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Web Application Development of “Purchase Management System” at Right Brain Solution Limited

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Web Application Development of “Purchase Management System” at Right Brain Solution Limited

By

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Autumn, 2022

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January 31, 2023

Dissertation submitted in partial fulfillment for the degree
of Bachelor of Science in Computer Science
Department of Computer Science & Engineering

Independent University, Bangladesh

Attestation

Attestation

This is to certify that this report is completed by me, Jannatul Nawar (1830008), submitted in partial fulfillment of the requirement for the degree of Computer Science and Engineering from Independent University, Bangladesh (IUB). It was completed under the guidance of Md. Mahmudul Kabir Peyal (Supervisor). I also certify that all the work presented in the report is original which I have learned during my internship including all the sources of information used in this project and report.

Jannatul
Signature

31.01.2023
Date

Jannatul Nawar
Name

Acknowledgement

I would like to thank Almighty Allah (SWT), the most merciful and compassionate, for His help in completing this internship journey successfully and delivering this report timely. Secondly, I want to thank my family for being there for me always and for being my biggest cheerleader. I would also like to express my gratitude to the Faculty of Computer Science and Engineering department to keep internship credit in the curriculum of the graduation program and give me a scope of having this glimpse of industry-oriented tasks and the field of work with my interest.
I would like to thank to my supervisor, Mr. Md Mahmudul Kabir Peyal, Research & Development Officer, Department of Computer Science and Engineering, Independent University, Bangladesh, who encouraged and directed me with his continuous guidance, valuable instructions, stimulating suggestions and thoughtful advice during pursuing this internship and preparation of this report.
I am also thankful to my organizational supervisor and senior colleagues at Right Brain Solution Limited for being patient and helping me learn new technology. Their support is something I will always remember, and this organization will always be special to me as this was my first industry experience as an Engineer.

Letter of Transmittal

Md. Mahmudul Kabir Peyal
Research & Development Officer
Department of Computer Science & Engineering
School of Engineering, Technology & Sciences
Independent University, Bangladesh

Subject: Submission of Internship Report for the completion of graduation.

Dear sir,

This it to inform you that I am submitting my Internship Report, which is a part of the Bachelor Program in Computer Science and Engineering curriculum. It is a great learning opportunity to work under your active supervision.

This report is based on, "Web Application Development of Purchase Management System at Right Brain Solution Ltd". I had the opportunity to work at Right Brain Solution Ltd. for four months, under the supervision of Mr. Shafiqul Islam, Executive Officer, Right Brain Solution Ltd. This internship has given me both academic and practical exposures. The internship has given me the opportunity to develop a network with the corporate community. I tried to make this report as informative as possible with the experience I have gained during my internship period. To prepare a well-organized internship report, I have followed the guidelines given in the course outline of CSE 499, and I also included the detailed explanation of the required fields.

I sincerely believe that this report will serve the purpose of my internship program. I shall be highly obliged if you are kind enough to receive this report and provide your valuable judgement.

Sincerely,

Jannatul Nawar
ID: 1830008
Department of Computer Science & Engineering
Independent University, Bangladesh

Evaluation Committee

Evaluation Committee

Asif Bin Khaled
.....
Signature

Asif Bin Khaled 30.01.23
.....
Name

.....
Internal Examiner-1 / Panel Member-1

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Signature

Mahmudul Islam
.....
Name

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External Examiner-2 / Panel Member-2

30.01.2022
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Signature

Md. Mahmudul Kabir Pegal
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Name

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Supervisor of the intern

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Signature

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Name

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Head, Department of Computer Science & Engineering

Abstract

This report outlines the duties of a 4-month internship at Right Brain Solution Ltd. in Dhaka, Bangladesh. Along with that the report's purpose is to give a detailed insight into a modern firm trying to bring innovative and creative tech solutions to clients at an affordable cost. When I was offered an internship at Right Brain Solution Ltd, I got the chance to work and learn with the developer team. I was a Web Developer intern there. The project's goal was to create a web application for Right Brain Solution Ltd named "Purchase Management System", please note that the original project name had the client's custom name based on that organization, but for privacy that name was changed with a generic name. This report covers the whole project that I learned about throughout my internship period. My work assignment during the internship started from 1st September 2022 with learning the tech-stack for the project. This report covers the project completed during my internship period. My internship ended on 29th December 2022.

Keywords— *Purchase Management System, Right Brain Solution Ltd, UI/UX design, Frontend, System Analysis, React JS, Tailwind CSS.*

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Chapter 1

Introduction

1.1 Overview/Background of the Work

One of the main challenges that I faced as an intern was to relate theoretical knowledge with practical real life experience of the work. I started my internship as a Web Developer at Right Brain Solution Ltd on the 1st of September, 2022. The duration of my internship was four-months. In this software firm, I worked on the frontend part of the web application named “Purchase Management System”.

Businesses and organizations need to purchase goods and services on a daily basis [1]. The purchasing plan should be efficient in order to get business running smoothly. Hence, it is important to ensure that a formalized purchasing process is used to compete in the modern marketplace. The manual process of paper based record-keeping is no longer sufficient if a company wants the best outcome on their purchasing investment or a strategic supply chain. A purchase management software is the best solution. The automated system will help eliminate expense of paper-based storage and save time [2]. It will also add better accuracy, speed and consistency while eliminating human error to an elevated extent. This will be beneficial for a company in focusing on vendor collaboration and communication, it will also help companies not only benefit from having an organized purchasing management but also add value, saving and productivity to the business.

My proposed purchase management system will be created for a poultry farm, the goal is to ensure that the system is user friendly and gives the company a smooth running software that will help them achieve a secure and organized purchase management system.

1.2 Objectives

In a project’s objective, the goal that will be achieved by the end of a project is discussed. Each criteria of a project needs to be met, starting from setting goals, giving realistic time and should

be relevant. The main objectives of “Purchase Management System” web application are as follow:

- Automate the current manual process of purchase system of client.
- To ensure no data is lost.
- Make purchase requisition and purchase order process faster.
- To keep up to date with available stock.
- Generate budget plans.
- To store every information of the organization in a database for safety.

1.3 Scopes

The v1 of the web application is already shared with client and their feedback are taken. This app’s goal is to make purchase management system of an organization to run smoothly. The web application is currently running on two languages (English and Bengali), so user can easily switch between the languages. There is no Sign-Up page for this application because it is for an organization so the admin makes accounts for their employees. Users can search any project or check stock availability. There are many CRUD operations, where maximum is accessed by admin to entry new data of the company. Different user groups has different permission level of what they can view. For the simplicity of the app, project managers creates Purchase Orders/Purchase Requisitions and waits for the approval of the admin. The admin gets notified and gives their decision. The admin can delete any deactivate any employee account. In future there will be attendance module as well to track attendance of the employees.

Chapter 2

Literature Review

2.1 Relationship with Undergraduate Studies

To build a successful web application it is important to have analytical skills. The knowledge and skills that I obtained from various undergraduate courses will guide me while working for the “Purchase Management System” project. The courses directly related to my project and my job as a web developer include:

- **Object Oriented Programming (CSC 305):** The concept of classes, objects and polymorphism is required in building a web application. As the application becomes more complex, the concept of OOP will be used frequently to split the modules into manageable chunks while working with classes and objects. This also ensures that codes are reusable through inheritance concepts that I learned and eliminate use of repetitive codes.

- **Database and Management System (CSC 401):** We had a group project for this course where we had to build a web application. It also introduced me to concepts of ERD, Database and Queries, Rich Pictures and Data Dictionary. This knowledge will help me with the development planning of the application.

- **Algorithm (CSC 306):** This course taught me the techniques and principles of algorithms design, complexity analysis and their associated asymptotic notations (Theta, Big O, Omega). These methods I learned will help me design efficient and error free programs that will be required in the development of my application.

- **Web Application and Internet (CSC 455):** This is the course where the development of web applications was taught. I started learning extensively about HTML, JS and CSS. I practiced with Bootstrap 5 as well and that is now helping me in learning Tailwind CSS

more effectively. Since I am mostly working on frontend, the skills I gained from this course while building course projects will help me in my project.

- **Data Structures (CSC 203):** This course introduced me to the concept of arranging data in an efficient way so that it is easily retrieved when required. As my project will grow more difficult, these skills will be beneficial for me to give the desired output of the application.

- **System Analysis and Design (CSC 405):** This course taught me the research and development aspect of an application. The concepts included such as software development lifecycle, system prototyping and application architecture will help me further in making development plans.

2.2 Related works

There are many purchase management systems created based on user needs and some general usage purposes. Similar applications exist as they all have a common goal to make the purchase management system more efficient. Below are the lists of such systems:

- **eRequisition:** is a web-based solution that was designed to make the purchase process for organizations easier [3]. The system reduces the usage of paper-based requisitioning systems by replacing them with digital requisition method.

- **Procurify:** This procurement and purchasing software [4] that lets companies track, control, and checks all business spending so they can process the info faster.

- **ProcurementExpress:** This purchasing software [5] allows users to easily manage purchase orders online. They also include features such as track spending, manage budgets and draw reports.

- **Fraxion:** This app is cloud-based [6]. It provides services with advanced spend analytics. It automates the overall procurement process and makes budget plans with ease along with other features.

- **Teampay:** This app [7] allows companies to approve, request and track expenditures in real time of the purchasing aspect of a firm. It includes Integrations with QBO, Intacct, Netsuite, Xero & Slack.

Chapter 3

Project Management & Financing

3.1 Work Breakdown Structure

The main purpose of Work Breakdown Structure (WBS) is to divide a large project into manageable parts. This helps the team involved in a project to make sure the work is done concurrently by different team members which ultimately leads to increased productivity and smooth project management. In order to make sure the team is coordinated and updated on each other's work, in our project we created a WBS for better output. The top-down approach is planned. The details can be seen below.

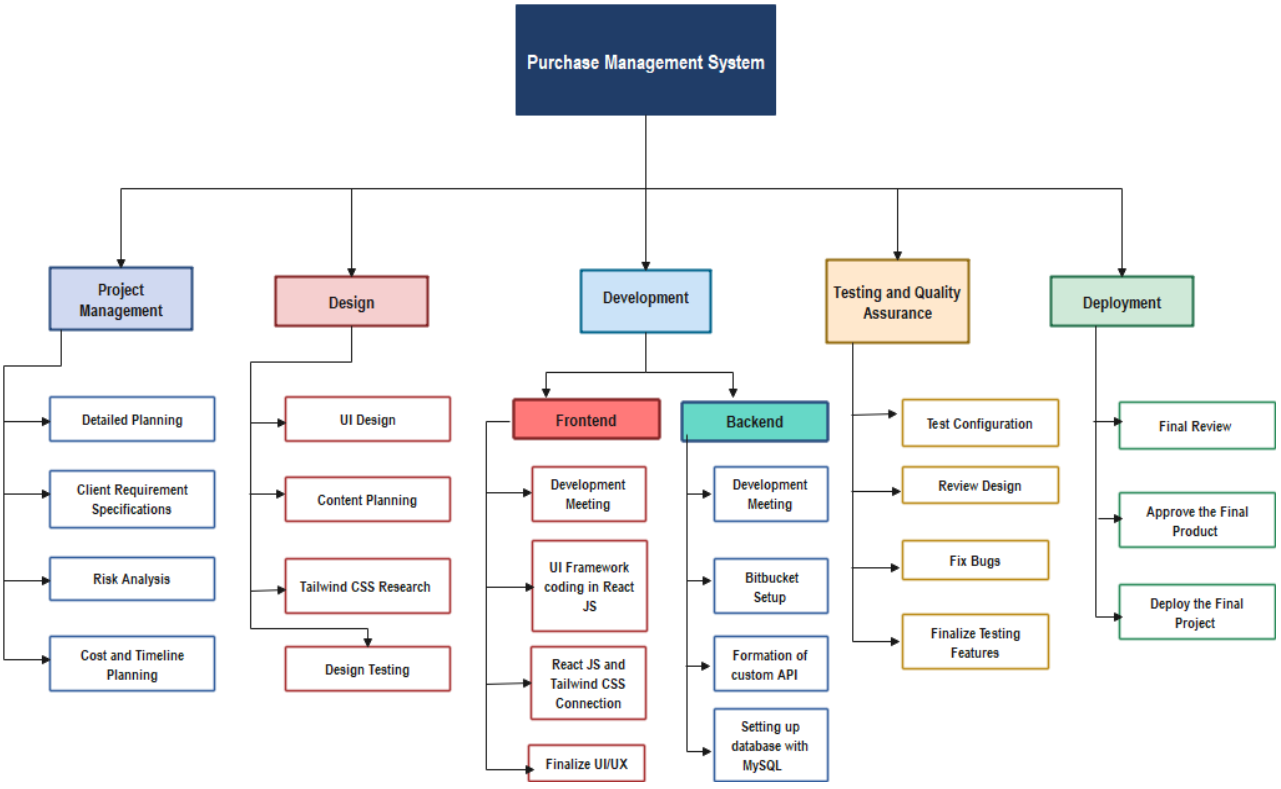


Figure 1: Work Breakdown Structure

3.2 Process/Activity wise Time Distribution

The timeline of a project depends on multiple factors. It is good practice to keep extra days for risk management. This allows developers to create a mind map and plan their project work accordingly. Frontend and backend developers should be always communicating so that coding and API is planned according to design and CRUD forms since a huge part of our designing includes forms as per client requirement. Good time management reduces stress, anxiety and gives better outcomes for the project. The planned timeline for the project is outlined below:

Table 1: Table for process activity time distribution

Activity	Time (Days)
Planning	5
Costing and Timeline Setup	2
Risk Analysis	4
Design	20
Development	35
Testing	10
Deployment	12

Start Date: 26th September, 2022
End Date: 29th December, 2022

In the above table, if we analyze the workload, the first three segments are for project management which makes up for 12.5% work. The design will take about 22.7%, the development takes majority time amounting to 39.8%, the testing takes 11.4% workload and finally the deployment is allocated 13.6% workload.

