



Quality Management System Admin Module Development: A Study in the Department of Computer Science

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Abstract

Elevating the quality of learning is central to ensuring academic programs align with national standards. One crucial aspect of this process is the semester-based learning planning. Traditionally, the Department of Computer Science orchestrates this planning by creating separate documents for various data points, including courses, CPL (Graduate Learning Outcomes), and CPMK (Course Learning Outcomes), which are then integrated into the RPS (Semester Learning Plan) document each term. This study seeks a solution to enhance the efficiency of such data management through the development of an admin module. The system, designed using the Rapid Test Development (RAD) approach and the Laravel framework, offers a more effective data management solution, subsequently elevating the pedagogical quality of the Department of Computer Science. In conclusion, an integrated approach to data management can make a significant contribution to educational quality. Through this research, the scholarly contribution provided is the introduction of a systematic model in educational data management to boost the efficiency and effectiveness of the learning process in higher education institutions.

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INTRODUCTION

Quality Management Systems (QMS) stand as a cornerstone in the development and sustenance of procedures that ensure the unwavering delivery of superior products and services [1]. Such systems, bolstered by comprehensive methodologies like ISO 9001, lay down the blueprint for organizations to integrate QMS seamlessly, enhancing their operational efficiency and reliability [2], [3]. At the heart of these systems lie fundamental pillars, including thorough documentation, vigilant process supervision, insightful performance assessments, and a culture deeply rooted in the pursuit of continuous improvement and excellence [4]. By adhering to these principles, organizations can foster a proactive environment where quality remains at the forefront of every endeavor.

High-quality higher education not only molds graduates to tap into and broaden their innate potential but also spurs the development

of knowledge or technology that can profoundly benefit society, the nation, and even on a global scale [5]–[11]. However, a notable challenge emerges when observing the current state of higher education in Indonesia. Accreditation results indicate that out of 4,472 universities in Indonesia, a mere 50 have achieved an 'A' accreditation. Additionally, from the myriad of study programs on offer, only 2,512 have secured this prestigious 'A' rating [12].

Building on the broader landscape of higher education in Indonesia, the trajectory of the Computer Science Department at the renowned Faculty of Mathematics and Sciences in Lampung University is a noteworthy example. Initially embedded within the Mathematics Department, the journey began with the initiation of an undergraduate program. By 2005, recognizing the growing importance and distinct nature of computer science, the institution formally established the

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Computer Science Department. It then became an integral part of the Faculty of Mathematics and Sciences at the University of Lampung, highlighting the university's commitment to adapting and evolving with the demands of modern education. This evolution not only underscores the importance of specialized fields of study but also mirrors the broader national ambition to elevate the standards of higher education.

Building on the transformative journey of the Computer Science Department at Lampung University, maintaining and elevating its educational quality remains paramount. Adhering rigorously to program benchmarks ensures consistent evolution in line with global standards [13], [14]. A critical aspect of this is refining the effectiveness of individual academic courses, which in turn, shapes the collective learning experience [15]–[18]. Yet, challenges persist. Processes such as crafting the Learning Plan (RPS) – which consolidates information on courses, Graduate Learning Outcomes (CPL), and Course Learning Outcomes (CPMK) – are currently hindered by inefficiencies. The fragmented nature of course data and CPL complicates their integration into the RPS, making it a tedious manual task. To combat these obstacles and streamline operations, this research endeavors to introduce a comprehensive system specifically designed to mitigate the challenges encountered by the Computer Science Department.

In the realm of system development, prior studies have delved deeply into the creation and optimization of admin modules across various sectors. These range from applications in e-grocery platforms [19], intricate academic procedures [20], [21], healthcare administration in hospitals [22], oversight of campus transportation [23], security infrastructures [24], [25], to the management of financial systems [26]. However, a discerning examination of the literature reveals a notable gap: dedicated research centered purely on the intricacies of admin modules remains elusive. Consequently, this study aims to bridge this lacuna, focusing specifically on the development and refinement of the admin module.

In light of the previously outlined challenges and the apparent dearth of integrated solutions custom-built for

specialized academic sectors such as Computer Science, this research introduces an innovative system. Designed with precision, this system endeavors to simplify and expedite the RPS formulation process by consolidating vital components into a cohesive unit. The objective is to not only alleviate the complexities inherent in the task but also to amplify its efficacy. In essence, this initiative seeks to fortify the existing quality management endeavors within the Computer Science Department, offering a comprehensive remedy to the identified issues. Rooted in the foundational principles of QMS, our novel approach is meticulously crafted to resonate with the nuanced demands and hurdles intrinsic to academic environments.

METHOD

The Rapid Application Development (RAD) method, a cornerstone in system development, is recognized for its adeptness in swiftly delivering software solutions. Unlike traditional models, RAD embodies a sequential and linear strategy complemented by succinct development phases [27]–[29]. Adopting RAD equips development squads with a toolkit of distinctive principles: active user engagement, iterative cycles, timeboxing, and rapid prototyping techniques [30].

Active user involvement ensures that the end users actively contribute to the software's evolution, providing input that shapes its features and functionality. On the other hand, Iterative development offers a framework for continuous refinement of the software, ensuring user feedback is assimilated throughout its development. Timeboxing introduces a systematic approach, segmenting the overall development process into manageable milestones, ensuring that projects remain on track. Lastly, rapid prototyping techniques are instrumental in swiftly producing initial models of the software, facilitating prompt user feedback and validation.

