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ENSURE: A Seamless Endowment Scholarship Management System

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ABSTRACT

Scholarships are important for supporting students' academic journeys; however, many institutions still depend on traditional manual processes, which are time-consuming, error-prone, and lack transparency, leading to inefficiencies in scholarship management and potentially hindering students' access to financial aid. Therefore, this study proposes to develop the ENSURE system, a holistic, web-based solution designed to digitise the endowment scholarship. An agile methodology will be employed to develop ENSURE, which consists of six phases: starting with planning, design, development, testing, release, and feedback. The system integrates eleven key modules: authentication, parameter setup, advertisement, instruction, student applications, shortlists, interviews, offers, scholarships, payments and reporting. The Perceive Ease of Use (PEOU) is used to measure the usability and comprehension of ENSURE. The results demonstrated a score 4.79 out of 5 based on the mean score. The system enhances the overall scholarship application process and serves as a model for other institutions that aim to modernise their scholarship management practices.

1. INTRODUCTION

An endowment fund consists of money or other financial assets donated to a higher education institute. The endowment is intended to be invested to ensure stable income for the higher education institute (Md Kamdari et al., 2026). The endowment should not rely on donations or operating funds from the higher education institute. Typically, an endowment fund must follow established investment and asset allocation policies and guidelines to generate returns without high risk (Hansmann, 1990; Lerner et al., 2008). The Unit Endowmen at Universiti Teknologi MARA was officially founded in September 2019, grounded in

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four principles: ensuring access to education and an optimal campus environment, enhancing research and academic excellence, fostering global mobility for a significant educational experience and crucially, reducing reliance on university master allocations. The Malaysian Education Blueprint (Higher Education) 2015-2025 endorses the fund, highlighting financial sustainability as the fifth strategic initiative among ten (Ministry of Higher Education, 2015). This plan seeks to guarantee the enduring financial viability of the higher education system. In line with this, the UniTP Purple Book: Enhancing University Income Generation, Endowment, and Waqf was developed, which serves as a relevant guide as a reference for managing university income generating activities (Ministry of Higher Education Malaysia, 2017). The revenues from this endowment fund will be allocated to four main purposes: providing endowment scholarships, supporting the global mobility fund, funding research and improving teaching and learning, which benefits all UiTM students across Malaysia at every academic level.

A systematic approach must be developed to allocate endowment scholarships to students, thereby facilitating a more expedient and efficient scholarship award process annually, given that UiTM encompasses 34 campuses, 24 faculties, and 7 academic centres nationwide, offering over 500 academic programmes across foundation, pre-diploma, diploma, bachelor's, master's, and doctoral levels and serving a total of more than 170,000 students. Following the manual scholarship award by the Unit Endowmen for the inaugural group in 2000, a decision was made to develop a web-based system to streamline the scholarship application procedure for annual implementation. This change is due to three primary issues highlighted with the manual method: inefficiency regarding time and process. The manual process necessitates considerable time for applicants to complete and submit the application form and the Unit Endowmen requires supplementary personnel to gather and verify the applications. Furthermore, there exists a potential for data loss and inaccuracies. Physical documents are susceptible to damage, loss, misplacement, or erroneous data entry into the computer. Third, the use of paper, ink, and mail or courier services may elevate expenses for applicants and be environmentally unsustainable.

Consequently, the Unit Endowmen submitted a proposal for the establishment of an endowment system to the Digital Department in early 2021. A pre-implementation meeting for the Endowment System Project occurred, during which the decision was made regarding whether to develop the endowment system independently within the MyStudent Portal or to manage all endowment-related administration entirely within the endowment system. The development of the endowment system took place independently, without any connection to the MyStudent Portal. The UiTM Endowment Scholarship Application System (UESA) is designed to administer UiTM endowment scholarships. The UESA system was subsequently renamed the Endowment Seamless and Unified Registry (ENSURE) system due to the expansion of its scope with additional modules. The Unit Endowmen, under the UiTM Vice-Chancellor's Office, serves as the process owner of ENSURE and the development starts in the middle of 2021 and continues until the end of 2022. Later, it was relocated to the treasurer's department within the Bahagian Kewangan Pelajar dan Endowmen (BKPE) as part of the UiTM organisational reorganisation in 2024.

The construction of the ENSURE system has three primary objectives: firstly, to create the system for the Unit Endowmen to manage UiTM endowment scholarships with more effectiveness and efficiency. Secondly, the workflow pertaining to endowment scholarships is conducted online using a web-based system, and thirdly, the Unit Endowmen may make more effective judgements informed by the data and information produced by the system. The ENSURE system will be developed internally using current resources. The ENSURE system can integrate with current and future systems, including the Student Information Management System (SIMS), Single Sign-On (SSO) for system access credentials, the finance portal for financial and payment data and the Human Resource Management System (HR2U) for staff information. Eleven project scopes have been identified: authentication module, parameter setup module, advertisement module, instruction module, student application module, shortlist module, interview module, offering module, scholarship module, payment module and reporting module.

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2. RELATED WORK

The study proposed by Khedekar et al. (2024) involves the development of an online platform called "Scholarship Seek", which is designed to help potential scholarship candidates access both government and private scholarships. It tackles the challenges of inefficient marketing and difficulty finding suitable scholarships by providing personalised lists tailored to users' criteria. The platform uses the Analytic Hierarchy Process (AHP) as a decision support system to aid scholarship providers in selecting suitable candidates. The combination of technologies comprising HTML, CSS, PHP, and MySQL ensures a user-friendly interface and effective data management. Orgianus et al. (2024) focus on improving the distribution of scholarships at Baitul Mal Unisba (BMU) by developing the management information system. It overcomes inefficiencies in administrative procedures caused by the lack of a comprehensive information system. The proposed system aims to improve the accuracy and efficiency of scholarship data management, supporting informed decision-making. The study emphasises the importance of user feedback for continuous improvement within the rapid application development process. Preliminary testing indicates that the prototype meets functional requirements, indicating its potential effectiveness in addressing existing issues. Paytaren et al. (2023) developed a project that aims to implement an online management system for educational assistance at Batangas State University ARASOF-Nasugbu to rectify the inefficiencies associated with conventional scholarship management methods. The study highlights significant obstacles encountered by scholars and scholarship administrators, including the management of scholarship applications and notifications.

A PHP, JavaScript, HTML, and CSS-based web platform streamlines the application process, improves user experience, and improves scholarship data administration. The testing phases ensure that the system meets all specifications and remains user-friendly. Al-Ayyubi & Maulana (2023) studied the creation of a web-based information system aimed at improving scholarship management by enabling rapid access to information and efficient dissemination of updates. It tackles the challenges posed by current manual processes and fragmented systems by emphasising speed, data protection, and user-friendly interfaces. The solution includes a central database, real-time notifications, and personalised updates that improve collaboration among stakeholders. The expected benefits include improved accessibility to scholarships, reduced administrative burdens, and increased transparency in the selection process, which fosters equitable educational prospects. Elwirehardja et al. (2022) presented a database design for scholarship recommender systems in Indonesia, addressing the absence of studies in this area. It employs Connolly and Begg's database design methodology to create a normalised Entity Relationship Diagram (ERD) and data dictionaries. The design aims to store various data types, encompassing educational history and achievements, in formats compatible with recommender systems. The proposed design aims to enhance accessibility to scholarship information for Indonesian students and serve as a reference for future research. Limitations encompass the lack of previously developed baseline designs for evaluation. Jibrin et al. (2016) examine the difficulties encountered by the Niger State Scholarship Board in managing a substantial number of scholarship applications resulting from their paper-based approach. The document presents an e-Scholarship System created utilising the Object-Oriented Analysis and Design approach, together with PHP, AJAX, JavaScript, HTML, and MySQL, facilitating online applications for students from Niger State across the nation. The system provides effective online application capabilities that save time and improve transparency by delivering timely notifications via SMS and email alerts; hence, it facilitates accessible scholarship processes.

