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Short Paper

School-IntegrIS: An Integrated System Approach to a School Management System of a State College in Northern Mindanao, Philippines

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Abstract

Purpose — With the increasing demands of system development in the school in terms of converting manual transactions into digital and computer-based systems, some systems and modules use independent URLs or subdomains in the school's website that need to be memorized to access those systems. This project incorporates all independent systems into a single domain for easy access and user control.

Method — This study covers the system's primary functions, including its modules and subsystems, as well as the Agile Model research technique and methodology.

Results — The ISO/IEC 25010 quality evaluation system has been used to assess the project's functionality, efficiency, and usability. The project's overall evaluation is 4.58, which indicates excellent performance based on a descriptive interpretation using a Likert scale for qualitative description. The initiative has been operational and hosted online using the school's domain name with annually subscribed web hosting.

Conclusion — The Integrated System meets the objectives per user requirements. The web application is well-recommended and acceptable to users. The system is cloud-hosted and is accessible 24/7 on the World Wide Web. With its implementation, personnel including students, can access their portals using one log-in credential, accessing multiple online services.

Recommendations — To ensure the project's longevity, future development should proceed consistently and integrate all systems, subsystems, and modules. New technologies should be incorporated to make the integrated system more adaptable to changes.

Research Implications — All systems, subsystems, and modules developed independently are incorporated into the study into a single, easily accessible integrated system periodically updated for continuous quality improvement.

Practical Implications — The main benefit of the Integrated system is that it can incorporate all school's independent systems into a single domain name and URL to avoid confusion about what to access, as it is already an enterprise-grade type of system.

Keywords — integrated system, information system, school management system, school systems, Philippines

INTRODUCTION

Considering the quick developments and growing dependence on technology (Cascio and Montealegre, 2016), most organization embraces and begun digital transformation in their workplace (Alshammari, 2023), which radically changes how they deal with data and information, those organizations developed or procured computers systems in their offices to aid them in their day-to-day office operation. The information system is crucial to the business's operations, particularly in the administrative sector where the goal is to streamline routine tasks and aid in efficient information processing to ensure no errors occur in the regular process (Da Costa Santos and Estender, 2018). Some organizations and

government offices use local-based systems, while others use web-based and cloud computing (Golightly et al., 2022) and other technologies. Working in the academe, specifically the state runned-colleges and universities, is not similar to different government offices since it deals with students as their main stakeholders (Degjarjova, Lapina and Freidenfelds, 2018) handling their information and records from enrollment to employment (Riño and Daing, 2022).

An effective computer-based school management system is already a must in most Academic Institutions (myEdu, 2019), including those schools run by the government. In the case of a State College in Northern Mindanao, Philippines, the SUC has developed its school systems to address the demanding needs of digitalization regarding school management (Grepon et al., 2021). As the school progressed in using the school management system, the demands of adding more and more subsystems and modules were necessary to address some administrative and academic concerns for paperless transactions and report generation. With these advances, each office-assigned programmer created their own designs and platforms. This drawback makes it difficult to remember and access each platform or portal.

The Project proponents have undertaken a rapid appraisal of college peers, and a prevalent impression is that the various electronic links for information management, such as Google Drive and portals, are confusing. Another concern that came up is how to maximize the electronic mechanism of a variety of college administrative operations, such as the faculty portal, enrollment portal, student portal, Online Rating Sheet (ORS), Individual Performance Commitment Review (IPCR), and Office Performance Commitment Review (OPCR), Human Resource Information System, Procurement System. Given that staff are required to declare their individual ORS, many find it challenging to connect the IPCR and OPCR with the specifics of their given responsibilities, particularly faculty with administrative designations. Another concern was expressed regarding the difficulties of document tracking. In addition, there is a perception that ORS is only a means to satisfy DTR criteria. Furthermore, there is a consensus that archiving college administrative information in the cloud is more efficient. Finally, suggestions were made to streamline the monitoring procedures.

