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Application management information systems in research and student activities: a case study of NAEM Vietnam

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ABSTRACT

The management information systems (MIS) for education bring many benefits to management at universities, educational institutions, and academies. The Vietnam National Academy of Education Management (NAEM) has successfully integrated information technology into the management, teaching, and learning process, bringing many benefits. Many professional activities have been included in the standard framework of the academy's faculties. However, more specific and detailed activities at specialized faculties are being actively researched and implemented for management purposes. This article presents a study on the construction and implementation of a management information system to support the management of activities at faculties, such as managing information about lecturers' teaching, information about scientific research activities, and published works, In addition, this system also allows students to engage in learning activities such as registering for internships and internships at enterprises, information about graduation thesis implementation, and lecturers' assignments to guide students. Deploying this system at faculties supports the management of detailed operations, improves data management and processing, and ensures consistency in management.

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1. INTRODUCTION

In today's educational landscape, the integration of information technology within academic institutions is an inevitable trend, facilitating streamlined, accurate, and efficient information management and operational execution. Management information systems (MIS) have been extensively deployed across numerous universities globally, providing invaluable support in managing student and faculty information, as well as various educational and research activities. The learning management system (LMS) is an essential system for managing, teaching, and learning in universities. Many studies on LMS systems in higher education highlight key factors like satisfaction, student attitudes, usefulness, and ease of use, as shown in research by Ashrafi *et al*. [1] and Zhang *et al.* [2]. The integration of social networks into LMS, emphasized by Al-Maroof *et al*. [3] and Al-Rahmi *et al.* [4], enhances learning efficiency, while supportive conditions and voluntariness, noted by Bervell and Arkorful [5], influence distance learning. Studies like those of Avcı and Ergün [6] and El-Said [7] link LMS with student engagement and academic performance, proving its value during the COVID-19 pandemic. Additionally, research by Abuhassna *et al*. [8] explores factors affecting learning outcomes, and other studies focus on leveraging MIS systems and technology to optimize LMS deployment.

In Vietnam, training management software like Mona eLMS [9], iLeader MIS [10], and Unisoft [11] supports credit-based systems with functions such as student management, timetabling, score entry, and exam organization developed on demand at each university. The National Academy of Education Management (NAEM) has been deploying software to manage students and credit training for students, which brings many benefits to studying and teaching. However, the management of lecturer information in each Faculty, the management of scientific research activities of staff and lecturers, the management of training activities such as registration, and the assignment of lecturers to guide internships and graduation projects are still being done manually on Microsoft Office applications. Using only office software leads to increased work processing time or confusion, mistakes, and difficulty in integrity. Consequently, developing and implementing a comprehensive system for managing research, teaching, and learning activities within faculties holds the potential to address these limitations and challenges. Furthermore, such a system could be a practical illustration for specialized courses, aligning educational practices with real-world requirements. In this article, the authors present a plan to build and deploy an information system to manage lecturers' scientific research and teaching activities, as well as registration for internships and graduation theses of students managed by the faculties.

The main contributions of the paper include: researching the implementation model of the management information system application in managing information about teaching and learning at the faculty level in academies and universities; developing a management information system to serve data management at faculties and departments in the academy; deploying the MIS at the faculties of the NAEM Vietnam, collecting feedback, and evaluating the system performance.

The next section of the article presents the following contents: section 2 presents related domestic and foreign studies on building and deploying management information systems in institutes, schools, and affiliated units. Section 3 presents the analysis and design of application management information systems at the Faculty of Education Management Institute. This section will determine in detail the tasks of the system that need to be built and analyze the processing procedures, as well as the database of the system. Section 4 presents some of the results achieved by the system. Section 5 presents conclusions and development directions.

2. LITERATURE REVIEW

Integrating MIS in educational institutions has gained significant traction in recent years, driven by the need to enhance administrative efficiency and improve academic outcomes. MIS in education, including LMS and other digital platforms, plays a crucial role in streamlining operations, supporting teaching and learning, and providing actionable insights for decision-making.

