

PROJECT PROPOSAL

FACTORY MANAGEMENT SYSTEM



PREPARED BY :



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BACKGROUND

Lanka MountCastle (Pvt) Ltd. is a company that specialises in providing a wide range of embroidery and garments embellishment services to the Sri Lankan apparel industry. They provide both customised and non-customized garments to their customers. The client has requested a web application, which uses an internet platform that will provide an integrated and automated system with easy accessibility that aids in regulating the business operations with minimum complications.

PROBLEM AND MOTIVATION

The company has encountered multiple issues due to inefficiencies within the factory. The main reason is that the existing system is manual and unintegrated. As a result, each business function works as isolated segments. They have also found that the maintenance of the system is complex, and it has resulted in the wastage of resources like paper because currently, the company keeps track of the details on paper before entering it into the computer. Moreover, they have also identified that their system has led to the inefficient handling of stocks, financial losses, production inefficiencies and difficulty in tracking the tasks. The system must keep track of large volumes of data and without a computerised system, the process seems to be tedious and faulty. They have also found that they are facing difficulties in forecasting future sales and production quantities as it is difficult to obtain and compare data from other departments.

The motivation to develop the system is due to the client wanting to reduce inefficiencies, and disruption of services and solve the major problems threatening the survival of their company. The client believes that with an integrated and automated system, there will be less chance of the occurrence of errors while recording data and it simplifies the workload. Easy accessibility of data can help in administering and monitoring tasks while minimising losses to improve the financial status of the company.

AIM AND OBJECTIVES

AIM

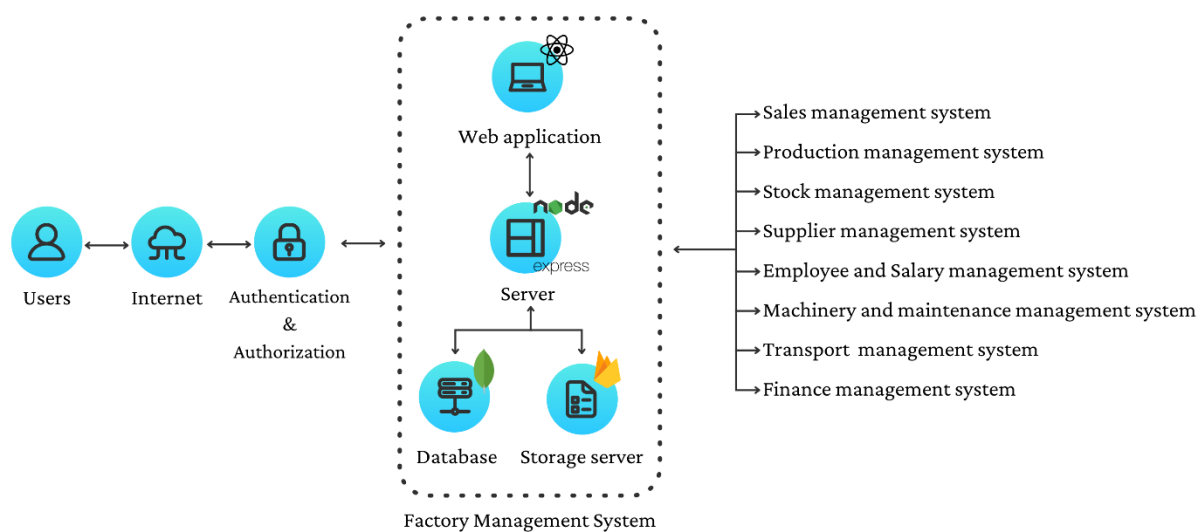
The aim of this project is to develop a web-based factory management system to increase the manageability and productivity of the client's factory.

OBJECTIVES

- Finalising the product requirements before the start of the development process.
- Developing the system architecture for the factory management system.
- Developing the user interfaces for the system within a period of 1 month.
- Developing the individual business functions planned for the prototype version within a 1-month period.
- Launching a working prototype of the factory management system within a 2-month period.
- Developing the rest of the business functions planned for the final version within the next 2 months.
- Assessing the User experience of the factory management system using the client's feedback after the development of the system.
- Conducting system testing for the integrated system before the launch of the final product.
- Launching a fully functioning, integrated factory management by the end of 4-month period.
- Presenting the final project report by the end of the 4-month period.

