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Electronic Clearance System with SMS Notification in the Case of Guimaras State University

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Abstract

In response to the inefficiencies of manual clearance processes at Guimaras State University (GSU), this study presents the development of an Electronic Clearance System integrated with SMS Notification. Literature findings motivated researchers to craft the objective of streamlining clearance procedures and enhance accessibility for both students and employees. The system aims to reduce processing time, eliminate paperwork, and provide real-time updates to stakeholders. The methodology involved the adoption of the System Development Life Cycle (SDLC), encompassing requirements gathering, analysis, design, implementation, and testing phases. Through interviews with administrative offices at GSU, user requirements and clearance process intricacies were identified. Leveraging technologies such as PHP, MySQL, and CSS, a user-friendly web-based system was developed to facilitate clearance management. Key results of the study include a significant reduction in clearance processing time and improved user experience. By automating processes and integrating SMS notifications, the system ensures timely updates and enhances communication between stakeholders. Overall, the Electronic Clearance System with SMS Notification offers a scalable and efficient solution to streamline clearance management at GSU.

Keywords: *electronic; clearance; digital; centralize ;SMS*

1. Introduction

Clearance forms act as an official declaration or verification that the individual has maintained a clean record throughout their existence and has successfully met all the required criteria. These documents can also function as a ticket for an individual to proceed further or in order to move to the next level or higher year. There are different kind of clearances implemented in Guimaras State University both for students and employees. As for the employees, they are required to comply two clearances which are teacher's clearance and civil service form. On the other hand, a student can use a clearance depending on its purpose.

This study aims to handle the challenge specifically time consuming and requiring physical appearance[1] as it is done manually[2] in documenting and keeping track of students and employees in this institution where there is a growth in their number as this becomes highly alarming when there is a change in management.

Employee's clearance can be a challenging process as it necessitates the completion of two essential forms: the Civil Service Form and the Teacher's Clearance. As for the staff of the said institution, a Civil Service Form is the only requirement in gaining clearance [3]. On the other hand, instructors are required to comply the two mentioned essential form. These forms are integral in ensuring that employees undergo a thorough and systematic clearance procedure

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Employees who are retiring, separating, transferring, leaving the Philippines, or going on maternity leave must complete the Civil Service form[3]. This clearance is a prerequisite for receiving their final salary or any outstanding payments. If employees are cleared from their unit, office, or department, the authorized official can include relevant documents confirming their clearance from any obligations or accountabilities. However, if there are outstanding accountabilities, the clearance will be accompanied by documents specifying the remaining obligations and the actions employees must take to clear

The teacher's clearance encompasses the necessary items to acquire, including the Civil Service Form, Course Syllabus, TOS, Test Questionnaires, grade sheets, and any special reports if necessary. Additionally, the form contains details about any absences within the last three months of duty. To complete this form, signatures are required from the instructor, university librarian, university registrar, college dean, and the vice president for academic affairs.

These two forms, when meticulously filled out and processed, pave the way for employees to achieve proper clearance[4], [5], which is crucial for their continued employment and adherence to organizational regulations.

Student's clearance on the other hand, serves a multitude of essential purposes within the academic field, ranging from enrollment and course shifting to school transfers and the acquisition of graduate transcripts of records. The specific requirements for obtaining signatures on these clearances vary depending on the intended purpose, ensuring that the necessary procedures are followed meticulously. It is crucial to note that any documents procured through the Student Services Office necessitate the completion of clearance processes, underscoring the significance of maintaining clear and standardized procedures to ensure the smooth flow of administrative tasks and the integrity[4], [5] of academic records.

Hence, maintaining accurate track records through the implementation of an Electronic Clearance System with SMS Notification holds immense importance [6] in today's fast-paced and data-driven world[7]. This system ensures the preservation of comprehensive and up-to-date records, reducing the likelihood of oversight or confusion during clearance procedures. Furthermore, by incorporating SMS notifications, it enhances communication and transparency, keeping employees and students informed through notification [8] about their clearance status in real-time, thereby reducing uncertainty and delays.

