SYSTEM FOR UNIVERSITY AND COLLEGE ADMISSION PROJECTS: DESIGNING AND IMPLEMENTATION BASED ON LINEAR PROGRAMMING

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Abstract

The rapid development of information technology and network infrastructure has brought about numerous opportunities and breakthrough applications in management and operations across all sectors of modern life, with education holding a significant position. Currently, the Ministry of Education and Training has implemented transactional portals to support universities and colleges in constructing admission plans. However, these transactional portals only provide basic support such as uploading data on lecturers, floor area, student scale, and some forms and reports. Despite some improvements, these systems are still incomplete and not consistently updated with admission plan data over the years. Additionally, there is no automated mechanism to propose an optimal solution for balancing the faculty size, student scale, and floor area to estimate admission targets for specific fields and disciplines. Therefore, we propose a new solution: building a web-based system integrated with linear programming algorithms. The goal is to optimize the admission process, balance the faculty, minimize errors, and enhance efficiency, thereby fixing the limitations of the current Ministry's system.

Keywords: *Admission, college, education, linear programming, university.*

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HỆ THỐNG ĐỀ ÁN TUYỂN SINH ĐẠI HỌC, CAO ĐẲNG: THIẾT KẾ VÀ TRIỂN KHAI DỰA TRÊN QUY HOẠCH TUYẾN TÍNH

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Tóm tắt

Sự phát triển nhanh chóng của công nghệ thông tin và hạ tầng mạng đã đem lại nhiều cơ hội và ứng dụng đột phá trong quản lý và điều hành ở mọi lĩnh vực của đời sống hiện đại, trong đó giáo dục chiếm một vị trí quan trọng. Hiện nay, Bộ Giáo dục và Đào tạo đã triển khai các cổng nghiệp vụ hỗ trợ các trường Đại học, Cao đẳng xây dựng đề án tuyển sinh. Tuy nhiên, các cổng nghiệp vụ này chỉ hỗ trợ cơ bản như việc upload dữ liệu đội ngũ, diện tích sàn, quy mô sinh viên, và một số biểu mẫu, báo cáo. Mặc dù đã có những cải tiến, nhưng vẫn chưa đầy đủ và không liên tục trong việc cập nhật dữ liệu đề án tuyển sinh qua các năm. Ngoài ra, chưa có cơ chế tự động giúp đề xuất phương án tối ưu cho sự cân đối giữa đội ngũ giảng viên, quy mô sinh viên và diện tích sàn để ước tính chỉ tiêu tuyển sinh cho từng lĩnh vực và ngành cụ thể. Do đó, chúng tôi đề xuất một giải pháp mới: xây dựng một hệ thống trên nền tảng web kết hợp với thuật toán quy hoạch tuyến tính. Mục tiêu là tối ưu hóa quy trình tuyển sinh, cân đối đội ngũ giảng viên, giảm thiểu lỗi và nâng cao hiệu suất, từ đó khắc phục những hạn chế hệ thống hiện tại của Bộ.

Từ khóa: *Cao đẳng, đại học, giáo dục, quy hoạch tuyến tính, tuyển sinh.*

1. Introduction

The admissions project is a crucial strategic document that guides the admissions process of universities and colleges. It is considered a detailed design blueprint, clarifying not only the admission criteria and methods but also reflecting the commitment of the educational system to enhancing the quality of education to meet the increasingly diverse needs of society.

Based on the regulations and guidelines of the Ministry of Education and Training (MOET), according to Decrees No. 02/2022/TT-BGDĐT, 03/2022/TT-BGDĐT, 09/2022/TT-BGDĐT, 10/2023/TT-BGDĐT, the admissions plan ensures transparency and fairness while promoting creativity and innovation in the application of new admission methods and technologies. This optimizes the process, improves the efficiency and quality of the admissions process, ensuring that universities and colleges acquire quality human resources that meet the demands of labor market.

In summary, the admissions project is not just a regulatory document but also a symbol of innovation, improvement, and development in education. It correctly applies the regulations and guidelines by MOET, ensuring that Vietnamese education remains at the forefront serving modern society and the labor market.

2. Related works

Building the admissions project is an extremely important task, taking place regularly every year and significantly influencing the success or failure of the entire admissions process at universities and colleges. Currently, at Can Tho University of Technology, completing this task annually calls for extra coordination and funding from a number of related functional departments, including the departments of training, organization and administration, politics and student management, administration and equipment, and many more. On the other hand, the process of collecting, analyzing, and processing data on the student body and the scale of existing facilities often takes place manually, leading to a considerable amount of time and errors, along with challenges in selecting optimal solutions.

