Tec Graphics Operations Management System

L. I. Fernando
2024

Tec Graphics Operation Management System

A dissertation submitted for the Degree of Master of Information Technology

L. I. Fernando
University of Colombo School of Computing
2024

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ABSTRACT

In today's competitive world, where visibility and brand recognition is essential for business success, advertising and promotions play a pivotal role in reaching target audiences. As a result, there has been a significant rise in the number of companies specializing in this service. TecGraphics is a company which has entered this market recently amidst heavy competition. The company is currently using a manual system to manage their day-to-day operations, which is an obstacle in the growth of the company.

As a result of the manual system the organization has come to face problems such as data inaccuracy, redundancy and delay in decision making due to unavailability of timely reports. Thus the need to update their systems to increase productivity and accuracy of the information recorded, has become a vital part of the organization's development in today's competitive market. As a solution they have decided to adopt a computer based system.

The Operations Management System is developed using the Iterative Waterfall Model and Object Oriented method was used for designing. PHP was chosen for coding the system. Database for the system was designed using MySQL. A Bootstrap based framework was selected for building the user interface of the system.

The Operations Management System is built and customized in order to overcome the challenges faced by the client company. The system is designed to eliminate the manual paper work involved in activities such as purchase, sales and inventory control. It also facilitates report generation. Thus providing the organization with ready reference data, that will be accurate, that will aid the decision making process. The system will reduce redundancy and save time by reducing the manual work.

ACKNOWLEDGEMENT

It would not have been possible to complete this project without the kind support and help of many individuals and organization. I would like to extend my sincere thanks to all of them.

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CHAPTER 1 INTRODUCTION

1.1 PROJECT OVERVIEW

Information and communication technology profoundly impacts our world today, making most organizations digitize their business processes by adopting computerized systems. The main goal of such systems is to ensure efficiency and reliability and thereby increase the profitability of the business. The systems support organizations by automating possible processes and eliminating errors. It stores centralized data avoiding duplication, and aids the management with sufficient decision-making information.

Tech Graphics is an organization that carries out its business in digital printing. The company specializes in printing banners, brochures, business cards, and other marketing materials. It also offers photo copying and printing services. The company is situated in the heart of the city and accepts about twenty five orders daily. The company's customers include a wide range of businesses and organizations. It also serves individual customers who need printing services.

The main functionalities of the company include creating quotations for customer inquiries, producing artwork and preparing designs for printing, printing production, procurement and inventory management. Maintaining records and information transition between departments are currently done manually.

1.2 MOTIVATION

The client organization uses a time-consuming manual system that is prone to errors. All necessary details are manually entered and maintained in different spreadsheets, resulting in data repetition. There is also more room for human errors, causing inaccurate data. Managing timelines and workflows has become difficult due to the time spent referring data. It is also challenging to track the progress of orders which involves referring different documents or inquiring related parties.

The company is encountering difficulties in fulfilling customer demand because it is unable to obtain precise inventory levels in a timely manner. Additionally there is a high risk of unauthorized access or loss of sensitive data when it is handled manually. Moreover, decision-making has become cumbersome for management due to the unavailability of accurate and timely data.

The organization needs an accurate, centralized, secure, and efficient computerized system to overcome the drawbacks and survive and succeed in today's competitive world. The organization's need for an automated system that helps to carry out their daily operations smoothly and the anticipation of implementing the knowledge gathered through the degree program inspired the proposed project.

An Operations Management system for Tech Graphics is proposed as a key contribution towards the enhancement of the business.

1.3 OBJECTIVES OF THE PROJECT

The aim of the project is to design and develop an operations management system for Tech Graphics to efficiently manage their daily operations and improve productivity. This can further be broken down into several primary objectives:

- Optimize the organization's workflow by automating repetitive tasks such as creating quotation letters, invoices and purchase orders, thereby reducing the time and effort required to complete them.
- Improve efficiency by minimizing errors caused by manual work and improving the speed of task completion.
- Provide real-time tracking of customer orders and tasks related to the orders, enabling managers to monitor progress.
- Enhancing customer satisfaction by fulfilling orders in accordance with specified requirements, thereby catering to the organization's reputation and customer loyalty.

- Generate reports that provide insight into the organization's performance, helping managers make decisions and identify improvement areas.
- Enhance security by providing robust security features to protect sensitive information from unauthorized access, thereby reducing the risk of data breaches and other security threats.

1.4 SCOPE OF THE PROJECT

In the initial phase of the project, the identification of key users of the system was conducted to understand the involvement of the stakeholders in the operational process of the company. Among these users, the pivotal role of the manager emerged as the authorized individual responsible for overlooking the entire operations of the company. Then, the inventory officer assumes the crucial responsibility of managing the procurement, maintenance, and issuance of goods within the company's inventory. Furthermore, the sales executive plays a vital role in customer interaction, communicating with clients and formulating quotations tailored to their specific requirements.

Once an order is confirmed by the customer, the coordinator steps into the proceedings, ensuring seamless execution from creating the job card until delivery. Additionally, the accountant takes care of financial transactions, generating invoices and handling payments efficiently. Lastly, the customer, as the primary initiator of the transactional process, places orders and facilitates payments. After identifying the key users, the scope of the system was defined to ensure alignment with their operational requirements. The scope of the proposed system could be listed as follows,

- Manager shall,
    - Create and manage user types and users.
    - Grant privileges to users to prevent unauthorized access to the system.
    - Generate necessary reports to support decision making.
- Inventory officer shall,
    - Create and manage suppliers.
    - Create and categorize raw material.

    - Generate purchase orders to purchase raw materials.
    - Prepare a goods received note against the order.
    - Maintain details of stock available for each raw material.
    - Issue raw materials for job card.
    - Return unused raw materials to the store.
- Sales executive shall,
    - Create and manage customers.
    - Create quotation for new orders received from customers.
- Coordinator shall,
    - Allocate confirmed order to designer.
    - Create a job card with all specification and update the progress of the job card.
    - Monitor the progress of jobs.
    - Track profitability of jobs.
    - Prepare the delivery of goods relevant to order.
- Accountant shall,
    - Generate invoice against job card.
    - Generate invoice for tasks that do not require a job card.
    - Maintain outstanding.
    - Record advance payment and later settle against invoice.
    - Generate payment receipts against invoices.
    - Generate payment vouchers against purchases.
- Customer shall,
    - Register themselves.
    - Make payments using the payment gateway.

1.5 STRUCTURE OF THE DISSERTATION

The outline of the dissertation is as follows:

- **Introduction Chapter :-** The introduction chapter provides an overview of the project. It also states the motivation for the project. The chapter also lists the objectives and the scope of the proposed system.
- **Background Chapter :-** The background chapter describes the existing system and requirements of the new system along with the methods used to gather the requirements. The chapter also includes a review of similar systems.
- **Design Chapter :-** The design chapter explains the design approach of the system design using diagrams. It further describes the design of the user interface and database.
- **Implementation Chapter :-** The implementation chapter includes the main code segments and the hardware and software environment used to implement the system. It also describes the interaction between the modules of the system.
- **Test and Evaluation Chapter :-** The test plan and test cases are described along with the expected test results in the evaluation chapter. Different test strategies used to test are also explained in this chapter.
- **Conclusion Chapter :-** The conclusion chapter of the dissertation discusses the achievements according to the objectives mentioned earlier and explains how the system could be further developed in the future.

In addition to the main chapters, the reference section lists all materials referred to within the dissertation. The appendices include the system documentation, design documentation and user documentation.

CHAPTER 2 BACKGROUND

2.1 INTRODUCTION

Background chapter covers the analysis phase of the system development. System analysis is the study carried out on the existing system. This also consist domain understanding and requirements gathering. Analysis phase is vital for building a system as it lays the foundation for the system.

This chapter gives an overview of the existing system. It also describes the process of requirement gathering and lists the functional and non-functional requirements identified through the analysis. Background chapter further gives brief summary of existing similar systems.

2.2 REQUIREMENT GATHERING

Requirement gathering and analysis are considered crucial tasks in system development process as it ensures building a system that satisfies users. There are many techniques used for this purpose and following techniques were used to capture requirements of different stakeholders of the system.

- Interviews
- Observation
- Document review

Interviews were conducted engaging the stakeholders of the company to investigate the existing manual system. Staff members playing different roles in the organization were selected for the interview to gather details regarding their daily work and managers were interviewed to gain insight into managerial reports.

Observation was carried out to gather facts about the daily operations. This facilitated the identification of system features that could be integrated to enhance the ease of the user's daily tasks. Document review involves thoroughly examining the documented records. This provided a clear understanding of the data that needs to be collected and stored.

2.3 EXISTING SYSTEM

The activities carried out in the current manual system are depicted in the use case diagram shown in Figure 2.1: Use case diagram of existing system.

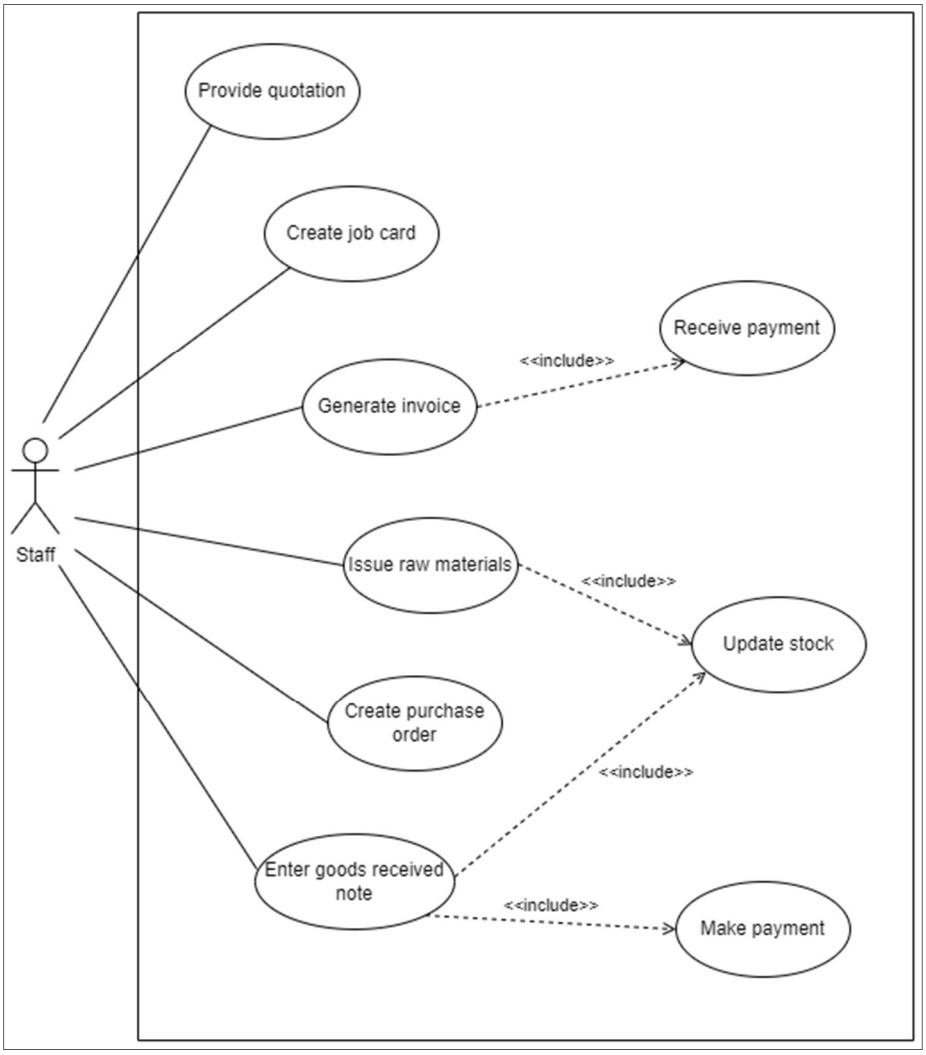

Figure 2.1: Use case diagram of existing system

The primary business process of Tech Graphics involves digital printing. Upon receiving inquiries, the estimator does the costing and provides quotations to prospective customers. Customer details are recorded and quotation letter is created manually. Once a job is confirmed, a job card is created with all specifications written on it, and an advance payment is collected.

Next, the job is allocated to a graphic designer who provides artwork. The artwork is attached to the job card and passed to the stores. Raw materials are then issued from the stores and stock details are updated. Then the materials are sent to the printing process. Necessary information is written on the job card during various stages of the job. Consequently, referring to the job card becomes imperative in order to monitor the progress of the job.

After printing process is completed the goods are packed and dispatched along with an invoice. Orders could be dispatched either once the full quantity is processed or partially completed, making it important to record the data for future follow up. Customer outstanding is maintained in another spread sheet. The sheet is regularly checked and payments are collected from the customers.

The procurement process involves generating purchase orders for suppliers. A goods received note is created upon the receipt of goods, and the items are added to the stock. Payments made to suppliers are documented as payment vouchers.

2.4 FUNCTIONAL REQUIREMENTS

Functional requirements are the operations delivered by the system. The functional requirement of the system which are identified can be summarized as follows,

- User management
    - Manager shall be able to create new user logins to prevent unauthorized access to the system.

    - Manager shall be able to grant and revoke privileges to user types so that sensitive information is accessible only to privileged personnel.
- Procurement management
    - Inventory officer should be able to create new suppliers and manage their details.
    - Inventory officer shall be able to create purchase order when there is a need to purchase raw material.
    - Inventory officer shall be able to prepare a goods received note against the order so that stock is updated.
- Inventory management
    - Inventory officer should be able to create and categorize raw material in order to efficiently manage inventory.
    - Inventory officer should be able to get details of stock available for each raw material so that resource consumption could be planned accordingly.
    - Inventory officer shall be able to issue raw materials for job cards so that printing jobs proceed smoothly while maintaining the traceability of inventory.
    - Inventory officer shall be able to return unused raw materials to store so that wastage is eliminated.
- Quotation management
    - Sales executives shall be able to create new customers and maintain details to ensure smooth coordination.
    - Sales executives shall be able to create quotation for new orders received from customers.
- Jobcard management
    - Coordinators shall be able to allocate confirmed orders to designers in order to complete the artwork needed for the order.
    - Coordinators shall be able to create jobcard with all specification and update the progress of the jobcard.
    - Coordinators should be able to monitor the progress of jobs to ensure timely completion.
    - Manager should be able to track profitability of jobs to improve efficient resource management.

- Sales management
    - Accountant shall be able to generate invoice for completed job orders so that delivery could be arranged.
    - Coordinator shall be able to create dispatch note for invoiced orders.
    - Accountant shall be able to generate invoice for tasks that does not require a jobcard such as photocopy and printout.
    - Coordinator should be able to manage partial dispatches.
    - Accountant should be able to maintain outstanding.
- Payment management
    - Accountant shall be able to record advance payments received for orders, which can be later setoff against invoice.
    - Accountant shall be able to generate payment receipts against invoices so that customer outstanding are updated.
    - Accountant shall be able to generate payment vouchers so that supplier outstanding are paid off.
- Report management
    - Users should be able to generate necessary reports to support decision making process.

2.5 NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements are essential elements that define the overall quality and performance characteristics of a system. The non-functional requirements identified can be listed as follows,

- Accuracy - Data accuracy denotes the degree to which data is correct and free from errors. Accurate data ensures that the printing process produces high-quality outputs meeting customer expectations.

- Consistency - The uniformity of the data should be maintained throughout the system. Consistent data ensures that decisions made based on that data are trustworthy, leading to better business outcomes.

- Security - The system should be safe from unauthorized access and data breeches. Outside parties should not have access to the organization's sensitive information. Confidential data, such as financial details, should only be accessible to authorized users.
- Reliability - The system should perform consistently over time and minimize down time, errors and failures as the users will heavily depend on the system to perform their day-to-day tasks.
- User friendly - The system interface should be simple and easy to use so that the users should be able to interact with the system with minimal effort even amidst their busy schedules.
- Timeliness - Processing and response time should be minimized and information should be available at the required time in order to complete orders on time. Timely data is also crucial for enabling efficient and instantaneous decision-making.
- Maintainability – As the industry continues to grow, the system may necessitate future modifications and enhancements. In such instances, these advancements should not be a challenging task.

2.6 REVIEW OF SIMILAR SYSTEMS

There are number of off-the-shelf systems available to manage printing companies. PressWise, ePRO, PrintVis, PrintSmith, Avanti Slingshot and Ordant are some systems among those.

2.6.1 PressWise

PressWise (Datatech SmartSoft, Inc., 2022) print MIS is one of the widely used web based operations management systems for printing companies. The system's print order management module enables seamless workflow optimization, empowering effective management of tasks and

monitoring of orders through an intuitive dashboard interface. By automating certain processes of regular orders, it notably increases the processing speed.

The interface for printing quotation of the system is depicted in Figure 2.2: Quotation screen of PressWise system.

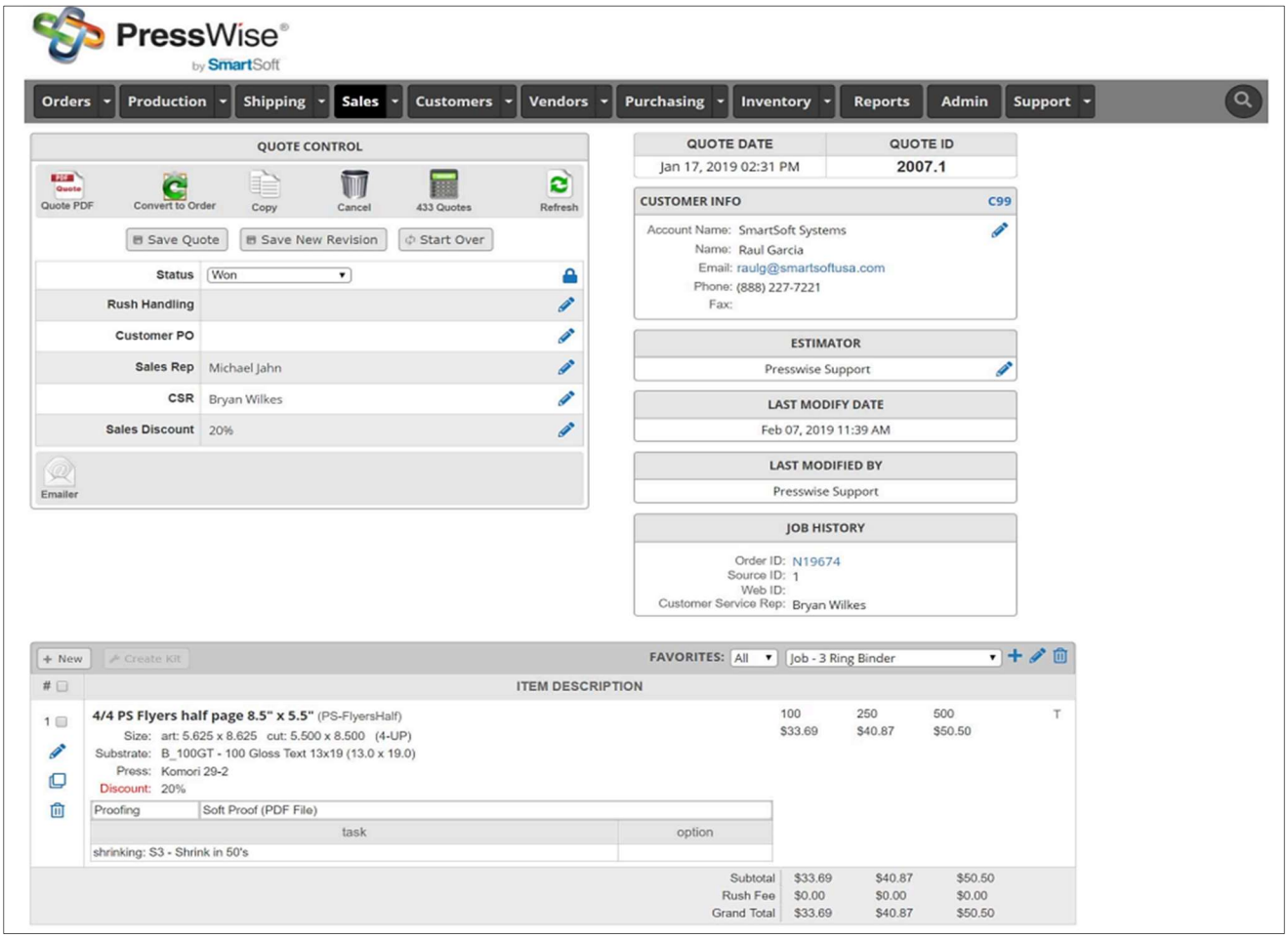

Figure 2.2: Quotation screen of PressWise system

Furthermore, the inventory management component of PressWise empowers generating purchase orders, efficiently managing suppliers, and establishing optimal stock levels. It automatically monitors real-time inventory levels which are crucial for accurately planning and executing jobs. Estimating, job production management, mail processing and shipping are other features included in this package. The interface for viewing inventory is illustrated in Figure 2.3: Inventory summary screen of PressWise system.

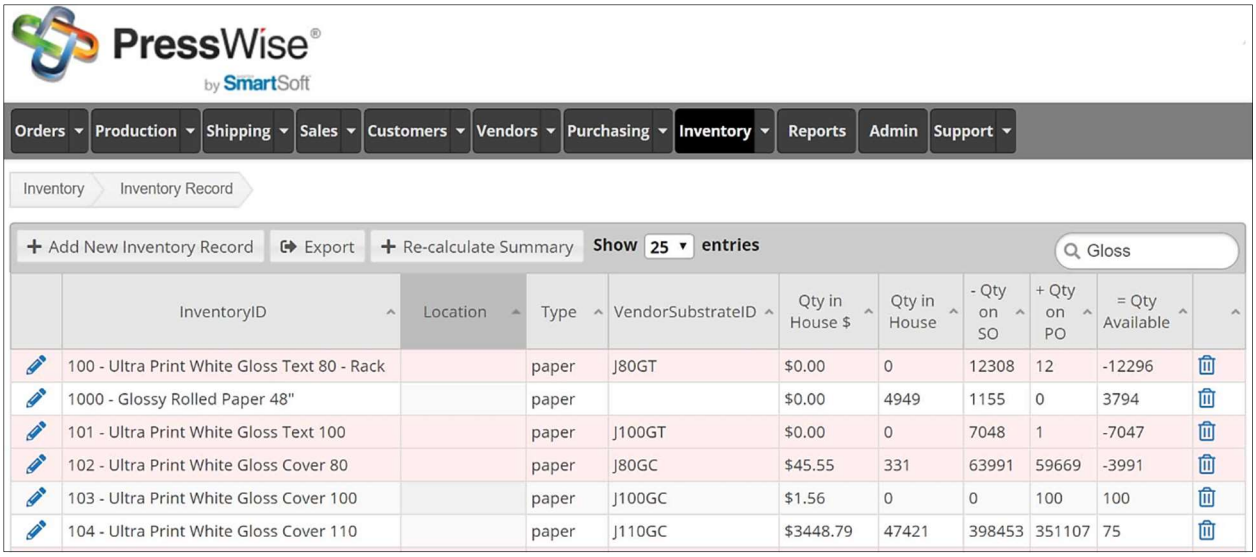

Figure 2.3: Inventory summary screen of PressWise system

Despite its notable strengths, the system under examination also possesses certain limitations that warrant critical consideration. It is noted that the process of setting up pricing table is somewhat tedious. Additionally, there is no straightforward solution for partial delivery of an order.

2.6.2 ePRO Print MIS

ePRO print MIS (Print Management Information Systems, n.d.) is a cloud-based print shop management software. The CRM section of ePRO provides a centralized database to store and manage customer information, contact details, and sales pipeline data. One of the standout features of ePRO print MIS is its advanced jobcard and tracking system, which utilizes barcodes to significantly reduce manual data entry for production and tracking purposes.

Furthermore, ePRO print MIS offers robust supplier management capabilities, allowing to maintain a comprehensive vendor database with categorized filters based on type, methods, and capabilities. The inventory management module of ePRO print MIS empowers automatic purchase order generation, maintain warehouse operations and enables real-time tracking of stock levels. Additionally, the system facilitates streamlined invoicing processes and creating delivery notes for single or multiple locations. To support decision-making process, ePRO print MIS offers

customizable reporting options that provide valuable insights into the status of the business. The interface for viewing the active estimates is shown in Figure 2.4: Estimate list of ePRO system.

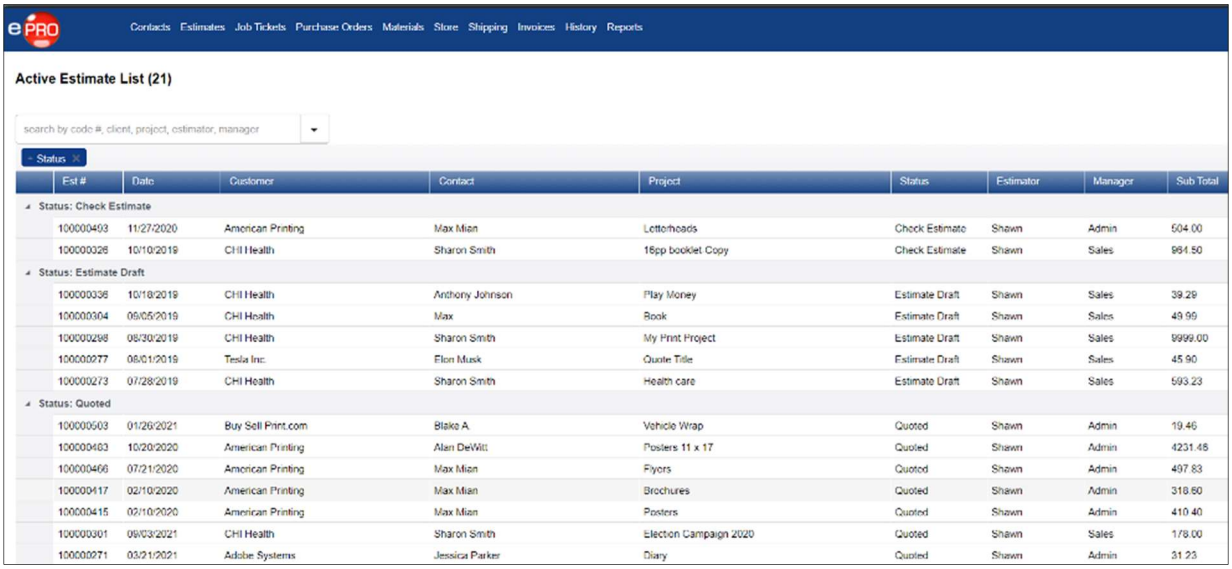

Figure 2.4: Estimate list of ePRO system

Moreover, ePRO print MIS encompasses additional features such as advanced estimating, outsourcing management, production scheduling, and finished goods management, ensuring a comprehensive solution. The interface for viewing the job list is displayed in Figure 2.5: Job list of ePRO system.

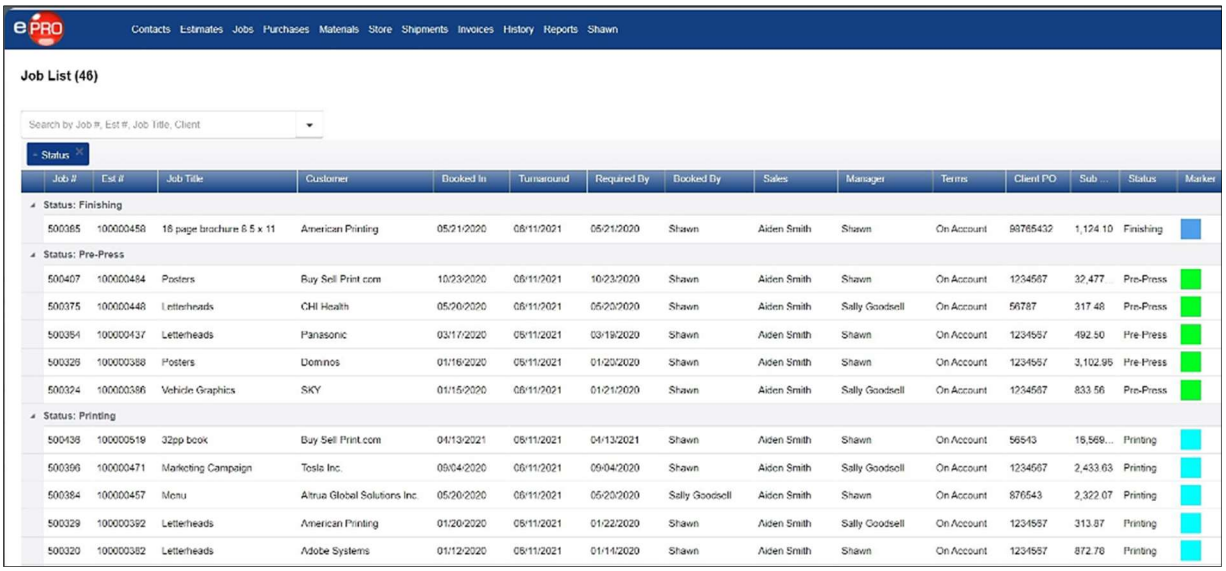

Figure 2.5: Job list of ePRO system

The main drawback of the system is the costs involved. It has a one-off setup cost and a monthly or annual license fee. For small or budget-conscious printing companies, this upfront expense may be a challenge.

2.6.3 PrintVis

PrintVis (PrintVis, 2023) is the Print Management Information System powered by Microsoft Dynamics 365 that manages the daily activities of a print business in one complete solution. The Case Management aspect of the system is designed to provide all the information on each individual order, from quote to invoice such as detailed information on deadlines, delivery dates, customer information, job history, etc. The interface for job planning is portrayed in Figure 2.6: Planning screen of PrintVis system.

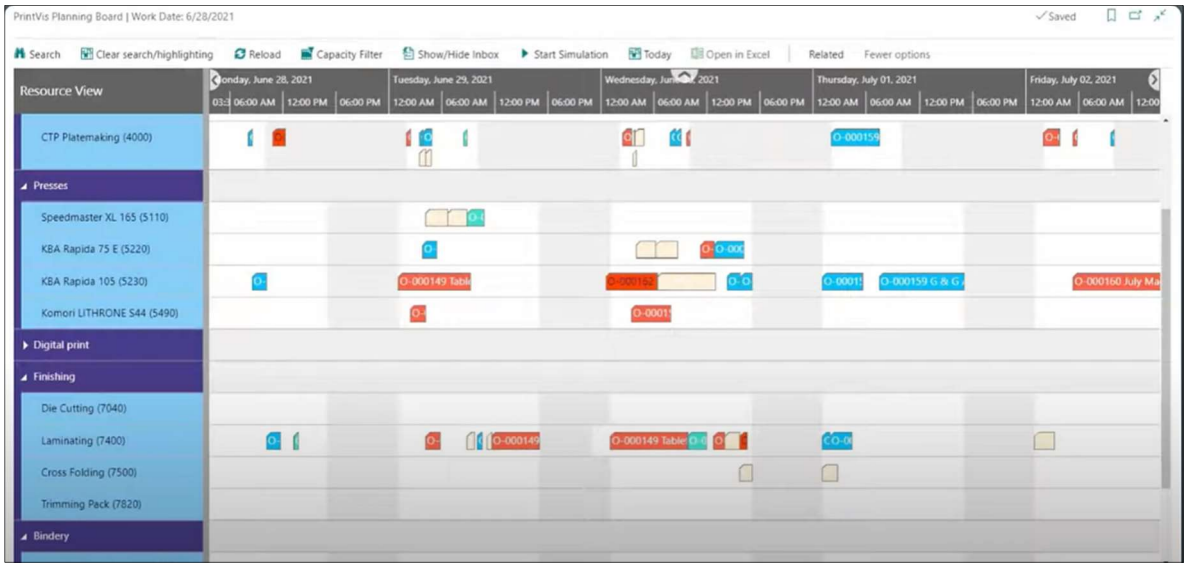

Figure 2.6: Planning screen of PrintVis system

Through the inventory management and purchasing module, PrintVis grants a full overview of purchase needs for both goods and services based on individual job planning. It allows centralized purchasing, individual purchasing per job, or combination of the two. Purchase orders can be easily generated with purchase wizard. PrintVis also grants full control over which items are to be managed by automated purchase suggestions in the system.

