Applied Information Technology and Computer Science Vol. 4 No. 2 (2023) 1158-1177

AITCS

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/aitcs
e-ISSN :2773-5141

Jabatan Kerja Raya Johor Tender Management System

Muhammad Haziq Rifqi Hassan[1], Muhaini Othman[1]*,

[1]Faculty of Computer Science and Technology Information,
Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat, 86400, MALAYSIA

DOI: https://doi.org/10.30880/aitcs.2023.04.02.066
Received 24 June 2023; Accepted 29 October 2023; Available online 30 November 2023

Abstract: *The Tender Management System is designed to efficiently handle tender management tasks. Its development was motivated by the need to address issues arising from manual system usage. The proposed solution involves creating a web-based system that offers user-friendly features. To achieve this, an agile development model was adopted. MySQL software serves as the database, while Hypertext Markup Language (HTML) and Hypertext Preprocessor (PHP) are utilized as the programming languages. The system undergoes iterative development based on the chosen model, ensuring it aligns with the customer's requirements. Primarily, the system aids administrators, tendering staff, and companies in managing the tender process by providing online access to tender documents. The aim is to enhance efficiency and effectiveness in tender management at Jabatan Kerja Raya Johor.*

Keywords: Tender Management System, Web-based system, Agile development model

1. Introduction

Web-based management systems have become instrumental in facilitating efficient and streamlined operations in various industries. These systems leverage the power of the internet to provide organizations with centralized control, real-time data access, and enhanced collaboration. This article provides an introduction to web-based management systems, exploring their key features, benefits, and applications across different sectors.

The term "tender" encompasses various meanings, but in this context, it refers to a formal offer made by a company to provide services, goods, or complete a specific job within a specified price range. Typically, formal offers are requested when the duration of a previous contract is nearing its final week, prompting the client to seek new proposals. The company successfully wins a tender when their bid or price range for the job aligns with the client's budgetary constraints. In today's highly competitive business environment, the implementation of a web-based management system is crucial, especially in tendering management. Such a system offers indispensable advantages, including convenience, flexibility, and efficiency. By utilizing a web-based tender management system, organizations can streamline their tendering processes, enhance collaboration among stakeholders, and make data-driven decisions, ultimately

*Corresponding author: muhaini@uthm.edu.my

increasing their chances of securing valuable contracts and outperforming competitors in the challenging tendering landscape.

The objective of developing the tender management system is to enhance the efficiency of managing tender workflows for JKR Johor and associated companies. Currently, the tender process involves email invitations or the use of JKR Johor Bahru's system. However, the process is not fully online as it requires site visits and the purchase of tender documents at the JKR Johor Bahru office or during the site visit. This reliance on paper-based documentation poses significant challenges, as it necessitates the printing of numerous copies for companies to fill in their best price bids.

This issue is worsened when multiple tender documents are advertised simultaneously, leading to an excessive amount of paper usage. Once the company submits their bid, the documents are sent back to JKR Johor Bahru for evaluation, resulting in limited office space due to the need to sift through the papers to identify the best offers. Consequently, the extensive paper usage becomes wasteful and inefficient throughout the entire process.

2. Literature Review

The literature review plays a crucial role in the development of a project by identifying and analyzing relevant information. Its primary objective is to examine the previous tender management system, aiming to uncover essential data collection requirements that will facilitate the creation of an innovative and updated tender management system. This chapter provides insights into the system's analysis, design, and methodology, which serve as a roadmap for developing a high-quality tender management system that meets the users' requirements. To achieve this, the chapter explores literature sources related to tender management systems through research. Simultaneously, it highlights the distinctions between the current existing system and the proposed system to ensure that the developing system offers additional features that effectively address user needs and significantly impact the tender process.

2.1 Web-based system

Web-based systems have revolutionized the way businesses and individuals interact and operate in the digital age. These systems utilize the power of the internet to provide users with access to a wide range of services, applications, and information from any location and at any time. This introductory article aims to explore the concept of web-based systems, their characteristics, and their significance in today's interconnected world. Web-based systems, also known as web applications or web services, refer to software applications or services that are accessed and operated through web browsers via the internet. Unlike traditional software that requires installation on individual devices, web-based systems are hosted on remote servers and accessed through a web interface, eliminating the need for local installations and enabling cross-platform compatibility. One of the key characteristics of web-based systems is their ubiquitous accessibility. Users can access these systems using a variety of devices, such as desktop computers, laptops, tablets, and smartphones, as long as they have an internet connection and a compatible web browser. This accessibility allows for greater flexibility and convenience, enabling users to interact with the system from virtually anywhere. Web-based systems also benefit from centralized management and updates. Since the software is hosted on remote servers, system administrators can easily manage and update the application without requiring individual installations or manual updates on each user's device. This centralized approach simplifies maintenance, ensures version control, and provides a consistent user experience across different platforms.

2.2 Management System

A management system refers to the approach employed by an organization to coordinate various aspects of its operations in order to achieve its objectives. These objectives encompass a wide range of areas, including product or service quality, operational efficiency, environmental performance, workplace health and safety, among others. The complexity of the system depends on the organization's context. In some cases, especially with smaller firms, a clear definition of employee expectations and their contribution to the organization's overall goals, along with strong leadership from the company owner, may be sufficient without the need for extensive paperwork.

Among the different types of management systems, two that are particularly suitable for current project development are the report management system and the transaction process system. The transaction process system (TPS) involves the collection and processing of data during the organization's activities, such as payment for tender documents before representatives can obtain them. On the other hand, the report management system is vital for the project's development as it generates reports not only for payments but also for work ratings given by the winning company in a tender, allowing for filtering of companies for future tender projects.

2.3 Study of Existing System

The examination of the current system was conducted by analyzing previously developed systems. Within this study, several types of existing tender management systems were identified and chosen as references for the development of the Jabatan Kerja Raya Johor Tender Management System. Three systems, namely Sistem Tender Online Selangor 2.0, Sarawak Energy e-Procurement (SEPRO) Tender Notices, and Kapar Energy Tender Management System, were specifically selected for this purpose. The Jabatan Kerja Raya Johor Tender Management System will be created based on the knowledge acquired from these systems, integrating additional features to ensure a superior system that meets the necessary requirements.

Table 1: Comparison between current exisiting system dan suggested system

Existing System / **Modules**	**Jabatan Kerja Raya Tender Management System**	**Sistem Tender Online Selangor 2.0**	**Sarawak Energy e-Procurement Tender Notices**	**Kapar Energy**
Registration and login module	√	√	x	x
Tender purchase module	√	√	x	√
Payment Module	√	√	x	√
Tender Approval Module	√	x	x	x
Company Profile Module	√	√	x	x

3. Methodology

In recent years, the Agile Model has emerged as a popular Software Development Life Cycle (SDLC) and has found application in various work fields[3]. This methodology divides a project into multiple phases, which are utilized for project management purposes. The Agile approach emphasizes

continuous improvement at each stage and requires ongoing collaboration with stakeholders. Once the work begins, teams go through a cycle of planning, execution, and evaluation. It is crucial to maintain consistent collaboration among team members and project stakeholders throughout the process.