Many studies are related to implementing LMS systems in higher education to serve the learning of students and the management of training units. Some studies examine the intention to continue using and user satisfaction with the LMS system [1]–[8], [12], [13]. Studies have shown that some important factors affecting the intention to continue using the system include user satisfaction, student attitude, usefulness, and ease of use. Ashrafi *et al.* [1] built a multidimensional theoretical framework to explain students' intention to use LMS. The author surveyed, analyzed, and showed that ease of use and system quality play a key role in promoting the continued use of LMS. Zhang *et al.* [2] applied the technology acceptance model (TAM) in their study and showed that students' attitude toward LMS greatly influences their intention to use it. Through their research, Al-Adwan *et al.* [12] also emphasized the critical role of learner satisfaction. Nguyen [13] studied student satisfaction at the International University–Vietnam National University HCMC; the study showed that system quality and ease of use are the main factors driving satisfaction.

Some studies focused on integrating networks into LMS systems to support university learning and teaching. Al-Maroof *et al.* [3] studied and evaluated the perceived usefulness and ease of information systems as essential factors for accepting blended learning. Bervell and Arkorful [5] also emphasized that supportive conditions and voluntariness in using LMS greatly influence usage behavior in distance learning environments. Al-Rahmi *et al.* [4] studied the integration of social networks into LMS systems. The TAM model for conducting the analysis shows that the interaction between students and social networks can enhance learning efficiency and implies that social networks can be an important support tool for LMS systems.

Some other studies develop the direction of the influence of LMS on learners' engagement and learning performance. Avcı and Ergün [6] used the multivariate analysis of variance (MANOVA) method to study and show that students' learning achievement is closely related to participation in activities on the LMS system but not to students' information literacy. Therefore, closely monitoring the level of student engagement can help instructors identify students' needs and support appropriate learning. El-Said [7] studied the impact of the COVID-19 pandemic on online learning experiences in developing countries and found that despite the transition to online learning, student learning outcomes were not significantly affected. This

proves that LMS can meet distance learning needs during the pandemic. Abuhassna *et al*. [8] studied the potential factors affecting student learning outcomes, and the research model proposed by the authors is built on transactional distance theory (TDT) and bloom's taxonomy theory (BTT). In addition to studies on the effects and impacts of LMS systems on teaching and learning at universities, there are also many studies on the development and application of MIS systems and technology platforms to deploy LMS systems.

Several research studies have focused on applying LMS and MIS systems in universities and training institutes to enhance adaptability in the new era, particularly during the COVID-19 pandemic. Ouajdouni *et al.* [14] examine the application of information technology in teaching at universities in Morocco during the COVID-19 pandemic. Similarly, in the research [15], the authors investigate the implementation of LMS and MIS at the University of Computer Science and Information Technology (CUSIT) in Pakistan. The authors highlight frequently and infrequently used features within both systems and propose strategies for more effective implementation, particularly during COVID-19. Other studies have focused on mobile LMS deployment and its influencing factors. For instance, Qashou [16] explores mobile learning (m-learning) adoption in universities, specifically the factors influencing university students' intention to adopt m-learning in Palestine. In another context, Lavidas *et al*. [17] examine the limitations and influencing factors affecting LMS deployment in Greek universities. Furthermore, Chick *et al*. [18] propose innovative solutions such as flipped classrooms, online practice questions, and e-learning methods to reduce face-to-face interaction during learning activities. Bhaskar *et al*. [19] discuss implementing blockchain technology in education, addressing blockchain knowledge dissemination, deployment potential, and existing barriers, and offering recommendations for future blockchain applications in education.

In Vietnam, there are many software applications for training management according to the credit system, such as Mona eLMS [9], iLeader MIS [10], and Unisoft [11]. The systems are applied to student information management, program management, school year plan management, creating timetables, allowing students to register for study, and helping lecturers enter the process scores. Functional departments update exam scores, and the benefits it brings have also been confirmed. Each university uses different management software depending on its needs and purposes. Mona eLMS training management software ecosystem [9] provides functions related to online training and teaching, classroom management, student and teacher management, exam management and organization, financial management, revenue and expenditure, and paperwork. The iLeader training management software [10] uses a hierarchical architectural model, divided into registration modules, student management tools, class management modules, and reporting modules, creating simplicity and consistency in the use process. An iLeader has successfully deployed over 200 large and small language training centers nationwide. At the NAEM, Unisoft's training management software version 6.0 [11] is being used, including functions from system administration, enrollment management, training management, student management, tuition management, health insurance; learning outcomes management, summary reports, and great support in training according to the credit system.