Under the Government and MOET, two important platforms have been implemented in the process of developing the admission project for universities and colleges: the admission information portal (tuyensinh.moet.gov.vn) and the HEMIS system (hemis.moet.gov.vn). The former is an online application that provides detailed information about determining admission quotas, forms, and related regulations, helping students and parents have a comprehensive and easy understanding of the admission process. Meanwhile, HEMIS assists schools in managing and tracking information of candidates, from the registration process to admission evaluation and results, creating a clear and effective database. The achievements of these two systems include enhancing transparency and fairness in the admission process, improving convenience and efficiency for candidates in submitting applications and tracking results, as well as strengthening the management and data analysis capabilities of schools.

However, there are also some limitations and shortcomings, such as:

(1) - The data for the admissions project between years is still lacking, not consistently maintained. To implement the admissions project for the next year, one has to reload all the data instead of inheriting the data from the previous year.

(2) - No automated mechanism suggests optimal solutions for balancing the lecturer team with the student scale, floor space, and calculating admissions quotas for each specific field and industry

(3) - The data has not been detailed and calculated in the functions. Moreover, managing and updating data in HEMIS requires high accuracy and synchronization from the schools, potentially leading to errors and difficulties in processing admissions information.

Thus, this study proposes a solution to build a new system as a significant step to address the three limitations from the two aforementioned systems and to optimize processes and activities in these issues. This new system is designed and developed based on the waterfall development model. This model, introduced by (Royce, 1970), is a software engineering framework that includes steps such as: requirements analysis, system design, program design, coding, unit testing and integration, system testing, acceptance testing, deployment, and maintenance. Additionally, we integrate linear programming algorithms into the system to address the remaining limitations. This proposed solution

not only enhances the level of support for admission project consultancy but also paves the way for a new direction in automating this process.

3. Materials and methods

The architecture of the system is presented in Fig.1. Here, the admission project system provides comprehensive information about quality assurance conditions: physical facilities (classrooms, practice rooms, or laboratories, and essential equipment, learning materials), teaching staff, training scale, and some other crucial information as stipulated in the regulations and guidelines of the Ministry of Education and Training.

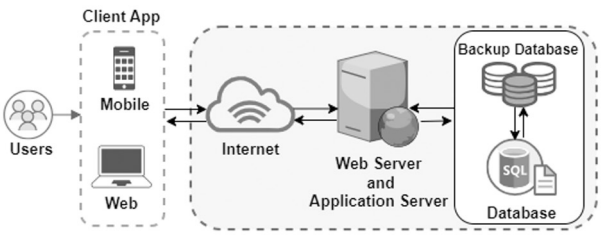

Fig. 1. Architecture diagram of the system

To meet the system requirements as described, we build modules based on relevant theoretical foundations and perform the following functions:

• Develop a management module for admission disciplines (training fields, training department groups, disciplines, and field coefficients) to assist users in configuring admission disciplines by the year and field.

• Build a management module for the faculty team (primary lecturers, visiting lecturers, primary lecturer conversion factor, visiting lecturer conversion factor).

• Create a management module for physical facilities (classrooms, practice/experiment rooms, computer rooms, and other facilities for training) to determine floor area.

• Establish a management module for students (currently enrolled, withdrawn, graduated, on leave).

• Develop a management module for admission projects (implement regulations, execute admission projects) to support proposing optimal solutions for balancing the teaching staff

• Analyze, design, and construct a complete system (web-based) to integrate the aforementioned modules.

3.1. Development tools and technology

In this study, we utilized ASP.NET (Cwalina et al., 2020; Price et al., 2020) and SQL Server (Bai et al., 2020; Siahaan et al., 2020), to develop and build the application. ASP.NET, an advanced web application framework by Microsoft, has been widely adopted to create high-quality and easily maintainable web applications. When combined with SQL Server as a relational database management system, we can construct dynamic and interactive web applications that efficiently and flexibly interact with data.

To optimize performance and utilize network resources efficiently, we integrated Ajax (Asynchronous JavaScript and XML) (McGrath, 2020; Ranjan et al., 2020; Castillo, 2017). Ajax not only reduces page loading time but also enhances the performance and responsiveness of the website. The ability to combine data from multiple sources without reloading the page is a prominent advantage of Ajax, allowing web applications to integrate and display data smoothly and flexibly. Ajax has provided a better interactive and personalized user experience, simultaneously improving the performance and responsiveness of the website. This demonstrates that Ajax is not just a technology but also a significant advancement in the field of web development, bringing substantial benefits to both developers and users.

3.2. Construction of system modules

3.2.1. Building a module for managing admissions disciplines

The module for managing admission majors and the field coefficient for each major in the software is designed to meet the regulations of the Ministry of Education and Training. This section of the software is responsible for managing and organizing information about training majors, fields, and related coefficients, making it easy for the organization to monitor and adjust the admission process.

