Institute Of Universal Higher Studies
Project Report

Project Name: Latex Harvesting

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TABLE OF CONTENT

1. LIST OF TABLES 4
2. LIST OF FIGURES 5
3. LIST OF ACRONYMS AND ABBREVIATIONS 6
4. DECLARATION 6
5. GIT RPOSITORY 6
6. ABSTRACT 6
7. ACKNOWLEDGEMENT 7
8. SYSTEM DIAGRAM 8
9. CHAPTER1 – INTRODUCTION 9
   - 9.1. Background 9
   - 9.2. Problem and Motivation 9
     - 9.2.1. Problem 10
     - 9.2.1. Motivation 10
   - 9.3. Literature Review 11
   - 9.4. Aims & Objectives 12
     - 9.4.1. Aim 12
     - 9.4.2. Objectives 12
   - 9.5. Solution Overview 14
   - 9.6. Methodology 15
10. CHAPTER 2 – REQUIREMENTS 16
   - 10.1. Stakeholders 16
   - 10.2. Requirements Analysis 17
   - 10.3. Requirement Modeling 20
11. CHAPTER 3 - DESIGNING AND DEVELOPMENT 23
   - 11.1. Union Diagram 23
   - 11.2. Diagrams Of Components 24
     - 11.2.1. Customer Management 24
     - 11.2.2. Supervisor Management 27
     - 11.2.3. Admin Management 29
     - 11.2.4. Vehicle, Workers and Root Management 33
     - 11.2.5. Bill Calculation, Report & Summary Management 38
   - 11.3. ER Diagram 42

11.4. Database schema 43
11.5. Work Flow 43
11.6. Development Aspects 45
11.7. User Interfaces 46
11.7.1. Customer Management 46
11.7.2. Supervisor Management 51
11.7.3. Admin Management 53
11.7.4. Vehicle, Workers and Root Management 57
11.7.5. Bill Calculation, Report & Summary Management 59
11.8. Innovative parts 61
11.9. Commercialization 61
12. CHAPTER 4 – TESTING 62
12.1. Customer Management 62
12.2. Supervisor Management 63
12.3. Admin Management 63
12.4. Vehicle, Workers, Route Management 64
12.5. Bill Calculation, Report, and Summary Management 65
13. CHAPTER 5 - EVALUATION AND CONCLUSION 66
14. CHAPTER 6 – REFERENCES 67

1. LIST OF TABLES

Table 1. Acronyms and Abbreviation.....6

Table 2. Use case Scenario for Customer Management. 26

Table 3. Use case Scenario for Supervisor Management.....29

Table 4. Use Case Scenario for Admin Management.....33

Table 5. Use Case Scenario for Vehicle, Workers and Root Management 36

Table 6. Use case Scenario for Bill Calculation, Report & Summary Management 40

Table 7. Test Case for Customer Management.....62

Table 8. Test Case for Supervisor Management.....63

Table 9. Test Case for Admin Management 64

Table 10. Test case for Vehicle, Workers, Route Management.....65

Table 11.Test Case for Bill Calculation, Report, and Summary Management.....65

2. LIST OF FIGURES

Figure 1. System Diagram 8

Figure 2. Union Diagram 23

Figure 3. Use case Diagram for Customer Management 24

Figure 4. Activity Diagram for Customer Management 25

Figure 5. Use case Diagram for Supervisor Management 27

Figure 6. Activity Diagram for Supervisor Management 28

Figure 7. Use case Diagram for Admin Management 30

Figure 8. Activity Diagram for Admin Management 31

Figure 9. Use case Diagram for Vehicle, Workers and Root Management 34

Figure 10. Activity Diagram For Vehicle, Workers & Root Management 37

Figure 11. Use case Diagram for Bill Calculation, Report & Summary Management 39

Figure 12. Activity Diagram for Bill Calculation, Report & Summary Management 41

Figure 13. ER Diagram 42

Figure 14. Work Flow 44

Figure 15. Development Aspects 45

3. LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Description
MERN	MySQL, Express.jsx, React.jsx, Node.js
ER	Entity Relationship Diagram
DBMS	Database Management System
UI	User Interface
SDLC	Software Development Life Cycle

Table 1. Acronyms and Abbreviation

4. DECLARATION

We hereby declare that the work presented in this report is our own and has been carried out under the supervision of Mis. Jenny Krishna. The information and data presented in this report are true to the best of our knowledge and belief. We understand that the inclusion of any material that is not our own work will be treated as academic misconduct and may result in a failing grade for this report.

5. GIT RPOSITORY

https://github.com/NaduniH/Latex-Harvesting

6. ABSTRACT

This project aims to develop a comprehensive Latex Harvesting Management System designed to streamline and optimize the operations involved in latex harvesting. The system integrates various functions essential to the management of latex production, including Customer Management, Supervisor Management, Admin Management, Vehicle, Workers & Route Management, Bill

Calculation, and Reports & Summary Management. By automating these processes, the system enhances efficiency, reduces human error, and provides real-time data for better decision-making. The project focuses on creating a user-friendly interface that meets the needs of all stakeholders, from customers and supervisors to administrators and field workers, ensuring smooth and efficient latex harvesting operations.

7. ACKNOWLEDGEMENT

We would like to express our deepest gratitude to all individuals and organizations who have contributed to the successful completion of this project. First and foremost, we thank our project supervisor, [Supervisor's Name], for their invaluable guidance, support, and encouragement throughout the development of this system.

We also extend our heartfelt thanks to the staff members and field workers who provided essential insights and feedback during the requirement gathering and testing phases. Their practical knowledge and experience were instrumental in shaping the functionalities of the system.

A special thanks to the technical team for their dedication and hard work in coding, testing, and deploying the system. Their expertise and commitment to excellence ensured that we met our project milestones effectively.

Lastly, we would like to acknowledge the support of our families and friends, who have been a source of motivation and understanding during this demanding project. Their patience and encouragement have been crucial to our success.

Thank you all for your unwavering support and contributions.

8. SYSTEM DIAGRAM

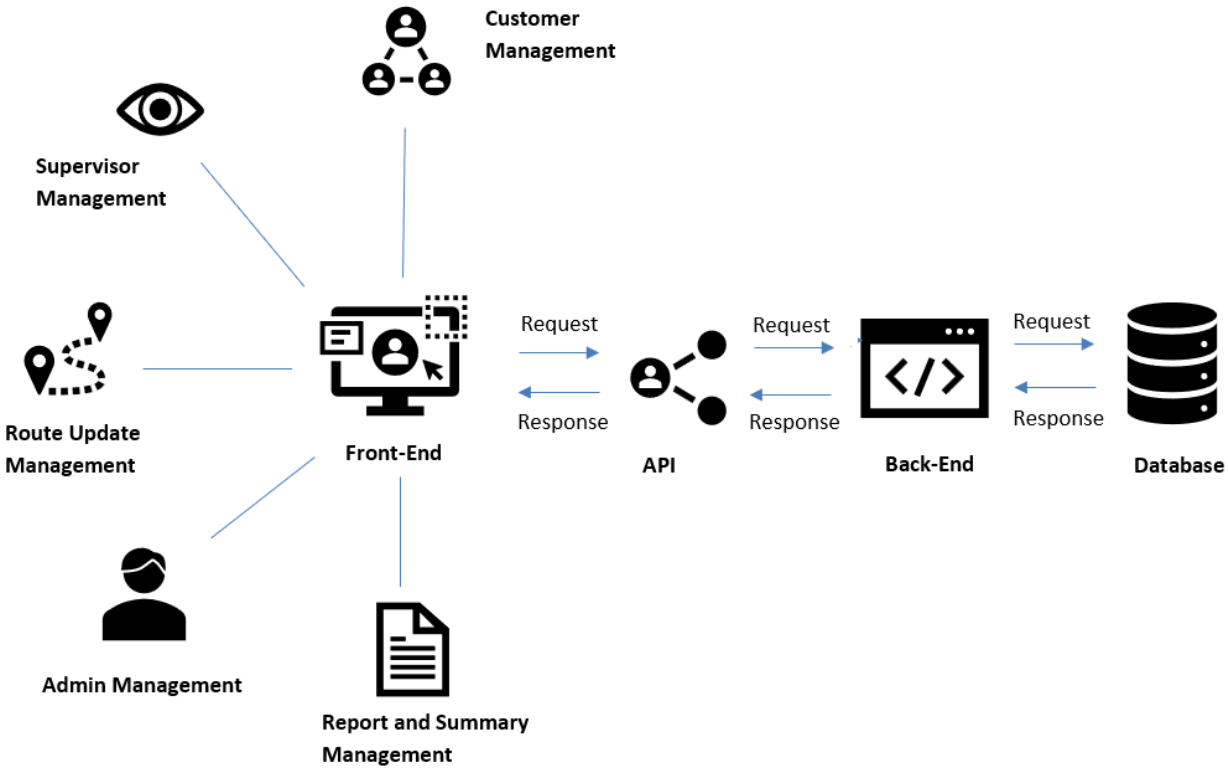


Figure 1. System Diagram

9. CHAPTER1 – INTRODUCTION

9.1. Background

Project Background:

The rubber latex collection industry plays a vital role in the agricultural sector, particularly in Sri Lanka. Client, Lalan Rubbers pvt Ltd, has been a key player in this industry for 10 years. Their operations involve the collection of rubber latex from various roots across the country, serving numerous a who rely on this industry for their livelihoods.

Current Challenges:

Despite its importance, the rubber latex collection process faces several challenges due to the reliance on outdated paper-based systems. These challenges include:

Manual Processes: The current system heavily relies on manual processes for recording latex collection, chemical distribution, and communication with farmers.

Inefficiency: The manual nature of the process leads to inefficiencies, including delays in communication, errors in data entry, and difficulty in tracking collection levels.

Limited Visibility: Lack of real-time visibility into collection levels and farmer requests makes it challenging for the company to optimize its operations and resources.

Customer Experience: Farmers often face inconvenience in requesting additional ammonia or communicating with the company due to the need for manual phone calls and paperwork.

9.2. Problem and Motivation

9.2.1. Problem

The latex collection process at Lalan rubbers(pvt) ltd currently operates through manual procedures, resulting in inefficiencies, delays, and quality control challenges. These manual processes lead to errors in data recording, lack of real-time monitoring, and difficulty in coordinating field activities. As a result, the company faces several operational challenges, including:

Inefficiencies in Route Planning:

Manual route planning leads to suboptimal allocation of resources and inefficient collection routes, resulting in increased travel time and fuel consumption.

Quality Control Issues:

Lack of real-time monitoring and analysis of latex quality parameters such as Dry Rubber Content (DRC), Volatile Fatty Acid (VFA), and ammonia levels leads to quality control issues and customer dissatisfaction.

Billing Calculation Errors:

Manual calculation of billing based on collected latex quantity and quality parameters is prone to errors, leading to discrepancies in invoicing and revenue loss.

Communication and Coordination Challenges:

Limited communication channels and manual coordination processes result in delays, miscommunication, and inefficiencies in field activities, affecting overall productivity.

9.2.1. Motivation

The motivation behind addressing these challenges and implementing a web-based system for latex collection management stems from several factors:

Operational Efficiency:

By automating manual tasks, optimizing routes, and streamlining processes, the company aims to improve operational efficiency, reduce costs, and enhance overall productivity.

Quality Assurance:

Ensuring consistent quality of collected latex is essential for maintaining customer satisfaction and reputation. Real-time monitoring of quality parameters enables proactive measures to uphold quality standards.

Customer Satisfaction:

Enhancing communication channels, providing transparency in operations, and delivering timely service contribute to improved customer satisfaction and loyalty.

Revenue Optimization:

Accurate billing calculation and invoicing reduce revenue leakage and ensure fair and transparent transactions with customers, ultimately optimizing revenue generation.

Competitive Advantage:

Embracing technological advancements and innovation in latex collection management positions the company as a leader in the industry, enhancing competitiveness and market positioning.

9.3. Literature Review

Generic Customer Relationship Management (CRM) Systems:

Pros: CRM systems offer robust tools for managing customer interactions, including communication and data management.

Cons: They may lack specialized features for managing specific tasks like latex collection and route optimization.

Fleet Management Software:

Pros: These systems focus on vehicle tracking, route optimization, and maintenance scheduling.

Cons: They may not include features for customer interaction or billing, which are crucial aspects of latex collection management.

Customized Logistics Management Systems:

Pros: Tailored solutions can be designed to meet specific needs, including latex collection and customer interaction.

Cons: Development costs can be high, and implementation may be complex and time-consuming.

Summary of Existing Systems:

While there are existing systems available that address aspects of latex collection management, such as CRM systems for customer interaction and fleet management software for vehicle tracking, none provide a comprehensive solution tailored specifically for the needs of this client. Existing systems may lack critical features like integrated customer and supervisor management, route update management, and specialized billing and reporting functionalities required for efficient latex collection operations.

9.4. Aims & Objectives

9.4.1. Aim

The aim of the project is to develop and implement a comprehensive web-based system for managing the latex collection process at Lalan Rubbers (Pvt) Ltd, with the goal of enhancing operational efficiency, improving quality control measures, and maximizing customer satisfaction.

9.4.2. Objectives

Automate Manual Processes:

Develop automation mechanisms to replace manual tasks involved in route planning, order management, billing calculation, and reporting, reducing human errors and processing times.

Optimize Route Planning:

Implement algorithms for route optimization based on estate locations, tapping schedules, and bowser capacity constraints, ensuring efficient resource utilization and minimizing travel time.

Enhance Quality Control Measures:

Integrate real-time monitoring and analysis tools for latex quality parameters such as Dry Rubber Content (DRC), Volatile Fatty Acid (VFA), and ammonia levels, enabling proactive quality control measures and adherence to industry standards.

Improve Communication and Coordination:

Develop communication channels and collaboration tools for supervisors, field workers, and customers to facilitate seamless coordination, task assignment, and real-time updates on collection activities.

Streamline Billing and Invoicing Processes:

Implement automated billing and invoicing systems based on collected latex quantity and quality parameters, ensuring accuracy, transparency, and timely invoicing for customers.

Provide Customer-Centric Features:

Develop customer portals with features such as order placement, tracking, feedback submission, and invoice management, enhancing customer experience and satisfaction throughout the collection process.

Enable Data-driven Decision Making:

Implement reporting and analytics tools to generate actionable insights on collection performance, latex quality trends, customer feedback, and operational efficiency, empowering management to make informed decisions and drive continuous improvement.

Ensure Scalability and Flexibility:

Design the system architecture to be scalable and flexible, capable of accommodating future growth, changing business requirements, and technological advancements in the latex collection industry.

Ensure Security and Compliance:

Incorporate robust security measures and compliance mechanisms to safeguard sensitive data, protect against cybersecurity threats, and ensure compliance with regulatory standards and data protection laws.

Provide Training and Support:

Offer training sessions and ongoing support to users, including supervisors, field workers, and customers, to familiarize them with the system's functionalities and maximize its utilization and effectiveness.

9.5. Solution Overview

The Latex Harvesting Management System is designed to address the complexities and inefficiencies associated with latex harvesting operations. This system integrates various management functions into a cohesive platform to enhance operational efficiency, improve communication among stakeholders, and ensure accurate and timely data processing. Below is an overview of the key functional components of the system:

1. Customer Management

- Tapping Details: Track and record the tapping details for individual customers.
- Home: Provide a user-friendly interface for customers to navigate the system.
- Contacting with Company: Facilitate communication between customers and the company.
- Chemical Details: Record and manage the details of chemicals used in the harvesting process.
- Customer Logging and Registration: Enable new customers to register and existing customers to log in.
- Ordering: Allow customers to place orders for latex and related products.

2. Supervisor Management

- Filling Bill: Supervisors can fill out and manage billing information.
- Daily Route Latex Updating**:** Update and track daily latex collection routes.
- Individual Customer Reports & Bills: Generate and manage reports and bills for individual customers.
- Individual Information: Maintain detailed records of each supervisor's activities and responsibilities.
- Supervisor Logging: Enable supervisors to log in securely.

3. Vehicle, Workers & Route Management

- Next Day Routes: Plan and display routes for the next day’s latex collection.
- Garage Management: Oversee vehicle availability and maintenance.
- Vehicle and Helper Allocation**:** Assign vehicles, drivers, and helpers based on requests and priorities.
- Night Work Assignment: Allocate night shift duties to workers.
- Worker Management**:** Add, edit, and delete records for helpers, drivers, and supervisors.

4. Admin Management

- Logging: Secure login for administrators.

- Personnel Management: Add and remove helpers, drivers, and supervisors.
- Communication: Contact and send bills to customers, and send alerts to supervisors.
- Approval of Details: Review and approve all system entries and updates.
- Chemical Usage Management: Monitor and manage the use of chemicals.
- Dry Rubber Management: Track and manage the total dry rubber content.