3.3 Gantt Chart

Gantt Chart is a project management tool used to plan and set a timeline for a project. This chart helps to establish an initial plan for a project, allocate resources based on work, make adjustments and monitor progress of the project. For our Purchase Management System, the estimated 13 week planning's Gantt Chart is outlined below:

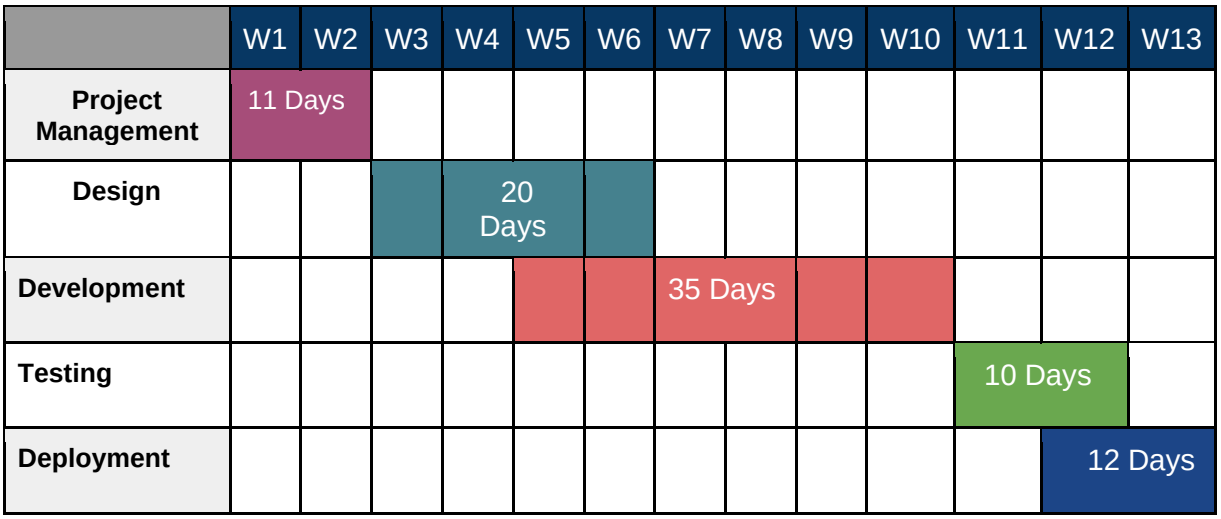


Figure 2: Gantt Chart

3.4 Process/Activity wise Resource Allocation

Resource allocation plays a crucial part in meeting the project's goal. It is essential to make sure that the work is assigned properly and there should not be any communication gap between team members. For any web development project, the developers are the primary resource followed by gadgets and servers required for the deployment of the project. In our project the same scenario is seen. For this project we will approximately take 88 days to build the whole application. The project and activity wise allocation is discussed below:

- **Project Management:** This is the starting point of the project, the client selected our company for the project and the CEO conveyed this to the Executive Director. Later on the Executive Director formed a team and assigned them with this project. This contained meetings with developers and finalizing an estimated plan.

- **Design:** Then comes the designing of the UI/UX. Initially few designs are presented to the team and upon approval a certain design is selected.

- **Development:** In this phase, the frontend and backend developers come together and do work simultaneously. The deadlines are also kept in mind while carrying out this phase.

- **Testing:** Then the testing begins with the QA Engineer. Their job is to make sure the application is free of bugs and make sure nothing is missed out by the developers.
- **Deployment:** After the testing is complete and the outcome is satisfactory, the application is deployed in a server and documentation is created and the product is planned to be delivered to the client.

Table 2: Table for process activity time distribution

Activity	Time (Days)	Workload Percentage
Project Management	11	12.5%
Design	20	22.7%
Development	35	39.8%
Testing	10	11.4%
Deployment	12	13.6%
TOTAL	88	100%

3.5 Estimated Costing

The pricing of the application took account on the modules and the functionalities, the salary of the employees, the developing tools, the subscription package bought for Tailwind CSS to name a few.The organization for whom we are building this application is a recurring customer and had many applications developed from our company, hence they received a great discount.

The financial proposal is already formed. The purchase management system is priced as follow:

Table 3: Table for Estimated Costing

	Features	Price (in BDT Excluding VAT & TAX)
Purchase Management System	**Development, Design, Installation, Project Manager, Domain Bills**	**800,000**
	Discount	**100,000**
	TOTAL	**700,000**
	AMC (Annual Maintenance Charge)	**12% of the Quote Value**

Chapter 4

Methodology

4.1 Course of action

The methodology is the detailed procedures used to identify, select, process, and analyze information about a topic (the web application in this context). The application I am working on is based on fully functional web pages, and it is developed using modern web technologies The backend of the project will be built on Python Django. The frontend will be a combination of React JS and Tailwind CSS. The database used will be MySQL. Moreover, the interface of the application will be of two languages, Bengali and English. Users can choose any language they want when using the application.

4.2 Software Development Life Cycle

It is crucial to follow a strategy when working on an app. In software projects, the model Software Development Life Cycle is used. This model defines the stages and milestones in a system development project starting from initial feasibility study to the maintenance of the completed project. A typical Software Development Life Cycle follows the stages in the order: first we have to identify the problem, after that determines the requirements, then comes analyzing needs of the system, then designing the recommended system, afterwards developing the system, then testing and maintaining the software and finally evaluating the system.

4.3 Software Development Methodology

For this project my team has chosen to follow the Agile Methodology. Often it works in iterative development as well. Agile is a process by which a team can manage a project by fragmenting it into several stages and the collaboration is continuous with stakeholders and involves

constant improvement and iteration at every stage. This approach starts with customers portraying how the finished result will be utilized and what issue it will solve. It doesn't fabricate a whole framework on the double, yet rather grows steadily.

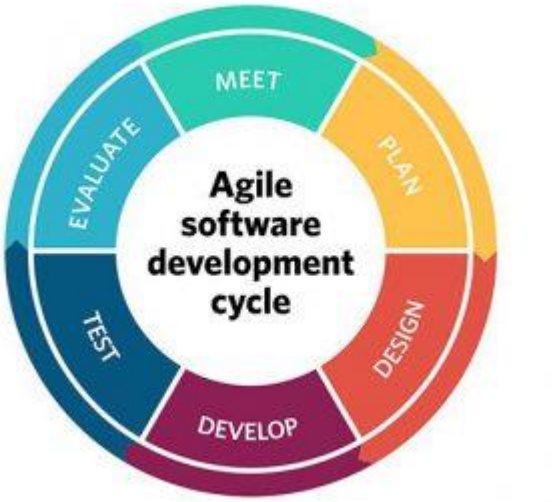


Figure 3: Agile Methodology

The benefits of this approach include:

Building the right product: The ultimate goal is to make sure we are building the right product, regardless of whether we are building the specific highlights that our customer requested, steady delivery encourages the developing team to assemble them in a way in which our clients will really use them. The delivery of product in smaller increments allows clients to see the developing item, express their opinions to it and change it as the project progresses. Agile helps the customer and the team converge on the best possible outcome.

Customer Satisfaction: The customers will be involved as much as the developers and the frequent feedback will allow both the developing team and customer to come to a common ground.

Early Risk Reduction: Agile model also helps with risk management. By conveying early and getting feedback, we lessen the danger of building an imprecise product.

Better quality: Agile model is strategized with time-management fixes, it is cost effective and ensures good quality products to be delivered.

Chapter 5

Body of the Project

5.1 Work Description

Purchase Management System is a software that allows a company to have an organized process for procuring items and materials. It also creates customized rules for purchase order and purchase requisition approvals. Moreover, this web application deals with multiple suppliers in an endeavor to procure new stock and makes sure that the material is procured in the best possible quality and cost in less time.

The system consists of eight modules, they are:

- **Login and logout:** This module allows the users to login to their accounts by entering their email and password. The user can also logout from the system.
- **Dashboard:** After logging in to the system, the user will be able to see the dashboard, it will differ from user to user.
- **Master Data:** The admin controls this module, in this module CRUD operations will be done the details of sub-modules are added, the sub-modules of this module are:
    - Item
    - Item Type
    - Project
    - Project Type
    - Company
    - Company Type
    - Category
    - Sub-Category
    - Area
    - Cost Header
    - ERP Ledger Account
    - Terms and Conditions
    - Company Settings
    - Related Bank
    - Signature

- **Vendor:** In this module the users can add vendors and suppliers and add details. The sub-modules are- create vendor and add supplier.
- **Budget:** The admin can create budget related information in this module, the two sub-modules of this category are: add budget and additional budget.
- **Purchase Requisition:** In this module, all purchase requisitions can be viewed, at first the project manager creates a purchase requisition and waits for approval. The purchase requisitions are approved by admin.
- **Purchase Order:** Like purchase requisitions, purchase order also contains two steps, at first the project manager create a PO and then wait for confirmation by the admin. Once the admin gets the PO, they either approve or deny it.
- **Delivery Issued:** The delivery information and goods received details are found in this module, this can be viewed and updated by admin and project manager.

5.2 Requirement Analysis

5.2.1 Rich Picture

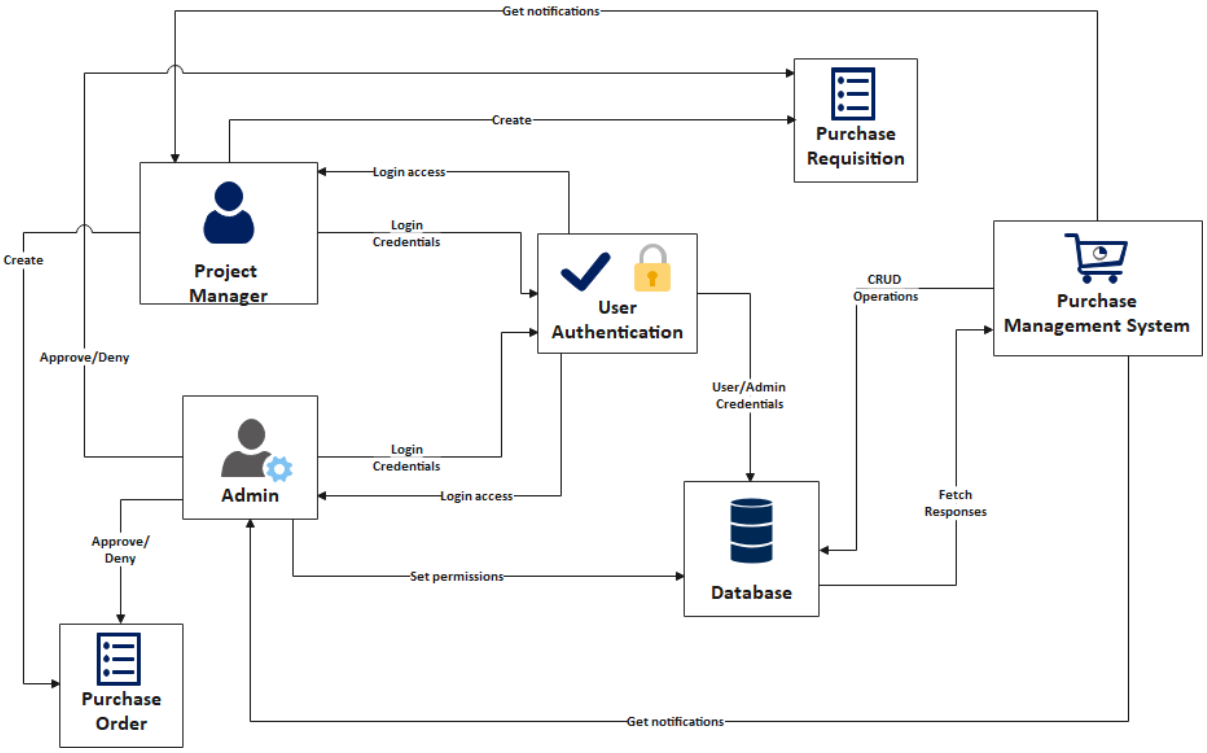


Figure 4: Rich Picture for Purchase Management System

5.2.2 Functional Requirements

The system's function and its intended features are described in functional requirements. It defines a system's behavior which can range from services to tasks performed by a system. The functionalities tables of the Purchase Management System is given below in the following tables:

Table 4: Functional Requirement 1

Function: User Login		
Input: Username/ Email & Password.	**Process:** Save User Credentials.	**Output:** User Saved.
Precondition: Must have internet connection.		
Postcondition: Login is confirmed and the user is redirected to the Dashboard of the system.		

Table 5: Functional Requirement 2

Function: Master Data CRUD Operations		
Input: Enter item, project, category, terms and conditions, erp ledger etc.	**Process:** Save details in database.	**Output:** Item, project, category etc will be created.
Precondition: Must have internet connection.		
Postcondition: Saved data's confirmation dialogue box will appear on screen.		

Table 6: Functional Requirement 3

Function: Purchase Requisition Create/ Approve		
Input: The fields of the PR form are entered by the Project Manager. The Admin will approve/decline that.	**Process:** Save details in database.	**Output:** PR forms are created by Project Manager. The admin will be

		able to view it and will either approve or decline it.
Precondition: Must have internet connection.		
Postcondition: Project manager will get form created successfully notification, the admin will get notified that their decision was saved.		

