A MAJOR PROJECT REPORT

ON

PORTAL FOR NEEPCO PROCUREMENT PROCESS AND VENDOR PAYMENT DETAILS

Submitted

to

JAWAHARLAL NEHRU TECHNOLOGY UNIVERSITY HYDERABAD

(In partial fulfillment of the requirements for the award of bachelor degree) In

COMPUTER SCIENCE AND ENGINEERING

Submitted

by

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CERTIFICATE

This is to certify that the project report entitled **" PORTAL FOR NEEPCO PROCUREMENT PROCESS AND VENDOR PAYMENT DETAILS"** that is being submitted by **Komminni Umadevi(21QM1A0558), Alli Sravani(21QM1A0505), Bobbili Sandeep(21QM1A0523), Venkat Tharun(21QM1A0560), Trilokeshwar Rao(21QM1A0551)** under the guidance of **Dr. Raghu Kumar L** with fulfillment for the award of the Degree of **Bachelor of Technology in Computer Science and Engineering** to the **Jawaharlal Nehru Technological University.** It is a record of bonafide work carried out under my guidance and supervision. The results embodied in this project report have not been submitted to any other University or Institute for the award of any graduation degree.

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ACKNOWLEDGEMENT

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DECLARATION

This is to certify that the major project titled **"PORTAL FOR NEEPCO PROCUREMENT PROCESS AND VENDOR PAYMENT DETAILS"** (Ensures proper case scheduling) is a bonafide work done by us in fulfillment of the requirements for the award of the degree **Bachelor of Technology** in **Computer Science and Engineering submitted, to the Department of C.S.E, KG Reddy College of Engineering and Technology**, Chilkur, Moinabad, Hyderabad.

We also declare that this project is a result of our effort and has not been copied or intimated from any source. Citations from any websites are mentioned in the bibliography. This work was not submitted earlier at any other university for the award of any degree.

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ABSTRACT

NEEPCO is facing significant challenges in effectively managing its procurement processes and vendor payments, leading to inefficiencies and delays that impact operational effectiveness and vendor relationships. A critical concern is the inadequate support for Micro and Small Enterprises (MSEs) within the procurement framework, along with the complexities associated with purchases made through the Government e-Marketplace (GeM) portal. The lack of a streamlined and transparent system hinders the organization's ability to capture and manage essential procurement data, compromising its operational efficiency and commitments to vendors and stakeholders. To address these issues, a comprehensive solution is proposed, focusing on enhancing procurement processes, improving support for MSEs, and fostering better relationships with supplier

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List of Abbreviations

S.NO	List of Abbreviations	Meaning
1	NEEPCO	North Eastern Electric Power Corporation
2	MSEs	Micro and Small Enterprises
3	GeM	Government e-Marketplace
4	ERPS	Enterprise Resource Planning Systems
5	SDLC	Software Development Lifecycle
6	RAD	Rapid Application Development
7	IDE	Integrated Development Environment
8	RAM	Random Access Memory
9	UI	User Interface
10	API	Application Programming Interfaces
11	HTTPS	Secure Hypertext Transfer Protocol
12	VPN	Virtual Private Network
13	KPI	Key Performance Indicators
14	UML	Unified Modeling Language

CHAPTER - 1

INTRODUCTION

1. INTRODUCTION

1.1 Basic Introduction

The management of procurement and vendor payment processes for large organizations like the North Eastern Electric Power Corporation (NEEPCO) demands a high level of organization, transparency, and efficiency. To improve operational efficiency and streamline procurement workflows, NEEPCO aims to implement a comprehensive online portal. This portal will modernize traditional procurement processes, eliminating the need for manual paperwork and spreadsheets, which are often time-consuming and prone to error. By centralizing and automating procurement and payment functions, NEEPCO can better serve its vendors, ensure compliance, and optimize resources, thus enhancing operational efficiency.

1.2 Purpose

The purpose of the NEEPCO Portal is to create a unified and transparent platform that simplifies vendor management, procurement tracking, and payment processing. This online system will allow for real-time tracking of procurement activities, especially those involving Micro and Small Enterprises (MSE) and Government e-Marketplace (GeM) transactions. By offering a structured and automated approach to procurement, NEEPCO can allocate resources more effectively, reduce administrative burdens, and improve coordination among departments. The portal is intended to promote accountability, reduce processing delays, and provide a user-friendly interface for all stakeholders involved.

1.3 Scope

The NEEPCO Portal encompasses all procurement and vendor payment processes, with a particular focus on purchases made from MSEs and through the GeM portal. It aims to offer tools for managing the entire procurement lifecycle, including vendor registration, purchase orders, invoicing, and payment status tracking. This system will ensure transparency and compliance by providing detailed reports and data for auditing and analysis purposes. Additionally, the portal will streamline interdepartmental communications, improve record-keeping, and enhance visibility into procurement metrics.

1.4 Goals

1. **Resource Optimization**:

By centralizing procurement data and processes, the portal will help NEEPCO allocate resources—such as staff, time, and budget—more effectively. The system's streamlined workflow will direct resources where they are most needed, minimizing redundancies and allowing the procurement team to focus on high-priority tasks.

2. **Timely Procurement and Payment Processing:**

A primary goal of the portal is to expedite procurement and vendor payment processes. By automating approval workflows and integrating with existing financial systems, the portal will reduce delays, allowing for faster vendor payments and a smoother procurement cycle.

3. **Transparency and Compliance:**

To promote fairness and compliance, the portal will provide a transparent procurement framework that is accessible to relevant departments and vendors. This ensures that all procurement activities adhere to NEEPCO's standards and regulatory requirements, reducing the risk of discrepancies and fostering trust with vendors.

4. **Improved Record Management:**

The portal will offer advanced tools for storing, managing, and tracking procurement records. Automated data tracking and reporting capabilities will improve record-keeping accuracy, reduce paperwork, and facilitate better data analysis.

5. **Continuous Improvement:**

The portal will allow for continual updates and enhancements, adapting to changes in procurement policies, industry standards, and user feedback. This commitment to continual improvement will help NEEPCO stay responsive to evolving needs and incorporate best practices over time.

1.5 Features of Our Project

- **Automated Vendor Registration and Classification:** Enables efficient registration of vendors, categorizing them based on criteria such as business size, product specialization, and MSE status. This facilitates a more tailored approach to managing vendor relationships.
- **Customizable Procurement Workflows**: The portal supports customizable workflows for different procurement scenarios, including those specific to MSE and GeM purchases. This allows for more flexible and efficient procurement pathways.
- **Real-Time Purchase Order and Payment Tracking**: Vendors and NEEPCO staff can access real-time updates on purchase orders and payment statuses, enhancing transparency and reducing follow-up inquiries.
- **Integrated Financial Tools**: Financial tools within the portal will streamline invoicing, payment processing, and budget management, ensuring that all financial transactions align with NEEPCO's accounting protocols.
- **Advanced Reporting and Analytics**: Built-in reporting and analytics will allow users to generate reports on procurement activities, vendor performance, and compliance metrics. This helps NEEPCO evaluate procurement efficiency and make data-driven decisions.
- **User-Friendly Interface with Role-Based Access Control**: The portal will feature an intuitive design with access controls tailored to various user roles (e.g., procurement officers, finance department staff, vendors), ensuring security and ease of use.
- **Continuous Evaluation and Feedback Loop**: Regular feedback from stakeholders and system audits will guide iterative improvements, keeping the portal aligned with best practices and organizational goals.

CHAPTER - 2

SYSTEM ANALYSIS

2. SYSTEM ANALYSIS

2.1 Existing System

Currently, NEEPCO's procurement and vendor payment processes are managed manually or through outdated software tools. These systems often lack integration, which can lead to inefficiencies, such as delayed payments, poor record-keeping, and limited transparency. Vendor information, purchase order tracking, and payment status are tracked through spreadsheets and standalone applications that are cumbersome to maintain and prone to errors. This decentralized approach makes it challenging to ensure compliance, provide real-time updates, and achieve effective collaboration among departments.

2.2 Proposed System

The proposed NEEPCO portal is designed to be a centralized, online platform that enhances transparency, automates procurement workflows, and simplifies vendor payment processes. The system will allow procurement officers, finance staff, and vendors to access relevant information, track orders, and monitor payment statuses in real-time. Key functionalities will include role-based access, automated purchase order generation, real-time notifications, and integrated reporting features. By streamlining these processes, the portal aims to reduce administrative overhead, increase transparency, and improve overall operational efficiency.

2.3 Overall Description

The proposed NEEPCO Portal provides an efficient, structured, and user-friendly approach to procurement and vendor payments. Key elements include:

Customized Workflows: The system offers customizable workflows that allow NEEPCO to handle different procurement types, such as MSE and GeM orders, with appropriate priority levels and processing requirements.

Prioritization: Purchases are classified based on urgency, procurement category, and strategic importance, ensuring timely attention to critical orders.

Resource Allocation: By automating routine tasks and reducing manual intervention, the portal allows for better utilization of resources, minimizing time and cost inefficiencies.

Tracking Mechanisms: A robust tracking feature helps users monitor each purchase order and payment at various stages of processing, enhancing accountability and transparency.

Specialized Modules: Dedicated modules for financial transactions, vendor management, and procurement analytics ensure that each area receives the appropriate attention and expertise.

2.4 Feasibility Study:

To ensure the viability of the NEEPCO Portal, a comprehensive feasibility study is necessary to assess the project's economic, technical, operational, and scheduling aspects.

2.4.1 Technical Feasibility:

- **Evaluation of Requirements**: The portal requires a secure, web-based platform compatible with the existing infrastructure at NEEPCO.
- **Compatibility**: Integration with existing financial and ERP systems will be evaluated to enable smooth data sharing and continuity in operations.
- **Infrastructure Needs**: Necessary hardware and software upgrades, as well as a robust database system, are considered to ensure the portal's functionality and performance.

2.4.2 Economic Feasibility:

- **Financial Assessment**: A cost analysis will examine initial development expenses, infrastructure upgrades, and ongoing maintenance.
- **Cost-Benefit Analysis**: The investment is weighed against anticipated benefits, such as reduced administrative costs, faster payment cycles, and improved procurement efficiency.

2.4.3 Operational Feasibility:

- **Workflow Integration**: The portal is designed to integrate seamlessly with NEEPCO's existing processes, ensuring minimal disruption.
- **User Readiness**: Training sessions and user support mechanisms are planned to prepare staff for adopting the new system.
- **Challenges**: Identifying and addressing potential operational challenges, such as user resistance and process adjustments, are prioritized.

2.4.4 Schedule Feasibility:

- **Timeline Development**: A realistic implementation timeline is established, including critical milestones and dependencies.
- **Risk Assessment**: Potential scheduling constraints are considered to ensure timely completion, such as resource availability or required approvals.

2.5 SDLC Model:

For the NEEPCO Portal, an Agile methodology is recommended due to its flexibility, iterative nature, and ability to adapt to changing requirements. Agile, particularly methodologies like Scrum or Kanban, is suitable for this project as it encourages collaboration with stakeholders, regular feedback loops, and the rapid delivery of incremental improvements.

- **Scrum**: This approach, with its structured sprints and regular feedback, is ideal for iterative development. Scrum allows for frequent releases, enabling stakeholders to review and provide feedback throughout the development process, ensuring the portal meets their needs effectively.
- **Kanban**: For tasks requiring high flexibility and ongoing updates, Kanban offers a visualized workflow and limits work in progress, allowing for continuous delivery and faster resolution of issues.

Additionally, elements from other SDLC models, such as Rapid Application Development (RAD) for prototyping and the Waterfall model for initial requirements gathering, may be incorporated to further tailor the Agile process to the project's unique demands.

Benefits of Agile for the NEEPCO Portal:

1. **Flexibility:** Agile adaptability allows the team to respond to changing needs and priorities, essential for a project with diverse stakeholders and evolving requirements.
2. **Iterative Development:** Incremental functionality delivery enables stakeholders to validate features early on, ensuring alignment with user expectations.
3. **Stakeholder Engagement:** Regular communication with procurement officers, finance teams, and vendors ensures that the portal is designed with end-user input, leading to higher satisfaction and usability.
4. **Reduced Risk:** Incremental task breakdowns and iterative development reduce project risks by identifying issues early, minimizing rework, and avoiding large-scale project failures.
5. **Improved Transparency:** Visualizing project progress in tools like Scrum boards or Kanban boards keeps all stakeholders informed, promoting trust and alignment with development objectives.

6. **Continuous Improvement:** Agile retrospectives after each sprint encourage continuous refinement of the development process, enhancing both efficiency and quality over time.
7. **Enhanced Team Collaboration:** Agile's focus on collaboration and self-organization empowers team members, encouraging innovation and effective problem-solving.
8. **Faster Time-to-Market:** Agile methodologies enable more frequent delivery of working software, allowing NEEPCO to realize benefits from the portal sooner while continuing to build on and improve the system.

CHAPTER - 3

SYSTEM REQUIREMENT SPECIFICATIONS

3. SYSTEM REQUIREMENT SPECIFICATIONS

3.1 Software Requirements

Tools:

- Operating System: Windows, Linux, or macOS.
- Database Management System: Supabase.
- A web hosting Server.
- Programming Languages: JavaScript (for both frontend and backend).

Frameworks and Libraries:

- Express.js (Node.js web framework).
- React.js (JavaScript library for building user interfaces).
- Browser Compatibility: Chrome, Firefox, Edge, Safari.

Development Tools:

- Integrated Development Environment (IDE) such as Visual Studio Code.
- Version control system (e.g., Git).
- Package Manager: npm (Node Package Manager)

3.2 Hardware Requirements

- A web server with a minimum of 1GB of RAM and 10GB of disk space
- A database server with a minimum of 1GB of RAM and 10GB of disk space
- A development workstation with a minimum of 4GB of RAM and 50GB of disk space

3.3 Communication Interfaces:

User Interface (UI):

- Web-based graphical user interface accessible via standard web browsers.
- Responsive design to support desktop, tablet, and mobile devices.

Application Programming Interfaces (API):

- **RESTful APIs**: Enable integration with existing procurement and financial systems and potential third-party applications.
- **Authentication and Authorization**: Implement secure API access to protect data and ensure only authorized users can perform operations.

Network Interfaces:

- **Secure HTTP (HTTPS)**: Ensures encrypted communication between clients and servers to maintain data security and user privacy.
- **Virtual Private Network (VPN)**: Supports secure remote access for authorized personnel, especially for offsite access or during network constraints.

CHAPTER - 4

SYSTEM DESIGN

4. SYSTEM DESIGN

4.1 Design Overview

The NEEPCO Procurement Management System is designed as a modular web-based platform to streamline the procurement and vendor payment processes. This design enables efficient handling of procurement requests, vendor registrations, payment tracking, and report generation. It incorporates secure access control, supports integration with external government portals, and provides real-time insights through analytics. The modular architecture ensures scalability, maintainability, and ease of future integration.

4.2 System Architecture

- **Web Server**: Responsible for serving the web pages and handling user interface interactions of the NEEPCO procurement system.
- **Database Server**: Uses MySQL to store procurement data, vendor details, purchase orders, and payment records securely and efficiently.
- **Application Server**: Hosts and executes the application code for the procurement management system, managing requests, processing business logic, and interacting with the database.
- The separation of the web server, database server, and application server enhances scalability, flexibility, and overall system performance.

4.3 Modules Description

User Management:

- Handles user registration, login, and profile management.
- Enforces role-based access control for NEEPCO staff and vendors to ensure secure and authorized data access.

Procurement and Vendor Management:

- Manages procurement requests, vendor registration, purchase order creation, and tracking.
- Supports filtering and categorization for efficient procurement operations and compliance tracking.

GeM Integration:

- Facilitates the tracking of purchases made through the Government e-Marketplace (GeM) portal.
- Ensures compliance with government regulations and maintains records for easy access and reporting.

Payment Processing:

- Tracks vendor invoices and payments, supporting detailed logging of payment status and updates.
- Manages workflows for approving and processing vendor payments.

Reporting and Analytics:

- Generates reports on procurement activities, vendor performance, and compliance metrics.
- Provides data visualization tools to facilitate decision-making and track key performance indicators (KPIs).

4.4 DFD Design:

The DFD represents the flow of data within the NEEPCO Procurement Portal. It includes processes, data stores, data flows, and external entities.

Level 0 DFD (Context Diagram):

Entities: Vendors, Procurement Officers, Admin Users.
Processes: Procurement Management, Vendor Management, Payment Processing.
Data Stores: Vendor Data, Procurement Data, Payment Records.

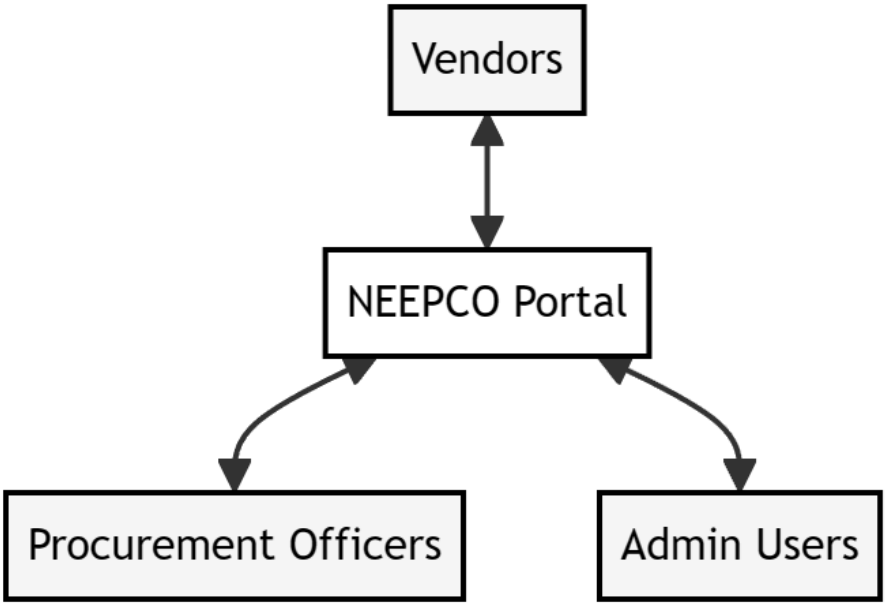

Figure: 4.4.1 Level 0 DFD

- Vendors interact with the NEEPCO Portal for bid submissions and procurement updates.
- Procurement Officers manage tender creation and vendor approvals through the portal.
- Admin Users oversee the entire portal's functioning and data management.

