Adventist University of Central Africa

PROFESSIONAL DEVELOPMENT TRACKING SYSTEM

CASE STUDY: UNIVERSITY OF RWANDA

(UR)

A final-year project

Presented in partial fulfillment of the

Requirement for the degree

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

Major in

SOFTWARE ENGINEERING

By:

UWIRAGIYE Rose

May, 2024

ABSTRACT

Research project for the Bachelor's Degree in Information Technology

Adventist University of Central Africa

Topic: **PROFESSIONAL DEVELOPMENT TRACKING SYSTEM(Prodev track system)**

Name of the researcher: **UWIRAGIYE Rose**

Name and the degree of the faculty advisor: **Dr. SEBAGENZI Jason**

Date of completion: May 2024

The primary objective of the research on the university of Rwanda promotion application is to develop a user-friendly and efficient platform that simplifies and enhances the promotion application process for academic staff. This system aims to automate key tasks such as secure authentication, electronic submission of promotion applications, real-time tracking of application status, automatic analysis of submitted documents, and generation of promotion decisions based on predefined criteria. By conducting this research, the goal is to design a system that minimizes manual intervention and errors, thereby improving the experience for both applicants and administrative staff.

Another critical aspect of this research is to ensure that the system aligns with the institution's values and principles. It will incorporate necessary requirements to ensure that all promotion applications processed through the system adhere to established guidelines and standards. This approach aims to maintain the integrity and significance of the promotion process while leveraging modern technology to streamline administrative tasks.

In summary, the research aims to create a user-friendly system for managing promotion applications efficiently. It will automate essential tasks, reduce errors, and make the process smoother for both applicants and administrative personnel. The system will also uphold and follow institutional values and regulations to ensure a fair and consistent evaluation of promotion applications.

DECLARATION

I confirm that I am the only one who wrote this project report, and it has never been submitted before for any degree application, either in full or in part. The work presented here is entirely my own, except when I mention or give credit to other sources.

Signature: _____

Name: UWIRAGIYE Rose

Date: May 2024

APPROVAL

I Dr. SEBAGENZI Jason, confirm that I have given my consent for this project report to be completed and submitted under my supervision.

Signature…….

Date……

DEDICATION

To the Divine Creator, the Almighty God,

To my beloved family, particularly my parents and siblings,

I will forever be grateful for everything that lecturers have done,

To all my friends,

You all have been my greatest supporters.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AI	Artificial Intelligence
API	Application Programming Interface
CRUD	Create, Read, Update, Delete
DB	Database
IDE	Integrated Development Environment
ISO	International Organization for Standardization
MVC	Model-View-Controller
NoSQL	Not Only SQL (Non-relational databases)
SDK	Software Development Kit
SQL	Structured Query Language
UML	Unified Modeling Language
UR	university of Rwanda
UI	User Interface
UX	User Experience

DEFINITION OF TERMINOLOGIES

Authentication: The process of verifying the identity of a user or system.

Authorization: The process of determining what an authenticated user is allowed to do.

User Interface (UI): The space where interactions between humans and machines occur.

User Experience (UX): The overall experience of a person using a product, especially in terms of how easy or pleasing it is to use.

System Architecture: The conceptual model that defines the structure, behavior, and more views of a system.

Database Schema: The structure of a database described in a formal language.

API (Application Programming Interface): A set of tools and protocols for building software and applications.

Data Privacy: The aspect of information technology that deals with the ability of an organization or individual to determine what data can be shared with third parties.

Data Security: Protective digital privacy measures that are applied to prevent unauthorized access to computers, databases, and websites.

Promotion Application: The process or system by which staff members can apply for a promotion.

Application Status Tracking: The ability to monitor the progress of submitted applications.

Document Analysis: The process of examining documents to extract meaningful information.

Notification System: A system that sends messages to users to inform them of various events or actions.

Report Generation: The process of creating reports for analysis and decision-making.

Accessibility Standards: Guidelines and principles to ensure systems are accessible to all users, including those with disabilities.

GDPR (General Data Protection Regulation): A regulation in EU law on data protection and privacy.

ISO Standards: International standards ensuring that products and services are safe, reliable, and of good quality.

Admin Tools: Tools used by administrators to manage system settings and user accounts.

Evaluation Criteria: The standards or benchmarks used to assess the qualifications of applicants.

Access Management: The process of managing user access to resources and systems.

ACKNOWLEDGMENT

I extend my sincere gratitude to everyone who played a role in the development and implementation of the ProDev Track System.

First and foremost, I express immense thanks to the Almighty and faithful God for providing guidance, blessings, and strength throughout this project. His divine presence has been a constant source of comfort and inspiration.

My heartfelt appreciation also goes to my wonderful family, especially my parents and siblings, for their unwavering support and understanding. Their love and encouragement have been the driving force behind my success.

I am deeply grateful to my teachers and mentors for their valuable guidance, expertise, and patience. Their dedication to my growth and learning has been truly commendable.

Acknowledging the contributions of my classmates, who have been great companions on this journey, is essential. Their camaraderie, discussions, and teamwork have enriched the project and made it a fulfilling experience.

Lastly, I want to express my gratitude to my supervisors for their continuous support, encouragement, and valuable insights. Their guidance has been instrumental in shaping the system and making it more effective.

To all of you, thank you for being part of this significant project. Your contributions and encouragement have made a positive impact, and I am genuinely grateful for your presence in my life.

UWIRAGIYE Rose

CHAPTER 1

GENERAL INTRODUCTION

Introduction

In today's academic landscape, the University of Rwanda recognizes the importance of supporting the professional growth and advancement of its educators. Central to this mission is the implementation of a streamlined and efficient process for educator promotion and application review.

At the University of Rwanda, faculty members play a pivotal role in shaping the academic experience and driving institutional excellence. As educators seek to advance their careers and contribute further to the university's mission, the need for a transparent and accessible promotion and application review system becomes increasingly crucial.

The Professional Development Track aims to address this need by introducing an innovative solution tailored to the specific requirements of educator promotion and application review. This initiative seeks to optimize the process, providing educators with a user-friendly platform to submit their applications, track their progress, and receive timely feedback.

By leveraging technology and best practices in professional development, the Professional Development Track strives to enhance transparency, fairness, and efficiency in the promotion and application review process. Ultimately, this initiative aims to empower educators to pursue their career goals effectively while supporting the University of Rwanda in maintaining academic excellence and fostering a culture of continuous improvement.

Background of the Study

In the realm of academia, universities like the University of Rwanda grapple with the challenge of efficiently disseminating information to their diverse stakeholders. Recognizing this imperative, particularly among educators seeking career advancement, faculty members, and administrators, the University of Rwanda acknowledges the necessity for streamlined access to comprehensive professional development resources.

Traditional methods of accessing such resources, including manual submissions and in-person interactions, often prove cumbersome, time-consuming, and prone to inaccuracies. In response to these challenges, the Professional Development Track seeks to introduce an innovative solution tailored to the specific needs of educator promotion and application review.

The Professional Development Track endeavors to revolutionize the process of accessing professional development opportunities. By leveraging technology to create a user-friendly platform, this system aims to empower educators with seamless access to promotion criteria, application submission, and feedback mechanisms.

The Professional Development Track aspires to transform the professional development landscape at the University of Rwanda, fostering a culture of transparency, fairness, and continuous improvement. By offering educators enhanced access to career advancement opportunities, this initiative not only supports individual growth but also contributes to the overall excellence and innovation within the university community.

Statement of the problem

The promotion process at the University of Rwanda (UR) is primarily manual-based, relying on outdated procedures and paper-based documentation. This manual approach leads to inefficiencies, delays, and inconsistencies in the evaluation and decision-making process. Faculty members are required to navigate complex administrative procedures, submit physical documents, and communicate with multiple stakeholders, resulting in a cumbersome and time-consuming process.

Moreover, UR receives a significant volume of promotion applications, ranging from 50 to 80 applications per cycle. The manual handling of these applications exacerbates the challenges faced by administrators and evaluators, leading to further delays, errors, and difficulties in managing the promotion process effectively. The sheer volume of applications overwhelms the existing infrastructure and resources, making it challenging to ensure fairness, transparency, and thoroughness in the evaluation process.

As a consequence, faculty members may experience frustration, uncertainty, and inequity in the promotion process, while administrators struggle to cope with the administrative burden and maintain consistency in decision-making. This manual-based approach not only impedes the timely advancement of deserving faculty members but also erodes trust in the institution's promotion system, potentially leading to disengagement and turnover among faculty members.

Choice and motivation of the study

The decision to focus on the professional development track stems from its critical significance for the University of Rwanda and the broader national context. The pressing need for a streamlined application review process within the university has been identified, highlighting the reliance of educators, administrators, and staff on accurate and timely

information for promotion and career advancement. By providing educators with seamless access to promotion criteria, application submission, and feedback mechanisms, this system aims to enhance transparency, efficiency, and fairness.

Implementing this system aligns with the university's goals of fostering capable servant leaders and contributes valuable documentation for future research in web application development.

Objectives of the study

General objective

The overarching goal of the study is to develop and implement a digital platform aimed at streamlining the educator application review process at the University of Rwanda. This platform seeks to enhance transparency, efficiency, and fairness in the promotion process, ultimately contributing to the professional development and advancement of educators within the university community.

Specific objectives

To address the pressing need for a streamlined and efficient application review process for educator promotion at the University of Rwanda, this study sets forth specific objectives aimed at developing and implementing a digital platform as below:

- Develop a user-friendly digital platform that provides educators at the University of Rwanda with readily accessible information regarding promotion criteria, application submission, and feedback mechanisms.
- Reduce reliance on traditional, manual methods such as in-person submission of applications and phone inquiries, by implementing an automated system for application review.
- Minimize delays and potential miscommunications in the application review process by establishing clear communication channels and automated notifications for applicants and reviewers.
- Ensure that the digital platform delivers accurate, up-to-date, and consistent information to all users, enhancing transparency and fairness in the promotion process.

Scope of Study

The scope of the Professional Development Track encompasses the development and implementation of a digital platform tailored specifically for the educator application review

process at the University of Rwanda. The focus of the study is on creating a user-friendly system that enables educators to access promotion criteria, submit applications, and receive feedback efficiently and transparently.

This study will address the challenges associated with the manual-based application review process, including delays, inefficiencies, and potential errors. It will involve the design and development of the digital platform, taking into account key requirements such as data security, user authentication, and integration with existing university systems.

Furthermore, the scope includes testing and validation of the platform to ensure its effectiveness and usability. The study will also involve the development of training materials and resources to support educators in utilizing the platform effectively.

Overall, the scope of the Professional Development Track is limited to the development and implementation of the digital platform for educator application review at the University of Rwanda, with a focus on enhancing transparency, efficiency, and fairness in the promotion process.

Method and techniques used in the study.

Research methodology describes how to conduct research. Many facets are involved in conducting research. To deeply understand the requirements and the problem domain, some techniques will help achieve the aim of this research. Data can be gathered from several sources, which include documents, the workplace, the internet, field notes, questionnaires, and social interactions or interviews.

The following are techniques used in the analysis of the existing system:

Personal Observation

Personal observation is a research method utilized to systematically gather data by directly observing and experiencing naturally occurring events, behaviors, or phenomena within the context of the University of Rwanda (UR) for the purpose of gathering information relevant to the development of the ProDev Track system[1].

Within UR, personal observation involves researchers immersing themselves in various academic settings, such as classrooms and administrative offices, to directly observe and document the processes, interactions, and challenges associated with the promotion process. By utilizing all senses to perceive and interpret the environment, researchers can gain

[1] Kawulich, B. B. (2005, May). View of Participant Observation as a Data Collection Method | Forum Qualitative Sozialforschung / Forum: Qualitative Social Research (qualitative-research.net)

firsthand insights into the complexities of the promotion process, including the manual procedures followed, communication channels utilized, and the overall efficiency and effectiveness of the current system.

Through personal observation, researchers can capture rich, context-specific data that may not be readily apparent through other research methods. By immersing themselves in the daily activities and routines of faculty members, administrators, and other stakeholders involved in the promotion process, researchers can uncover valuable insights and identify areas for improvement that may inform the development of the ProDev Track system.

Overall, personal observation serves as a valuable tool for gathering qualitative data and gaining a deeper understanding of the promotion process within UR. By directly observing and experiencing the challenges and opportunities inherent in the current system, researchers can inform the design and implementation of ProDev Track to better meet the needs of faculty members and administrators while enhancing the efficiency and transparency of the promotion process.

Interview

Interview is a process of communication or interaction in which the subject or interviewee provides information verbally in a face-to-face situation[2]. To gather insights into the challenges and opportunities associated with the promotion process at the University of Rwanda (UR), conducting interviews with key stakeholders such as faculty members, administrators, and human resources personnel is essential.

Interviews can be structured to explore various aspects of the promotion process, including the current procedures followed, perceived strengths and weaknesses of the existing system, experiences of faculty members in preparing and submitting promotion applications, and perspectives on potential improvements or reforms. Additionally, interviews can delve into specific topics such as the criteria used for evaluating promotion applications, the role of department heads and review committees in the process, and any barriers or obstacles faced by applicants.

By engaging in interviews with knowledgeable individuals within the UR community, researchers can gain valuable insights into the intricacies of the promotion process and identify areas for enhancement. Through open and candid discussions, stakeholders can provide valuable feedback and suggestions for streamlining procedures, improving

[2] Shukhdeba, H. (2024). *Effective Communication and Interaction in Qualitative Research*. Research Methods Publishing.Qualitative Research - Methods, Analysis Types and Guide (researchmethod.net)

transparency, and ensuring fairness in the promotion process. Ultimately, interviews serve as a crucial method for gathering firsthand perspectives and experiences that inform the development of the ProDevTrack system tailored to the unique needs and challenges of UR.