Generally, this study is to design and develop a centralized electronic clearance system with SMS notification for Guimaras State University to modernize and streamline the clearance process, thereby optimizing administrative efficiency and the overall experience[9] for students and employees by establishing a web portal to enable students/personnel to file for clearance online[10], [11], eliminate long queue of students/personnel processing the clearance by incorporating a digital queue of clearance sequenced per signing office, embed a short messaging service to notify the students/personnel applying for clearance with respect to the status of their application and build a Clearance Report Generator allowing students/personnel to download a PDF file format supported electronic clearance

The main objective of this study is to design, develop, and implement a centralized Electronic Clearance System with SMS Notification capabilities that is specifically customized to the needs of Guimaras State University. The goal of the study is to develop a user-friendly electronic clearance platform to take the place of the current manual clearance procedure. It includes the integration of SMS notifications to update and inform students and employees on clearance statuses. The safe handling of Electronic Clearance Records inside a specific database is also discussed. Moreover, this study is limited to the demands of students and employees of Guimaras State University. Likewise, deeper or further information of students and employees are not included in the system.

2. Review of Related Literature

The theoretical underpinnings of the proposed Electronic Clearance System with SMS Notification for Guimaras State University draw upon several key frameworks to inform its design and implementation: Automata or Automation Theory aims to develop methods by which computer scientists can describe and analyze the dynamic behavior of discrete systems, in which signals are sampled periodically[12]. The essence of Automation Theory lies in minimizing manual efforts and streamlining processes through technology[13], and this aligns seamlessly with the goals of the electronic clearance system. By integrating automated processes into clearance procedures, the system can efficiently verify transactions, update records, and manage workflows without heavy reliance on manual intervention. This not only accelerates the pace of clearance processes but also reduces the likelihood of errors that may arise from manual data handling[13]. In the context of SMS notifications, automation ensures that timely and accurate messages are triggered automatically as transactions progress through the clearance workflow. This enhances the overall efficiency of the system, contributing to a smoother and more expedited clearance experience for stakeholders at Guimaras State University.

The Information Systems Theory (IST) aims to build a bridge between the general systems theory's formalism, the world of information and information technologies[14], dealing with transformation of information as a common non-material substance, whose models in forms of computer algorithms and

programs could be implemented to different material objects, including a human's thoughts and languages. The core idea behind Information Systems Theory is the effective management and processing of information[15], and this aligns seamlessly with the goals of the electronic clearance system. In practice, the system leverages this theory by incorporating a well-designed information system[16] that can efficiently handle and organize transaction data. By centralizing information in a structured manner, the electronic clearance system ensures accurate and timely processing of clearance transactions. This theory underscores the importance of creating an integrated and cohesive platform that facilitates real-time updates and notifications through SMS[8]. Through the lens of Information Systems Theory, the electronic clearance system becomes not only a tool for automating processes but also a sophisticated information hub that enhances the overall efficiency and effectiveness of clearance operations at Guimaras State University.

A theory on User Experience Design involves the design of the entire process of acquiring and integrating the product, including aspects of branding, design, usability and function[17]. At its core, the said theory emphasizes creating systems that provide a positive and user-friendly experience, and this philosophy is integral to the development of the electronic clearance system. The user interface is meticulously crafted to be intuitive and accessible, ensuring that stakeholders, including students, faculty, and administrative staff, can easily navigate the system. In the context of SMS notifications, UX Theory guides the creation of clear and concise notification system. By prioritizing the end-user's needs and preferences, the electronic clearance system becomes more than just a functional tool—it becomes a seamless and enjoyable experience for all involved. This user-centric approach not only facilitates efficient clearance processes but also contributes to a positive perception of technology adoption within the academic community at Guimaras State University.

The theoretical background regarding the Electronic Clearance System with SMS Notification at Guimaras State University provides a solid foundation for its development and implementation. Drawing upon principles from Automation Theory[12], Information Systems Theory[14], [15], [16], User Experience Design Theory[17], the system is poised to revolutionize the university's clearance processes. By synthesizing these theories, the Electronic Clearance System not only addresses administrative challenges but also sets the stage for a technologically advanced, efficient, and user-friendly clearance process[18] at Guimaras State University.

Significant Literatures pointed notable benefits of establishing Electronic System and its technical considerations, that the development of a system to address the shortcomings of current manual processes[1] and enhance existing automated ones like in the case of a prominent tertiary institution in Southwest Nigeria that focused on transforming the comprehensive manual system and create a functional prototype. Initially, a thorough understanding of the current procedures is established. A new web-based system is constructed using Hypertext Markup Language (HTML)[19] for the user interface, PHP Hypertext Pre-Processor [20] for the business logic layer, CSS for proper display page rendering on the front end[21], and MySQL for data management[22]. The new system is expected to reduce the time and effort spent on student clearance processes and lower the institution's paper-related costs. Additionally, students will have the advantage of initiating and monitoring their clearance status from anywhere, eliminating the need for physical presence or travel[23].