The proposed study makes several major contributions. Firstly, it enhances operational efficiency and accuracy. The ENSURE system reduces manual processing times by digitising application submission, verification, and approval workflows. Automation minimises human error, prevents data loss, and ensures consistent and accurate data entry. The system also streamlines internal operations, reducing the need for additional manpower. Second, cost-effectiveness and sustainability. By eliminating paper forms, physical storage, mailing, and courier services, the ENSURE system significantly lowers administrative and

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applicant costs. The digital approach supports UiTM's sustainability goals by reducing its reliance on paper and ink, contributing to environmentally friendly practices. Third, the system offers data-driven decision support and facilitates system integration. The ENSURE system provides centralised, real-time data that enhances transparency and supports data-driven decision-making for scholarship allocation. The system allows for seamless connection with current systems such as the Student Information Management System (SIMS), Single Sign-On (SSO), the Finance Portal and the Human Resource Management System (HR2U), which facilitates better cooperation, future growth, and the creation of a single digital environment.

The ENSURE system stands out from the other authors' works because it has a complete post-award administration and lifecycle management system. Unlike the other six systems (Al-Ayyubi & Maulana, 2023; Elwirehardja et al., 2022; Jibrin et al., 2016; Khedekar et al., 2024; Orgianus et al., 2024; Paytaren et al., 2023), which primarily focus on pre-award phases such as matching, filtering, ranking, and selecting applicants, the ENSURE system includes comprehensive tools for managing students after they receive their scholarship awards. The distinctive functions identified as a research gap only within the ENSURE system comprise the following as illustrated in Table 1.

Table 1. ENSURE unique functions

No	Function	Description
1	Financial and Payment Management	ENSURE is the sole system capable of executing the actual disbursement of money. It encompasses administrative functions to "manage scholarship payments", "manage scholarship submissions", and access historical "payment reports" while enabling students to "view payment status".
2	Academic Progress Monitoring	To guarantee students retain their eligibility, the system includes a "Submit Progress Report" capability for active scholarship recipients to upload their final examination results. Administrators possess the requisite tools to configure "Progress Report Alerts" and "Manage Progress Report evaluations".
3	Management of Active Scholarship Holders	Administrators can oversee current scholarship recipients by incorporating "contract agreement details", producing official offer letters, and revising their status.
4	"Save & Continue Later" Feature	Throughout the application process, ENSURE has a distinctive functionality enabling students to preserve partial application forms and subsequently resume them prior to the deadline.

3. METHODOLOGY

3.1 Project methodology

The agile model was employed as the project methodology, as depicted in Fig. 1 (Huang et al., 2023; Sulaiman et al., 2024). The model was chosen due to its flexibility and its ability to adapt quickly to evolving requirements. It offers iterative development, which is suitable for scholarship management processes that may evolve due to changes in university policies, financial regulations, or integration needs with other systems (e.g., SIMS, HR2U, and the Finance Portal).

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Fig. 1. Agile model

The agile paradigm consists of six phases: plan, design, develop, test, release and feedback. The initial steps include assigning roles (as shown in Fig. 2), gathering requirements (as shown in Fig. 3), defining user stories or workflow (as shown in Fig. 4 and Fig. 5) and making timeline estimations. This stage established the necessary components for development. There is also a need to set the goals for the upcoming iteration or sprint. The second phase involved designing the architecture as illustrated in Fig. 5, the database scheme, the user interface or user experience (UI/UX) guidelines as illustrated in Fig. 5 to Fig. 10, and the system components. In the third phase, the system is developed with appropriate application techniques. The integration and the security component are implemented. The fourth stage is testing, such as unit testing, integration testing, user acceptance testing and performance testing, during which the created product is put through a thorough testing process. The fifth stage is release, which resolves any problems or errors with the deployed program; the users are trained, and updates are rolled out. In the sixth stage, the feedback from users and stakeholders is collected. These phases repeat in cycles (sprints), which allows the product to evolve based on refining the backlog, improving the process and enhancing features.

3.2 Project organisation

The stakeholders involved in this development project are organised into four groups to facilitate implementation and task delegation: the project steering committee, the manager, the business process team, and the technical team, as illustrated in Fig. 2. The job scope for the project steering committee is to determine the trajectory of the ENSURE system project, create synergy between responsible centres to ensure that processes that depend on different responsible centres can be integrated, provide support in terms of resource and training needs, and deliver advocacy, facilitation, insights, and suggestions to the project team to ensure project success. A project manager's responsibilities include planning, managing, and coordinating the entire project; ensuring all deliverables and project success; managing necessary project resources; planning and managing project risks; coordinating the preparation of project documentation; and reporting project progress to department management through project status reporting meetings. The job scope for the business process team includes designing work processes, creating related instructions and regulations, establishing standards for work procedures, identifying reference sources and markers for validating business processes, mapping the process flow within the system, and promoting the use of the developed system. The technical team's responsibilities include acquiring system requirements from the responsibility centre, producing system documentation, developing the system as required by the applicant, ensuring the developed system can be used and maintaining the developed system.

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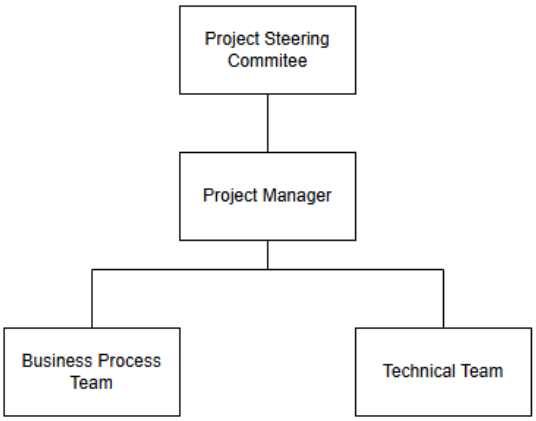

Fig. 2. Project steering committee

3.3 Use Case Diagram

Fig. 3 illustrates the core functional requirements of the proposed system. The use case diagram depicts how a user interacts with each function to complete a task within the system. The purpose of a use case diagram is to provide an overview of who and what activities the user can do (Xinxin et al., 2025). An actor is a person or system that integrates with the activities. In this case, the actors are student and administrator.