Expected Results

The implementation of the ProDev Track system at the University of Rwanda (UR) is anticipated to yield the following outcomes:

- **Enhanced Transparency:** Through the ProDev Track platform, faculty members will have increased visibility into the promotion process, including clear guidelines, criteria, and timelines. This transparency will foster trust and confidence among faculty members in the fairness and equity of the promotion process.
- **Streamlined Processes:** By digitizing promotion applications and automating workflows, the ProDev Track system will reduce manual paperwork and streamline administrative processes. This efficiency gain is expected to result in faster processing times for promotion applications, enabling timely decision-making and feedback to applicants.
- **Improved Communication:** ProDev Track will facilitate seamless communication between faculty members, department heads, and administrators involved in the promotion process. The system will provide channels for notifications, updates, and inquiries, reducing reliance on emails and phone calls and ensuring timely and consistent communication throughout the promotion cycle.
- **Enhanced Data Accuracy:** With ProDev Track, promotion-related data will be stored electronically in a centralized database, reducing the risk of errors associated with manual data entry. This improved accuracy will enable better tracking and reporting of promotion activities, leading to more informed decision-making and evaluation.
- **Comprehensive Reporting:** ProDev Track will generate comprehensive reports and analytics on promotion trends, outcomes, and performance metrics. These insights will enable administrators to assess the effectiveness of promotion initiatives, identify areas for improvement, and make data-driven decisions to optimize the promotion process over time.

Overall, the implementation of ProDev Track is expected to modernize and optimize the promotion process at UR, leading to greater efficiency, transparency, and fairness in faculty advancement and professional development.

Organization of Report

This research project comprises five distinct chapters, each serving a specific purpose in the exploration, analysis, and development of the proposed system.

Chapter One serves as a comprehensive introduction to the study, providing an overview of the background and context within which the research is conducted. It outlines the fundamental objectives of the system, detailing both its purpose and the commonalities shared between the existing and proposed systems. By delving into the core issues that the system aims to address, this chapter lays the foundation for subsequent discussions on its implementation and impact.

Chapter Two focuses on the in-depth analysis of the existing system, aiming to unearth the inherent strengths and weaknesses of the current setup. Through meticulous examination, this chapter highlights the disparities between the old and new systems, elucidating the deficiencies of the former and the corresponding features required to bridge the gap. By identifying the key problem areas, this analysis sets the stage for the subsequent design and development phases.

Chapter Three delves into the meticulous process of requirement analysis and design for the proposed system. Here, a detailed exploration of the logical and physical models utilized within the system is presented, utilizing various diagrams to enhance comprehension and clarity. By elucidating the intricacies of the system's architecture, this chapter ensures a thorough understanding of its underlying structure and functionality.

Chapter Four shifts focus to the practical implementation and testing of the new system, providing a visual walkthrough of the graphical interface and operational functionalities. Through the presentation of screenshots and detailed descriptions of testing procedures, this chapter offers insights into the system's usability, reliability, and performance. By rigorously testing and validating the system, any potential issues or deficiencies are identified and addressed before deployment.

Chapter Five concludes the study by summarizing key findings and insights gleaned throughout the research process. It offers recommendations for future projects, outlining areas for further exploration and improvement. By reflecting on the journey from conception to implementation, this chapter encapsulates the project's outcomes and implications for future endeavors.

CHAPTER 2
ANALYSIS OF THE EXISTING SYSTEM

Introduction

In this chapter, we undertake a comprehensive analysis of the existing manual promotion system within the University of Rwanda, recognizing its pivotal role in facilitating career advancement and organizational success. Acknowledging the significance of efficient and transparent promotion processes, we delve into the system's operations, identifying key challenges such as inefficiency, delays, and a lack of transparency. Moreover, we explore the implications of these challenges on employee morale and organizational performance, emphasizing the need for a systematic review and enhancement of the current promotion system.

Through this analysis, we aim to gain a thorough understanding of the core issues plaguing the manual promotion system and their broader impact on the university's operations. By aligning our examination with the university's core values and objectives, we lay the foundation for proposing effective solutions that streamline promotion processes, enhance transparency, and elevate employee satisfaction. This chapter serves as a critical starting point for the development of a revamped promotion system that better supports career advancement and contributes to the overall success of the University of Rwanda.

Description of existing system environment

Historical background

According to Marius Dion, a former general secretary of the reign of the first rector, in 1962, Rwanda’s first president Grégoire Kayibanda approached the congregation of Dominicans that had joined the Rwandan community from Canada in 1960 and asked them to establish a university. With the cooperation of missionaries and government, the university was established in 1963 and was headed by Georges-Henri Lévesqueuntil 1978.

James Karera, one of the first students at the National university of Rwanda, says initially, the university which was being sponsored by Canada was divided into the faculties of Medicine, Social Sciences and Lattre which taught subjects such as English, French, History and Geography. A few years down the road, however, Canada stopped funding the university, an act described by some as a blessing in disguise because soon after, University de Gent of Belgium filled that gap. Consequently, Belgium spearheaded the establishment of law and agronomy, political sciences, social science, education science and economic science.

According to records, the university had about 51 students then. However, the number of students has since grown to over 13,000.

During the 1994 Genocide against the Tutsi, the university, too, was affected – it closed in 1994 and reopened in April 1995. At that time, English was introduced as a medium of instruction alongside French.

In 2013, it was merged with all public higher education institutions in Rwanda to form University of Rwanda.[3]

Mission

To support the development of Rwanda by discovering and advancing knowledge, committed to the highest standards of academic excellence, where students are prepared for lives of service, leadership and solutions[4].

Vision

To be a leading University that develops highly enterprising graduates prepared and dedicated to building a more just and sustainable society locally, nationally and globally, with appropriate innovations that advance quality of life[5].

Description of existing system

The University of Rwanda employs a manual and paper-based promotion system that involves circulating a call for applications internally among faculty and staff members, as well as extending the opportunity to external candidates who meet the qualifications to apply. This call for applications is disseminated through internal communication channels, such as email and official announcements, as well as external channels, including university websites, job boards, and professional networks. Interested candidates, both internal and external, are required to submit their promotion applications along with supporting documentation, including academic qualifications, teaching evaluations, research publications, and service contributions, by specified deadlines outlined in the call for applications. Following the submission of applications, designated committees or panels undertake a meticulous review process to assess the qualifications and eligibility of each candidate based on established criteria. This evaluation involves a thorough examination of submitted documents to determine the candidates' suitability for promotion to their desired rank or position within the university hierarchy. While the inclusion of external candidates enriches the applicant pool

[3] KT Press. (2023, June). University of Rwanda history. Retrieved from https://www.ktpress.rw/2023/06/university-of-rwanda-history/

[4] University of Rwanda (ur.ac.rw)

[5] University of Rwanda (ur.ac.rw)

and promotes diversity within the institution, the manual and paper-based nature of the system may pose challenges in efficiently managing and evaluating applications from both internal and external sources. Thus, there is a growing recognition of the need to modernize and digitize the promotion system to streamline processes, enhance transparency, and attract top talent to the University of Rwanda.

Analysis of existing system

The promotion system at the University of Rwanda (UR) operates within a manual and paper-based framework, presenting challenges that hinder its efficiency and transparency. One significant issue is the lack of a centralized information hub dedicated to managing promotion applications and disseminating essential information to faculty, staff, and external candidates. This decentralized approach leads to difficulties accessing critical information regarding promotion criteria, submission deadlines, and required documentation, potentially resulting in delays and inaccuracies in the promotion process. Furthermore, the reliance on outdated communication channels, such as email and physical submissions, contributes to administrative burdens and increases the likelihood of errors and miscommunication. Faculty and staff members may encounter challenges in accessing relevant information about promotion opportunities and requirements, while external candidates may face difficulties navigating the application process and understanding promotion criteria within the university.

To address these challenges, UR could benefit from implementing a centralized and digitized promotion system that streamlines communication, facilitates the submission and review of promotion applications, and enhances transparency and accessibility for all stakeholders. An online portal or application could provide a user-friendly interface for submitting applications, tracking progress, and accessing relevant information about promotion criteria and timelines. By modernizing its promotion system, UR can improve efficiency, transparency, and overall satisfaction among faculty, staff, and external candidates participating in the promotion process.

Modeling of existing system

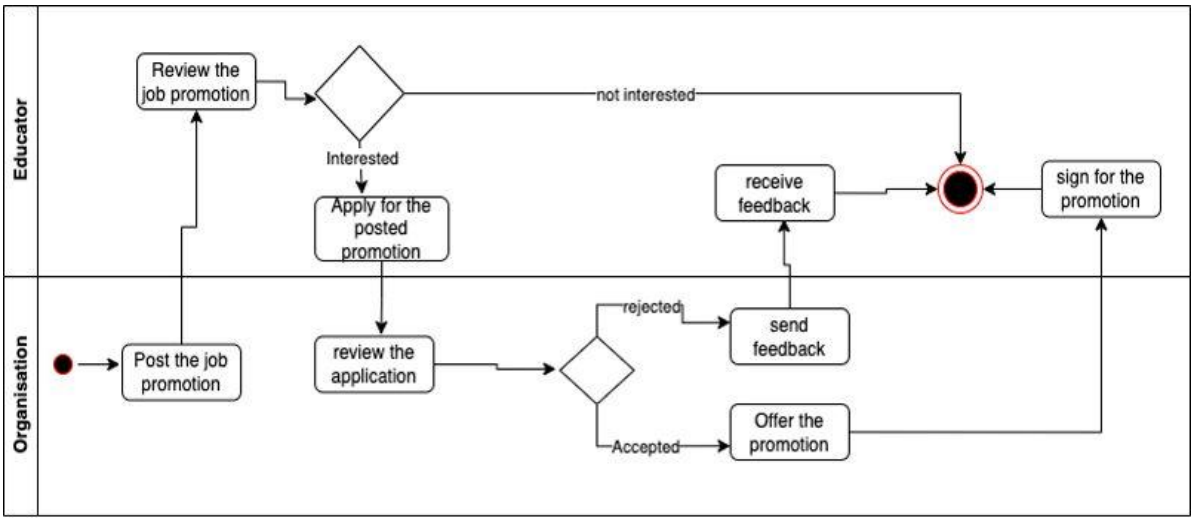


Figure 1: Modelling of current system

Problems with existing system

The existing system at the University of Rwanda (UR) for managing promotions faces several significant challenges that hinder its effectiveness and efficiency:

- **Manual Processes:** The promotion process at UR relies heavily on manual procedures, including paper-based documentation, manual data entry, and physical submission of promotion applications. This manual approach leads to inefficiencies, delays, and a higher risk of errors.

- **Lack of Centralization:** Promotion-related information and documentation are often scattered across different departments and administrative offices, making it challenging to access and track promotion applications, criteria, and decisions. The lack of a centralized system results in inconsistencies and difficulties in managing promotion activities.

- **Communication Challenges:** Communication between faculty members, department heads, and administrators involved in the promotion process is often fragmented and inefficient. Important updates, deadlines, and feedback may be communicated inconsistently or through informal channels, leading to confusion and misunderstandings.

- **Limited Accessibility:** Faculty members may face challenges in accessing information about promotion criteria, procedures, and deadlines due to the lack of a centralized repository or easily accessible platform. This limited accessibility can result in delays and misunderstandings, particularly for faculty members located in remote areas or with limited access to administrative resources.

- **Transparency Issues:** The promotion process may lack transparency, with unclear criteria, inconsistent evaluation methods, and a lack of visibility into decision-making processes. Faculty members may perceive the promotion process as arbitrary or biased, leading to decreased trust and satisfaction with the system.

- **Administrative Burden:** Managing promotion applications, tracking progress, and coordinating evaluation committees impose a significant administrative burden on department heads, human resources personnel, and other administrators involved in the process. This administrative overhead detracts from other essential responsibilities and may lead to burnout and inefficiencies.

- **Inconsistencies in Evaluation:** The evaluation criteria and processes used to assess promotion applications may vary between departments or faculties, leading to inconsistencies in decision-making and outcomes. This lack of standardization can result in perceived inequities and disparities in promotion opportunities for faculty members.

Addressing these challenges is crucial for enhancing the fairness, efficiency, and transparency of the promotion process at UR and ensuring the recognition and advancement of deserving faculty members.

Proposed solutions

To address the challenges faced by the existing promotion system at the University of Rwanda (UR), the implementation of a comprehensive digital platform, referred to as ProDevTrack, is proposed. ProDevTrack aims to modernize and streamline the promotion process, ensuring transparency, efficiency, and fairness for faculty members and administrators alike.

- **Digitalization of Processes:** ProDevTrack will digitize all promotion-related processes, including application submission, documentation, evaluation, and decision-making. Faculty members will have access to an online portal where they can submit promotion applications, upload supporting documents, and track the progress of their applications in real-time.

- **Centralized Repository:** ProDevTrack will serve as a centralized repository for all promotion-related information, criteria, guidelines, and documentation. This centralized platform will ensure consistency, accessibility, and transparency, allowing faculty members and administrators to access relevant information easily.

- **Automated Workflows:** ProDevTrack will automate workflows and notifications throughout the promotion process, reducing manual intervention and streamlining administrative tasks. Automated reminders, updates, and notifications will keep faculty members informed about deadlines, requirements, and evaluation progress, enhancing communication and accountability.

- **Standardized Evaluation Criteria:** ProDevTrack will establish standardized evaluation criteria and rubrics for assessing promotion applications across departments and faculties. This standardization will ensure consistency and fairness in the evaluation process, minimizing biases and disparities in promotion outcomes.

- **Collaborative Decision-Making:** ProDevTrack will facilitate collaborative decision-making by enabling department heads, review committees, and administrators to access and review promotion applications electronically. This collaborative approach will enhance transparency and accountability in decision-making, ensuring that promotion decisions are based on merit and alignment with established criteria.

- **Data Analytics and Reporting:** ProDevTrack will provide data analytics and reporting capabilities to track promotion trends, outcomes, and performance metrics. Administrators will have access to comprehensive reports and dashboards to assess the effectiveness of promotion initiatives, identify areas for improvement, and make informed decisions to optimize the promotion process over time.