5. Bill Calculation, Report, and Summary Management

- Logging: Secure login for managing billing and reports.
- Lab Report Entry: Enter and manage lab reports (DRC, VFA, NH3) for vehicle tanks and estate side.
- Weight Bill Entry: Record and manage weight bills.
- Short Calculation: Calculate discrepancies in latex volumes and adjust accordingly.
- Dry Rubber Content Calculation: Calculate dry rubber content based on lab reports and tally sheets.
- Billing Updates: Update original bills and send them to the admin for approval.
- Cost Sheet Update: Maintain and update the monthly cost sheet.

Benefits

- Efficiency: Automates routine tasks and reduces manual effort.
- Accuracy: Minimizes human errors and ensures accurate data entry and processing.
- Communication: Enhances communication between stakeholders.
- Transparency: Provides clear and transparent records of all transactions and activities.
- Decision-Making: Offers real-time data and analytics to support informed decision-making.

9.6. Methodology

The system will be developed using the MySQL, Express and Node.js, React.js. MySQL is what we use to connect to databases. Express and Node.js are our backend projects. Moreover, we are using Tailwind as our frontend CSS library. Designing is done using Figma. We use GitHub for code management and Click Up for projects. The Express.js backend framework is the best option because it is dependable and able to manage a lot of requests. We may use the node package manager to install all required packages in the Node.js server-side environment. making the development of a web application the perfect option. One well-known frontend CSS library is tailwind.

The web application uses GitHub as its version controller; it helps us to maintain track of the development process, provides a quick overview of the timetable, and ensures that the code is properly handled and documented.

API-First Design

The Latex Harvesting follows an API-first design approach, where the design and development of APIs precede the implementation of frontend or backend features. This allows Latex to expose its functionalities as APIs, enabling seamless integration with third-party systems, mobile applications, or other services. API-first design fosters modularity, reusability, and interoperability

Cloud Computing:

Latex utilizes cloud computing platforms such as AWS or Azure for hosting its infrastructure. Cloud services offer scalability, flexibility, and cost-effectiveness, allowing Latex dynamically allocate resources based on demand. By leveraging cloud providers, Latex can focus on its core functionalities while offloading infrastructure management tasks.

10. CHAPTER 2 – REQUIREMENTS

10.1. Stakeholders

1. **Customers**
   The Customer purchasing latex products. They easy-to-use interface for browsing and purchasing products, Timely delivery and quality assurance of latex products, Access to order history and updates on order status, Personalized marketing and product recommendations based on preferences.

2. **Supervisors**
   The Supervisor responsible for overseeing the harvesting process and managing workers. They Access to compliance tracking to ensure safety and procedural adherence, Tools to efficiently assign tasks to workers and track their progress, Ability to generate performance reports and provide feedback to workers.

3. **Admin**
   The admin responsible for the overall system management, including user management, data security, and system maintenance. They Comprehensive access to all system functions

for monitoring and maintenance, Tools for managing users and roles, ensuring proper access control, Ability to generate detailed reports and summaries on various aspects of the system, Implementation and management of security protocols to protect data integrity.

4. **Workers & Vehicle Management Team**
   The Workers responsible for managing the fleet of vehicles used for latex collection and delivery. They Clear instructions and task assignments for efficient harvesting operations, Access to route details and tools for reporting issues encountered during harvesting, Real-time tracking of vehicle locations and statuses to ensure efficient operations, Tools for route optimization to minimize travel time and costs.

5. **Billing Department**
   The Billing Department responsible for calculating bills and managing financial transactions. They Accurate and efficient billing systems integrated with sales and delivery data, Tools for generating and managing invoices for customers and suppliers, Secure integration with payment gateways to process transactions, Reporting tools for financial tracking and reconciliation.

6. **Technical Engineers**
   The Technical Engineers responsible for the development, maintenance, and technical support of the system. They Tools and resources to ensure the system functions smoothly and efficiently, Access to system logs and performance data for troubleshooting and optimization, Clear communication with other stakeholders to address technical issues promptly.

10.2.Requirements Analysis

Customer Management

1. Tapping Details
   - Requirement**:** The system must allow customers to view and update tapping details.
   - Functionality: View history, add new entries, and update existing details.
2. Previous Details
   - Requirement: The system must provide access to previous transaction and order details.

- Functionality: Retrieve and display past orders, payments, and communication history.

3. Contacting with Company
    - Requirement: Customers should be able to easily contact the company for support and inquiries.
    - Functionality: Provide contact forms, live chat, and customer support contact information.
4. Chemical Details
    - Requirement**:** The system must provide information on chemicals used in the latex harvesting process.
    - Functionality: Display details of chemicals, usage instructions, and safety guidelines.
5. Customer Logging and Registration
    - Requirement**:** The system must facilitate customer registration and login.
    - Functionality: Provide registration forms, login authentication, and account management features.
6. Ordering
    - Requirement: Customers should be able to place and track orders.
    - Functionality: Browse products, add to cart, place orders, and track order status.

Supervisor Management

1. Filling Bill
    - Requirement**:** Supervisors must be able to fill and submit bills.
    - Functionality: Provide bill entry forms, submission, and tracking features.
2. Daily Root Latex Updating
    - Requirement: The system must allow supervisors to update daily latex collection details.
    - Functionality: Record and update daily collection amounts and details.
3. Route Information
    - Requirement: Supervisors need access to route information for planning and execution.
    - Functionality: Display route maps, schedules, and updates.
4. Individual Customer Reports & Bills
    - Requirement**:** Generate and manage individual customer reports and bills.
    - Functionality: Generate reports, view bills, and update records.
5. Individual Information
    - Requirement: Maintain and access individual information of workers and customers.
    - Functionality: View, update, and manage personal and contact details.
6. Supervisor Logging

- Requirement: Supervisors need a secure login system.
- Functionality: Provide login authentication and session management.

7. Bill Handling
    - Requirement: Manage the generation and handling of bills.
    - Functionality: Generate, review, and submit bills for approval.

Vehicle, Workers, Route Update Management

1. Logging
    - Requirement**:** Provide logging capabilities for vehicle and worker management.
    - Functionality: Log activities, routes, and assignments.
2. Next Day Routes
    - Requirement: Display next day's routes and assignments.
    - Functionality: View and update next day’s routes and transport plans.
3. Available Vehicles, Helpers, Drivers
    - Requirement: Maintain and display availability of resources.
    - Functionality: Track and update the availability of vehicles, helpers, and drivers.

4. Request Handling
    - Requirement: Manage requests for resources based on priority.
    - Functionality**:** Handle requests for routes, garage access, and resource assignments.

5. Night Work Assignment
    - Requirement: Assign tasks and routes for night operations.
    - Functionality: Manage and assign night work duties.
6. Resource Management
    - Requirement: Add, delete, and edit helper, driver, and supervisor details.
    - Functionality: Manage personnel records and assignments.
7. Route History
    - Requirement: Access and review past routes and assignments.
    - Functionality: View historical route data and reports.

Admin Management

1. Logging
    - Requirement: Provide secure login for admins.
    - Functionality: Admin login authentication and session management.
2. Resource Management
    - Requirement: Add and remove helpers, drivers, and supervisors.
    - Functionality: Manage personnel records and system access.
3. Communication
    - Requirement: Communicate with supervisors, helpers, and customers.
    - Functionality: Send emails and notifications, manage communication records.

4. Approval and Alerts
    - Requirement: Approve bills and manage alerts for supervisors.
    - Functionality: Review and approve submissions, send alerts.
5. Chemical Usage Management
    - Requirement: Track and manage chemical usage.
    - Functionality: Monitor chemical inventory and usage details.
6. Dry Rubber Management
    - Requirement: Manage total dry rubber production and records.
    - Functionality: Track production data and generate reports.
7. Route Details
    - Requirement: View and manage route-wise details.
    - Functionality: Access route data and generate summaries.

Bill Calculation, Report, and Summary Management

1. Logging
    - Requirement**:** Provide secure login for billing and reporting.
    - Functionality: Authentication and session management for billing personnel.
2. Lab Report Entry
    - Requirement: Enter lab results (DRC, VFA, NH3) for vehicle tanks and estate side.
    - Functionality: Record and manage lab data entries.
3. Weight Bill Entry
    - Requirement**:** Enter and manage weight bill data.
    - Functionality: Record weights and calculate totals.
4. Litter Short Calculation
    - Requirement: Calculate shortages using tally sheets and weight bills.
    - Functionality: Perform calculations and generate reports.
5. Dry Rubber Content Calculation
    - Requirement: Calculate dry rubber content and make necessary adjustments.
    - Functionality: Calculate and adjust DRC based on lab reports and tally sheets.
6. Original Bill Update
    - Requirement: Update original bills and send them for admin approval.
    - Functionality: Manage bill updates and approval process.
7. Monthly Cost Sheet Update
    - Requirement: Update monthly cost sheets.
    - Functionality: Record and track monthly financial data.

10.3.Requirement Modeling

1. Customer Management

Description**:** The customers can access tapping details, chemical information, previous transaction records, and order products seamlessly.

Requirements**:**

- Tapping Details Management**:** The system must allow recording and viewing of tapping details for each customer.
- Customer History Access**:** Customers should be able to access their previous transaction records.
- Communication Channel**:** The system must provide a platform for customers to contact the company.
- Chemical Usage Information**:** Details of chemicals used should be accessible to customers.
- Customer Registration and Login**:** The system must facilitate secure registration and login for customers.

2. Supervisor Management

Description**:** The supervisors to manage daily operations, including updating latex collection, managing routes, generating customer reports, and handling bills.

Requirements**:**

- Bill Management**:** Supervisors should be able to fill out and manage customer bills.
- Latex Collection Updates**:** Supervisors must update daily latex collection details.
- Route Information Management**:** The system should provide and manage route information for supervisors.
- Supervisor Profile Management**:** Supervisors should manage their profiles and information.
- Supervisor Login**:** Secure login for supervisors to access their tasks and information.
- Bill Handling: Efficient handling and processing of bills by supervisors.

3. Vehicle, Workers, and Route Management

Description**:** The vehicles and worker Manager including scheduling routes, managing available vehicles, and updating route information.

Requirements**:**

- Logging and Tracking**:** The system must log and track vehicle, worker, and route details.

- Route Management**:** Display and update next-day routes, including centrifuge transport and garage details.
- Resource Availability**:** Track and manage the availability of vehicles, helpers, and drivers.
- Resource Allocation**:** Efficiently allocate resources based on requests and priority.
- Night Work Scheduling**:** Manage and schedule night work assignments.
- Personnel Management: Add, edit, and delete records of helpers, drivers
- Route History**:** Maintain and display the history of routes taken.

4. Admin Management

Description**:** Admin Management oversees the entire system, ensuring proper operation, personnel management, approval processes, and communication with stakeholders.

Requirements**:**

- Admin Login**:** Secure login for admin users to access all functionalities.
- Personnel Management**:** Admins can manage helpers, drivers, and supervisors.
- Communication**:** Enable communication with supervisors, helpers, and customers, including bill approvals.
- Approval Processes**:** Approve actions and details within the system.
- Chemical Management: Track and manage chemical usage.
- Rubber Production Tracking**:** Monitor total dry rubber production.

5. Bill Calculation, Reports, and Summary Management

Description**:** This function manages the financial aspects, including bill calculation, lab report entry, and generating comprehensive reports and summaries.

Requirements**:**

- Lab Report Entry**:** Enter and manage lab reports (DRC, VFA, NH3) for vehicle tanks and estate sides.
- Weight Bill Entry**:** Support entry and integration of weight bills for accurate financial calculations.
- Litter Short Calculation**:** Calculate litter short using tally sheets and weight bills.
- Dry Rubber Content Calculation**:** Calculate dry rubber content, including DRC deductions and 2% ACC making.
- Bill Update and Approval**:** Update original bills and send for admin approval.
- Monthly Cost Sheets**:** Generate and update monthly cost sheets, providing a financial overview

