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Development of GSO Item Borrowing and Inventory Management System

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Abstract: The General Services Office (GSO) of Tagoloan currently relies on paper-based processes for item borrowing, often resulting in delays, lost forms, and workflows. This project aimed to create a web-based system to streamline item requests, approvals, and inventory tracking for both GSO staff and local users. Using the Modified Waterfall Model, the development followed stages, requirements gathering, system design, implementation, and testing. Technologies used include PHP (Laravel), MySQL, HTML, CSS, and JavaScript. The system enables digital submission of borrowing forms, real-time inventory updates, approval routing, and status notifications. Users can submit and track requests online, while staff can manage records and generate reports. Many local government unit still uses paper-based forms, that includes the General Services Office (GSO) of Tagoloan, Misamis Oriental. Wherein it often results in having delays, lost forms in borrowing item process. This project is trying to solve this by creating web-based system to simplify item requests, approvals, and inventory tracking for both GSO staff and local borrowers. During evaluation, the system showed improvements in processing time and data accuracy. Functional testing showed that the system met the specified requirements for recording borrowing requests, updating inventory, and generating reports. The System Usability Scale (SUS) results, however, indicated only marginal usability, and the client expressed that the current design did not fully match their preferred forms and workflows. These findings suggest that, while the system is technically functional, further refinement of the interface, simplification of processes, and closer alignment with the client's existing practices are needed before full adoption.

Keywords: *Item Borrowing, Inventory System, LGU Digitalization, Laravel, Web-Based Tool, Usability Evaluation, Modified Waterfall Model.*

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I. INTRODUCTION

Technology has become a key driver of modernization in government operations, allowing institutions to streamline workflows, enhanced transparency, and reduce reliance on paper-based documentation (World Bank, 2021; United Nations, 2020). Global and national digital governance initiatives highlight the importance of adopting information systems to improve service delivery, minimize administrative delays, and ensure accurate record-keeping (World Bank, 2021; DICT, 2023). In the Philippines, the Department of Information and Communications Technology (DICT) actively promotes e-government systems to support more efficient and citizen-centered public services, particularly at the level of local government units (DICT, 2023).

Despite these developments, the General Services Office (GSO) of the Local Government Unit (LGU) of Tagoloan, Misamis Oriental continued to manage item borrowing through manual, paper-based procedures (Tagoloan LGU Report, 2022). Borrowers who need government-owned equipment such as chairs, tables, tents, and other items for community or barangay activities must personally visit the GSO, fill out printed forms, and wait while staff manually check availability in logbooks (Tagoloan LGU Report, 2022). This traditional practice consumed time, depended heavily on the physical presence of both staff and borrowers, and makes the process vulnerable to misplaced forms and incomplete documentation (UNDP, 2020; Asian Development Bank, 2022

These operational challenges reveal the limitations of the current system and their impact on both staff and residents. Manual verification of records created bottlenecks, increases the risk of human error, and makes it difficult to monitor borrowed items when multiple requests occur at the same time (UNDP, 2020; ADB, 2022). Borrowers may experience delays or uncertainty about the status of their requests, while GSO personnel often need to repeatedly check logbooks and paper files, leading to redundant work and

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inefficient coordination (World Bank, 2021; Tagoloan LGU Report, 2022). As community activities and demand for government resources grow, these issues further hinder the GSO's ability to provide timely, organized, and transparent service.

To address these gaps, a web-based Item Borrowing and Inventory Management System is proposed as a practical and scalable solution for the Tagoloan GSO. The system will digitize key steps in the borrowing process, including request submission, availability checking, approval or disapproval of requests, item assignment, dispatch, and return monitoring (ADB, 2022; DICT, 2023). By centralizing data in a digital platform, the system can provide real-time visibility of item availability, reduce reliance on manual logbooks, and minimize the likelihood of double bookings or overlooked requests. This digital approach is expected to lessen paperwork, shorten processing time, and improve communication between borrowers and GSO staff (World Bank, 2021; UNDP, 2020).

The development of this system is anchored on core information technology principles such as structured database management, secure handling of user information, and automated workflow management (NIST, 2020; DICT, 2023). Although it will initially operate within a local server environment, the system design considered compliance with the Data Privacy Act of 2012 to ensure that personal and transaction data are handled ethically and securely (National Privacy Commission, 2012). By transitioning from paper-heavy procedures to an organized, web-based platform, the Tagoloan GSO can enhance efficiency, accuracy, and accountability in managing government-owned equipment, contributing to a more responsive and modern local government administration (World Bank, 2021; ADB, 2022).