The Agile Model consists of seven distinct phases that must be followed in a sequential manner. These phases include concept development, inception or requirement identification, iteration or development, release, maintenance, and retirement. Each phase is dedicated to module development, and this process is repeated for subsequent modules. The Agile Model's development process is illustrated below:

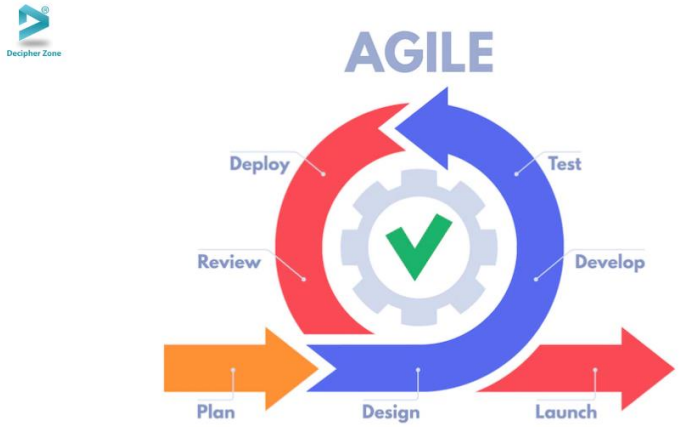


Figure 1: Agile Development Model [3]

3.1 System Development Workflow

To meet the requirements and successfully navigate through each phase outlined in the Agile Development Model, various techniques and tools are employed. The comprehensive workflow for each phase is presented in a well-defined manner in Table 2.

Table 2: Project Workflow

Phase	Techniques	Tools
Concept	The study of system requirements will be conducted.	Survey, Interview
	The analysis of the system's key requirements will be conducted.	Analysis
Inception or Requirement Identification	Estimation of the entire project duration.	Gantt Chart
	Designing the mock-up for user interface and database.	Pencil
	Gather requirement to determine the functionality of the system.	Interview
Iteration or Development	The developed features are designed to meet both user and system requirements.	Discussion
	Coding the system functionality	MySQL, XAMPP, Sublime Text 3
Release	System Testing	Computer
	User feedback	Survey

Maintenance	Documentation	Any related software
Retirement	The end of the system development	

3.2 Testing Phase

In software development, the testing phase is a crucial part of the development life cycle that involves evaluating the functionality, performance, and reliability of a software application or system. It is the process of validating the software against specified requirements and identifying any defects or issues that need to be addressed before the final release. The primary goal of the testing phase is to ensure that the software meets the intended quality standards and functions as expected in different scenarios and environments. This phase typically follows the completion of the development phase and precedes the deployment or release of the software.

Test categories	**Explanation**	**Expected result**	**Actual Results**
1	Account login I. Enter the details of the registered account. II. Click on sign in.	Access to the respective system pages according to their respective roles.	Pass / Fail
2	Account login I. Enter the details of the registered account. II. Click on sign in.	Access to the respective system pages according to their respective roles.	Pass / Fail
2	Register new company I. Enter company information. II. Submit on save.	New company with detailed information added.	Pass / Fail
2	Check company I. Admin clicks on company added.	Selected company information will be displayed.	Pass / Fail
2	Updates company I. Select the company added and edit the information.	The updated information will be saved and displayed.	Pass / Fail
2	Delete company I. Select a company and click on delete.	Deleted company will no longer be displayed.	Pass / Fail
2	Approve company I. Enter the status of the company. II. Click on approve.	Access system pages, update company status and submit.	Pass / Fail
3	Register new tender I. Enter tender information. II. Submit on save.	New tender with detailed information added.	Pass / Fail

Table 3: Test Plan

Test categories	**Explanation**	**Expected result**	**Actual Results**
3	Check tender I. Admin clicks on tender added.	Selected tender information will be displayed.	Pass / Fail

3	Updates tender I. Select the tender added and edit the information.	The updated information will be saved and displayed.	Pass / Fail
3	Delete tender Select a tender and click on delete.	Deleted tender will no longer be displayed.	Pass / Fail
4	Add tender submission I. Company add tender submission.	Tender submission information will be added	Pass / Fail
4	Check tender submission I. admin, company check tender submission.	Selected tender information will be displayed	Pass / Fail
4	Update tender submission I. Select the tender submission added and edit the information.	The updated information will be saved and displayed.	Pass / Fail
4	Delete tender submission Select a tender and click on delete.	Deleted submission tender will no longer be displayed	Pass / Fail
5	Purchase tender Select a tender and click to purchase	Selected tender information will be buy	Pass / Fail
6	Add tender receive Select a company and assign tender	New company with tender information added.	Pass / Fail
6	Check tender receive Admin clicks on assigned tender.	Selected company with tender information will be displayed.	Pass / Fail
6	Update tender receive Staff clicks on selected company receive tender and edit the information	The updated company tender receive will be saved and displayed.	Pass / Fail
6	Delete tender receive Staff clicks on selected company tender receive and delete the information	Deleted company with tender information will no longer be displayed.	Pass / Fail

Table 4: Tender Management System security checklist

No	Check list	Actual result
1.	Make sure the error message does not directly indicate which part of the verification data is incorrect. For example, "incorrect password" should not be shown as an error message.	Pass / Fail
2.	Enforce password lengths in policies. For example, at least eight characters in creating a password.	Pass / Fail
3.	Passwords cannot be obscured in the text box.	Pass / Fail

4. Analysis and Design

The system design and analysis of the web-based Jabatan Kerja Raya Tender Management System are covered in this chapter. A structural method was employed in the system's development. Flow charts, context diagrams, data flow diagrams, and entity relationship diagrams are structural approach diagrams that included in this chapter. In this chapter, database design and interface design examples will be provided. The discussion will start by outlining the project's functional and non-functional requirements.

4.1 Functional and Non -Functional Requirements

Functional requirements must be implemented by developers for users to complete their tasks. For the development team as well as the stakeholders, it is crucial to make them clear. Functional requirements typically describe how a system will behave under circumstances. A set of specifications known as non-functional requirements, or NFRs, describe the system's operational capabilities and limitations and make an effort to increase its functionality. These define how well it will function, including aspects like speed, security, dependability, data integrity, etc. Table 5 shows the functional requirements of the tender management system for admin, tendering staff and company representatives while table 4 shows the non-functional requirement of the tender management system.