These concerns are acknowledged by (Carvalho et al., 2020) and (Grepon et al., 2022) that, indeed, the HEI sector is faced with a new reality in terms of implementing information ecosystems. This system comprises a large spectrum of platforms, such as academic management enterprise resource planning (ERP), financial ERP, student relationship management, learning management systems, content management systems, survey tools, business intelligence, current research information systems, and a repository of publications (Carvalho et al., 2020). Given this situation, HEIs could benefit from an integrated vision of all these individual platforms in the form of a unique information

system (IS) capable of supporting their transversal organizational processes (Carvalho et al., 2020).

LITERATURE REVIEW

Developing an Information System in an academic institution benefits the school. Below are some studies that use the same technology and methods the proponent could relate to.

In terms of the design and development of Information Systems, a study by Grepon (2020) uses Computer-based Information systems for case management of a regional trial Court utilizing frameworks such as System Development Life Cycle (SDLC) to guide the design and development of its Information System. Another study by Grepon et al. (2021) focuses on the design and development of e-School Systems, an Information Approach to School Management of a Local College which uses the Agile Model and ISO/IEC 25010 as a quality model for software quality evaluation systems, the system lifted and improved the transaction process of the school. An e-School system development based on different Cross-Platforms was studied by Hassan, et. al (2022) that uses Flutter framework and native PHP and MySQL as their backend, which has similarity with the study at hand given that it uses the same framework enabling a cross-platform capability to support different OS, the study aims to help the school management and improve the educational aspect of communities and enhance the academic aspect. Zhang and Metwa (2022) use an information system in the business workflow and define it as an overall solution covering the internal management activities and office affairs of their administrative system, given that a Higher Education Institution also adopts a business type of workflow the study also incorporated business-related transactions in terms of educational and administrative work support.

A study by Rebeiro et al. (2022) created an e-roadmap supporting the digital transformation accelerating digitalization in Lean Companies; this study aims to move towards digital transformation incorporating industry 4.0 technologies; the study at hand already incorporates and aligned to the digital transformation with industry 4.0 technologies already embedded to ensure alignment. Another study by Kotsaki and Simeli (2023) in which web tools 2.0 has been developed for recording and monitoring training processes were implemented in Vocation Training Institutes, and it shows from the result that the tools were very useful for documenting and monitoring the training process, web 2.0 tools have been used in the development of the study since it uses web technologies for the development of the web application that incorporates all stand-alone systems into a single enterprise school systems. Another study of e-governance by Mulokozi and Kitul (2023) assesses the application of electronic governance systems and their influence on the governance of public secondary schools, with a positive trend in the application of electronic governance systems in public secondary school management in their area, with

a very little to no budget allocated for systems development the study has been developed in a public school adopting the concept of digitalization as it creates a positive trend. An evaluation of an e-school pilot in Kenya was studied by Nyagowa (2024) that uses an adaption of DeLone and McLean's (2003) information system success evaluation model. They study and determine the quality of the ICT Infrastructure installed in their e-schools. It was found that six dimensions of e-schools contributed to the success of implementing their e-school systems; the study incorporated a similar success evaluation model using ISO/IEC 25010, quality evaluation standards for products or software, ensuring correctness and reliable results.

With all the success stories of implementing e-schools and integrating ICT systems into the education system, it is of great importance that academic institutions adopt and implement digitalization and use computer-based systems in their daily operations.

METHODOLOGY

Software Development

SDLC has remained the reliable approach to software development (Khan et al., 2020). The Agile technique, as indicated in Figure 1, is ideally suited for speedy and effective software development due to its adaptive nature, early delivery, and flexible lifecycle (Srivastava, Bhardwaj & Saraswat, 2017). The proponent continues to use agile as it is the developmental model that guides from planning to acceptance.

