

Cloud Based Sales Analysis System

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Declaration

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

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Date:

Dedication

I would dedicate this thesis to my beloved parents, Mr. D.B.Kaluarachchi and Mrs. D.P.Senadheera who have never failed to give me a tremendous support, for giving all not only throughout my project but also throughout my life. As well they teach me that even the largest task can be accomplished if it is done one step at a time.

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Abstract

OREL group was established in 1991. At the started they were deeply into home electrical and providing lighting solutions for companies. After years of experience OREL Corporation enhances to 12 businesses. Now, Orange Electric has become a formidable force in the electrical industry in Asia and it is also the flagship brand of THE OREL CORPORATION.

Using POS relief data (POS) manufacturer can realize the demand for products and improve demand analysis. Sales analysis is the way of estimating future sales. The sales analysis period can be annually, monthly, weekly, daily, area wise, dealer wise, district wise, product wise, and occasional wise. With accurate sales analysis, companies can make informed business decisions and predict short-term and long-term performance. Companies can make predictions based on historical sales data, industry-wide comparisons, and economic trends. It is easy for existing companies to predict future sales based on past business data over the past few years. Newly established companies need to make predictions based on unverified information such as market research to predict future business and competitive information. This research introduced a web base and stand-alone application solution for analysis day to day sales activities, analysis and sales process such as create Good received notes (GRN), accepts purchase orders, Invoicing, Return and Payment management, obtain analyzing reports. Analyzing and POS solution developed JAVA/SE, PHP and MySQL used for database. Develop this Solution research used Waterfall model. Currently this research design a sales analyzing solution. Revenue analyze provide insight as to how companies should manage employees, cash flows, and resources. In addition to enabling companies to effectively allocate internal capital, predictive sales data is important for companies seeking to acquire investment capital. With sales analyze, companies can predict achievable sales revenue, efficient allocation of resources & plan for future sales.

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Introduction

1.1 Prolegomena

This chapter gives an overview of the research. It describes a background of the research and a brief explanation on the proposed solution. Then, this research aims and objectives are outline. This chapter concludes with the outline of the remaining chapters.

1.2 Background and Motivation

Cloud-based sales analysis system and point of sale (POS) offer several compensation over more usual traditional POS systems, one of which is decrease in expenses, principally to tiny company owners. POS software is enduring to advance at a remarkable speed. It's expected you've noticed that the days of old, clunky cash registers are an item of the history [1]. Nowadays, vendors are leaning more towards enhanced modernize systems that work on smartphones and tablets, rather than compound systems that charge a big deal of money. Though, trade supplies aren't the only ones concerned in modern POS systems, a lot of ecommerce store merchants who trade their products at tradeshow, craft fairs, and farmer's markets also need easy-to-use, fewer costly POS solutions as well. This research project mainly focus to develop feasible retail circulation system and accurate sales analyzing system to Sri Lankan retail industry.

Inventory software programs now on the market let user to track usage, calculate when user need to reorder, and analyze inventory levels on an item-by-item basis. User can even control inventory right at the cash register with point-of-sale (POS) software systems.

POS software records each sale when it happens, so inventory records are always up-to-date. Better still, user get much more information about the sale than user could gather with a manual system. By running reports based on this information, user can make better decisions about ordering and merchandising.

Nowadays there are many Point of Sales (POS) programs systems that provides to use upload-on devices at checkout stations, which include credit card readers, electronic cash drawers, bar-code scanners and bill printers. POS applications regularly come with integrated accounting modules. Which includes bills payable, bills receivable, standard ledger and stock management systems. [2]

POS software is what element and mortar retailers use to conduct sales. It's sometimes a cash register, computer. Most POS software will also communicate with inventory levels to keep everything in balance. A lot of big box stores have wildly expensive POS solutions, some of which were custom built for their needs. Smaller retailers are moving away from these traditional POS systems and toward cloud based sale analyzing solutions.

Through a POS system: User able to analyze sales data, determine how well all the items on user`s shelves sell, and adjust purchasing levels accordingly. User can maintain a sales history to help adjust user`s buying decisions for seasonal purchasing trends. Furthermore User able to improve pricing accuracy by join in bar-code scanners and credit card authorization ability with the POS system.

1.3 Problem statement

When sales analyzing we found various unsolved problems such as complexity, not having proper connectivity between the customers, take long time to detect trends and patterns, not having proper plan to collect previous sales data, not considering territory sales information for retail analyzing.

Orange Electric dealer base is consisting of two categories.

- (i) Direct dealers
Dealers, who are dealing directly with Orange Electric Company.
- (ii) In-direct dealers
Dealers, who are dealing through a distributor.

Currently both direct and in-direct dealers are using an outdated and isolated POS solution handle their day to day sales. There are several identified issues such as;

- (i) High complexity.
- (ii) Less efficiency.
- (iii) Lack of proper payment handling process.
- (iv) Need to face stacks of difficulties when retrieving past reports.
- (v) Lack of proper sales tracking system.
- (vi) Lack of proper return management.
- (vii) Lack of report management

Due to those issues, Orange Electric management team has requested to build a whole new Point of Sales system and sales analysis solution. Therefore orange team has to develop a proper system by eliminating above mentioned issues.

1.4 Hypothesis

The hypothesis of this research is create cloud base analyzing and common dealer portal using PHP and related web technology for manage process and obtain centralized control.

1.5 Objectives

- (i) Identify present retail circulation process.
- (ii) Identify the problems of existing circulation process. Circulation process includes retail return, retail sales handling and the payment collections.
- (iii) A possible resolution is introduce to retail circulation.
- (iv) Identify the retail sales surmising process and issues of that process.
- (v) To find out each customer's returns, sales, payments and outstanding details monthly and yearly.

- (vi) Introduces accurate net sales predicting solution for the Sri Lankan retail industry
- (vii) Identify customer base, district base, area base (annually, monthly, and daily) sales and returns

1.6 Sales Analysis Based Approach

The proposed system would be consist of a web application. The web application would be developed using PHP server side scripting language JAVA-SE Platform and MySQL relational database management system (RDBMS) analysis use with hibernate ORM for the system database. Apache2 Server is use as web server to run this application.

In this application there are three types of users as administrators, Dealer and cashier users. The administrator role has system privileges to modify application user registration, manage master data, manage purchase order and goods received notes. The output of the system would be Report. Report is the formatted result of database queries and contains useful data for decision-making and analysis .Main application hosted on a cloud server which can be accessed any ware over Internet. The application provides administration interface. The user management module facilitate of user management tasks such as add, approve, disable, and update. All the management privileges will be given to the administrative users (Administrator) only. Finance and Audit users can generate sales report from reports area.

1.7 Structure of the Thesis

The rest of the thesis is organized as follows. Chapter 1 gives an overview of the research. And describes a background of the research and a brief explanation on the proposed solution.

This Interim Report is organized under main six chapters. Chapter 2 represents Present Learning of the Sales analyzing and Point of sale solution. Technologies Use for Developing Sales analyzing and Point of sale solution is discussed in chapter 3. Chapter 4 contains Technologies Use for Developing Sales analyzing and Point of

sale solution. Chapter 5 is representing Approach for Developing Sales analyzing and Point of sale solution. Finally in Chapter 7 describes the Implementation Process of Propose solution.

1.8 Summary

This chapter gave an overall picture of the entire project presented in this thesis. As such we described the background and motivation, problem definition, hypothesis, objectives and brief overview of the solution. Next chapter presents a critical review of literature on sales analysis solutions.

Chapter 2

Developments and Challenges in Sales Analyzing Systems

2.1 Introduction

Previous chapter gives an overview of the research. And describes a background of the research and a brief explanation on the proposed solution. In this chapter the first section will describes what sales analyzing is, the cause of it and who uses it. The later part is about practices to analyze sales and what impact errors and correctness has on an industry. For this purpose, the review of the past researches have been presented under three major sections, namely, early developments, recent developments and currently available systems.

2.2 Early Developments

While trying to manage with sales analyzing control it's miles essential that the fundamentals of sales analyzing is completely understood a separation of numerous components to sales analyzing can be made, and via that, get a clean photograph of what sales analyzing is, it's functions and uses, strategies for a way analysis may be produced, what indicators impacts the analysis and, possibly most importantly, what impacts mistakes in analysis have. With this separation, several aspects among the person and the manufacturer attitude are highlighted and easier to cope. Sales analysis is the best predict approximately customer demand for an enterprise's goods in a selected duration. How that is made relies upon on whether one using a qualitative or a quantitative approach. Its' cause is to, as correctly as viable, try and are expecting what quantity of products or services may be offered, and by means of doing that, try to lower the expenses for inventory and transportation. An analysis works as a control gadget and has almost the same attributes as a price range, even though there are

applicable variations among the two. An analysis may be expressed in each financial and bodily gadgets whereas a price range is expressed only in financial units [3]. An analysis can be for any length and has no longer a duty to satisfy the analyzed results. Similarly, an analysis is typically not authorized by way of senior management while the finance is. An analysis is updated as quickly as indicators show a change in the projection, which is not the case with the budget wherein there may be a greater useful resource-worrying technique with revisions. With regard to this, groups regularly use the call analysis rather than a revised price range. Another difference is that variances in analysis aren't periodically or officially analyzed [4]. An analysis is, while efficiently used, a fee-reducer, but except that it also works as a motivational, coordinating and controlling tool for humans involved within the system [5].

The hypothetical argument for why groups should use sales analyzing is to provide a prediction of what the future might be, and how the business enterprise can use these analysis to revise and put in force plans to acquire the proper results. Analysis are one device for control as they try to lower the role of threat whilst dealing with its surroundings [6]. A more scientific technique whilst coping with the surroundings, each external and inner, makes the analysis useful in specially conditions. Those are when the destiny is uncertain however factors affecting the business enterprise can be recognized and whilst there is a time lag among the incidence of an occasion and the attention of the same occasion. While the lead time of the notice of an occasion and the prevalence of its miles zero, there's no want for an analysis, or maybe planning [7]. The problem appears when the time lag turns into extra, then the want for an analysis to decide when an event will arise will increase, so that plans can be implemented and actions taken. In exercise, many agencies revise their analysis in preference to revising their plans whilst analyzed outcomes aren't high-quality. Armstrong means that analyzing strategies may be utilized by planners to expect results from opportunity plans [6]. Although analysis can be used for plans, studies emphasizes that analyzing most effective is beneficial while the techniques and methods used are implemented to an enterprise's selection-making and making plans techniques. It is emphasized that a strong bridge between the theories and the sensible use in an employer is needed for a green use in management situations [8].

A separation of analysis from plans and goal-putting, expand the possibility of successful analyzing. Whilst the analysis is attempting to give an image of what the future might be and the goal-setting units up consequences, which the company wishes to attain, the operational plan is making an attempt to articulate how the company gets to the preferred consequences. Smaller companies use sales analyzing for personnel making plans more frequently, whilst massive companies use it extra common in element to income quotas putting and in purchasing making plans [6] and [10]. The operational plans on what sales level to reap need to be primarily based on the analysis. Likewise with target-putting, a real evaluation of what sales degree is possible to acquire must be conducted where this evaluation comes from the sales analysis. In step with white's survey, the primary purpose the various respondents, behind training sales analyzing, is to set a statement of preferred performance [9]. Within reach one third of the respondents wanted to derive a real assessment of the marketplace capacity.

The sales analysis units a supposed upcoming sales capacity, which offers indicators to the shopping, the production, the logistical, the monetary and the advertising characteristic of a corporation. When the organization has a bendy value chain, analysis errors can effortlessly be outfitted into, and altered inside, the cost-chain. For an enterprise with a rigid value chain the significance for a greater accurate sales analysis is greater. In thing to this, the useful resource planning may be made more efficiently in a business enterprise if the restrictions of sales analyzing accuracy are understood. Those boundaries have historically fallen into four standards which highlight the realistic angle of analyze as input for managerial decisions. They specify that analyze need to be express, honestly state their reason, the underlying assumptions and the meant use for managers so as for them to be beneficial for an employer. Mostly smaller organizations use sales analyzing for individual planning, though massive organizations use it more frequent in aspect to sales quotas setting and in purchasing planning [11]. The time horizon for analyzing differs among each groups and one-of-a-kind industries. However whether the business enterprise analysis sales on an every year, month-to-month or maybe on a day by day basis it's miles critical that the analysis is frequent in order for the enterprise to make the analysis useful for the future. Most commonly used monthly basis time period for

producing analyze [12]. Whether organizations use dissimilar analyzing methods for different time horizons is still not certain, but agreeing to the above mentioned study, the more distant the time horizon gets, the fewer models will be trusted and used. Those records are from a survey made on Canadian companies and might consequently not be significant for companies worldwide. A value evaluation is a beneficial tool whilst figuring out the timeliness of analysis inside the organization. A consistent analyzing agenda value cash and if they're now not carried out efficaciously, the price will exceed the blessings and it'll consequently no longer prove to be a beneficial investment. Even though the analysis are made in an excellent way there may nonetheless be problems [13].

2.3 Existing System Analysis

Sales Management System

The Orel Cooperation's orange electronic business unit is currently using few standalone and web systems for the inventory management and the sales management. Where sales process is recorded on documents and manually feed into the information system. The major drawback of this system is the inability of updating stock with the current sales process it is unable to track customer details for the sales person on the field. There is no way to get sales information on the areas. As the sales management system and inventory management system work separately. Therefore, it needs more individuals for the data entry process so cost of maintaining the systems is very high and this process consumes more time. All systems unable to access everywhere and no centralized controlling facility.

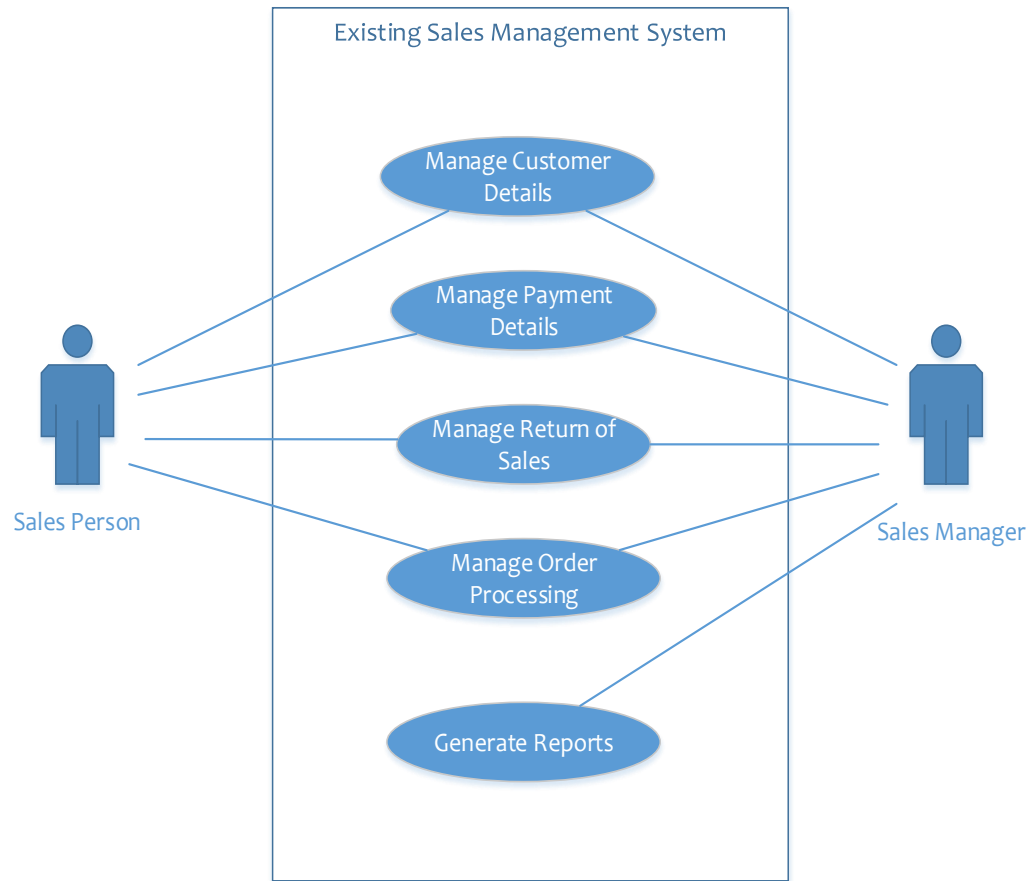


Figure 2.3.1: Existing Sales Management System

As the diagram all the sales process is currently processing with printed documents manually. And they have to visit the sales department and hand over the documents. All documents are archived in racks. If they need more information about sales they have to contact over the phone and get the required information. This process takes more time and operation costs.

This system keeps track of customer details and capable of handling payment details as well as return on sales are entered manually. A lot of the information is duplicated on various information systems. It is difficult to get immediate and maintain.

Inventory Management System

Inventory control system is a standalone application which is very useful and the important system in the sales point and organization. It is capable of handling all the product details and helps to track the storage location of the relevant product and so on. This inventory management solution helps to get an idea about product movement and notify the re order when it near to reorder level

Number of suppliers, services, goods received notes, purchase orders and invoice, the standalone system keeps track of suppliers and manages the purchases. It should generate timely reports to manage stock effectively.

The following Use case diagram illustrates the existing system in the organization.

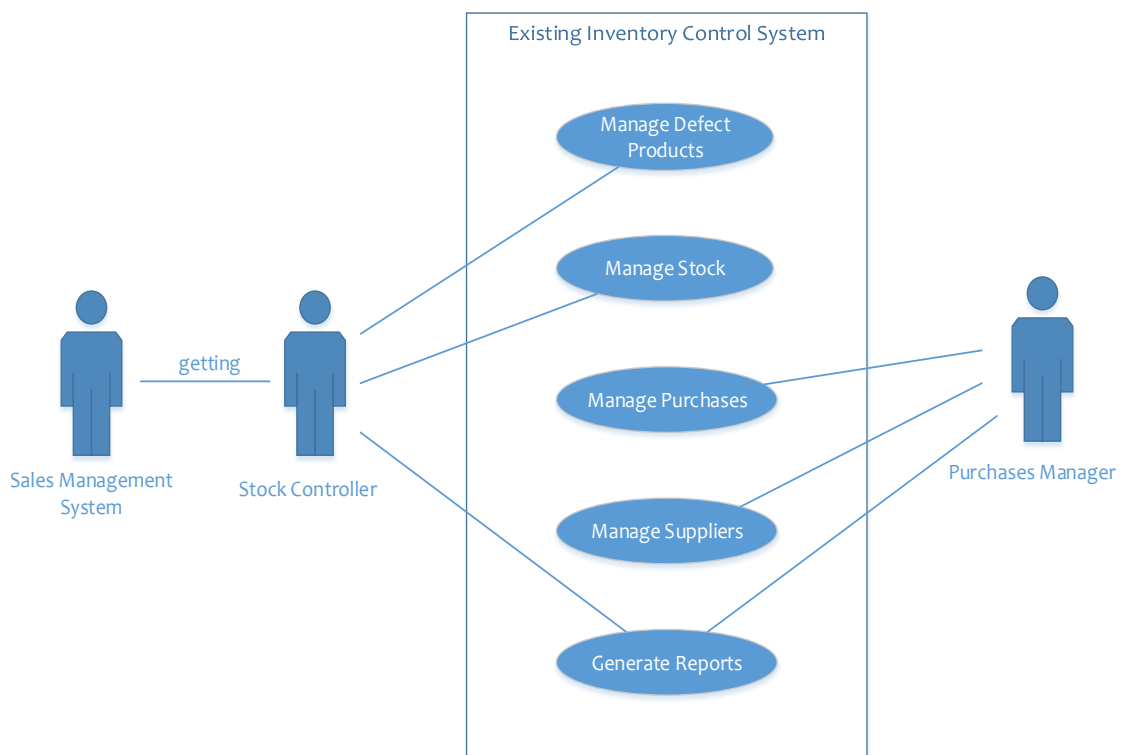


Figure 2.3.2: Existing Inventory Control System

2.4 Functional Requirements

Functional requirements are statements that the developed system should satisfy. System function and the input output expectation.

2.4.1 Reports Module

The system should generate reports periodically related to sales, purchase, and stock. It also allow user to print the reports and documents.

2.4.2 Administration module

The system manages all the system users according to their privileges. By using the system admin should be able to add new users to the system as well as remove from the system. Manage the recovery of the password.

2.4.3 Sales Module

- Item Search
Authorized user can search items by using their item codes and add them to the bill.
- Discount management
 - Customer wise / Item wise discount hierarchy
 - Discount management on percentage wise and cash wise
 - Item discounts (only percentage wise)
 - Total bill discounts (percentage and cash wise)

The system will let authorized person give either total bill discounts or item wise discounts.

- Item updating

From this feature, the user can delete, edit item quantity and add new items while they are proceeding the bill.

- Customer return handling
- Payment methods
 - Cash payments
 - Credit payments
 - Cheque payments
 - Card payments

2.4.4 Purchase Order Module

Proposed system can proceed two kinds of purchasing orders.

- **Orange purchase order**
 - Direct purchase order

This category is designed for direct dealers to handle their purchase orders.

- (i) The dealer can place the order by sending purchase orders directly to the orange
- (ii) Proposed solution will generate auto-suggestion orders.
 - Indirect purchase order

This category is designed to generate purchase orders for non-Orange distributors.

Distributor will receive their ordered quantities by System notification

- **Non-Orange purchase order**

2.4.5 Good receive management

When proceeding this function it will affect for three different parties

- (i) Direct Orange dealers

The system will update their good receive notices automatically.

For Orange products and services,

Only for Orange products, company's ERP system will send a GRN against dealer's PO and it will automatically direct for dealer approval. After receiving the stock dealer will approve the GRN, at the same time proposed POS system and Orange ERP system will update with GRN details.

- (ii) In direct non-Orange dealers
Authorized person needs to enter their good receive notice details manually.
- (iii) Direct good receive
Without purchase order reference dealers can add items as GRN and do billing. This is only applicable for non-orange items.

2.4.6 Company return management module

The dealer will return their received goods for their suppliers for many reasons. Therefore the proposed system will let the user (dealer) to handle their company returns in a proper manner.

2.4.7 Inventory Module

Proposed solution will provide a proper inventory management function to the company. As well the user can do batch wise item management along with its price and it will synchronize Orange products from the dealer portal.

The system should provide stock details when necessary.

Sales person should be able to get available stock information instantly.

2.4.8 Customer & User and employ management module

The proposed system will provide a proper credit and register customer management function.

- (i) Register new customers.
- (ii) Give credit limit and credit period for registered customers.

Authorized person can set credit limits for their customers. If a customer exceeds the credit limit, they need to get approvals for further purchases.

- **Manage employee information**

The proposed system will provide a proper employee management function for their users.

- **User management**

- Add system users
- Modify system users
- Active or deactivate system users

- **Debtor management**

Proposed solution will help to manage company debtors. Add and update debtor details and cash collection of (cash, card and cheques) debtors.

2.4.9 Reports Module

- Daily sales reports
- Summary reports
- Inventory report
- Purchase order report
- Profit and loss report
- Customers detail report

2.5 Non Functional Requirements

Non-functional requirements are not the direct services delivered to the user. It will change according to the domain that the system operates, some common requirements are reliability, performance, security, availability and it is more important to accomplish these requirements to use the software effectively, if these non-functional requirements are not fulfilled then the system will be a failure.

- This is a cloud based system so there are multiple users can access the system at a time so the system should be capable of handling high traffic.
- The system should secure from hacker, intruders because it handles the transactions.
- Information should be access from the remote areas, with the low bandwidth.
- System should customize according to the authorized level of users.
- System generated reports should more reliable and accurate.
- Cloud system is compatible with popular web browsers both mobile and desktop

Ex. Firefox, Google chrome, Safari, and Opera. Also, system should have responsive UI design

- Need best performance Cloud system shouldn't go beyond 10 seconds
- Ensure grant system access only authorized system users. When the user cratering enforce users to create strong user password and that password save in database with sha1 or higher encryption method for secure users data.
- Add password expire policy within time period usually 3 month.
- System need to facilitate manage user wise permissions only authorized users to enable create edit delete process. And secured transaction with web server and database server
- System available should high 99% uptime through the internet for all remote users. Company Network infrastructure fully support the high availability and high traffic tolerance for huge user and web service request.

2.6 Future Challenges

There can be some challenges have to face when sales analyzing. Such as,

(i) Large-scale automatic analysing

The goal in any commercial enterprise is to have the proper product in the right location at the right time – and in an appropriate amount. A massive retailer may also have tens of tens of millions of item combinations. This automation minimizes staffing requirements, while allowing analysers to focus on the "high cost" analyses which have the best impact on customer pleasure and economic performance

(ii) Analysing and sales optimisation

Revenue optimization structures help the retail planner make better choices on normal product pricing, promotional activity and markdown pricing. Such systems are designed to optimize a goal (e.g., maximize revenue, maximize margin or decrease stock)

2.7 Problem Definition

The literature review has identified various unsolved problems such as complexity, not having proper connectivity between the customers, take long time to detect trends and patterns, not having proper plan to collect previous sales data, not considering territory sales information for sales analyzing. Table 2.1 summarize the achievements and the limitations of the key research projects discussed in this chapter.

Research	Technology/ Algorithm used	Key benefits	Limitations	Domain
Sales analyzing Practice	Fuzzy Neural Back Propagation (FNBP) Algorithm	Decreasing the error rate of analyzing	Complex algorithm	Sales analysis
Sales analysis of retail industry	Multiple regression technique.	Intensification the accuracy of analyzing result	needs to consider a long time to detect trends and patterns	Retail Industry
Time Series Prediction: Analyzing the future	State-space reconstruction and neural networks	Observed system and for predicting its future behavior	Take long time to get sales information in territory sales	Sales prediction
The Analyzing Accuracy of Major Time Series Methods	Time Series Analysis	Provides the business with valuable information that the business can use to make decisions about the future of the organization	There are no close contact with customers and the how the business environment is now	Analyzing Accuracy
Sales analyzing: Methods and accuracy	Regression analysis	Allows for the right resources to be allocated at the right time	Not having proper plan for collecting the previous sales data	Methods and Accuracy

Table 2.7 Summary of key researches

According to the above summary it is evident that many reaches has been done with different technologies.

2.8 Summary

This chapter presented a comprehensive literature review on the POS solutions and Sales analyzing System research. Next chapter will discuss the technology to be used for our solution.

Technology & Tools Adopted for Cloud Based Sales Analysis System

3.1 Introduction

This chapter mainly concerns about technologies and software engineering tools that use for developing the POS solutions and Sales analysing System. Mainly used JAVA and PHP language for developing client side and server side the System and Maria DB Relational Database Management System (RDBMS) with HIBERNATE ORM framework for the POS module database. Apache2 Server is used as a web server to run web applications. Cloud analysis module developing in larval 5 PHP framework

3.2 Java Programming Language.

Java is a programming language and computing platform first released by Sun Microsystems in 1995.[14] Now a day's java is very popular multiplatform programming language. Java evolved from an oak programming language. Java allows to create modular maintainable applications and reusable code. Java SE (standard Edition) chosen for cloud base sales analysis sales module development because java has follow mentioned features and advantages.

Java programming language has many advantages such as,

- Easy to learn-Java was designed to be easy to use and is therefore much easier to write, compile, debug, run and learn than other programming languages.
- Object-oriented- there are plenty of programs and websites so as to no longer work except you've got java set up, and extra are created every day. Java is fast, at secure, and reliable.

- Platform independent- one of the most important benefit of java is its capability to move easily from one application to another. The ability to run the equal code on many unique structures is critical to www, and java succeeds at this by being platform-independent at the source and nearly binary ranges.
- Distributed- Java is designed to make expended computing clean with the networking capability this is inherently integrated into it. Writing community programs in java is like sending and receiving statistics to and from a document.
- Secure- Java considers safety as part of its design. The java language, compiler, interpreter, and runtime surroundings were each developed with security in mind.
- Robust means reliability. Java puts a number of emphasis on early checking for feasible errors, as java compilers are able to detect many issues that would first display up all through execution time in other languages.
- Multithreaded -Multithreaded is the capability for a software to perform several duties concurrently within an application. In java, multithreaded programming has been easily integrated into it, at the same time as in other languages, operating system-specific procedures have to be called in order to enable multithreading.