An insightful comparative study contrasting RAD and Agile methodologies, especially in supervising computing students' graduation projects, highlighted RAD's edge in producing comprehensive documentation, outpacing Agile by a notable 13.33% [31]. Such detailed documentation is paramount for significant projects, serving as a linchpin for

understanding, maintenance, and knowledge transfer. RAD's meticulous approach ensures that every nuance of the software is documented, reducing potential information gaps and streamlining future modifications.

However, the merits of RAD's documentation-centric approach extend beyond the academic realm. In diverse software development contexts, well-structured documentation facilitates a seamless transition from the creation phase to the subsequent maintenance and support stages. Comprehensive documentation aids developers and stakeholders alike in grasping the intricacies of the software, from its architecture and design rationale to its core functionality. This repository of information

becomes invaluable during software enhancement, debugging, or when integrating new team members.

Additionally, the study underscores the importance of aligning the chosen methodology with the specific demands of a project. While RAD stands out with its emphasis on documentation, Agile, with its inherent flexibility and iterative nature, might be a better fit for projects prioritizing rapid releases and frequent updates. Every methodology has its strengths and potential pitfalls, and it is incumbent upon project managers to evaluate a project's unique requirements and constraints before making a methodological commitment.

The structural framework of the RAD method is visually represented in Figure 1.

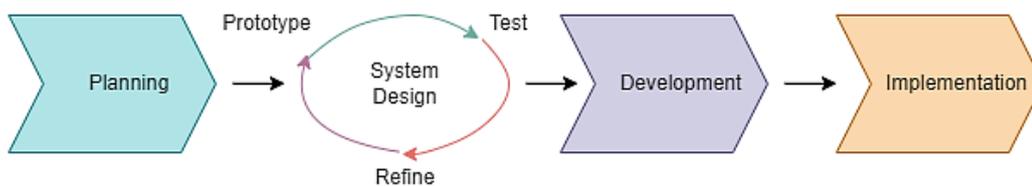


Figure 1. RAD flow

The testing conducted in this research follows the black box testing procedure. Black-box testing aims to determine the accuracy of the system's functionality according to the desired specifications. This testing phase, known as alpha testing, will be performed by the development team to ensure that the system operates successfully according to the specified scenarios.

RESULTS AND DISCUSSION

The research culminated in creating the Quality Management System for Teaching, explicitly designed to manage teaching data for the Computer Science Department at Lampung University. This system aims to streamline and enhance the efficiency of formulating teaching plans tailored for each semester and every course in the department.

The system was brought to life using the Laravel framework, providing the backbone for a PHP-based website. It amalgamates the Bootstrap interface, leveraging the Star Admin template and employing JavaScript. The primary functionality centers around an admin module. An individual granted the "admin" status can onboard other users, encompassing professors and quality assurance staff.

Planning

The Quality Management System for Teaching bifurcates into two core modules: the admin and the lecturer modules. This phase crystallized user requirements, depicted vividly in Figure 2.

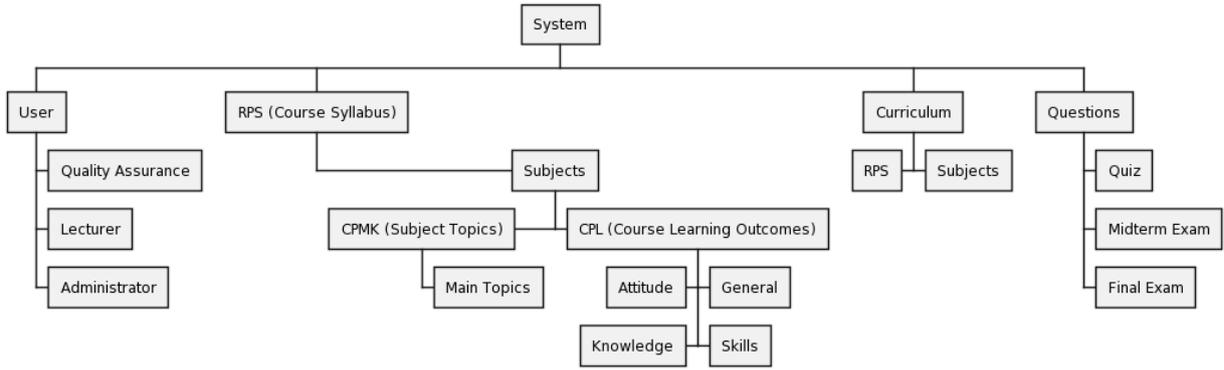


Figure 2. Planning result

1st System Design

The initial design aligns with the user requirements outlined in Figure 2. In this design framework, the Semester Learning Plan, or RPS, serves as an input and directly relates to the Course's Curriculum. The RPS incorporates the Graduate Learning Outcomes (CPL) which are segmented into four key aspects: attitude, knowledge, general aptitude, and skills. Additionally, it encompasses Course Learning Outcomes (CPMK), provided by the creator of the RPS and details the primary topics. The system is

designed to cater to users with varying permissions and includes a versatile question bank to accommodate an array of topics or CPMKs.

The Entity Relationship Diagram (ERD) acts as the data model for this initial design, and it's based on the pre-established requirements. This diagram can be referenced in Figure 3.