Internet-based software for post-graduation services and monitoring, replacing the manual process of clearance for graduating students that offers a more dependable and efficient way to eliminate delays and facilitate comprehension of the clearance procedures through online means. Data collection was conducted at BUC College, and the approach involved in developing the software for post-graduation services was detailed. The online clearance system was constructed using Basic Visual 2015 for both static and dynamic programming, and MySQL was employed for database management. The results indicate substantial utilization of the software, demonstrating the effectiveness and efficiency of these service-related software applications[24]. Moreover, the use of Short Messaging service helped in managing documents, sharing information via Email and SMS notifications, and monitoring member attendance for the Letran Calamba Faculty and Employees Association (LCFEA)[25].

The existing studies has relation to the proposed project since it developed a web-based SMS notification clearance system wherein it is like the proposed project of the researchers. Likewise, the language utilized in the existing study will be also utilized in the proposed study. Moreover, an electronic clearance using web-based system which aims to replaced manual process with digital innovations and attendance monitoring of the previous study can be a basis to the integrated activity attendance system which the researchers are proposing to develop [25].

3. Methodology

The overall output of the study on Electronic Clearance with SMS Notification System will address these issues and updating the clearance procedure which aims to streamline procedures, increase accessibility, decrease errors, and ultimately give students and employees a more effective and user-friendly clearance experience by switching from manual paperwork to digital solutions.

Figure 1 manifests the Conceptual Framework which illustrates the Electronic Clearance with SMS Notification System. The procedures for the E-clearance involve the development of a web-based application to streamline the clearance processes. A logbook will record all activities and interactions within the system, ensuring transparency and traceability of clearance-related actions. The web server hosts the application, the script manages application logic and interacts with both the database and the SMS API. The database stores relevant data, and the SMS API facilitates communication with users through SMS notifications and responses. Thus, the output will be the notification and the reports regarding the clearance processes.

In the development of the Electronic Clearance System, the researchers adopted the Modified Waterfall Model as the project management methodology[26]. This approach allowed for a structured and sequential process while providing flexibility to revisit previous stages when necessary. The following outlines the key phases of the methodology: Requirements Modeling, Analysis, Design, Implementation, Testing and Maintenance Phase.

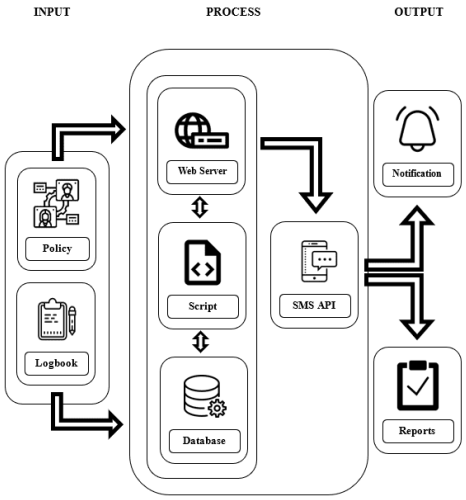


Figure 1. Conceptual Framework of the Electronic Clearance System

The study employed the System Development Life Cycle (SDLC) framework[27], encompassing a comprehensive plan for the creation, maintenance, and potential replacement of the software. By delineating each phase, the life cycle establishes a structured approach to enhancing software quality and refining the development process as a whole. The model consists of five stages: Requirements Gathering, Analysis, Design, Implementation, and Testing and Maintenance as shown in Figure 2.

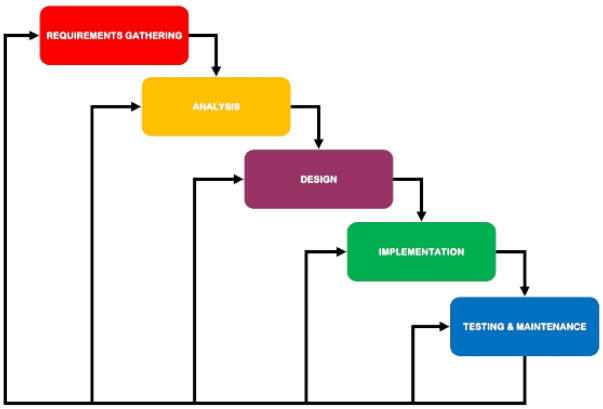


Figure 2. The Modified Waterfall Model

The Modified Waterfall Model enhances the traditional approach by incorporating feedback loops for greater flexibility. It starts with thorough requirements gathering and analysis, followed by design and implementation phases that integrate periodic reviews and validations. Finally, rigorous testing and ongoing maintenance ensure the system meets requirements and adapts to changes, allowing for revisions at any stage.