The purpose of this project is to develop a GSO Item Borrowing and Inventory Management System for the Local Government Unit of Tagoloan, Misamis Oriental, to improve how government-owned equipment is requested and managed by the General Services Office (GSO) (Tagoloan LGU Report, 2022). At present, the GSO uses a paper-based process where borrowers personally visit the office, fill out printed forms, and wait for staff to manually check item availability in logbooks, which often leads to delays, misplaced documents, and difficulty in monitoring items over time (Tagoloan LGU Report, 2022; UNDP, 2020). By introducing a computerized system, the project aims to offer a more organized, timely, and accessible way of handling item borrowing transactions for both staff and residents (World Bank, 2021; DICT, 2023).

Through this project, the item borrowing process will be transferred to a simple, user-friendly digital platform where requests can be submitted and processed more systematically (DICT, 2023). Borrowers will be able to enter their personal details, specify the items they need, and indicate the date and purpose of use through an online form instead of handwritten documents (Tagoloan LGU Report, 2022). GSO personnel, in turn, will review these requests, verify item availability, and decided whether to approve or deny them using the same system, reducing the need to repeatedly check physical records (UNDP, 2020; ADB, 2022). The system will also record agreed return dates to help remind borrowers and support the timely return of items (ADB, 2022).

In addition to processing requests, the system is intended to help the GSO maintain a clearer and more accurate view of its equipment inventory (World Bank, 2021). It will provide organized records showing which items are available, which are currently borrowed, and which have already been returned, helping to avoid double booking and confusion during busy periods such as barangay activities or community events (Tagoloan LGU Report, 2022; ADB, 2022). Each borrowing transaction will be documented with details such as the borrower's name, date borrowed, date of return, and item condition, which supports greater accountability and easier tracking of government property (UNDP, 2020; National Privacy Commission, 2012).

The system also aims to improve communication between the GSO and borrowers by providing clearer information about the status of each request (UNDP, 2020). Instead of returning to the office multiple times, borrowers can be informed if their request is pending, approved, or denied through system-generated updates, reducing uncertainty and unnecessary follow-ups (DICT, 2023). For GSO personnel, the system can produce summary reports on borrowing activities and commonly requested items, which can be used to support planning, identify shortages, and guide decisions on resource allocation and maintenance (World Bank, 2021; ADB, 2022).

Furthermore, the development of the GSO Item Borrowing and Inventory Management System is intended to provide a practical and timely solution to problems caused by manual, paper-based procedures in the office (Tagoloan LGU Report, 2022). By offering a more efficient, accurate, and accountable way of handling requests and tracking inventory, the system is expected to lessen administrative burden, reduce errors, and improve the service experience of residents who rely on government equipment for community and barangay activities (World Bank, 2021; UNDP, 2020; DICT, 2023).

II. REVIEW OF RELATED WORK

Digital transformation has become central to improving administrative service delivery in both public and private institutions. Modern information systems often integrate web-based platforms, cloud-hosted databases, automated workflows, and real-time monitoring to support efficiency and accountability (Mahula et al., 2022). In developing the GSO Item Borrowing and Inventory Management System, widely adopted technologies are used due to their reliability, security, and suitability for structured information processing.

The system follows a standard web-based architecture, where PHP (Laravel framework) manages backend logic, user authentication, and routing. Front-end technologies such as HTML, CSS, and JavaScript provide an accessible and

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responsive user interface for borrowers and GSO personnel. MySQL serves as the system's main data repository, ensuring structured storage of user accounts, item records, borrowing logs, and approval data. These technologies are commonly used in inventory and reservation systems because they support modular development, maintainability, and secure data handling (Espenida & Formanes, 2025).

Real-time tracking is an essential component of inventory systems. Studies emphasize that automated inventory updates help prevent double bookings, reduce manual errors, and support timely decision-making (Badnjevic et al., 2025). Therefore, the proposed system includes dynamic item availability monitoring, status notifications for pending and approved requests, and history logs for accurate audit trails. Following the requirements of the Philippine Data Privacy Act, the system integrates authentication safeguards and role-based access control to maintain user confidentiality and protect sensitive information.

Existing literature on borrowing, reservation, notification, and inventory systems demonstrated a consistent shift toward automation to improve efficiency, accuracy, and accountability in various institutional settings. Early innovations in automated lending systems, such as the RFID-based library borrowing model developed by Sunmin (2020), highlighted the benefits of fast identification, reduced manual encoding, and real-time inventory accuracy, solutions that directly address the challenges commonly found in manual processes. These advantages were further echoed in the work of German et al. (2021), whose Quickip platform digitized laboratory borrowing workflows through online forms, multi-layer approval routing, and system-generated borrowing records. Their findings emphasized how digital platforms reduce paperwork, shorten processing times, and minimize errors, demonstrating principles essential to an LGU's General Services Office where accountability and timely service matter significantly.