SYSTEM OVERVIEW

A web application is proposed to develop as a solution to the above problems. A web application will provide a reliable factory management system with the currently available resources without investing in additional resources. The web application has 8 different business functions to handle the business process of the factory.



SALES MANAGEMENT SYSTEM

Manages all the incoming orders to the factory. The system will be developed to use by the sales Managers, Executives, and Sales Assistants. System maintenance Orders and Customer information in the database and use CRUD operations on relevant functions. All the orders and customers' data should be added to the database when making an order. Every order data should be up to date until the production is finished and delivered successfully. Assistants can view the ongoing status of the order. After finishing production, users can retrieve order details and notify the customer. The system will generate a bill with the total amount of the order. The user shall be able to remove/cancel any order in case of cancellation.

The system should be able to make weekly, monthly, or annual reports. Report generation can be categorised into two categories, based on product type and customers. Product reports show the revenue made in the last sales, most selling products. Customer reports help to identify the best customers. Sales managers can view and analyse data from reports to improve upcoming sales.

Report generation also makes predictions based on future income through Sales Forecasts, which will help the business to forecast likely profit, plan the required level of production, and help to plan sales strategy. Analysing and gathering insights from previous sales data can create more accurate forecasts, which can be helpful for the factory to reach its sales objectives and improve surviving and flourishing sales in the future. Non-functional Requirements are usability & User-friendly UI, Real-time availability of orders, and Accuracy on reports. Technical Requirements are Security of Information, Speed & performance, Maintainability.

PRODUCTION MANAGEMENT SYSTEM

Production Management System works as a sequential co-dependent system. The main functionality of the system will be to optimise production by considering the data extracted from the given insights of the Production Management System. This system benefits users such as the Production Manager and Production Supervisors.

The work distribution management system takes all the orders made by sales management then delegates work to employees according to the status and severity. Production delegation will be allotted monthly, daily, and weekly. Records of Orders and Production will be imported and recorded by production supervisors and, mentioned records can be removed, updated, read, and created but must be approved by the Production Manager.

Production Cost Management facilitates the calculation of total cost related to the entire production, materials, and production overheads and creates reports for higher management plus lower management. Then comes the sequence where the system correlates with the supplier management system and stock management system to facilitate stock requisition and stock allocation for production according to due relevance. In addition, Efficiency Tracking Management provides several sub-functions to highlight key performance indexes related to the effectiveness by comparing actual production and estimated production of each employee according to a specific time frame. In addition, determine the idle time of the employees and the calculation of overheads of the production site with relevance to absorption costing and marginal costing, generating insightful reports for executive decisions, and passing down information to the finance management system for the cost of sales reference. The Production Manager must approve every CRUD operation done by production supervisors to keep the accuracy, integrity and correctness of any given information or data. Non-functional Requirements are, Reliability, User-friendly UI, Accurate information processing, and Integrity. Technical Requirements are, Information Security, Integrity, Performance and Quality Assurance.

STOCK MANAGEMENT SYSTEM

The Stock management system is an important business function, and inefficiencies in this component can lead to loss of production and sales. Maintaining all these details using the traditional bookkeeping methods is a tedious task and could lead to incorrect values and errors, therefore automating the system would help in faster decision making and easy stock monitoring. This system is responsible to satisfy user expectations in terms of functional and non-functional requirements and CRUD operations. Non-functional requirements include speed, real-time stock monitoring, user-friendly interface, scalability, reliability etc. Some technical requirements include availability, security, data integrity, maintainability, performance, etc.

Functional requirements include monitoring and tracking the stocks and meeting user expectations and using the CRUD operations to insert, read, update, and delete stock details. The primary system users are the stock supervisor and quality inspector. The stock supervisor is responsible for recording the details of stock, that is, performing the insert, update, delete, read and calculation functions, while the quality inspector is responsible to inspect, review the stock and update the quantity and value of damaged stocks. The stock supervisor and the quality inspector can log into the stock management system using valid authentication to perform their respective operations which may include inserting, deleting, updating, and viewing stock details. Furthermore, they can also generate detailed and summarised reports. The system should also be able to calculate the remaining quantity after meeting production demands and automatically calculate and show stocks that are below reorder level. The following details are recorded in the stock management system: type of stock that is, raw materials, work in progress or finished products. The raw materials are further divided into two categories which are raw materials provided by clients and raw materials owned by the business. Other details include the date, quantity, reorder level, per unit price, valuation of inventory, product ID and name, supplier, and damaged stock. The quantity of damaged stock and its value should also be updated after the quality inspector reviews the stocks. These details can be recorded accordingly depending on the service needed. The above operations should be available anytime to authorised users and they should be able to receive their services without any failure.