3.1. Requirements Gathering Phase

To determine the user requirements of the system, the researchers conducted interviews with various offices involved in the clearance processes at Guimaras State University. This phase involved a comprehensive investigation of administrative units to understand clearance procedures in depth, specifically: the Civil Service Form was retrieved from the Human Resource Office and open-ended interviews were conducted to explore how the form is completed. Teacher's Clearance and Student's Clearance documents were acquired and analyzed from the Office of the Vice President for Academic Affairs, focusing on the methodology of Teacher's Clearance.

Qualitative interviews with administrative personnel in the Office of Student and Development Services were conducted to clarify student clearance procedures. This multifaceted approach enabled a comprehensive analysis of clearance protocols across different administrative domains within the university.

Table 1. Modified Waterfall Model and the Assigned Tasks for each phases

Phases	Task
Planning/Requirements	T1 Group Organization T2 Project Planning T3 Project Proposal T4 Data Gathering T5 Project Task Scheduling
Analysis	T6 User Requirements Analysis
Design	T7 Plan System Logical and Physical Desing T8 System Logical and Data Modelling T9 System Physical Design, Interface, and Database Design T10 Database Coding and Development T11 Program Coding and Development
Implementation	T12 Project Presentation T13 Delivery and Support
Testing & Maintenance	T14 System Testing and Debugging

Table 1 outlines the phases of the Software Development Life Cycle (SDLC) and corresponding tasks for each phase. It highlights the Planning, Requirements, Design, Implementation, Testing, Deployment, and Maintenance phases, providing a brief overview of key activities involved in each step of the software development process.

3.2. Analysis Phase

During the Analysis Phase, the existing procedures for both student and employee clearances within the institution were observed. Issues associated with these processes were systematically identified, and a thorough assessment of potential alternative solutions was conducted. This phase was crucial for understanding the gaps in the current system and setting the groundwork for an improved solution.

3.3. Design Phase

The Design Phase marked the initiation of the system design. The researchers focused on developing the framework for the Electronic Clearance System, utilizing a Windows application as the platform. The system interface was designed using CSS to enhance its appearance. PHP was employed to create interactive window pages, and MySQL was used as the relational database management system. Design documents, including Entity Relationship Diagram[28], Flowchart[29], and DFD[30] diagrams, were created to visualize the system structure and workflow.

3.4. Implementation Phase

In the Implementation Phase, the design was translated into code, breaking down the development into smaller, manageable modules. Each module was coded and tested individually before integration. Comprehensive training sessions for students, employees, and administrators were conducted to ensure

smooth adoption of the system. This phase involved continuous assessment during system operation to gauge user satisfaction and utility.

3.5. Testing and Maintenance Phase

The final phase focused on rigorous testing to ensure the system's smooth operation and functionality. User feedback was sought and keen observation to the ongoing system usage and maintenance was performed to identify and rectify errors and enhance overall system performance.