Overall, the implementation of ProDevTrack offers a holistic solution to the challenges faced by the existing promotion system at UR. By leveraging technology, standardizing processes, and promoting transparency and collaboration, ProDevTrack aims to modernize and enhance the promotion process, ultimately supporting the professional development and recognition of faculty members at UR.

Requirement specifications

The requirements specification is a process of clearing and precisely describing the expected functionality and behavior of the software system to be developed, it acts as a bridge or a translator between software stakeholders and the software development team to ensure that they share the same understanding of the behavior of the software system on how it does the environment and conditions it will work on.

The software requirements are divided into two parts, One Functional requirements which state the functions the system must perform to be considered valid, and the second the non-

functional requirements of a software system which deal with the functional quality a software system must have to function well this are not directly related to the functions of a software system.

Function Requirements

- REQ 1: The ProDev Track system shall provide secure authentication for applicants to register and login to the system.
- REQ 2: The ProDev Track system shall allow the admin to create or post promotion application calls.
- REQ 3: The ProDev Track system shall allow applicants to view available promotion application calls.
- REQ 4: The ProDev Track system shall allow applicants to submit their promotion applications.
- REQ 5: The ProDev Track system shall provide a tracking mechanism for applicants to monitor the status of their promotion applications.
- REQ 6: The ProDev Track system shall automatically analyze the submitted inputs, excluding supporting documents, of applicants to determine their qualifications.
- REQ 7: The ProDev Track system shall indicate if the applicant has passed the first phase based on the qualifications analysis.
- REQ 8: The ProDev Track system shall allow the admin to review and verify the supporting documents submitted by the applicants as a second phase of the evaluation process.
- REQ 9: The ProDev Track system shall provide administrative tools for managing promotion applications, including assigning applications for review and setting evaluation criteria.
- REQ 10: The ProDev Track system shall include communication features such as notifications to inform applicants of their application status and any required actions.
- REQ 11: The ProDev Track system shall generate reports on promotion activities, including application status and decision outcomes.

Non-Functional Requirements

Performance

- REQ 12: The system must support 3,000 users per hour.
- REQ 13: The system must provide 6 second or less response time in a chrome desktop browser.

Scalability

- REQ 14: The system must have the capacity to accommodate 5,000 simultaneous users without experiencing any degradation in performance.

Portability

- REQ 15: The must be run on window 10 or window 11 without change in its behavior.

Reliability

- REQ 16: The System must perform without failure in 95 percent of use cases during a month.

Maintainability

- REQ 17: The time it takes to restore the system after a failure, should not exceed 15 minutes.

Security

- REQ 18: The system will safeguard all stored data from malicious software attacks or unauthorized entry.

CHAPTER 3

REQUIREMENTS ANALYSIS AND DESIGN OF THE NEW SYSTEM

Introduction

In this chapter, we embark on a pivotal phase of our project, one that serves as the cornerstone for developing an innovative and user-centric system tailored to address the needs of our stakeholders. This chapter unfolds the essential stages of Requirements Analysis and System Design, pivotal steps that lay the groundwork for the successful realization of our vision.

Requirements Analysis initiates our journey by undertaking a comprehensive examination of the existing challenges and opportunities inherent in the promotion system at the University of Rwanda. By meticulously studying user needs and pain points, we define the scope and functionalities of our system, ensuring alignment with the aspirations and expectations of our users. This phase serves as a guiding compass, directing us towards optimal design decisions that prioritize user experience and satisfaction.

Following Requirements Analysis, the chapter transitions seamlessly into the System Design phase, where we translate our insights and findings into a tangible and cohesive blueprint. Here, we meticulously craft the architecture and components of the system, strategically organizing its elements to seamlessly integrate into the user's workflow. This holistic approach to system design ensures that every piece of the puzzle fits snugly, resulting in a powerful and harmonious system poised to revolutionize the promotion process at UR.

As we navigate through the intricacies of Requirements Analysis and System Design, it becomes evident that we are not merely developing a technical solution but shaping a transformative system that addresses real-world challenges. This chapter delves into the methodologies, principles, and thought processes that underpin these crucial phases, illustrating how they converge to create a dynamic and user-centric solution poised to elevate user experiences and meet their evolving needs.

Unified Modelling Language (UML)

Unified Modeling Language (UML) stands as a standardized and widely recognized visual modeling language that holds a significant role in the realms of software engineering and

systems analysis. With its structured notation and comprehensive set of symbols[6], UML serves as a common language for communication, documentation, and design within the software development process.

UML provides a systematic way to represent complex systems, helping stakeholders visualize and understand intricate relationships, interactions, and structures that are integral to software projects. Through its various diagrams and notations, UML enables software engineers, architects, and analysts to convey design concepts, system functionalities, and user interactions in a clear and concise manner[7].

This standardized approach offered by UML promotes effective communication and collaboration among multidisciplinary teams, bridging the gap between technical experts, business analysts, and other stakeholders. As a result, UML facilitates the translation of abstract ideas and requirements into tangible software solutions, reducing ambiguity and enhancing the accuracy of system design.

Furthermore, UML's versatility extends beyond individual projects; its standardized nature empowers software professionals to communicate design concepts universally, fostering a consistent and coherent approach across the software engineering landscape. As technology evolves and software systems become increasingly complex, UML remains a steadfast tool for effectively modeling, designing, and documenting software solutions, thereby contributing to the advancement of both software engineering practices and systems analysis methodologies.

Object-Oriented Programming (OOP)

Object-Oriented Programming (OOP) stands as a foundational paradigm in software development, redefining how we conceptualize, design, and build complex systems. At its core, OOP organizes data and functionality into self-contained entities known as "objects." These objects are the building blocks of a program, encapsulating data attributes and methods that manipulate those attributes. This approach promotes modularity, reusability, and easier maintenance, making it an ideal match for the intricacies of modern software systems.

[6] James. (2023, June 22). What is Unified Modeling Language (UML)? Retrieved from https://www.visual-paradigm.com/: https://www.visual-paradigm.com/guide/uml-unified-modeling-language/what-is-uml/

[7] Booch, G., Rumbaugh, J., & Jacobson, I. (2005). *The Unified Modeling Language User Guide* (2nd ed.). Addison-Wesley Professional. Retrieved from Pearson.

The synergy between OOP and Unified Modeling Language (UML) is undeniable. UML serves as a powerful tool for visualizing and communicating the design principles and structures of an object-oriented system. UML diagrams, such as class diagrams, sequence diagrams, and state diagrams, provide a common language for stakeholders to represent classes, relationships, interactions, and states of objects. This shared visual vocabulary enhances collaboration among developers, designers, and project stakeholders, reducing ambiguity and ensuring a shared understanding of the software's architecture[8].

In the context of my project, OOP and UML played a pivotal role in shaping the design process. By employing OOP principles[9], I was able to break down the functionality of the airline services analytic system into distinct and manageable classes, each encapsulating specific attributes and behaviors. These classes formed the basis for creating comprehensive UML class diagrams, illustrating the relationships, attributes, and methods of various system components.

UML diagrams, such as use case diagrams, depicted the interactions between different actors (users, passengers, employees) and the system itself. They provided a clear overview of how various components interacted, allowing for a systematic analysis of use cases, scenarios, and user interactions.

Additionally, sequence diagrams portrayed the dynamic interactions between objects during different processes, such as filing complaints or tracking them. These diagrams showcased the sequence of method calls and exchanges of information, aiding in the identification of potential bottlenecks, errors, or optimization opportunities.

Ultimately, the integration of OOP and UML enriched the design-making phase of my project. It helped streamline the translation of conceptual ideas into concrete software components and user interactions. By leveraging the principles of OOP and the visual language of UML, I was able to create a robust and well-structured system design that aligns with industry best practices and enhances the overall user experience.

Design of the New System _Diagrams

System design governs the execution of functionalities outlined in the analysis model. During this phase, you and the user collaboratively establish a robust understanding of how the system will operate. An "actor" embodies a role assumed by an external entity during

[8] Martin, R. C. (2008). *Clean Code: A Handbook of Agile Software Craftsmanship*. Prentice Hall. Retrieved from InformIT.

[9] Fowler, M. (2004). *UML Distilled: A Brief Guide to the Standard Object Modeling Language* (3rd ed.). Addison-Wesley Professional.

their interaction with a system publicly. This entity can encompass individuals, organizations, or external systems engaging with your application or system.

Use Case

A use case embodies a sequence of steps or occurrences that delineate the exchanges between an actor and a system, with the intention of achieving a distinct objective. These actors could range from individuals to machinery or even specific time periods. Use cases function as a vehicle for capturing and recording the fundamental engagements between users and the system. They are marked by descriptive phrases that combine verbs and nouns, serving as a cornerstone in outlining the system's capabilities. The visual portrayal of a use case showcases the progression of these interactions, presenting a lucid portrayal of the system's conduct. Through the utilization of use cases, stakeholders can acquire a comprehensive comprehension of how users interact with the system to attain their goals.

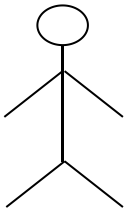
Elements

Use case: constituting a distilled rendition of a segment of a business process model, a use case encapsulates a collection of actions nested within a system. The portrayal of a use case materializes through the lens of the corresponding actors, specifically those entities that engage with the system. It is represented as follow:

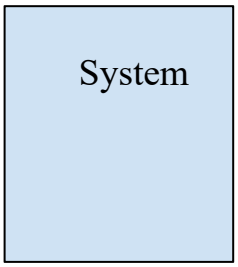
Use Case

Actor: In the realm of system modeling, an actor embodies a distinct function undertaken by an external entity while engaging directly with the system. This external entity might personify a user or an alternative system that interfaces with the system under consideration. Actors find manifestation within the system model, elucidating their engagement and impact. They hold a pivotal function in delineating the system's limits and extent, while also discerning the diverse interconnections and obligations attributed to each role. In visual depictions, actors take form through designated symbols or icons, serving to facilitate the lucid and instinctive communication of their participation and role in the system.

Actor



System boundary: Within the realm of use case modeling, the concept of a system boundary takes on the role of a visual representation that outlines the scope or confines of the system under scrutiny. When observing a use case diagram, the system boundary takes the form of a rectangular enclosure, enveloping the internal mechanisms and functionalities intrinsic to the system. Conversely, actors exist as entities external to the system, finding their position outside this boundary. They embody the various roles or entities that engage with the system, steering it toward specific tasks or objectives. The graphical portrayal of the system boundary and actors within a use case diagram facilitates a clear differentiation between the system's internal constituents and the external entities implicated in the system's activities and operational essence. It is represented as follow:



Relationship between Use Cases

"**Extend**" relationship: «extend» An extended Use Case finds its purpose in elucidating deviations from the typical sequence of events expounded by a comprehensive use case. The scenario of Use Case B extends itself from the narrative of Use Case A, manifesting when the behavior of Use Case A takes on a specific disposition within a certain circumstance.

"**Include**" relationship: «include»[10]. Use Case A encompasses Use Case B when the functionality embodied by Use Case B becomes essential to the operation of Use Case A.

[10] Larman, C. (2004). *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development* (3rd ed.). Prentice Hall. Retrieved from Results for "applying uml and patterns an introduction to objec" (pearson.com)

This particular behavior has been abstracted into its distinct Use Case to facilitate its reuse across multiple use cases.

– – – – – – <<include>> – – – – – –>

"**Association**" relationship is a bridge connecting an actor and a use case, establishing their interaction. This linkage is symbolized by a line that links an actor and a use case. This association goes beyond a mere visual representation on a diagram; it embodies the very essence of how actors and use cases collaborate within the system's operations. The linking line symbolizes a conduit through which information, actions, and interactions flow between the actor and the use case, establishing a seamless flow of communication and functionality.

Use-Case Diagram

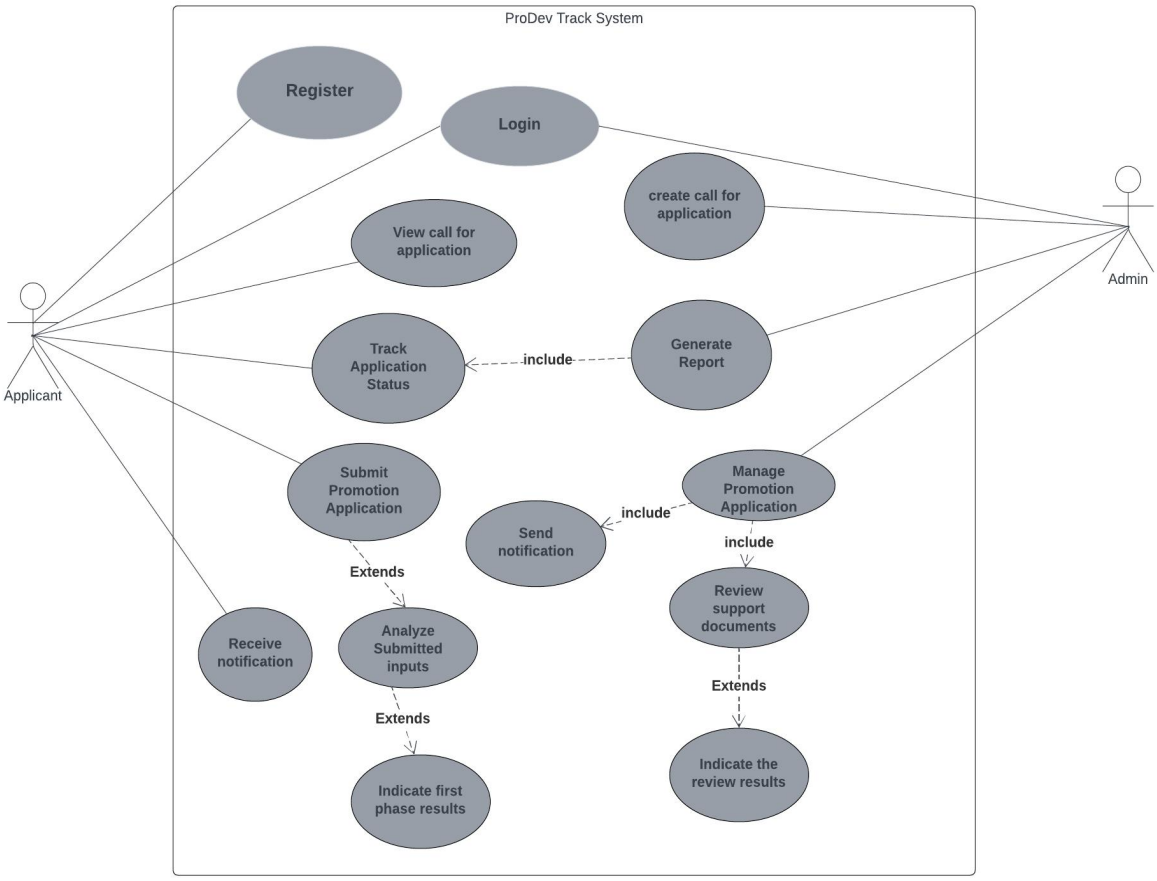


Figure 2: Use case Diagram.