Table 7: Functional Requirement 4

Function: Purchase Order Create/Approve		
Input: The fields of the PO form are entered by the Project Manager. The Admin will approve/decline that.	**Process:** Save details in database	**Output:** PO forms are created by Project Manager. The admin will be able to view it and will either approve or decline it.
Precondition: Must have internet connection.		
Postcondition: Project manager will get form created successfully notification, the admin will get notified that their decision was saved.		

Table 8: Functional Requirement 5

Function: Add Delivery Item		
Input: Provide delivery item, stock items and budget details in the respective modules.	**Process:** Save information in database	**Output:** Delivery items, stock items and budget information are updated and added to the database.
Precondition: Must have internet connection.		
Postcondition: Notification will be shown after successfully adding the information.		

Table 9: Functional Requirement 6

Function: Add Stock Item		
Input: Provide stock items details in the respective modules.	**Process:** Save information in database	**Output:** Stock items are updated and added to the database.

Precondition: Must have internet connection.
Postcondition: Notification will be shown after successfully adding the information.

Table 10: Functional Requirement 7

Function: Add Budget		
Input: Provide budget details in the form.	**Process:** Save information in database	**Output:** Budget information updated and added to the database.
Precondition: Must have internet connection.		
Postcondition: Notification will be shown after successfully adding the information.		

Table 11: Functional Requirement 8

Function: Create Vendor		
Input: Enter the details of the vendor related information.	**Process:** Save information in database	**Output:** Information about vendors are created and added to the database.
Precondition: Must have internet connection.		
Postcondition: Notification will be shown after successfully adding the information.		

Table 12: Functional Requirement 9

Function: Add Budget		
Input: Provide supplier details in the form.	**Process:** Save information in database	**Output:** Supplier information is updated and added to the database.
Precondition: Must have internet connection.		
Postcondition: Notification will be shown after successfully adding the information.		

5.2.3 Non-Functional Requirements

The non-functional requirements are the traits of a system, it defines the criteria that can be used as guide to judge the operations of a system. It works as a contrast to functional requirements, where functions of a system and its features are defined.

The types of non-functional requirements in Purchase Management System are stated below:

- **Performance and Scalability:** Response time of this system is satisfactory; it logs into and out of the system instantly and other features, such as going from one module to another, are quite smooth too. However, CRUD operations take a bit longer to load so there is scope here for improvement.
- **Reliability, Maintainability and Availability:** The Purchase Management System has been trialed through several performance tests and based on test results; it can be concluded that the system will run smoothly for quite a long time. The maintenance is also easy, as this system has backup so availability and reliability also work.
- **Portability and Compatibility:** Any web browser can be used to access this system, there is no need for any high-end devices. However, internet access is required. The portal is compatible with laptops and desktops. It runs on any type of browser or operating system.
- **Security:** Users' accounts credentials are saved into the database securely. Passwords of each account are encrypted and then saved to database.
- **Usability:** The UI is user-friendly. The buttons are easily visible and for each module and sub-modules respective page title and sub-title is given so it is easier for the user to use this system. Users will be able to run the system very easily.

5.3 System Analysis

System analysis is a detailed evaluation of a system to identify areas of improvement, it is required to make sure the software maintains quality and suggests possible solutions to errors encountered.

5.3.1 Six Element Analysis

A computer is made up of six important components, the evaluation of these components is basically the six element analysis, the table below shows that in details:

Table 13: Six Element Analysis of Purchase Management System

Process	System Roles				
	Human	Hardware	Software	Database	Network & Communication
Login	User	Computer	Web Browser	MySQL	WAN/LAN
Dashboard	User	Computer	Web Browser	MySQL	WAN/LAN
Master Data CRUD Operations	User	Computer	Web Browser	MySQL	WAN/LAN
Create Purchase Requisition	Project Manager	Computer	Web Browser	MySQL	WAN/LAN
Purchase Requisition Approve	Admin	Computer	Web Browser	MySQL	WAN/LAN
Create Purchase Order	Project Manager	Computer	Web Browser	MySQL	WAN/LAN
Purchase Order Approve	Admin	Computer	Web Browser	MySQL	WAN/LAN
Add Delivery Item	User	Computer	Web Browser	MySQL	WAN/LAN
Add Stock Item	User	Computer	Web Browser	MySQL	WAN/LAN
Issue Item	Admin	Computer	Web Browser	MySQL	WAN/LAN
Bank Information	Admin	Computer	Web Browser	MySQL	WAN/LAN
Add Budget	Admin	Computer	Web Browser	MySQL	WAN/LAN
Create Vendor	Admin	Computer	Web Browser	MySQL	WAN/LAN
Add Supplier	Admin	Computer	Web Browser	MySQL	WAN/LAN
Logout	User	Computer	Web Browser	MySQL	WAN/LAN

5.3.2 Feasibility Analysis

Through feasibility analysis, we can assess the practicality of a system. This study aims to identify the possible problems and issues that could arise in making a project.

The feasibility analysis of the Purchase Management System consists of the following parts:

- **Technical Feasibility**: This consists of evaluating the software, hardware, and other technical requirements of the proposed project. This also evaluates the detailed plan of how the product is set to be delivered to the client. Purchase Management System has been developed using Tailwind CSS framework and React JS. Along with these, latest version of PHP, Alpine JS, MySQL 8.0 and PHP. By using these technologies, the web application was built in a faster and efficient way. The project is updated regularly in Bitbucket.

- **Operational Feasibility:** This measures the efficiency rate of the system and how well the proposed system will be able to solve the problems and achieves customer satisfaction that was specified in the requirements engineering phase of the project. The human resources available for the project play a crucial role in determining this factor. Along with these, it also involves projecting the success of the project after it is developed and implemented. Purchase Management System is a user-friendly web application, and it can be conducted easily. People of all ages will be able to use it. It is a well-documented and planned system. The automated system reduces the workload of the existing manual system.

- **Economic Feasibility:** Here the costs and benefits are determined. It identifies the flow of cash and assigns values to cost accordingly. Production and development cost are included in this part of feasibility analysis. Since this system was developed for a company so cost was customized. This system will be beneficial to users as it reduces the cost of pens, papers and other manual process that requires huge amount of time and are subjected to human error.

- **Legal Feasibility:** It identifies the legal aspects of the project. This includes license agreements, copyrights, and contracts. For this project, the company we are developing this system for had formal contracts made, hence some parts of the projects and especially the original title name of the project is altered.

5.3.3 Problem Solution Analysis

The constant changing of requirements of a system imposes a major challenge for the web developers. Hence, gathering requirements is important before creating any product. In an ideal scenario, certain aspects should be considered, the following points can be included:

- Describe the project's scope.
- Communication between team and stakeholders is essential.
- No requirement should be assumed.
- Requirements should be documented before implementation.
- Clients should be involved from the beginning.

During the implementation of this project, certain issues occurred. The details are stated below:

Problem: The project management planning was difficult to follow since there were multiple on-going projects, we were falling behind with the schedule. Moreover, the UI design had to be changed many times since we had to come in a common ground while making the decision.

Solution: For the first problem, a skilled panner is needed to efficiently schedule the project, unrealistic timeline should be discouraged as it imposes challenge to team and if it is not delivered timely, client is also not satisfied. The second problem could have been solved if we had just started making prototypes instead of directly started using Tailwind CSS and HTML on planning phase, this could have saved a lot of time.

5.3.4 Effect and Constraints Analysis

Effect: Before this software was developed, the company's supply-chain management system was handled manually that subjected to human error and other increased costs that are effectively reduced from this automated system. In the old system, the details were all written in documents and stored in files. As a result, finding old files was getting difficult and the process took lot of time, some were lost as well. For this reason, the system was built to have a smooth flow of work in the supply-chain management system. The data is stored in database so searching for old files has become easier and there is no scope for lost data. There will not be any shortage of manpower to go through all of the documents and keep track of everything the process in software will be efficient.

Constraint: The old manual process takes longer. The cost for the overall process was higher and the amount was not fixed. But for the current software, certain amount of money has to be spent on the hosting, domain, etc. At first, the budget of the software was a problem for the system, but later there were some changes that involved minimizing few functionalities of

the software to meet up with the client budget. This software was effective for the company. It saves time and reduces cost.

5.4 System Design

5.4.1 Architecture

The architecture of a software consists of three tiers. The first one is the Presentation Tier, here the system's front end is shown, this gives the idea about what the user will see, basically it is the user-interface. The second tier is Logic Tier, in this case, the system's logical flow and backend coding is put, what the system is supposed to do and its functional and non-functional requirements are in this tier. Finally, the third tier is called Data Management Tier, this is where the data flow and database related architecture are planned.

The Purchase Management System's architecture includes these three tiers and are showcased in the figure below.

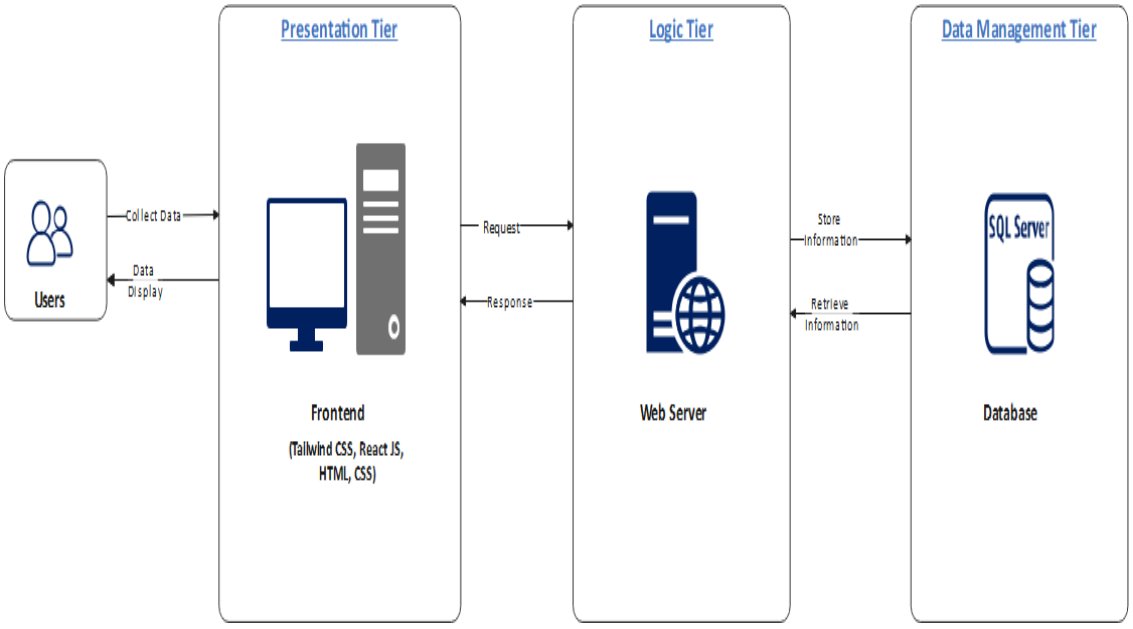


Figure 5: Architecture of Purchase Management System

5.4.2 Use Case Diagram

The use case diagram gives a summary of the system and analyzes the functional requirements of a system. It mainly highlights the important functionality of a software and what each user (referred to as actors) are supposed to do in the software, it shows how the system is supposed to flow logically and what tasks are expected to be performed by users.

The Purchase Management System's use case diagram is given below. It shows two users' perspectives. Both the user groups have the basic functionality of signing up and logging into the system along with the logout option. The admin user gets more features as shown in the figure, the project manager handles the stock and creating certain requisitions and orders that await decision of the admin.