Level 1 DFD:

Processes:

- User Authentication for secure access control.
- Procurement Management for handling procurement requests and tracking.
- Vendor Management for onboarding, monitoring status, and approvals.
- Payment Processing for recording transactions and confirming payments.

Data Flows:

- User credentials flow to the Authentication System for verification.
- Procurement details are managed and tracked within the Procurement Management System.
- Payment records are updated and tracked by the Payment System.

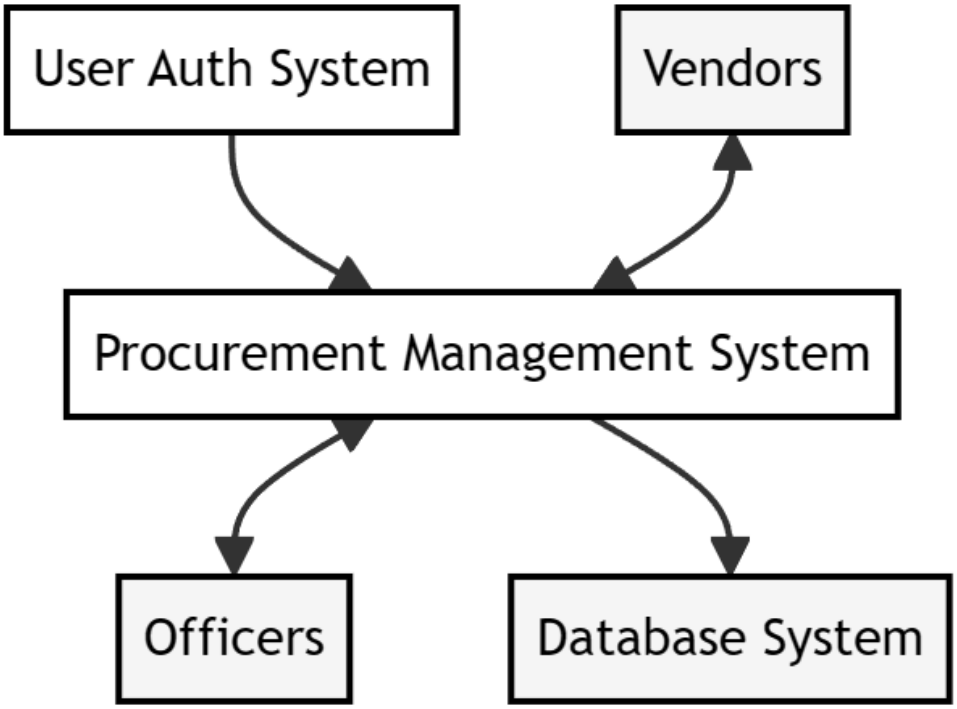

Figure: 4.4.2 Level 1 DFD

- Vendors connect with the Procurement Management System to submit bids and track tender statuses.
- Procurement Officers manage tender creation, vendor approvals, and payments.
- The Database System stores all procurement, vendor, and payment-related data.

Level 2 DFD - Procurement Process

Processes:

- Procurement Officers initiate and manage tender creation.
- Vendors submit bids for available tenders.
- Tenders undergo evaluation to determine suitable vendors.
- The Payment System processes transactions after successful tender evaluation.

Data Flows:

- Tender creation data flows from Procurement Officers to the Tenders process.
- Bid data flows from Vendors to Tenders.
- Evaluation results flow to the Payment System for transaction processing.

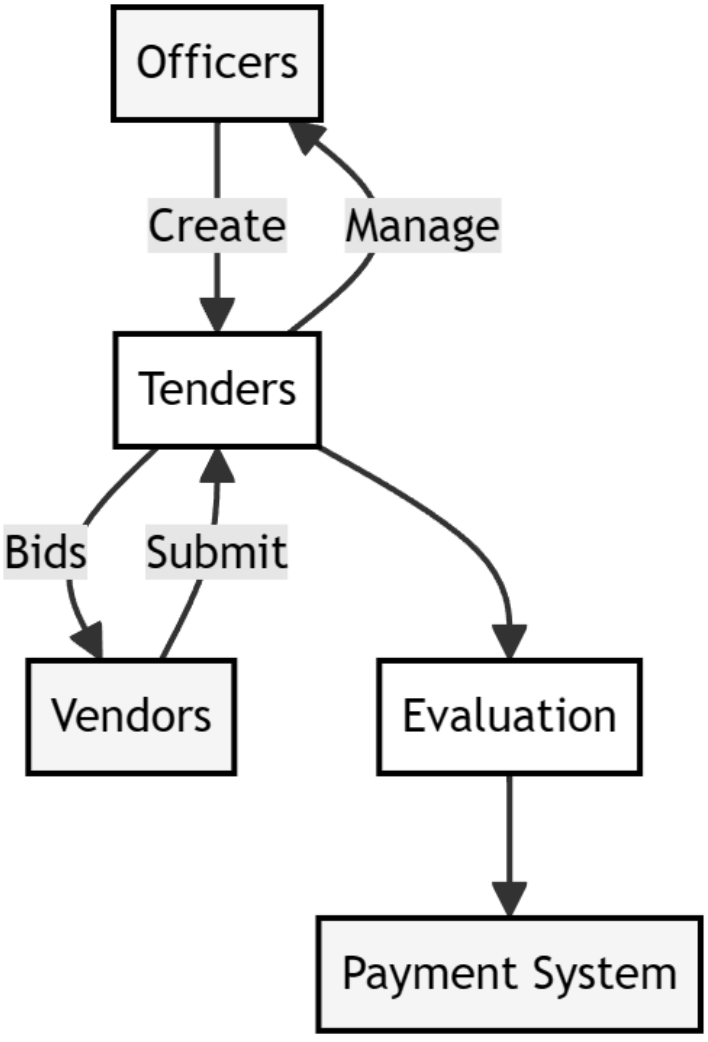

Figure: 4.4.3 Level 2 DFD

Level 3 DFD - Vendor Management

Processes:

- Vendors register on the system.
- Vendor Management handles registration data, status updates, and approvals.
- Approved vendors are granted permission to submit bids.

Data Flows:

- Registration data flows from Vendors to Vendor Management.
- Vendor status updates and approvals are managed within Vendor Management.

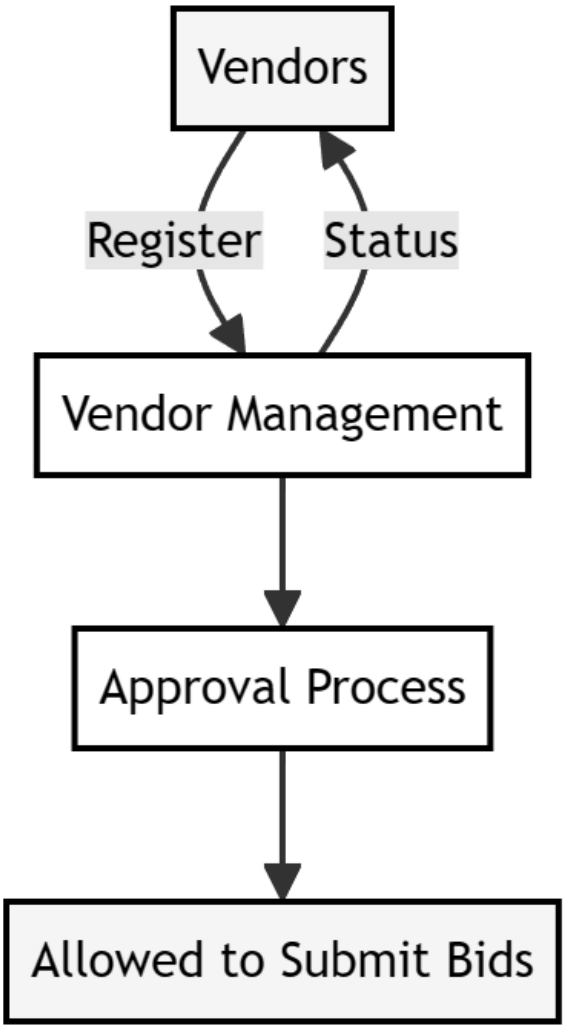

Figure: 4.4.4 Level 3 DFD - Vendor Management

Level 3 DFD - Payment Process

Processes:

- Vendors submit invoices through the Payment System.
- Procurement Officers verify the submitted invoices.
- Payment records are updated and confirmed in the Transaction Records.

Data Flows:

- Payment submission data flows from Vendors to the Payment System.
- Verification data flows between Procurement Officers and the Payment System.
- Payment confirmation data flows from the Payment System back to Vendors.

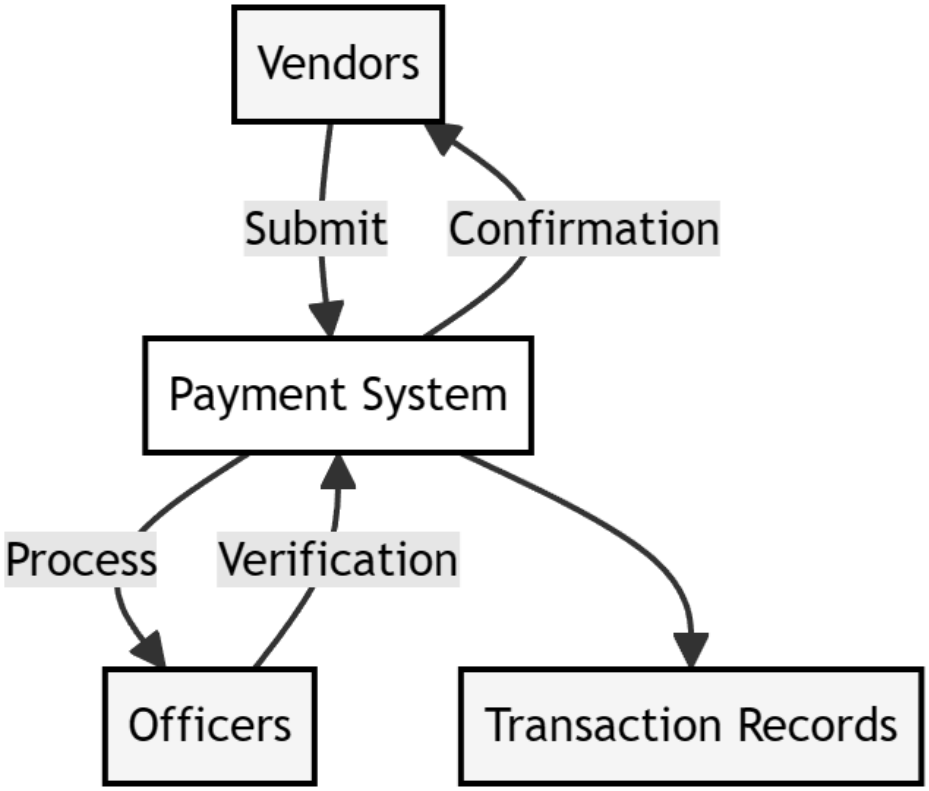

Figure: 4.4.5 Level 3 DFD - Payment Process

4.5 UML Design:

The UML stands for Unified modeling language, is a standardized general-purpose visual modeling language in the field of Software Engineering. It is used for specifying, visualizing, constructing, and documenting the primary artifacts of the software system. It helps in designing and characterizing, especially those software systems that incorporate the concept of Object orientation. It describes the working of both the software and hardware systems.

Goals of UML

- Since it is a general-purpose modeling language, it can be utilized by all the modelers.
- UML came into existence after the introduction of object-oriented concepts to systemize and consolidate object-oriented development, due to the absence of standard methods at that time.
- The UML diagrams are made for business users, developers, ordinary people, or anyone who's looking forward to understanding the system, such that the system can be software or non-software.

UML Building Block

UML is composed of three main building blocks, i.e., things, relationships, and diagrams. Building blocks generate one complete UML model diagram by rotating around several different blocks. It plays an essential role in developing UML diagrams. The basic UML building blocks are listed below:

1. Things
2. Relationships
3. Diagrams

Things and its types

- **Structural Things**
- **Behavior Things**
- **Grouping Things**
- **Annotation Things**

Structural Thing:

Nouns that depict the static behavior of a model are termed as structural things. They display the physical and conceptual components. They include class, object, interface, node, collaboration, component, and a use case.

Class:

A Class is a set of identical things that outlines the functionality and properties of an object.

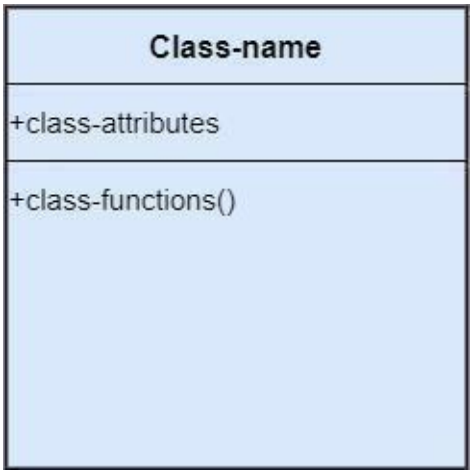

Figure: 4.5.1 Notation of Class

Object: An individual that describes the behavior and the functions of a system. The notation of the object is similar to that of the class; the only difference is that the object name is always underlined and its notation is given below.

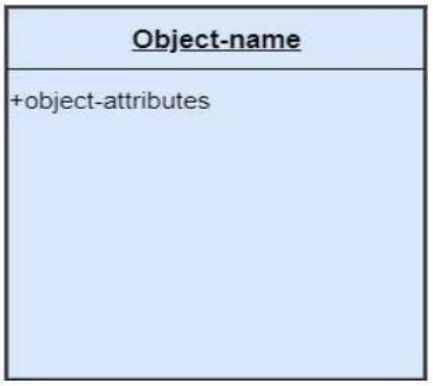

Figure: 4.5.2 Notation of Object

Interface: A set of operations that describes the functionality of a class, which is implemented whenever an interface is implemented.

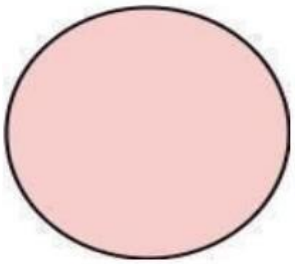

Figure: 4.5.3 Notation of Interface

Use case: The use case is the core concept of object-oriented modeling. It portrays a set of actions executed by a system to achieve the goal.

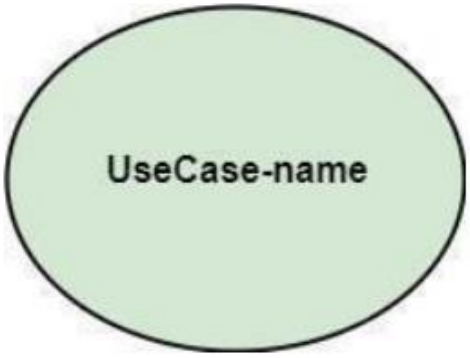

Figure: 4.5.4 Notation of Use Case

Actor: It comes under the use case diagrams. It is an object that interacts with the system, for example, a user.

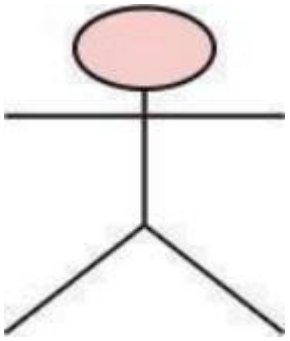

Figure: 4.5.5 Notation of Actor

Behavioral Things

They are the verbs that encompass the dynamic parts of a model. It depicts the behavior of a system. They involve state machines, activity diagrams, Interaction diagrams, grouping things, and annotation of things.

State Machine: It defines a sequence of states that an entity goes through in the software development life cycle. It keeps a record of several distinct states of a system component.

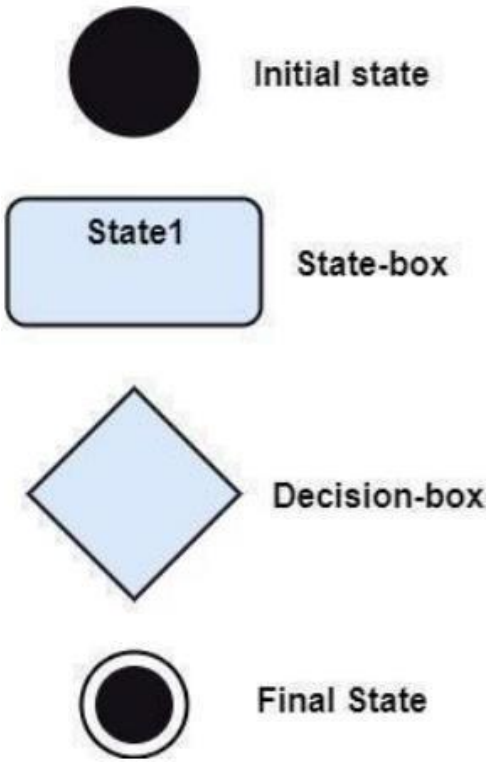

Figure: 4.5.6 State Machine

Activity Diagram: It portrays all the activities accomplished by different entities of a system. It is represented the same as that of a state machine diagram. It consists of an initial state, a final state, a decision box, and an action notation.

Grouping Things

It is a method that together binds the elements of the UML model. In UML, the package is the only thing, which is used for grouping.

Package: The package is the only thing that is available for grouping behavioral and structural things.