3.3 PHP Server Side Scripting Language.

PHP originally called Personal Home Page but now it's called PHP Hypertext Preprocessor[15]. PHP is an open source server side scripting language with embedded with HTML. It's used to create dynamic web pages. PHP is originally created by Rasmus Lerdorf in 1994 and current major version is PHP5 [15]. PHP programming language has many advantages such as

- Embedded with HTML through PHP special tags there for developers can used both HTML codes and PHP codes in one interface. Its helps to reduces number of codes in HTML.
- Codes are executed on the server therefore, client cannot see the PHP source code.
- Can communicate through network by using IMAP, SNMP, NNTP, POP3, and HTTP.
- High performance language that can save millions of hits per day by using single inexpensive server
- Provide interfaces to integrate many database systems apart for MySQL such as Oracle, PostgreSql, etc; in addition using ODBC user can connect any other databases that support ODBC driver. Therefore, Microsoft products also used in PHP
- Have many built in libraries that help to performing many web related activates. Such as send emails, generate PDF documents, etc;
- Can download by free of charge
- Easy to learn.
- Strong object oriented support language.
- Support many operating systems therefore, any application written in PHP works many operating systems without any modification.
- Source code freely available therefore developers modify or add to the language.

Consider above advantages this research used PHP scripting language for develop the web base Circulation System.

3.4 Hibernate Object Relational Mapping (ORM tool)

Hibernate is an object-relational mapping (ORM) tool. Object-relational mapping or ORM is a programming methodology for mapping the objects to the relational version wherein entities/training are mapped to tables, times are mapped to rows and attributes of times are mapped to columns of desk Hibernate is grate java object

relational mapping tool below reasons describes the reasons why select hibernate for the HIBERNATE sales module development.

- No need worry about database structure because hibernate all database tables and relations when we run application first time. After that it automatically change database structure according to java entity. This help manage database versions time to time.
 - Hibernate is free and open source tool developed under general public license.
 - Hibernate both support native query language and hibernate query language (HQL) this allow to use full of features provides in database system.
 - Hibernate has dual layer architecture cache architecture and it high scalability
 - Hibernate can easily configuration with the connection pooling facility. For multiuser access environment.
 - Hibernate supports relationships like One-To-Many, One-To-One, Many-To-Many-to-Many, Many-To-One. This will also supports collections like List,Set,Map (Only new collections)
 - Hibernate has capability to generate primary keys automatically while we are storing the records into database
 - Hibernate has its own query language (HQL), i.e. hibernate query language which is database independent. So if we change the database, then also our application will works as HQL is database independent
 - Supports caching mechanism.
 - Supports annotations, apart from XML
- Consider above advantages this research used Hibernate framework for develop the Point of sale application.

3.5 About APACHE2

Apache is the most widely used web server software. Developed and maintained by Apache Software Foundation, Apache is an open source software available for free. It

is fast, reliable, and secure. It can be highly customized to meet the needs of many different environments by using extensions and modules. Apache2 has many advantages such as,

- Apache Web Server is open source software and free
- Apache is compatible with numerous hardware configurations and operating systems
- There is a LOT of documentation about apache installation and configurations.
- Lightweight and powerful webserver.

3.6 About Maria DB

MariaDB is a fork of the MySQL relational database management system developed by the community and it is made available for free under the GNU General public license it is worth noting that concerns about Oracle's acquisition led by MySQL's original developer. Contributors need to share copyrights with MariaDB Foundation. MariaDB maintains high compatibility with MySQL, We guarantee "drop in" replacement function by library binary equivalence and exact match of MySQL API and commands.XtraDB storage engine for replacing InnoDB,

We aim for both Aria, a new storage engine, Perhaps included in a future version of MySQL is a transactional, non-transactional engine.

Features of Maria DB,

- A bunch of third-party storage engines
- Various performance enhancements
- Parallel replication and multi-source replication
- Virtual columns
- Free and open source DBMS

3.7 Software Tools Adopted for System

- **GRADLE** - GRADLE is a build automation tool that system is developed using the concept of Apache Maven and Apache Ant, maven is a dependency manager. Ant is a build tool. Gradle include both dependency

management and build automation features with lots of more other features. As a build and dependency manager gradle can use with sales analysis sales module.

Advantages of GRADLE

- No need worry about dependency -: not need manually add java library for application and don't worry library versions.
- Able to build project without IDE
- Facilitate to set pre configuration of the system.

- **GIT** - Software Version control is more important in the development environment. GIT is a very useful source code version control system. A Version control system that helps to manage different version of source codes and development history time to time. GIT creates remote (GIT server) and local (programmer's computer) repository of the source codes. GIT branching and margin are very useful features of the project development environment.

- **Navicat** - Navicat is a Rich graphical user interface based database management and development application. Navicat supports a series of database engine. For Revers engineer provided database script to entity relational diagram and re-synchronize after make amendments Navicat is good tool.

- **SmartGIT** - Smart GIT is a GIT client witch is help to easily select updated content of the source code. Smart GIT has all GIT it functional GUI represent such as Commit, pull, push and managing branch easy way.

- **Bit Bucket** - bit bucket is an online git repository solution it's same like Github but it allows to create free privet repository with small teams. Bit bucket can use for manage this project source code.

3.8 About LARAVAL

Laravel is a free, open source PHP web framework. It is created by Taylor Otwell and is aimed at developing Web applications that follow the MVC (Model-View-Controller) architecture pattern. Among the features of Laravel are modular packaging systems with dedicated dependency managers, various ways to access relational databases, utilities to aid deployment and maintenance of applications

Laraval has many advantages such as,

- **Template Engine**- The Laravel framework includes a lightweight template that allows you to create amazing layouts with dynamic content seeds. It has many widgets including JS and CSS code with solid structure. These framework templates are designed to create simple layouts in different sections.
- **Artisan**- Developers usually have to interact with the Laravel framework using a command line that creates and processes the Laravel project environment. Laravel has a command line tool called Artisan built in. With this tool you can perform most of the iterative and tedious programming tasks that most developers avoid running manually.
- **Ellquent ORM (Object-Relational Mapping)** - Laravel provides Eloquent ORM including a simple PHP Active Record implementation that can issue database queries using PHP syntax rather than writing SQL code. Each table of the database has a corresponding model for the developer to interact with the table. ORM is relatively faster than all other PHP frameworks.
- **Library**- This has an object-oriented library and other preinstalled libraries that cannot be found in many other common PHP frameworks. One of the pre-installed libraries is the authentication library. It is easy to implement, but it has many advanced features such as Bcrypt hash, active user check, CSRF (cross site request forgery) protection, password reset, encryption,

- **MVC architecture support-** Laravel follows the MVC pattern and guarantees the clarity of logic and presentation. This architecture helps improve performance, enables better documentation, and has multiple built-in functions.
- **Security-** When developing an application, everyone needs to use several methods or other methods to ensure the security of the application. Laravel is in charge of security within that framework. This uses a salted and hashed password, which means that the password is not saved as password and plain text in the database.

3.9 Summary

POS solutions and Sales analyzing System is developed by using PHP server side scripting language JAVA-SE Platform and MySQL relational database management system (RDBMS) analysis use with hibernate ORM for the system database. Apache2 Server is use as web server to run this application. Circulation department staff of the company is main user of this system. In addition management, accounts department, audit department is other users of this system. Mainly this system has two separate sub modules such as Sales Management and analyzing reports engine. In addition this system maintains Dealer, products and products category master files that include master information.

Chapter 4

Analysis of Cloud Base Sales Analyzing System

4.1 Introduction

In chapter 3, we will explain techniques for solving research problems. We follow the technology used to solve research problems such as JAVA, PHP, HIBERNATE (ORM TOOL)

APACHE2, Maria DB, LARAVAL. In this chapter explains how technology is used to solve research problems.

4.2 Hypothesis

The hypothesis of this research is build cloud base analyzing and common dealer portal using PHP and related web technology for manage process and obtain centralized control.

4.3 Users

There are three types of users as administrators, dealer and cashier users. The administrator role has system privileges to modify application user registration, manage master data, manage purchase order and goods received notes.

4.4 Input

Initial master data such as products, category, dealers account is added to the application through the admin panel.

4.5 Output

The output of the system would be Report. Report is the formatted result of database queries and contains useful data for decision-making and analysis.

4.6 Process

Main application hosted on a cloud server which can be accessed any ware over Internet. The application provides administration interface. The user management module facilitate of user management tasks such as add, approve, disable, and update. All the management privileges will be given to the administrative users (Administrator) only. Finance and Audit users can generate sales report from reports area. This System use web services to synchronize data with dealer point of sales system.

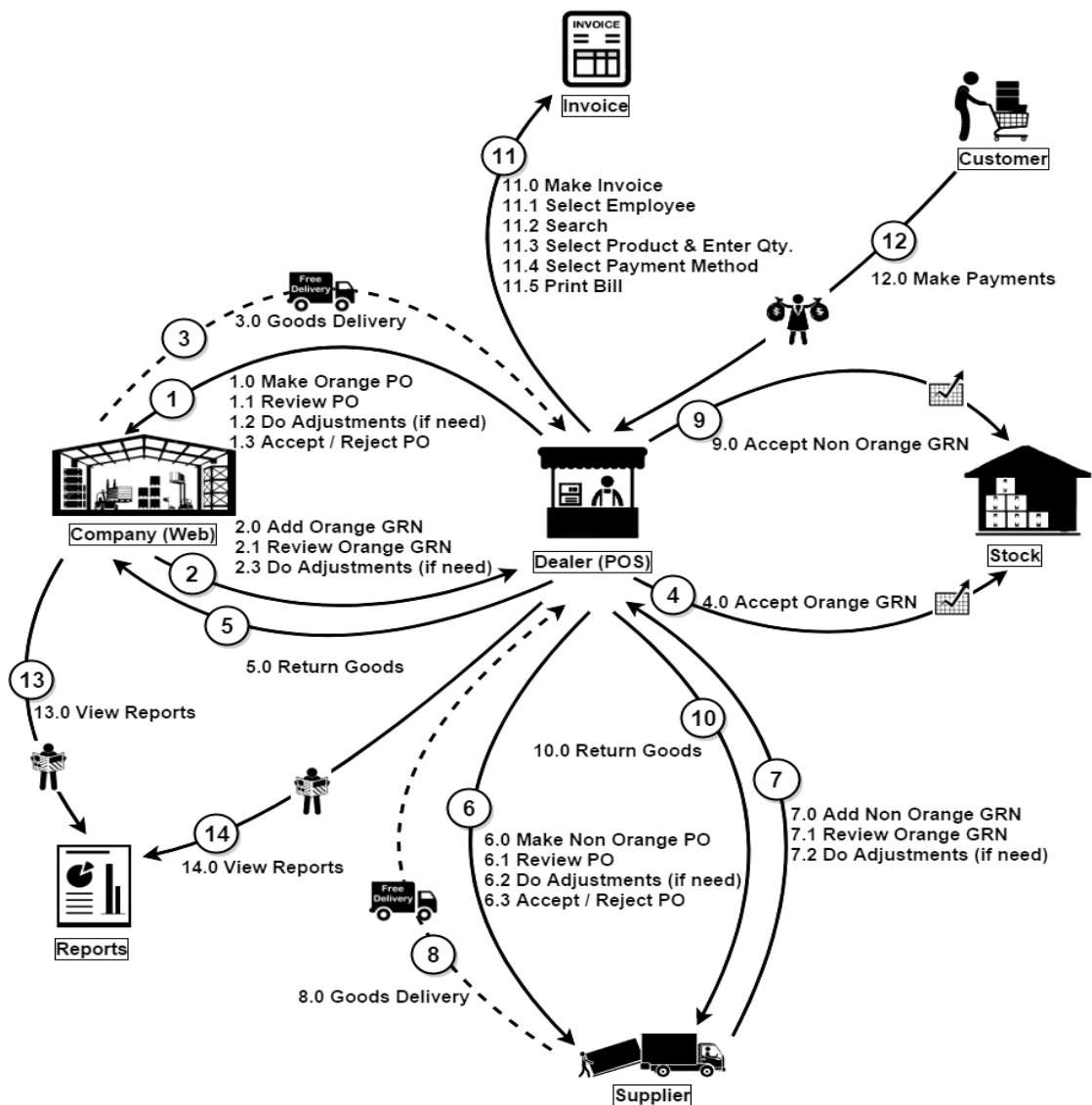


Figure 4.6.1: Rich Picture of the system

4.7 Features

In connection with the input, output, users and process, the over features of the system include following characteristics.

- Cloud Portal
- Standalone point of sales application.
- Real-time data synchronization.
- User friendly
- Easy accessibility
- Centralized controller.

4.8 Summary

This chapter presented the overall approach to develop POS solutions and Sales analyzing System. Can be developed using open source web technology and Android technology. Next Chapter will discuss the overall design of POS solutions and Sales analyzing System

Chapter 5

Design of POS solutions and Sales analyzing System

5.1 Introduction

This chapter will describe detailed and specific requirements of the project. And also will explain the initial situation of the system with reference to requirement analysis, project goals and the way of the design of the system to be carried out based on the requirements.

5.2 Top Level Architecture

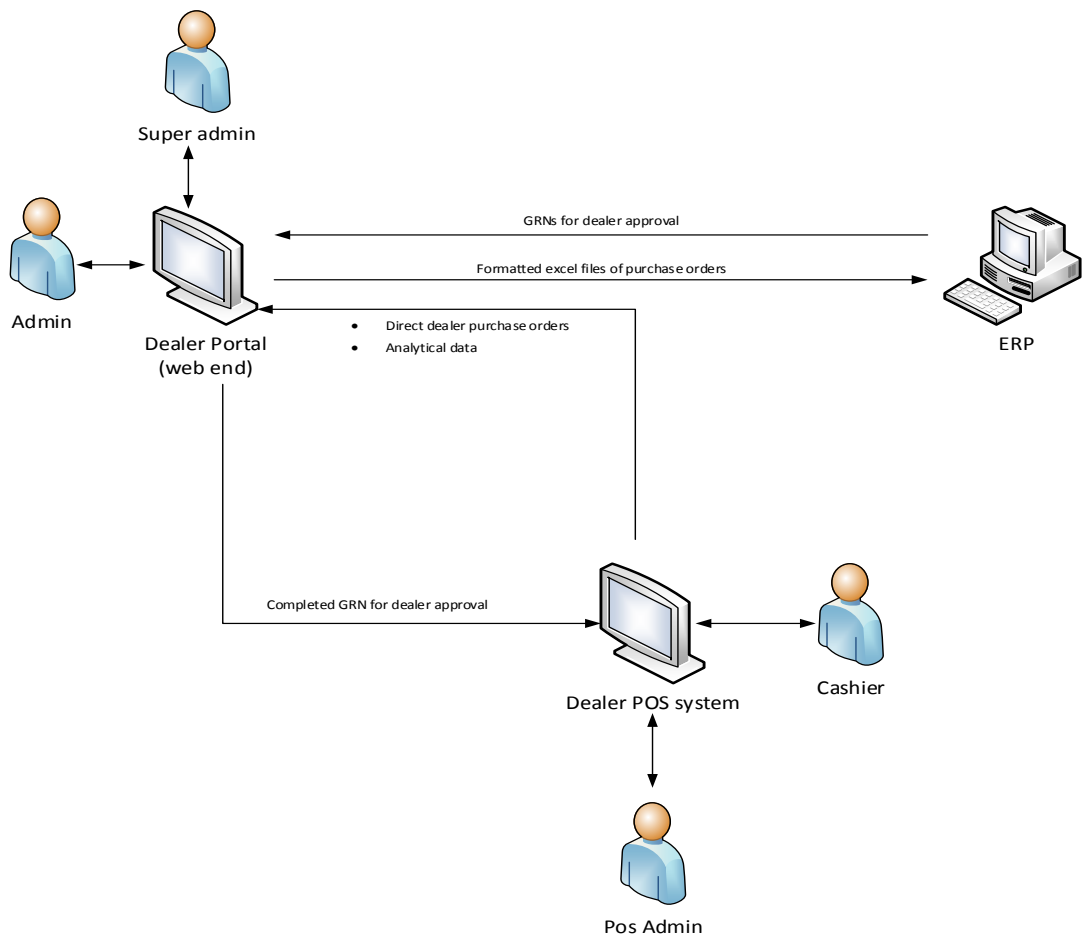


Figure 5.2.1: Top level architecture

POS solution is stand-alone application and sales analyzing system is a cloud web based web application. MySQL use for database. This system has two main modules such as

- Point of sale application
- Analyzing module

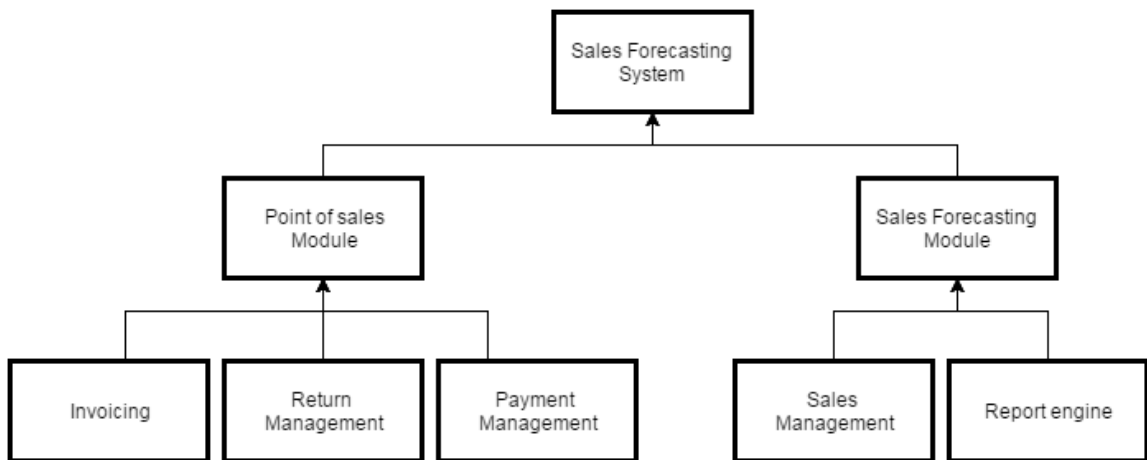


Figure 5.2.2: Main Architecture

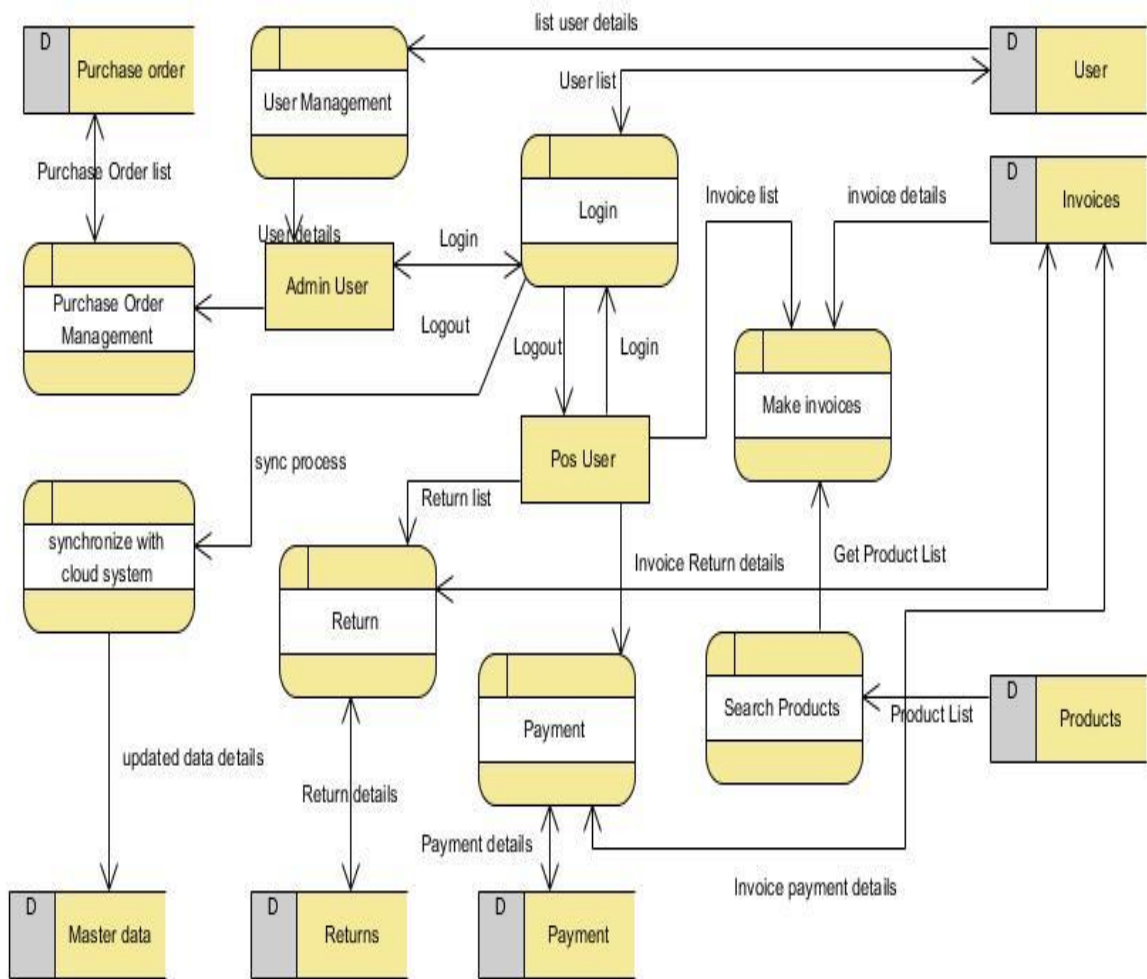


Figure 5.2.3: Top Level Design for retail

The class diagram of the system is shown below

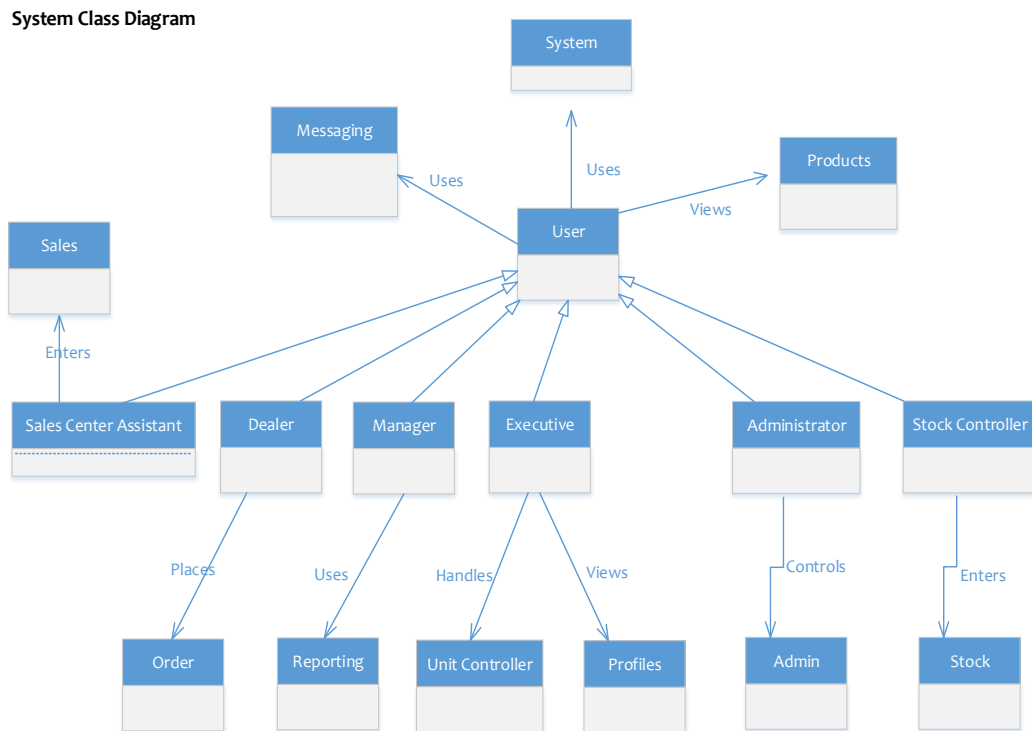


Figure 5.2.4: System Class Diagram

In below figures provides an overview of the database structure. It has been normalized to third normal form to reduce the redundancy of data.

There are two database structures,

- (i) Cloud base Sales analysis module Database (Web application)
- (ii) Point of sale solution Database



Figure 5.2.5: Cloud base Sales analysis DB Structure

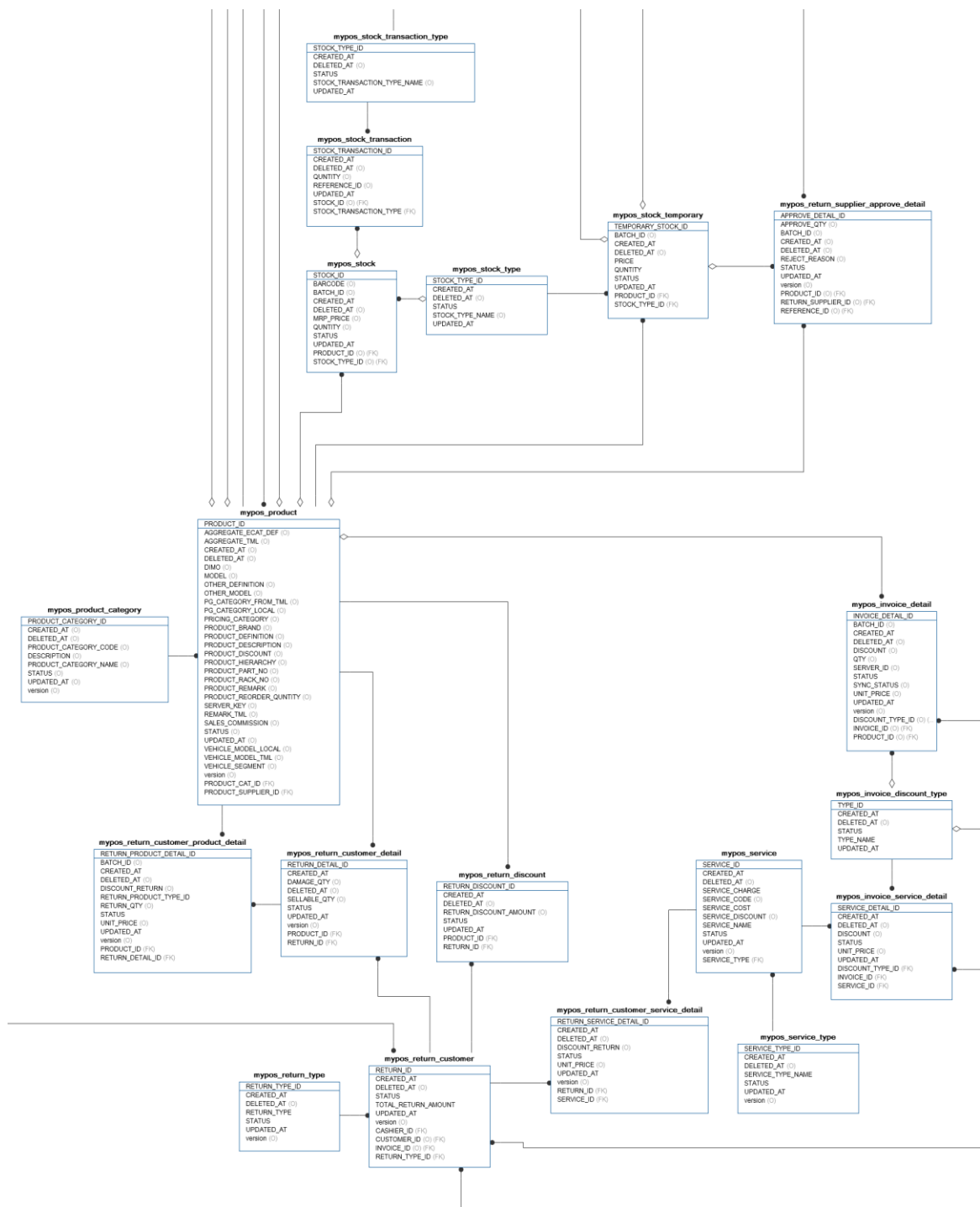


Figure 5.2.6: Point of sale DB diagram

5.3 Design Architecture

5.3.1 Process Models

Software development involves a set of methodical tasks, activities. The development includes some steps such as analysis, design, implementation, Testing, delivery and maintenance. It is described as SDLC (System development life cycle or Software development life cycle).