Use-case description

A Use Case description outlines the actions performed by a use case and the requirements necessary for its successful execution. Every use case encompasses the following elements:

- **Name**: The title of the use case

- **Actor**: The participant engaged in the use case

- **Description**: The intended actions of the system

- **Pre-condition:** The initial state of the system before the use case initiation

- **Post-condition:** The state of the system once the use case concludes

- **Normal flow:** The primary sequence of steps in the use case

- **Alternative flow:** Potential steps if the primary flow encounters an issue

Analysis of the new system

Name: Secure Authentication
Actor: Applicant
Description: This use case allows applicants to securely register and log in to the Prodev Track system.
Pre-condition: : The system is operational, and the applicant has access to the registration and login interface.
Post-condition: The applicant is authenticated and logged into the system.
Normal flow: 1. The applicant navigates to the registration/login page. 2. The applicant enters their username and password. 3. The system validates the credentials. 4. If the credentials are valid, the system logs the applicant in. 5. The applicant is redirected to their dashboard.
Alternative flow: If the credentials are invalid, the system displays an error message, and the applicant can re-enter their credentials.

Table 1: Use case description of secure Authentication.

Name: Create Promotion Application Call
Actor: Admin
Description: This use case allows the admin to create or post promotion application calls.
Pre-condition: The Admin is logged into the ProDev Track system.

Post-condition: The admin is authenticated and logged into the system.
Normal flow: 1. The admin navigates to the promotion application call creation page. 2. The admin enters the details of the promotion application call (title, description, deadline). 3. The system saves the promotion application call. 4. The system displays a confirmation message.
Alternative flow: ● If any required fields are missing, the system prompts the admin to fill in the missing information.

Table 2: Use case description of creation of call of promotion application.

Name: View Promotion Application Calls
Actor: Applicant
Description: This use case allows applicants to view available promotion application calls.
Pre-condition: The applicant is authenticated and logged into the system.
Post-condition: The applicant views the list of available promotion application calls.
Normal flow: • The applicant navigates to the promotion application calls page. • The system retrieves and displays a list of available promotion application calls. • The applicant selects a promotion application call to view more details.
Alternative flow: If there are no available promotion application calls, the system displays a message indicating that no calls are available.

Table 3: Use case description of View promotion application calls.

Name: Submit Promotion Application
Actor: Applicant
Description: This use case allows applicants to submit their promotion applications.
Pre-condition: The applicant is authenticated and logged into the system, and a promotion application call is available.
Post-condition: The promotion application is submitted and stored in the system.
Normal flow: • The applicant navigates to the promotion application submission page. • The applicant fills out the application form and uploads supporting documents. • The applicant submits the application. • The system saves the application and sends a confirmation notification to the applicant.
Alternative flow: If any required fields or documents are missing, the system prompts the applicant to provide the missing information.

Table 4: Use case description of Submit promotion Application

Name: Track Application Status
Actor: Applicant
Description: This use case allows applicants to monitor the status of their promotion applications.
Pre-condition: The applicant is authenticated and logged into the system, and has submitted a promotion application.
Post-condition: The applicant views the current status of their promotion application.
Normal flow: • The applicant navigates to the application status tracking page.

• The system retrieves and displays the status of the applicant's promotion application.
Alternative flow: If the application status is not available, the system displays a message indicating the status is currently unavailable.

Table 5: Use case description of Track application status.

Name: Automatic Inputs Analysis
Actor: The Prodev Track system
Description: This use case allows the system to automatically analyze the submitted inputs of applicants to determine their qualifications.
Pre-condition: The applicant has submitted a promotion application with the required inputs.
Post-condition: The system completes the analysis and updates the application status.
Normal flow: • The system retrieves the submitted inputs of the applicant. • The system analyzes the inputs to determine the applicant's qualifications. • The system updates the application status based on the analysis. • The system notifies the applicant of the analysis results.
Alternative flow: If the analysis encounters an error, the system logs the error and notifies the admin for manual review.

Table 6: Use case description of Automatic inputs analysis

Name: First Phase Result Indication
Actor: The Prodev Track system
Description: This use case allows the system to indicate if the applicant has passed the first phase based on qualifications analysis.
Pre-condition: The system has completed the automatic document analysis.

Post-condition: The system indicates whether the applicant has passed the first phase.
Normal flow: • The system evaluates the analysis results. • The system updates the application status to indicate if the applicant has passed the first phase. • The system notifies the applicant of the first phase result.
Alternative flow: If there is an issue with the evaluation, the system logs the issue and notifies the admin for manual review.

Table 7: Use case description of First phase Results Indication

Name: Admin Review of Supporting Documents
Actor: Admin
Description: This use case allows the admin to review and verify the supporting documents submitted by the applicants as a second phase of the evaluation process and to make the final promotion decision.
Pre-condition: The applicant has passed the first phase, and supporting documents are available for review.
Post-condition: The admin completes the review, updates the application status, and indicates the promotion decision.
Normal flow: • The admin navigates to the supporting documents review page. • The admin reviews the submitted supporting documents. • The admin verifies the authenticity and validity of the documents. • The admin updates the application status based on the review. • The admin makes the final promotion decision (approved or rejected). • The system updates the application status with the promotion decision. • The system notifies the applicant of the review results and the promotion decision.

Alternative flow: • If the documents are incomplete or invalid, the admin requests additional information from the applicant. • If the admin encounters an issue during the review process, the system logs the issue and notifies the admin for further action.

Table 8: Use case description of Admin Review of Supporting Documents

Name: Communication Features
Actor: The Prodev Track system
Description: This use case allows the system to send notifications to inform applicants of their application status and any required actions.
Pre-condition: The system has updated information regarding the applicant's application status.
Post-condition: The applicant receives the notification.
Normal flow: • The system generates a notification based on the application status. • The system sends the notification to the applicant. • The applicant receives the notification.
Alternative flow: If the notification fails to send, the system retries and logs the failure.

Table 9: Use case description of Communication features

Name: Receive Notification
Actor: Applicant
Description: This use case allows the applicant to receive notifications about their application status and required actions.
Pre-condition: The system has sent a notification regarding the applicant's application status.

Post-condition: The applicant is informed about their application status or required actions.
Normal flow: • The system sends a notification to the applicant. • The applicant receives the notification on their dashboard or via email. • The applicant views the notification details.
Alternative flow: If the applicant does not receive the notification, they can check their dashboard for updates or contact support.

Table 10: *Use case description of Receive Notification*

Name: Generate Reports
Actor: Admin
Description: This use case allows the admin to generate reports on promotion activities.
Pre-condition: The system has collected data on promotion applications and activities.
Post-condition: The admin receives the generated report.
Normal flow: • The admin navigates to the reports generation page. • The admin selects the desired report criteria. • The system generates the report based on the selected criteria. • The system displays or downloads the report for the admin.
Alternative flow: If the report generation fails, the system logs the failure and notifies the admin.

Table 11:Use case description of Generate Reports

Name:Review Results Indication
Actor: Admin
Description: The Prodev Track system allows the admin to update the application status.
Pre-condition: The admin has completed the review of supporting documents and made a promotion decision.
Post-condition: The promotion decision is recorded, and the applicant is notified.
Normal flow: • The system receives the promotion decision from the admin. • The system updates the application status with the promotion decision. • The system generates a notification based on the promotion decision. • The system sends the notification to the applicant. • The applicant receives the notification and views the promotion decision.
Alternative flow: • If the notification fails to send, the system retries and logs the failure. • If the applicant does not receive the notification, they can check their dashboard for updates or contact support.

Table 12:Use case description of Review Results Indication

Class Diagram

A class diagram in the Unified Modeling Language (UML) is **a type of static structure diagram** that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects. At its core, a class diagram essentially delineates the blueprint of a system by highlighting the constituent classes that form the foundation of the software. These classes encapsulate the key elements that define the system's functionalities, embodying both data and behavior.

Tools to be used.

Term and definition	Symbol

An attribute: ➢ Represents properties that describe the state of an object. ➢ Can be derived from other attributes, shown by placing a slash before the attribute's name.	**Class Name** +attribute1 : int -attribute2 : float #attribute3 : Circle
An operation: ➢ Represents the actions or functions that a class can perform. ➢ Can be classified as a constructor, query, or update operation. ➢ Includes parentheses that may contain parameters or information needed to perform the operation.	**Class Name** +op1 () -op2 () #op3()
An association: ➢ Represents a relationship between multiple classes or a class and itself. ➢ Is labeled using a verb phrase or a role name. whichever better represents the relationship. ➢ Can exist between one or more classes. ➢ Contains multiplicity symbols, which represent the minimum and maximum times a class instance can	

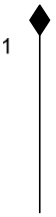
be associated with the related class instance.	
A generalization: ➢ Represents a-kind-of relationship between multiple classes.	
An aggregation: ➢ Represents a logical a-part-of relationship between multiple classes or a class and itself. ➢ It is a special form of an association.	
A composition: ➢ Represents a physical a-part-of relationship between multiple classes or a class and itself. ➢ It is a special form of an association.	

Table 13: Meaning of symbols used in class diagram.

In a class diagram, each class is depicted as a box with compartments detailing its name, attributes, and methods. Arrows, lines, and multiplicity notations indicate the relationships between classes, such as associations, aggregations, and inheritances.

Associations signify how classes are connected, while multiplicity indicates the cardinality of these relationships. Aggregations show a whole-part relationship between classes, and inheritances depict the hierarchical structure of classes within an inheritance hierarchy. Class diagrams help in understanding the architecture, designing new features, identifying opportunities for optimization, and facilitating communication between technical and non-technical stakeholders, thus playing a pivotal role throughout the software development lifecycle.

In the realm of software design, class diagrams serve as a bridge between conceptual thinking and technical implementation. They provide a clear visual representation of the system's building blocks and their interactions, making them an indispensable tool for both developers and stakeholders. By presenting a holistic view of the software's structure, class

diagrams facilitate the understanding of complex systems and enable effective communication among team members.

Class Diagram

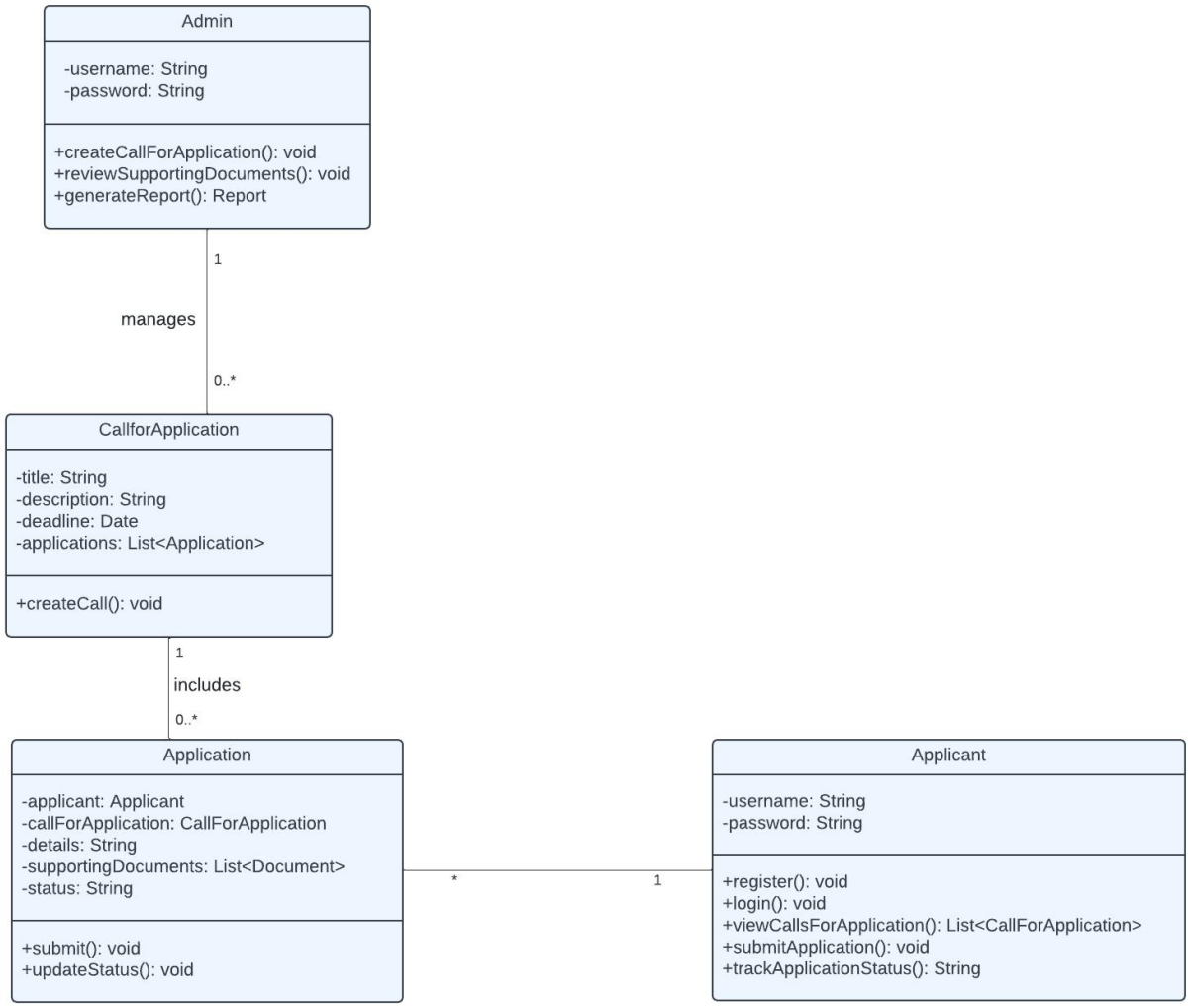


Figure 3: Class Diagram

Sequence Diagram

A sequence diagram falls under the category of interaction diagrams, as it illustrates the coordinated actions and chronological sequence in which a set of entities collaborate. These visual representations are utilized by software engineers and professionals in the business realm to comprehend the prerequisites for a novel system or to record an established procedure. Sequence diagrams are occasionally referred to as event diagrams or event scenarios.