The admission major management module provides the ability to add, update, and delete information about training majors in the system. Administrators can input detailed information about each major, including the training field, group of majors, and other related factors. This helps create a clear and comprehensive database of training majors.

The field coefficients for each major are integrated to ensure that the software complies with specific regulations set by MOET. The system allows administrators to update and adjust these coefficients based on requirements and current regulations. Through this functionality, users can adapt flexibly to changes in admission regulations and ensure that the coefficients are applied accurately and timely during the admission process, in accordance with the regulations of the education management authority.

3.2.2. Building a module for managing faculty team

During the development of the module for managing the faculty team and conversion coefficients, the objective is to provide a tightly integrated, synchronized, and efficient management database for instructor information. Additionally, the module automates the conversion of coefficients based on the qualifications of each instructor as required by the educational program.

The function of managing the faculty team in the software allows administrators to input detailed information about instructors, including both permanent and guest lecturers. Users have the ability to add, edit, and delete instructor information, as well as track important details such as qualifications, expertise, and experience. This creates a comprehensive and accurate database of the faculty team, facilitating efficient management and optimization of instructor assignments for each major and field of study.

The conversion coefficients for instructors based on their qualifications are a crucial component in the implementation of the admission project. This functionality allows administrators to update and manage these coefficients according to the requirements and regulations by MOET (Ministry of Education and Training, 2022). Different academic ranks such as Professor, Associate Professor, Ph.D, Master, and University are associated with specific conversion coefficients, automating the calculation process for the faculty team across various fields of study.

Therefore, to calculate and verify compliance with the requirements, we use formula (1) as follows:

$$\mathcal{T} + \mathcal{V} \geq \frac{\mathcal{Q} - \mathcal{N} + \mathcal{C}}{\mathcal{H}} \quad (1)$$

where:

$\mathcal{T}$: Total conversion of primary lecturers

$\mathcal{V}$: Total conversion of visiting lecturers

$\mathcal{Q}$: The number of students is taken from the number of students currently studying.

$\mathcal{N}$: Expected number of graduating students

$\mathcal{C}$: Expected criteria

$\mathcal{H}$: Field coefficient

Total conversion of primary lecturers ($\mathcal{T}$): For the degrees of Professor, Associate Professor, Doctorate, Master, University, the corresponding general is x_1, x_2, x_3, x_4, x_5 and conversion coefficient respectively k_1, k_2, k_3, k_4, k_5. At that time, the total converted primary lecturers for the of the industry are calculated according to degrees and the lecturers conversion coefficient according to formula (2) as follows:

$$\mathcal{T} = k_1x_1 + k_2x_2 + k_3x_3 + k_4x_4 + k_5x_5 \quad (2)$$

Total conversion of visiting lecturers ($\mathcal{V}$): Is also calculated similarly to the total converted primary lecturers ($\mathcal{T}$), however, it does not exceed 10 of the current number of primary lecturers. If the number of visiting lecturers is greater than 10 of the number of primary lecturers, only 10 of visiting lecturers will be considered for calculation.

Expected number of graduating students ($\mathcal{N}$): Enabling users to easily determine the expected number of graduating students for each major, based on crucial factors such as training duration and number of current students. Calculated using formula (3), where represents the total current number of students (currently studying, reserved) in the major, and $\mathcal{L}$ is the training duration for that major.

$$\mathcal{N} = \frac{\mathcal{S}}{\mathcal{L}} \quad (3)$$

Expected criteria ($\mathcal{C}$), Field coefficient ($\mathcal{H}$): Derived from the criteria, the industry and field coefficients are taken according to the current regulations by MOET (Ministry of Education and Training, 2022).

In summary, this module not only provides an accurate database and management of information about the faculty team but also plays a crucial role in efficiently implementing the admission project.

3.2.3. Building a management module for physical facilities

We have designed and developed a facility management module to ensure efficiency and comprehensiveness in the management of the school's physical resources. This function allows administrators to input and track details about classrooms, laboratories, and other necessary equipment for the educational process.

The facility management module allows users to add, edit, and delete information about rooms and equipment. Details such as area, equipment inventory, and current condition help administrators easily monitor and assess the status of the physical facilities.

The function not only focuses on storing information but also provides data during the inspection of facilities to meet training needs and implement the admission project. The inspection is calculated based on formula (4) as follows:

$$\mathcal{U} \leq \frac{\mathcal{R}}{\mathcal{Q} - \mathcal{N} + \mathcal{C}} \quad (4)$$

where: $\mathcal{U} = 2.8\text{m}^2$ is taken according to current regulations of the Ministry of Education and Training.

$\mathcal{R}$: Total floor area is calculated based on the area of classrooms, hallways, and other buildings.

$\mathcal{Q}$: The number of students is taken from the number of students currently studying.