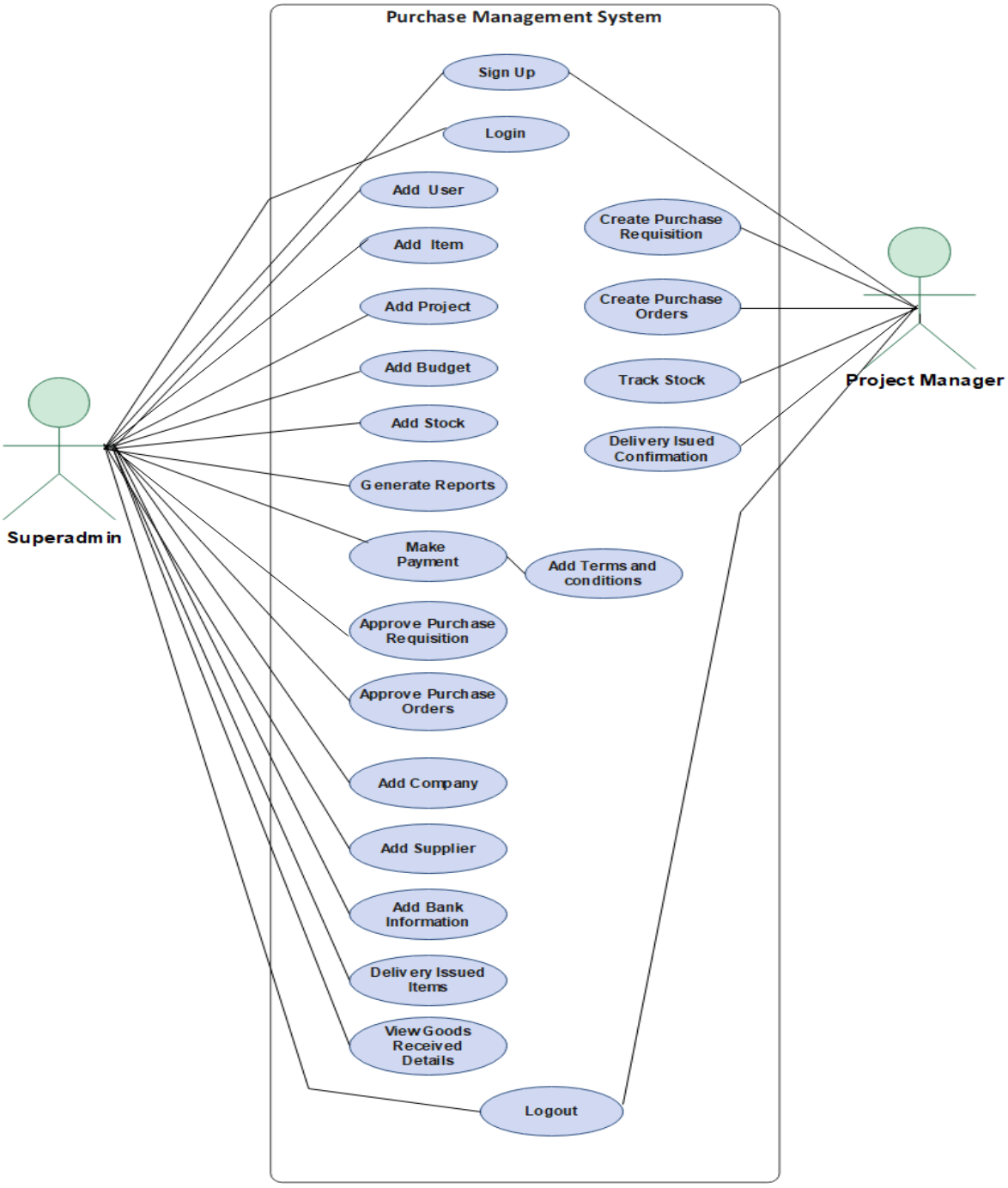


Figure 6: Use Case Diagram of Purchase Management System

5.5 Implementation

1.5.1 Design

The design of the Purchase Management System is made using Tailwind CSS, HTML and React JS. One of the basic designs of one module is given below in Figure 4.

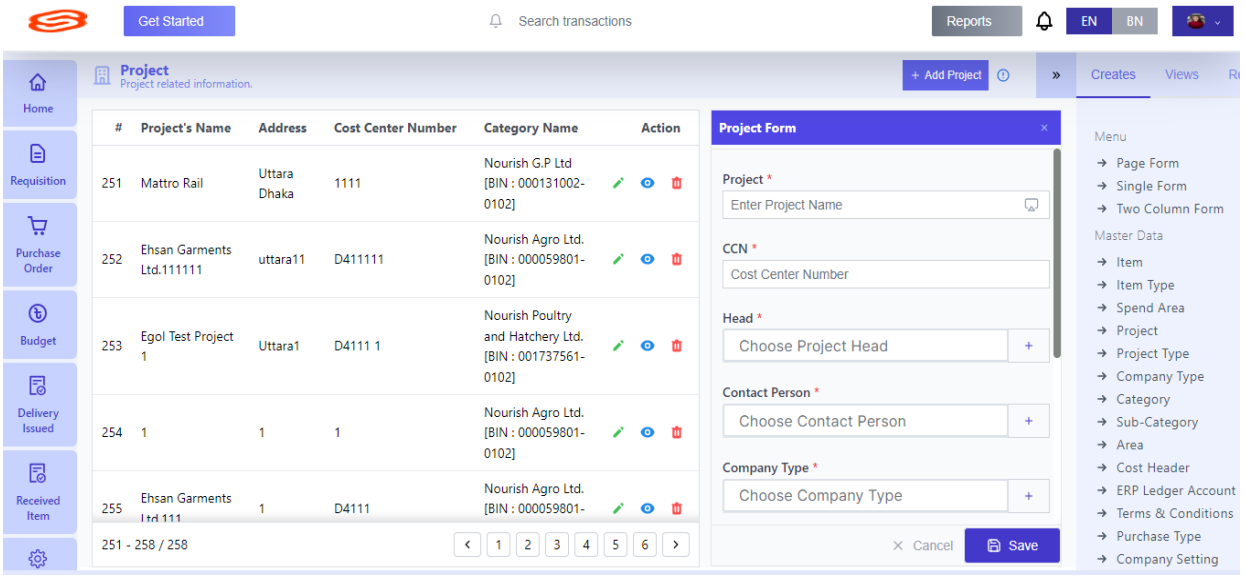


Figure 7: Design Demo of Purchase Management System

1.5.2 Development

The development of the system consists of coding in Visual Studio Code Studio and using React JS functionalities, two of the codes examples are given below:

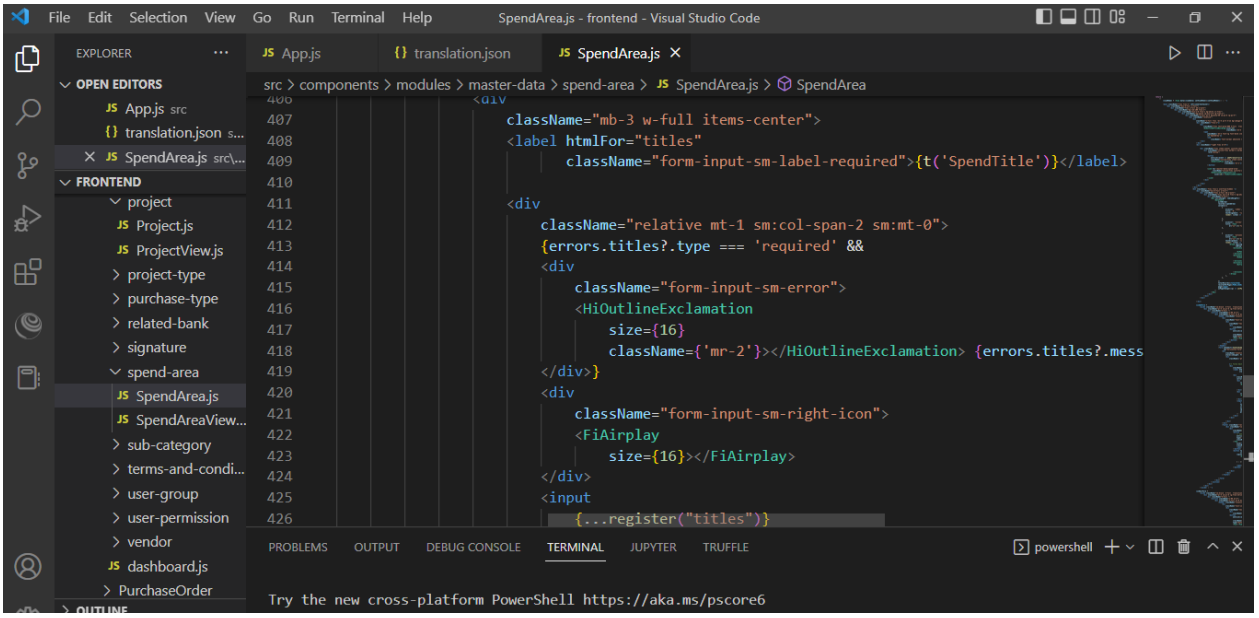


Figure 8: Code of Spend Area sub-module Purchase Management System

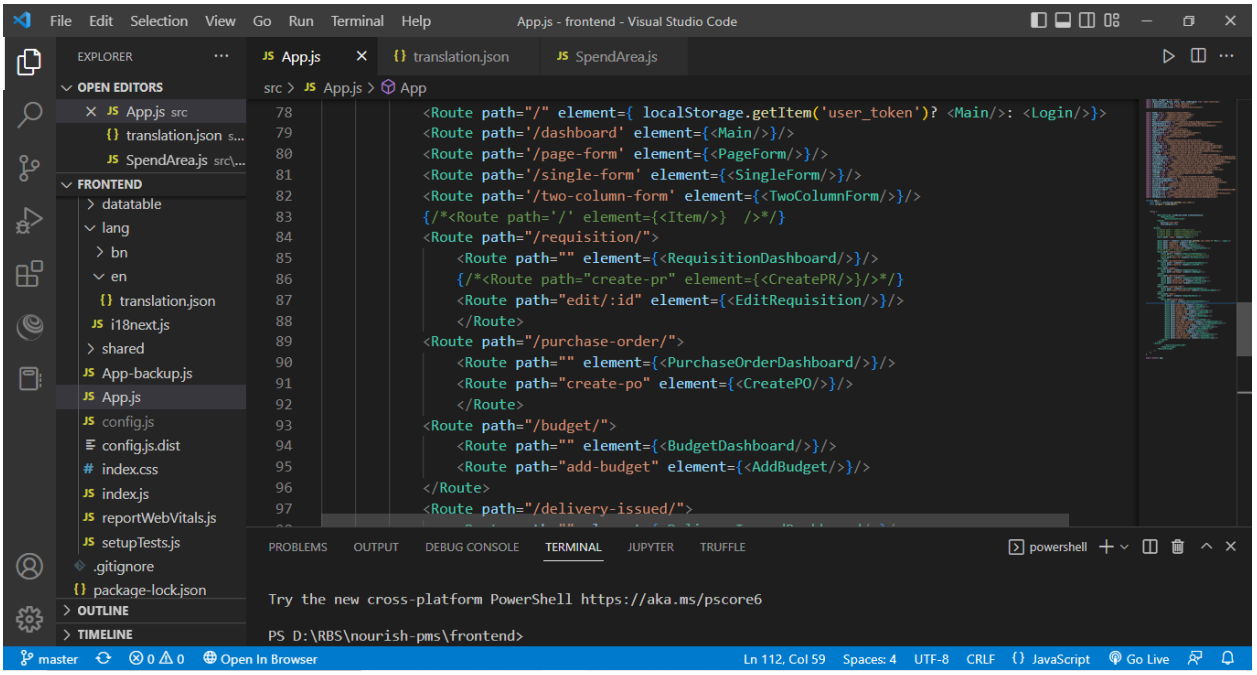


Figure 9: Code of routing in local host of Purchase Management System

5.6 Testing

The process of testing software is conducted to ensure that the system is running smoothly and the output is what the system was intended to do. Approval refers to the process of verifying that the generated computer software fits the clients' requirements. The main goal of software testing is to find bugs in the program. The QA Engineer tests the software and conveys the findings to the Web Developer. The testing should be conducted carefully and accurately, and descriptions of test cases are written in detail, so the team understands the flow. Each of the tasks is planned to verify the client's requirements are met successfully. The official testing has not been started yet, hence just the expected test cases are stated as for now. Once it is implemented, we can review the status of test cases.

The table below shows the test cases for Admin:

Table 14: Testing for Admin

Test ID	Test Case	Description
T1	Admin Log In	Admin needs to enter credentials to enter the system.
T2	Master Data CRUD	Admin needs to sign in, then they will go to the Master Data module and will be able to do CRUD operations.
T3	Purchase Requisition View and Approve	Admin will be able to view Purchase Requisitions and will be able to approve/decline them.
T4	Purchase Order View and Approve	Admin will be able to view Purchase Orders and will be able to approve/decline them.
T5	Add Budget	Admin will be able to add new budgets and plan budgets.
T6	Create Vendor	Admin will be able to create new vendors and update existing vendors' details.
T7	Add Supplier	Admin will be able to add new suppliers and update existing suppliers' details.

T8	Add Delivery Item	Admin will be able to add new delivery items.

The table below shows the test cases for Project Manager:

Table 15: Testing for Project Manager

Test ID	Test Case	Description
T1	Project Manager Log In	Project Manager needs to enter credentials to enter the system.
T2	Create Purchase Requisition	After signing into the system, the project manager can create purchase requisitions.
T3	Create Purchase Orders	After signing into the system, the project manager can create purchase orders.
T4	Wait for confirmation from Admin	The project manager gets notification of the admin's decision of approval or decline of the PR and PO.
T5	Track Stock Items	Project Manager will be able to view stock items to Make sure stock is available.
T6	Issue Delivery Items	Once an item is delivered, the project manager will get notified.

Chapter 6

Results & Analysis

The Purchase Management System was regularly updated and feedback from the clients were taken. Majority of the sub-modules of the Master Data have successfully passed the testing. Reports of the testing were provided by the QA Engineer and the bugs and other issues found during testing were updated in PrimeTrack, where the development team had access. For clients, the application is given on a live server. Initially the application was run on a local host. The main struggle with the live server is the fact that the app cannot be refreshed, this issue is still not resolved. The user has to logout and login every time instead of refreshing the app, so this causes trouble, however the back button feature works.