11. CHAPTER 3 - DESIGNING AND DEVELOPMENT

11.1. Union Diagram

Figure 2. Union Diagram

11.2.Diagrams Of Components

11.2.1. Customer Management

Use case Diagram for Customer Management

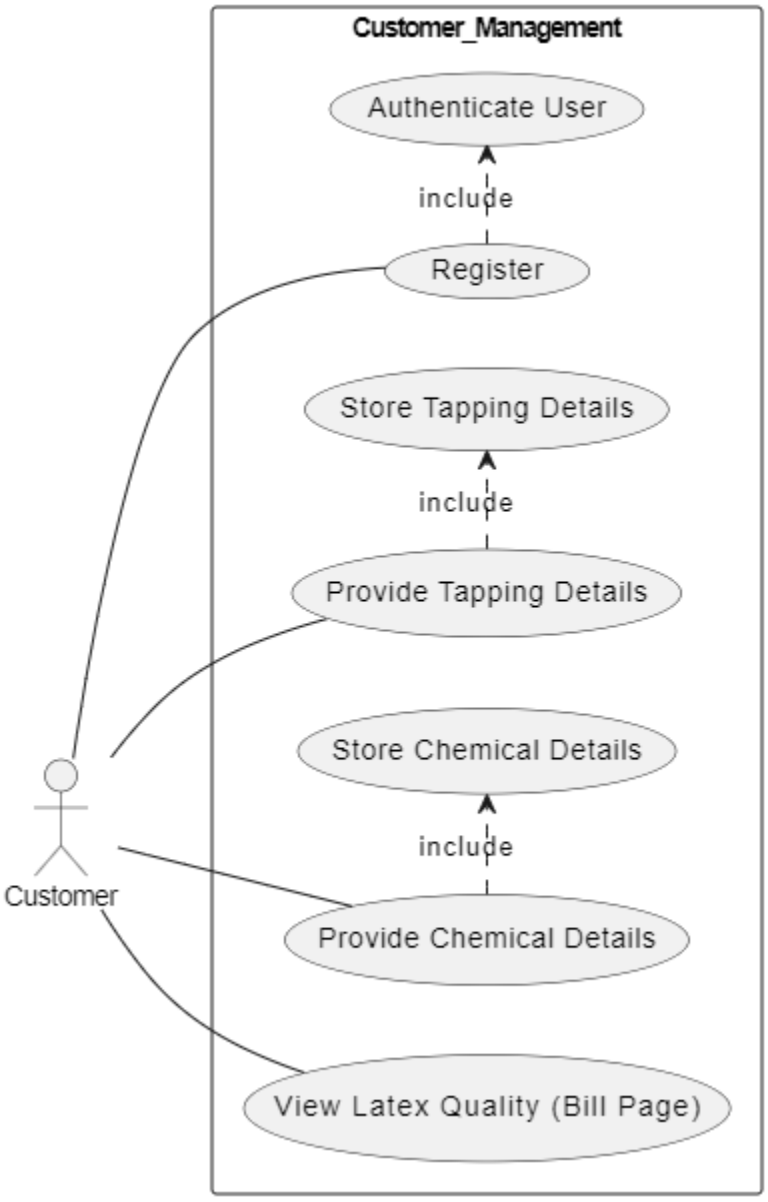


Figure 3. Use case Diagram for Customer Management

Activity Diagram for Customer Management

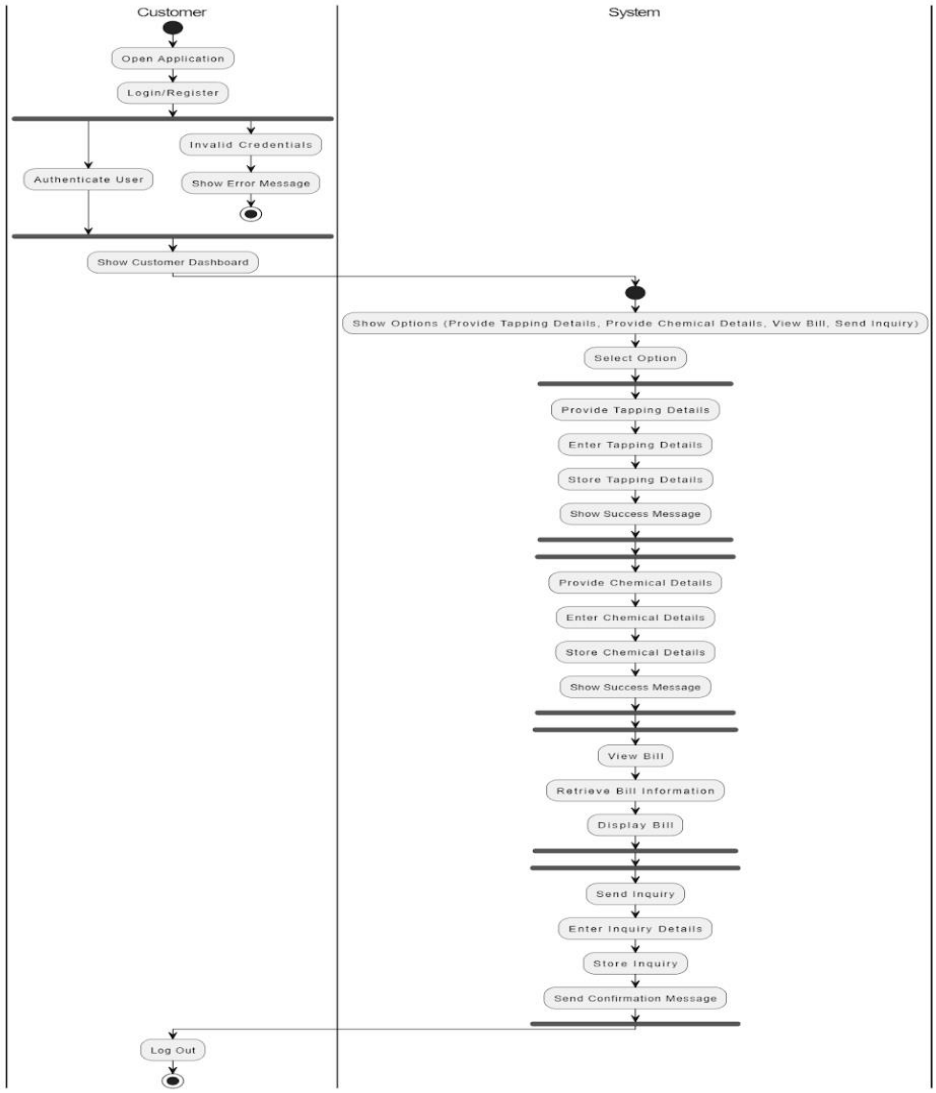


Figure 4. Activity Diagram for Customer Management

Use case Scenario for Customer Management

Field	Update Tapping Details	Register Customer	Send Inquiry
Use Case Name	Update Tapping Details	Register Customer	Send Inquiry
Primary Actor	Customer	New Customer	Customer
Precondition	- Customer is logged into the system. - Existing records of tapping details are available.	- Customer is on the registration page	- Customer is logged into the system.
Post Condition	- Tapping details are updated and saved in the system.	- Customer's registration details are saved in the system	- Inquiry is sent and saved in the system
Main Success Scenario	1. Customer selects the "Update Tapping Details" option. 2. System prompts for required details. 3. Customer enters details. 4. System validates and updates tapping info. 5. Customer reviews and confirms changes. 6. System saves details and provides confirmation messages.	1. Customer selects the "Register" option. 2. System prompts for registration details. 3. Customer enters details. 4. System validates and registers the customer. 5. System provides confirmation and login details.	1. Customer selects the "Send Inquiry" option. 2. System prompts for inquiry details. 3. Customer enters details. 4. System validates and sends the inquiry. 5. System provides a confirmation message.
Extensions	- If details are invalid, the system displays error and prompts for re-entry. - If there is a system error, the customer is notified and changes are not saved.	- If details are invalid, the system displays error and prompts for re-entry. - If there is a system error, customer is notified and registration is not completed	- If details are invalid, the system displays error and prompts for re-entry. - If there is a system error, the customer is notified and an inquiry is not sent.

Table 2. Use case Scenario for Customer Management.

11.2.2. Supervisor Management

The Supervisor in the Latex Harvesting project is responsible for overseeing and managing the harvesting operations. This role involves updating visiting dates, selecting tapping dates, managing orders, and planning dates. The Supervisor ensures that the harvesting schedule is accurate and up-to-date, facilitating smooth operations and effective resource allocation.

Use case Diagram for Supervisor Management

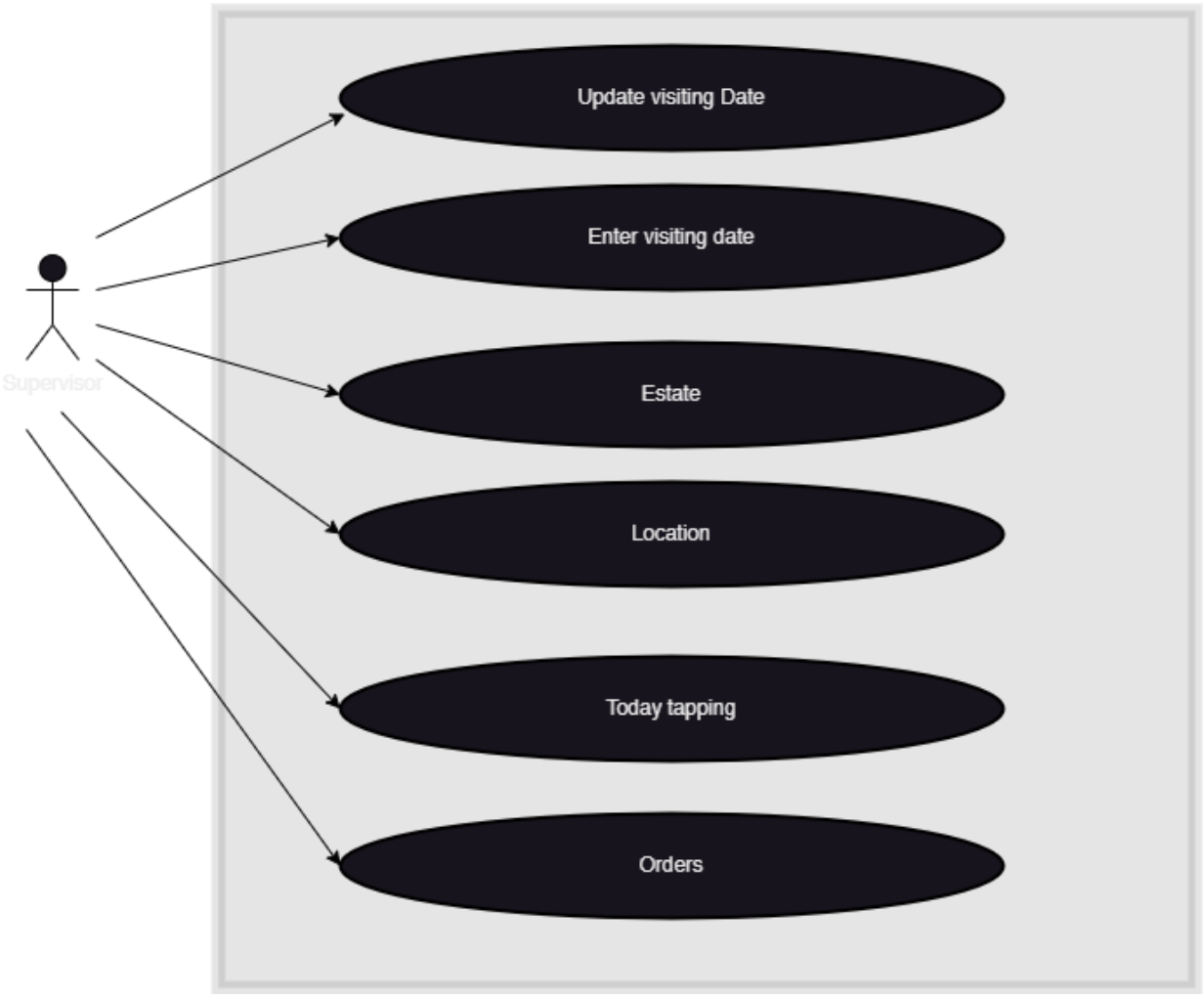


Figure 5. Use case Diagram for Supervisor Management

Activity Diagram for Supervisor Management

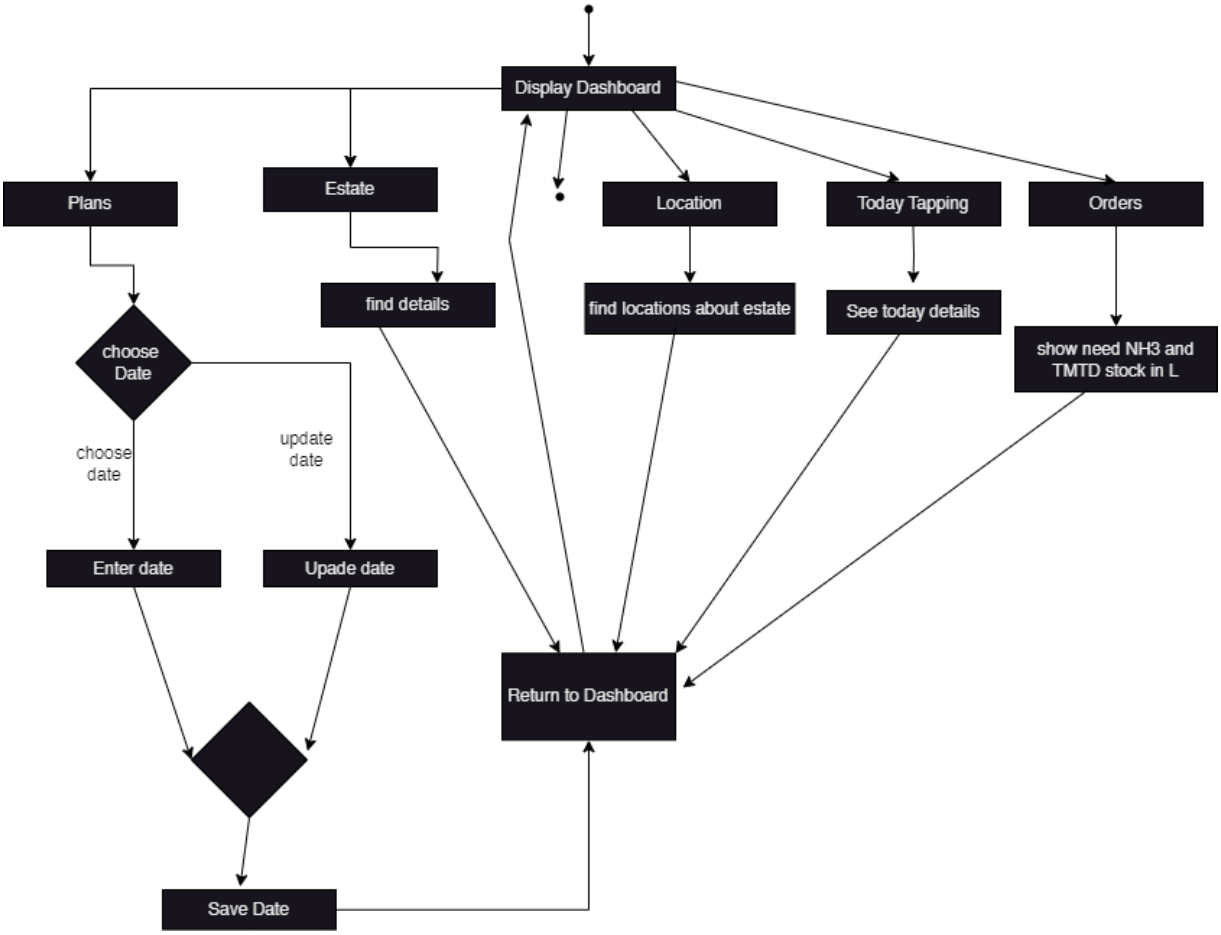


Figure 6. Activity Diagram for Supervisor Management

Use case Scenario for Supervisor Management

Field	Description
Use case name	Manage Dates
Primary Actor	Supervisor
Precondition	Supervisor is logged into system Existing records of visiting dates are available
Postcondition	Visiting dates are updated and saved in the system.
Main Success Scenario	1. Supervisor selects the "Manage Visiting Dates" option. 2. System prompts for the required details (e.g., new visiting date). 3. Supervisor enters the details 4. System validates the details and updates the visiting date. 5. Supervisor reviews and confirms the changes. 6. System saves the updated visiting date and provides a confirmation message.
Extensions	• If the entered details are invalid, the system displays an error message and prompts the supervisor to re-enter the details. • If there is a system error, the supervisor is notified, and the changes are not saved.

Table 3. Use case Scenario for Supervisor Management

11.2.3.Admin Management

The Admin Management is a crucial component of the Rubber Latex Collection Management System, providing administrative control and oversight for the entire operation. This function allows administrators to efficiently manage various aspects of the system, ensuring smooth and organized operations. Key features include:

Supervisor Management: Administrators can register, update, and manage details of supervisors, ensuring that only authorized personnel are in charge of field activities. This includes the ability to view and modify supervisor assignments and monitor their performance.

Access Control: The system provides role-based access control, ensuring that sensitive information is accessible only to authorized personnel. This enhances data security and prevents unauthorized access.

Use case Diagram for Admin Management

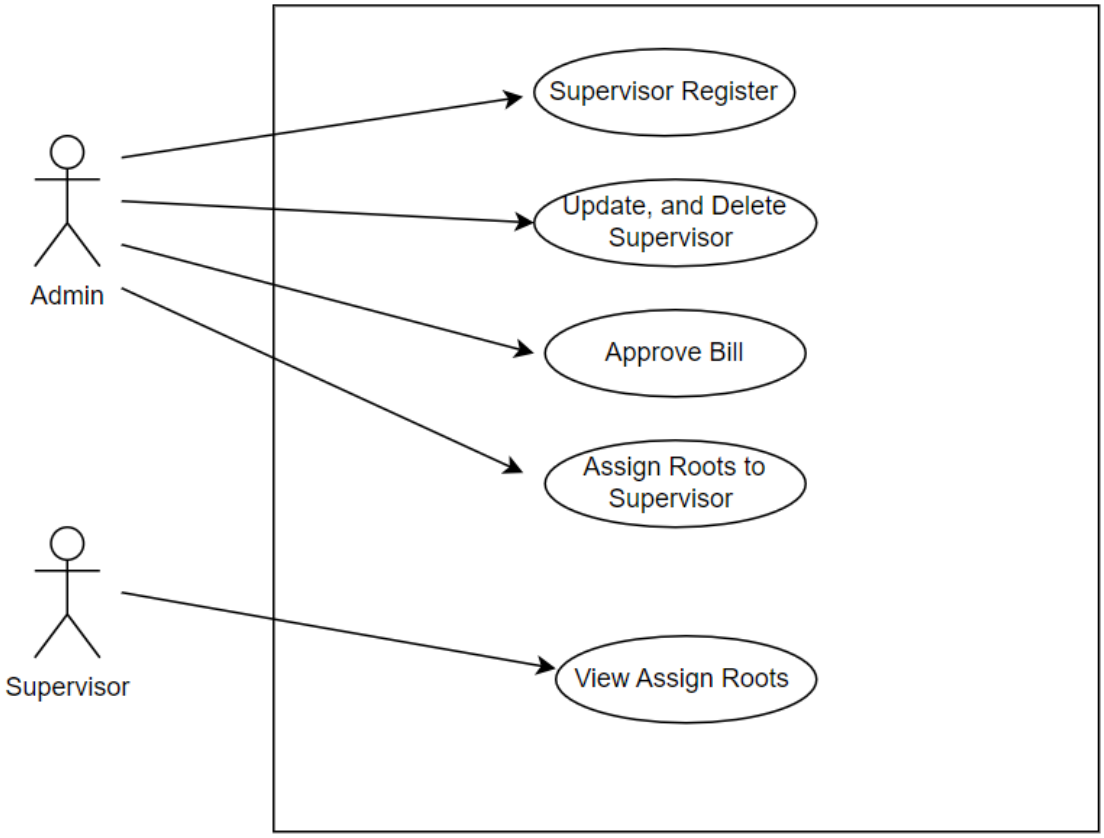


Figure 7. Use case Diagram for Admin Management

Activity Diagram for Admin Management

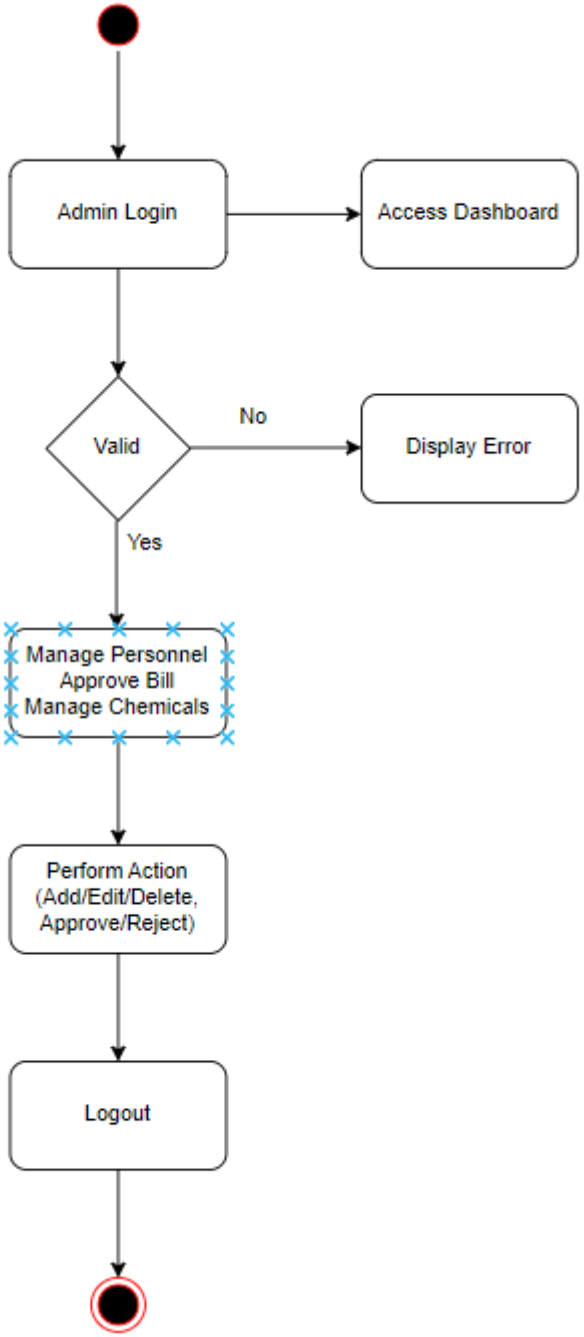


Figure 8. Activity Diagram for Admin Management

Use Case Scenario for Admin Management

Field	Description
Use case name	Admin Management
Primary Actor	Admin
Precondition	The admin must be logged into the system with valid credentials. The system must be operational and connected to the network.
Postcondition	All changes made by the admin are saved and updated in the system. Notifications are sent to relevant personnel if needed (e.g., new personnel added, bills approved).
Main Success Scenario	1. Admin Logs In 2. Approve Bills: 3. Manage Chemicals:
Extensions	Admin Logs In: • Invalid Credentials: If the admin enters invalid credentials, the system displays an error message and prompts for re-entry. Approve Bills: • Discrepancies: If there are discrepancies in the bill, the system flags the bill and provides options for correction before approval. Manage Chemicals: • Stock Errors: If there is an error in the stock levels, the system alerts the admin to verify and correct the information.
Special Requirements	The system must provide real-time updates to ensure that all data viewed by the admin is current. All sensitive actions (e.g., personnel management, bill approvals) should require confirmation to prevent accidental changes.