Lastly, the use-case diagram, illustrating the process modeling for the initial design, is available in Figure 4.

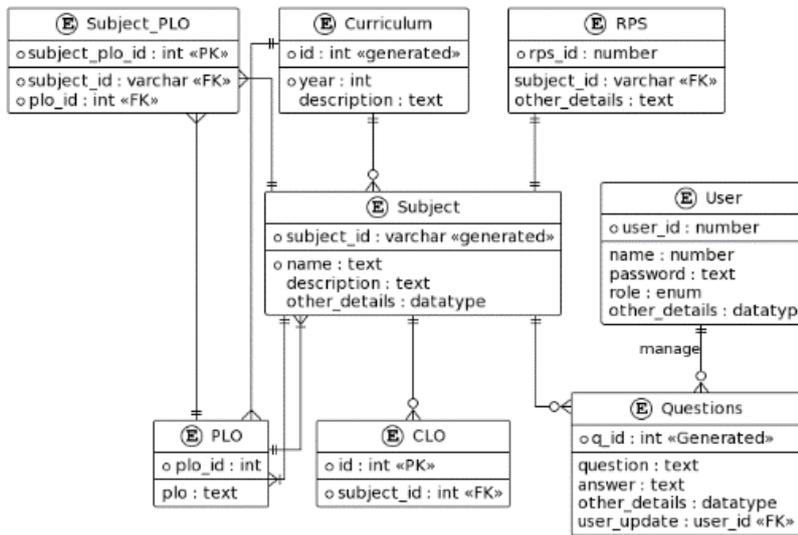


Figure 3. Entity Relationship Diagram

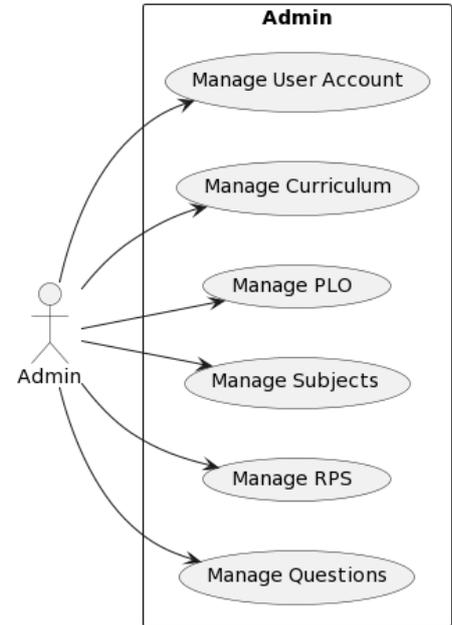


Figure 4. 1st Usecase Diagram

1st Development

The system's development employs the Rapid Application Development (RAD) approach. The principles of RAD are exemplified in recent methodologies,

including the open standard referred to as the Dynamic Systems Development Method [30].

The "Login" page is depicted in Figure 5. It features fields for both email and password input. If the provided email and password

correspond to an admin account, the user will be navigated to the dashboard. Conversely, if the credentials match other roles, the user will

be directed to the dashboard specific to that role.

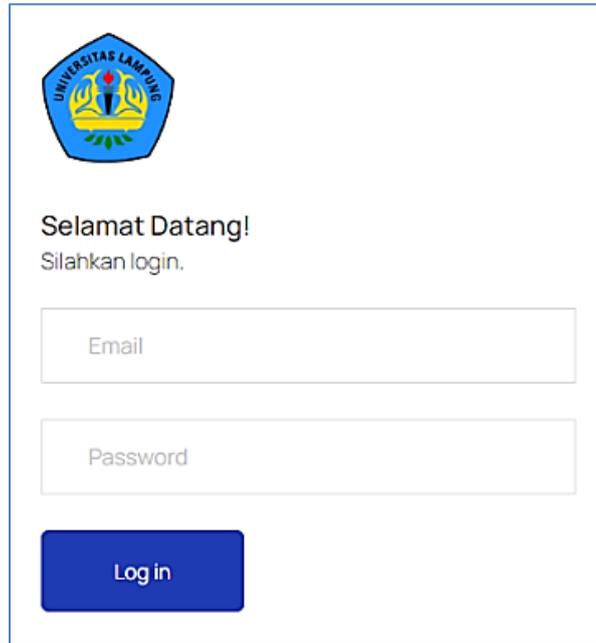


Figure 5. Login page

In Figure 6, the "Add User" page features multiple input fields to be completed. At the top are two buttons: "Template" and "Import." The "Template" button allows for the download of an Excel template to facilitate

user data import in the specified format. Conversely, the "Import" button enables uploading an Excel file with the necessary user data.