This app can be run in two languages (English and Bengali), the user can simply switch on their preferred language. Below the pictures of some of the working modules are given:

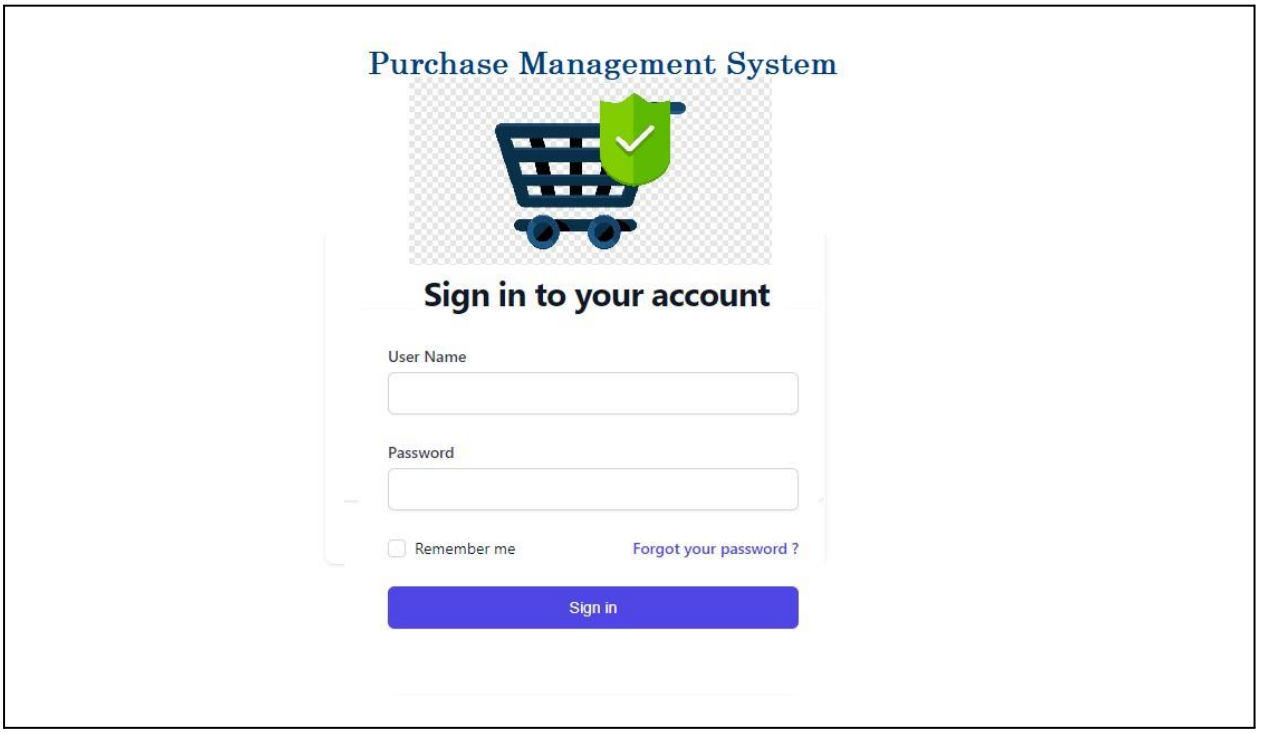


Figure 10: Login page of Purchase Management System

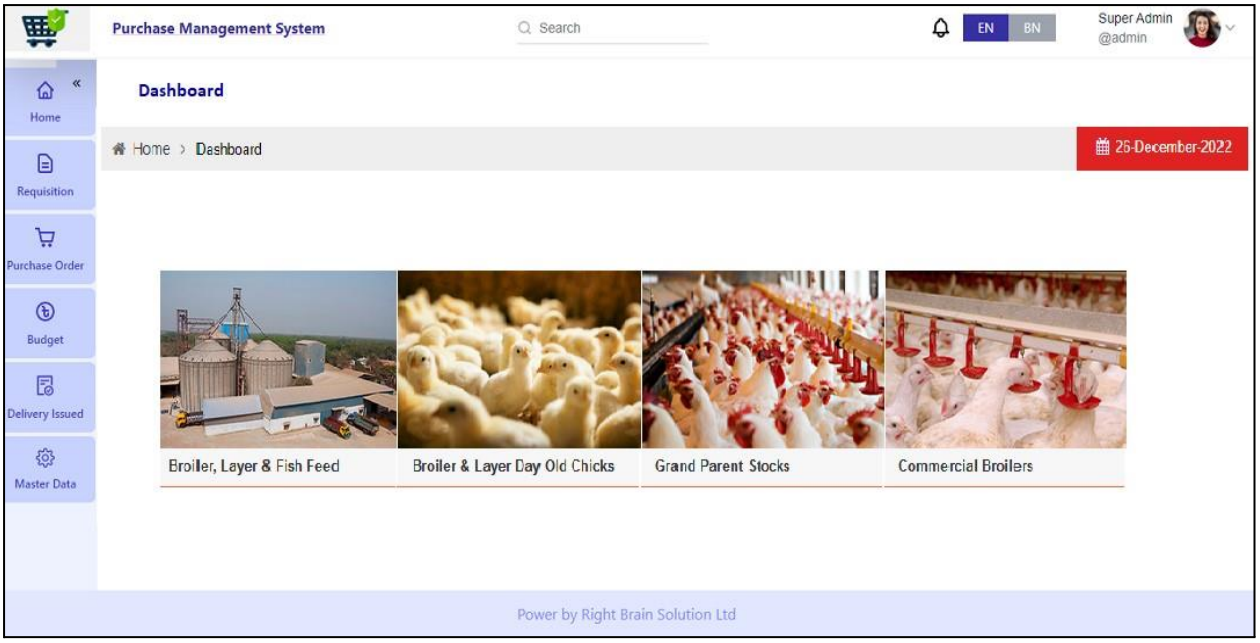


Figure 11: Homepage

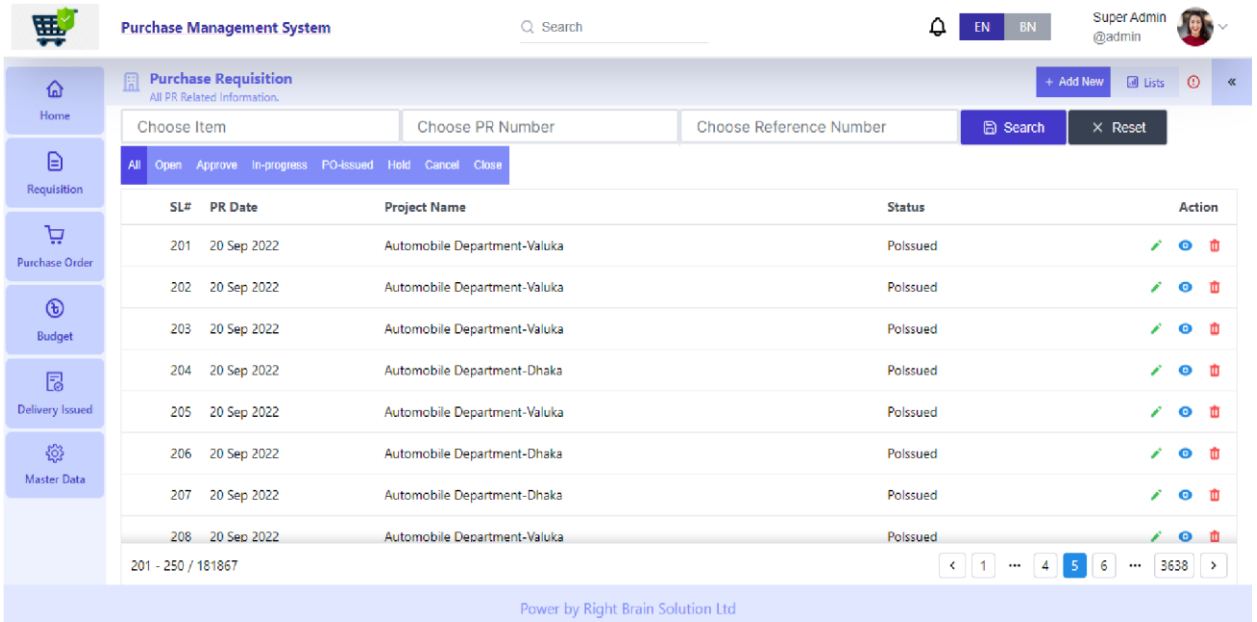


Figure 12: Purchase Requisition Page

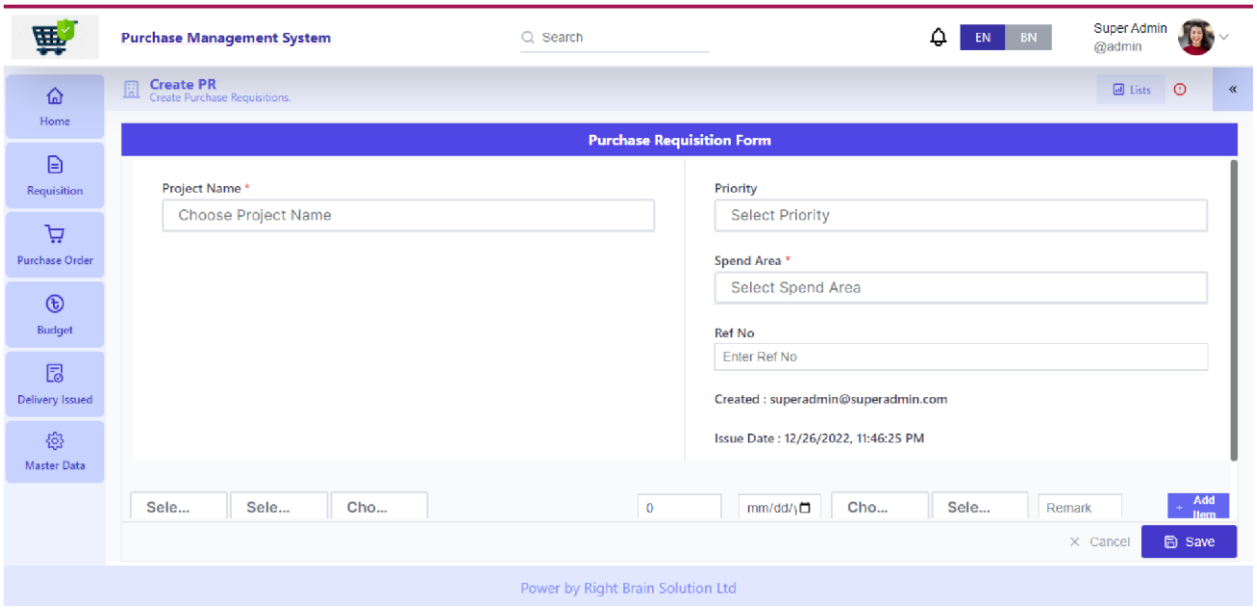


Figure 13: Purchase Requisition Form

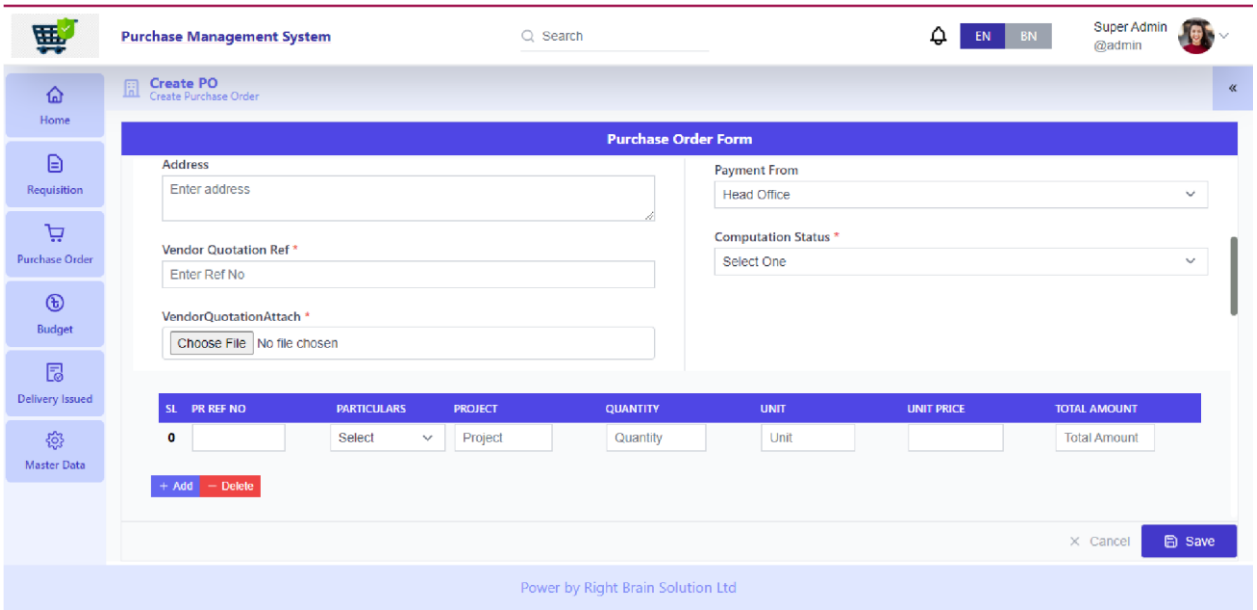


Figure 14: Purchase Order Form- First Half

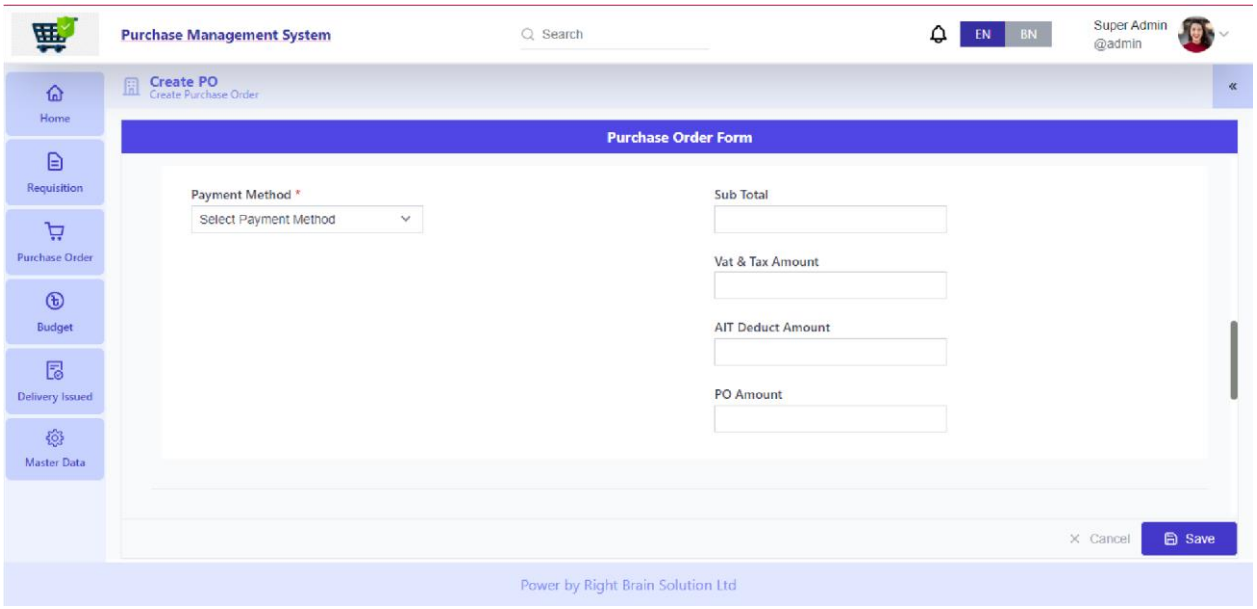


Figure 15: Purchase Order Second Half

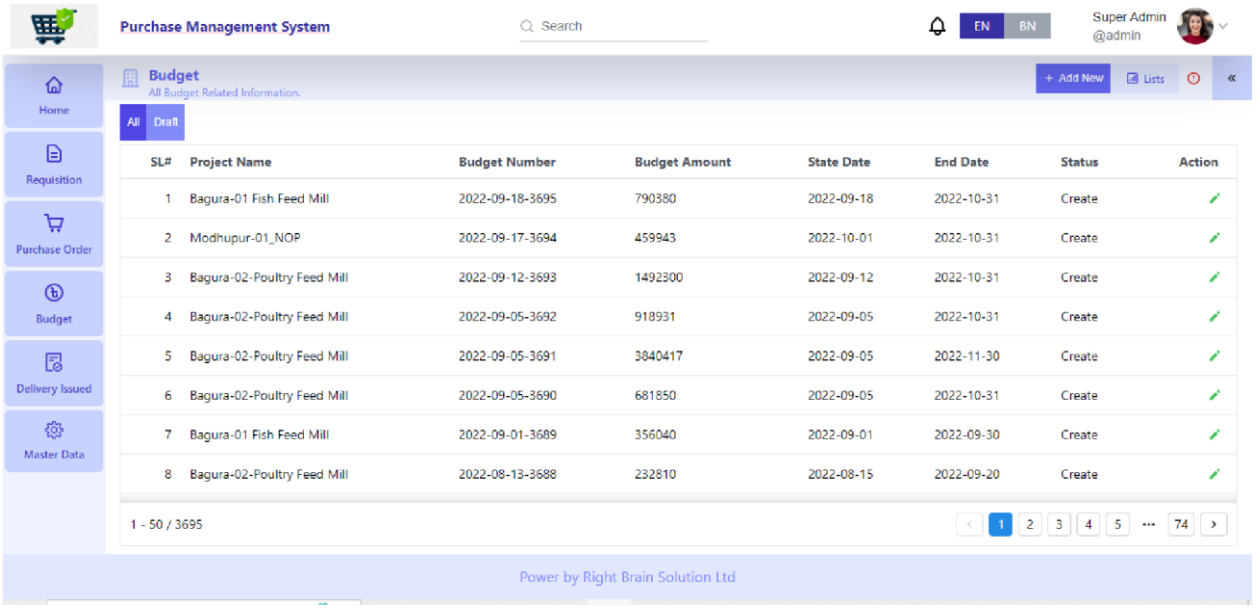


Figure 16: Budget Page

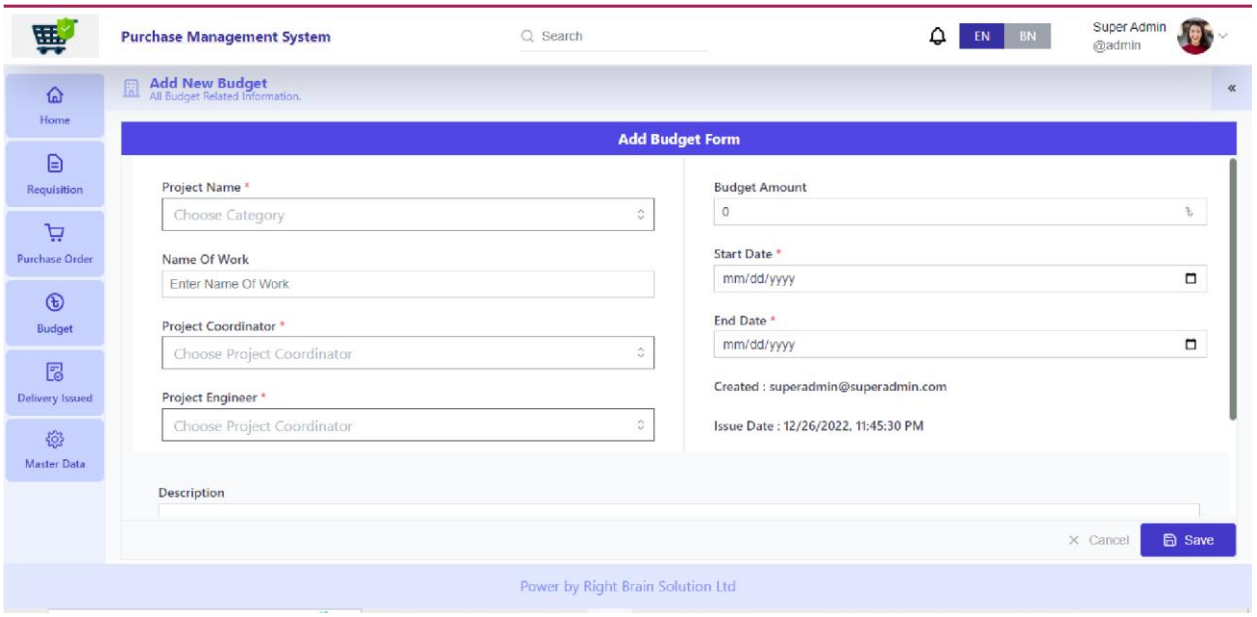


Figure 17: Budget Form

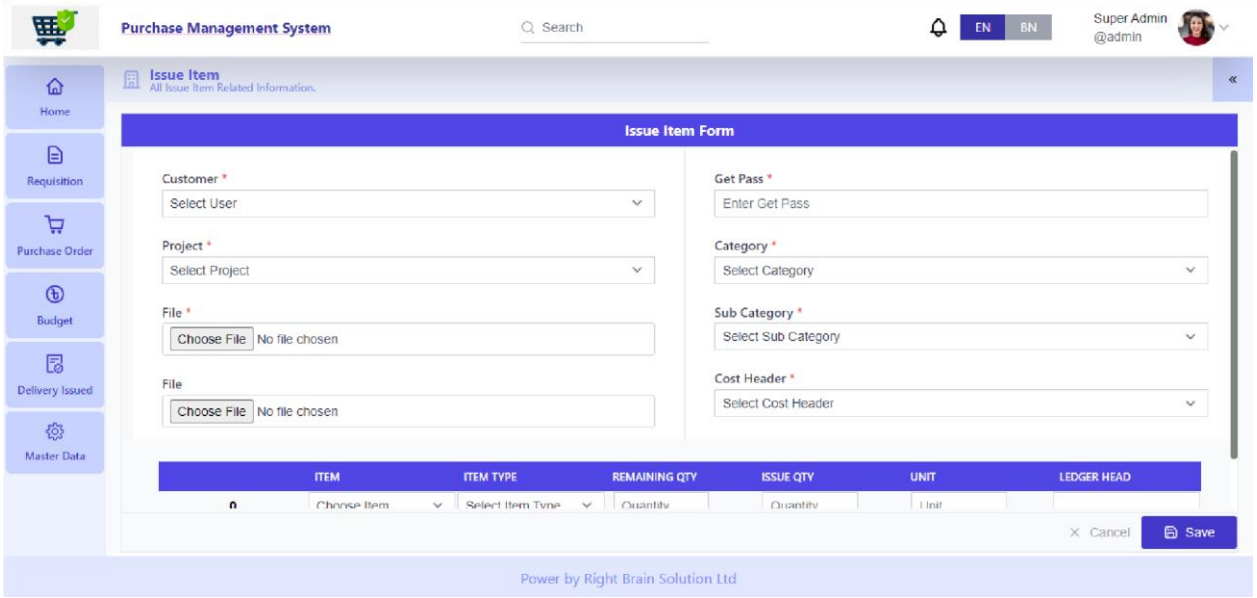


Figure 18: Delivery Issue Form

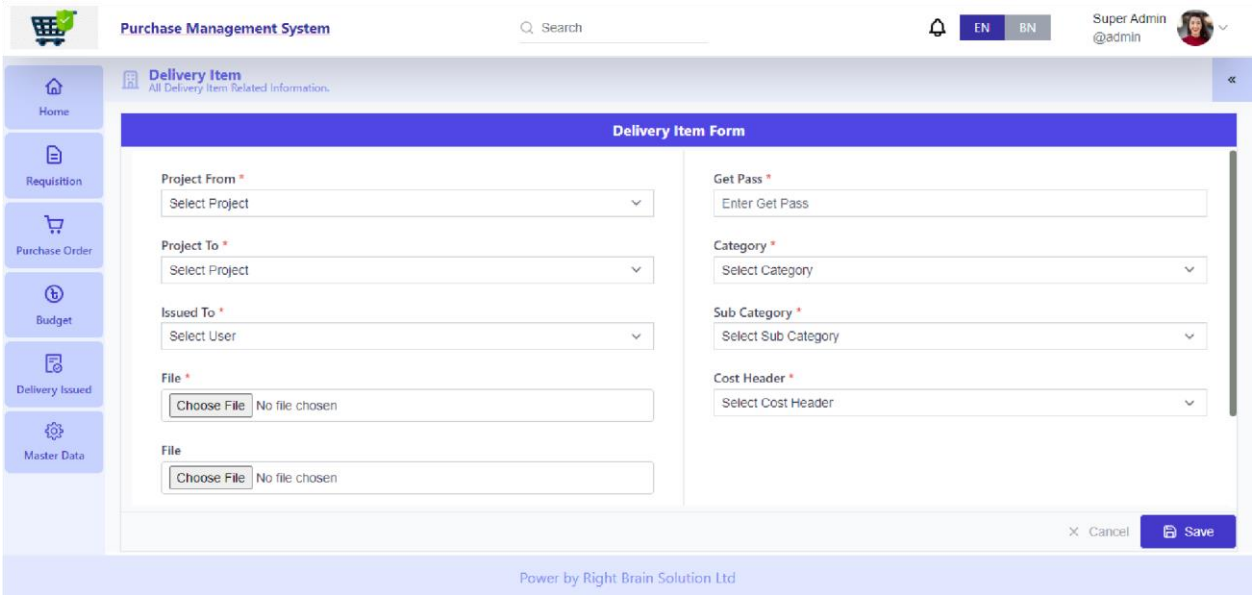


Figure 19: Delivery Item Form

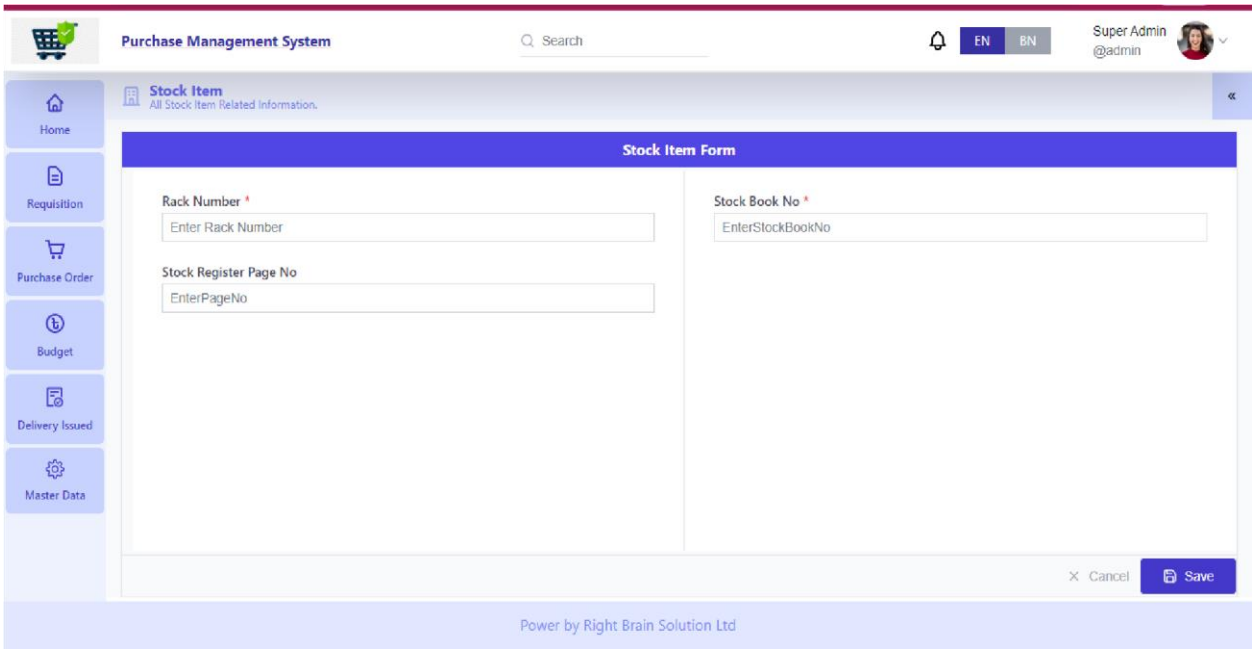


Figure 20: Stock Item Form

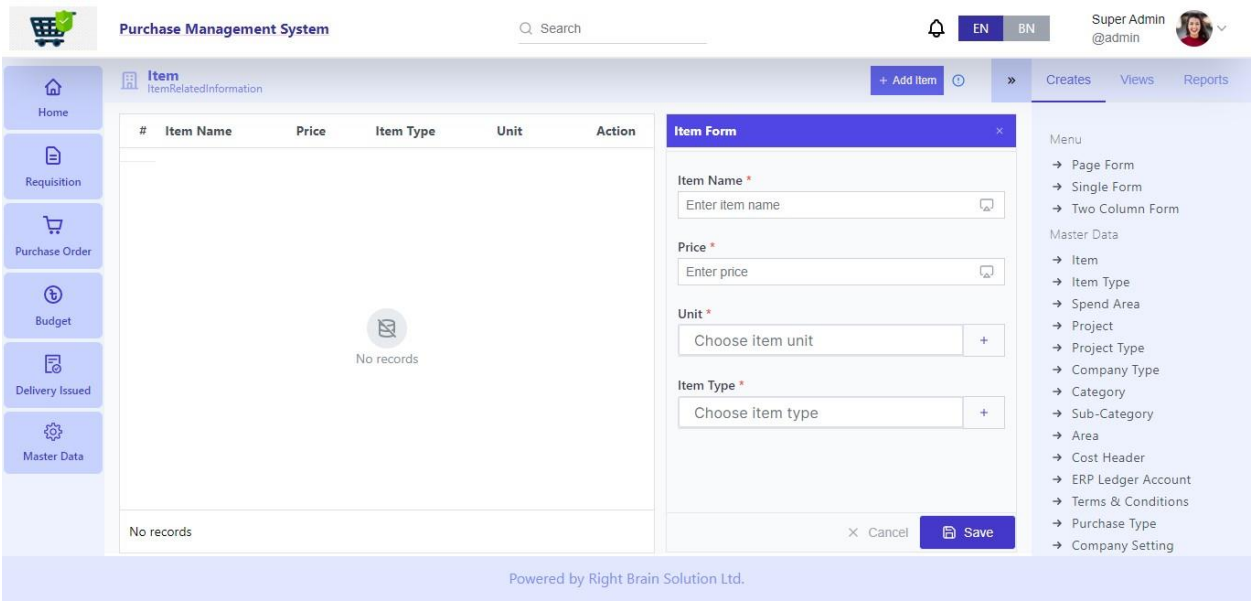


Figure 21: Item Form

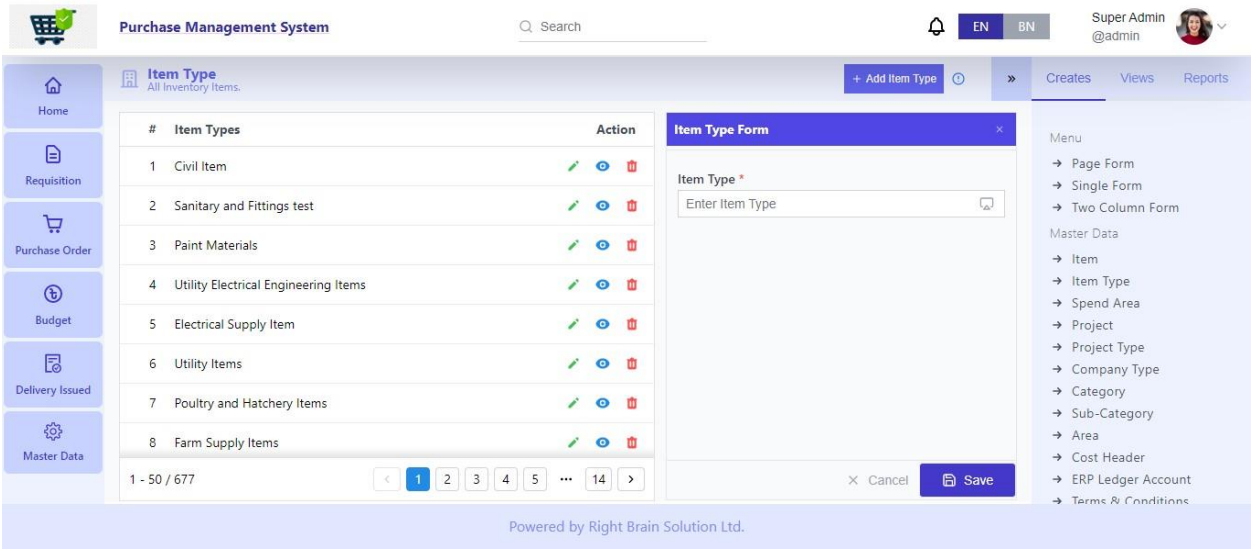


Figure 22: Item Type Form

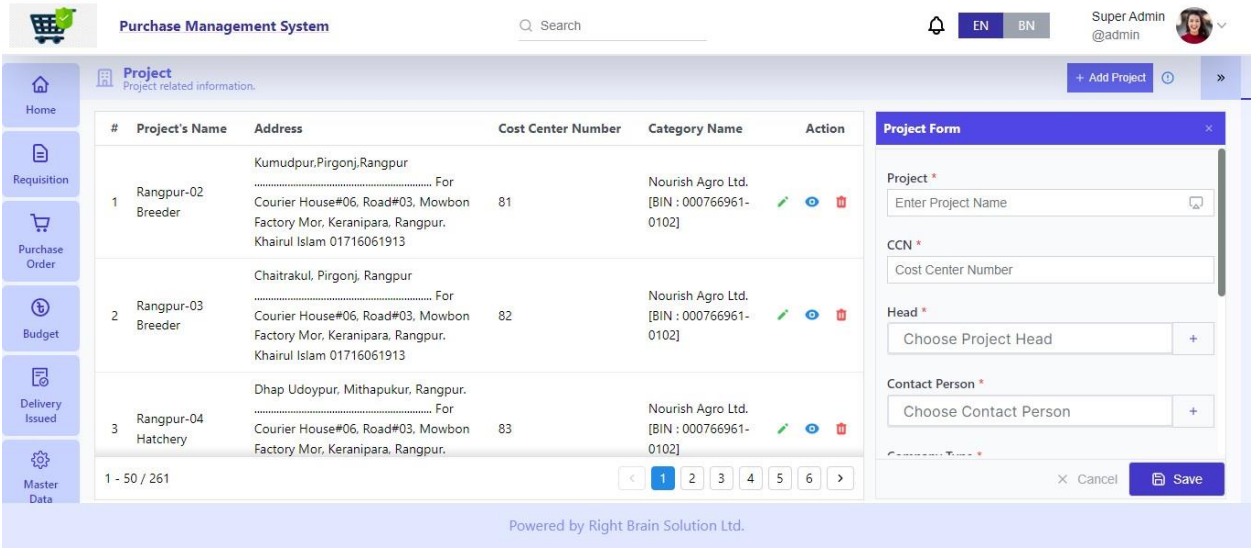


Figure 23: Project Form

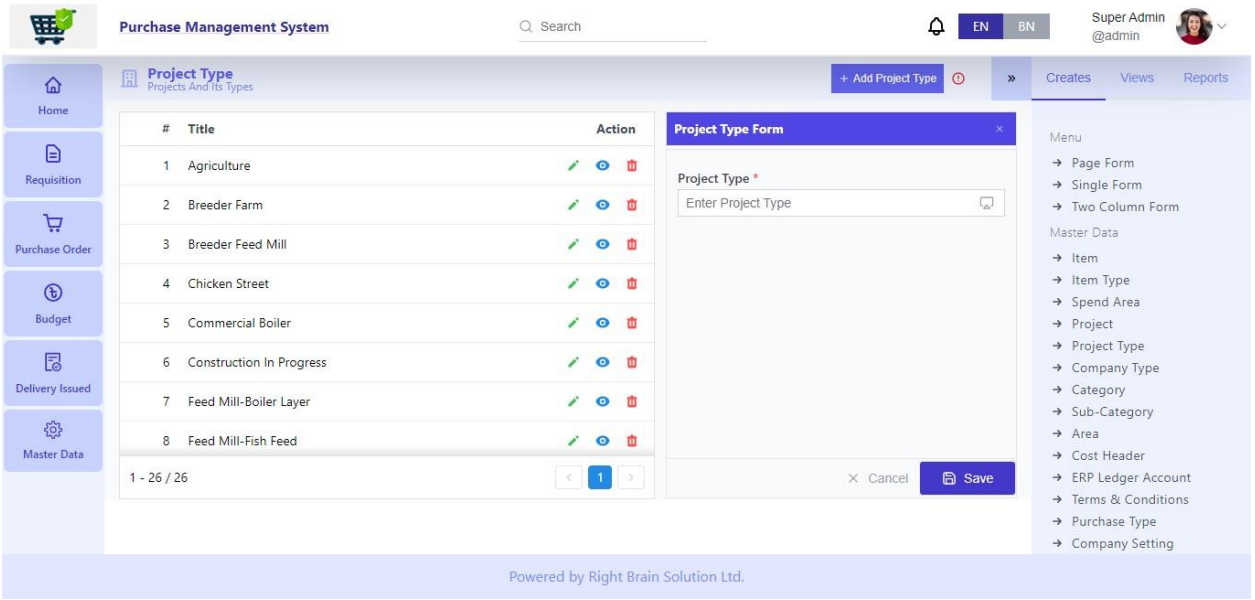


Figure 24: Project Type Form

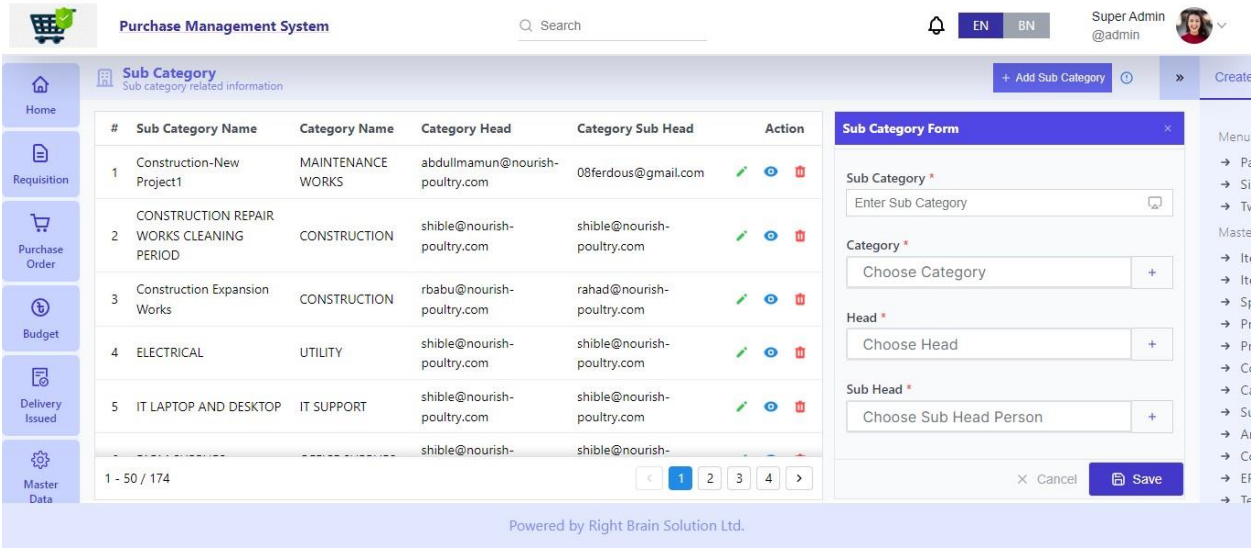


Figure 25: Sub Category Form

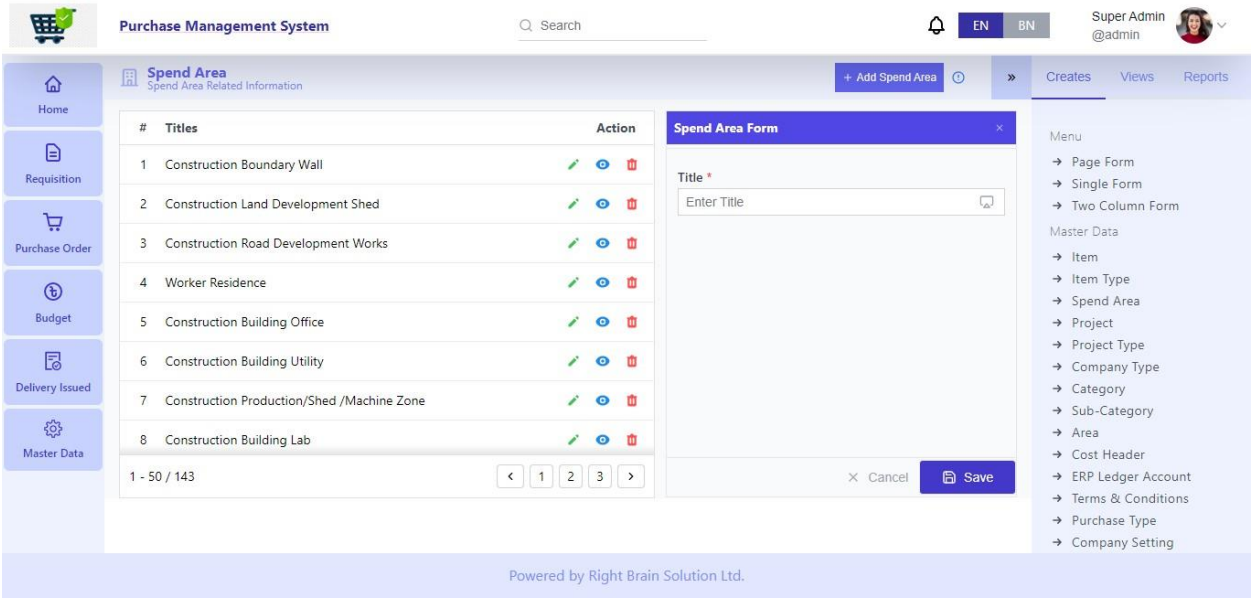


Figure 26: Spend Area Form

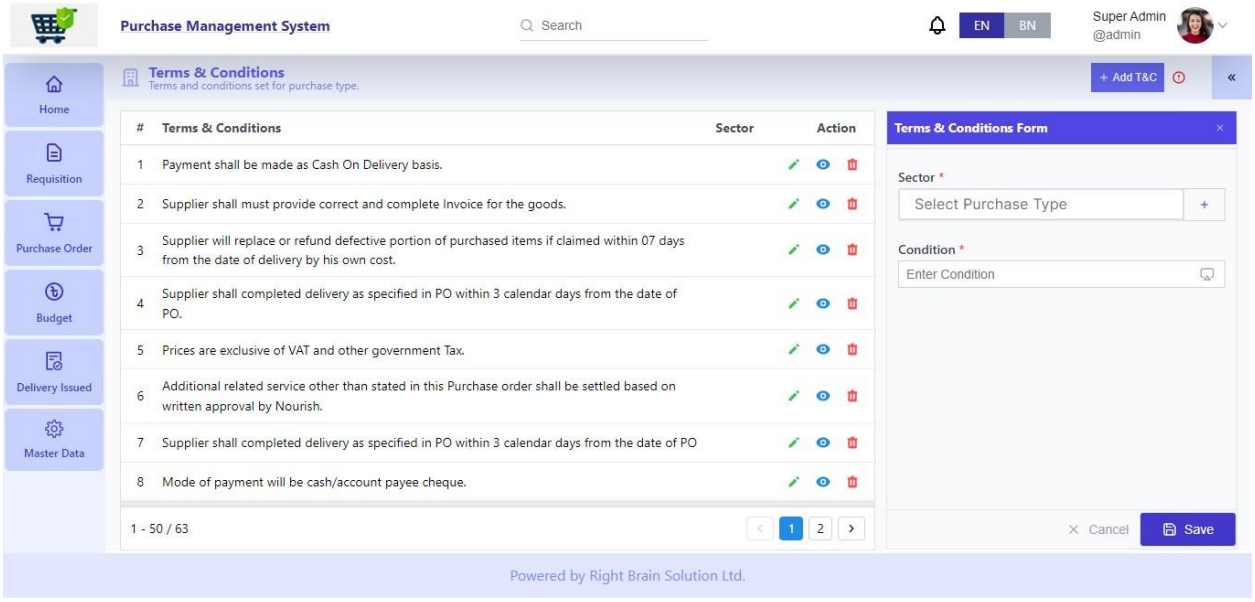


Figure 27: Terms & Conditions Page

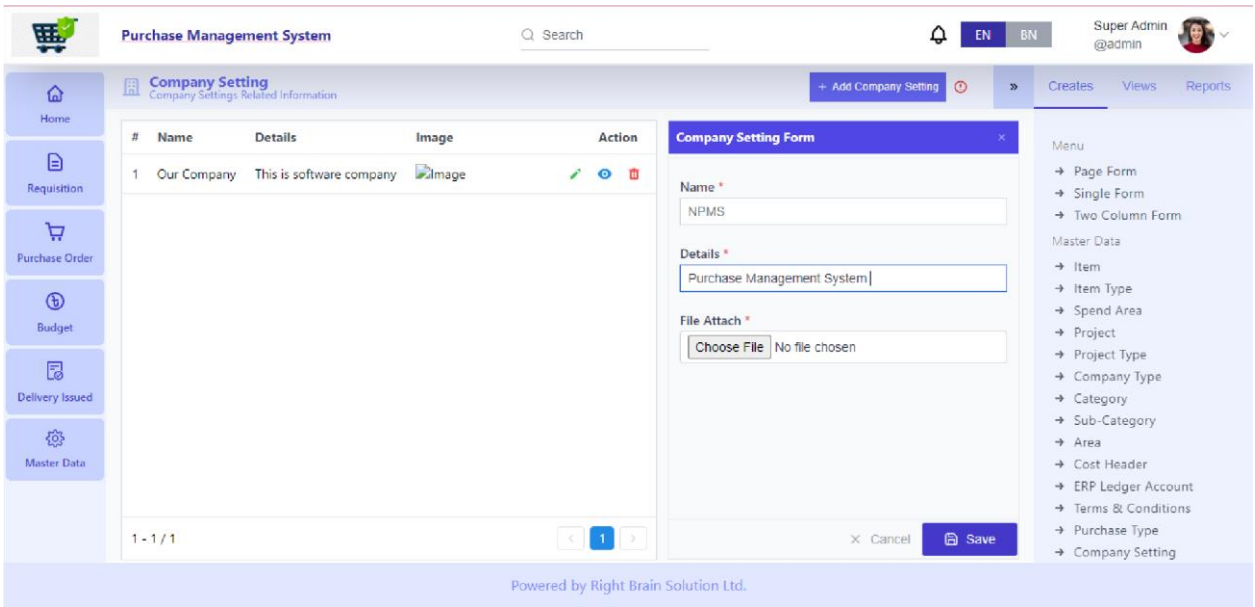


Figure 28: Company Settings Form

Chapter 7

Project as Engineering Problem Analysis

Problem solving is a skill that every engineer should have. This deals with the internal guidance of a problem by analyzing the issues of a project.

7.1 Sustainability of the Project/Work

A product's sustainability is measured in three categories, they are:

Community Sustainability: After the deployment and official release of "Purchase Management System", we believe it will help organizations to maintain their business' supply-chain more efficiently. The client's feedback shows positive response, since the app still has few implementations left, the project is continuously updated.

Organization Sustainability: It refers to how the organization will continue to operate after the release of the application. After the release of an app, the organization usually maintains the system with its current team, an extended team or by a fresh new team. Moreover, organizations update their project by adding newer features to keep it trendy and organization may pivot to other projects, expand the teams, create new teams, etc. Purchase Management System has further plans for new features to be added in the near future, it also has plans to make a mobile application version. Hence, the project will be maintained and updated after its release as well. In conclusion, it can be said that the project is organizationally sustainable.