Similarly, the integration of QR and RFID technologies in institutional equipment monitoring, as examined by Dizon and Balagtas (2023), reinforced the role of automated identification in preventing item losses and ensuring accurate tracking of borrowed property. While their implementation focused on academic environments, the underlying logic of centralizing borrowing records and providing traceable transaction histories remains highly applicable to government contexts, where asset management requires strict oversight.

Beyond borrowing-specific systems, reservation and scheduling studies also showcase approaches that parallel the needs of an LGU GSO. For instance, Wang and Mutang (2024) designed an online classroom reservation system that prevented schedule conflicts and displayed real-time availability, demonstrating how automated conflict detection improves the allocation of shared resources. Complementing this perspective, Abando et al. (2023) developed a reservation platform enhanced with QR verification and SMS updates, showing how integrated notifications improve communication, streamline verification, and reduce user uncertainty, functionalities that are equally valuable in keeping borrowers informed about the status of government-issued items.

The importance of communication technologies in automated systems is further supported by Osman et al. (2022), who implemented an SMS-enabled vehicle rental platform that delivered real-time booking confirmations. Their findings, alongside those of Reyes et al. (2022) in event management systems, highlight how automated alerts reduce miscommunication and ensure timely updates for end users. These insights corresponded with the need for transparency in GSO operations, where borrowers must remain informed about approval results and return schedules. Furthermore, studies on workflow digitization, such as the office automation work of Capili and Tolentino (2023), demonstrated that structured routing of digital forms significantly improves interdepartmental coordination, an operational requirement in municipal offices where requests need proper documentation and approval tracking.

Inventory-focused studies also contribute important considerations. Badnjevic et al. (2025) underscored the importance of digital tools in maintaining equipment traceability and preventing misplacement, while Espenida and Formanes (2025) showed that school-based e-inventory systems improved record accuracy and administrative reporting through centralized digital logs. Although conducted in educational environments, these systems highlight the general effectiveness of automated inventory platforms in environments that rely on multiple users and high-volume transactions. At the government level, Mahula et al. (2022) provided evidence that digital transformation significantly enhanced efficiency, transparency, and citizen trust. Their findings emphasize that modernization efforts in public offices must involve reliable systems that reduce manual workload and strengthen administrative accountability.

Finally, borrowing-related innovations in specialized fields such as healthcare also provide relevant lessons. The study by Boonkleang et al. (2023) on a digital medical records borrowing system showed that improved workflow tracing, borrower identification, and return monitoring reduced the likelihood of misplaced documents and strengthened accountability. Although medical records differ from government-issued equipment, the principles of traceability, responsibility, and centralized monitoring applied strongly to the GSO's context.

Taken together, these studies reveal common themes across different sectors: automation reduces manual errors, real-time tracking avoided conflicts and resource shortages, structured workflows improve coordination, and notification systems strengthen communication. However, a clear research gap emerged, none of the reviewed systems directly address the operational needs of a Local Government Unit's General Services Office. Existing systems tend to focus on academic, corporate, or healthcare settings and do not incorporate the specific approval flows, administrative protocols, and asset-accountability requirements of an LGU.

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This gap supports the relevance and necessity of the proposed GSO Item Borrowing and Inventory Management System, which adapted proven concepts from prior works and applies them to a government context where transparency, traceability, and service efficiency are essential.

➢ *Synthesis*

The reviewed literature consistently demonstrated that automation in borrowing, reservation, notification, and inventory systems greatly reduces human error, improves operational efficiency, and enhanced accountability across various institutional settings. Whether through RFID- and QR-enabled borrowing systems, online reservation platforms, workflow automation tools, or inventory management applications, the studies collectively highlight the importance of real-time tracking, structured approval processes, centralized digital records, and timely user notifications. Across library systems, laboratory platforms, equipment monitoring solutions, and healthcare record–borrowing systems, the transition from manual to digital processes resulted in reduced delays, fewer lost items, more accurate documentation, and clearer communication between users and administrators. Despite differences in context, these systems share the foundational principle that digitalization greatly strengthens transparency and operational control.

Most importantly, the synthesis of related works underscores that the GSO system is not merely an adaptation of existing solutions but a targeted response to an unmet public-sector need. By integrating best practices from academic, healthcare, and organizational systems and contextualizing them for government operations, the project addresses a critical gap in LGU service delivery. The implication is that the proposed system is positioned not only to automate borrowing transactions but also to contribute to broader government digital transformation efforts, improving efficiency, strengthening public trust, and supporting transparent management of government-owned property. This establishes the system as both a technically sound and socially relevant innovation for the municipality of Tagoloan.