There are numerous processes that can be used in software development such as Waterfall Process, Iterative Process, Agile Software Development, Extreme Programming, Rational Unified Process and Rapid Application Development are most commonly used process models.

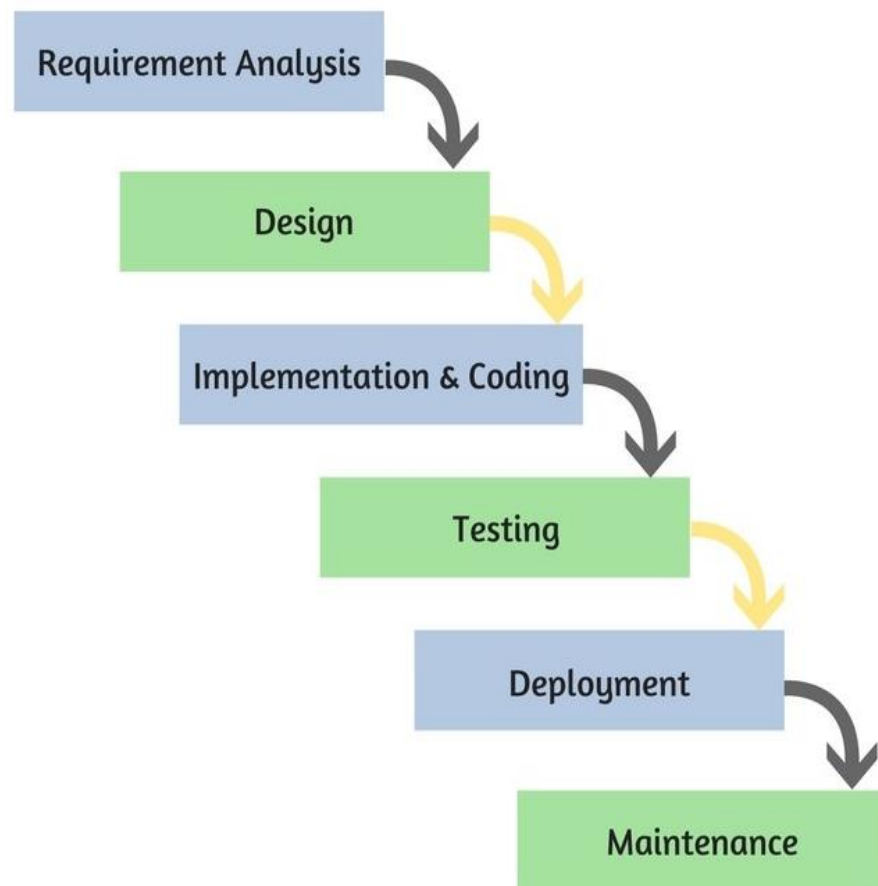


Figure 5.3.1.1: Waterfall model

Object Oriented Analysis and Design

(OOAD) is a way of representing a domain in terms of entities (Objects) composed of verbs and nouns matched or classified according to functional dependency. This analysis and design method creates a set of models, communicated to others via an agreed notation, such as the Unified Modeling Language (UML). OOAD applies object-modeling techniques to analyze the requirements and to design a solution for improving the processes involved. Most modern object-oriented analysis and design methodologies are use ease driven across requirements, design, implementation, testing, and deployment

Design Techniques

The two main design techniques are object oriented and structured approach. Structured approach mainly follows the software development life cycle and focuses on the processes. Since the object oriented approach uses iterative and incremental way it was used as the design approach for the project.

RUP model was decided to be used in the project. It consists of four phases Inception, Elaboration, Construction and Transition. The UML diagrams were used for the design of the system.

5.3.2 Alternative Solutions

The Client specifically needs a Web based System since the users need to use the system from multiple locations all over the region so there is no need of for a Standalone System.

As well as the system should be available 24 hours and provide up to date information. The alternative solutions would be implementing a Web based System to fulfil the need of the Client.

Acquiring an off the shelf POS Software is not suitable since the client has its unique requirements such as Product management, Order management and Stock management. This may lead to unnecessary functions at a high of cost.

5.3.3 Process Models System Architecture

The architecture used for the system is MVC architecture representing ‘model, view, and controller’ as shown in figure 3.1. The interface pages are located in the view and the interaction with the database is done through the model. The controller receives the web request and updates the presentation at the view and update data through model.

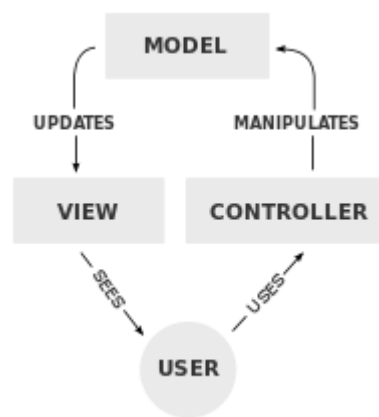


Figure 5.3.3.2: MVC Architecture

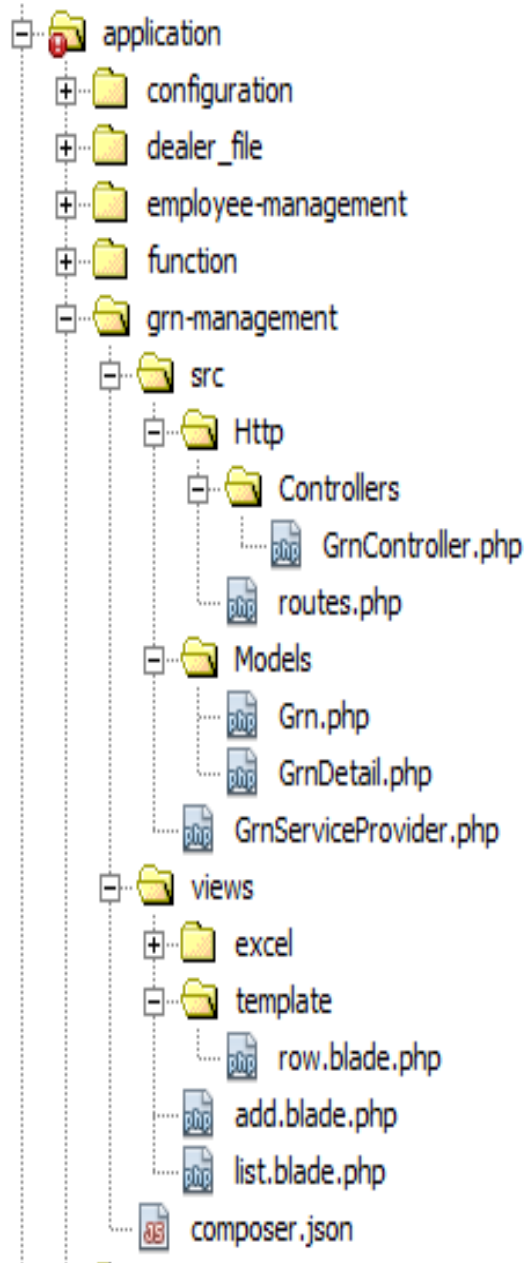


Figure 5.3.3.3: Web application MCV architecture

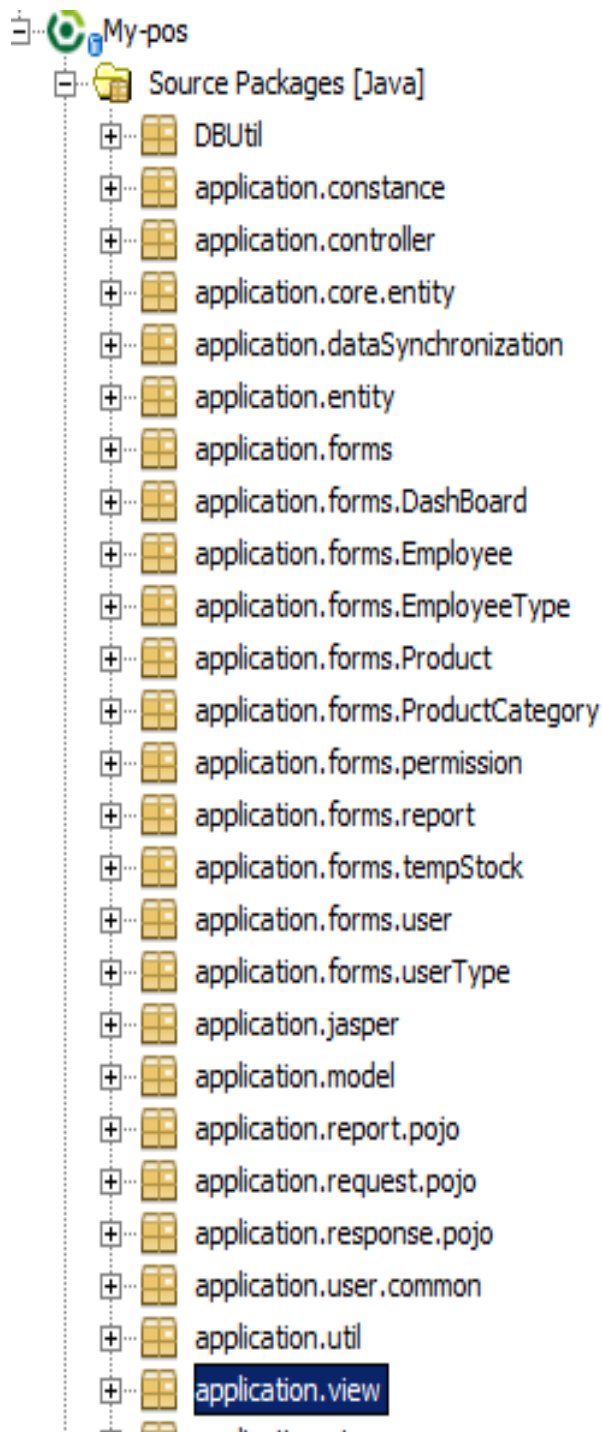


Figure 5.3.3.4: POS application MVC Architecture

5.4 Sales analysis system High level Use case diagram

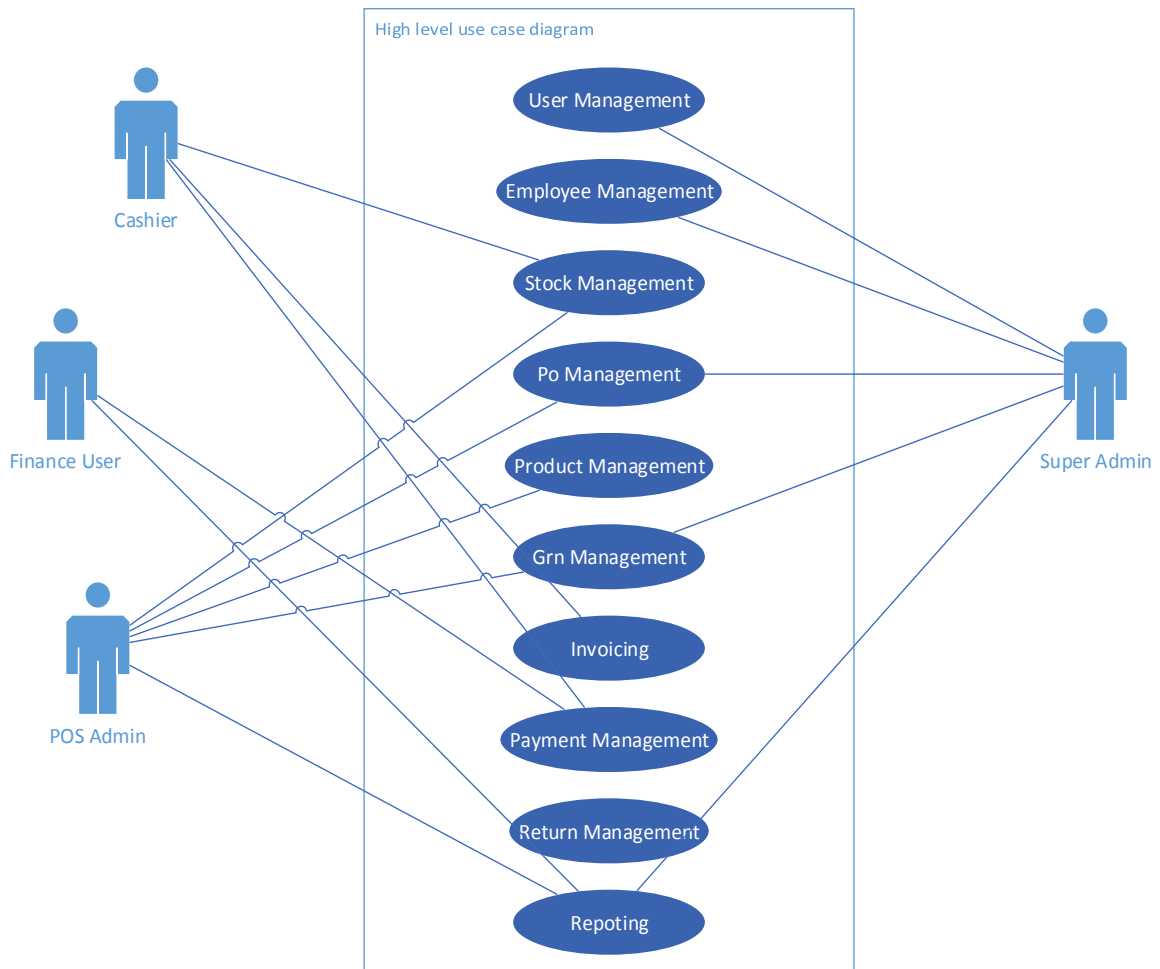


Figure 5.4.1: High level Use case Diagram

Usually four main persons are given access to the system. The dealer is provided user access and permissions to the system. Executives provide access to maintain and monitor personal information, product registry, invoicing, and payment, return unit amount controlling and messaging.

The stock controller is provided access primarily to record and keep track of the inventory. The dealer, the executive and the stock controller will all be the front end system users.

The back end system users will be the orange Administrator and the Finance, Sales officers who will be accessing the system to extract information and update system data. Also Sales officers can manage purchase order and GRNs.

5.5 Use Case Diagrams & Activity Diagram

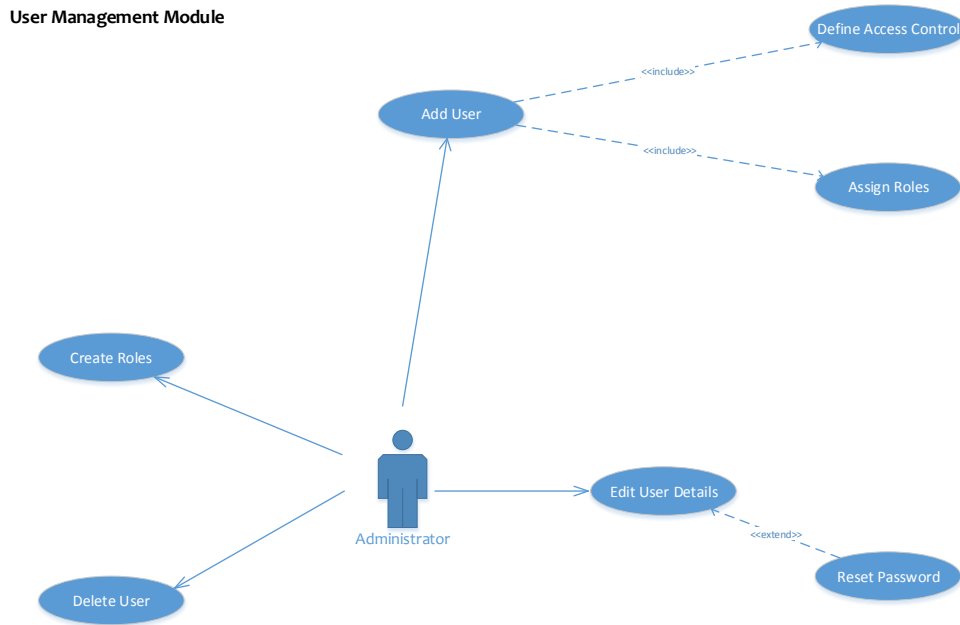


Figure 5.5.1: User Management Module

An overview of the user management module of the system has been laid out in above 5.5.1 figure.

The administrator has privileges to create and add users, edit and delete users. The administrator will also be responsible for any password re-sets. To create, add, edit and delete users the administrator will require the authorization from the department head. This would ensure governance around the system and avoid unnecessary user being added to the system. Such an authorization would also ensure that the data which the system holds will only be available to those who require this information.

The case diagram in figure 5.5.2 below lays out the customer Management Module.

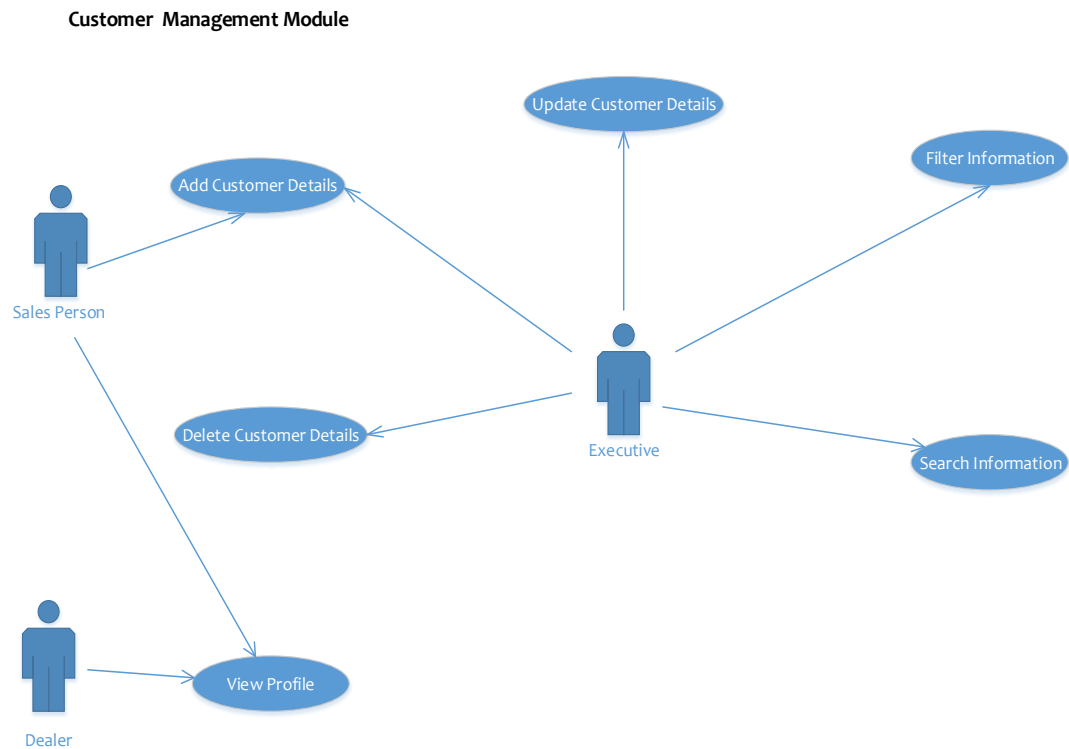


Figure 5.5.2: Customer Management Module

Sales Persons at the Center, Dealers, Executives and Regional Marketing Managers will have read only access to personal information. This would allow filter information by each dealer or sales agent for the purpose of analysis of performance, and commission payment. It would also allow identify any trends by region since the each dealer and sales agent will be allocated a region in which they make sales. The Regional Marketing Managers and Executives will be provided access to filter and download reports as back end users whereas the dealers and sales persons will be provided front end access to update information. These front end users will only be able to view their personal information such as the sales made and will not have access to information of other sales persons.

Figure 5.5.3 below provides an overview of the Product Registry.

Product Management

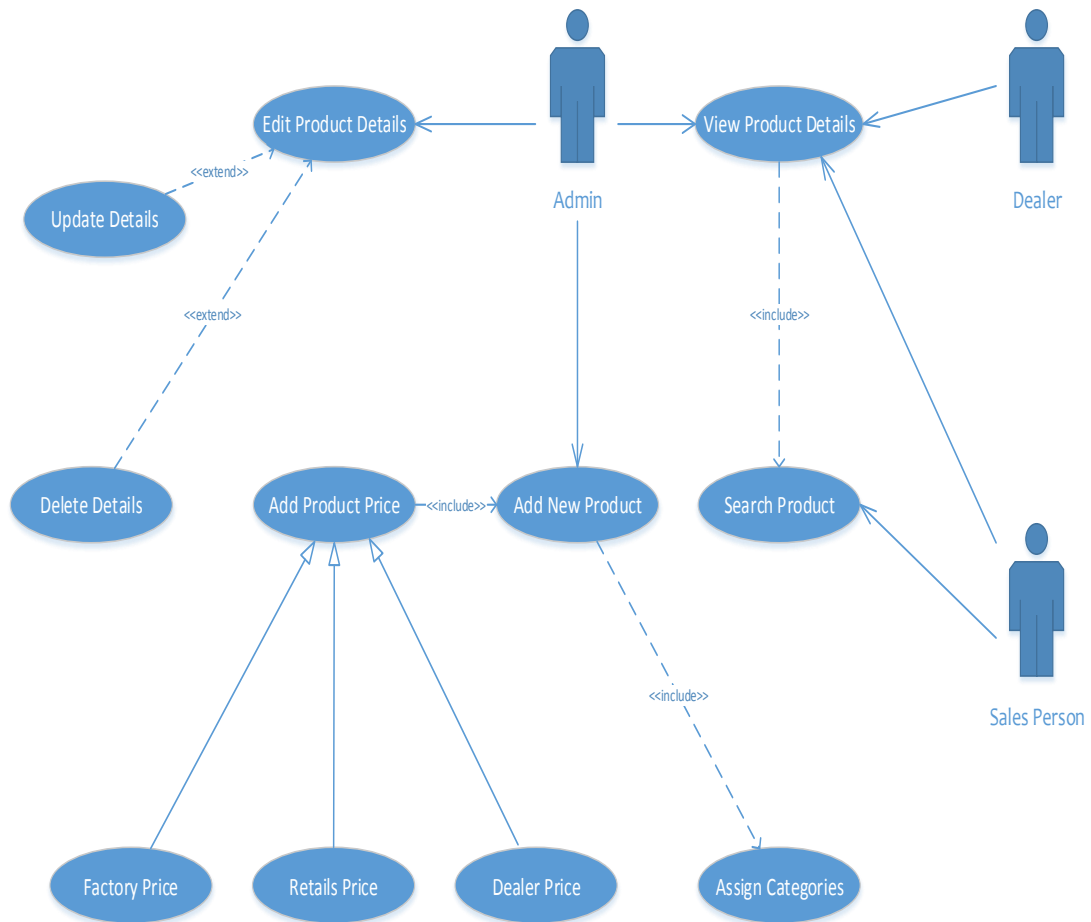


Figure 5.5.3: Product Management Module

Access to the product registry is granted to the Dealers, Executives and Sales Persons. The product registry will be used to update sales for each Point of Sales and also for price quotations. The product registry will allow the users to add the product price under the 3 categories. These 3 categories would be the Ex-Factory Price, Retail Price and the Dealer Price. These categories would vary as each has a different element of costing attached to it.

Figure 5.5.4 outlines the Sales Management Module.

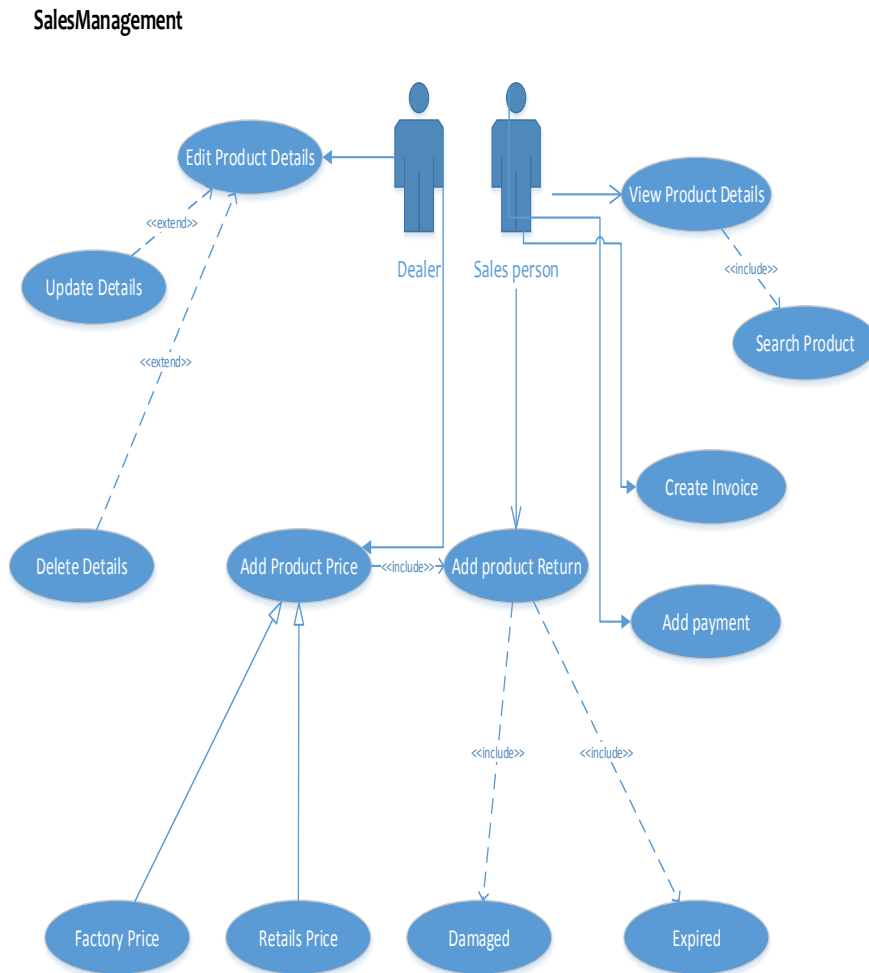


Figure 5.5.4: Sales Management Module

Sales Persons and Executives are providing access the main sales module which is linked to the inventory system. Sales registry will also include the cost of distribution by capturing delivery costs and vehicle maintenance costs. This module therefore will include the daily sales, bad returns and in terms of costs will also include vehicle mileage reading and repair costs to record distribution and delivery costs.

Administrative Module

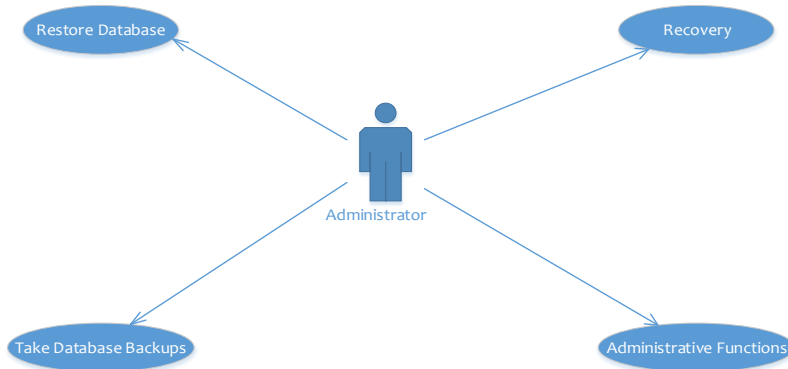


Figure 5.5.5: Administrative Module

An overview of the administrative module is provided in figure 5.5.5 above. The primary responsibility of the Administrator will be to carry out system maintenance activities such as performing all administrative functions which includes granting user access to restoring the database, backing up the database and performing recovery actions where required.