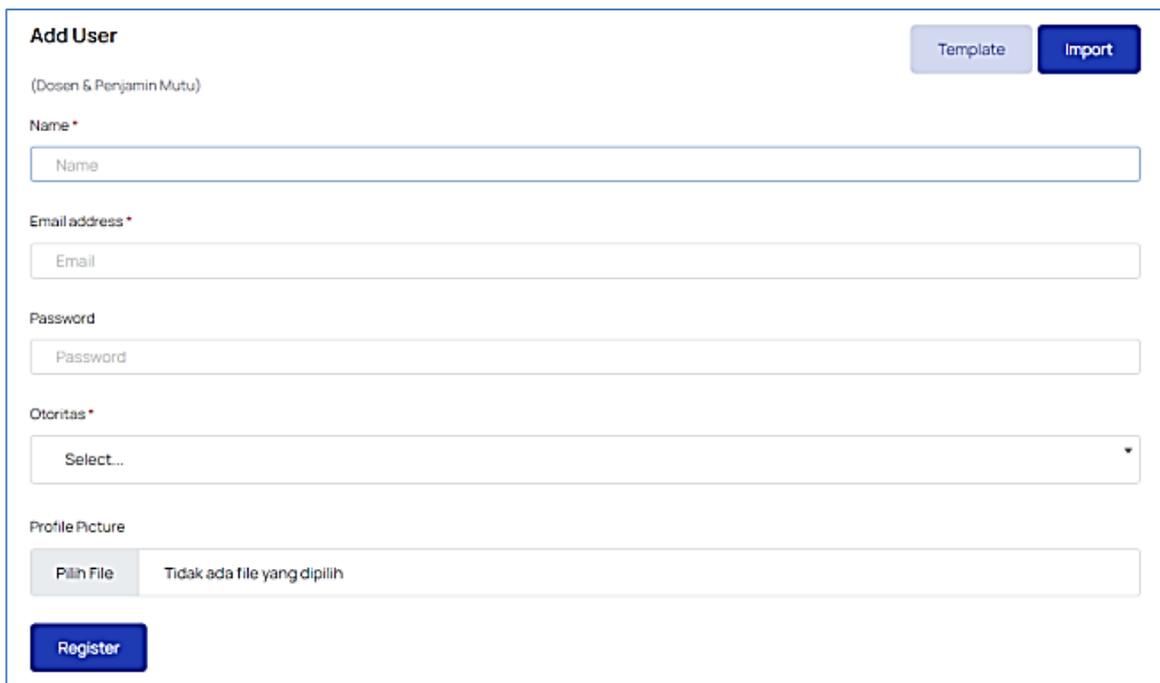


Figure 6. Add user page

In Figure 7, the "User List" page showcases the roster of registered users, with options to edit, delete, and reset their passwords. Figure 8's "Profile" page allows to modify the account name, profile picture, and password. The "Course List" page, as seen in

Figure 9, presents the catalog of added courses with editing and deletion capabilities. Lastly, the "Add Course" page in Figure 10 provides input fields necessary for introducing a new course.