	The system should have audit trails to log all actions performed by the admin for accountability and security purposes. Notifications should be sent automatically for critical events such as low chemical stock or pending bill approvals. The system should support multi-factor authentication for admin login to enhance security.

Table 4. Use Case Scenario for Admin Management

11.2.4.Vehicle, Workers and Root Management

The Vehicle, Workers & Route Management is a comprehensive system designed to enhance the efficiency and reliability of latex collection operations. By integrating vehicle registration and maintenance, worker assignment management, route updates, and maintenance scheduling, this system ensures that all aspects of the operation are well-coordinated and optimized. Administrators and supervisors can efficiently manage vehicles and personnel, ensuring smooth operations, reducing downtime, and improving overall productivity.

Use case Diagram for Vehicle, Workers and Root Management

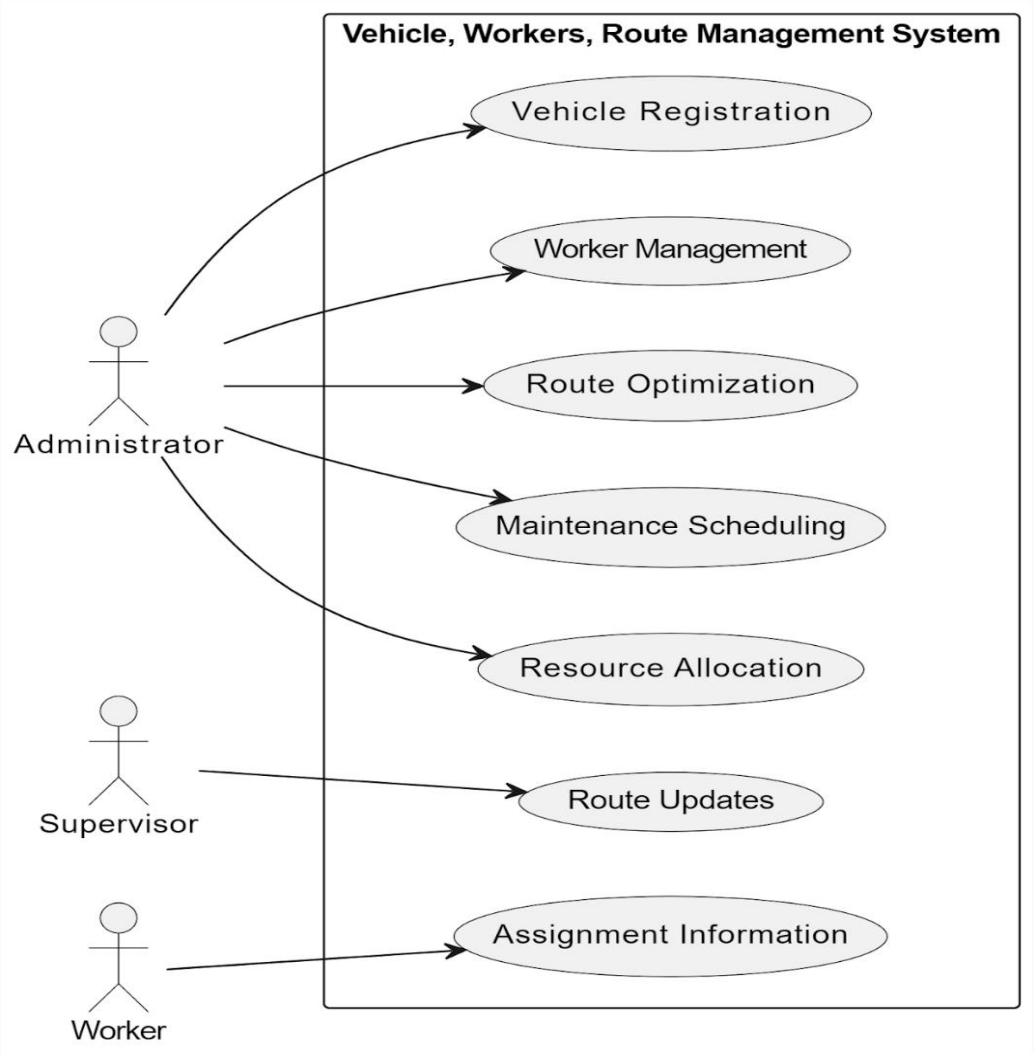


Figure 9. Use case Diagram for Vehicle, Workers and Root Management

Use Case Scenario for Vehicle, Workers and Root Management

Field	**Description**	
Name	Manage Vehicle, Workers, and Route	
Summary	Administrators and Supervisors manage vehicles, workers, and routes to ensure efficient operation and maintenance	
Priority	High	
Preconditions	The user has access to the system The system is up and running	
Post condition	The system updates the vehicle, worker, or route details successfully The user receives confirmation of the changes	
Primary Actors(s)	Administrator Supervisor	
Trigger	The need to register or update vehicles The need to manage worker assignments The need to update route information	
Main Scenario	Step	Action
	1	The Administrator logs into the system
	2	The Administrator clicks the “Vehicle Management” button
	3	The system displays the vehicle registration details
	4	The system saves the vehicle registration details
	5	The Administrator clicks the “Worker Management” button
	6	The system displays the worker management form

	7	The Administrator assigns drivers, helpers, and security personnel
	8	The system saves the worker assignments
	9	The Supervisor logs into the system
	10	The Supervisor clicks the “Route Update” button
	11	The system displays the route update form
	12	The Supervisor updates estate assignments, tapping schedules, and route optimizations
	13	The system saves the route updates
Extensions	Step	Action
		If the vehicle registration form is not working, the system prompts the user to refresh the page
		If worker details are already used, the system shows an error message "Details already exist
		If route update details are incorrect, the Supervisor refills the form with correct information
		If maintenance scheduling details are incorrect, the Administrator refills the form with correct information
		If resource allocation details are incorrect, the Administrator refills the form with correct information

Table 5. Use Case Scenario for Vehicle, Workers and Root Management

Activity Diagram for Vehicle, Workers & Root Management

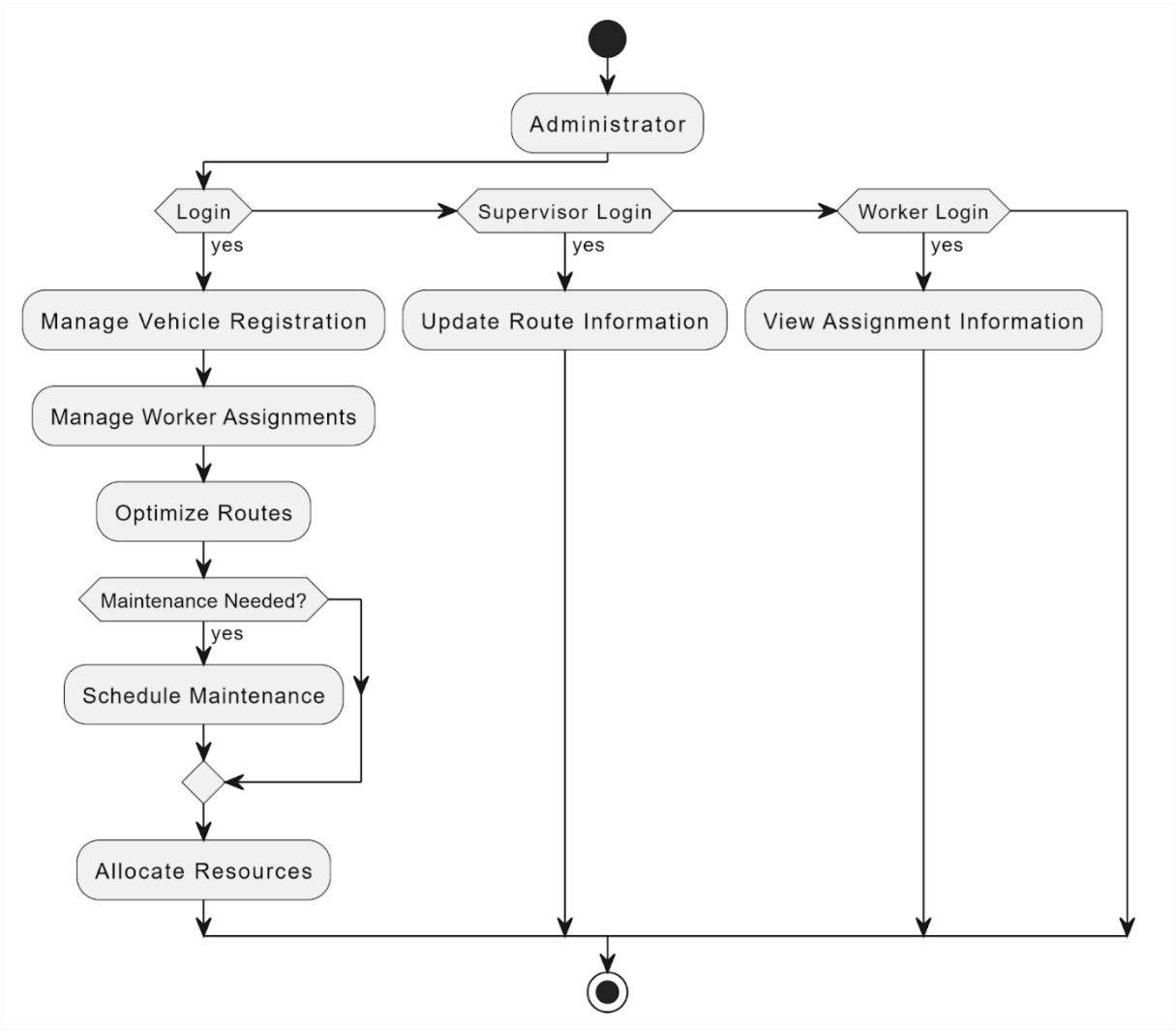


Figure 10. Activity Diagram For Vehicle, Workers & Root Management

11.2.5.Bill Calculation, Report & Summary Management

The Latex Harvesting project involves the management of the harvesting process of latex from rubber trees. The function of Bill Calculation, Reports & Summary Management is critical in ensuring that all harvested latex is properly accounted for, billed accurately, and summarized effectively for reporting purposes. This function is responsible for generating and managing bills for the harvested latex, creating detailed reports of the activities, and providing summaries for management reviews and decision-making.

- Bill Calculation: This involves calculating the amount due for the harvested latex based on various parameters such as the quantity harvested, the quality of latex, and the rates applicable.
- Reports Management: This includes generating detailed reports on the harvesting activities, including data on harvested quantities, quality, and financials.
- Summary Management: This function provides summarized data for higher-level management review, which can be used for strategic decision-making and operational adjustments.

Use case Diagram for Bill Calculation, Report & Summary Management

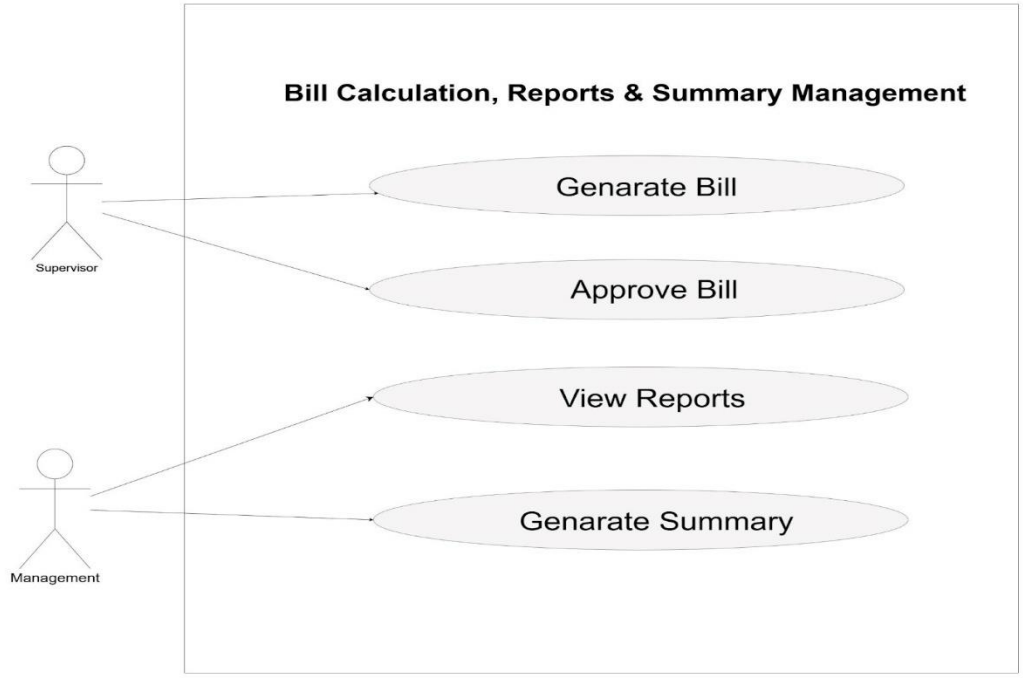


Figure 11. Use case Diagram for Bill Calculation, Report & Summary Management

Use Case Scenario for Bill Calculation, Report & Summary Management

Field	**Description**
Use case name	Generate bill
Primary Actor	Accountant
Precondition	• Customer details and service/product details are available in the system. • Accountant is logged into the system

Postcondition	Bill is calculated and stored in the system.
Main Success Scenario	1. Accountant selects the "Generate Bill" option. 2. System prompts for customer ID and service/product details. 3. Accountant enters the required details. 4. System calculates the bill and displays it. 5. Accountant reviews and confirms the bill. 6. System saves the bill and provides an option to print or email it to the customer.
Extensions	• If the customer ID is not found, the system displays an error message. • If the entered details are incomplete or invalid, the system prompts the accountant to correct them.
Special Requirements	• The system must calculate the bill accurately based on predefined rules and rates. • The system should provide a user-friendly interface for entering details and confirming the bill.