Table 5: Functional requirements for tender management system

No	Function	Functionality	Users
1.	Login	Allow users to log in using a username and password.	Admin and company representative
2.	Update profile for first time login	Allow users to change passwords.	Admin
3.	Registration staff account	Allow admin to register tendering staff account	Admin
4.	Registration company account	Allow company to register account	Company Representative
5.	Company account approval	Allow admin to approve company account	Admin
6.	Create tender	Allow tendering staff to create new tender	Admin
7.	Purchase Tender	Allow company to buy tender document	Company representative
8.	Tender Submission	Allow company to submit offer list and tender document	Company representative
9.	Tender Offer Price Filter	Allow tendering staff to filter the offer price for current tender	Admin
10.	Update profile	Allow company representative to update company profile	Company representative

Table 6: Non-functional requirements of Tender Management System

No	Requirements	Functionality
1.	Operation	i. This system can be used in any web browser such as Chrome, Mozilla Firefox and Internet Explorer. ii. The system will have a database to store all the data.
2.	Performance	The system response time is relatively short in 1 to 2 seconds.
3.	Security	i. User information is secure. ii. Users need to enter the correct username and password to log in to the system.
4.	Usability	The system is easy to use which is user friendly.

4.2 User Requirement Analysis

User requirements can be referenced such as what the user can do and the user's expectations of the system function. Understanding user needs is an important part of information system design and essential to the success of interactive systems (Kraeling, M., & Tania, L., 2019). Table 4.3 shows the admin user requirements while Table 4.4 shows the tendering staff user requirements for the proposed system. The user requirements of the company are shown in Table 4.5.

Table 7: Admin user requirements for Tender Management System

No	User requirements
1.	Admin can log in to this system.
2.	Admin can register new tendering staff
3.	Admin can delete tendering staff.
4.	Admin can approve company account.
5.	Admin can create new tender.
6.	Admin can modify tender.
7.	Admin can filter the offer price.
8.	Admin can select company to win the tender.
9.	Admin can log out of the system.

Table 8: Company user requirements for tender management system

No	User requirements
1.	Company can register a new account.
2.	Company can log in to the system.
3.	Company can purchase tender document.
4.	Company can submit tender document.
5.	Company can update profile.
6.	Company can log out of the system.

4.3 Context Diagram

An internal software system's interaction with external entities are depicted in a context diagram. It is primarily employed to assist businesses in comprehending the scope of a system. For this tender management system, there are two entities which are admin and company. Admin have input in company approval, tender details, evaluation tender offer , rate score and user details while submit tender report, company details, tender selection, tender offer details, status tender offer. More details of DFD level 1 can be referred to in Appendix B.

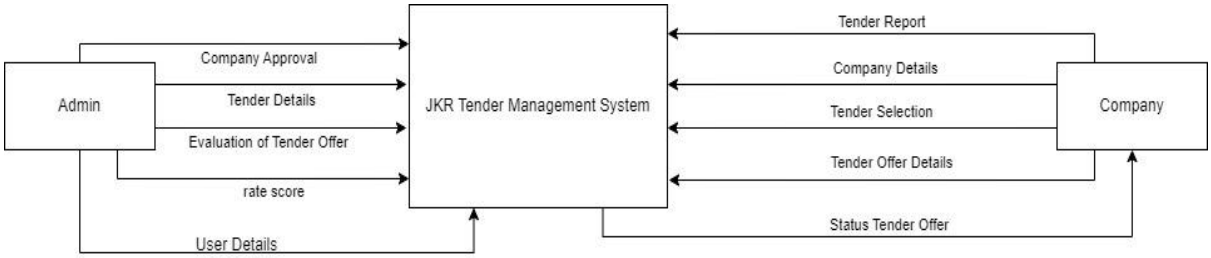


Figure 2: Context Diagram of Tender Management System

4.4 Entity Relationship Diagram

A graphical representation that shows relationships between individuals, things, places, concepts, or events within an information technology (IT) system is called an entity relationship diagram (ERD), also known as an entity relationship model. In order to define business processes and lay the groundwork for a relational database, an ERD employs data modelling techniques. Figure 3 shows the ERD diagram for the tender management system. Based on ERD, in this system, the company registers the bidding, where one tender can have many biddings, while the team will approve the company and manage the bidding.

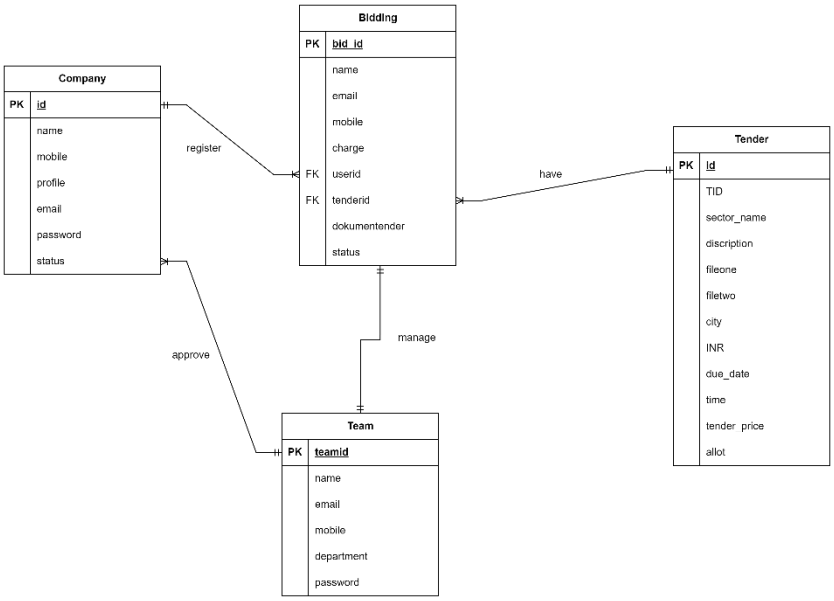


Figure 3: Entity Relationship Diagram (ERD) for tender management system.

5. Result and Discussion

The implemented system has six functionalities for different users to perform tasks. In this section, the User Acceptance Testing (UAT) is carried out to collect feedback and satisfaction from the real target users and the functionalities of each module are discussed in detail.

5.1 User Acceptance Testing

User Acceptance Testing (UAT) is a critical phase in software development, where end-users or stakeholders assess the software's usability, functionality, and overall user experience. It serves as the final validation step before deployment or release. UAT ensures that the software meets the specified requirements and aligns with user expectations. This testing phase involves real-world scenarios and usage to verify if the software performs as intended in different situations. UAT typically involves end-users performing test cases, providing feedback, and approving the software for deployment. It helps identify any gaps, issues, or necessary improvements, ensuring a high-quality and user-centric software product. Table 9 shows the result of user on user interface design where the features in the system will be examined using rating score. Rating 1 shows the lowest rating while 5 shows the highest rating and the total represent the number of tester.