4. Result and Discussion

4.1. High Level Diagrams

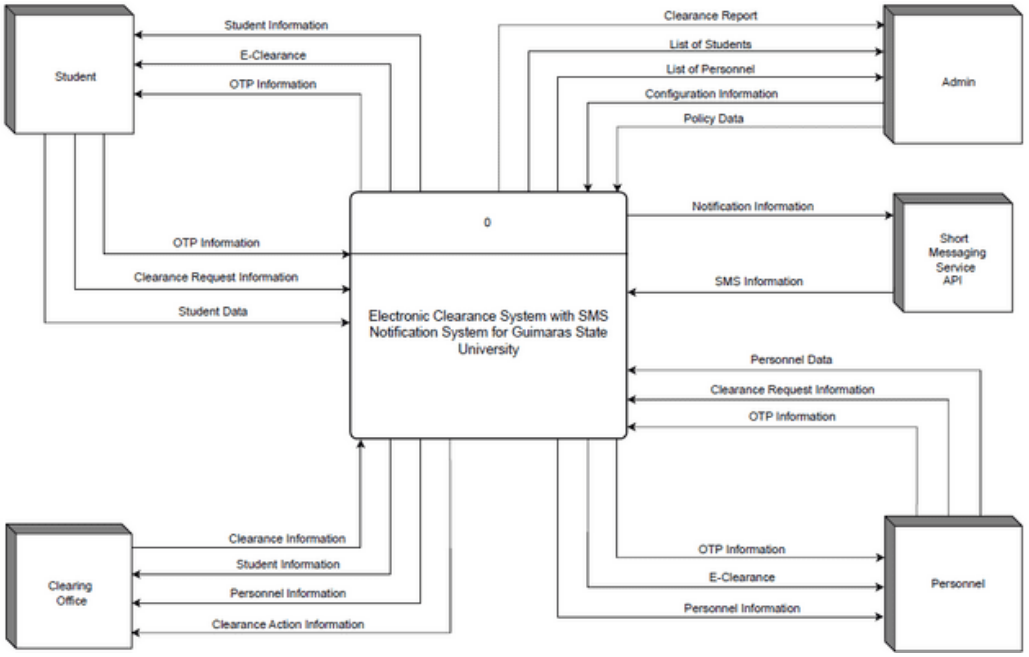


Figure 3. The Data Flow Diagram of the System (Context)

Figure 3 shows the context diagram and was illustrated to define and clarify the boundaries of the software system. It identified the flows of information between the system and external entities. The entire software system was shown as a single process where the study consists of flow of data[31] that includes significant entities that are directly involved in using the platform such as personnel, admin, student, clearing offices and the SMS Application Programming Interface (API)[32] that is used to bridge allowing the system to communicate with another application[33], in this case the short messaging service.

System flowchart was the graphical representation of the flow of data in the system and represented the work process of the system. Various symbols were used in the flowchart to designate specific actions. Figure 4 presents the flow of system through flowchart whereas, each step functions as planned based on the requirements identified in Planning/Requirements phase as shown in Figure 2.

The system commenced in the Start System and Actual system treat it as Landing page as shown in Figure 6 then proceed to the Login as shown in Figure 7.a to verify the user through initiation of Generating OTP and proceed to 7.b for cross-checking where, One-Time Password (OTP) [34] is the key to access the system and process the clearance, in the case of the students and take action to clearances in the case of the Clearing office.

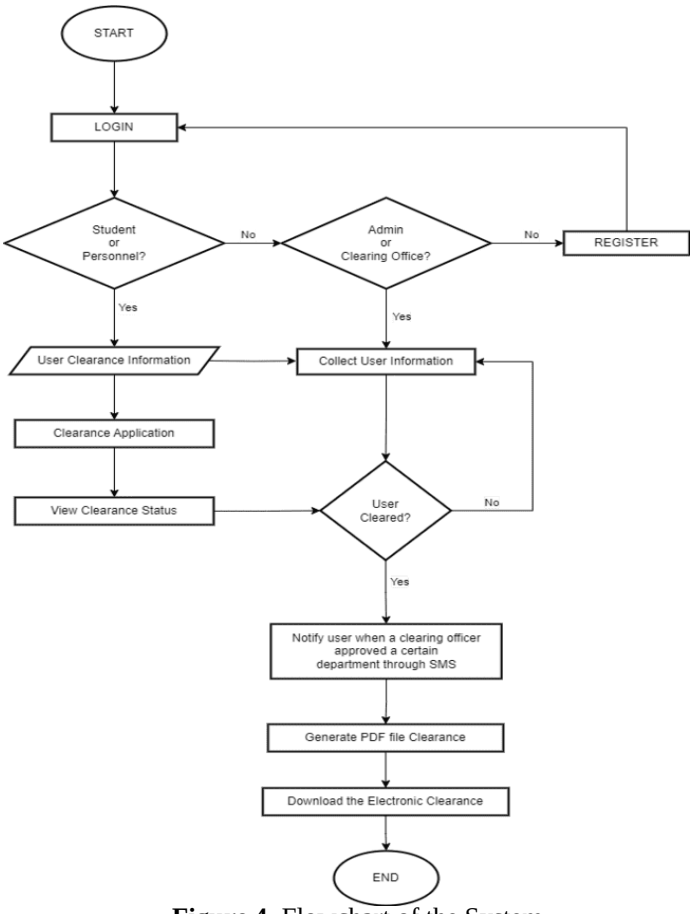


Figure 4. Flowchart of the System

Figure 4 illustrates the flow chart of the system, starting with login. Depending on whether the user is student/personnel or an admin/clearing office, it guides the user through inputting clearance information, applying for clearance, and checking clearance status. If the user is an admin or clearing office, it collects information, checks clearance status, notifies via SMS upon approval, generates a PDF for e-clearance, and ends the process. If no account is detected, the system prompts the user to register.