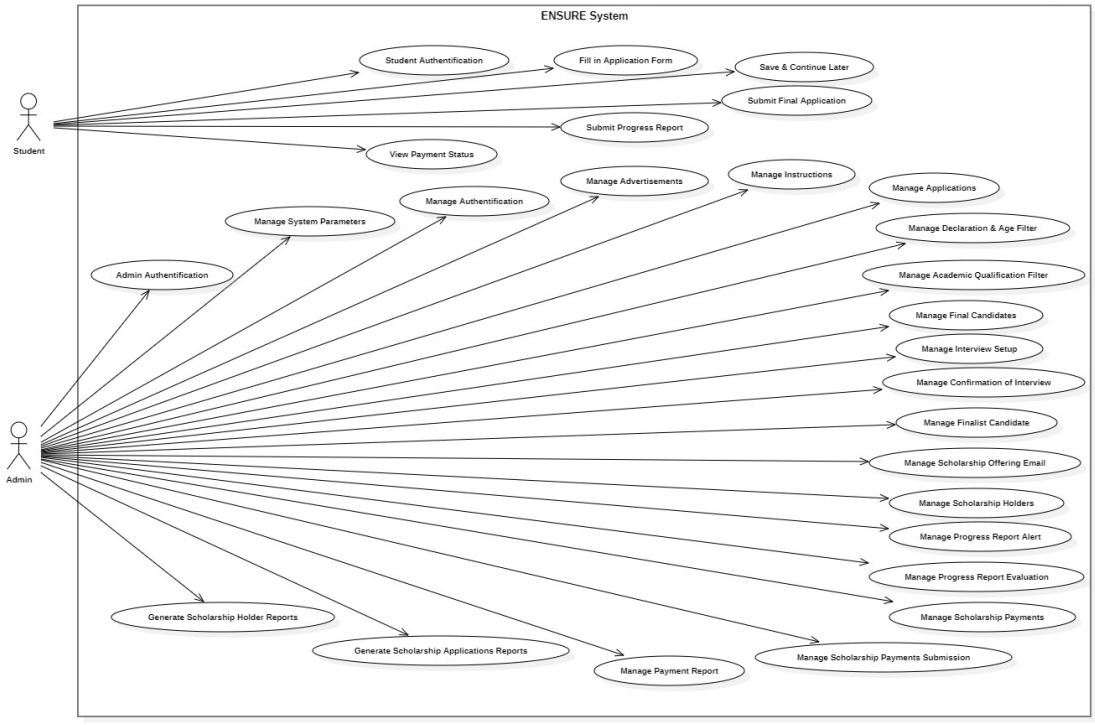

Fig. 3. Use case diagram for ENSURE

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The students have access to six use cases and an administrator has access to 21 use cases as described in Table 2.

Table 2. Use Cases of ENSURE

User	Use Case (UC)	Page	Function and description
Admin	UC1: Admin Authentication	Cover Page	To click on login button and to enter the Staff No and Password or choose to sign in with UiTM SSO or Sign in with UiTM Google
	UC2: Manage System Parameters	Age Condition List	To create, view, edit and delete the limit of age for each academic level for normal and disabled student
		Academic Qualification List	To create, view, edit and delete the minimum CGPA for each education level based on nationality for normal and disabled student
		Category List	To create, view, edit and delete the category of Endowment Scholarship for international, local and disabled student
		Status List	To create, view, edit and delete the status of the applicant before, during and after receiving the scholarship
		Declaration Checklist List	To create, view, edit and delete the list of declaration of the applicant
		Document Checklist List	To create, view, edit and delete the need of resume for master and PhD student
		Family Relationship List	To create, view, edit and delete the relationship of the applicant
		Education Level List	To create, view, edit and delete the education level of the applicant
		Indexed list	To create, view, edit and delete the publication indexed for master and PhD student
		Meeting list	To create, view, edit and delete the meeting of committee of endowment
		Scholarship Value List	To create, view, edit and delete the scholarship value for each academic level and scholarship category
		Email BCC List	To create, view, edit and delete the blind carbon copy (bcc) for email notification for each education level of student
		Faculty List	To create, view, edit and delete the name of faculty, centre, institute and academy
		Course List	To create, view, edit and delete the courses name
		Level of Studies List	To create, view, edit and delete the level of studies
		Semester List	To create, view, edit and delete the semester, scholarship intake, progress report and semester active
		Country List	To create, view, edit and delete the name of country
		State List	To create, view, edit and delete the name of state
		City List	To create, view, edit and delete the name of city
	UC3: Manage Authentication	Users List	To create, view, edit, delete and impersonate the category of user
		Roles List	To create, view, edit and delete the limit of interface that user can access
	UC4: Manage Advertisements	Advertisement Setup List	To create, view, edit and delete the advertisement setup for each new batch, semester and duration.
	UC5: Manage Instructions	Instructions List	To create, view, edit and delete the instructions for the student to complete the form
	UC6: Manage Applications	Application List	To search the applicant based on advertisement, student no, application category, level of study, student name and status. To view, edit and set status of applicants
	UC7: Manage Declaration & Age Filter	Applicant Declaration & Age Filter	To run the applicant declaration & age filtering, search and export the filtered list and view the applicant details
	UC8: Manage Academic Qualification Filter	Academic Qualification Filter	To run the academic qualification filtering, search and export the filtered list, view applicant details and manually set the academic qualification status
	UC9: Manage Final Candidates	Final Candidate	To search, export, view and the set the status of the student for interview session

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	UC10: Manage Interview Setup	Interview List	To create, view, edit, add panel and add candidate for the new interview session
	UC11: Manage Confirmation of Interview	Confirmation of interview	To search, export, view and set the status of interview confirmation
	UC12: Manage Finalist Candidate	Finalist of Candidate	To search, export, view and set the result status of interview
	UC13: Manage Scholarship Offering Emails	Email Scholarship Offering	To email the successful and unsuccessful email offering, search and export the list
	UC14: Manage Scholarship Holders	Scholarship Holders List	To search the scholarship holder based on semester offered, student no, study level, status, name and category. Add new scholarship holder (e.g. for batch 1), add the contract agreement information, generate the offer letter, update the current status
	UC15: Manage Progress Report Alert	Progress Report Alert List	To create, view and edit the progress report alert based on semester and duration
	UC16: Manage Progress Report Evaluation	Progress Report Evaluation	To search, export, view and evaluate the progress report of student
	UC17: Manage Scholarship Payments	Search Preparation list	To search and view the preparation list
	UC18: Manage Scholarship Payments Submission	Submission of scholarship payments	To select the meeting, semester payment, submit and export the submission of scholarship payments, and view the submission list
	UC19: Manage Payment Report	Search Payment List	To search, export and view the history of payment list information
	UC20: Generate Scholarship Applications Reports	Search Scholarship Application	To search and view the list of applications, list of submitted application based on level of study and age, declaration and academic filtering for overall and every batch intake
	UC21: Generate Scholarship Holder Reports	Search Scholarship Holder	To search and view the number of scholarship holder based on the status and study level, list of scholarship holders based on status, and list of scholarship holders based on level of study for overall and every batch intake
Student	UC22: Student Authentication	Cover Page	To press the “apply now” button at ENSURE cover page to move to application form. To enter student No and MyKad No to login to ENSURE. The student can access the ENSURE within the period that set by admin. The active status scholarship holder can access the ENSURE except when the status is non active.
	UC23: Fill in Application	Instruction page, personal form page, family form page, academic form page, extra info page and declaration form page	To complete all the form such as personal, family, academic, extra information and declaration
	UC24: Save & Continue Later		To save and continue later and login again to fill incomplete form.
	UC25: Submit Final Application		To submit the complete application before the deadline.
	UC26: Submit Progress Report		An active student or the scholarship holder must upload and submit a copy of final examination result within 2 weeks after the date of final examination result officially released.
	UC27: View Payment Status		The student can view the status of payment status