Financial Sustainability: This indicates how the application's running cost will be maintained after it has been released and whether it will generate enough revenue as acceptable profit. An application's running cost includes - server cost, database storage cost, third party API cost, etc. Since this is a client based project, Purchase Management System already got payment of some amount in advance, total bill will be paid after the completion of the project. Since there is plans to make it a generic app, as the user base grows there are plans to introduce new premium services which will eventually be used to generate revenue.

7.2 Social and Environmental Effects and Analysis

Social Effect: An efficient solution of managing a business' budgets and supply-chain ensures better productivity [8]. The Purchase Management System improves the overall inventory management system and avoids unnecessary expenses.

Environmental Effect: The process of taking orders, making delivery, and waiting for purchase requisition approvals are a hectic process. This app will allow the process to run smoothly without any delay and will help have better time management within the organization. This will also help use less papers as the whole process is updated in the system, so eventually the usage of less paper is beneficial for the environment as well.

7.3 Addressing Ethics and Ethical Issues

Data Security: It is crucial to keep user data secured, so only the senior software developers and project manager have access to the server and the database system. Database is secured with user name and password, without this logging information no one else can have access to the data collection.

Fraud and Identity Theft: Identity theft issues may arise if proper measures are not taken to maintain the system. The website does not allow any other third-party software to the database. Data are from what user provides no other information are stored. There is no option of sign up, hence all the accounts are created by super-admin for the employees of the organization.

No Discrimination: There is no discrimination of any kind based on race, gender, religious views, color, language, political or other opinion, national or social origin, property, citizenship, birth, or other status.

Chapter 8

Lesson Learned

8.1 Problems Faced During this Period

During my internship, there were few challenges that I faced. Below the challenges are noted:

- **Work life and culture:** As this was new for me, adapting to work life was different but gradually this felt like new normal. I struggled to ask for assistance from seniors too.