Tools to be used.

Term and definition	**Symbol**

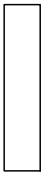
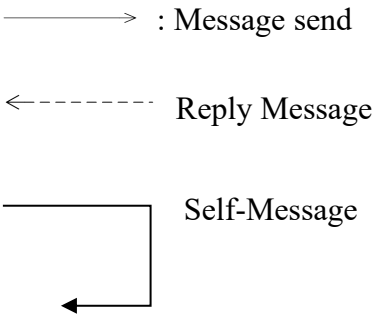
An actor: ✓ It refers to an entity, either an individual or a system, that gains advantages from the system's functionalities and exists externally to the system itself. ✓ It engages in a series of actions within a sequence, involving the transmission or receipt of messages. ✓ It is. positioned along the upper section of the diagram.	
An object lifeline: ✓ It engages in a sequence by transmitting or receiving messages. ✓ It is placed across the top of the diagram.	
An activation: ✓ It takes the form of an elongated and narrow rectangle positioned atop a lifeline. ✓ It denotes the instances when an object is either transmitting or receiving messages.	
A message: ✓ It sends information from one object to another one. ✓ Messages are used to depict the flow of information, requests, or responses between different parts of the system.	

Table 14: Sequence diagram symbols description

Sequence Diagram

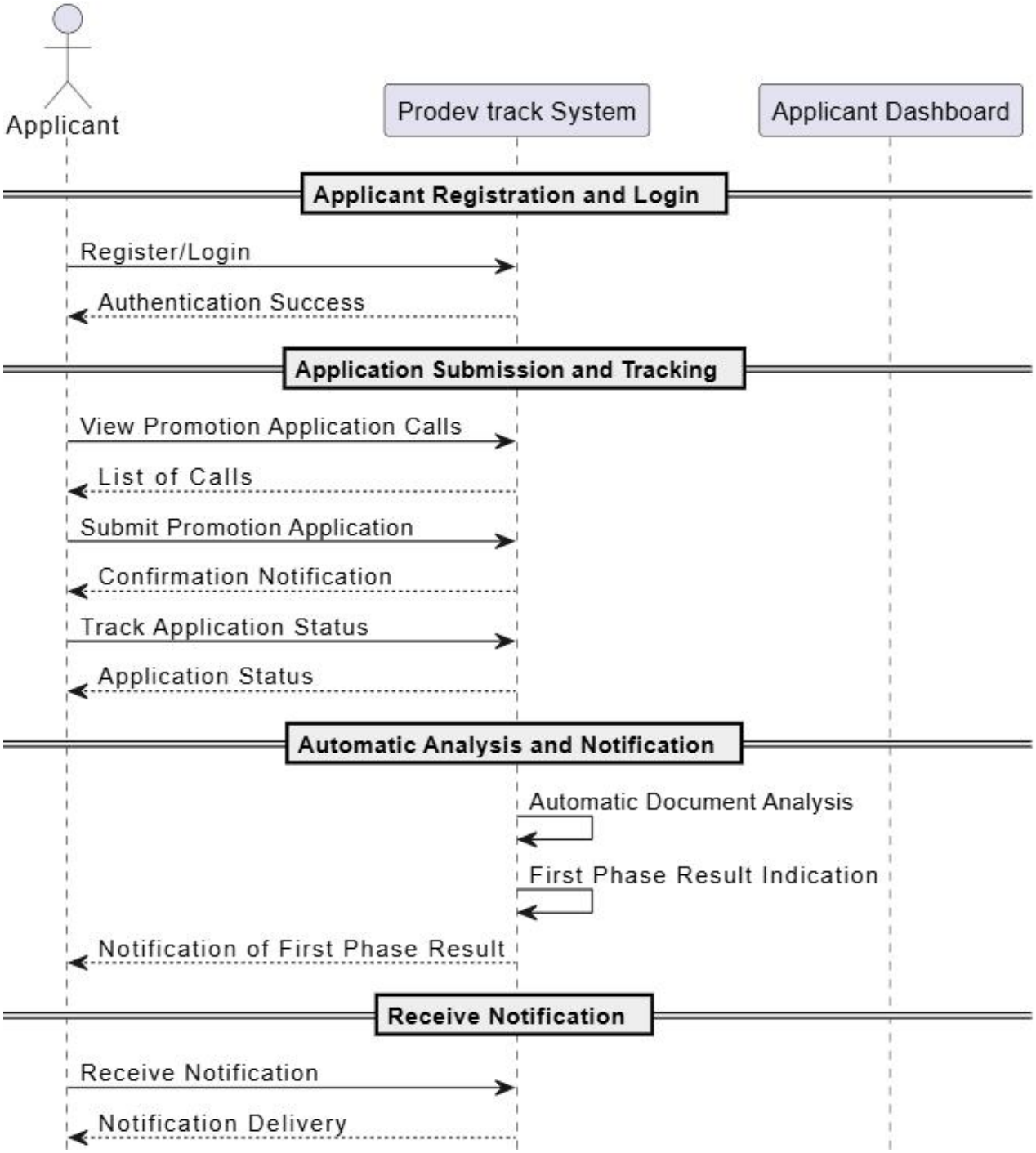


Figure 4: Sequence Diagram for an Applicant

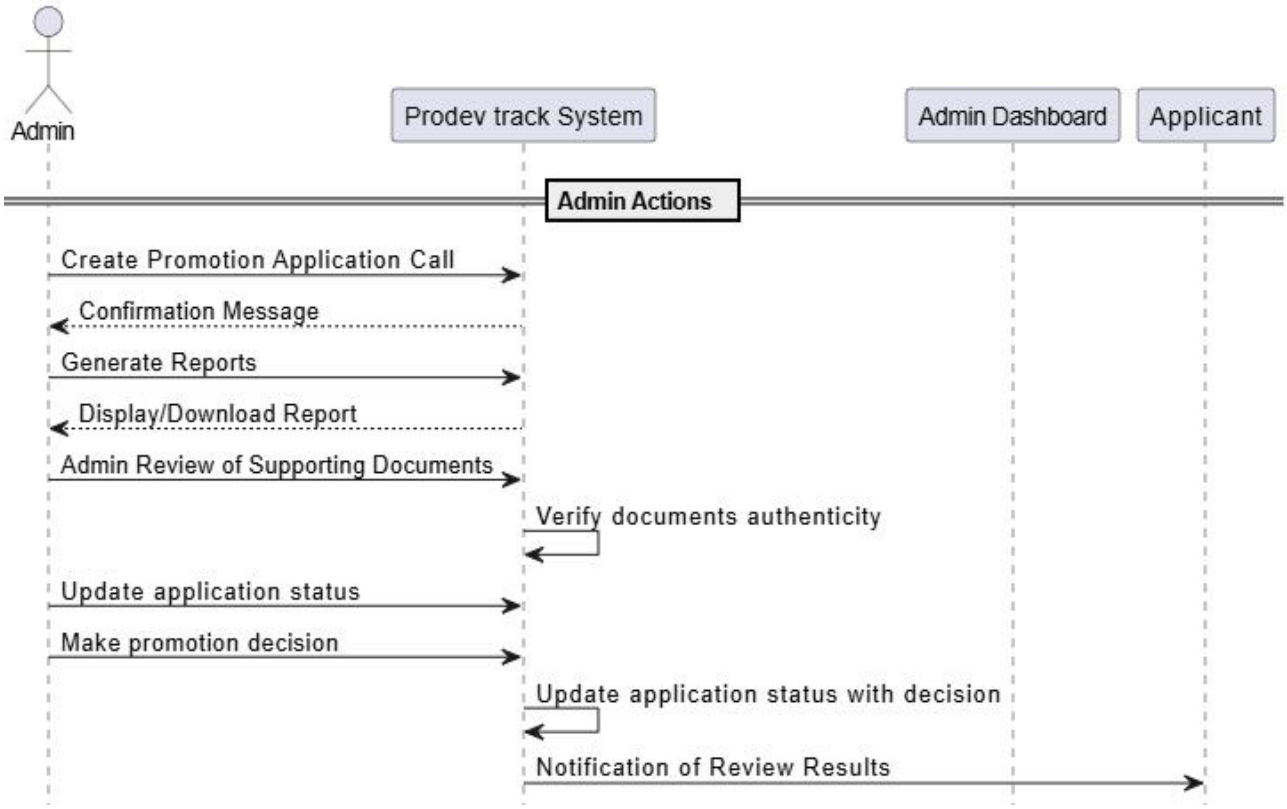


Figure 5: Sequence Diagram for an Admin

Activity Diagram

Activity Diagram visually presents a series of actions or flow of control in a system similar to a flowchart or a data flow diagram. They are often used in business process modeling; they can also describe the steps in a use case diagram.

Activity diagrams are constructed from a limited number of shapes, connected with arrows. The most important shape types:

- ellipses represent actions.
- diamonds represent decisions.
- bars represent the start (split) or end (join) of concurrent activities.
- a black circle represents the start (initial node) of the workflow.
- an encircled black circle represents the end (final node).

Arrows run from the start towards the end and represent the order in which activities happen.

Activity Diagram

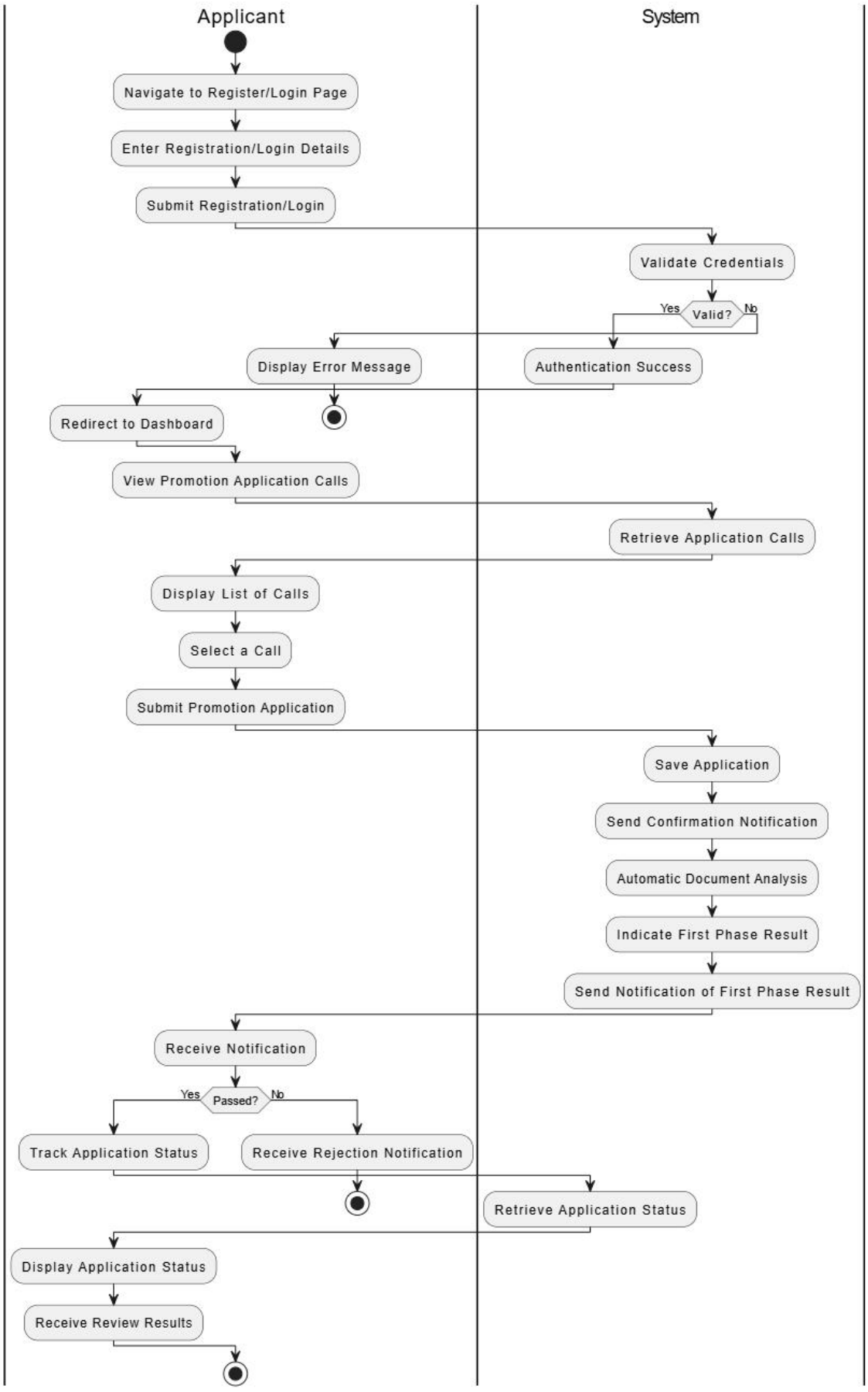


Figure 6: Activity diagram description

Database design

Database design is the process of developing, implementing, and maintaining a company's data management systems. The primary objective of database design is to create physical and logical models that represent the planned database system.