Table 6. Use case Scenario for Bill Calculation, Report & Summary Management

Activity Diagram for Bill Calculation, Report & Summary Management

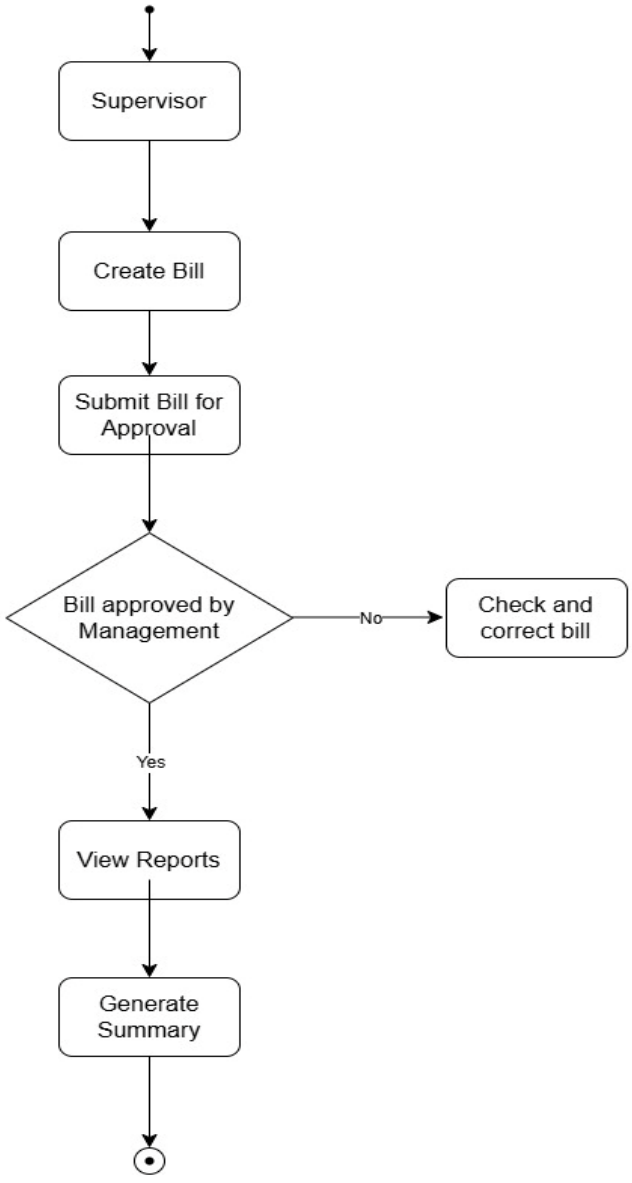


Figure 12. Activity Diagram for Bill Calculation, Report & Summary Management

11.3. ER Diagram

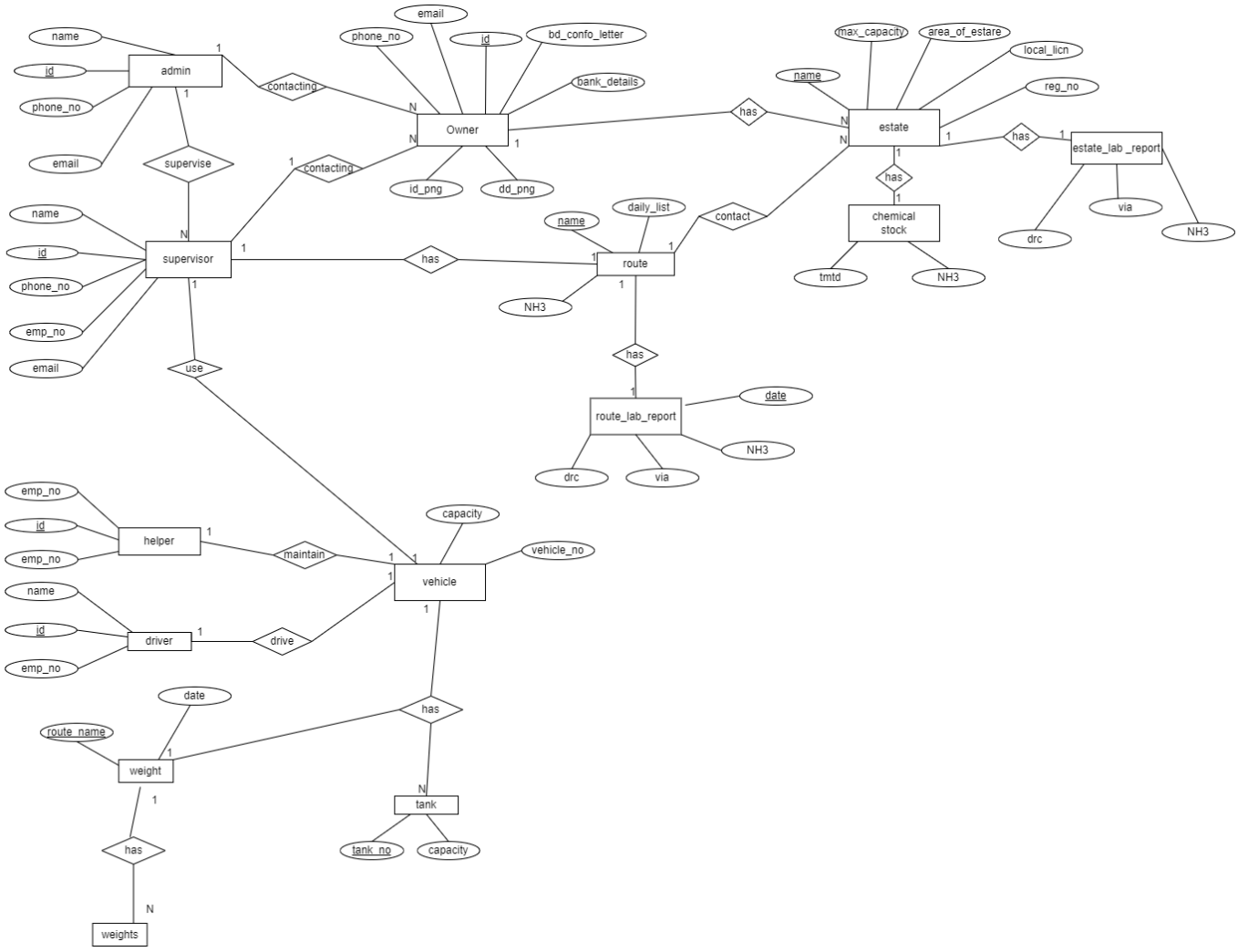
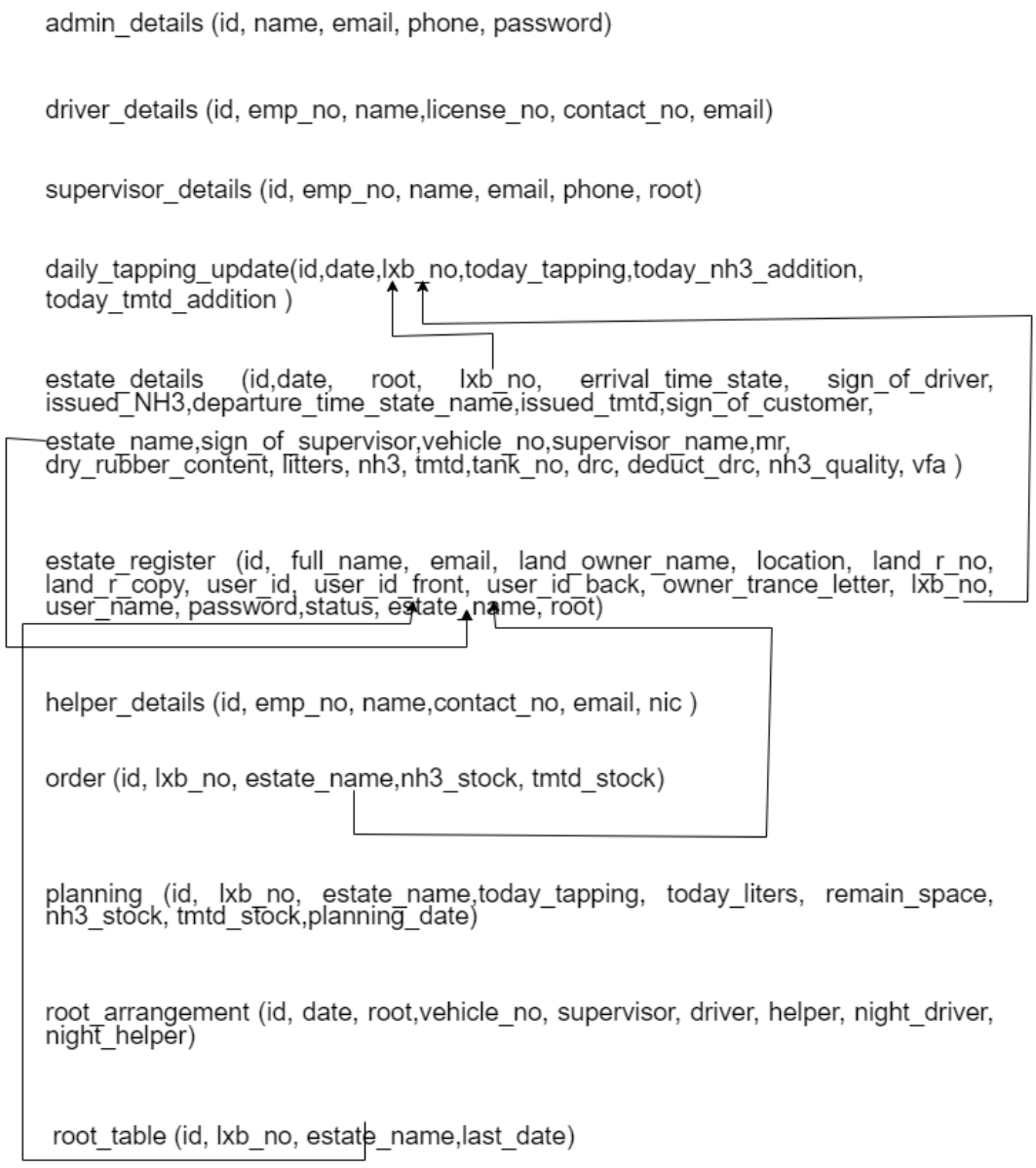