The study of the above research works shows that most of the studies focus on evaluating the effectiveness of LMS implementation and the factors affecting the application of LMS and teaching and learning methods at universities and academies. Studies in analyzing, designing, and implementing MIS systems or educational management support platforms related to detailed management operations serving management in university training are almost nonexistent. In this paper, we focus on analyzing, designing, developing, and implementing a MIS system for departmental management at higher education institutions and implementing it in practice at NAEM [20]. The results from this study have brought high efficiency in teaching and learning management at NAEM.

3. SYSTEM ANALYSIS AND DESIGN

3.1. The deployment model of the management information systems at the National Academy of Education Management

To effectively support management and operations at NAEM, the MIS system must ensure that users (staff, lecturers, and students) can access it from anywhere via the internet. To meet this requirement, the system must be deployed on a platform that supports access through the internet, allowing multiple users to work simultaneously on many different devices. Therefore, this system will be deployed in a cloud computing environment using a microservices model, as detailed in Figure 1.

In Figure 1, the academy's staff, lecturers, and students will use mobile phones, laptops, tablets, or PCs to perform actions on the system's front-end interface. These devices must be connected to the internet to send user requests to the back-end system (deployed in a cloud computing model). The server-side system will receive these requests (via the application server and application programming interface (API) gateway, which handle the connection and data query). Then, the requests will be forwarded to the microservices system for processing. The microservices will connect to the database if data retrieval is required to fetch the

necessary information. Finally, the processed results will be returned to the user through the internet and displayed on the user's device screen.

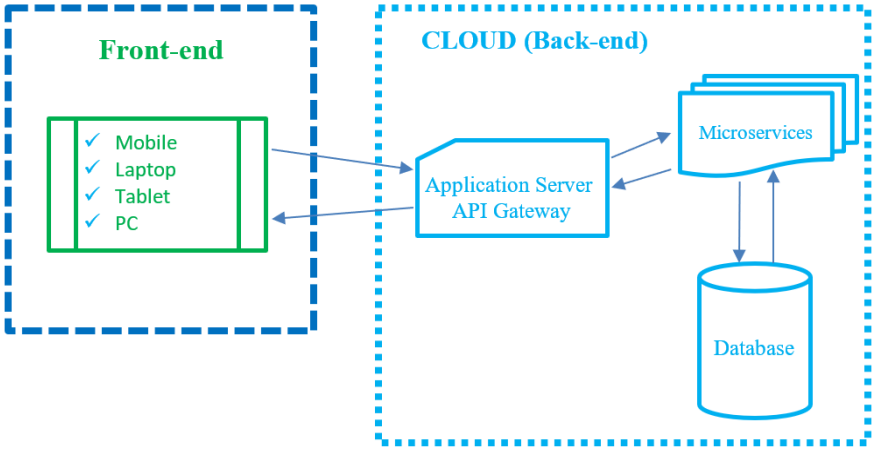

Figure 1. The model of MIS deployment in NAEM faculties

3.2. Functions of management information systems

The objective of MIS is to manage information about lecturers, including information related to teaching and scientific research activities of lecturers. In addition, the system also provides the ability to manage the internship activities of final-year students. Through that, the system helps to manage and organize information effectively, improving the efficiency of lecturer management in universities and educational institutions.

The software will include the following features: i) lecturer information management: this includes personal information from lecturers, a list of subjects they teach, information related to their scientific research activities, and other activities; ii) Teaching schedule management: the software will allow lecturers to enter their teaching schedules into the system, allowing better management of their teaching schedules and time; iii) Scientific research activities management: including a list of scientific research projects, articles, books, and other research products from lecturers; and iv) Statistical reports: the software will generate statistical reports on the lecturers' teaching and scientific research activities. This report will help better manage lecturers' information and results in the teaching and scientific research process.

The software will be developed on a web platform, allowing remote information management and easy access from any location. The system database will be centrally stored on a cloud database, allowing easy sharing and exploitation. In addition, the software will have a user-friendly interface that is easy to use and customizable for different types of users. Figure 2 is the management system's functional hierarchy diagram [21].

3.3. Analysis of faculty management process operations

The Academy of Educational Management faculties have many different management tasks, such as managing teaching assignments, scientific research activities, students doing internships, writing graduation theses, statistics, and reporting data related to the above activities. The main tasks of the entire system will be modeled using the object-oriented design analysis method [22] with a use case diagram, as shown in Figure 3, and details of the tasks are described in Table 1. Scientific management details of the business activities are described in Table 2.