Database Schema

A database schema defines the logical structure of a database, including the names of tables, fields, data types, and relationships between entities. It outlines the rules and constraints that govern how data is organized in a relational database.

Database Schema diagram

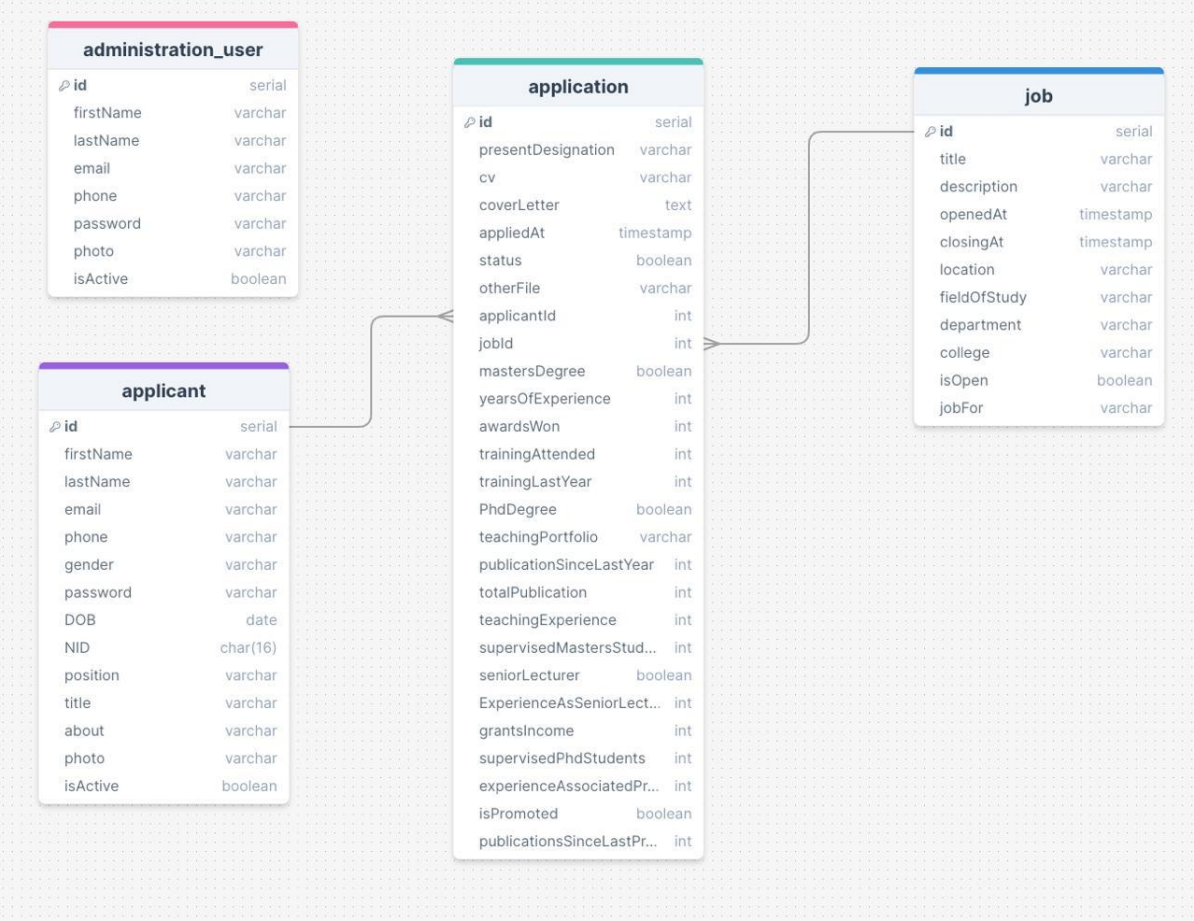


Figure 7: Database design diagram

System Architecture Design

System architecture is like the blueprint or plan for a big project or machine. Just like a blueprint shows how different parts of a building fit together, system architecture shows how different parts of a system, like a computer or a software program, work together.

It describes what each part does and how they all connect and communicate to make the whole thing work smoothly. So, it's basically a map that helps everyone understand how the system operates and how all the pieces fit together to achieve its goals.

Architectural design

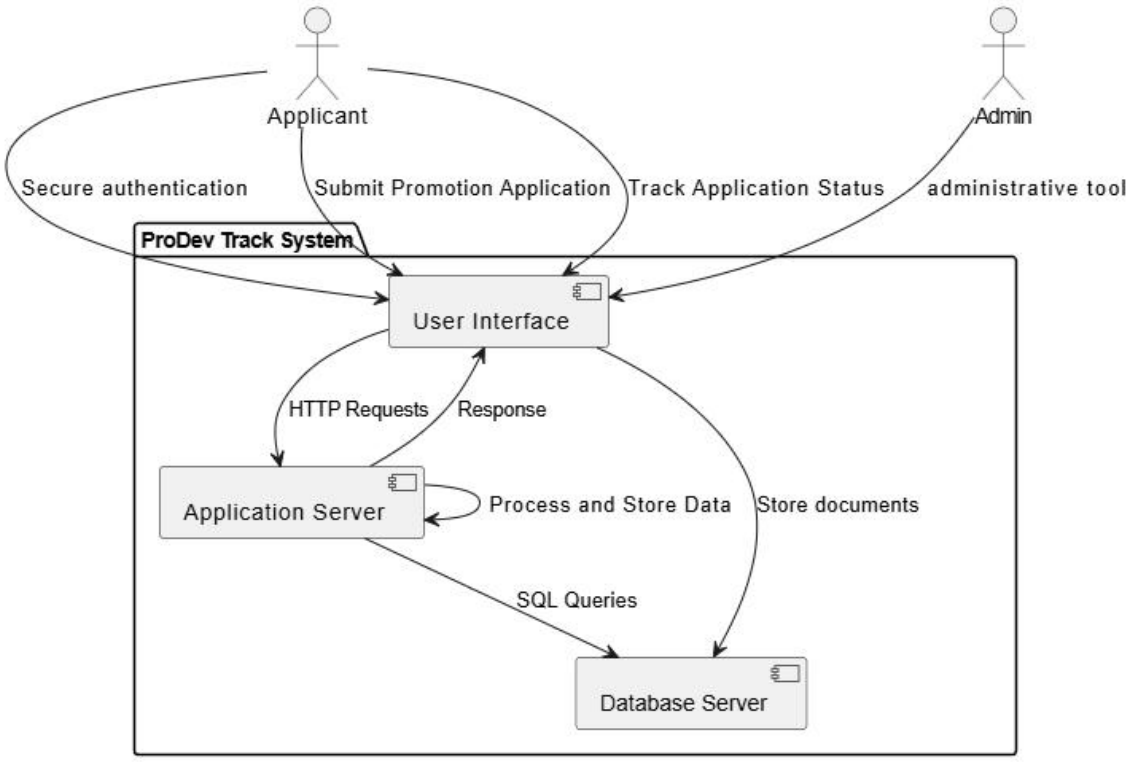


Figure 8: Architecture design for the new system

A server meets the service requests of a client by providing the requested service. Managing resources is often necessary for server tasks. This involves the server maintaining access to the resource, coordinating access to it, and responding to client requests by providing data or status information.

CHAPTER 4
IMPLEMENTATION AND TESTING OF THE NEW SYSTEM

Introduction

This chapter delves into the implementation and testing phases of the "ProDev Track System," a comprehensive solution designed to automate the promotion application process for both new and current staff. It provides an overview of the technologies employed to develop and operate the system, alongside screenshots showcasing its various functionalities. Rigorous testing has been performed to ensure the system operates as intended and meets all specified requirements. Additionally, this chapter addresses the compatibility considerations necessary for both software and hardware during the implementation planning phase, ensuring seamless integration and optimal performance.

Technologies used

Front-end Development:

- **React with Vite**: React serves as the cornerstone for building the user interface, offering a comprehensive framework for creating interactive and stateful UI components. Vite complements React by providing a modern frontend build tool that significantly accelerates development with features like instant server start and lightning-fast hot module replacement, making the developer experience smoother and more efficient[11].
- **Tailwind CSS**: This utility-first CSS framework is instrumental in crafting custom designs quickly without leaving the HTML. It provides a vast set of predefined classes that can be composed to build complex designs directly in markup, facilitating a more streamlined workflow and ensuring that the application's design is responsive and adaptable to different screen sizes.
- **Context API**: As part of React's suite, the Context API offers a more straightforward approach to state management. It allows global state to be shared across components, eliminating the need to pass props down manually through multiple levels of the component hierarchy, thus simplifying the codebase and improving maintainability.
- **TypeScript**: By incorporating TypeScript, the project benefits from static type checking, which enforces type safety and can prevent many types of errors before the

[11] React Documentation. (2023). React – A JavaScript library for building user interfaces.

code is even run. TypeScript's advanced features, such as interfaces and generics, provide a more structured approach to JavaScript development, leading to cleaner, more predictable, and easier-to-debug code.

- **Axios**: Chosen for its promise-based structure, Axios makes it simpler to write asynchronous code for HTTP requests. It provides a clean API for handling requests and responses, supports interception of request and response data, and facilitates the handling of errors, making the data-fetching process more robust.

Back-end Development:

- **Python**: Selected for its simplicity and power, Python is a top choice for backend development, particularly in data-intensive applications. Its readability and concise syntax make it accessible for rapid development, while its vast ecosystem of libraries and frameworks streamlines the creation of complex functionalities.
- **Flask**: Flask's minimalistic and flexible nature makes it an excellent choice for creating lightweight web services and APIs. It allows for the easy integration of extensions and middleware to add functionality as needed, making it suitable for both small-scale applications and complex projects with higher demands.
- **PostgreSQL**: This enterprise-grade database system is renowned for its reliability and feature-richness. It supports advanced data types and performance optimization features, making it a robust backend storage solution for applications that require high levels of data integrity and complex queries.