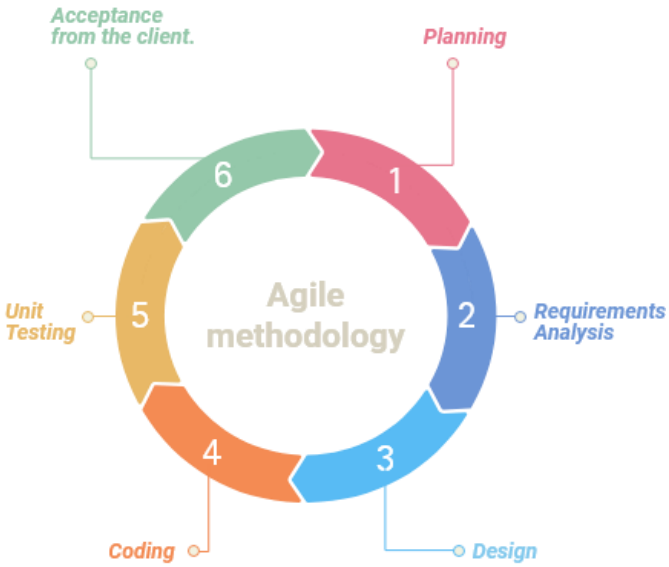

Figure 1. Agile Methodology in System Development

Planning

The researchers obtained data within the institution where the system was developed and implemented. They examined the typical issues they observed while implementing the Integrated System within the organization.

Requirements Analysis

To analyze the requirements using some of the many system flow diagrams and flowcharts available. Data flow diagrams are used to represent the flow and to help advocates better understand how to put systems into place and ensure that data is flowing accurately. Additionally, flowcharts are used to demonstrate the system's process, which aids the proponents in making clear how things will operate. The process that needs to be carried out in an operation is depicted using a flowchart as a series of steps.

Design

In this phase, the researcher plans to make a good design for the project. The researcher surveyed random riders and commuters to gather data information to collect the essential needs of this system. The proponents came up with a functional design of the Network Infrastructure, a framework for the specification of a network's physical components and their functional organization and configuration; the System Architecture, which is the conceptual model that defines the structure, behavior, and more views of a system, the Database Model that determines the logical structure of a database and fundamentally determines in which manner data can be stored.

Coding

In this phase, the development and writing of the actual code, the researcher uses PHP as the native programming language to develop web apps with AJAX and jQuery for user-side scripting language for smooth User Interface (UI) and User Experience (UX). The researcher also uses CSS cascading style sheets for creative design to look better. Lastly is JavaScript (JS) for animation and interaction.

User Testing

The researcher must repeat this procedure until no errors are identified in the functionality of the software development at this stage, where it involves the designing and coding processes.

Acceptance of the Client

The researchers presented the output web application to propose a random user for acceptance through a mobile browser demonstration with the System Evaluation Scale (SUS). This demonstration will be used as the application's introductory and brief flow.

System Testing and Evaluation

During the evaluation of the regular users, the participants will give the feedback score about the system of the final output. ISO/IEC 25010 is used for the application evaluation assigned to the participants because this ISO Standard provides a uniform vocabulary for defining, assessing, and comparing the quality of systems and software products. Out of 8 quality characteristics, this research project will be evaluated by 3 measures from the end users of the school: Functional Suitability, Performance Efficiency, and Usability.

Table 1. The Likert table for qualitative interpretation is used in interpreting the survey results.

Scale	Mean Range	Verbal Interpretation
1	1.0 – 1.50	Poor
2	1.51 – 2.50	Fair
3	2.51 – 3.50	Good
4	3.51 – 4.50	Very Good
5	4.51 – 5.00	Excellent

Table 1 is the Likert Scale used to rank or measure people's opinions on a subject matter or specific topic. It can also be used to measure the questions or results. The proponents used the Likert Scale to interpret the result and overall, ISO/IEC 25010 evaluation average. Table 2 is the ISO/IEC 25010, which defines the Characteristics and the considered sub-characteristics for the application quality evaluation. Equation 1 has been used to generate and compute the overall average of the ISO/IEC 25010 evaluation results.