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3.4 Application working process for applicants

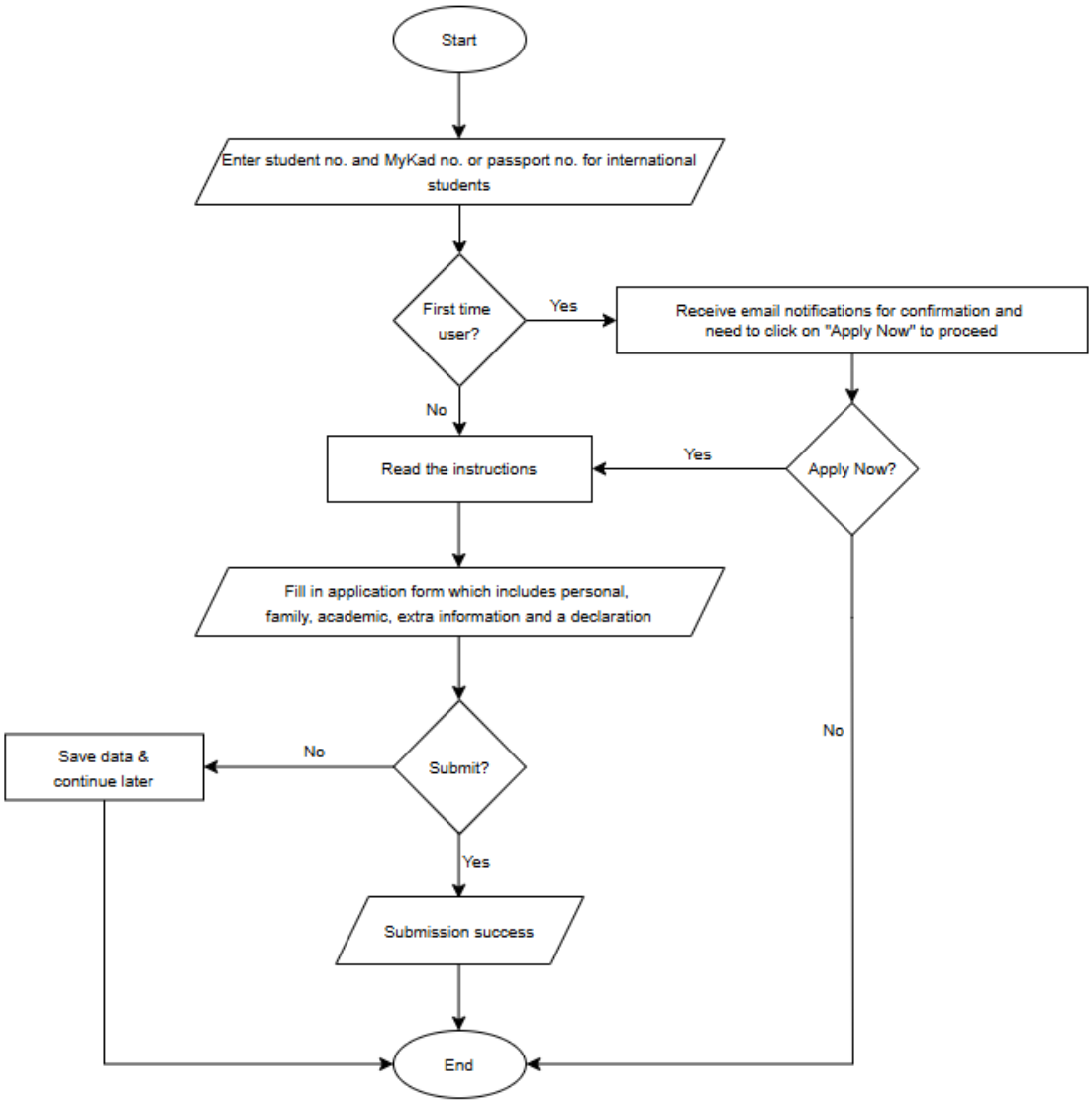

Fig. 4. Application process in ENSURE for the applicants

The student will be informed of the scholarship's advertisement through official university social media and student email. The advertisement will provide information about the opening and closing dates, as well as a URL link that directs to detailed and up-to-date information regarding the scholarship on the Unit Endowmen website. The student must read all the detailed, latest information about the scholarship and click on the "ENSURE Now" button at the bottom of the scholarship page on the Unit Endowmen website. This will be forwarded to the ENSURE system. The student needs to click on the “Apply Now” button at the bottom of the ENSURE main page and will be forwarded to the application form. Fig. 4 illustrates the application process for the student who wishes to apply for the scholarship through the ENSURE system. The student needs to fill in their student number and either MyKad number or passport number if they are

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an international applicant. Thereafter, the student will receive an email notification and need to verify it by clicking on the "Apply Now" button to proceed to the application form. The student needs to read the instruction first before filling in the personal, family, academic, extra information and declaration before submitting it. The student can save their current data and log in again to complete the form before submitting it.