Stock Management

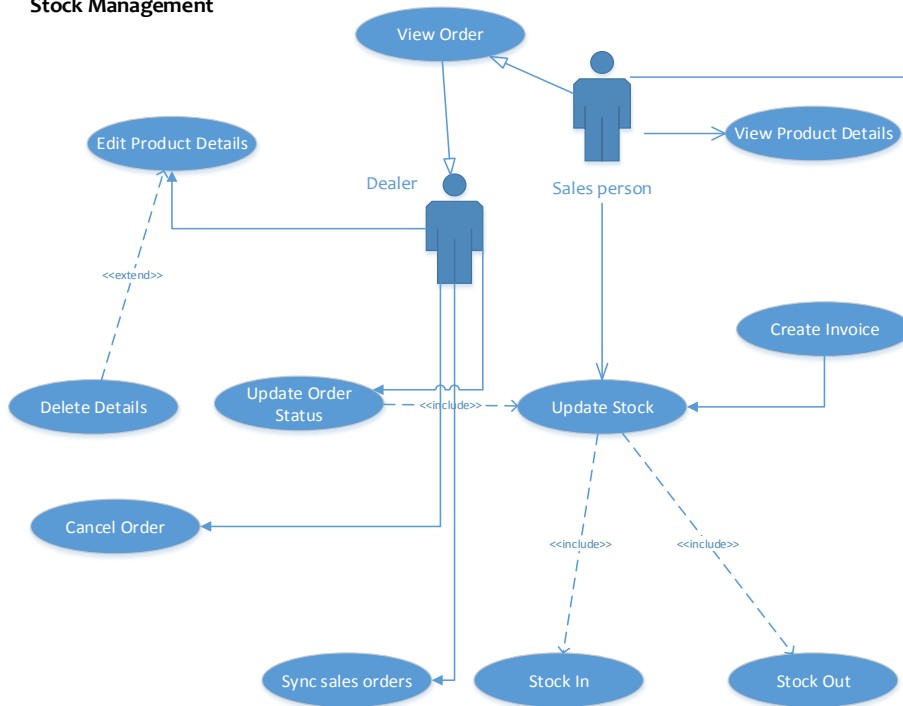


Figure 5.5.6: Stock Management Module

Figure 5.5.6 is the overview of the Stock Management System. Front end users of the Stock Management System will be the Dealers, Sales, Persons and Store Keeper.

Dealers and Sales Persons will be allowed access to the Stock Management Module so that they could inquire about availability of stocks before making a sale or agreeing for delivery of a product. The Store Keeper will be provided access to monitor the movement of products and place orders accordingly to ensure that the correct amount of stock is maintained for each product. Holding the correct amount of inventory is important as excess stock would mean the higher storage costs and an inadequate stock may result in the loss of business.

The final module of the Cloud Based Sales Analysis System for Orel Cooperation will be the report generator as seen in figure 5.5.7 below.

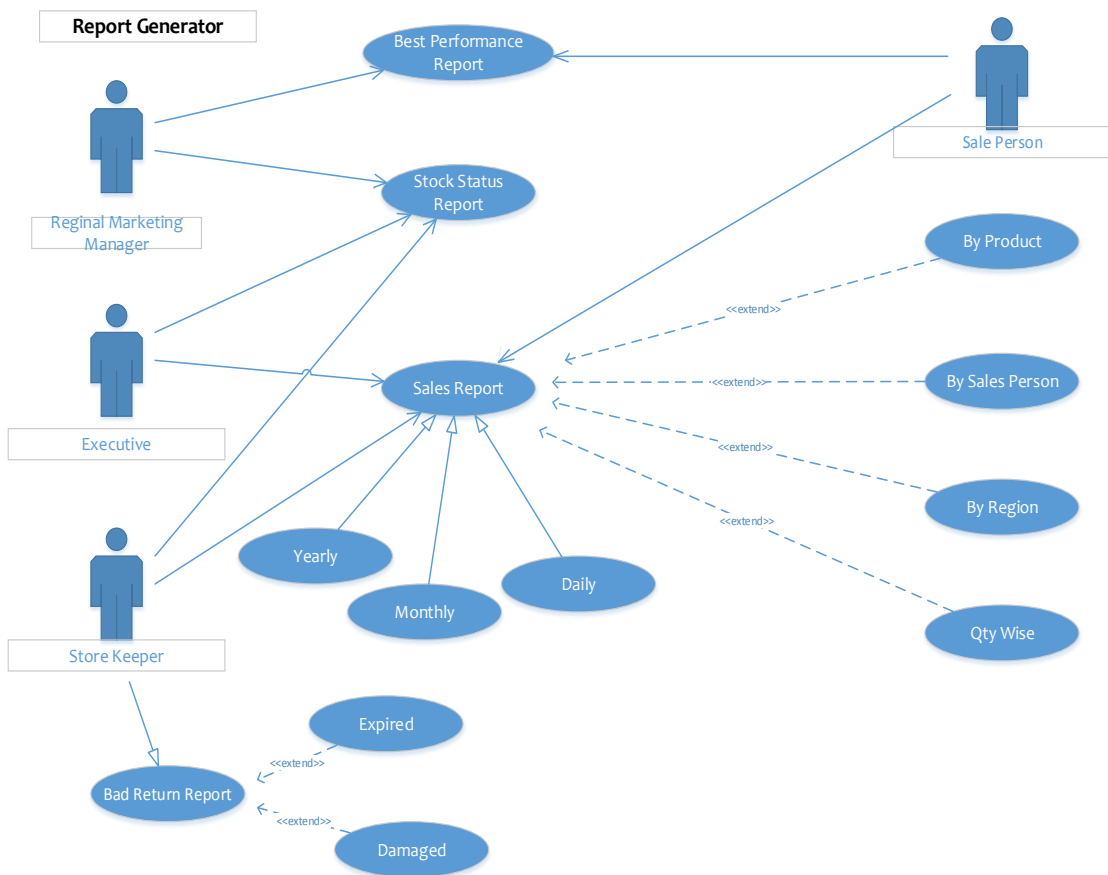


Figure 5.5.7: Report Generator Module

The Report Generator would primarily be a back end function. Access to the report generator will be provided to the Regional Marketing Manager, Store Keeper, Executive Sales Persons and Admin users. The Report Generator will allow any of these users who are provided access to the module to extract real time reports. This would be a rather simple task as opposed to the system which is presently in use. With the system being a Web Based system it will facilitate real time information to be updated.

Order Processing

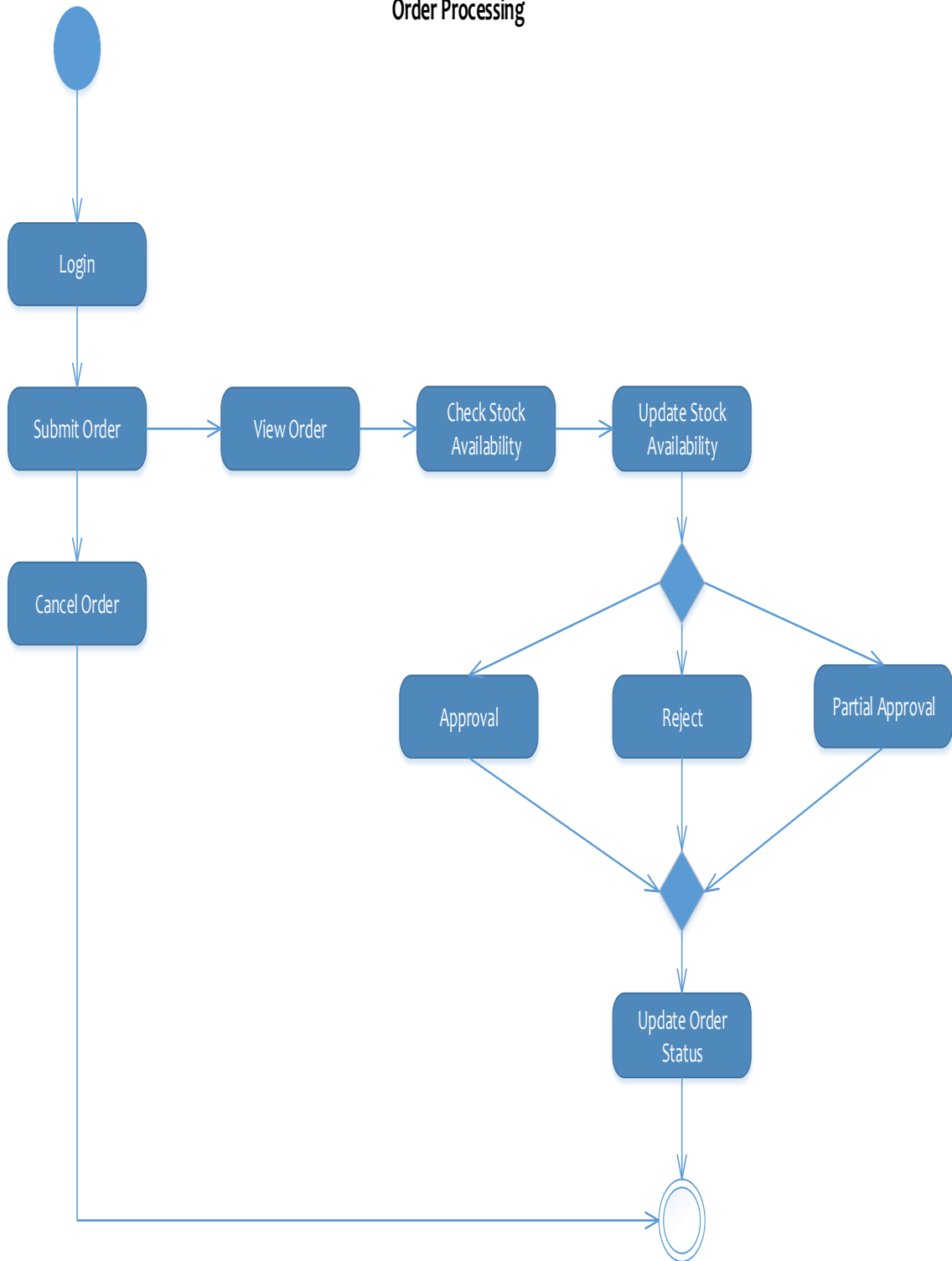


Figure 5.5.8: Order Processing

5.6 Main Web application

Main web application developed using PHP scripting language with laraval5 MVC framework. Main web system able to access from anywhere through the internet. This application contain few modules such as user management module, product management and report engine.

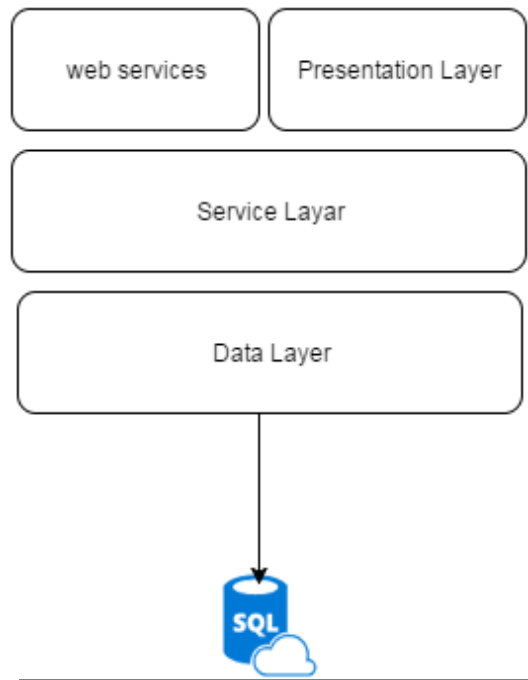


Figure 5.6.1: Main Web application

Presentation Layers represent data view and report generation areas. The data access layer performs CRUD (Create, Read, Update, and Delete) operations on the database. Web services use for fetch data from main database to clients (POS applications).

Web Application Run on Apache2 web Server and using Maria DB Database server for store and retrieve data.

5.7 Point of sale

Point of sale application which is application used by dealers and cashiers. It has Invoice, Return, Payment, User management, Stock modules.

5.8 Web services

Web service is a function that can be accessed by other programs over the web (Http). Simple we use web services for retrieve data from remote server. Point of sale solution communicate with web application using the web services that web services provide necessary data to point of sale application and Point of sale system can send important sales details to main application using the web services.

5.9 Summary

This chapter mainly described the overall architecture and the design of each components with relevant technologies and their interconnections.

Chapter 6

Implementation of POS solutions and Sales analyzing System

6.1 Introduction

Previous chapter consider about details of design of the propose solution. This chapter discussed about details related to the implementation of the solution.

6.2 Overall solution

As the sales analyzing system is a Web-based solution, researchers used the PHP 5 server-side scripting language and the laraval 5 framework to develop prediction systems. According to requirements and system design researchers, developed the system. Two separate sub modules are developed in Sales Management and analyzing reports engine. In this system, the MySQL RDBMS is used as a database using Hibernate ORM. Apache 2 is used as a web server to run this solution.

6.3 Main Web Application

As the integrated development environment (IDE), Netbeans 8.0.1 was used to develop the main application. Since the web application is PHP based, most reliable and secure Drupal 7 CMS core (Content Management System) is utilized to avoid reinventing the wheel. It provide extendable API to make customized developments for each module such as user permissions, business logic and theming layers. The project set up in the Netbeans IDE is shown in Figure 6.1

PhpStrom 10 IDE use for develop that web application module hedi sql client use for work with Marida DB Web application developed using php and laraval 5 framework.

Project structure

.git	11/21/2016 11:43 ...	File folder	
assets	8/3/2016 12:11 PM	File folder	
core	8/3/2016 12:11 PM	File folder	
.gitignore	8/3/2016 12:11 PM	Text Document	1 KB
.htaccess	8/3/2016 12:11 PM	HTACCESS File	1 KB
favicon.ico	8/3/2016 12:11 PM	Icon	0 KB
index.php	8/3/2016 12:11 PM	PHP File	2 KB
product.php	8/3/2016 12:11 PM	PHP File	1 KB
robots.txt	8/3/2016 12:11 PM	Text Document	1 KB

Figure 6.3.1: Laraval Root Folder

app	8/3/2016 12:11 PM	File folder	
bootstrap	8/3/2016 12:11 PM	File folder	
config	8/3/2016 12:11 PM	File folder	
database	8/3/2016 12:11 PM	File folder	
resources	8/3/2016 12:11 PM	File folder	
storage	8/3/2016 12:11 PM	File folder	
.env	8/3/2016 12:11 PM	ENV File	1 KB
.env.example	8/3/2016 12:11 PM	EXAMPLE File	1 KB
.gitattributes	8/3/2016 12:11 PM	Text Document	1 KB
.gitignore	8/3/2016 12:11 PM	Text Document	1 KB
artisan	8/3/2016 12:11 PM	File	2 KB
composer.json	8/3/2016 12:11 PM	JSON File	3 KB
gulpfile.js	8/3/2016 12:11 PM	JScript Script File	1 KB
package.json	8/3/2016 12:11 PM	JSON File	1 KB
phpspec.yml	8/3/2016 12:11 PM	YML File	1 KB
phpunit.xml	8/3/2016 12:11 PM	XML Document	1 KB
readme.md	8/3/2016 12:11 PM	MD File	2 KB
server.php	8/3/2016 12:11 PM	PHP File	1 KB

Figure 6.3.2: Application folder

6.4 Point of sale application

Point of sale application developing using java with net beans 8.0 IDE This system use hibernate ORM tool and entity framework for data retrieve and manipulate