Figure 13. ER Diagram

11.4. Database schema



11.5. Work Flow

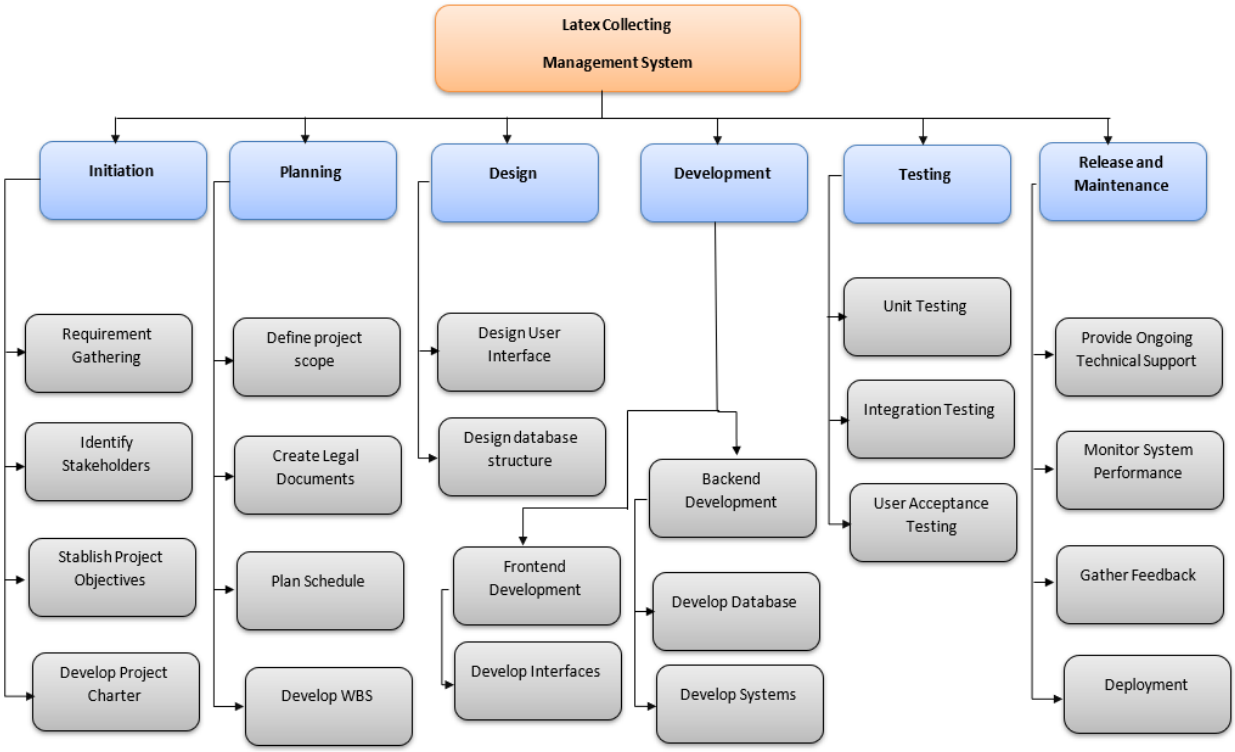


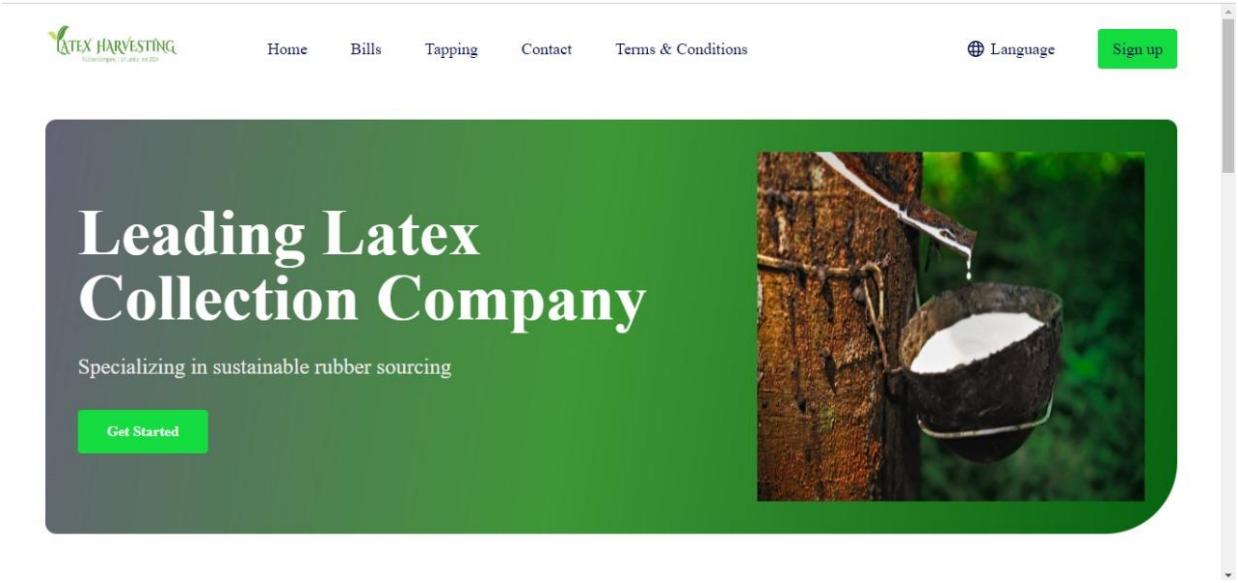
Figure 14. Work Flow

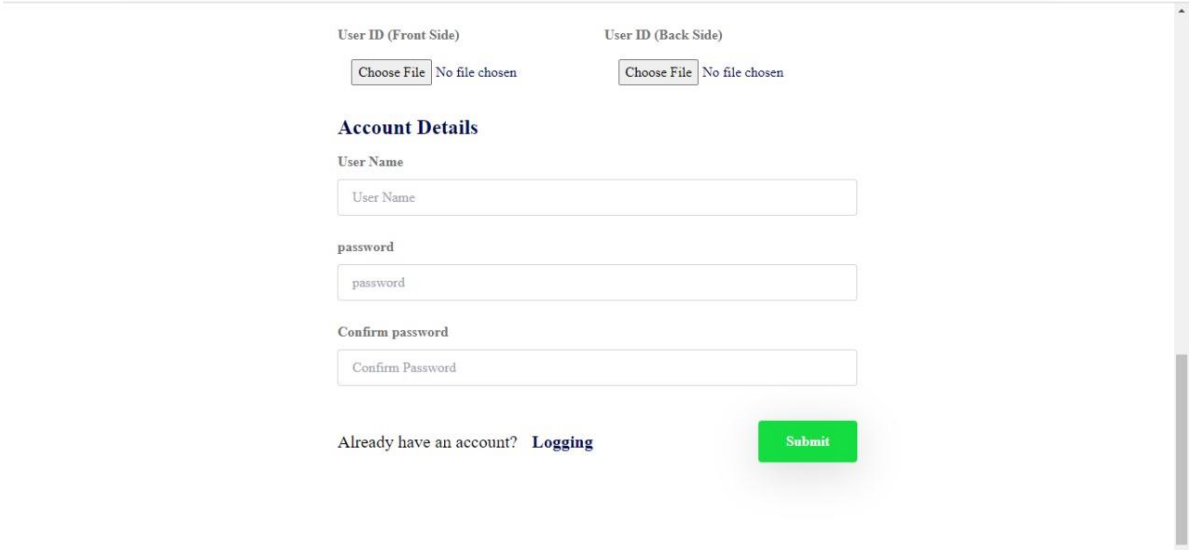
11.6. Development Aspects

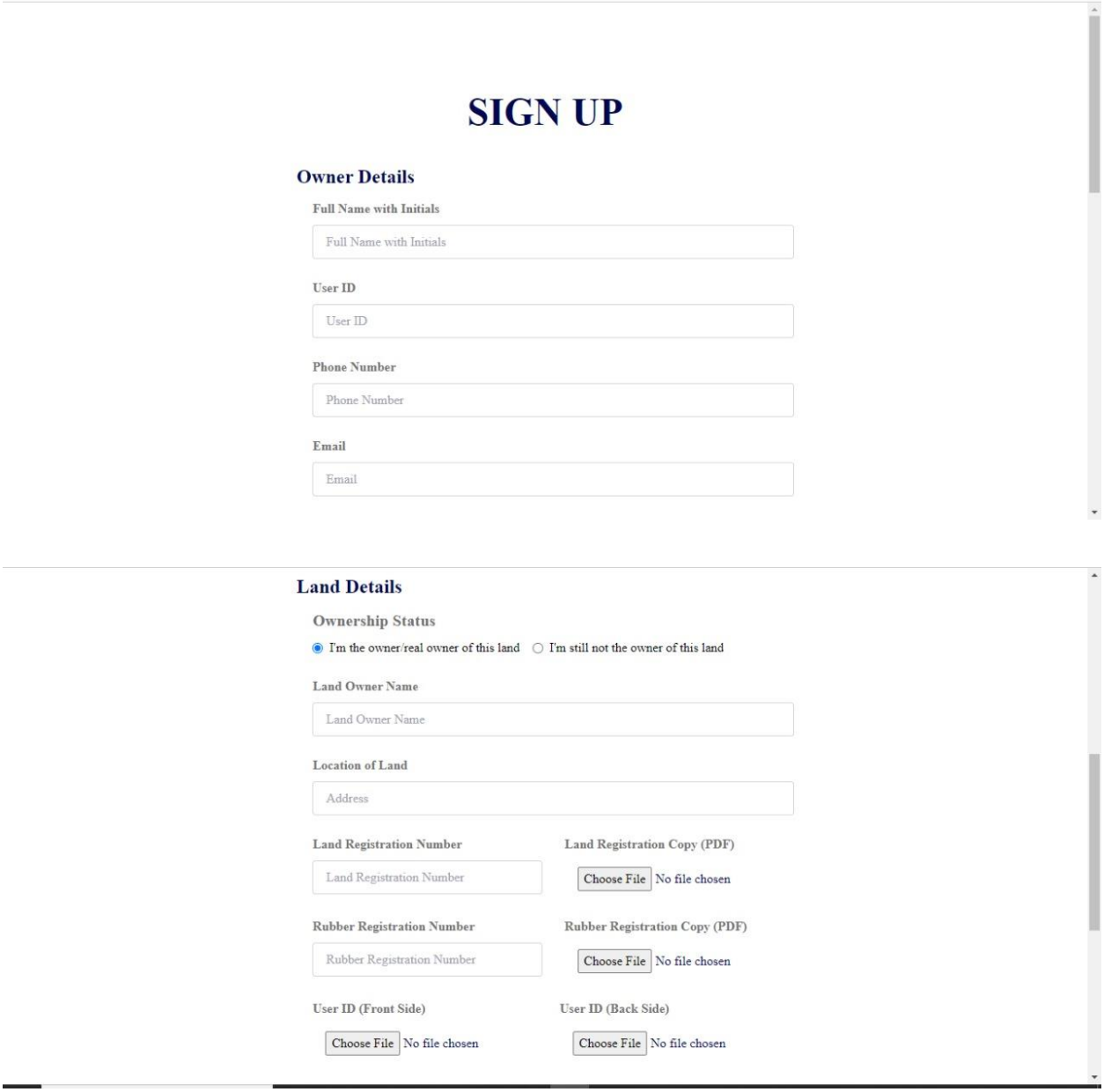
Figure 15. Development Aspects

11.7. User Interfaces

11.7.1. Customer Management






SIGN UP
Owner Details
Full Name with Initials
Full Name with Initials
User ID
User ID
Phone Number
Phone Number
Email
Email
Land Details
Ownership Status
I'm the owner/real owner of this land
I'm still not the owner of this land
Land Owner Name
Land Owner Name
Location of Land
Address
Land Registration Number
Land Registration Number
Land Registration Copy (PDF)
Choose File
No file chosen
Rubber Registration Number
Rubber Registration Number
Rubber Registration Copy (PDF)
Choose File
No file chosen
User ID (Front Side)
Choose File
No file chosen
User ID (Back Side)
Choose File
No file chosen

Tapping Details

04/01/2023 To 04/05/2023 Search

Date	Liters	Ammonia Addition	TMTD Addition
2023-04-01	10 liter	5 liter	2 liter
2023-04-02	15 liter	3 liter	1 liter
2023-04-03	20 liter	2 liter	4 liter
2023-04-04	18 liter	4 liter	3 liter
2023-04-05	22 liter	1 liter	5 liter
Total Liters	**85 liters**		

Previous Next

Recent Quality of Latex

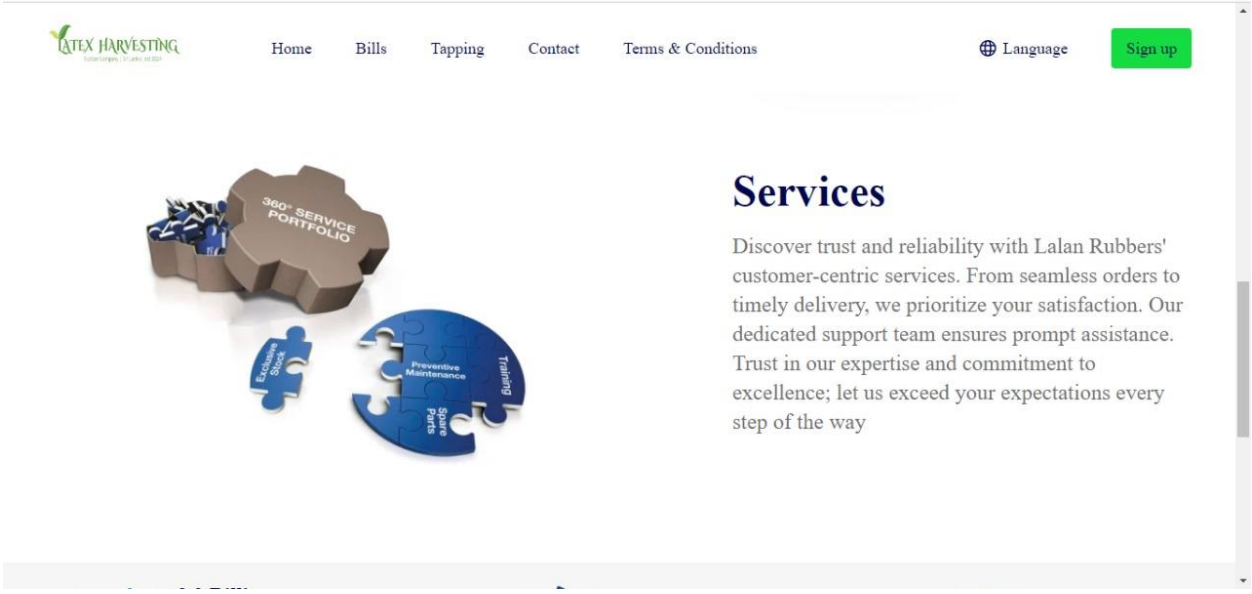
05/07/2024 To 05/14/2024 Search

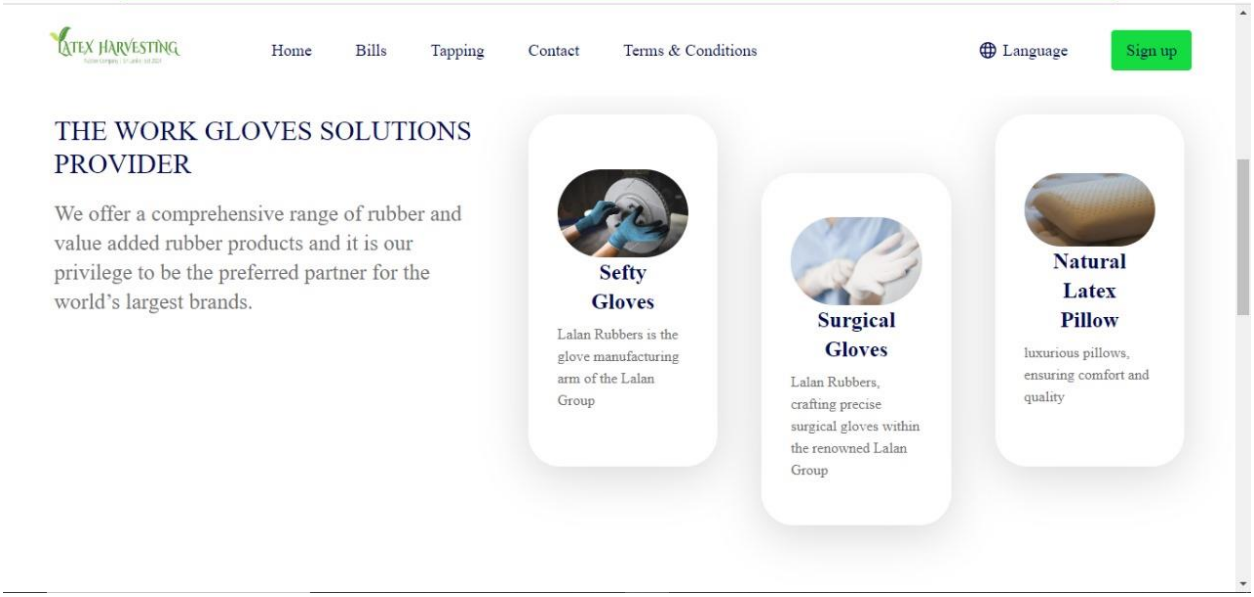
Dry Rubber	M/R	DRC	Date	VFA	Ammonia	Supervisor	Driver	Helper	Vehicle
1100 kg	21%	61%	2024-05-14	0.82%	0.05%	Patricia Lewis	Thomas Anderson	Paul Thomas	JKL-3141
1050 kg	20.5%	60.5%	2024-05-13	0.03	0.035	Richard Johnson	Laura Davis	Mark Wilson	MNO-7890
900 kg	19.5%	57.5%	2024-05-12	0.78%	0.035%	Jennifer Brown	Michael Taylor	Lisa Garcia	PQR-2468
1150 kg	21.5%	61.5%	2024-05-11	0.81%	0.055%	Jessica Clark	David Hernandez	Karen Martinez	STU-1357
950 kg	20%	60%	2024-05-10	0.85%	0.065%	Matthew Anderson	Emma White	Stephen Lee	VWX-3690
1000 kg	20%	60%	2024-05-09	0.85%	0.05%	Nicole Martinez	Christopher Johnson		YZA-8025
Total Dry Rubber	**6150 kg**								

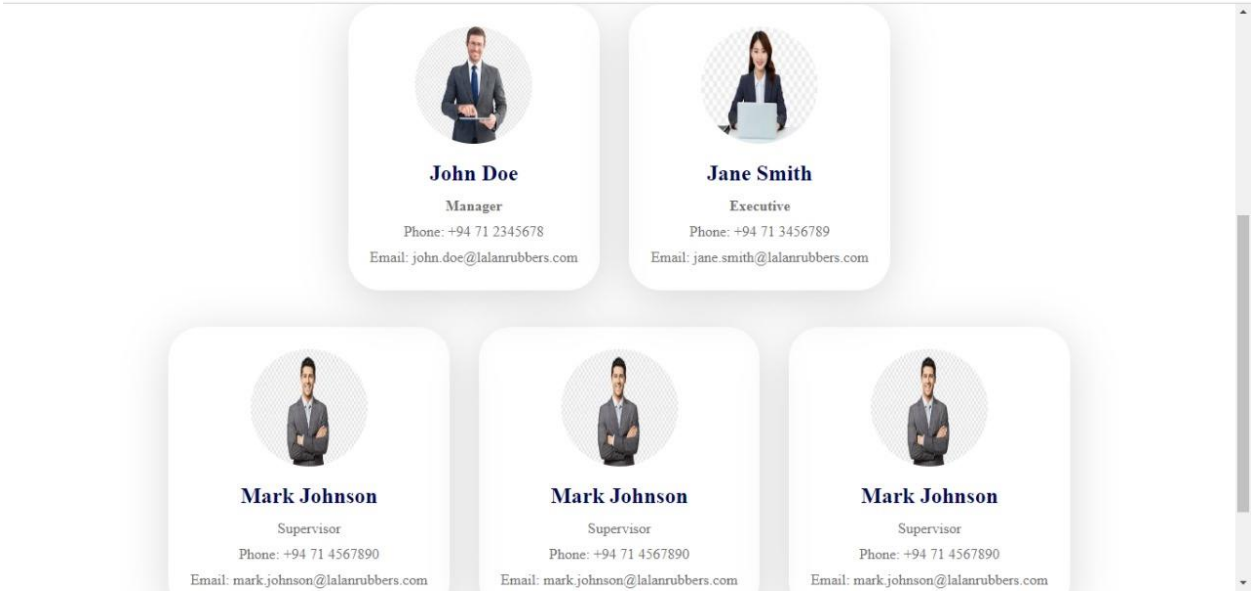
Previous Next

Terms & Conditions

1. Quality Standards: Lalan Rubbers maintains stringent quality standards for latex collection. Latex collected must meet the specified quality criteria to ensure optimal performance and customer satisfaction.
2. VFA Measurement: The VFA measurement is a critical indicator of latex quality. Latex samples will be tested for VFA content upon collection.
3. Consequences of High VFA Content: Latex samples with a VFA measurement above 0.04% may indicate lower quality and may require additional chemical treatment. Lalan Rubbers reserves the right to reject such samples or impose additional charges for processing.
4. Chemical Treatment: In cases where latex samples exhibit high VFA content, Lalan Rubbers may apply chemical treatments to improve quality. Additional charges may apply for chemical treatments.
5. Client Notification: Clients will be promptly notified of any deviations from the specified quality standards, including high VFA content. Clear communication regarding quality issues and potential solutions will be maintained throughout the latex collection process.
6. Compliance with Regulations: All latex collection activities must comply with relevant regulatory requirements and industry standards. Lalan Rubbers is committed to environmentally responsible practices and will ensure compliance with all applicable laws and regulations.
7. Dispute Resolution: In the event of disputes regarding latex quality or any other related matters, both parties agree to resolve the issue amicably through mutual discussions and negotiations.
8. Modification of Terms: Lalan Rubbers reserves the right to modify these terms and conditions as necessary to adapt to changing circumstances or regulatory requirements. Clients will be duly informed of any modifications to the terms and conditions.
9. Acceptance of Terms: By engaging in latex collection services provided by Lalan Rubbers, clients acknowledge and accept these terms and conditions in their entirety.
10. Contact Information: For inquiries or further information regarding these terms and conditions, please contact Lalan Rubbers at [contact information].