No	Feature	Rating					
		1	2	3	4	5	Total
1	How the overall design of the interface?	0	0	10	10	0	20
2	The layout of the user interface intuitive?	0	0	12	7	0	20
3	Easy to navigate on the system?	0	0	11	9	0	20
4	Is the user interface easy to understand with relevant titles that describe functionality?	0	0	11	9	0	20
5	How satisfied on current interface design?	0	0	9	11	0	20

Table 9: Result of User on User Interface Design

Table 9 shows the result of user on user interface design. The result was moderate in terms of user interface design.

No	Feature	Rating					
		1	2	3	4	5	Total
1	Login Function	0	0	2	2	0	4
2	Tender Management Function	0	0	2	1	1	4
3	Tender Submission Function	0	0	1	2	1	4
4	Tender Approval Function	0	0	3	1	0	4

Table 10: Result on Administrator on System Functionalities

Table 10 shows the result of the administrator voted on system functionalities. The overall result voted by the administrator is 3 and 4 which means that the satisfaction of the implemented system is generally moderate.

No	Feature	Rating					
		1	2	3	4	5	Total
1	Login Function	0	0	2	2	0	4
2	Tender Management Function	0	0	2	1	1	4
3	Tender Submission Function	0	0	1	2	1	4
4	Tender Approval Function	0	0	3	1	0	4
5	Company Profile Function	0	0	2	2	0	4

Table 11: Result on Company on System Functionalities

Table 11 shows the result of the company voted on system functionalities. The overall result voted by the company is 3 and 4 which means that the satisfaction of the implemented system is generally moderate.

5.2 Functionalities of the modules

The first module is login module. Admin and company can log into the system if the input email and password are authorized. The input email and password will match into the database table of registration and team. Figure 4 and 5 shows the login interface.

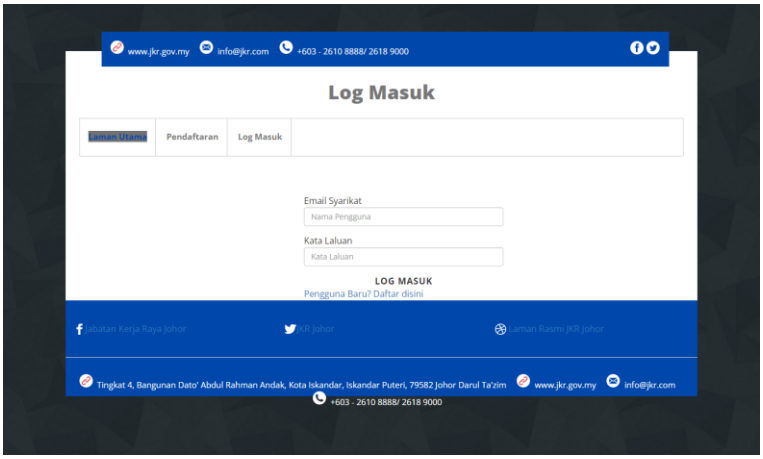


Figure 4: Company Login Interface

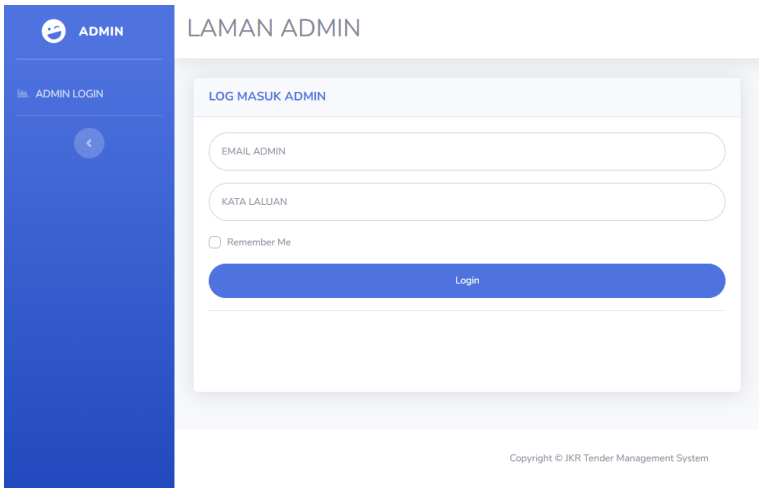


Figure 5: Admin Login Interface

Second module in this system is tender module. In this model, admin have an authorized action where admin can manage tender especially in creating, reading, updating and deleting tender. For the company, they only can view the tender details in company interface. Figure 6, 7 and 8 shows the tender module interface.