Structure

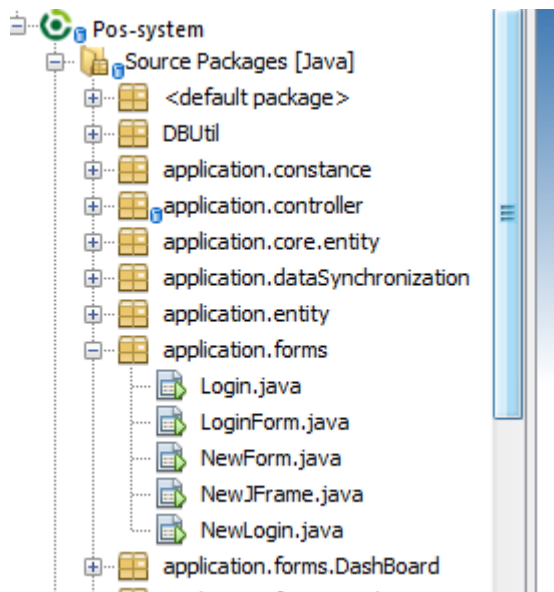


Figure 6.4.1: Application Structure

Hibernate Configuration

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE hibernate-configuration SYSTEM "hibernate-configuration-3.0.dtd">
<hibernate-configuration>
  <session-factory>
    <property name="hibernate.dialect">org.hibernate.dialect.MySQLDialect</property>
    <property name="hibernate.connection.driver_class">com.mysql.cj.jdbc.Driver</property>
    <property name="hibernate.connection.url">jdbc:mysql://localhost:3307/pos?useSSL=false</property>
    <property name="hibernate.connection.username">root</property>
    <property name="hibernate.connection.password">123</property>
    <property name="hibernate.hbm2ddl.auto">update</property>
    <property name="show_sql">>true</property>
    <property name="hibernate.c3p0.min_size">2</property>
    <property name="hibernate.c3p0.max_size">1000</property>
    <property name="hibernate.c3p0.timeout">100</property>
    <property name="hibernate.c3p0.max_statements">1</property>
    <property name="hibernate.c3p0.idle_test_period">1</property>
    <property name="hibernate.c3p0.validate">>true</property>
    <property name="current_session_context_class">thread</property>
    <property name="hibernate.temp.use_jdbc_metadata_defaults">>false</property>
    <property name="current_session_context_class">thread</property>
  </session-factory>
</hibernate-configuration>
```

Figure 6.4.2: Hibernate Configuration

6.5 Web Application

Web Module (Analyzing module) developed by using PHP scripting language with laraval 5 framework and Maria as database and Apache2 server used as the web server. This solution is web base solution therefore; we need to installed Apache2 web server and Maria DB version -10

And also we need install composer for manage Laraval5 Framework dependency management. Linux Platform is better to host that web application.

This solution has two sub modules that integrated together. Sub modules are Sales Management and analyzing reports engine.

.

6.6 Implementation of Database

For implementation for the database we install Maria DB server to cloud and dealer computers for store point of sale application data. We use **mysqldump** command for restore and backup database.

6.7 Summary

This system has two main module such as POS solution and analyzing module. Analyzing module has two sub modules such as Sales Management and analyzing reports engine. This system developed as a cloud base system and stand-alone application by using PHP/JAVA-SE, MARIA DB with hibernate used for handling database and APACHE2 server used as a web server. After implementation researcher need to conduct proper testing mechanism.

Chapter 7

Assessment of the Cloud Based Sales Analysis System

7.1 Introduction

In the chapter 6 it mainly focuses to describe the implementation of the cloud base sales analysis and POS System. This Chapter contains details related to the evaluation of the developed cloud base sales analysis and POS System. It mainly assesses developed system achieved and objectives of the project. In evaluating the cloud base sales analysis and POS System this research used the test cases developed by research and checked whether expected outputs executed or not. Analysis module accurate tested by comparing actual data and predicted test data. Test use different methods for checking the accuracy in each technique.

7.2 Evaluation of the Sales Management system

The process which ensures that the developed software meets and complies with the defined or standardized quality specifications is referred to as software quality assurance or SQA. Software quality assurance is also considered as an ongoing process within the software development life cycle (SDLC). In this context therefore, the software which was developed for Orel Cooperation Limited was tested during various stages of the development cycle before the recommended roll out.

Consider the project objectives first four objectives mainly focus to the sales analysis and POS System. Such as,

- Identify current sales process of organization.
- Identify the issues of current sales, stock management, return and delivery.
- Introduces new solution for easy sales activities.
- Identify area wise, occasionally, product wise sales progress.

In first two objectives mainly link to the pre steps of the system development. It's known as requirement gathering, Achieved this task perform test cases (Refer Appendix C) for identified the issues.

Sales analysis process mainly has two separate sub modules such as Sales Management and analyzing reports engine. To run this sub process smoothly Company need good system. Handling customer smoothly, is key objectives in the company. Current system has some draw back are following,

- Unable to access remotely.
- Less user-friendly interface.
- Less efficiency for information processing.
- Separate access.
- Less security.
- Centralized control.

In order to address these issues this research develops sales analysis and POS System. Evaluate the accuracy of the sales analysis and POS System developed the test cases (Refer Appendix C) and tests the sales analysis and POS System. This test cases are related to the main functions of the developed system. This test cases are successfully pass by the develop system. Therefore, accuracy of the developing sales analysis and POS System was high and above mention sub objectives are achieved.

7.3 Evaluation of the Sales analysis and POS system

This section consider for achieving the following sub objectives of this project

- Introduces accurate sales analysis solution and identifying the sales patterns in Sri Lankan retail industry,
- Reduced unnecessary cost for retail returns.

This research used Weka version 3.7.13 tool for retail sales analysis and pattern identification.

In here researcher used 4 years of net sale information monthly basis in six main orange products. Such as Switch & Sockets (SWS), Allied Accessories (ALA), Cables (CBL), Lighting (LHT), Circuit Protections (CRP), Industrial Products (INP). This research used 2013 to 2015 monthly basis data for training and 2016 to 2017 data for test.

This results output get sample form dealer basis, city basis, district basis and island wide. This research selects randomly ten agents in cover ten cities and ten districts in the data set and applies the weka tool. This instant research used following analyzing methods that available in Weka and try to figure out suitable analyzing method. Such as Gaussian, Linear Regression, Multilayer Preceptron Regression and SMO Regression Then use of testing and evaluation algorithms that available in Weka, Mean Squared Error (MSE), Mean Absolute Error (MAE), Root Mean Squared Error (RMSE) and Relative Absolute Error (RAE).

Mean Absolute Error and Mean Squared Error figured out the closer between actual and analyze result. Relative Mean Squared Error and Relative Absolute Error are used for measure the accuracy. This research separately measure the error in dealer wise, city wise, district wise and island wide. Then calculate average value of error in each algorithm based on dealer wise, city wise, district wise and island wide. Selected samples illustrate in table 7.1.

Dealer ID	City	District
761A0003	Colombo 6	Colombo Inner
731A0016	Kaduwellla	Colombo Outer
761D0006	Ampara	Ampara
734G0004	Anuradhapura	Anuradhapura
734I0001	Kandy	Kandy
731I0010	Galle	Galle
741K0012	Kurunagalla	Kurunagalla
711L0001	Monaragala	Monaragala
721L0002	Jaffna	Jaffna
734M0020	Kegalle	Kegalle

Table 7.1 Selected Samples

Following tables and graphs illustrate analyzing results.

Year	Linear	SMOReg	Gaussian	Multi	Actual
2016-05*	193.4087	195.1935	189.7551	172.8702	184
2016-06*	171.4937	170.3049	173.1084	172.8702	171
2016-07*	185.0872	183.6829	184.7535	172.8702	183
2016-08*	169.7336	168.6115	172.41	172.8702	169
2016-09*	184.1069	187.3886	188.6398	172.8702	192
2016-10*	178.4568	191.9586	184.6528	172.8702	182
2016-11*	159.6084	175.2591	173.5976	172.8702	175
2017-12*	168.7272	181.9931	181.6188	172.8702	172
2017-01*	166.9416	166.0016	177.1377	172.8702	164
2017-02*	210.3318	198.7551	201.1633	172.8702	183
2017-03*	182.9141	175.8885	178.0576	172.8702	181
2017-04*	182.5784	182.9912	180.5887	172.8702	190

Table 7.2 Analyzing Results of Switch & Sockets - Dealer 761A0003

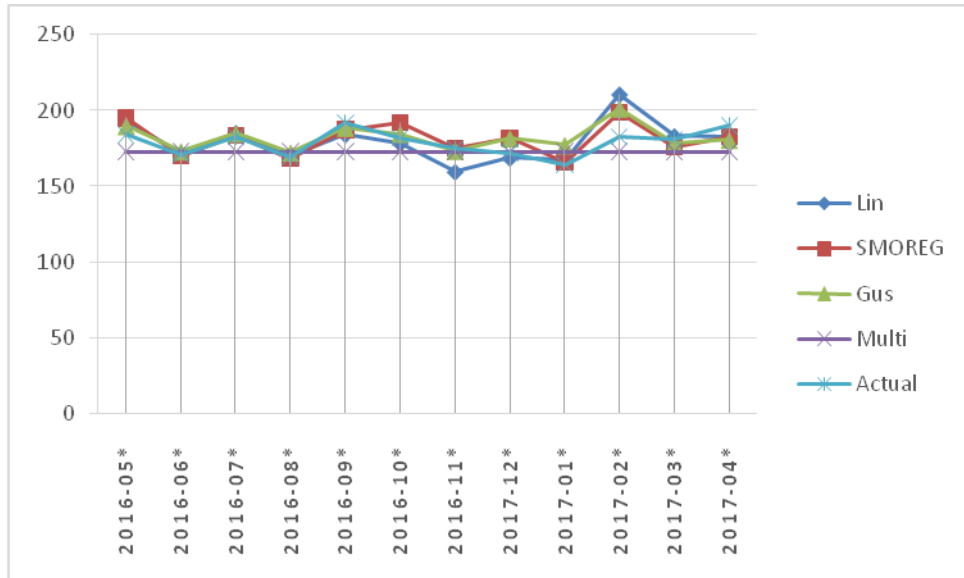


Figure 7.1 Analyzing Results of Switch & Sockets - Dealer 761A0003

Year	Linear	SMOReg	Gaussian	Multi	Actual
2016-05*	130.8244	139.4198	118.0923	125.7705	125
2016-06*	97.0085	92.9602	116.1424	125.7705	120
2016-07*	155.8787	130.3796	128.5778	125.7705	172
2016-08*	116.9018	105.7713	102.4055	125.7583	100
2016-09*	90.5395	79.0676	97.8279	125.7418	108
2016-10*	137.8608	139.6836	125.2686	125.7476	139
2016-11*	109.0921	103.1986	128.3728	125.6446	99
2017-12*	150.1761	121.0072	98.9398	125.5137	128
2017-01*	103.4824	136.9322	117.0619	125.5124	99
2017-02*	119.3918	129.6247	142.6557	125.3344	152
2017-03*	166.8637	151.0769	124.3067	124.7067	142
2017-04*	69.2884	58.4793	97.6033	123.3617	108

Table 7.3 Analyzing Result of Allied Accessories - Dealer 761A0003

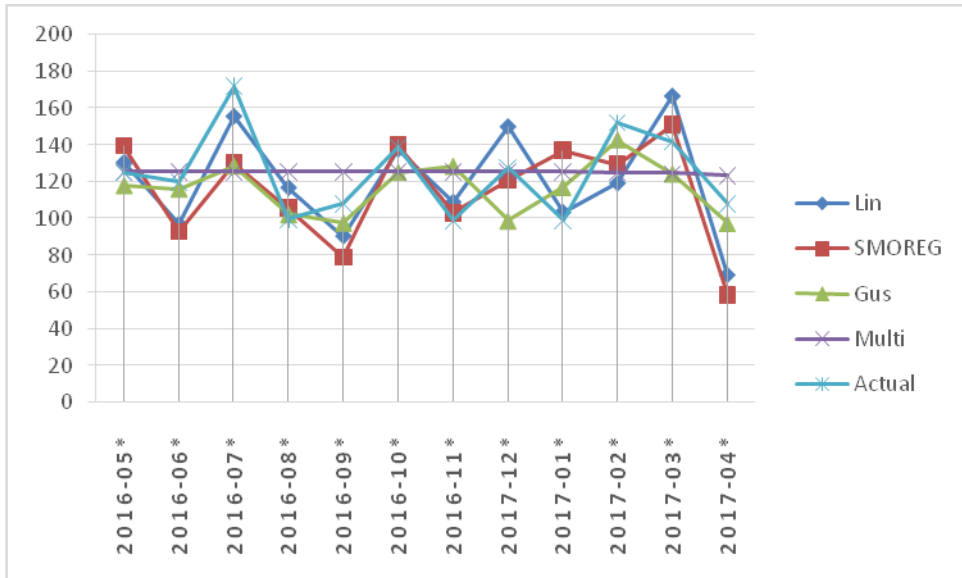


Figure 7.2 Analyzing Result of Allied Accessories - Dealer 761A0003

Year	Linear	SMOReg	Gaussian	Multi	Actual
2016-05*	26.0126	22.4822	24.5037	28.4863	24
2016-06*	27.4013	25.2261	26.0949	28.4863	28
2016-07*	34.7333	32.5976	30.4527	28.4863	30
2016-08*	27.2545	20.6414	22.9164	28.4863	28
2016-09*	26.3777	27.2365	27.9894	28.4863	29
2016-10*	25.8811	23.4994	24.5416	28.4863	23
2016-11*	28.9661	27.3495	25.9664	28.4863	34
2017-12*	16.9624	20.1667	21.1808	28.4863	28
2017-01*	31.5313	30.2489	30.2553	28.4863	28
2017-02*	29.5439	28.1823	29.6051	28.4863	27
2017-03*	24.5002	15.7106	20.6712	28.4863	23
2017-04*	37.1519	31.4337	27.3646	28.4863	32

Table 7.4 Analyzing Result of Cables- Dealer 761A0003

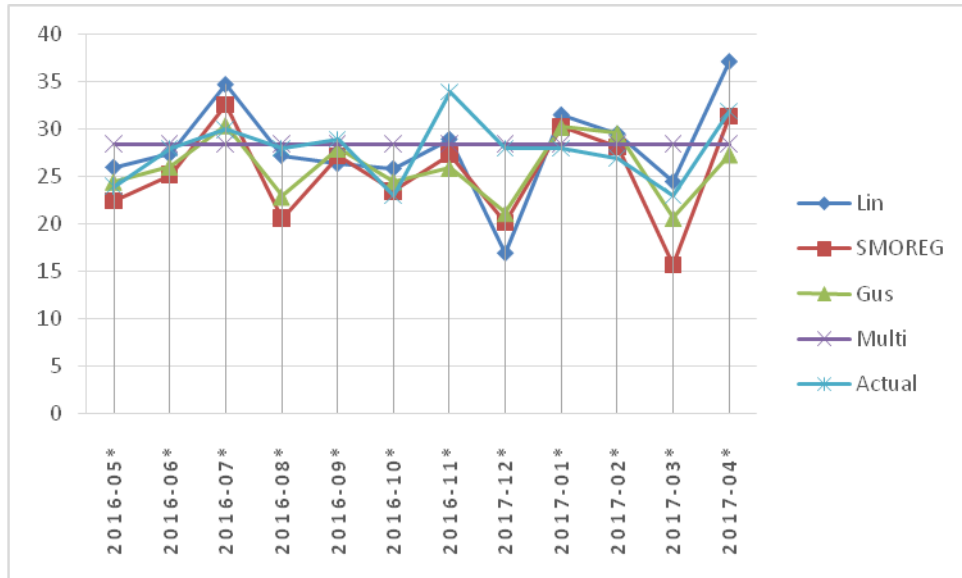


Figure 7.3 Analyzing Result of Cables- Dealer 761A0003

Year	Linear	SMOReg	Gaussian	Multi	Actual
2016-05*	15.1755	12.894	11.6777	13.4785	14
2016-06*	15.9011	12.7007	14.2235	13.4786	14
2016-07*	21.1927	14.0846	14.6392	13.4785	19
2016-08*	16.7628	11.994	10.9397	13.4785	15
2016-09*	12.8011	10.5663	11.1372	13.4785	13
2016-10*	20.4979	21.47	14.9333	13.4785	17
2016-11*	1.1767	6.9254	7.1856	13.4784	14
2017-12*	4.7715	4.6857	5.7319	13.4784	11
2017-01*	18.3194	15.8545	14.9198	13.4785	15
2017-02*	20.8341	13.7933	17.5618	13.4785	17
2017-03*	16.9898	11.2766	9.7071	13.4785	18
2017-04*	9.0266	7.1344	6.5788	13.4785	12

Table 7.5 Analyzing Result of Lighting - Dealer 761A0003

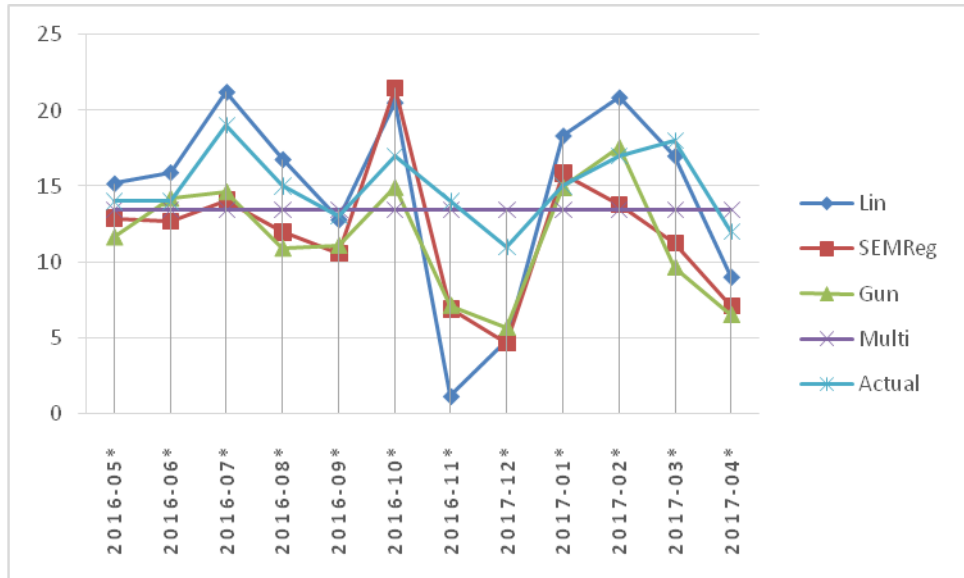


Figure 7.4 Analyzing Result of Lighting - Dealer 761A0003

Year	Linear	SMOReg	Gaussian	Multi	Actual
2016-05*	39.2899	36.59	30.805	33.8344	38
2016-06*	15.8616	16.746	19.1508	33.8344	27
2016-07*	19.5204	12.4798	19.3729	33.8344	27
2016-08*	27.9707	10.0592	16.9098	33.8344	28
2016-09*	41.6278	30.1739	31.8656	33.8344	38
2016-10*	29.5352	27.6829	23.4753	33.8344	23
2016-11*	26.172	36.2231	26.8949	33.8344	32
2017-12*	9.406	17.6392	18.4183	33.8344	24
2017-01*	18.5692	15.3784	21.151	33.8344	23
2017-02*	38.0472	33.7125	36.0426	33.8344	32
2017-03*	35.8259	16.3958	19.0861	33.8344	30
2017-04*	33.3019	23.2416	18.5024	33.8344	32

Table 7.6 Analyzing Results of Circuit Protections - Dealer 761A0003

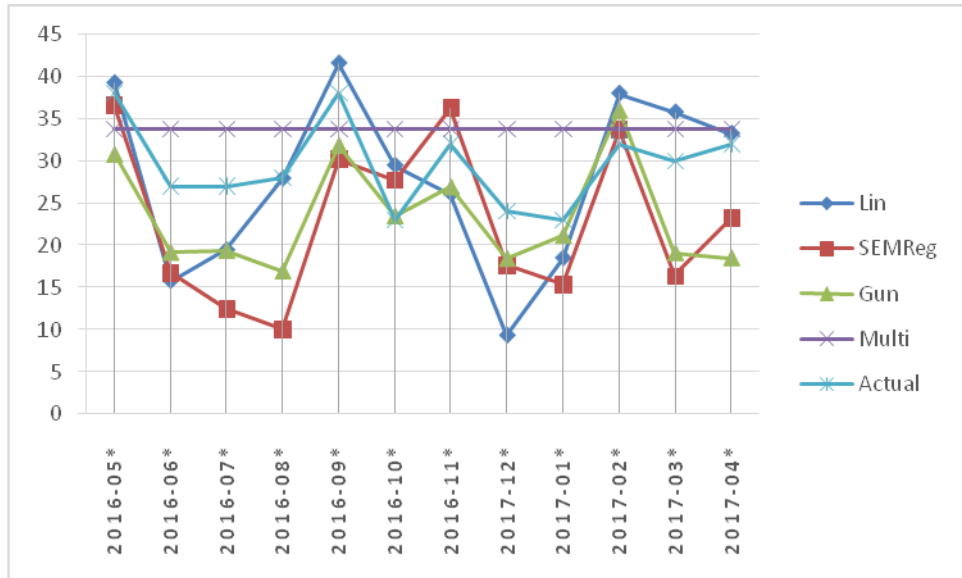


Figure 7.5 Analyzing Results of Circuit Protections - Dealer 761A0003

Year	Linear	SMOReg	Gaussian	Multi	Actual
2016-05*	3.896	4.1551	4.4746	7.8054	4
2016-06*	8.0284	6.5146	7.4075	7.8054	7
2016-07*	16.0682	8.8938	8.2711	7.8054	7
2016-08*	9.4608	3.5482	3.5006	7.8054	8
2016-09*	7.7353	3.8267	5.6539	7.8054	7
2016-10*	17.9005	13.2804	8.4987	7.8054	9
2016-11*	5.522	6.3032	4.3117	7.8054	6
2017-12*	0.7734	2.8408	1.7535	7.8054	4
2017-01*	8.3098	9.4838	7.4809	7.8054	5
2017-02*	9.6962	5.588	9.2506	7.8054	8
2017-03*	8.6857	1.472	2.3564	7.8054	8
2017-04*	10.1176	7.7258	5.2015	7.8054	7

Table 7.7 Analyzing Results of Industrial Products - Dealer 761A0003

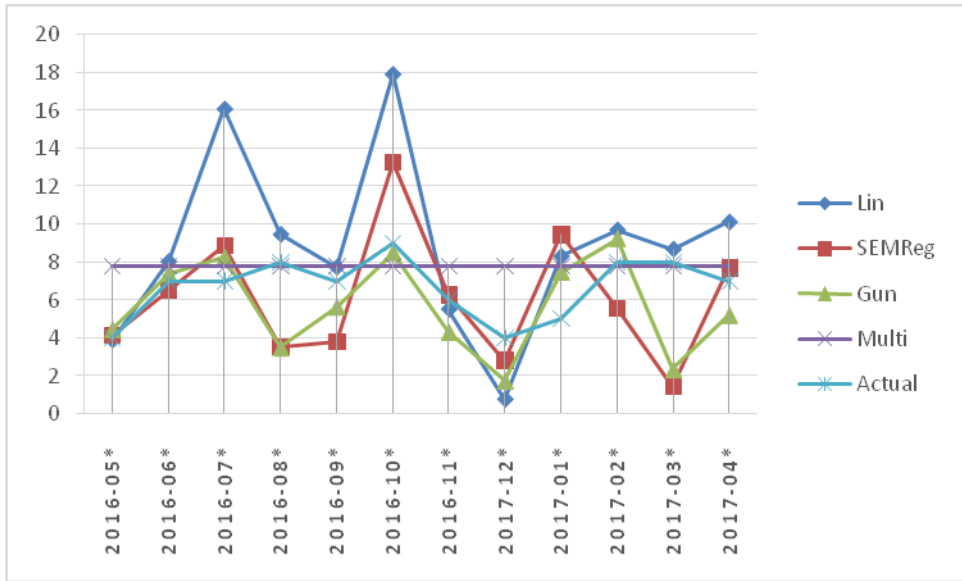


Figure 7.6 Analyzing Results of Industrial Products - Dealer 761A0003

Customer Wise Performance Evaluation-

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	0.0702	1.8635	12.5633
	RMSE	0	0.0767	2.4164	15.3698
	RAE	0	0.4317	11.7045	77.4635
	MSE	0	0.0059	5.839	236.2313
ALA	MAE	0	0.1204	5.6122	22.6658
	RMSE	0	0.1275	7.4382	26.2852
	RAE	0	0.3899	17.2962	72.3946
	MSE	0	0.0162	55.3262	690.9107
CBL	MAE	0	0.0288	1.1904	5.8706
	RMSE	0	0.0315	1.5263	7.0530
	RAE	0	0.4002	15.6838	79.6413
	MSE	0	0.001	2.3296	49.7447
LHT	MAE	0	0.0388	1.0549	1.1945
	RMSE	0	0.0415	1.442	1.6976
	RAE	0	0.641	17.3089	20.5238
	MSE	0	0.0017	2.0794	2.882
CRP	MAE	0	0.0587	2.2787	7.4567
	RMSE	0	0.0636	2.9338	9.907
	RAE	0	0.4653	17.3664	60.6313
	MSE	0	0.004	8.6071	98.1484
INP	MAE	0	0.0323	0.8875	3.757
	RMSE	0	0.0343	1.2135	7.253
	RAE	0	0.7273	19.9537	89.9728
	MSE	0	0.0012	1.4727	52.6055

Table 7.8 Performance Comparisons with Analyzing Dealer 761A0003

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	0.9086	18.6461	0.0002
	RMSE	0	0.9945	23.5181	0.0002
	RAE	0	0.2609	5.2228	0
	MSE	0	0.9897	553.1001	0
ALA	MAE	0	0.5698	14.4332	32.4019
	RMSE	0	0.5983	18.5043	43.539
	RAE	0	0.4512	11.4632	25.1209
	MSE	0	0.355	342.4033	1395.6463
CBL	MAE	0	0.3952	12.4636	0.0001
	RMSE	0	0.435	14.6701	0.0001
	RAE	0	0.4184	13.6874	0.0001
	MSE	0	0.1892	215.2126	0
LHT	MAE	0	0.2271	7.7526	0.0442
	RMSE	0	0.2417	10.5337	0.054
	RAE	0	0.4012	13.7659	0.0744
	MSE	0	0.0584	110.9591	0.0029
CRP	MAE	0	0.1037	6.0555	24.2364
	RMSE	0	0.1127	7.3066	29.0197
	RAE	0	0.384	22.4364	91.8924
	MSE	0	0.0127	53.3871	842.1411
INP	MAE	0	0.0583	1.8922	0.4556
	RMSE	0	0.0635	2.3995	0.7112
	RAE	0	0.5052	17.1274	3.9635
	MSE	0	0.004	5.7592	0.5057

Table 7.9 Performance Comparisons with Analyzing Dealer 731A0016