During operation, data is stored in the system database. Output reports will synthesize and render data for management purposes. The data synthesis process for reporting is presented in the use case diagram in Figure 4; this function's business rules are shown in Table 3.

3.4. The management information systems database structural

The system database is designed to ensure simultaneous exploitation by many users through the internet environment. To ensure consistency and security and meet strict constraints between entities in the system, the database is built in a relational database management system that meets the 3NF standard [23]. The system database is built through requirement analysis with tables, as shown in Table 4.

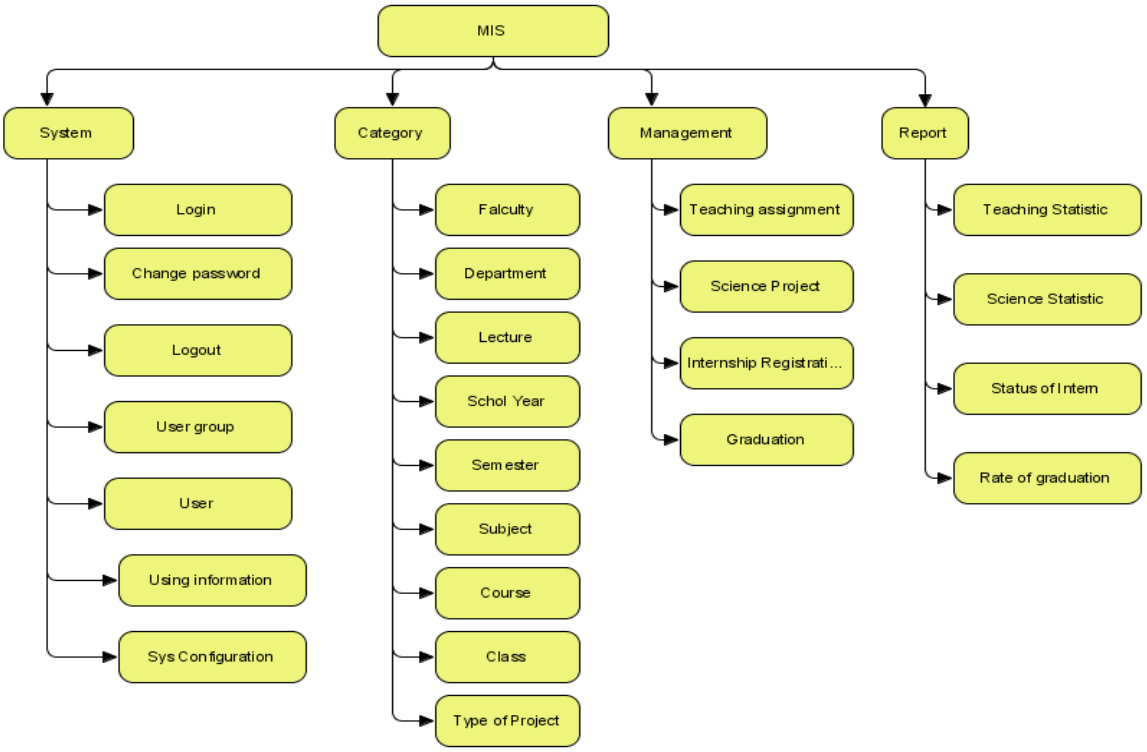

Figure 2. Functional decomposition diagram of the software

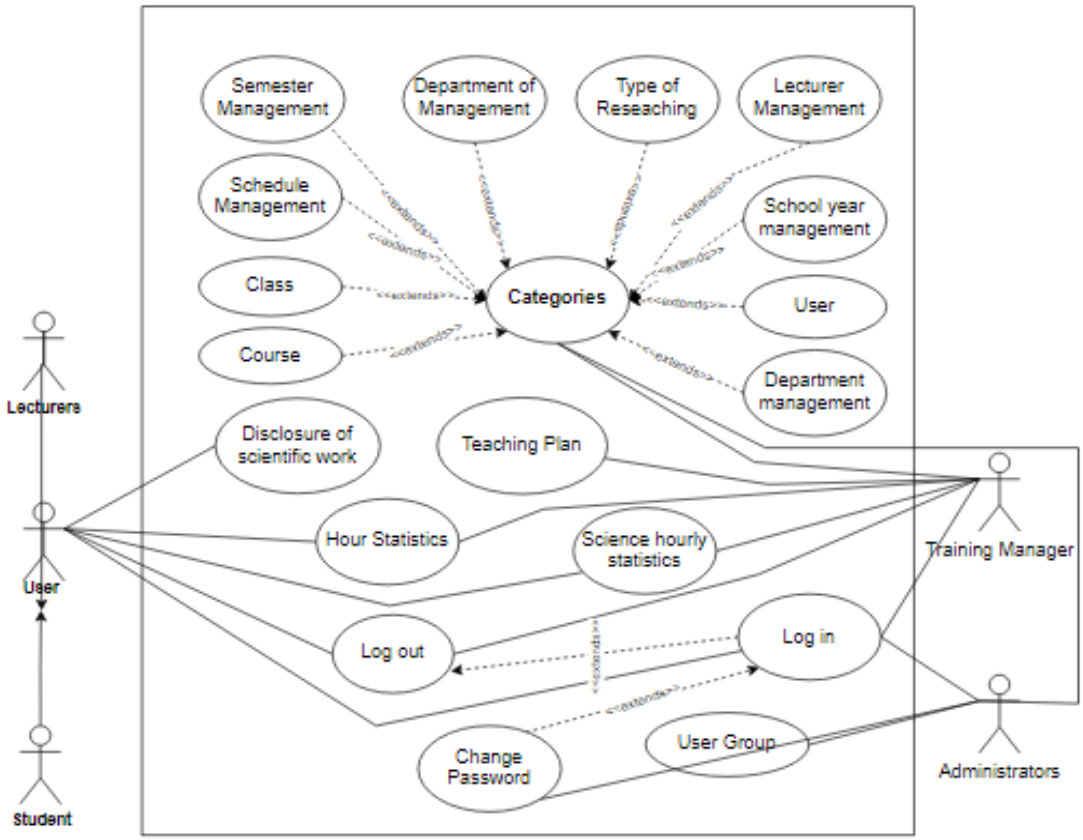

Figure 3. General use case model of MIS

Table 1. The description of the MIS' main functions

Subject	Description
Code	BD01
Name	General
Description	This diagram describes the general functionality of the education management software, allowing actors to interact with the system to perform management and monitoring activities related to training management
Main actors	Administrator; training manager; instructor; student
Pre-conditions	- The software system has been deployed and is operational - The user has logged into the system
Post-conditions	Changes related to training management have been updated and stored in the system
Main flow	- The user accesses the main interface of the training management software - The system displays functions and options for the user, including: - The user selects a specific function to perform - The system displays options and lists related to the selected function - The user performs specific actions such as viewing, adding new information, editing, deleting, or extracting information - The system processes the corresponding actions from the user and updates the relevant information in the database - End
Exception flow	If the system encounters technical problems, it may display a general error message to the user

Table 2. The business description of the scientific function

Subject	Description
Code	BD02
Name	Scientific works
Description	Describes how users (lecturers, students) use the scientific work declaration function to register and manage information about scientific research projects in which they participate in the training management system
Main actors	Lecture; student
Pre-conditions	- The training management system has been deployed and is operational - Users have logged into the system and have access to the scientific work declaration function
Post-conditions	Information about scientific works has been recorded and stored in the system
Main flow	- Users (lecturers or training managers) access the interface to declare scientific works in the system - The system displays a list of registered scientific works or allows users to add new works
Alteration flow	- Step 3a: if the user chooses to view the details of a project, they can return to the list after viewing the details - Step 3b: if the user chooses to add a new project, they will enter the information and return to the list after adding - Step 3c: if the user chooses to edit the project information, they can update it and then return to the list after editing - Step 3d: if the user chooses to delete the project, they will confirm the deletion and then return to the list after deleting
Exception flow	If the system encounters technical problems, it may display an error message to the user