LATEX HARVESTING
Home
Bills
Tapping
Contact
Terms & Conditions
Language
Sign up
THE WORK GLOVES SOLUTIONS PROVIDER
We offer a comprehensive range of rubber and value added rubber products and it is our privilege to be the preferred partner for the world's largest brands.
Sefty Gloves
Lalan Rubbers is the glove manufacturing arm of the Lalan Group
Surgical Gloves
Lalan Rubbers, crafting precise surgical gloves within the renowned Lalan Group
Natural Latex Pillow
luxurious pillows, ensuring comfort and quality


John Doe
Manager
Phone: +94 71 2345678
Email: john.doe@lalanrubbers.com
Jane Smith
Executive
Phone: +94 71 3456789
Email: jane.smith@lalanrubbers.com
Mark Johnson
Supervisor
Phone: +94 71 4567890
Email: mark.johnson@lalanrubbers.com
Mark Johnson
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Email: mark.johnson@lalanrubbers.com
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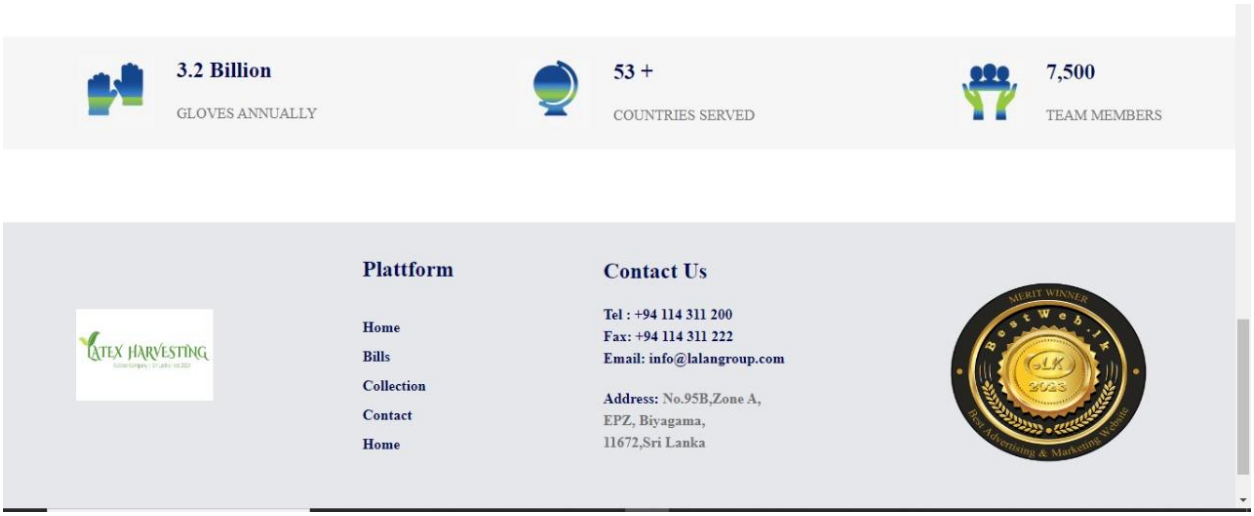
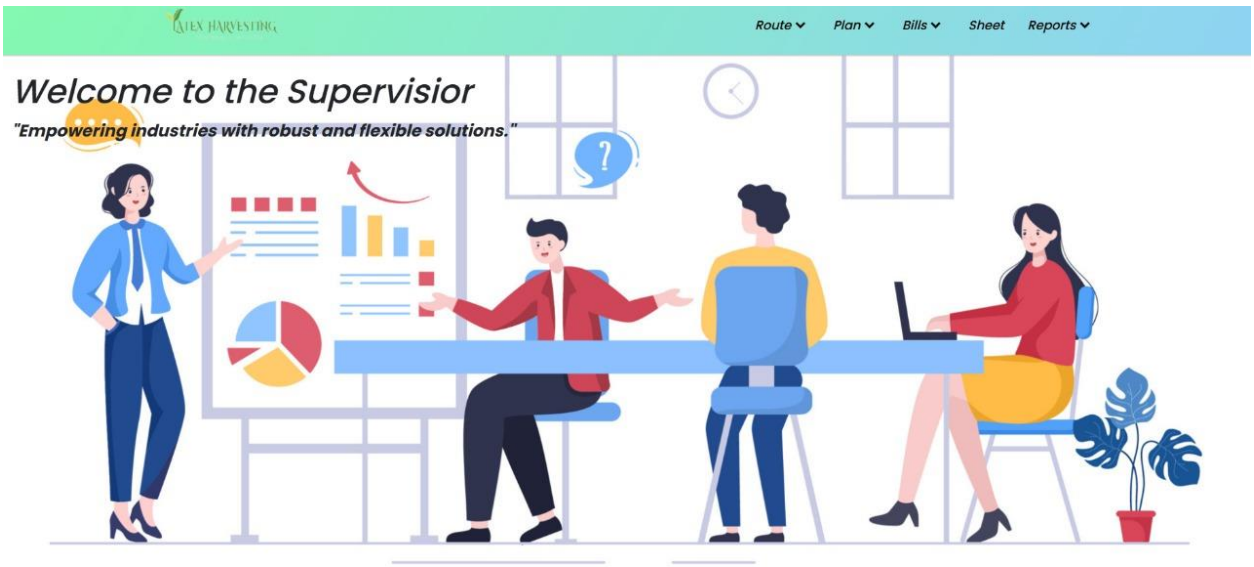
Email: mark.johnson@lalanrubbers.com



11.7.2. Supervisor Management

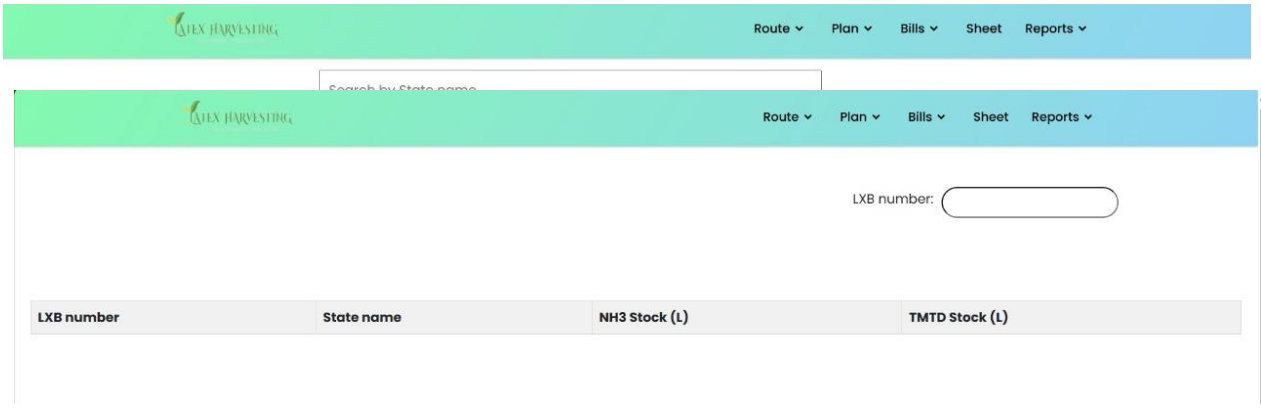


Kamurupitiya Route

Search by State

No	LXB number	State name	Today Tapping	Today Liter	Remain Space	NH3 Stock	T.M.T.D Stock	Collection Date
1	lxb 109	walahaduwa	345	4000L	800L	300L	1L	3 days
2	lxb 201	example	-	-	10000L	1000L	2L	6 days

Total Today Liters: 4000L

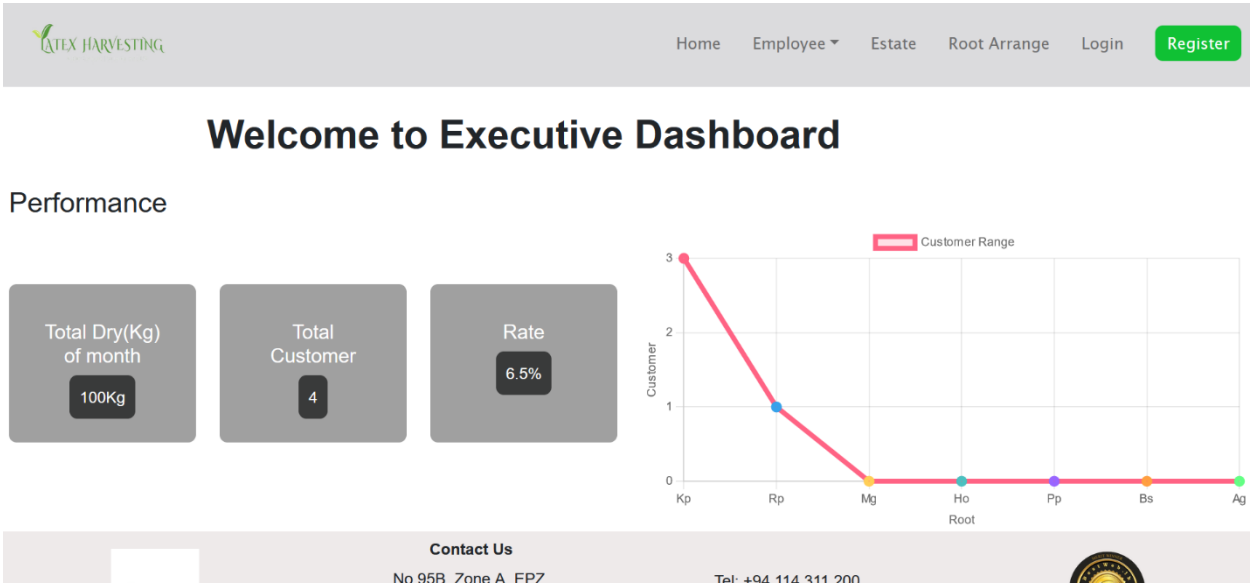


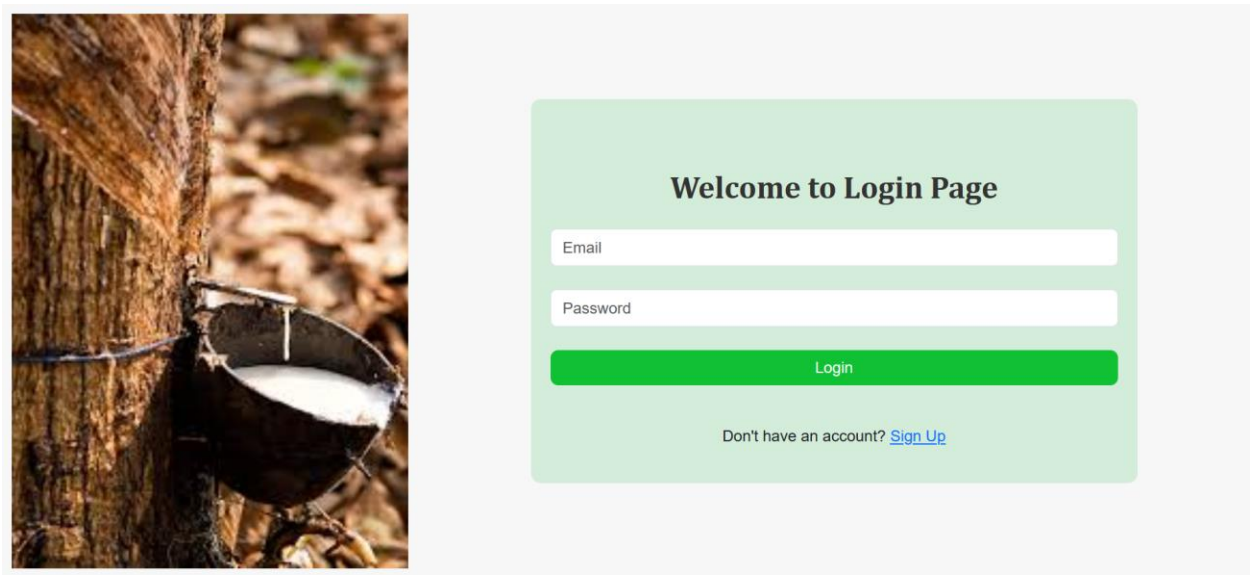
Kamurupitiya Route

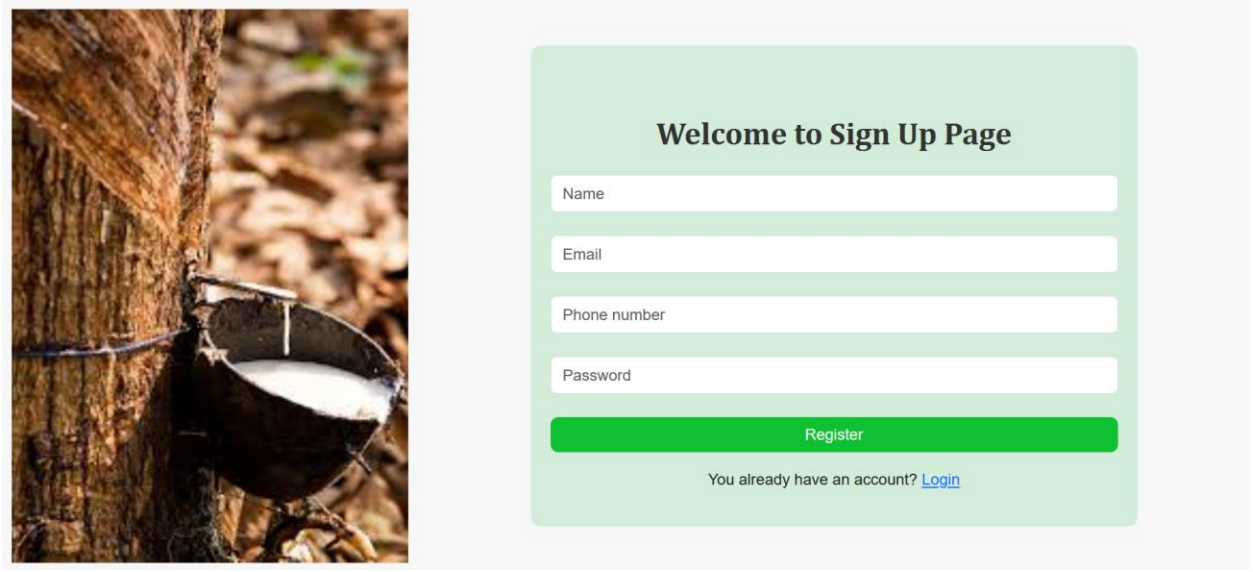
Search by "LXB number"

No	LXB number	State name	Last collection date	Collection Date
1	lxb 109	walahaduwa	2024-04-22	73 days ago
2	lxb 201	walahaduwa	2024-04-22	73 days ago
3	lxb 021	horana	2024-05-21	44 days ago

11.7.3.Admin Management




Welcome to Login Page
Email
Password
Login
Don't have an account? Sign Up


Welcome to Sign Up Page
Name
Email
Phone number
Password
Register
You already have an account? Login

Supervisor's Details

Add Supervisor

Emp No	Supervisor Name	Root	Contact	Email	Edit	Delete
S001	Kasun	Kamburupit	0716166318	kasun@gmail.com	Edit	Delete
S002	Amal	Horana	0712134567	amal@gmail.com	Edit	Delete
S003	Damith	Puwakpitiya	0716789123	damith@gmail.com	Edit	Delete