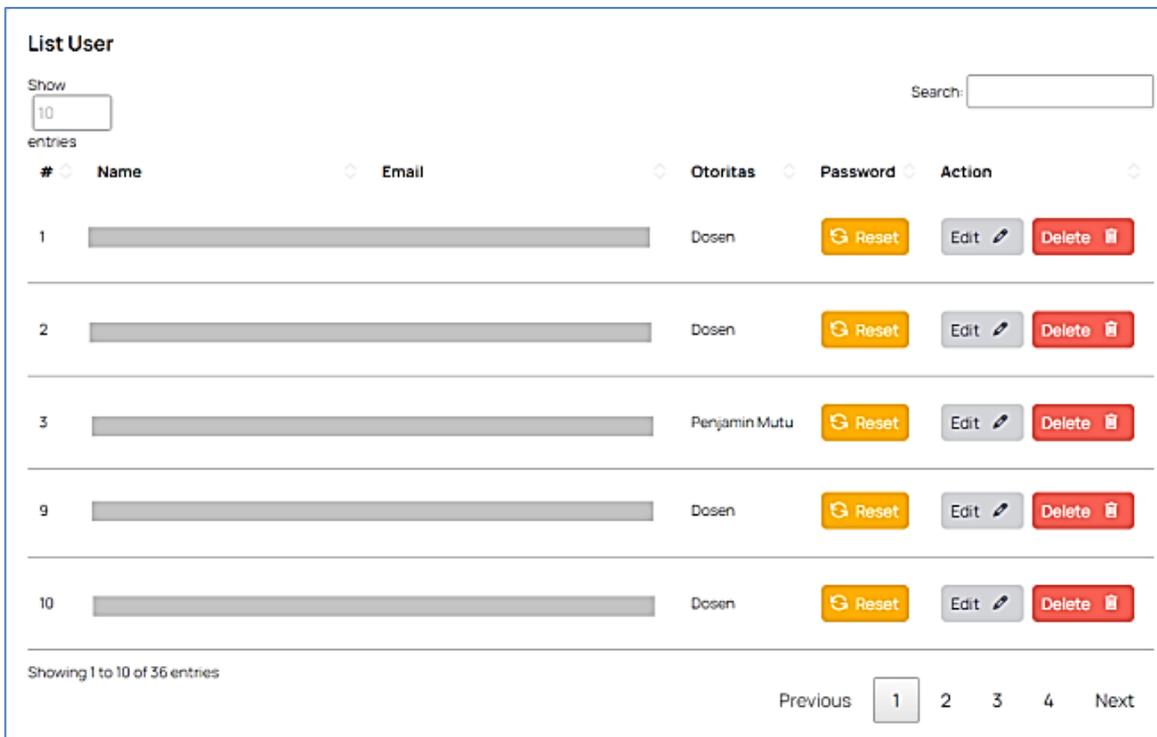


Figure 7. User list page

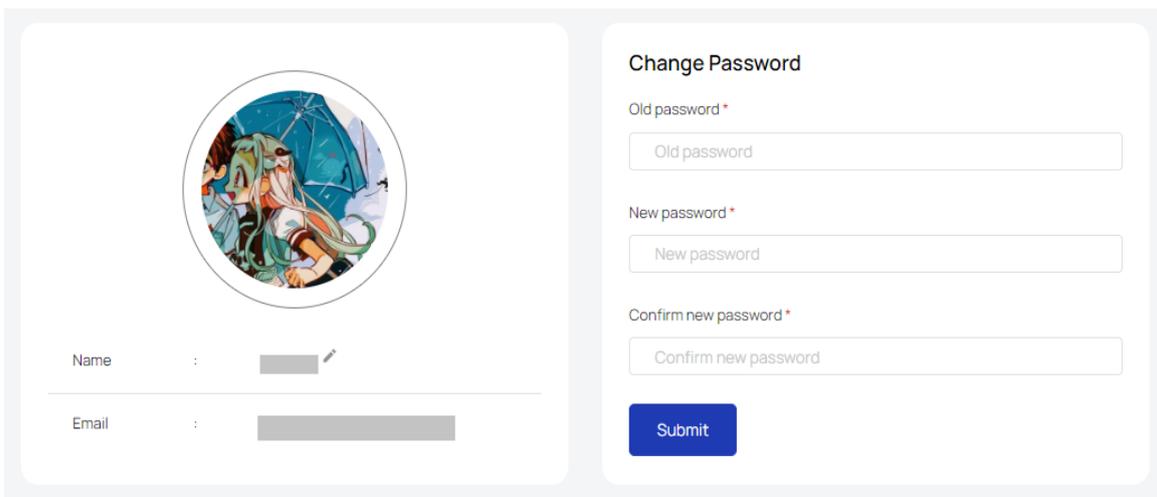


Figure 8. Profile page

#	Kode MK	Nama MK	Rumpun	Tahun kurikulum	Bobot	Action
1	COM620101	LINEAR ALGEBRA	MK Wajib	2020	2 SKS	Edit Delete
2	COM620102	ENGLISH	MK Wajib	2020	3 SKS	Edit Delete
9	COM620109	INTRODUCTION TO COMPUTER ORGANIZATION	MK Wajib	2020	2 SKS	Edit Delete
10	COM620110	INTRODUCTION TO INFORMATION SYSTEMS	MK Wajib	2020	2 SKS	Edit Delete

Figure 9. Course list page

Add Mata Kuliah

Kode MK *

Nama MK *

MK prasyarat

Tahun kurikulum *

Rumpun *
 Wajib
 Peminatan

Bobot teori (sks) * Bobot praktikum (sks)

Deskripsi *

Figure 10. Add course page

The "Graduate Learning Outcomes List" page showcases a categorized list of added graduate learning outcomes based on their aspects. For instance, Figure 11 presents a list where attitude is one of the emphasized aspects. The "Add Graduate Learning Outcome" page, depicted in Figure 12, contains several input fields. To accommodate

multiple graduate learning outcomes, these fields can be augmented by pressing the "Add Field" button in the Action column. Figure 13's "Dashboard" card page exhibits an aggregate count of users and curricula, among other elements, and features a graph that is adjustable based on the curriculum. This visual representation illustrates the quantity

of Graduate Learning Outcomes (CPL), Courses (MK), Semester Learning Plans (RPS), and available questions. Notably, it highlights the frequency of CPL integrated within each

course. Lastly, the “Curriculum” page in Figure 14 facilitates the addition and review of previously incorporated curricula.