Financial management feature of PrinVis facilitates managing bank accounts, creating accounting periods and automating cheque writing and bank statement reconciliation. It is also possible to set up business rules such as payment terms and discounts. Similarly PrintVis consist of features such as estimating, planning and scheduling, shop floor management and job costing.

Comparison of similar systems

A comparison of the studied systems and the proposed system is described in Table 2.1: Comparison of similar systems.

Table 2.1: Comparison of similar systems

Features	Presswise	ePRO	PrintVis	Proposed System
Estimating	✓	✓	✓	
Print order management	✓		✓	✓
Job production management	✓	✓	✓	✓
Supplier Management	✓	✓		✓
Purchase order	✓	✓	✓	✓
Inventory management	✓	✓	✓	✓
Mail processing	✓			
Shipping	✓			
Outsourcing		✓		
CRM		✓		✓
Production scheduling		✓	✓	
Financial management			✓	
Reporting		✓		✓

The proposed project incorporates a comprehensive set of core features. While there are commercially available software solutions that offer additional features, they have been not included in the proposed system based on the customer's specific requirements as explained below,

- Outsourcing process – not included to the proposed system as the organization is well equipped to carry out necessary tasks in-house and therefore do not require outsourcing.
- Production scheduling – not included as the organization does not have a bigger prospect of managing large number of machinery and production teams.
- Financial management – not included as they are currently using a comprehensive accounting package from which they do not tend to switch.

The proposed system's key advantage lies in its high degree of customizability, allowing for tailored functionality to meet the unique needs of users such as distributing the jobs among team members, follow-up with the team to ensure completion of various stages of the order, arrange partial delivery of order according to customer’s specific requirements and etc.

CHAPTER 3 DESIGN

3.1 INTRODUCTION

The design phase is the stage in which the requirements, gathered during the analysis phase, transform into the precise specifications that define the outline of a computer based solution. In abstract terms, system design involves the process of crafting both the system architecture and the user interface.

Design chapter gives an overview of the design strategies and describes the architecture of the system. This chapter also focuses on designing of inputs, outputs, database and interface with the use of design diagrams.

3.2 DESIGN STRATEGIES

Object-oriented design is one of the widely used design strategies. It focuses on entities in the software system and its characteristics. The whole concept of software solution revolves around the engaged entities (Tutorialspoint.com, 2019).

Important concepts of object-oriented design are,

- Objects: All entities involved in the solution design are known as objects.
- Classes: A class is a generalized description of an objects. Class defines all the attributes, which an object can have and methods, which defines the functionality of the object.
- Encapsulation: Bundles the attributes and methods of an object together, but also restricts access of the data and methods from the outside world.

- Inheritance: Allows similar classes to stack up in hierarchical manner where the lower or sub-classes can import, implement and re-use allowed variables and methods from their immediate super classes.
- Polymorphism: Provides a mechanism methods performing similar tasks but vary in arguments, can be assigned same name.

Structured design (Kumar, 2022) is one of the other design strategies used. It is primarily base on 'divide and conquer' technique, in which a large problem is divided into smaller ones, each of which is handled independently until the larger problem is solved. A good structured design has high cohesion and low coupling arrangements. The hierarchical organization of structured design allows developers to focus on high-level design before delving into lower-level details.

The structured design approach may introduce additional overhead in the initial stage of design. The emphasis on planning and documentation may require more time and resources upfront. Moreover the hierarchical structure can lead to rigidity, making it challenging to accommodate change or adapt to evolving requirements.

Function-oriented design is the other design strategy. This strategy splits the entire system into subsystems known as functions. The system is viewed as collection of all the bundled functions. There is more information travelling between the functions, whilst the smaller functions promote abstraction. The functions developed in a function-oriented design can often be reused in different parts of the system or in other projects.

In some cases, function-oriented design may lead to tight coupling between functions, where changes to one function require modifications to multiple other functions and makes the system more difficult to maintain. While this design works well for smaller, less complex systems, it may face scalability problems in more complex projects as managing large number of functions can become increasingly difficult and error-prone.

Having reviewed the available strategies, Object-oriented design is used for designing the proposed system. Reasons for selecting this strategy:

- Objects can model real world entities and their relationships, representing the actual problem domain.
- It modularizes the system into components known as objects. In the proposed system, where various operations and processes need to managed, these objects could be reused in different parts of the system.
- Encapsulation, simplifies complex parts of the system by hiding avoidable attributes and focusing on necessary attributes.
- As the industry evolves, operations management system is expected to be highly maintainable. Object-oriented design makes the system more adaptable as new features can be added by introducing new classes or modifying existing classes with minimum impact to the entire system.

3.3 SYSTEM ARCHITECTURE

System architecture (SEBoK Editorial Board, 2023) is a comprehensive solution based on principles, concepts and properties logically related to and consistent with each other. It also focuses on high-level structure in systems and system elements.

3.3.1 WEB-BASED SYSTEM

The system is decided to be deployed as a web-based system. A web-based system is an information system that is accessed over a network connection and uses web technology to deliver information and services to users. Reasons for implementing a web-based system are,

- The client will not have the hassle to maintain a server in their premises.
- The system need not be installed in every device.

- Users from higher management will be able to access the system from wherever they are.

3.3.2 CLIENT-SERVER ARCHITECTURE

Client-server architecture is selected as the most suitable architecture for the proposed system. In a client-server model, the server manages and provides resources while clients request resources. Causes for selecting this architecture are,

- All information are centralized and therefore easy to maintain.
- Data is well protected due to the centralized architecture and easy to backup.
- High scalability with growing needs.
- Every client has the opportunity to login, irrespective of location and platform.

The architecture of the system is illustrated in Figure 3.1: Architecture of the Operations Management System.

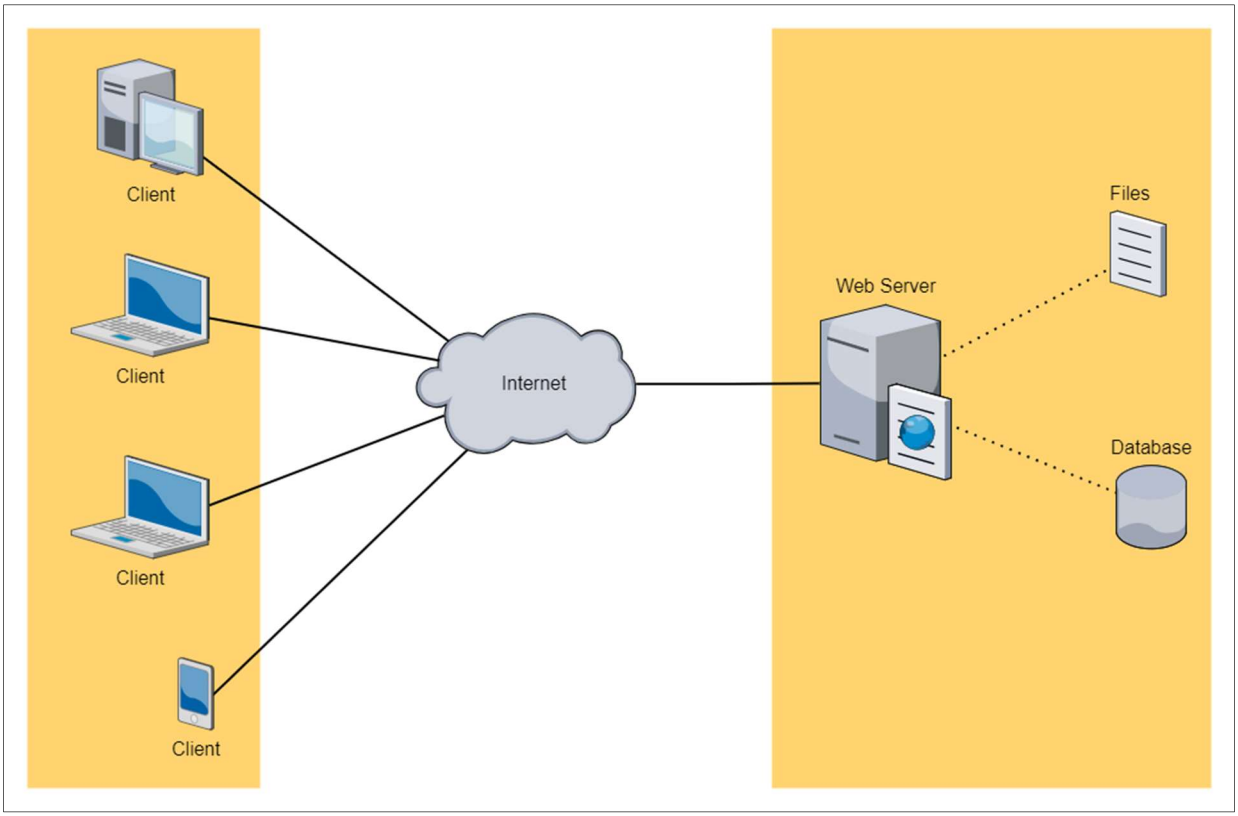

Figure 3.1: Architecture of the Operations Management System

3.4 UML DIAGRAMS

3.4.1 USE CASE DIAGRAM FOR THE OPERATIONS MANAGEMENT SYSTEM

A use case diagram generally shows a graphic depiction of the users of the system and the main functionalities carried out by the identified users. The key users of the system are identified as the manager who oversees the entire operations, sales executive who creates quotation and follows up, coordinator who handles the job process, inventory officer who is in-charge of procurement and inventory, accountant who handles financial transactions and customer who interacts with the system to place order and make payment.

The overall use case diagram for the proposed system is described in Figure 3.2: Use case diagram for the Operations Management System.

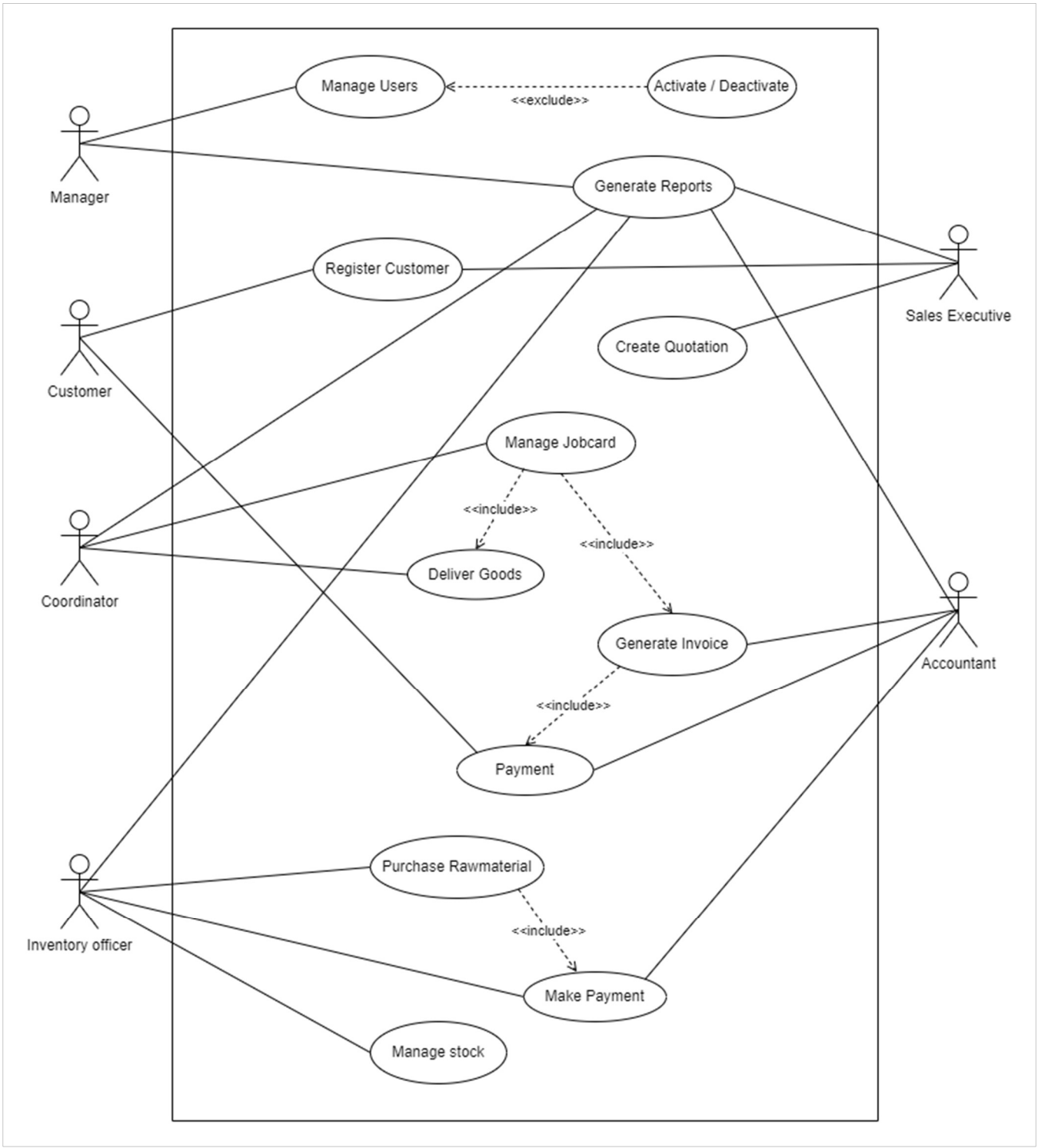

Figure 3.2: Use case diagram for the Operations Management System

3.4.2 CLASS DIAGRAM FOR THE OPERATIONS MANAGEMENT SYSTEM

Class diagrams are used to model the objects that make up the system, relationship between them and their functionalities. The class diagram for the proposed system is described in Figure 3.3: Class Diagram for the Operations Management System.

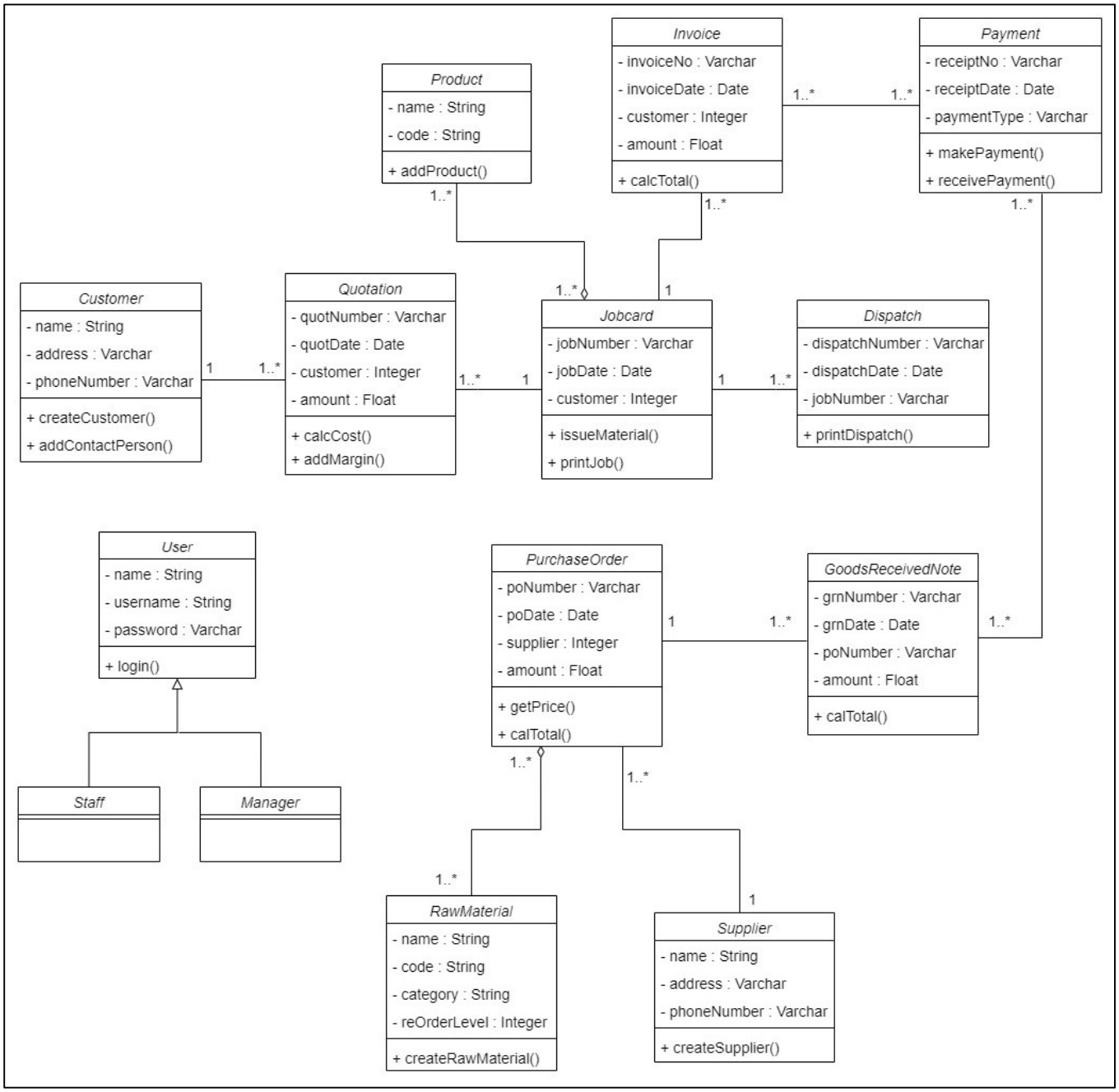

Figure 3.3: Class Diagram for the Operations Management System

3.4.3 SEQUENCE DIAGRAM

A sequence diagram is an interaction diagram that shows the process interaction in a system arranged in time sequence. It helps to identify the correct flow of events in a module. The sequence diagram of login module is depicted in Figure 3.4: Sequence diagram for login.

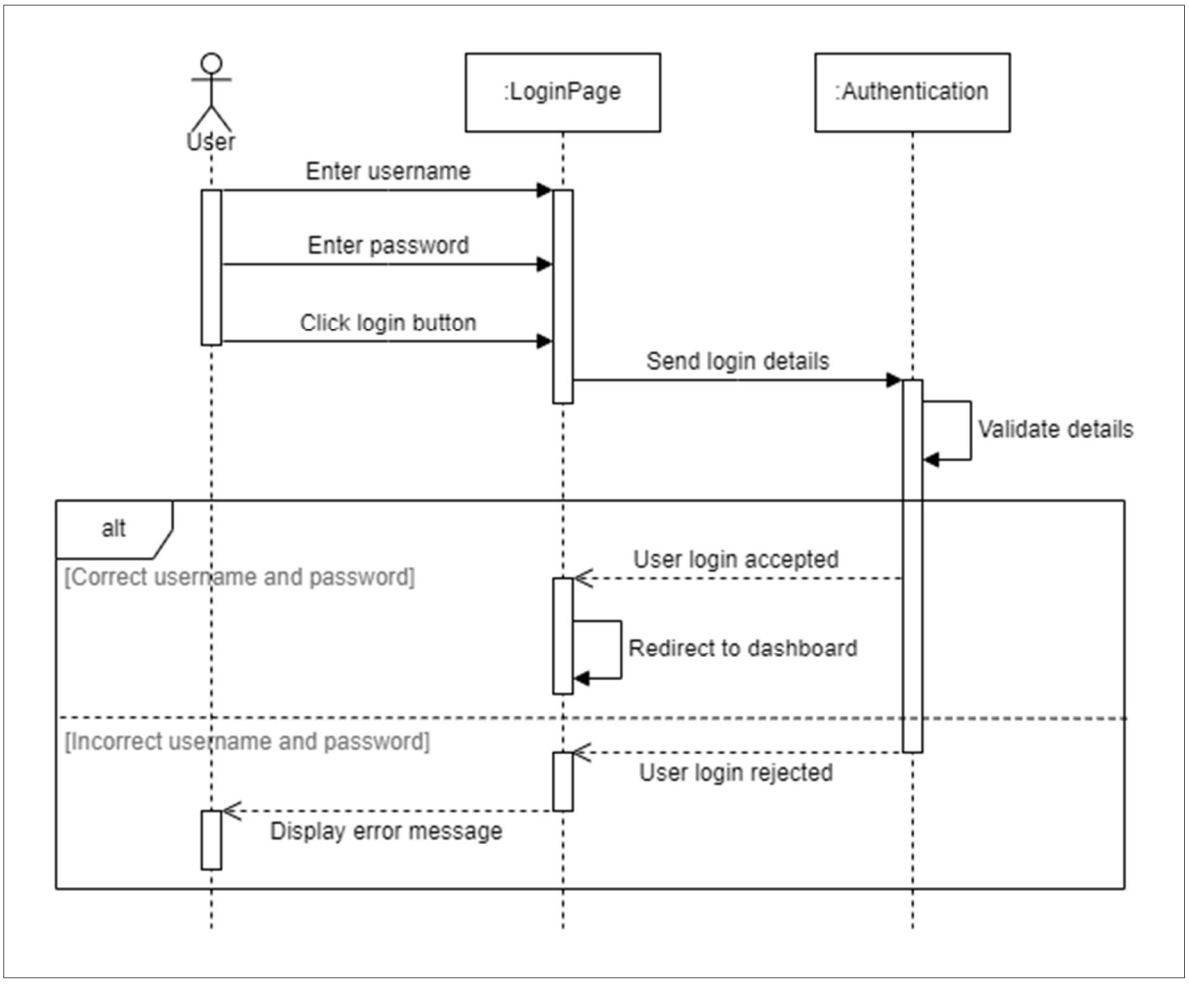

Figure 3.4: Sequence diagram for login

Sequence diagram of customer registration is described in Figure 3.5: Sequence diagram for customer registration.

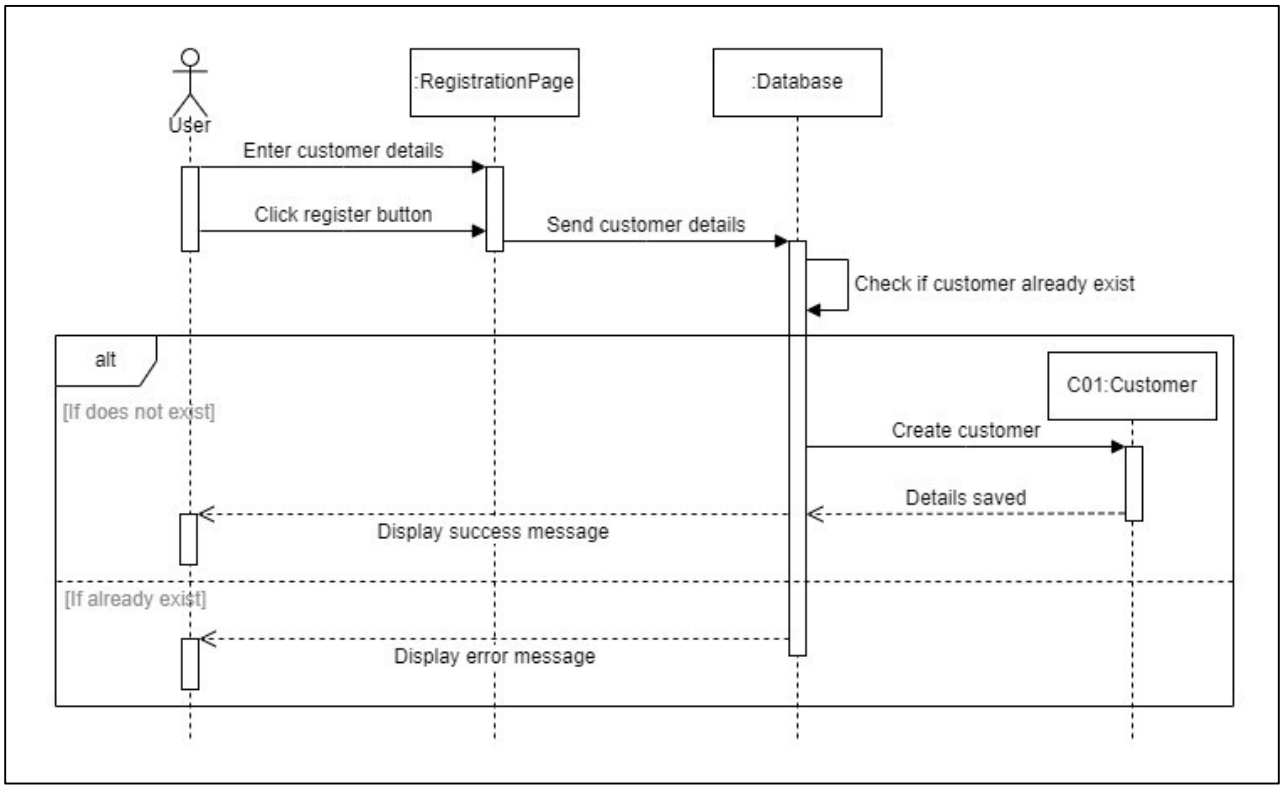

Figure 3.5: Sequence diagram for customer registration

3.5 USER INTERFACE DESIGN

The user interface is where the user connects and interacts with the system. Systems are often judged by their user interface rather than their functionalities. A good interface will guide the user to successfully achieve the objectives, while a poorly designed interface can lead to serious errors. Thus user interface design is considered most important in designing phase.

The user interface of the login page which is the first interaction point of the system, is illustrated in Figure 3.6: User interface design for the login page.

Figure 3.6: User interface design for the login page

User dashboard of the system is illustrated in Figure 3.7: User interface design for dashboard. Dashboard comprises of the summary of crucial data. Information displayed in dashboard will vary from user to user.

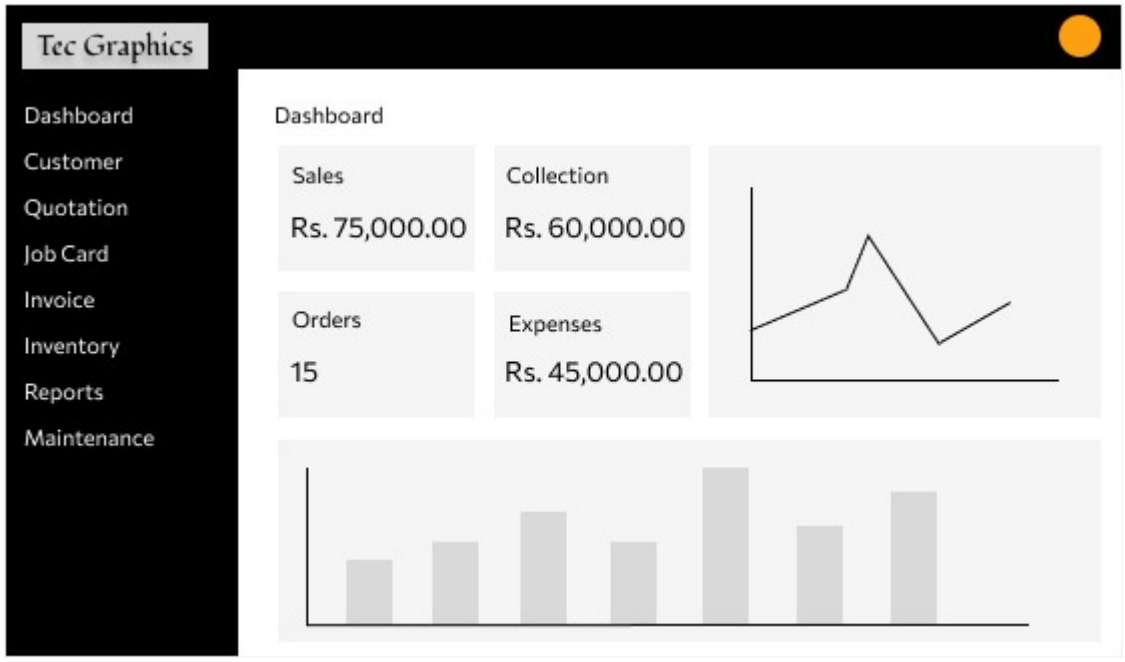

Figure 3.7: User interface design for dashboard

The customer registration consist of individual customer registration and company registration. The user interface of individual customer registration is described in Figure 3.8: User interface design for customer registration.

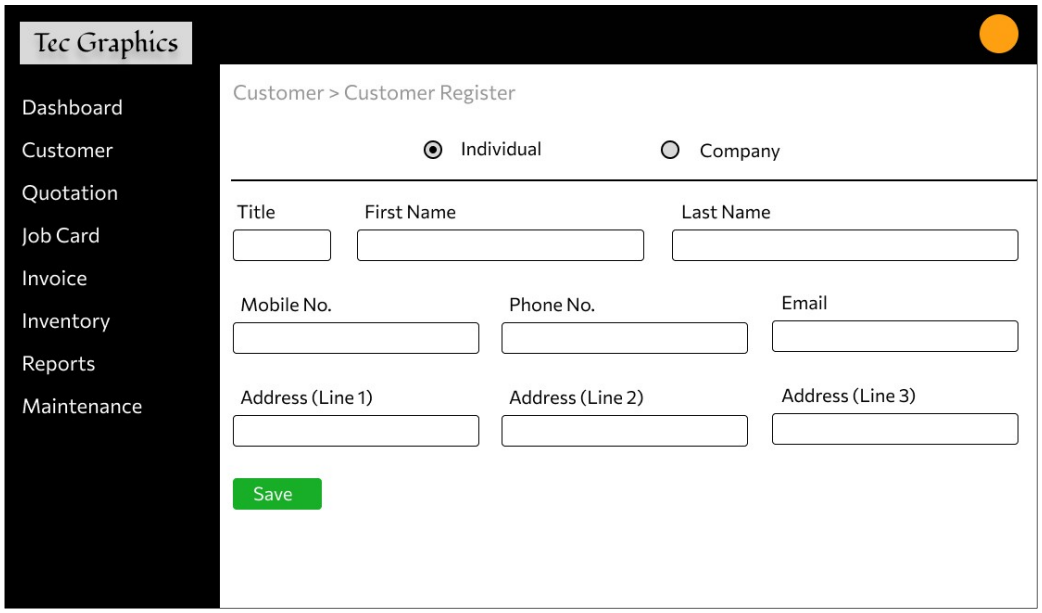

Figure 3.8: User interface design for customer registration

3.6 METHODOLOGY

Iterative waterfall model is the methodology adopted for the Software Development Life Cycle. The iterative waterfall model (Pal, 2018) is a software development approach that combines the sequential steps of the traditional waterfall model with the flexibility of iterative design. The development process is divided into smaller iterations and each iteration goes through all phases of the waterfall model such as requirement gathering, design, implementation, testing and deployment. The feedback gathered after each iteration is passed on to the next iteration.

The primary rationale for opting for the iterative waterfall model is the presence of clearly identified, stable and well-defined requirements. Other reasons include,

- At every stage of the process, collaboration with business owners is maintained, ensuring the system meets the needs of the business and that any concerns are addressed in a timely manner.
- It offers flexibility, enabling seamless integration of changes or new requirements into subsequent iterations of the website.
- Feedback from the users can be gathered and used to improve the system in succeeding iterations.
- Easy to manage as each phase is well-defined and has a clear set of deliverables, making it easier to track progress, identify issues and manage resources.
- It is highly cost-effective to change the plan or requirements in the model.

CHAPTER 4 IMPLEMENTATION

4.1 INTRODUCTION

Implementation phase is where the functional system takes form and becomes usable. In this phase the design is translated into executable code segments, ensuring the functionalities align with specifications identified through analysis phase. It also includes addressing any challenges encountered during the code processing.