3.5 Application working process for administrator

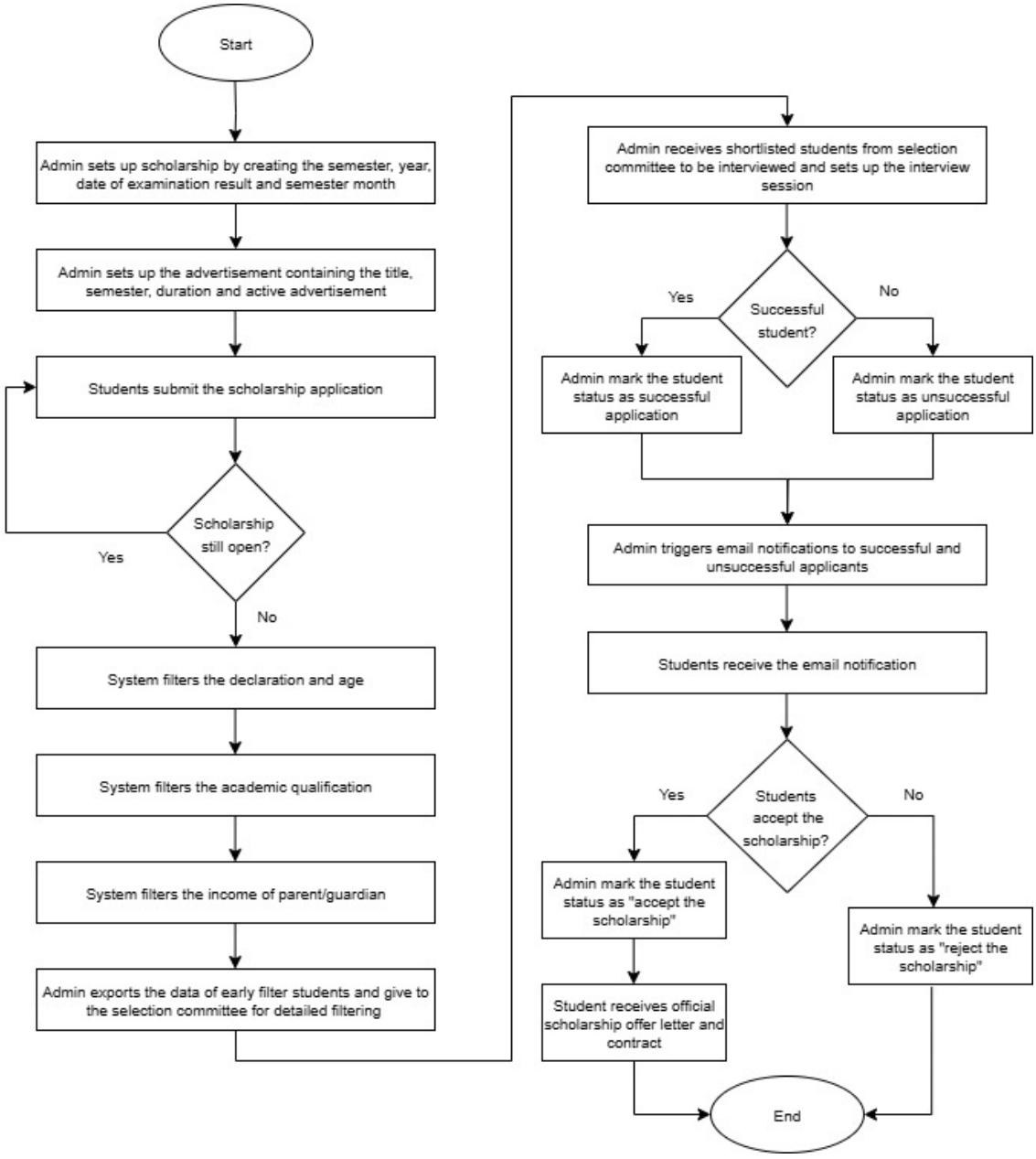

Fig. 5. Application process in ENSURE for the administrator

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As shown in Fig. 5, the ENSURE administrator needs to make settings for certain parameters, such as the semester, year, date of the examination results and month of the semester before the scholarship offer is open to applicants. Then, the administrator needs to make advertising settings that contain the title, semester, and opening period. After the scholarship is opened, applicants can apply for it until the period closes. The administrator will make an initial screening, such as a declaration of the age, academic qualifications, and income of parents or guardians. The admin will provide the initial screening list to the selection committee to make a more detailed screening. Thereafter, the selection committee will provide the shortlist data to the administrator for the interview session. The system will mark successful and unsuccessful applicants with their respective status, and the applicant will receive an email notification. Next, we will manually offer a scholarship offer letter and contract to successful applicants.

3.6 Architecture diagram

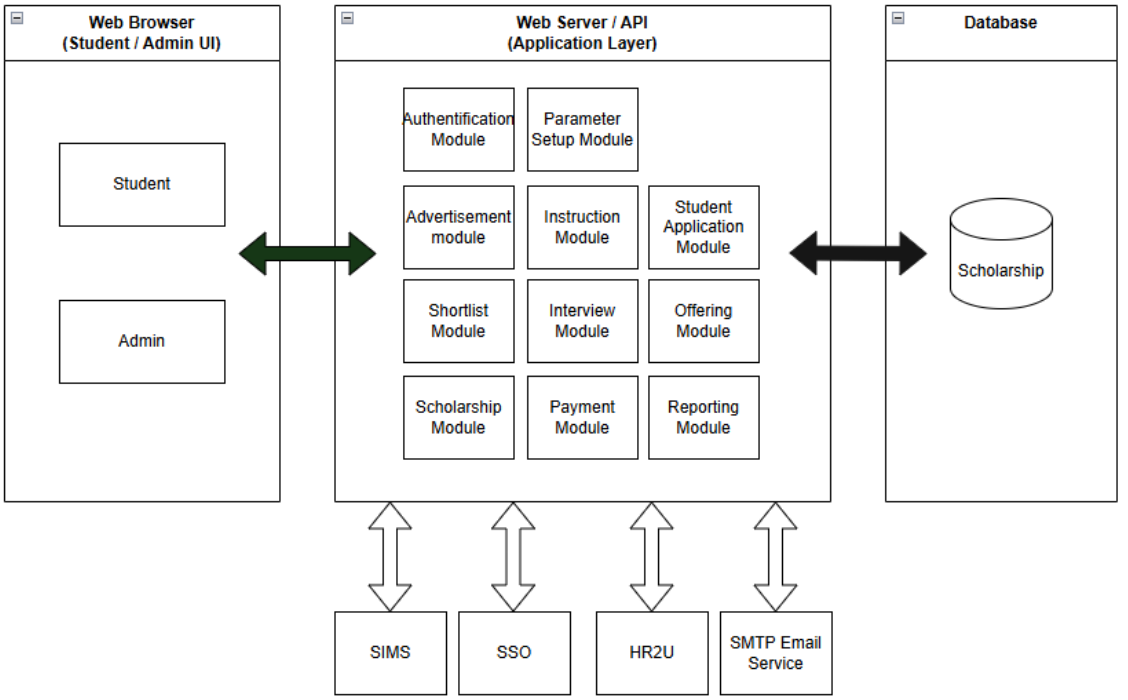

Fig. 6. Architecture diagram for ENSURE

Fig. 6 illustrates the system architecture of ENSURE. It follows a classic three-tier architectural pattern, which separates the user interface, business logic, and data storage. On the left side, the frontend is a presentation layer using a web browser. The frontend is what the users interact with. It consists of a student UI, where students apply for scholarships, verify their status, and upload documents. The admin UI allows staff to manage scholarship postings, review applications, and generate reports. The communication uses a two-way arrow to show that it sends requests to and receives data from the web server. The middle section is the "brain" of the system. The application layer contains the business logic, which is implemented using a web server and an application programming interface (API), and is divided into specific modules: the core processes and the administrative tools. The core processes consist of modules like advertisement, instruction, student application, shortlist, interview, offering, scholarship and payment to handle the life cycle of a scholarship. The administrative tools consist of authentication (login), parameter setup (rules/deadlines) and reporting (data analysis). On the far right is the storage tier as a data layer (database).

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This is a centralised repository where all persistent data, for example, student profiles, application records, scholarship criteria and payment logs, is securely stored. The system is not isolated; it integrates with existing institutional services through APIs or middleware, such as SIMS, to verify student enrolment and all related student data. The SSO is enabling users to log in using their official university credentials. The HR2U system allows staff to verify employee-dependent eligibility, while the SMTP email service is used to send automated notifications, such as "Your application has been received" or "You have an interview".

4. RESULT AND DISCUSSION

4.1 High-level user interface

The ENSURE system's UI is to make it easier for users to communicate with a computer and software system (Sulaiman et al., 2024). The instruction page, as illustrated in Fig. 7, serves as a preparation guide so that the applicants comprehend what is expected, thereby reducing errors and missing documents.