III. METHODS

The researchers used a Modified Waterfall Model for developing the GSO Item Borrowing and Inventory Management System. Each phase, requirements gathering and analysis, system design, implementation, integration and testing, and evaluation, followed a structured sequence (actiTIME, n.d., STEP Media Software, 2022). Inspired by Comandao et al. (2021), the model will include evaluation checkpoints after each stage to review progress, gather stakeholder feedback, and applied refinements. This ensured the system aligns with user needs while maintaining quality and minimizing rework.

➢ *Research Gathering and Analysis:*

The researchers conducted structured interviews with General Services Office (GSO) personnel using standardized questions to ensure consistent and reliable data collection. This approach enabled the identification of key issues in the existing manual process, including miscommunication, delayed approvals, incomplete records, and challenges in tracking borrowed items. The interviews provided clear functional requirements (e.g., online request submission, inventory monitoring, and real-time notifications) and non-functional requirements (e.g., accessibility, performance, and data security). The findings informed the development of the Software Requirements Specification (SRS), defining system inputs, processes, outputs, and user roles to ensure alignment with GSO workflows and support a stable system design.

➢ *System Design:*

The system design phase transforms the gathered requirements into a technical blueprint for system development. User interactions, workflows, and data structures were defined using Figma mockups and stakeholder feedback to ensure usability. Use case diagrams, Data Flow Diagrams (DFDs), and Entity-Relationship Diagrams (ERDs) were used to model system behavior and data relationships. The system follows a three-tier architecture, with Laravel as the backend framework and MySQL for secure data management. The main output of this phase is the System Design Specification, which guides system implementation.

➢ *Implementation:*

The implementation phase converted the system design into a functional web-based application using a three-tier architecture. The presentation layer was developed with HTML, CSS, and JavaScript, the application layer used PHP with the Laravel framework, and the data layer was managed using MySQL. The system supports user authentication, online borrowing requests, approval workflows, real-time inventory updates, notifications, and reporting features. It was deployed on a cloud-based server to allow browser-based access and support future system enhancements.

➢ *Integration and Testing:*

The integration and testing phase ensured the reliability and correctness of the system by combining all modules into a single, cohesive application. Integration testing verified proper interaction among features such as authentication, borrowing, inventory tracking, and reporting. Functional Testing was conducted using structured test cases to confirm that all features met system requirements and behaved as expected. In addition, a System Usability Scale (SUS) evaluation was performed to assess ease of use and user satisfaction. All identified issues and results were documented in a test report to support system quality and readiness for use.

➢ *Evaluation:*

The system was evaluated based on functionality, usability, accuracy, efficiency, reliability, security, and user satisfaction. Functional testing ensured all features worked as intended, while usability and satisfaction were assessed through surveys and user feedback. Accuracy and efficiency were measured using simulated transactions and task time comparisons, and reliability was tested through repeated system use. Security evaluation focused on authentication and access control. The results confirmed that the system met technical standards and user needs.

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IV. RESULTS AND DISCUSSIONS

This chapter presents the results from the early stages of the Modified Waterfall Model used in developing the GSO Item Borrowing and Inventory Management System. It highlights the outputs created and how they help solve problems in the manual borrowing process. These results show that the system was designed based on user needs and supports clear, accurate, and easy system development.

➢ *Research Gathering and Analysis:*

To gather the needed system requirements, the researchers first prepared and submitted a formal letter to the General Services Office (GSO) requesting permission to conduct interviews and access sample records. After approval, structured interviews were conducted with selected GSO personnel to collect detailed information about the current manual borrowing process. Paper-based forms used by the GSO were also reviewed to better understand existing procedures and identify common problems. The gathered data revealed issues such as misplaced documents, delayed approvals, lack of real-time inventory updates, and difficulty in tracking borrowed items. Based on the interview responses and document review, the researchers identified the functional and non-functional requirements of the proposed system. A workflow was then developed to illustrate the borrowing process, showing how requests are submitted, validated, approved, and recorded. This workflow helped determine the essential system features needed to support accurate tracking, faster approvals, and improved record management.

➢ *System Design:*

The system design phase transformed the analyzed requirements into visual models that served as guides for system development. Use case diagrams, Data Flow Diagrams (DFDs), and Entity-Relationship Diagrams (ERDs) clearly defined user roles, system processes, and database structure, ensuring that the system design matched the actual workflow of the GSO and supported efficient item borrowing and inventory management. Below are the Use Case diagram:

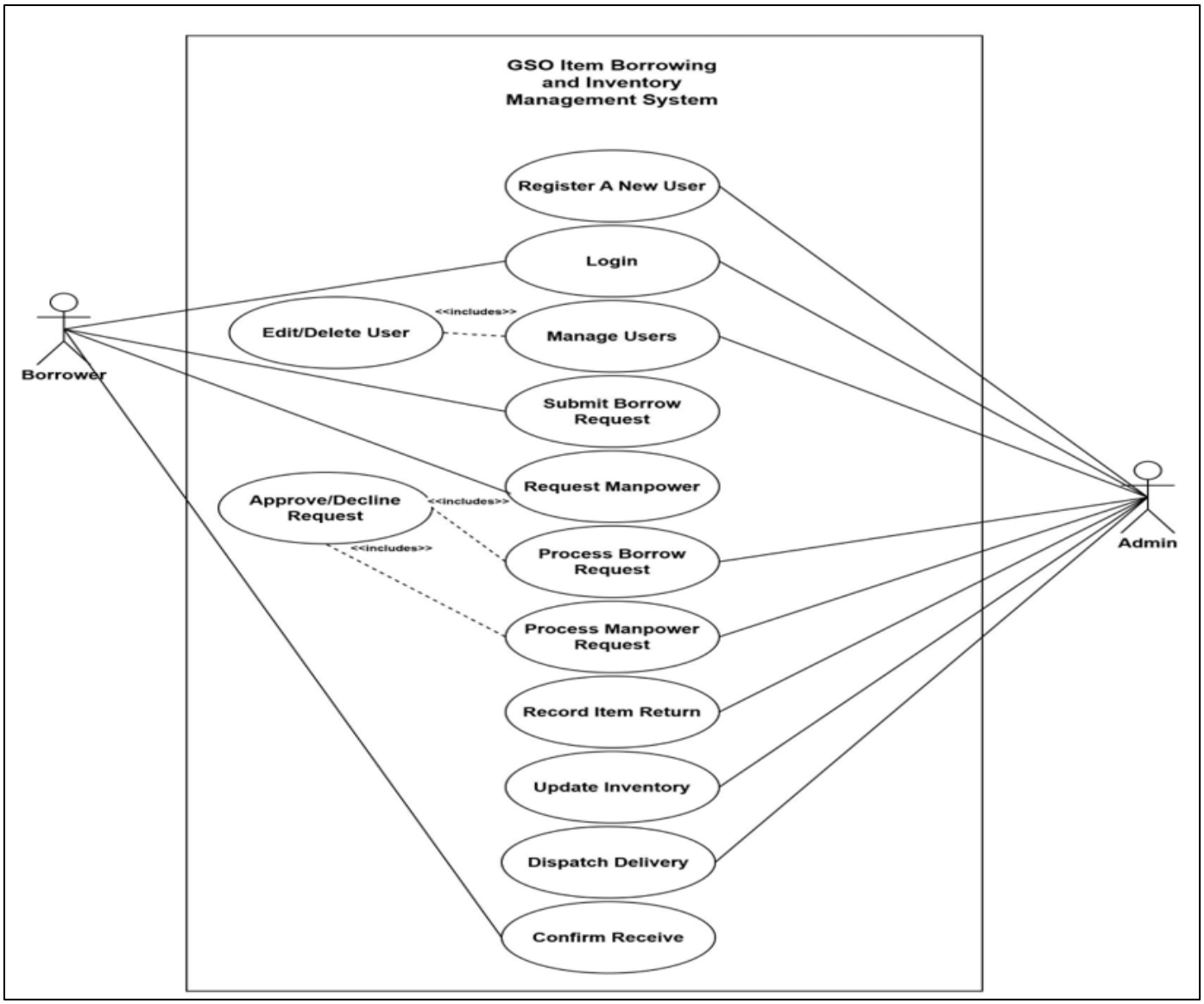

Fig 1 Use Case for IBIMS.

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Figure 1 presents the interaction between the Borrower and the Admin within the GSO Item Borrowing and Inventory Management System. Both roles interact with the system, but their permissions differ, with the Admin having full control and oversight.

The Admin manages user accounts, reviews and processes item and manpower requests, approves or declines requests, dispatches items or manpower, records item returns, and updates inventory records. The Borrower's primary functions include logging in, submitting item or manpower requests, confirming receipt of items, and returning borrowed items. This role-based interaction ensures proper validation, accountability, and efficient management of borrowing transaction.

Implementation: In this stage of developing the GSO Item Borrowing and Inventory Management System, the researchers used various software tools following a three-tier architecture to build the web-based system. This phase focused on implementing the system features and user interfaces based on the approved design. Below is the examples of High-Fidelity (Hi-Fi) of each user interface along with the login page.