Formula:

$$\text{Over-all Average} = \frac{\text{Total Average}}{\text{Total No. of Items}} \qquad \textit{Equation 1}$$

Table 2. ISO/IEC 25010 Characteristics and its sub-characteristics

Software Product Quality Characteristics	Sub-Characteristics
Functional Suitability. *This characteristic represents the degree to which a product or system provides functions that meet stated and implied needs when used under specified conditions.*	1 **Functional Completeness**. *The degree to which the set of functions covers all the specified tasks and intended users' objectives.* 2 **Functional Correctness.** *The degree to which a product or system provides accurate results when used by intended users.* 3 **Functional Appropriateness**. *The degree to which the functions facilitate the accomplishment of specified tasks and objectives.*
Performance Efficiency. *This characteristic represents the performance relative to the resources used under stated conditions.*	4 **Time-behavior.** *The degree to which the response time and throughput rates of a product or system, when performing its functions, meet requirements.* 5 **Resource Utilization**. *The degree to which the amounts and types of resources used by a product or system, when performing its functions, meet requirements.*
Usability. *The Degree to which specified users can use a product or system to achieve specific goals with effectiveness, efficiency, and satisfaction in a specified use context.*	6 **Appropriateness Recognizability**. *The degree to which users can recognize whether a product or system is appropriate for their needs.* 7 **Learnability**. *The degree to which the functions of a product or system can be learned to be used by specified users within a specified amount of time.* 8 **Operability**. *The degree to which a product or system has attributes that make it easy to operate and control.* 9 **User error protection**. *The degree to which a system prevents users from operation errors.* 10 **User interface aesthetics**. *The degree to which a system enables pleasing and satisfying interaction for the user.* 11 **Accessibility.** *The degree to which data can be accessed in a specific context of use, particularly by people who need supporting technology or special configuration*

RESULTS

System Architecture

The full system architecture diagram, shown in Figure 2, provides a visual representation of the Project's architecture for a cloud-based web application system that incorporates user and admin roles, an authentication mechanism, and a cloud database. Users can manage their accounts, while admins can manage users. At the center is the authentication system, which validates the credentials of both users and admins before granting access to their respective management functions. Once authenticated, both users and admins can access the data in the database. The cloud database stores all the necessary data related to users and their accounts. The authentication system accesses this database to verify credentials and manage data operations. The architecture ensures secure access to user data through centralized authentication, distinguishes between user and admin roles for proper access control, and leverages cloud storage for scalability and accessibility.

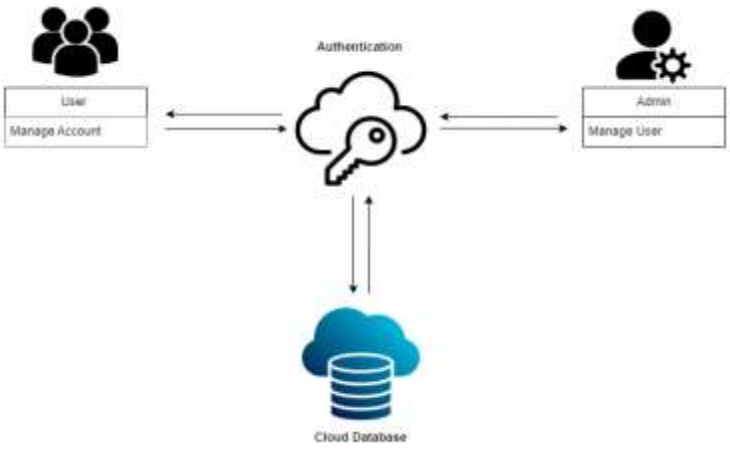

Figure 2. System Architecture Diagram

System Login

The login form provides access to your data and, consequently, your website or online application. Although this form completes a basic security requirement. A system login is utilized to identify the user's privileges depending on the access (Figure 3). This ensures that sensitive information remains secure and that users can only perform actions appropriate for their role within the system, thereby safeguarding the sensitive information. The Login form also identifies who the users are based on the provided login credentials; students are redirected to their student portal when identified by the system when their user roles belong to the student account, while the employees are also identified based on their account type.