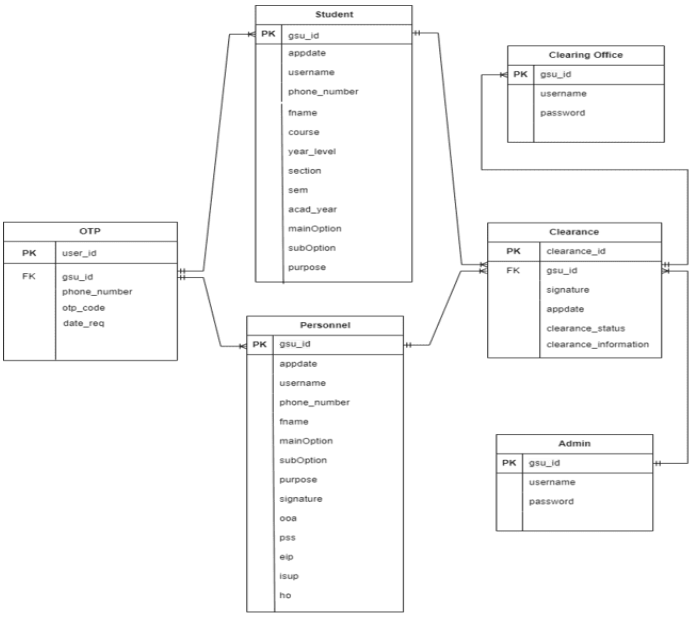


Figure 5. Entity Relationship Diagram of the System

All flowing data from entity to the system containing modules or processes shown in Figure 3 are programmatically validated, cleansed and processed in accordance with the system flowchart in Figure 4, where these processed data are stored in the database structured and normalized in the database system arranged logically as shown in Figure 5 as entity relationship diagram. Each entity was identified based on the DFD Context Diagram to ensure data were normalized and were adaptive to data migration, flexibility in system upgrade and other necessary functions that dealt with database management activity.

The Entity Relationship Diagram (ERD) of the System shown in Figure 5, provide a visual representation of how different entities within the system are related to each other. It shows relationships between entities such as users, clearance applications, departments, and clearance statuses, illustrating how data is structured and interconnected within the system. This diagram helps in understanding the data model and relationships that govern the e-clearance system's functionality and data flow.

4.2. Developed User Interfaces

Figure 6 presents the prototype of the User Interface of the System, offering a visual representation of how users interact with the system. It includes elements like navigation menus, input fields for entering clearance information, options for checking clearance status, and features for downloading e-clearance documents. This interface design aims to provide users with a user-friendly experience while navigating through various functionalities related to clearance processes within the system.