The implementation chapter gives an overview of the technologies, tools and programming languages used in the implementation. It also outlines the rationale behind the selection. In addition, the chapter describes the development environment and provides the main code segments.

4.2 IMPLEMENTATION ENVIRONMENT

The system was built within the WampServer 2.4 environment, which encompasses:

- Windows
- Apache server 2.4.4
- MySQL 5.6.12
- PHP 5.4.12

The technologies used to build the system are described below.

4.2.1 FRONT-END AND DATABASE OF THE SYSTEM

- The front-end of the system was developed using HTML and PHP. PHP which is a server-side scripting language is selected for its ease of use and flexibility. Also it is open source

and freely available. Additionally, PHP code can be easily embedded into HTML code. Further, PHP has large number of libraries available.

- Bootstrap was the tool selected for designing the user interface along with CSS. Bootstrap is selected as it ensures responsive interfaces across different devices and screen sizes which is essential for a web-based system. It also allows to quickly create visually appealing and consistent user interfaces.
- JavaScript was used to code the client-side validation. JavaScript is chosen because it is a client-side scripting language and therefore it can be used to perform real-time updates, form validations and interactive user interfaces. It is also supported by all modern web browsers.
- Database for the system was designed using MySQL. MySQL is preferred to be used as it is an open source relational database management system that offers scalability for a growing database and provides data security. MySQL is also easy to use and has user-friendly interface to interact.

4.2.2 REUSED MODULES

Ninestars website template (Anon., n.d.) **–** Ninestars is a one page Bootstrap HTML template for business, corporate or startup company. This template was used to facilitate customer interaction in the system, allowing users to place orders, track them and make payments. It was decided to select Ninestars template as it is easy to use, highly customizable and free. Additionally, the interface is compatible with desktop as well as mobile devices.

AdminKit template (Anon., n.d.) – AdminKit is a professional admin and dashboard template based on Bootstrap 5. This was used as the foundational framework for the system. The decision to select this template was based on its well-documented code and easy customizability. Furthermore, it is fully responsive across various devices – mobile, tablet and desktop – and compatible across different web browsers.

PayHere Payment Gateway (Anon., 2022) – PayHere is one of Sri Lanka's leading online payment gateway service. The sandbox version of the payment gateway is integrated to the website in order to enable online payment to customers. PayHere was chosen for the system as the set up process is easy and fast. It is also considered to be a secure platform for online payments. Most importantly, with PayHere, customer gets multiple payment options as it is an authorized payment gateway that accepts all major credit cards, mobile wallets and internet banking systems.

4.3 MAJOR CODE SEGMENTS

Using good practices when writing code is essential for readability, maintainability and scalability of the program. Following good practices were taken into consideration when writing the code,

1. Code indentation – Proper indentation is important for readability and understandability. Space and new lines are added to the code so that each block of code is readily identifiable.
2. Naming conventions – Variable names and function names should be intuitive.
3. Comments – Comments are added to explain the code.
4. Don't repeat yourself – Reduce code duplication for maintainability and ease of bug fixing.

Following code segment depicts the code for establishing the database connection. This code is reused throughout the software.

```
<?php

$host = "localhost";
$username = "root";
$password = "";
$database = "tecgraphics";

$con = mysqli_connect($host, $username, $password, $database);  //database connection
?>
```

Following segment describes the code used for login functionality. When writing this code, measures are taken to prevent injection attacks.

```
<?php
session_start();
include('db_connection.php');

$username = mysqli_real_escape_string($con,$_POST['email']);
$password = mysqli_real_escape_string($con,$_POST['password']);

$new_password = md5($password);              //encrypt the password using MD5

$select_user = mysqli_query($con, "SELECT * FROM users WHERE username = '$username'
AND password = '$new_password' AND active = 'yes'");
$result_user = mysqli_fetch_array($select_user);

if(mysqli_num_rows($select_user) <= 0){     //if there are no matching records

        $_SESSION['error'] = "Invalid login.";
?>
<script>
        setTimeout('location.href = "login.php"',0);
</script>
<?php
} else {                    //if there are matching records

        $_SESSION["logUserId"]      = $result_user['id'];
        $_SESSION["logUserName"]= $result_user['first_name'];
        $_SESSION["logUserType"] = $result_user['user_type'];

?>
<script>
        setTimeout('location.href = "dashboard.php"',0);       //redirect to dashboard
</script>
<?php } ?>
```

Following code is used to check whether the user is logged in, to prevent unauthorized access.

```
<?php
session_start();
$loguser = $_SESSION["logUserId"];

if($loguser == ''){                 //check if user is logged in
        header('Location: login.php');
} else {
        //Code that needs to be executed
}
?>
```

Following code segment is used to destroy the session when a user is logged out of the system.

```
<?php
        session_start();

        unset($_SESSION["logUserId"]);
        unset($_SESSION["logUserName"]);

        session_destroy();                  //destroy the session
        header("Location:login.php");       //redirect to login page
?>
```

Please refer Appendix F for further code listing.

4.4 USER INTERFACE

Some interfaces of the operations management system are listed below. Rest of the interfaces are listed in the Appendix C.

The login page of the system for the organizations internal users is depicted in Figure 4.1: Login screen. The user has to enter valid username and password to access the system.

Figure 4.1: Login screen

Dashboard of the admin user is illustrated in Figure 4.2: System Dashboard. Dashboard provides an at-a-glance graphical view of crucial information. Each user type has a customized dashboard.

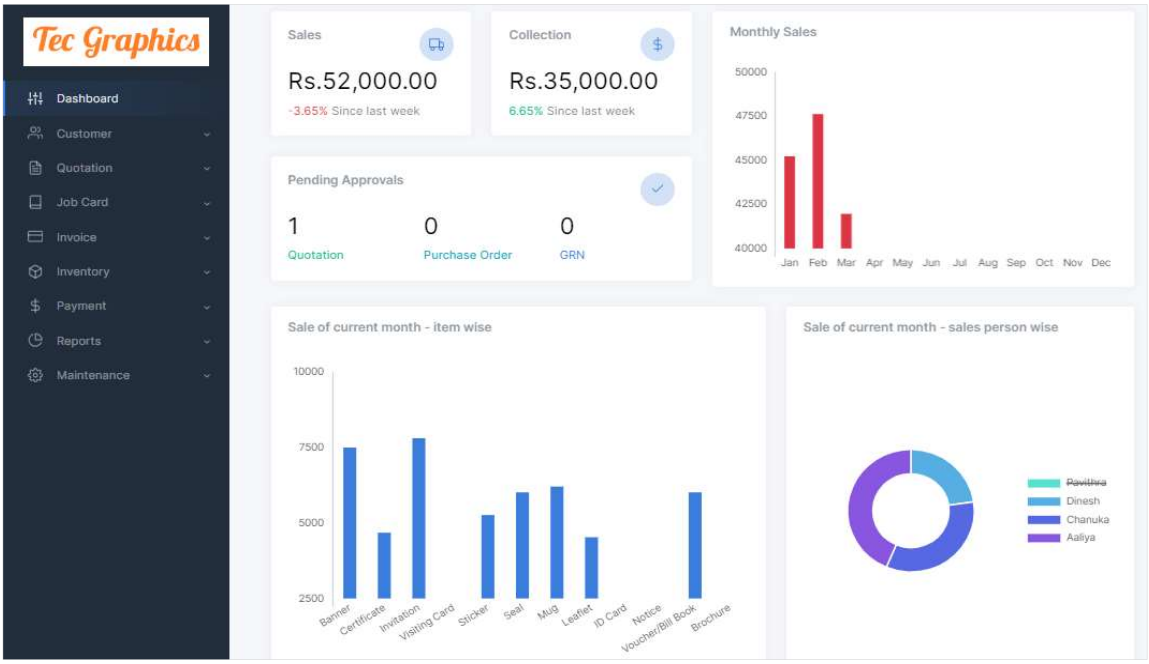

Figure 4.2: System Dashboard

The user interface for customer registration is depicted in Figure 4.3: Customer registration screen. User can access this page through navigation pane.

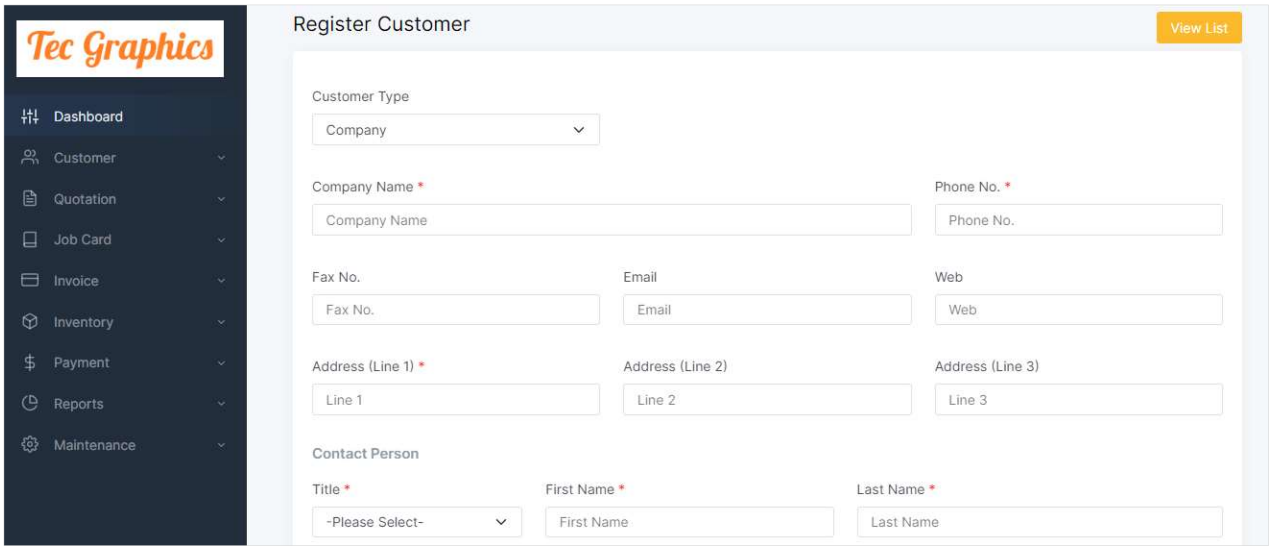

Figure 4.3: Customer registration screen

The user interface for quotation list is portrayed in Figure 4.4: Quotation list screen. This contains the list of created quotations. Additionally, a print option is given to print the quotation.

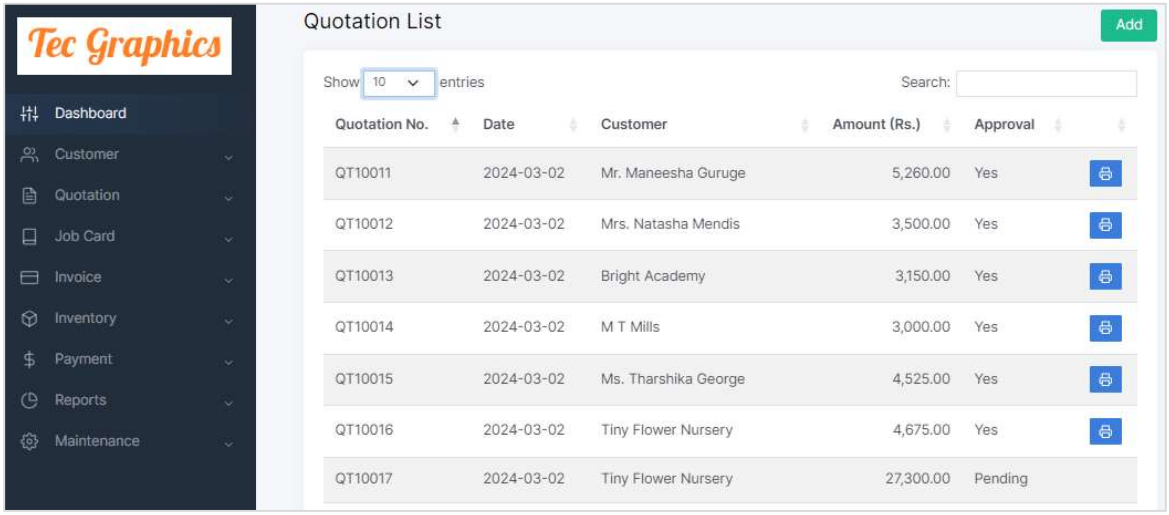

Figure 4.4: Quotation list screen

The user interface for sales report is described in Figure 4.5: Sales report screen. Only authorized users can access this. User can view the sales data for a selected date range and also filter by customer name.

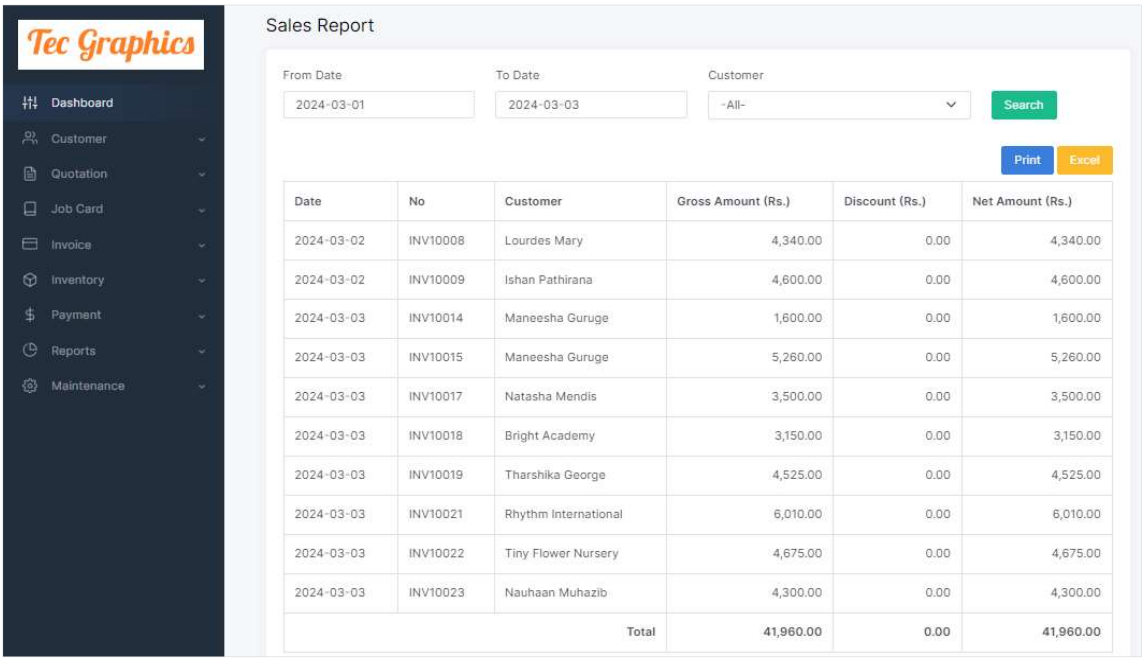

Figure 4.5: Sales report screen

The home page of the website is portrayed in Figure 4.6: Home page. The information about the organization and the services provided is described on this page.

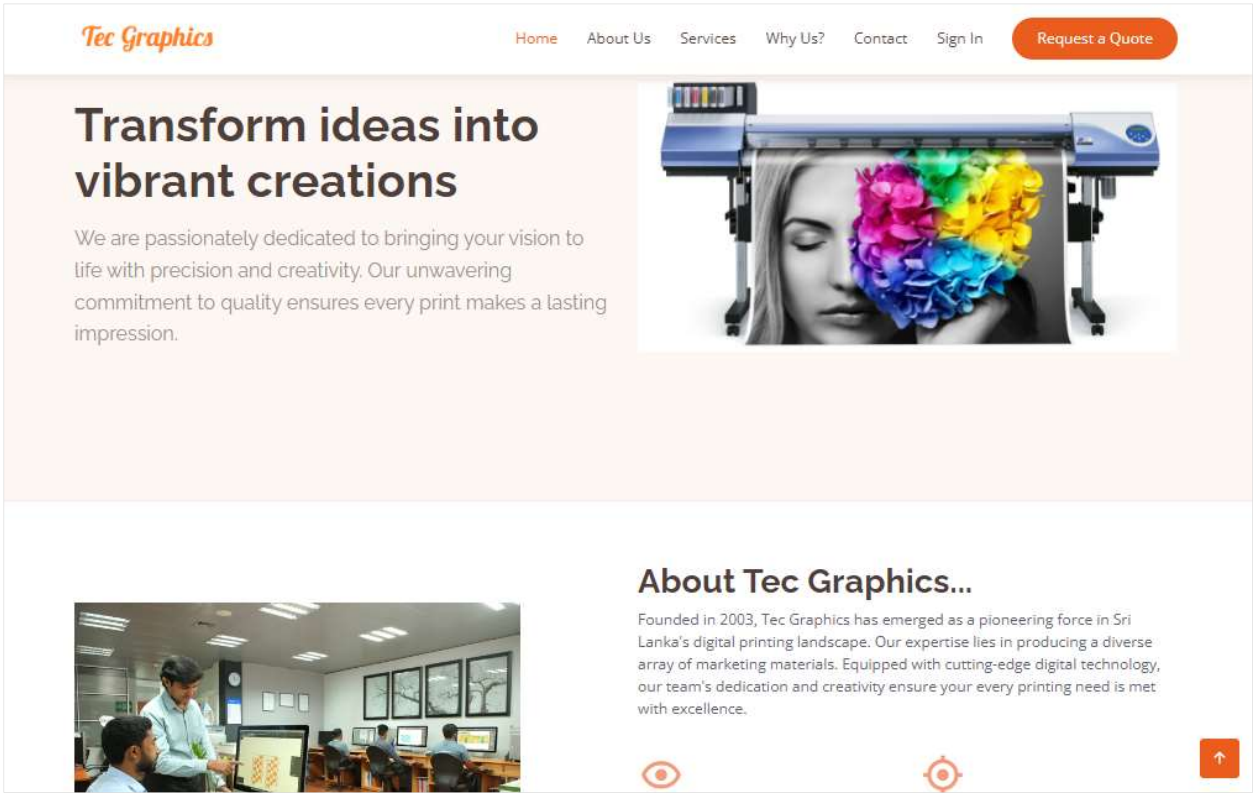

Figure 4.6: Home page

CHAPTER 5 TEST AND EVALUATION

5.1 INTRODUCTION

Testing and evaluation phase of software development involves carrying out testing to identify and rectify any defects or discrepancies in the behavior of the software and verifying whether the functionalities of the developed system align with the specified functional and non-functional requirements. It is considered a crucial phase as software errors sometimes may cause costly repercussions.

This chapter outlines the test strategies adopted for the purpose of testing the software. It also includes the test cases and results.

5.2 TEST STRATEGIES

The test plan included two types of testing such as functional testing and non-functional testing.

5.2.1 FUNCTIONAL TESTING

The objective of functional testing is to confirm that the software accomplishes the functionalities that it is intended to perform. The different types of functional tests performed are,

- **Unit Testing**: Individual components of the software such as customer registration module, item registration module, purchase order module, invoicing module and etc. were tested in isolation. This was done once the development of particular module was completed.
- **Integration Testing**: The combined functionality of the interconnected components of the system was tested after integrating the related modules to ensure that the interaction and data flow were carried out seamlessly as expected.

- **User Acceptance Testing**: This was the final phase of testing. A selected group of users consisting sales executive, coordinator, inventory officer, accountant and manager were introduced to the system and requested to use the system functionalities and assess whether they fulfilled their requirements. The main goal was to confirm that the software satisfied the criteria for acceptance.

5.2.2 NON-FUNCTIONAL TESTING

The main focus of non-functional testing is to assess qualities such as performance, reliability, scalability, usability and maintainability and examine how the system performs under various conditions. Following types of non-functional tests were performed.

- **Performance Testing**: The system was tested by increasing the number of simultaneous users and increasing the volume of data that was entered and assessed its response time. This was carried out to ensure that the system performed as expected under different workloads.

- **Usability Testing**: User-friendliness and overall user experience of the software were tested by evaluating the consistency in page layout, ease of navigation and etc.

- **Security Testing**: Tests were carried out to evaluate the system's resistance to unauthorized access, data beaches and other security vulnerabilities.

5.3 TEST CASES

Test cases were designed to cover all modules and aspects of the developed software. Some of the important test cases for the website are depicted in Table 5.1: Test cases for website of proposed system. The detailed list of test cases and results are listed in Appendix E.

Table 5.1: Test cases for website of proposed system

TC ID	Test Objective	Pre-Conditions	Steps	Expected Results	Test Status
1	User should be able to sign in with valid credentials	User is in the sign in page of the website	1. User enters a valid username 2. User enters a valid password 3. User click on the sign in button	User should be signed into the website	Pass
2	User can sign in only with valid credentials	User is in the sign in page of the website	1. User enters a valid username 2. User enters an invalid password 3. User click on the sign in button	Display error message as "invalid login"	Pass
3	User should be able to sign up by providing necessary details	User is in the sign up page of the website	1. User enters all mandatory details 2. User enters a new username 3. User click on sign in button	User should be signed into the website	Pass
4	User can sign up only by giving a new username and providing all necessary details	User is in the sign up page of the website	1. User does not fill all mandatory details 2. User enters a new username 3. User click on sign in button	Display error message focusing mandatory fields	Pass
5	User can sign up only by giving a new username and providing all necessary details	User is in the sign up page of the website	1. User enters all mandatory details 2. User enters an existing username 3. User click on sign in button	Display error message as "login already exist"	Pass
6	Signed in user should be able to request for a quote by filling required details	User has signed in and selected a product to request for a quote	1. User enters all mandatory details 2. User click on request a quote button	Proceed to request page	Pass

7	User should be able to request for a quote by filling required details	User has signed in and selected a product to request for a quote	1. User does not fill all mandatory details 2. User click on request a quote button	Display error message focusing mandatory fields	Pass
8	User can request for a quote only if signed in	User has selected a product to request for a quote	1. User enters all mandatory details 2. User click on request a quote button	Pop up sign in prompt	Pass
9	User should be able to add more services to the request	User is in the request for a quote page and has already selected a product	1. User click on the 'Add service' button 2. User selects another product 3. User enters all mandatory details 4. User click on request a quote button	Proceed to request page which displays all selected products	Pass
10	User can remove services from the request list before sending message	User is in the request for a quote page and has selected more than one product	1. User click on the remove button of the product	Remove only selected product from the list	Pass
11	Logged in user can successfully send message requesting a quote	User has signed in and selected products to request for a quote	1. User click on the 'Send Message' button	Display success message with request number	Pass
12	User should be able to view the orders	User has signed in to the website	1. User click on profile option on the menu bar 2. User click on 'My Orders' option	Display the requests made by the user and the status	Pass

5.4 USER EVALUATION

Main objective of user evaluation was to assess whether the system meets the functional and non-functional requirements of the users. Users from different user types were selected to participate in the evaluation. Selected users were requested to use the system in the actual working environment and their activities were monitored. Then a questionnaire was distributed among them to collect their feedback on the system.

Following pie charts summarizes the feedback given by users. Feedback given on user-friendliness is illustrated in Figure 5.1: Feedback on user-friendliness.

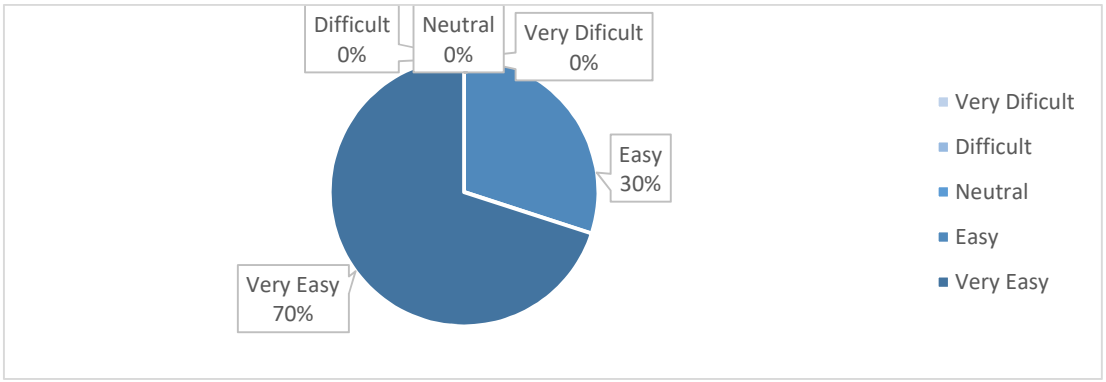

Figure 5.1: Feedback on user-friendliness

User feedback on the appearance of the system is depicted in Figure 5.2: Feedback on appearance.

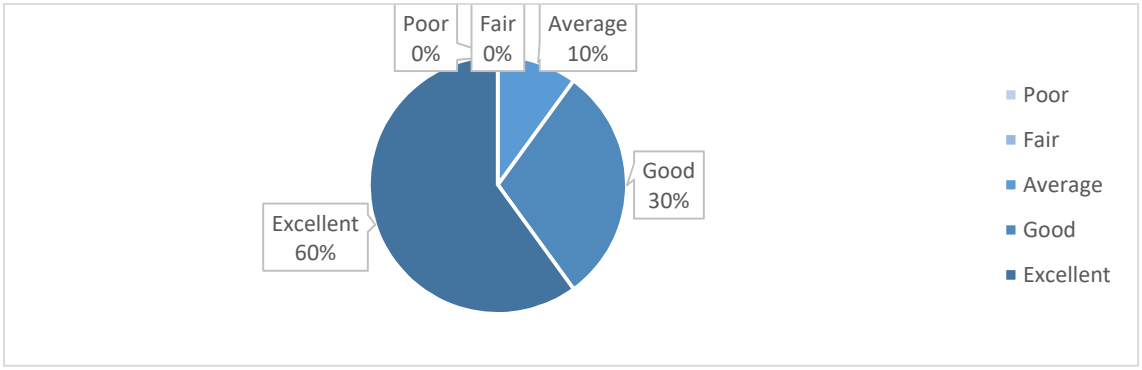

Figure 5.2: Feedback on appearance

Feedback given on the functional requirements of the system is described in Figure 5.3: Feedback on functional requirements.

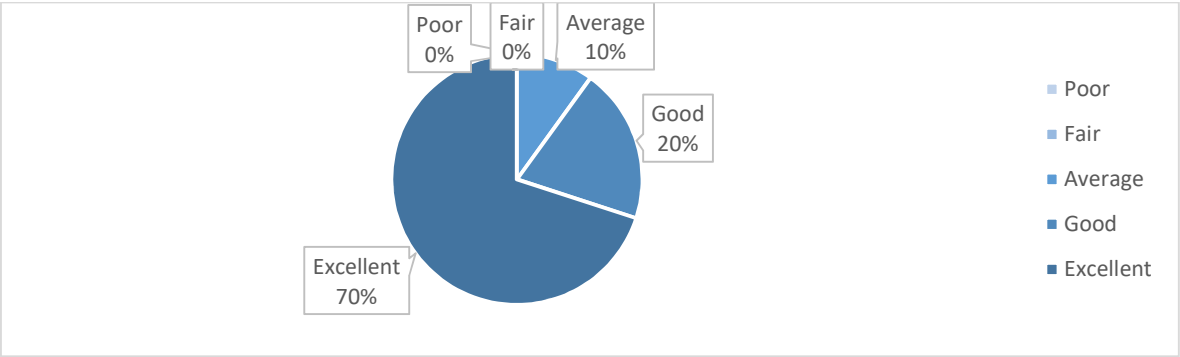

Figure 5.3: Feedback on functional requirements

User feedback on the performance of the system is illustrated in Figure 5.4: Feedback on performance.

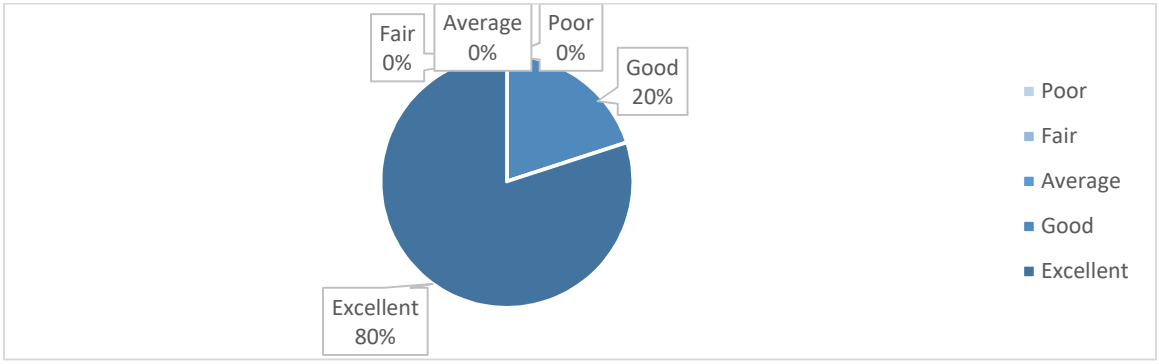

Figure 5.4: Feedback on performance

Feedback given on the reliability of the system is shown in Figure 5.5: Feedback on reliability.

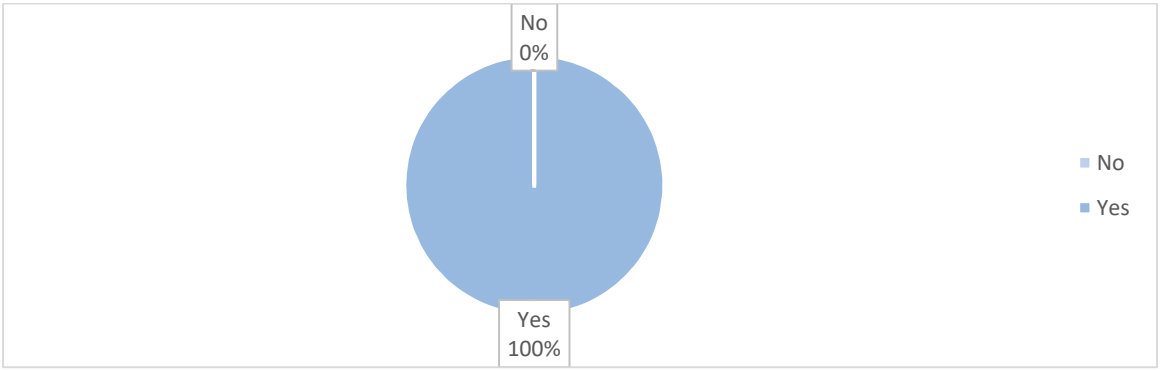

Figure 5.5: Feedback on reliability

User feedback given on the reports of the system is displayed in Figure 5.6: Feedback on reports.

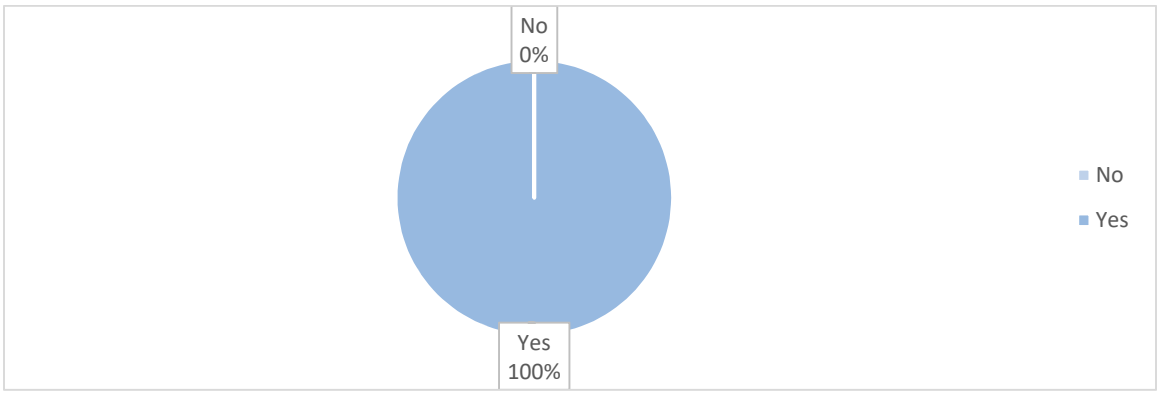

Figure 5.6: Feedback on reports

User satisfaction on overall system is depicted in Figure 5.7: Overall user satisfaction.