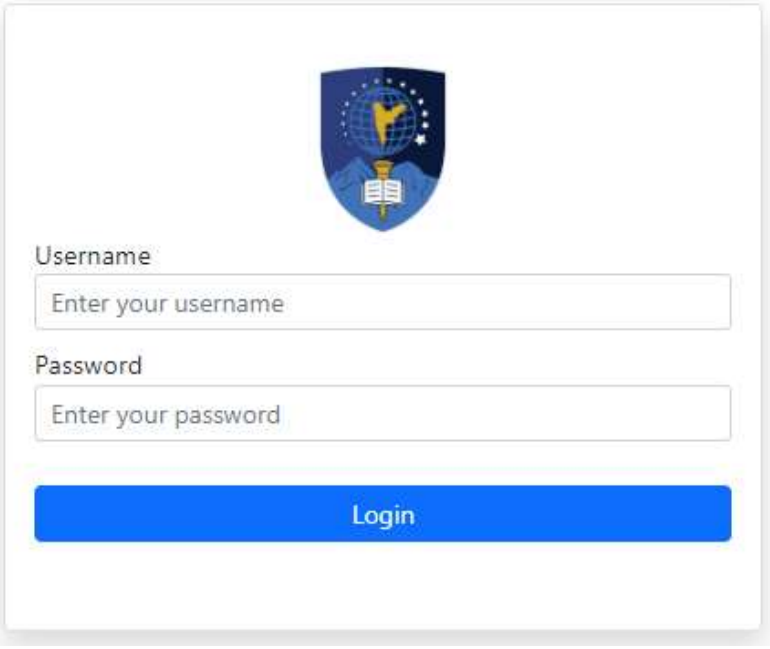

Figure 3. User Login

Dashboard

Figure 4 depicts the user's dashboard or landing page, where access is displayed and only authorized users can access the different kinds of modules. This landing page provides a clear and organized interface, making it easy for users to navigate modules and information for the user's needs.

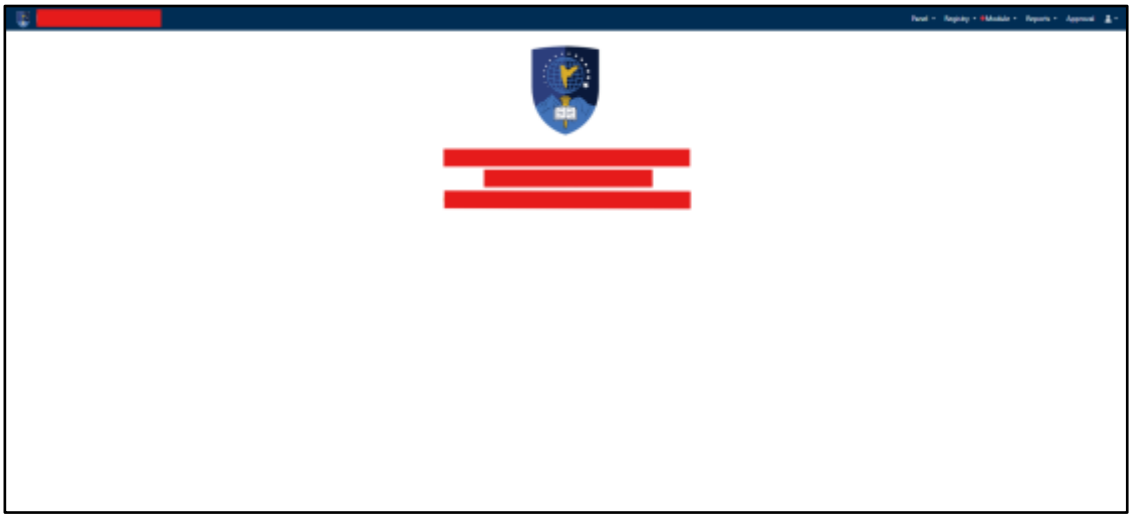

Figure 4. Integrated System Dashboard

Panel Menu

The panel navigation acts as a central hub for effective access to and administration of essential academic and administrative tasks. It not only provides streamlined access to various modules but also enhances productivity by simplifying procedures and enabling quick access to critical resources. This ensures smooth and efficient navigation, as illustrated in Figure 5.