$\mathcal{N}$: Expected number of graduating students

$\mathcal{C}$: Expected criteria

3.2.4. Building a management module for admission project

In this module, we have developed based on previous research on linear programming algorithms (Syifa et al., 2023; Solow et al., 2014). The main function of the module is to optimize the utilization of lecturers, student scale, and infrastructure for each major of study and training area. We also reuse conditions from modules 3.1 and 3.2 to propose hypotheses for the problem as follows:

• $i \in N =$ {Professor, Associate Professor, Ph.D, Master, University}

• k: The number of educational disciplines, $k = 1, 2, 3... n$.

• x_{ik} The number of lecturers with a degree , for the major k.

• y_{ik}: The number of visiting lecturers with a degree i, for the major k.

The total number of lecturers in each discipline must not be less than 10 and there must be more than 1 Ph.D.

Consequently, we have an objective function:

$$Minimize\ Z = \sum_i \sum_k (x_{ik} + y_{ik}) \quad (5)$$

Subject to:

$$x_{ik} \geq 10,\ \forall i \in N \quad (6)$$

$$x_{ik} + y_{ik} \geq 1,\ \forall i \in N = \{ph.D\} \quad (7)$$

$$x_{ik} \leq G_{ik},\ \forall i \in N \quad (8)$$

$$y_{ik} \leq O_{ik},\ \forall i \in N \setminus \text{(University)} \quad (9)$$

$$\Sigma_i (x_{ik} + y_{ik}) * C_i \leq S_k\ \forall k \quad (10)$$

$$\Sigma_{i,k} (x_{ik} + y_{ik}) \leq U_{ik} \quad (12)$$

$$x_{ik}, y_{ik} \geq 1,\ G_{ik},\ O_{ik},\ C_i,\ U_{ik} \geq 0 \quad (13)$$

where G_{ik}: The total number of primary lecturers with a degree i for the major k; O_{ik}: The total number of visiting lecturers with a degree i for the major k; S_k: Student scale for the major k; C_i: The conversion coefficient of primary and visiting lecturers for each level is determined based on the policies and regulations of the Ministry of Education and Training (Ministry of Education and Training, 2022); U_{ik}: The total number of lecturers

Therefore, to find the optimal solution for problem (5), we transform the problem into standard form, construct the simplex tableau to apply the simplex algorithm to find the solution (Syifa et al., 2023; Solow et al., 2014).

4. Building the system and integrating modules

Similar to other management systems, the development process of this system includes stages of analysis, design, construction, and deployment, followed by integration with management modules to implement the admission project. However, due to the page limit of the article, we will only describe one model database diagram and functional flowchart according to the units, Fig.2.

The detailed Entity Relationship Diagram (ERD) is presented in Fig.3. In it, the main entities of the system include: User, Student, Field, Major, Degree, Position, Unit, Class, Regulations, User Permissions, and Results of the implementation of the admission project.