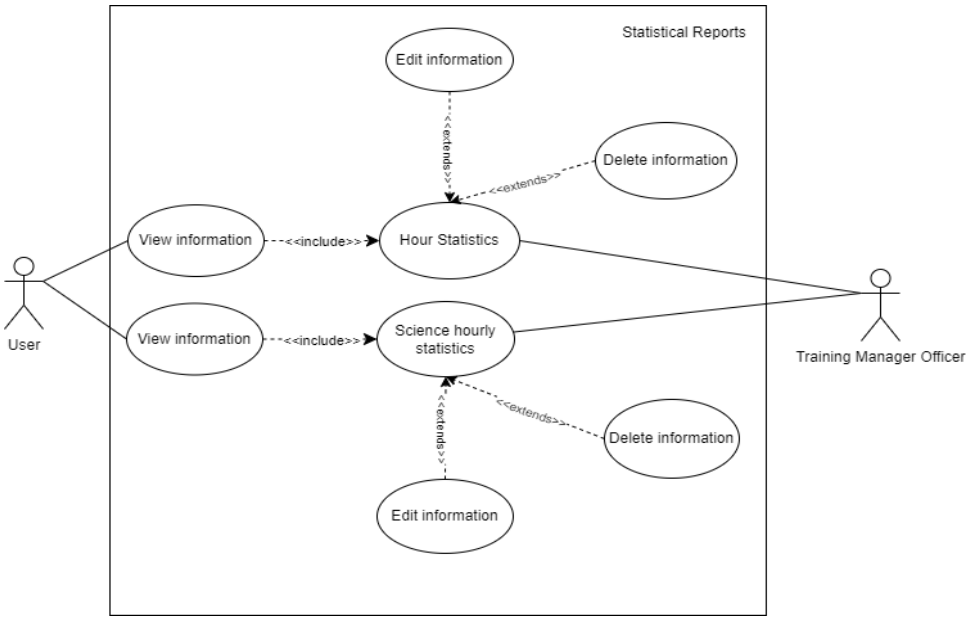

Figure 4. Use case diagram of statistical reporting activity

Table 3. The business roles of the report function

Subject	Description
Code	BD04
Name	Report
Description	Describes how to create and access statistical reports in the training management system. This function allows training managers and users to query and create statistical reports related to activities and data in the system
Main actors	Users (students, lecturers, training staff)
Pre-conditions	- The training management system has been deployed and is operational - The user has logged into the system
Post-conditions	The statistical report has been generated and displayed to the user or exported as a file
Main flow	- The user (administrator, training manager, regular user) accesses the statistical report interface in the system - The system displays a list of available statistical report types and options to create a new report - The user selects a report type from the list or selects the option for creating a new report - The system displays the parameters and options for the statistical report, including items such as time, object, and subject - The user enters the required parameters or selects options to create the report as requested - The user confirms the request to create a statistical report - The system processes the request and creates a statistical report based on the parameters and options entered - The system displays the statistical report to the user in the interface or allows the user to download the report as a file - Finish
Alteration flow	- Step 3a: If the user chooses to create a new report, they will enter information about the type of report they want to create - Step 5a: Depending on the type of report, the user may need to enter different parameters
Exception flow	- If the system has technical problems, it may display a general error message to the user - If the user does not enter enough information required for the report, the system will display a message asking for additional information

Table 4. Data tables of the management information system

No.	Table name	Description
1	tblPhongKhoa	List of departments and faculties
2	tblBomon	Department
3	tblGiangVien	List of lecturers and staff: each lecturer will have an account to log in to the software
4	tblGiangVienHoso	Lecturer's profile: progress, history of adjusting information of staff and lecturers
5	tblHocPhan	List of courses
6	tblNamHoc	Year students in: a class of a subject, organized by semester
7	tblNganhHoc	Major: research topics, books, magazines, seminars
8	tblHocKy	Semester list
9	tblLopHocPhan	List of class
10	tblLoaiCongTrinh	Type of scientific research. Each lecturer will have an account to log in to the software
11	tblCongTrinh	Lecturer's scientific work. Progress, history of adjusting information of staff and lecturers
12	tblUser	List of users
13	tblLich	Contains information about events in the department such as department meetings, student internship schedules, thesis defenses
14	tblBangTin	Information about the department's bulletin boards

4. SYSTEM IMPLEMENTATION RESULTS

The MIS management system at NAEM's faculties was built based on the requirements identification and database construction as in section 3. Through the analysis in section 3, an MIS system was deployed to meet the above requirements. The system has been deployed and achieved some critical initial results.