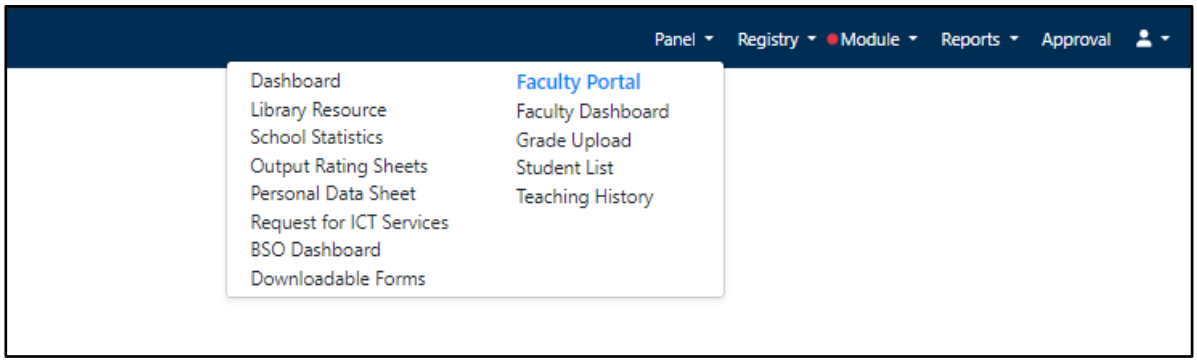

Figure 5. Panel Menu

Registry Menu

The Registry navigation, as shown in Figure 6, serves as a hub for the management and configuration of fundamental school operations. The various registry types represent the key modules for School Settings, Enrollment Portal, Human Resource, and Procurement Services, each of which includes a variety of sub-modules. Users can access and control various registry functions using this navigation, such as data entering, record maintenance, and setting setup. It encourages an effective and well-organized operations registry within the system by combining these essential features into a single navigation.

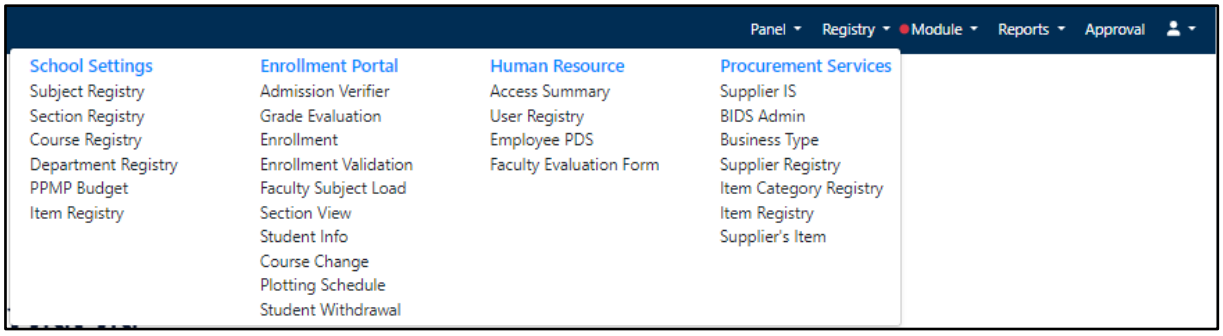

Figure 6. Registry Menu

Module Menu

The Module navigation acts as a primary hub for overseeing administrative functions, as shown in Figure 7. It features various key sub-modules, such as Procurement Activity, Document Tracking, and Library Portal.