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	0.8007	29.8155	70.2634
	RMSE	0	0.9157	54.8979	139.0475
	RAE	0	0.6899	27.4745	63.4166
	MSE	0	0.8384	3013.7847	19334.1977
ALA	MAE	0	0.8296	36.6368	91.2315
	RMSE	0	0.9459	50.7914	146.4898
	RAE	0	0.6035	26.3516	66.838
	MSE	0	0.8948	2579.7638	21459.2702
CBL	MAE	0	1.5639	45.8294	118.375
	RMSE	0	1.641	85.6988	219.0988
	RAE	0	0.7362	22.32	57.9514
	MSE	0	2.6929	7344.29	48004.3005
LHT	MAE	0	1.1384	34.0951	144.5883
	RMSE	0	1.2377	41.5163	196.7005
	RAE	0	0.6394	19.5823	85.222
	MSE	0	1.532	1723.6009	38691.0682
CRP	MAE	0	0.0773	2.397	6.4712
	RMSE	0	0.0847	4.5548	12.6012
	RAE	0	0.8017	24.1768	66.7088
	MSE	0	0.0072	20.7464	158.7902
INP	MAE	0	0.0209	0.9412	3.8089
	RMSE	0	0.023	1.403	5.0712
	RAE	0	0.4511	19.9689	81.0684
	MSE	0	0.0005	1.9683	25.7172

Table 7.10 Performance Comparisons with Analyzing Dealer 761D0006

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	2.5276	87.6133	87.6133
	RMSE	0	2.7048	159.0936	159.0936
	RAE	0	0.8645	30.3047	30.3047
	MSE	0	7.316	25310.764	25310.764
ALA	MAE	0	0.6284	26.2136	26.2136
	RMSE	0	0.7005	39.5991	39.5991
	RAE	0	0.5713	23.3166	23.3166
	MSE	0	0.4907	1568.0879	1568.0879
CBL	MAE	0	1.1682	45.8642	45.8642
	RMSE	0	1.2237	73.5418	73.5418
	RAE	0	0.6854	26.8971	26.8971
	MSE	0	1.4975	5408.4002	5408.4002
LHT	MAE	0	0.2476	8.1982	8.1982
	RMSE	0	0.2643	14.0577	14.0577
	RAE	0	0.7702	24.8383	24.8383
	MSE	0	0.0698	197.619	197.619
CRP	MAE	0	0.1694	6.3343	6.3343
	RMSE	0	0.1772	10.0246	10.0246
	RAE	0	0.7285	28.1988	28.1988
	MSE	0	0.0314	100.4923	100.4923
INP	MAE	0	0.0787	2.4396	2.4396
	RMSE	0	0.0828	3.826	3.826
	RAE	0	0.8496	26.3145	26.3145
	MSE	0	0.0068	14.6386	14.6386

Table 7.11 Performance Comparisons with Analyzing Dealer 734G0004

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	5.8898	262.0153	478.016
	RMSE	0	6.6528	462.4878	1084.7203
	RAE	0	0.6767	30.3208	54.3578
	MSE	0	44.2595	213895	1176618.2
ALA	MAE	0	4.0228	185.7365	427.0196
	RMSE	0	4.2544	258.8987	655.1291
	RAE	0	0.6258	28.6747	67.4839
	MSE	0	18.1003	67028.56	429194.17
CBL	MAE	0	8.1200	302.0842	642.5064
	RMSE	0	9.0081	523.1345	1313.7311
	RAE	0	0.6546	23.3939	51.4655
	MSE	0	81.1463	273669.72	1725889.5
LHT	MAE	0	2.6229	153.9126	376.2465
	RMSE	0	2.7964	200.4137	491.7429
	RAE	0	0.508	29.1657	73.5373
	MSE	0	7.82	40165.654	241811.06
CRP	MAE	0	2.4138	91.0932	190.8389
	RMSE	0	2.5949	155.0707	374.246
	RAE	0	0.8124	30.9106	64.427
	MSE	0	6.7335	24046.914	140060.06
INP	MAE	0	0.3758	20.643	48.6402
	RMSE	0	0.4031	27.262	79.4072
	RAE	0	0.4769	26.4795	63.9017
	MSE	0	0.1625	743.2159	6305.4991

Table 7.12 Performance Comparisons with Analyzing Dealer 734I0001

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	0.3904	12.161	0.3614
	RMSE	0	0.4186	16.8499	0.4235
	RAE	0	0.7131	21.6037	0.6538
	MSE	0	0.1753	283.9193	0.1793
ALA	MAE	0	0.1123	3.1551	0.0044
	RMSE	0	0.1195	4.5705	0.0054
	RAE	0	0.7082	19.9285	0.0265
	MSE	0	0.0143	20.8897	0
CBL	MAE	0	0.0408	1.0363	0.0054
	RMSE	0	0.0449	1.3682	0.0076
	RAE	0	0.7232	19.0802	0.0964
	MSE	0	0.002	1.872	0.0001
LHT	MAE	0	0.0096	0.2857	0.3447
	RMSE	0	0.0099	0.3519	0.5612
	RAE	0	1.1657	33.6958	41.0374
	MSE	0	0.0001	0.1238	0.315
CRP	MAE	0	0.1502	4.3141	10.8269
	RMSE	0	0.1654	6.3438	12.8002
	RAE	0	0.707	18.8601	43.4324
	MSE	0	0.0274	40.2444	163.8446
INP	MAE	0	0.0272	1.0058	0.0027
	RMSE	0	0.0287	1.3259	0.0033
	RAE	0	0.5676	21.0699	0.057
	MSE	0	0.0008	1.758	0

Table 7.13 Performance Comparisons with Analyzing Dealer 731I0010

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	0.0364	1.015	0.3614
	RMSE	0	0.0404	1.3753	0.4235
	RAE	0	0.6497	19.3191	0.6538
	MSE	0	0.0016	1.8914	0.1793
ALA	MAE	0	0.0258	0.4157	0.0044
	RMSE	0	0.0272	0.5008	0.0054
	RAE	0	1.0066	16.8975	0.0265
	MSE	0	0.0007	0.2508	0
CBL	MAE	0	0.4473	12.8265	0.0054
	RMSE	0	0.4771	19.5107	0.0076
	RAE	0	0.6562	19.4824	0.0964
	MSE	0	0.2276	380.6687	0.0001
LHT	MAE	0	0.0683	1.508	0.3447
	RMSE	0	0.0748	2.1788	0.5612
	RAE	0	0.5482	12.6362	41.0374
	MSE	0	0.0056	4.7474	0.315
CRP	MAE	0	0.0893	1.7783	10.8269
	RMSE	0	0.0946	2.2759	12.8002
	RAE	0	1.7404	33.5309	48.4324
	MSE	0	0.009	5.1799	163.8446
INP	MAE	0	0.0161	0.3935	0.0027
	RMSE	0	0.017	0.4956	0.0033
	RAE	0	0.7762	18.8597	0.057
	MSE	0	0.0003	0.2456	0

Table 7.14 Performance Comparisons with Analyzing Dealer 741K0012

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	6.0081	184.1637	447.2631
	RMSE	0	6.458	320.7967	914.2386
	RAE	0	0.7912	24.5029	61.134
	MSE	0	41.7054	102910.49	835832.29
ALA	MAE	0	2.97	125.9071	407.1491
	RMSE	0	3.2787	187.2788	543.3066
	RAE	0	0.5006	21.5335	71.6138
	MSE	0	10.7499	35073.364	295182.09
CBL	MAE	0	8.1801	243.7097	627.0917
	RMSE	0	8.5791	426.6135	1215.1307
	RAE	0	0.7091	21.8236	56.344
	MSE	0	73.6017	181999.11	1476542.5
LHT	MAE	0	2.21	77.8892	293.2083
	RMSE	0	2.4032	113.5436	403.1527
	RAE	0	0.5021	18.799	68.7429
	MSE	0	5.7755	12892.154	162532.07
CRP	MAE	0	0.3937	20.226	10.518
	RMSE	0	0.4425	31.1197	13.033
	RAE	0	0.5014	25.6979	13.4639
	MSE	0	0.1958	968.4383	169.8593
INP	MAE	0	0.1825	9.8016	9.4996
	RMSE	0	0.1919	12.9841	11.8105
	RAE	0	0.4825	24.8152	26.0732
	MSE	0	0.0368	168.5874	139.488

Table 7.15 Performance Comparisons with Analyzing Dealer 711L0001

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	0.8753	21.4267	53.4292
	RMSE	0	0.9223	43.0119	125.2137
	RAE	0	0.9231	23.5823	59.7748
	MSE	0	0.8506	1850.0262	15678.472
ALA	MAE	0	0.1245	3.8946	14.2969
	RMSE	0	0.1316	6.345	22.0575
	RAE	0	0.5842	18.0863	68.3513
	MSE	0	0.0173	40.2588	486.5342
CBL	MAE	0	1.3653	37.4292	107.9272
	RMSE	0	1.4488	68.4357	198.6846
	RAE	0	0.8466	24.2916	63.3793
	MSE	0	2.0991	4683.4437	39475.568
LHT	MAE	0	0.0816	2.7495	12.1764
	RMSE	0	0.0906	4.4758	17.2485
	RAE	0	0.4519	15.604	69.5198
	MSE	0	0.0082	20.0324	297.5095
CRP	MAE	0	0.0363	1.8782	5.4656
	RMSE	0	0.0395	2.9586	7.0812
	RAE	0	0.5501	30.45	86.2614
	MSE	0	0.0016	8.7531	50.1437
INP	MAE	0	0.0085	0.3523	2.2688
	RMSE	0	0.0093	0.4258	2.4847
	RAE	0	0.3822	16.5852	103.6438
	MSE	0	0.0001	0.1813	6.1737

Table 7.16 Performance Comparisons with Analyzing Dealer 721L0002

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	0.1586	7.3518	30.9289
	RMSE	0	0.174	9.2837	39.1245
	RAE	0	0.3635	16.3235	70.7011
	MSE	0	0.0303	86.1878	1530.7288
ALA	MAE	0	0.137	5.2679	1.6483
	RMSE	0	0.1417	7.1197	1.9477
	RAE	0	0.4641	18.5261	5.5685
	MSE	0	0.0201	50.6897	3.7934
CBL	MAE	0	0.5896	19.3816	120.3379
	RMSE	0	0.6219	24.4765	162.3353
	RAE	0	0.6161	19.8942	128.6858
	MSE	0	0.3868	599.1005	26352.747
LHT	MAE	0	0.1418	4.8744	0.0521
	RMSE	0	0.1504	6.8834	0.0685
	RAE	0	0.55	18.6805	0.2033
	MSE	0	0.0226	47.3806	0.0047
CRP	MAE	0	0.1932	5.1952	0.0689
	RMSE	0	0.2113	6.9466	0.0813
	RAE	0	0.706	18.4184	0.2455
	MSE	0	0.0447	48.2558	0.0066
INP	MAE	0	0.0294	0.8466	0.0367
	RMSE	0	0.0313	1.1287	0.0483
	RAE	0	0.5935	16.831	0.6874
	MSE	0	0.001	1.274	0.0023

Table 7.17 Performance Comparisons with Analyzing Dealer 734M0020

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	1.76657	62.60719	119.1632
	RMSE	0	1.93581	109.37313	248.88962
	RAE	0	0.63643	21.03588	61.97814
	MSE	0	9.61727	34791.1	207467.71
ALA	MAE	0	0.95406	40.72727	102.42605
	RMSE	0	1.03253	58.10465	148.03237
	RAE	0	0.59054	20.20742	46.72224
	MSE	0	3.06623	10675.96	75048.436
CBL	MAE	0	2.18992	72.68151	174.16165
	RMSE	0	2.35111	123.89761	327.75039
	RAE	0	0.6446	20.65542	57.91792
	MSE	0	16.18441	47430.414	332945.28
LHT	MAE	0	0.67861	29.23205	84.43531
	RMSE	0	0.73105	39.53969	113.77976
	RAE	0	0.61777	20.40766	45.75251
	MSE	0	1.52939	5516.4351	44368.913
CRP	MAE	0	0.36856	14.15505	27.61379
	RMSE	0	0.39864	22.95351	48.28757
	RAE	0	0.73963	25.00463	73.72277
	MSE	0	0.70673	2530.1018	14184.177
INP	MAE	0	0.08297	3.92038	7.3604
	RMSE	0	0.08849	5.24644	11.402
	RAE	0	0.58121	20.8005	52.73522
	MSE	0	0.0214	93.9101	655.62211

Table 7.18 Performance Comparison with Analyzing Output Dealer Average

City wise Performance Evaluation-

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	1.5938	53.8139	125.9851
	RMSE	0	1.6938	88.6259	237.701
	RAE	0	0.8179	28.6332	65.6958
	MSE	0	2.869	7354.5578	56501.761
ALA	MAE	0	0.6332	21.7128	78.7782
	RMSE	0	0.6631	31.4696	109.7965
	RAE	0	0.7033	24.3666	91.2213
	MSE	0	0.4463	990.3343	12055.275
CBL	MAE	0	3.6729	133.9526	413.7636
	RMSE	0	4.0605	225.6233	655.039
	RAE	0	0.6672	25.4843	77.5286
	MSE	0	16.4399	50905.355	429076.03
LHT	MAE	0	0.5997	25.3157	85.25
	RMSE	0	0.6425	35.0051	114.4951
	RAE	0	0.5368	23.0877	76.1456
	MSE	0	0.4123	1225.3601	13109.136
CRP	MAE	0	0.7908	25.2446	60.648
	RMSE	0	0.3243	45.0024	119.0338
	RAE	0	0.7565	24.6683	59.5173
	MSE	0	0.6303	2025.2175	14169.041
INP	MAE	0	0.0687	3.3597	4.7435
	RMSE	0	0.0747	4.6322	6.4469
	RAE	0	0.5497	26.2349	39.4119
	MSE	0	0.0056	21.4571	41.562

Table 7.19 Performance Comparison with Analyzing Output City Ampara

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	1.7454	46.6843	0.0184
	RMSE	0	1.8538	51.9384	0.0067
	RAE	0	0.7577	19.9246	0.0003
	MSE	0	3.4366	2697.596	0.003
ALA	MAE	0	1.8483	40.9311	0.0034
	RMSE	0	1.969	56.8742	0.0011
	RAE	0	0.665	14.5186	0
	MSE	0	3.8768	3234.6711	376.6979
CBL	MAE	0	5.714	178.3223	436.6578
	RMSE	0	5.9833	232.8165	45.1088
	RAE	0	0.7198	22.24	190670.05
	MSE	0	35.8002	54203.521	123.5536
LHT	MAE	0	0.7383	23.2416	161.8668
	RMSE	0	0.8219	28.7828	65.8495
	RAE	0	0.3652	11.7717	26200.853
	MSE	0	0.6755	828.4521	0.0236
CRP	MAE	0	0.447	10.4354	0.0302
	RMSE	0	0.4801	11.9196	0.0278
	RAE	0	0.5277	12.2035	0.0009
	MSE	0	0.2305	142.0773	0.0027
INP	MAE	0	0.0924	3.4677	0.0035
	RMSE	0	0.1006	4.3604	0.0105
	RAE	0	0.3562	13.232	0
	MSE	0	0.0101	19.0131	41.562

Table 7.20 Performance Comparison with Analyzing Output City Anuradhpura

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	3.9734	150.6664	0.0203
	RMSE	0	4.1512	205.3734	0.0346
	RAE	0	0.6001	21.8483	0.0032
	MSE	0	17.2325	42178.222	0.0012
ALA	MAE	0	1.3086	33.3488	205.2255
	RMSE	0	1.3886	42.371	240.0139
	RAE	0	0.5681	14.606	87.5686
	MSE	0	1.9283	1795.3014	57606.675
CBL	MAE	0	1.1527	43.079	0
	RMSE	0	1.2311	56.987	0
	RAE	0	0.6044	22.2879	0
	MSE	0	1.5157	3247.5179	0
LHT	MAE	0	0.4585	12.1665	6.4354
	RMSE	0	0.4865	16.1096	7.7647
	RAE	0	0.5305	14.4228	7.2111
	MSE	0	0.2367	259.5186	60.2903
CRP	MAE	0	0.153	6.0558	1.4007
	RMSE	0	0.1662	7.1448	1.7585
	RAE	0	0.4194	16.3347	3.8837
	MSE	0	0.0276	51.0482	3.0923
INP	MAE	0	0.0664	2.6236	0
	RMSE	0	0.0686	3.2631	0.0001
	RAE	0	0.5199	20.2406	0.0003
	MSE	0	0.0047	10.6475	0

Table 7.21 Performance Comparison with Analyzing Output City Colombo 6

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	2.0874	64.1475	40.9039
	RMSE	0	2.2602	76.9102	56.3354
	RAE	0	0.4397	13.4321	8.5171
	MSE	0	5.1085	5915.1737	3173.6734
ALA	MAE	0	2.0903	101.4821	0
	RMSE	0	2.3198	124.6454	0
	RAE	0	0.3693	18.6036	0
	MSE	0	5.3813	15536.482	0
CBL	MAE	0	2.8888	77.4215	0.0104
	RMSE	0	3.1655	90.1454	0.0194
	RAE	0	0.3423	8.7878	0.0012
	MSE	0	10.0204	8126.1968	0.0004
LHT	MAE	0	2.8408	95.211	0.0346
	RMSE	0	3.0525	113.7037	0.0409
	RAE	0	0.5188	17.9456	0.0061
	MSE	0	9.3178	12928.529	0.0017
CRP	MAE	0	0.8723	23.5373	0.0002
	RMSE	0	0.916	29.1545	0.0002
	RAE	0	0.6389	17.7617	0.0002
	MSE	0	0.8391	849.9837	0
INP	MAE	0	0.2931	11.3702	9.2528
	RMSE	0	0.3155	14.9749	13.4823
	RAE	0	0.4335	17.4216	14.2772
	MSE	0	0.0996	224.2473	181.7729

Table 7.22 Performance Comparison with Analyzing Output City Galle

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	1.7488	95.1455	0.2012
	RMSE	0	1.9119	121.0209	0.2634
	RAE	0	0.4876	26.0858	0.0526
	MSE	0	3.6552	14646.054	0.0694
ALA	MAE	0	0.9734	55.0987	0.1177
	RMSE	0	1.0468	64.9822	0.1599
	RAE	0	0.4565	25.0499	0.0536
	MSE	0	1.0958	4222.6814	0.0256
CBL	MAE	0	0.4338	18.0255	0.3915
	RMSE	0	0.4819	24.8106	0.5485
	RAE	0	0.7853	34.8092	0.741
	MSE	0	0.2322	615.5642	0.3009
LHT	MAE	0	0.1184	5.0702	0.0113
	RMSE	0	0.1288	6.9893	0.0176
	RAE	0	0.899	38.1439	0.0874
	MSE	0	0.0166	48.8502	0.0003
CRP	MAE	0	0.8199	43.4431	1.698
	RMSE	0	0.921	52.9355	2.1922
	RAE	0	0.4047	20.5735	0.8511
	MSE	0	0.8482	2802.1645	4.8057
INP	MAE	0	0.1363	10.1844	0.3505
	RMSE	0	0.155	11.7143	0.4665
	RAE	0	0.2751	20.2627	0.703
	MSE	0	0.024	137.2253	0.2176

Table 7.23 Performance Comparison with Analyzing Output City Jaffna

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	1.1339	38.3415	91.5233
	RMSE	0	1.2566	70.97	193.0204
	RAE	0	0.7329	25.5918	61.2031
	MSE	0	1.579	5036.7363	37256273
ALA	MAE	0	1.4089	48.4038	138.7333
	RMSE	0	1.4883	71.4514	213.8382
	RAE	0	0.6677	23.276	69.33
	MSE	0	2.2151	5105.2994	45726.776
CBL	MAE	0	1.7472	58.7473	144.2144
	RMSE	0	1.8558	98.1215	258.0401
	RAE	0	0.7149	23.588	58.5213
	MSE	0	3.4441	9627.8251	66584.67
LHT	MAE	0	1.3691	53.2814	173.5988
	RMSE	0	1.4751	73.5005	228.7114
	RAE	0	0.6341	23.6	79.6344
	MSE	0	2.1761	5402.3308	52308.91
CRP	MAE	0	0.0726	2.4629	7.269
	RMSE	0	0.0769	3.7086	12.1301
	RAE	0	0.7286	23.2083	74.4251
	MSE	0	0.0059	13.7536	147.1389
INP	MAE	0	0.0254	1.1205	4.2573
	RMSE	0	0.0278	1.7121	5.8213
	RAE	0	0.4394	19.2206	73.0326
	MSE	0	0.0008	2.9312	33.8871

Table 7.24 Performance Comparison with Analyzing Output City Kaduwela

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	4.8252	112.8432	66.288
	RMSE	0	5.4086	134.728	85.1303
	RAE	0	0.3881	9.368	5.1661
	MSE	0	29.2532	18151.632	7247.1603
ALA	MAE	0	6.7729	190.7608	101.5769
	RMSE	0	7.2704	239.7107	131.0464
	RAE	0	0.5348	14.899	8.0664
	MSE	0	52.8581	57461.218	17173.162
CBL	MAE	0	6.1778	223.6125	57.9398
	RMSE	0	6.5738	281.1229	64.306
	RAE	0	0.4346	15.9105	4.0813
	MSE	0	43.2142	79030.11	4135.2618
LHT	MAE	0	3.5956	108.1114	542.3093
	RMSE	0	3.8106	144.1602	656.2315
	RAE	0	0.4744	14.947	73.5901
	MSE	0	14.5204	20782.154	430639.83
CRP	MAE	0	0.96	28.4414	17.7675
	RMSE	0	1.0184	36.3382	21.2408
	RAE	0	0.3103	9.3644	5.8831
	MSE	0	1.0371	1320.4637	451.1736
INP	MAE	0	0.5835	24.7931	0
	RMSE	0	0.6277	32.0127	0
	RAE	0	0.4225	18.0568	0
	MSE	0	0.394	1024.8101	0

Table 7.25 Performance Comparison with Analyzing Output City Kandy

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	1.4764	23.7163	0.809
	RMSE	0	1.5498	35.8733	0.9709
	RAE	0	1.2365	23.9403	0.6825
	MSE	0	2.4018	1286.8966	0.9427
ALA	MAE	0	1.0643	36.7816	155.5417