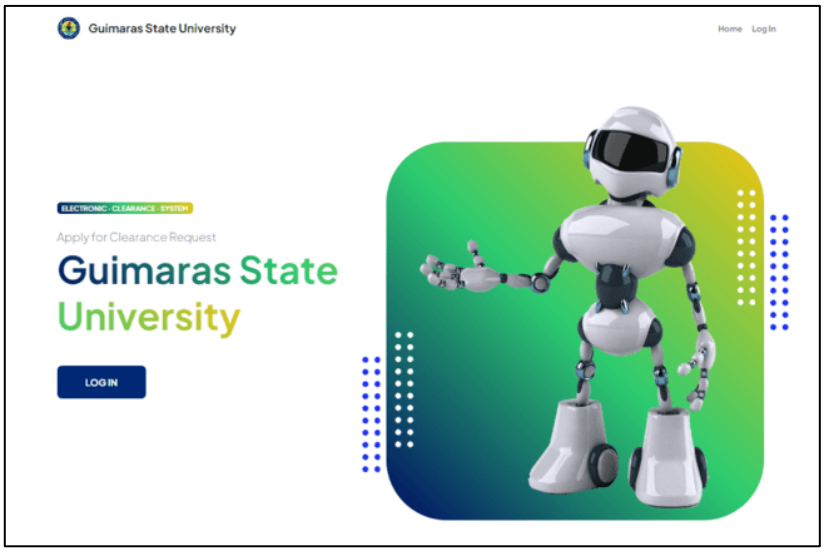


Figure 6. Landing Page Prototype of the Developed System

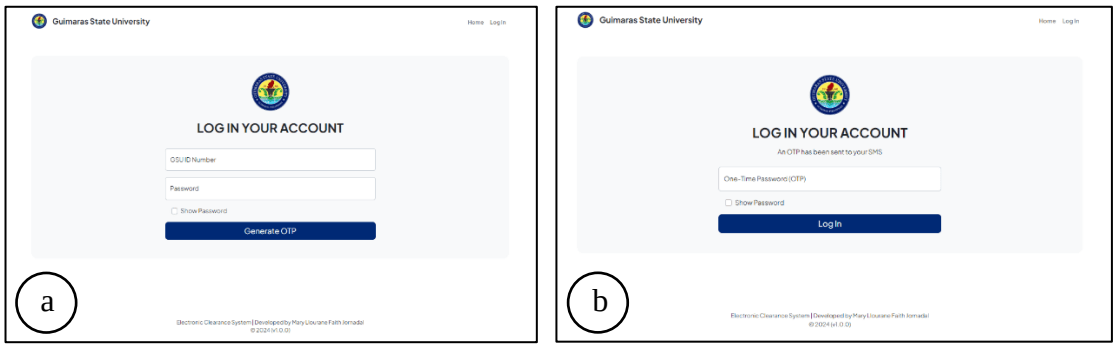


Figure 7. Login Prototype of the Developed System

Figure 7 depicts the prototype of the Login Interface, (a) showcasing the fields where users input credentials created by the admin. It also includes a step where users enter an (b) OTP code sent to their registered phone number for verification. This illustration highlights the initial login process for accessing the system, ensuring secure authentication and user verification.

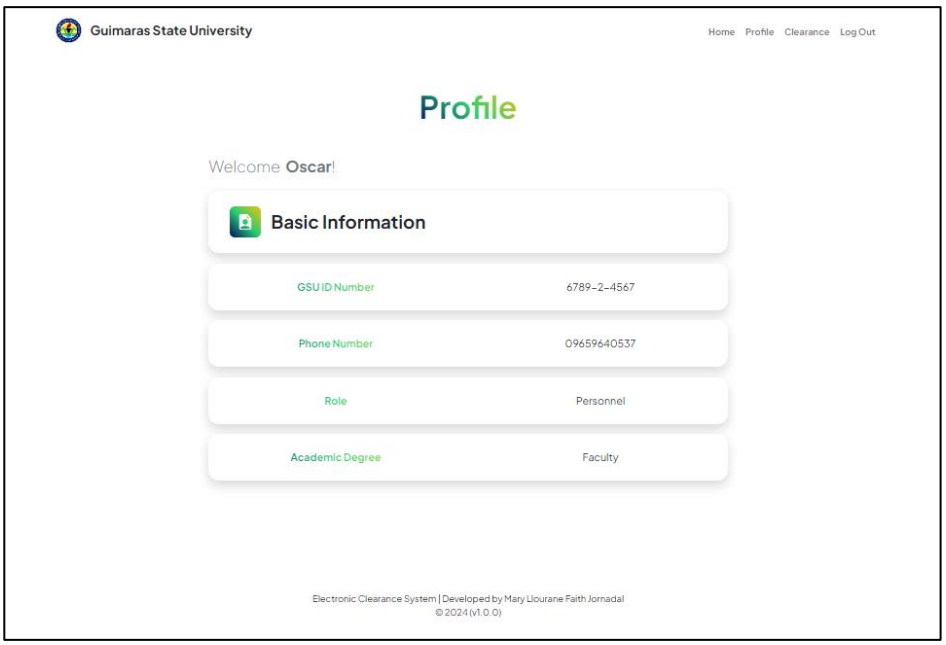


Figure 8. Screenshot of the User Clearance Information

Figure 8 depicts the prototype of the user to process the clearance like the GSU ID number, contact information and relevant information as input for the generation of the forms.

All requests for clearance are consolidated in a matrix format as shown in Figure 9 whereas, clearing offices has options to act and track the status of the application. Moreover, Figure 10 shows the sample System Generated Student's Clearance with Control Number CLR2406120261.