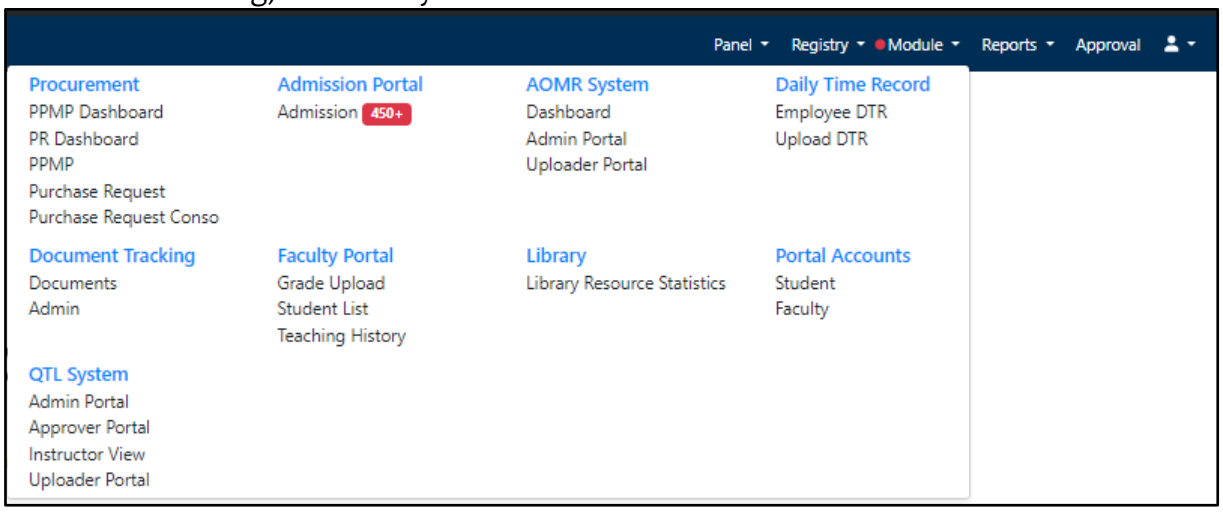

Figure 7. Module Menu

Reports

Figure 8 illustrates the main modules for the Registrar's Report and Course Evaluation. The Report navigation is the center for obtaining and evaluating data throughout the institution. Users can create a wide range of reports with this menu, including real-time analytics, dynamic dashboards, and historical data comparisons. By combining these features into a single, intuitive interface, the user can effectively collect, analyze, and use the data for organizational decision-making and strategic planning.

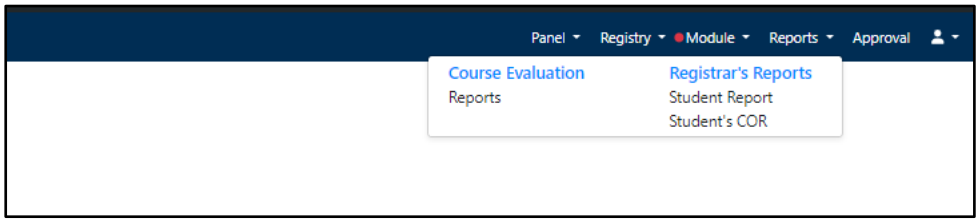

Figure 8. Reports

Evaluation Results

Table 3 displays the results following ISO/IEC 25010, which includes the quality characteristics that serve as the key criteria for assessing a system's or software's quality. The sub-characteristics that quantify the precise extent of each quality characteristic are included in the table. The Mean is the verbal interpretation of the mean of all user comments. To make the findings of this survey easy to recognize and comprehend, the

replies were ranked using a Likert scale. The system's success or failure is determined by the Overall Weighted Average based on the ISO standard, which is widely adopted globally. According to the table, the mean for each sub-characteristic is between very good and excellent, and the overall weighted average is 4.58, which is interpreted as excellent on the Likert scale.

Table 3. ISO/IEC 25010 Evaluation Result.

ISO/IEC 25010 Quality Characteristics	Result	Remarks
Functional Suitability		
Functional Completeness	4.54	Excellent
Functional Correctness	4.61	Excellent
Functional Appropriateness	4.54	Excellent
Average	**4.56**	**Excellent**
Performance Efficiency		
Time Behavior	4.61	Excellent
Resource Utilization	4.50	Very Good
Average	**4.56**	**Excellent**
Usability		
Appropriateness Recognizability	4.61	Excellent
Learnability	4.71	Excellent
Operability	4.73	Excellent
User Error Protection	4.44	Very Good
User Interface Aesthetics	4.57	Excellent
Accessibility	4.59	Excellent
Average	**4.61**	**Excellent**
General Average	**4.58**	**Excellent**

DISCUSSIONS

This study intends to integrate the existing School Management Systems, including its stand-alone sub-systems, modules, and portal. Figure 2 shows the overall System Architecture of the study, where we can see the conceptual model, which defines its structure, behavior, and more views of the developed system; in the case of this study, three external entities can access the API set by the proponents for front end use. For this system to function, a working internet connection is necessary in syncing the Front-end, API, and access to the data and information in the database.