	RMSE	0	1.1763	46.8301	198.2968
	RAE	0	0.5627	19.9271	86.5626
	MSE	0	1.3836	2193.0541	39321.638
CBL	MAE	0	3.4987	90.7096	180.9557
	RMSE	0	3.8666	110.8556	221.8893
	RAE	0	1.0351	26.4966	52.2125
	MSE	0	14.9507	12288.959	49234.854
LHT	MAE	0	1.8266	46.6684	174.29
	RMSE	0	1.908	55.2245	187.8413
	RAE	0	0.9657	25.2762	95.399
	MSE	0	3.6407	3049.7502	35284.352
CRP	MAE	0	0.1651	3.8353	0.0452
	RMSE	0	0.177	4.8425	0.053
	RAE	0	0.9424	21.337	0.2511
	MSE	0	0.0313	23.4498	0.0028
INP	MAE	0	0.0625	1.4265	0
	RMSE	0	0.0696	1.7021	0
	RAE	0	0.9962	22.2852	0
	MSE	0	0.0048	2.8972	0

Table 7.26 Performance Comparison with Analyzing Output City Kegalle

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	2.0093	46.4739	187.5156
	RMSE	0	2.1138	61.7647	241.6641
	RAE	0	0.5308	12.2846	51.0029
	MSE	0	4.4682	3814.8827	58401.542
ALA	MAE	0	2.17	73.607	421.7926
	RMSE	0	2.3365	89.6028	449.7419
	RAE	0	0.434	14.9386	84.5555
	MSE	0	5.4607	8023.6604	202267.81
CBL	MAE	0	3.0306	90.2026	0.0028
	RMSE	0	3.2454	117.1802	0.0031
	RAE	0	0.3978	12.4986	0.0004
	MSE	0	10.5328	13731.204	24
LHT	MAE	0	2.4315	61.951	285.2568
	RMSE	0	2.6441	73.4293	335.0235
	RAE	0	0.6563	17.201	81.1238
	MSE	0	6.9912	6151.1486	112240.72
CRP	MAE	0	0.4802	9.4981	44.3833
	RMSE	0	0.5082	11.6541	53.135
	RAE	0	0.6537	11.9998	59.9346
	MSE	0	0.2583	135.819	2823.3285
INP	MAE	0	0.2241	7.6094	32.2059
	RMSE	0	0.2368	9.5587	37.7314
	RAE	0	0.5701	19.2021	79.4187
	MSE	0	0.0561	91.3681	1423.6585

Table 7.27 Performance Comparison with Analyzing Output City Kurunegala

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	0.2824	4.032	77.3528
	RMSE	0	0.3135	5.5702	98.0799
	RAE	0	0.4736	6.6788	128.2784
	MSE	0	0.0983	31.0272	9619.6696
ALA	MAE	0	0.2295	13.0219	8.9334
	RMSE	0	0.2543	14.5132	14.4025
	RAE	0	0.3601	20.3109	14.1684
	MSE	0	0.0646	210.6335	207.4319
CBL	MAE	0	0.8327	20.9122	102.6696
	RMSE	0	0.9142	26.2488	130.0705
	RAE	0	0.3608	8.9284	45.8851
	MSE	0	0.8357	689.0008	16918.329
LHT	MAE	0	0.2566	9.4807	36.68
	RMSE	0	0.2769	10.9303	41.1398
	RAE	0	0.3886	14.5752	55.9535
	MSE	0	0.0767	119.4715	1692.4802
CRP	MAE	0	0.3817	6.6474	1.2133
	RMSE	0	0.4154	8.7899	1.5058
	RAE	0	0.8983	15.5595	2.7137
	MSE	0	0.1725	77.2621	2.2676
INP	MAE	0	0.1477	6.9571	42.1168
	RMSE	0	0.1634	8.3549	46.1916
	RAE	0	0.5553	25.0067	156.3135
	MSE	0	0.0267	69.8045	2133.6646

Table 7.28 Performance Comparison with Analyzing Output City Monaragala

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	2.0376	64.0865	59.06181
	RMSE	0	2.25132	85.2775	91.32067
	RAE	0	0.64652	13.7783	32.0602
	MSE	0	7.01023	10161.3	17220.17
ALA	MAE	0	1.34999	61.5149	111.0703
	RMSE	0	1.99184	78.2451	135.7297
	RAE	0	0.53215	19.0496	44.15264
	MSE	0	7.47106	9877.83	37473.55
CBL	MAE	0	2.91492	93.4985	133.6606
	RMSE	0	3.13784	126.391	137.5025
	RAE	0	0.60622	20.1031	19090.9
	MSE	0	13.7036	23246.6	56610.2
LHT	MAE	0	1.42351	44.0493	146.5733
	RMSE	0	1.52469	56.2835	163.7115
	RAE	0	0.59694	20.0971	2667
	MSE	0	3.80645	5079.56	64533.57
CRP	MAE	0	0.51426	15.9602	13.44554
	RMSE	0	0.5504	21.149	21.10772
	RAE	0	0.62805	17.3011	20.74608
	MSE	0	0.41308	744.124	1760.085
INP	MAE	0	0.17001	7.29122	9.29303
	RMSE	0	0.18397	9.22854	11.01509
	RAE	0	0.51179	20.1163	36.31572
	MSE	0	0.06264	160.44	381.4763

Table 7.29 Performance Comparison with Analyzing Output City Average

District Wise Performance Evaluation-

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	1.964	60.9326	322.5559
	RMSE	0	2.0718	73.4719	381.6751
	RAE	0	0.3165	10.1525	50.5653
	MSE	0	4.2924	5398.1236	145675.89
ALA	MAE	0	1.6433	43.6814	0.0229
	RMSE	0	1.8762	57.3244	0.0283
	RAE	0	0.4769	13.6903	0.0062
	MSE	0	3.5201	3286.0871	0.0008
CBL	MAE	0	2.2718	73.3863	0
	RMSE	0	2.4414	89.2158	0
	RAE	0	0.3732	12.5024	0
	MSE	0	5.9606	7959.4571	0
LHT	MAE	0	0.5601	18.9798	0
	RMSE	0	0.6145	23.877	0
	RAE	0	0.3393	11.3407	0
	MSE	0	0.3776	570.1106	0
CRP	MAE	0	7.3137	197.7756	8.5814
	RMSE	0	7.7771	233.4776	12.4012
	RAE	0	0.2924	8.1327	0.3478
	MSE	0	0.4831	54511.797	153.7909
INP	MAE	0	2.7825	130.453	0.0001
	RMSE	0	2.9354	157.4248	0.0001
	RAE	0	0.3134	15.5835	0
	MSE	0	8.6163	24782.566	0

Table 7.30 Performance Comparison with Analyzing Output Ampara District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	2.4255	77.8334	0
	RMSE	0	2.5935	105.4759	0
	RAE	0	0.2974	8.5307	0
	MSE	0	6.7261	11125.165	0
ALA	MAE	0	2.011	69.2024	0.0458
	RMSE	0	2.1132	79.2935	0.057
	RAE	0	0.4351	14.7804	0.0098
	MSE	0	4.4657	6287.4539	0.0033
CBL	MAE	0	8.7581	384.7429	0.0034
	RMSE	0	9.6365	486.2765	0.0043
	RAE	0	0.3065	13.7366	0.0001
	MSE	0	9.8627	236464.87	0
LHT	MAE	0	2.7823	70.6892	7.6513
	RMSE	0	2.9224	89.7634	9.661
	RAE	0	0.426	11.0526	1.1726
	MSE	0	8.5402	8057.4722	93.3351
CRP	MAE	0	2.0656	69.5582	164.232
	RMSE	0	2.2409	87.8737	218.6393
	RAE	0	0.345	11.7996	28.9474
	MSE	0	5.0216	7721.7932	47803.164
INP	MAE	0	0.8772	38.7674	0.0106
	RMSE	0	0.9241	45.9856	0.0133
	RAE	0	0.4355	13.6461	0.005
	MSE	0	0.8539	2114.6734	0.0002

Table 7.31 Performance Comparison with Analyzing Output Anuradhapura District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	18.8197	655.0767	0.0487
	RMSE	0	20.3881	861.8049	0.0641
	RAE	0	0.358	12.5963	0.001
	MSE	0	415.6744	742707.67	0.0041
ALA	MAE	0	12.0655	376.9201	0.0005
	RMSE	0	12.5152	473.4457	0.0007
	RAE	0	0.4863	15.8854	0
	MSE	0	156.6307	224150.82	0
CBL	MAE	0	11.7887	399.643	374.0212
	RMSE	0	12.867	471.8775	492.169
	RAE	0	0.4693	16.0314	15.0673
	MSE	0	165.5584	222668.36	242230.31
LHT	MAE	0	3.9252	101.0928	2.8524
	RMSE	0	42247	141.3364	3.4548
	RAE	0	0.5908	15.7242	0.4095
	MSE	0	17.848	19975.989	11.9355
CRP	MAE	0	3.7036	161.8678	0.0126
	RMSE	0	3.9853	196.4655	0.0171
	RAE	0	0.4459	19.5448	0.0016
	MSE	0	15.8826	38598.708	0.0003
INP	MAE	0	0.6926	25.3296	0.3907
	RMSE	0	0.7402	37.7038	0.554
	RAE	0	0.4898	18.1501	0.2863
	MSE	0	0.5478	1421.5736	0.307

Table 7.32 Performance Comparison with Analyzing Output Colombo inner District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	38.5737	814.1361	5477.4877
	RMSE	0	41.7789	1002.3572	6675.8157
	RAE	0	0.3811	8.0833	54.8468
	MSE	0	1745.4729	1005722.6	44566516
ALA	MAE	0	51.2463	1745.1346	2288.7994
	RMSE	0	53.2625	2156.1724	2713.1373
	RAE	0	0.4918	16.2715	21.5627
	MSE	0	2836.8888	4649079.3	7361114
CBL	MAE	0	27.4121	498.2395	2934.1849
	RMSE	0	28.4903	607.5224	3526.8873
	RAE	0	0.3779	7.2131	41.5006
	MSE	0	811.6949	369083.52	12438934
LHT	MAE	0	51.2343	1406.9829	6565.4622
	RMSE	0	55.3335	1768.9827	7834.6559
	RAE	0	0.6086	17	80.1346
	MSE	0	3061.7914	3129299.7	61381833
CRP	MAE	0	2.8432	91.3683	539.7902
	RMSE	0	3.0119	140.1068	629.293
	RAE	0	0.4057	13.3922	78.9597
	MSE	0	9.0714	19629.907	396009.7
INP	MAE	0	0.8033	37.9996	0.0274
	RMSE	0	0.3926	49.1361	0.0325
	RAE	0	0.312	14.6321	0.0098
	MSE	0	0.7967	2414.3612	0.0011

Table 7.33 Performance Comparison with Analyzing Output Colombo Outer District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	3.9448	113.6357	0.7153
	RMSE	0	4.1873	146.8905	0.8923
	RAE	0	0.3067	8.9062	0.0538
	MSE	0	17.5335	21576.819	0.7962
ALA	MAE	0	5.409	203.4526	0
	RMSE	0	5.6445	239.0706	0
	RAE	0	0.4596	17.5994	0
	MSE	0	31.8607	57154.759	0
CBL	MAE	0	12.8169	289.56	0.014
	RMSE	0	13.4997	378.5197	0.018
	RAE	0	0.369	8.7183	0.0004
	MSE	0	182.2425	143277.15	0.0003
LHT	MAE	0	9.8924	288.9503	1326.3213
	RMSE	0	10.7405	354.2533	1541.3526
	RAE	0	0.5512	16.3759	75.8105
	MSE	0	115.3593	125495.38	2375768
CRP	MAE	0	1.0071	26.3807	6.2786
	RMSE	0	1.0598	31.6373	7.5915
	RAE	0	0.4257	11.3375	2.6081
	MSE	0	1.1232	1000.9188	57.6312
INP	MAE	0	0.4081	15.2946	0.0001
	RMSE	0	0.4341	20.6091	0.0001
	RAE	0	0.4708	18.2682	0.0001
	MSE	0	0.1885	424.734	0

Table 7.34 Performance Comparison with Analyzing Output Galle District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	2.5402	53.5708	288.0427
	RMSE	0	2.7076	68.5653	356.5044
	RAE	0	0.6874	14.6219	79.4967
	MSE	0	7.3311	4701.1941	127095.41
ALA	MAE	0	1.3684	49.4779	232.4531
	RMSE	0	1.4534	62.2237	256.399
	RAE	0	0.456	16.9984	76.6804
	MSE	0	2.1125	3871.7884	65740.47
CBL	MAE	0	1.5009	45.8408	30.0695
	RMSE	0	1.6085	56.4465	38.1107
	RAE	0	1.4284	44.0941	27.4162
	MSE	0	2.5882	3136.2037	1452.4285
LHT	MAE	0	0.1681	6.7893	0.0036
	RMSE	0	0.1824	9.0702	0.0043
	RAE	0	0.7596	32.318	0.017
	MSE	0	0.0333	82.2684	0
CRP	MAE	0	4.0716	74.0975	321.378
	RMSE	0	4.4179	91.7814	391.5064
	RAE	0	1.0749	19.0111	83.7938
	MSE	0	9.5174	8423.83	153277.27
INP	MAE	0	1.0885	28.2356	0.0006
	RMSE	0	1.1221	37.4504	0.0007
	RAE	0	1.0059	26.4298	0.0005
	MSE	0	1.2592	1402.5303	0

Table 7.35 Performance Comparison with Analyzing Output Jaffna District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	8.5079	193.4745	0
	RMSE	0	9.1805	241.0748	0.0001
	RAE	0	0.3557	8.389	0
	MSE	0	84.2816	58117.079	0
ALA	MAE	0	12.7209	363.5621	1595.0922
	RMSE	0	13.3865	442.6317	2079.4577
	RAE	0	0.5391	15.4886	65.4626
	MSE	0	179.1975	195922.8	4324144.2
CBL	MAE	0	15.5958	513.3358	2294.8476
	RMSE	0	16.3749	664.3474	2600.4147
	RAE	0	0.3732	12.4649	54.3238
	MSE	0	268.1362	441357.45	6762156.7
LHT	MAE	0	8.2567	256.1257	0.0001
	RMSE	0	8.7789	336.1384	0.0001
	RAE	0	0.4463	14.2424	0
	MSE	0	77.0699	112989.04	0
CRP	MAE	0	3.4413	124.9269	23.5277
	RMSE	0	3.7591	150.4107	33.7135
	RAE	0	0.2384	8.7784	1.9324
	MSE	0	14.1308	22623.37	1136.6034
INP	MAE	0	2.8291	99.6819	0.139
	RMSE	0	2.9965	128.4238	0.2082
	RAE	0	0.4275	15.7142	0.0218
	MSE	0	8.9792	16492.673	0.0433

Table 7.36 Performance Comparison with Analyzing Output Kandy District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	2.9129	60.6004	0.0073
	RMSE	0	3.1611	71.6738	0.013
	RAE	0	0.4837	10.5586	0.0012
	MSE	0	9.9928	5137.1304	0.0002
ALA	MAE	0	4.5798	128.6801	0.0237
	RMSE	0	4.7734	158.5327	0.0276
	RAE	0	0.6947	20.1536	0.0036
	MSE	0	22.7857	25132.6257	0.0008
CBL	MAE	0	16.1015	320.0628	0.0033
	RMSE	0	16.8252	372.2555	0.0042
	RAE	0	0.6834	13.387	0.0001
	MSE	0	283.0863	138574.194	0
LHT	MAE	0	6.8004	198.4989	932.5066
	RMSE	0	7.4081	253.2962	1004.4066
	RAE	0	0.6313	18.2766	85.6799
	MSE	0	54.8799	64158.9757	1008832.67
CRP	MAE	0	3.7532	101.7449	0.0444
	RMSE	0	4.136	132.9938	0.0535
	RAE	0	0.534	14.6676	0.0061
	MSE	0	17.1068	17687.3607	0.0029
INP	MAE	0	2.0338	71.1253	0.0006
	RMSE	0	2.1706	96.1081	0.0007
	RAE	0	0.6292	22.0898	0.0002
	MSE	0	4.7113	9236.772	0

Table 7.37 Performance Comparison with Analyzing Output Kegalle District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	4.842	136.7575	683.24
	RMSE	0	5.444	164.7927	822.9025
	RAE	0	0.4006	11.0003	56.6231
	MSE	0	29.6374	27156.638	677168.58
ALA	MAE	0	6.8357	225.8321	10.2076
	RMSE	0	7.293	267.3829	11.9346
	RAE	0	0.5011	16.7389	0.7074
	MSE	0	53.1882	71493.594	142.4355
CBL	MAE	0	21.7624	501.5379	2610.2715
	RMSE	0	24.2754	589.8726	3007.5345
	RAE	0	0.4835	11.4231	55.8591
	MSE	0	589.2966	347949.72	9045263.8
LHT	MAE	0	11.143	306.9604	0.2964
	RMSE	0	11.7349	366.2528	0.363
	RAE	0	0.6575	17.8651	0.0177
	MSE	0	137.7087	134141.12	0.1318
CRP	MAE	0	2.774	101.7644	507.2772
	RMSE	0	3.0289	121.3501	603.8839
	RAE	0	0.3074	11.2958	55.1765
	MSE	0	9.1745	14725.858	364675.72
INP	MAE	0	2.2987	74.745	0
	RMSE	0	2.3848	100.3534	0
	RAE	0	0.5024	16.9	0
	MSE	0	5.6872	10070.807	0

Table 7.38 Performance Comparison with Analyzing Output Kuranagala District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	0.6242	13.7516	67.9757
	RMSE	0	0.683	16.5031	76.6712
	RAE	0	0.4215	9.3783	45.984
	MSE	0	0.4665	272.353	5878.4687
ALA	MAE	0	0.4074	20.3034	0.0989
	RMSE	0	0.4509	24.6218	0.2025
	RAE	0	0.3279	15.8202	0.0804
	MSE	0	0.2033	606.2308	0.0411
CBL	MAE	0	1.6924	51.5164	0
	RMSE	0	1.8757	62.1823	0
	RAE	0	0.2392	7.6005	0
	MSE	0	3.5184	3866.6392	0
LHT	MAE	0	0.6779	18.7674	0
	RMSE	0	0.7425	24.0504	0
	RAE	0	0.3621	10.4107	0
	MSE	0	0.5517	573.423	0
CRP	MAE	0	0.6346	24.7245	3.7549
	RMSE	0	0.6652	30.4804	4.3567
	RAE	0	0.4869	19.3361	2.8045
	MSE	0	0.4425	929.0539	19.243
INP	MAE	0	0.2231	7.6516	47.3714
	RMSE	0	0.2411	9.2412	53.9937
	RAE	0	0.5903	20.0663	125.5751
	MSE	0	0.0581	85.3996	2915.3246

Table 7.39 Performance Comparison with Analyzing Output Monaragala District

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	5.51552	217.977	684.0073
	RMSE	0	921958	275.311	831.4538
	RAE	0	0.40086	10.2217	28.75719
	MSE	0	232.141	188191	4552234
ALA	MAE	0	9.82873	323.125	412.6744
	RMSE	0	10.2769	396.07	506.1245
	RAE	0	0.48685	16.3427	16.45131
	MSE	0	329.085	523699	1175114
CBL	MAE	0	11.9701	307.787	824.3415
	RMSE	0	12.7895	377.852	966.5143
	RAE	0	0.51036	14.7171	19.41676
	MSE	0	232.194	191439	2849004
LHT	MAE	0	9.54409	267.384	883.5094
	RMSE	0	10.2683	336.702	1039.39
	RAE	0	0.53732	16.4606	24.32418
	MSE	0	347.416	359535	6476654
CRP	MAE	0	3.16079	97.4209	157.9877
	RMSE	0	3.40821	121.658	190.1486
	RAE	0	0.45563	13.7296	25.45779
	MSE	0	8.19539	18585.3	96313.31
INP	MAE	0	1.40369	52.9234	4.79405
	RMSE	0	1.48415	68.2436	5.48033
	RAE	0	0.51768	18.648	12.58988
	MSE	0	3.16982	6844.61	291.5676

Table 7.40 Performance Comparison with Analyzing District Average

Island wide Performance Evaluation-

Product	Algorithm	Linear	SMOReg	Gaussian	Multilayer
SWS	MAE	0	129.4807	2811.4811	2811.4811
	RMSE	0	141.7618	3567.2613	3567.2613
	RAE	0	0.3728	8.1326	8.1326
	MSE	0	20096.402	12725353	12725353
ALA	MAE	0	152.056	4887.4228	4887.4228
	RMSE	0	163.8941	6020.5419	6020.5419
	RAE	0	0.4997	16.3198	16.3198
	MSE	0	26861.261	36246925	36246925
CBL	MAE	0	173.1683	4570.3538	4570.3538
	RMSE	0	196.7004	5689.3357	5689.3357
	RAE	0	0.3833	10.1886	10.1886
	MSE	0	38691.056	32368541	32368541
LHT	MAE	0	174.359	4936.633	4936.633
	RMSE	0	187.8463	6114.5225	6114.5225
	RAE	0	0.5469	15.852	15.852
	MSE	0	35286.235	37387386	37387386
CRP	MAE	0	39.6276	1249.7997	1249.7997
	RMSE	0	44.1335	1607.6154	1607.6154
	RAE	0	0.2682	8.5753	8.5753
	MSE	0	1947.7632	2584427.1	2584427.1
INP	MAE	0	24.8073	953.9316	953.9316
	RMSE	0	26.201	1285.8863	1285.8863
	RAE	0	0.443	17.3227	17.3227
	MSE	0	686.4928	1653503.7	1653503.7

Table 7.41 Performance Comparison with Analyzing Output Island Wide