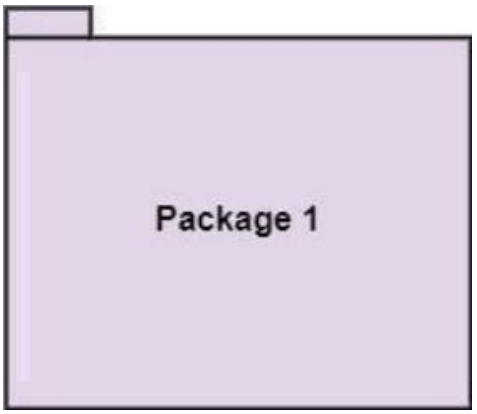

Figure: 4.5.7 Notation of Package

Annotation Things

It is a mechanism that captures the remarks, descriptions, and comments of UML model elements. In UML, a note is the only Annotational thing.

Note: It is used to attach the constraints, comments, and rules to the elements of the model. It's Kind of yellow sticky.

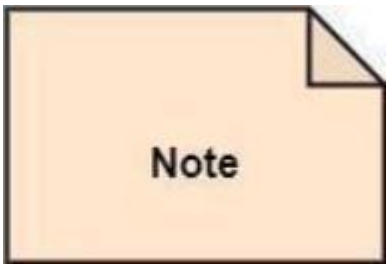

Figure: 4.5.8 Notation of Note

Relationships

It illustrates the meaningful connections between things. It shows the association between entities and defines the functionality of an application. There are four types of relationships given below:

- **Dependency:** Dependency is a kind of relationship in which a change in the target element affects the source element, or simply we can say the source element is dependent on the target element. It is one of the most important notations in UML. It depicts the dependency from one entity to another. It is denoted by a dotted line followed by an arrow on one side as shown below

Figure: 4.5.9 Dependency

- **Association:** A set of links that associates the entities to the UML model. It tells how many elements are taking part in forming that relationship. It is denoted by a dotted line with arrowheads on both sides to describe the relationship with the element on both sides.

Figure: 4.5.10 Association

- **Generalization:** It portrays the relationship between a general thing (a parent class or superclass) and a specific kind of thing (a child class or subclass). It is used to describe the concept of inheritance. It is denoted by a straight line followed by an empty arrowhead at one side.

Figure: 4.5.11 Generalization

- **Realization:** It is a semantic kind of relationship between two things, where one defines the behavior to be carried out, and the other one implements the mentioned behavior. It has interfaces. It is denoted by a dotted line with an empty arrowhead at one side.

Figure: 4.5.12 Realization

DIAGRAMS

- The diagrams are the graphical implementation of the models that incorporate symbols and text. Each symbol has a different meaning in the context of the UML diagram.
- There are thirteen different types of UML diagrams that are available in UML 2.0, such that each diagram has its own set of symbols. Each diagram manifests a different dimension, perspective, and view of the system.

CLASS DIAGRAM

This class diagram represents the structure and relationships of various entities involved in the **NEEPCO Portal**. It outlines the key classes, their attributes, and associations. Below is a detailed explanation:

1. User Class

- **Attributes:** Includes user details such as email, firstName, lastName, role, department, employment status, etc.
- **Relationships:**
  - A **User** can create multiple **Tenders**.
  - A **User** can perform various actions recorded in the **ActionLog**.
  - A **User** also receives **Notifications**.

2. Vendor Class

- **Attributes:** Contains key information such as name, businessType, contact details, mseCertificate, and bankDetails.
- **Relationships:**
  - A **Vendor** has a one-to-one relationship with a **User** (indicating that each vendor has a profile).
  - A **Vendor** submits **Bids** for tenders.
  - A **Vendor** tracks payment details through the **Payment** class.

3. Tender Class

- **Attributes:** Includes details like title, description, category, estimatedValue, submissionDeadline, and status.
- **Relationships:**
  - Each **Tender** is created by a **User**.
  - A **Tender** receives multiple **Bids** and awards one successful **Bid**.
  - Each **Tender** tracks its related **Payments**.

4. Bid Class

- **Attributes:** Contains tenderId, vendorId, amount, status, technicalScore, and documents.
- **Relationships:**
  - Each **Bid** is linked to a specific **Tender** and submitted by a **Vendor**.
  - A winning **Bid** is linked to its corresponding **Tender**.

5. Payment Class

- **Attributes:** Includes payment-related details such as amount, paymentMethod, transactionId, and paymentDate.
- **Relationships:**
  - Each **Payment** is linked to a specific **Tender** and **Bid**.
  - Payments are processed and tracked by the **Vendor**.

6. VendorApprovalLog Class

- **Attributes:** Tracks the approval status of vendors, including previousStatus, newStatus, reason, and approvedBy.
- **Relationships:**
  - Each **VendorApprovalLog** entry corresponds to a **Vendor** and tracks changes in their approval status.

7. ActionLog Class

- **Attributes:** Tracks user actions with details like entityType, entityId, actionType, and details.
- **Relationships:**
  - Each action is linked to a **User**, ensuring accountability for system activities.

8. Notification Class

- **Attributes:** Contains notification details such as type, message, isRead, and relatedId.
- **Relationships:**
  - Each **Notification** is sent to a **User** to alert them about system updates, bid statuses, or tender changes.

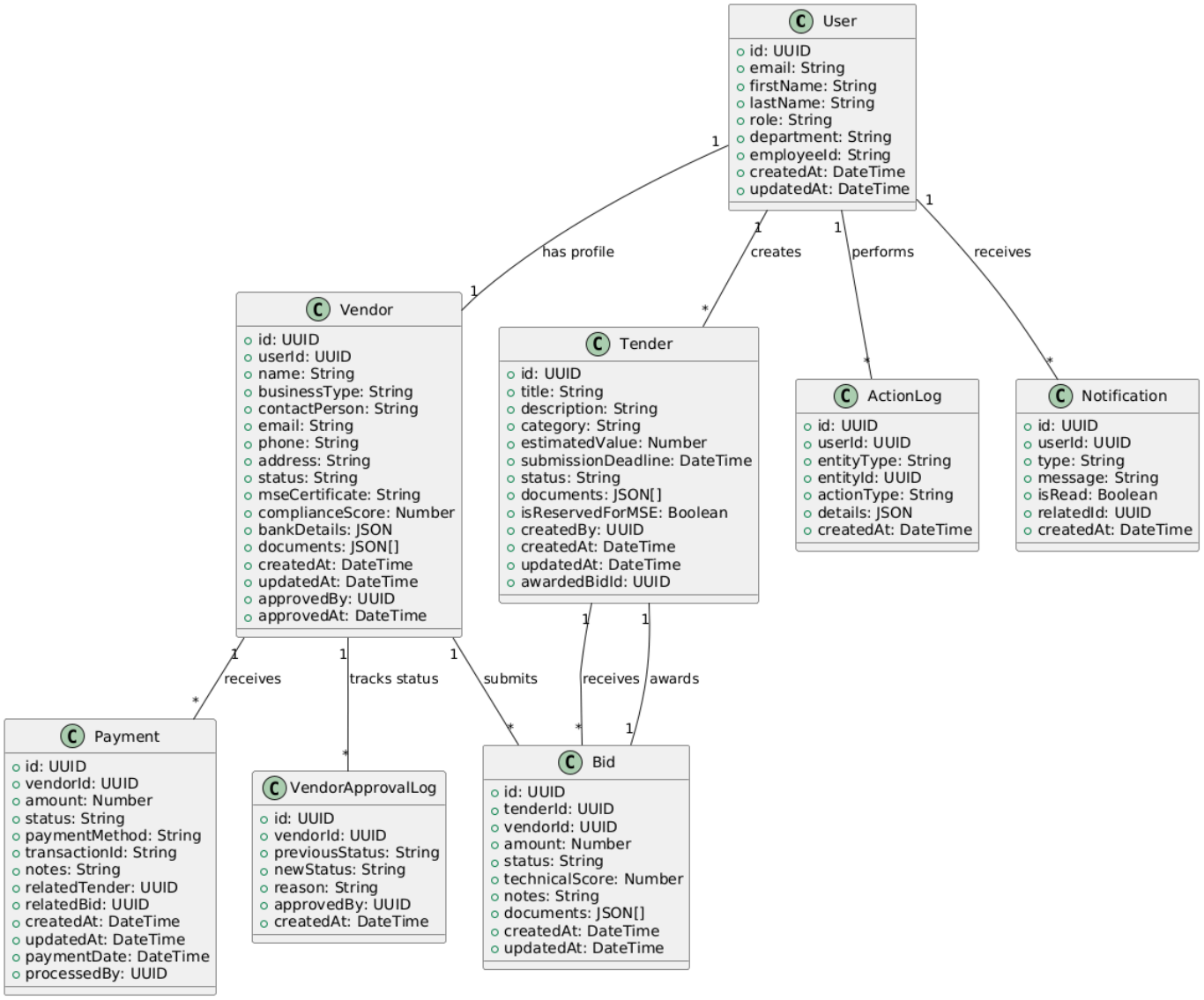

Figure: 4.5.13 Class Diagram

USE-CASE DIAGRAM

This use case diagram outlines the various user roles, their corresponding functions, and system interactions within the **NEEPCO Portal**. It effectively captures the core activities performed by the **Admin**, **Procurement Officer**, and **Vendor**.

Actors (Users):

1. **Admin**
   - Responsible for managing system users, vendors, and ensuring compliance.
2. **Procurement Officer**
   - Handles tender creation, bid reviews, report generation, and payment processing.
3. **Vendor**
   - Manages their profile, submits bids, and tracks payments.

Use Cases (Functions):

Each role has distinct functions grouped under respective categories:

Admin Functions

- **Manage Users:** Add, edit, or delete users within the system.
- **View Reports:** Access detailed procurement reports for monitoring and analysis.
- **Manage Vendors:** Oversee vendor registration, updates, and removals.
- **Monitor Compliance:** Ensure vendors and procurement activities adhere to organizational policies.

Procurement Officer Functions:

- **Create/Manage Tenders:** Initiate new tenders, update existing ones, or cancel tenders.
- **Review Bids:** Evaluate submitted bids and select appropriate vendors.
- **Generate Reports:** Produce procurement summaries, payment status, and compliance records.
- **Approve Vendors:** Authorize vendor registrations or profile updates.
- **Process Payments:** Manage and track vendor payments.

Vendor Functions:

- **Manage Profile:** Create or update their business profile.
- **Submit Bids:** Provide quotations or proposals for tenders (extends `View Tenders` functionality).
- **View Tenders:** Access available tenders posted by procurement officers.
- **Track Payments:** Monitor payment status after bid approval.

Relationships in the Diagram:

- **Association:** Solid lines indicate the primary relationship between actors and their associated use cases.
- **Extension (`extends`) Relationship:** Dashed lines with "extends" indicate optional functionality that enhances core actions. For example:
  - `Submit Bids` extends `View Tenders`.
- **Generalization (`extends` Actor Relationship):** The **Admin** actor extends the **Procurement Officer** role, signifying that the Admin has all Procurement Officer capabilities plus additional privileges.

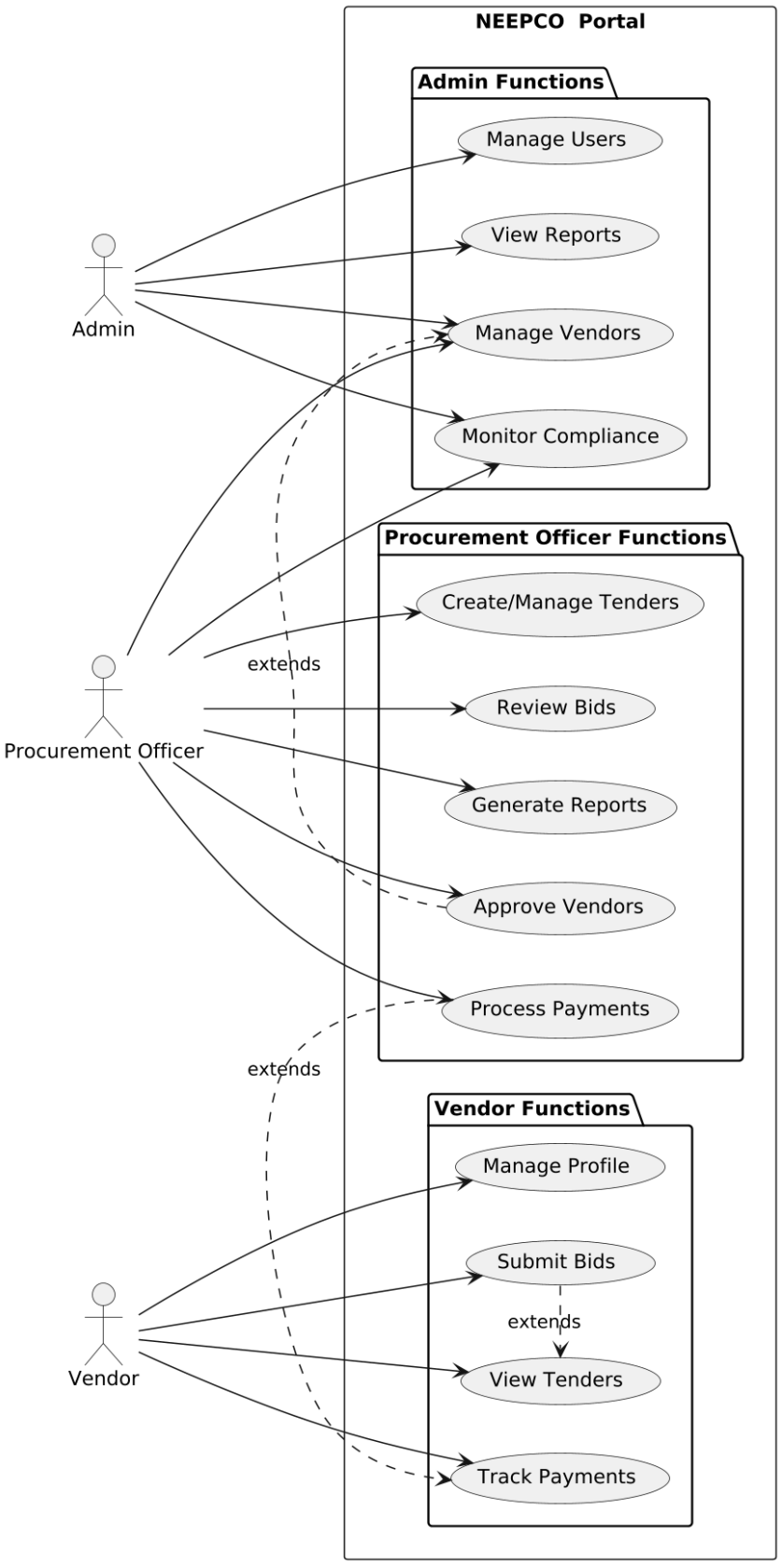

Figure: 4.5.14 Use Case Diagram

ACTIVITY DIAGRAM

An Activity Diagram is a type of Unified Modeling Language (UML) flowchart that visually represents the flow of activities in a system or process. It is classified as a behavior diagram since it describes how the system behaves during various stages of the workflow. This type of diagram is particularly useful in modeling system logic, control flow, and business processes.

The provided activity diagram represents the workflow for the **NEEPCO System** and follows these key processes:

1. **Vendor Registration Process**
   - The process starts with **Vendor Registration**.
   - The registration is then **approved by the Procurement Officer**.
     - ➢ **If approved**, the vendor becomes **Active**.
     - ➢ **If rejected or pending**, the vendor is marked as **Pending**.
2. **Tender Creation Process**
   - A **Procurement Officer** creates a tender.
   - The tender can be saved as a **Draft**.
   - If the draft is ready, the tender is **Published**.
   - After publication:
     - ➢ **If the deadline passes**, the tender goes **Under Review**.
     - ➢ During review:
       - ➢ **If valid bids are found**, a **Winner is selected** and the tender is marked as **Awarded**.
       - ➢ **If no valid bids are found**, the tender is marked as **Cancelled**.
3. **Bid Submission Process**
   - Vendors can **Submit Bids** after the tender is published.
   - Following an **Evaluation** process:
     - ➢ If the bid is **Selected**, it is marked as **Accepted**.
     - ➢ If the bid is **Not Selected**, it is marked as **Rejected**.
4. **Payment Process**
   - The vendor can **Initiate Payment**.
   - The payment process undergoes **Verification**:
     - ➢ If **Verified**, the payment is marked as **Completed**.
     - ➢ If there's an **Error**, the payment is marked as **Failed**.
5. **Process Completion**
   - The diagram concludes when all the above steps are successfully processed.