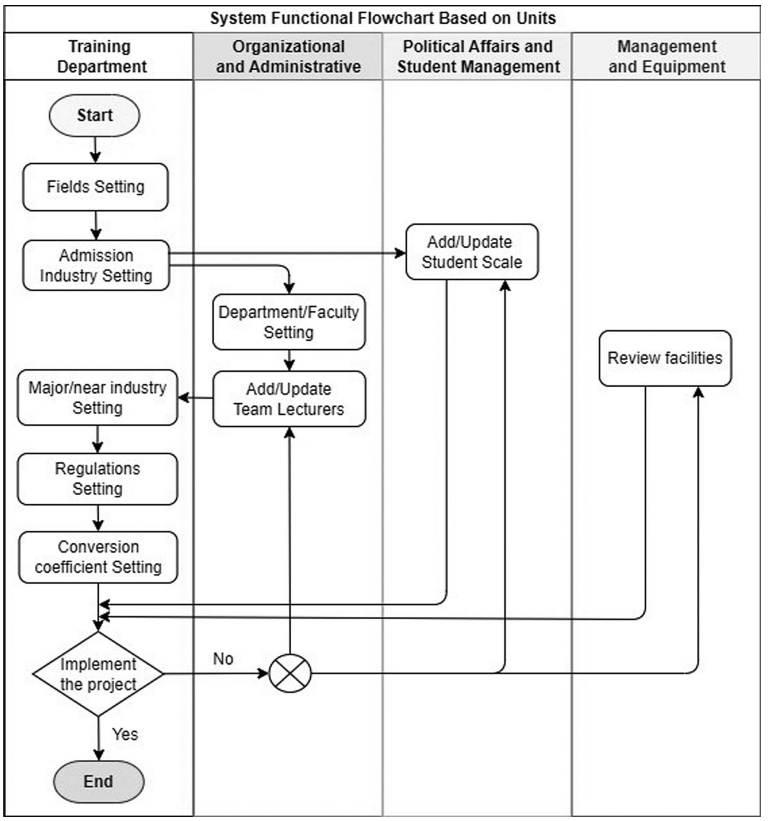

Fig. 2. System functional flowchart based on units

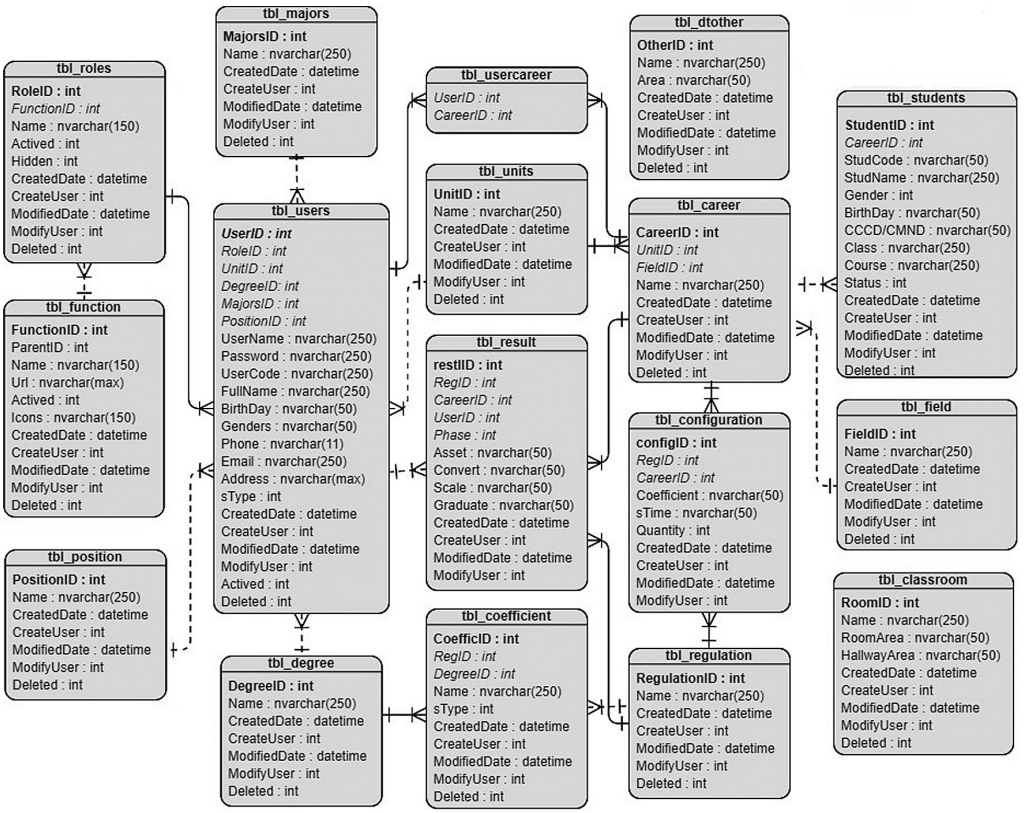

Fig. 3. Databases diagram of the system

The analysis and design steps were then followed by implementing and integrating modules into the system.

5. Experimental and evaluation

The process of software experimentation and evaluation is a crucial step in ensuring that the software meets the requirements and expectations of users. During this process, tests were conducted on the features and functions of the software in a controlled environment to ensure its stability and performance. Software evaluation focuses not only on identifying bugs and technical issues but also on assessing usability, user interface, and overall user experience. Therefore, we employ an evaluation method based on surveys.

5.1. The survey method and results

5.1.1. The survey method setup

In the survey methodology setup, determining and constructing quality scales is crucial for accurately measuring and collecting information from participants. We applied a Likert scale with 5 levels of response (Alabi, *et al.,* 2023): Strongly Disagree (1); Disagree (2); Neutral (3); Agree (4); Strongly Agree (5). Survey participants were categorized into five main sections: Functional Suitability - (1); Reliability - (2); Performance Efficiency - (3); Security - (4); Maintainability - (5). The survey data was collected through Google Forms and analyzed using Microsoft Excel 2013 before being summarized and presented in the evaluation results table.

5.1.2. Evaluation of survey results

The survey results from 40 users across four different departments (Training Department, Organization and Administration Department, Political Affairs and Student Management Department, and Management and Equipment Department) show synthesis and statistical analysis of survey results for 5 types based on evaluation criteria for software quality assessment of Table 1.