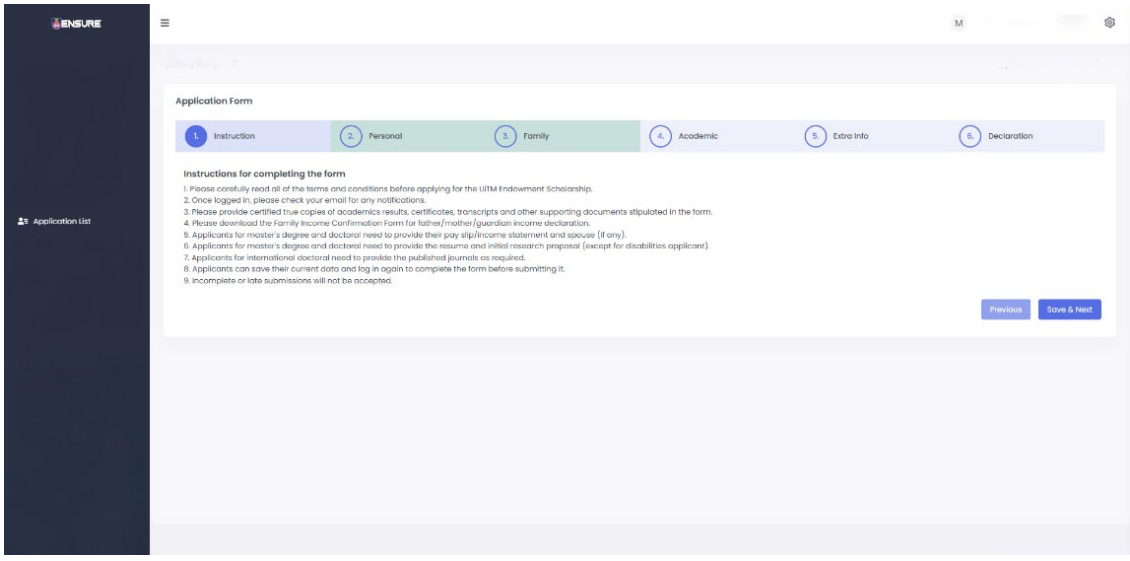

Fig. 7. Instruction page

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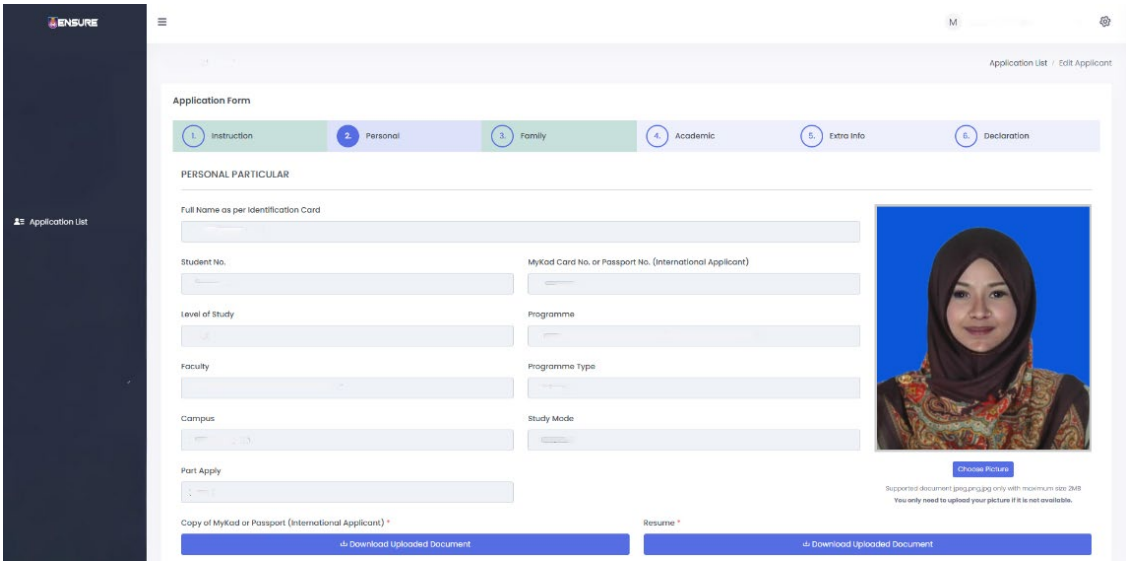

Fig. 8. Personal form page

Fig. 8 depicts the personal form page, which includes personal particulars, financial information, contact details, mailing address, health condition and additional information. Postgraduate applicants must complete an additional form, such as a resume and initial research proposal. Fig. 9 exhibits the family form page, which includes the particulars of the parents or guardians, their gross income, supported by verified documentation and information about siblings.

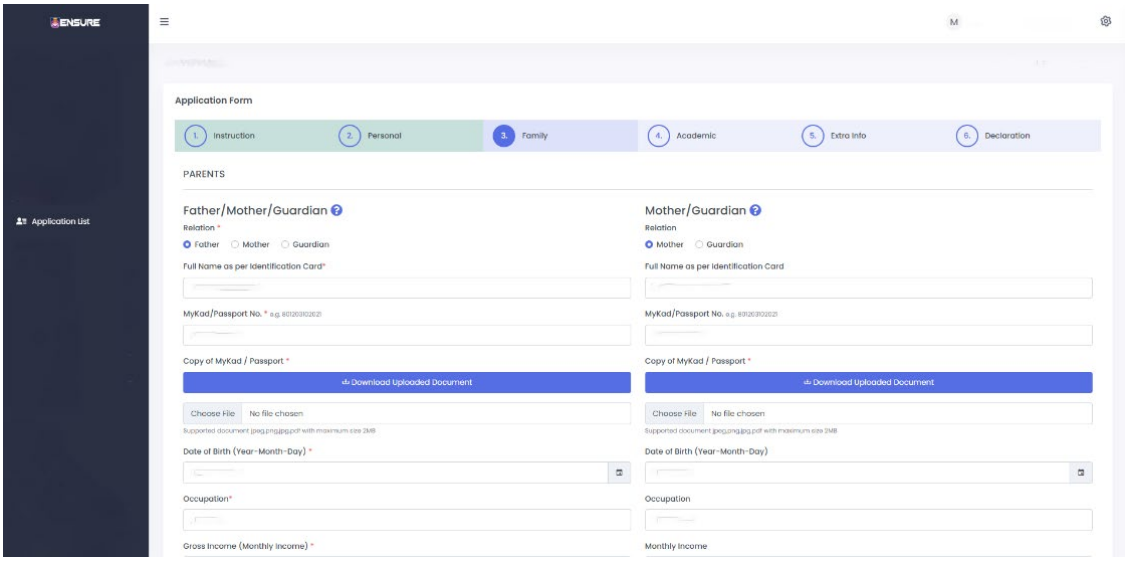

Fig. 9. Family form page

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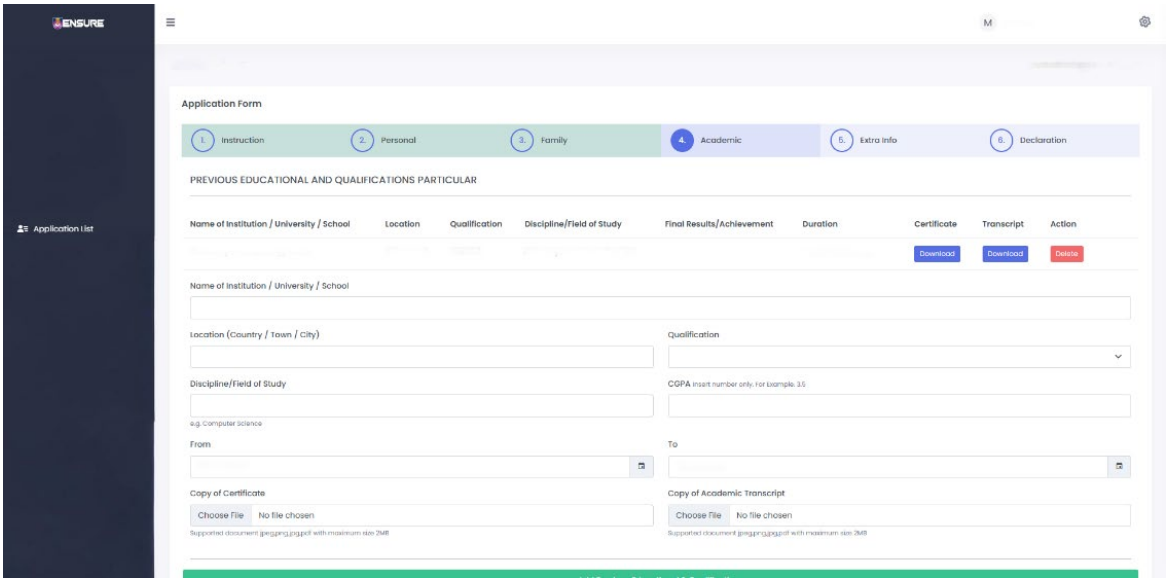

