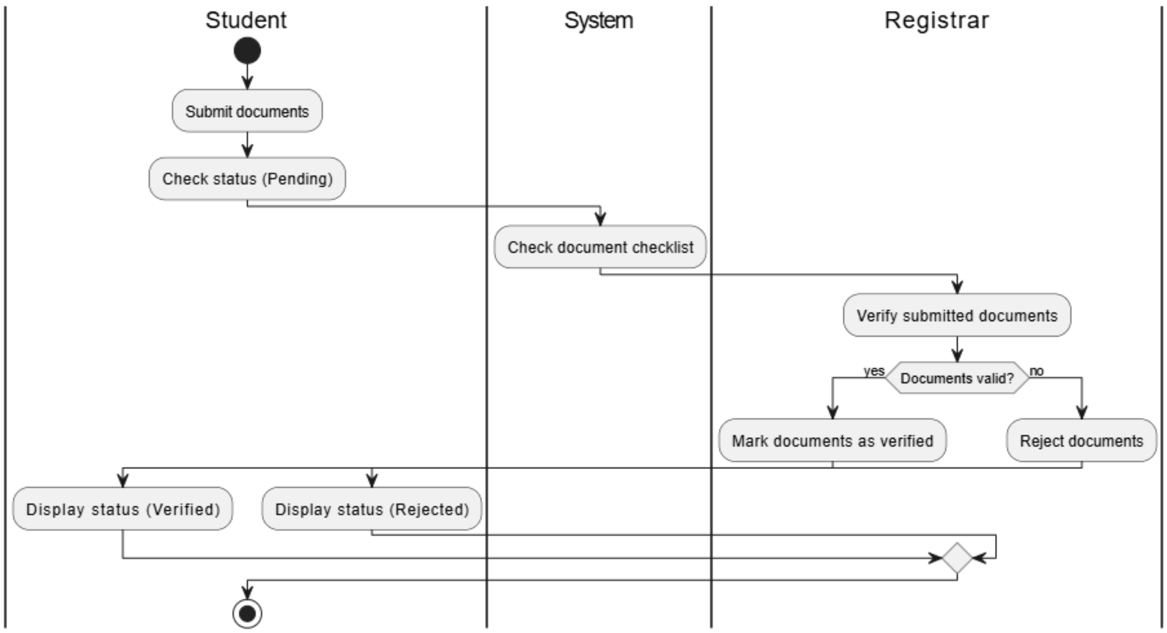


Figure 17.3 Verify Documents Activity Diagram

Figure 17.3 activity diagram explains how the registrar checks against official requirements and approves or rejects student-submitted papers for completeness and authenticity.

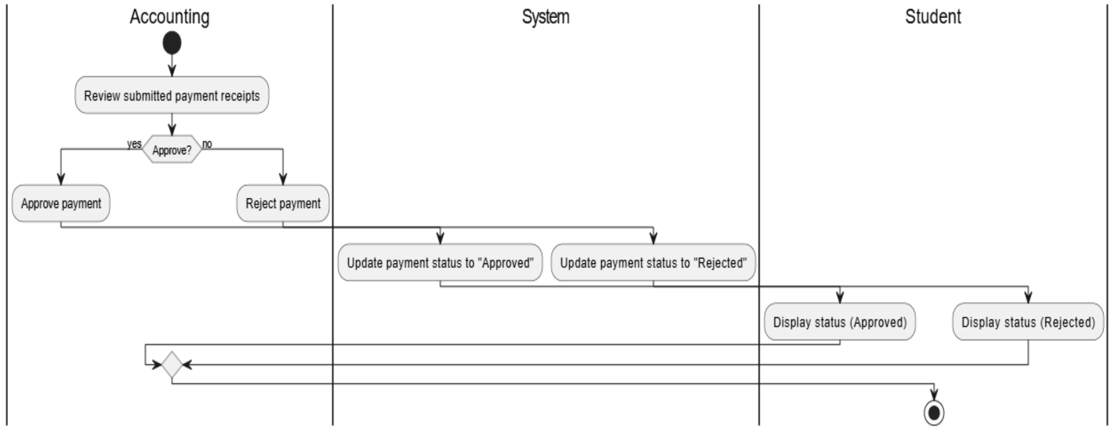


Figure 17.4 Approve Payment Receipt/s Activity Diagram

Figure 17.4 activity diagram explains how the accounting staff reviews and approves valid payment receipts, updating the student's payment status in the system.

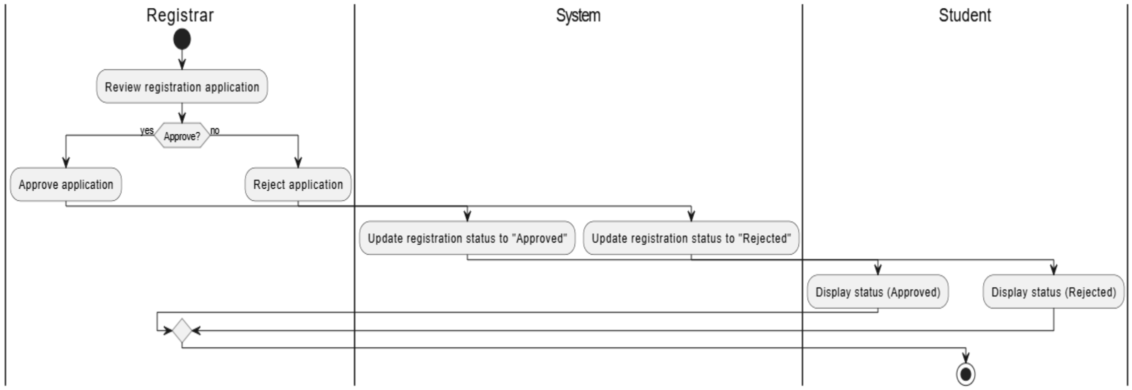


Figure 17.5 Approve Registration Application Activity Diagram

Figure 17.5 activity diagram explains how the registrar accepts or declines the registration of the student upon verification of all documents and payment status.

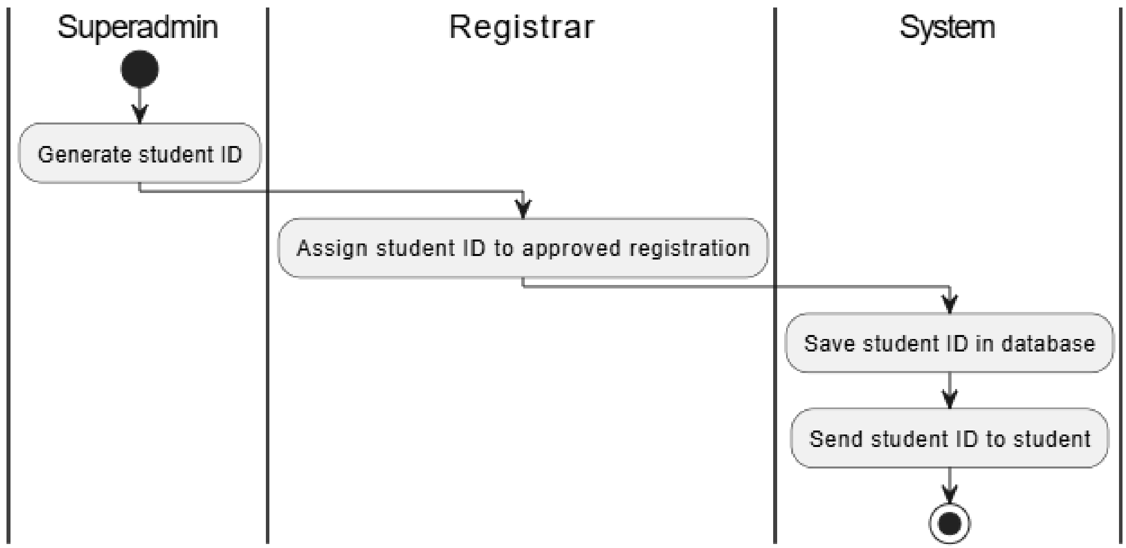


Figure 17.6 Assign Student ID Activity Diagram

Figure 17.6 activity diagram explains how the procedure by which, after approval of registration, the system automatically creates and assigns a new student ID to the applicant.

Profile Settings

The researchers created the profile settings module so that users could modify their account-related and personal details whenever they wanted.

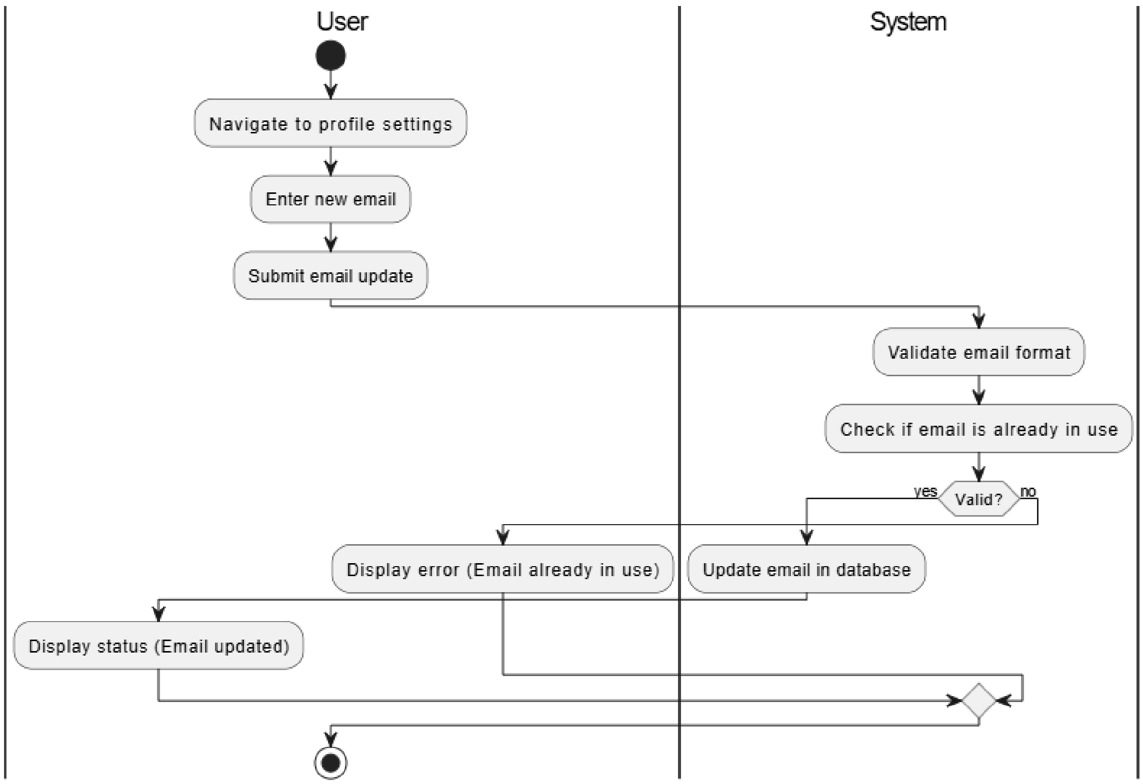


Figure 18.1 Update Email Activity Diagram

Figure 18.1 activity diagram explains how to change one's email address and verify the new address so that communication is secure.

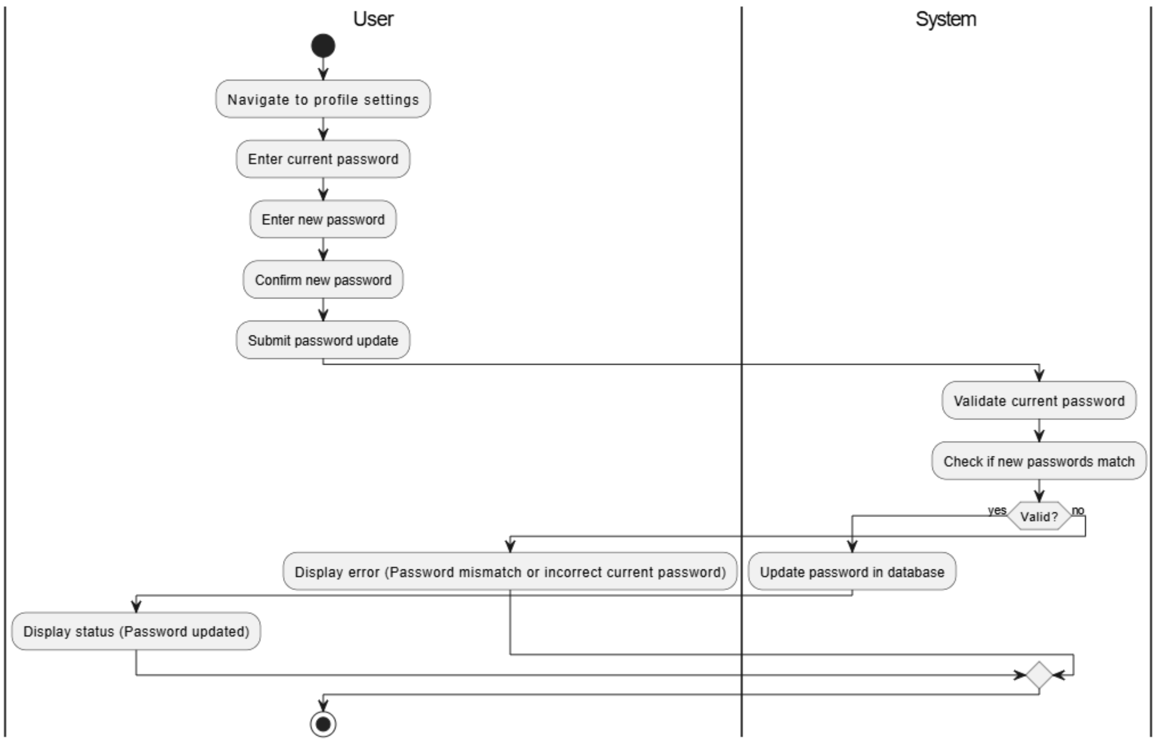


Figure 18.2 Update Password Activity Diagram

Figure 18.2 activity diagram explains the process a user follows to replace their password with a new one of their preference securely.

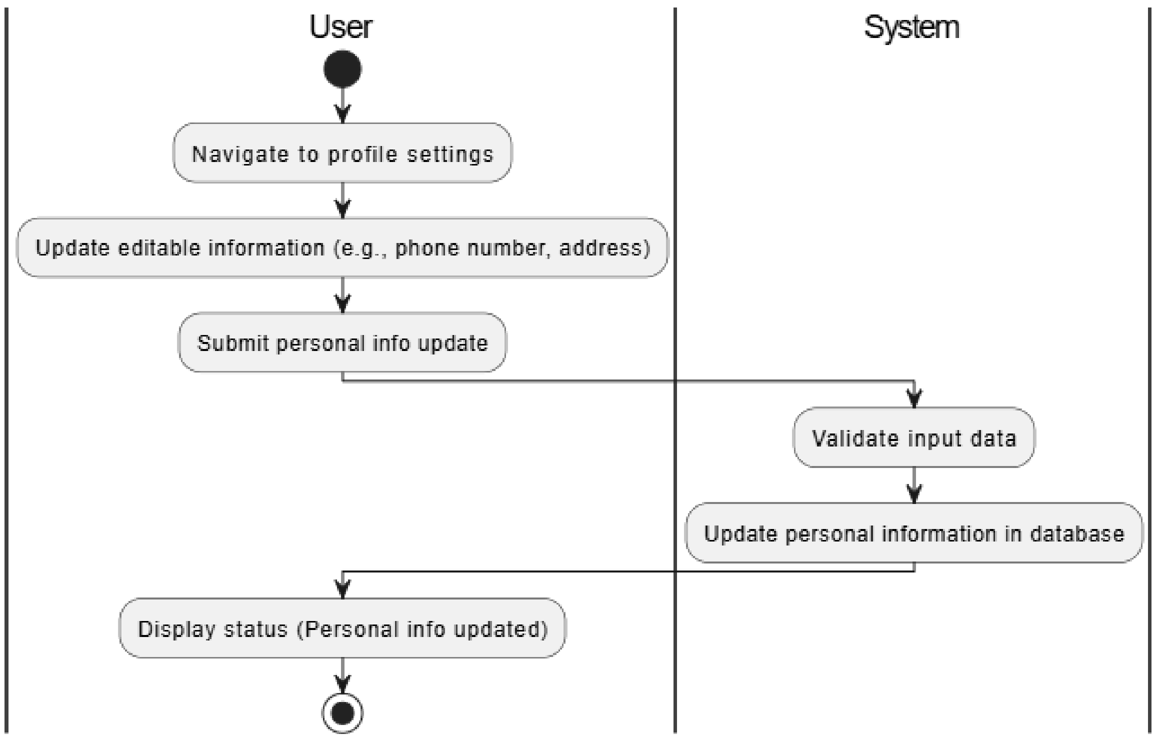


Figure 18.3 Update Personal Information Activity Diagram

Figure 18.3 activity diagram explains and shows that users can change editable individual information like name, address, and telephone number, which are stored and displayed on their account's profile page area.

Enrollment

The researchers developed the registration module that would help students manage their registration status, look at grades, enroll easily, and track clearance or checklist status changes.

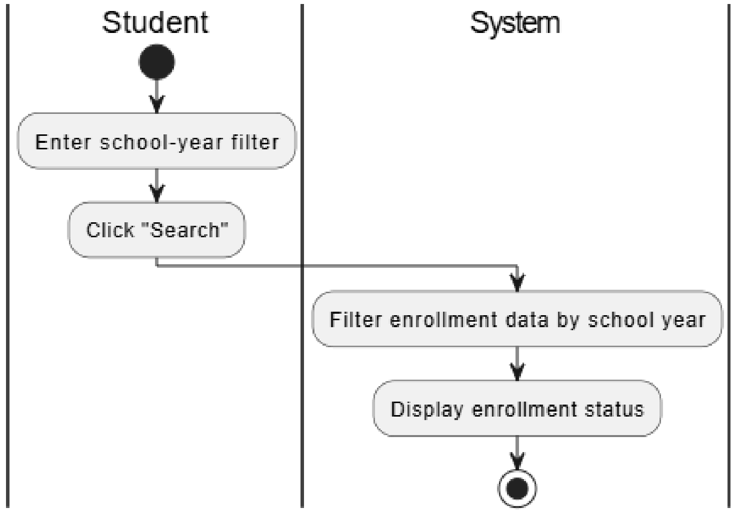


Figure 19.1 Search Account's Enrollment Status Using Filter School-Year Activity Diagram

Figure 19.1 activity diagram explains how students apply a filter for a school year to verify enrollment status and history.

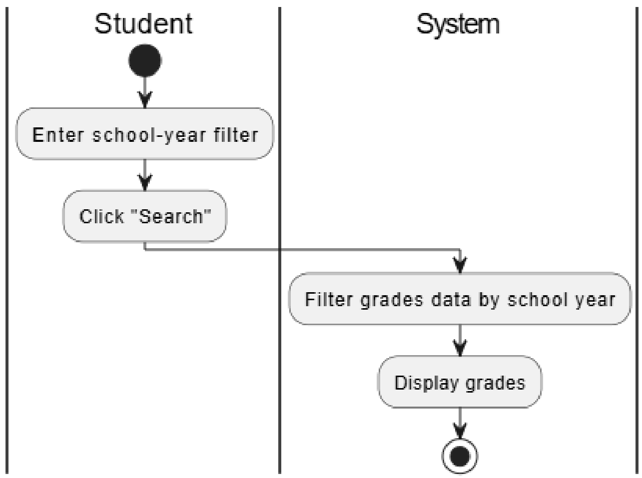


Figure 19.2 Search Grades Using Filter School-Year Activity Diagram

Figure 19.2 activity diagram explains how students could view academic performance records by grouping their grades by school year.

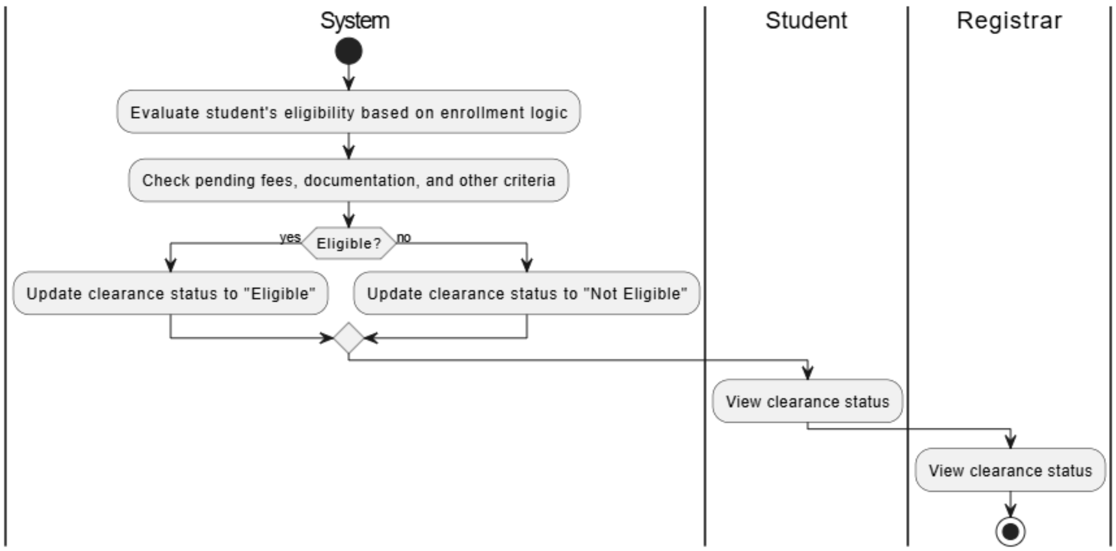


Figure 19.3 System Automatic Update Clearance Status by Evaluating Enrollment Eligibility Logic Activity Diagram

Figure 19.3 activity diagram explains the way the system instantly verifies whether the student qualifies based on the criteria (e.g., fees, documents) for clearance and reflects the status accordingly.

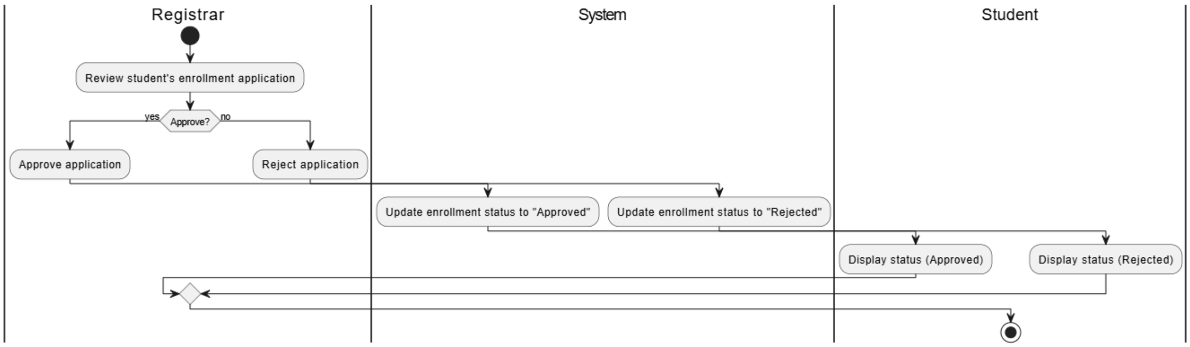


Figure 19.4 Update Enrollment Application Status Activity Diagram

Figure 19.4 activity diagram explains how the registrar processes and approves or denies a student's application, and the outcome is displayed in the account of the student.

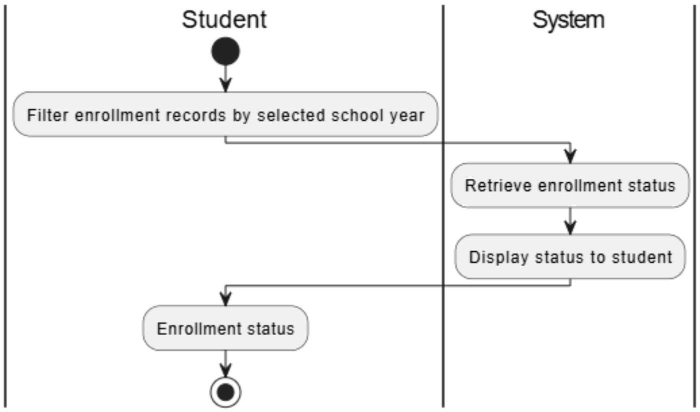


Figure 19.5 Search Using Filter by School-Year Enrollment Status Activity Diagram

Figure 19.5 activity diagram explains that students would be able to filter their enrollment status records by choosing a particular academic year.

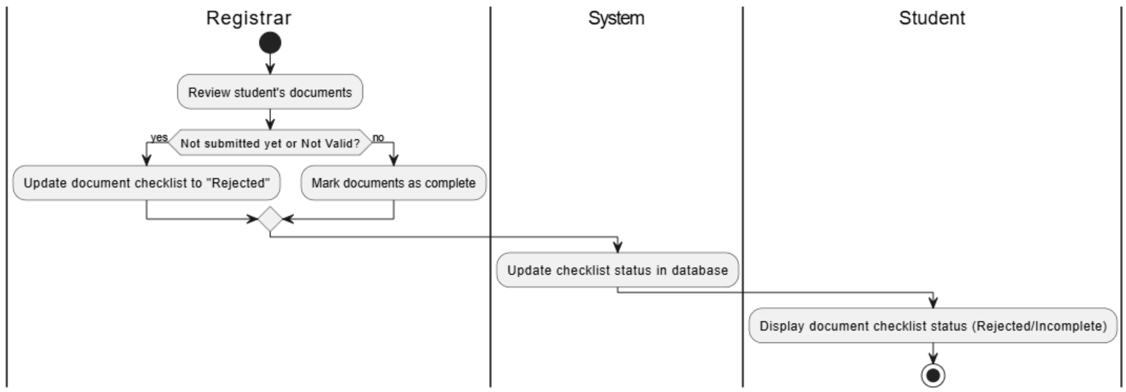


Figure 19.6 Update Document Checklist – Lacking Activity Diagram

Figure 19.6 activity diagram explains how the registrar updates the checklist for the students who are missing some documents, and students has to complete the missing requirements.

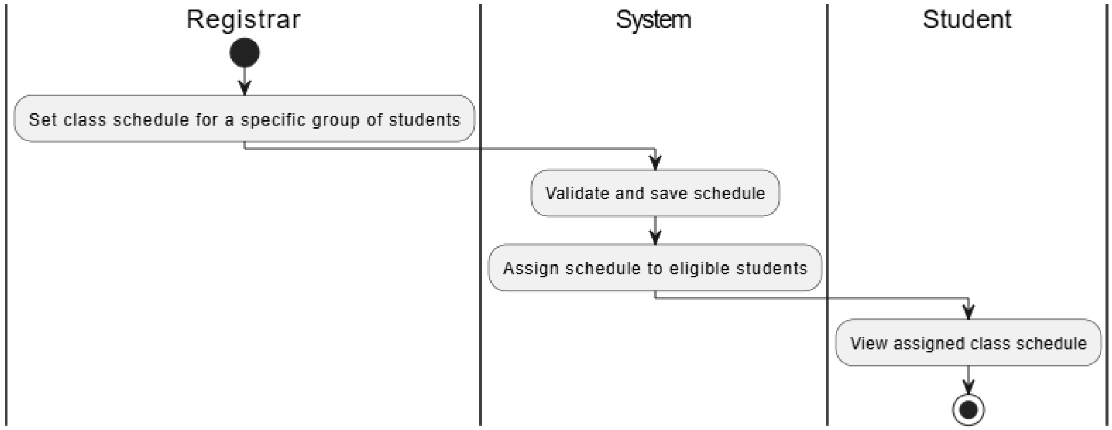


Figure 19.7 Apply Schedule Activity Diagram

Figure 19.7 activity diagram explains how the registrar set schedules which is verified by the system and executed automatically to students if it is valid.

Payment-Receipt Tracking

The researchers showed in this activity diagram the payment-receipt tracking controlling the verification of tuition payments-receipt/s details and track history by students and accounting staff.

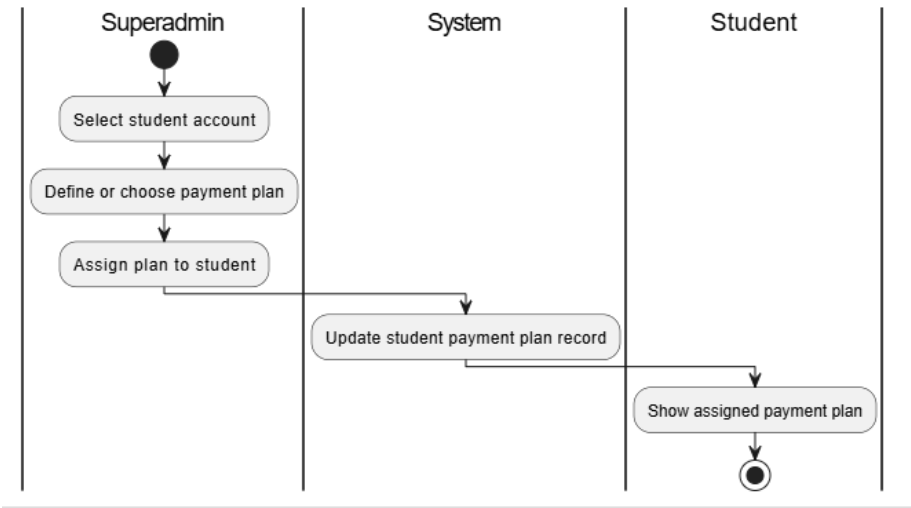


Figure 20.1 Assign Payment Plan Activity Diagram

Figure 20.1 activity diagram explains how the accounting staff outlines a particular payment plan for the student account that prescribes the breakdown and amount of payment the student will shoulder.

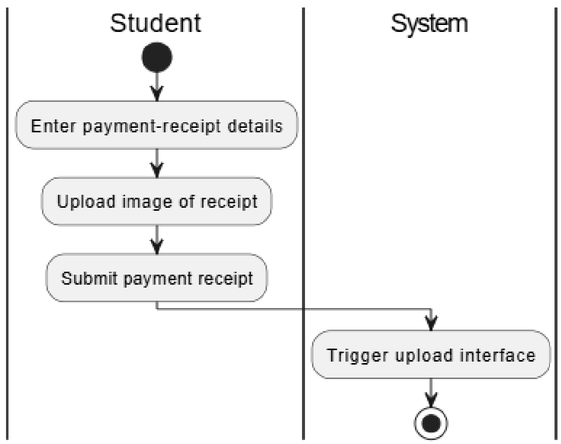


Figure 20.2 Submit Payment Receipt/s Activity Diagram

Figure 20.2 activity diagram explains the procedure whereby the students provide their payment receipts as evidence of payment.

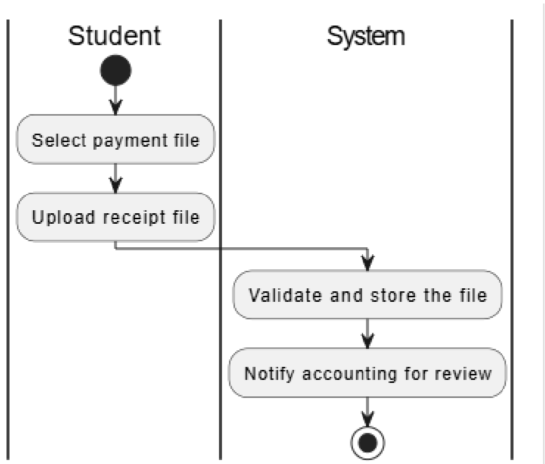


Figure 20.3 Upload Receipt File Activity Diagram

Figure 20.3 activity diagram explains how the students upload receipt files into the system for future tracking and verification.

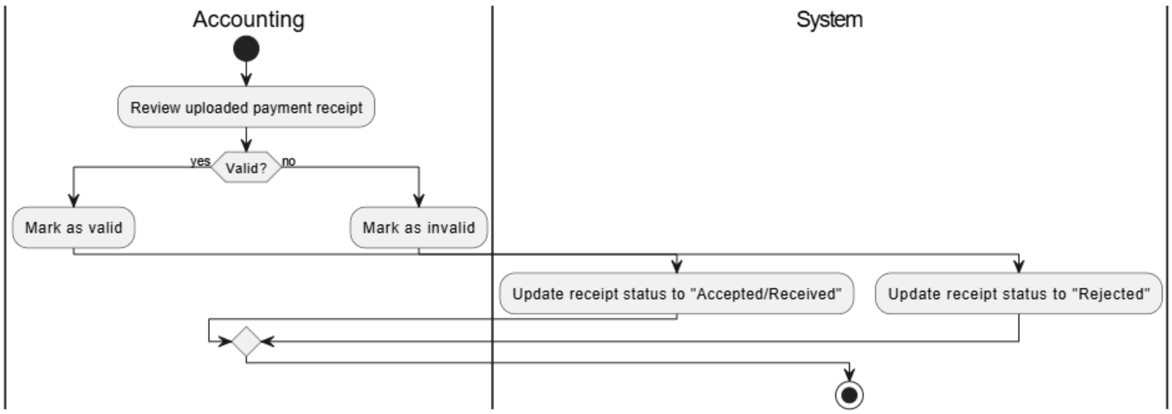


Figure 20.4 Verify Payment Receipt/s Activity Diagram

Figure 20.4 activity diagram explains how the accounting staff checks uploaded receipts and marks them as valid or invalid and updates the system in return.

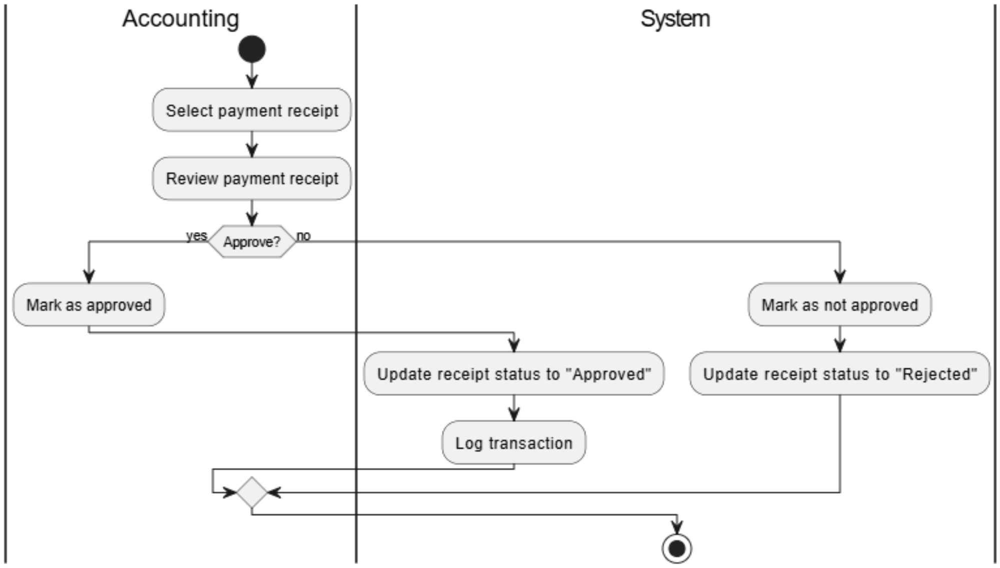


Figure 20.5 Approve Payment Receipt/s Activity Diagram

Figure 20.5 activity diagram explains how accounting personnel officially verify legitimate receipts, which triggers an update in the payment status of the student.

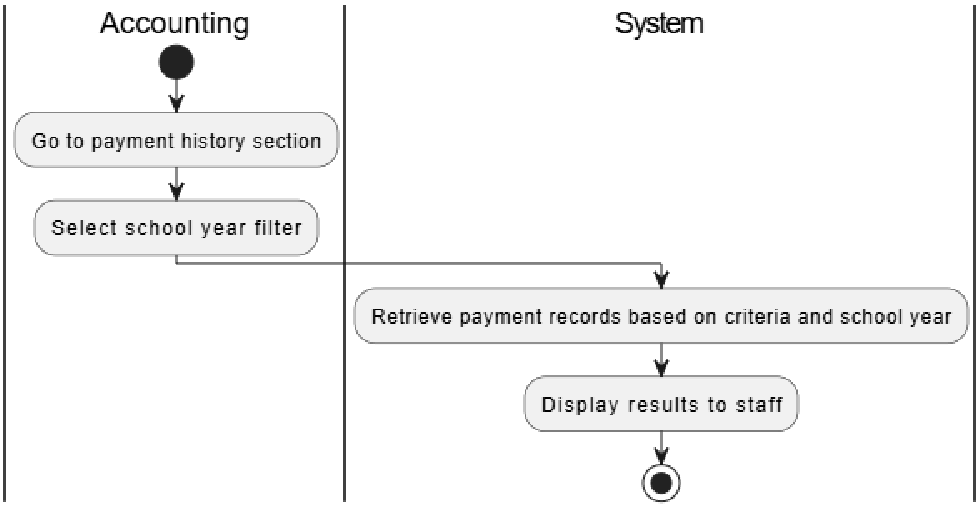


Figure 20.6 Search All Payment History - Filter by School Year Activity Diagram

Figure 20.6 activity diagram explains how accounting could sort and filter payment records by academic year to analyze financial histories.

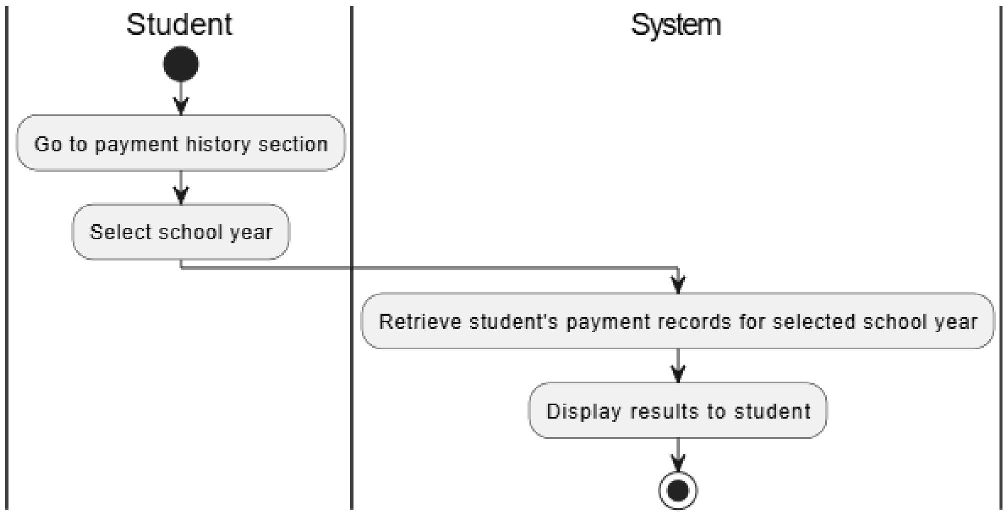


Figure 20.7 Search Account's Payment History (Student) - Filter by School Year Activity Diagram

Figure 20.7 activity diagram explains how they use the system to see their payment history by school year to monitor their financial compliance.

Grades Viewing

The researchers created this module to enable transparency of academic records to students and staff with functionalities like requests for change, filtering, search, and access control.

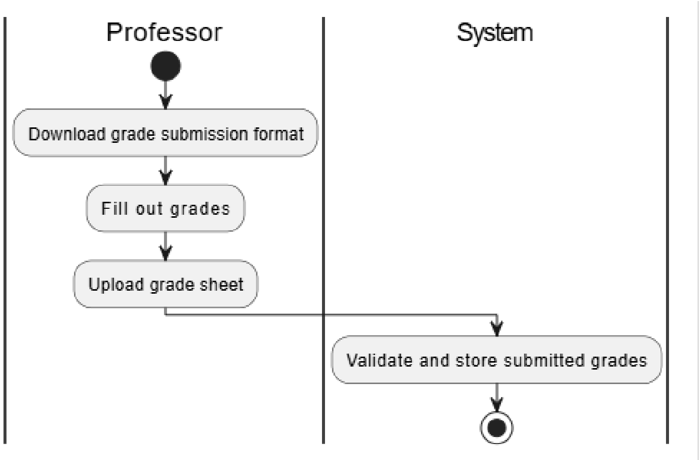


Figure 21.1 Submit Grades Activity Diagram

Figure 21.1 activity diagram explains how the teachers input final grades for their students, which are stored and made available in the system for grades viewing.

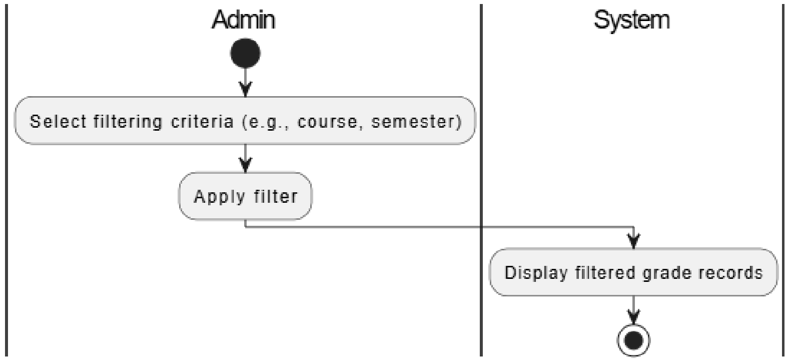


Figure 21.2 Search All Grades - Filter by School Year Activity Diagram

Figure 21.2 activity diagram explains how school staff / admin like registrar or professor or superadmin could view all grades of the students and filter them by the academic year.