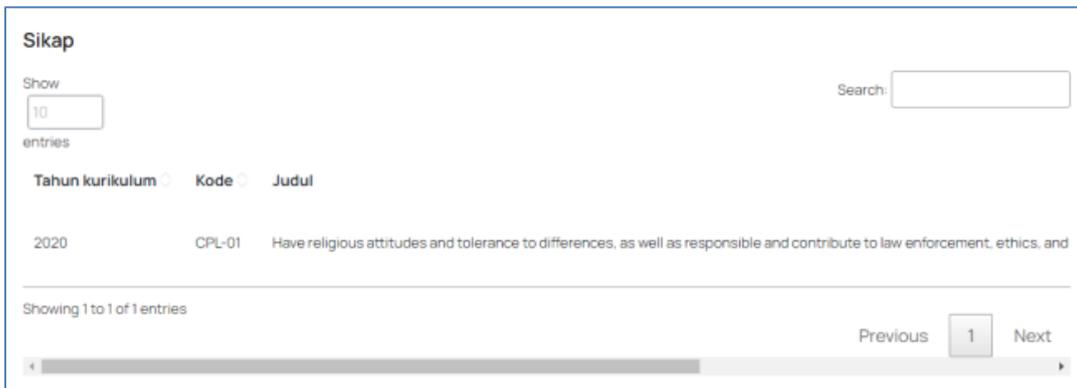


Figure 11. Graduate Learning Outcome list page

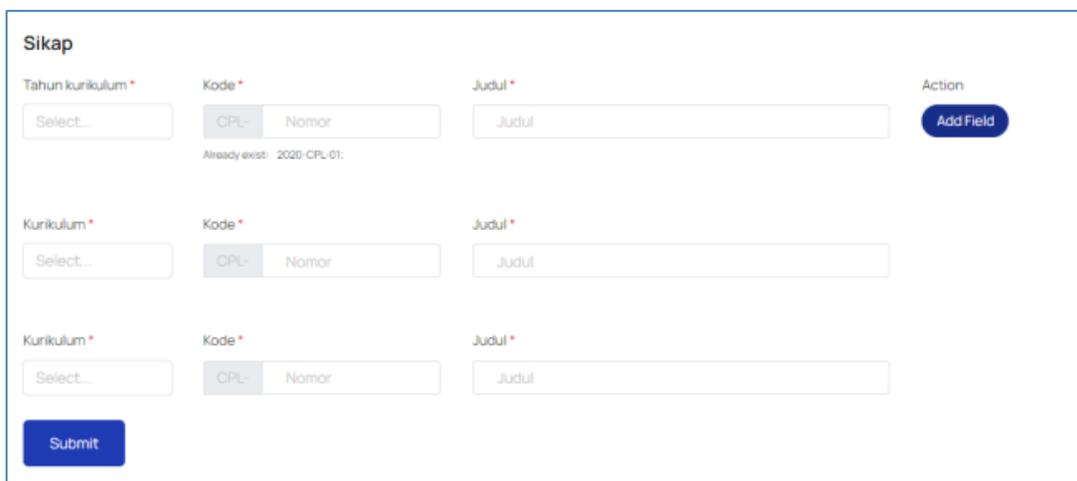


Figure 12. Add Graduate Learning Outcome page

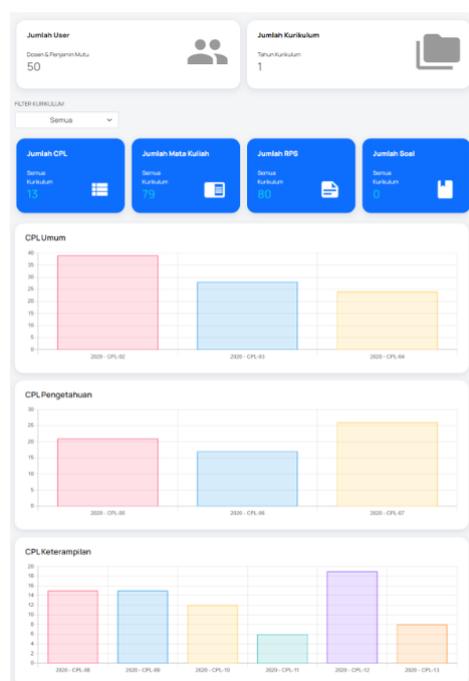


Figure 13. Dashboard page

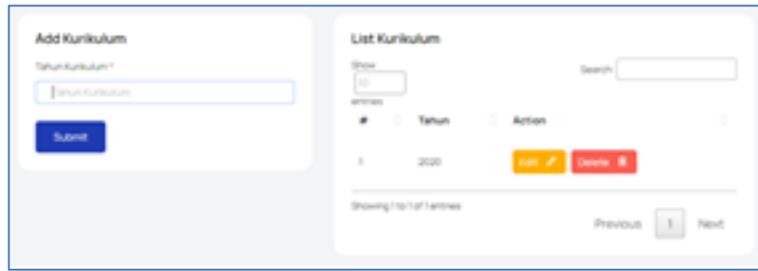


Figure 14. Curriculum page

2nd System Design

The design was revised based on feedback from the initial development phase, leading to alterations in the Entity Relationship Diagram (ERD) depicted in

Figure 15. Moreover, the use-case diagram underwent adjustments to include the newly added features within the admin module, as illustrated in Figure 16.

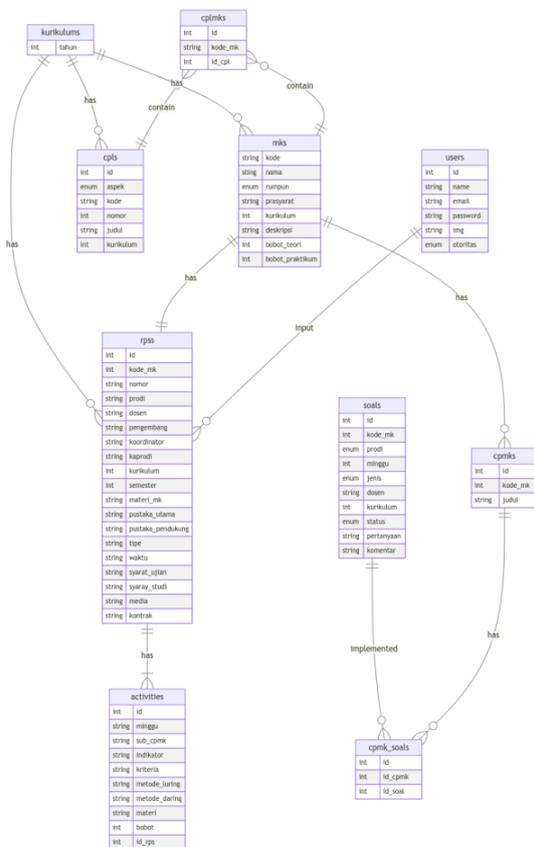


Figure 15. 2nd Entity Relationship Diagram



Figure 16. 2nd use-case diagram

2nd Development

The development of this system employs the RAD method, emphasizing the reuse of pre-existing components. For instance, the RPS pages in the lecturer module come equipped with create, edit, and delete features. These components will be integrated into the admin module, supplemented with additional components. The "Add RPS" page within the admin module is illustrated in Figure 17.