SUPPLIER MANAGEMENT SYSTEM

The supplier management system is there to manage suppliers. The supplier manager and the supplier management executive are the primary users of this system and they login to the system with valid credentials to perform CRUD operations and other tasks. There are two types of suppliers, raw material suppliers, and half-made material suppliers. The system will be able to store information about all the suppliers (supplier's company name, contact

person, email, phone number, address), their product details, lead times, order capacity etc. A supplier ID will be given to each supplier for identification. The system will store and keep track of previous records of the suppliers (quality of the products delivered, prices, timely delivery, and quantity (complete delivery within the time period, etc.)). Supplier manager will be able to decide on the most suitable supplier according to the requirements of the stock for next month by using the data stored. This subsystem can be used to search and view supplier data. The system can be used to generate reports monthly on supplier performance. Records of the suppliers can be deleted if a supplier resigns from the factory. The system will generate the purchase orders and keep track of them. The system will store proforma invoice details received from the supplier. Non-functional requirements include usability, speed, data integrity, maintainability, and User-friendly UX/UI while the technical requirements are data security and Performance.

EMPLOYEE AND SALARY MANAGEMENT SYSTEM

This system involves the management of all the employee-related details and their salaries. This system concerns CRUD operations related to employee-related details and their salaries. Data validations and delivering value-added reports are also part of the employee and salary management system.

This system involves several functional requirements. Primarily being able to perform CRUD operations related to employee details. The system should also be able to manage employee attendance and manage their leave requests. Moreover, the system should also be able to manage employee salaries. It should be able to calculate the wages of executive and non-executive employees based on the different methods of salary calculations. Furthermore, the system users should be able to perform CRUD operations related to OT rates, incentives and salary deductions and advance payments. Also, the system should manage loans obtained by employees. Correspondingly, the system should be able to manage details related to employee welfare. Employee welfare includes medical insurance, transportation, board, and lodging.

Likewise, the system should create employee profiles where the users can access employee details in one place. Furthermore, the system should generate reports based on employees' attendance and performance. Reports should also be generated based on employee salaries as well. Non-functional requirements of the system include reliability, usability, and speed while the technical requirements include information security and performance.

MACHINERY MANAGEMENT AND MAINTENANCE MANAGEMENT SYSTEM

The administrator is the primary user in this system. They can log into this system with valid credentials. Non-functional requirements included maintainability, recoverability, and serviceability while the technical requirements are performance, security, and regulations. Following are several functional requirements which are provided by both managing systems and each system's main CRUD operations.

The Machinery Management is aiding the machinery utilisation to provide the optimum output. This type of system helps to ensure the machines are in safe operating condition to avoid downtime, accidents, and costly replacement purchases. This allows the Administrative to manage the details on machines on repairs and replacements, ownerships, renewal dates and schedules, depreciation of machines needed, and new purchases. All the details should be entered into the system so that anything related to the machines that are used in the factory can be found in one place. Whenever a new machinery-related purchase happens, the system needs to be updated. The system needs to maintain a net book value which is calculated as the original costs of the machines when purchasing minus any accumulated depreciation of machines. Reports are generated by the updated details and then directed to the financial management system for further inspections. The dates and schedules for the machine renewals also should be added and updated when needed. The records in the database can be deleted when machines are unavailable, damaged, or no longer in need.

The Maintenance management ensures the maintenance of the company's assets including buildings, machines, vehicles, AC, compressors, etc. It will feature a fault index with typical breakdowns and steps that should be taken to fix the problems to keep track of all maintenance. Based on data from the machinery management, scheduling the examination of the machines and other resources. The system handles tracking past maintenance on the company resources. It is scheduling preventative maintenance based on the date the equipment, machines, and vehicles were purchased, how long it has been in use, etc. All the details are getting updated and removed. In addition, this kind of management system allows the maintenance and safety tasks to be assigned to the appropriate personnel. Reports are made for the productive time of the company resources, fully compiled equipment, maintenance history, failures, maintenance expenses, depreciation charges, etc. There will be support for all CRUD operations. This will also provide the user with real-time equipment monitoring dashboards (operation speed, areas of increased safety risk, downtime, performance).