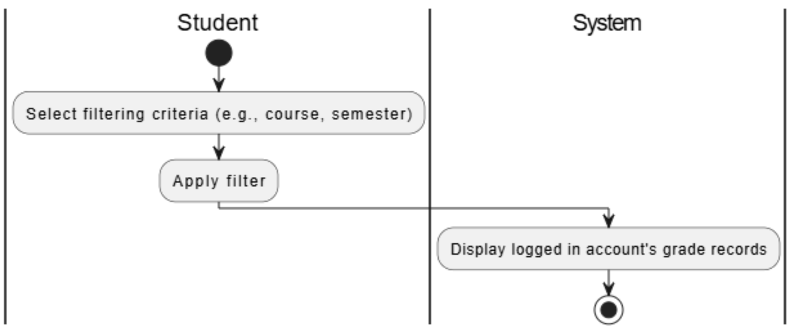


Figure 21.3 Search Account Grades (Student) - Filter by School Year Activity Diagram

Figure 21.3 activity diagram explains how the students view their grade reports by selecting a specific school year to compare.

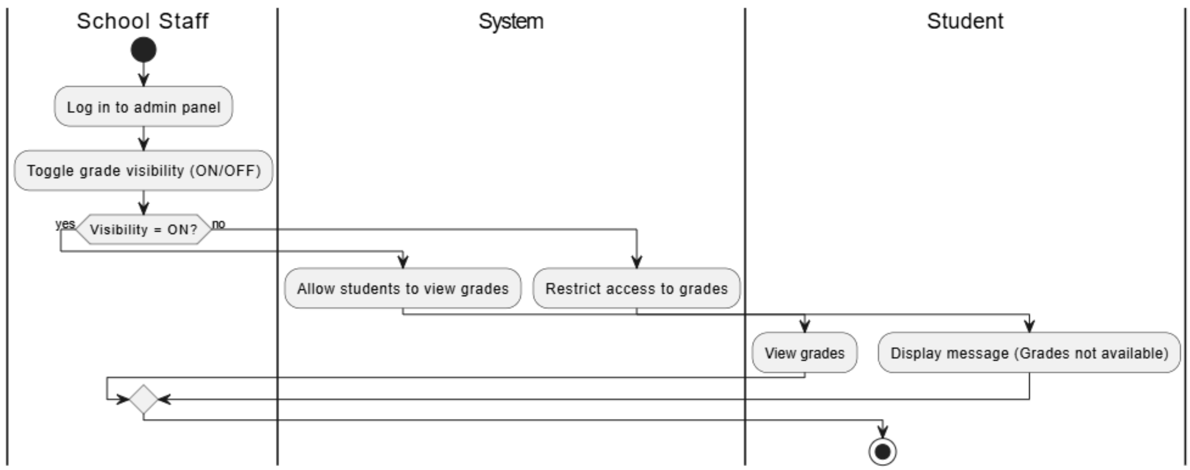


Figure 21.4 Control Grades Access Activity Diagram

Figure 21.4 activity diagram explains how the admin toggles between making grades visible and not visible to students, with discretion over when information is displayed.

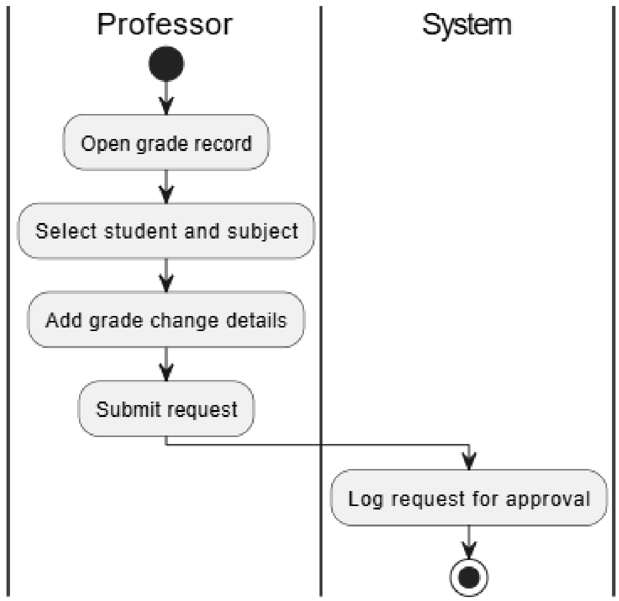


Figure 21.5 Add Grade Change Request Activity Diagram

Figure 21.5 activity diagram explains how the professor would request to have grades changed by submitting a formal application, which is stored in the system.

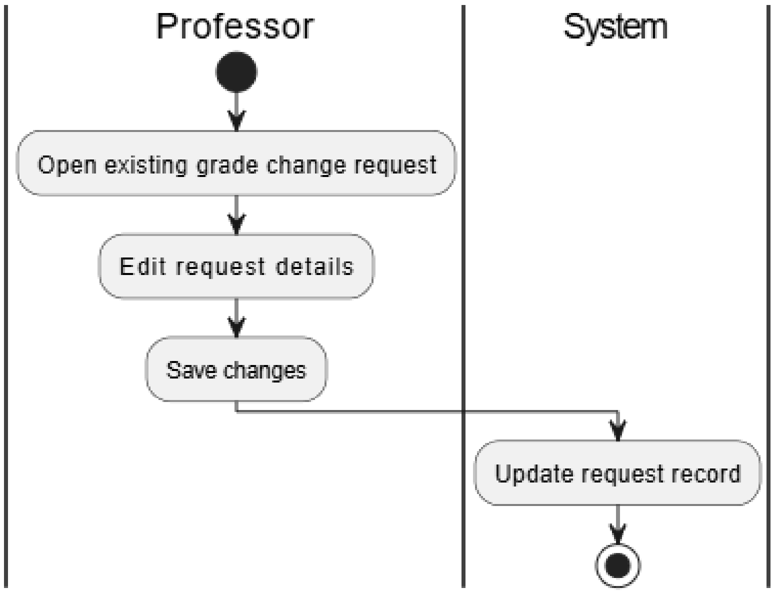


Figure 21.6 Edit Grade Change Request Activity Diagram

Figure 21.6 activity diagram explains how a professor updates the students' current grade and change requests in case they had to change the details.

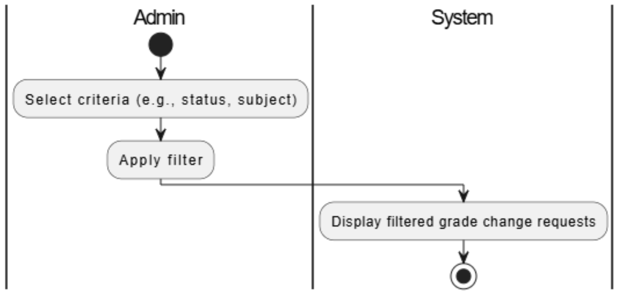


Figure 21.7 Search Grade Change Request - Filter by School Year Activity Diagram

Figure 21.7 activity diagram explains how the professor or registrar queries and screens grade change requests by school year for purposes of review.

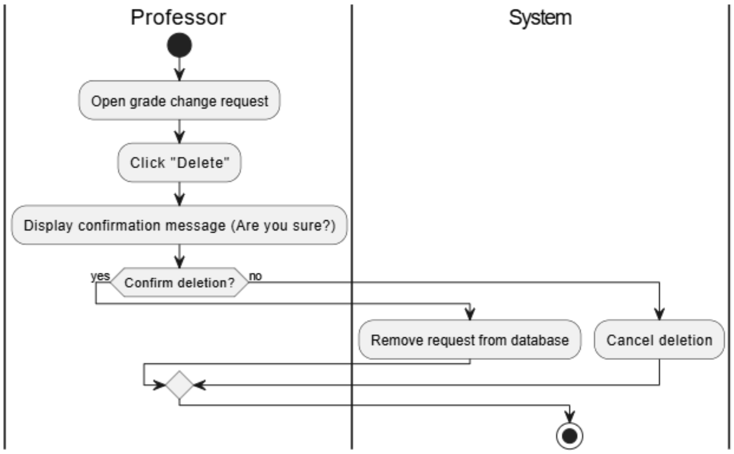


Figure 21.8 Delete Grade Change Request Activity Diagram

Figure 21.8 activity diagram explains how the professor removes an existing request once a confirmation pop-up has appeared.

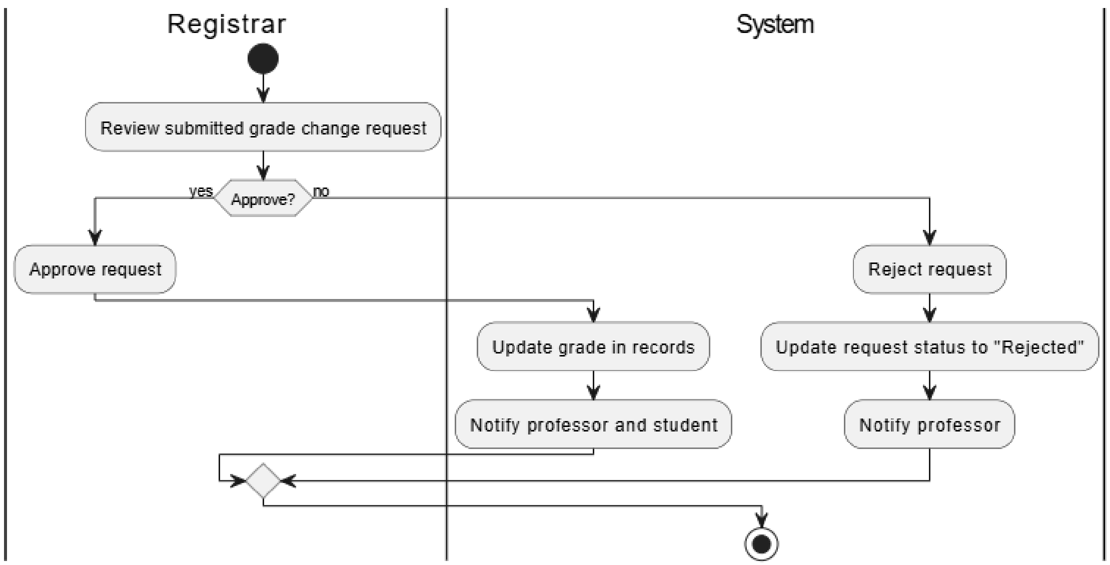


Figure 21.9 Approve Grade Change Request Activity Diagram

Figure 21.9 activity diagram explains how the registrar revisits and approves the request to change a grade or rejects it, updating grade records where necessary.

Enrollment Forecasting

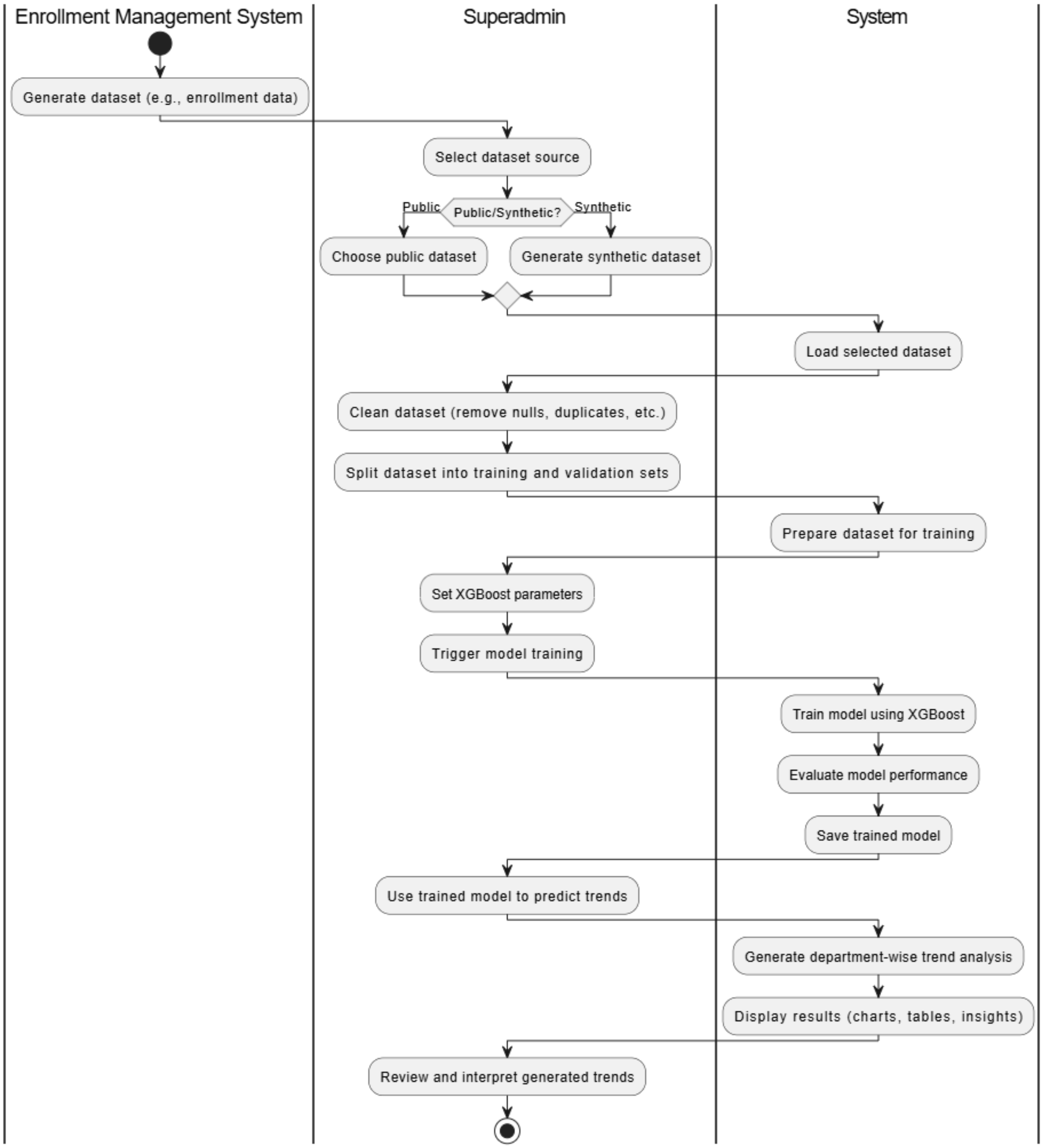


Figure 22.0 Trend Analysis by Department Using XGBoost Algorithm Activity Diagram

Figure 22.0 activity diagram explains how to apply machine learning methods, specifically the XGBoost algorithm, in analyzing past trends of enrollments. They prepared and cleaned the dataset, trained the model, and created department-level trends. This assisted administrators in making more informed decisions as they could forecast future trends in enrollments.

SYSTEM FEATURES

This section outlines the core features developed by the researchers to address the needs of the target users. Each feature is carefully designed to improve system functionality, support the overall objectives, and provide a user-friendly experience. The researchers ensure that these features align with the identified problems and proposed solutions.

Landing Page

Figure 23.1 Home Page

The homepage of the system has a chatbot that offers immediate assistance through answering common questions. The chatbot enables the quick retrieval of information, easy navigation of the system, and solution of frequent issues.

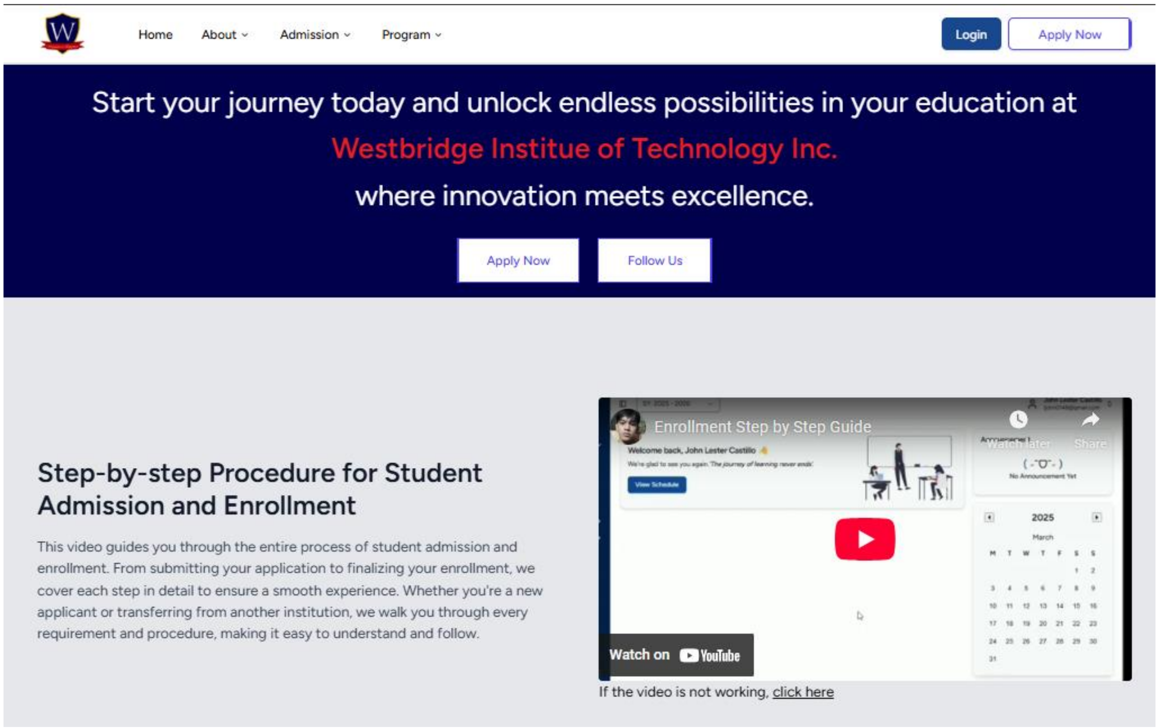
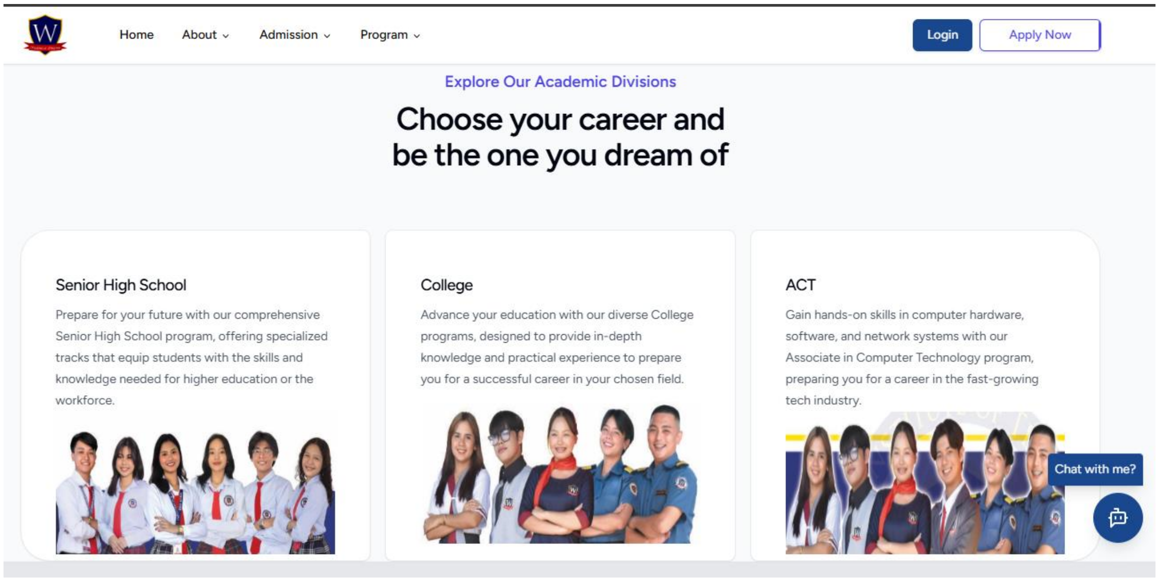


Figure 23.2 Banner and Guide

The platform includes a banner to encourage users to begin, and a step-by-step video guide of the admission and enrollment process for a clear and unproblematic experience for all users.



The site includes academic levels like Senior High School, College, and ACT. Each program includes specialized training to allow users to achieve professional aspirations with corresponding skills and academic capability.

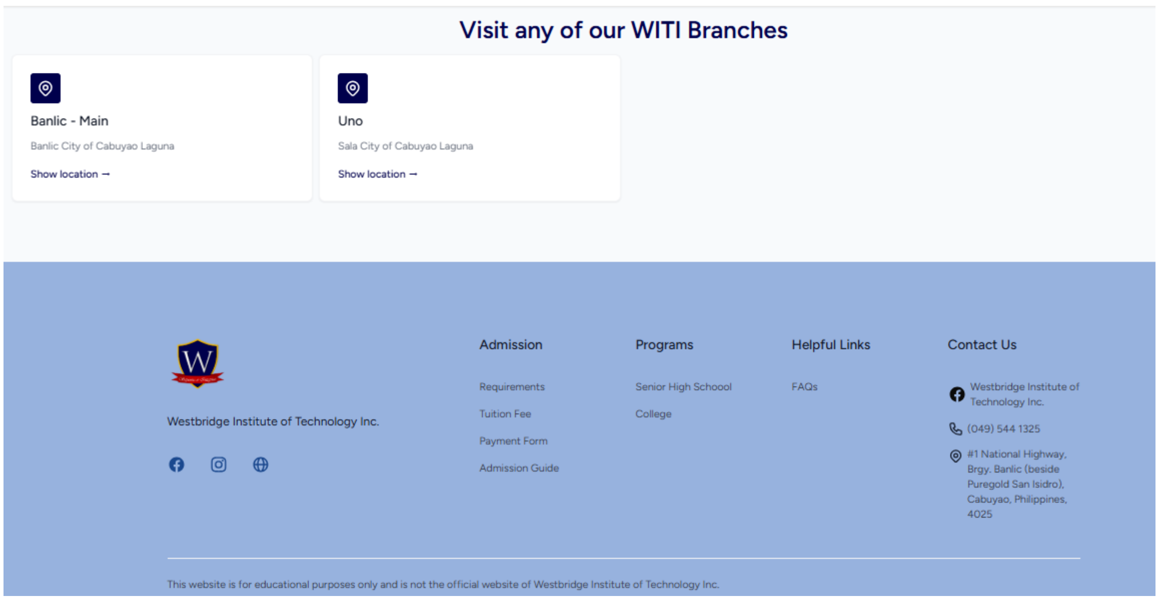


Figure 23.4 School Branches and Footers

The system displays various school branches, helping users explore campus options. The footer provides essential links, contact details, and social media, ensuring easy access to important institutional information.

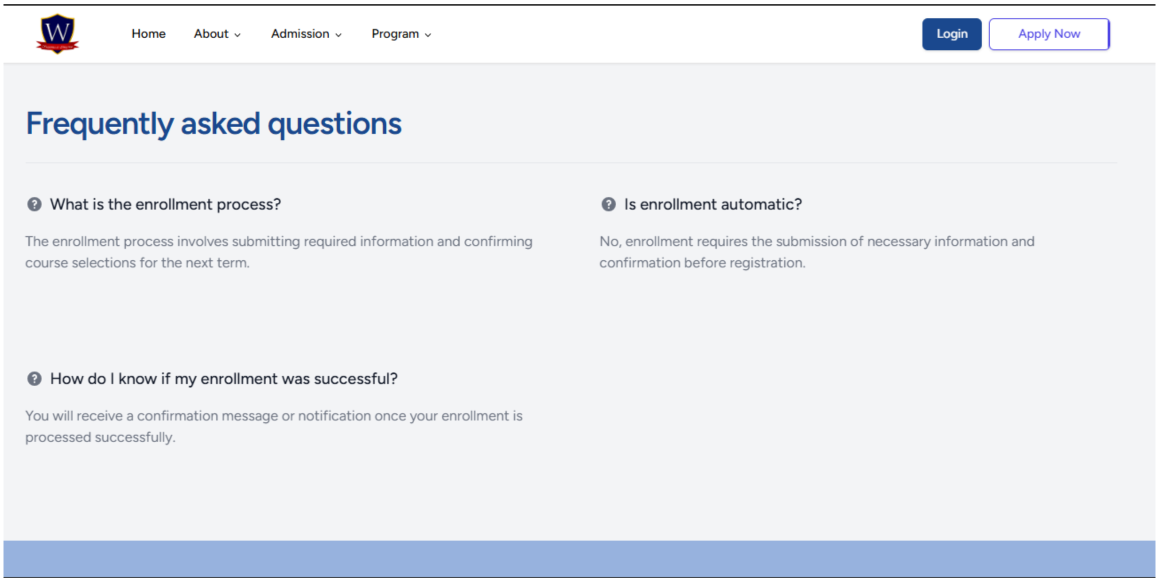


Figure 23.5 FAQs Section

The system has a devoted FAQ section for displaying users with the instant answer to frequently asked questions. It directs users how to utilize the platform for maximum benefits, answering frequent questions and providing accurate and concise details.

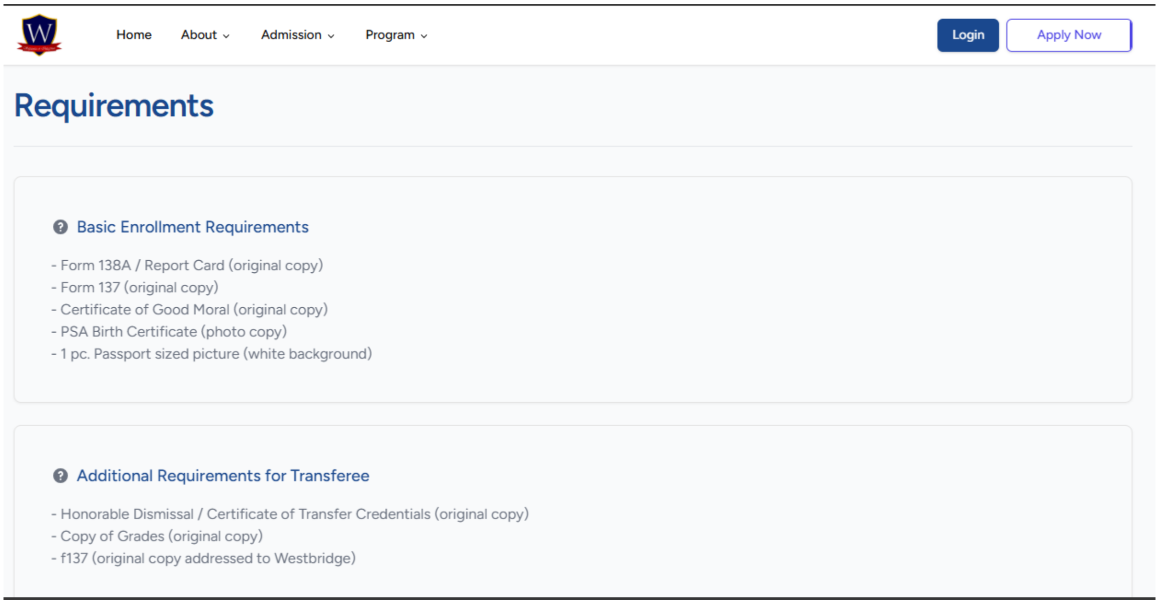


Figure 23.6 Required Documents Section

The system contains a Requirement Document section through which users can easily view and download the required documents for application, enrollment, and other procedures so that it becomes simple to access all the materials required for successful completion.

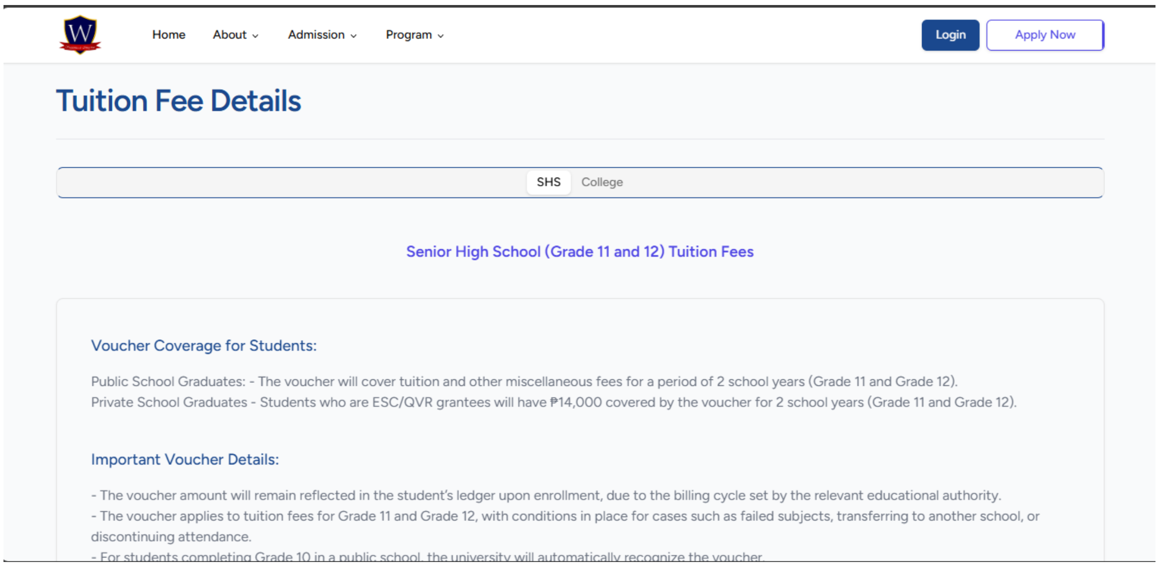


Figure 23.7 Tuition Fee Details Section

The system gives a clear breakdown of Senior High School and College tuition fees, including calculation of tuition for regular students, with clear indication of payment terms and balance needed.

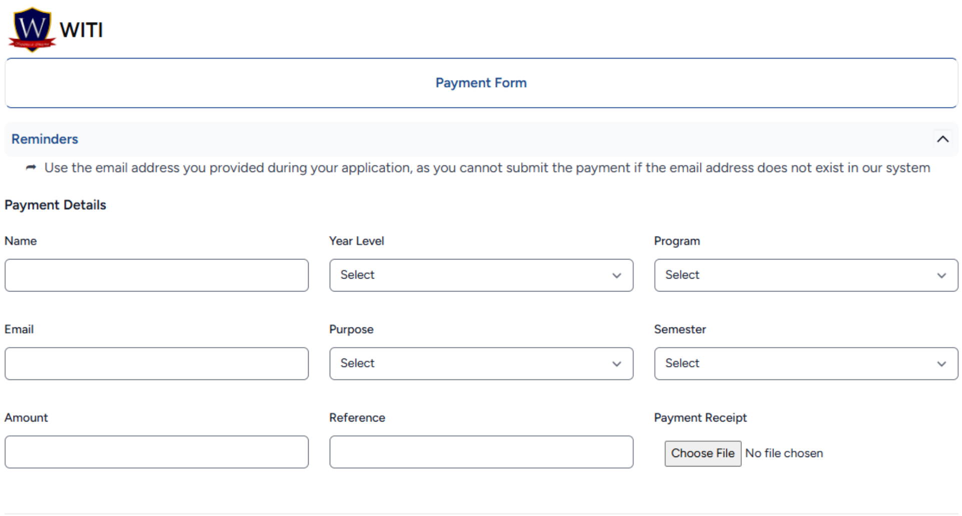


Figure 23.8 Payment Form

The system features a payment form which enables users to safely input payment information and make payments for tuition, fees, or services, in an effortless and efficient process of making transactions.

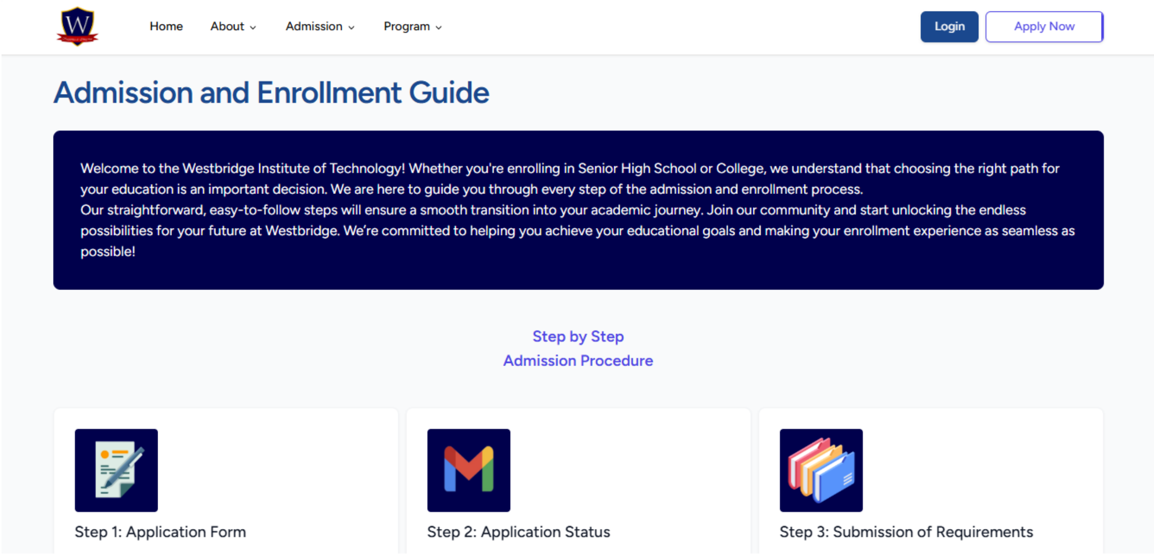


Figure 23.9 Admission Guide Section

The system provides an admission guide that outlines the step-by-step process of applying, stating the documentation and procedures needed to ensure a smooth and successful application process for all users.

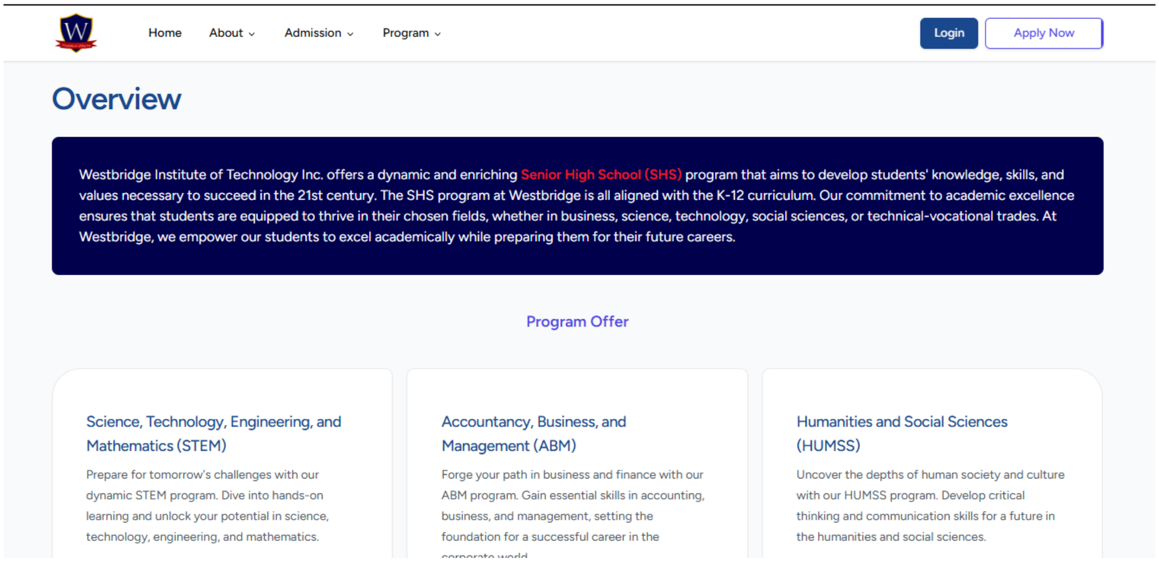


Figure 23.10 Program Offer Section

The system is also equipped with numerous programs accessible with broad information concerning careers, course, and studies programs to influence decisions for individuals in order to select an optimal program suited for achievement.

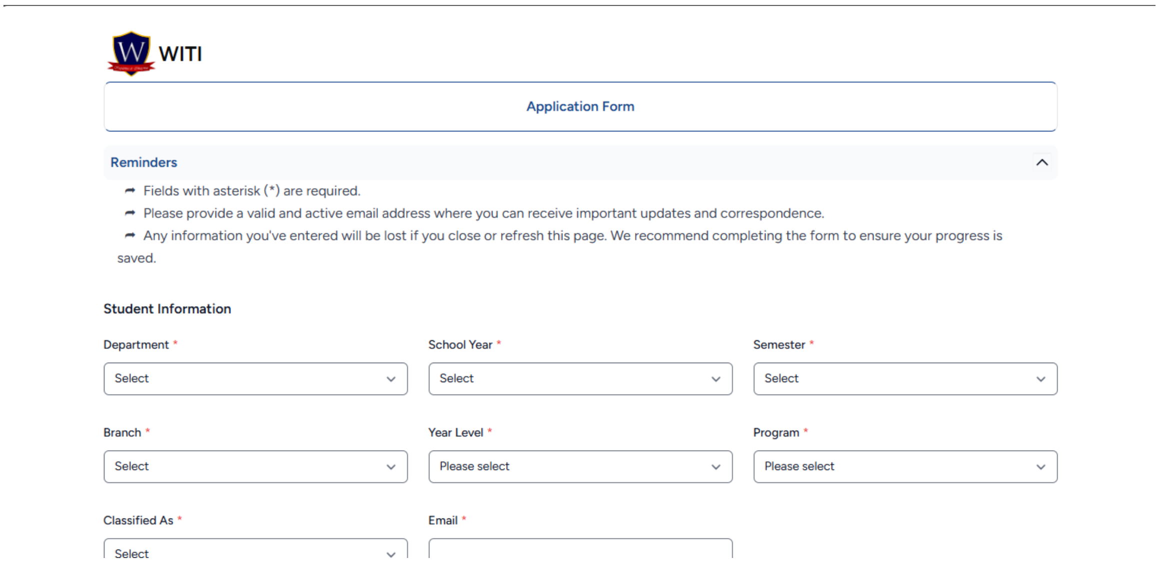
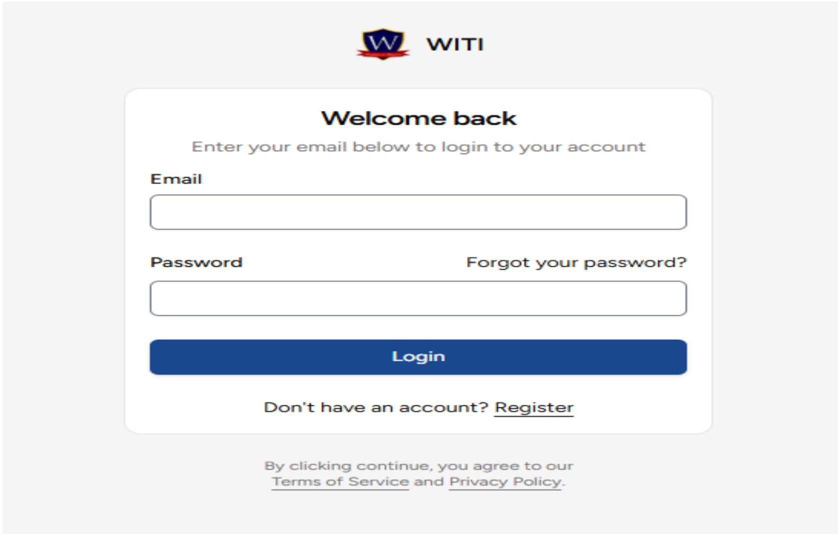


Figure 23.11 Application Form Section

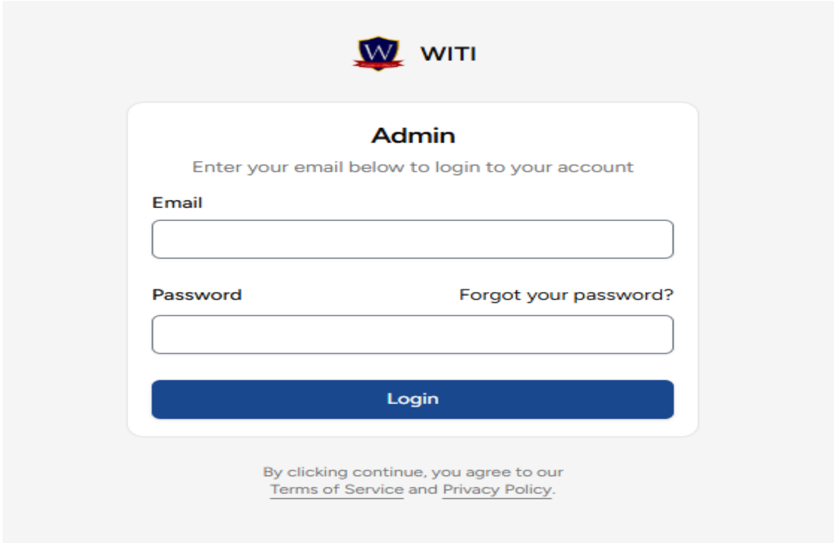
The system also includes an application form through which users are able to input necessary information for admission. It collects all the necessary data in an effective manner, thus easier for the prospective students to apply.