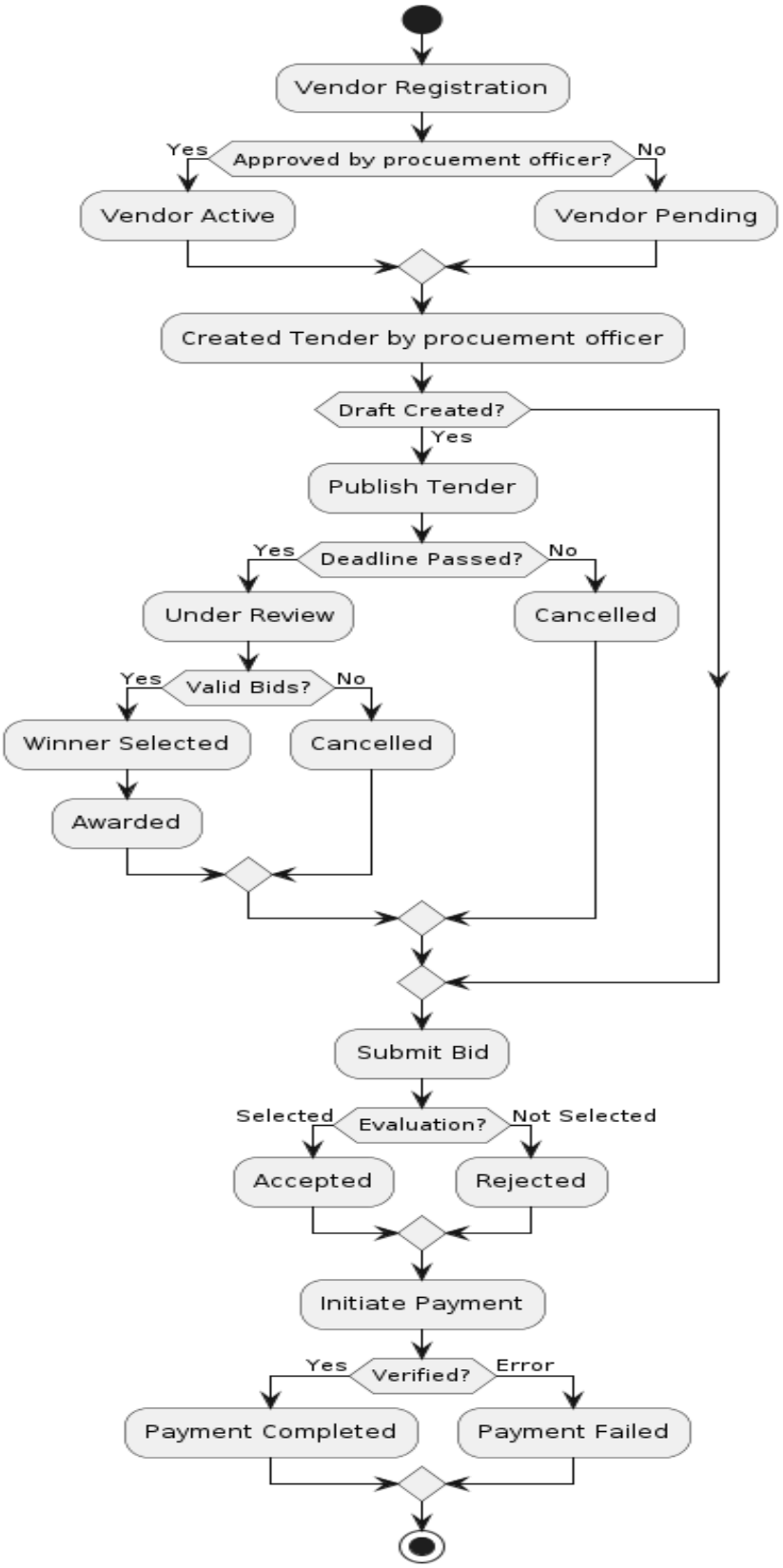

Figure: 4.5.15 Activity Diagram

STATE DIAGRAM

The State Diagram for the NEEPCO Procurement System illustrates the lifecycle of four key entities: Vendor, Tender, Bid, and Payment. Vendors begin in a Pending state after registration, progressing to Active if approved or Suspended if rejected or facing violations, with the possibility of reactivation. Tenders start in a Draft state, move to Published, and may proceed to Under Review, ultimately becoming Awarded or Cancelled based on outcomes. Bids are initially Submitted, then reviewed and either Accepted or Rejected. Payments begin as Pending, move to Processing, and conclude as either Completed or Failed depending on verification outcomes. This structured flow ensures clarity in managing procurement activities and transactions within the system. The diagram covers the following key components:

1. **Vendor Status**
2. **Payment Status**
3. **Tender Status**
4. **Bid Status**

1. Vendor Status

This section represents the stages a vendor goes through during registration and operational processes.

States and Transitions

- **Pending:** Initial state after registration.
  - Transitions:
    - ➢ **Approved** → Leads to **Active** status.
    - ➢ **Rejected** → Ends the process.
- **Active:** Represents a vendor with approved status.
  - Transitions:
    - ➢ **Violation** → Leads to **Suspended** status.
    - ➢ **Reactivated** → Brings a suspended vendor back to **Active** status.
- **Suspended:** Indicates vendors who have violated policies or failed compliance checks.
  - Transitions:

- ➢ **Reactivated** → Leads back to **Active**.

- **Pending** status can also reoccur if vendors are awaiting re-approval or re-evaluation.

2. Payment Status

This section tracks the payment process for vendors or procurement-related transactions.

States and Transitions

- **Processing:** Payment is initiated but not yet confirmed.
  - Transitions:
    - ➢ **Verified** → Leads to **Completed** status (successful payment).
    - ➢ **Error** → Leads to **Failed** status (payment failure).
- **Completed:** Final successful state after verification.
- **Failed:** Final unsuccessful state due to errors.

3. Tender Status

This section highlights the different phases in the tender lifecycle.

States and Transitions

- **Draft:** Initial state when a tender is created.
  - Transitions:
    - ➢ **Published** → When the tender is made public.
- **Published:** An active tender that vendors can bid on.
  - Transitions:
    - ➢ **Cancelled** → If the tender is withdrawn before review.
    - ➢ **Under Review** → Once the bidding deadline has passed.
- **Under Review:** Evaluation phase for submitted bids.
  - Transitions:
    - ➢ **Cancelled** → If no valid bids are found.
    - ➢ **Awarded** → If a winner is selected.

4. Bid Status

This section outlines the flow of bid submissions and evaluations.

States and Transitions

- **Submitted:** A new bid has been submitted.
  - Transitions:
    - ➢ **Accepted** → If the bid meets evaluation criteria.
    - ➢ **Rejected** → If the bid fails technical evaluation.
- **Accepted/Rejected** are final states.

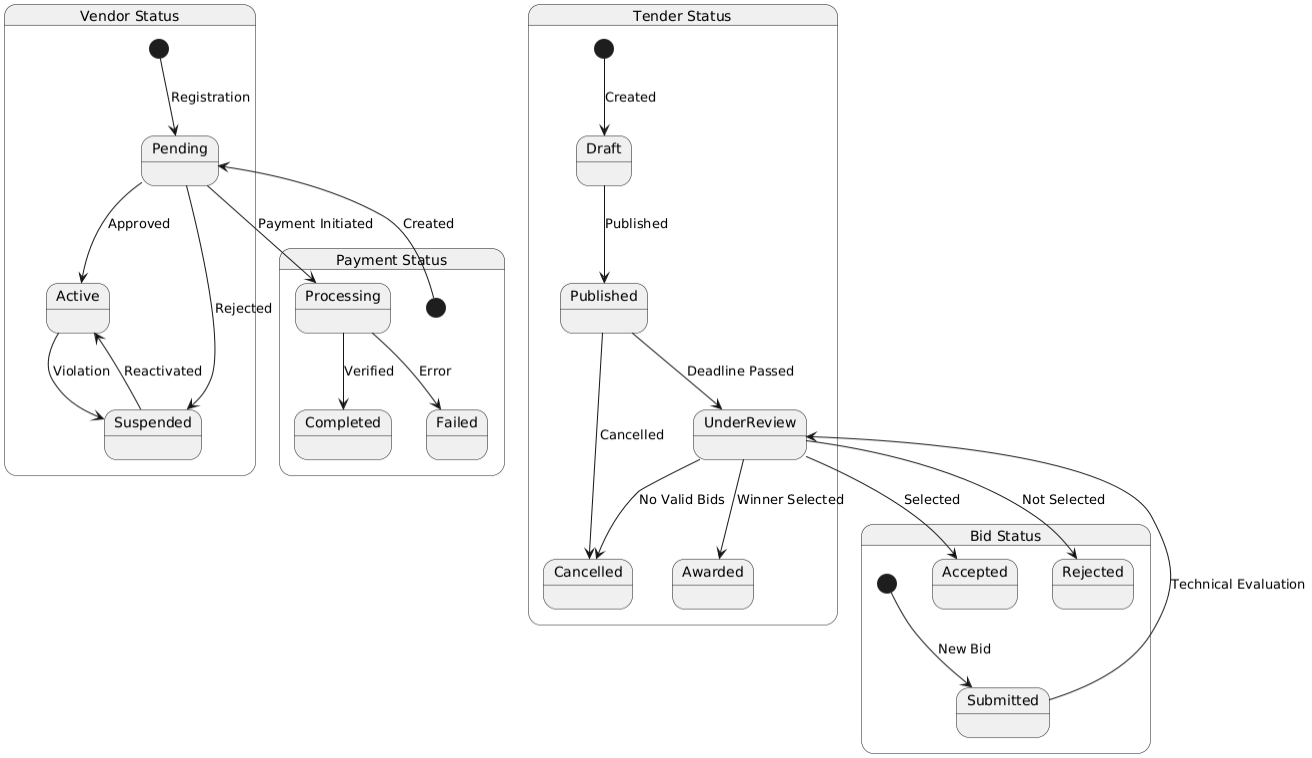

Figure: 4.5.16 State Diagram

SEQUENCE DIAGRAM

This sequence diagram that interaction between different actors and systems involved in the NEEPCO Procurement Portal. It illustrates the process flow across four key stages: Vendor Registration, Tender Management, Bid Evaluation, and Payment Processing. Here's a detailed breakdown of each stage:

1. Vendor Registration

- Actors Involved: Vendor, Procurement Officer, Auth System, Tender System, Database
- Process Overview: This phase handles vendor registration and profile creation.

Register Account:

- The Vendor initiates registration, and the Auth System creates a new user account.
- Upon successful creation, an Account Created response is sent back.

Submit Vendor Profile:

- The Vendor submits their profile details.
- The Tender System stores this profile data in the Database and confirms the profile creation.

Profile Pending Approval:

- The system notifies the vendor that their profile is pending approval.

2. Tender Management

- Actors Involved: Procurement Officer, Tender System, Database
- Process Overview: This phase covers the tender creation and bid submission process.

Create Tender:

- The Procurement Officer initiates a tender creation request.
- The Tender System stores the tender details in the Database and confirms tender creation.

View and Display Tender:

- Vendors can request to view published tenders.
- The Tender System fetches tender details from the Database and displays them.

Submit Bid:

- Vendors submit their bids via the Bid System, which stores bid details in the Database.
- A confirmation message confirms that the bid has been submitted successfully.

3. Bid Evaluation

- Actors Involved: Procurement Officer, Bid System, Database
- Process Overview: This stage involves evaluating bids and awarding tenders.

Review Bids:

- The Procurement Officer requests to review all submitted bids.
- The Bid System retrieves bid details from the Database and displays them.

Award Tender:

- After reviewing, the Procurement Officer awards the tender.
- The system updates both the tender and bid status in the Database.
- A notification is sent to the winning vendor.

4. Payment Processing

- Actors Involved: Procurement Officer, Payment System, Database
- Process Overview: This stage manages the payment process for successful bids.

Create Payment:

- The Procurement Officer initiates the payment creation process.
- The Payment System stores the payment details in the Database.

Process Payment:

- After notification, the Payment System processes the payment.
- Once verified, the system updates the payment status in the Database and confirms payment completion.

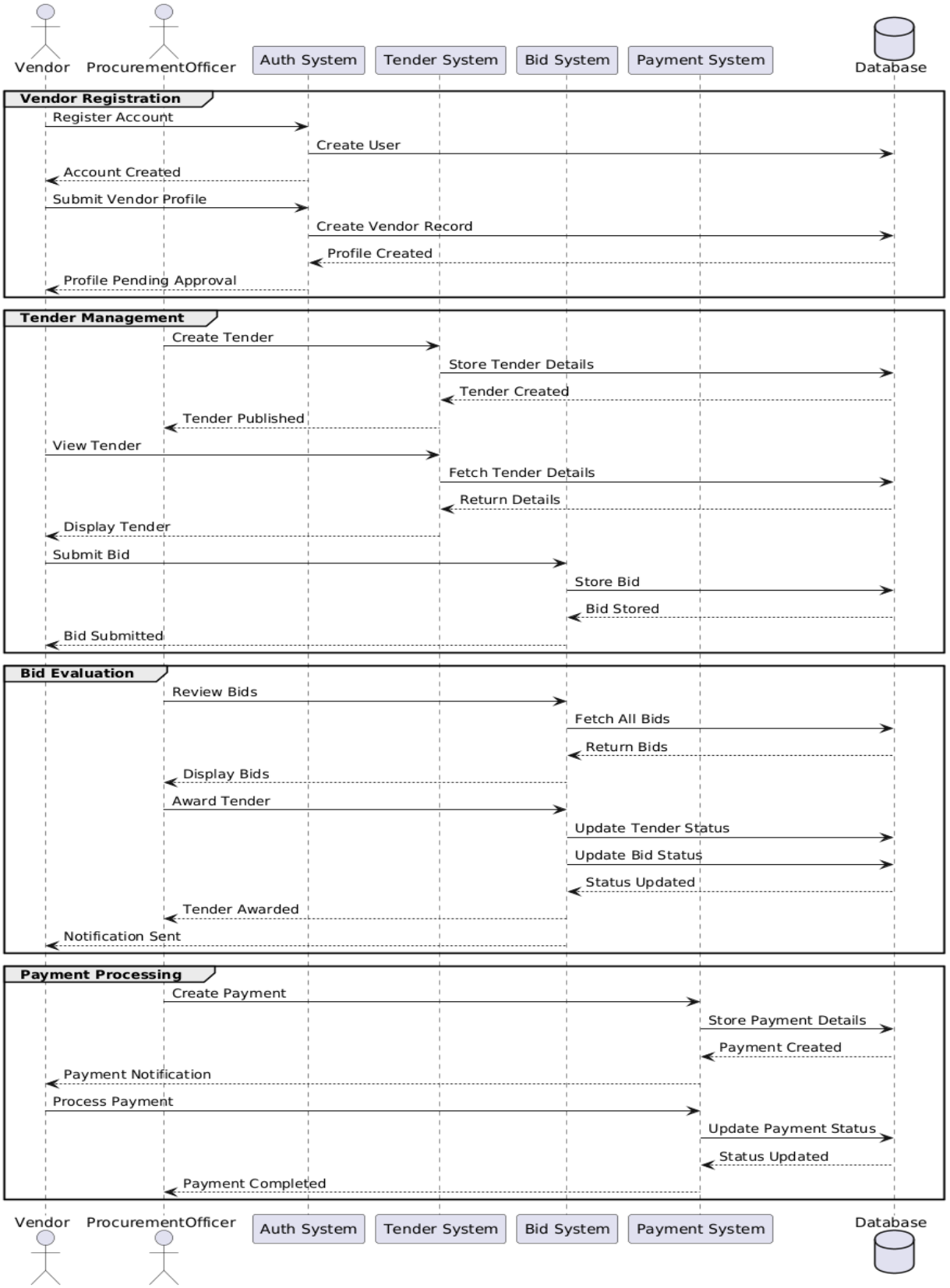

Figure: 4.5.17 SEQUENCE Diagram

CHAPTER - 5

SYSTEM IMPLEMENTATION

5. SYSTEM IMPLEMENTATION

Implementing the **NEEPCO Portal** involves several key steps, including selecting technologies, developing modules, testing, deploying the application, and configuring the database. Below is a detailed guide on how to implement the system effectively.

5.1 Implementation of the Application

The first step in building the procurement portal is selecting the appropriate tools and technologies. The choices made are as follows:

- Programming Languages: JavaScript (for both frontend and backend).
- Development Frameworks:
    - Frontend: React.js with TailwindCSS for UI design.
    - Backend: Node.js with Express.js for server-side operations.
- Database System: Supabase to store procurement and vendor data.

Develop the Application

Once the technologies are selected, the development process begins. The **NEEPCO Portal** consists of multiple modules, each handling specific tasks.

- User Authentication: Secure login system using JWT and bcrypt for encryption.
- Vendor Management: Allows vendors to register, update details, and track their tenders.
- Procurement Management: Enables officers to create, modify, and approve procurement requests.
- Payment Tracking: Manages vendor payments and invoices.
- Reports and Dashboard**:** Displays key statistics on procurement and vendor activities.
- Notifications System: Sends real-time updates on tender approvals, payments, and deadlines.

Test the application

Testing ensures the portal functions correctly before deployment. The following testing methods are applied:

- Unit Testing: Checks individual functions like authentication and form validation.
- Integration Testing: Ensures different modules work together seamlessly (e.g., procurement data updates in vendor records).
- System Testing: Tests the complete system, simulating real-world user scenarios.

Deploy the application

After successful testing, the application is deployed for user access. The steps involved in deployment are:

- Select a Web Server: Hosting is done using Nginx or Apache.
- Deploy the Application: Upload the frontend and backend files to the server.
- Configure Database: Connect supabase to the deployed server.
- Launch the Application: Make it accessible via a web URL.

5.2 Required Modules for Implementation

The NEEPCO Portal is divided into several essential modules, each performing a unique function:

1. User Authentication Module – Manages user login, registration, and role-based access.
2. Vendor Management Module – Handles vendor registration, profile updates, and procurement tracking.
3. Procurement Management Module – Allows procurement officers to create, edit, and approve tenders.
4. Payment Tracking Module – Maintains records of vendor payments and pending invoices.
5. Reports & Analytics Module – Generates procurement performance reports.
6. Notification Module – Sends alerts and updates about tenders, payments, and deadlines.
7. Integration Module – Enables integration with external procurement systems and government portals.

5.3 Running Application

To run the NEEPCO Portal, follow these steps:

1. Start the Web Server: Ensure the hosting server is running.
2. Start the Database: Make sure supabase is active and connected.
3. Deploy the Application: Upload and configure the application on the server.
4. Access the Portal: Open a web browser and enter the server's URL.
5. Log In: Enter your credentials to access the system.
6. Start Using the System: Manage procurement activities, vendor details, and payments.

Additional Tips for Running the Application

- Ensure Server and Database Availability: Check the server status regularly.
- Keep the Application Updated: Apply security patches and feature updates periodically.
- Monitor Performance: Use monitoring tools to track system efficiency and resolve issues.