Table 1. Survey results for 5 types based on evaluation criteria for software quality assessment

#	Assessment criteria are based on surveys	Response rate (%)				
		1	**2**	**3**	**4**	**5**
(1) Functional Suitability	Functional completeness	0	3	10	70	18
	Accuracy	0	5	15	65	15
	Functional correctness	0	3	13	68	18
	Functional appropriateness	0	8	15	63	15
	Average rate (%):	**0**	**4**	**13**	**66**	**16**
(2) Reliability	Completeness of application structure	0	3	15	73	10
	Complexity of programming algorithms	0	5	10	68	18
	Processing and fault tolerance capability	0	3	8	70	20
	Recovery capability, resource management	0	10	13	65	13
	Data integrity and consistency management	0	3	8	68	23
	Average rate (%):	**0**	**5**	**11**	**69**	**17**
(3) Performance Efficiency	Fast response speed, efficiency	0	0	10	70	23
	Appropriate interaction with resource sources	0	10	13	63	15
	Performance, access time, and data management	0	5	8	60	28
	Memory, network, and disk space management	0	15	13	58	15
	Average rate (%):	**0**	**8**	**11**	**63**	**20**
(4) Security	Confidentiality	0	13	15	53	20
	Integrity	0	8	10	65	18
	Non-repudiation	0	13	8	68	13
	Accountability	0	15	5	55	25
	Authenticity	0	3	8	68	23
	Average rate (%):	**0**	**10**	**9**	**62**	**20**
(5) Maintainability	Modularity	0	0	10	70	23
	Analyzability	0	3	5	65	28
	Modifiability	0	5	13	68	15
	Testability	0	10	10	63	18
	Average rate (%):	0	4	9	66	21

The obtained results are impressive regarding the performance of the application, presented in Table 1. Among the participants in the survey, up to 94% of users found the app very user-friendly and easy to use. A notable highlight is the application's capability to assist in the implementation of the admissions project; users highly rated its effectiveness. Furthermore, the application programming also received high for ratings supporting the balancing and distribution of teaching staff through the application of linear algorithms. According to the software quality evaluation criteria, we recorded impressive scores: Functional Suitability achieved an average rate of 96%, Reliability 96%, Performance Efficiency 93%, Security 90%, and Maintainability 96%. Overall, user feedback confirms their high satisfaction with the quality and performance of the application, as well as its problem-solving ability and stability. In general, the survey results confirm that the application not only meets but also exceeds expectations, becoming a reliable tool in supporting work and management within the organization.

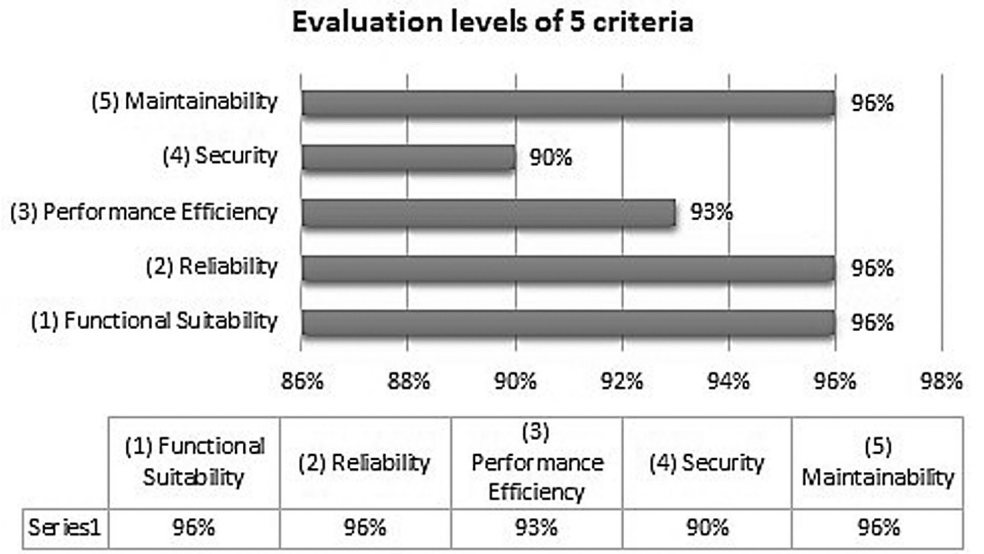

Fig. 4. This chart summarizes the survey rates based on five software quality evaluation criteria according to ISO/IEC 25010 standards. Users have rated the application very highly, which is clearly illustrated on the chart with specific criteria

5.2. System deployment

The results of implementing the system have brought significant progress and advantages for the organization. The system not only helps optimize management processes but also provides comprehensive and accurate information, thereby effectively supporting education and resource management. This reduces the workload pressure on officials and employees while enhancing the ability to make accurate and flexible decisions. The system has created an efficient working environment, enhancing interaction among relevant parties such as lecturers, students, and administrators. The automation of administrative processes, such as admissions, has reduced administrative procedures, increased transparency, and minimized errors.