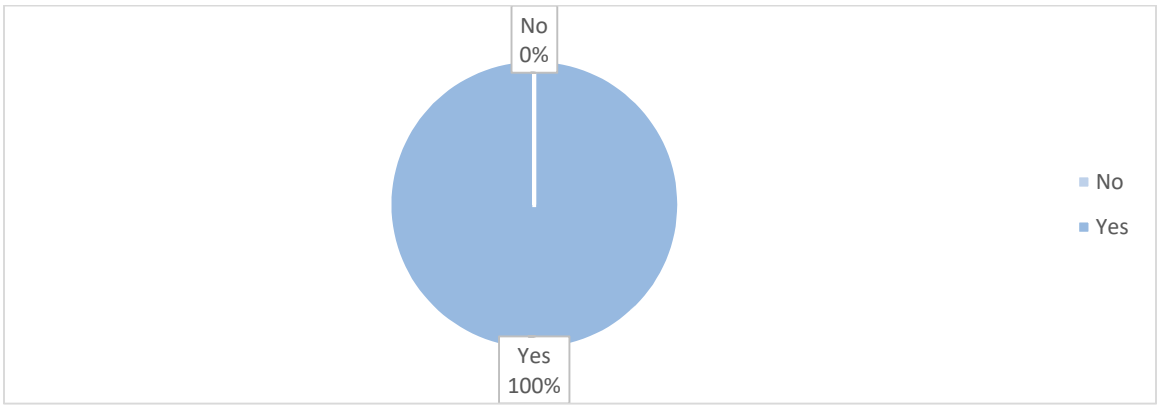

Figure 5.7: Overall user satisfaction

The ultimate results of the evaluation clearly stated that the system satisfies all the functional requirements of the users. It also specified that the system is user friendly and fulfills the non-functional requirements. The questionnaire that was used to collect feedback from the users, is attached in the Appendix G.

CHAPTER 6 CONCLUSION

6.1 CRITICAL ANALYSIS

The conclusion chapter gives an overview of the achievements as per the objectives set out in introduction chapter and the features which could be added to the system in future.

The operations management system was developed with the purpose of streamlining the organization's operations and addressing the limitations inherent in manual processes. The major challenge of manual system was the time consumed for simple repetitive tasks such as creating quotation letters, invoices and purchase orders. The operations management system optimized the workflow of the organization by providing facility to generate above from the system, reducing the time and manual work. The system also improved the efficiency by implementing validations to eliminate errors in data entering and speedup task completion.

The system facilitated tracking customer orders from initiation to fulfillment, offering real-time visibility into each order's progress. This capability empowered the staff to proactively manage workflows and ensure adherence to delivery timelines. Additionally, the system offered reporting feature where users could effortlessly generate comprehensive reports tailored to their specific requirements and objectives. As a result stakeholders could make informed choices and allocate resources effectively.

The system ensured customer satisfaction by delivering accurate and timely data at every stage of the order process, facilitating the fulfillment of customer requirements and catering to the organization's reputation. Also, the system enforced security by user authentication, mitigating the risk of unauthorized access or data breeches. Further, role-based access control ensured only authorized personnel could access sensitive data.

6.2 FUTURE ENHANCEMENTS

The system could be improved by adding new features mentioned below,

- Include production planning module which allows users to schedule printing jobs efficiently, allocating resources and timelines effectively. Additionally, it enables real-time monitoring of printing machine performance, providing insights into productivity, uptime and maintenance needs.
- Include a comprehensive accounting module to facilitate all financial transactions of the organization. Centralizing accounting processes within the system, rather than having a separate accounting package, will help streamline overall operations of the organization.
- Integrate advanced artificial intelligence (AI) tools to analyze data and forecast future behaviors, enabling proactive decision making and facilitating strategic planning and resource allocation.
- Incorporate SMS functionality to notify the customers upon completion of their orders. It can also be used to send reminders to customers regarding payments as SMS is a faster and more communication mode compared to email.

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APPENDIX A SYSTEM MANUAL

The system manual provides necessary technical guidelines for system administrator or any interested party on how to install the system appropriately. This consists of minimum hardware and software requirements needed to run the system. The system manual can be referred in the future if there is any improvement to be done to the operations management system.

Hardware and software requirements for the system are cited below.

HARDWARE REQUIREMENTS

- Intel dual core, 1 GHz processor or greater
- 256 MB RAM
- 1 GB free hard disk space
- 1366 x 768 screen resolution

SOFTWARE REQUIREMENTS

- Windows 10
- WampServer 2.4 which includes
    - Apache server 2.4.4
    - PHP 5.4.12
    - MySQL 5.6.12

INSTALLING THE OPERATIONS MANAGEMENT SYSTEM

INSTALLING WAMP

- Download WAMP from https://www.wampserver.com/ and install it to the C: drive or any preferred drive of the computer.

DATABASE SETUP

1. Click on  button in task bar and select phpMyAdmin.
2. In phpMyAdmin window, click on 'Databases' tab and create a database named 'tecgraphics'.
3. Click on 'Import' tab and browse 'tecgraphics.sql' from the supplementary CD through the path X:\Operations Management System\Database\tecgraphics.sql (Note: X: is your CD drive).
4. Click on the 'Go' button to import the database tables.

SYSTEM SETUP

- Copy the 'tecgraphics' folder from the supplementary CD and paste it in the following location, Y:\wamp\www (Note: Y: is the drive where wamp is installed).

LAUNCHING THE SYSTEM

- Go to start menu and select 'start WampServer'.
- Open web browser and type URL http://localhost/tecgraphics/login.php in the address bar.
- Login by providing valid username and password to gain access to the system.

APPENDIX B

DESIGN DOCUMENTATION

USE CASE DIAGRAMS

User Management

User management is the crucial stage where users of the system are identified and privileges are controlled. The use case diagram of user management is depicted in Figure B.1: Use case diagram for user management.

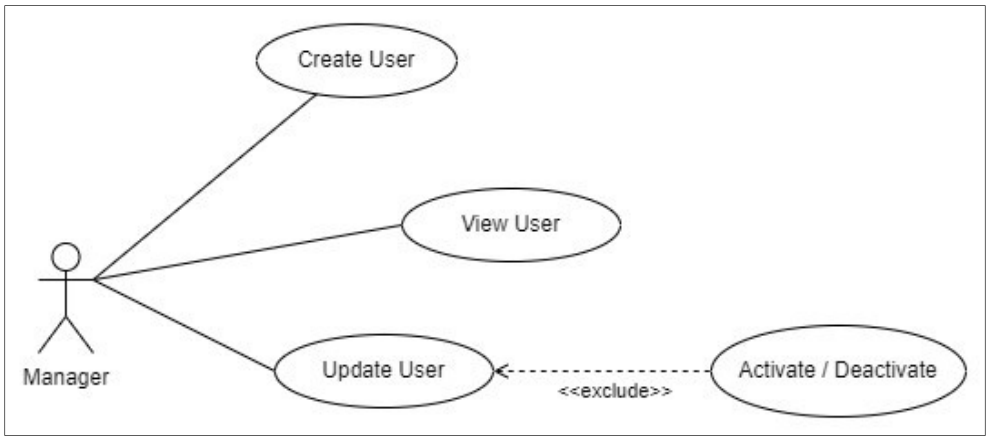


Figure B.1: Use case diagram for user management

Login management is described in Table B.1: Use case description of user management.

Table B.1: Use case description of user management

Use Case Name	User Management
Actors	Manager
Overview	Manager can manage user accounts
Pre-Conditions	Manager should login to the system
Flow of Events	1. Manager creates user accounts for users. 2. Manager views / updates user accounts.

	3. Manager activates / deactivates user accounts.
Post-Conditions	Users with active user accounts can login to the system.

Purchase Raw Material

Purchasing raw material involves acquiring the necessary resources from suppliers to support the production process. The use case diagram of purchase raw material is illustrated in Figure B.2: Use case diagram for purchase raw material.

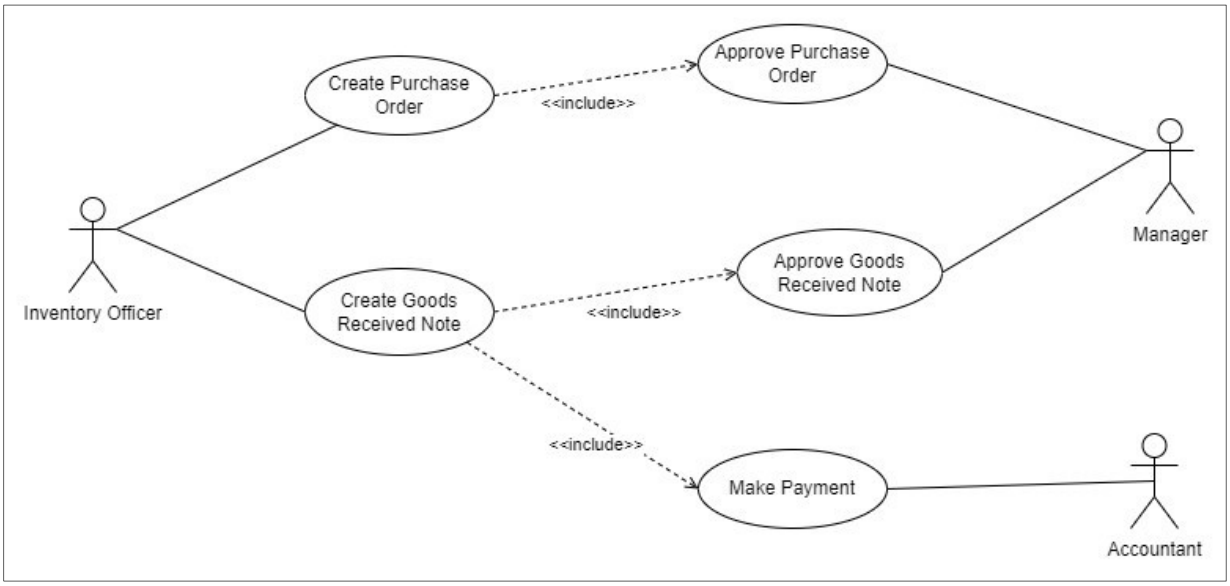


Figure B.2: Use case diagram for purchase raw material

Purchase raw material is explained in Table B.2: Use case description of purchase raw material.

Table B.2: Use case description of purchase raw material

Use Case Name	Purchase Raw Material
Actors	• Inventory Officer • Manager • Accountant
Overview	Inventory officer can purchase raw material
Pre-Conditions	Inventory items reach minimum level.

Flow of Events	1. Inventory officer creates purchase order. 2. Manager approves purchase order. 3. Inventory officer creates goods received note against purchase order. 4. Manager approves goods received note. 5. Accountant creates payment voucher to make payment.
Post-Conditions	Stock is updated.

ACTIVITY DIAGRAMS

Login

Activity diagram of login is shown in Figure B.3: Activity diagram for login.

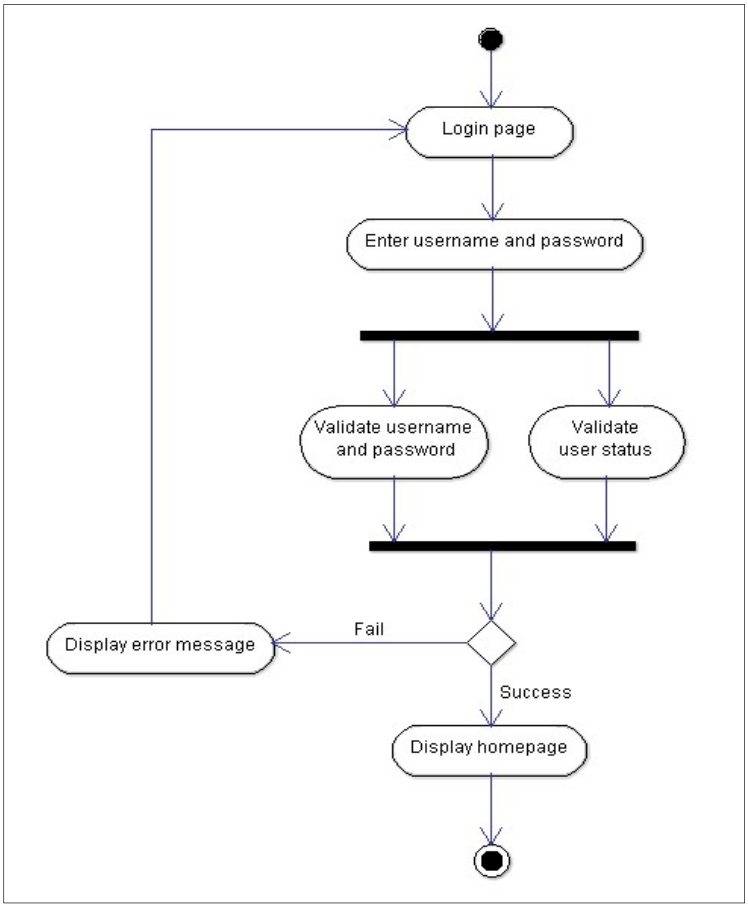


Figure B.3: Activity diagram for login

Activity diagram of add user process is portrayed in Figure B.4: Activity diagram for add user.

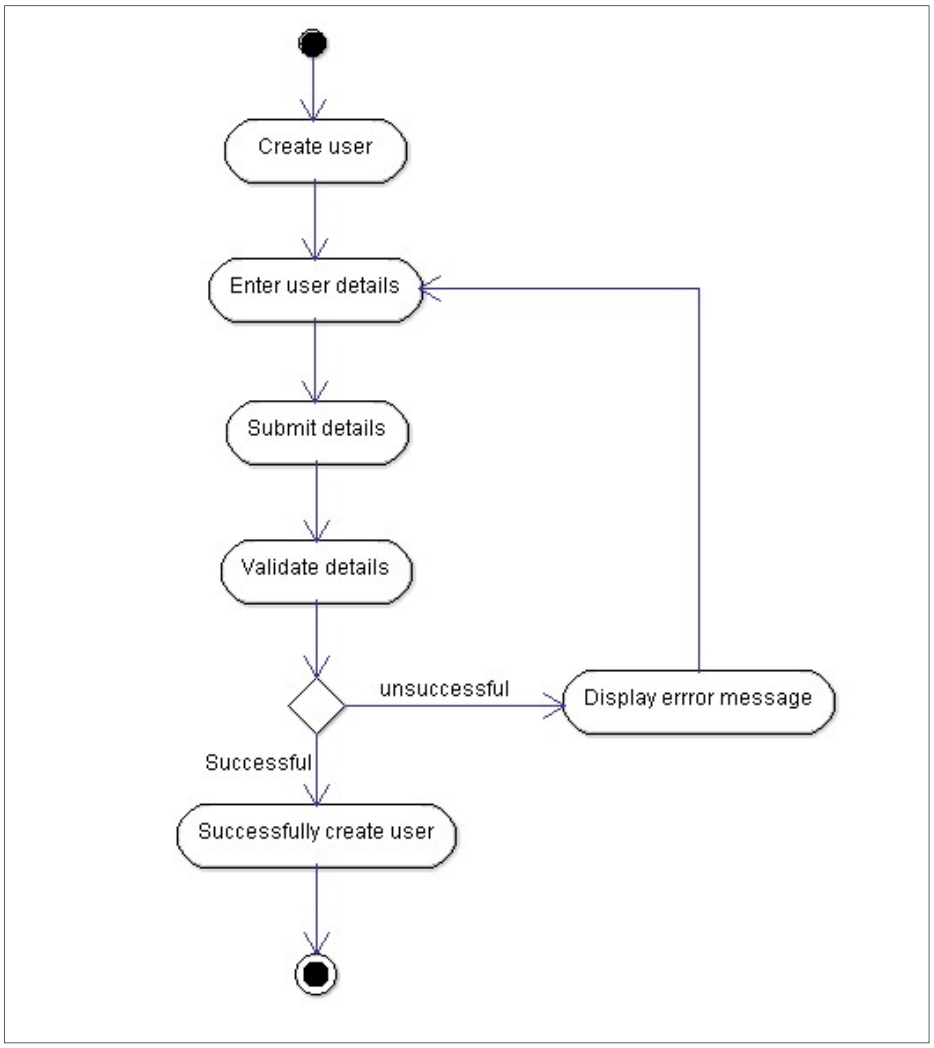


Figure B.4: Activity diagram for add user

APPENDIX C

USER DOCUMENTATION

The user documentation is created to guide the users to identify the functionalities of the system and interact with the system. This will enable users to utilize the system in an efficient manner.

Access the website

To access the website, type the URL 'http://localhost/tecgraphics/' in the address bar of any browser and hit enter. This will load the home page of the website which is depicted in Figure C.1: Home page.

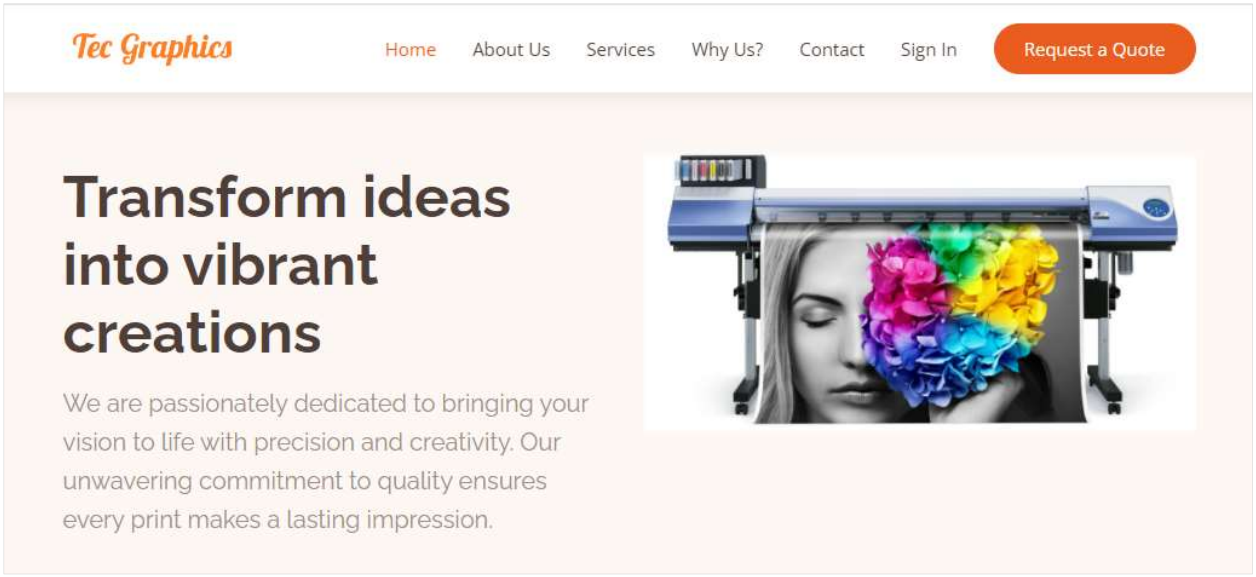


Figure C.1: Home page

Sign in / sign up

1. Click the 'Sign In' option on the menu bar.
2. If already signed up, fill the email address and password and click the 'Sign In' button.
3. To sign up, click the 'click here' link on Sign in page which is displayed in Figure C.2: Sign in page.

4. Fill the necessary details and click the ‘Sign up’ button.

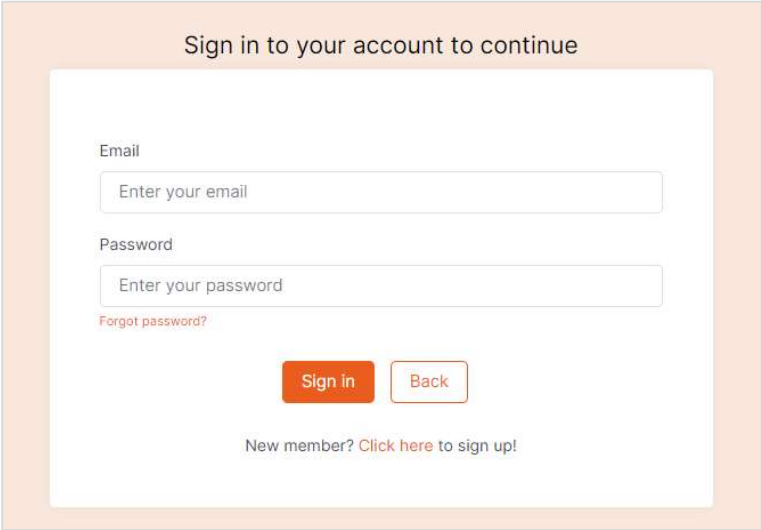


Figure C.2: Sign in page

Request a quotation

1. Click the ‘Request a Quote’ button located on the menu bar.
2. Click the ‘Add service’ button.
3. Select the required service and click the ‘+’ mark displayed over the service on mouse hover.
4. Fill the provided questionnaire and click the ‘Request a Quote’ button below it.
5. If another service needs to be added, click the ‘Add service’ button and repeat steps 3 and 4.
6. Click the ‘Send Message’ button.

View order history

1. Click the ‘Profile’ option on the menu bar.
2. Click the ‘My Orders’ option on the side pane. Page displaying the order history is portrayed in Figure C.3: My orders page.

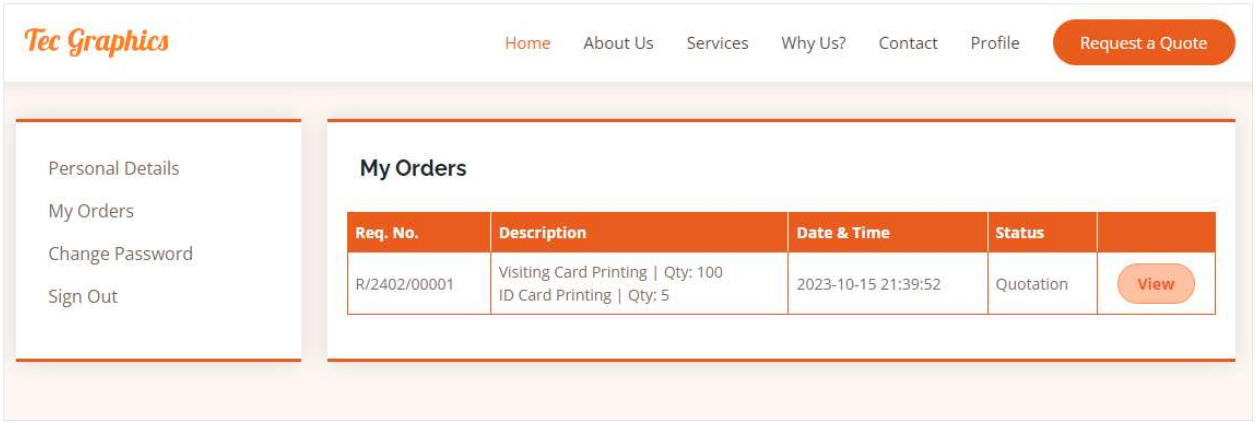


Figure C.3: My orders page

Other functions

- To update personal details, click the 'Personal Details' option on the side pane of profile page and fill in necessary details. Make sure that all mandatory fields are filled. Then click the 'Update' button.
- To change password, click the 'Change Password' option on the side pane of profile page. Then fill the current password, new password and re-type new password. Finally click the 'Change Password' button.
- Click the 'Sign Out' option on the side pane of profile page to sign out from the website.

Confirm a quotation

1. Click the 'Confirm' button in the email received from TecGraphics including the quotation.
2. Click the 'Proceed' button to confirm the quotation by making a payment.
3. Select the preferred payment method from the options provided. The payment page is shown in Figure C.4: Payment page.

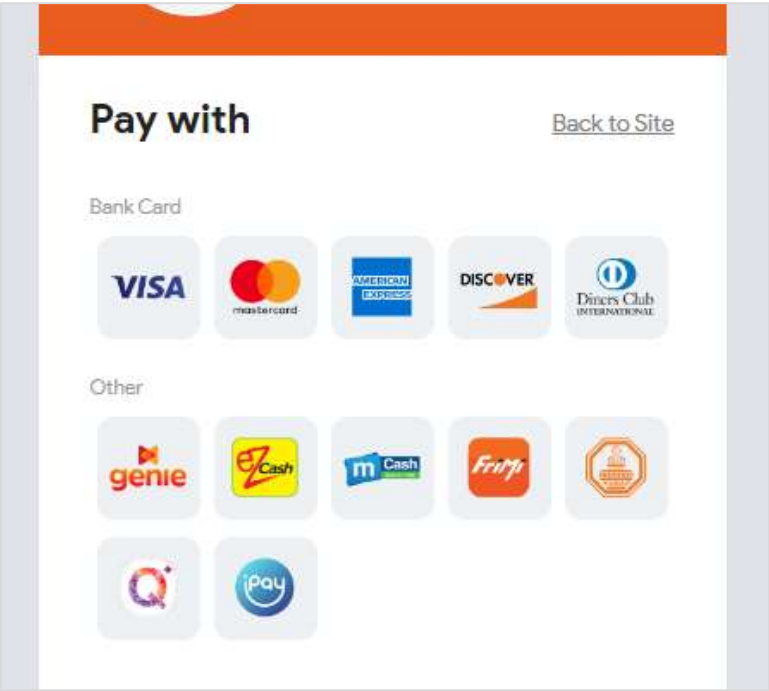


Figure C.4: Payment page

4. If card payment is selected, fill your name, credit card number, CVV and expiry date in the form that is displayed in Figure C.5: Card details form. Then click the 'Pay' button.

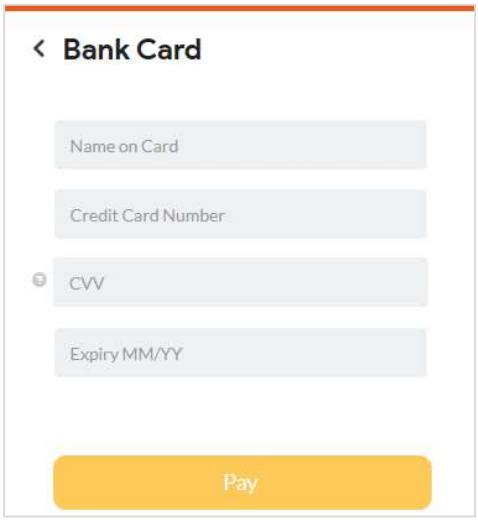


Figure C.5: Card details form

5. System will display a message whether transaction was successful or not.

Login to system (for internal users)

1. Browse the system by typing the URL http://localhost/tecgraphics/login.php in the address bar of the browser and click the ‘Login’ button. The login page is shown in Figure C.6: Login page.

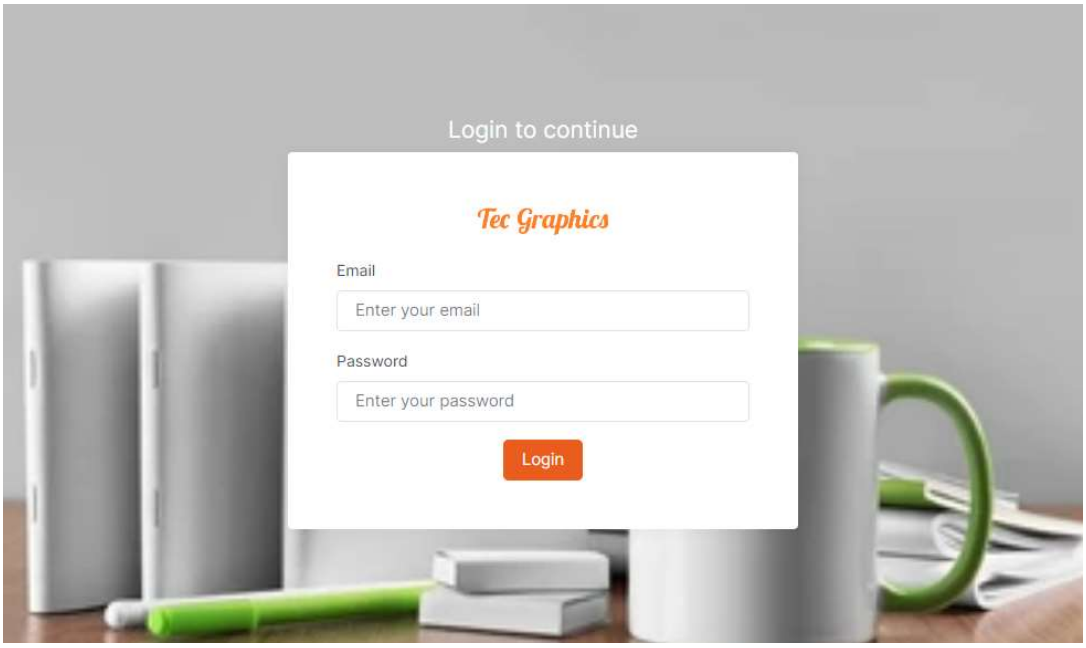


Figure C.6: Login page

2. Enter the email address and password and click the ‘Login’ button. If login credentials are correct and the user is active, system will redirect to the dashboard. If invalid details are entered, system will throw an error message.

Logout

1. The name and user type of the logged-in user will be displayed in the top left corner. Click on the displayed name and ‘Log Out’ option will appear. Click the ‘Log out’ option to log out of the system. The top bar of the system interface is depicted in Figure C.7: Top bar.

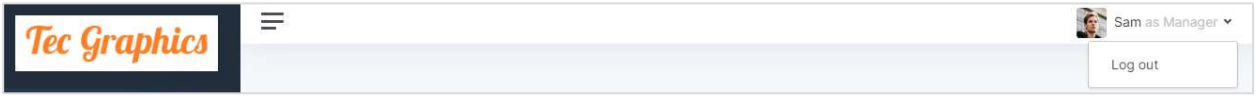


Figure C.7: Top bar

Create user

1. Browse: Maintenance > Create User
2. Fill necessary details of the user, especially select the user type and enter email and password for the login. Then click the 'Submit' button. The interface for creating a user is illustrated in Figure C.8: Create user page.

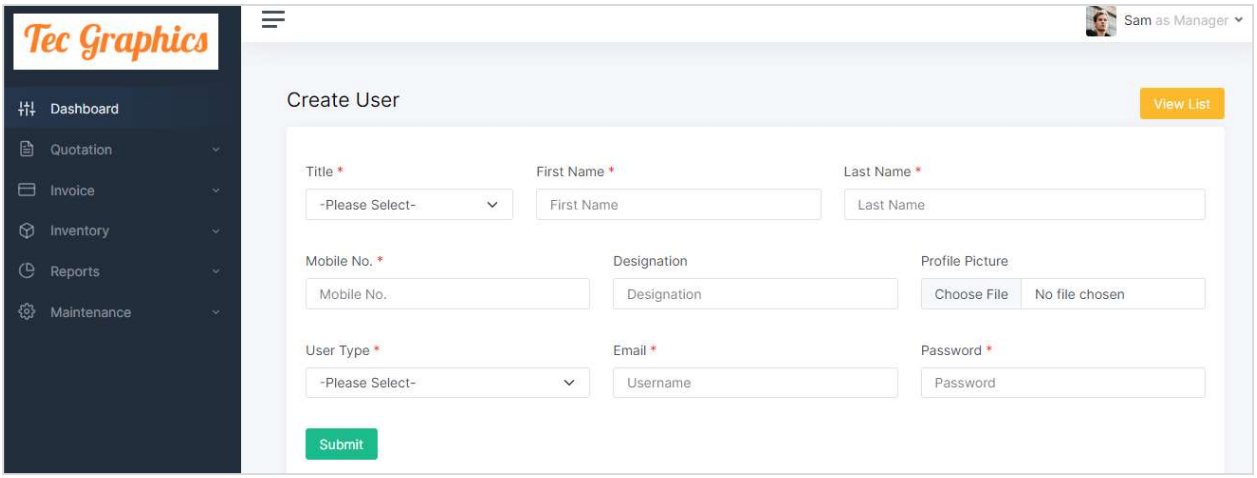


Figure C.8: Create user page

Update user

1. Click the 'View List' button on the create user page, which will display the list of registered users. The view page is depicted in Figure C.9: User list.
2. Click the  button to update user details or activate / deactivate user.