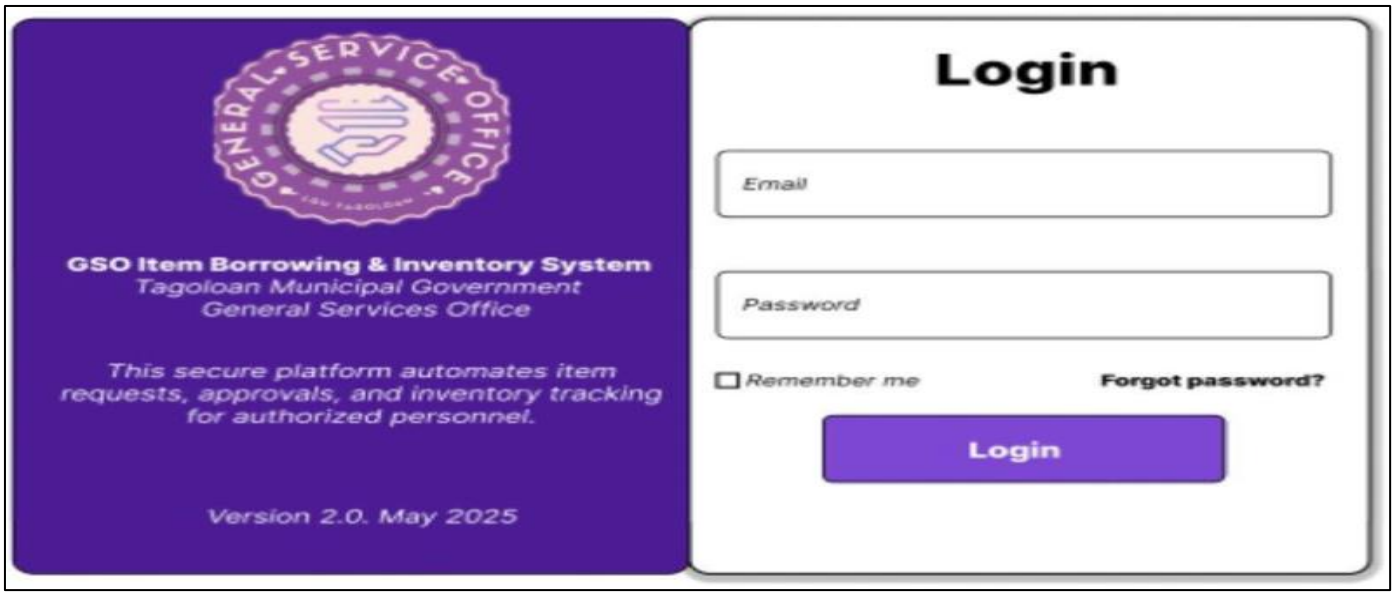

Fig 2 Login Page

Figure 2 displays the login page of the GSO Item Borrowing and Inventory Management System. Users enter their email and password to access the system and may reset their password using the "Forgot password" option. After successful login, users are redirected to the dashboard where system features are available based on their assigned role.