Login Features



(a) Student / Professor

Figure 24.1 Login: (a) Student / Professor, (b) Super Admin, Accounting, Registrar



(b) Super Admin, Accounting, Registrar

Figure 24.1 Login: (a) Student / Professor, (b) Super Admin, Accounting, Registrar

In figure 24.1 and figure 24.2, it shows that the system offers two login types: Admin Login and Student/Professor Login. Admin Login is accessed by Super Admins, Accounting, and Registrar staff to control enrollment records, student information, grades, and system settings. Student/Professor Login enables students to see their profiles, apply for enrollment, and monitor their status, while professors can see their schedules, control assigned subjects, and enter student grades.

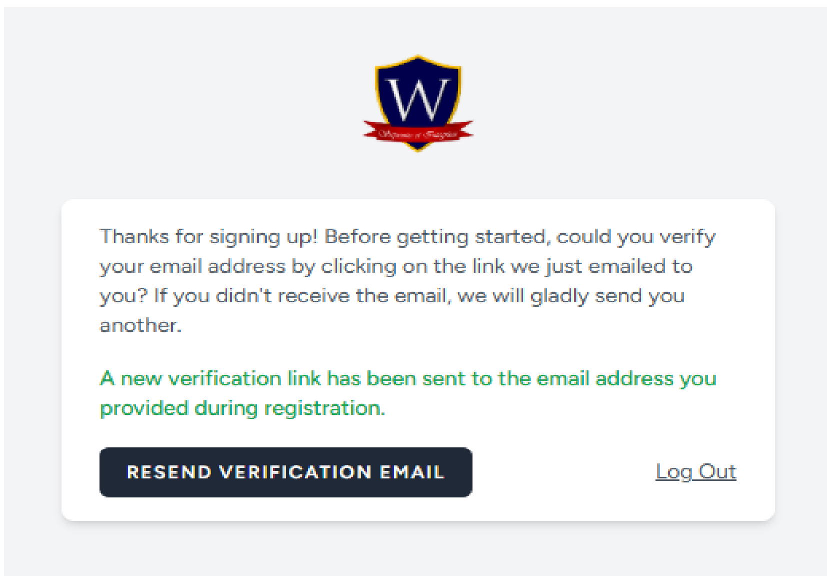


Figure 24.2 Email Verification

Users must confirm their email address by clicking on a confirmation link received in their mailbox upon registration. This step validates the authenticity of their account, improving security and protecting system integrity.

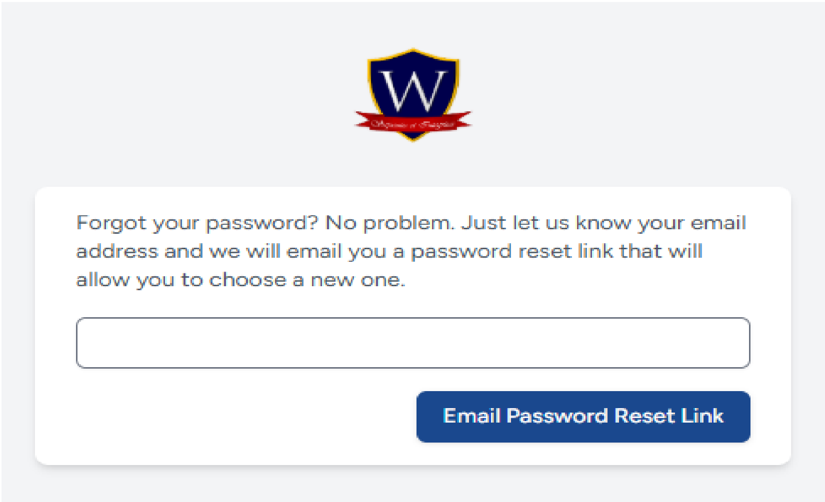
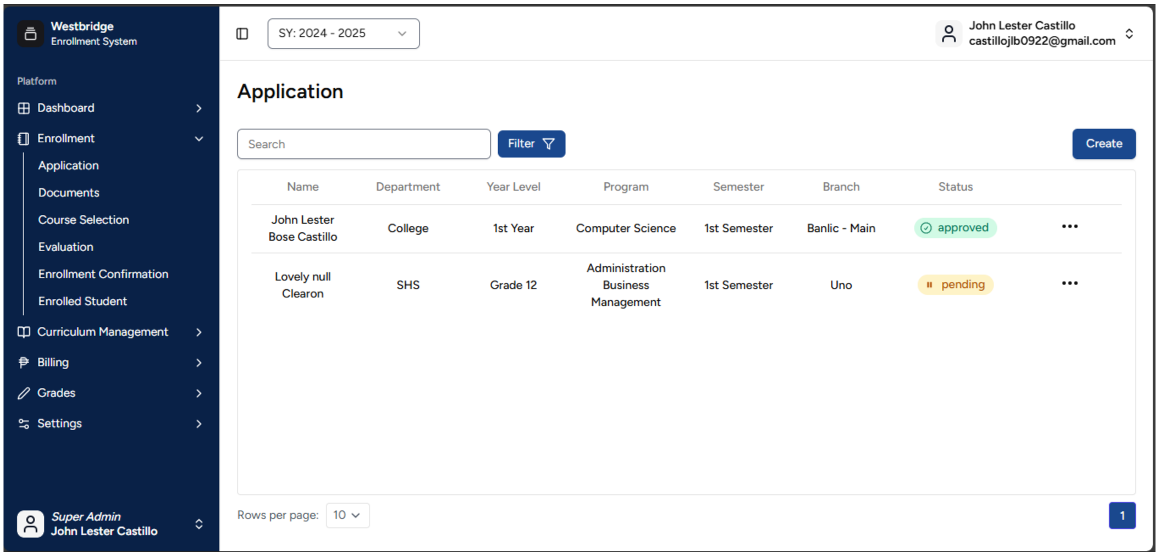


Figure 24.3 Password Reset

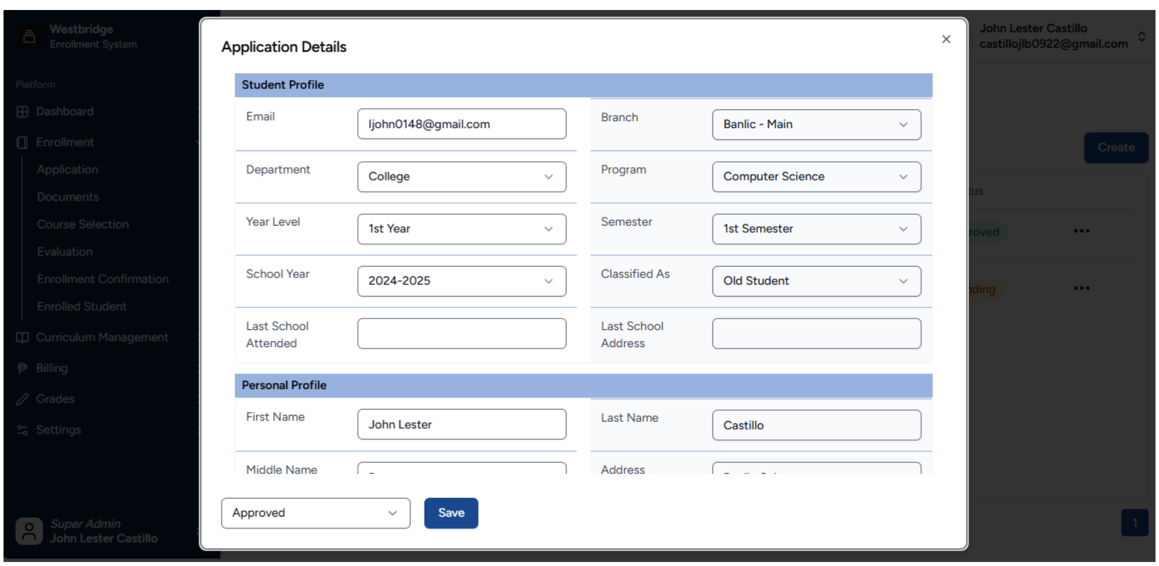
Users are able to reset the password by requesting a reset link that is sent to their registered email. This method enables users to safely recover access to their accounts in the event that they forget their password.

Admin: Enrollment Features



(a) View Interface

Figure 24.4 Application Review: (a) View Interface, (b) Form Interface



(b) Form Interface

Figure 24.4 Application Review: (a) View Interface, (b) Form Interface

In figure 24.4 *a* and *b*, admins have the ability to view student applications pulled by the system that include complete personal data. Admins may accept or deny individual applications based on the submitted information.

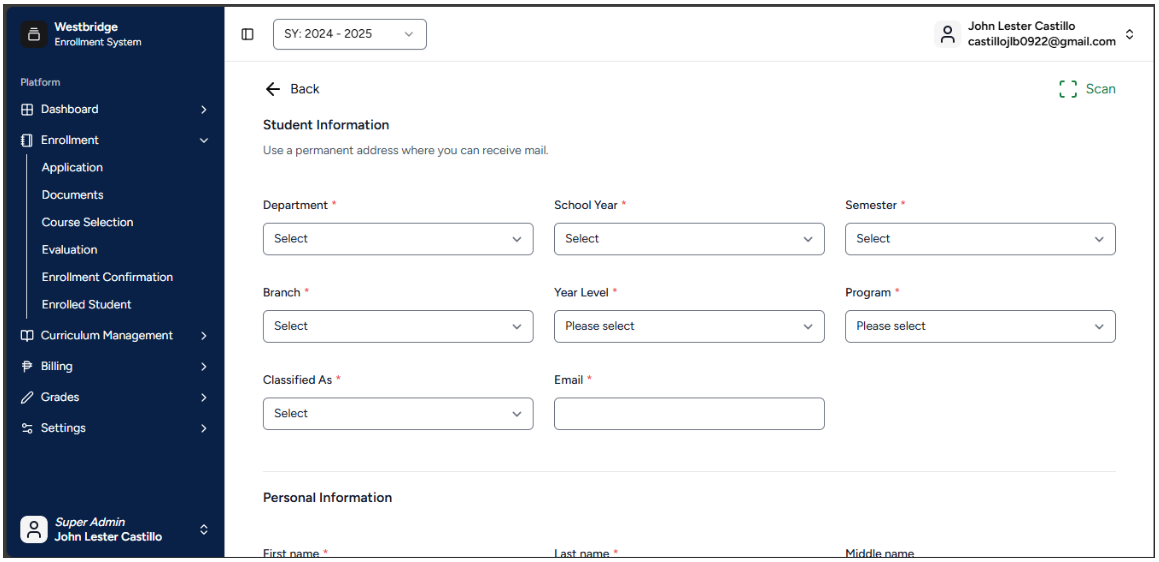


Figure 24.5 Application Creation

The system allows admins to create enrollment applications for students. This capability provides accurate and complete documentation of enrollment information when students cannot initiate, complete, or submit their own applications.

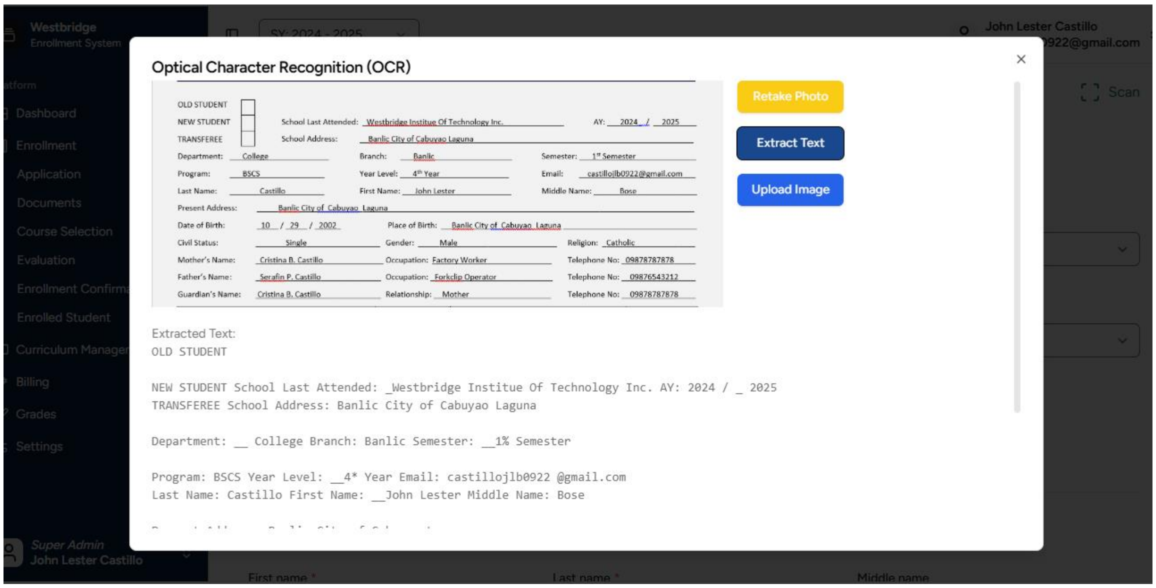
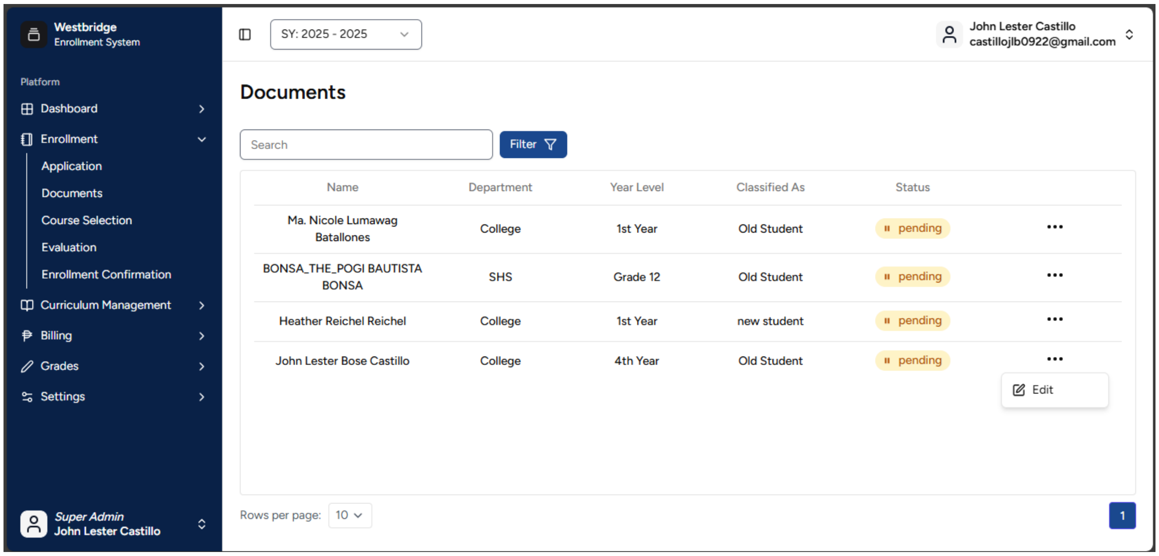


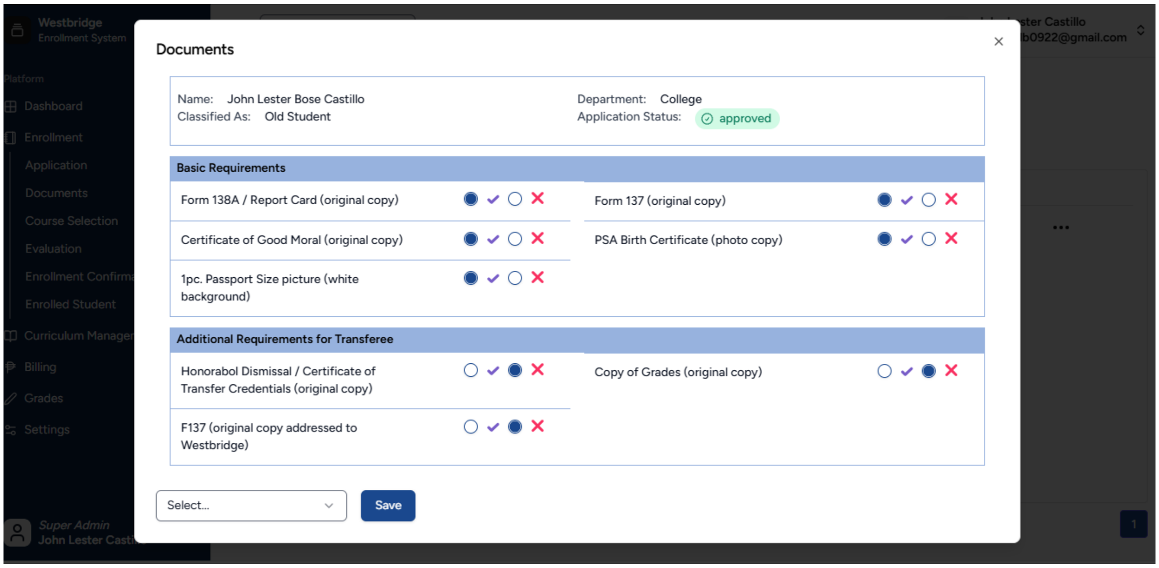
Figure 24.5 Optical Character Recognition (OCR) Scanning

The system uses Optical Character Recognition for student application form scanning. Printed or written text data retrieved are processed automatically, minimizing manual entry and making processing of enrollment applications more efficient.



(a) View Interface

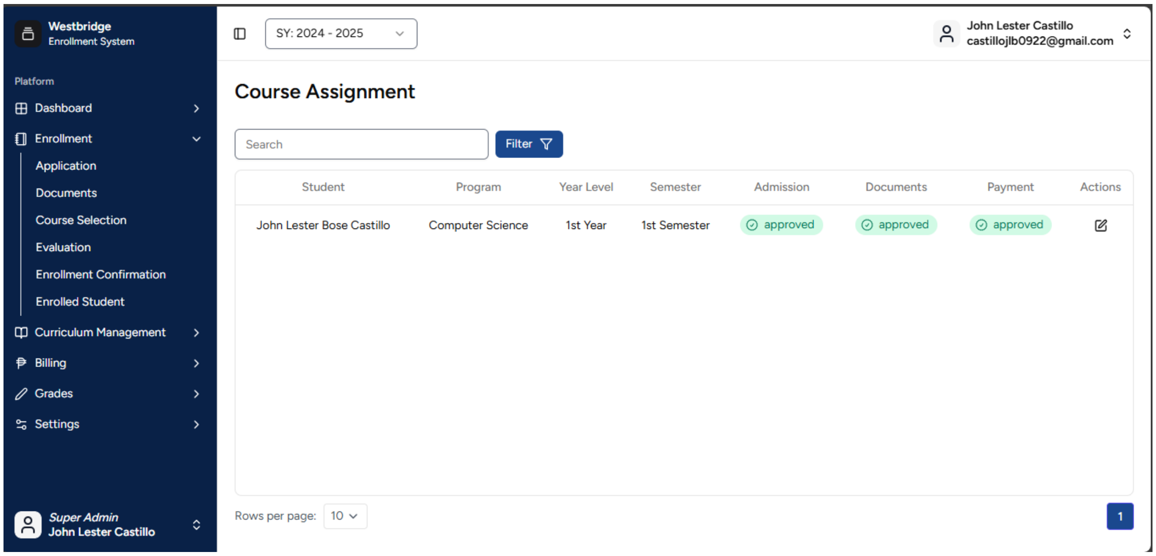
Figure 24.6 Document Verification: (a) View Interface, (b) Checklist Interface



(b) Checklist Interface

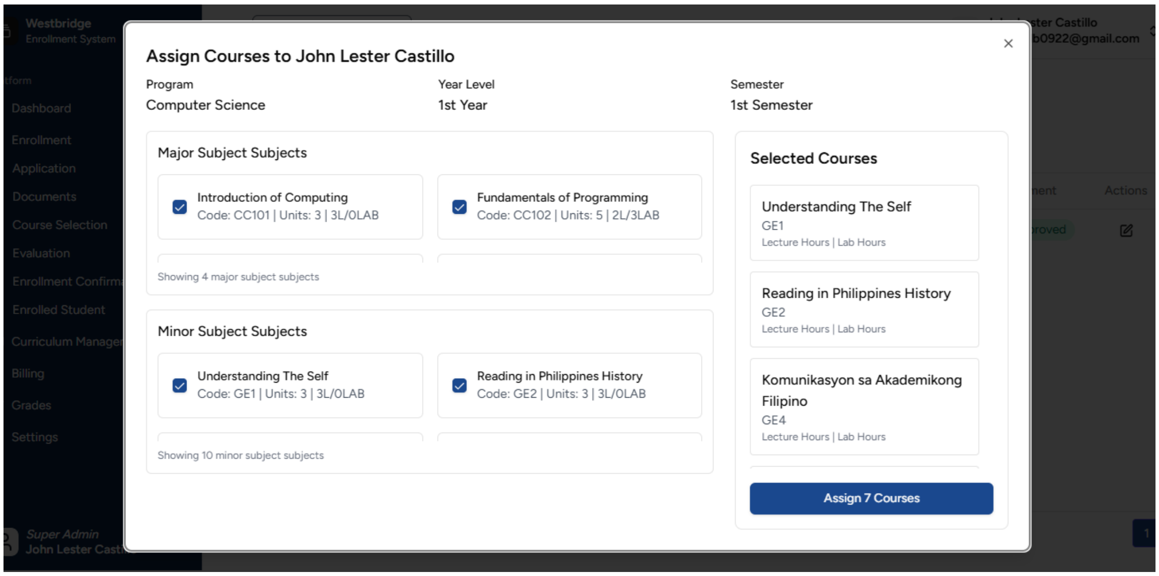
Figure 24.6 Document Verification: (a) View Interface, (b) Checklist Interface

In figure 24.6 *a* and *b*, the system allows admins to label submitted student documents, helping track submissions required. This ensures the registration process is seamless, with all documents required submitted and verified.



(a) View Interface

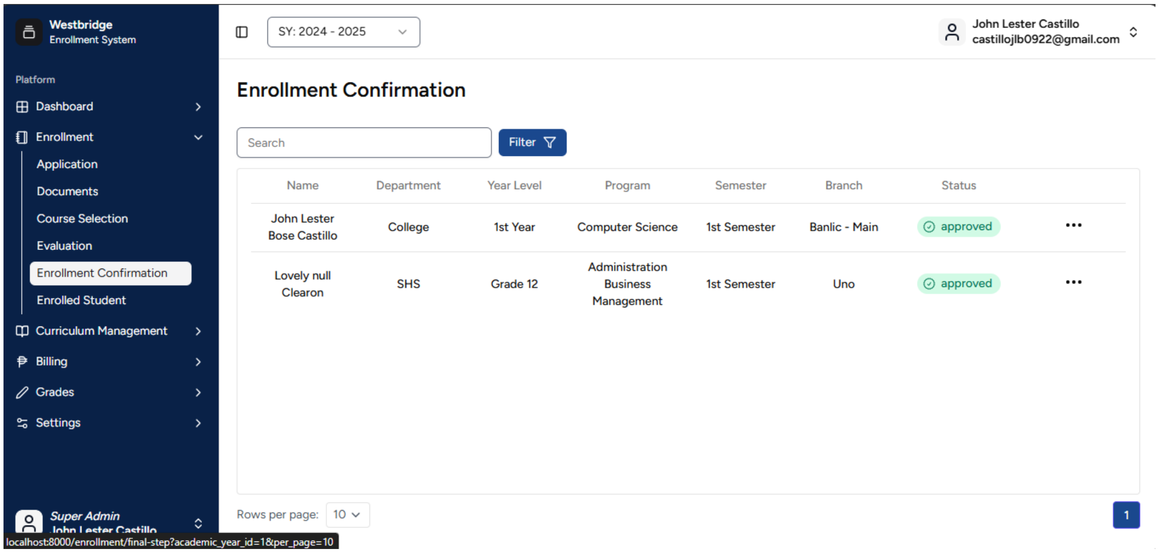
Figure 24.7 Course Assignment: (a) View Interface, (b) Course Selection Interface



(b) Course Selection Interface

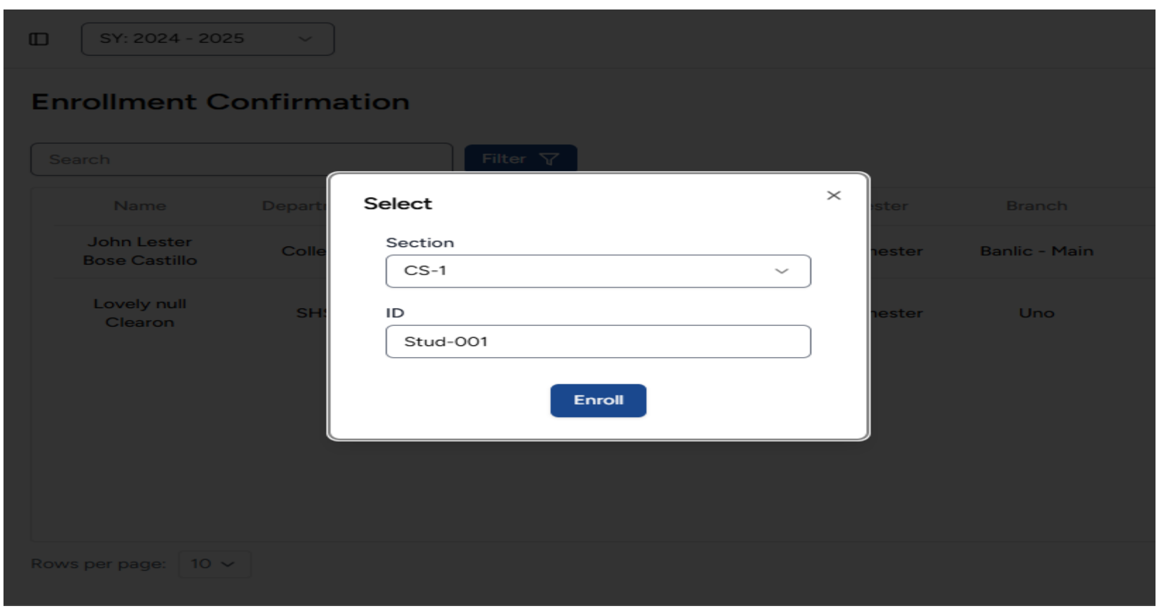
Figure 24.7 Course Assignment: (a) View Interface, (b) Course Selection Interface

In figure 24.7 *a* and *b*, admins can assign students to subjects based on their enrollment. This feature makes it easy to choose appropriate courses, which allows for proper course assignment based on each student's program and semester requirements.



(a) View Interface

Figure 24.8 Enrollment: (a) View Interface, (b) student id auto-assigning



(b) student id auto-assigning

Figure 24.8 Enrollment: (a) View Interface, (b) student id auto-assigning

The system enables admins to assign the right section to each student. Upon selection, a student ID is automatically generated, confirming enrollment and proper identification for record-keeping purposes.

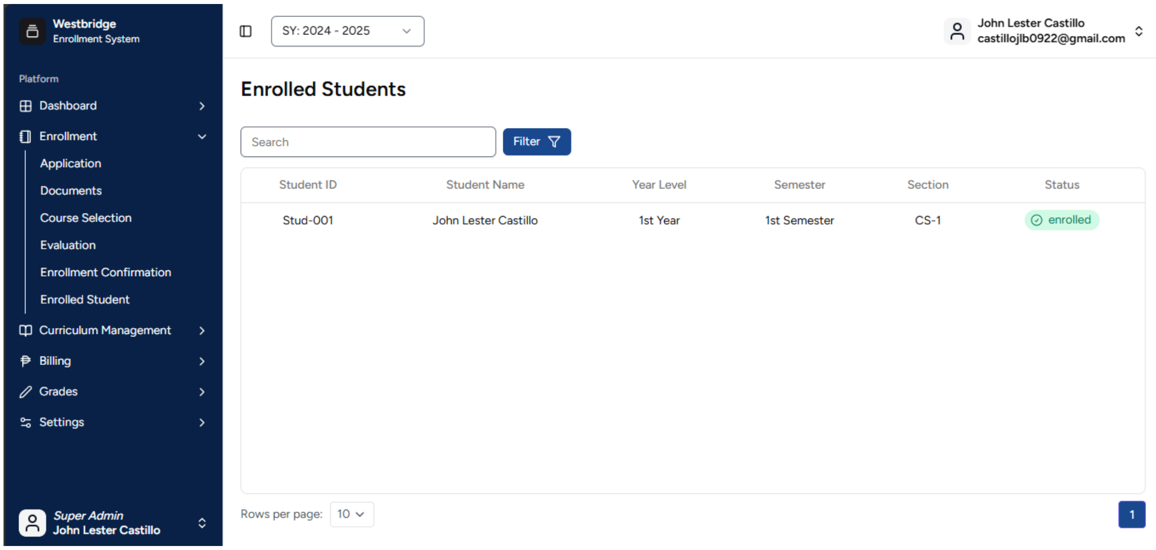


Figure 24.9 Enrolled Students Interface

The system shows a roll of students who have enrolled successfully. It displays the section of each student and the system-generated student ID, giving a clear record of enrolled students.

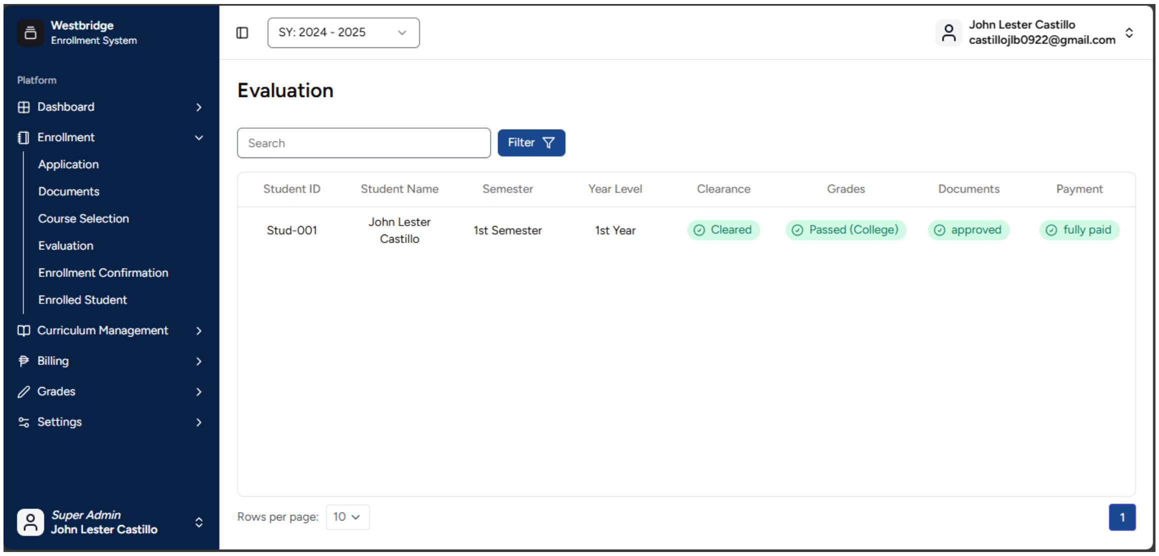
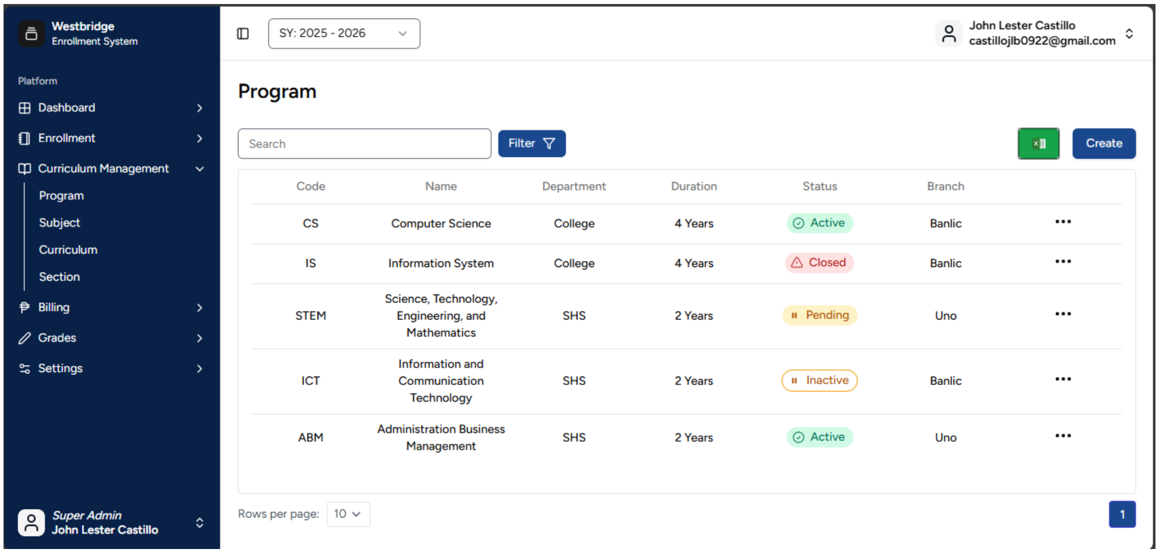


Figure 24.10 Enrollment Evaluation

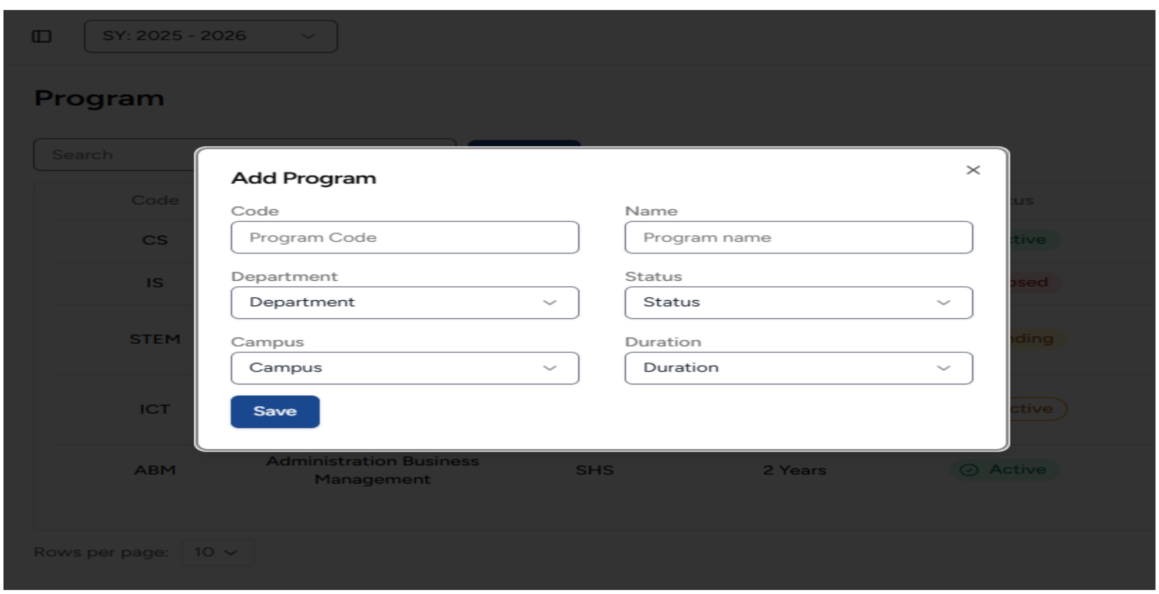
The system tracks and displays student documents, payment, grades, and clearances status. It allows admins to see and track the progress of each student to ensure that everything required is achieved.

Curriculum Management



(a) View Interface

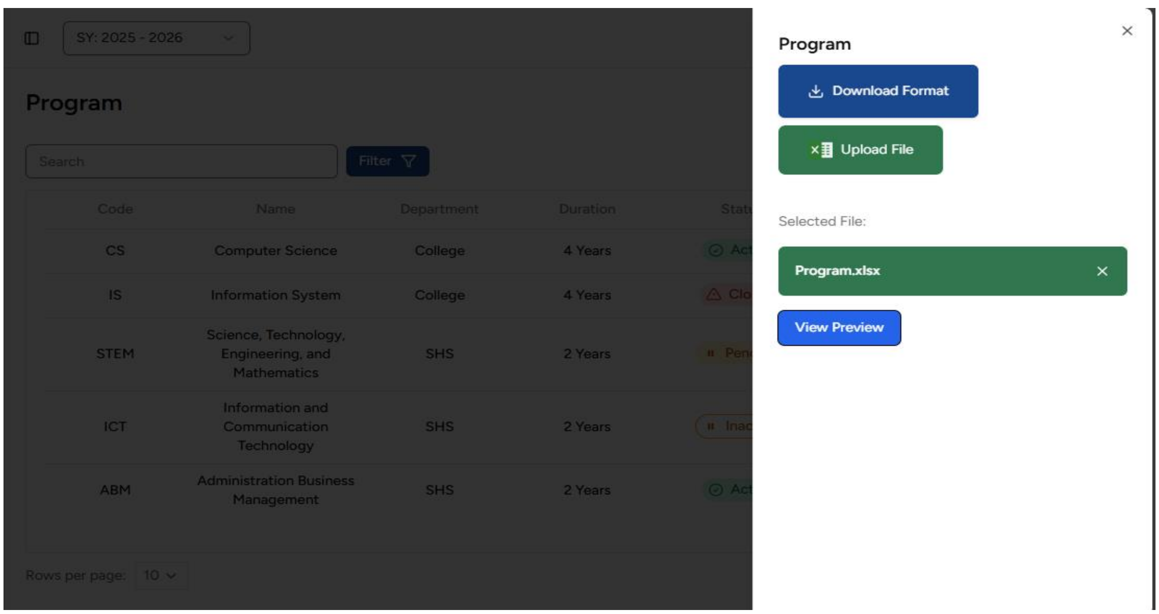
Figure 25.1 Setup Program: (a) View Interface, (b) add program



(b) add program

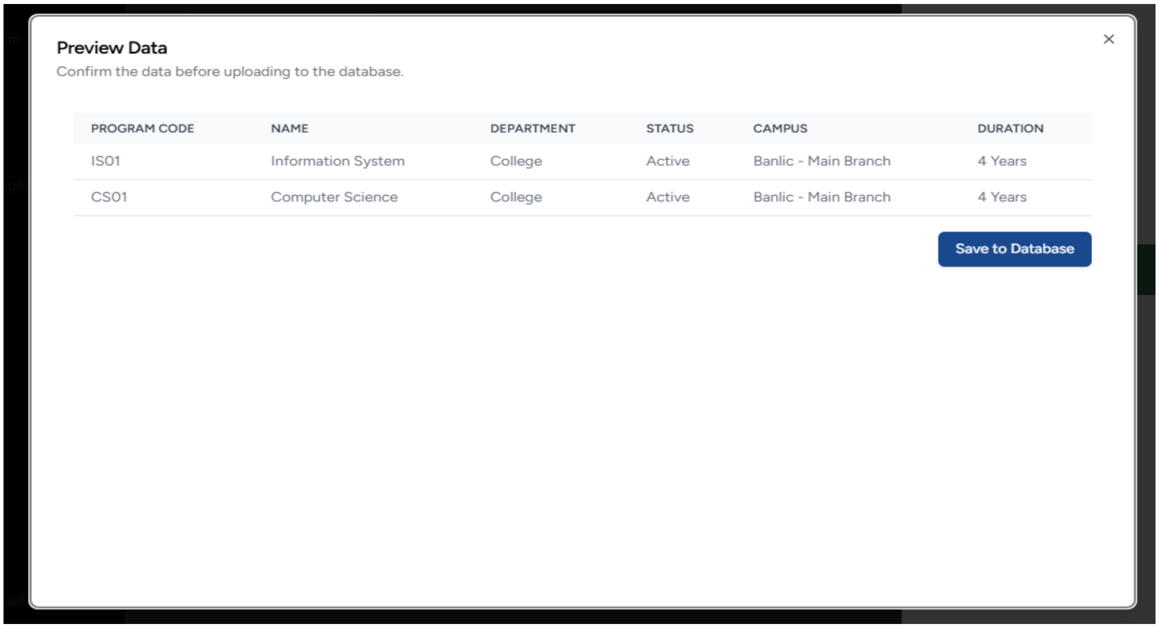
Figure 25.1 Setup Program: (a) View Interface, (b) add program

In figure 25.1 *a* and *b*, the system allows authorized staff to design academic programs by specifying necessary information like program name, code, duration, and department to ensure planned curriculum in line with institutional academic standards.