5.4 Configuring Database

Configuring the database is an essential step in ensuring smooth data management for the procurement portal. The key steps include:

1. Create a Database User: Set up a supabase user with the necessary permissions.
2. Grant Permissions: Ensure the user has rights to create, read, update, and delete data.
3. Create Collections (Tables): Define collections for users, vendors, tenders, payments, and reports.
4. Configure Database Connection: Update the backend configuration to establish a connection with supabase.

5.5 Coding

PublicLayout.jsx

```
import { Outlet, Link } from 'react-router-dom';
export default function PublicLayout() {
 return (
  <div className="min-h-screen bg-gray-50">
   <header className="bg-primary-700 text-white">
    <nav className="max-w-7xl mx-auto px-4 sm:px-6 lg:px-8 py-4">
     <div className="flex items-center justify-between">
      <Link to="/" className="text-xl font-bold">
       NEEPCO
      </Link>
      <div className="space-x-4">
                <Link to="/about" className="text-white hover:text-primary-200">About Us</Link>
        <Link to="/login" className="text-white hover:text-primary-200">Login</Link>
        {/*
          <Link to="/admin/login" className="text-white hover:text-primary-200">Admin Login</Link>
        */}

                <Link to="/signup" className="text-white hover:text-primary-200">Sign Up</Link>
      </div>
     </div>
    </nav>
   </header>

   <main className="max-w-7xl mx-auto px-4 sm:px-6 lg:px-8 py-8">
    <Outlet />
   </main>
   <footer className="bg-gray-800 text-white mt-auto">
    <div className="max-w-7xl mx-auto px-4 sm:px-6 lg:px-8 py-4">
     <p className="text-center text-sm">
      © 2024 NEEPCO |{' '}
      <Link to="/terms" className="hover:text-primary-300">
       Terms & Conditions
      </Link>{' '}
      |{' '}
      <Link to="/privacy" className="hover:text-primary-300">
```

```
            Privacy Policy
          </Link>
        </p>
      </div>
    </footer>
  </div>
 );
}
```

DashboardLayout.jsx

```
import { Outlet, Link, useLocation, useNavigate } from 'react-router-dom';
import { HomeIcon, DocumentTextIcon, UserGroupIcon, BuildingStorefrontIcon, CreditCardIcon, ChartBarIcon, ShieldCheckIcon, UserIcon } from '@heroicons/react/24/outline';
import { useAuth } from '../../hooks';
import { NotificationBell } from '../ui';

export default function DashboardLayout() {
  const location = useLocation();
  const navigate = useNavigate();
  const { user, signOut, hasRole } = useAuth();

  // Define navigation items with role-based access
  const navigationItems = [
      { name: 'Dashboard', path: '/', icon: HomeIcon, roles: ['admin', 'procurement_officer', 'vendor'] },
      { name: 'Procurement', path: '/procurement', icon: DocumentTextIcon, roles: ['admin', 'procurement_officer'] },
    { name: 'Tenders', path: '/tenders', icon: DocumentTextIcon, roles: ['vendor'] },
          { name: 'Vendors', path: '/vendors', icon: UserGroupIcon, roles: ['admin', 'procurement_officer'] },
     { name: 'MSE Facilitation', path: '/mse-facilitation', icon: BuildingStorefrontIcon, roles: ['admin', 'procurement_officer'] },
          { name: 'Payments', path: '/payments', icon: CreditCardIcon, roles: ['admin', 'procurement_officer', 'vendor'] },
        /* { name: 'Reports', path: '/reports', icon: ChartBarIcon, roles: ['admin', 'procurement_officer'] }, */
        { name: 'Compliance', path: '/compliance', icon: ShieldCheckIcon, roles: ['admin', 'procurement_officer'] },
      { name: 'Profile', path: '/profile', icon: UserIcon, roles: ['admin', 'procurement_officer', 'vendor'] },
```

```
];

// Filter navigation items based on user role
const filteredNavigation = navigationItems.filter(item => {
  return item.roles.some(role => hasRole(role));
});

const handleSignOut = async () => {
  try {
    await signOut();
    navigate('/login');
  } catch (error) {
    console.error('Error signing out:', error);
  }
};

// Get user role for display
const userRole = user?.user_metadata?.role || 'user';
const formattedRole = userRole.replace('_', ' ').replace(/\b\w/g, l => l.toUpperCase());

return (
  <div className="min-h-screen bg-gray-50">
    <header className="bg-primary-700 text-white">
      <div className="max-w-7xl mx-auto px-4 sm:px-6 lg:px-8">
        <div className="flex items-center justify-between h-16">
          <div className="flex items-center">
            <Link to="/" className="text-xl font-bold">
              NEEPCO
            </Link>
          </div>
          <nav className="hidden md:flex items-center space-x-4">
            {filteredNavigation.map((item) => {
              const isActive = location.pathname === item.path;
              return (
                <Link
                  key={item.name}
                  to={item.path}
                  className={`flex items-center px-3 py-2 rounded-md text-sm font-medium ${
                    isActive
                      ? 'bg-primary-800 text-white'
                      : 'text-primary-100 hover:bg-primary-600'
                  }`}
```

```
              >
                <item.icon className="h-5 w-5 mr-2" />
                {item.name}
              </Link>
            );
          })}
          {user && (
            <div className="flex items-center space-x-4">
              {/* Add notification bell */}
              {(hasRole('admin') || hasRole('procurement_officer')) && (
                <NotificationBell />
              )}
              <span className="text-sm text-primary-100">
                {formattedRole}
              </span>
              <button
                onClick={handleSignOut}
                      className="flex items-center px-3 py-2 rounded-md text-sm font-medium
text-primary-100 hover:bg-primary-600"
              >
                Sign Out
              </button>
            </div>
          )}
        </nav>
      </div>
    </div>
  </header>

  <main className="max-w-7xl mx-auto px-4 sm:px-6 lg:px-8 py-8">
    <Outlet />
  </main>

  <footer className="bg-gray-800 text-white mt-auto">
    <div className="max-w-7xl mx-auto px-4 sm:px-6 lg:px-8 py-4">
      <p className="text-center text-sm">
        © 2024 NEEPCO |{' '}
        <Link to="/terms" className="hover:text-primary-300">
          Terms & Conditions
        </Link>{' '}
        |{' '}
        <Link to="/privacy" className="hover:text-primary-300">
```

```
            Privacy Policy
          </Link>
        </p>
      </div>
    </footer>
  </div>
 );
}
```

About.jsx

```
import { Link } from 'react-router-dom';
function About() {
 return (
    <main className="max-w-7xl mx-auto px-4 sm:px-6 lg:px-8 py-12">
      <div className="bg-white rounded-lg shadow-lg p-8">
        <h1 className="text-3xl font-bold text-gray-900 mb-6">
          About NEEPCO  Portal
        </h1>
        <div className="prose max-w-none">
          <p className="text-lg text-gray-700 mb-6">
            The NEEPCO  Portal is designed to streamline and simplify the procurement
                process for NEEPCO (North Eastern Electric Power Corporation Limited) by
providing
            a user-friendly platform for managing procurement activities, vendor relationships,
            and payments. Our portal aims to ensure transparency, compliance, and efficiency
            in all procurement-related tasks.
          </p>

                    <h2 className="text-2xl font-semibold text-gray-900 mt-8 mb-4">Our
Mission</h2>
          <p className="text-gray-700 mb-6">
            To create a seamless and efficient procurement system that enhances operational
            effectiveness, reduces delays, and fosters stronger partnerships with vendors,
            while ensuring compliance with governmental and organizational regulations.
          </p>
          <h2 className="text-2xl font-semibold text-gray-900 mt-8 mb-4">
            Features of the Portal
          </h2>
          <ul className="list-disc pl-6 space-y-2 text-gray-700 mb-6">
            <li>
              <strong>Procurement Management:</strong> Simplified purchase order creation
```

```
            and vendor selection process.
          </li>
          <li>
            <strong>Vendor Management:</strong> Centralized database to track vendor
            performance, contact details, and compliance statuses.
          </li>
          <li>
            <strong>Payment Tracking:</strong> Real-time updates on payment statuses
            and due amounts for vendors.
          </li>
          <li>
            <strong>Reports and Compliance:</strong> Generating procurement-related
            reports and ensuring adherence to regulatory requirements.
          </li>
        </ul>
        <h2 className="text-2xl font-semibold text-gray-900 mt-8 mb-4">
          Why Choose Us?
        </h2>
        <p className="text-gray-700">
          Our portal is designed to provide greater transparency, increase procurement
          efficiency, and improve decision-making. We ensure that all procurement
          activities are documented, monitored, and optimized for the best possible
          outcomes.
        </p>
      </div>
    </div>
  </main>
 );
}

export default About;
```

CHAPTER - 6

SYSTEM TESTING

6. SYSTEM TESTING

6.1 Testing Introduction

Testing plays a crucial role in the development lifecycle of the NEEPCO Portal, ensuring its quality, reliability, and functionality. This phase systematically evaluates the software application to identify defects, errors, and inconsistencies, ensuring it meets specified requirements and functions as intended.

The NEEPCO Portal undergoes various testing methodologies to verify its performance under different scenarios:

Manual Testing:

Human testers execute predefined test cases to simulate end-user interactions, assessing the system's performance, usability, and functionality. Manual testing ensures that user interfaces are intuitive and that all features work as expected.

Automated Testing:

Automated tools execute test scripts and compare actual outcomes with expected results, streamlining the testing process and improving repeatability. Automated testing is particularly useful for regression testing, ensuring that new updates or changes do not introduce unintended side effects.

Functional Testing:

This type of testing evaluates the functional requirements of the system, ensuring that each feature operates according to specifications. It verifies user actions, data processing, and system responses to various inputs.

Non-Functional Testing:

Non-functional testing focuses on aspects such as performance, security, scalability, and reliability. Performance testing assesses how well the system performs under different loads and conditions, ensuring optimal responsiveness. Security testing evaluates the system's resilience against security threats and vulnerabilities, safeguarding sensitive data. Scalability testing examines the system's ability to handle increasing workloads and resource demands. Reliability testing ensures consistent system operation without unexpected failures.

6.2 TEST CASES

6.2.1 UNIT TESTING

Unit testing in the NEEPCO Portal involves testing individual units or components to ensure they perform as expected. These tests are conducted during the development phase by developers to verify the correctness of each unit of code. Here are some examples of unit tests for the NEEPCO Portal:

1. User Authentication Function: Testing the function responsible for authenticating users, including verifying valid login credentials and rejecting invalid ones.
2. Tender Creation Module: Testing the module that allows procurement officers to create new tenders, ensuring that all required fields are properly validated and saved to the database.
3. Vendor Approval Logic: Verifying that the system correctly processes vendor approval requests based on predefined criteria and permissions.
4. Bid Submission Function : Testing the function that allows vendors to submit bids for tenders, ensuring that the bids are correctly recorded in the system.
5. Notification System : Verifying that the system sends notifications to relevant parties (e.g., vendors, procurement officers) when there are updates or changes to tenders or bids.
6. Reporting Module : Testing the module responsible for generating reports on procurement statistics, ensuring that the reports contain accurate and up-to-date information.
7. Error Handling : Validating that error-handling mechanisms are in place to handle unexpected situations gracefully, such as database errors or network issues.

6.3 WHITE BOX TESTING

Test Case ID	Test Description	Expected Outcome	Actual Outcome	Result
WB-001	Creating a New Tender: • Log into the NEEPCO Portal as a procurement officer. • Navigate to the "Procurement" section. • Click on "Create New Tender". • Fill in all required information fields and submit the form.	The system should create a new tender with the provided details and set its status to "draft".	The new tender is successfully created and saved with the entered information in draft status.	Test case passed.
WB-002	Publishing a Tender: • Log into the system as a procurement officer. • Navigate to the "Procurement" section. • Select a draft tender. • Click on "Publish Tender".	The tender status should change to "published" and become visible to vendors.	The tender is correctly published and appears in the vendors' tender list.	Test case passed.
WB-003	Submitting a Bid: • Log into the system as a vendor. • Navigate to "Tenders". • Open a published tender and click "Submit Bid". • Fill in bid details and submit.	The bid should be submitted and saved in the system with status "submitted".	The bid is successfully submitted and saved with the correct status.	Test case passed.

WB-004	Evaluating Bids: • Log into the system as a procurement officer. • Navigate to a tender with submitted bids. • Review bids and update their status (e.g., from "submitted" to "under_review").	The bid status should be updated and saved in the system.	The bid status is successfully updated and saved.	Test case passed.
WB-005	Generating Procurement Reports: • Log into the system and navigate to the "Reports" section. • Select criteria for generating a report (e.g., date range, tender status). • Generate the report.	The system should generate a report that meets the specified criteria.	The report is generated accurately with the correct data.	Test case passed.
WB-006	Handling Vendor Approval: • Log into the system as a procurement officer. • Navigate to "Vendors" section. • Review a pending vendor and approve their account.	The vendor status should change to "Active" and they should receive a notification.	The vendor status is updated to "Active" and a notification is sent.	Test case passed.
WB-007	Error Handling for Bid Submission: • Log into the system as a vendor. • Attempt to submit a bid with invalid data (e.g., negative bid amount).	The system should validate the input and display appropriate error messages without submitting the bid.	The system correctly validates the input and displays error messages.	Test case passed.

WB-008	User Role-Based Access Control: • Log into the system with different user roles. • Attempt to access various sections of the application.	The system should only allow access to sections appropriate for the user's role.	Access is correctly restricted based on user roles.	Test case passed.
WB-009	Handling High Load During Bid Submission: • Simultaneously submit multiple bids from different vendor accounts. • Observe system performance and response times.	The system should handle multiple bid submissions without slowing down or crashing.	The system processes concurrent bid submissions efficiently.	Test case passed.
WB-010	SQL Injection and Security Testing: • Attempt to enter SQL injection payloads in form fields (e.g., bid submission, tender creation).	The system should sanitize inputs and prevent unauthorized access or database manipulation.	The system correctly blocks SQL injection attempts.	Test case passed.
WB-011	Cross-Site Scripting (XSS) Prevention: • Attempt to inject malicious JavaScript code into text fields (e.g., bid comments, vendor name).	The system should sanitize inputs and prevent XSS attacks.	The system correctly prevents XSS attacks.	Test case passed.

Table: 6.3 Results of White box Testing

6.4 BLACK BOX TESTING

TEST CASE ID	Test Description	Input	Expected Outcome	Actual Outcome	Result
BB-001	User Registration	User selects "Sign Up," enters personal details, selects roles, and submits the form.	A new user account is created and the user is redirected to the appropriate next step based on their role.	A new user account is successfully created and the user is redirected correctly.	Pass
BB-002	Vendor Profile Verification	Vendor completes profile verification form with business details and submits for approval.	The vendor profile is saved with "Pending" status and awaits procurement officer approval.	The vendor profile is successfully saved with "Pending" status.	Pass
BB-003	Tender Creation	Procurement officer creates a new tender with title, description, estimated value, and submission deadline.	A new tender is created in "draft" status and can be edited before publishing.	The tender is successfully created in "draft" status.	Pass
BB-004	Bid Submission	Vendor selects a tender, enters bid amount and supporting details, and submits the bid.	The bid is recorded in the system and associated with the vendor and tender.	The bid is successfully submitted and recorded.	Pass
BB-005	Tender Evaluation	Procurement officer reviews bids for a tender and changes the tender status to "under_review".	The tender status is updated and vendors with submitted bids are notified.	The tender status is updated and notifications are sent.	Pass

BB-006	Awarding a Tender	Procurement officer selects a winning bid and awards the tender.	The tender status changes to "awarded", the winning bid status changes to "accepted", and other bids are automatically rejected.	The tender is successfully awarded with correct status updates.	Pass
BB-007	Payment Processing	Procurement officer creates a payment for a vendor and processes it.	The payment is recorded in the system and the vendor can view the payment details.	The payment is successfully processed and visible to the vendor.	Pass
BB-008	Report Generation	User selects the report type and criteria and generates a report.	A report is generated based on the selected criteria with accurate data.	The report is generated with correct data.	Pass
BB-009	Vendor Approval	Procurement officer reviews a pending vendor and approves their account.	The vendor status changes to "Active" and they can access the full functionality of the portal.	The vendor is successfully approved and gains appropriate access.	Pass
BB-010	User Login	User enters email and password and clicks "Login".	User is authenticated and redirected to their role-appropriate dashboard.	User is successfully logged in and redirected to the correct dashboard.	Pass

Table: 6.4 Results of Black box Testing

6.5 INTEGRATION TESTING

Test case ID	Action	Input	Expected Outcome	Actual Outcome	Result
IT-001	User Authentication Integration: Test the integration between the authentication system and user roles.	Valid email and password	Users are successfully authenticated and granted access based on their role.	User is authenticated and has appropriate role-based access.	Pass
IT-002	Tender-Bid Relationship: Test the relationship between tenders and bids.	Create a tender and submit multiple bids for it.	Bids are correctly associated with the tender and can be retrieved together.	Bids are properly linked to the tender and can be retrieved.	Pass
IT-003	Vendor Approval Workflow: Test the complete vendor approval process.	Submit vendor details for approval and process the approval.	Vendor status changes appropriately and notifications are sent at each step.	Vendor status updates correctly and notifications are sent.	Pass
IT-004	Tender Status Updates: Test how tender status changes affect related entities.	Change tender status from "published" to "under_review" to "awarded".	Related bids and notifications are updated appropriately at each stage.	All related entities are updated correctly with status changes.	Pass
IT-005	Payment Processing Flow: Test the end-to-end payment processing workflow.	Create and process a payment for a vendor.	Payment is recorded, status updates correctly, and vendors can view payment details.	Payment workflow functions correctly from creation to completion.	Pass