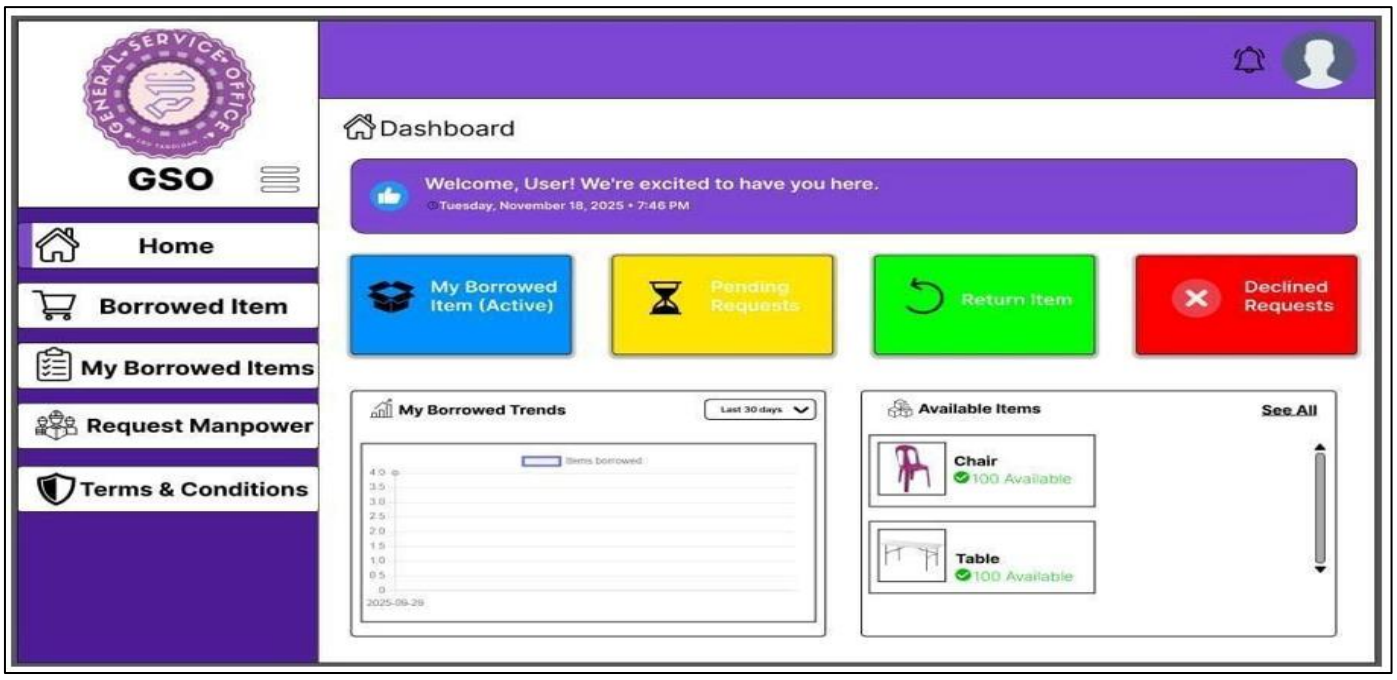

Fig 3 Borrower's Interface

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Figure 3 displays the Dashboard of borrower's interface of the GSO Item Borrowing and Inventory Management System. The dashboard provides borrowers with an overview of key information, including active borrowed items, pending requests, returns, and declined requests. It also includes visual summaries of borrowing activity and item availability to support quick navigation and efficient task management.

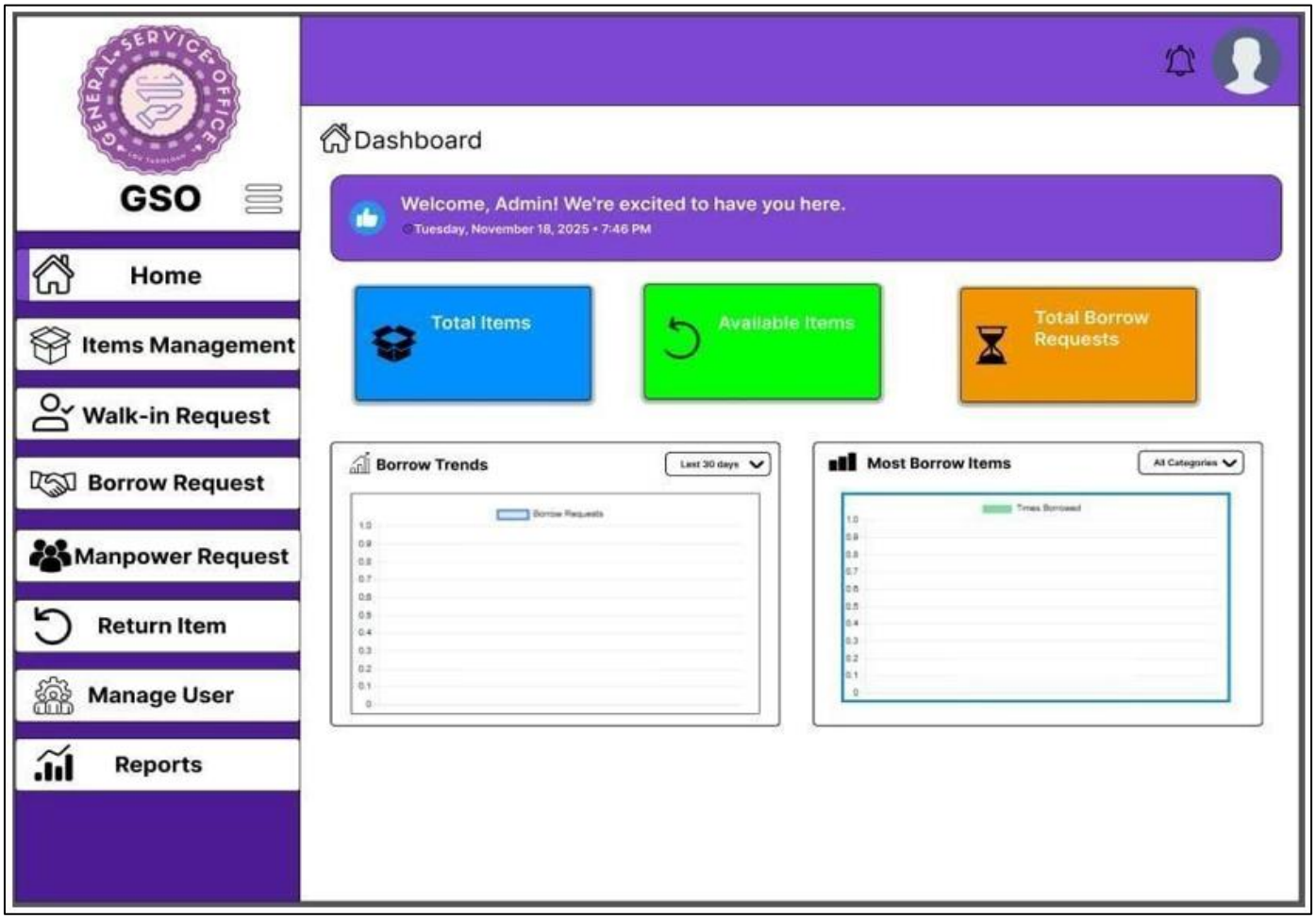

Fig 4 Admin's Interface

Figure 4 displays the Admin Dashboard of the Development of GSO Item Borrowing and Inventory Management System. The dashboard provides administrators with an overview of inventory status.