The presentation of the new system

Applicant Dashboard

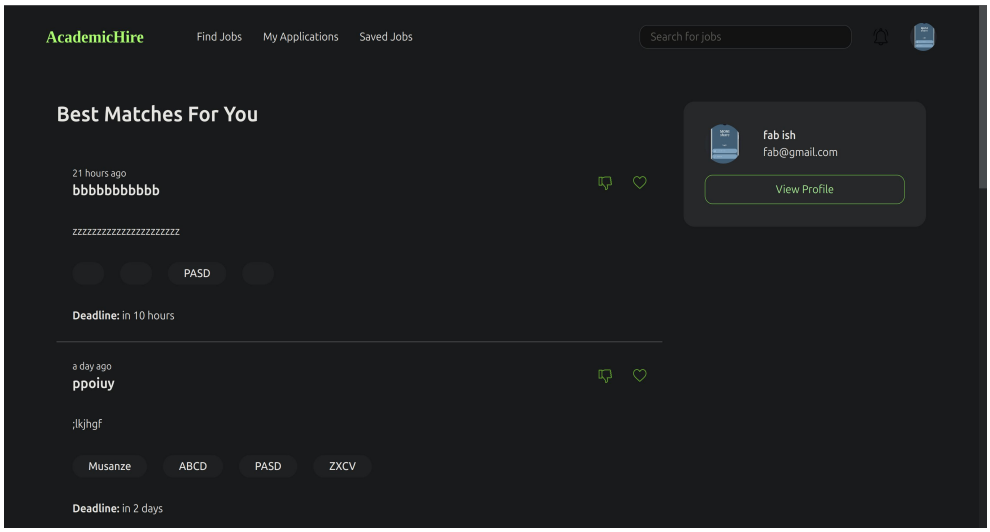


Figure 9: Applicant dashboard

Applicant Profile Page

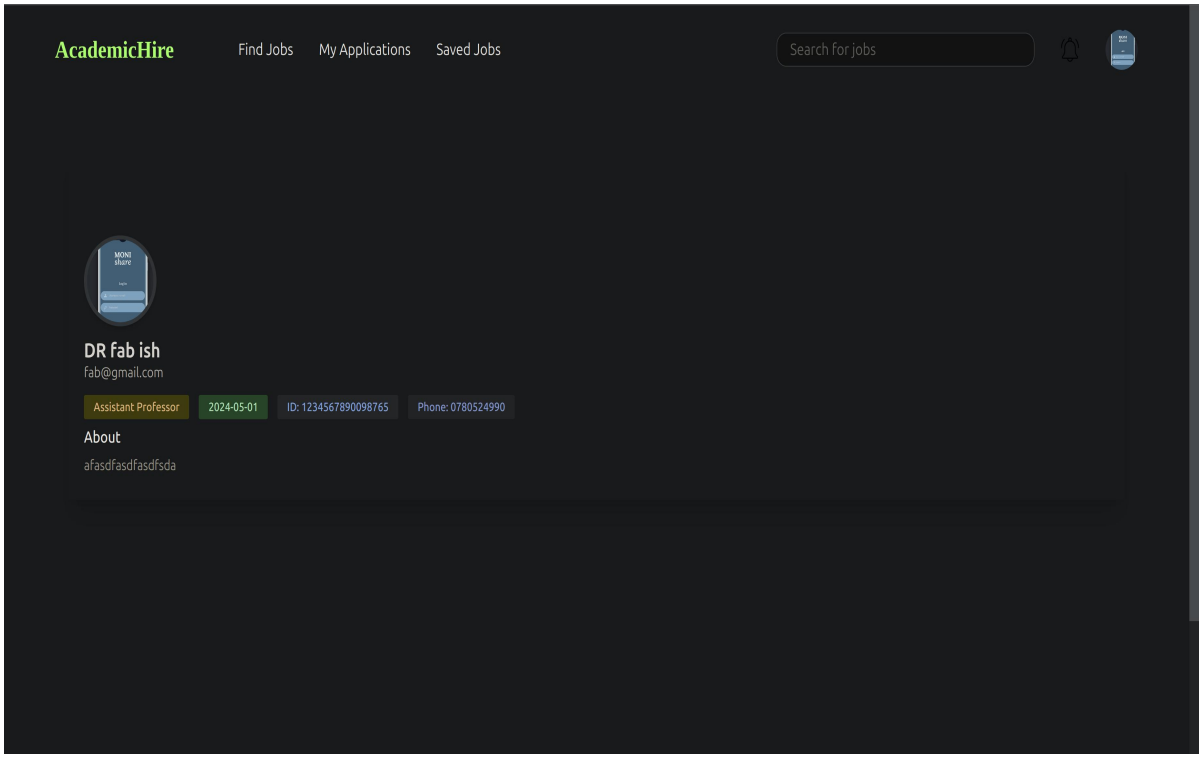


Figure 10: Applicant Profile Page

View the call for Application available

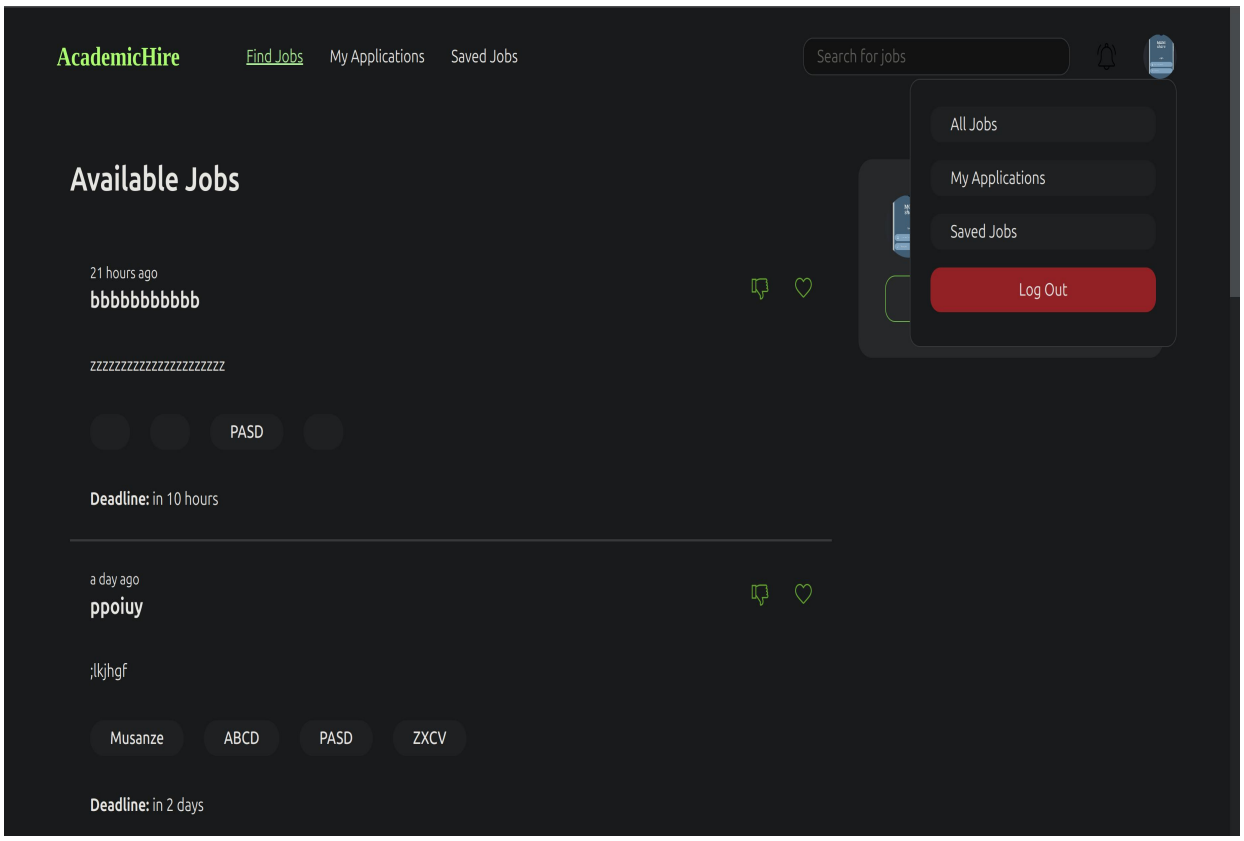


Figure 11: Applications Available

Open Application Page

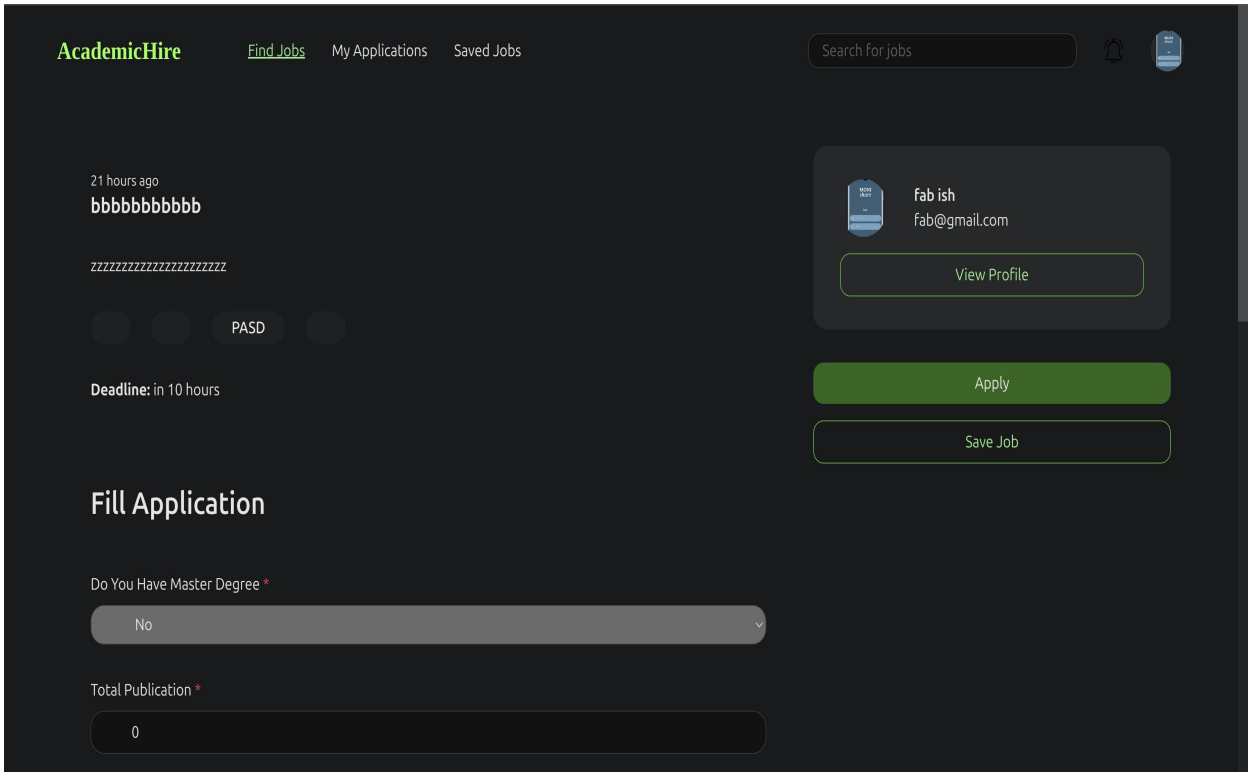


Figure 12: Application page

Application Form

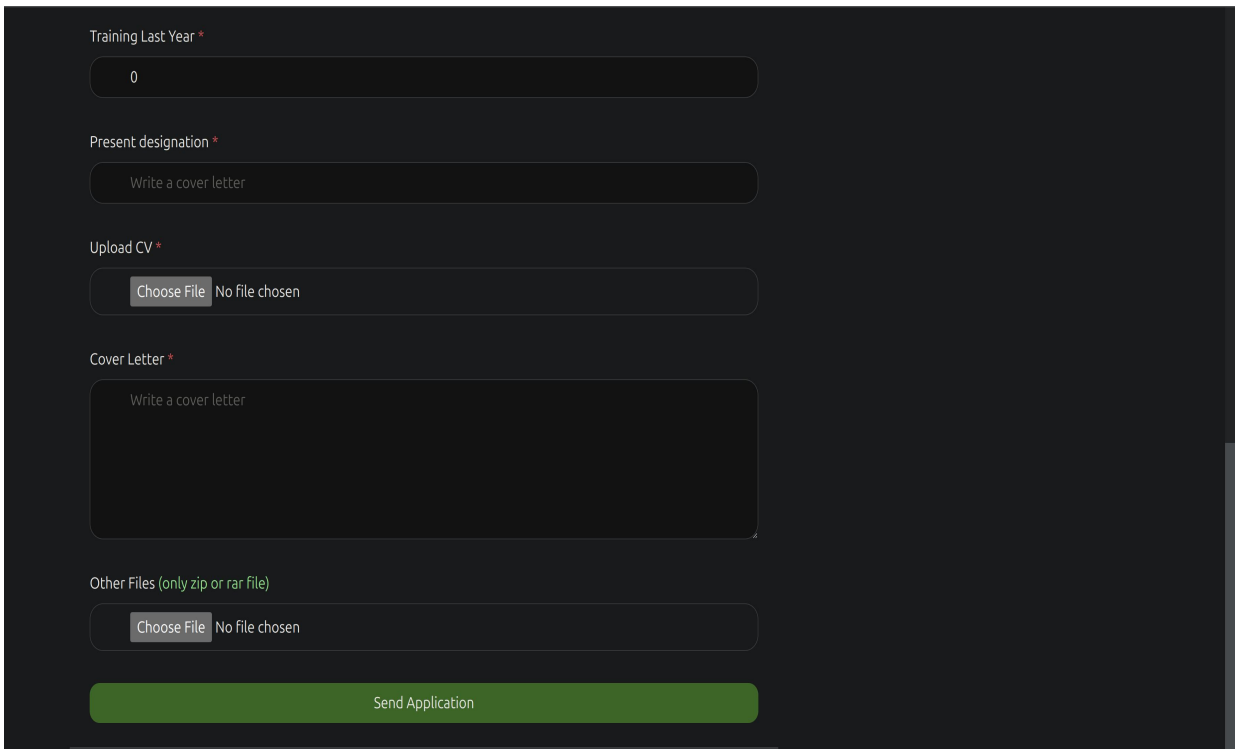


Figure 13: Application Form

Admin dashboard

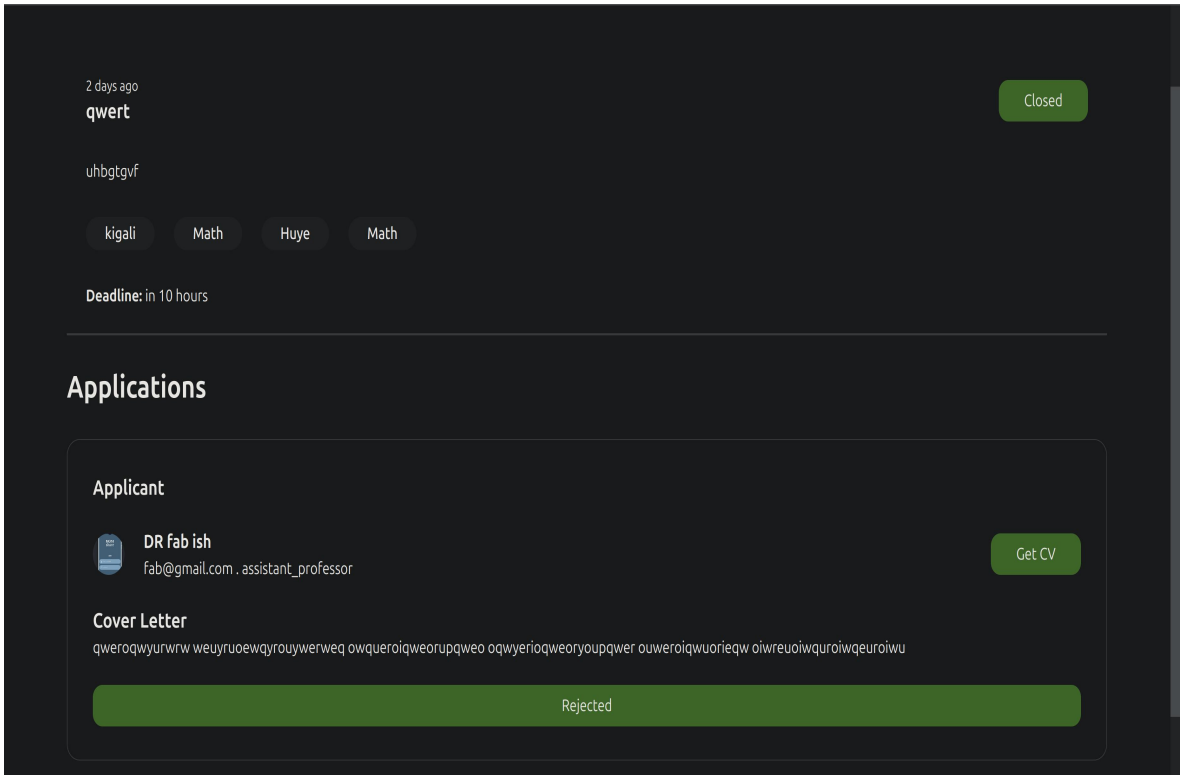


Figure 14: Admin Dashboard

Applications Management

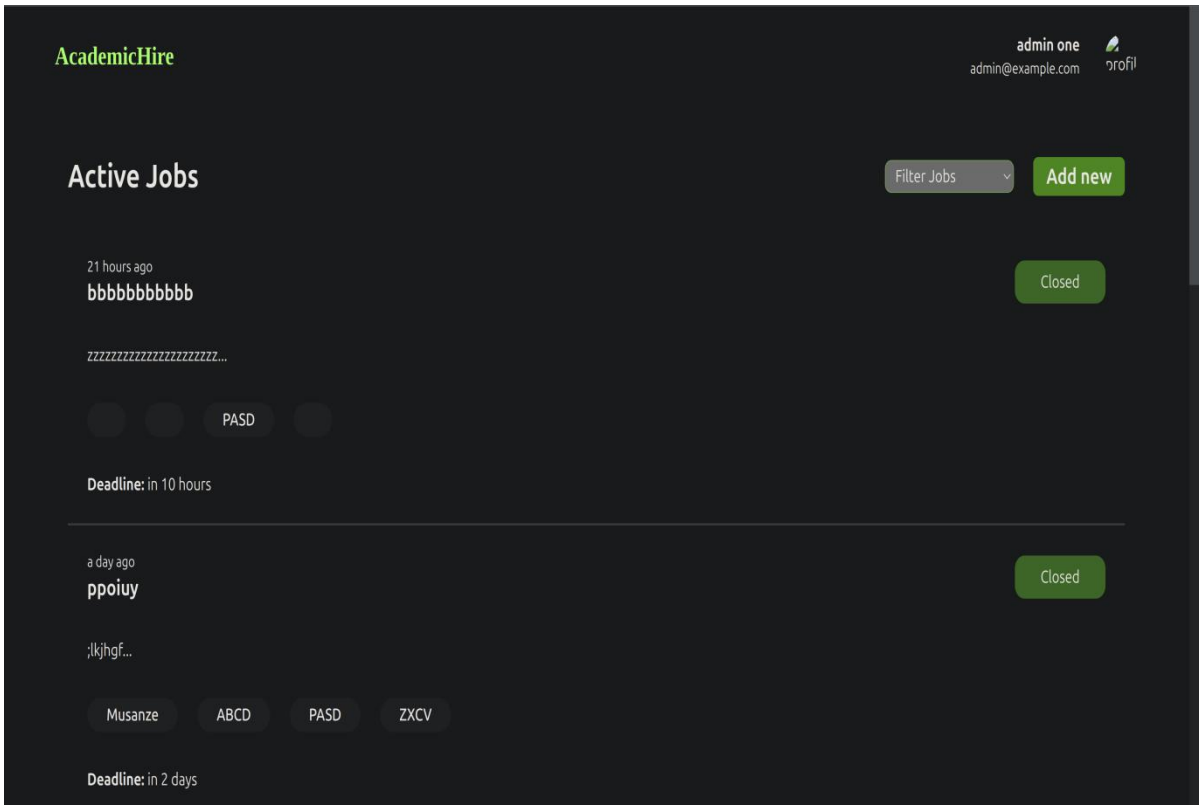


Figure 15: Manage Application

Create/Post an Application

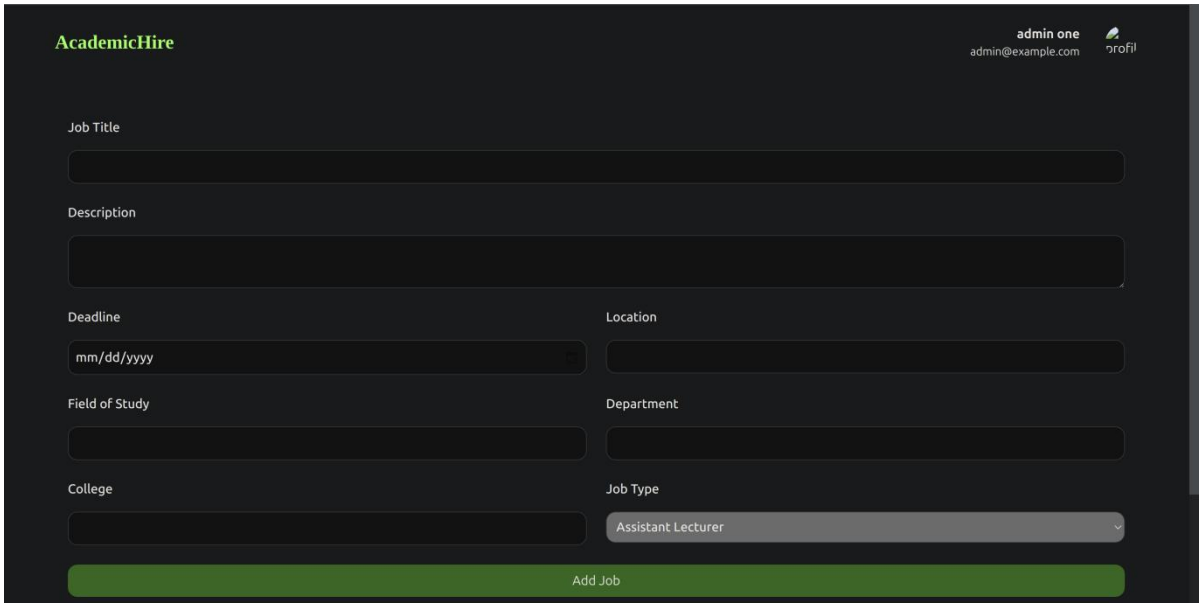


Figure 16: Create Call for application

Software Testing

Software testing plays a vital role in the software development process, ensuring that the software is reliable and functions correctly. The main objectives of software testing are:

1. To determine if the software aligns with the predetermined requirements that shaped its architectural design and development.
2. To assess whether the software functions as expected across different scenarios.
3. To evaluate if the software can be implemented without losing its intended features and meeting the needs of the stakeholders.

Following these standards, software testing provides valuable insights into how effectively the software operates, confirming its ability to solve the intended problems it was created for.

The following are some software tests:

Unit testing

Unit tests designed in the module design phase are executed on during this validation phase. Unit testing is the testing at the code level and helps eliminate bugs at an early stage, though all defects can’t be uncovered by unit testing.

Integration testing

Integration testing is associated with the architectural design phase. Integration tests are performed to test the coexistence and communication of the internal modules within the system.

System testing

System testing is directly associated with the system design phase. System tests check the entire system functionality and the communication of the system under development with external system. Most of the software and hardware compatibility issues can be uncovered during system test execution.

Validation Test

The last test phase has the role of validating the software in its external environment. The product has been put in a final situation to verify if it perfectly answers the needs expressed in the first phase. The validation test is important since it is necessary to verify if the setting up of the application corresponds to the expressed needs. The application has been tested in its entirety, and it is in this way that we noticed that the progress of operations corresponds to the functional specifications.

Software and hardware compatibility requirements

Client-side Requirements

Software Requirements:

- Operating System: Compatible with Windows 10 and above, macOS 10.14 and above, and Linux distributions (Ubuntu 18.04 LTS and above).
- Web Browser: Latest versions of Chrome, Firefox, Safari, or Edge.
- JavaScript: Enabled on the web browser.
- Libraries and Frameworks: React (compatible with the latest stable release), Vite for development, Tailwind CSS for styling, Context API for state management, TypeScript for type safety, Axios for HTTP requests.
- Internet Connection: Stable internet connection to access the application.

Hardware Requirements:

- Processor: Intel Core i3 or equivalent.
- RAM: Minimum 4GB RAM.
- Storage: Minimum 500MB free storage space for browser caching and application data.
- Display: Screen resolution of 1280x720 or higher.

Server-side Requirements

Software Requirements:

- Operating System: Compatible with any Linux distribution (e.g., Ubuntu 20.04 LTS, CentOS 7 and above), Windows Server 2016 and above.
- Programming Language: Python 3.8 and above.
- Framework: Flask (compatible with the latest stable release).
- Database: PostgreSQL 12 and above.
- Machine Learning Libraries: Scikit-learn, TensorFlow or PyTorch (latest stable releases).

Hardware Requirements:

- Processor: Intel Xeon or equivalent.
- RAM: Minimum 16GB RAM.
- Storage: Minimum 100GB SSD for fast data access and storage.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

Conclusion

The primary aim of this project was to design and implement the ProDev Track System to streamline and automate the promotion application process for both new and current staff. By replacing the manual review system with an AI-driven approach, the ProDev Track System significantly enhances efficiency and accuracy in evaluating applicants' qualifications and credentials.

Through a comprehensive analysis of the existing promotion application processes, it became clear that an automated solution was essential to improve operational efficiency and decision-making. The ProDev Track System addresses these needs by providing a secure platform for applicants to submit their documents, tracking application status in real-time, and automatically analyzing qualifications without human intervention.

This project employed various methodologies, technologies, and tools to achieve its objectives. Unified Modeling Language (UML) was utilized for the analysis and design phases, ensuring a structured and clear representation of system requirements and functionalities. Data collection techniques, including observations, documentation review, and interviews, provided a thorough understanding of the existing processes and informed the development of the new system.