- **Learning new tech-stack:** technology aspect, I was not fully familiar with React JS, so it took me awhile to grasp its concepts, then Tailwind CSS was a completely new framework that my organization started, in fact my project was the first one that Tailwind CSS was tried upon as experiment. Although learning this new tech stack skill was possible, it became hard to apply them in real life situations.

- **Learning about purchase management:** As I am from an Engineering background, understanding the concept of this app was difficult for me. This app is entirely dependent of knowledge of finances and accountings.

- **Keeping up with deadlines:** Another issue was keeping up with the deadlines, I was struggling in my first month to keep up with my senior colleagues. The workload put quite stress on me. After learning new technologies and applying them in the application was a slow process for me as it was the first time, I have ever used it with an office environment. This affected my progress with the app.

- **Attending Meetings and Deciphering Clients' Needs:** It was difficult to track with the clients' requirements as their demands kept changing, it was sometimes difficult to make last minute changes.

8.2 Solution of those Problems

The solutions of those problems mentioned above are described below:

- **Work life and culture:** After couple of weeks, I adapted to the work schedule, I was punctual and attentive. Gradually, I started asking for assistance from my seniors whenever I faced any problem. This was possible because, whenever I went to them with problem they helped me with it, as this was for the project everyone was helpful to make the project a success for client satisfaction.

- **Learning new tech-stack:** With the support from my supervisor and senior software developers I got to learn to implement those skills that I learned in real-life applications.

- **Learning about purchase management:** Since this app is entirely dependent of knowledge of finances and accountings, so I studied few articles of these concepts to understand the application better.

- **Keeping up with deadlines:** Although initially it was difficult for me to keep up, after the first month I became habitual and handled the deadlines better. I successfully managed to finish my part of the work and my supervisor was happy with my progress too.

- **Attending Meetings and Deciphering Clients' Needs:** I handled this problem by recording the meeting sessions. So when I listened to those recordings repeatedly, some things made more sense and I was able to understand the clients requirements better. As a result made proper documentations before finally coding.

Chapter 9

Future Work & Conclusion

9.1 Future Works

Purchase Management System's first version is initially released, however, few features are yet to be added. Such new features are given by clients, they are:

- Construction Budget
- BOM (Bill Of Materials)
- Goods Received Note
- Users Groups
- Bank Information Store
- Creating Logo For Company

Moreover, there is planning to make a mobile version of the application. Currently, this system is available in two languages (Bengali and English) so more languages are planned to be added.

9.2 Conclusion

This internship has been a wonderful experience for me. I consider myself lucky to have found people who are so patient and kind when it comes to teaching me. I have gotten a huge number of resources and support from the company I worked in. The people here constantly motivated me to complete the project I was involved in. Being the youngest and the least experienced of the bunch, I got a lot of advice from the people of the company. I also learned the uses of tools and techniques for developing a project.

Last but not least, I would like to convey my gratitude to both my internal and external supervisors, whose guidance and motivations have allowed me to be successful in completing the project and writing this report.

Bibliography

[1] Melanie (2021) Purchase management: What is it and why does it matter?, Unleashed Software. Available at: https://www.unleashedsoftware.com/blog/purchase-management-matter

[2] Vecchio, W.by L.D. (2022) *Purchasing process: Definition, steps, and best practices*, *Planergy Software*. Available at: https://planergy.com/blog/purchasing-process/

[3] *Erequisition™* . Available at: https://www.erequisition.com/pricing (Accessed: January 29, 2023).

[4] *Procurement and purchasing software Procurify*. Available at: https://www.procurify.com/ (Accessed: January 29, 2023).

[5] *Purchasing software: Create purchase orders ProcurementExpresscom*. Available at: https://www.procurementexpress.com/ (Accessed: January 29, 2023).

[6] *Procurement software* (no date) *Fraxion*. Available at: https://www.fraxion.biz/ (Accessed: January 29, 2023).

[7] *All-in-one purchasing platform* (no date) *Teampay*. Available at: https://www.teampay.co/ (Accessed: January 29, 2023).

[8] Bruneaux, T. (2022) "What is procurement management, and why is it important?," *Vendr*, 14 July. Available at: https://www.vendr.com/blog/procurement-management.

Consent Form

Web Application Development of "Purchase Management System" at Right Brain Solution Ltd.

By

Jannatul Nawar

Student ID: **1830008**

Autumn, 2022

Consent from Supervisor

The student modified the internship final report as per the recommendations made by her academic supervisor and/or panel members during and/or before final viva, and the department can use this version for archiving as well as the OBE course material for CSE499.

30.01.2022

(Signature of the Supervisor)

Md. Mahmudul Kabir Peyal
Department of Computer Science & Engineering
Independent University, Bangladesh