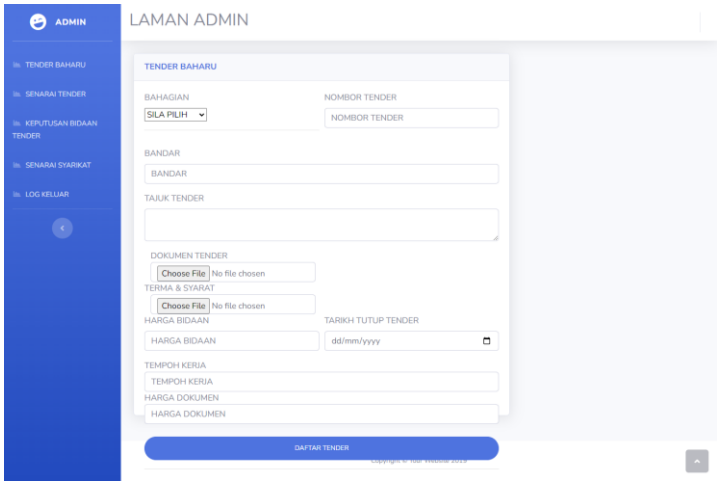


Figure 6: Create Tender Interface

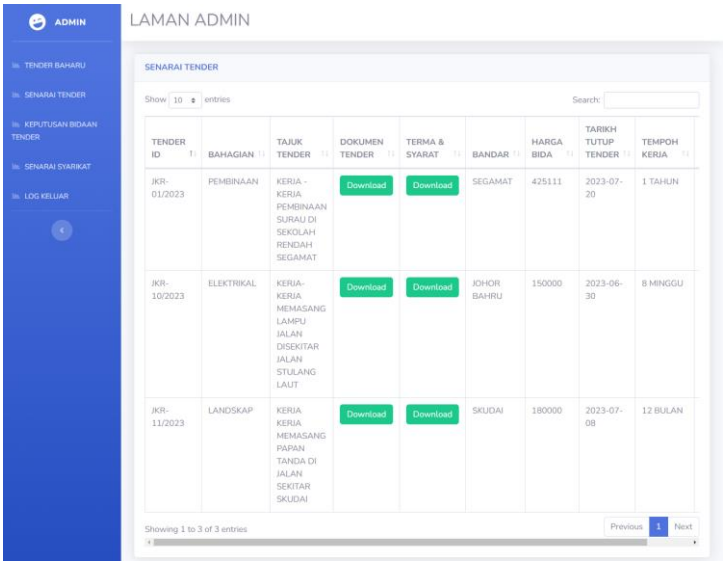


Figure 7: Tender View Interface

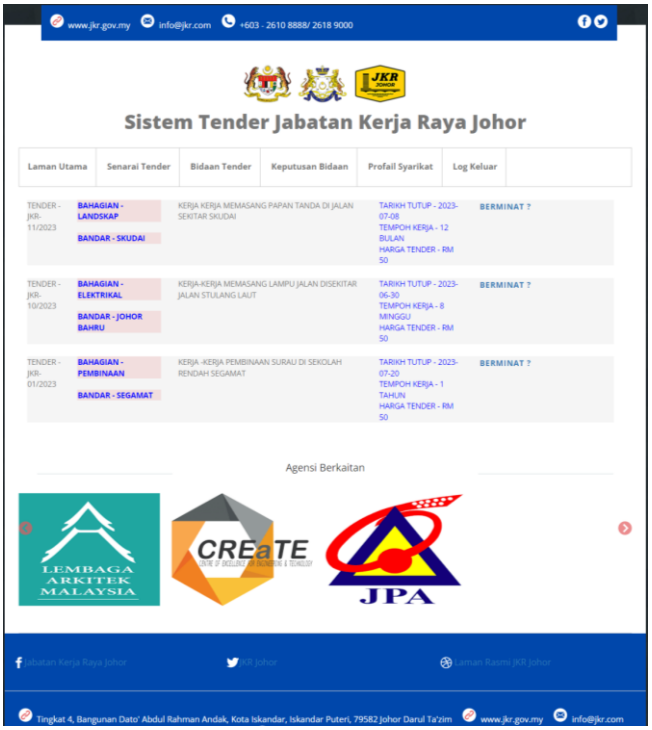


Figure 8: Tender List of Company View Interface

Third module is bidding module where it starts with the company that purchase tender through the system and upload the documents needed to complete the bidding process. Figure 9,10 and 11 show the interface of the bidding module.

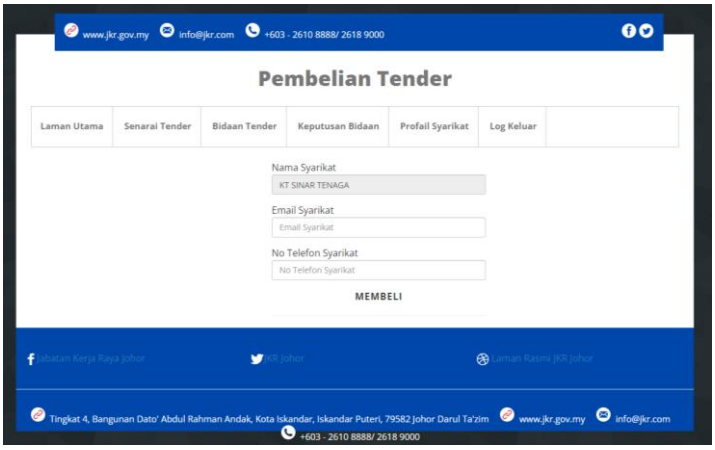


Figure 9: Purchase Tender Interface

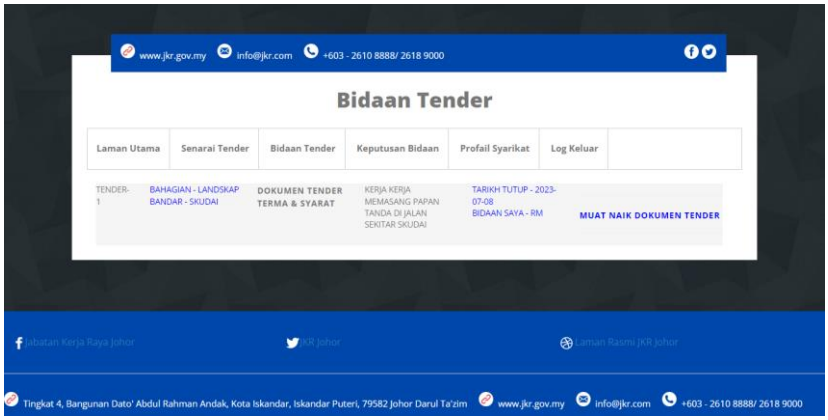


Figure 10: Bidding Tender Interface

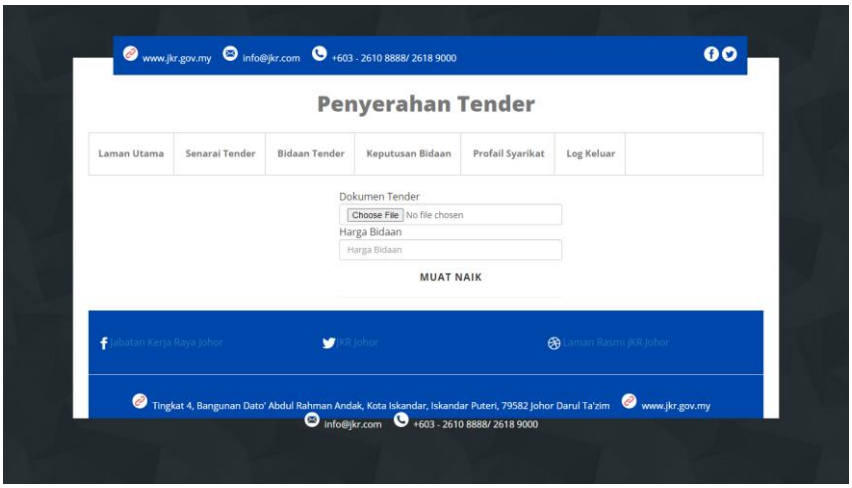


Figure 11: Bidding Tender Upload Interface

Next module is Tender Approval Module. Admin has been authorized to view the bidding tender list and changed the status of bidding tender. The company can see the status of the tender that already they bid. Figure 12,13 and 14 shows the tender approval module.