(a) Import

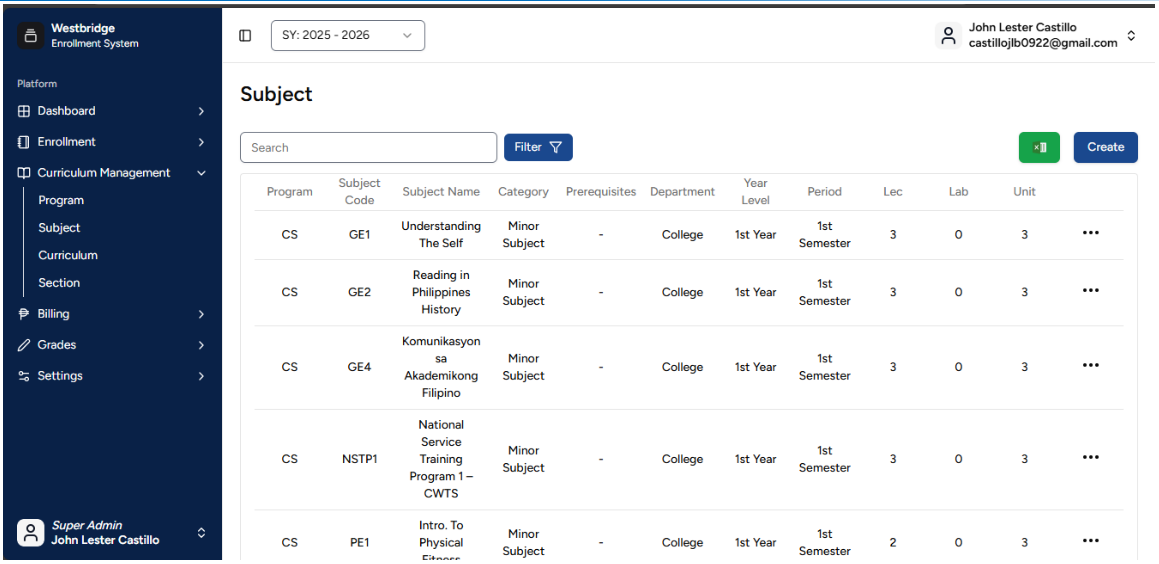
Figure 25.2 Program Excel Import/Export: (a) Import, (b) Preview



(b) Preview

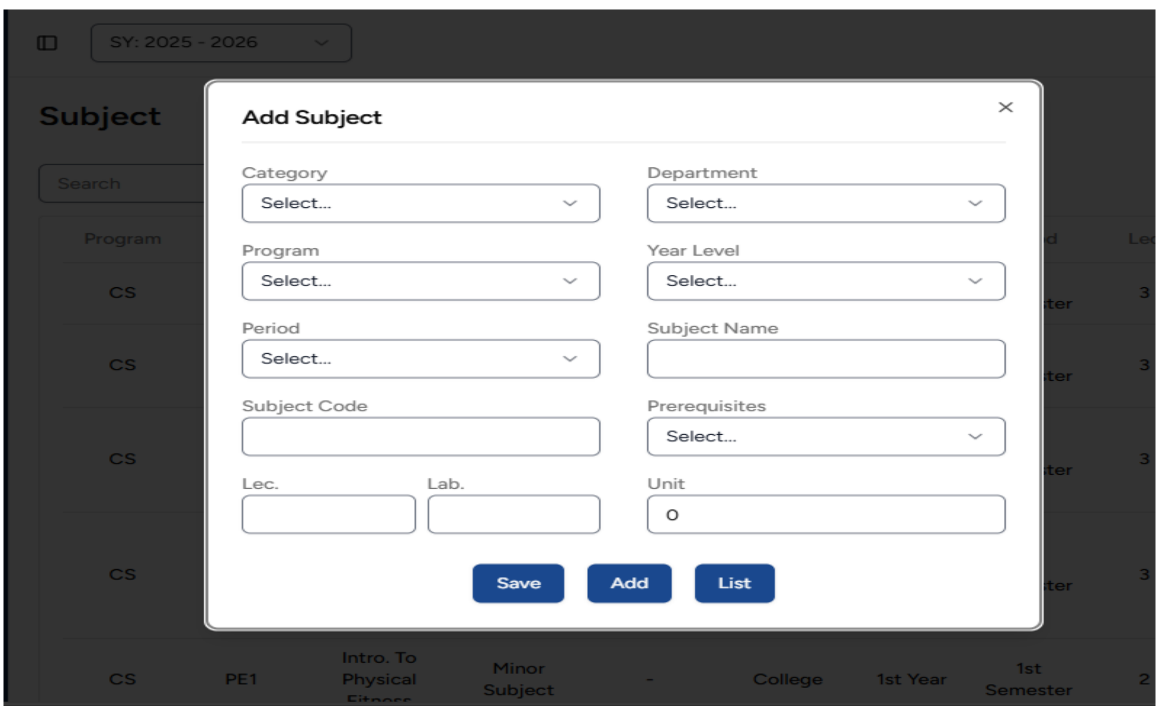
Figure 25.2 Program Excel Import/Export: (a) Import, (b) Preview

In figure 25.2 *a* and *b*, the system supports downloading a pre-defined template and uploading Excel files for program development. This capability enhances efficiency by providing quicker input and handling of several academic programs simultaneously.



(a) View Interface

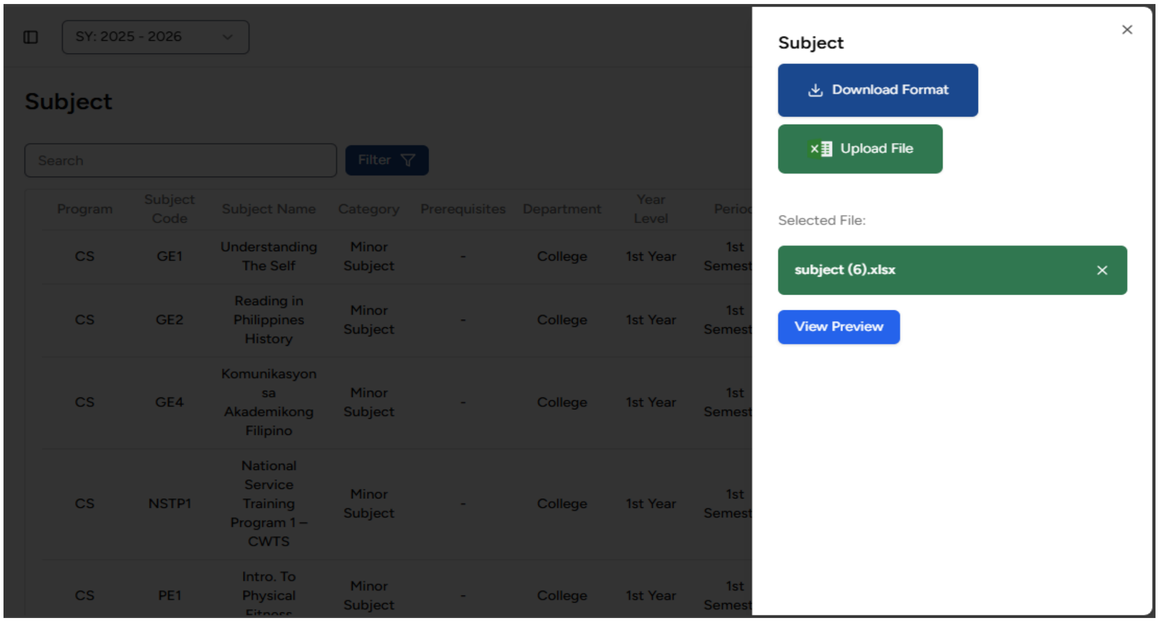
Figure 25.3 Setup Subject/Course: (a) View Interface, (b) add Subject/Course



(b) add Subject/Course

Figure 25.3 Setup Subject/Course: (a) View Interface, (b) add Subject/Course

In figure 25.3 *a* and *b*, the system supports administrators to configure the academic subject from entering specified details like course code, course name, units, semester, and prerequisites that aid in setup confirmation against proper curriculum standards.



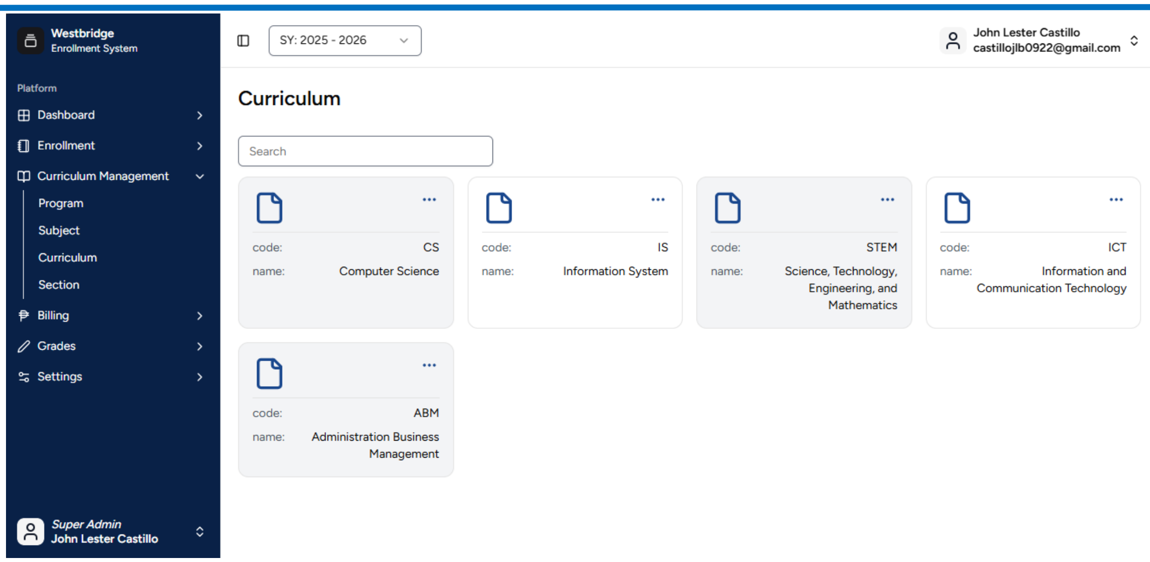
(a) import

Figure 25.4 Subject Excel Import/Export: (a) import, (b) preview

(b) preview

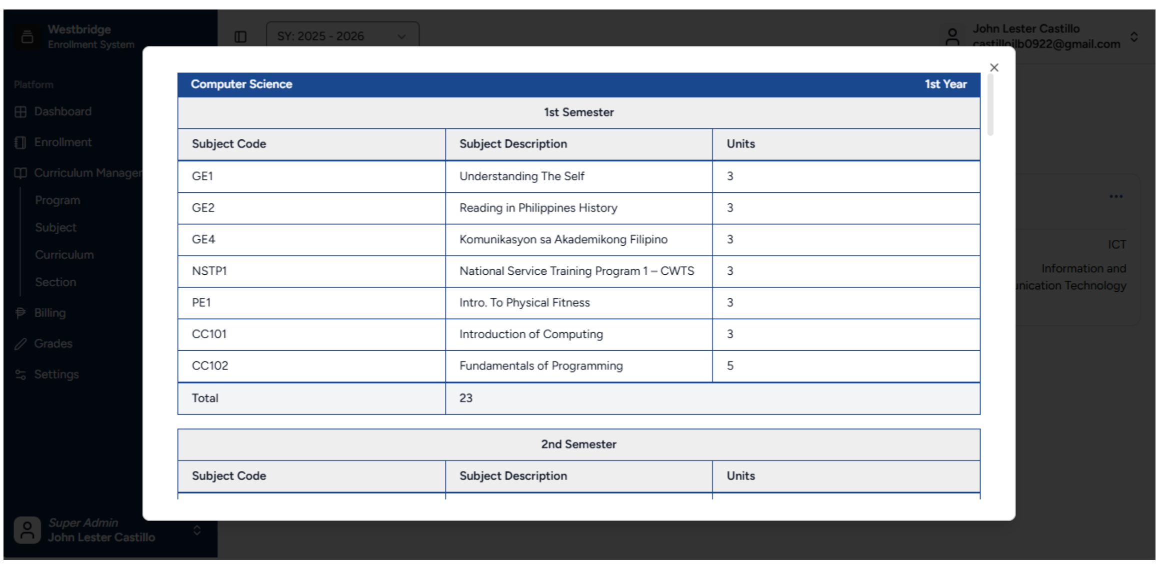
Figure 25.4 Subject Excel Import/Export: (a) import, (b) preview

In figure 25.4 *a* and *b*, the system allows for downloading a templated Excel file and uploading subject data files. This feature automates the setup, management, and maintenance of multiple courses to facilitate quicker curriculum setup and organization.



(a) overview

Figure 25.5 Curriculum: (a) overview, (b) specific



(b) specific

Figure 25.5 Curriculum: (a) overview, (b) specific

In figure 25.5 *a* and *b*, the system shows the curriculum of the school developed while creating programs and subjects. It enables the viewing and management of formal academic programs by authorized staff to ensure compliance with institutional standards and regulations.

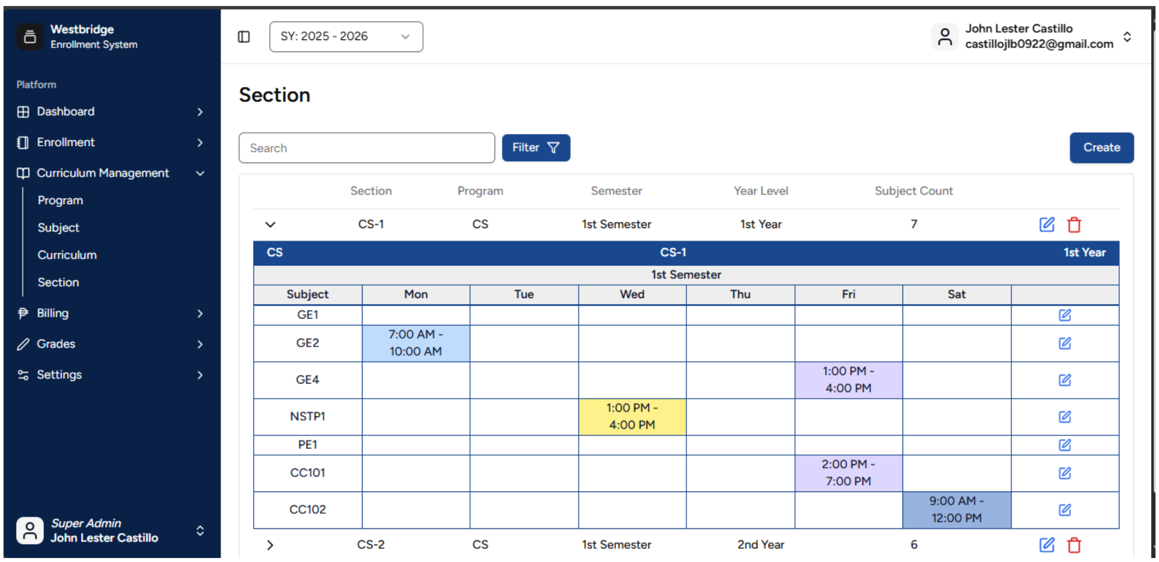


Figure 25.6 Section

The system enables authorized users to define sections for academic programs. It enables individual students and instructors to be assigned to each section, enabling well-structured delivery of courses and effective management of students.

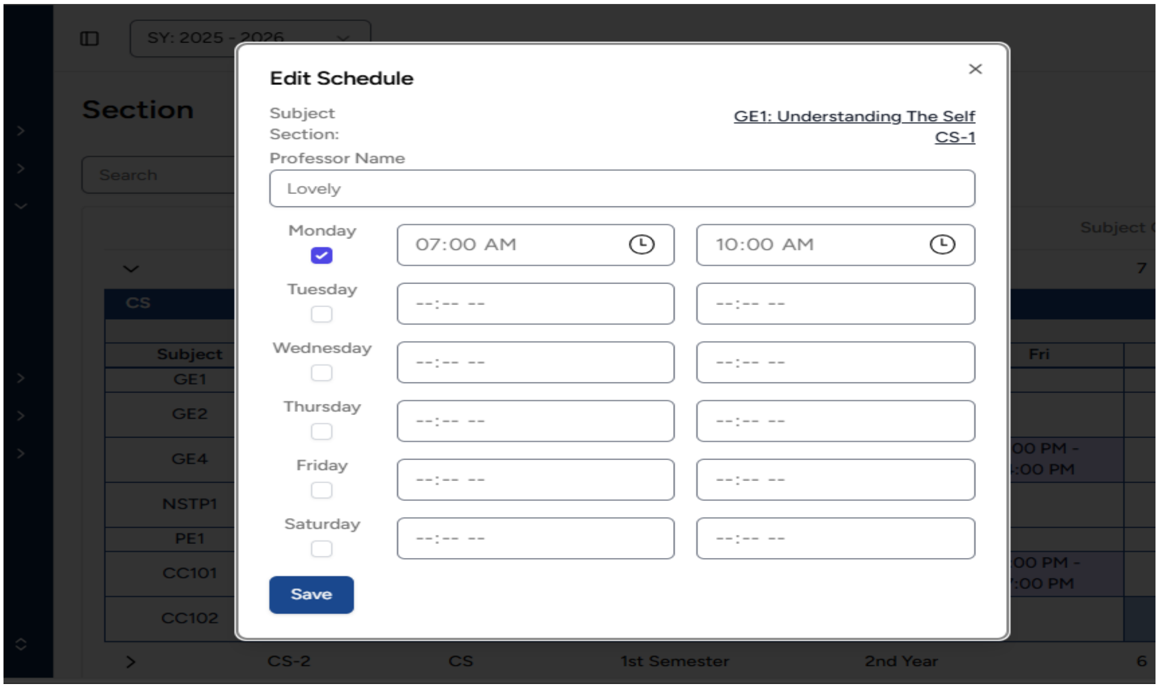
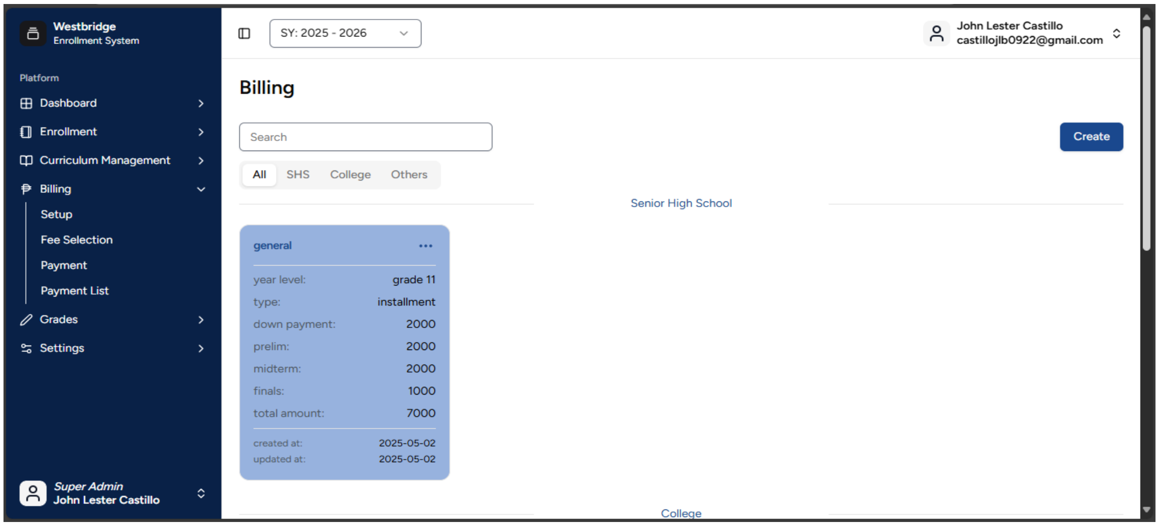


Figure 25.7 Schedule

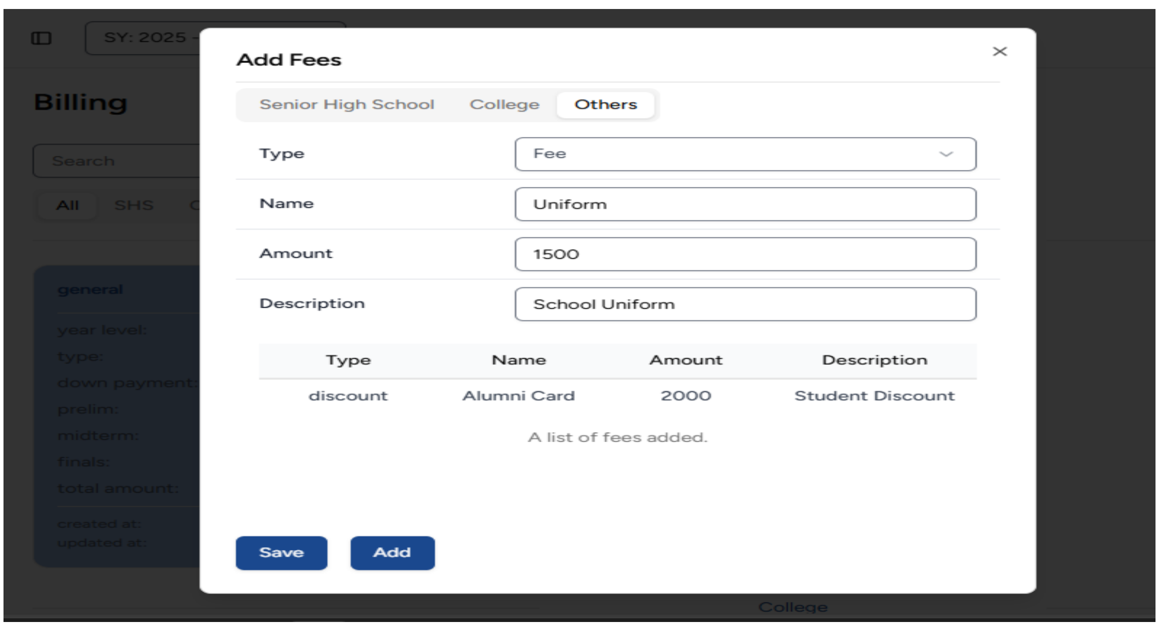
It facilitates the sanction of professors and class schedules for every subject by the concerned authorities. It provides for appropriate assignment of instructors to the correct subjects with appropriate timings for smooth delivery of the courses.

Billing



(a) billing overview

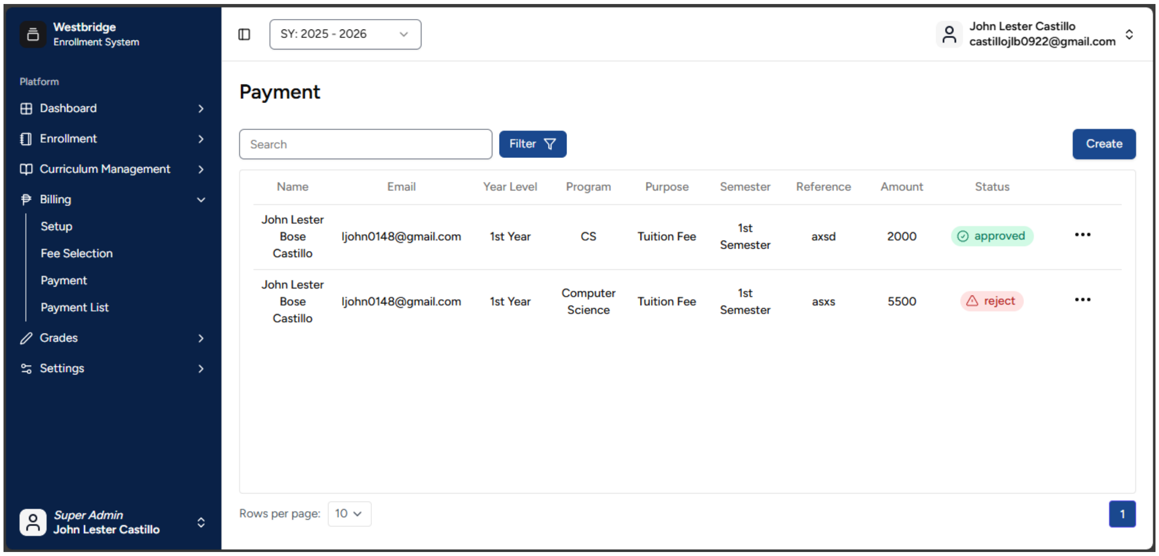
Figure 26.1 Fee Creation: (a) billing overview, (b) add fee/s



(b) add fee/s

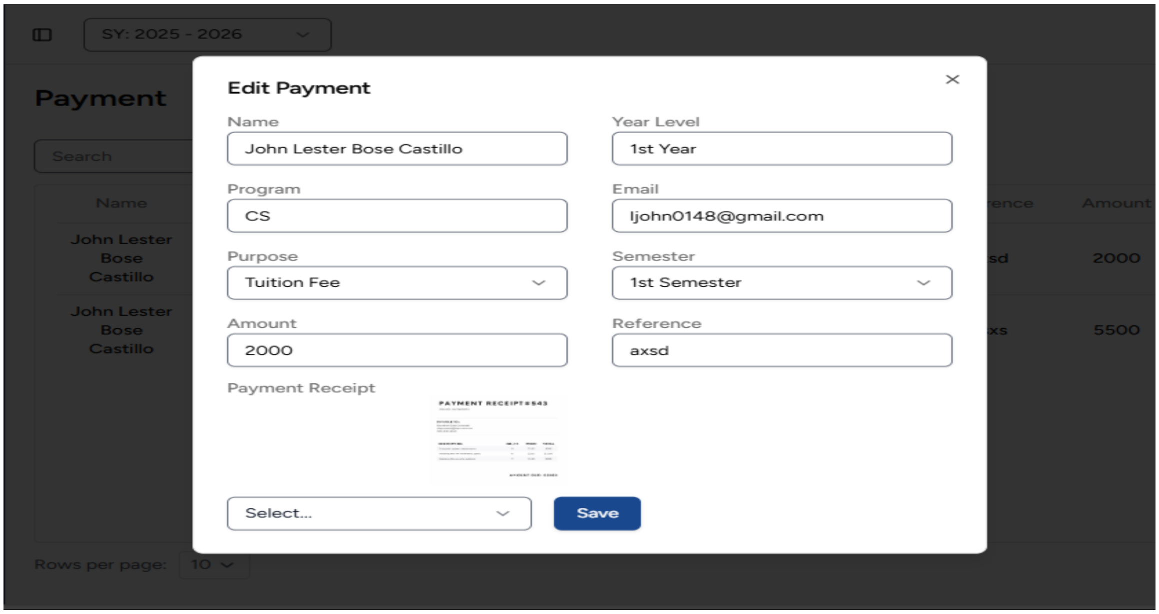
Figure 26.1 Fee Creation: (a) billing overview, (b) add fee/s

In figure 26.1 *a* and *b*, the system allows authorized staff to create billing files for students that contain tuition fees alongside other charges. It assists in accurate financial records to facilitate easy fee management and tracing of payments.



(a) View Interface

Figure 26.2 Payment: (a) View Interface, (b) add payment



(b) add payment

Figure 26.2 Payment: (a) View Interface, (b) add payment

In figure 26.2 *a* and *b*, the system supports authorized staff in checking payments by the students and also checks approval status. It verifies payments properly so that payments can be processed on time and only approved payments are accounted for enrollment.

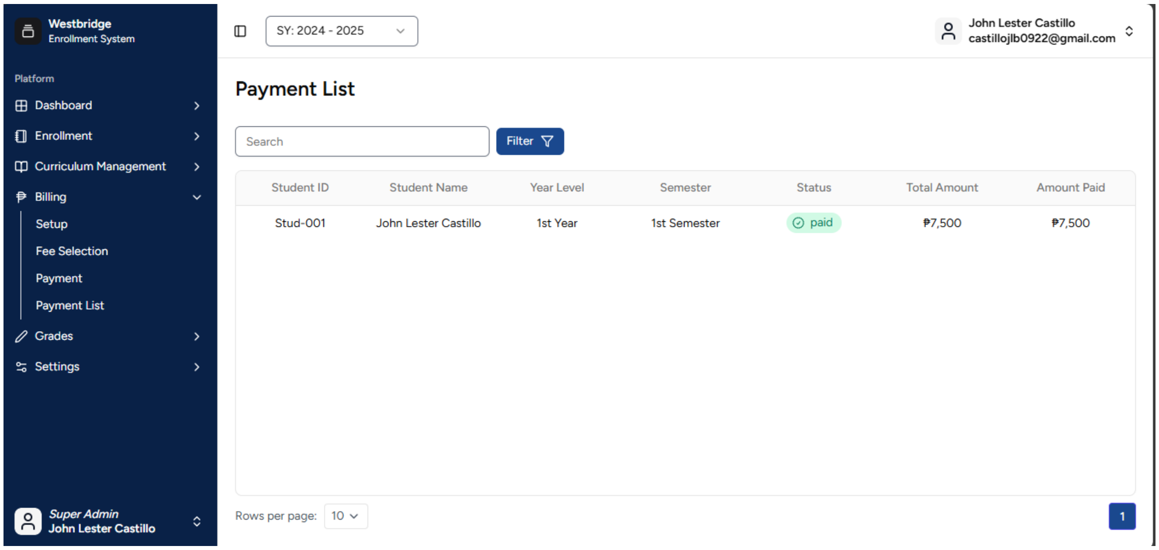
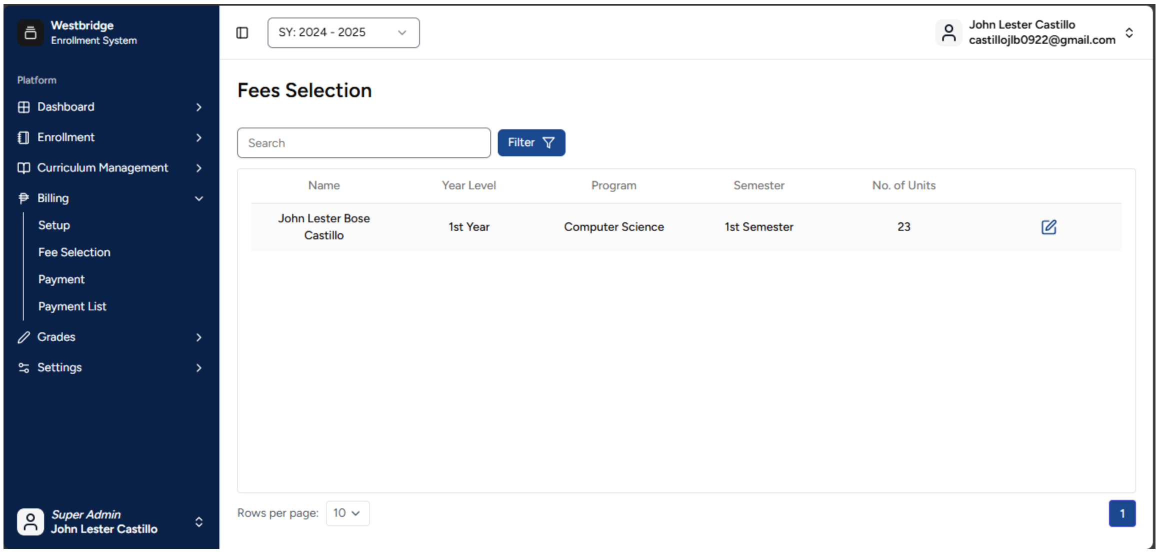


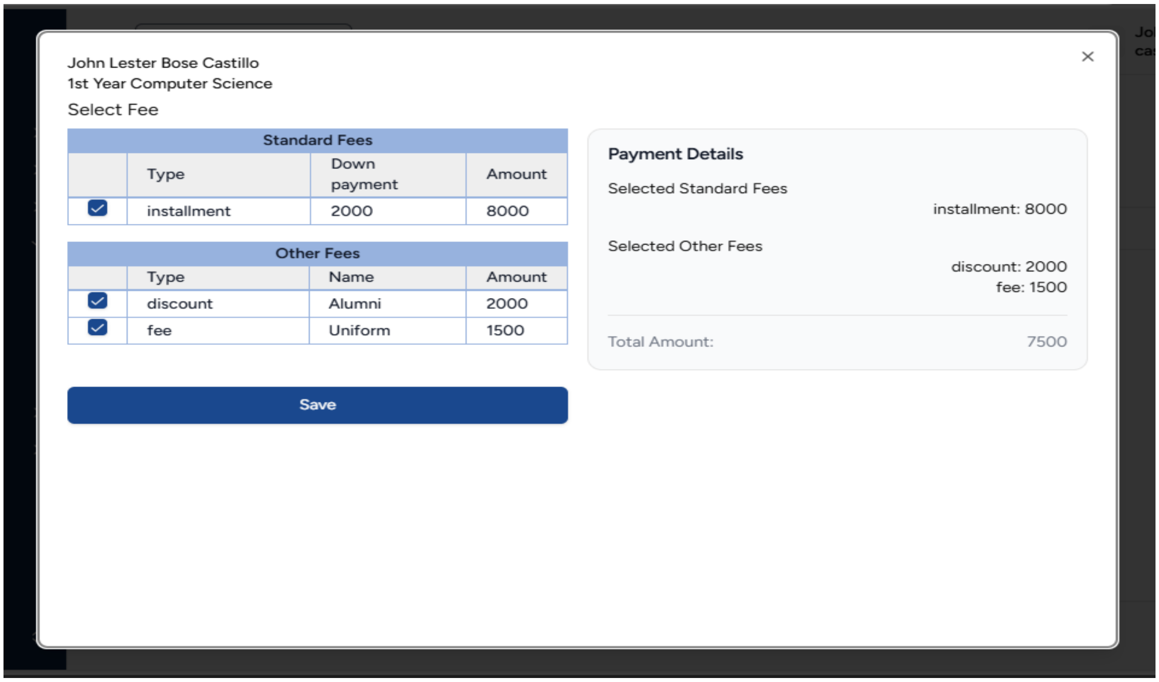
Figure 26.3 Payment List

The system shows an elaborate payment report with each student's balance, amount paid, and payment status. This can be used to track payment history by authorized individuals and maintain precise financial records.



(a) View

Figure 26.4 Fee Selection: (a) View, (b) Assigning



(b) Assigning

Figure 26.4 Fee Selection: (a) View, (b) Assigning

The system allows authorized users to choose the right fees for students depending on their program and enrollment information. This ensures proper fee assignment and efficient processing of student financial responsibilities.

Grades Viewing

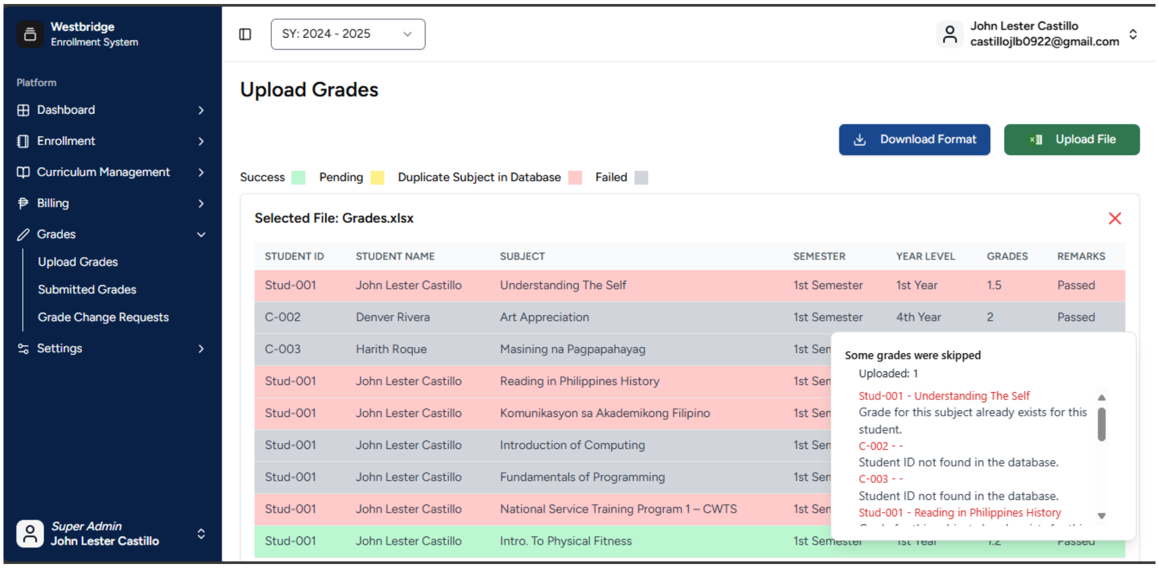


Figure 27.1 Upload Grades

The system has a provision to download an excel template and upload student grades. It makes grading easier through bulk input, with status indicators of success (green), duplicate (red), pending (yellow), and failed (gray).

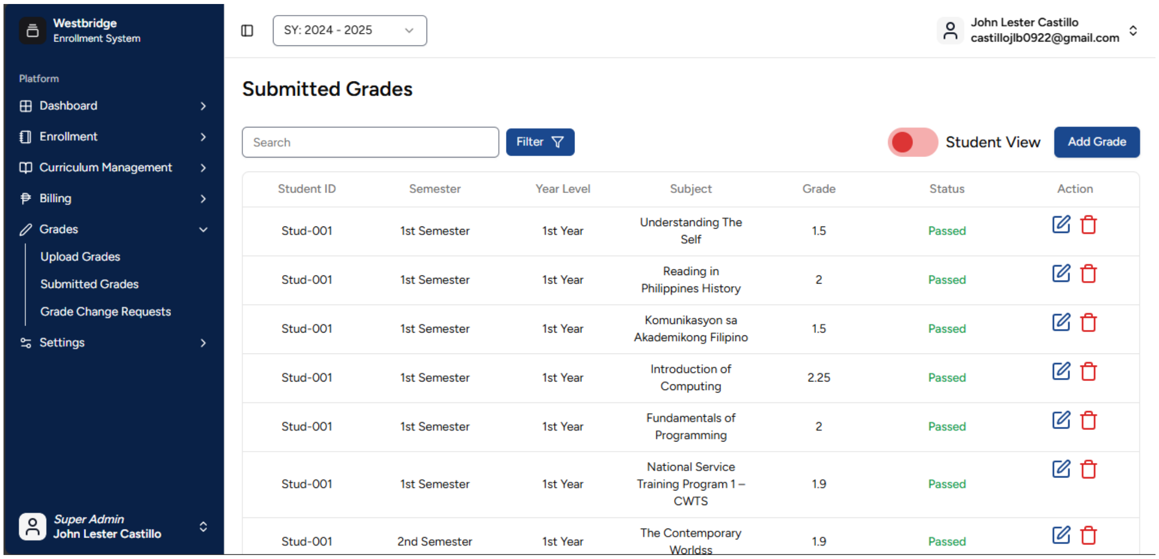


Figure 27.2 Submitted Grades

The system shows grades submitted by students. As soon as the student view is enabled, grades are automatically available to the concerned students so that results can be accessed securely and correctly.

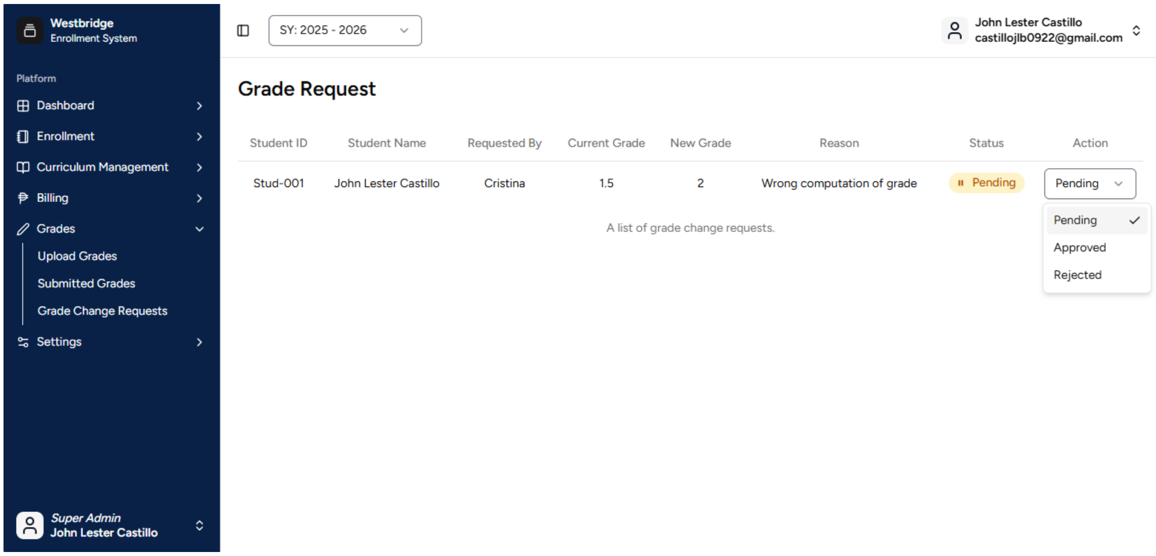


Figure 27.3 Grade Change Request

The system facilitates the processing of grade change requests made. Each request may be accepted or rejected, ensuring adequate verification of the grade updates and ensuring standardization in processing academic records.