IT-006	Report Generation System: Test the integration between data sources and report generation.	Select report criteria spanning multiple data entities.	Report accurately combines and presents data from different sources.	Report correctly integrates data from multiple sources.	Pass
IT-007	Notification System: Test the notification system across different events.	Trigger various events that should generate notifications.	Appropriate notifications are sent to the correct users for each event.	Notifications are correctly generated and delivered.	Pass
IT-008	User Profile Updates: Test how profile updates affect system behavior.	Update user profile information and role.	System permissions and displayed information update accordingly.	System correctly reflects profile changes.	Pass
IT-009	Compliance Score Calculation: Test the integration between vendor actions and compliance scoring.	Perform actions that affect vendor compliance score.	Compliance score is calculated correctly based on vendor actions.	Compliance score updates accurately.	Pass
IT-010	Activity Logging: Test the system's activity logging across different modules.	Perform various actions throughout the system.	All significant actions are properly logged with correct details.	Actions are logged accurately with appropriate details.	Pass

Table: 6.5 Results of Integration Testing

6.6 SYSTEM TESTING

Test Case ID	Test Scenario	Test Steps	Expected Result	Actual Result	Status
ST-001	End-to-End Procurement Process	1. Create a new tender as procurement officer. 2. Publish the tender. 3. Submit bids as multiple vendors. 4. Review and evaluate bids. 5. Award the tender. 6. Process payment.	The entire procurement process should flow smoothly from tender creation to payment processing with appropriate status changes and notifications at each step.	The procurement process flows correctly through all stages with proper status updates and notifications.	Pass
ST-002	Vendor Lifecycle Management	1. Register as a new vendor. 2. Complete profile verification. 3. Get approved by the procurement officer. 4. Submit bids for tenders. 5. Win a tender and receive payment. 6. Update vendor profile.	The vendor should be able to progress through the entire lifecycle from registration to receiving payment with appropriate access at each stage.	Vendor successfully progresses through all lifecycle stages with correct access controls.	Pass

ST-003	Role-Based Access Control	1. Log in with different user roles. 2. Attempt to access various system features. 3. Verify permission enforcement.	Each user role should only have access to appropriate features and be prevented from accessing unauthorized areas.	Access control correctly enforces permissions for different user roles.	Pass
ST-004	Data Consistency Across Modules	1. Make changes in one module. 2. Verify that related data in other modules is updated.	Changes in one part of the system should be reflected in related areas to maintain data consistency.	Data remains consistent across all related modules when changes are made.	Pass
ST-005	Reporting and Analytics	1. Perform various procurement activities. 2. Generate different types of reports. 3. Verify report accuracy.	Reports should accurately reflect all system activities and provide meaningful analytics.	Reports correctly display accurate data and analytics.	Pass
ST-006	Notification System	1. Trigger various system events. 2. Verify that appropriate notifications are sent. 3. Check notification content accuracy.	Notifications should be sent for all relevant events with accurate content to the correct recipients.	Notifications are correctly generated and delivered for all relevant events.	Pass

ST-007	Error Handling and Recovery	1. Introduce various error conditions. 2. Verify system response. 3. Check recovery mechanisms.	The system should handle errors gracefully with appropriate messages and recovery options.	System handles errors appropriately with clear messages and recovery paths.	Pass
ST-008	Concurrent User Access	1. Have multiple users access the system simultaneously. 2. Perform overlapping operations. 3. Verify data integrity.	The system should maintain data integrity and performance when accessed by multiple concurrent users.	System maintains integrity and performance under concurrent access.	Pass
ST-009	Browser Compatibility	1. Access the system from different browsers. 2. Perform key operations in each browser.	The system should function correctly across all supported browsers.	System functions consistently across all tested browsers.	Pass
ST-010	Responsive Design	1. Access the system from devices with different screen sizes. 2. Verify UI adaptation.	The UI should adapt appropriately to different screen sizes while maintaining functionality.	UI correctly adapts to different screen sizes with full functionality.	Pass