The implementation of the ProDev Track System has demonstrated significant improvements in the promotion application process. Applicants can now easily submit their applications and track their progress, while the system ensures timely and unbiased promotion decisions based on predefined criteria. The administrative tools within the system allow for efficient management of applications and the generation of insightful reports and analytics on promotion activities.

In summary, the ProDev Track System has achieved its goal of creating a more efficient and transparent promotion application process. This system will greatly benefit both applicants and administrators by simplifying the application process, providing clear communication, and ensuring fair and consistent evaluation of promotion applications. Future enhancements and feedback integration will continue to refine and perfect the system, further solidifying its value to the organization.

Recommendations

This work focused on the ProDev Track System, which aims to streamline the promotion process for new and current staff within the University of Rwanda. By automating the review and decision-making process, the system enhances efficiency and accuracy in staff promotions.

Continuous System Updates and Support:To ensure the ProDev Track System remains up-to-date and aligned with evolving university requirements and regulations, regular updates and technical support should be provided. This will enable the University of Rwanda to leverage the latest technological advancements and address any potential issues promptly, ensuring a seamless and reliable experience for users.

Security and Data Privacy: Given the sensitive nature of personal and professional information involved in promotion applications, utmost importance should be placed on system security and data privacy. Implementing robust security measures and adhering to industry best practices will safeguard the confidentiality and integrity of the data, fostering trust among users and ensuring compliance with privacy regulations.

In light of these considerations, I recommend that all staff members at the University of Rwanda, both new applicants and those seeking promotion, utilize the ProDev Track System. This system has been meticulously designed to address every step of the promotion application process, analyzing and resolving all potential issues. By adopting this system, staff can ensure their promotion applications are processed efficiently and effectively.

Finally, I welcome and encourage contributions to the ongoing improvement of this work. Your feedback and suggestions will be invaluable in refining and enhancing the ProDev Track System to better serve the needs of the university community.

References

Books

Booch, G., Rumbaugh, J., & Jacobson, I. (2005). *The Unified Modeling Language User Guide* (2nd ed.). Addison-Wesley Professional. Retrieved from Pearson.

Fowler, M. (2004). UML Distilled: A Brief Guide to the Standard Object Modeling Language (3rd ed.). Addison-Wesley Professional.

Martin, R. (2008). Clean Code : A handbook of agile software craftsmanship. Nashville: Springer.

React Documentation. (2023). React – A JavaScript library for building user interfaces.

Websites

James. (2023, June 22). What is Unified Modeling Language (UML)? Retrieved from Ideal Modeling & Diagramming Tool for Agile Team Collaboration (visual-paradigm.com).

Kawulich, B. B. (2005, May). View of Participant Observation as a Data Collection Method | Forum Qualitative Sozialforschung / Forum: Qualitative Social Research (qualitative-research.net)

KT Press. (2023, June). University of Rwanda history. Retrieved from https://www.ktpress.rw/2023/06/university-of-rwanda-history/

Larman, C. (2004). Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development (3rd ed.). Prentice Hall. Retrieved from Results for "applying uml and patterns an introduction to objec" (pearson.com)

Shukhdeba, H. (2024). *Effective Communication and Interaction in Qualitative Research*. Research Methods Publishing.Qualitative Research - Methods, Analysis Types and Guide (researchmethod.net)

University of Rwanda (ur.ac.rw)

APPENDIX

Curriculum Vitae

ROSE UWIRAGIYE

Student

+250780651192 roseuwiragiye8@gmail.com Rwanda kigali,Gasabo

ABOUT ME

I am a young driven and ambitious girl pursuing a Bachelor's degree in Software Engineering, with a passion for developing innovative solutions. Dedicated to applying technical knowledge, problem-solving skills, and creativity to tackle complex software challenges. Seeking a challenging internship opportunity to gain hands-on experience, contribute to cutting-edge projects, and collaborate with industry professionals. Committed to continuous learning and growth in the field of software engineering.

EDUCATION

High School Diploma (2016– 2018)

College St Andre (Physics-Biology-Chemistry)

Adventist Univerity of Central Africa(2020– 2024)

- Bachelor of IT major in Software engineering

SKILL

- Programming Languages: Java, Python, C#
- Web Development: HTML, CSS, JavaScript
- Databases: MySQL, PostgreSQL
- Version Control: Git
- Software Development Tools: IDEs (Visual Studio Code, IntelliJ IDEA)
- Software Engineering Principles and Methodologies
- Problem-Solving and Analytical Thinking
- Collaboration and Teamwork
- Strong Communication Skills

WORK EXPERIENCE

January 2024 - February 2024: Bridge program at CMU Africa

March 2024 - May 2024: Software Development trainee at IT Solution Group

LANGUAGES

- English
- Kinyarwanda