TRANSPORT MANAGEMENT SYSTEM

The primary role of transport management is to manage all the staff, workers, and goods transportation. In this system, an administrator will be able to track the status of the finished products and schedule delivery to customers. When scheduling a transport, an administrator should enter the destination address, date, time of dispatch, distance, and goods information, and the system performs the data validation. Once the system retrieves all available drivers, an administrator can assign a driver to deliver the order. Based on the transportation distance, the system should be able to calculate the delivery cost. In addition, the administrator can organise transportation for the factory both staff and employees through the system and update the transportation details. Moreover, the administrator can delete the transport details and will remove relevant transportation information from the database. This system helps to monitor order and delivery performance. When registering the vehicle in the system, the vehicle number, model, year, and driver details can be entered into the system. Also, this sub-function supports all the CRUD operations. If the vehicle has been repaired or any services are done, that details should be forwarded to the maintenance management system. In this function, the main challenges are to deliver orders on demand, provide more efficient service and reduce the workload of transport. The system will generate a report that includes all relevant transportation information, the total cost of transportation, a report on delivery times, and an expense report for vehicle maintenance and repairs, with comparison charts. Non-functional requirements are a User-friendly interface, delivery of the goods on demand, speed of the system, reliability, and availability etc. Technical Requirements are the security of data, performance, maintainability, etc.

FINANCE MANAGEMENT SYSTEM

This function will take data from all other functions to compile all financial data in the company into one system to generate reports as required. This system will be put in place to be used by the Chief Financial Officer (CFO), Finance Manager, Finance Executives etc. The main functionalities of this will be to provide the Financial Executives with the means to incorporate all received data from other functions into usable information for higher-ups, as well as for Financial Managers to manually make any required alterations to reconcile the accounts and to take a day to day decisions within the business, as well as finally to allow the administration and owners to make decisions within the business with the given financial reports from the system. All these functional requirements will include CRUD in any relevant manner to the parties who will be using the system.

Further, the information gathered then will be utilised to make relevant reports such as the Profit and Loss Statement, The Statement of Financial Position, etc. as well as any custom

report required by relevant parties. The company will also be able to create forecasts for the future using the information created with the system, these forecasts can be used by the CFO to make long-term decisions. All these information and reports will include graphical diagrams to make interpreting the reports easier for all relevant parties.

The non-functional requirements include the scalability and maintainability of the system and ease of reconciling all financial data. Technical Requirements will include an audit trail so that all records will be tracked, as well as high speed and throughput of operations so that report generation is done efficiently and effectively.

LITERATURE REVIEW

Our system to be developed will be a complete system with all the functions required by the business in one application. All business functions will be accessible through one comprehensive system for the customer. The client investigated getting individuals apps to manage their business functions but was weary of having eight different applications with no integration to manage their business. To help them run their business, they sought us out to develop a fully integrated system. It is important to evaluate a project's feasibility before beginning it to decide whether it can be completed with the resources available. Afterwards, since it is new to the software developer, it is difficult to understand the problem domain. To create the requirements specification, a literature review and data collection are needed once the framework and flow of the process have been established. As a result of interviews and questionnaires, we have decided that the client's business currently uses pen and paper solutions for tracking most functions. Some functions use desktop applications, such as finance management and employee management, but they are not interconnected or integrated. Currently, they are having trouble getting rid of their current system. This is because it is easy to use pen and paper systems that are easy to understand for anyone literate. This also reduces the requirements of the employees to use the system. Because everyone has been using the current system for years, implementing a revamped system will require a learning curve for anyone who isn't already accustomed to it. The newly designed system will be much more efficient on time to use, effective in providing information, and will overtime be easier to use. As the upgraded system is implemented, there will be a backlog of paper documents to deal with. While the brand-new system may have some cons, it will prove to be much more profitable for the client's business over time since it was made specifically to maximise efficiency and profitability. The client will not be able to grow and expand their business in the future if the current system is maintained. This is because their pen and paper system prevents them from scaling the business. However, with our comprehensive system, it is merely a matter of adjusting a few variables to allow for a much larger business to be managed with the

software. We started the project by researching several websites related to our project which really aid us to gain knowledge of the system. According to the research, Through the website of Sri Lanka Mountcastle PVT Limited, a business that provides the Sri Lankan apparel industry with the broadest selection of embroidery and garment embellishing services, we were able to get a clear idea about the system including its functional and non-functional requirements regarding our system.[1] The TEAFMS (Tea Factory management system) project, which was a BIT final year project in 2011, explores the object-oriented approach to developing the software. The purpose of this project was also to address the factory management task of a tea factory, which served as a baseline for developing our project. TEAFMS is predominantly focused on the financial aspects of the factory, while our project, based on an embroidery manufacturing factory, focuses on the production and maintenance aspects of the factory. [2]