In addition, the system also provides flexibility for adjustments and expansion over time. Its ability to integrate with modules and adapt to changes in processes ensures that the system will continue to meet the needs and goals of the organization. Some screenshots and functionalities of our system are detailed as follows:

Implementing the admissions project function has enhanced management efficiency and optimized the process, bringing modernity and flexibility to meet the diverse needs of the institution.

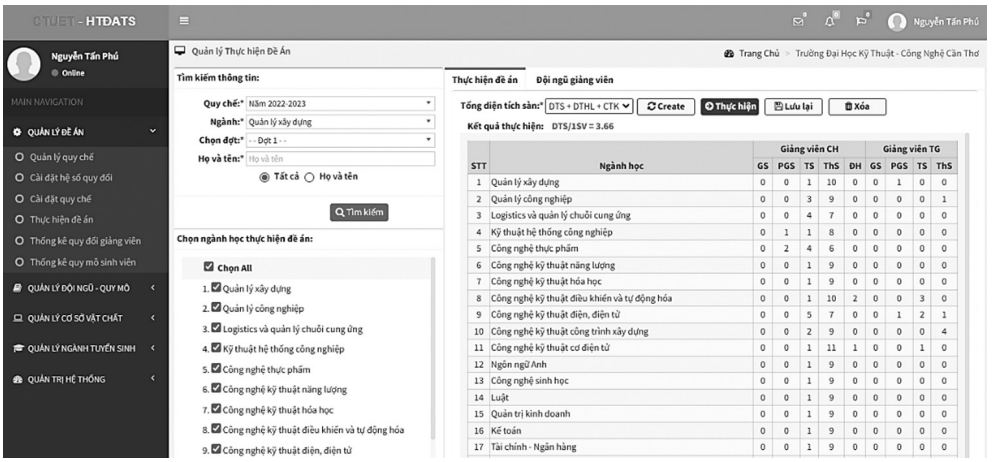

Fig. 5. The function of implementing the admission project

During the implementation process, the deployment function of the admissions project has significantly optimized operations, reducing time-consuming and labor-intensive manual steps. With its automation capability, it not only aids in searching but also suggests balanced solutions among faculty, admissions, and infrastructure for each field of study, thereby enhancing the efficiency of the organizational process. Additionally, the application features a function to export lists after executing the admissions project, a crucial element in the system, has been robustly implemented in the admissions process. It helps organize information systematically and in detail, facilitating the management process and decision-making.

STT	Ngành	Hệ số lĩnh vực	Số năm TN	Quy mô đăng ký chỉ tiêu tuyển sinh			Năng lực đào tạo																	Tổng NL
							Cơ hữu									Thỉnh giảng								
				Chỉ tiêu	Dự kiến TN	Quy mô dự kiến	Giáo sư	Phó giáo sư	Tiến sĩ	Thạc sĩ	Đại học	Tổng	Duy trì ngành	GV quy đổi	Năng lực	Giáo sư	Phó giáo sư	Tiến sĩ	Thạc sĩ	Tổng	GV quy đổi	Năng lực		
1	Công nghệ kỹ thuật cơ điện tử	20	4.25	65	64	273	0	0	1	11	1	13	12	13.201	264	0	0	1	0	1	0.4	8	272
2	Công nghệ kỹ thuật công trình xây dựng	20	4.25	70	64	278	0	0	2	9	0	11	11	13	260	0	0	0	4	4	0.9	18	278
3	Công nghệ kỹ thuật điện, điện tử	20	4.25	90	87	373	0	0	5	7	0	12	12	17	340	0	1	2	1	4	1.66	33	373
4	Công nghệ kỹ thuật điều khiển và tự động hó	20	4.25	65	64	273	0	0	1	10	2	13	11	12.45	249	0	0	3	0	3	1.2	24	273
5	Công nghệ kỹ thuật hóa học	20	4.25	50	21	119	0	0	1	9	0	10	10	11	220	0	0	0	0	0	0	0	220
6	Công nghệ kỹ thuật năng lượng	20	4.25	60	29	155	0	0	1	9	0	10	10	11	220	0	0	0	0	0	0	0	220
7	Công nghệ sinh học	20	4.25	60	47	212	0	0	1	9	0	10	10	11	220	0	0	0	0	0	0	0	220
8	Công nghệ thông tin	20	4.25	100	61	299	0	0	5	5	0	10	10	15	300	0	0	0	0	0	0	0	300
9	Công nghệ thực phẩm	20	4.25	100	93	403	0	2	4	6	0	12	12	20.2	404	0	0	0	0	0	0	0	404
10	Hệ thống thông tin	20	4.25	65	62	267	0	0	3	7	0	10	10	13	260	0	0	1	0	1	0.3	6	266
11	Kế toán	25	4	80	40	199	0	0	1	9	0	10	10	11	275	0	0	0	0	0	0	0	275
12	Khoa học dữ liệu	20	4.25	60	43	200	0	0	1	9	0	10	10	11	220	0	0	0	0	0	0	0	220
13	Khoa học máy tính	20	4.25	65	62	267	0	0	3	7	0	10	10	13	260	0	0	1	0	1	0.4	7	267
14	Kỹ thuật hệ thống công nghiệp	20	4.25	60	59	252	0	1	1	8	0	10	10	13	260	0	0	0	0	0	0	0	260
15	Kỹ thuật phần mềm	20	4.25	80	94	385	0	0	4	10	1	15	14	18.3	366	0	0	2	0	2	0.9	18	384
16	Logistics và quản lý chuỗi cung ứng	20	4.25	90	65	301	0	0	4	7	0	11	11	15	300	0	0	0	0	0	0	0	300
17	Luật	25	4	80	31	173	0	0	1	9	0	10	10	11	275	0	0	0	0	0	0	0	275
18	Ngôn ngữ Anh	25	4	70	34	172	0	0	1	9	0	10	10	11	275	0	0	0	0	0	0	0	275
19	Quản lý công nghiệp	20	4.25	65	74	305	0	0	3	9	0	12	12	15	300	0	0	0	1	1	0.2	4	304
20	Quản lý xây dựng	20	4.25	65	58	254	0	0	1	10	0	11	11	12	240	0	1	0	0	1	0.65	13	253
21	Quản trị kinh doanh	25	4	100	44	231	0	0	1	9	0	10	10	11	275	0	0	0	0	0	0	0	275
22	Tài chính - Ngân hàng	25	4	80	37	192	0	0	1	9	0	10	10	11	275	0	0	0	0	0	0	0	275