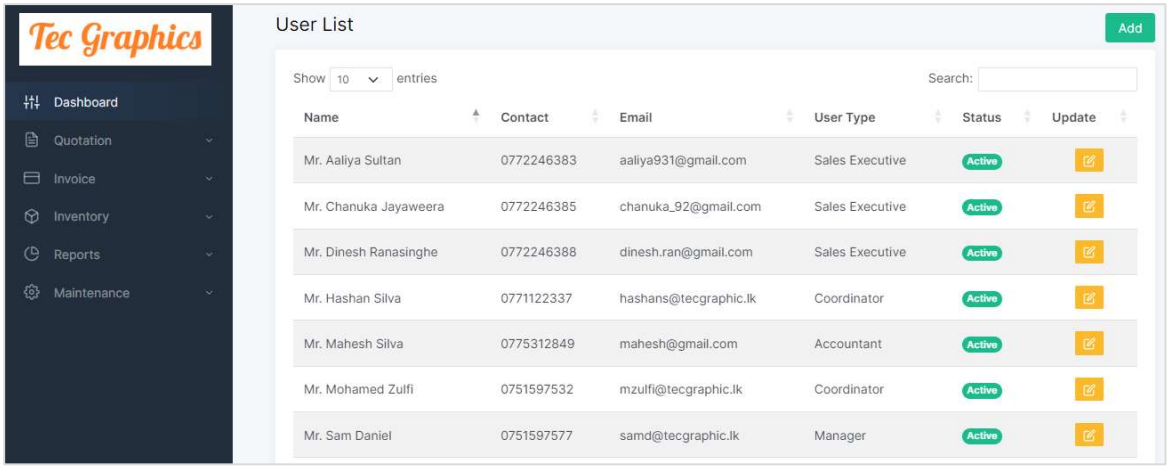


Figure C.9: User list

3. Change the necessary details and click the ‘Submit’ button.

Add / update user privileges

1. Browse: Maintenance > Manage Privileges
2. Select the user type and click the ‘Search’ button. The manage privileges page is portrayed in Figure C.10: Manage privileges.

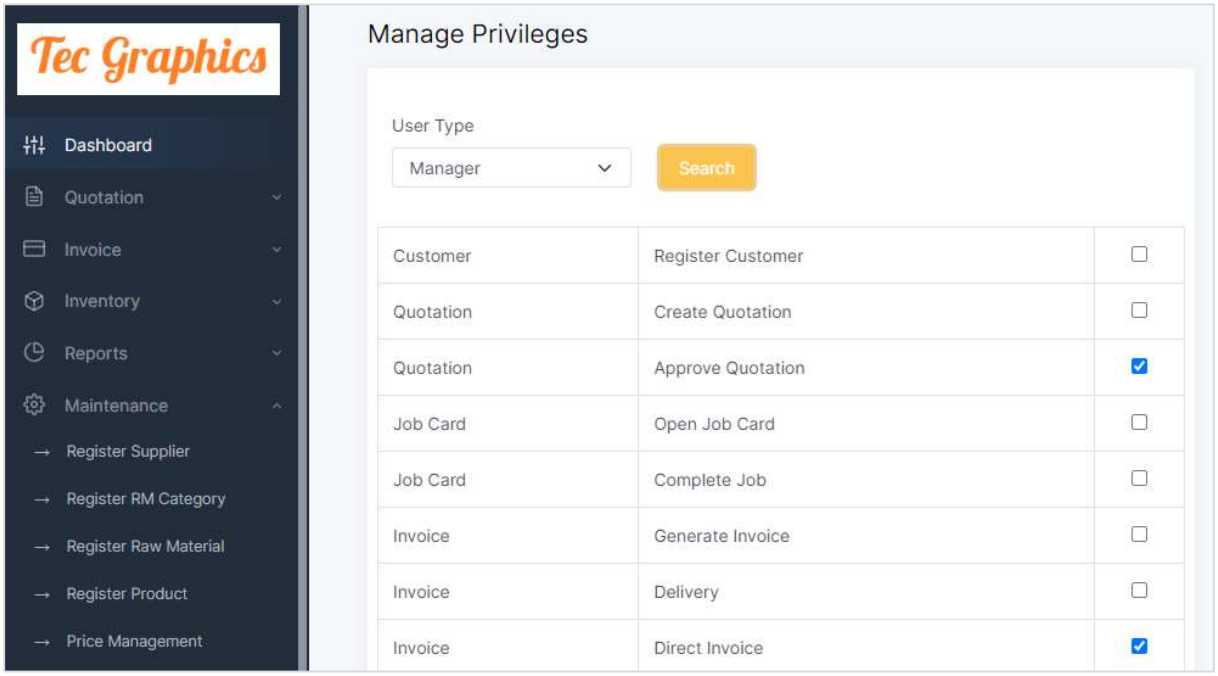


Figure C.10: Manage privileges

3. Check the checkboxes next to the functions that need to be granted privileges for the selected user type and click on ‘Submit’ button.

Register product

1. Browse: Maintenance > Register Product
2. Enter product name and select pricing method.
3. Attach images of the product that will be displayed in the website.

4. Enable the appropriate categories and enter the denominations for each category. This will construct the questionnaire that will be displayed in the website which the customer has to fill.
5. Finally click the 'Submit' button. The product register page is depicted in Figure C.11: Register product.

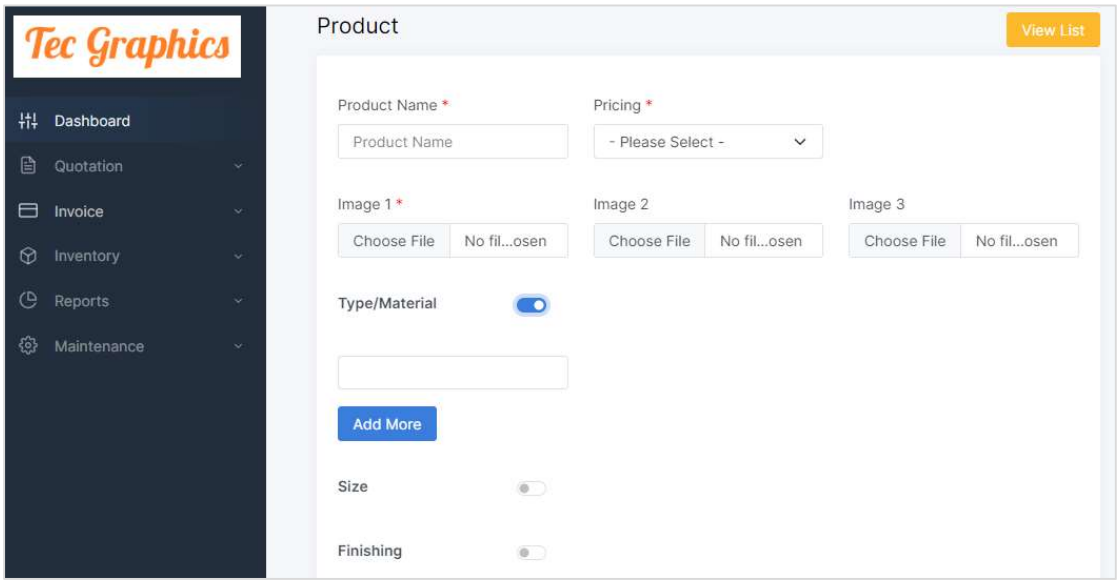


Figure C.11: Register product

Update product

1. Click on 'View List' button on the register product page, which will display the list of registered products. The view page is illustrated in Figure C.12: Product list.

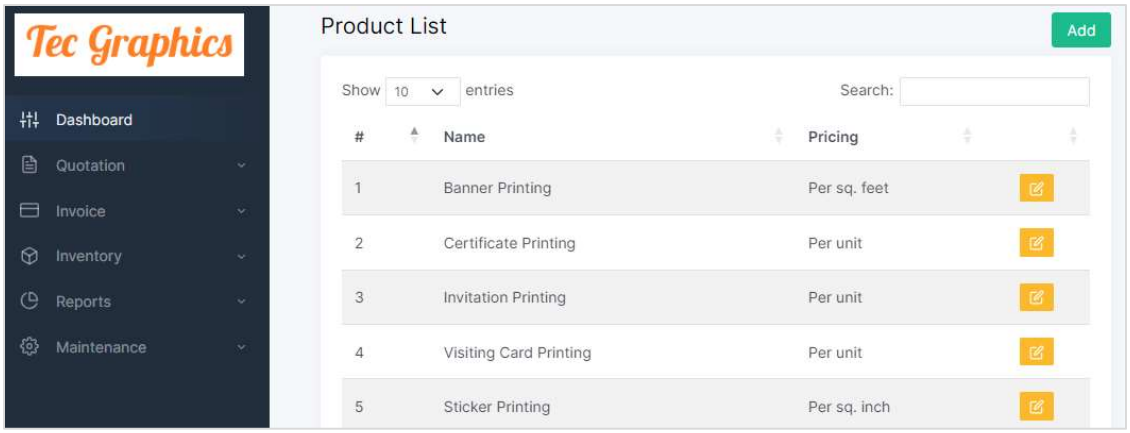


Figure C.12: Product list

2. Click on  button to update product details.
3. Enter the details that need to be updated and click the ‘Submit’ button.

Price Management

1. Browse: Maintenance > Price Management
2. All registered products and their respective denominations determining their prices are listed. Enter the effective price and click the ‘Submit’ button. The price management page is showed in Figure C.13: Price management.

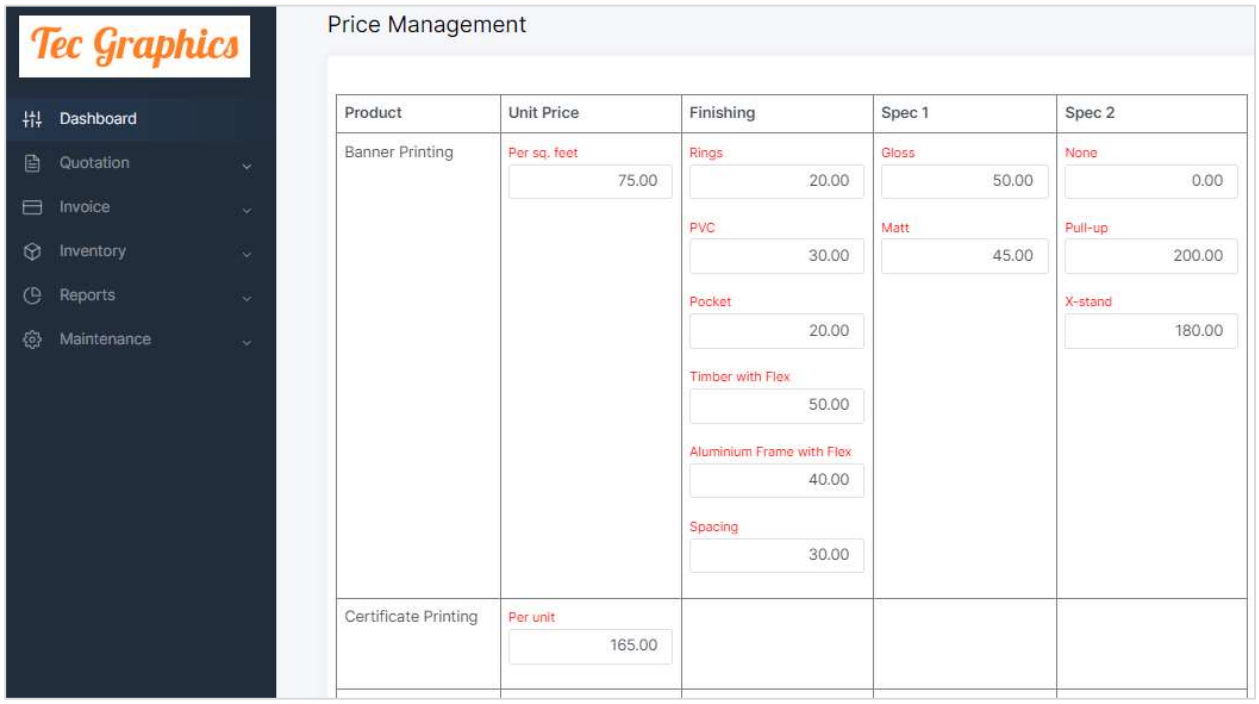


Figure C.13: Price management

Register raw material category

1. Browse: Maintenance > Register RM Category
2. Enter category name and click on ‘Submit’ button. The page for registering raw material category is illustrated in Figure C.14: Register raw material category.

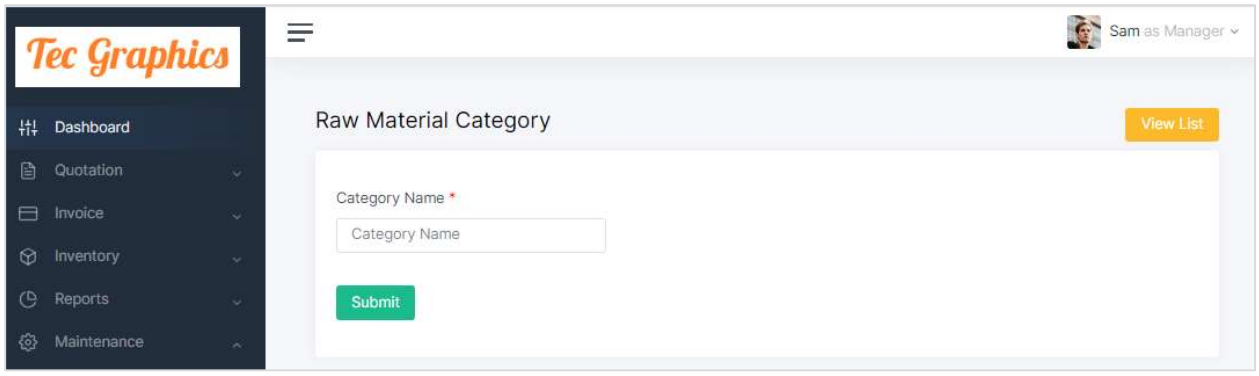


Figure C.14: Register raw material category

Update raw material category

1. Click the 'View List' button on the register raw material category page, which will display the list of registered categories. The view page is shown in Figure C.15: Raw material category list.
2. Click the  button to update category details.
3. Enter the details that need to be updated and click the 'Submit' button.

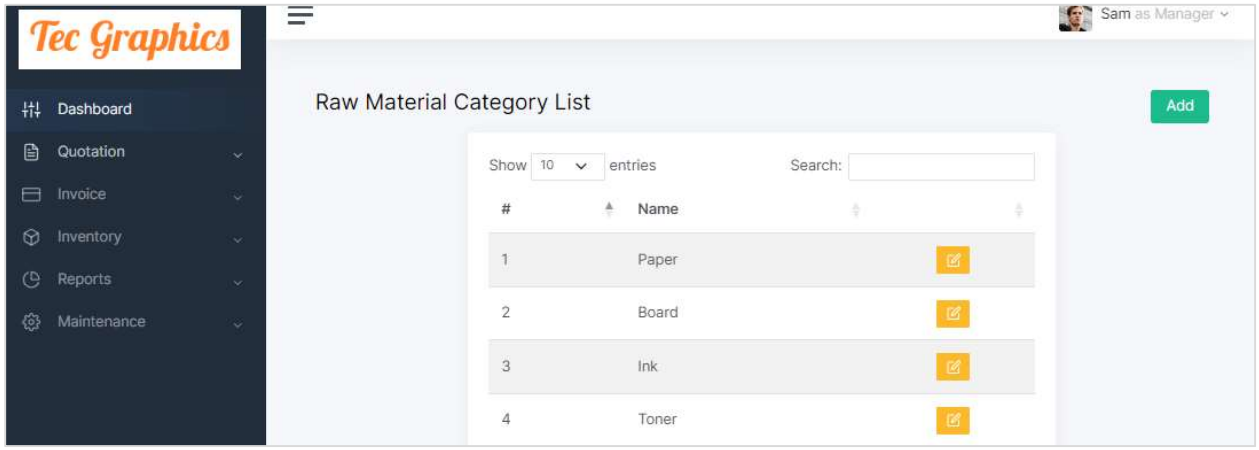


Figure C.15: Raw material category list

Register raw material

1. Browse: Maintenance > Register Raw Material

2. Fill in the form and click on ‘Submit’ button. The register raw material page is depicted in Figure C.16: Register raw material.

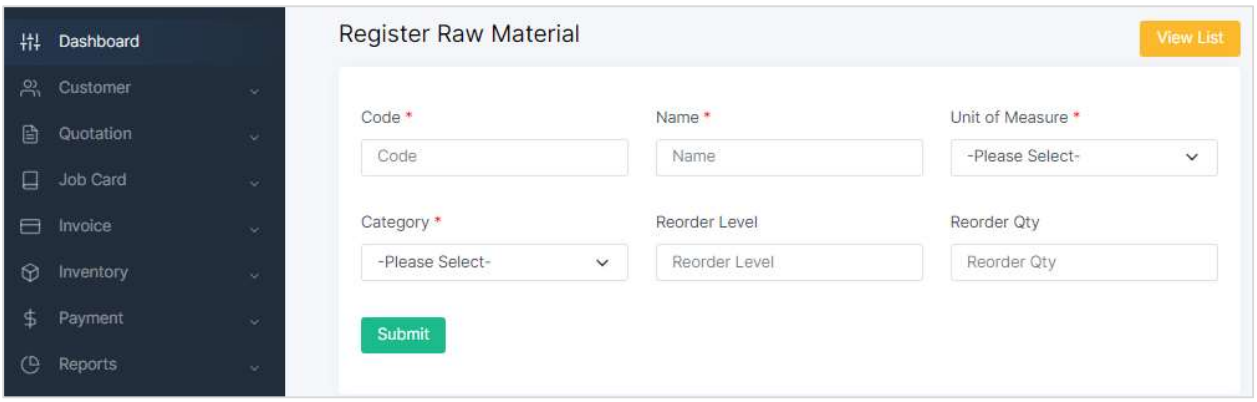


Figure C.16: Register raw material

Update raw material

1. Click the ‘View List’ button on the register raw material page, which will display the list of registered raw materials. The view page is shown in Figure C.17: Raw material list.
2. Click the  button to update raw material details.
3. Enter the details that need to be updated and click on ‘Submit’ button.

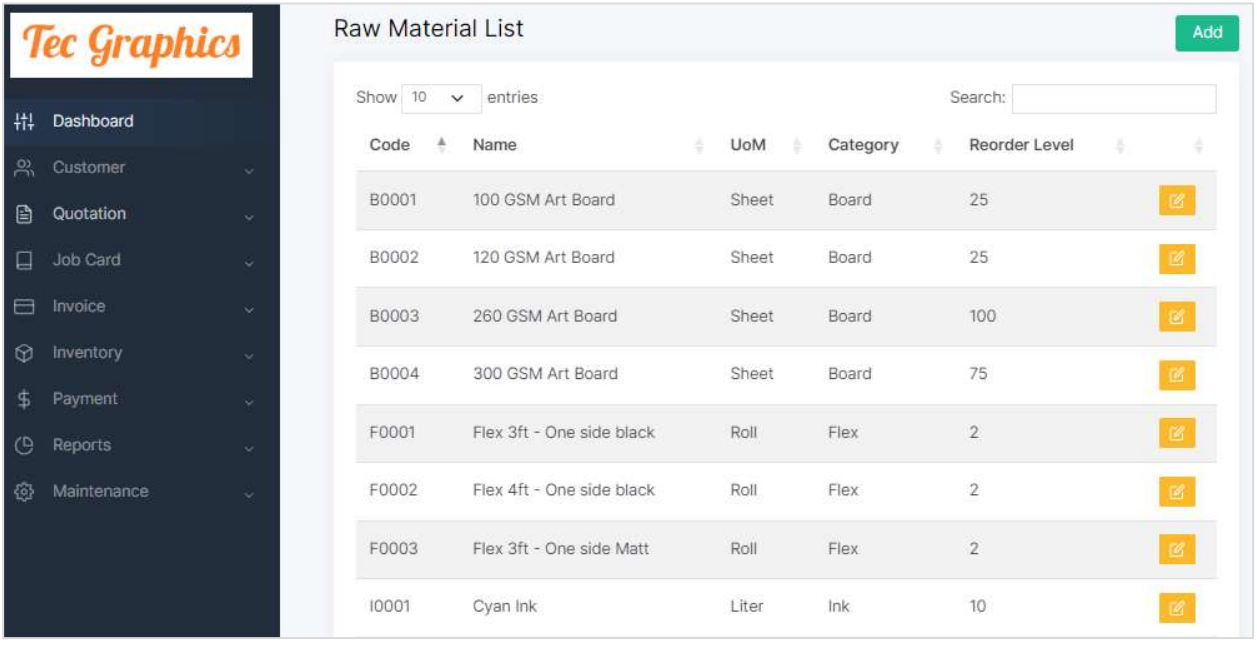


Figure C.17: Raw material list

Register supplier

1. Browse: Maintenance > Register Supplier
2. Fill in the supplier details and click the 'Submit' button. The interface for registering a supplier is described in Figure C.18: Register supplier.

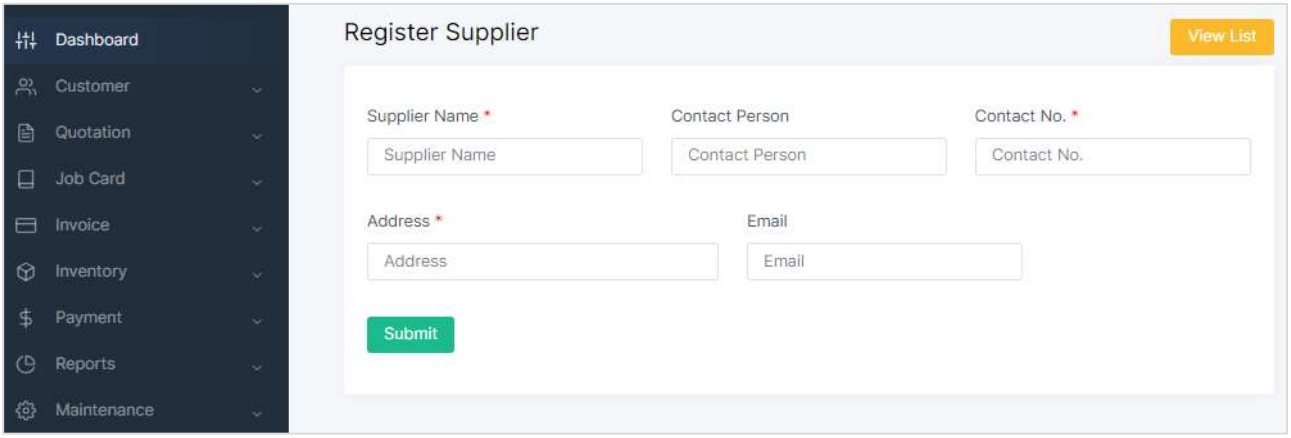


Figure C.18: Register supplier

Update supplier

1. Click the 'View List' button on the register supplier page, which will display the list of registered suppliers. The view page is shown in Figure C.19: Supplier list.
2. Click the  button to update supplier details.
3. Enter the details that need to be updated and click the 'Submit' button.

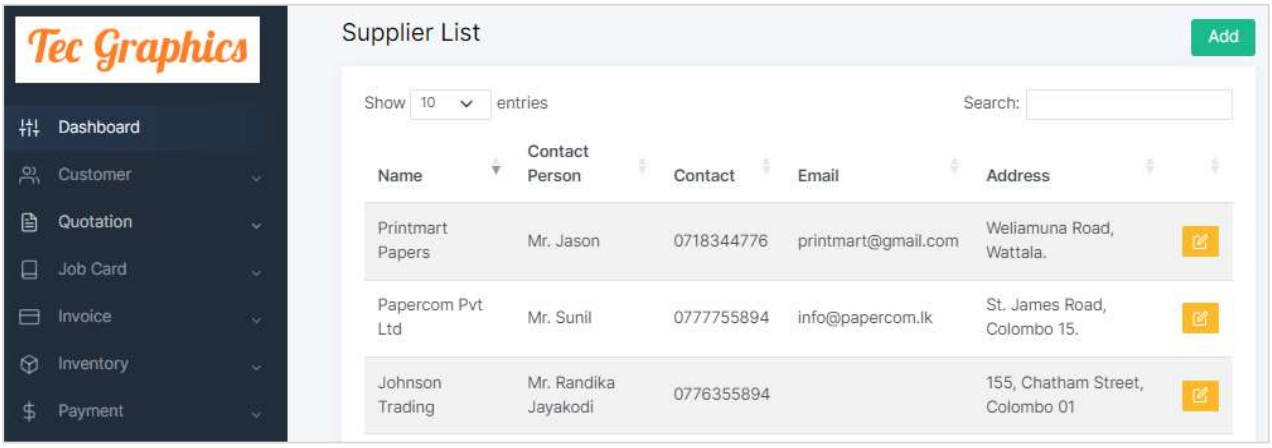


Figure C.19: Supplier list

Register customer

1. Browse: Customer > Register Customer
2. Select whether the customer is an individual or a company.
3. Enter the customer details. If the customer type is selected as company, more than one contact person could be added.
4. Then click on 'Submit' button. The customer register page is portrayed in Figure C.20: Customer register.

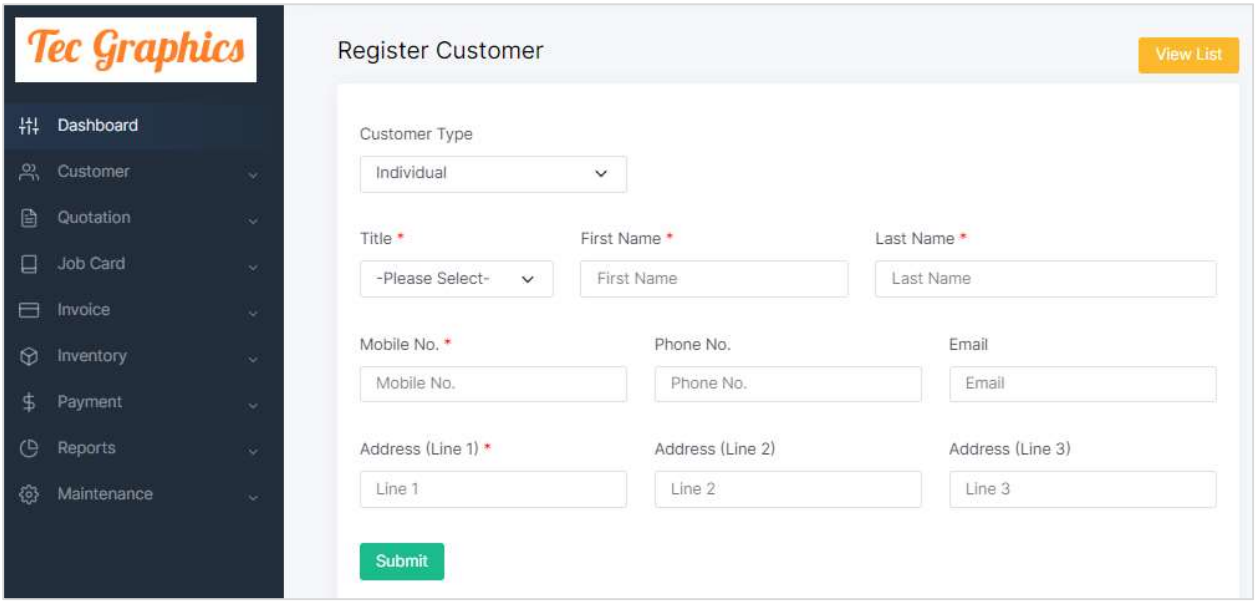


Figure C.20: Customer register

Update customer

1. Click the 'View List' button on the register customer page, which will display the list of walk-in customers and customers registered through the website. The view page is shown in Figure C.21: Customer list.
2. Update option is given only for walk-in customers. Click the  button to update customer details.
3. Enter the details that need to be updated and click on 'Submit' button.

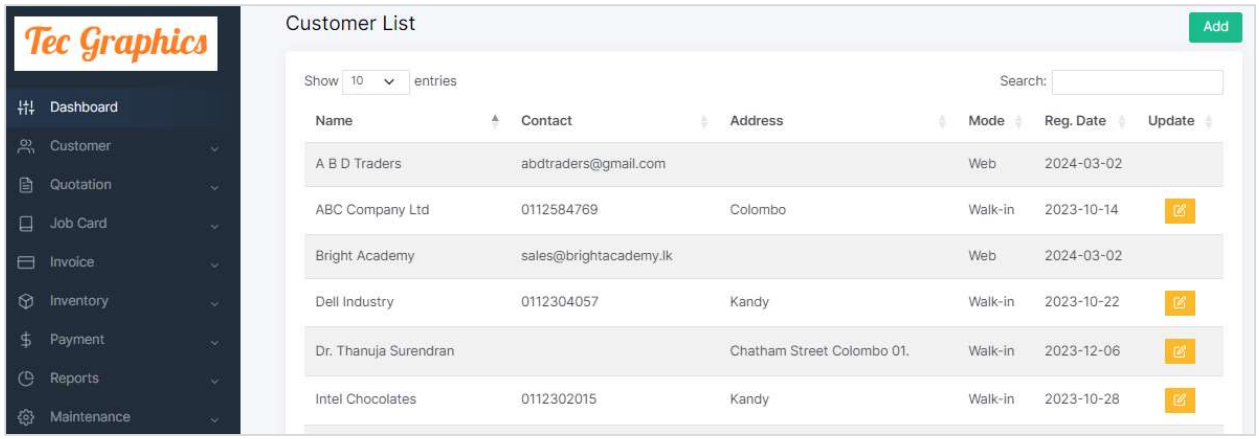


Figure C.21: Customer list

Create quotation

1. Browse: Quotation > Create Quotation
2. Requests for quotations made by customers through website are list in this screen. Click on quotation button to create a quotation. The create quotation page is depicted in Figure C.22: Create quotation.