METHODOLOGY

To identify the client's requirements, we scheduled interviews with our client. We use questionnaires on management-level employees and others who are going to use the new system to get ideas about how they would prefer the new system. We identify data that need to be collected to generate reports. To implement the new integrated system, the current manual database system should be replaced by an automated database approach.

FEASIBILITY STUDY

Before taking on the contract with Lanka Mountcastle, we had decided to conduct a feasibility study through third parties and relevant authorities. The project was evaluated in the following categories of feasibility.

Technical Feasibility – We will be doing more Requirements Engineering to understand if the factory has the required technologies and resources for the system to be implemented, thus satisfying the technical feasibility conditions.

Operational Feasibility – We will be consulting with a third-party Quality Surveying Organisation that will ascertain if the project plan satisfies the client's requirements, for the client to proceed with the plan. The QS team will confirm if all the required resources are available to make the system operative.

Economic Feasibility – We will be consulting with the client's Financial Team, to identify the economic and financial ability of the factory to ensure that the factory has the required

capability to conduct the new system, including all the hardware and software costs. The new system will be beneficial in terms of the financial status of the factory.

Legal Feasibility – We will be consulting with the client's Legal Team to identify any legal obstacles that we may have to face. Thus, ensuring that the project is legally doable and that there will be no unexpected future repercussions to the Development Team.

Schedule Feasibility – Given the 14-week schedule within which the project needs to be completed, we have produced a Gantt chart which shows that the probability of completion is nearly 100% within the given time frame.

SYSTEM DESIGN

In the designing phase of our project, we intend to make use of several designing tools to draw UML diagrams, Wireframes, and create prototypes. Draw.io will be used to build UML diagrams. When designing our wireframes, we are intending to make use of Mock Flow as our wireframing tool. After wireframing, we will be using Figma for prototyping. We'll be using the Agile development method for developing our web application.