Table: 6.6 Results of System Testing

CHAPTER - 7

OUTPUT SCREENS

7. OUTPUT SCREENS

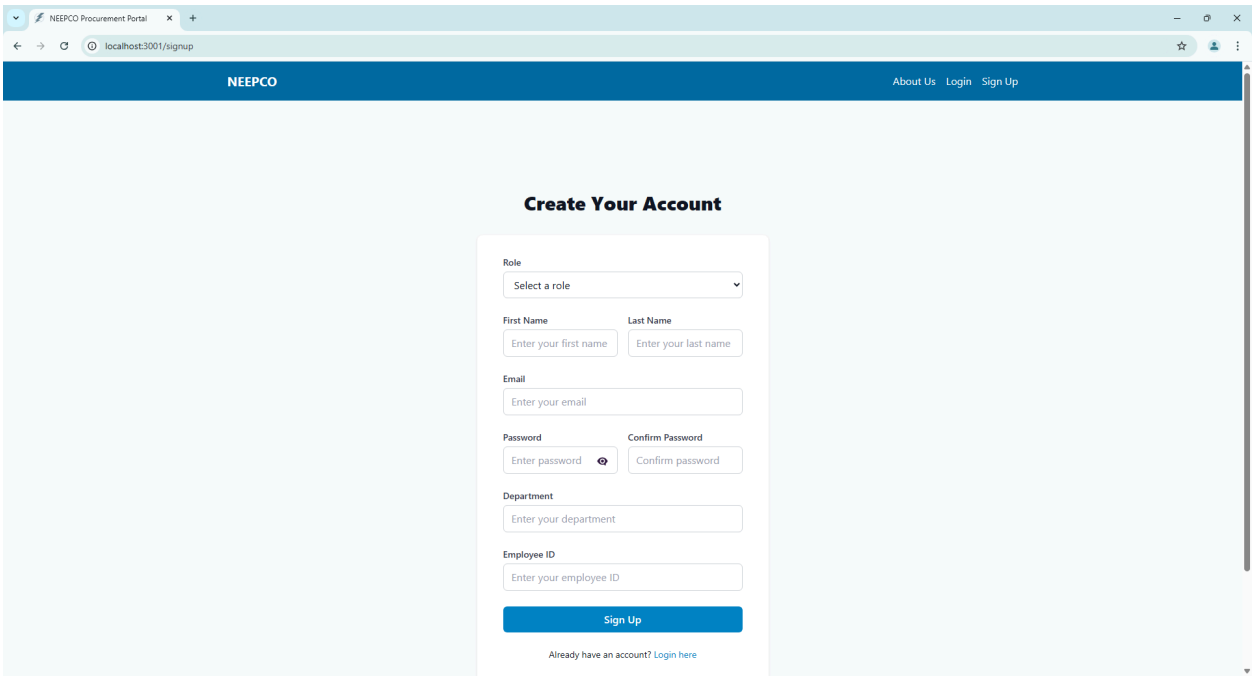

Figure: 7.1 Signup Page

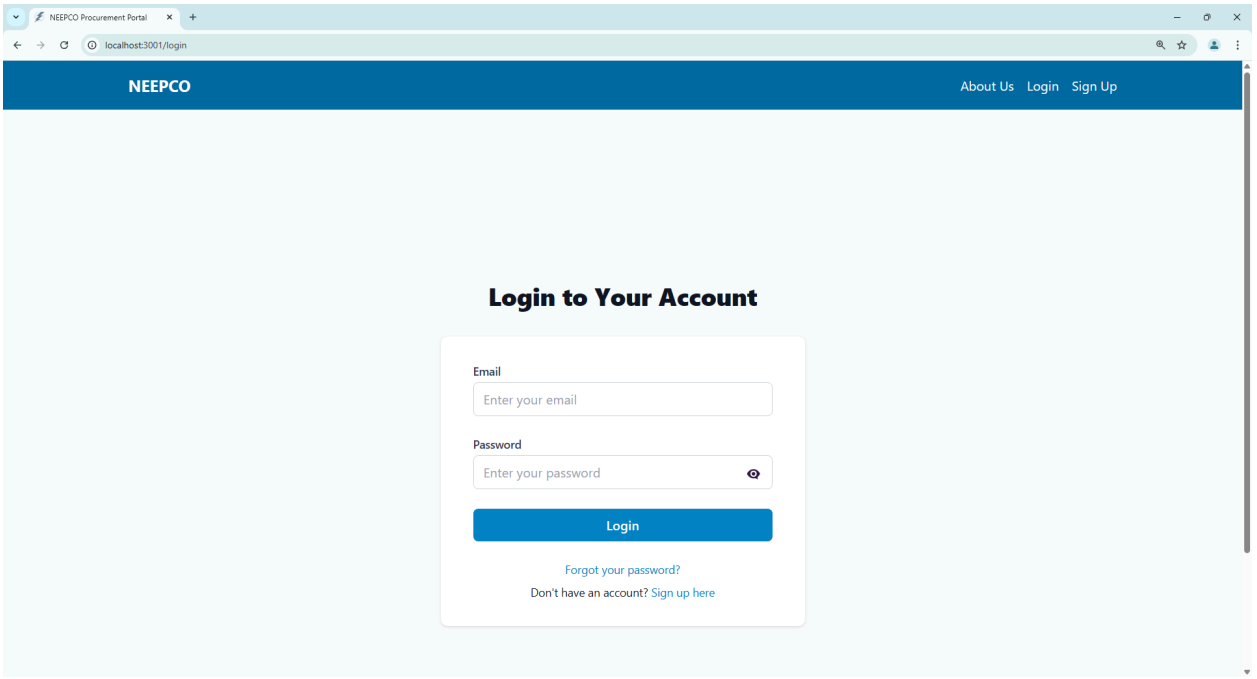

Figure: 7.2 Login Page

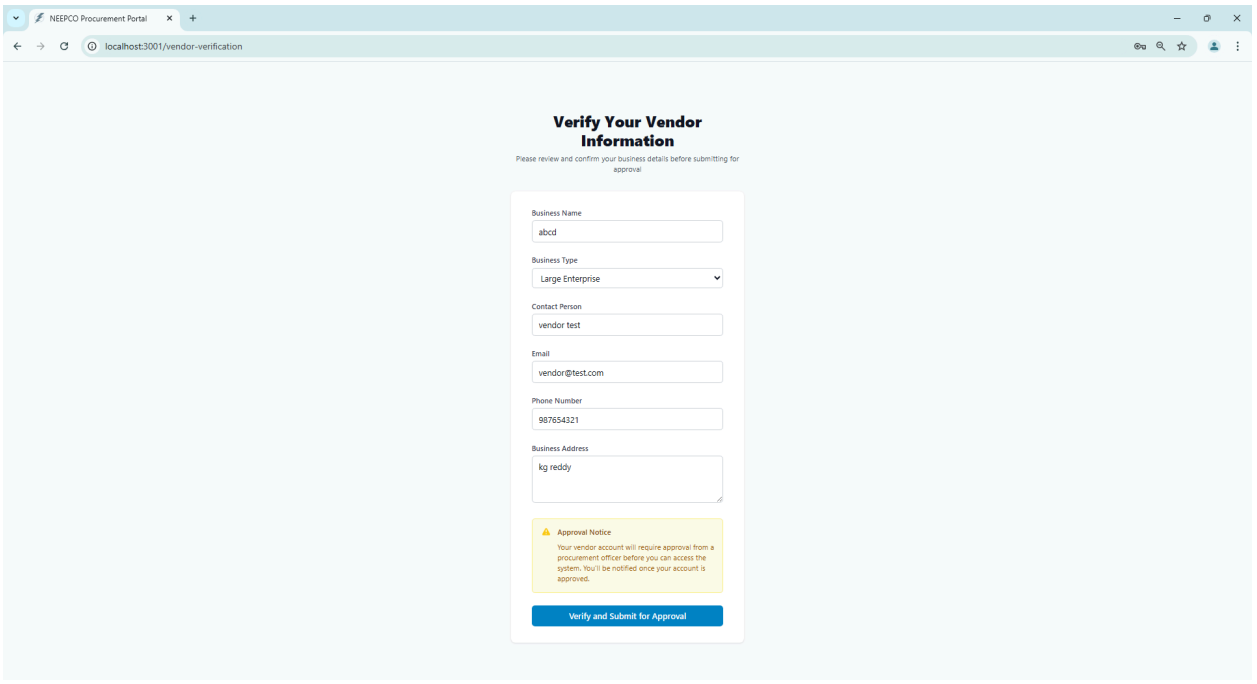

Figure: 7.3 Vendor Verification Page

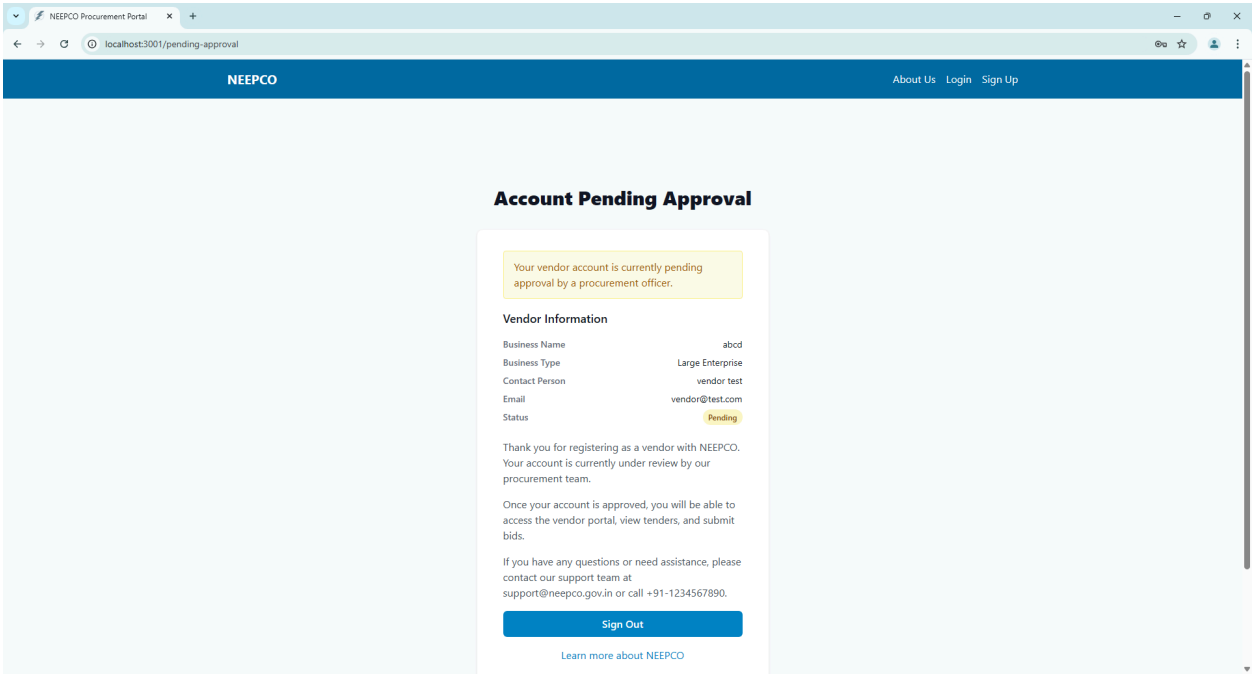

Figure: 7.4 Pending Approval Page

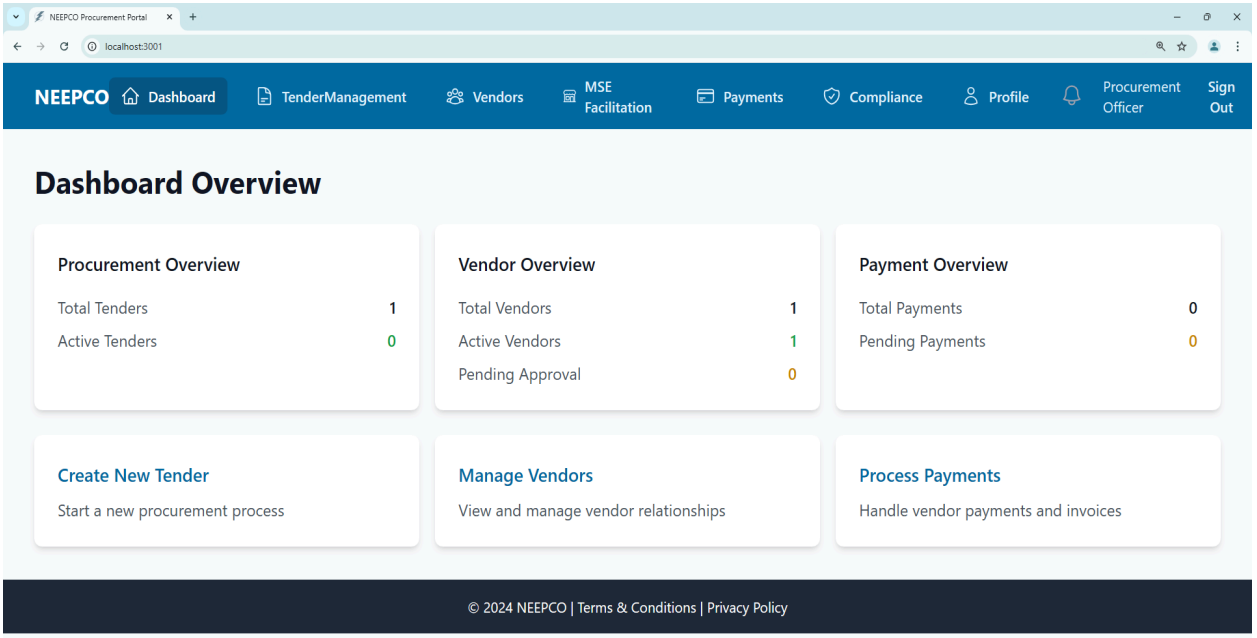

Figure: 7.5 Procurement Dashboard Page

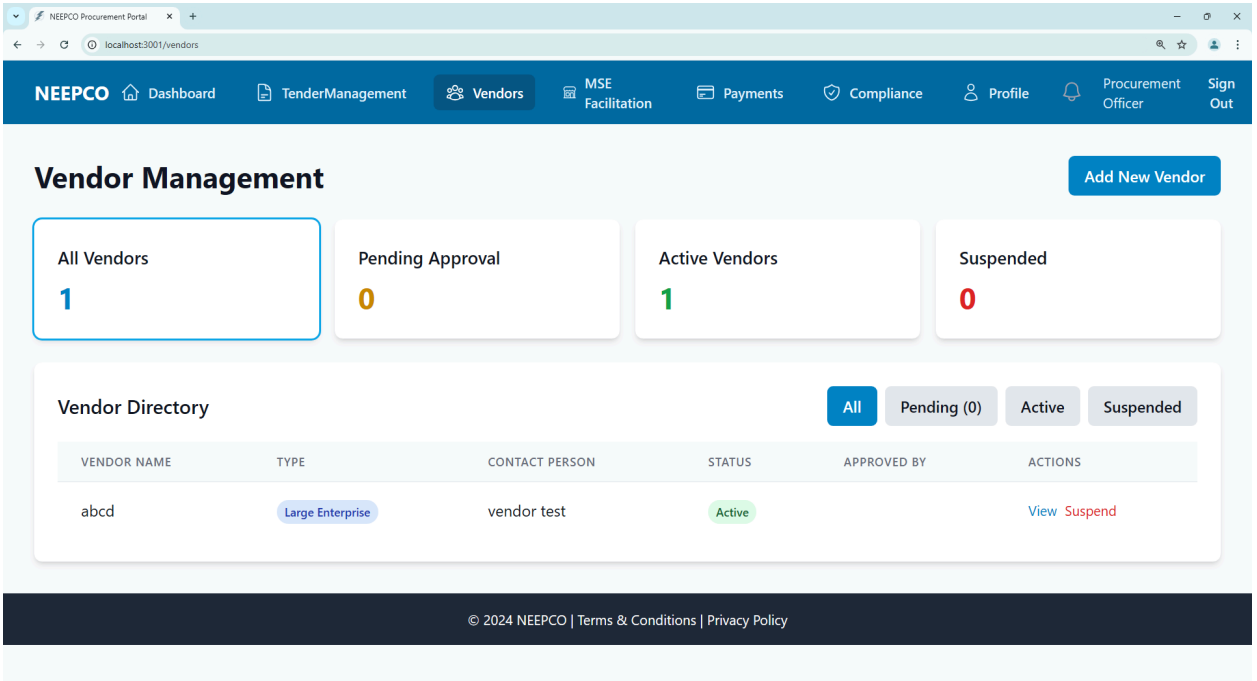

Figure: 7.6 Vendor Management Page

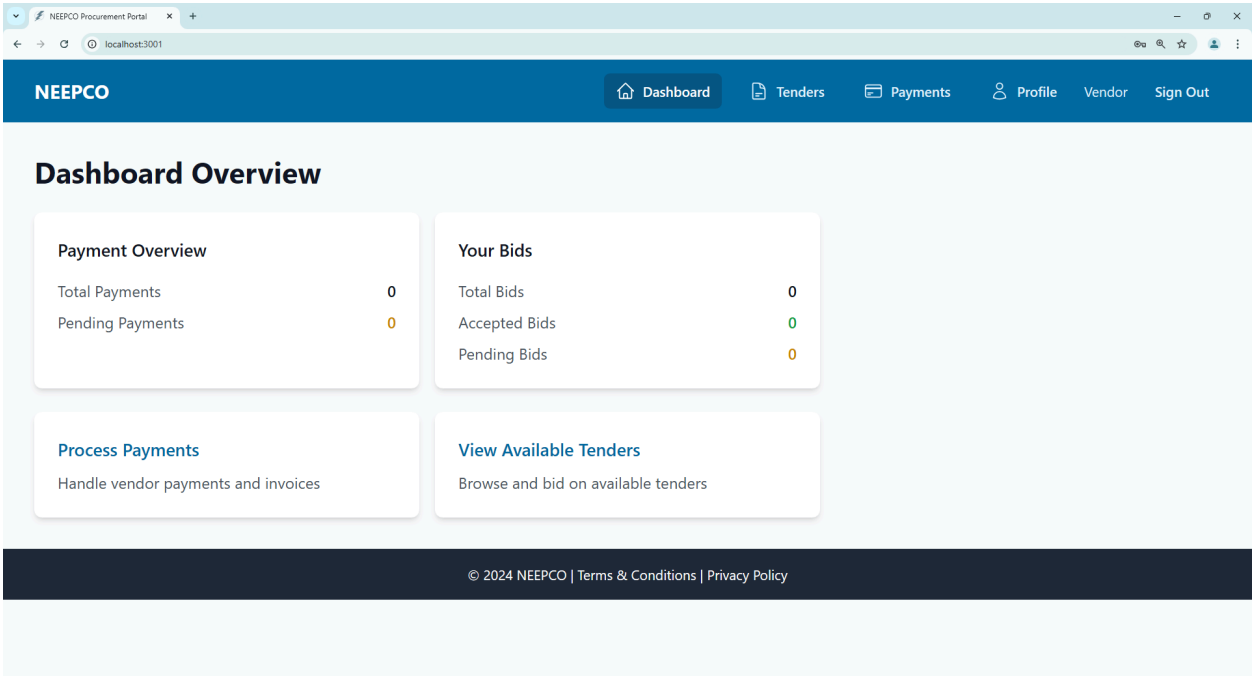

Figure: 7.7 Vendor Dashboard Page

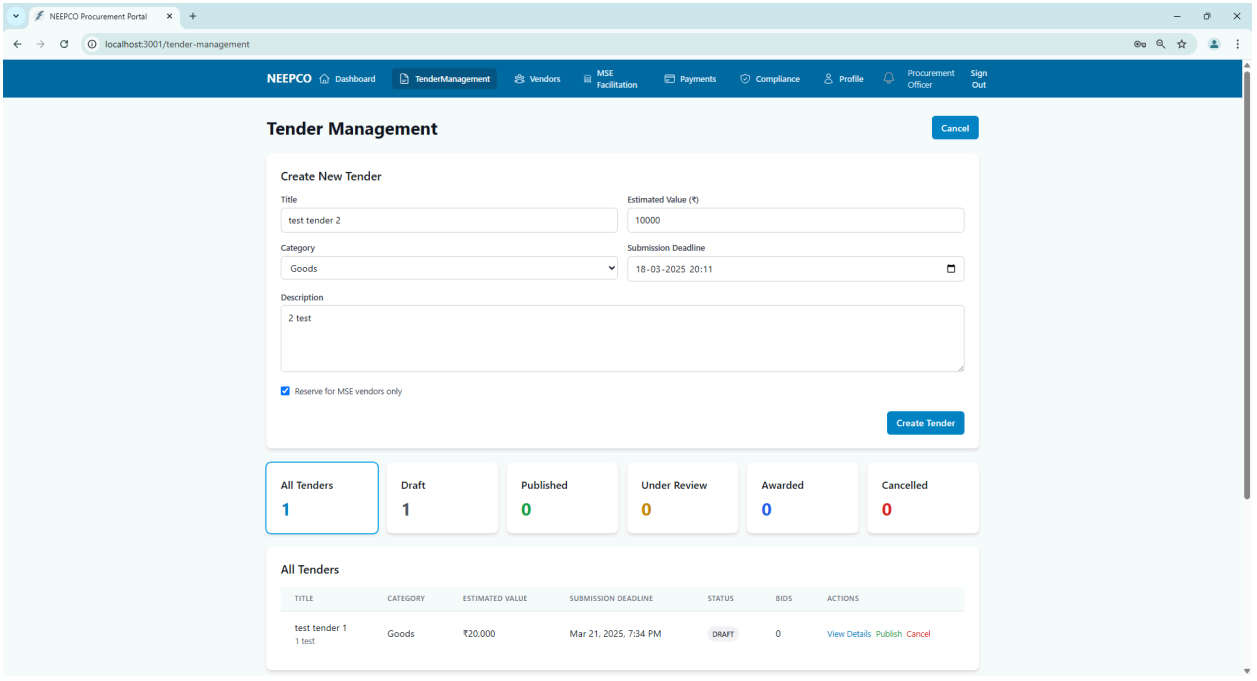

Figure: 7.8 Tender Management Page

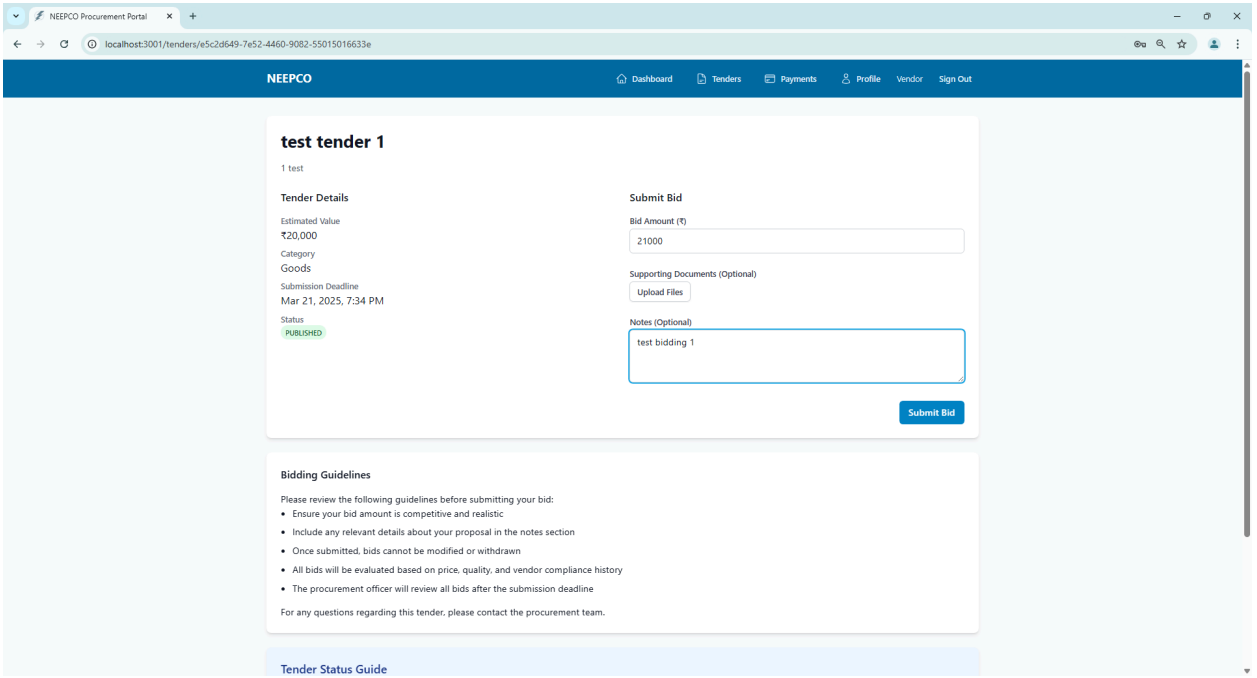

Figure: 7.9 Bidding for Tender Page

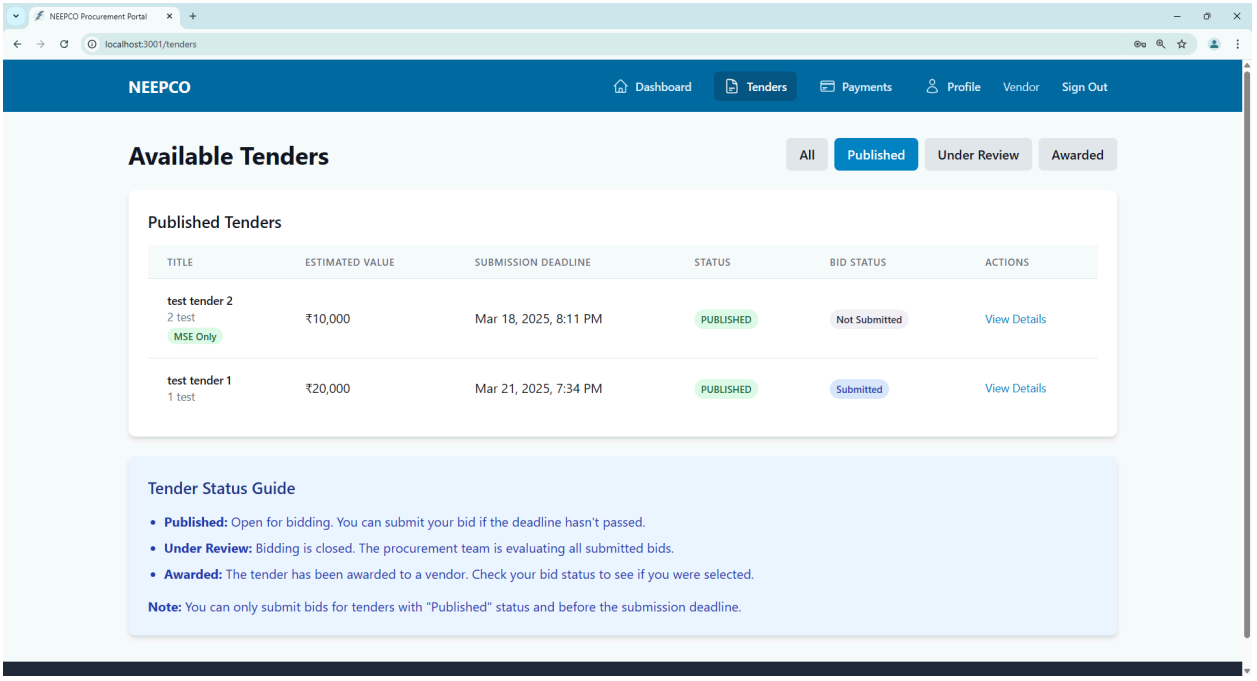

Figure: 7.10 Available Tenders Page

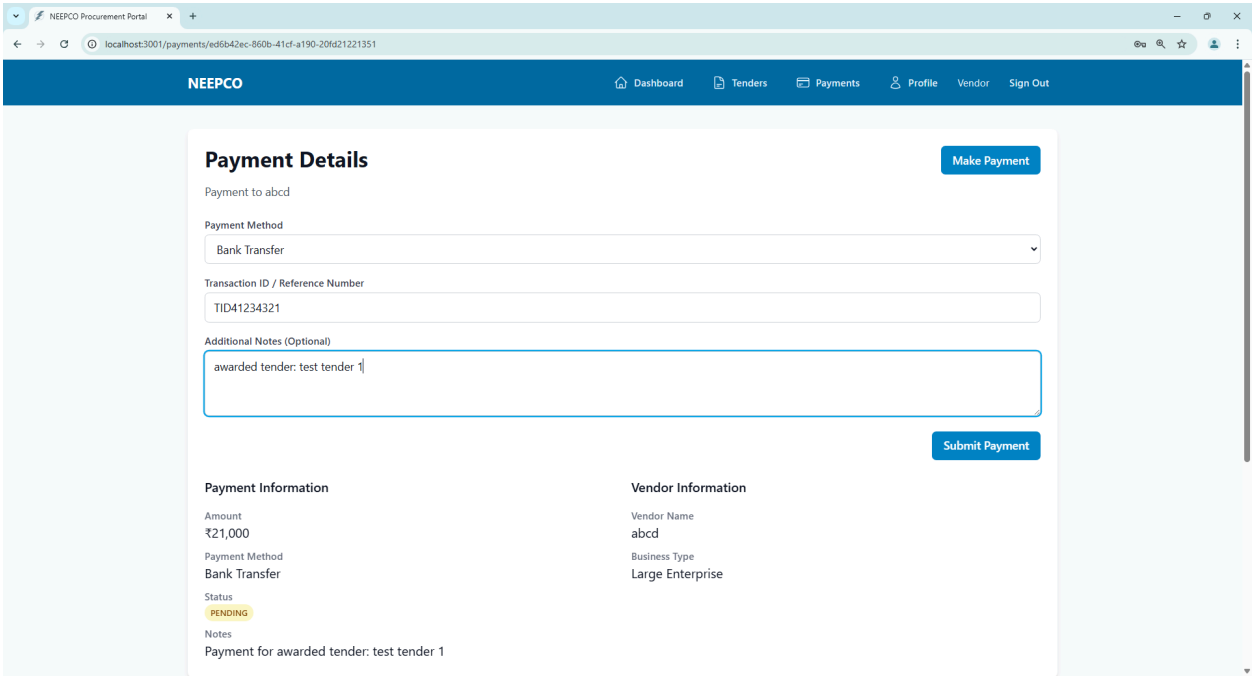

Figure: 7.11 Payment for Tender

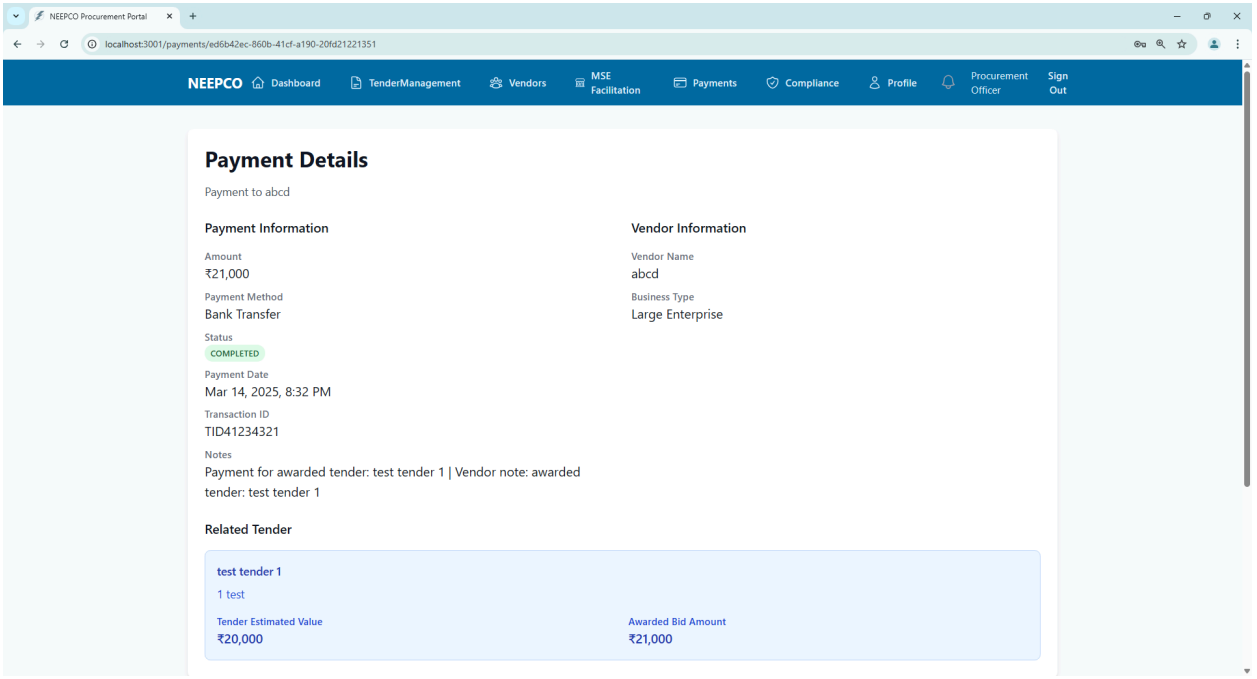

Figure: 7.12 Payment Completed for Tender

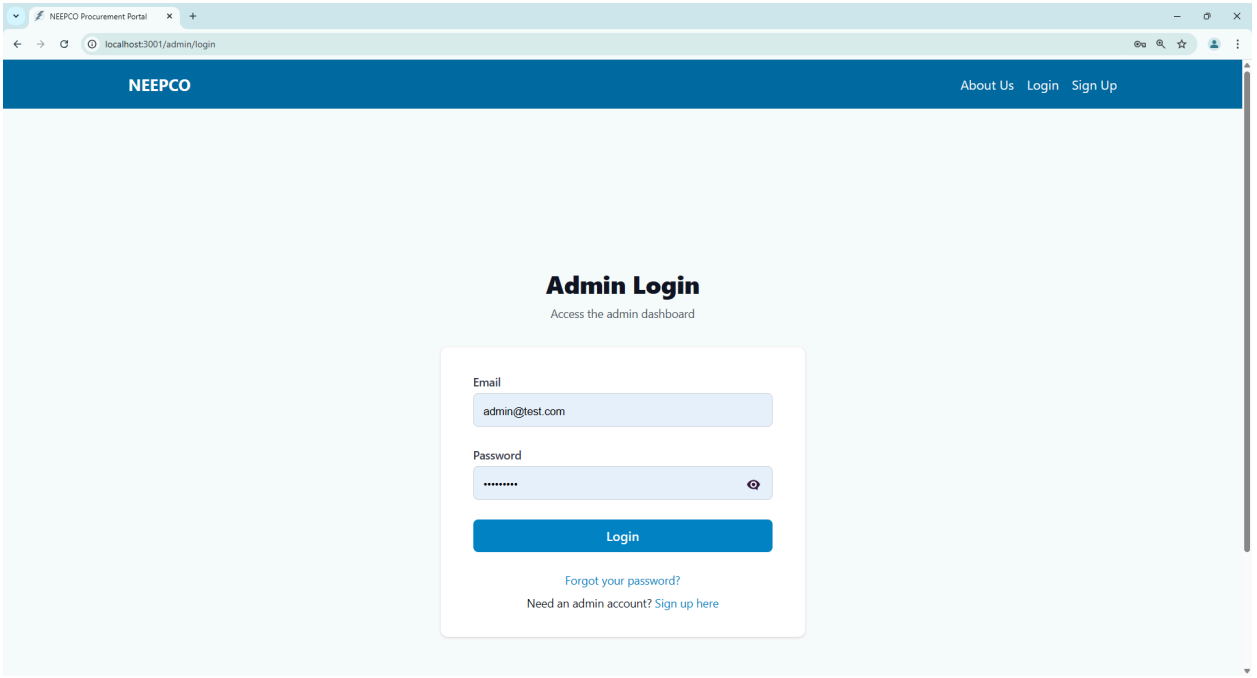

Figure: 7.13 Admin Login

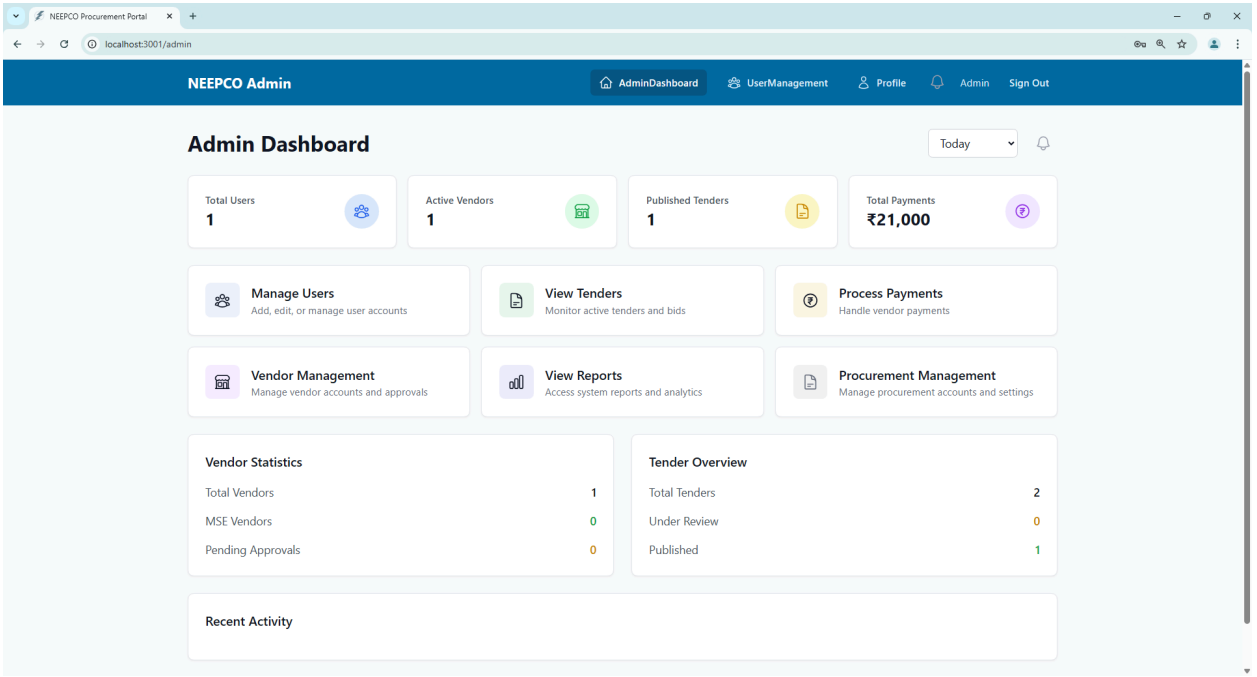

Figure: 7.14 Admin Dashboard

CHAPTER - 8

CONCLUSION

8. CONCLUSION

The development of the NEEPCO Portal has successfully tackled the challenges NEEPCO faced in managing its procurement processes and vendor payments. By introducing a centralized platform, the system has improved transparency, enhanced efficiency, and ensured better compliance with organizational standards. Key features such as automated workflows, real-time tracking, and integrated reporting have streamlined procurement activities, reduced delays, and strengthened vendor relationships. The portal's ability to provide real-time updates and maintain detailed records has improved communication between procurement officers, finance teams, and vendors. With role-based access control, each stakeholder can efficiently manage their respective responsibilities, ensuring better accountability and control. By eliminating outdated manual processes, the portal has minimized errors, reduced administrative burdens, and improved overall operational effectiveness. The system's structured approach also offers improved support for Micro and Small Enterprises (MSEs) . As a result, the NEEPCO Portal is expected to play a vital role in enhancing the organization's efficiency, ensuring smoother procurement workflows, and fostering stronger vendor partnerships.

CHAPTER - 9

FUTURE ENHANCEMENT

9. FUTURE ENHANCEMENT

To ensure the portal continues to meet evolving organizational needs, several enhancements are proposed for future development:

- **AI-Based Analytics:** Implement advanced analytics powered by AI and machine learning to predict procurement trends, identify risks, and recommend optimal procurement strategies.
- **Mobile Application Integration:** Develop a mobile-friendly application to allow stakeholders to access procurement data, submit bids, and track payments on the go.
- **Enhanced Security Features:** Introduce multi-factor authentication (MFA) and biometric login to improve system security.
- **Blockchain Integration:** Implement blockchain technology to enhance data security, improve traceability, and ensure tamper-proof procurement records.
- **Chatbot Support:** Integrate a smart chatbot to assist users with procurement queries, troubleshooting, and status updates.
- **Vendor Performance Tracking:** Introduce detailed vendor performance metrics to aid in selecting reliable vendors for future contracts.

CHAPTER - 10

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10. REFERENCES

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CHAPTER - 11

CONTRIBUTIONS

(PUBLICATION)

11. CONTRIBUTIONS(PUBLICATION)

Submitted a paper titled as "PORTAL FOR NEEPCO PROCUREMENT PROCESS AND VENDOR PAYMENT DETAILS" and it is in the process of publication.

Analysis Of The Portal For Managing NEEPCO Procurement Processes And Vendor Payment Details

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Abstract:

This research will highlight challenges in the process of procurement, and also vendor payment details by North Eastern Electric Power Corporation, but more directly on the issues related to MSE support and the complexities encountered in purchases through the Government e-marketplace portal. The paper sets out to build upon developing a holistic improvement plan tailored to optimize procurement, improve transparency, and simplify payment procedures for better cooperation with suppliers. Utilizing a mixed-methods approach, the paper's goal is to conduct qualitative key stakeholder interviews, quantitative data analysis of procurement data and benchmarks against best practices in public sector procurement. Expected outcomes include an automated procurement system that eliminates inefficiencies, ensures timely payment to vendors, and strengthens support for MSEs. Improved communication strategies enhance vendor relationships, thus improving the services delivered to the various stakeholders. This research provides tailored solutions specifically for NEEPCO, in the light of other generalized solutions suitable for similar procurement challenges in other organizations and thus contributes to the discourse related to public sector procurement best practices, with a sharp emphasis on the sense of transparency, efficiency, and inclusivity of vendors.

INTRODUCTION

The North Eastern Electric Power Corporation Limited is a power utility located in Shillong, Meghalaya. The corporation was established in 1976 and is aimed at hydroelectric power generation mainly in the northeastern region of India. The procurement processes of NEEPCO are found to be highly stressed and thus impede the productivity of operations and the vendor relationship. For example, in research, specific to vendor payment complexities and assistance for MSEs under the transactions on the Government e-marketplace (GeM) platform, six micro-enterprises were engaged in open interviews. The complexity of such procurement practices not only hinders effective cooperation from the perspective of a vendor but also imperils the corporation's ability to meet promises to stakeholders. There exists a strong justification for this study because there is an urgent need to improve the efficiency of procurement in public sector organizations, which would make the success of sustainable economic development and powerful supplier relationships quite inevitable. The study would provide for a focused analysis of challenges specific to NEEPCO and find its way to actionable improvement. What's more, MSEs being crucial for economic development, something like that which falls within inadequate support within the procurement frameworks demands urgent attention. The research would work on developing

an all-rounded improvement plan specific to the NEEPCO procurement process that would optimize transparency and ease payment procedures, thereby further supporting cooperative behavior among suppliers. Toward this, through a mixed-methods approach incorporating qualitative interviews with key stakeholders and quantitative data analysis, this study attempts to conceptualize best practices that can not only enhance NEEPCO's procurement but also become the model for other organizations facing similar challenges in their procurement processes. In this regard, the contribution of the study lies in the overall discourse on the best practices of public sector procurement, where it places a great deal of emphasis on transparency, efficiency, and inclusiveness in those relationships with vendors.

LITERATURE SURVEY