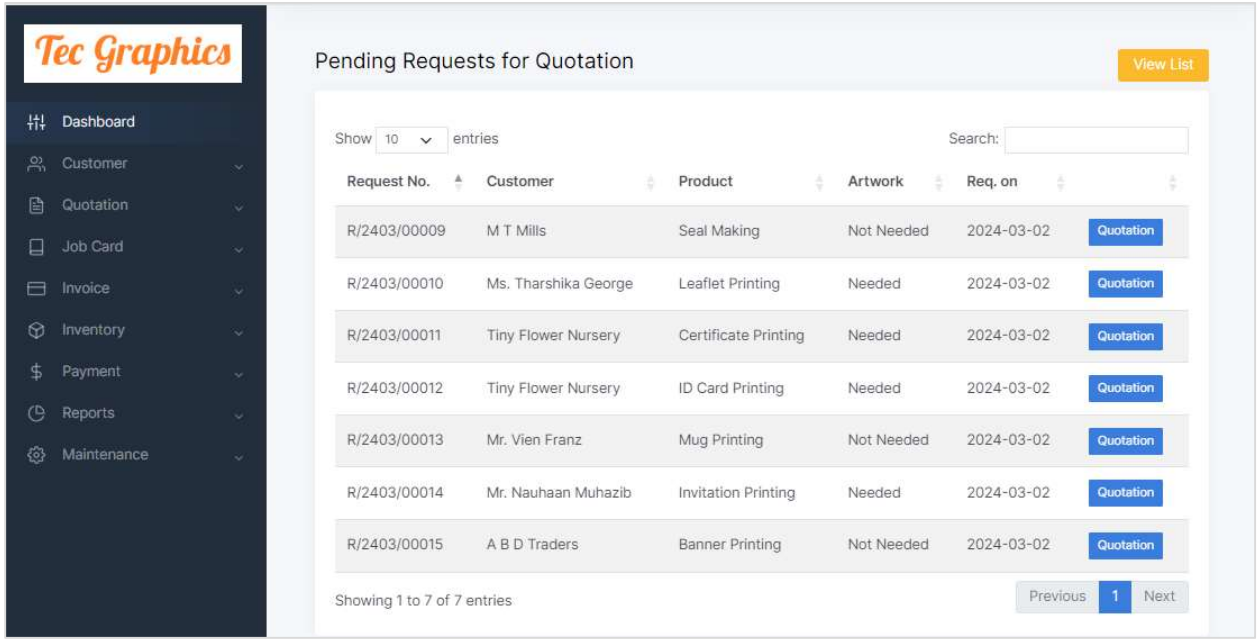


Figure C.22: Create quotation

3. The system will redirect to the page where customer preferences are displayed and quotation prices are calculated. These calculations are based on the prices pre-defined in 'Price management' section. The quotation detail page is described in Figure C.23: Quotation detail.

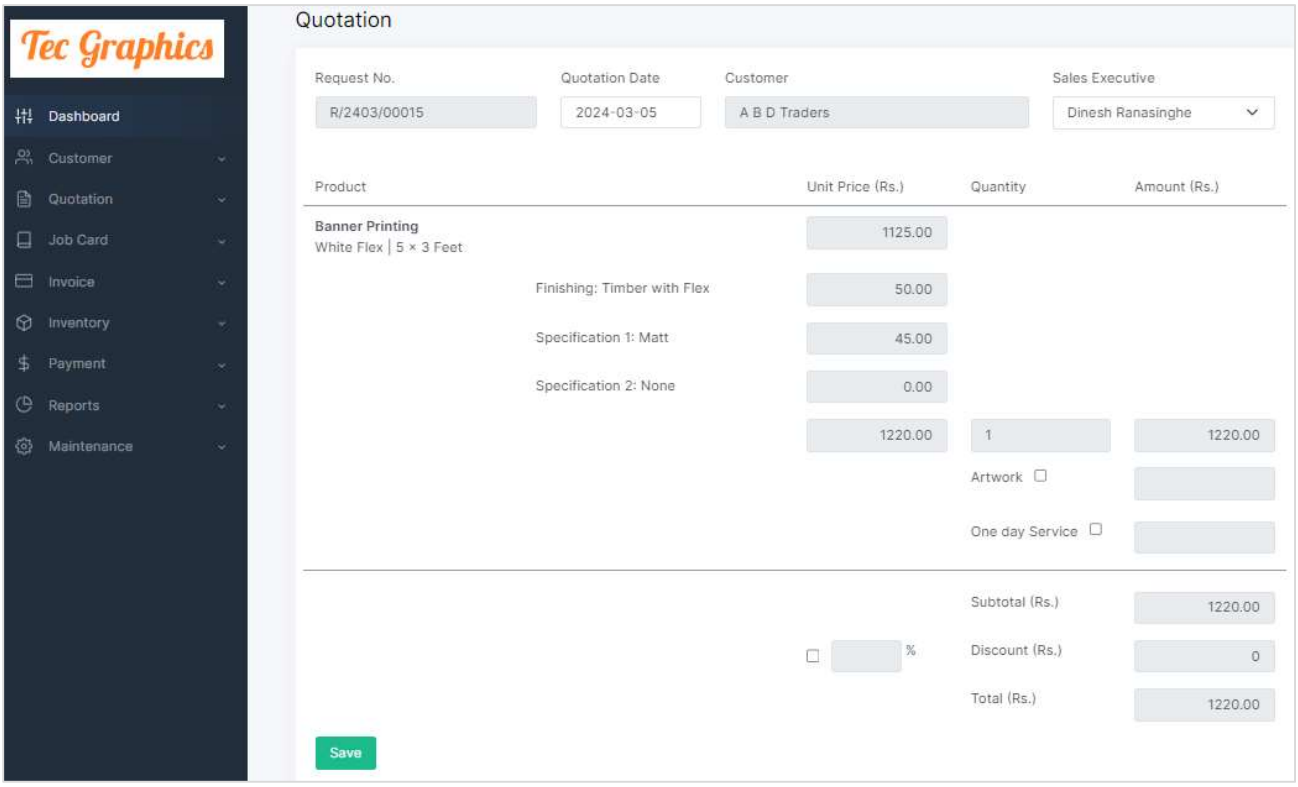


Figure C.23: Quotation detail

4. If customer has requested for artwork, the relevant field will be enabled and the price can be entered. Even if customer has not requested it, but still there is a need to create an artwork the field could be enabled by checking the checkbox. Likewise if the customer has requested one day service, the relevant field will be enabled.
5. A discount can be given for the calculated total.
6. Then click on the 'Save' button.

Print quotation

1. Click the 'View List' button on the create quotation page, which will display the list of quotations created. The view page is shown in Figure C.24: Quotation list.

2. Print option will be available only for approved quotations. Click the  button to print the quotation.

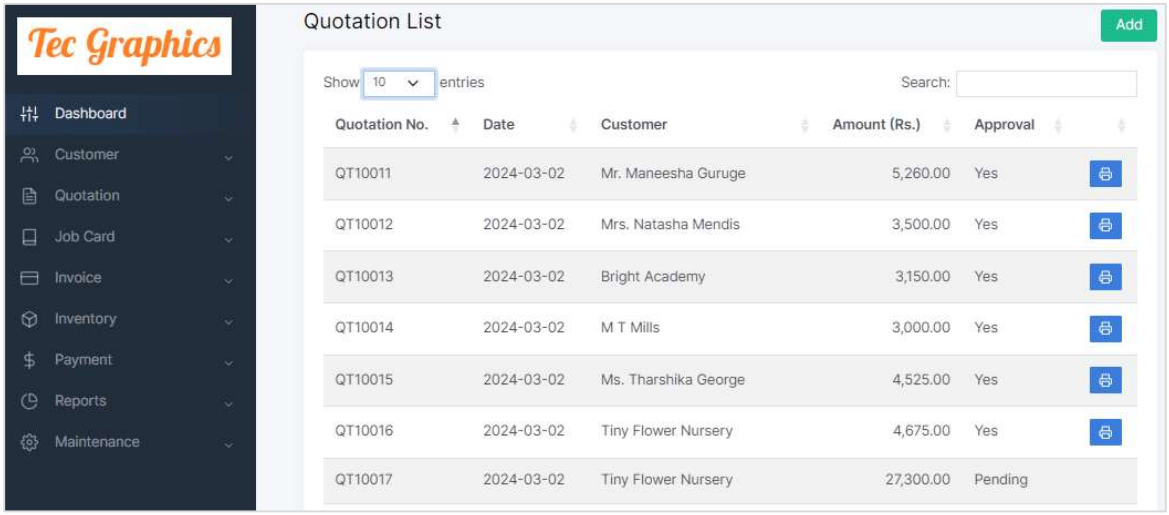


Figure C.24: Quotation list

Approve quotation

1. Browse: Quotation > Approve Quotation
2. Quotations created by sales executives will be listed in this page. Click the  button to view details. Pending quotation list is depicted in Figure C.25: Pending quotation list.

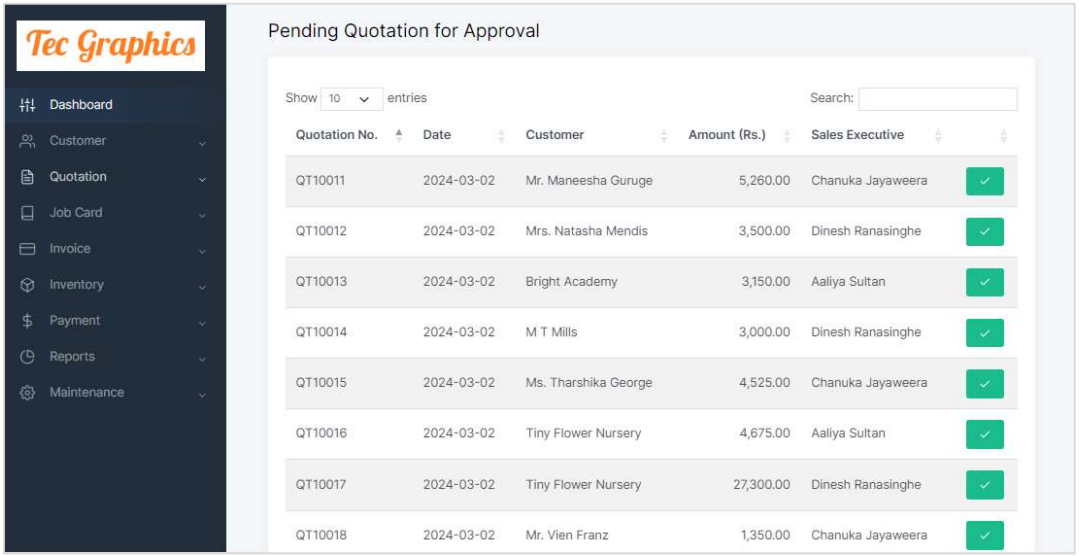


Figure C.25: Pending quotation list

3. The system will redirect to the quotation detail page illustrated in Figure C.26: Approve quotation.

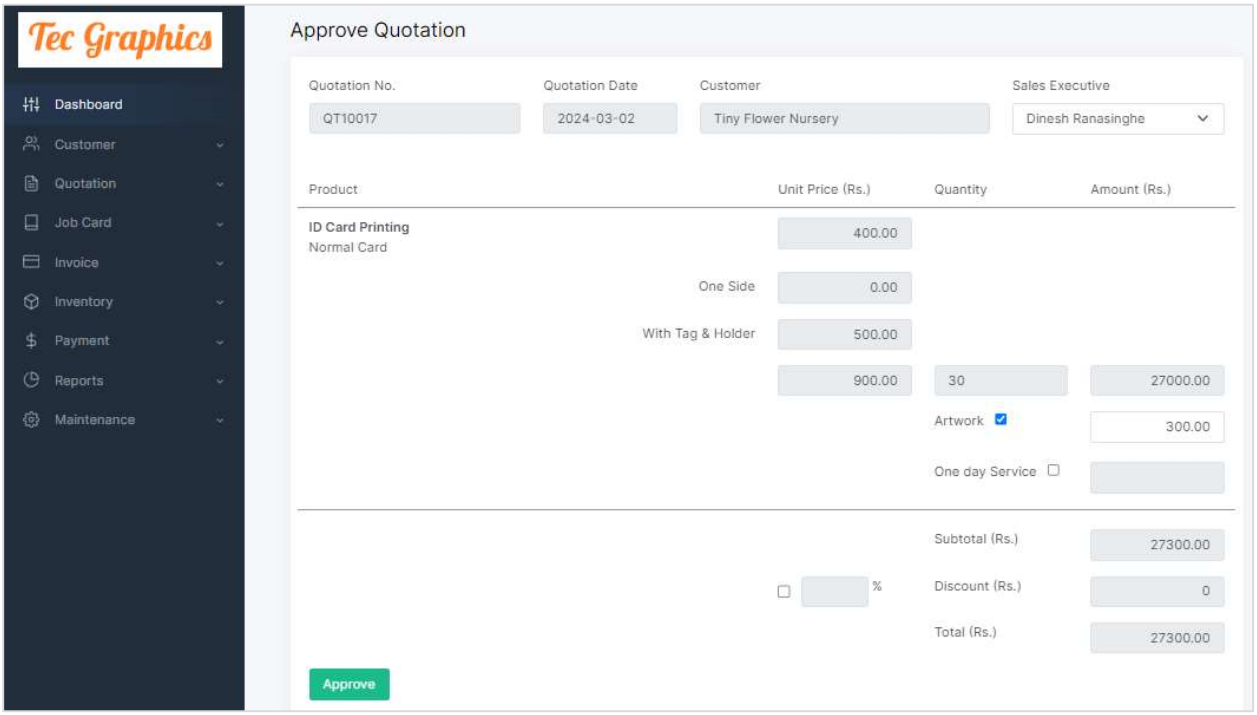


Figure C.26: Approve quotation

4. Check the details and click on 'Approve' button. An email will be automatically sent to customer once approved. The email will contain the quotation details and a link for customer to confirm the quotation.

Allocate a job to a coordinator

1. Browse: Job Card > Open Job Card
2. The job plan page lists all ongoing jobs and is illustrated in Figure C.27: Job plan. Unallocated jobs have a blue colored button in 'Unallocated' column. It displays the number of days since the quotation was confirmed by the customer. Click on the blue button.
3. Select the name of the coordinator from the popup and allocate.

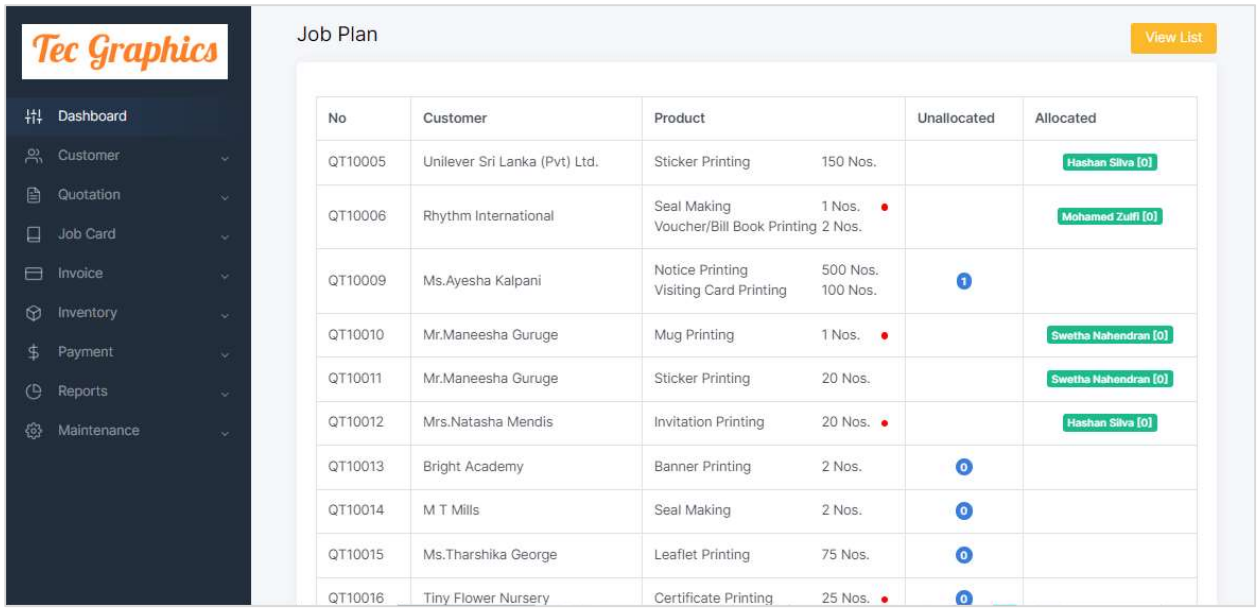


Figure C.27: Job plan

Create job card

1. Browse: Job Card > Open Job Card
2. Jobs that are allocated to a coordinator have a green colored button in ‘Allocated’ column. It displays the name of the coordinator and number of days since the quotation was allocated to the coordinator. Only the corresponding coordinator can create a job card by clicking in the green button.
3. The system will redirect to the open job card page. Open job card page is described in Figure C.28: Open Job Card.
4. Enter the required material for processing the job, select the machine used and specify any special instructions and click the ‘Save’ button.

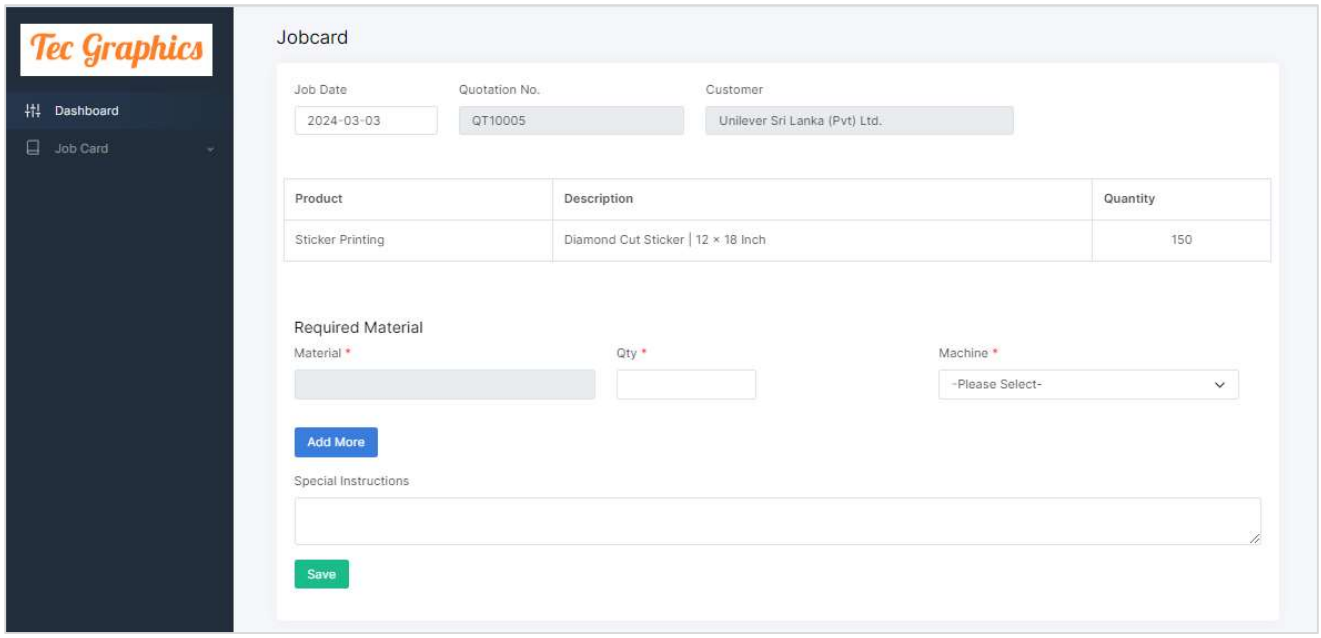


Figure C.28: Open Job Card

Complete job

1. Browse: Job Card > Complete Job Card
2. Check the select checkbox to enter the completed quantity of the job and click on 'Save' button. The complete job screen in illustrated in Figure C.29: Complete job.

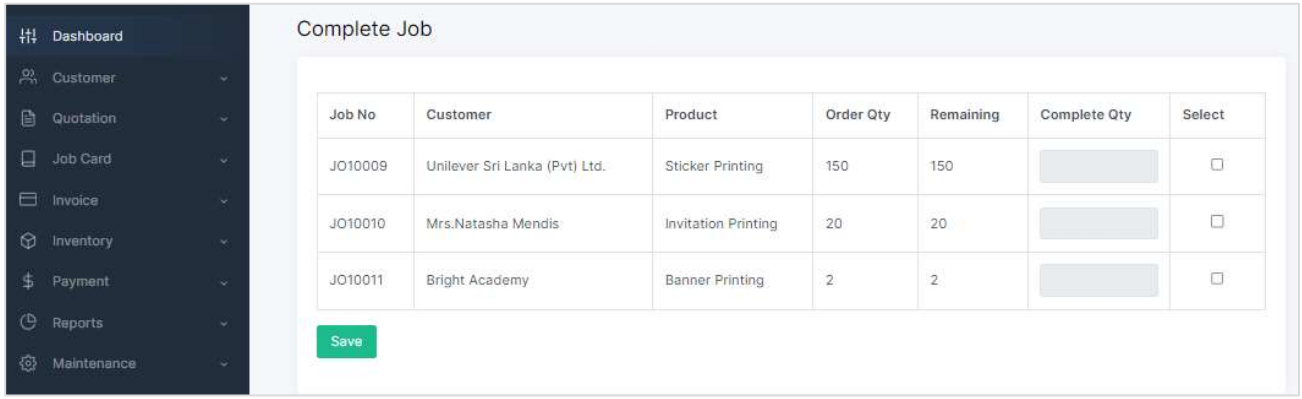


Figure C.29: Complete job

Generate invoice

1. Browse: Invoice > Generate Invoice
2. Pending invoice screen lists items of the jobs that are completed. Click on 'Invoice' button to open the detail page. The pending invoice page is depicted in Figure C.30: Pending invoice.

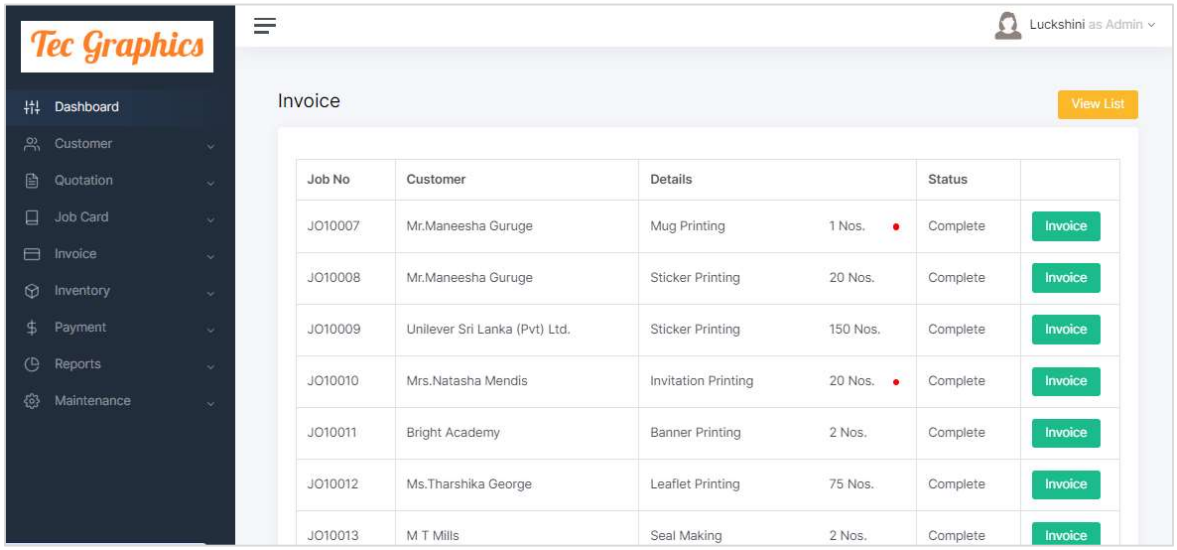


Figure C.30: Pending invoice

3. The page for generating the invoice is described in Figure C.31: Generate invoice. Completed quantity is displayed as default for invoice quantity. Change the quantity if required. Note that invoice quantity should be less than completed quantity. Then click on 'Save' button.

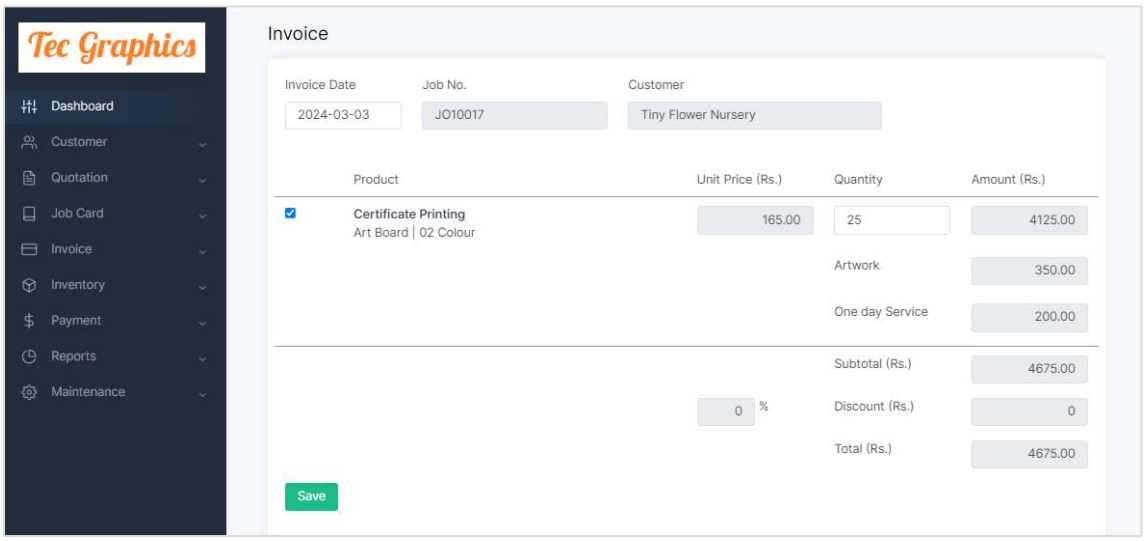


Figure C.31: Generate invoice

Print invoice

1. Click the ‘View List’ button on the generate invoice page, which will display the list of invoices.
2. Click the  button to print the invoice.

Delivery

1. Browse: Invoice > Delivery
2. The pending list for delivery is portrayed in Figure C.32: Pending delivery. Click on the ‘Delivery’ button to open delivery page.

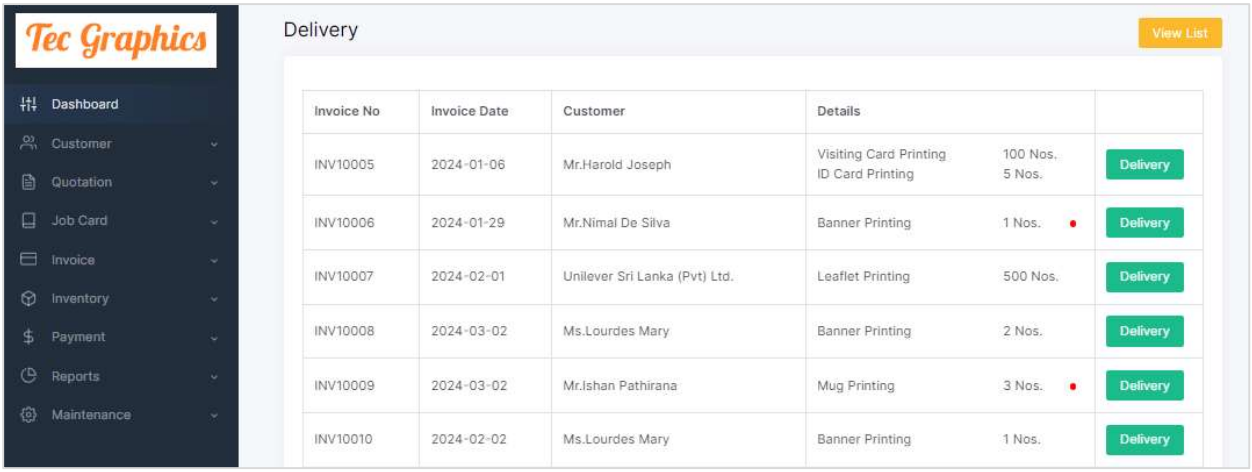


Figure C.32: Pending delivery

3. Fill the packing details of the delivery and click on ‘Save’ button. The delivery page is showed in Figure C.33: Delivery.

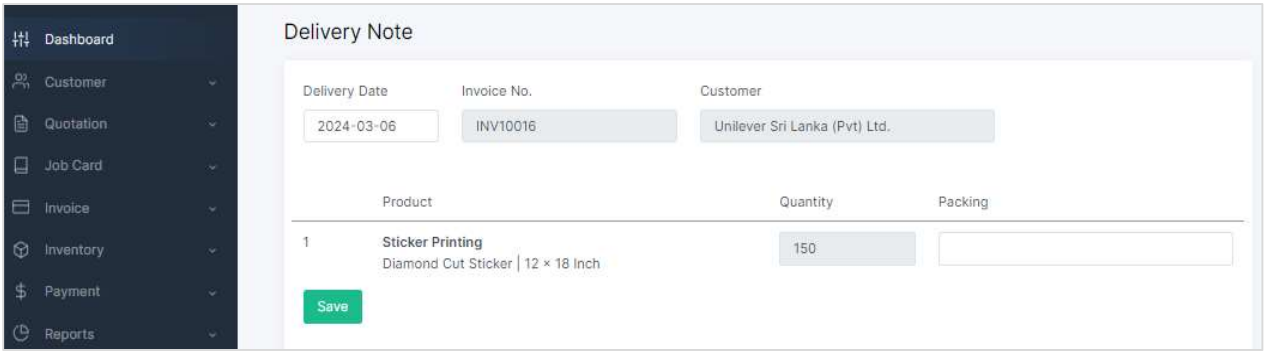


Figure C.33: Delivery

Direct Invoice

1. Browse: Invoice > Direct Invoice
2. Select customer and enter description of item or service to be invoiced, unit price and quantity.
3. Add more item or service by clicking the ‘Add More’ button.
4. Discount can be given for the calculated total.
5. Click on the ‘Save’ button. The interface for direct invoice is shown in Figure C.34: Direct invoice.

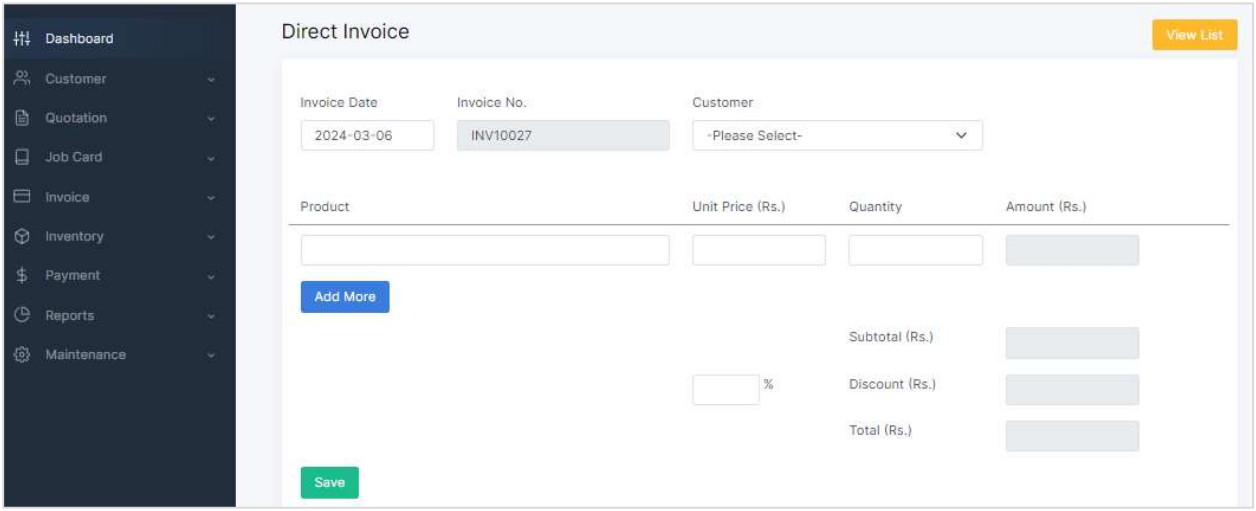


Figure C.34: Direct invoice

Purchase Order

1. Browse: Inventory > Purchase Order
2. Select supplier. Then select raw material from the popup window opened once clicked on the field provided. Fill the rate and quantity.
3. Add more raw materials to the purchase order by clicking on ‘Add More’ button.
4. Click on ‘Submit’ button. The interface for purchase order is illustrated in Figure C.35: Purchase order.
5. View purchase order list by clicking on ‘View List’ button.
6. Click the print button in the view list to print the purchase order.