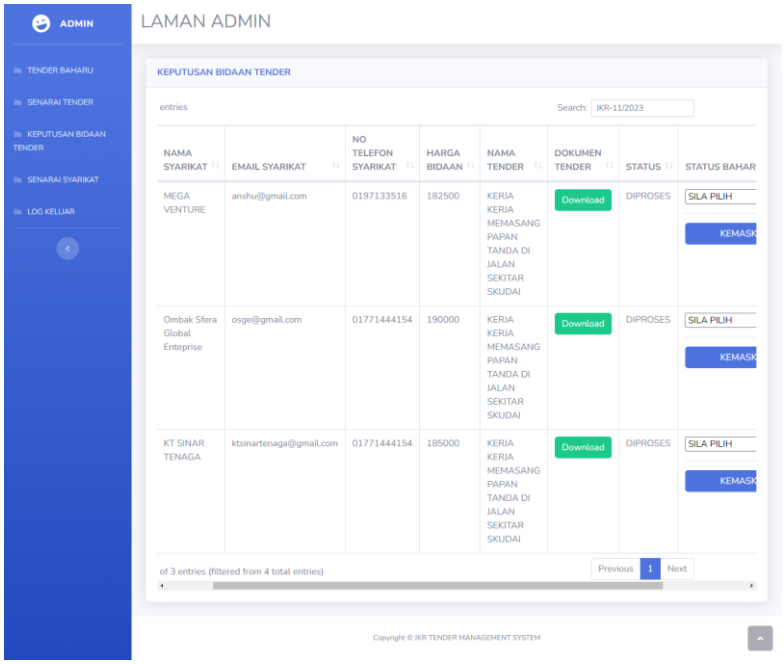


Figure 12: Bidding List Interface

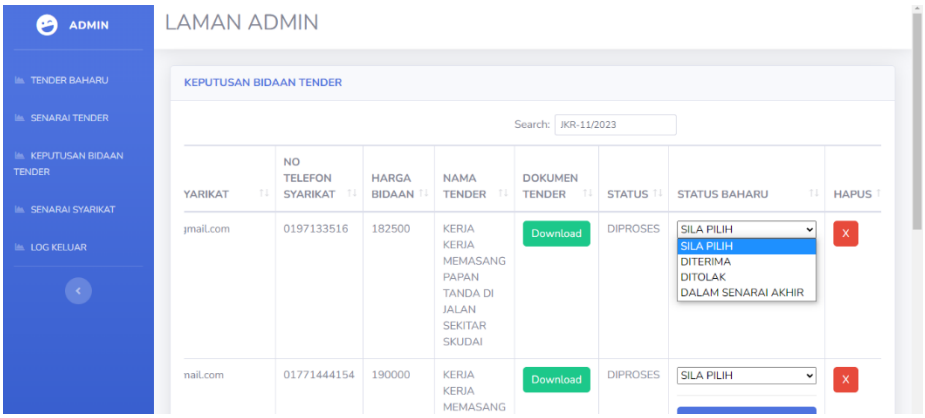


Figure 13: Tender Bidding Status Update Interface

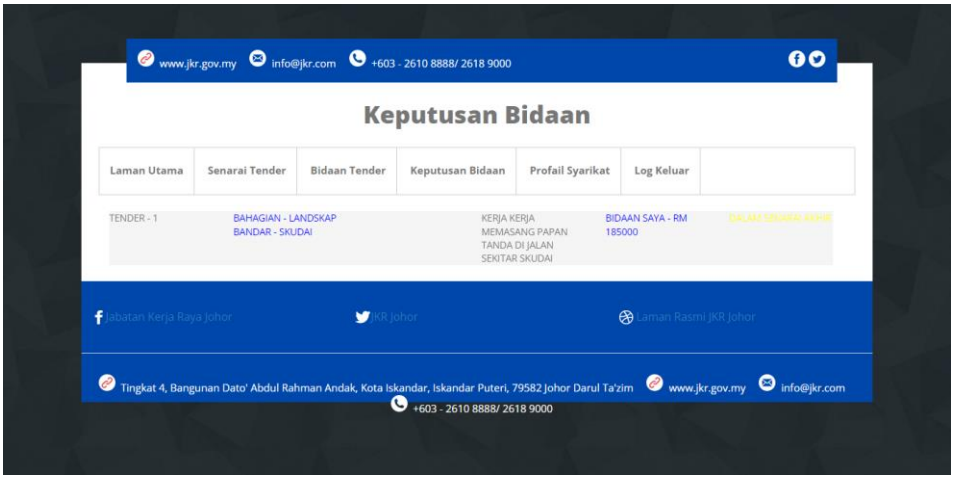


Figure 14: Company Bidding Status View

The final module is the Company Profile Module, which grants authorized companies the ability to update their data to ensure their active status within the system. Additionally, administrators are authorized to update the company status. The interface for updating company information is depicted in Figures 15 and 16.

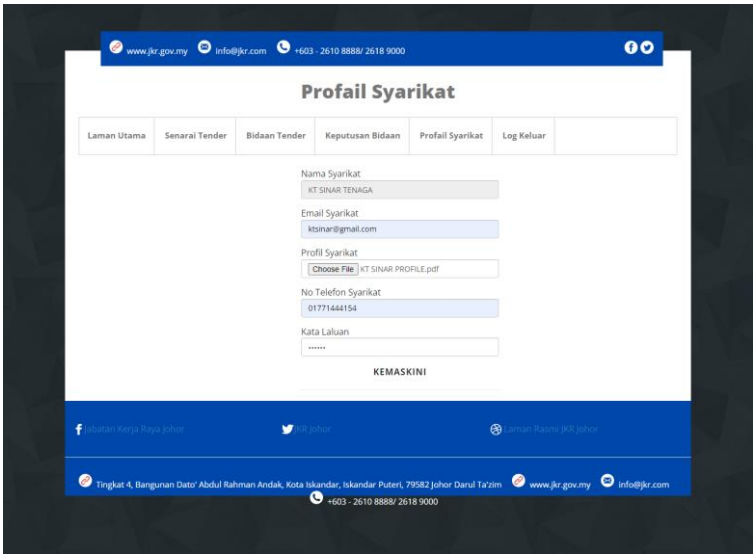


Figure 15: Company Profile Update Interface

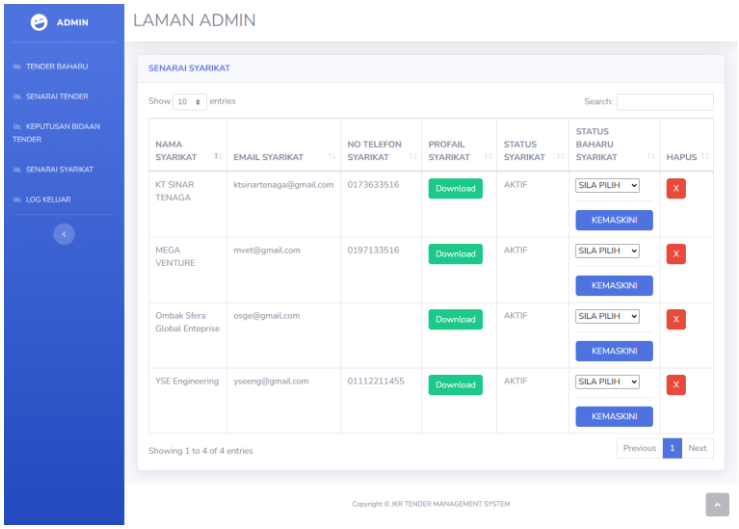


Figure 16: Company Status Interface

6. Conclusion

The JKR Tender Management System provides a user-friendly platform that facilitates interaction between staff and tendering companies. Through the implementation of role-based access management, organizations can ensure that each user category has appropriate permissions and restrictions. The system efficiently logs and monitors all information pertaining to registered businesses with the Jabatan Kerja Raya, streamlining processes such as managing bidder applications and tender submissions. The user experience is enhanced through a user-friendly design and accurate record-keeping, simplifying system access and usage for administrators, managers, and staff.