Similarly, the CPMK page, initially found in the lecturer module, has been incorporated into the admin module. The "Add CPMK" page and the "CPMK List" page in the admin module are depicted in Figures 18 and 19, respectively.

The CPLMK page from the lecturer module has also been adapted for use in the admin module. The "Add CPLMK" page and the "CPLMK List" page are presented in Figures 20 and 21, respectively.

Add RPS Template Import

Nomor *

Program studi *

Mata kuliah *

Semester *

Pengembang RPS *

Koordinator RPK *

Dosen pengampu *

Kepala program studi *

Materi MK *

Kontrak kuliah *

Pustaka utama * Pustaka pendukung

Figure 17. Add RPS page

Add CPMK

Mata Kuliah *

Judul rincian CPMK * Action

Figure 18. Add CPMK page

List CPMK

Show Search:

entries

Nama MK Rincian CPMK

1	LINEAR ALGEBRA	Understanding of the basic concepts of Linear Algebra, including vector spaces, linear transformations, and eigenvalues/eigenvectors.
10	ENGLISH	Development of critical thinking, analytical and communication skills, as well as the ability to understand and appreciate different culture

Showing 1 to 10 of 400 entries

Previous 2 3 4 5 ... 40 Next

Figure 19. CPMK list page

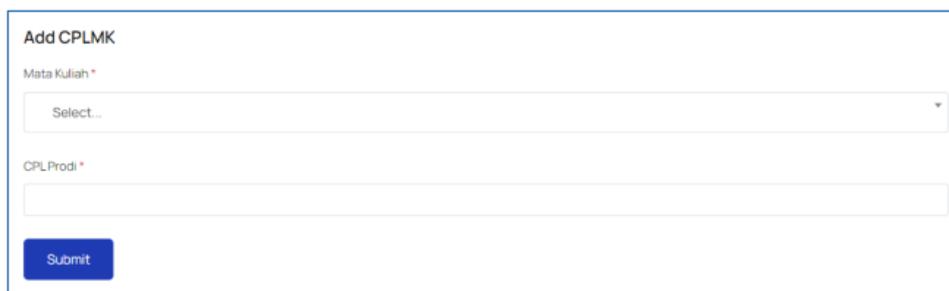


Figure 20. Add CPLMK page

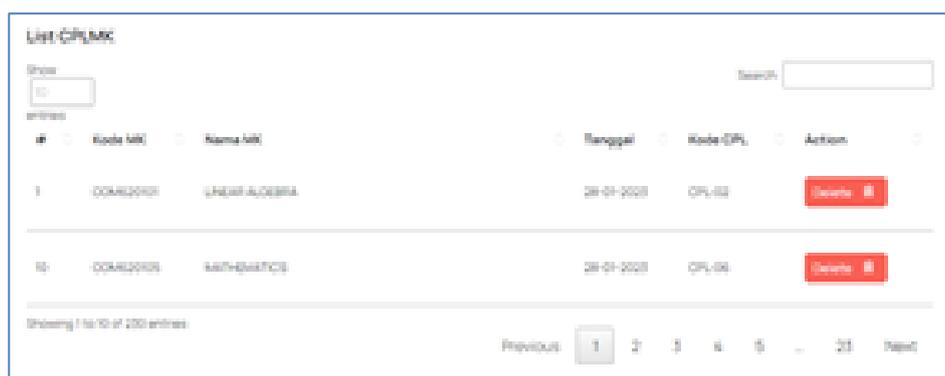


Figure 21. CPLMK list page

Implementation

The system has fulfilled the user requirements based on the planned needs and feedback during the development process. The next step is to conduct testing to identify any errors or discrepancies in the system.

System Testing

The system was tested using the black-box testing method to ensure that the developed system aligns with the expected outcomes. This alpha testing was conducted internally by the system developers. The testing results for the lecturer module are presented in Table 1, Table 2, Table 3, and Table 4.

Table 1. Normal testing on authentication testing

Test List	Expected Result	Actual Result	Conclusion
Login Page	Display login page	Display login page	Valid
Login Function	Log into the system	Log into the system	Valid

Table 2. Normal testing on functionality testing

Test List	Expected Result	Actual Result	Conclusion
List User Page	Display a list of users with the authority of dosen and penjamin mutu	Display a list of users with the authority of dosen and penjamin mutu	Valid
Edit Button	Redirect to the user edit form page for the selected user	Redirect to the user edit form page for the selected user	Valid
Delete Button	Delete the selected user	Delete the selected user	Valid
Add User Page	Display the user addition form	Display the user addition form	Valid
Kurikulum Page	Display the curriculum addition form and a list of added curricula	Display the curriculum addition form and a list of added curricula	Valid
Edit Button	Transform the curriculum list column into an edit-form field	Transform the curriculum list column into an edit-form field	Valid