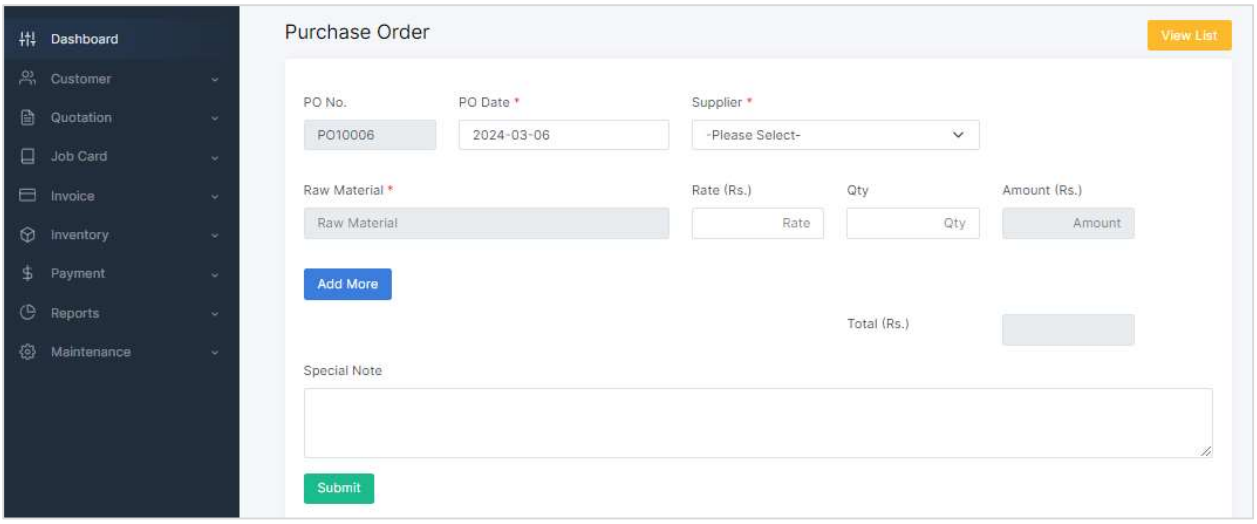


Figure C.35: Purchase order

Approve purchase order

1. Browse: Inventory > Approve PO
2. Click on  button to open the approve page. The page listing the pending purchase orders is depicted in Figure C.36: Pending PO.

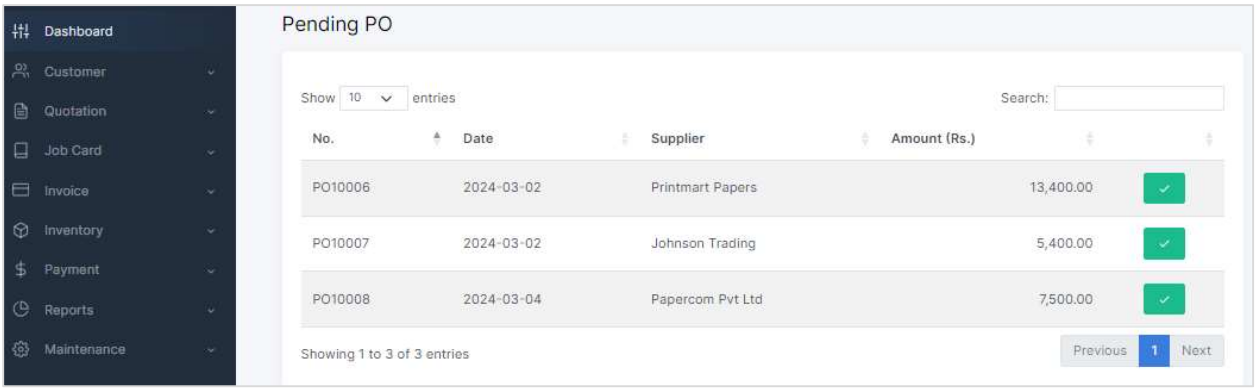


Figure C.36: Pending PO

3. Purchase order approval page is illustrated in Figure C.37: Approve PO. Check the purchase order details and click on ‘Approve’ button to approve or ‘Reject’ button to reject the purchase order.

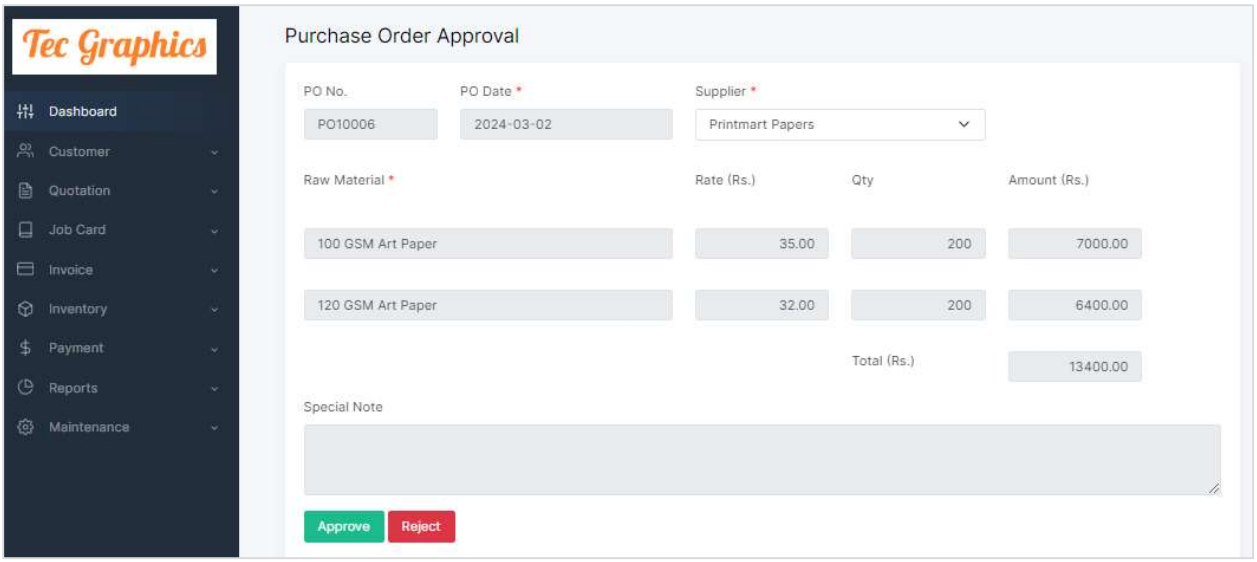


Figure C.37: Approve PO

Good received note

1. Browse: Inventory > Good Received Note
2. Select the purchase order number from the drop down.
3. Select the items by checking the checkbox and enter received quantity.
4. Click on ‘Submit’ button. The interface for good received note is shown in Figure C.38: Good received note.

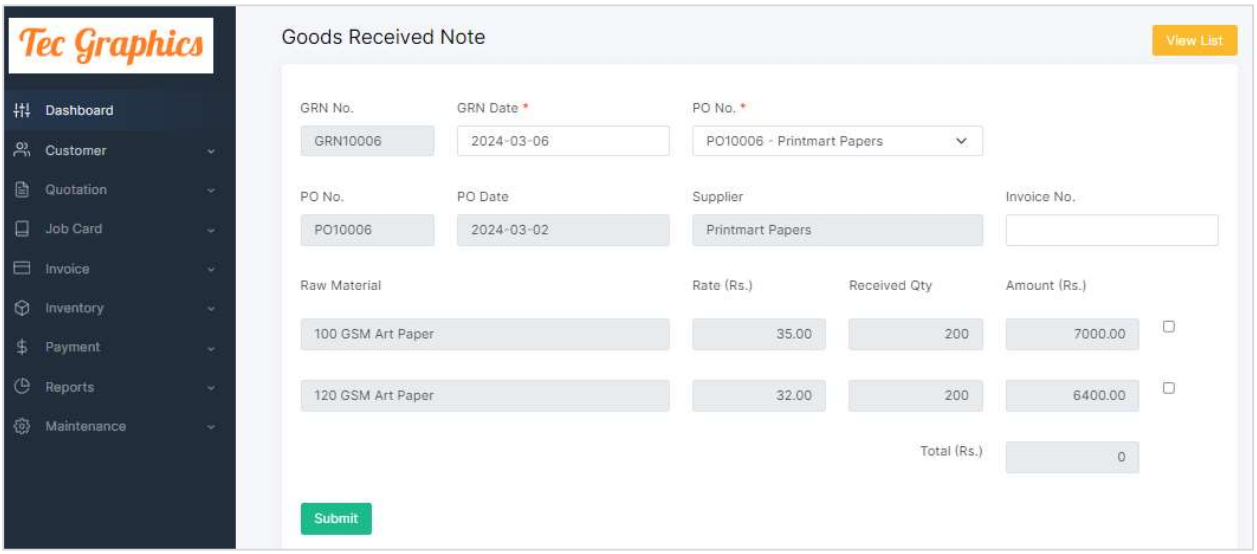


Figure C.38: Good received note

Approve GRN

1. Browse: Inventory > Approve GRN
2. Click on  button to open the approve page. The page listing the pending good received notes is described in Figure C.39: Pending GRN.

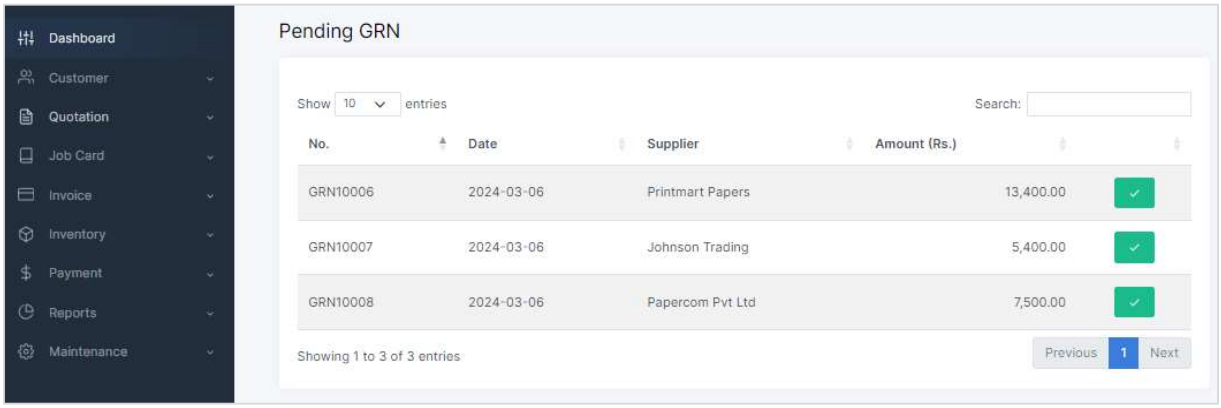


Figure C.39: Pending GRN

3. Check the GRN details and click on 'Approve' button to approve or 'Reject' button to reject the GRN.

Issue raw material

1. Browse: Inventory > Issue Raw Material
2. Select job number from the drop down and enter the name of employee to whom the raw materials are issued.
3. Select raw material and enter quantity.
4. Add more raw materials by clicking the 'Add More' button.
5. Click on 'Submit' button. The interface for issuing raw material is portrayed in Figure C.40: Issue raw material.
6. View the list of issue notes by clicking the 'View List' button.

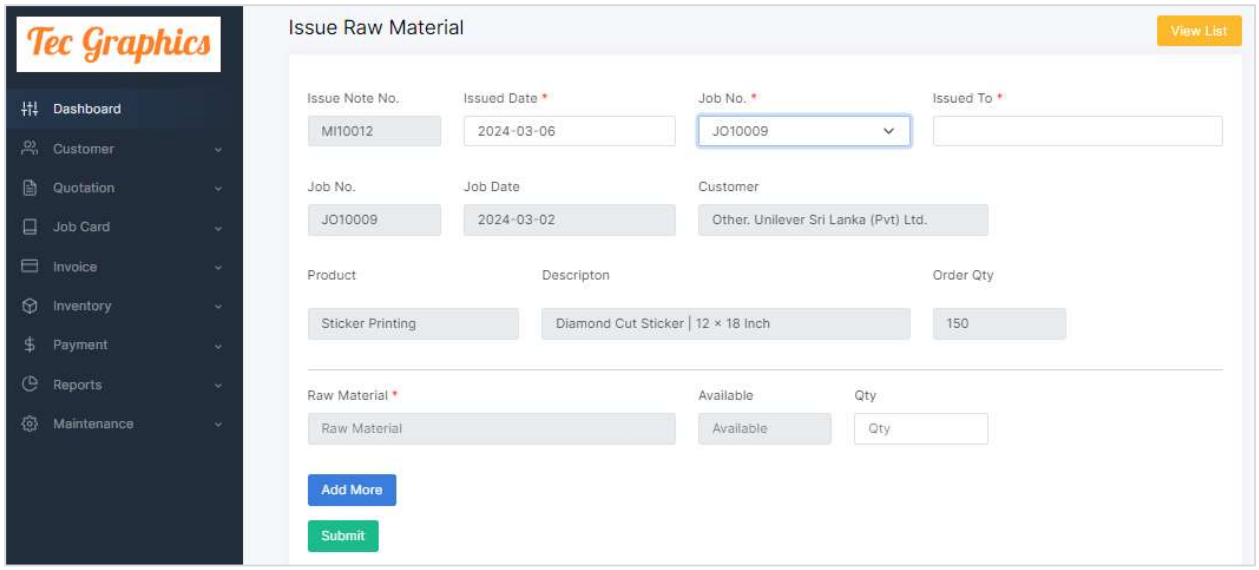


Figure C.40: Issue raw material

Return raw material

1. Browse: Inventory > Return raw material
2. Select the issue note number from the drop down.
3. Select the raw materials to be returned by checking the checkbox and enter the quantity that is returned and click the 'Submit' button. The return raw material page is depicted in Figure C.41: Return raw material.

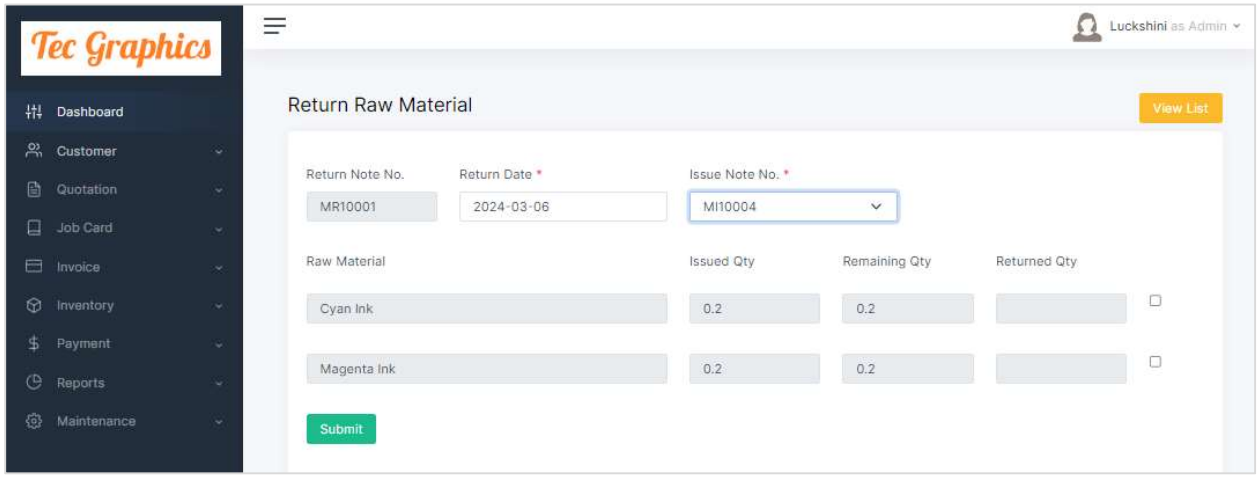


Figure C.41: Return raw material

Advance Payment

1. Browse: Payment > Advance Payment
2. Select customer and enter description and received amount.
3. Select payment type. If payment type is cheque, fill cheque number and date.
4. Click the 'Submit' button. The interface for advance payment is depicted in Figure C.42: Advance payment.

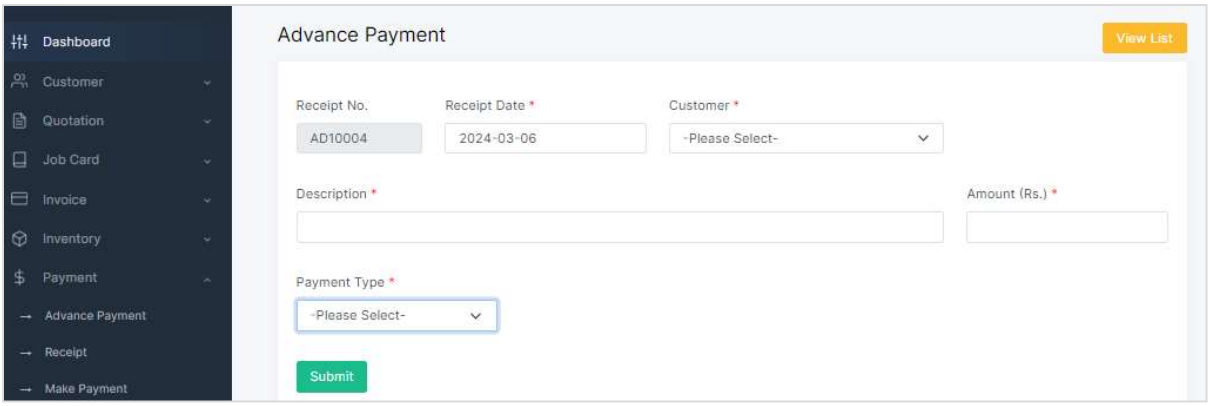


Figure C.42: Advance payment

Receipt

1. Browse: Payment > Receipt
2. Select customer from the drop down. The interface for advance payment is depicted in Figure C.43: Receipt.

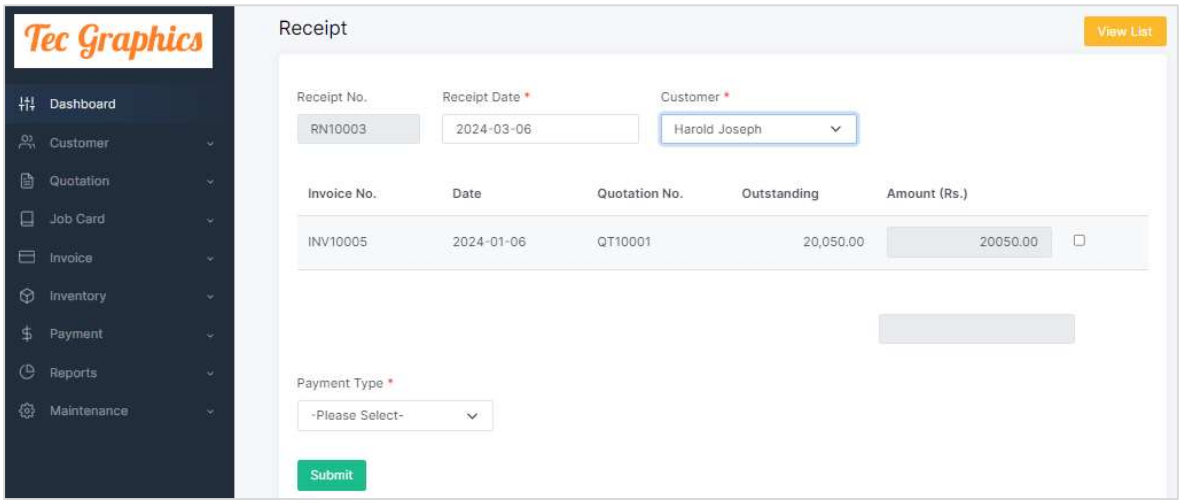


Figure C.43: Receipt

3. Select the invoices to be settled by checking the checkboxes and enter received amount.
4. Select payment type. If payment type is cheque, fill cheque number and date.
5. Click the 'Submit' button.

Make payment

1. Browse: Payment > Make payment
2. Select supplier from the drop down.
3. Select the GRN to be settled by checking the checkboxes and enter paid amount.
4. Select payment type. If payment type is cheque, fill cheque number and date.
5. Click the 'Submit' button. The interface for making a payment is described in Figure C.44: Make payment.

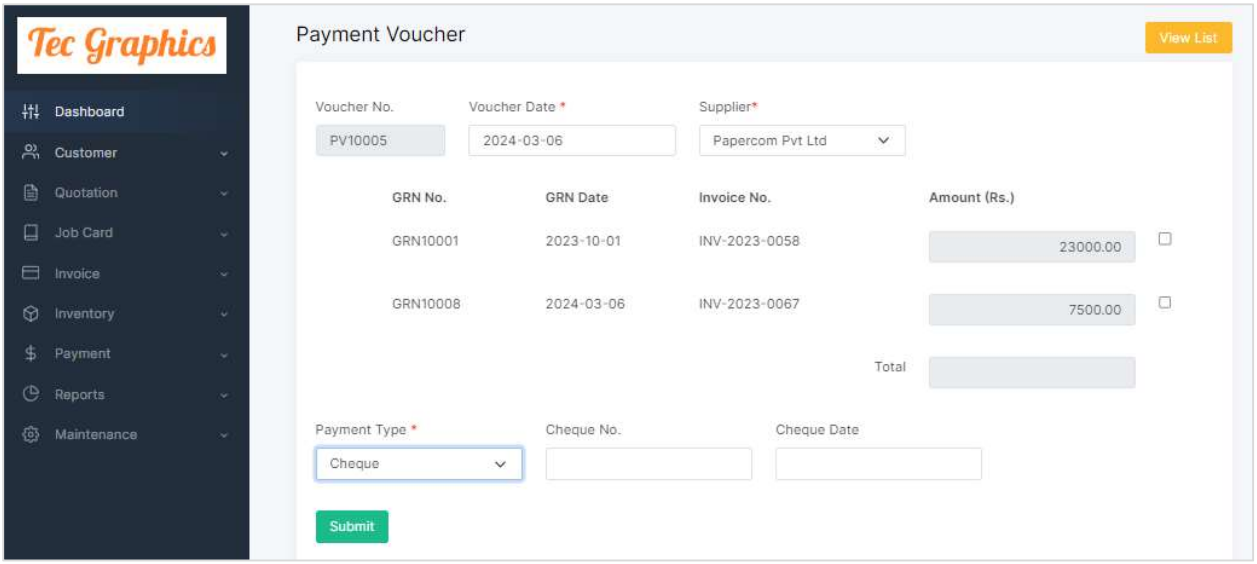


Figure C.44: Make payment

APPENDIX D

MANAGEMENT REPORTS

SALES REPORT

Sales details for the selected date range is depicted in the sales report. This report could be filtered by customer name as well. The sales report is illustrated in Figure D.1: Sales report.

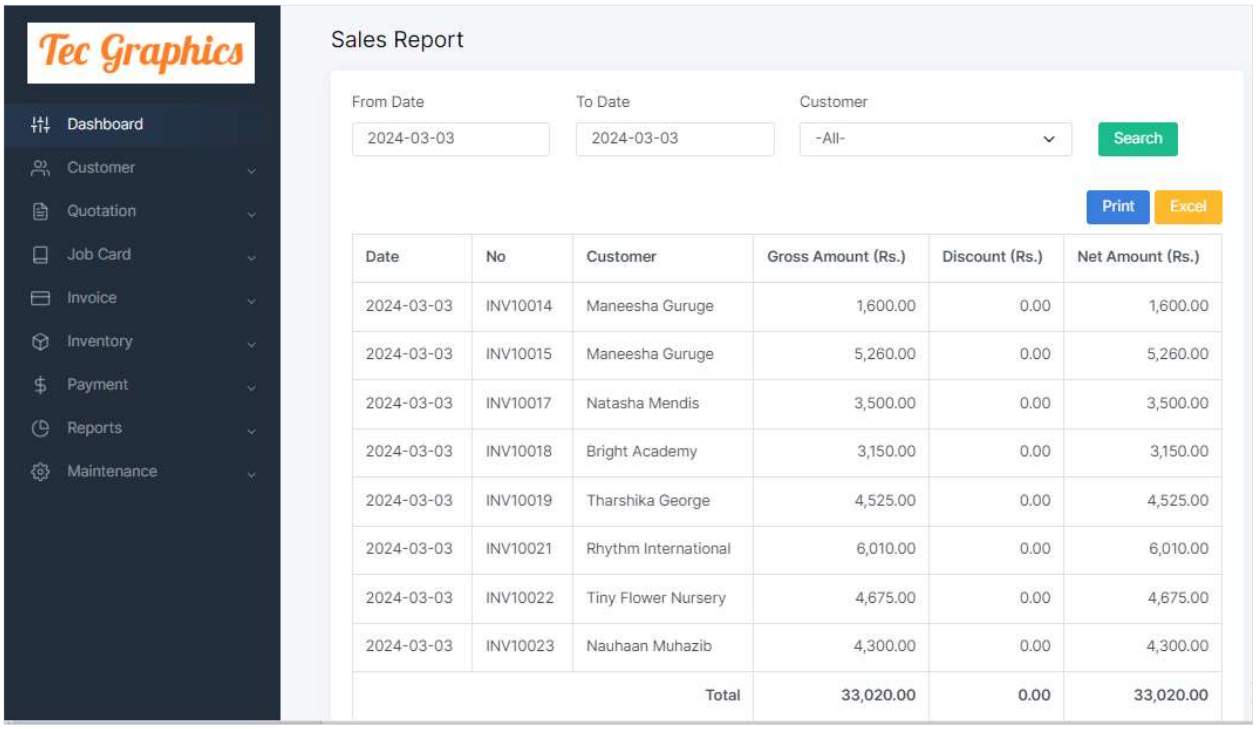


Figure D.1: Sales report

STOCK REPORT

The stock report lists the registered raw materials along with their current available stock levels. The stock report is portrayed in Figure D.2: Stock report.

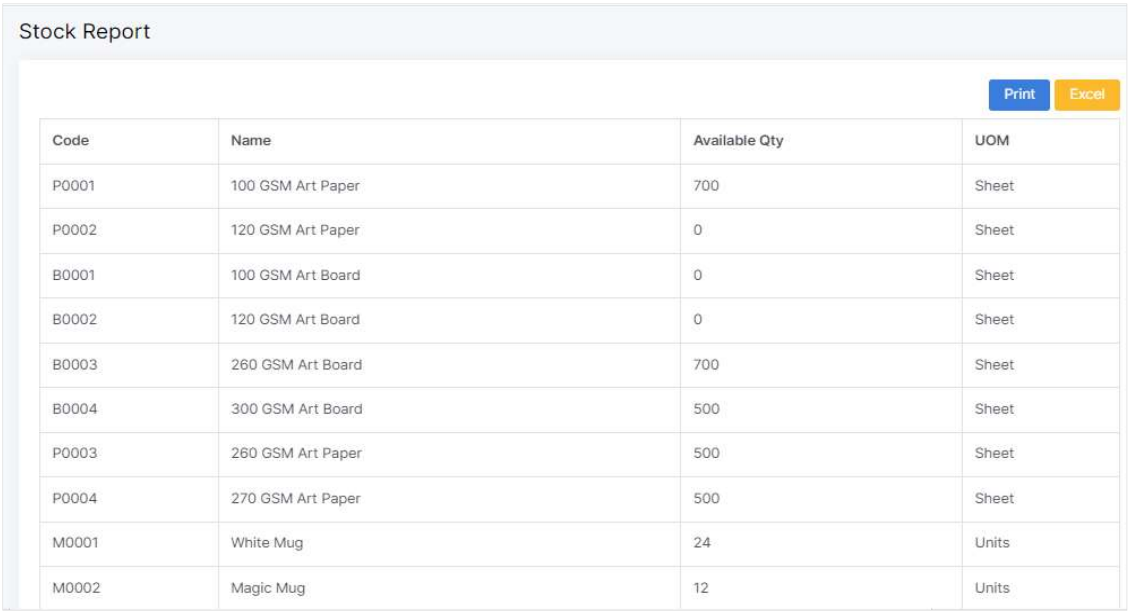


Figure D.2: Stock report

CUSTOMER AGEING REPORT

Age analysis of customer outstanding is described in customer ageing report. This report could be filtered by customer name as well. Customer ageing report is pictured in Figure D.3: Customer ageing report.

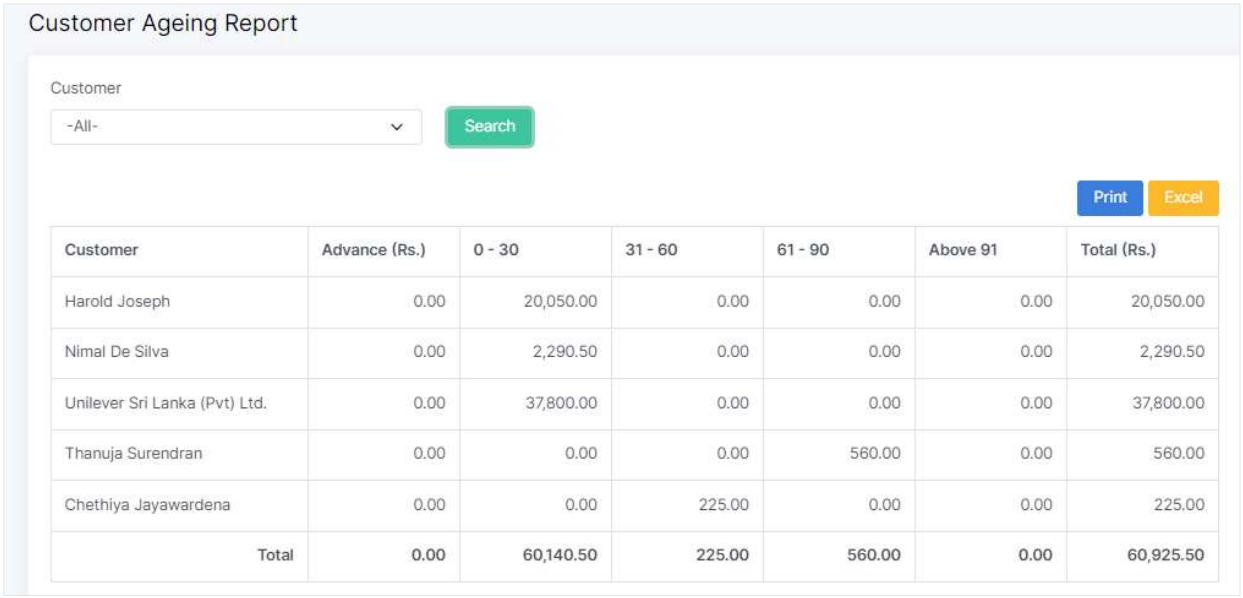
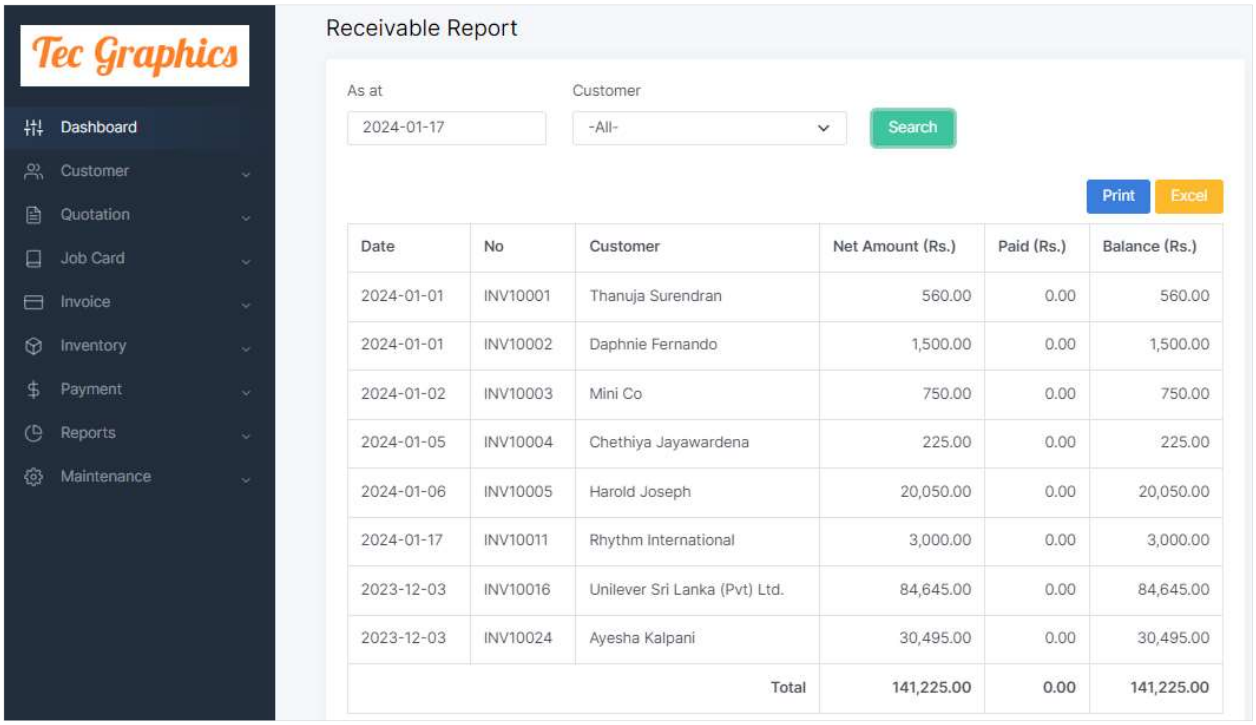


Figure D.3: Customer ageing report

RECEIVABLE REPORT

This report is used to get the customer outstanding as at a given date. This report could be filtered by customer name. Receivable report is pictured in Figure D.4: Receivable report.