- Testing: After system testing, the researchers evaluated user experience using the System Usability Scale (SUS). While functional testing confirmed proper operation of features, SUS was used to measure ease of use, comfort, and user satisfaction. The next section presents the SUS results based on participant responses.
- Evaluation: The System Usability Scale (SUS) was conducted at GSO office, and where actual users interact with the system. Below is the System Usability Scale Result, that was participated by five users, namely four randomly selected users, and one client representative.

And borrowing activities through summary cards and visual charts. This interface is designed to support efficient monitoring and management of system operations.

Table 1 System Usability Scale (SUS) Raw

		Participants				
Question #	**Questions**	**P1**	**P2**	**P3**	**P4**	**P5**
1	I think that I would like to use this system frequently.	4	5	4	4	3
2	I found the system unnecessarily complex.	4	5	4	4	4
3	I thought the system was easy to use.	5	5	4	4	3
4	I think that I would need the support of a technical person to be able to use this system.	4	4	4	4	5
5	I found the various functions in this system were well integrated.	5	5	4	4	4
6	I thought there was too much inconsistency in this system.	4	3	4	4	4

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7	I would imagine that most people would learn to use this system very quickly.	5	3	4	4	3
8	I found the system very cumbersome to use.	5	3	4	3	4
9	I felt very confident using the system.	4	5	4	3	3
10	I needed to learn a lot of things before I could get going with this system.	4	3	4	4	5

Table 1 presents the SUS evaluation that involved five participants who directly used the GSO Item Borrowing and Inventory Management System. Four were regular users and one was a client representative.

Table 1 presents their raw responses, reflecting impressions of the system's ease of use, complexity, functionality, and overall usability, which serve as the basis for computing the SUS score.

Table 2 System Usability Scale (SUS) Overall Result

Participants						
Question #	**Questions**	**P1**	**P2**	**P3**	**P4**	**P5**
1	I think that I would like to use this system frequently.	3	4	3	3	2
2	I found the system unnecessarily complex.	1	0	1	1	1
3	I thought the system was easy to use.	4	4	3	3	2
4	I think that I would need the support of a technical person to be able to use this system.	1	1	1	1	0
5	I found the various functions in this system were well integrated.	4	4	3	3	3
6	I thought there was too much inconsistency in this system.	1	2	1	1	1
7	I would imagine that most people would learn to use this system very quickly.	4	2	3	3	2
8	I found the system very cumbersome to use.	0	2	1	2	1
9	I felt very confident using the system.	3	4	3	2	2
10	I needed to learn a lot of things before I could get going with this system.	1	2	1	1	0
Participants Score:	22	25	20	20	14	
Total Score (PS * 2.5):	55.0	62.5	50.0	50.0	35.0	
Total SUS Score (TS/6):	252.5					
Average SUS Score:	50.5					

Table 2 shows the overall result of the System Usability Scale (SUS) based on the participants' raw responses. Odd-numbered questions were scored by subtracting 1 from the response, while even-numbered questions were scored by subtracting the response from 5.

The adjusted scores were added to obtain each participant's score and multiplied by 2.5 to compute the SUS score. The total SUS score of 252.5 was divided by five participants, resulting in an average SUS score of 50.5, which indicates a marginal usability level of the system.

V. CONCLUSION

The development of the GSO Item Borrowing and Inventory Management System successfully addressed the need for a more organized and reliable way of handling item borrowing and inventory records at the General Services Office. The system was able to support the complete borrowing process, from login and request submission to approval, item release, return, and report generation, helping reduce delays and errors caused by the previous paper-based method.

The System Usability Scale (SUS) evaluation resulted in an average score of 50.5, indicating that while the system is functional, its usability still needs improvement. Users were able to complete tasks, but some experienced difficulty during initial use, especially those with limited technical experience. Feedback showed that clearer navigation, simpler labels, and better on-screen guidance would help improve ease of use.

Overall, the system meets its technical goals and serves as a useful replacement for the manual process. With further interface refinement and user training, the system has strong potential to become an effective and dependable tool for the GSO and its borrowers in future use.

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