System settings

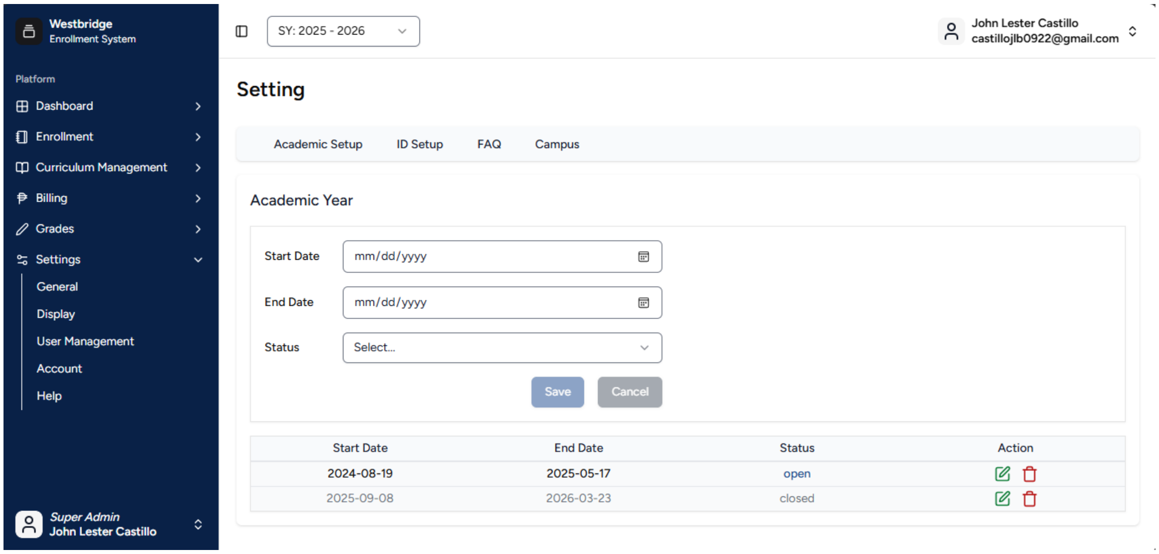


Figure 28.1 General Setting

The system also has a general settings function where school year, student and employee number formats, school branches, and the FAQs can be set up to support system-wide consistency and customization.

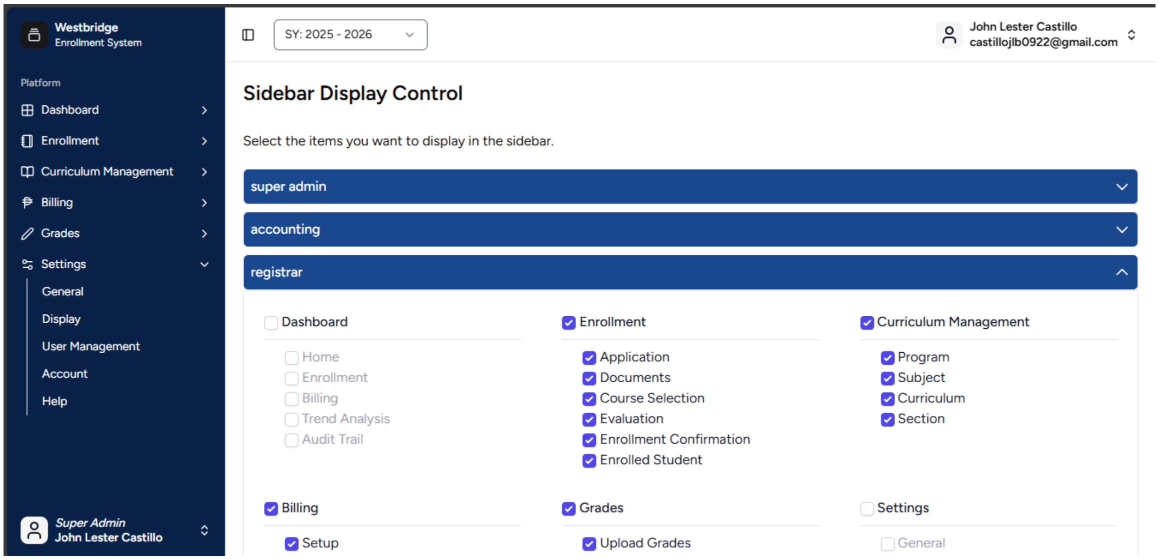
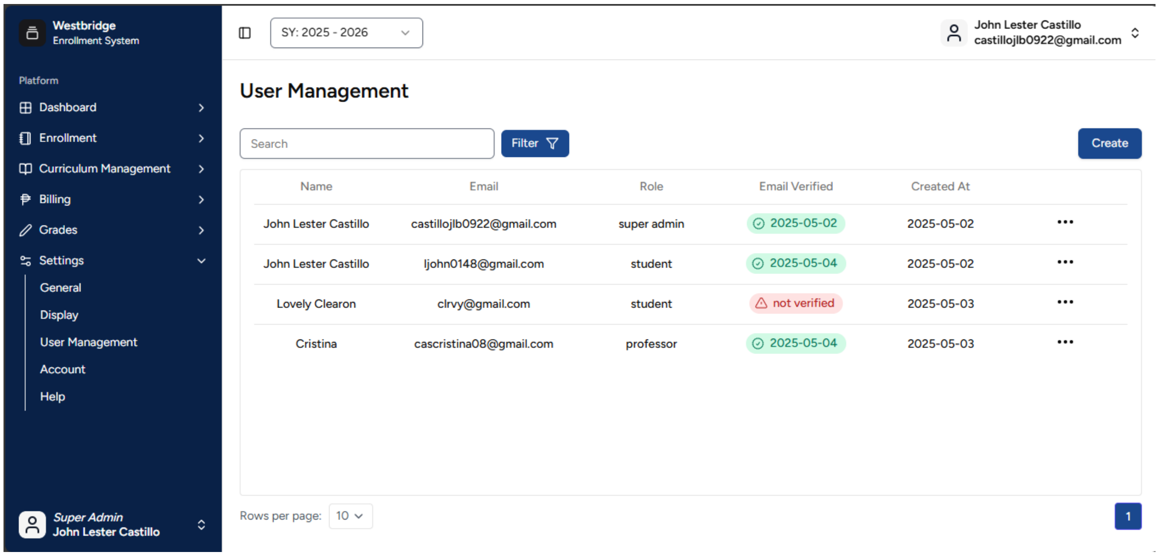


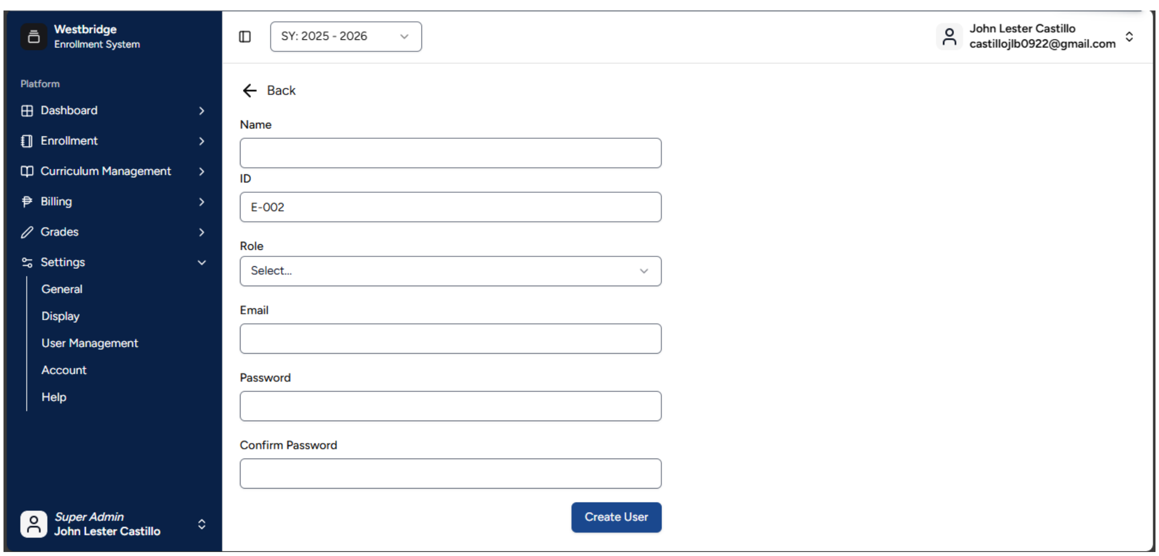
Figure 28.2 Display Control

The system supports the super admin to control what sidebar items are displayed to different user roles. This gives a personalized interface, displaying only relevant features depending on user permissions and roles.



(a) View Interface

Figure 28.3 User Management: (a) View Interface, (b) Add admin user



(b) Add admin user

Figure 28.3 User Management: (a) View Interface, (b) Add admin user

The system allows super admins to see account statuses and establish new user accounts. The feature allows for effective management of users in that administrators can track account activity and ensure secure system access.

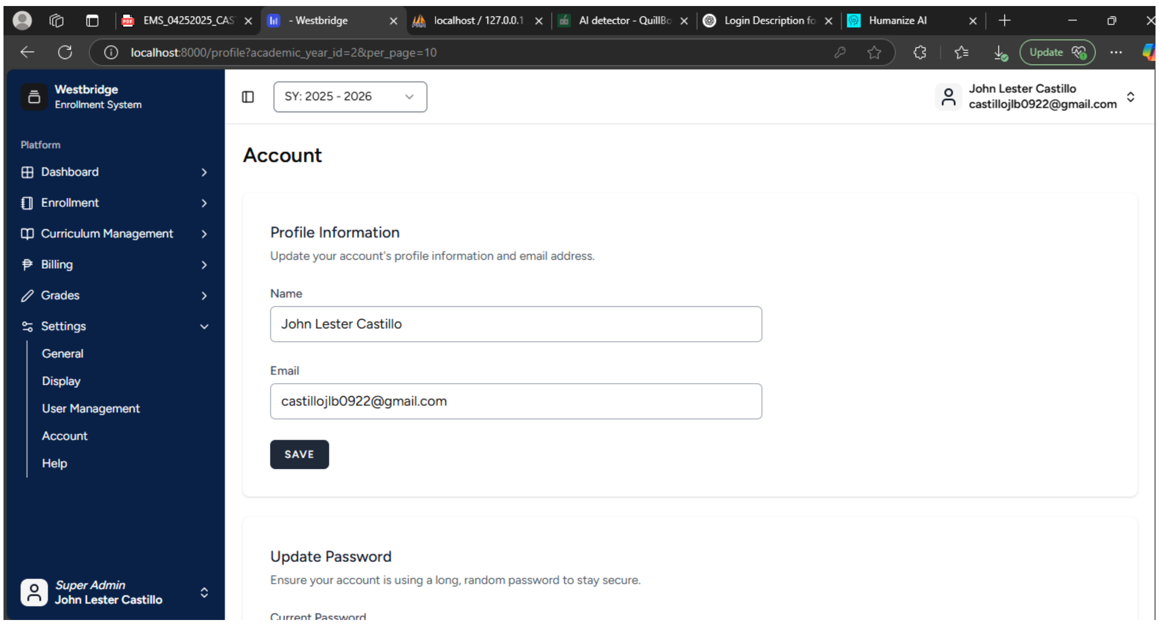


Figure 28.4 Account Management

The system enables user to modify profiles, update profile information such as name and e-mail, and modify their passwords. This enhances the ability for users to retain up-to-date and secure account information.

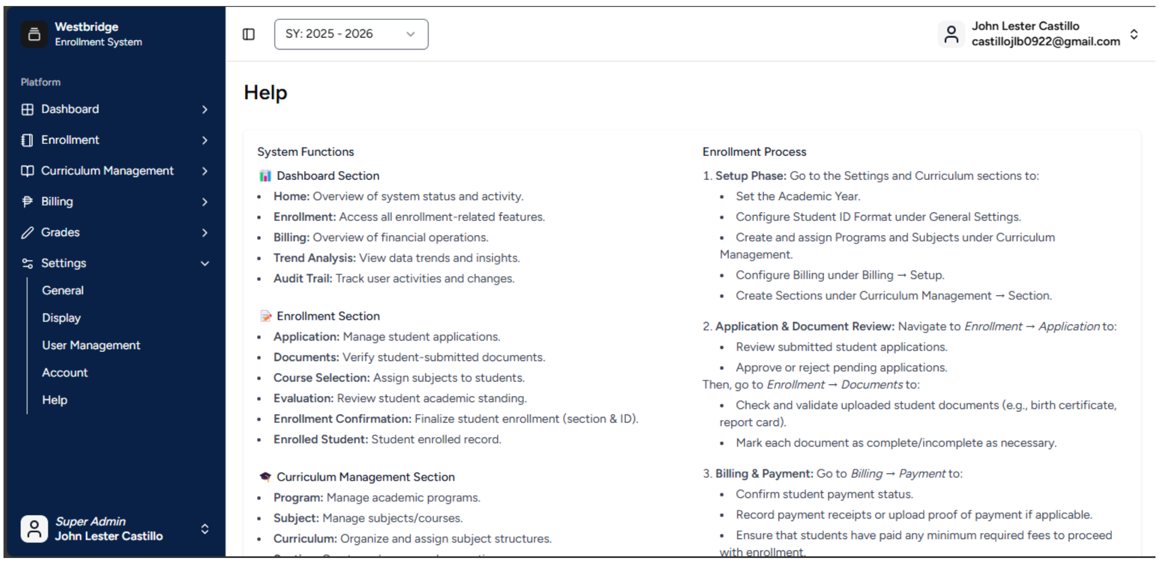


Figure 28.5 Help Section

The system has a help section that contains detailed information on how to utilize the enrollment system. It documents the process flow, leading users through processes such as registration, application, and tracking status.

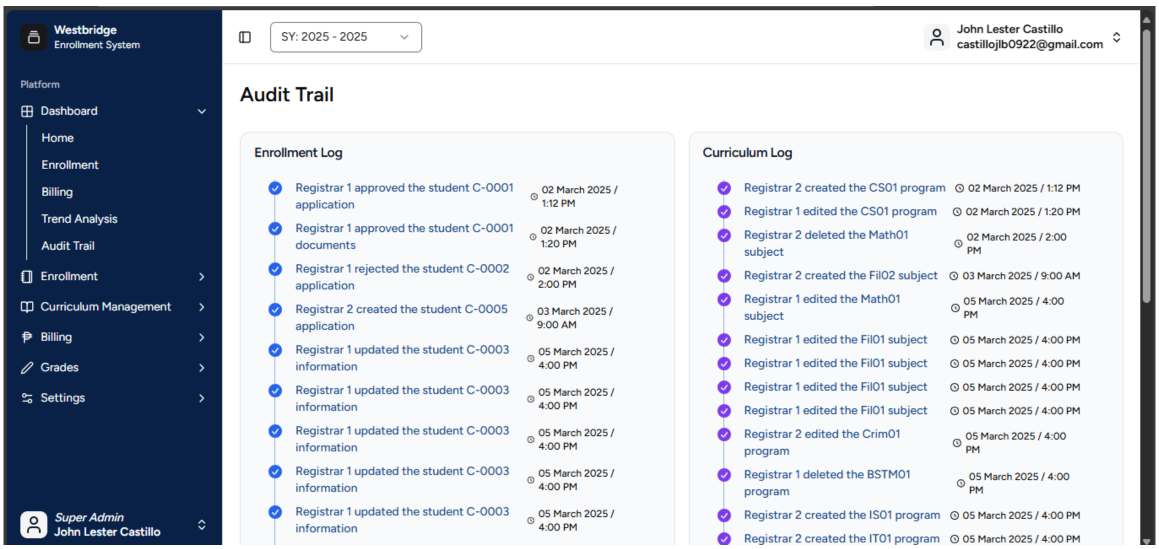


Figure 28.6 Audit Trail

The system has an audit trail, which records all the user activity and system changes. This provides transparency, security, and accountability so admins can monitor old actions for compliance and troubleshooting.

Student: General Features

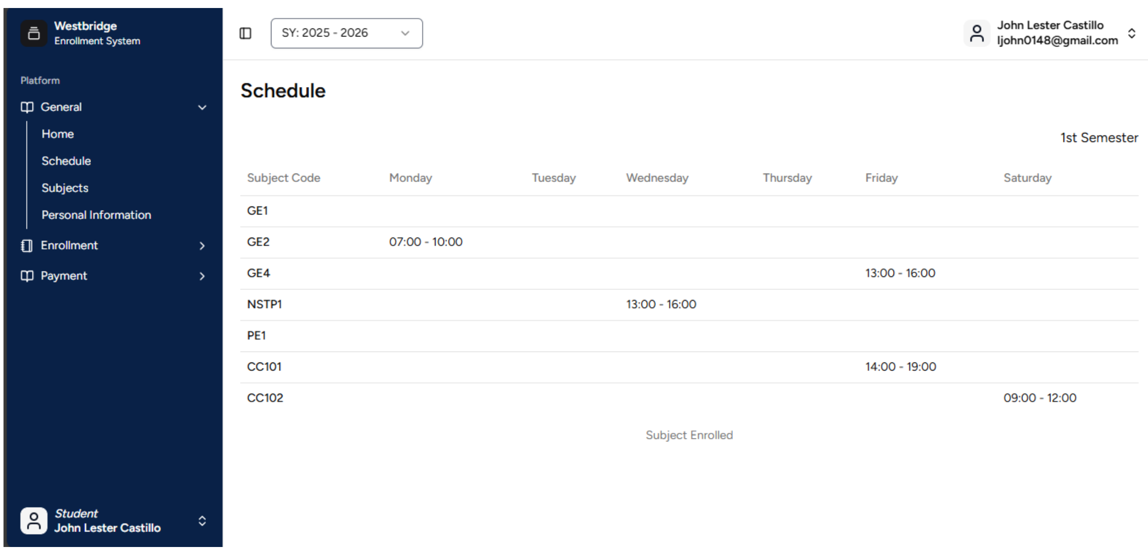


Figure 29.1 Schedule Display

The system shows the student's subject schedule, i.e., class time of every subject he has registered for. This makes the students’ view and schedule their subject timings at their own ease for the semester.

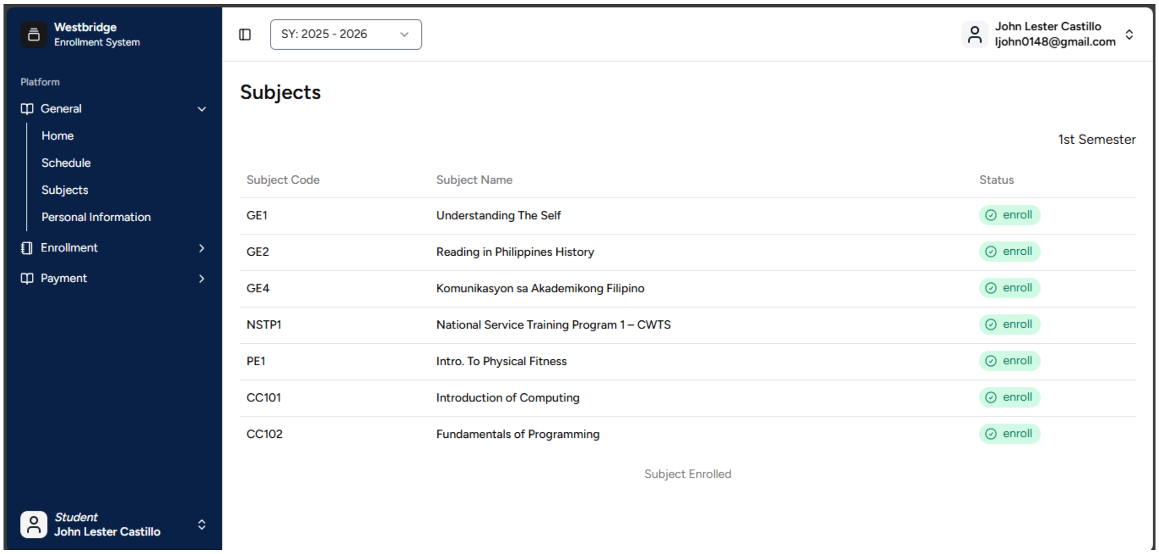


Figure 29.2 Subjects Display

The system displays subjects as well as related information like subject code, subject name, and enrollment status. Through this feature, students can easily view enrolled subjects and keep track of their enrollment status.

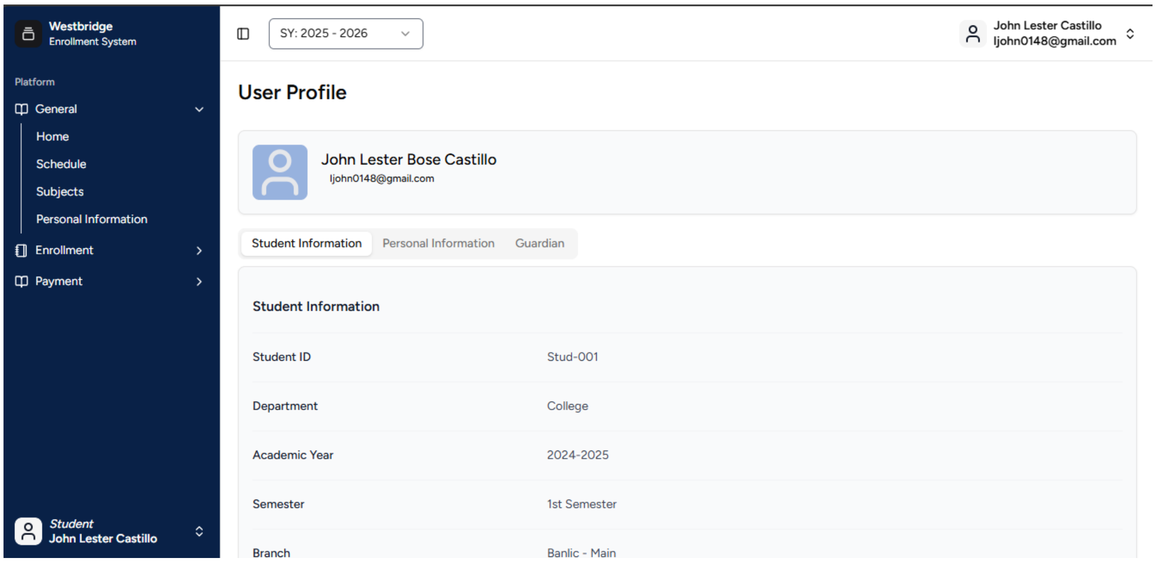


Figure 29.3 Personal Information

The system delivers required student information, including identification, academic information, and personal data such as name, contact, and other relevant attributes. The functionality facilitates the ability to retrieve student records with ease.

Student: Enrollment

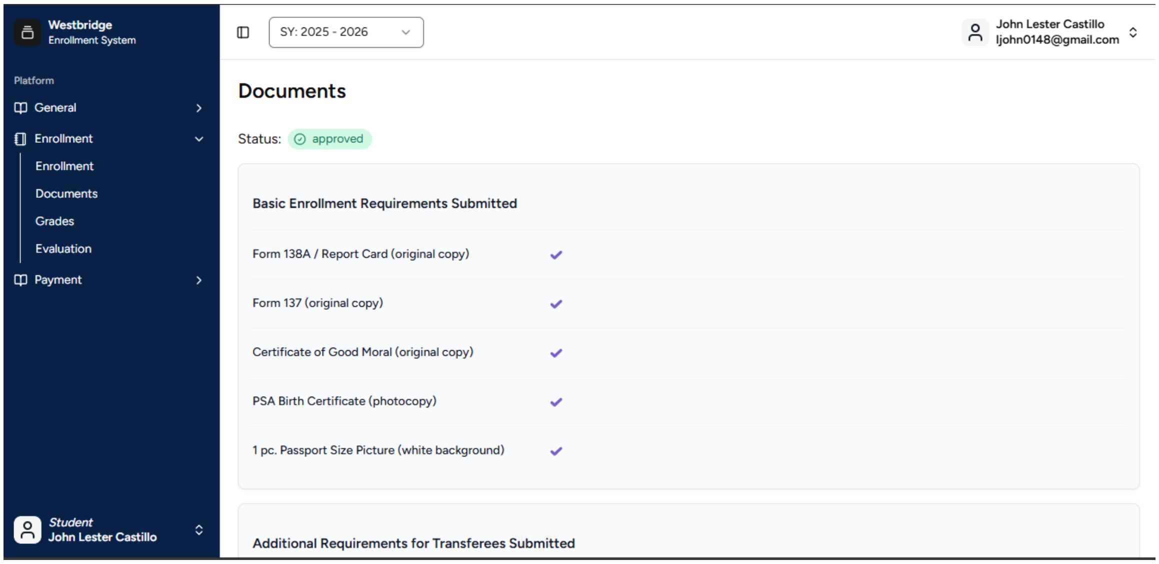


Figure 30.1 Documents Display

The system shows both pending and submitted student documents, clearly showing which documents are required and which are completed. This feature assists in monitoring required documentation for the enrollment process.

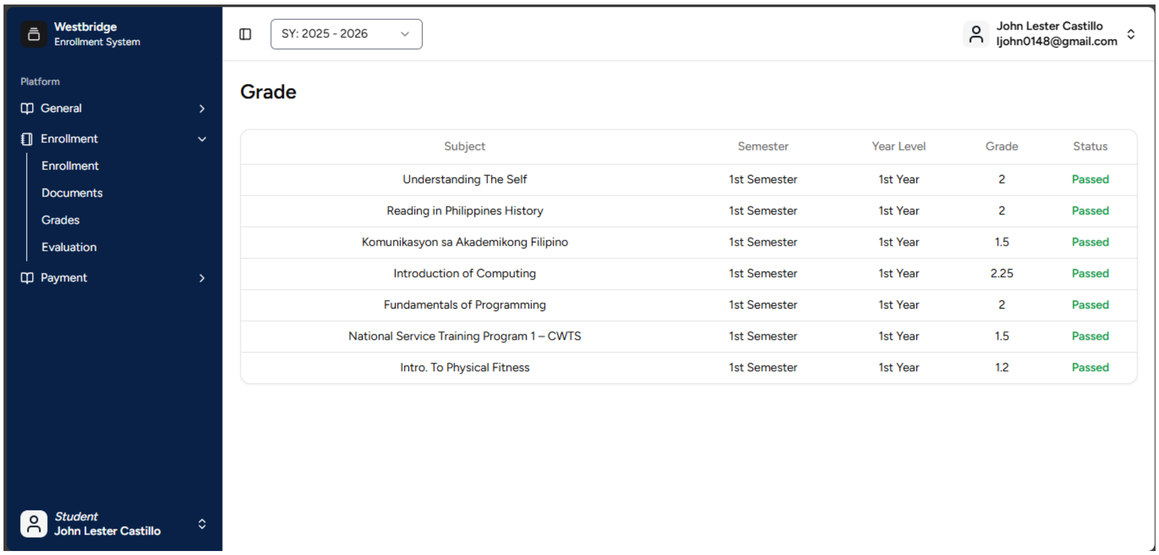


Figure 30.2 Grade Display

The system shows the students' grades along with status indicators to which they have been assigned, labeling each "Passed" or "Failed." This makes it easy for the students to monitor their performance and progress throughout the courses.

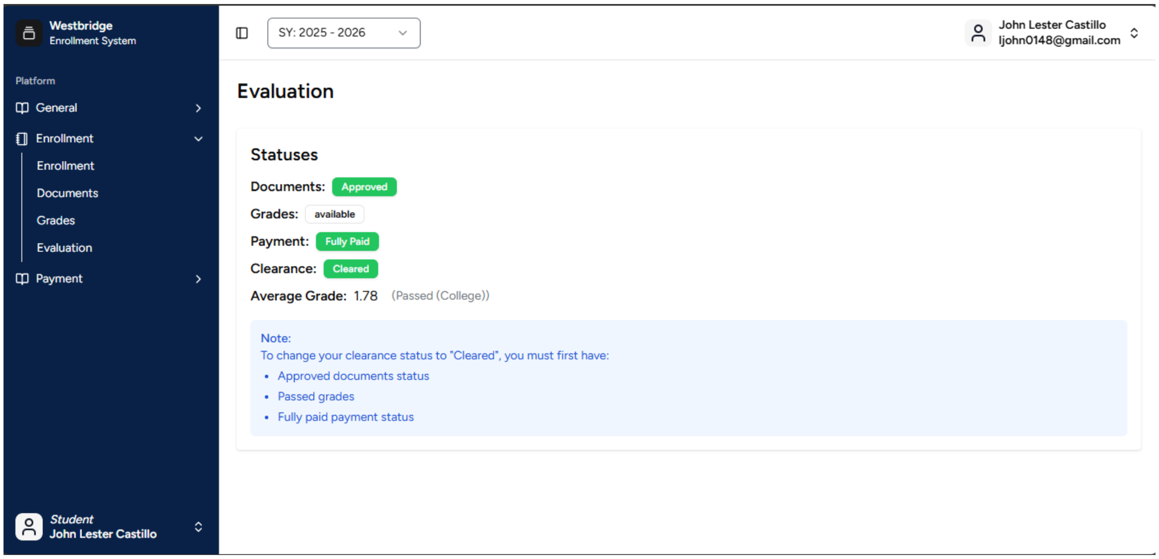
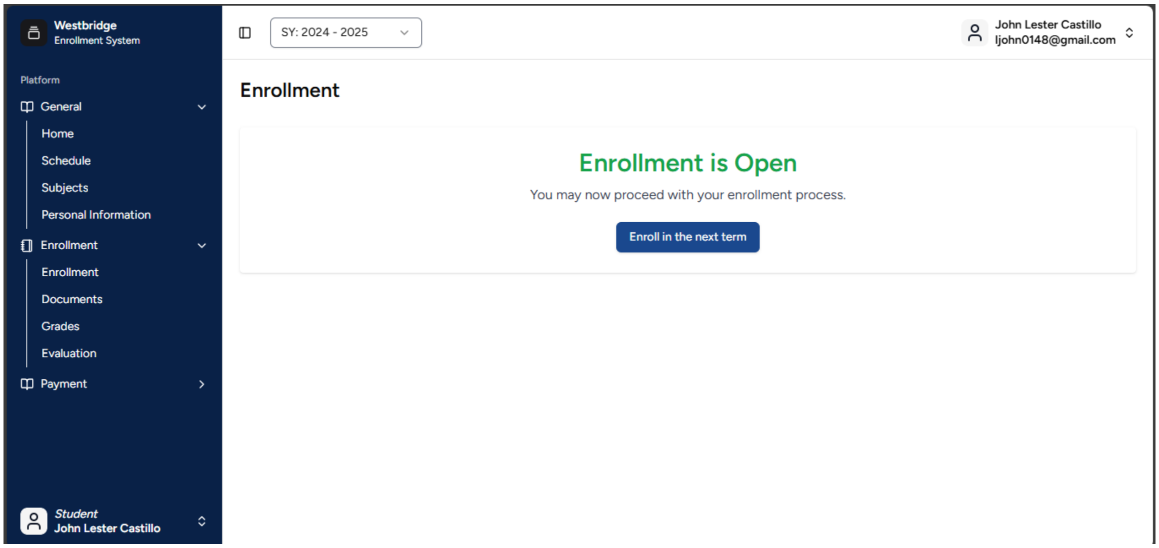


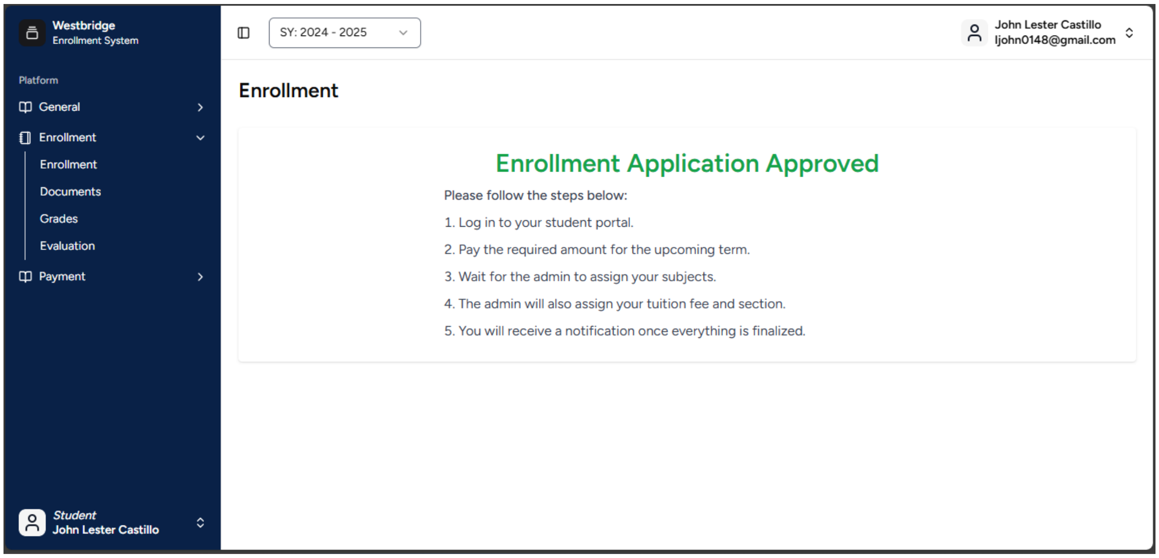
Figure 30.3 Evaluation and Clearance Status

The system has an evaluation section where the payment status, documents, grades, and clearance are indicated clearly. This makes it easy for the users to monitor and handle the fulfillment of all the necessary academic and financial processes.



(a) Interface

Figure 30.4 Student Enrollment: (a) Interface, (b) Status



(b) Status

Figure 30.4 Student Enrollment: (a) Interface, (b) Status

The system has an enrollment page where, by clicking the button, the information required is automatically posted for enrollment in the subsequent term. This facilitates the enrollment process so that students are enrolled quickly for future terms.

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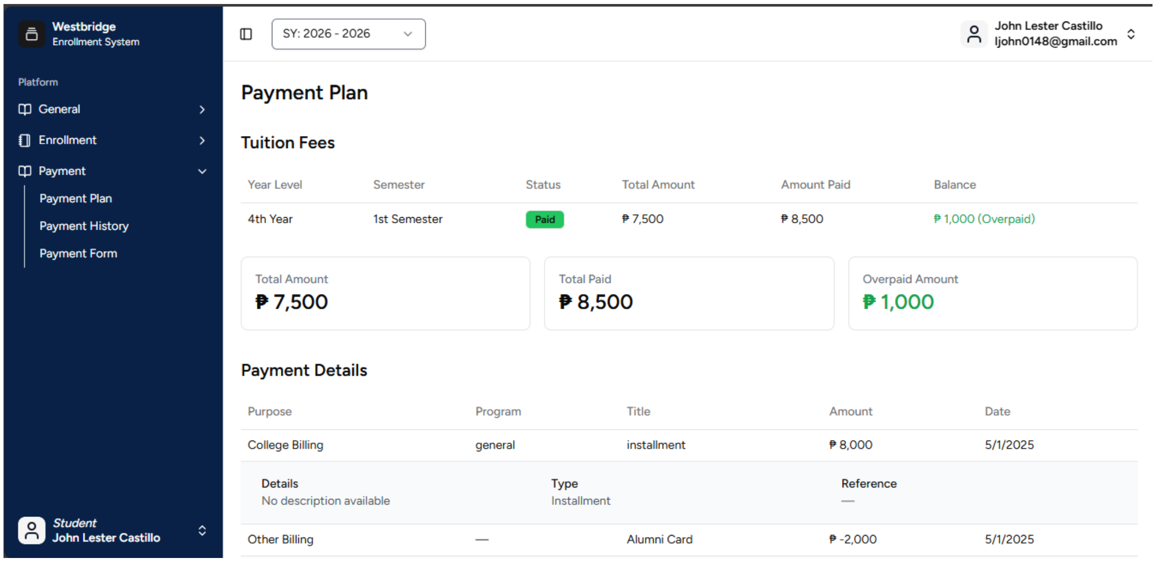


Figure 30.5 Student Payment Plan

The system also features a payment plan section that indicates a detailed breakdown of payments to be made, the amount to be paid, paid already, and status of payments. The feature enables users to track their finances and status of payments.

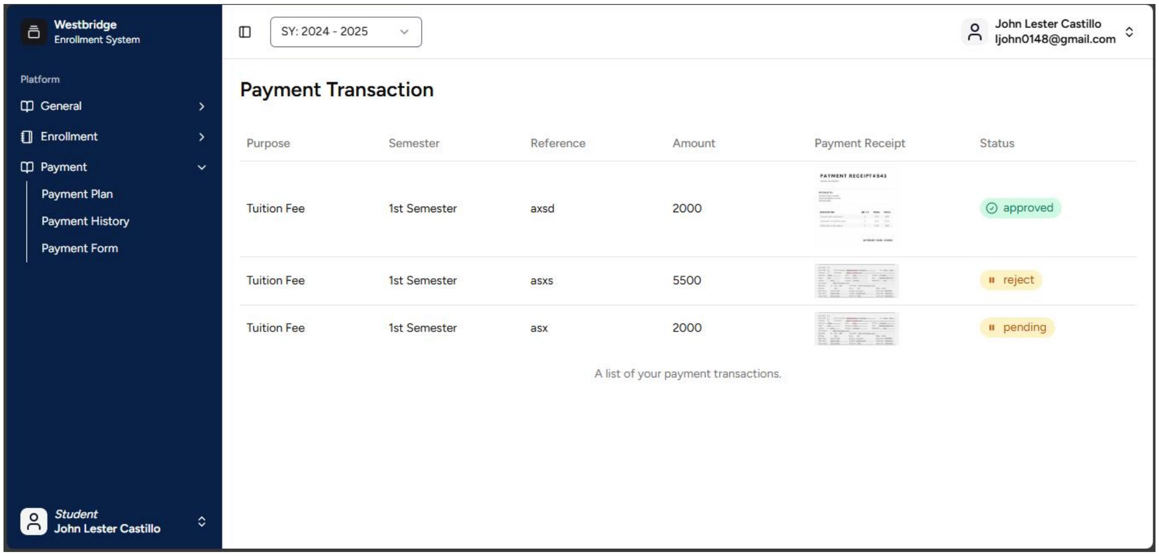


Figure 30.6 Student Payment Transaction

The payment transaction area shows a record of payments submitted, the payment amount, date of submission, and transaction status. This enables users to monitor their payment history and verify correct processing.

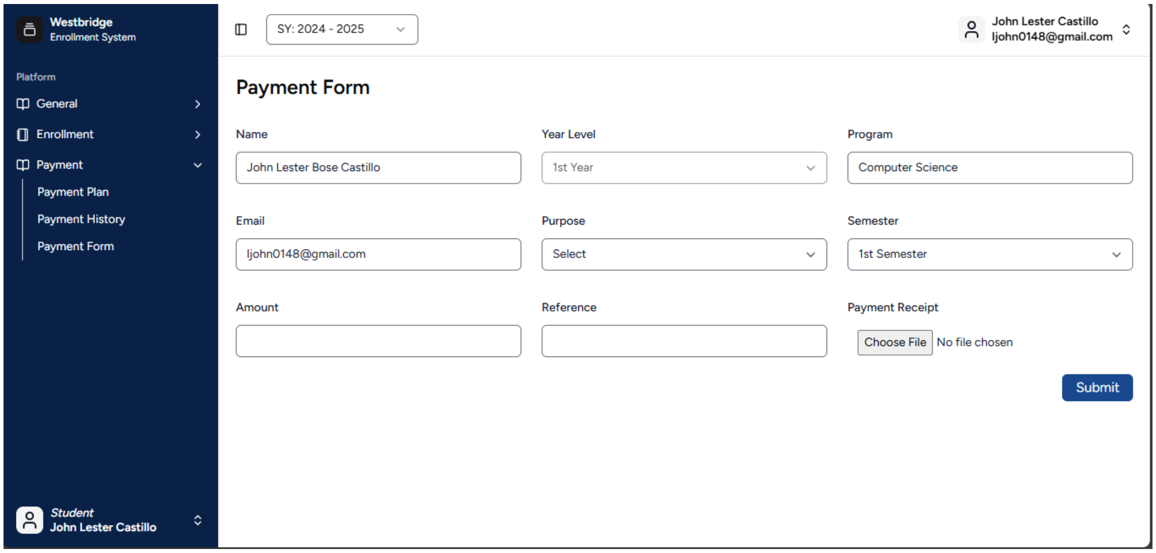
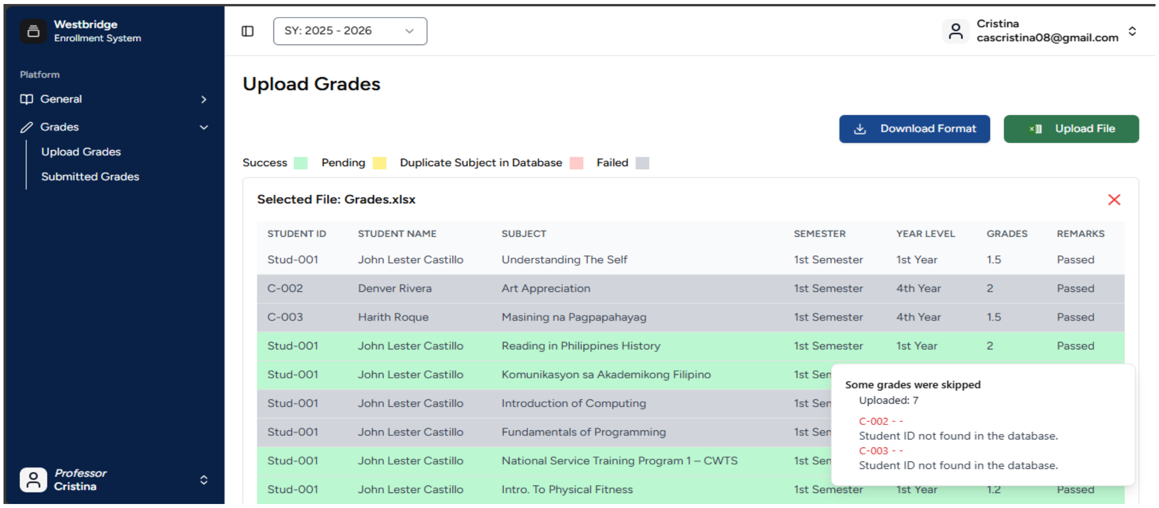


Figure 30.7 Student Payment Form

The system includes a payment form where students are able to enter and submit their payment details. The form allows students to enter the payment amount, select the mode of payment, and complete the transaction securely.