P2P stands for the procurement-to-payment cycle of steps incurred in the acquisition of goods and services by an organization. It covers all activities initiated from the time that a procurement request is made until the final settlement of payment is effected. Commonly included in this are requisitioning, sourcing, purchasing, receiving, and invoice processing. By making these steps streamlined and more efficient, organizations can contribute to efficiency, ensure cost control, and provide proper governance in the overall procurement cycle. The procurement process of an organization is, in fact, a success factor, for it ensures that the company gets what it wants across at the best possible price.

Procurement is a technique and structured method for streamlining an organization's procurement process so as to achieve desired results in saving the cost, time, and building win-win supplier relationships. Procurable items can be of various types, namely direct or indirect procurable items, reactive or proactive procurable items.

Procurement refers to the actions or steps an organization defines to acquire goods or services, from the point of requisition up to the approval of the purchase order and invoice. Of course, we often use procurement interchangeably with the phrase purchasing; however, if they were technically separated, they carry some subtle variations.

Although buying is the overall process of acquiring required goods and services on behalf of an organization, procurement refers to the activities related to the getting process and consists of the steps that need to be followed while reviewing, ordering, acquiring, and settling for goods/services. Procurement within an organization would be specific to its context and operation.

The innovative cycles of absorbing new technologies and ideas can raise the efficiency of an enterprise business, eventually leading to additional economic development. In recent history, the most up-to-date information and communication technologies (ICT) innovation changed business processes tremendously. Among them, electronic procurement, simply known as E-procurement, is one technology aid that helps a company gain what it requires. Electronic sales and purchase of goods or services in business-to-business, business-to-consumer, or business-to-government transactions may be defined as E-procurement. A procurement is said to be an advance in the delivery relationship between buyers and sellers (Subramaniam & Shaw, 2004; Saeed et al., 2005).

It involves the acquisition of every type of goods, services, and work that an organization needs, including selecting suppliers, managing contracts, and negotiating. Good procurement helps save a lot on costs, enhances the quality and delivery, and gives much better relationships between an organization and its suppliers. As such, optimizing procurement processes and strategies has remained the best approach to developing overall performance (Cao & Wang, 2022; Mohamud et al., 2023).

PROBLEM STATEMENT

The procurements are being dealt with a lot of difficulties while making payments to the vendors by NEEPCO. These have resulted in inefficiencies and delays, which impact its operational effectiveness and relations with the vendors. Among other issues, there is no facilitation of MSEs under the procurement framework, and issues associated with procurement are made through the Government e-marketplace portal. In the absence of an appropriate streamlined and transparent mechanism, NEEPCO is unable to acquire and manage the various data across the procurements which has reduced the capability of the entity to effectively and efficiently fulfill commitments toward the vendors and stakeholders.

METHODOLOGY

The entire process of development of the online portal for procurement and vendor payments in this research study was taken up by considering the following key steps in a systematic manner:

1. Research and Requirement Gathering:

Analysis of the existing procurements and payment systems of NEEPCO was done in detail through the following methodologies:

- Stakeholders' interviews: procuring officers, finance managers, and vendors to understand the workflow, problems, and expectations.
- Data collection: acquire historical data about procurement cycles, vendor management, and payment processes.
- Benchmarking: the process of comparing an organization's current workflows to industry benchmarks to spot the areas that require improvement.

2. System Design and Architecture:

The portal architecture was designed according to NEEPCO's specific requirements so that it would have an effortless interface with outside systems such as GeM. The above aspects have been concentrated during the design of the system.

- Modular Design: Separate modules have been developed within the system that deal with vendor management, procurement, and payment tracking.
- UI/UX Design: All procurement officers, finance teams, and vendors should have easy navigation.
- Data Flow and Security: Storage of data and transaction flow has been ensured to be secure with compliance with the regulatory requirements.

3. Development and Implementation:

The portal had been built on highly advanced technologies about robustness as well as scalability:

- Front-end Development: Developing a responsive and accessible interface (e.g., HTML5, CSS, JavaScript)

- Back-end Development: Implementing the core functionalities related to procurement, vendor management, and payment processing (e.g.,Node.js, Python, or Java.)
- Database Design: Designing a structured database for managing procurement records, vendor details, as well as transactional data
- API Integration: Interaction with the Government e-Marketplace or GeM

4. Testing and Quality Assurance:

To establish the reliability and security of the system, a very tight testing phase was conducted as follows:

- Functional Testing: Testing every module for correctness in their operations.
- User Acceptance Testing (UAT): Involving the personnel of NEEPCO and the vendors to get feedback.
- Performance Testing: Checking whether the system functions as desired under all conditions to scale up.
- Security Testing: Identifying vulnerabilities to ensure appropriate security measures for data protection.

5. Deployment and Training:

Once the system tested satisfactorily, it was rolled out on the infrastructure of NEEPCO as:

- Deployment: Deploys the application on cloud servers to meet scalability and accessibility needs.
- User Training: Organized sessions for end-users which encompasses procurement officers and vendors.
- Monitoring: Tools developed that monitor the performance of the system and feedback from users

6. Evaluation and Continuous Improvement:

After deployment, the effectiveness of the portal was analyzed based on user feedback and operations performance measures as shown below:

- Review and assessment: Continuously monitors system efficiency, user satisfaction, and overall procurement performance.
- Continuous Upgrades: Design and implementation upgrades based on various stakeholders' feedback ensure that the portal keeps pace with the requirement of NEEPCO.

CONCLUSION:

NEEPCO, its online procurement and vendor management portal is the most strategic leap in procurement management organization. In order to procure the power from NEEPCO, one has to go through three different websites each having specific functionality such as Vendor and Bidder registration, Bidding and Auctioning and there is no specific portal for online payment so the payment transaction has to be done at an authorized bank and then the receipts has to be uploaded in the respective website. In the proposed portal we are planning to integrate Registration, Bidding, Auctioning and online Payment. Automation and digitization in procurement and payment workflows increase efficiency, transparency, and compliance. This appropriate streamlined and transparent mechanism also provides facilitation of MSEs under the procurement framework and supports them. This portal can be customized to other organizations as per their requirements and workflow and also this can serve as an example to other large public sector companies that face such challenges.

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