Delete Button	Delete the selected curriculum	Delete the selected curriculum	Valid
List CPL Page	Display a list of CPLs according to their aspects	Display a list of CPLs according to their aspects	Valid
Edit Button	Redirect to the CPL edit form page for the selected CPL	Redirect to the CPL edit form page for the selected CPL	Valid
Delete Button	Delete the selected CPL	Delete the selected CPL	Valid
Add CPL Page	Display the CPL addition form according to the aspect	Display the CPL addition form according to the aspect	Valid
List MK Page	Display a list of added MKs	Display a list of added MKs	Valid
Edit Button	Redirect to the MK edit form page for the selected MK	Redirect to the MK edit form page for the selected MK	Valid
Delete Button	Delete the selected MK	Delete the selected MK	Valid
Add MK Page	Display the MK addition form	Display the MK addition form	Valid
List CPMK Page	Display a list of added CPMKs	Display a list of added CPMKs	Valid
Edit Button	Redirect to the CPMK edit form page for the selected CPMK	Redirect to the CPMK edit form page for the selected CPMK	Valid
Delete Button	Delete the selected CPMK	Delete the selected CPMK	Valid
Add CPMK Page	Display the CPMK addition form	Display the CPMK addition form	Valid
List CPLMK Page	Display a list of added CPLMKs	Display a list of added CPLMKs	Valid
Delete Button	Delete the selected CPLMK	Delete the selected CPLMK	Valid
Add CPLMK Page	Display the CPLMK addition form	Display the CPLMK addition form	Valid
List RPS Page	Display a list of added RPS	Display a list of added RPS	Valid
Edit Button	Redirect to the RPS edit form page for the selected RPS	Redirect to the RPS edit form page for the selected RPS	Valid
Delete Button	Delete the selected RPS	Delete the selected RPS	Valid
Add RPS Page	Display the RPS addition form	Display the RPS addition form	Valid

Table 3. Abnormal testing on authentication testing

Test List	Expected Result	Actual Result	Conclusion
Empty Email and Password	Failed login attempt	Failed login attempt	Valid
Incorrect Email and Password	Failed login attempt	Failed login attempt	Valid

Table 4. Abnormal testing on functionality testing

Test List	Expected Result	Actual Result	Conclusion
Incorrect format in adding user data	Failed to add user	Failed to add user	Valid
Incorrect format in editing user data	Failed to edit user	Failed to edit user	Valid
Deleting a curriculum with associated CPL/MK	Failed to delete curriculum	Failed to delete curriculum	Valid
Incorrect format in adding curriculum data	Failed to add curriculum	Failed to add curriculum	Valid
Incorrect format in editing curriculum data	Failed to edit curriculum	Failed to edit curriculum	Valid
Incorrect format in adding CPL data	Failed to add CPL	Failed to add CPL	Valid
Incorrect format in editing CPL data	Failed to edit CPL	Failed to edit CPL	Valid
Incorrect format in adding MK data	Failed to add MK	Failed to add MK	Valid
Incorrect format in editing MK data	Failed to edit MK	Failed to edit MK	Valid
Incorrect format in adding CPMK data	Failed to add CPMK	Failed to add CPMK	Valid
Incorrect format in editing CPMK data	Failed to edit CPMK	Failed to edit CPMK	Valid
Incorrect format in adding CPLMK data	Failed to add CPLMK	Failed to add CPLMK	Valid
Incorrect format in adding RPS data	Failed to add RPS	Failed to add RPS	Valid
Incorrect format in editing RPS data	Failed to edit RPS	Failed to edit RPS	Valid

Based on the test results, we can conclude that the system meets the expected scenarios. The Teaching Quality Management System, equipped with the Admin Module, effectively addresses the outlined challenges and aligns with the set requirements. The internal development team conducted the testing, and the system was found to be free of bugs or errors.

The Admin Module fortifies administrators' capability to oversee accounts with diverse privileges, guaranteeing effective access control and user governance within the Quality Management System in Teaching [32]–[34]. This system permits role and permission allocation, fostering a safeguarded and systematized environment [35], [36]. Furthermore, curriculum management becomes seamless, ensuring its pertinence and synchronization with pedagogical objectives. The module simplifies the management of Graduate Learning Outcomes (CPL) and Course Learning Outcomes (CPMK), confirming that academic programs align with requisite benchmarks. Additionally, it facilitates the crafting and supervision of Semester Learning Plans (RPS), enriching the academic journey. Including CPL in Courses (CPLMK) lets administrators oversee the realization of educational aims across diverse courses.

The Admin Module's development hinged on the Rapid Application Development (RAD) methodology, prioritizing teamwork, cyclical development, and swift prototyping. This modus operandi fostered efficient creation, punctuated by continuous stakeholder engagement and feedback. Comprehensive black-box testing was undertaken to vouch for the module's robustness and dependability [37]. Assessing the system's external functionality without delving into its inner workings led to discovering and rectifying potential performance disparities [38], [39].

To sum up, this research heralded the successful inception of the Admin Module for the Quality Management System in Teaching. Deployed via the Laravel framework and sculpted using the RAD approach, the module bestows administrators with an expansive suite of functionalities. It promotes a cohesive educational milieu by adeptly managing various facets, from accounts to CPLMK. The meticulous testing regimen underscores the

module's dependability, ensuring it dovetails with the outlined scenarios and is a cornerstone for exemplary teaching administration.

CONCLUSION

The research undertaken culminated in the successful creation of the Admin Module for the Quality Management System in Teaching. Crafted as a website via the Laravel framework, this module equips administrators with the tools required to oversee various system components proficiently. Through applying the Rapid Application Development (RAD) technique, coupled with extensive black-box testing, the module consistently aligns with the anticipated functionality based on predefined scenarios. This enables administrators to adeptly manage accounts with varying privileges, curricula, CPL, CPMK, RPS, and CPLMK.

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