Fig. 6. Results of the numerical data after implementing the admission project

In summary, the results of system deployment not only demonstrate robust progress in management but also establish a flexible and robust infrastructure to support the sustainable development of the university.

6. Conclusion

In this study, we have successfully developed an admission project system for universities and colleges. Our system has proven to be effective in achieving the set objectives. Through the testing phase, the system provided strong support for the implementation of the 2023 admission project at Can Tho University of Technology.

With the current teaching staff, student population, and floor area serving education, we utilized a linear programming algorithm to find the most efficient distribution of instructors for 22 admission disciplines, complying with the regulations by MOET. Simultaneously, the system ensures the fulfillment of the expected admission targets for each program and field of study at the University.

Compared to manually implementing the admission project, as done in previous years, our system has demonstrated clear advantages. It reduces the pressure and effort placed on staff and officials

during the project development. This not only enhances efficiency but also contributes to reducing the costs associated with the implementation of the admission project for the University.

References

Alabi, A. T., & Jelili, M. O. (2023). Clarifying likert scale misconceptions for improved application in urban studies. *Quality & Quantity, 57*(2), 1337-1350.

Bai, Y. (2020). *SQL Server database programming with visual basic. NET: Concepts, designs and implementations*. John Wiley & Sons.

Cwalina, K., Barton, J., & Abrams, B. (2020). *Framework design guidelines: conventions, idioms, and patterns for reusable. net libraries*. Addison-Wesley Professional.

Castillo, A. A. (2017). *Curso de programación web: JavaScript, Ajax y jQuery*. IT Campus Academy.

Herron, D. (2020). *Node. js web development: Server-side web development made easy with Node 14 using practical examples*. Packt Publishing Ltd.

McGrath, M. (2020). *HTML, CSS & JavaScript in easy steps*. In Easy Steps Limited.

Ministry of Education and Training. (2022). *Circular Regulations on determining admission criteria for University, Master's, Doctorate and College admission criteria for early childhood education.*

Price, M. J. (2020). *C# 9 and. NET 5–Modern Cross-Platform Development: Build intelligent apps, websites, and services with Blazor, ASP. NET Core, and Entity Framework Core using Visual Studio Code*. Packt Publishing Ltd.

Ranjan, A., Sinha, A., & Battewad, R. (2020). *JavaScript for modern web development: building a web application using HTML, CSS, and JavaScript*. BPB Publications.

Royce, W., *Managing the development of large software systems*, Proceedings of IEEE WESCON 26, pp.1-9, 1970

Siahaan, V., & Sianipar, R. H. (2020). *The Absolute Beginner's Guide to Learn Database Programming Using Python GUI with PostgreSQL and SQL Server*. Sparta publishing.

Solow, D. (2014). *Linear programming: An introduction to finite improvement algorithms*. Courier Corporatio.

Syifa, E. A., Istiqomah, T. N., Puspita, N. P., Ratnasari, L., Khabibah, S., Anggoro, P. W., & Bawono, B. (2023). The application of linear programming for the optimal profit of Pt. Naruna using the simplex method. *Management Systems in Production Engineering*, *31*(2), 138-143.