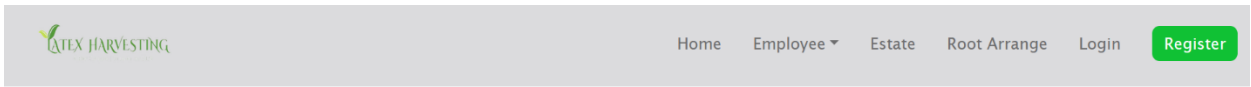
Estate's Details

All Kp Rp Mg Ho Pp Bs Ag

Search

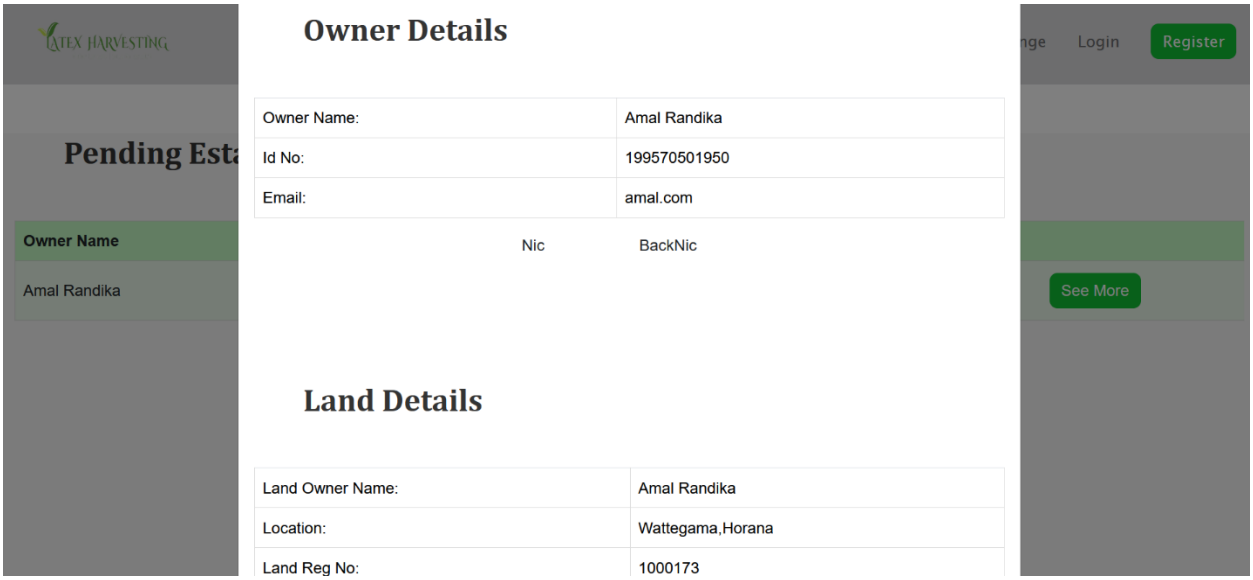
New State Pending

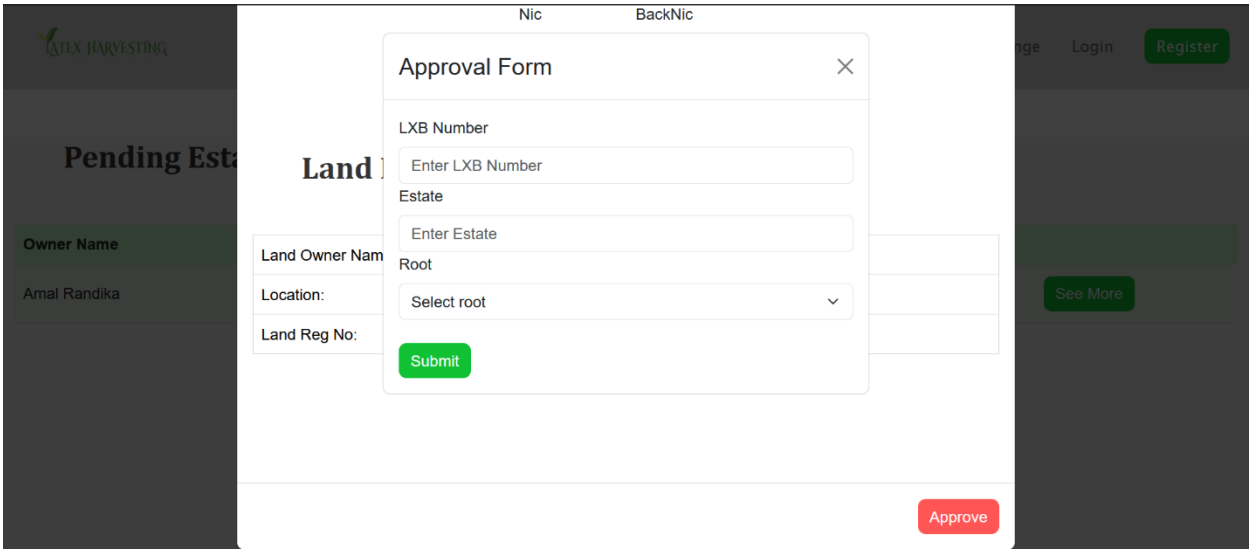
LXB Number	State Name	Owner Name	Email	Location	Root
Rp002	Kuruwita	Naduni Harshika	naduni@gmail.com	Kuruwita,Rathnapura	Rp
Kp002	Mathugama	mohamad aslin anver zekeriya	asankadilshan198@gmail.com	mathugama,walallavita,bopitiya	Kp
Kp001	Pitabeddra	Lakshitha Dihan	lakshitha@gmail.com	Pitabeddara,Akuressa	Kp
Kp005	Galle	amal chinthaka	amal@gmail.com	galla .methbosewana	Kp



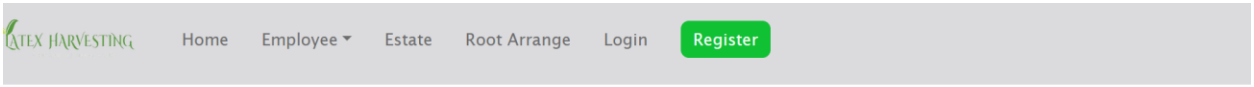
Pending Estate Details

Owner Name	Email	Location	Action
Amal Randika	amal.com	Wattegama,Horana	See More


LATEX HARVESTING
Login
Register
Pending Esta
Owner Name
Amal Randika
See More
Owner Details
Owner Name:
Amal Randika
Id No:
199570501950
Email:
amal.com
Nic
BackNic
Land Details
Land Owner Name:
Amal Randika
Location:
Wattegama,Horana
Land Reg No:
1000173


LATEX HARVESTING
Login
Register
Pending Esta
Owner Name
Amal Randika
See More
Nic
BackNic
Approval Form
LXB Number
Enter LXB Number
Estate
Enter Estate
Root
Select root
Submit
Land
Land Owner Nam
Location:
Land Reg No:
Approve

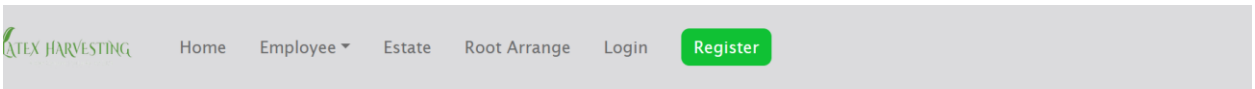
11.7.4.Vehicle, Workers and Root Management



Add

Helper Details

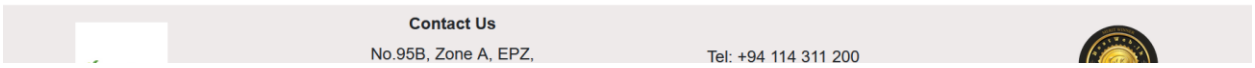
Employee No	Name	Contact Number	Email	NIC	Edit	Delete
0	Saman	0779345678	lahiru@gmail.com	20059500783	Edit	Delete
0	Saman	0779345678	lahiru@gmail.com	20059500783	Edit	Delete
0	lahiru	0779824002	lahiru@gmail.com	20059500783	Edit	Delete
H001	Sithum	0711206789	sithum@gmail.com	2001732167890	Edit	Delete
H002	Dasun	0711133789	dasun@gmail.com	200068967891	Edit	Delete

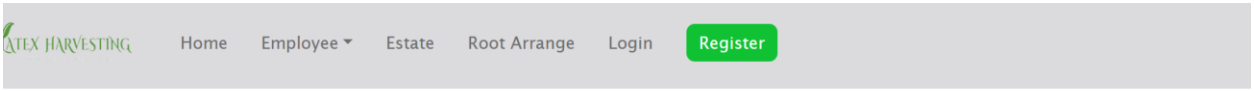


Add

Driver Details

Emp No	Name	License Number	Contact Number	Email	Edit	Delete
1	Saman	B4815929	0779893402	saman@gmail.com	Edit	Delete
1	lahiru	B4815929	0779345678	lahiru@gmail.com	Edit	Delete
13	lahiru	B4815929	0779824002	lahiru@gmail.com	Edit	Delete
6	Naduni	12345	0711234567	nadu@gmial.com	Edit	Delete





Root Arrangement

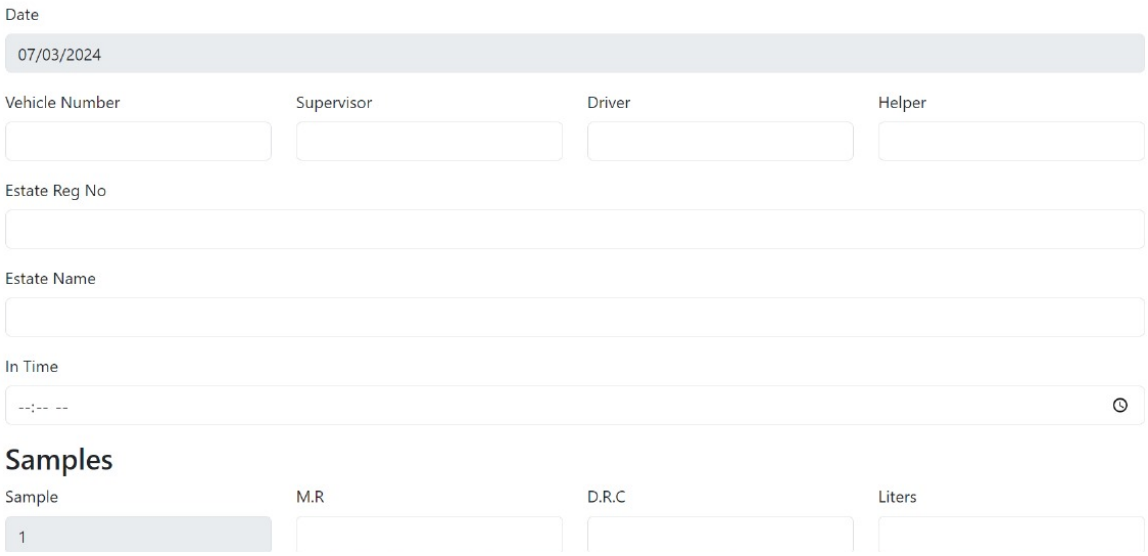
Add

Select Date

mm / dd / yyyy

Date	Route	Vehicle No	Supervisor	Driver	Helper	Night Driver	Night Helper	Edit	Delete
06/02/2024	kaburupitiya	AB-7899	Saman	Ravin	Samith	Kamal	Harsha	Edit	Delete
06/12/2024	Rathnapura	AS-6789	Bhagya	Nadishan	Anuhas	Iduwara	Roshitha	Edit	Delete

11.7.5.Bill Calculation, Report & Summary Management



Approved Bill

Date: 7/3/2024
Vehicle No: vf123
Driver: Saman
Helper: Avishka
Supervisor: Chamath

Lxb Number	State Name	Dry Rubber Content	VFA	NH3
			30	

Date: 7/1/2024
Vehicle No: vf123
Driver: Avishka
Helper: Anudha
Supervisor: Bihan

Lxb Number	State Name	Dry Rubber Content	VFA	NH3

Root Report

Search Date: 2024.07.03

Report for 7/3/2024

Vehicle No: vf123
Driver: Saman
Helper: Avishka
Supervisor: Chamath

Tank No	DRC	VFA	NH3
2	56	30	90

Estate Report

Search Date: 2024.07.03

Report for 2024.07.03

Vehicle No: vf123
Driver: Saman
Helper: Avishka
Supervisor: Chamath

Estate Name	DRC	VFA	NH3
Walahanduwa	56	30	90

11.8. Innovative parts

Customer Management

- Blockchain for Customer Data Security: Ensuring the highest level of data security and transparency using blockchain technology.

Supervisor Management

- Augmented Reality for Field Supervision: Utilizing AR glasses or mobile AR apps to provide supervisors with real-time overlays of data and instructions in the field.

Admin Management

- AI-Powered Decision Support System: Integrating AI to provide data-driven recommendations for strategic decision-making and policy formulation.

Vehicle, Workers, Route Management

- Eco-Friendly Route Optimization: Using algorithms that not only optimize for time and cost but also minimize environmental impact by reducing emissions and fuel consumption.

Bill Calculation, Report, and Summary Management

- Real-Time Financial Analytics: Offering real-time analytics and visualization of financial data to enable quick and informed decision-making.

11.9. Commercialization

We are excited to introduce our revolutionary Rubber Latex Collection Management System, tailored specifically for Lalan Rubbers (Pvt) Ltd. This innovative solution is designed to address the unique challenges faced in your latex collection operations. Our system automates manual processes, optimizes route planning, and provides real-time monitoring of latex quality and quantity, significantly enhancing operational efficiency and reducing costs. With integrated features for customer management, supervisor coordination, vehicle and worker allocation, and comprehensive reporting, our platform ensures that Lalan Rubbers can maintain the highest standards and streamline its workflow seamlessly.

By adopting our Rubber Latex Collection Management System, Lalan Rubbers will benefit from increased accuracy, improved customer satisfaction, and enhanced productivity. This technology will empower your team to make data-driven decisions, optimize resource allocation, and

strengthen relationships with farmers, positioning Lalan Rubbers as a leader in the rubber latex industry. We are confident that our system will not only meet but exceed your expectations, driving your business towards greater efficiency and profitability.

We look forward to the opportunity to discuss how our solution can be integrated into your operations and to demonstrate the transformative impact it will have on Lalan Rubbers.

12. CHAPTER 4 – TESTING

12.1. Customer Management

Test Case ID	Test Case	Test Case Description	Test Data	Expected Result
01	Customer Registration	Verify that a new customer can register successfully	Name: John Doe Contact Information: john@example.com Address: 123 Rubber Street	The system should save the customer details and display a confirmation message.
02	Latex Order Placement	Verify that a customer can place a latex order	Quantity: 100 liters Tapping Date: 2024-06-10	The system should save the order and display a confirmation message.
03	Order Tracking	Verify that a customer can track the status of their orders	Order ID: 12345	The system should display the current status of the order.

Table 7. Test Case for Customer Management

12.2. Supervisor Management

Test Case ID	Test Case	Test Case Description	Test Data	Expected Result
01	Route Assignment	Verify that an administrator can assign routes to supervisors	Supervisor ID: 5678 Route: Route A	The system should save the route assignment and display a confirmation message.
02	Daily Planning	Verify that a supervisor can plan daily activities	Estate Visits: Estate 1, Estate 2 Tapping Schedules: 8 AM, 2 PM	The system should save the daily plan and display a confirmation message.
03	Data Collection	Verify that a supervisor can input data related to latex collection	Quantity: 200 liters DRC: 35%	The system should save the data and display a confirmation message.

Table 8. Test Case for Supervisor Management

12.3. Admin Management

Test Case ID	Test Case	Test Case Description	Test Data	Expected Result
01	Supervisor Management	Verify that an administrator can register	Name: Jane Smith Contact Information: jane@example.com	The system should save the supervisor details and display a confirmation message.
02	Worker Management	Verify that an administrator	Worker Name: Emily Green 	The system should save the

		can manage worker assignments	Assignment: Helper	worker details and display a confirmation message.
03	Route Update	Verify that an administrator can update route information	Route ID: 4567 New Route: Route C	The system should save the updated route information and display a confirmation message.
04	Maintenance Scheduling	Verify that an administrator can schedule and track vehicle maintenance	Vehicle ID: 5678 Maintenance Date: 2024-06-20	The system should save the maintenance schedule and display a confirmation message.

Table 9. Test Case for Admin Management

12.4. Vehicle, Workers, Route Management

Test Case ID	Test Case	Test Case Description	Test Data	Expected Result
01	Vehicle Management	Verify that an administrator can register vehicles	Vehicle Registration: ABC-123 Tank Number: TN-01	The system should save the vehicle details and display a confirmation message.
02	Worker Management	Verify that an administrator can manage worker assignments	Worker Name: Robert Brown Assignment: Driver	The system should save the worker details and display a confirmation message.
03	Route Update	Verify that supervisors can	Route ID: 2345 New Route: Route B	The system should save the updated route

		update route information		information and display a confirmation message.

Table 10. Test case for Vehicle, Workers, Route Management

12.5. Bill Calculation, Report, and Summary Management

Test Case ID	Test Case	Test Case Description	Test Data	Expected Result
01	Report Generation	Verify that the system can generate various reports	Report Type: Daily Activity Report	The system should generate the report and display it in the specified format.
02	Data Visualization	Verify that the system can present key metrics in a visual format	Metric: Latex Collection Quantity	The system should display the metric in the form of charts and graphs.
03	Summary Analysis	Verify that administrators and supervisors can analyze summary data	Data: Collection Performance, Quality Trends	The system should present the summary data for analysis and display actionable insights.
04	Export and sharing	Verify that users can export and share reports	Report Type: Monthly Summary Export Format: PDF	The system should export the report in the specified format and allow it to be shared.

Table 11.Test Case for Bill Calculation, Report, and Summary Management

13. CHAPTER 5 - EVALUATION AND CONCLUSION

The Latex Harvesting Management System was designed to enhance the efficiency, accuracy, and satisfaction of stakeholders involved in latex harvesting operations. Here's a brief overview:

Evaluation

1. Operational Efficiency:
    - Automation: Reduced manual tasks and time through automated processes.
    - Integration: Streamlined workflows by integrating various management functions.
    - Real-time Updates: Ensured timely notifications and information sharing.
2. Accuracy:
    - Data Entry: Minimized errors with validation checks.
    - Reporting: Generated accurate and detailed reports automatically.
3. Stakeholder Satisfaction:
    - Customer Experience: Improved user interface for easy order placement and communication.
    - Supervisor and Worker Efficiency: Facilitated better task and route management.
    - Admin Control: Provided centralized management and monitoring capabilities.

Conclusion

The system has achieved its goals of improving operational efficiency, data accuracy, and stakeholder satisfaction. It has streamlined workflows, minimized errors, and received positive feedback from all users.

Key Achievements:

- Enhanced efficiency through automation and integration.
- Improved data accuracy with validation and reporting features.
- High satisfaction levels among customers, supervisors, workers, and administrators.

Future Recommendations:

- Continuously update and enhance the system.
- Provide ongoing training and support.
- Scale the system to accommodate growth and additional functionalities.

14. CHAPTER 6 – REFERENCES

1. Lalan Rubber Company
   https://www.lalanrubbers.lk

2. Rubber Research Institute of Sri Lanka
   http://www.rrisl.gov.lk/content/files/downDoc/7.%20Collection%20&%20Preservation%20of%20Latex.pdf