Professor: Grades Features



STUDENT ID	STUDENT NAME	SUBJECT	SEMESTER	YEAR LEVEL	GRADES	REMARKS
Stud-001	John Lester Castillo	Understanding The Self	1st Semester	1st Year	1.5	Passed
C-002	Denver Rivera	Art Appreciation	1st Semester	4th Year	2	Passed
C-003	Harith Roque	Masining na Pagpapahayag	1st Semester	4th Year	1.5	Passed
Stud-001	John Lester Castillo	Reading in Philippines History	1st Semester	1st Year	2	Passed
Stud-001	John Lester Castillo	Komunikasyon sa Akademikong Filipino	1st Sen			
Stud-001	John Lester Castillo	Introduction of Computing	1st Sen			
Stud-001	John Lester Castillo	Fundamentals of Programming	1st Sen			
Stud-001	John Lester Castillo	National Service Training Program 1 – CWTS	1st Sen			
Stud-001	John Lester Castillo	Intro. To Physical Fitness	1st Semester	1st Year	1.2	Passed

Figure 31.1 Grade Upload

The system provides grade download and upload features via excel. The uploaded grades are processed with status indicators: green for success, yellow for pending, red for duplicate topics, and gray for failure. This makes it easy to track and monitor grade updates.

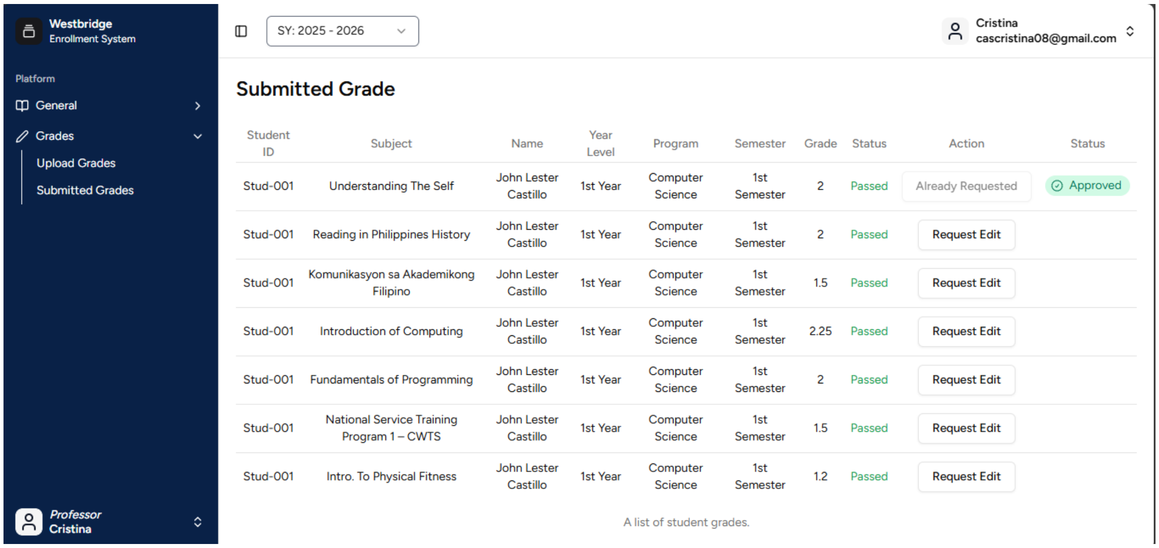


Figure 31.2 Submitted Grade

The system also grants the uploader visibility of viewing submitted grades. The provision allows the uploader to check and authenticate inputs, ensuring an easier overview of all posted grade entries.

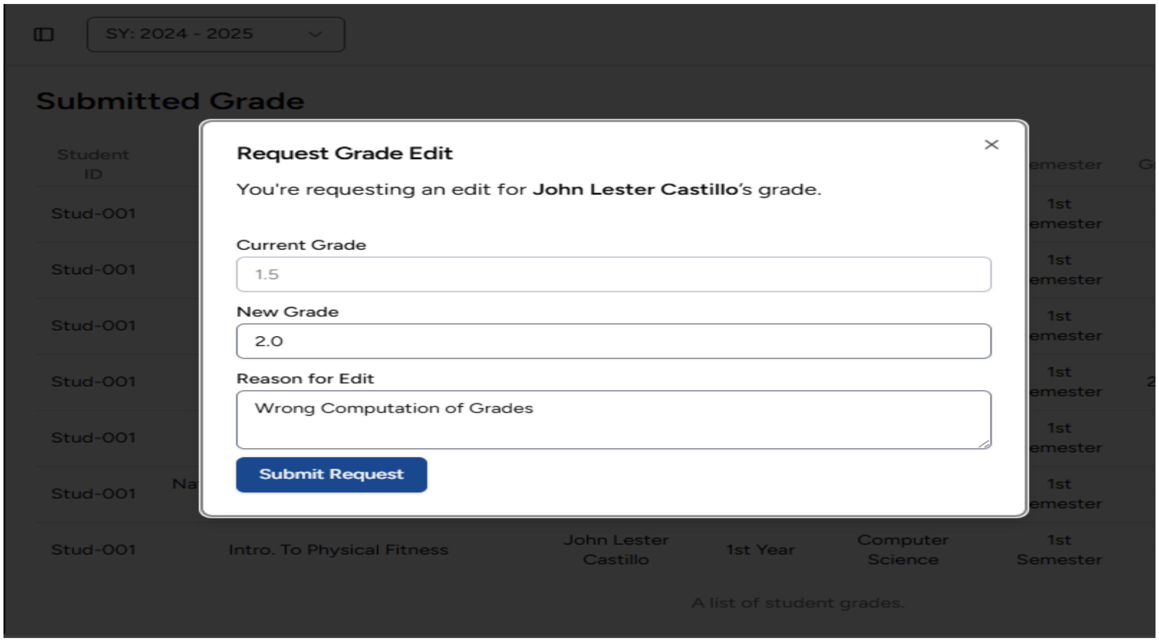


Figure 31.3 Grade Edit Request

The system allows a request to alter a submitted grade. After making the request, the status will reflect whether it is pending approval, approved, or rejected so that professors can monitor and handle grade change requests.

Trend Analysis by Department Features

The researchers developed a system to help schools make better decisions by analyzing student enrollment patterns across different programs like Computer Science and STEM. By examining historical data and predicting future trends, the tool aimed to guide staffing, resource allocation, and curriculum updates in a way that matched actual student demand.

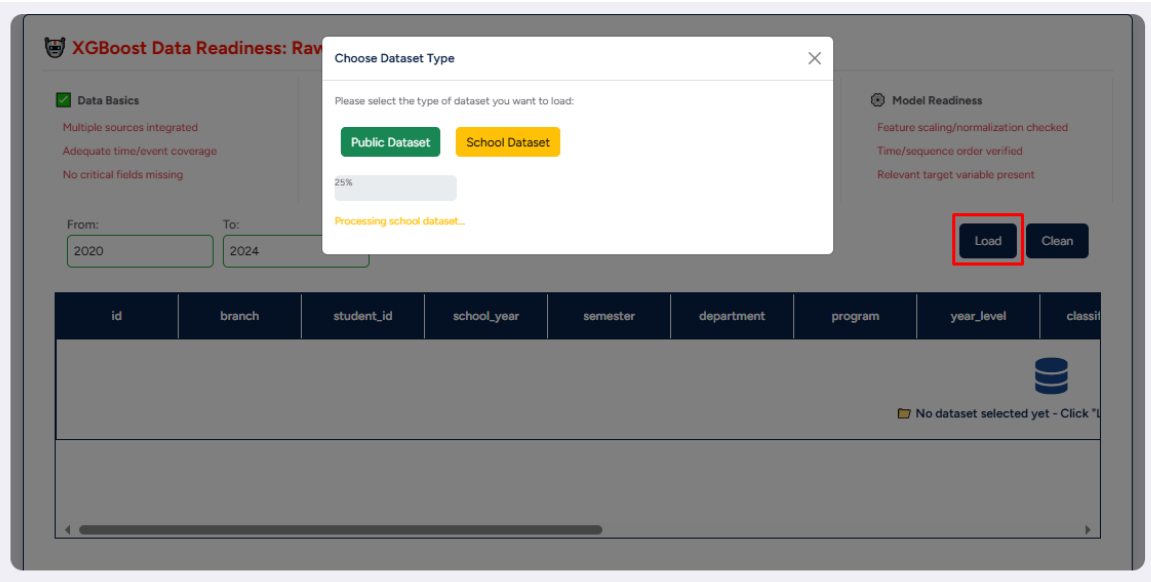


Figure 32.1 Load Dataset Feature

The researchers enabled school uploads of students' records using a simple-to-use interface. Users could work with public sample data or upload their school-specific datasets, featuring a progress indicator showing the real-time status of uploading. This feature allowed all relevant student information—such as program enrollment, grades, and demographics—to be securely uploaded into the system.

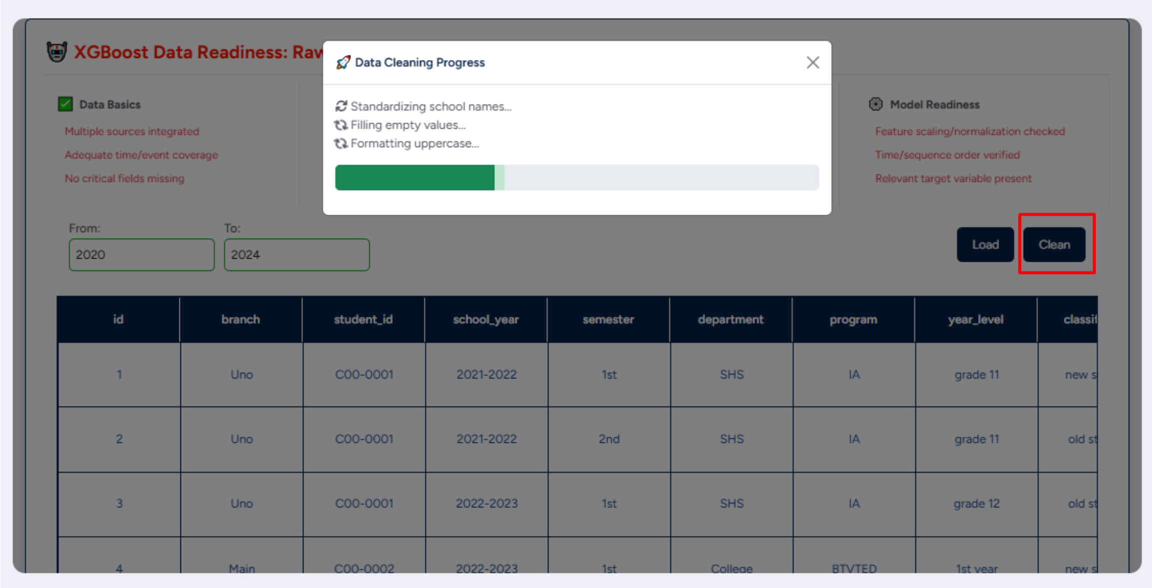


Figure 32.2 Clean Dataset Feature

To fix errors in the raw data, the researchers added automated cleaning tools. The system standardized school names (e.g., changing “Sci High” to “Science High School”), filled in missing birthdates using registration records, and removed duplicate entries. A progress tracker showed users how many issues were resolved during this process.

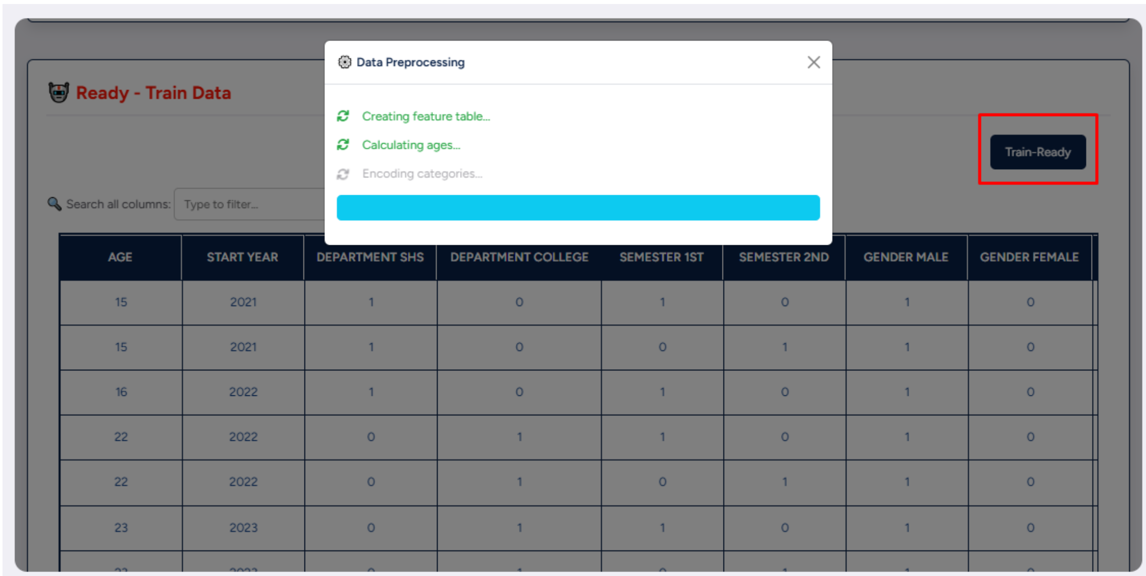


Figure 32.3 Train-Ready Dataset Feature

Before training the prediction model, the researchers prepared the data by converting categories like “program” or “gender” into numerical codes the computer could understand. They also calculated ages for students from birth dates and sorted records in chronological order. A "Train-Ready" button allowed users to validate the data were correctly formatted.

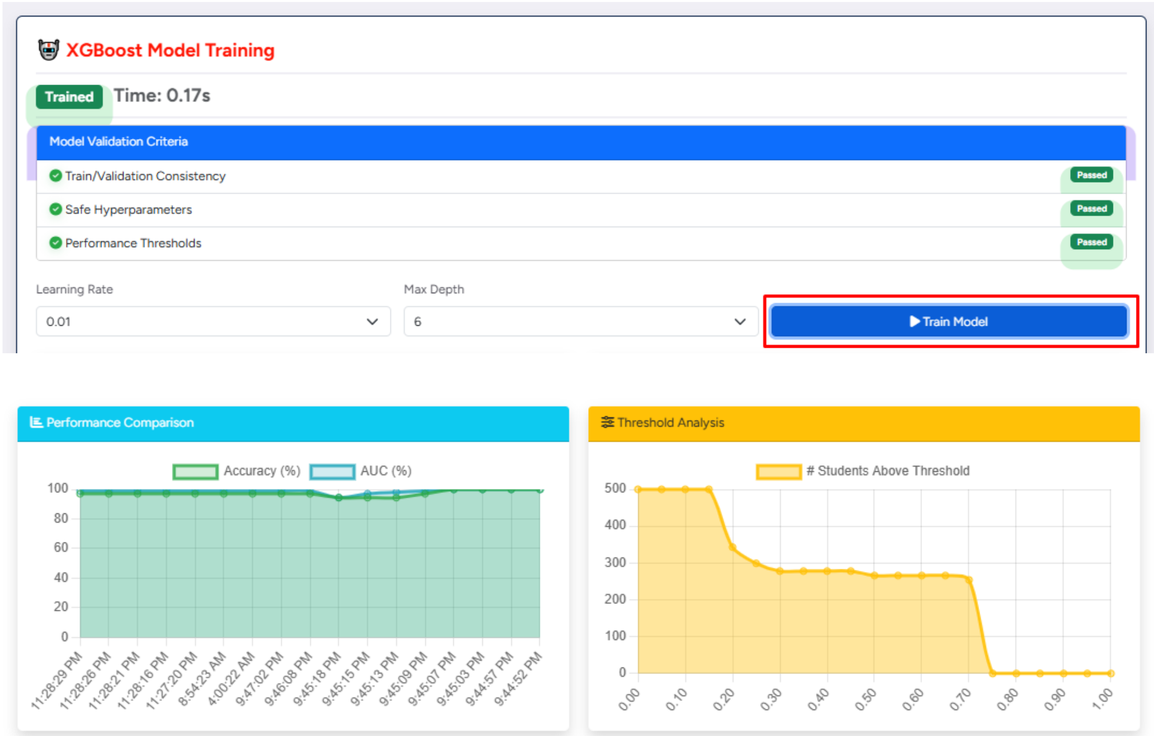


Figure 32.4 Training Model Feature

The researchers employed XGBoost, a machine learning algorithm, to forecast likelihood of enrollment. Users were able to tweak settings such as learning speed (how fast the model learns) and complexity (how intricate patterns it identifies). The system checked if predictions matched historical trends to ensure reliability, displaying training time (e.g., “Model trained in 2 minutes”).

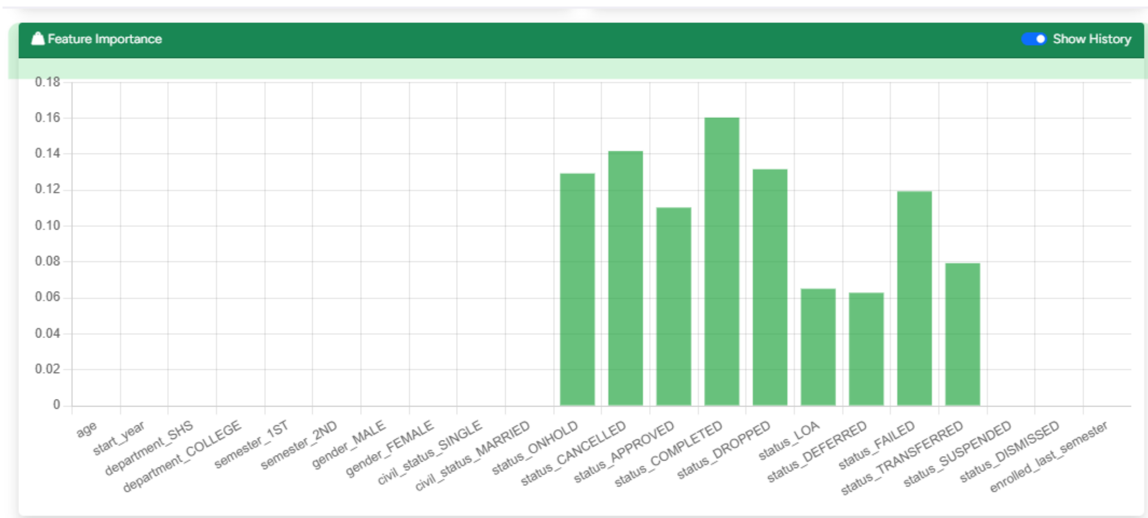


Figure 32.5 Feature Importance Visualization Feature

The system identified which factors most influenced enrollment—like GPA, financial aid status, or commute distance—and displayed them in a color-coded bar chart. This helped schools understand why the model predicted certain outcomes (e.g., "Low grades in math courses reduced STEM retention by 22%").

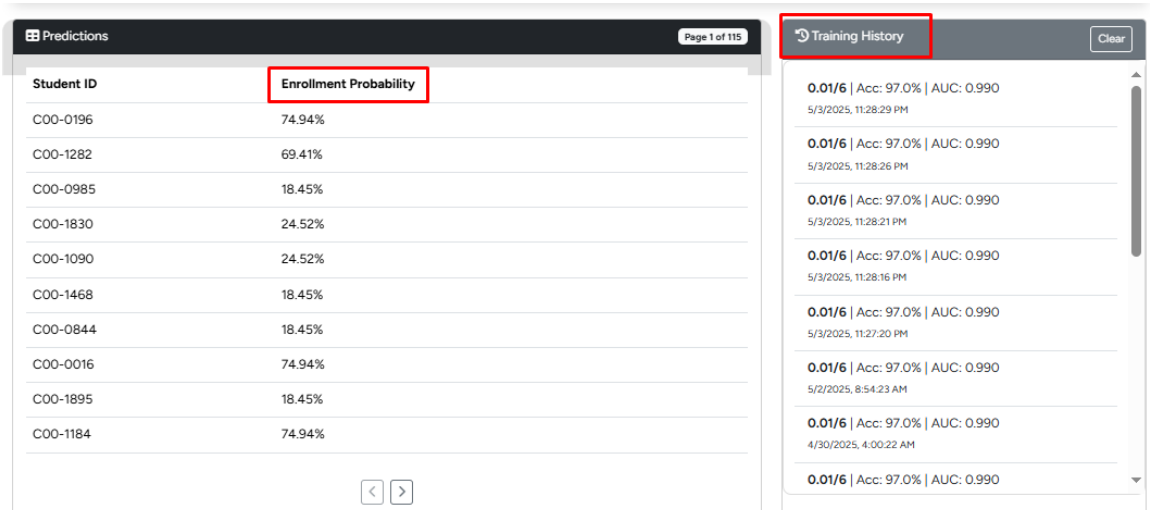


Figure 32.6 Enrollment Probability and Training Model History Feature

Each student received a “retention score” (e.g., “78% likely to re-enroll”) shown in a searchable table. A sidebar tracked past model versions, allowing comparisons like, “The March model flagged 15% more at-risk students than the January version.”

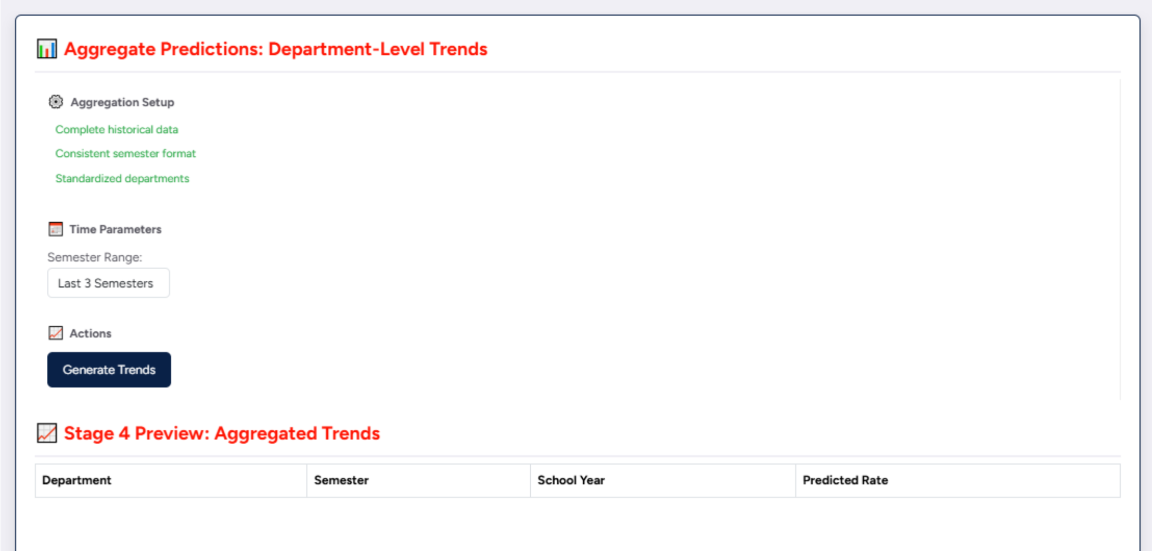


Figure 32.7 Enrollment Trends by Department Feature

The tool grouped predictions by program and semester shows trends through interactive line charts. For example, a downward red arrow next to “ABM Strand” indicated a 12% projected enrollment drop, while tables highlighted risk factors like “45% of dropouts cited course scheduling conflicts.”

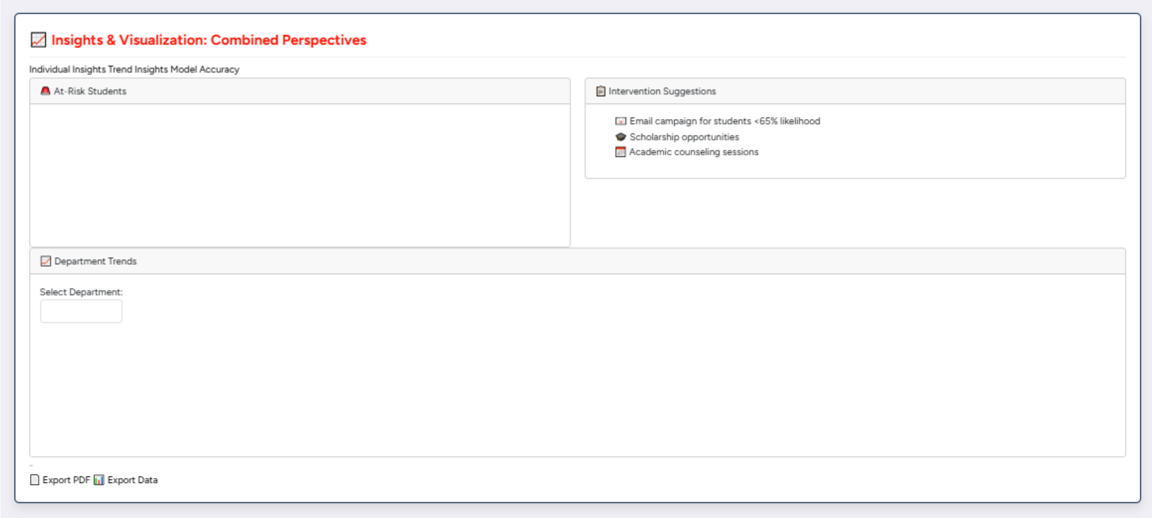


Figure 33.1 Insights and Visualization Feature

The researchers provided ready-to-use reports, including lists of high-risk students and classroom shortage warnings. Users could toggle between charts showing department trends or model accuracy rates, and then export results as PDFs or spreadsheets for meetings.

XGBoost Model Performance and Implications for Enrollment Forecasting

The researchers developed and trained an enrollment prediction model based on the XGBoost algorithm and trained it according to computer-simulated academic records of variables gathered from Westbridge Institute of Technology, Inc. The model was evaluated by applying conventional machine learning performance metrics and led to satisfactory score results. Apart from establishing the technical soundness of the model, the study also uncovered some interesting facts regarding student support metrics and decision-making at the college.

Performance Metrics:

Computational Foundations Model performance was also assessed on overall metrics like accuracy, precision, recall, F1-score, log loss, and ROC-AUC. Overall, these metrics provided a general idea about the ability of the model to predict the admission of students with high reliability.

- Accuracy

$$\text{Accuracy} = \frac{\text{True Positives} + \text{True Negatives}}{\text{Total Predictions}}$$

The XGBoost model consistently showed a good result, with values ranging from **92% to 97%** across runs like **RUN-1745514609**, indicating that the majority of student enrollment statuses were correctly predicted. This level of performance suggests the model captured underlying enrollment patterns effectively.

- Precision

$$\text{Precision} = \frac{\text{True Positives}}{\text{True Positives} + \text{False Positives}}$$

In runs such as **RUN-1745575818**, precision scores reached up to **91%**, indicating that the majority of students flagged as "at-risk" by the model were indeed at risk. This demonstrated that false alarms were minimal, making the model a trustworthy tool for early intervention.

- Recall

$$\text{Recall} = \frac{\text{True Positives}}{\text{True Positives} + \text{False Negatives}}$$

Recall scores improved significantly during model tuning, reaching **88%** in high-performing runs. This showed that the model was effective in identifying the majority of students who were genuinely at risk of not enrolling.

- F1-Score

$$\text{F1} = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

The balance between precision and recall was reflected in F1-scores of **89–90%**, as seen in models like **RUN-1745575818**. This confirmed the model's reliability and robustness in both detecting true positives and minimizing false detections.

- Log Loss

$$\text{Log Loss} = -\frac{1}{N}\sum_{i=1}^{N}\left[y_i \log(p_i) + (1 - y_i)\log(1 - p_i)\right]$$

The model maintained low log loss values, with typical results falling between **0.12 and 0.19**, indicating that its probability predictions were well-calibrated and not overly confident. For example, student **C00-0002** had a predicted enrollment probability of **91.4%**, which aligned closely with actual outcomes.

- **ROC-AUC**

ROC-AUC scores consistently ranged between **0.93 and 0.96**, demonstrating the model's strong capability to distinguish between enrolled and non-enrolled students. This high score confirmed that the model could effectively rank students by their enrollment likelihood, making it suitable for prioritization tasks in student services.

Empirical Results and Model Strengths

The SQL-based tests confirmed the model's performance. With k-fold cross-validation, the key metrics such as cv_mean were above 0.94 across the board with low cv_std (e.g., 0.009), reflecting high model stability and low variance of the validation split. For example, RUN-1745569290's cv_mean was 0.9497, reflecting high generalization beyond the training set.

The researchers addressed class imbalance using techniques such as SMOTE and strategic sampling, which helped the model perform well in minority classes. In one case, RUN-1745578011, the recall for "at-risk" students increased from 43% to 88% following these improvements. This allowed the institution to better support vulnerable student populations who might otherwise have been overlooked.

Overconfidence was corrected by Platt scaling, which normalized predicted probabilities to correspond to observed outcomes. For instance, C00-0010 was originally predicted at 98.3%, reduced to a more reasonable probability of 85.6%, which was closer to what enrolled the student. Similarly, extremes like C00-0018's original fluctuation between 99.5% and 0.2% were brought into stable 83–87% by better data encoding and model fine-tuning.

SOFTWARE EVALUATION

The Software Evaluation of the Enrollment Management System at Westbridge Institute of Technology, Inc. focused on assessing its effectiveness, functionality, and performance with a particular emphasis on the use of the XGBoost algorithm for predicting enrollment trends and optimizing decision-making. The evaluation adhered to industry standards like ISO/IEC 25010:2011 to determine that the system is satisfactory to the institution's operational needs and provides a secure, reliable, and user-friendly solution to the administration of enrollment processes. The objective was to provide a concise overview of the information obtained via questionnaires, as shown on the next page.

Table 4.1. Evaluation of the Enrollment Management System (EMS) in terms of functional suitability based on ISO/IEC 25010 software quality standards.

Indicators	Mean	SD	Verbal Interpretation
1. The system provides all the necessary features for me to complete enrollment.	3.53	0.52	Very High
2. The system provides all the necessary features for me to complete enrollment.	3.45	0.54	Very High
3. The system feels appropriate for handling student enrollment tasks.	3.55	0.52	Very High
4. The system simplifies complex enrollment steps.	3.57	0.54	Very High
5. The system allows me to complete enrollment without needing extra help.	3.55	0.56	Very High
Overall Mean	**3.53**		**Very High**

Table 4.1 presents the Evaluation of the Enrollment Management System (EMS) in terms of functional suitability based on ISO/IEC 25010 software quality standards. Among the statements, "The system simplifies complex enrollment steps" received the highest mean score of 3.57 (SD = 0.54) and was remarked as Strongly Agree. This was followed by the statements "The system feels appropriate for handling student enrollment tasks" and "The system allows me to complete enrollment without needing extra help," both of which obtained a mean score of 3.55 (SD = 0.52 and 0.56, respectively) and were also rated Strongly Agree. The statement "The system provides all the necessary features for me to complete enrollment" earned a mean score of 3.53 (SD = 0.52) and was similarly marked as Strongly Agree. Meanwhile, the statement "The system correctly processes my data without errors" had the lowest mean score of 3.45 (SD = 0.54) but still fell within the Strongly Agree category.

Overall, the functional suitability of the Enrollment Management System (EMS) achieved an average mean score of 3.53 (SD = 0.53), indicating a very high level of functional suitability.

Table 4.2. Evaluation of the Enrollment Management System (EMS) in terms of performance efficiency based on ISO/IEC 25010 software quality standards.

Indicators	Mean	SD	Verbal Interpretation
1. The system responds quickly during each step of the enrollment process.	3.50	0.50	Very High
2. The system loads fast, even when many students are using it.	3.50	0.52	Very High
3. The system performs without freezing or lagging on my device	3.49	0.56	Very High
4. The system processes my data efficiently without delays.	3.54	0.50	Very High
5. The system helps me complete enrollment without repeating steps or re-entering information.	3.64	0.50	Very High
Overall Mean:	**3.53**		**Very High**

Table 4.2 presents the Evaluation of the Enrollment Management System (EMS) in terms of performance efficiency based on ISO/IEC 25010 software quality standards. Among the statements, "The system helps me complete enrollment without repeating steps or re-entering information" received the highest mean score of 3.64 (SD = 0.50) and was remarked as Strongly Agree. This was followed by the statement "The system processes my data efficiently without delays," which obtained a mean score of 3.54 (SD = 0.50) and was also rated Strongly Agree. The statements "The system responds quickly during each

step of the enrollment process" and "The system loads fast, even when many students are using it" both earned a mean score of 3.50 (SD = 0.50 and 0.52, respectively) and were similarly marked as Strongly Agree. Meanwhile, the statement "The system performs without freezing or lagging on my device" had the lowest mean score of 3.49 (SD = 0.56) but still fell within the Strongly Agree category.

Overall, the performance efficiency of the Enrollment Management System (EMS) achieved an average mean score of 3.53 (SD = 0.52), indicating a very high level of efficiency.

Table 4.3. Evaluation of the Enrollment Management System (EMS) in terms of compatibility based on ISO/IEC 25010 software quality standards.

Indicators	Mean	SD	Verbal Interpretation
1. The system works properly on my preferred device (e.g., phone, laptop).	3.61	0.53	Very High
2. The system runs smoothly with other apps or websites I use.	3.54	0.54	Very High
3. The system remains functional across different browsers.	3.61	0.51	Very High
4. The system doesn't require me to change my device settings to work.	3.53	0.51	Very High
5. The system works regardless of the internet connection I'm using.	3.65	0.50	Very High
Overall Mean:	**3.61**		**Very High**

Table 4.3 presents the Evaluation of the Enrollment Management System (EMS) in terms of compatibility based on ISO/IEC 25010 software quality standards. Among the statements, "The system works regardless of the internet connection I'm using" received

the highest mean score of 3.65 (SD = 0.50) and was remarked as Strongly Agree. This was followed by the statement "The system doesn’t require me to change my device settings to work," which obtained a mean score of 3.63 (SD = 0.51) and was also rated Strongly Agree. The statements "The system works properly on my preferred device (e.g., phone, laptop)" and "The system remains functional across different browsers" both earned a mean score of 3.61 (SD = 0.53 and 0.51, respectively) and were similarly marked as Strongly Agree. Meanwhile, the statement "The system runs smoothly with other apps or websites I use" had the lowest mean score of 3.54 (SD = 0.54) but still fell within the Strongly Agree category.

Overall, the compatibility of the Enrollment Management System (EMS) achieved an average mean score of 3.53 (SD = 0.52), indicating a very high level of compatibility.

Table 4.4. Evaluation of the Enrollment Management System (EMS) in terms of interaction capability based on ISO/IEC 25010 software quality standards.

Indicators	Mean	SD	Verbal Interpretation
1. The system’s layout is clear and easy to understand.	3.59	0.59	Very High
2. I can quickly learn how to use the system without instructions.	3.56	0.62	Very High
3. The system helps me avoid mistakes while entering information.	3.51	0.58	Very High
4. The system gives helpful feedback when I make errors.	3.61	0.55	Very High
5. The system keeps me engaged and feels simple to navigate.	3.55	0.58	Very High
Overall Mean:	**3.56**		**Very High**

Table 4.4 presents the Evaluation of the Enrollment Management System (EMS) in terms of interaction capability based on ISO/IEC 25010 software quality standards. Among the statements, "The system gives helpful feedback when I make errors" received the highest mean score of 3.61 (SD = 0.55) and was remarked as Strongly Agree. This was followed by the statement "The system’s layout is clear and easy to understand," which obtained a mean score of 3.59 (SD = 0.59) and was also rated Strongly Agree. The statements "I can quickly learn how to use the system without instructions" and "The system keeps me engaged and feels simple to navigate" earned mean scores of 3.56 (SD = 0.62) and 3.55 (SD = 0.58), respectively, both receiving Strongly Agree ratings. Meanwhile, the statement "The system helps me avoid mistakes while entering information" had the lowest mean score of 3.51 (SD = 0.58), but it still fell within the Strongly Agree category.

Overall, the interaction capability of the Enrollment Management System (EMS) achieved an average mean score of 3.56 (SD = 0.58), indicating a very high level of interaction capability.

Table 4.5. Evaluation of the Enrollment Management System (EMS) in terms of reliability based on ISO/IEC 25010 software quality standards.

Indicators	Mean	SD	Verbal Interpretation
1. The system is available whenever I need to access it.	3.58	0.55	Very High
2. The system rarely crashes or fails while I'm using it.	3.46	0.66	Very High
3. If the system crashes, it recovers my progress.	3.48	0.59	Very High
4. The system keeps running smoothly without interruptions.	3.52	0.58	Very High
5. The system maintains its performance over time.	3.56	0.61	Very High
Overall Mean:	**3.52**		**Very High**

Table 4.5 presents the Evaluation of the Enrollment Management System (EMS) in terms of reliability based on ISO/IEC 25010 software quality standards. Among the statements, "The system is available whenever I need to access it" received the highest mean score of 3.58 (SD = 0.55) and was remarked as Strongly Agree. This was followed by the statement "The system maintains its performance over time," which obtained a mean score of 3.56 (SD = 0.61) and was also rated Strongly Agree. The statements "The system keeps running smoothly without interruptions" and "If the system crashes, it recovers my progress" earned mean scores of 3.52 (SD = 0.58) and 3.48 (SD = 0.59), respectively, both receiving Strongly Agree ratings. Meanwhile, the statement "The system rarely crashes or fails while I'm using it" had the lowest mean score of 3.46 (SD = 0.66), but it still fell within the Strongly Agree category.

Overall, the reliability of the Enrollment Management System (EMS) achieved an average mean score of 3.52 (SD = 0.60), indicating a very high level of reliability.

Table 4.6. Evaluation of the Enrollment Management System (EMS) in terms of security based on ISO/IEC 25010 software quality standards.

Indicators	Mean	SD	Verbal Interpretation
1. The system keeps my personal data secure from unauthorized access.	3.55	0.54	Very High
2. The system ensures no one can change my information without permission.	3.61	0.62	Very High
3. I feel confident that my enrollment data is protected.	3.58	0.54	Very High
4. The system prevents others from using my account.	3.61	0.51	Very High
5. The system ensures my identity is verified before submission.	3.60	0.51	Very High
Overall Mean:	**3.59**		**Very High**

Table 4.6 presents the Evaluation of the Enrollment Management System (EMS) in terms of security based on ISO/IEC 25010 software quality standards. Among the statements, "The system ensures no one can change my information without permission" and "The system prevents others from using my account" received the highest mean scores of 3.61 (SD = 0.62 and SD = 0.51, respectively) and were remarked as Strongly Agree. This was followed by the statement "The system ensures my identity is verified before submission," which obtained a mean score of 3.60 (SD = 0.51) and was also rated Strongly Agree. The statements "I feel confident that my enrollment data is protected" and "The

system keeps my personal data secure from unauthorized access" earned mean scores of 3.58 (SD = 0.54) and 3.55 (SD = 0.54), respectively, both receiving Strongly Agree ratings.

Overall, the security of the Enrollment Management System (EMS) achieved an average mean score of 3.59 (SD = 0.54), indicating a very high level of security.

Table 4.7. Evaluation of the Enrollment Management System (EMS) in terms of maintainability based on ISO/IEC 25010 software quality standards.

Indicators	Mean	SD	Verbal Interpretation
1. The system feels like it could be updated without causing problems.	3.48	0.62	Very High
2. The system seems easy to improve or modify if needed.	3.56	0.59	Very High
3. The system feels like errors could be quickly fixed.	3.59	0.57	Very High
4. The system’s layout and design still make sense after multiple uses.	3.59	0.60	Very High
5. The system feels like it could adapt to future needs.	3.64	0.59	Very High
Overall Mean:	**3.57**		**Very High**

Table 4.7 presents the Evaluation of the Enrollment Management System (EMS) in terms of maintainability based on ISO/IEC 25010 software quality standards. Among the statements, "The system feels like it could adapt to future needs" received the highest mean score of 3.64 (SD = 0.59) and was remarked as Strongly Agree. This was followed by the statements "The system feels like errors could be quickly fixed" and "The system’s layout and design still make sense after multiple uses," both obtaining a mean score of 3.59 (SD

= 0.57 and SD = 0.60, respectively), and were also rated Strongly Agree. The statement "The system seems easy to improve or modify if needed" earned a mean score of 3.56 (SD = 0.59), while "The system feels like it could be updated without causing problems" had the lowest mean score of 3.48 (SD = 0.63), but both still fell within the Strongly Agree category.

Overall, the maintainability of the Enrollment Management System (EMS) achieved an average mean score of 3.57 (SD = 0.60), indicating a very high level of maintainability.

Table 4.8. Evaluation of the Enrollment Management System (EMS) in terms of flexibility based on ISO/IEC 25010 software quality standards.