System screenshots and system views are presented in Figures 3, 4, 5, 6, 7, and 8. Figure 3 requires the Login of an administrator to have access to the system to control malicious use and to verify that all contributors are legit users to avoid inaccurate updates. The Dashboard in Figure 4 shows the landing page of the web application by accessing through a smartphone's browser, Laptop, and Computer. It is the landing page of a web application

that the users can access. Figure 5 shows the Panel that holds the subsystems: Library Resource, School Statistics, Output Rating Sheets, Personal Data Sheets, Requests for ICT Services, BSO Dashboard, and Downloadable forms. This menu also holds the Faculty Portal: Faculty Dashboard, Grade Upload, Student List, and Teaching History. Figure 6 shows the Registry that houses the following systems: School Settings, Enrollment Portal, Human Resources, and Procurement Services. Figure 7 shows the Module that houses the following system: procurement, Admission Portal, AOMR System Daily Time Records, Document Tracking, Faculty portal, Library, Portal Accounts, and QTL System. Lastly, Figure 8 shows the Reports menu that houses Course Evaluation and Registrar's Reports. These menus represent all main systems with corresponding sub-systems, modules, and portals.

In terms of the evaluation results, table 3 shows a very interesting and amazing result. There are 81 participants comprising school personnel, administrators, and students who responded to the online evaluation questionnaire. ISO/IEC 25010 is used for the application evaluation assigned to the participants. There are 8 quality characteristics of the ISO/IEC 25010, but for this project, only 3 measures are measured: Functional Suitability, Performance Efficiency, and Usability. The participants evaluated the Integrated System.

The Integrated system was evaluated, and a highly accepted average is 4.58. Functionality suitability with a mean of 4.56, which is "Excellent", the degree to which a product or system provides functions accomplished defined and suggested needs when used under specified conditions; performance efficiency has a mean of 4.56, which is "Excellent", the performance relative to the number of resources used under stated conditions; compatibility has a mean of 4.61, which is "Excellent" the system can interchange details with other goods, systems/structure or elements, and/or carry out its necessary functions while sharing the same hardware or software environment. The overall average weighted mean of the application is 4.58, rated as "Excellent". This means that the application is acceptable during the conduct of the evaluation.

CONCLUSIONS

The integrated system meets the users' objectives. The web application is well-recommended and acceptable by the users. The researchers used the school's subscribed web hosting for the implementation, accessible 24/7 on the World Wide Web. With its implementation, the entire personnel, including students, can access their accounts and portals using one login credential to access multiple online services depending on the user roles and access list provided by the school's MIS department.

RECOMMENDATIONS

To ensure the project's longevity, it is advised that future development proceed and integrate all systems, subsystems, and modules consistently. Incorporating new

technologies is also advised to make the integrated system more adaptable to changes, particularly rapidly evolving technology.

RESEARCH IMPLICATIONS

The study is an in-house developed Enterprise system that incorporates all existing systems, modules, and portals into a single and organized dashboard for easy access and aid in generating various reports and records for decision-making and the basis for short-term and long-term planning through digital transformation.

PRACTICAL IMPLICATIONS

The main benefit of the Integrated System is that it summarizes all existing systems developed by different programmers and system developers from the past and incorporates it in a single dashboard for easy access and use. It also helps present developers to be able to navigate and conduct upgrades and updates since it provides a friendly environment and structured coding structures, this system allows present and future system developers to navigate and create additional innovations without creating different subdomains or separate standalone programs outside the Integrated System.

DECLARATIONS

Conflict of Interest

No author has disclosed any conflicts of interest.

Informed Consent

The study did not involve humans as participants and only used scene text datasets already available online hence this is not applicable.

Ethics Approval

The research used only scene text datasets already available online and did not include humans as participants; hence, this is not applicable.

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