Fig. 10. Academic form page

Fig. 10 displays the academic form page, including the previous educational and qualification particular, academic awards and extracurricular activities. PhD-level applicants must include the published journals. Fig. 11 illustrates the extra information form page, such as professional membership (if any), employment record (if any), and the applicants must provide two referees who are other than relatives.

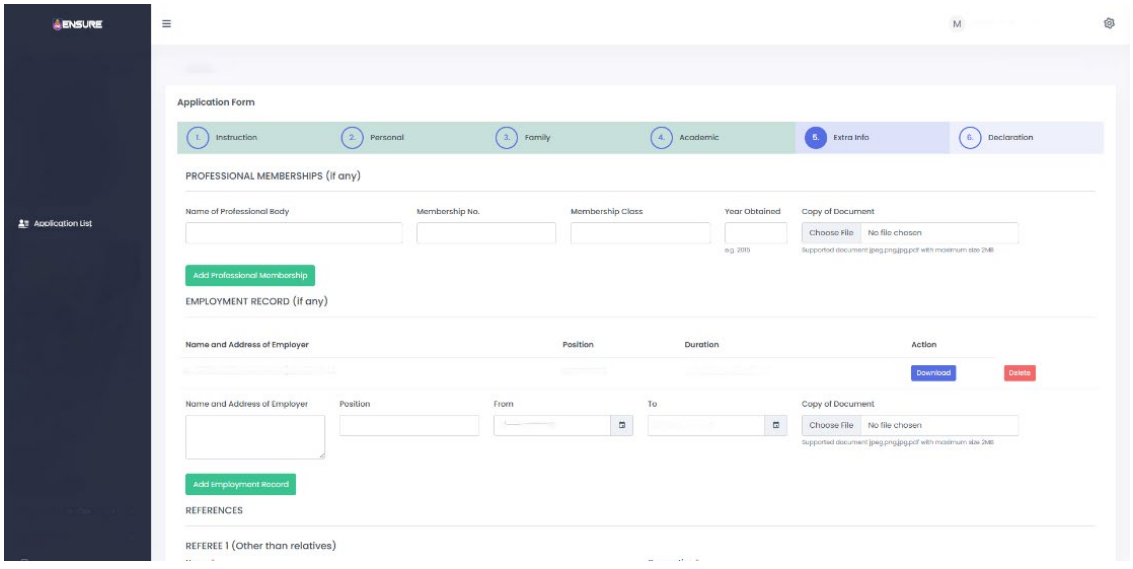

Fig. 11. Extra info form page

Fig. 12 depicts the declaration form page. This page serves to formally bind the applicant to truthfulness, compliance and eligibility criteria before they click the submit application button.

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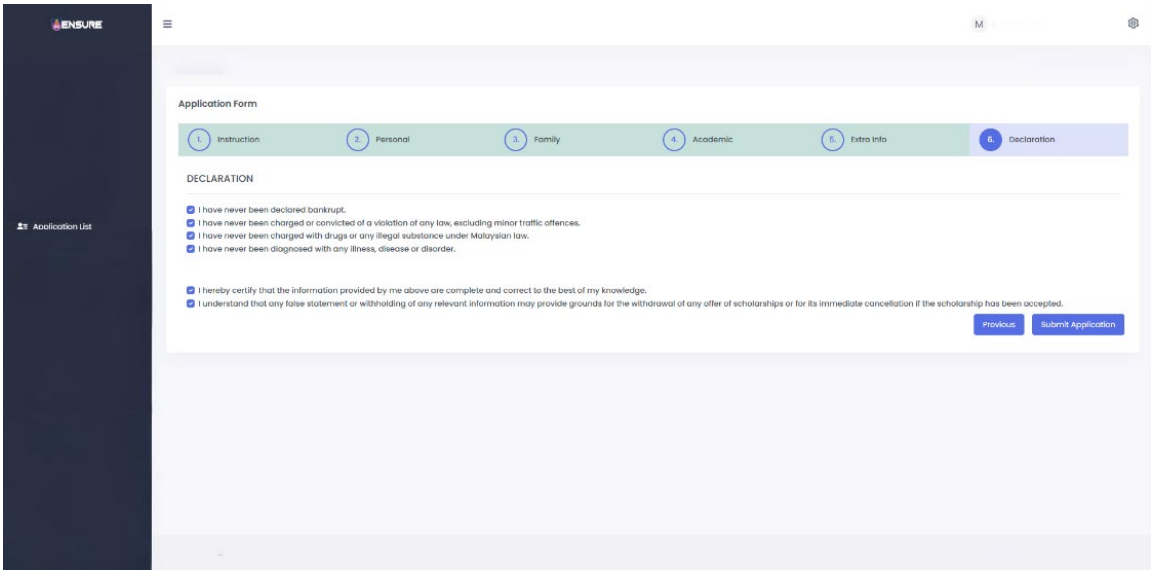

Fig. 12. Declaration form page

4.2 Comparison between manual approach and computerised system

The primary reason for upgrading the manual process to a computerised system is that manual approaches are time-consuming, error-prone, and lack transparency, which leads to inefficiencies in scholarship management. Table 3 presents an analysis of seven aspects of improvement following the release and use of ENSURE by the end user.

Table 3. Comparison between manual approach and computerised system

Feature / Aspect	Manual Approach	Computerised System
Data Storage & Management	Data is handled using physical paper records or fragmented Excel files, which can easily be misplaced and often lead to duplicated information.	Utilizes a centralized server and database, ensuring data is safely stored, easily searchable and prevents duplication.
Application Submission	Applicants must print out requirements, fill out physical forms, or submit documents via scattered emails, making it a tedious job.	Applicants can fill out online forms and directly upload their requirement files (e.g., passports, credentials) through a web portal.
Time & Efficiency	Highly time-consuming due to heavy paperwork, slow evaluation and slow decision-making.	Automates workflows and reduces administrative overhead, leading to faster processing, screening and decision-making.
Communication & Updates	Relies on fragmented channels or physical boards, making it difficult to reach scholars with timely announcements or changes.	Features real-time dissemination of information through integrated email notifications and centralized report system features.
Error Handling	Highly prone to human errors during compilation and scrutiny; correcting mistakes requires sending paperwork back through previous steps, causing severe delays.	Provides accurate and reliable information; allows students to easily change or update incorrect documents online without disrupting the whole process.
Security & Fraud Vulnerability	Often lacks strict access controls (anyone can access data) and is highly vulnerable to	Emphasizes security through strict authentication, encrypted data, and restricted access ensuring

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	corruption, such as staff guaranteeing scholarships for advance.	only authorized parties view sensitive information.
Tracking & Monitoring	Requires immense manual effort to verify documents, check if a student already has another scholarship, or calculate remaining scholarship quotas.	Provides administrators with immediate, real-time access to available scholarship quotas and easily verifies if an applicant holds concurrent scholarships.