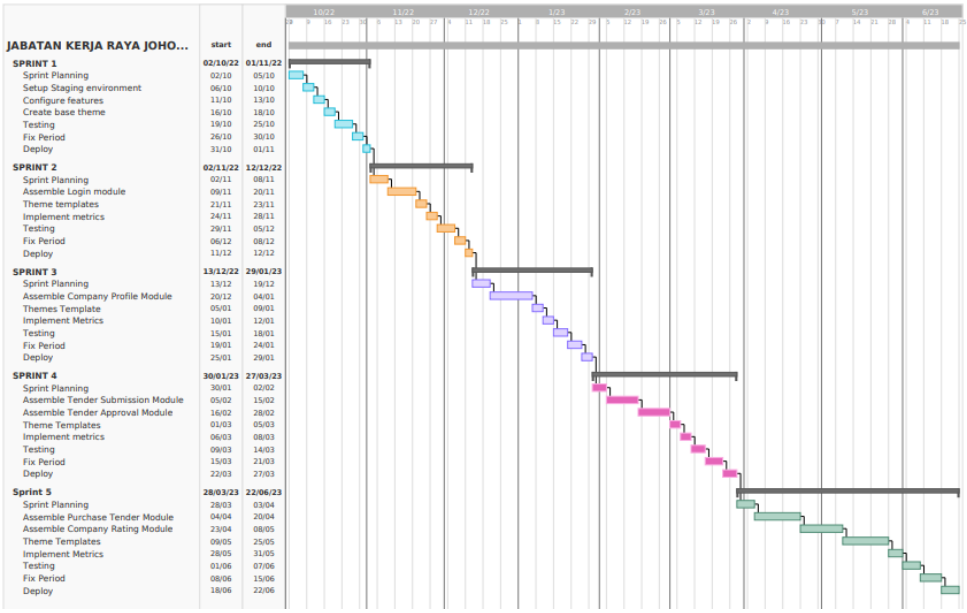
The development of the JKR Tender Management System has been carefully executed, utilizing Visual Studio Code as the Integrated Development Environment (IDE) for coding both the front and back end of the system. Additionally, XAMPP is employed as the database management tool. By leveraging these technologies, the JKR Tender Management System significantly improves the efficiency and effectiveness of Jabatan Kerja Raya operations. It simplifies day-to-day activity management and delivers an enhanced experience for all stakeholders involved.

Acknowledgement

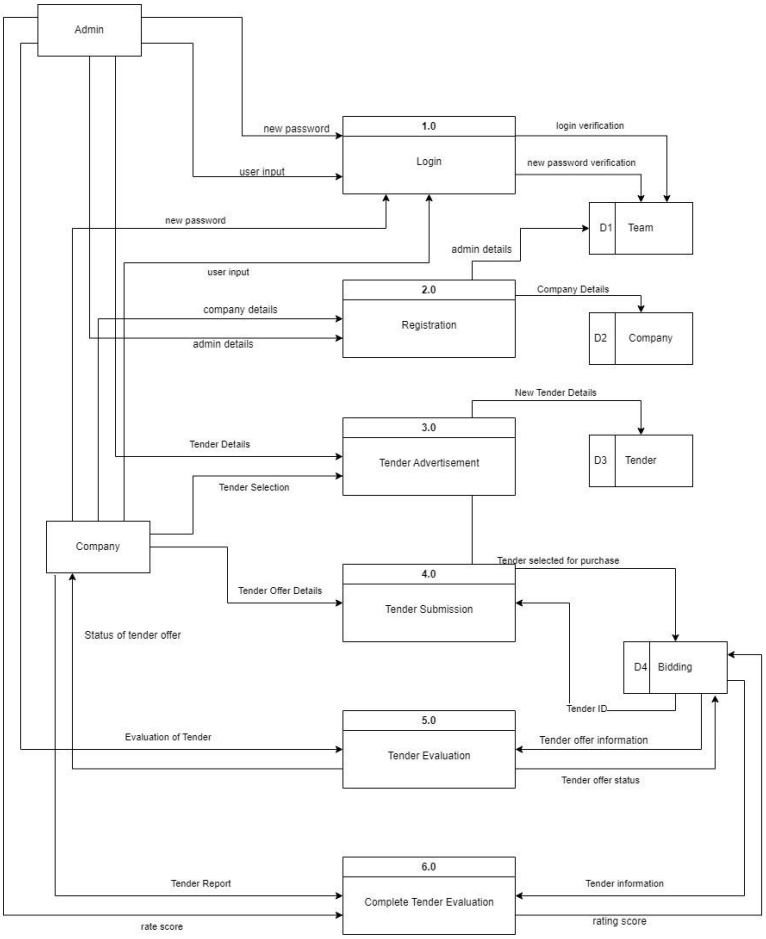
The author would like to thank the Faculty of Computer Science and Information Technology, Universiti Tun Hussein Onn Malaysia for their support and encouragement throughout the process of conducting this study.