4.1. The technology frameworks

Development based on powerful and popular application frameworks (specifically, Microsoft's model-view-controller (MVC) model). The MVC [24], is a software architecture used in web programming. This architecture divides the web application into three parts: model, view, and controller. Microsoft has also developed an MVC technology called c MVC to support the development of web applications on the .NET platform. ASP.NET MVC is a programming language for building Microsoft application systems with many advantages, including: providing a clear separation architecture between MVC, making web application development easier; allowing the development of web applications that interact with users flexibly and efficiently; supporting modern web technologies such as AJAX, HTML5 and CSS3.; allows more accessible

coding and easier application testing; API+ web programming languages: C#, HTML5, CSS, JQuery, AngularJS, and Microsoft SQL server [25] database management system.

4.2. Software interface

The information system for managing scientific research, teaching, and learning activities at the Faculty of Educational Management has been built and deployed. The actual implementation shows that the system has met the main business requirements. Some of the main and specific functions in the system include the teaching assignment function (Figure 5), managing the list of graduated students (Figure 6), and statistics of lecturers' teaching hours (Figure 7).

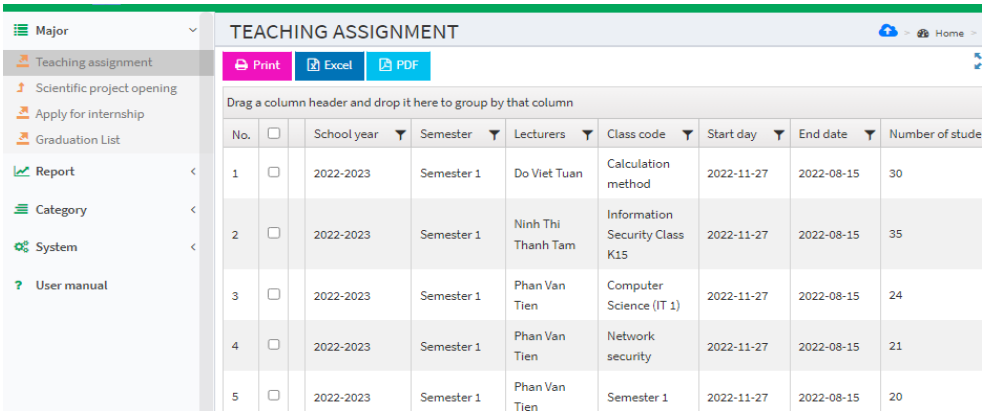

Figure 5. Teaching assignment interface

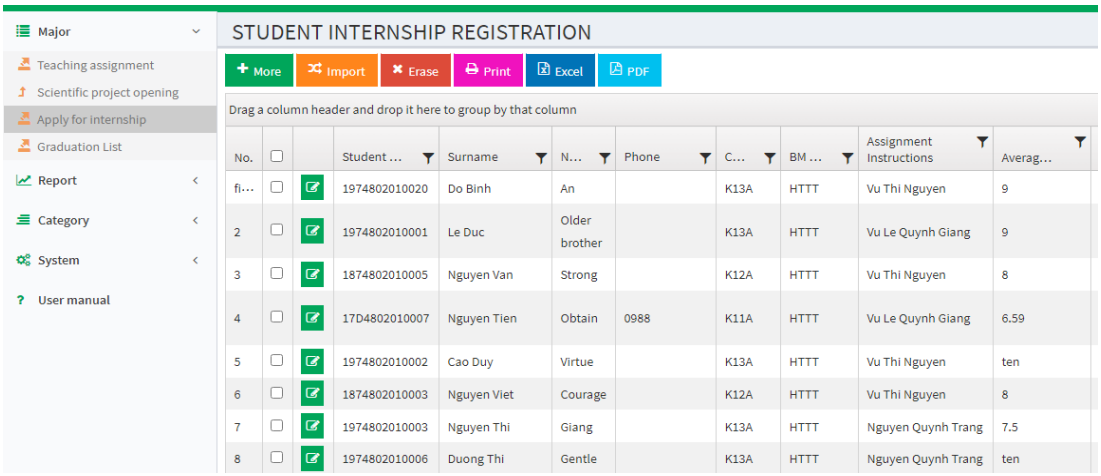

Figure 6. Function for graduation internship registering of students

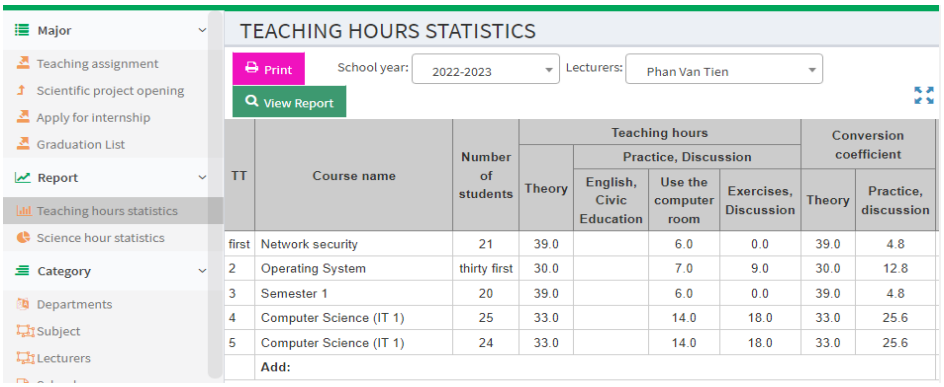

Figure 7. Teaching hours statistics interface

5. DISCUSSION AND IMPLICATIONS FOR DEPLOYING MIS IN HIGHER EDUCATION

The MIS developed for the NAEM demonstrates significant results in supporting faculty operations and administrative tasks. By leveraging a cloud-based microservices architecture and implementing modern technology frameworks, the system ensures scalability, reliability, and accessibility for users, including staff, lecturers, and students.

The MIS system was designed to meet the operational needs described in the analysis phase, providing a robust infrastructure for managing diverse activities. Key functions include managing lecturer information, scientific research, teaching schedules, internship supervision, and generating statistical reports. The system's deployment in a cloud computing environment ensures secure, real-time access across various devices, enabling users to perform tasks seamlessly from remote locations. The system employs the Microsoft MVC framework for development, ensuring a clear separation of the application's components. This architecture supports modern web technologies like HTML5, CSS3, and AJAX, offering flexibility and efficiency in web application interaction. Additionally, the system integrates C#, AngularJS, and Microsoft SQL server, enabling robust data processing and management.