4.3 User acceptance test

A user acceptance test (UAT) was implemented to ensure that the system was fit for purpose, user-friendly, and ready for real-world use by letting users verify that it met their needs before release. A list of students from different levels of categories, such as bachelor, master, and PhD, is selected to participate in UAT. The student is given the testing script as illustrated in Table 4 and Table 5 and access to the development page environment to enter their particulars. The test script is to verify that the system works as expected by following a structured testing process. In software development, having separate development and production environments is a best practice. The development page environment acts as a safe sandbox where developers build, test and modify the system. It enables coding, debugging, and feature testing without affecting real users. The developers can experiment with new ideas safely. An error or crash here won't disrupt actual operations. The production page environment, on the other hand, acts as a live environment used by actual users. It ensures stability, reliability and performance for real-world applications. It also provides the final or polished version of the system. The advantage of separating these two different environments is that, first, for risk management, bugs in development won't impact real users. Second, it ensures data safety by protecting sensitive information in the production environment. Third, for testing and quality assurance, developers can fully test features before release; and fourth, for continuous improvement, features are developed and refined in the development environment before being deployed to production only when they are ready. Once they complete their application submission, they will be asked to provide feedback for improvement. All the feedback is recorded in a document form called a system feedback form.

Table 4. Sample test script for UC4: Manage Authentication

Test Case No	**UC4: Manage Authentication**
Role	Administration
Test Scenario	Register roles in the system and assign access to modules and permissions.
Test Scenario Description	Register/Create role. Update/Edit existing role. View role information. Delete role.

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Table 5. Sample description of test scenarios

Functionality/ Task	Screen	Sub Screen	Description of Test Scenario	Data Entered/ Selected	Expected Result	Remark/ Error/ Notes
Authentication	Roles List	Roles Management	1. List of existing roles		Roles List is displayed	Success
Create			2. Click the '+Create' button		Create Role Form is displayed	Success
			3. Enter a name for the role to be created		Field Name* required	Success
			4. Select the Permissions allowed for the role 5. Click the 'Save' button		Notification 'Role created successfully' is displayed	Success
Edit			6. Click the Edit button from the Actions column		Edit Role Form is displayed	Success
			7. Update the Name / Permission 8. Click the 'Save' button		If successful, the following notification is displayed 'Role updated successfully'	Success
View			9. Click the View button from the Actions column		Detail Role Screen is displayed	Success
			10. Click the 'Back' button		Return to Roles List screen	Success
Delete			11. Click the Delete button from the Actions column		The system displays a notice as follows: 'Are you sure wanted to delete it?'	Success
			12. Click the 'OK' or 'Cancel' button			Success
			13. The system will remove the role from the list		Roles that have been deleted are removed from the list	Success
			End			

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4.4 ENSURE evaluation

In addition to the UAT, which is based on scenario or qualitative testing, the Perceived Ease of Use (PEOU) was selected to evaluate the quantitative aspect using thirty respondents (Sulaiman et al., 2024). The PEOU was selected due to one of the two core pillars of the Technology Acceptance Model (TAM), a well-known framework to measure the degree to which a person using a particular system would be free of effort. The online forms were used to conduct this evaluation. Each of the respondents is given the demonstration video, and they need to respond to the questions in the online forms. Table 6 lists the questions and responses from the respondents.

Table 6. PEOU Questions

No	Questions	Scale					Mean Score
		1	2	3	4	5	
1	I think using the ENSURE is easy				3	27	4.90
2	I think using the ENSURE is understandable			1	4	25	4.80
3	I think using the ENSURE will not require much mental effort			1	7	22	4.70
4	I think I can use ENSURE independently			1	5	24	4.77
5	I believe ENSURE will be easy to use				6	24	4.80
	Overall Score						4.79

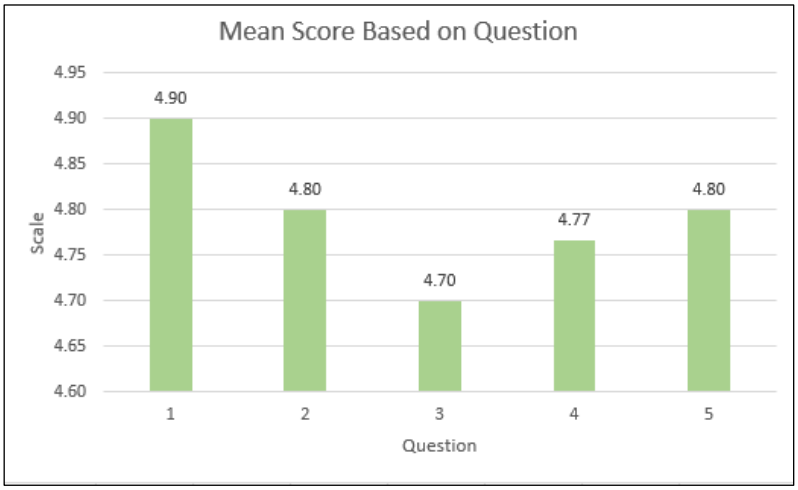

Fig. 13. Mean score of PEOU

The results obtained from the respondents, as shown in Fig. 13. Based on each question, the mean score exceeds 4.0. The overall score, which is 4.79, represents that ENSURE is easy to be used.

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5. CONCLUSION

The focus of this study is to develop the ENSURE system, which demonstrates a holistic approach to managing endowment scholarships using a web-based platform. The initial aim was to replace the traditional manual process. The system provides several modules, such as administration, student applications, screening, offers, payments, monitoring, and reporting. The implementation of the ENSURE system gives significant benefits to all stakeholders. For students, the system offers a seamless application process with several features, such as online form submissions, email verification, and the ability to save and resume applications. For administrators, the system provides smooth operational tasks, such as filtering applications, managing interview sessions, processing payments, and generating reports. These upgrades will enhance the workflow efficiency and improve the accuracy of data handling and reduce human error as well. At the institutional level, the system promotes transparency in scholarship allocation and supports the strategic goals of the Unit Endowmen.

The recommendations for future enhancements may include advanced features such as machine learning-based applicant ranking and a real-time analytic visualisation dashboard for administrators to support decision-making. In conclusion, the ENSURE system has demonstrated its capacity to not only improve the effectiveness and efficiency of solutions for scholarship management but also serve as a potential model for similar initiatives in other higher education institutions.

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7. CONFLICT OF INTEREST STATEMENT

The authors declared that they have no conflict of interest to disclose.

8. AUTHORS' CONTRIBUTIONS

The article was written, edited and conducted by **Mohd Suffian Sulaiman**, **Aruan Effendy Mohd Ghazali** conceptualised the main idea of the research and **Mohamad Hairi Ramli** anchored the review and made necessary adjustments.

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