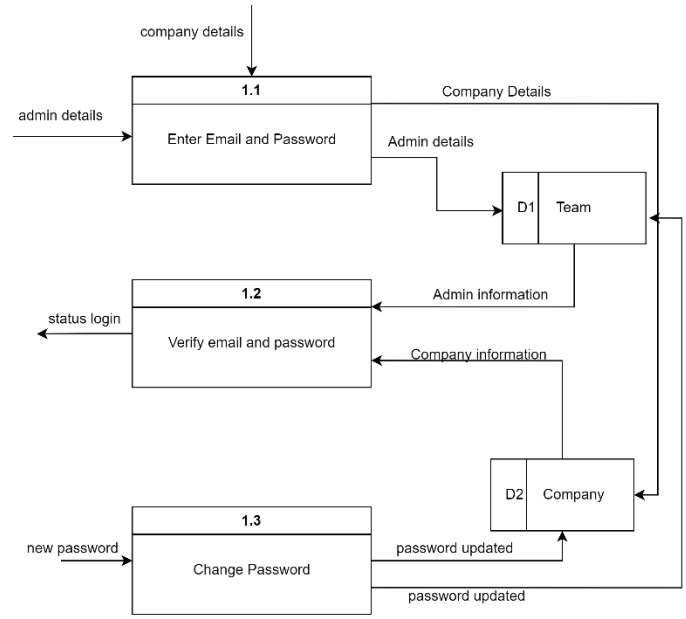
Appendix A

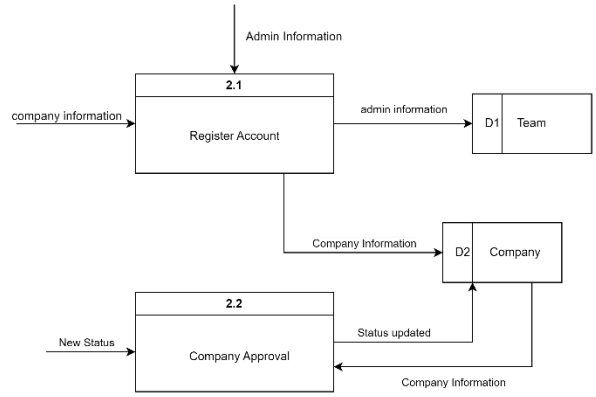
Gantt Chart

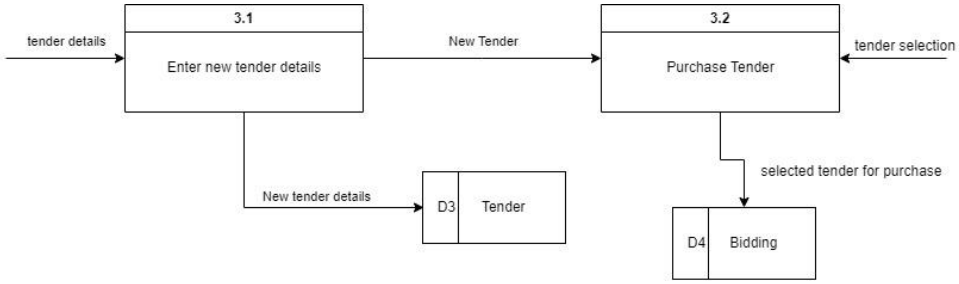


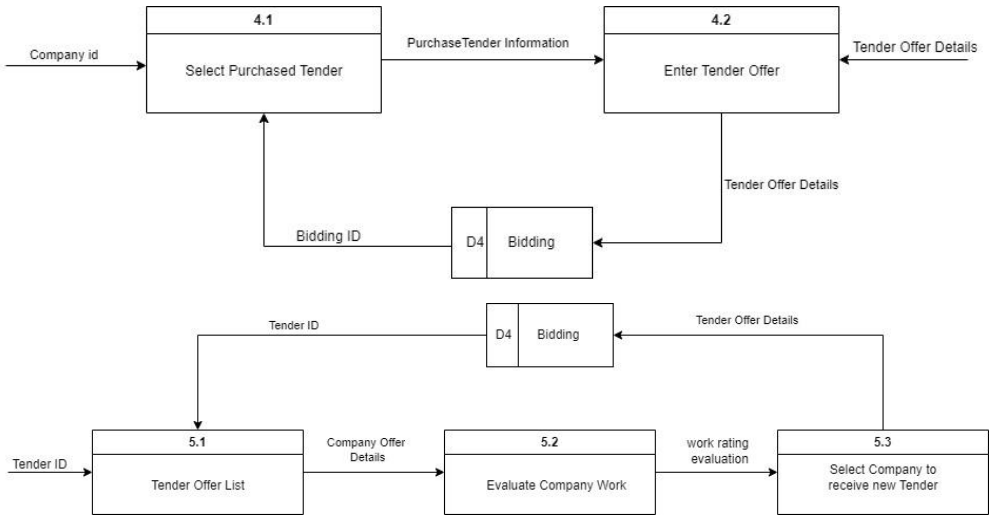
Appendix B

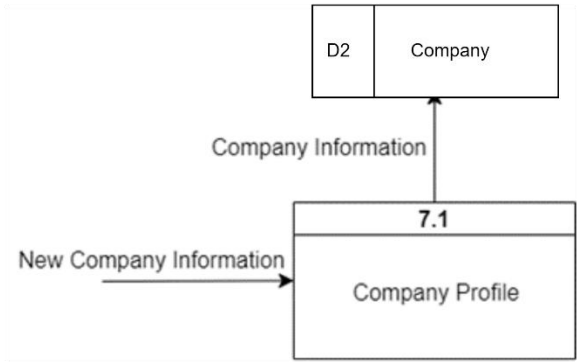



company details
1.1
Enter Email and Password
admin details
Company Details
Admin details
D1
Team
1.2
Verify email and password
status login
Admin information
Company information
D2
Company
1.3
Change Password
new password
password updated
password updated


Admin Information
2.1
Register Account
company information
admin information
D1
Team
Company Information
D2
Company
2.2
Company Approval
New Status
Status updated
Company Information


3.1
Enter new tender details
tender details
New Tender
3.2
Purchase Tender
tender selection
New tender details
D3
Tender
selected tender for purchase
D4
Bidding





Reference

[1] "Agile Workflow: The Ultimate Guide." ClickUp, https://clickup.com/blog/agile-workflow/.

[2] "Agile Development Life Cycle." Wrike, https://www.wrike.com/agile-guide/agile-development-life-cycle/

[3] Kraeling, M., & Tania, L. (2019). User Requirement - an overview | ScienceDirect Topics. ScienceDirect. https://www.sciencedirect.com/topics/engineering/user-requirement

[4] "Entity-Relationship Diagram (ERD)." TechTarget, https://www.techtarget.com/searchdatamanagement/definition/entity-relationship-diagram-ERD.

[5] "Functional and Non-Functional Requirements: Specification and Types." AltexSoft, https://www.altexsoft.com/blog/business/functional-and-non-functional-requirements-specification-and-types/.

[6] "Context Diagram." Miro, https://miro.com/blog/context-diagram/.

[7] "What is a Management System?" DQS Global, https://www.dqsglobal.com/en-my/about/certification/system-certification/what-is-a-management-system.

[8] "Web-Based Applications." Lvivity, https://lvivity.com/web-based-applications.

[9] "Research Guides." Benedictine University, https://researchguides.ben.edu/c.php?g=915975&p=6600609.

[10] Pressman, R. S. (2014). Software Engineering: A Practitioner's Approach (8th ed.). McGraw-Hill Education.

[11] Sommerville, I. (2016). Software Engineering (10th ed.). Pearson Education Limited.

[12] Smith, J. D. (2021). Introduction to Web-Based Systems. In A. B. Editor (Ed.), Web Development Handbook (pp. 23-45). Publisher.

[13] Johnson, A. B. (2022). Introduction to Web-Based Management Systems. In C. D. Editor (Ed.), Handbook of Modern Management Tools (pp. 78-95). Publisher.