Indicators	Mean	SD	Verbal Interpretation
1. The system adapts to changes in the enrollment process.	3.48	0.58	Very High
2. The system scales well when more students enroll at once.	3.48	0.52	Very High
3. The system works across different devices without extra setup.	3.56	0.52	Very High
4. The system feels flexible enough to handle different types of student data.	3.55	0.54	Very High
5. The system supports a variety of student needs and enrollment scenarios.	3.59	0.49	Very High
Overall Mean:	**3.53**		**Very High**

Table 4.8 presents the Evaluation of the Enrollment Management System (EMS) in terms of flexibility based on ISO/IEC 25010 software quality standards. Among the statements, "The system supports a variety of student needs and enrollment scenarios"

received the highest mean score of 3.59 (SD = 0.49) and was remarked as Strongly Agree. This was followed by the statement "The system works across different devices without extra setup," which obtained a mean score of 3.56 (SD = 0.52) and was also rated Strongly Agree. The statement "The system feels flexible enough to handle different types of student data" earned a mean score of 3.55 (SD = 0.54), while "The system adapts to changes in the enrollment process" and "The system scales well when more students enroll at once" both had the lowest mean score of 3.48 (SD = 0.58 and SD = 0.52, respectively), but still fell within the Strongly Agree category.

Overall, the flexibility of the Enrollment Management System (EMS) achieved an average mean score of 3.53 (SD = 0.53), indicating a very high level of flexibility.

Table 4.9. Evaluation of the Enrollment Management System (EMS) in terms of safety based on ISO/IEC 25010 software quality standards.

Indicators	Mean	SD	Verbal Interpretation
1. The system warns me before I make a serious mistake.	3.50	0.54	Very High
2. The system prevents me from submitting incomplete information.	3.68	0.47	Very High
3. The system provides clear alerts when something goes wrong.	3.64	0.50	Very High
4. The system protects my data even if there’s a system failure.	3.59	0.53	Very High
5. The system keeps running safely even when errors occur.	3.61	0.55	Very High
Overall Mean:	**3.60**		**Very High**

Table 4.9 presents the Evaluation of the Enrollment Management System (EMS) in terms of safety based on ISO/IEC 25010 software quality standards. Among the statements, "The system prevents me from submitting incomplete information" received the highest mean score of 3.68 (SD = 0.47) and was remarked as Strongly Agree. This was followed by the statement "The system provides clear alerts when something goes wrong," which obtained a mean score of 3.64 (SD = 0.50) and was also rated Strongly Agree. The statements "The system keeps running safely even when errors occur" and "The system protects my data even if there’s a system failure" earned mean scores of 3.61 (SD = 0.55) and 3.59 (SD = 0.53), respectively, both receiving Strongly Agree ratings. Meanwhile, the statement "The system warns me before I make a serious mistake" had the lowest mean score of 3.50 (SD = 0.54), but it still fell within the Strongly Agree category.

Overall, the safety of the Enrollment Management System (EMS) achieved an average mean score of 3.60 (SD = 0.52), indicating a very high level of safety.

Table 4.10. Overall Evaluation of the Enrollment Management System (EMS) Based on ISO/IEC 25010 Software Quality Standards.

Indicators	Weighted Mean	Verbal Interpretation	Rank
1.Functional Suitability	3.53	Very High	
2. Performance Efficiency	3.53	Very High	
3. Compatibility	3.61	Very High	**1**
4. Interaction Capability	3.56	Very High	
5. Reliability	3.52	Very High	**3**
6. Security	3.59	Very High	
7. Maintainability	3.57	Very High	
8. Flexibility	3.53	Very High	
9. Safety	3.60	Very High	**2**
Overall Weighted Mean:	**3.56**	**Very High**	

Implications

The overall conclusion of Table 4.10 is that the Enrollment Management System (EMS) was evaluated against the ISO/IEC 25010 Software Quality Standards and has been rated consistently high against indicators. The weighted mean scores of all nine quality attributes are all in the range of "Very High," reflecting the excellent performance of the system. The high scores across all indicators reflect that the EMS is well-developed, providing efficiency, security, and reliability in the handling of enrollment procedures. Compatibility, Safety, and Interaction Capability score the highest among all attributes, reflecting that the system is highly flexible, secure, and easy to interact with for administrators and students. Besides, consistency of ratings, at a weighted mean rating of 3.56, indicates low measures of variability of quality, which implies an optimally performing and well-balanced system performance. High overall scores affirm the efficiency of the EMS in meeting the minimum quality levels of software, implying its applicability and usability in the company. Although all indicators score high, there could still be room for further optimization in reliability and flexibility to improve adaptability and fault tolerance to improve system enhancements in the future. Overall, the statistical findings reflect a solid, high-quality software system that effectively supports enrollment management activities while ensuring compatibility, security, and ease of interaction for users.

MARKET STRATEGY

The student enrollment system created by the researchers is an overall computer system for Westbridge Institute of Technology, Inc., with the final aim to automate and ease student enrollment activities. Among the key goals are enhanced operations efficiency, minimized manual administrative time, and provision of accuracy in handling students' records. The approach provides ease of adoption for stakeholders and emphasizes user satisfaction. The system supports three key groups of users with distinct advantages:

The administrators are the primary users of the system and will benefit immensely from automated processes of enrollment, enrollment trends, and insights generation. These will enable data-driven, insightful observations about trends in enrollments and allow administrators to base their decisions around program offerings, budget allocations, and planning enrollments in the future. Using automated tasking and real-time analysis production of analytical information, administrators can make automation possible, prevent human mistakes, and generally operate more efficiently as a system.

The system will allow the students a quicker and easier process of enrollment. The system with the processes of enrollment, verification, and registration will enable the students to easily and conveniently monitor their enrollment statuses.

Professors will be able to benefit from an easy-to-use interface to input grades and see relevant student information, resulting in streamlined and accurate enrollment verification processes.

The system was designed in a way that it provides an intuitive and friendly interface to all, such that it will be easy to use and learn. Both administrators and students will not find it hard to use the system. With automated tasks like data entry, the system allows administrators to process requests for enrollment within less time. It saves time and makes processing enrollment easier for all.

Automation reduces errors in the entry of data and the maintenance of records, ensuring that there are accurate records of students. This makes the system more reliable and reduces errors. Real-time information regarding enrollment process status is provided to the students. The openness of the information boosts trust and educates users to ensure that they can make decisions of the highest value.

The system is designed to expand with the institution. Implementing the system on a cloud-based server enables it to serve more users and data as necessary, remaining fast and responsive. To ensure that the system is user-friendly, administrators and faculty will be provided with extensive training. The ease-of-use design and automated functions will ensure that the transition is seamless. Regular support will also be provided to correct any problems and enhance the system based on users' comments.

Cost and Benefits Analysis

The Cost and Benefits Analysis is a crucial component in evaluating the feasibility, practicability, and value of the suggested system. This component sets the estimated cost required to develop, deploy, and maintain the system and equating them to the anticipated benefits the system will enjoy.

The analysis seeks to provide a lucid depiction of the overall effect of the project on stakeholders such that the investment reaps notable benefits in terms of functionality, efficiency, and productivity.

Category	Description	Frequency	Justification	Estimated Amount (₱)
Electricity	Power Consumption	Monthly (7 months)	Electricity consumption for development operations	1,000/month
Internet Subscription	High-speed internet	Monthly (7 months)	Necessary for cloud-based resources and remote development.	1,299/month
Hosting Service	Hostinger Subscription	Monthly (2 months)	Hosting service for deploying the online platform.	500/month
Documentation	Printing	Initial & Final Defense	Hard copy printing of research documents.	3,000
Flash Drive	Source Code Backup (3 copies)	3 pcs.	Backup storage for the system source code and documents.	300
			Overall Estimated Amount:	**20,393**

Table 5.0 Cost Analysis

Table 5.0 provides the specific costs involved in the project, grouped under development, operational, and support costs. The estimated total cost of developing and implementing the system is ₱20,393, accounting for necessary operating, technical, and documentation fees within the project duration. Monthly recurring costs consist of ₱1,000 for electricity for seven months to supply development devices, ₱1,299 per month for high-speed internet to cater to cloud-based applications and remote collaborations, and ₱500 per month for hosting services for the last two months to release the online platform. One-time expenditures include ₱3,000 for printing research papers needed for initial and final defense presentations and ₱300 for three flash drives to securely store the source code and documents of the system. The breakdown is an evenly distributed utilization of resources, supporting key infrastructure (Internet and hosting) for effective development and deployment, academic requirement compliance (documents), and data protection (backups). This cost model reflects pragmatic planning to ensure project efficiency without undue expense.

CHAPTER 5

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

Enrollment management is a critical process in schools where manual processes fail and result in unequal resource allocation. To address this, the researchers from Westbridge Institute of Technology, Inc. (WITI) developed a technology-driven Enrollment Management System (EMS) that applies department-level Trend Analysis using the XGBoost algorithm.

The EMS is designed to systematize enrollment oversight and identify student demand trends across departments using historical data. With the integration of Chart.js, the system offers interactive visualizations to assist administrators in understanding and responding to changes in enrollment patterns. XGBoost is the highest performing predictive engine that identifies enrollment trend shifts, producing data-based insights to serve as the planning guide for the institution.

Despite the sophisticated predictive function of the system, human judgment continues to be a dominant factor. Decision-makers will need to reconcile predictive output with institutional objectives, policy, and student circumstances. The research is requesting the blending of technology support with administrative wisdom in anticipation of delivering a more insightful but empathetic enrollment management strategy.

Conclusion

The study was able to place into focus the need to shift from conventional manual enrollment trends to data-driven predictive EMS. The integration of XGBoost was used to enhance trend prediction accuracy and enabled better-informed scholarly planning at the departmental level.

Most importantly, the system preserves the function of human control, where administrative discretion continues to shape enrollment decisions. The solution enables a hybrid approach that combines machine learning with institutional expertise—integrating data analysis with policy-driven decision-making.

Recommendations

1. Enhancing EMS Functionalities

- Feature Expansion: Add additional variables such as student demographics, grades, and socioeconomic factors to further improve model accuracy.
- Automated Notifications: Develop alert mechanisms for detecting dramatic changes in enrollment rates so that timely administrative action may be taken.

2. Enhancing Trend Analysis by Department

- Routine Evaluation: Perform periodic reviews of department-level trend data to aid course planning, faculty assignments, and resource allocation.
- Model Re-evaluation: Regularly re-evaluate and re-tune the XGBoost model to ensure predictive validity and reduce drift.

3. Facilitating User Training and Decision-Making

- Capacity Development: Provide formal training sessions to the enrollment staff to learn how to read and respond to predictive information.
- Decision Rule Formulation: Develop formal rules of decision-making to ensure proper use of predictive data is ethical and in conformance with institutional policy.

4. System Maximizing Functioning and Deployment

- Scalable Infrastructure: Allow for future data expansion and system scalability within the Hostinger deployment infrastructure.
- Database Optimization: Optimize database schema and query performance to support real-time data analysis and enhanced system responsiveness.

5. Ensuring Human Oversight and Continuous Improvement

- Manual Validation: Ensure human presence in interpreting predictions to guarantee outputs are aligned with institutional objectives.
- Feedback Integration: Obtain continuous feedback from system users—administrators and students—so as to allow incremental development of the system.

Future Work and Insights

- Model Configuration: Best performance was obtained with parameter like max_depth = 5 and learning_rate = 0.1, as concluded in RUN-1745575818. These parameters provided the optimal trade-off between precision, recall, and F1 score.
- Threshold Adjustment: Reducing the classification threshold from 0.5 to 0.4 improved recall with little effect on false positives, improving the model's capability to detect vulnerable students.
- Tiered Support Strategy: Calibrated probabilities enabled institutions to apply tiered interventions, targeting high-risk students while still tracking medium-risk cases.
- Department-Level Observations: Departments like C00-0004 (College) had high confidence scores, perhaps due to strong advising assistance. On the other hand, departments like C00-0010 (SHS) had lower scores, indicating potential reform or additional assistance.

By implementing these recommendations, Westbridge Institute of Technology, Inc. can evolve its Enrollment Management System into a forward-looking decision-support system that balances data-driven efficiency with institutional values. Trend Analysis via XGBoost is not a replacement for administrative decision-making but a powerful tool—facilitating informed, timely, and equitable academic planning.

APPENDIX A

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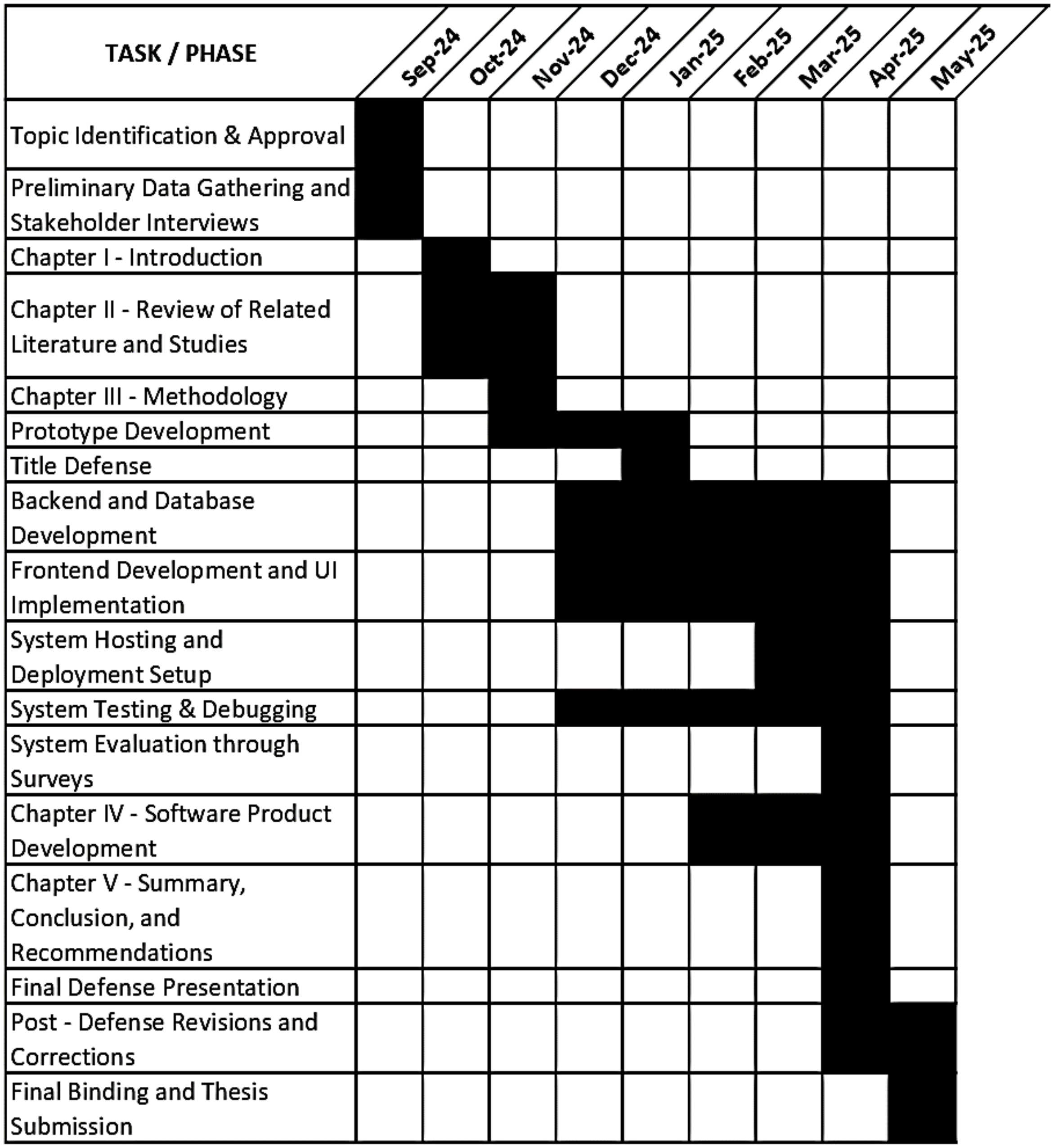
[65] Y. H. Kim and M. S. Alvi, "Real-Time Data Synchronization for Offline Educational Systems," IEEE Transactions on Learning Technologies, vol. 14, no. 4, pp. 567–577, Dec. 2021. DOI: 10.1109/TLT.2021.3076324.

APPENDIX B

Gantt Chart

GANTT CHART

System Development Thesis Timeline (September 2024 – May 5, 2025)



APPENDIX C

Survey Form

Enrollment Management System

with Trend Analysis by Department Using XGBoost Algorithm

Thesis 2025

Dear Respondent,

We are 4th-year BS Computer Science students at Westbridge Institute of Technology, Inc., conducting this survey for our thesis. The study evaluates the Enrollment Management System (EMS) based on ISO/IEC 25010 software quality standards: functional suitability, performance efficiency, compatibility, interaction capability, reliability, security, maintainability, flexibility, and safety. The Trend Analysis feature will be validated using a Performance Matrix (prediction accuracy) — not this survey. This survey focuses on user feedback to assess the system's overall experience and performance.

Your responses are confidential and for academic purposes only. Participation is voluntary, and the survey questionnaire takes 10-20 minutes to complete. By continuing, you confirm that you understand and agree to participate. Thank you for your time and participation!

Sincerely,

Castillo, John Lester B.
4th Year – Bachelor of Science in Computer Science
Westbridge Institute of Technology, Inc.

Clareon, Lovely J.
4th Year – Bachelor of Science in Computer Science
Westbridge Institute of Technology, Inc.

Name (Optional): _________________________ Year-Level/Grade: _________________

Program/ Strand: __________________________ Date: ____________________________

Have you experienced the enrollment process in WITI before? Yes☐ No☐

LIKERT SCALE:

Please carefully read each statement and rate how much you agree with it, using the guide below:

1 — STRONGLY DISAGREE	**2 — DISAGREE**
3 — AGREE	**4 — STRONGLY AGREE**

*Please put a ✔ **check mark** in the box that best represents your opinion for each statement.*

A. Functional Suitability	**1**	**2**	**3**	**4**
1. The system provides all the necessary features for me to complete enrollment.				
2. The system correctly processes my data without errors.				
3. The system feels appropriate for handling student enrollment tasks.				
4. The system simplifies complex enrollment steps.				
5. The system allows me to complete enrollment without needing extra help.				
B. Performance Efficiency	**1**	**2**	**3**	**4**
6. The system responds quickly during each step of the enrollment process.				
7. The system loads fast, even when many students are using it.				
8. The system performs without freezing or lagging on my device.				
9. The system processes my data efficiently without delays.				
10. The system helps me complete enrollment without repeating steps or re-entering information.				

*Please put a ✔ **check mark** in the box that best represents your opinion for each statement.*

C. Compatibility	**1**	**2**	**3**	**4**
11. The system works properly on my preferred device (e.g., phone, laptop).				
12. The system runs smoothly with other apps or websites I use.				
13. The system remains functional across different browsers.				
14. The system doesn't require me to change my device settings to work.				
15. The system works regardless of the internet connection I'm using.				
D. Interaction Capability	**1**	**2**	**3**	**4**
16. The system's layout is clear and easy to understand.				
17. I can quickly learn how to use the system without instructions.				
18. The system helps me avoid mistakes while entering information.				
19. The system gives helpful feedback when I make errors.				
20. The system keeps me engaged and feels simple to navigate.				
E. Reliability	**1**	**2**	**3**	**4**
21. The system is available whenever I need to access it.				
22. The system rarely crashes or fails while I'm using it.				
23. If the system crashes, it recovers my progress.				
24. The system keeps running smoothly without interruptions.				
25. The system maintains its performance over time.				
F. Security	**1**	**2**	**3**	**4**
26. The system keeps my personal data secure from unauthorized access.				
27. The system ensures no one can change my information without permission.				
28. I feel confident that my enrollment data is protected.				
29. The system prevents others from using my account.				
30. The system ensures my identity is verified before submission.				

*Please put a ✔ **check mark** in the box that best represents your opinion for each statement.*

G. Maintainability	**1**	**2**	**3**	**4**
31. The system feels like it could be updated without causing problems.				
32. The system seems easy to improve or modify if needed.				
33. The system feels like errors could be quickly fixed.				
34. The system's layout and design still make sense after multiple uses.				
35. The system feels like it could adapt to future needs.				
H. Flexibility	**1**	**2**	**3**	**4**
36. The system adapts to changes in the enrollment process.				
37. The system scales well when more students enroll at once.				
38. The system works across different devices without extra setup.				
39. The system feels flexible enough to handle different types of student data.				
40. The system supports a variety of student needs and enrollment scenarios.				
I. Safety	**1**	**2**	**3**	**4**
41. The system warns me before I make a serious mistake.				
42. The system prevents me from submitting incomplete information.				
43. The system provides clear alerts when something goes wrong.				
44. The system protects my data even if there's a system failure.				
45. The system keeps running safely even when errors occur.				

Your honest feedback is valuable and will contribute to enhancing the system's quality and student experience. **Thank you again for your participation!**

APPENDIX D

Interview Letter

March 13, 2023

Eleonor Calayag, Ed.D.
Market Research Adviser
Westbridge Institute of Technology, Inc.
1 National Highway, Brgy. Banlic
City of Cabuyao, Laguna 4025

Dear Dr. Calayag,

As a group of dedicated third and fourth-year students enrolled in the Bachelor of Science in Computer Science program at Westbridge Institute of Technology, Inc. - Main Branch, we humbly request your permission to conduct a series of comprehensive interviews with the utmost respect.

These interviews hold substantial value in engaging with personnel significantly involved in pivotal administrative processes, which encompass various critical aspects including, but not limited to, admission, enrollment, payments, ID generation, scheduling, document requests, releases, and other involved processes. We recognize these as integral components shaping and defining the diverse student experience at Westbridge Institute of Technology, Inc. - Main and Uno Branch.

The importance of these interviews lies in their role as the foundation for our ongoing collaborative research efforts, which are centered on the following thesis:

- "School Portal Security with Access Control Algorithm for Westbridge Institute of Technology, Inc."

Additionally, we have several projects underway that are directly related to the following projects:

- "Westbridge Institute of Technology, Inc.: Utilizing Queue Management Algorithm to Enhance Admission Workflow"
- "A Novel Approach to Enrollment Management: Decision Tree Algorithm for Westbridge Institute of Technology, Inc."
- "Automated Academic Scheduling System using Genetic Algorithm for Westbridge Institute of Technology, Inc."

These collaborative projects and thesis exemplify the interaction among third and fourth-year students in developing vital subsystems aimed at enhancing both administrative processes and the overall student experience at our institution. The proposed interviews at Westbridge Institute of Technology, Inc. - Main Branch are scheduled for March 22, 2024, and will require 10-30 minutes of every participant's time, with all sessions being meticulously documented. The insights garnered from these interviews will significantly impact and complement each proposed subsystem, enriching the depth and accuracy of our academic endeavors.

The interviews will be conducted in a private setting, and all collected data will be utilized to further our academic research objectives. Any personal information, such as name, age, or address, will remain confidential unless explicitly permitted otherwise.

We recognize and appreciate the significance of your cooperation and permission for this collaborative endeavor. Your unwavering support guides our interconnected educational initiatives toward excellence and innovation.

Thank you for your time and consideration.

Yours truly,

Arnold Olaño

Ma. Nicole Batallones

Lovely Clareon

Sherwin Espela

Noted:

MR. FRANCIS MICHAEL NUÑEZ
Thesis Writing Adviser

Approved: 3/13/2024

ELEONOR CALAYAG, Ed.D.
Market Research Adviser

Jay Rosales
3/13/24

3/16/24

March 13, 2023

Eleonor Calayag, Ed.D.
Market Research Adviser
Westbridge Institute of Technology, Inc.
1 National Highway, Brgy. Banlic
City of Cabuyao, Laguna 4025

Dear Dr. Calayag,

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- "Automated Academic Scheduling System using Genetic Algorithm for Westbridge Institute of Technology, Inc."

These collaborative projects and thesis exemplify the interaction among third and fourth-year students in developing vital subsystems aimed at enhancing both administrative processes and the overall student experience at our institution. The proposed interviews at Westbridge Institute of Technology, Inc. - Main Branch are scheduled for March 19. 2023, and will require 10-30 minutes of every participant's time, with all sessions being meticulously documented. The insights garnered from these interviews will significantly impact and complement each proposed subsystem, enriching the depth and accuracy of our academic endeavors.

The interviews will be conducted in a private setting, and all collected data will be utilized to further our academic research objectives. Any personal information, such as name, age, or address, will remain confidential unless explicitly permitted otherwise.

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Yours truly,

Arnold Olaño

Ma. Nicole Batallones

Lovely Clareon

Sherwin Espela

Noted:

MR. FRANCIS MICHAEL NUÑEZ
Thesis Writing Adviser

De Jasmin, John Jasper P.
3/13/24

Approved: 3/13/2024

ELEONOR CALAYAG, Ed.D.
Market Research Adviser

APPENDIX E

Interview Summary

INTERVIEW DOCUMENTATION

Title: Enrollment Management System with Trend Analysis Using Extreme Gradient Boosting Algorithm

Client: Westbridge Institute of Technology, Inc.

Address: #1 Banlic, National Highway, City of Cabuyao, Laguna 4025

Interview Date: March 16, 2024

Payment Tracking Process

- **Current Process:**
  - Upon student submission to accounting personnel, payments are encoded into an Excel file record.
  - Information includes: name, date of payment, control number, deposit slip details, amount paid, and total balance.
  - All payments are managed by the accounting department.
- **Suggestions for Improvement:**
  - Daily reports must generate, highlighting outstanding balances.
  - Hard copies can be requested if issues arise.

Enrollment Procedures

- **College Enrollment Procedure:**
    - Checking of grades and evaluation of courses to be taken.
    - Submission of payment to accounting.
    - Encoding subjects, printing, and enrollment stamp by the registrar.
    - No schedule is given upon releasing the e-form.
- **Suggestions:**
    - Schedule releasing must have an option controlled by the registrar.
- **Senior High School (SHS) Enrollment Procedure:**
    - Details were not provided as the registrar was new.
    -

Enrollment Verification

- **College:**
    - Verification based on completion of grades (pass/fail).
- **Senior High School (SHS):**
    - Verification is fast and straightforward since all courses for SHS students are nearly the same.
    - Irregular students may experience delays in verification.

Issues and Suggestions

- **Volume of Registrations:**
    - Issues with volume causing delays in processing.
- **Proof of Payment Submission:**
    - Admin users can validate payment proof (accepted, rejected + remarks).
    - Consider expanding payment categories in the tracking section.
- **Status and Remarks Tracking:**
    - Implementation of a system to track status and remarks for both payments and other registration steps.

Grade Viewing Suggestions

- **Access Control:**
    - Admin user can control when students can access and view their grades.
    - Unpaid students' grades should not be accessible.

Registration Process Improvement Suggestions

- **Temporary ID Assignment:**
    - Assignment of temporary ID numbers for students.
    - Ensure data integrity measures are in place to avoid duplication.

Document Handling

- **Suggestions:**
  - Option for hard copy requirement, setup by superadmin to specify if only softcopy or both soft and hard copies are needed.
  - Setup a system for choosing between soft and hard copies.
- **Search Feature Suggestions**
  - Search options by department, branch, or a combination for better organization.

Clearance Management Suggestions

- **Process Enhancement:**
  - Clearance signing will remain the same, but an option should be added for admin monitoring of status and remarks.
  - Students should be able to upload and check their clearance status created by admin.

ID Generation Suggestion

- Payment must be completed before the creation and issuance of ID.

Process Tracking Suggestions

- Establish a sequential process from registration to enrollment to improve transparency and ease of tracking.

Database Management Concerns

- **Issue:**
  - Challenges in searching files for quick access.
- **Suggestions:**
  - Implement better file searching tools to improve efficiency.

Quality of Service & Pre-Admission Process

- **Concerns:**
  - Concerns with manual record search and delays in processing.
- **Suggestions:**
  - Advocacy for technological alignment in the institution's services.

APPENDIX F

Data Collection Forms

REGISTRATION – CURRENT PROCESS

Westbridge Institute of Technology, Inc.

COLLEGE ENROLLMENT PROCEDURE Rev m7y24

NEW ENROLLEES / TRANSFEREES

Step 1 **Get ENROLLMENT FORM from Admin Staff (Table/Window 1)**

- Fill-out all information needed (with small √) in the ENROLLMENT FORM, when finished, give your ENROLLMENT FORM to the Program Head/Evaluator in-charge for queuing.
- Be seated and wait for your name to be called.
- After review and verification, Program Head/Evaluator will release to the student an ENDORSEMENT FOR ENROLLMENT SLIP.
- Write down the subjects in your ENROLLMENT FORM based on the subjects recommended by the Program Head/Evaluator in the ENDORSEMENT FOR ENROLLMENT SLIP.

Step 2 **Give your filled-out ENROLLMENT FORM and ENDORSEMENT FOR ENROLLMENT SLIP to Registrar (Window/Table 2) for review and signature.**

- Registrar will give Student's enrollment documents to the Finance Department for Assessment of Tuition Fee
- Finance will assess the total amount to be paid by enrollee
  - Add cost of uniform in the assessment slip
  - Add cost of Alumni Discount Card, if applicable
- Wait for your name to be called

Step 3 **Pay your tuition fee and other fees through your chosen payment channel – Chinabank, ___________, etc.**

- Give the receipt to the Cashier for recording and verification for processing
- Get your copy of the ENROLLMENT FORM and PAYMENT FORM.

**** End of Process ****

Welcome, Westinian!

Thank you for your trust and confidence in Westbridge.

ENROLLMENT – CURRENT PROCESS

Westbridge Institute of Technology, Inc.
COLLEGE ENROLLMENT PROCEDURE Rev m7y24

OLD ENROLLEES

A. *Get blank CLEARANCE FORM from the Guard*
B. *Fill-out information and start with the clearance process.*
C. *Submit the completely signed Clearance Form to Admin Staff (Table/Window 1) and get an blank ENROLLMENT FORM.*

Step 1 **Proceed to 2nd floor Science Room for EVALUATION OF GRADES**

- fill-out all information needed (with small √) in the ENROLLMENT FORM, when finished, give your ENROLLMENT FORM to the Program Head/Evaluator in-charge for queuing.
- Be seated and wait for your name to be called.
- After evaluation, sign your Prospectus and Undertaking, if applicable
- Program Head/Evaluator will release to the student an ENDORSEMENT FOR ENROLLMENT SLIP.
- Write down the subjects in your ENROLLMENT FORM based on the subjects recommended by the Program Head/Evaluator in the ENDORSEMENT FOR ENROLLMENT SLIP.

Step 2 **Give your filled-out ENROLLMENT FORM and ENDORSEMENT FOR ENROLLMENT SLIP to Registrar (Window/Table 2) for review and signature.**

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- Give the receipt to the Cashier for recording and verification for processing
- Get your copy of the ENROLLMENT FORM and PAYMENT FORM.

**** End of Process ****

Welcome, Westinian!
Thank you for your trust and confidence in Westbridge.

REGISTRATION/ENROLLMENT CARD – CURRENT

REGISTRATION CARD
Westbridge Institute of Technology, Inc.
COLLEGE DEPARTMENT AY 2024

Student No.:
Surname:
Course: √
Year Level √ 1 2 3 (4)
Semester √ (1st) 2nd

Name of student √ √ √
(PLEASE PRINT NAME) Surname First Name Middle Name

SUBJECTS ENROLLED FOR THE CURRENT SEMESTER

SUBJECT	ROOM	DAYS	TIME	INSTRUCTOR/PROFESSOR	REMARKS
THS 102 CS Thesis Writing I					
GV 101 Graphics & Visual Computing					
PD 101 Parallel & Distributed computing					

REMINDER: Please keep this card for future transactions with the school for the current AY. Replacement cost for lost card is Php 250.-

Evaluated by Program Head:
Noted by Registrar:
Student's/Parent's signature: √
Date of registration: √ 7-11-24

(STUDENT'S COPY)

No.: 0101

REGISTRATION CARD
Westbridge Institute of Technology, Inc.
COLLEGE DEPARTMENT A.Y. 2024 Semester 1ST

Program/Course: BS COMPUTER SCIENCE

Basic Requirements for Enrollment	*Received by Westbridge*	*Additional requirements for transferees*	*Received by Westbridge*
1. Form 138A/ Report Card (original copy)		1. Honorable dismissal/Certificate of Transfer Credentials	
2. Form 137 (original copy)			
3. Certificate of Good Moral		2. Copy of Grades	
4. PSA Birth Certificate (original copy)		3. F 137 (original copy addressed to Westbridge Institute of Technology Inc.)	
5. 1 pc. Passport sized picture (white background)			

TUITION AND OTHER FEES

DETAILS	AMOUNT (Php)
TUITION FEE	5500
UNIFORM	1500
ID & ID LACE	—
Less: DS#	
Less: SF#	
TOTAL	7000

ENROLLMENT GUIDELINES & REMINDERS

1. CASH BASIS - Students who will pay in cash will get 80% refund if he/she drops out within a week of registration.
2. CASH BASIS - Students who will pay in cash will get 50% refund if he/she drops out after the first week but within a month from date of registration.
3. CASH BASIS - Students who will pay in cash gets no refund if he/she drops out after a month from date of his/her registration.
4. INSTALLMENT BASIS - If student pays on Installment and he/she drops out any time, his/her down payment and payment for uniform will not be refunded /NON-REFUNDABLE and NON-TRANSFERRABLE.
5. Personal Protective Equipment (PPE), Laboratory uniforms, raw materials, consumables, school projects, test papers, are not yet included and shall be paid separately.
6. School activities such as (a) Industry Exposure, (b) Foundation Day, and c) Team Building shall be paid separately. Payment of Graduation Fee (4th year students) is not yet included in the fees and shall be announced latest 6 months before date of graduation.
7. Please keep your proofs of payment duly acknowledged by the school representative. In case of discrepancies in records, the burden of proof shall be on the student/parent.

I am hereby affixing my signature to confirm that I have fully understood the above guidelines and reminders which were clearly explained to me.

√

Name and signature of parent/student

BLUE CARD – CURRENT

Westbridge Institute of Technology, Inc.
PAYMENT RECORD

AY 2024 Semester 1st 2nd

Year level: COLLEGE 1 2 3 4 PROGRAM/COURSE BS COMPUTER SCIENCE

Name of student:
Surname First Name Middle Name

TUITION FEES

TUITION FEE	AMOUNT	NOTE:
TUITION FEE	1500	1. Students who will pay in cash shall get: a) 80% if he/she drops out within a week from registration date. b) 50% refund if he/she drops out after the first week but within a month of registration date. c) no refund if student drops out after a month from registration date.
ROTC FEE		
		2. If student pays on installment and he/she drops out any time, his/her down payment and uniform is NON-REFUNDABLE & NON-TRANSFERRABLE.
TOTAL	1500	

DETAILS OF PAYMENT

Date	OR/AR/Bank Ref#	Amount paid	Balance	Payment Received by
7/1/24	4BYT9U717V	2000	8000	
11-24-24	4BYTAVDWQF	3500	–	
TOTAL				

MISC. & OTHER FEES

MISC. & OTHER FEES	AMOUNT	NOTE:
ACADEMIC UNIFORM	–	1. Personal Protective Equipment (PPE), Laboratory uniforms, raw materials, consumables, school projects, test papers, are not included in the TF, Misc. & other fees and should be paid separately.
UNIFORM (complete set)	1500	
NSTP T-SHIRT	–	
ID & ID LACE	–	
LABORATORY FEES	–	2. Payments for uniform/s are NON-REFUNDABLE and NON-TRANSFERRABLE.
ROTC UNIFORM	–	
		3. School activities such as Team Building, Industry Exposure, Foundation day, and Graduation Fee (4th year students) should be paid separately.
TOTAL		

DETAILS OF PAYMENT

Date	OR/AR/Bank Ref#	Amount paid	Balance	Payment Received by
TOTAL				

Please keep your proof of payments duly acknowledged by the schoolrepresentative. In case of discrepancies in records, the burden of proof shall be the responsibility of the student/parent. Replacement fee for lost PMC shall be Php 250.-

CLEARANCE FORM – CURRENT

Control no. 000348

Students's copy

WESTBRIDGE INSTITUTE OF TECHNOLOGY
#1 Banlic National Highway , Cabuyao Laguna

CLEARANCE

Student Number: ______ 1st Sem. ✓ 2nd Sem. ______ Summer ______ A.Y 2024-20 25

Name of student: ______ (Surname) ______ (First Name) ______ J. (M.I)

Department: COLLEGE Course: BS COMPUTER SCIENCE

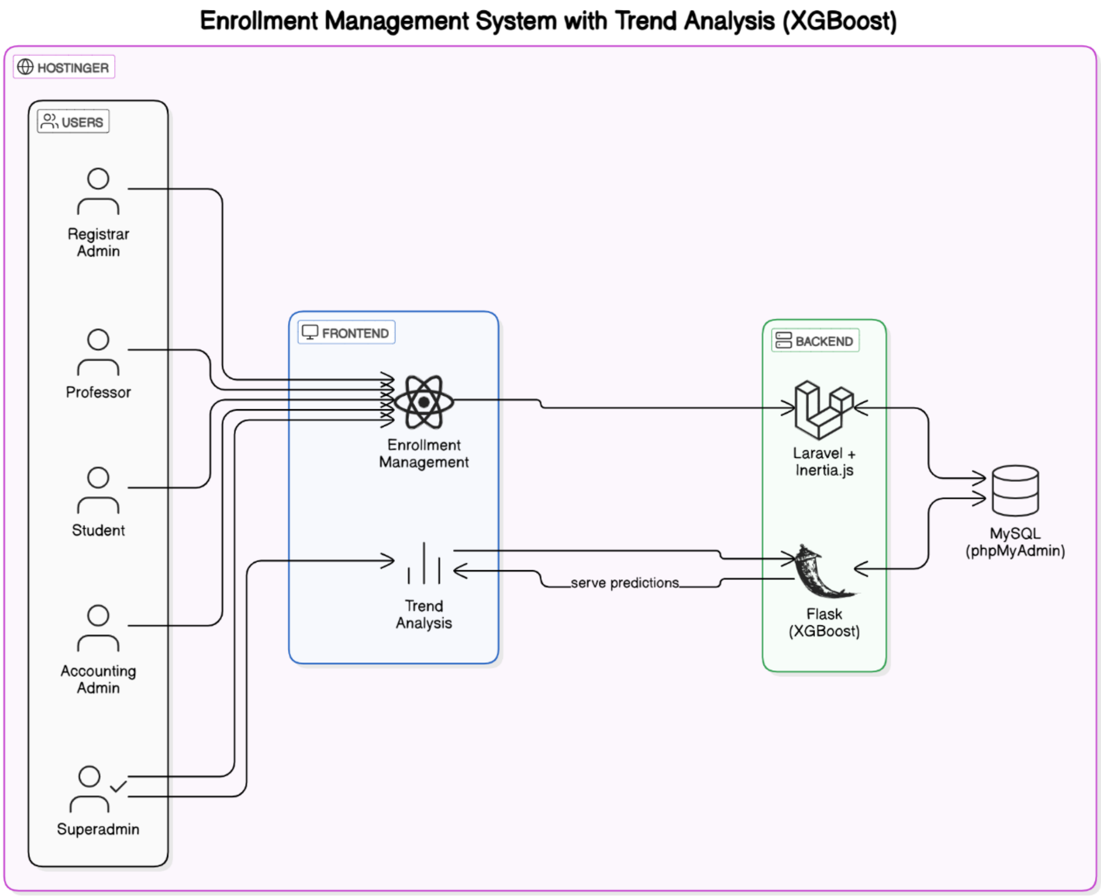
DEPARTMENT	CLEARED	DATE
1. Laboratories (Only for those applicable to the course/Program of the student)		
Computer Laboratory		12-30-24
Science Laboratory		
2. Library		
3. Assessment/Accounting		12-30-24
4. OSA Director		
5. Supply Center		12-30-24
7. School Registar		