Date	No	Customer	Net Amount (Rs.)	Paid (Rs.)	Balance (Rs.)
2024-01-01	INV10001	Thanuja Surendran	560.00	0.00	560.00
2024-01-01	INV10002	Daphnie Fernando	1,500.00	0.00	1,500.00
2024-01-02	INV10003	Mini Co	750.00	0.00	750.00
2024-01-05	INV10004	Chethiya Jayawardena	225.00	0.00	225.00
2024-01-06	INV10005	Harold Joseph	20,050.00	0.00	20,050.00
2024-01-17	INV10011	Rhythm International	3,000.00	0.00	3,000.00
2023-12-03	INV10016	Unilever Sri Lanka (Pvt) Ltd.	84,645.00	0.00	84,645.00
2023-12-03	INV10024	Ayesha Kalpani	30,495.00	0.00	30,495.00
		Total	141,225.00	0.00	141,225.00

Figure D.4: Receivable report

PAYMENTS RECEIVED REPORT

This report is used to view the payments received from customers within a selected date range. This report could be filtered by customer name and payment method. Payments received report is visualized in Figure D.5: Payments received report.

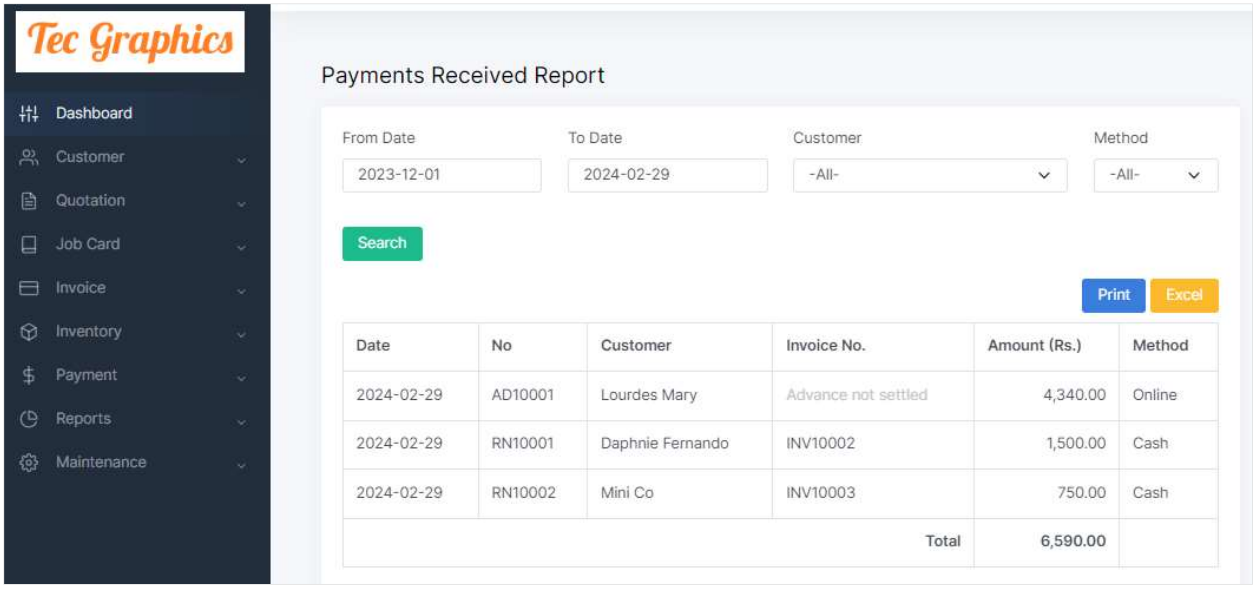


Figure D.5: Payments received report

PAYABLE REPORT

The amount that needs to be paid to suppliers as at a given date is detailed in payable report. This report could be filtered by supplier name. Payable report is shown in Figure D.6: Payable report.

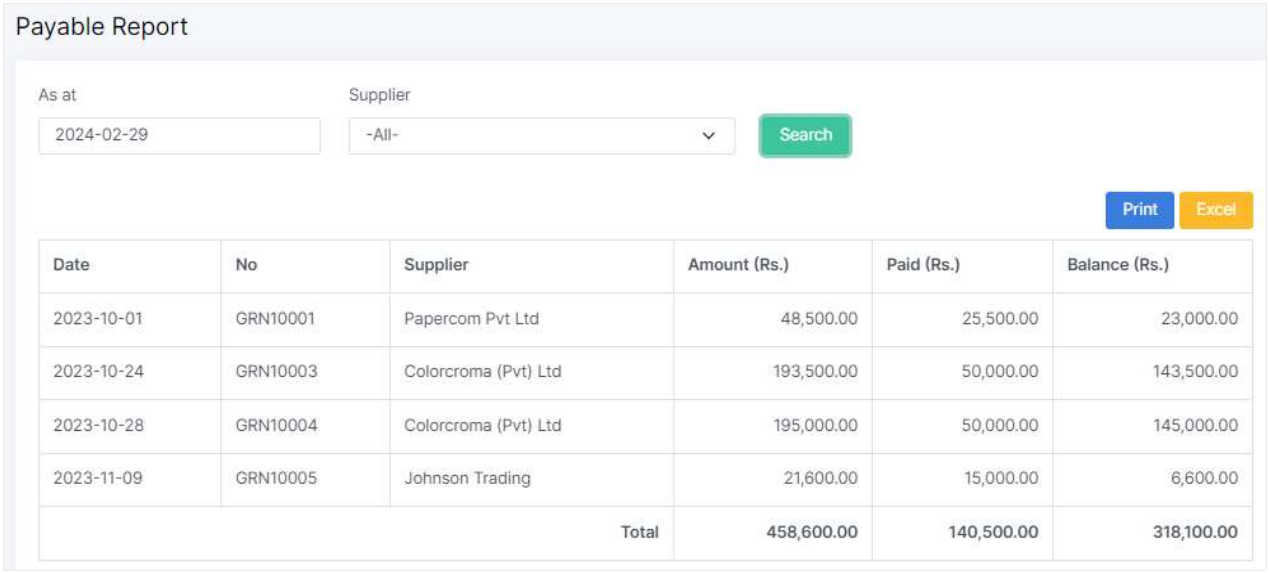
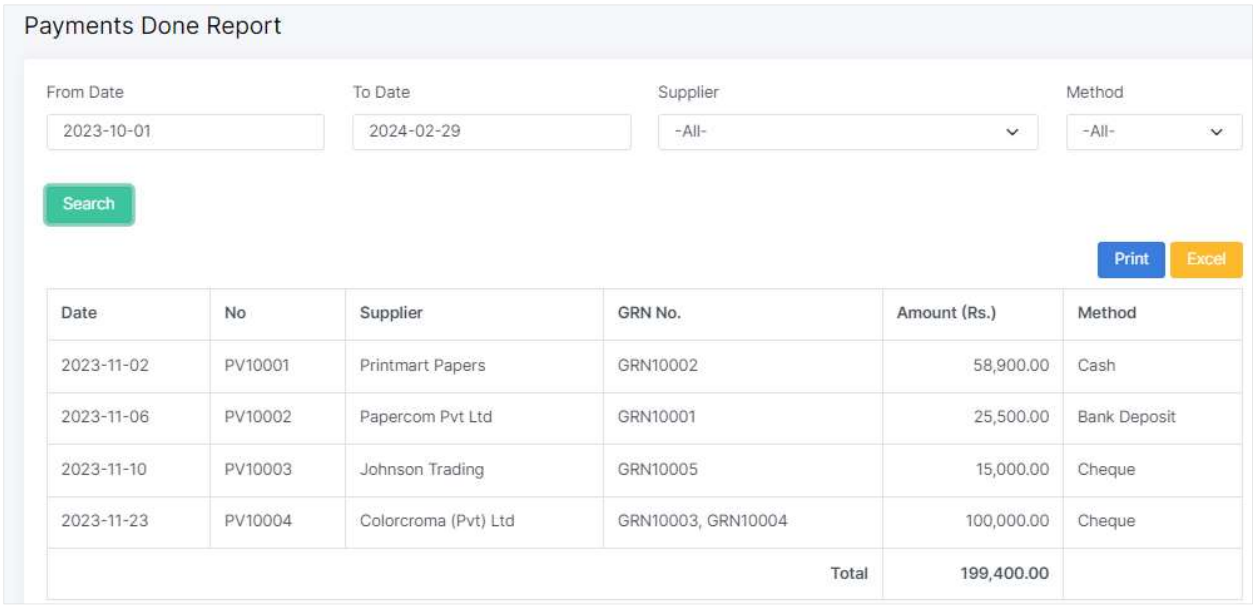


Figure D.6: Payable report

PAYMENTS DONE REPORT

This report is used to view the payments done to supplier within a selected date range. This report could be filtered by supplier name and payment method. Payments done report is pictured in Figure D.7: Payments done report.



Date	No	Supplier	GRN No.	Amount (Rs.)	Method
2023-11-02	PV10001	Printmart Papers	GRN10002	58,900.00	Cash
2023-11-06	PV10002	Papercom Pvt Ltd	GRN10001	25,500.00	Bank Deposit
2023-11-10	PV10003	Johnson Trading	GRN10005	15,000.00	Cheque
2023-11-23	PV10004	Colorcroma (Pvt) Ltd	GRN10003, GRN10004	100,000.00	Cheque
			Total	199,400.00	

Figure D.7: Payments done report

SALES – PRODUCT WISE REPORT

This report shows the product wise summary of sales done within the selected year. The information is represented as a graph and in tabular format. Product wise sales report is depicted in Figure D.8: Sales – product wise report graph and Figure D.9: Sales – product wise report.

Figure D.8: Sales – product wise report

Print Excel

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Banner Printing	2,290.50	6,820.00	7,490.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16,600.50
Certificate Printing	0.00	0.00	4,675.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4,675.00
Invitation Printing	0.00	0.00	7,800.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7,800.00
Visiting Card Printing	20,050.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20,050.00
Sticker Printing	0.00	0.00	5,260.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5,260.00
Seal Making	0.00	3,000.00	6,010.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9,010.00
Mug Printing	0.00	0.00	6,200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6,200.00
Leaflet Printing	0.00	37,800.00	4,525.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42,325.00
ID Card Printing	20,050.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20,050.00
Notice Printing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Voucher/Bill Book Printing	0.00	0.00	6,010.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6,010.00
Brochure Printing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure D.9: Sales – product wise report

SALES – SALES PERSON WISE REPORT

This report shows the sales person wise summary of sales done within the selected year. The information is represented as a graph and in tabular format. Sales person wise sales report is depicted in Figure D.10: Sales – sales person wise report graph and Figure D.11: Sales – sales person wise report.

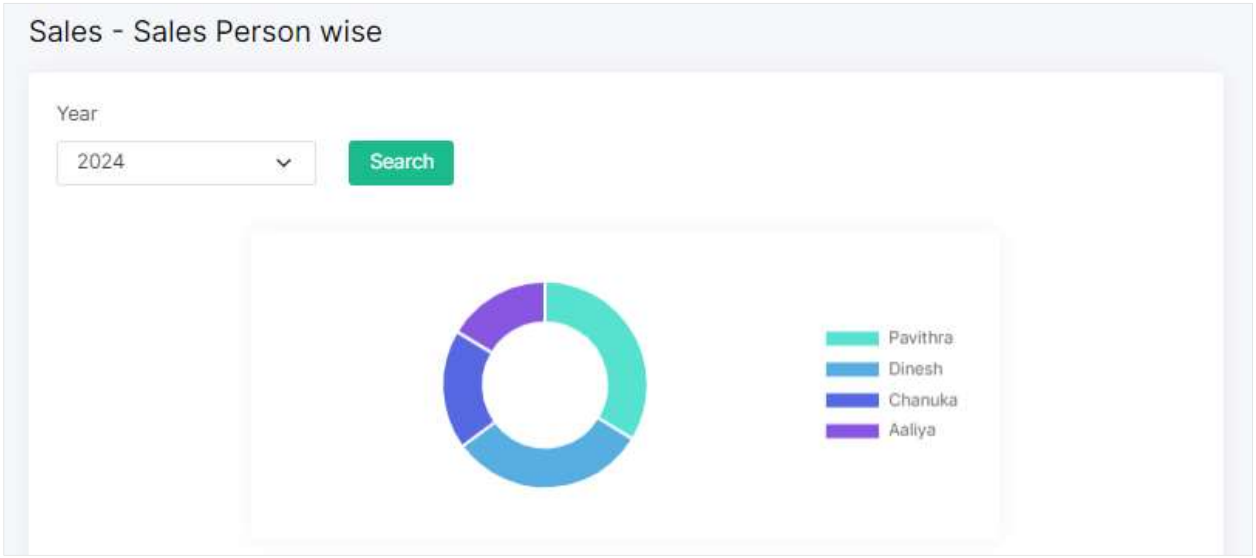


Figure D.10: Sales – sales person wise report graph

Print Excel

Sales Ex.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Pavithra	0.00	37,800.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37,800.00
Dinesh	22,340.50	3,000.00	9,510.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34,850.50
Chanuka	0.00	6,820.00	14,125.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20,945.00
Aaliya	0.00	0.00	18,325.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18,325.00
Total	22,340.50	47,620.00	41,960.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	111,920.50

Figure D.11: Sales – sales person wise report

GROSS PROFIT REPORT

This report displays the gross profit of each job, taking into account the income and material costs associated with the job. The gross profit report is portrayed in Figure D.12: Gross profit report.

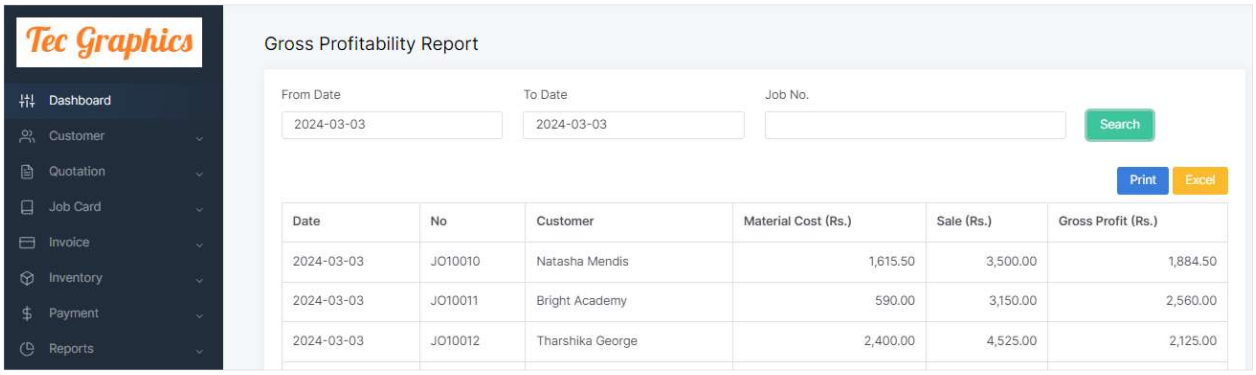


Figure D.12: Gross profit report

STOCK MOVEMENT REPORT

Stock movement report shows the inward and outward movement of the selected raw material within a selected date range. Stock movement report is illustrated in Figure D.13: Stock movement report.

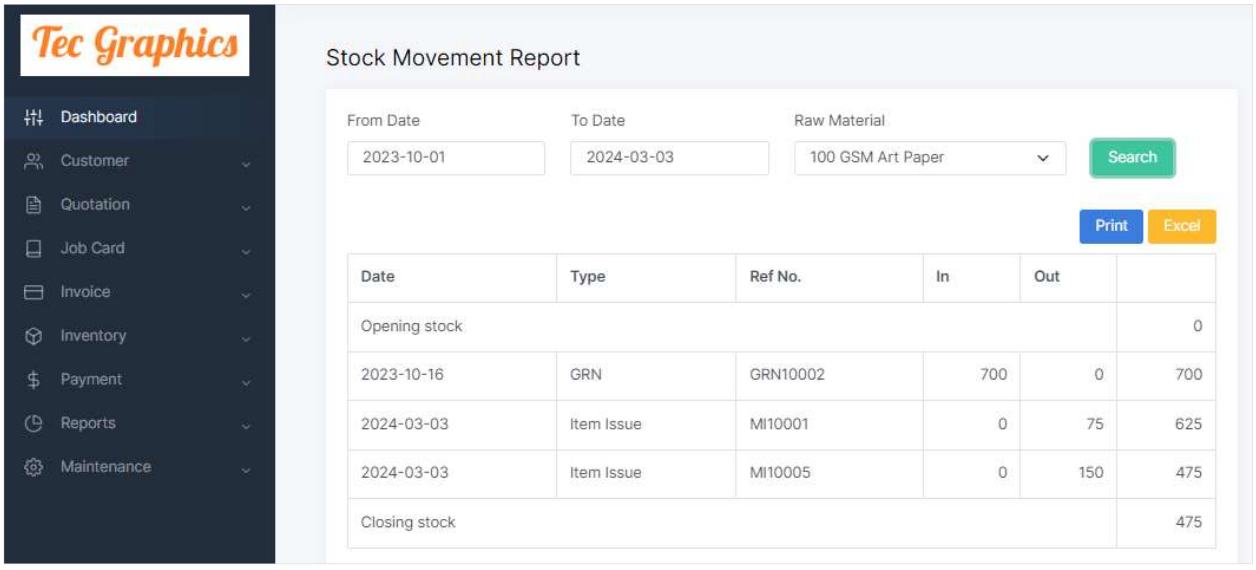


Figure D.13: Stock movement report

APPENDIX E TEST RESULTS

Some of the important test cases for the website of the proposed system are listed in the test and evaluation chapter. Remaining test cases for the website are depicted in Table E.1: Remaining test cases for the website.

Table E.1: Remaining test cases for the website

TC ID	Test Objective	Pre-Conditions	Steps	Expected Results	Test Status
13	User should be able to update personal details	User has signed in to the website	1. User click on profile option on the menu bar 2. User enters all mandatory details 3. User click on update button	Updated details are displayed	Pass
14	User should fill all necessary details to update personal details	User is in the personal details page	1. User does not fill all necessary fields 2. User click on update button	Display error message focusing mandatory fields	Pass
15	User can change the password of the login	User is in the change password page	1. User enters current password 2. User enters new password 3. User confirms new password 4. User click on change password button	Display success message as "Successfully changed password"	Pass
16	User must enter current password correctly to change the password	User is in the change password page	1. User enters incorrect current password 2. User enters new password 3. User confirms new password 4. User click on change password button	Display error message as "Entered current password is incorrect"	Pass

17	User must retype the new password correctly to change the password	User is in the change password page	1. User enters current password 2. User enters new password 3. User enters incorrect password for confirm password 4. User click on change password button	Display error message focusing confirm password field	Pass
18	User should be able to sign out of the website	User has signed in to the website	1. User click on profile option on the menu bar 2. User click on sign out	Sign out and redirect to the home page	Pass

Test cases for the proposed of the internal users of the organization are described in Table E.2: Test cases for the proposed system.

Table E.2: Test cases for the proposed system

TC ID	**Test Objective**	**Pre-Conditions**	**Steps**	**Expected Results**	**Test Status**
19	System user should be able to login with valid credentials	User is in the login page of the system	1. User enters a valid username 2. User enters a valid password 3. User click on the login button	User should be logged into the system	Pass
20	System user can login only with valid credentials	User is in the login page of the system	1. User enters a valid username 2. User enters an invalid password 3. User click on the login button	Display error message as “invalid login”	Pass
21	Only active users can login to the system	User is in the login page of the system	1. User enters username of an inactive user 2. User enters a password 3. User click on the login button	Display error message as “invalid login”	Pass

22	System user can log out of the system	User is logged in to the system	1. User click on log out link	User is logged out of the system and redirected to login page	Pass
23	User should be able to register new raw material	User is in the register raw material page of the system	1. User enters all mandatory details of raw material 2. User click on submit button	Display success message as "raw material registered successfully"	Pass
24	User can register new raw material only by filling necessary details	User is in the register raw material page of the system	1. User does not enter all mandatory details of raw material 2. User click on submit button	Display error message focusing mandatory fields	Pass
25	User should be able to search raw material	User is in the view raw material list page of the system	1. User enters the name of the raw material in the search field	Display details of searched raw material	Pass
26	User should be able to edit raw material	User is in the edit raw material page of the system	1. User edits the detail that has to be changed 2. User enters all mandatory details of raw material 3. User click on submit button	Display success message as "raw material updated successfully"	Pass

APPENDIX F CODE LISTING

Some code segments used to develop the system are listed below.

Code used to display success or failure message upon form submit:

```
<div class="row mb-3" id="alert_div">
    <?php
    if(isset($_SESSION['success']) && $_SESSION['success'] != ''){      //check if success
        echo '<div class="alert alert-success" role="alert"><div class="alert-message">'.$_SESSION['success'].'</div></div>';
        $_SESSION['success'] = '';
    }
    if(isset($_SESSION['error']) && $_SESSION['error'] != ''){          //check if error
        echo '<div class="alert alert-danger" role="alert"><div class="alert-message">'.$_SESSION['error'].'</div></div>';
        $_SESSION['error'] = '';
    }
    ?>
</div>
<script>
    setTimeout(function(){
      document.getElementById('alert_div').innerHTML = '';
    }, 3000);       //clear error message in 3 seconds
</script>
```

Code used in form submit page to capture variables passed from the form, check if similar record already exist and insert to database:

```
$rmcode = mysqli_real_escape_string($con, $_POST['rmcode']);
$rmname = mysqli_real_escape_string($con, $_POST['rmname']);
$uom = mysqli_real_escape_string($con, $_POST['uom']);
$category = mysqli_real_escape_string($con, $_POST['category']);
$rlevel = mysqli_real_escape_string($con, $_POST['rlevel']);
$rqty = mysqli_real_escape_string($con, $_POST['rqty']);
$cid = mysqli_real_escape_string($con, $_POST['cid']);

if($cid == ''){     //new record

$select_duplicate = mysqli_query($con, "SELECT id FROM rawmaterial WHERE code = '$rmcode'");    //check if code already exist

if(mysqli_num_rows($select_duplicate) > 0){                         //if item code already exist
$_SESSION['error'] = "Raw material code already exist.";            //pass error message
} else {                                                                //if item code does not exist

$insert = mysqli_query($con, "INSERT INTO `rawmaterial`
(`code`, `name`, `uom`, `category`, `ro_level`, `ro_qty`) VALUES
('$rmcode', '$rmname', '$uom', '$category', '$rlevel', '$rqty')");      //insert to table

$_SESSION['success'] = "Raw material registered successfully.";         //pass success message
}
```

JavaScript code used for form validation:

```javascript
function validateForm() {
  var prevent = '';

  let rmcode = document.forms["rawmat_form"]["rmcode"].value;       //validate code
  if (rmcode == "") {
    document.getElementById("rmcode_error").innerHTML = "Code must be filled";  //display error message
    document.getElementById("rmcode").className  = "form-control error";        //focus input field
    prevent = 'yes';
  } else {
    document.getElementById("rmcode_error").innerHTML = "";             //clear error message
    document.getElementById("rmcode").className  = "form-control";      //remove focus
  }

  let rmname = document.forms["rawmat_form"]["rmname"].value;       //validate name
  if (rmname == "") {...
  } else {...
  }

  let uom = document.forms["rawmat_form"]["uom"].value;             //validate unit of measure
  if (uom == "") {...
  } else {...
  }

  let category = document.forms["rawmat_form"]["category"].value;   //validate category
  if (category == "") {...
  } else {...
  }

  if(prevent == 'yes'){
     return false;             //prevent form submit if errors exits
  }
}
```

Code used in create job card page to grant permission according to user type:

```php
if($result_quot['job_alloc'] == 'no'){          //if job is not allocated to coordinator
    $diff = $date1 - $date2;
    $days = floor($diff / (60 * 60 * 24));

    if($_SESSION["logUserType"] == '1' || $_SESSION["logUserType"] == '5'){     //only admin and manager can allocate job to coordinator
        $job_unall = '<span class="badge bg-primary rounded-pill" data-bs-toggle="modal" data-bs-target="#Modal" onclick="send_row('.$i.')" >'.$days.'</span>';
    } else {
        $job_unall = '<span class="badge bg-primary rounded-pill" >'.$days.'</span>';
    }
        $job_all = '';
} else {                                        //if job is allocated
    $job_unall = '';
    $date3 = strtotime(substr($result_quot['joball_datetime'],0,10));
    $diff = $date1 - $date3;
    $days = floor($diff / (60 * 60 * 24));

    $sel_co = mysqli_query($con, "SELECT first_name, last_name FROM users WHERE id = '{$result_quot['job_user']}'");
    $res_co = mysqli_fetch_array($sel_co);

    if($_SESSION["logUserId"] == $result_quot['job_user']){         //only allocated user can create jobcard
        $job_all = '<span class="badge bg-success" onclick="open_job('.$i.')">'.$res_co['first_name'].' '.$res_co['last_name'].' ['.$days.']</span><?php } ?>';
    } else {
        $job_all = '<span class="badge bg-success" >'.$res_co['first_name'].' '.$res_co['last_name'].' ['.$days.']</span><?php } ?>';
    }

}
```

Code used in view list:

```
<table id="datatables-reponsive" class="table table-striped" style="width:100%">
    <thead>
      <tr>
        <th>Code</th>
        <th>Name</th>
        <th>UoM</th>
        <th>Category</th>
        <th>Reorder Level</th>
        <th> </th>
      </tr>
    </thead>
    <tbody>
      <?php
      $select_rmat = mysqli_query($con, "SELECT * FROM rawmaterial");
      while($result_rmat = mysqli_fetch_array($select_rmat)){

      $select_uom = mysqli_query($con, "SELECT name FROM unit_of_measure WHERE id = '{$result_rmat['uom']}'");
      $result_uom = mysqli_fetch_array($select_uom);

      $select_cat = mysqli_query($con, "SELECT name FROM rawmaterial_category WHERE id = '{$result_rmat['category']}'");
      $result_cat = mysqli_fetch_array($select_cat);

      ?>
      <tr>
        <td><?php echo $result_rmat['code']; ?></td>
        <td><?php echo $result_rmat['name']; ?></td>
        <td><?php echo $result_uom['name']; ?></td>
        <td><?php echo $result_cat['name']; ?></td>
        <td><?php echo $result_rmat['ro_level']; ?></td>
        <td align="center"><a href="raw_material_register.php?id=<?php echo $result_rmat['id']; ?>" >
          <button type="button" class="btn btn-sm btn-warning" ><i data-feather="edit"></i></button></a></td>
    </tr>
      <?php } ?>
    </tbody>
</table>
```

Code used for side bar to list functionalities according to user type

```
<?php
$select_section = mysqli_query($con, "SELECT p.icon, p.section FROM pages p, user_privilege u
WHERE p.id = u.page AND p.active = 'yes' AND u.user_type = '{$_SESSION["logUserType"]}' GROUP BY p.section ORDER BY p.section_order");
while($result_section = mysqli_fetch_array($select_section)){
?>
<li class="sidebar-item">
    <a data-bs-target="#<?php echo strtolower(preg_replace('/\s*/', '', $result_section['section'])).'smdiv'; ?>"
    data-bs-toggle="collapse" class="sidebar-link collapsed">
        <i class="align-middle" data-feather="<?php echo $result_section['icon']; ?>"></i>
        <span class="align-middle"><?php echo $result_section['section']; ?></span>
    </a>
    <ul id="<?php echo strtolower(preg_replace('/\s*/', '', $result_section['section'])).'smdiv'; ?>"
    class="sidebar-dropdown list-unstyled collapse " data-bs-parent="#sidebar">
        <?php
        $select_page = mysqli_query($con, "SELECT description, php_name FROM pages
        WHERE section = '{$result_section['section']}' AND active = 'yes' ORDER BY page_order");
        while($result_page = mysqli_fetch_array($select_page)){
        ?>
        <li class="sidebar-item">
        <a class="sidebar-link" href="<?php echo $result_page['php_name']; ?>"><?php echo $result_page['description']; ?></a>
        </li>
        <?php } ?>
    </ul>
</li>
<?php } ?>
```

APPENDIX G USER EVALUATION

User Evaluation

TecGraphics Operation Management System

Name : ……

User Type : ……

1. How would you rate the overall user-friendliness of the operations management system?

   ○ Very Difficult ○ Difficult ○ Neutral ○ Easy ○ Very Easy

2. How well was the look and feel of the system?

   ○ Poor ○ Fair ○ Average ○ Good ○ Excellent

3. Did the system meet your operational needs?

   ○ Poor ○ Fair ○ Neutral ○ Good ○ Excellent

4. How would you rate the speed and responsiveness of the system?

   ○ Poor ○ Fair ○ Neutral ○ Good ○ Excellent

5. Did you encounter any system crashes or downtime?

   ○ Yes ○ No

6. Were you able to generate the reports and analytics you needed?

   ○ Yes ○ No

7. How satisfied are you with the operations management system?

   ○ Very Dissatisfied ○ Dissatisfied ○ Neutral ○ Satisfied ○ Very Satisfied

8. Are there any improvements that you like to suggest?

……
……
……

GLOSSARY

Ajax (Asynchronous JavaScript and XML) – A collection of technologies used to update the parts of a web page without reloading the whole page.

Apache – An open source web server.

CSS (Cascading Style Sheet) – A language used to format contents of web pages.

Database – An organized collection of tables consisting data.

JavaScript – An object-oriented scripting language used in client-side.

MySQL – A relational database management system.

PHP (Hypertext Pre Processor) – A server-side programming language.

MD5 (Message Digest Method 5) – An encryption method used to convert plain text into a hash value.

URL (Uniform Resource Locator) – An address used to identify the location of a file.

Use Case – A behaviorally related sequence of steps for completing a single business task.

WAMPP – An open source cross platform web server package.