The deployed MIS successfully meets the operational requirements of NAEM's faculties. Notable achievements include: i) User-friendly interface: a well-structured interface supports key functions, such as teaching assignments, scientific research management, and statistical reporting, tailored for different user roles; ii) Data management improvements: centralized data storage ensures consistency, security, and easy access for data-driven decision-making; and iii) Enhanced operational efficiency: the system supports streamlined workflows, such as tracking lecturer activities and managing student internship processes, reducing manual effort.

The initial implementation results reveal the system's ability to address critical operational challenges in academic management. The use of advanced frameworks and cloud-based architecture ensures high performance and scalability, while the user-centric design enhances usability for diverse stakeholders. Future improvements may include expanding system functionalities, integrating additional analytics tools, and enhancing user training to maximize system benefits. This deployment underscores the potential of MIS to modernize educational management, demonstrating its value in improving operational efficiency, data accuracy, and user engagement in academic institutions.

However, the study has some limitations. Firstly, the system has only been deployed in certain faculties within the academy. Thus, evaluating its effectiveness comprehensively on a larger scale is impossible. Secondly, user feedback collection has been limited, resulting in insufficient data for optimal system improvement and expansion of functionalities.

6. CONCLUSION AND FEATURE WORKS

This paper presented the research process and deployment of a MIS at the NAEM in Vietnam. The primary objective of this research was to develop an effective information management system to enhance the administration of faculty teaching and research activities while also managing student internship and thesis registration processes. The system successfully addressed the limitations of the existing system by providing an efficient solution for managing faculty information, research activities, and other administrative procedures. The application of system analysis diagrams facilitated the modeling and optimization of business processes, leading to the development and implementation of an MIS that significantly improved processing time, enhanced data accuracy, and supported decision-making. These outcomes align with previous research demonstrating the positive impact of MIS adoption in education on academic performance and user satisfaction. Theoretically, this research has provided a model for MIS implementation, serving as a foundation for future studies in applying such systems to other higher education institutions. Practically, the research not only contributes to developing an MIS implementation model at the faculty level but also offers a practical solution proven feasible and effective at NAEM in improving management processes and minimizing errors in information management, thereby enhancing the quality of education and research. The system will soon expand its deployment to all faculties within the NAEM to assess its overall effectiveness and gather feedback from a broader range of users. In addition, the system can integrate new technologies such as artificial intelligence and big data analytics to enhance automation and decision support capabilities, thereby improving the effectiveness of this research management system.

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