Process owner: Registrar's Office OTR form#001
Rev.January2024

bal. ₱1,500.00 uniform

APPENDIX G

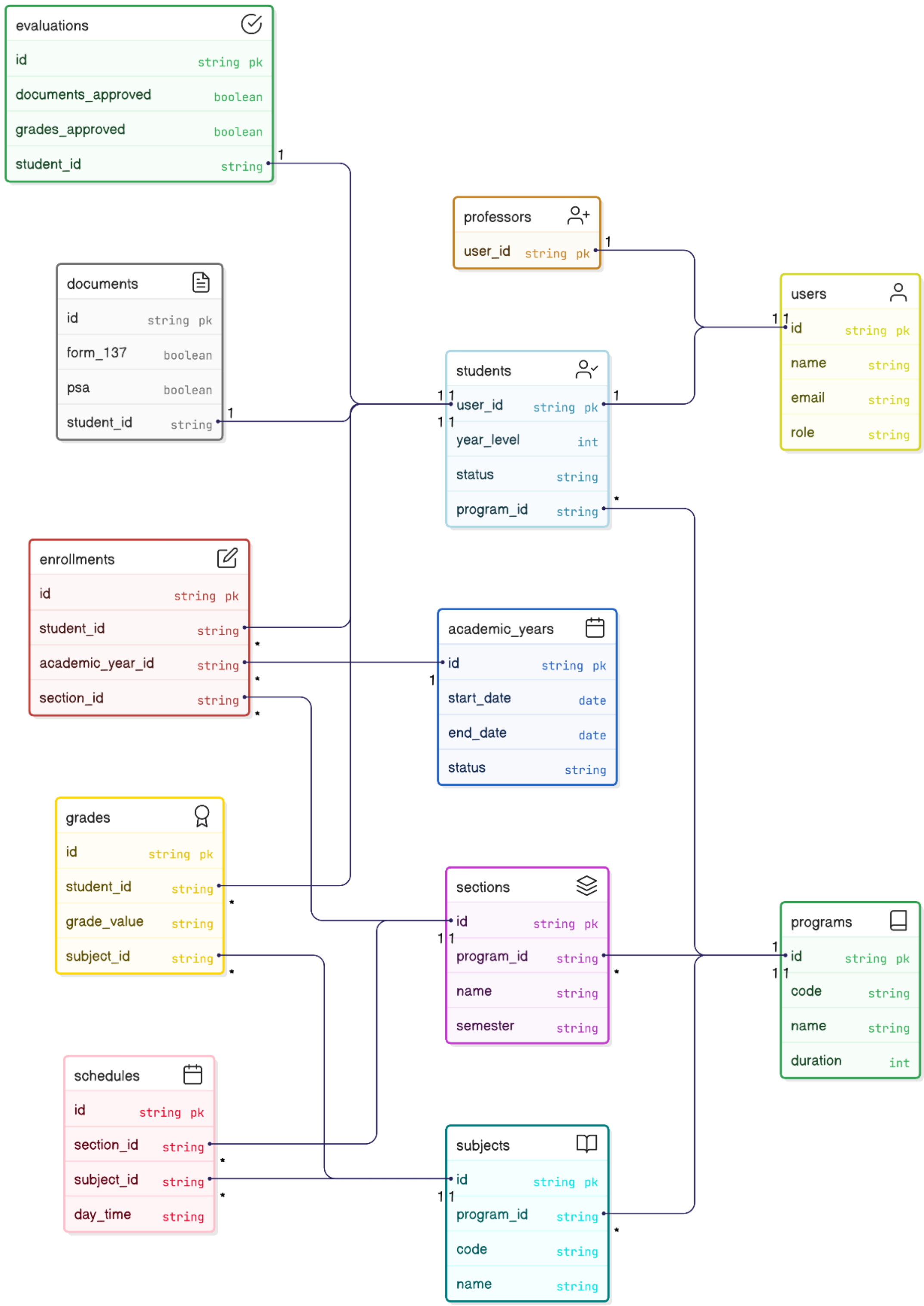
System Architecture Diagram


Enrollment Management System with Trend Analysis (XGBoost)
HOSTINGER
USERS
Registrar Admin
Professor
Student
Accounting Admin
Superadmin
FRONTEND
Enrollment Management
Trend Analysis
serve predictions
BACKEND
Laravel + Inertia.js
Flask (XGBoost)
MySQL (phpMyAdmin)

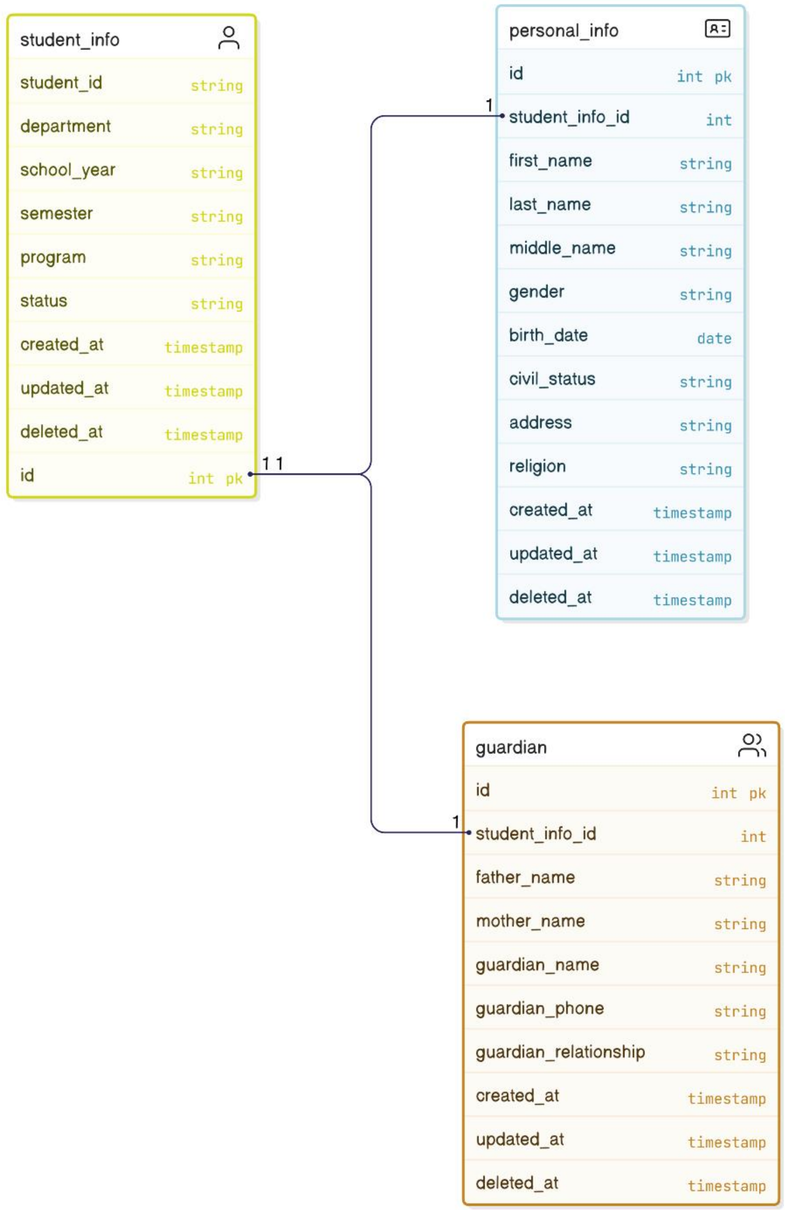
APPENDIX H

Database Design / ER Diagram

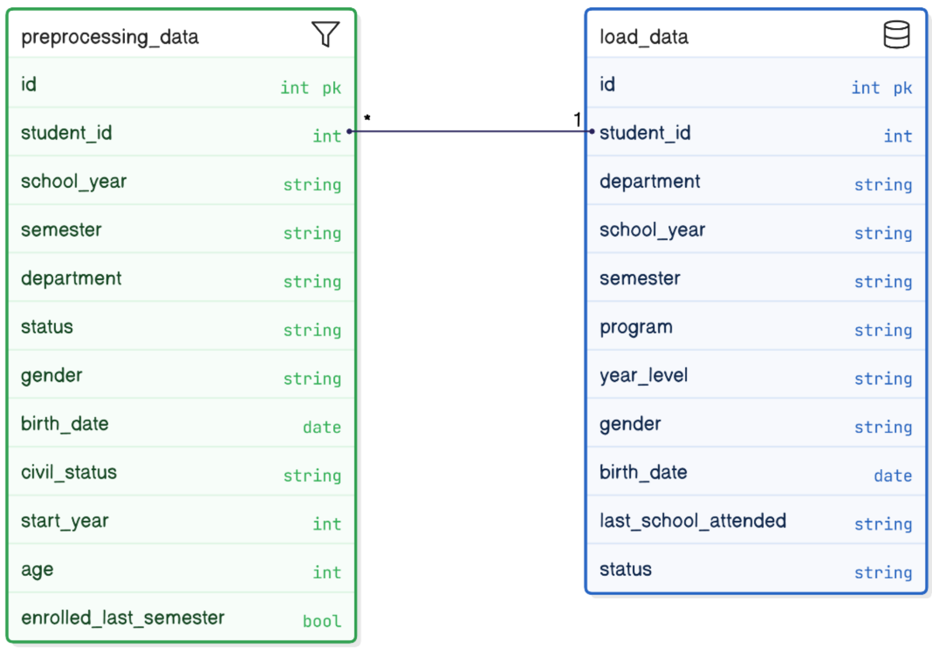
Enrollment Management System Data Model



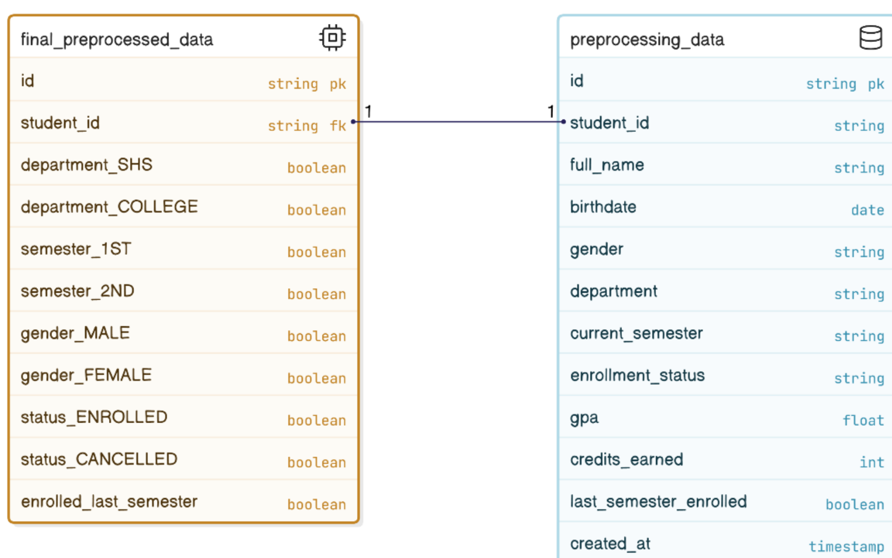
Building load_data dataset



Cleaning Dataset

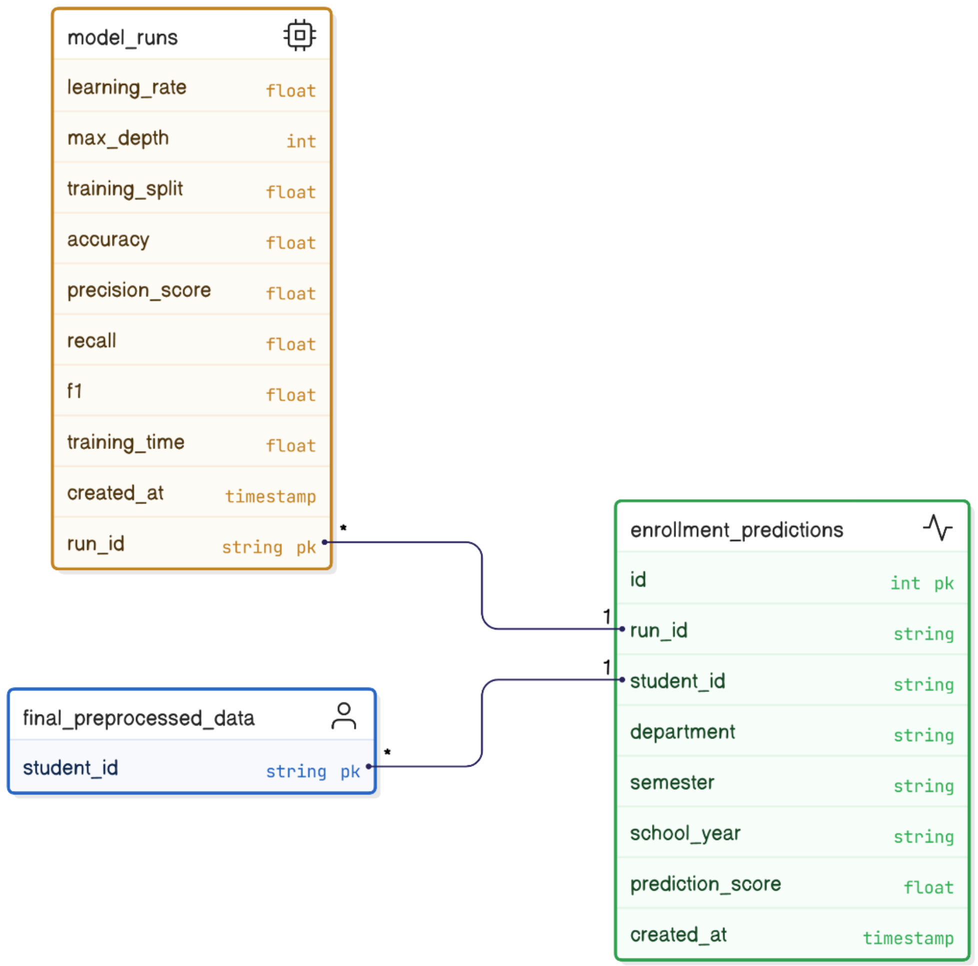


Machine Learning Data Preparation ERD



Model Training and Enrollment Prediction Data Model

Model Training and Enrollment Prediction Data Model



APPENDIX I

Program Listing (Main Code)

FRONTEND

Enrollment Application *(Enrollment.jsx)* 1/11

```
import Layout from "@/components/layout";
import TableData from "@/components/table";
import { Input } from "@/components/ui/input";
import { Button } from "@/components/ui/button";
import { useState } from "react";
import { ScrollArea } from "@/components/ui/scroll-area";
import { toast } from "sonner";
import { Tabs, TabsContent, TabsList, TabsTrigger } from
"@/components/ui/tabs";

import {
    DialogDescription,
    Dialog,
    DialogContent,
    DialogHeader,
    DialogTitle,
    DialogTrigger,
} from "@/components/ui/dialog";

import { useForm } from "@inertiajs/react";
import {
    Select,
    SelectContent,
    SelectItem,
    SelectTrigger,
    SelectValue,
} from "@/components/ui/select";
import ApplicationForm from "../Public/Section/Application";
import { Label } from "@/components/ui/label";
import PaymentDetails from "./Admission/PaymentDetails";
import DocumentDetails from "./Admission/DocumentDetails";
import BadgeSuccess from "@/components/BadgeSuccess";
import BadgeWarning from "@/components/BadgeWarning";
import StudentDetails from "./Admission/StudentDetails";
import SubjectDetails from "./Admission/SubjectDetails";
import SchoolFeeDetails from "./Admission/SchoolFeeDetails";
```

```
export default function Application({
    student = [],
    college_fee = [],
    other_fee = [],
    subjects = [],
}) {
    const tableHeader = [
        "Name",
        "Year Level",
        "Program",
        "Semester",
        "Application",
        "Documents",
        "Payment",
    ];

    const {
        data,
        setData,
        post,
        errors,
        delete: onDelete,
    } = useForm({
        id: "",
        status: "",
    });
const studentData = student.map((students) => ({
        // student info
        id: students.id,
        department: students.department,
        school_year: students.school_year,
        semester: students.semester,
        branch: students.branch,
        year_level: students.year_level,
        program: students.program,
        classified_as: students.classified_as,
        last_school_attended: students.last_school_attended,
        last_school_address: students.last_school_address,
        email: students.users.email,
        status: students.status,
```

```
// personal info
        first_name: students.personal_info.first_name,
        last_name: students.personal_info.last_name,
        middle_name: students.personal_info.middle_name,
        address: students.personal_info.address,
        birth_date: students.personal_info.birth_date,
        birth_place: students.personal_info.birth_place,
        civil_status: students.personal_info.civil_status,
        gender: students.personal_info.gender,
        religion: students.personal_info.religion,
        // guardian
        father_name: students.guardian.father_name,
        father_occupation: students.guardian.father_occupation,
        father_phone: students.guardian.father_phone,
        mother_name: students.guardian.mother_name,
        mother_phone: students.guardian.mother_phone,
        mother_occupation: students.guardian.mother_occupation,
        guardian_name: students.guardian.guardian_name,
        guardian_relationship: students.guardian.guardian_relationship,
        guardian_phone: students.guardian.guardian_phone,

        // documents
        doc_status: students.documents.status,
        form_138A: students.documents.form_138A,
        form_137: students.documents.form_137,
        good_moral: students.documents.good_moral,
        psa: students.documents.psa,
        pic_2x2: students.documents.pic_2x2,
        ctc_transferee: students.documents.ctc_transferee,
        grade_transferee: students.documents.grade_transferee,
        f137_transferee: students.documents.f137_transferee,
```

```
// payment
        payment_status: students.payment_verification.status,
        payment_verification_name: students.payment_verification.name,
        payment_verification_email: students.payment_verification.email,
        payment_purpose: students.payment_verification.purpose,
        payment_semester: students.payment_verification.semester,
        payment_reference: students.payment_verification.reference,
        payment_amount: students.payment_verification.amount,
        payment_receipt: students.payment_verification.payment_receipt,
        payment_created_at: students.payment_verification.created_at,
    }));

    const tableData = studentData.map((student) => ({
        id: student.id,
        name:
            student.first_name +
            " " +
            student.middle_name +
            " " +
            student.last_name,
        year_level: student.year_level,
        program: student.program,
        semester: student.semester,
        status: student.status,
        doc_status: student.doc_status,
        payment_status: student.payment_status,
    }));

    const [itemId, setItemId] = useState(null);
    const [add, setAdd] = useState(false);
    const [del, setDel] = useState(false);
    const [create, setCreate] = useState(false);

    const handleCreate = () => {
        setCreate((prev) => !prev);
    };
```

```
const handleDel = (student) => {
        setItemId(student);
        setDel(true);
    };

    const handleSubmitDel = () => {
        console.log("Delete id", itemId.id);
        onDelete(route("admin.program.destroy", { id: itemId }), {
            onSuccess: () => {
                toast("Program has been deleted", {
                    description: "Sunday, December 03, 2023 at 9:00 AM",
                });
                setDel(false);
            },
        });
    };

    const handleEdit = (student) => {
        student = studentData.find((s) => s.id === student.id);
        setItemId(student);
        console.log("student Data", student);
        setData({
            id: student.id,
            email: student.email,
            department: student.department,
            year_level: student.year_level,
            semester: student.semester,
            school_year: student.school_year,
            branch: student.branch,
            program: student.program,
            classified_as: student.classified_as,
            last_school_attended: student.last_school_attended,
            last_school_address: student.last_school_address,
            status: student.status,
```

```
name:
                student.first_name +
                " " +
                student.middle_name +
                " " +
                student.last_name,
            address: student.address,
            birth_date: student.birth_date,
            birth_place: student.birth_place,
            civil_status: student.civil_status,
            gender: student.gender,
            religion: student.religion,

            father_name: student.father_name,
            father_occupation: student.father_occupation,
            father_phone: student.father_phone,
            mother_name: student.mother_name,
            mother_occupation: student.mother_occupation,
            mother_phone: student.mother_phone,
            guardian_name: student.guardian_name,
            guardian_relationship: student.guardian_relationship,
            guardian_phone: student.guardian_phone,

            doc_status: student.doc_status,
            form_138A: student.form_138A,
            form_137: student.form_137,
            good_moral: student.good_moral,
            psa: student.psa,
            pic_2x2: student.pic_2x2,
            ctc_transferee: student.ctc_transferee,
            grade_transferee: student.grade_transferee,
            form137_transferee: student.form137_transferee,
```

```
payment_status: student.payment_status,
            payment_verification_name: student.payment_verification_name,
            payment_verification_email: student.payment_verification_email,
            payment_purpose: student.payment_purpose,
            payment_semester: student.payment_semester,
            payment_reference: student.payment_reference,
            payment_amount: student.payment_amount,
            payment_receipt: student.payment_receipt,
            payment_created_at: student.payment_created_at,
        });

        setAdd(true);
    };

    const handleSubmit = () => {
        post(route("admin.program.store"), {
            onSuccess: () => {
                toast("Program has been created", {
                    description: "Sunday, December 03, 2023 at 9:00 AM",
                });
                setAdd(false);
                setData({
                    code: "",
                    name: "",
                    department: "",
                    duration: "",
                    campus: "",
                    status: "",
                });
            },
        });
    };
```

```
const handleUpdateSubmit = () => {
        post(route("admin.application.update", { id: itemId }), {
            onSuccess: () => {
                toast("Student Application has been updated", {
                    description: "Sunday, December 03, 2023 at 9:00 AM",
                });
                setAdd(false);
                setData({
                    status: "",
                });
            },
        });
    };

    return (
        <Layout>
            <div className="flex items-end justify-between mb-7">
                <h1 className="text-2xl font-bold">Enrollment</h1>
            </div>
            <div className="flex justify-between mb-3">
                <Input type="text" placeholder="Search" className="w-
[300px]" />
                {/* <Button onClick={handleCreate}>Create</Button> */}
            </div>
            <div className="border rounded-sm px-4">
                <TableData
                    tablerow={tableHeader}
                    tabledata={tableData}
                    handleEdit={handleEdit}
                    handleDel={handleDel}
                />
{add && (
                    <Dialog open={add} onOpenChange={(open) =>
setAdd(open)}>
                        <DialogContent className="max-w-4xl h-[600px]">
                            <DialogHeader>
                                <Tabs defaultValue="details">
                                    <div className="flex justify-between">
```

```
<TabsList>
   <TabsTrigger value="details">
     Application Details
   </TabsTrigger>
   <TabsTrigger value="documents">
     Documents
   </TabsTrigger>
   <TabsTrigger value="payment">
     Payment
   </TabsTrigger>
</TabsList>
<TabsList>
   <TabsTrigger value="subject">
     Subject
   </TabsTrigger>
   TabsTrigger value="school_fee">
     School Fee
   </TabsTrigger>
</TabsList>
</div>
<TabsContent value="details">
   <DialogDescription>
       <ScrollArea className="h-[500px] p-4">
           <StudentDetails data={data} />
       </ScrollArea>
   </DialogDescription>
</TabsContent>
<TabsContent value="documents">
       <ScrollArea className="h-[500px] p-4">
           <DocumentDetails data={data} />
       </ScrollArea>
</TabsContent>
<TabsContent value="payment">
       <ScrollArea className="h-[500px] p-4">
           <PaymentDetails data={data} />
       </ScrollArea>
</TabsContent>
```

```
<TabsContent value="subject">
     <ScrollArea className="h-[500px] p-4">
           <SubjectDetails
                 subjects={subjects}
                 data={data}/>
                 {console.log("Subject", subjects)}
     </ScrollArea>
</TabsContent>
<TabsContent value="school_fee">
     <ScrollArea className="h-[500px] p-4">
             <SchoolFeeDetails
                 student={student}
                 college_fee={college_fee}
                 other_fee={other_fee}/>
     </ScrollArea>
</TabsContent>
</Tabs>
</DialogHeader>
</DialogContent>
</Dialog>
)}
{create && <ApplicationForm />}
       {del && (
           <Dialog open={del} onOpenChange={(open) => setDel(open)}>
                        <DialogContent>
                            <DialogHeader>
                                <DialogTitle>Delete Program</DialogTitle>
                                <DialogDescription>
                                    <div className="my-3">
                                        Are you sure to delete this program?
                                    </div>
                                    <div className="flex justify-end gap-2">
                                        <Button
                                            variant="outline"
                                            onClick={handleSubmitDel}
```

```
>
                                            Yes
                                        </Button>
                                        <Button
                                            className="bg-red-600"
                                            onClick={() => setDel(false)}
                                        >
                                            No
                                        </Button>
                                    </div>
                                </DialogDescription>
                            </DialogHeader>
                        </DialogContent>
                    </Dialog>
                )}
            </div>
        </Layout>
    );
}
```

BACKEND

Enrollment Application (create_student_info_table_php) 1/3

```
<?php

use Illuminate\Database\Migrations\Migration;
use Illuminate\Database\Schema\Blueprint;
use Illuminate\Support\Facades\Schema;

return new class extends Migration
{
    /**
     * Run the migrations.
     */
    public function up(): void
    {
        Schema::create('student_info', function (Blueprint $table) {
            $table->id();
            $table->unsignedBigInteger('users_id');
            $table->string('student_id', 50)->unique();
            $table->string('department', 50);
            $table->string('school_year', 50);
            $table->string('semester', 50);
            $table->string('branch', 50);
            $table->string('year_level', 50);
            $table->string('program', 255);
            $table->string('classified_as', 50);
            $table->text('last_school_attended')->nullable();
            $table->text('last_school_address')->nullable();
            $table->string('status', 50)->default('pending');
            $table->foreign('users_id')->references('id')->on('users')-
>onDelete('cascade')->onUpdate('cascade');

            $table->timestamps();
            $table->softDeletes();
        });
```

```
 Schema::create('personal_info', function (Blueprint $table) {
            $table->id();
            $table->string('student_info_id');
            $table->string('first_name', 255);
            $table->string('last_name',255);
            $table->string('middle_name',255)->nullable();
            $table->string('address', 255);
            $table->string('birth_date', 50);
            $table->string('birth_place', 255);
            $table->string('civil_status', 50);
            $table->string('gender', 50);
            $table->string('religion', 50)->nullable();

            $table->foreign('student_info_id')->references('student_id')-
>on('student_info')->onDelete('cascade')->onUpdate('cascade');

            $table->timestamps();
            $table->softDeletes();
        });

        Schema::create('guardian', function (Blueprint $table) {
            $table->id();
            $table->string('student_info_id');
            $table->string('father_name',255)->nullable();
            $table->string('father_occupation',255)->nullable();
            $table->string('father_phone',50)->nullable();
            $table->string('mother_name',255)->nullable();
            $table->string('mother_occupation',255)->nullable();
            $table->string('mother_phone',50)->nullable();
            $table->string('guardian_name',255)->nullable();
            $table->string('guardian_relationship',255)->nullable();
            $table->string('guardian_phone',50)->nullable();

            $table->foreign('student_info_id')->references('student_id')-
>on('student_info')->onDelete('cascade')->onUpdate('cascade');

            $table->timestamps();
            $table->softDeletes();
        });
```

```
}

    /**
     * Reverse the migrations.
     */
    public function down(): void
    {
        Schema::dropIfExists('student_info');
        Schema::dropIfExists('personal_info');
        Schema::dropIfExists('guardian');
    }
};
```

APPENDIX J

Installation Instructions

Installation Instructions

This appendix provides step-by-step installation instructions for the two main components of the system:

1. **Enrollment Management System**

   Built with React, Laravel, Inertia.js, shadcn/ui, Tesseract.js (OCR), and Sheet.js (Excel upload)

2. **Trend Analysis by Department**

   Built with Flask, Python, and Chart.js, using mysql.connector

Both systems are developed using Visual Studio Code and share a MySQL database accessed via phpMyAdmin.

System Requirements

- OS: Windows 10+, macOS Monterey+, or Ubuntu 20.04+
- Visual Studio Code
- Node.js + npm – https://nodejs.org/
- Composer (for Laravel) – https://getcomposer.org/
- Python 3.8+
- MySQL 8.0+ (with phpMyAdmin for GUI)
- Git

Clone the Repositories

```
git clone https://github.com/your-org/enrollment-management.git
git clone https://github.com/your-org/trend-analysis.git
```

Enrollment Management System (React + Laravel + Inertia.js)

```
cd enrollment-management/backend
composer install
cp .env.example .env
php artisan key:generate
```

Edit `.env` to set your MySQL connection (must match the shared DB):

```
DB_CONNECTION=mysql
DB_HOST=127.0.0.1
DB_PORT=3306
DB_DATABASE=your_shared_db
DB_USERNAME=root
DB_PASSWORD=your_password
```

Change this according to your MySQL database

Run migrations and serve:

```
php artisan migrate --seed
php artisan serve
```

React Frontend

```
cd enrollment-management/frontend
npm install
npm run dev
```

Trend Analysis by Department (Flask + Chart.js)

Python Environment Setup

```
cd trend-analysis
python -m venv venv
source venv/bin/activate        # Linux/macOS
venv\Scripts\activate           # Windows
```

Install Required Packages

```
pip install flask flask-cors pandas numpy xgboost scikit-learn mysql-connector-
python
```

MySQL Database Configuration

```
import mysql.connector
from mysql.connector import pooling

dbconfig = {
    "host": "localhost",
    "user": "root",
    "password": "your_password",
    "database": "your_shared_db"
}

connection_pool = pooling.MySQLConnectionPool(pool_name="mypool",
pool_size=5, **dbconfig)
```

Change this according to your MySQL database

Run the Flask Server

```
python app.py
```

MySQL phpMyAdmin Setup

1. Start MySQL and phpMyAdmin (XAMPP/WAMP or standalone).
2. Access phpMyAdmin at http://localhost/phpmyadmin.
3. Create the shared database, e.g., your_shared_db.
4. Import .sql schema files as needed for both systems.

Common Issues & Troubleshooting

Errors	Fixes
Access denied for user	Check credentials in `.env` and Python config.
ModuleNotFoundError	Ensure correct `venv` is activated before running Flask.
Port conflict	Use `--port=XXXX` to change Laravel or Flask server ports.
CORS issues	Flask must include `CORS(app)` to allow React to connect.

Running Both Systems Together

In VS Code, open two terminals:

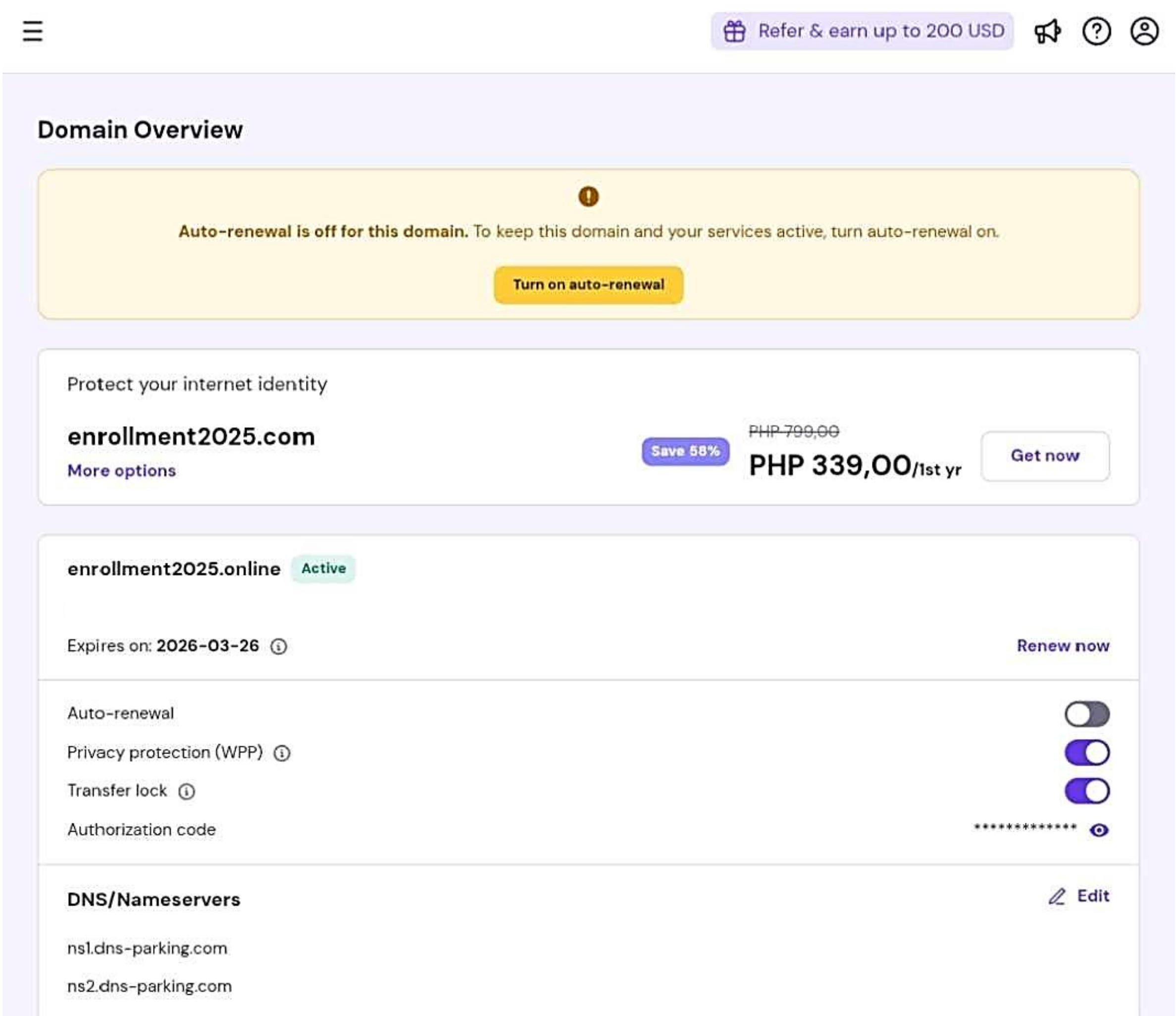
- One for Laravel backend (php artisan serve)
- One for React frontend (npm run dev)
- One for Flask (python app.py)

Ensure all systems point to the **same MySQL database**.

APPENDIX K

Deployment Documentation

Hostinger *(Deployed for Thesis Purposes Only. Subscription ended.)*



APPENDIX L

Endorsement Letter

ENDORSEMENT

"Enrollment Management System with Trend Analysis by Department Using Extreme Gradient Boosting Algorithm"

MR. FRANCIS MICHAEL NUÑEZ
Thesis Writing Adviser

APPENDIX M

Adviser Certificate

ADVISER'S CERTIFICATE

This is to certify that the undersigned has thoroughly reviewed and evaluated all pages of the thesis entitled, *"Enrollment Management System with Trend Analysis by Department Using Extreme Gradient Boosting Algorithm,"* prepared and submitted by John Lester B. Castillo and Lovely J. Clareon.

This review has been conducted in accordance with the structural rules governing the composition of the system and documentation required for the Thesis Writing Project. Signed this ___ day of May 2025, at University of Cabuyao (Pamantasan ng Cabuyao), Katapatan Mutual Homes, Brgy. Banay-Banay, City of Cabuyao, Laguna, Philippines 4025.

MR. JANUS RAYMOND TAN
Thesis Adviser

APPENDIX N

Grammarian and

Statistician Certificate

EDITOR'S CERTIFICATION

This is to certify that this thesis entitled, **"Enrollment Management System with Trend Analysis by Department using Extreme Gradient Boosting Algorithm",** prepared and submitted by John Lester B. Castillo, and Lovely J. Clareon, has been edited by the undersigned.

MARGIE A. PAPASIN, PhD.
Editor

STATISTICIAN'S CERTIFICATION

This is to certify that this thesis entitled, **"Enrollment Management System with Trend Analysis by Department using Extreme Gradient Boosting Algorithm",** prepared and submitted by John Lester B. Castillo, and Lovely J. Clareon, has been statistically reviewed by the undersigned.

DENNIS BRYAN A. BARAYANG, PhD.
Statistician

APPENDIX O

Certificate of Statistical Analysis with SPSS Software and Certificate of Evaluation with Turnitin Originality Check

CERTIFICATE OF STATISTICAL ANALYSIS WITH SPSS SOFTWARE

This is to certify that this thesis entitled "**Enrollment Management System with Trend Analysis by Department using Extreme Gradient Boosting Algorithm**", submitted by John Lester B. Castillo, and Lovely J. Clareon, was statistically analyzed with the Statistical Package for the Social Sciences (SPSS) Software at the College Department of Westbridge Institute of Technology, Inc.

DENNIS BRYAN A. BARAYANG, PhD.
Statistician

CERTIFICATE OF EVALUATION WITH TURNITIN ORIGINALITY CHECK

This is to certify that the thesis entitled, **"Enrollment Management System with Trend Analysis by Department using Extreme Gradient Boosting Algorithm"**, prepared and submitted by John Lester B. Castillo, and Lovely J. Clareon, has been evaluated using the Turnitin Originality Check System and yielded a similarity rate of 16 %.

DENNIS BRYAN A. BARAYANG, PhD.
Program Head, CCS

MARGIE A. PAPASIN, PhD.
Language Editor

APPENDIX P

Curriculum Vitae (CV)

JOHN LESTER CASTILLO

Bachelor of Science in Computer Science
Fullstack Web Developer

+(63) 991 9452 778 castillojlb0922@gmail.com
Cabuyao, Laguna, Philippines 4025

Academic Experience

Thesis - 4th Year

August 2024 - April 2025

Project Title

Enrollment Management System With Trend Analysis by Department Using Extreme Gradient Boosting Algorithm

Project Overview

Developed an online enrollment system that integrates:

- OCR (Tesseract.js) for scanning and extracting data from registration forms.
- XGBoost for department-level trend analysis.
- Role-Based Access Control (RBAC) to allow the super admin to configure dashboard sidebar visibility by user role.

Technology Used

- *Front-end:* React.js, Inertia.js, Tailwind CSS, ShadCN, SheetJS
- *Back-end*: Laravel Breeze, Tesseract.js
- *Database:* MySQL
- *Version Control:* Github
- *Hosting:* Hostinger

Trend Analysis with XGBoost

- *Front-end:* Materialize CSS, Bootstap, Chartjs
- *Back-end:* Flask, Python

Internship

January 2025 - March 2025

Company

Supsoft Technologies - Cainta, RIzal

Project Highlights

Proj 1:

- Developed exam-type features for a review web app.

Technology Used

- *Front-end*: React.js, Inertia.js ,Tailwind CSS, Flowbite
- *Back-end:* Laravel (with Laravel Breeze)
- *Version Control:* Github

Proj 2:

- Developed a login authentication page with Facebook and Google login.

Technology Used

- *Front-end:* React.js, Tailwind CSS
- *Back-end:* Laravel (REST API), JWT ,Laravel Breeze, Laravel Socialite
- *Authentication*: Facebook Developer, Google Cloud
- *Testing Tools*: ngrok, postman
- *Database*: MySQL
- *Version Control*: Github

Soft. Eng. - 3rd Year

September 2023 - May 2024

Project Title

A Novel Approach To Enrollment Management: Decision Tree Algorithm for Westbridge Institute of Technology Inc.

Project Overview

Developed a proposed enrollment management system for Westbridge Institute of Technology, Inc. The system integrates a decision tree algorithm to determine student eligibility for enrollment by analyzing various factors such as grades, tuition payments, submitted documents, and other relevant data.

Technology Used

- *Front-end:* HTML, CSS, JavaScript, Chart.js, SweetAlert
- *Back-end:* PHP, PHPMailer
- *Database:* MySQL
- *Version Control*: Github
- *Hosting*: Infinity Free

Education

College
2021 - Present
Cabuyao, Laguna

Westbridge Institute of Technology Inc.

Bachelor of Science in Computer Science

Technologies Used

- *Front-end:* React.js, Inertia.js, Tailwind CSS, Bootstrap, ShadCN UI, Flowbite, HTML5, Vanilla CSS, Javascript
- *Back-end:* Laravel (RESTful API), Java, Laravel Breeze, JWT ,Laravel Socialite
- *Database:* MySQL
- *Version Control*: Github
- *Tools:* Vscode, Xampp, Github ,Postman, ngrok, Eclipse
- *Other Technologies:* Google Cloud, Facebook Developer API
- *Hosting*: Hostinger, Infinity Free
- *Concept:* Object Oriented Programming (basic), SDLC

LOVELY CLAREON

Bachelor of Science in Computer Science

Contact

+(63) 997 9162 975
+(63) 966 7390 493

clareonlovely@gmail.com

Cabuyao, Laguna,
Philippines 4025

Education

2021 - 2025

COLLEGE

Westbridge Institute of Technology, Inc.

BS Computer Science

2016 - 2018

SHS

Calamba Doctors' College

Science, Technology, Engineering, & Mathematics

With Honors

Projects & Skills

Library Management System
(backend with Caesar cipher)

- vb.net
- MSSQL

Aurum Travels

- HTML & Materialize CSS (front-end development)

https://clrnlvly.github.io/Aurum-Travels-Landing-Page/

API_CRUD

- HTML, CSS, JavaScript, Chart.js
- Flask Python, Postman
- MySQL Database

https://youtu.be/ypaPl5iN9-8

Trend Analysis by Department

- HTML, CSS, JavaScript, Chart.js
- Flask Python, XGBoost Algorithm
- MySQL Database

About Me

I am a dedicated fourth-year Bachelor of Science in Computer Science student at Westbridge Institute of Technology, Inc., expecting to graduate on May 18, 2025. I am passionate about learning and adapting to emerging technologies, and I am committed to continuously improving my skills. I aspire to gain valuable experience in the IT industry and contribute meaningfully to the field of computer science.

Experience

Westbridge Institute of Technology, Inc. **Sept 2024 - May 2025**

#1 Brgy. Banlic, City of Cabuyao 4025

Enrollment Management System with Trend Analysis by Department Using XGBoost Algorithm

- Thesis I & Thesis II
- REACT, Laravel, Inertia js (EMS)
- Flask Python (XGBoost Algorithm)
- MySQL (Database)

Privileged Identity Management: Strategies for Prevention and Protection in the Digital Age

- Seminar

Gleent Incorporated **Aug 2023 - Nov 2023**

Software Company
Brgy. Sala, City of Cabuyao 4025

Advance Internship 300 hours (WFH setup)
Non-voice Technical Support (Customer Service)

- Manage customers ticketing system
- Checking/Testing System Errors
- Solving human-errors issues
- Analyzing and Reporting system-errors issues
- Backup client's databases
- Non-voice customer service for technical support

Integrated Micro-electronics, Inc. **Oct 2019 - July 2020**

Business Manufacturing & Supply
North Science Avenue, Laguna Technopark, Biñan 4024

Full-time Regular (On-site)
Human Resources (HR) Clerk

- Manage employees disciplinary action records
- Assisted employees filing of SSS, Pag-IBIG, & PhilHealth loans
- Assisted creation and distribution of memorandums
- Assisted company events
- Assisted clinic and canteen attendances