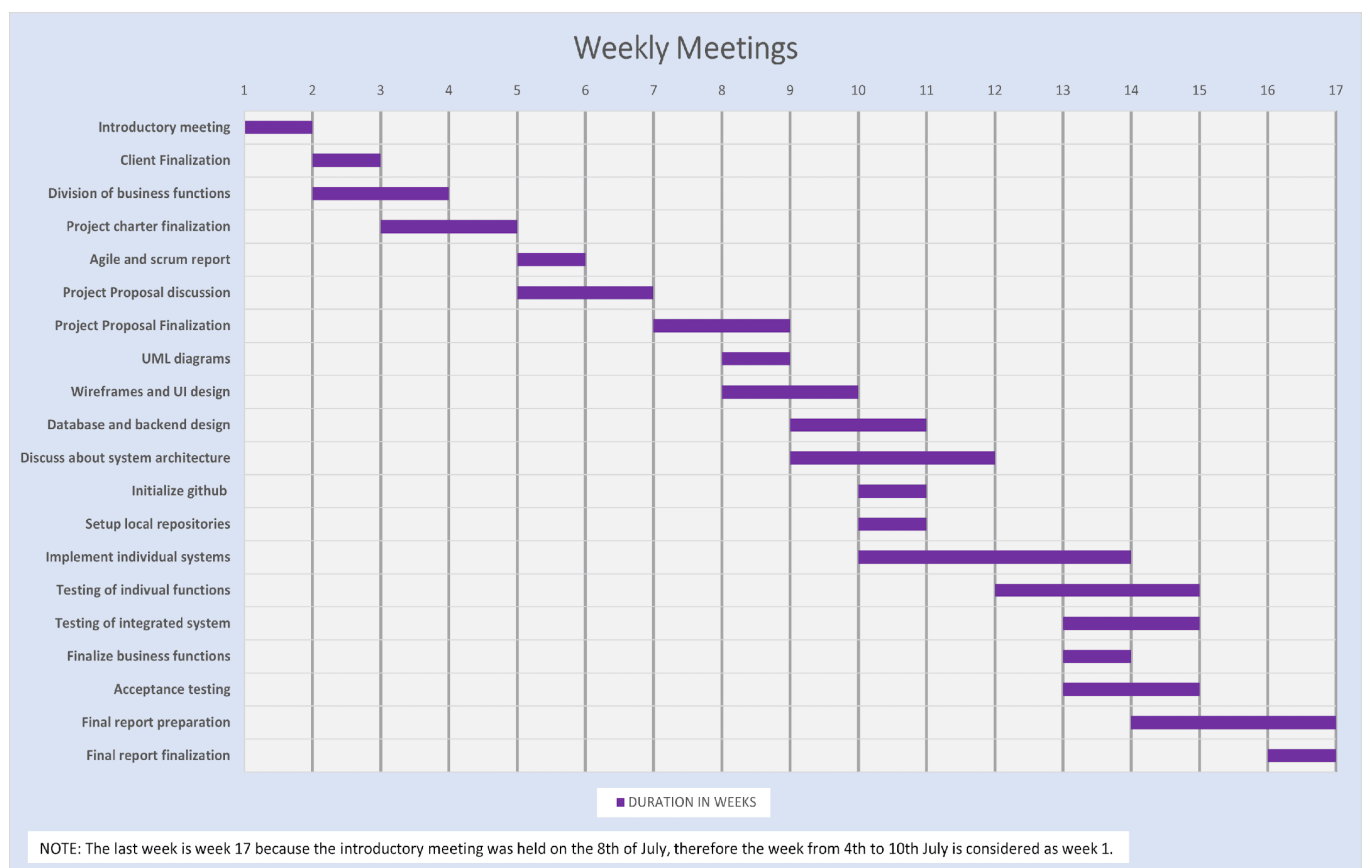
DEVELOPMENT TOOLS AND TECHNOLOGIES

In our project, we intend to use MERN stack technologies to implement our factory management system. The front end will be developed using React Js and the backend will be implemented using Express Js. The backend database will be implemented using MongoDB. In addition, we will be using React bootstrap, HTML, JSX, and yarn packages. We use JSX for our project because it [3] enables us to write HTML in React. Alternatively, we considered using AngularJS, Java Spring Boot, and MySQL for our project, but in the end, we chose the MERN stack. due to its high performance, easy integration with 3rd party technologies, ability to use JavaScript throughout the frontend and backend, and its high availability of developers to provide future development and maintenance to the system. We will use visual studio code as our primary integrated development environment. The API will be tested using the postman tool and it easily sends an API request to the web server and receives the response, whatever it is. For workflow visualisation, we intend to use the Kanban board. We will be using git for version control to track and manage different versions of our project code, which helps us collaborate with other group members. Additionally, Git and GitHub will be used to manage the main repository and integrate our project.

SYSTEM TESTING

In the testing phase of our project, we intend to use various testing techniques to test the system. When it comes to system quality, it is essential to evaluate since the system must perform the necessary function without any failures. Therefore, we use verification and validation techniques. During the testing process, our system will test every page. The tests will run using both black box and white box techniques, and thus can be regarded as unit testing. In the white box approach, every code part will be reviewed again to ensure that the logic is correct, while in the black box approach, the page or module will be used to conduct the necessary task, and then the database is queried to determine whether the work was completed successfully. To avoid errors and bugs in the system, the system will be tested for integration, functionality, etc. Finally, we will do the acceptance testing to verify that the web application fulfils the requirement specifications.

GANTT CHART



WORK BREAKDOWN STRUCTURE

Reg. Number	Surname with initials	Work allocation
IT21151392	Dissanayake D.M.J.C.B	Sales Management
IT21003332	Samarasinghe D.S	Production Management
IT21006166	Bishirhafi F.S.M.T	Stock Management
IT21128868	Vidanage D.S.D	Supplier Management
IT20159030	Lekamge L.R.S.T	Employee and Salary Management
IT21004322	Serasinghe C.M	Machinery and Maintenance Management
IT21110948	Weerawarna N.V	Transport Management
IT21003028	Perera M.D.M.R	Financial Management

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[1] <https://www.srilankabusiness.com/exporters-directory/company-profiles/lanka-mountcastle-pvt-ltd/>

[2] Z. M. Nawfal, Web Based Factory Management System for Deenside Tea Factory.

[3] Refsnes Data, "React JSX", W3School: https://www.w3schools.com/react/react_jsx.asp