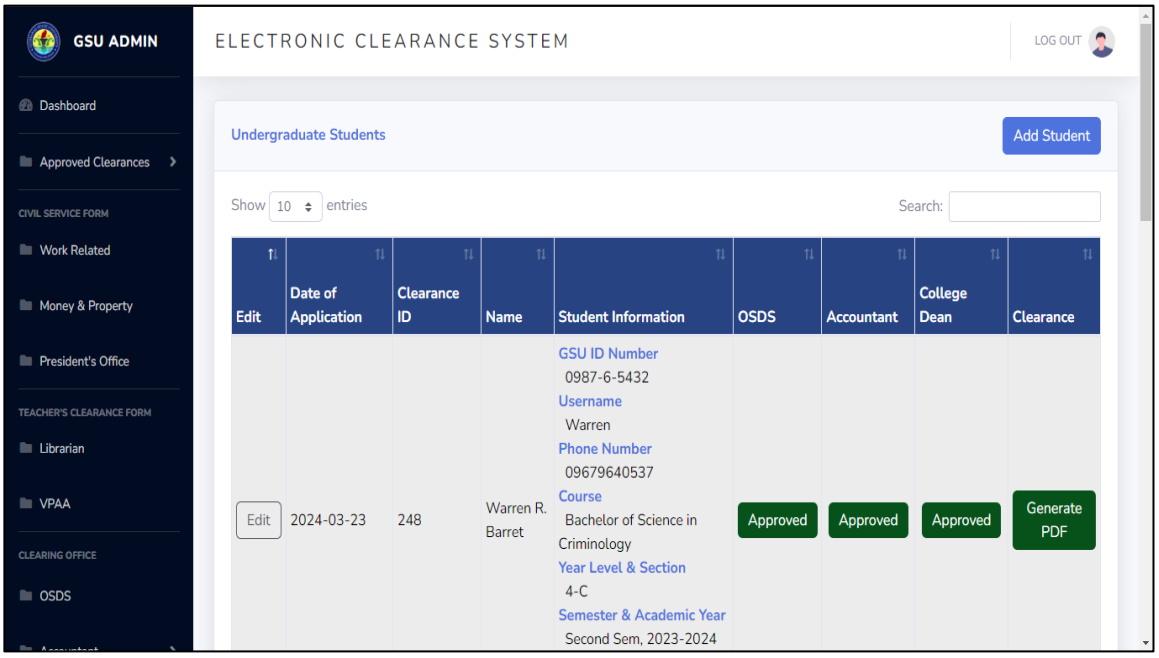
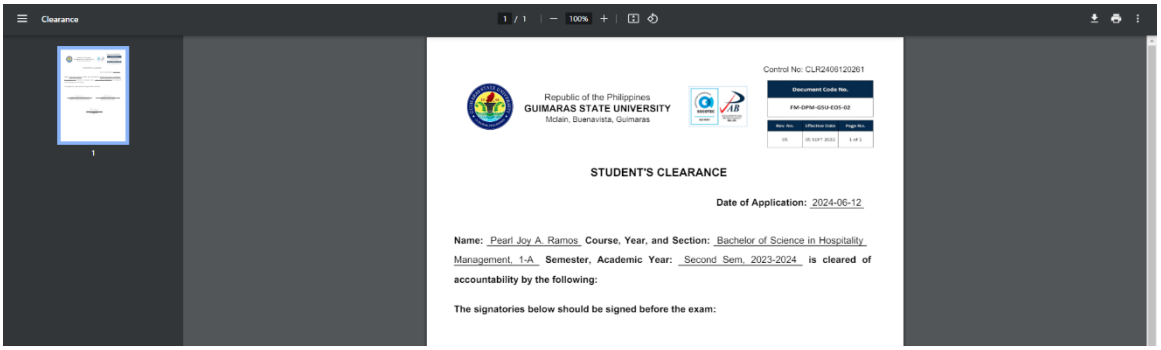


Figure 9. Screenshot of the Clearing Office



5. Conclusion

The study, Electronic Clearance System with SMS Notification for Guimaras State University was designed to eliminate long queues of students/personnel processing the clearance. The system provides effortless processing of clearance to the users. Using the system also consumes shorter time than using the traditional way of signing our clearance. Therefore, we conclude that the designed system was secure convenient and ready to use ensuring facile, swift and precise service. And by embracing this system, the university can position itself at the forefront of administrative innovation, ultimately contributing to its mission of providing quality education and services to its community. The success of implementing any system depends on the effectiveness of the recommendations provided. These recommendations are intended for future researchers who would like to implement and study our system with improvements: SMTP, Qr Code and ISO 25010:2015. [36]

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