Consider the results in average error values of each Dealer Wise (Table 7.18), City Wise (Table 7.29), District Wise (Table 7.40), Island Wide (Table 7.41) retail Sales analyze, Linear Regression and SMO Regression methods are best match technique for analyze the Dealer Wise and City Wise retail analyzing. As well as District Wise and Island Wide sales analyze more suitable method is Linear Regression. However, base on the average error values Linear Regression method can used as a common method for analyzing retail sales in dealer wise, city wise, district wise and country wide. Use of this prediction method (Linear Regression) company can may save huge amount of money or reduce wastage in 2015. Following table 7.8 shows the wastage. In this table actual retail issue mention as actual and prediction mention as predicted sales values based on previous year's net sales.

7.4 Summary

This chapter mainly focuses to evaluate the developed the Sales Analysis and POS System. Sales Analysis and POS System evaluates accuracy by using test cases. These test cases develop by developers and these test cases forces to main function of the system. User, Customer, Employee, supplier creation, Data synchronization, Return handling and payment are mainly checked. Then evaluate analysis system using by different test method such as black box and white box testing. As finally all the test cases successfully executed. As well comparing the analysis and actual data, results of testing algorithm this research identified Linear Regression predict the more accurate data related to the retail sales forecasting. Finally this system also identified the some sales patterns that helpful to decision making for the company. Chapter eight discuss about evaluation about this project as well limitation and future work of this research area.

Conclusion and Future Work

8.1 Introduction

Sales analysis is way for improve sales profitability and provide information for create sales forecasting plans. Sales Analysis systems is center point for accumulation of sales data generated from different modules. This Chapter discuss the overall achievement summary of cloud base sales analysis system, limitation Also, available findings for further development are described here. This chapter will also describe a critical discussion and assessment about project. It is described achieved results from the project.

OREL Corporation is prominent Electronic equipment selling company in Sri Lanka has enhanced their business by working with new innovative ideas and technologies. At the beginning OREL CORP use conventional and manual business processes for improve their business strategies and sales. That was commencement of development of this sales analysis system.

This clouded base sales analysis system is divide into two main system Component on is dealer base Point of sales solution which is developed by java technology and Maria DB DBMS another component is cloud base sales analysis solution. This two solutions join communicate via TCP/IP Internet and two solutions are share the relevant information's time to time.

The produced system support dealers to manage their stocks sales and generate essential reports.

Forecast module facilitate to create sales analysis report by gathered sales details from point of sale (POS).

POS solution mainly help to dealer to manage their sales activity POS solution provide all of modern features for help and save valuable time to sales persons.

This solution provide the facilities dealer to create purchase order to main company. After Company accept that purchase order it converts to Good received not and it load to dealer stock after his acceptance. Now he can start the sales process via point of sale solution and track sales process. Dealer can create new sales items and change necessary details ex -: category, Reorder Level, Stock level Also, he can create Employees and User account with different permission levels to users. Ex -: Supervisors, Cashiers

8.2 Achievement

The Sales Analysing System is a best solution for use replace the current manual system in the organization. This effect in decrease complexity and effort, improved communication, a better understand about the primary, secondary and tertiary sales, motivate sales persons working at the organization.

The Output of this system has provided point of sales solution for every sales point and enable there to manage their e sales activities such as inventory management, stock movement process, daily sales process and generate basic sales reports. By the system sent the sales details to company via internet for start the analysis process. This analysis process makes the forecast and predictions for the company for plane their sales activities.

The main goals of the project were to make future plans to enhance the company revenue. It can be achieved by analysing sales data with a wide range of reporting and also provide knowledge power for decision makers about profit and loss.

The Sales analysis system achieved objectives are listed below,

- Raising purchase orders, Good received notes and synchronization data over two platforms completed successfully.
- The sales analysis project was successfully completed the client requirements were understood and documented.
- The database and design stage of the system done successfully.
- User Interface of the both web and desktop applications developed with user friendliness.

- Invoicing module completed.
- Product management and stock process is complete
- User Registration and permission management
- Report generation for the management also successfully achieved.
- Admin users can manage master data via system.
- Main Goal of sales analysis is collect sales data and generate information for create sales forecast.

8.3 Limitations and Future Works

The following difficulties encountered up to the dissertation submission date and most of the difficulties encountered when it start the development of the system.

At The requirement Gathering stage it is difficult Due to the conflicting requirements by the different level of user and management level sales strategy concepts. Gathered information normalize and create database design is little bit tricky process.

Most of the difficulties encountered when development stage of the system. Such as,

- Lot Of difficulties rise at the Development stage of the system
- Java Library versions are incompatibility
- Real-time Data Synchronization process.
- Web services testing problem.
- Stock and sales quantity tally problems.
- Network Connectivity problems.
- ORM hibernate query is deferent than Normal SQL query.
- Most errors could be successfully resolved. And this system help learnt how to face errors and find the solutions reaching about it.

8.4 Summary

This chapter consider the overall achievement of the project as well this chapter describes limitations & future work related to this project.

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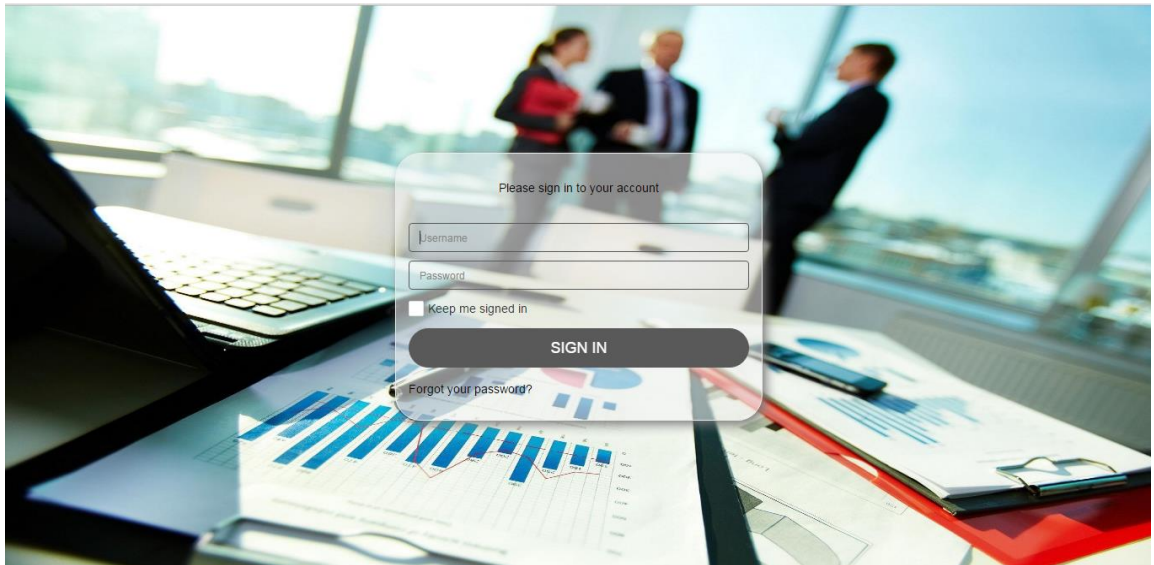
[12] Klassen, R. D., & Flores, B. E. (2001). Analyzing Practices of Canadian Firms: Survey Results and Comparisons. *International Journal of Production Economics*, 70 , p. 163-174.

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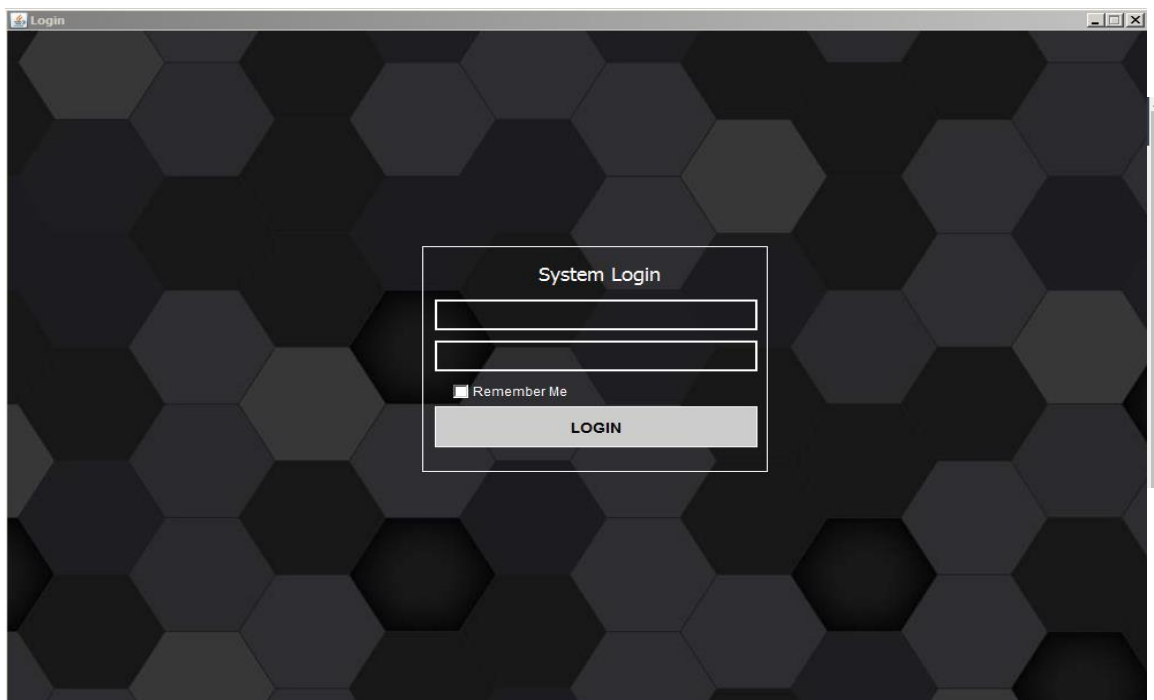
[14]“What is Java and why do I need it?” [Online]. Available: https://www.java.com/en/download/faq/whatis_java.xml. [Accessed: 13-Dec-2016].

Appendixes

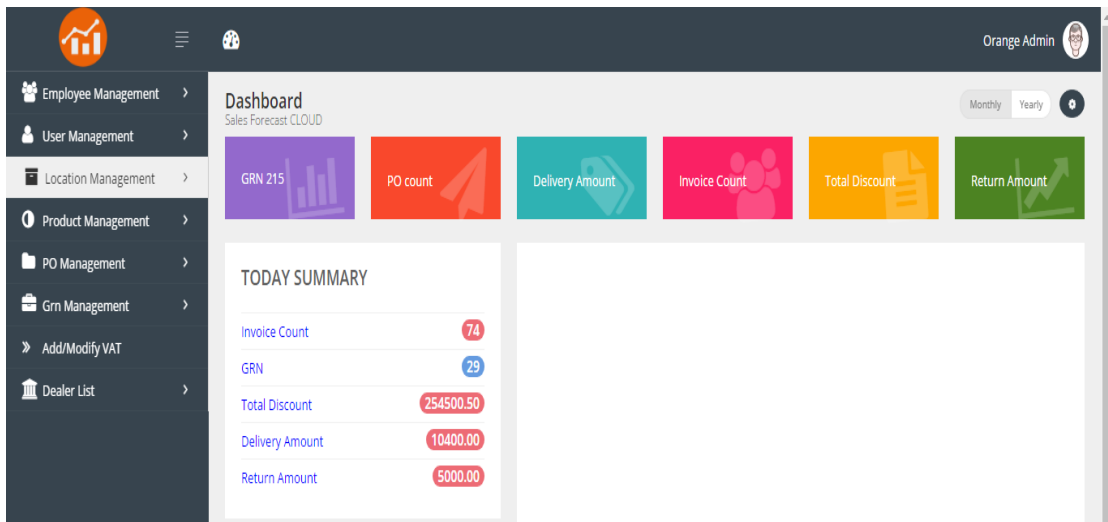
Appendix A – User Interfaces.



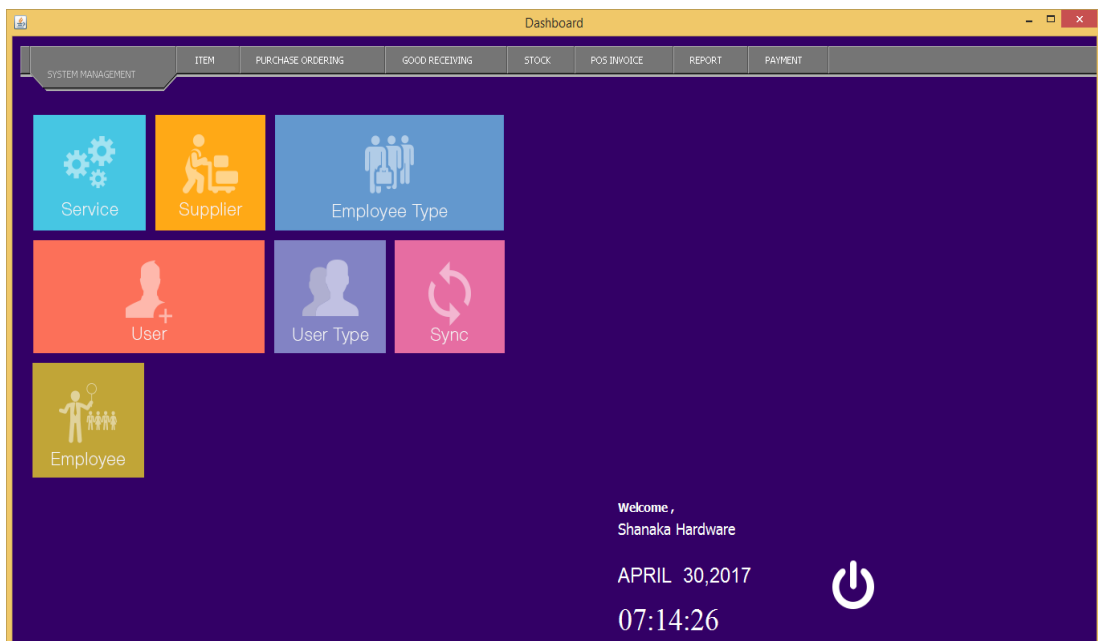
Cloud application Login



Point of sale Login



Cloud application dashboard



Point of sale dashboard

I. Employee and employee Type Modules.

- Cloud application.

Employee Management

Home > Employee Management > Add Employee

Add Employee

Employee Type* admin

Name* Kalpa Dissanayake

Address No.425/11.Pelenwatta, Pannipitiya

Email infokalpa@gmail.com

Mobile* 713998064

Save

Add Employee

Employee Management

Home > Employee Management > List Employee

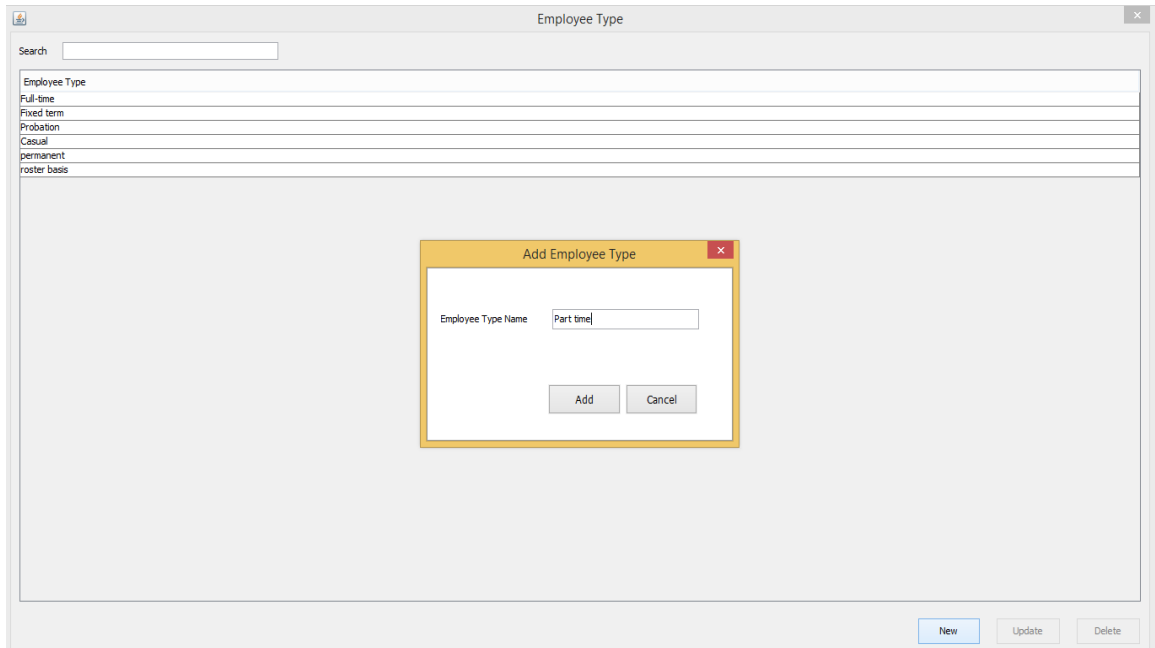
Employee List

First Name	Last Name	Address	Email	Mobile	Type	Action
Orange	Admin	Colombo	admin@orangelanka.c...	0111111111	admin	
Nuwan	Prasanna	No.23, Kottawa	nuwan@gmail.com	1234567891	admin	
Rasika	Perera	25	rasika@gmail.com	1225698741	admin	
Orange	RSM	Colombo	dimorsm@dimolanka.c...	0111111111	RSM	
Iresh	Madhushan	No.23, Dematagoda	iresh@orel.com	0745484564	RSM	
Maduka	Deshan	No.22, Kottawa	maduka@gmail.com	1345878945	RSM	
Orange	ASM	Colombo	dimosm@dimolanka...	0111111111	ASM	
PRADEEP	THILAKERATHNE	NO 14, DEVI ROAD, W...	Pradeep.Thilakarathne...	0771522591	Rep	
SHANAKA	GUNATHILAKE	NO 20/1, SRI DHARAM...	Shanaka.Gunathilaka...	0777867881	Rep	
DUMINDU	PATHIRANAGF	MAI NIGA WATTF WA	Dumindu Pathiranae	0773917166	Rep	

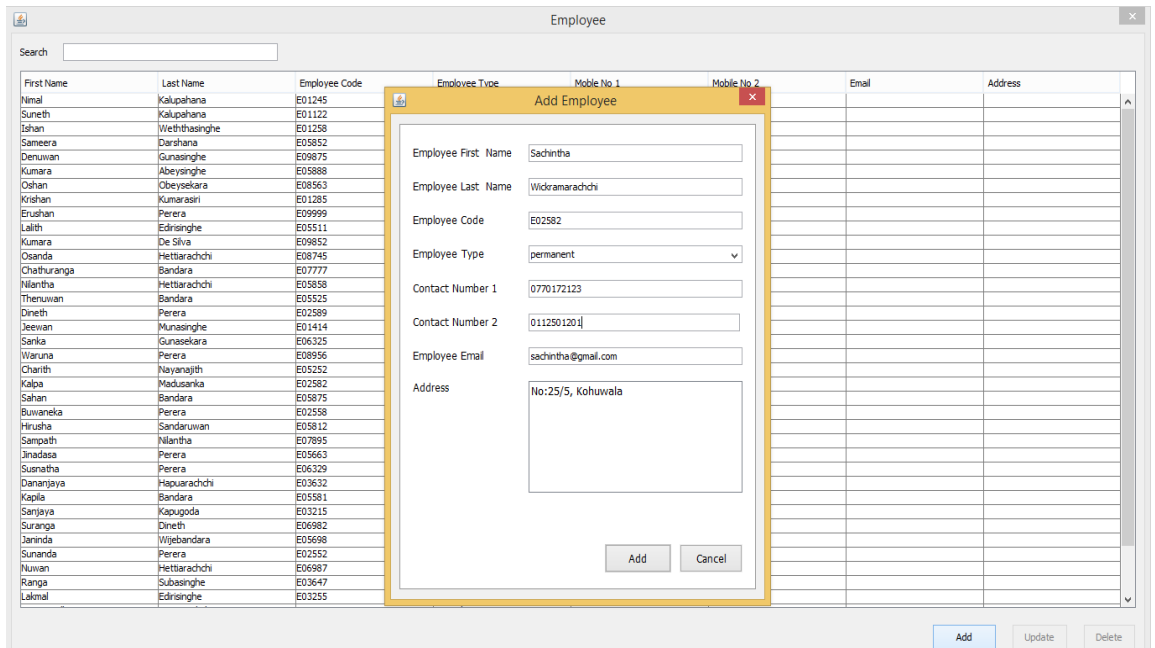
1 - 25 of 29 items

View Employee List

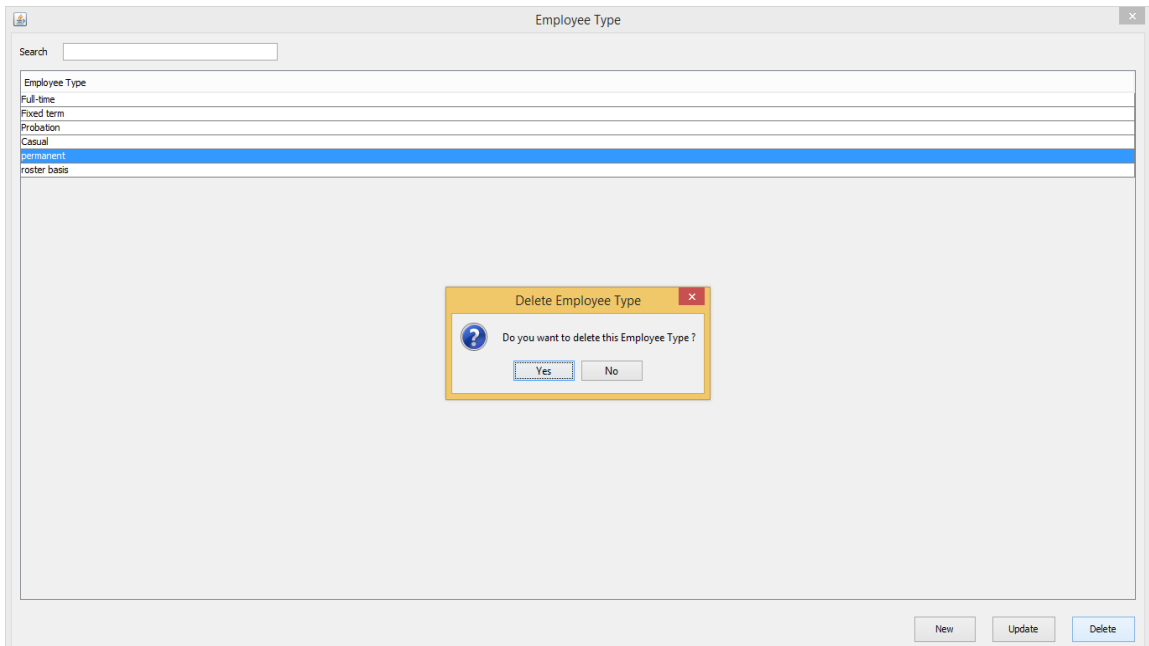
- POS Application



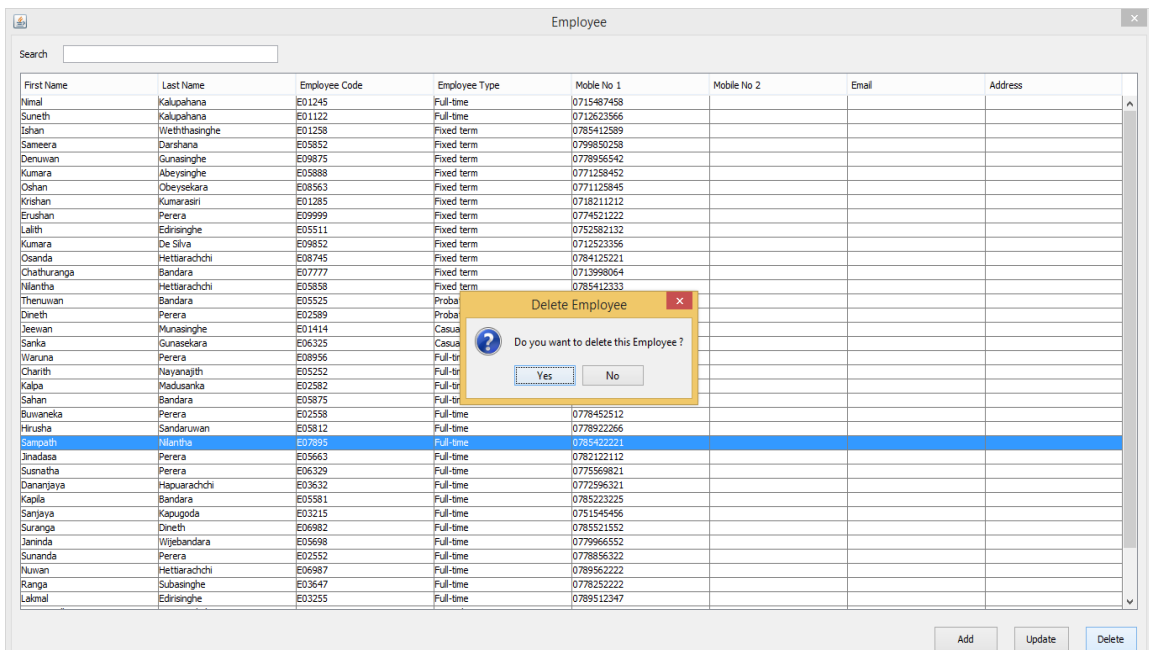
Add Employee Type



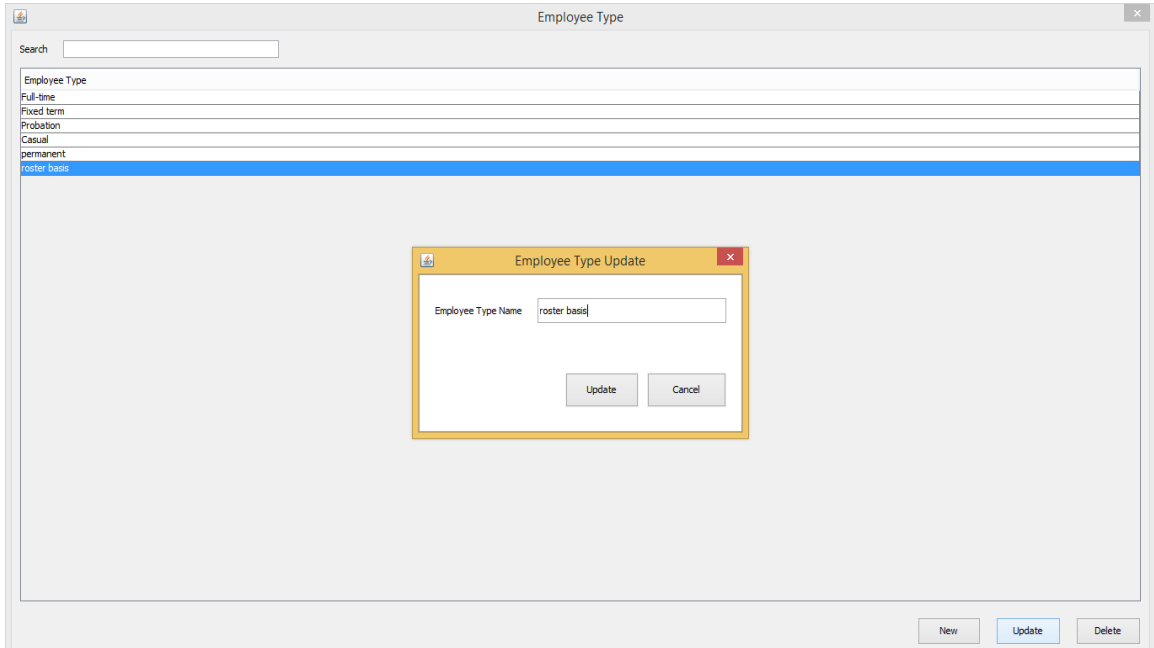
Add Employee



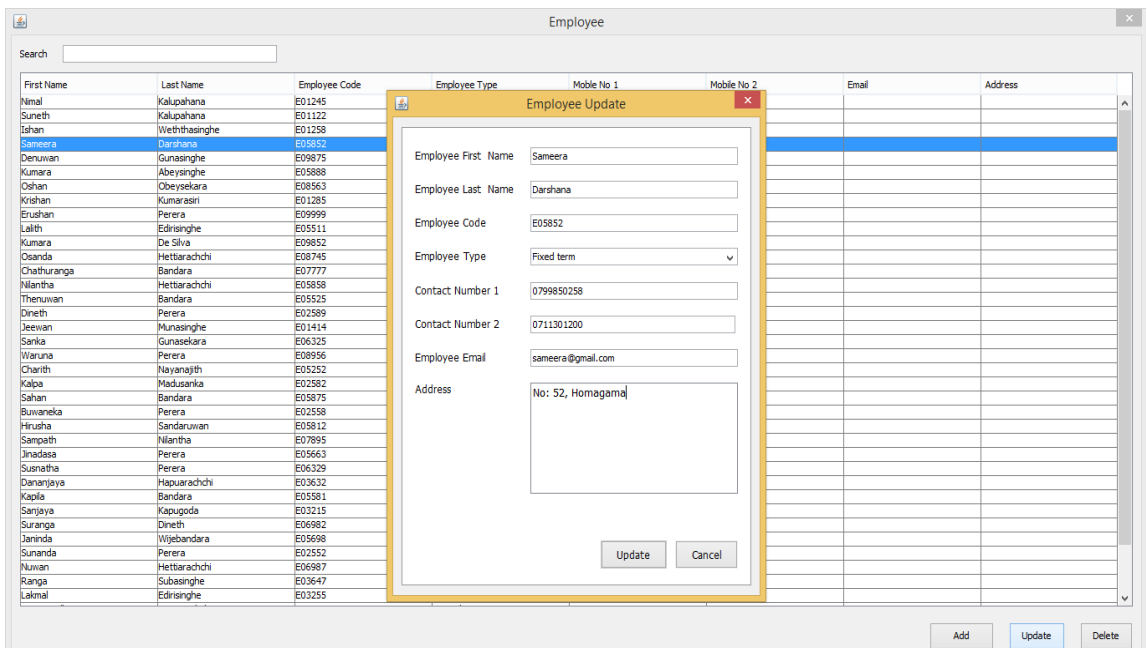
Delete Employee Type



Delete Employee



Update Employee Type



Update Employee

II. Location and Are Management.

- Cloud application.

The screenshot shows the 'Add Location' form in the Orange Admin interface. The browser address bar shows 'localhost/FORECAST-WEB/location/add?'. The left sidebar contains navigation options: Employee Management, User Management, Location Management (expanded), Product Management, PO Management, Gm Management, Add/Modify VAT, and Dealer List. The main content area is titled 'Add Location' and contains the following fields:

- Category*: Company (dropdown)
- Parent*: Select an Option (dropdown)
- Name*: Hemantha Motors (text input)
- Allowance: 1000 (text input)
- Supervisor*: Orange Admin (dropdown)

A 'Save' button is located at the bottom right of the form.

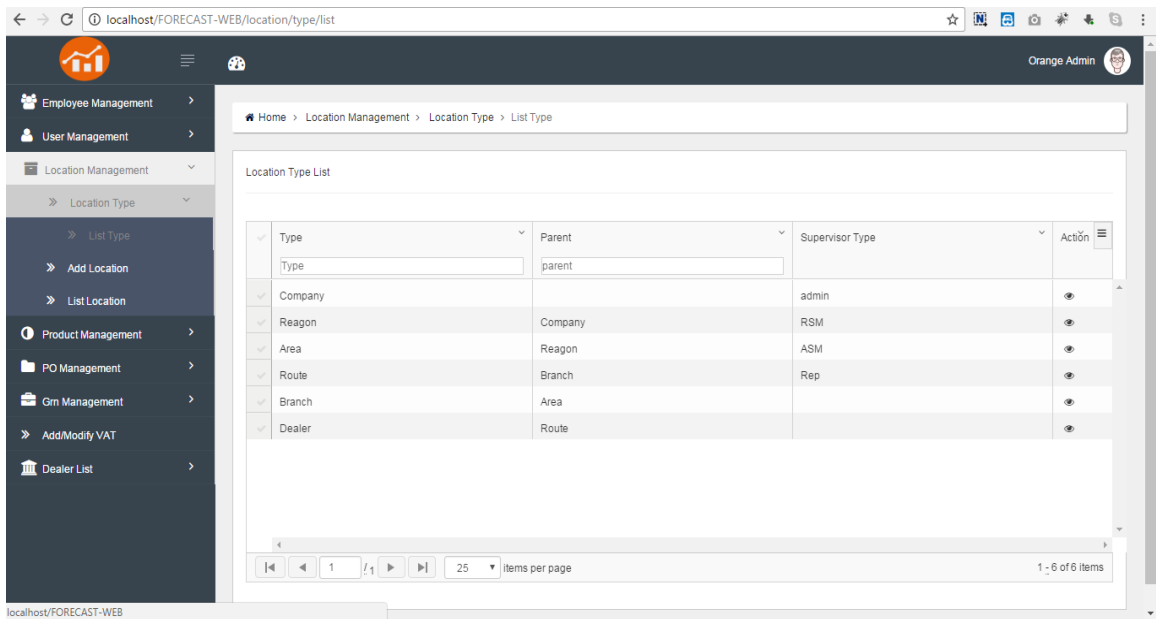
Add Location

The screenshot shows the 'List Location' table in the Orange Admin interface. The browser address bar shows 'localhost/FORECAST-WEB/location/list'. The left sidebar is the same as in the previous screenshot. The main content area is titled 'Location List' and contains a table with the following data:

Name	Type	Parent	Allowance	Action
Kandy	Branch	Orange AREA	0.00	Eye icon, Edit icon
Kandy Route 1	Route	Kandy	0.00	Eye icon, Edit icon
Auto Mart Service Station & Caean P...	Dealer	Kandy Route 1		Eye icon, Edit icon
Fiat Mama Motors	Dealer	Kandy Route 1		Eye icon, Edit icon
Pradeep Motors	Dealer	Kandy Route 1		Eye icon, Edit icon
Sumedha Tyre Centre	Dealer	Kandy Route 1		Eye icon, Edit icon
Thenuka Auto Service	Dealer	Kandy Route 1		Eye icon, Edit icon
Thilanka Motors	Dealer	Kandy Route 1		Eye icon, Edit icon
Up - Country Motors	Dealer	Kandy Route 1		Eye icon, Edit icon
A M S Motors	Dealer	Kandy Route 1	0.00	Eye icon, Edit icon

At the bottom of the table, there is a pagination control showing '1 / 1' and '25 items per page'.

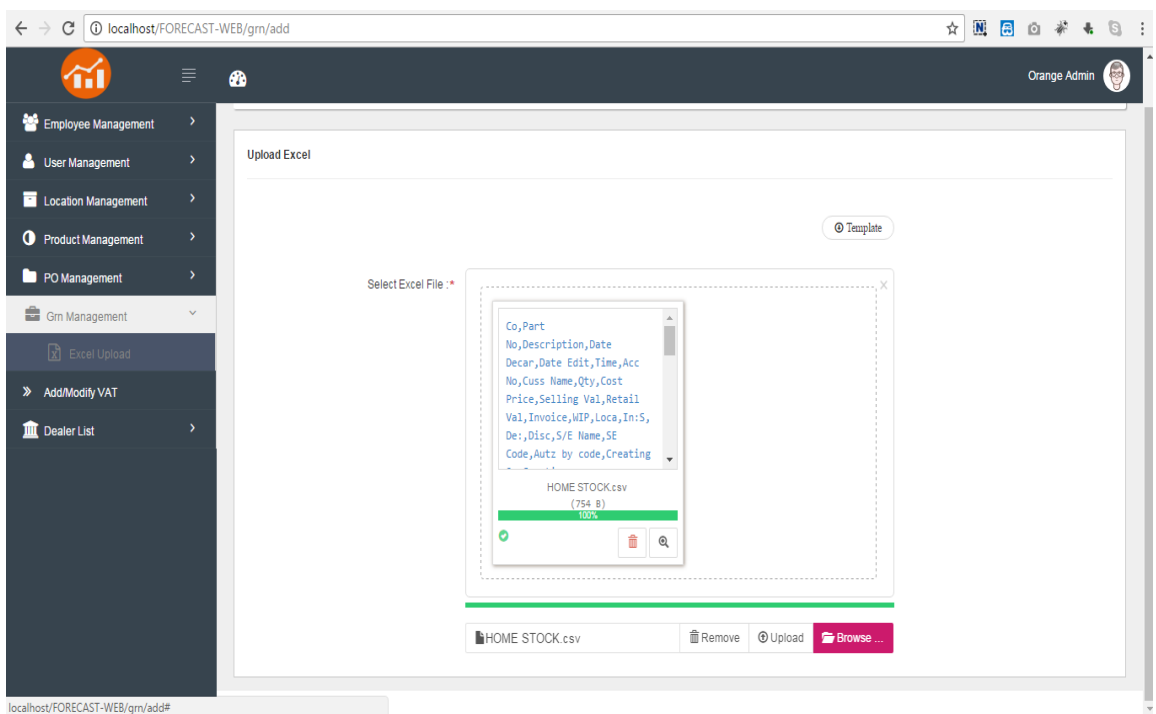
Location List



Location Types

III. GRN Management module.

- Cloud application.



Upload GRN Excel

- Point of sale.

New Orange GRN

Search:

Part No	Description	Buying Price	Invoiced Qty	MRP	Accepted Qty	Barcode	Return Qty	Reject Reason
WG1-040CM	GLS Pin type 40W Clear Bulb	2055.45	5	2569.32	5	1-040CM		
WG1-060C	GLS Pin type 60W Clear Bulb	2398.04	3	2997.54	3	1-060C		
WG1-025C	GLS Pin type 25W Clear Bulb	554.97	10	693.71	10	1-025C		

Total Amount (approx) : 23,021.07 Vat : 15.0%

Total Item Quantity : 3

Add New GRN

GRN

Orange GRN Accepted Orange GRN

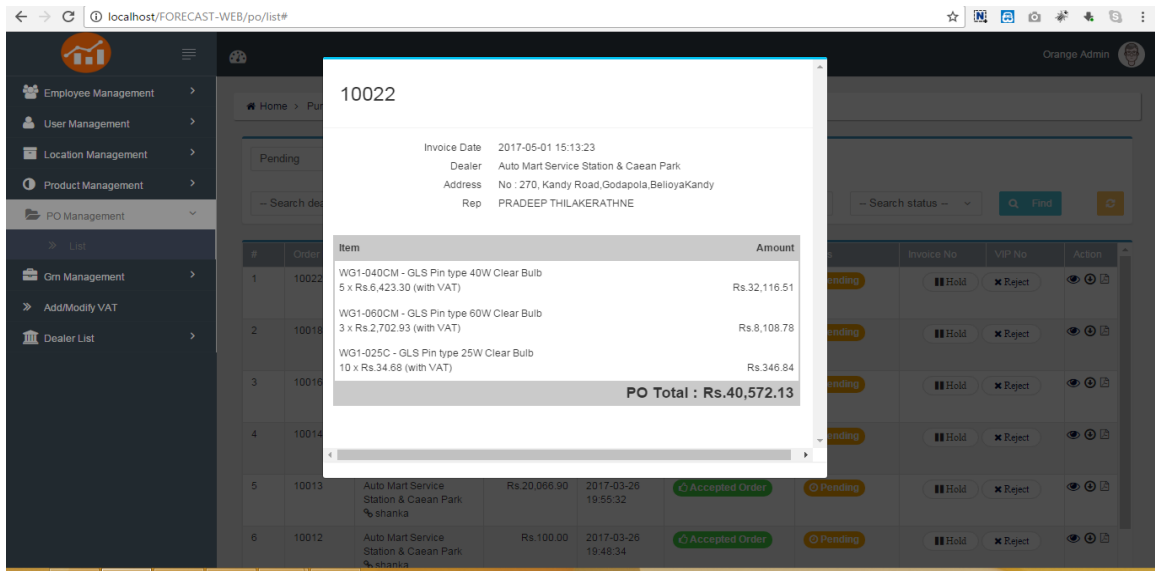
Search:

Wip No	Invoice No	Created Date	Updated Date
28	28	2017/03/24	2017/03/24
28	28	2017/03/26	2017/03/26
28	28	2017/03/26	2017/03/26
28	30	2017/03/26	2017/03/26
28	12	2017/03/26	2017/03/26
105	106	2017/03/28	2017/03/28
28	50	2017/05/01	2017/05/01

GRN List

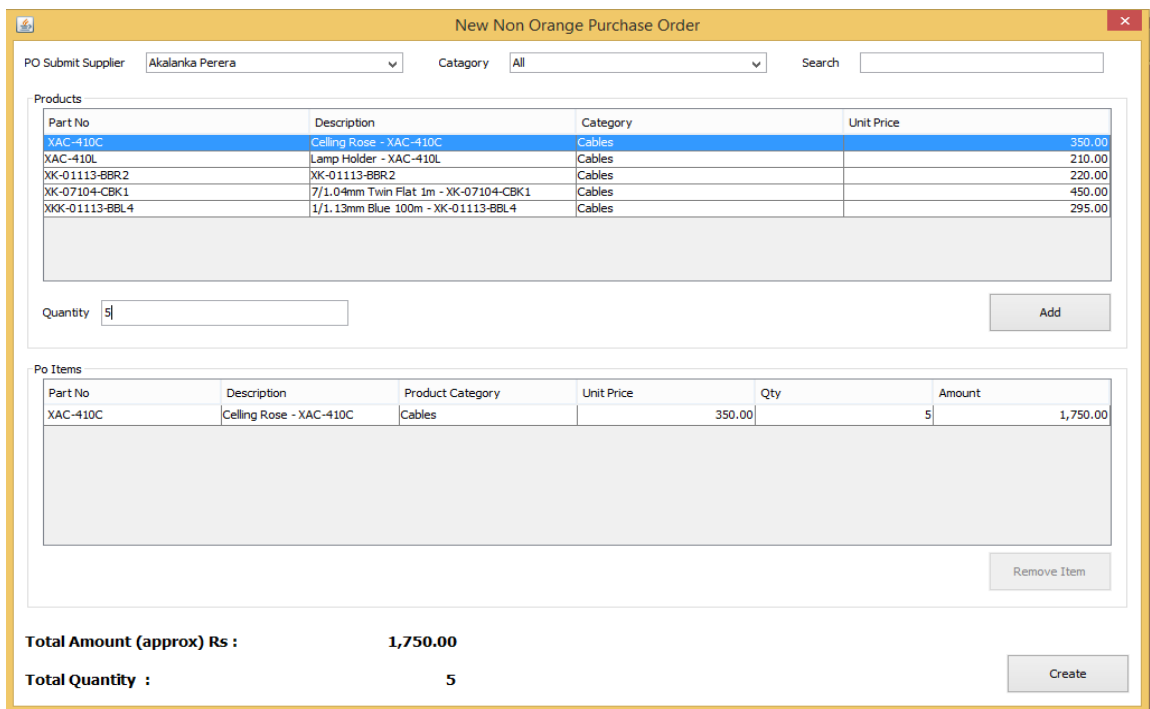
IV. PO Management Module

- Cloud application.

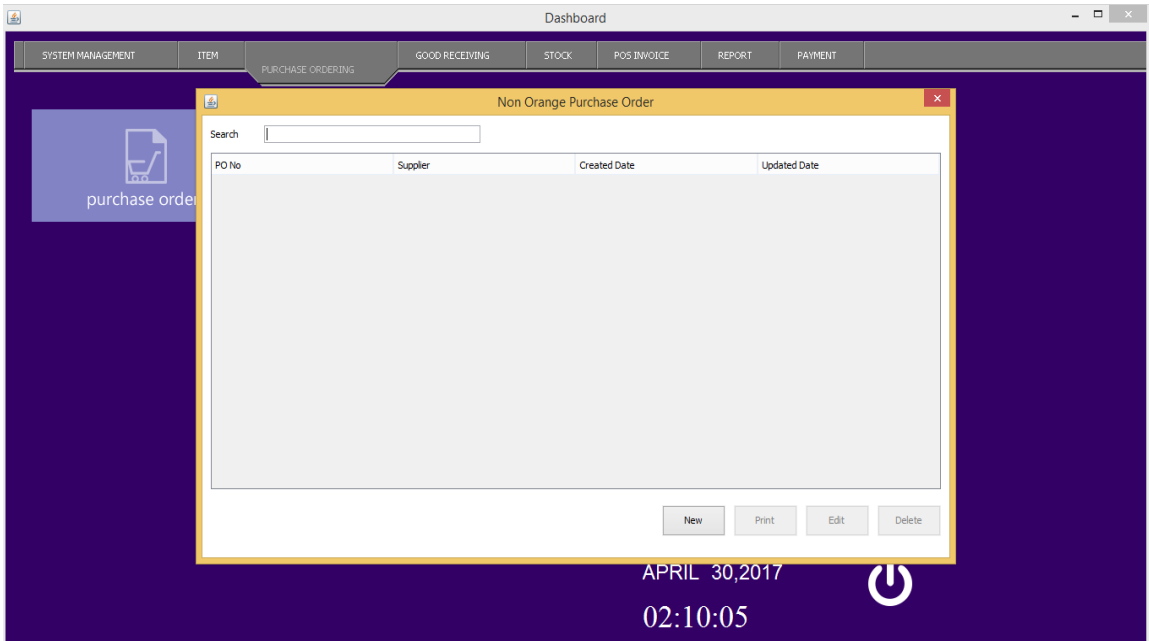


Purchase Order List

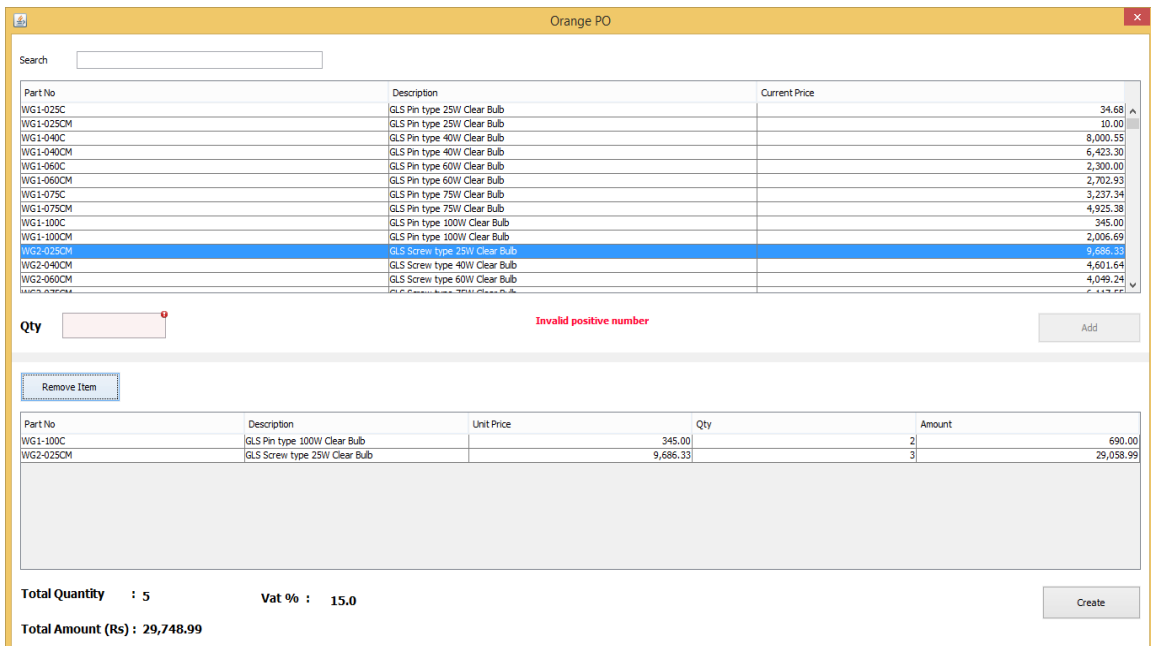
- Point of sale.



Add new none orange purchase order



None orange purchase order list



Add Orange purchase order

Update Non Orange Purchase Order

PO Submit Supplier: Akalanka Perera Category: All Search:

Product Details

Part No	Description	Category	Unit Price
XAC-410C	Celling Rose - XAC-410C	Cables	350.00
XAC-410L	Lamp Holder - XAC-410L	Cables	210.00
XK-01113-BBR2	XK-01113-BBR2	Cables	220.00
XK-07104-CBK1	7/1.04mm Twin Flat 1m - XK-07104-CBK1	Cables	450.00
XKK-01113-BBL4	1/1.13mm Blue 100m - XK-01113-BBL4	Cables	295.00

Quantity:

Product Items

Part No	Description	Product Category	Unit Price	Qty	Amount
XAC-410C	Celling Rose - XAC-410C	Cables	350.00	5	1,750.00

Total Amount (approx) Rs : 1,750.00

Total Quantity : 5

Update purchase order

Orange Purchase Order

Part No	Description	Product Category	Unit Price	Qty	Amount
WG1-100C	GLS Pin type 100W Clear Bulb	mypos_default	345.00	2	690.00
WG2-025CM	GLS Screw type 25W Clear Bulb	mypos_default	9,686.33	3	29,059.00

Total Amount (approx) Rs : Rs 29,749.00 Vat : 15.0%

Total Quantity : 5

Orange purchase order list

V. Product and Product Category Management Modules

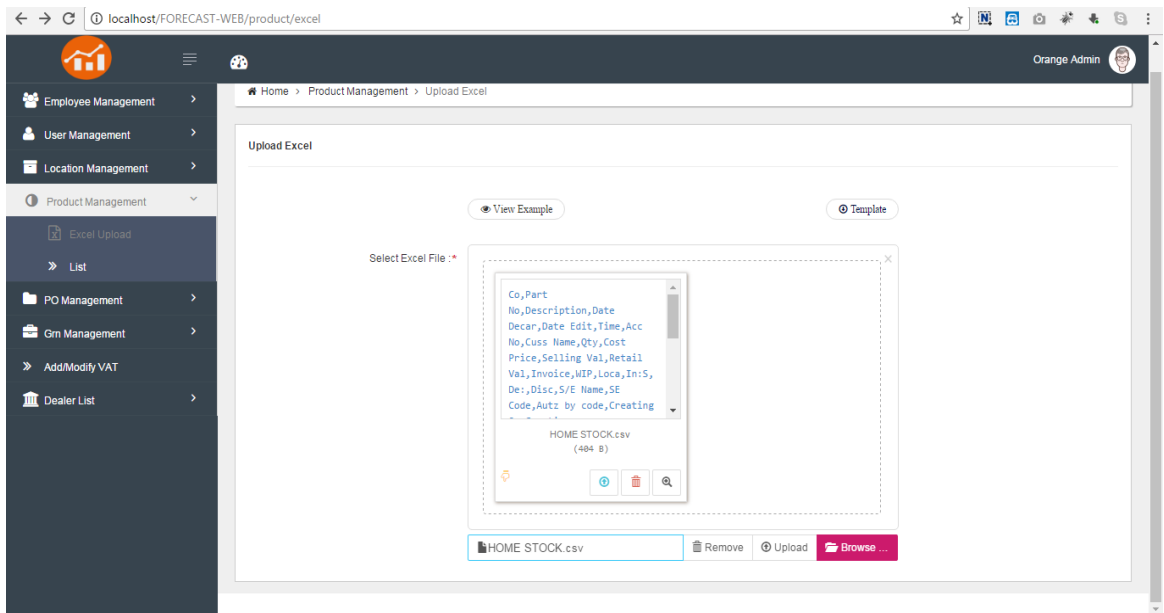
- Cloud application.

#	Part No	Description	Stock Qty	Selling Price +(VAT)	Actions
#1	WG1-025C	GLS Pin type 25W Clear Bulb	0	52,670.00	
#2	WG1-025CM	GLS Pin type 25W Clear Bulb	0	2,886.62	
#3	WG1-040C	GLS Pin type 40W Clear Bulb	1	1,158.27	
#4	WG1-040CM	GLS Pin type 40W Clear Bulb	2	3,909.15	
#5	WG1-060C	GLS Pin type 60W Clear Bulb	0	1,882.18	
#6	WG1-060CM	GLS Pin type 60W Clear Bulb	3	1,447.84	
#7	WG1-075C	GLS Pin type 75W Clear Bulb	392	1,561.90	
#8	WG1-075CM	GLS Pin type 75W Clear Bulb	0	1,249.51	
#9	WG1-100C	GLS Pin type 100W Clear Bulb	4	12,846.59	

Product List

	A	B	C	D	E	F	G
	Part number	Description	Total stock	AMD VSD	Average mthly demand	Average cost	Selling price
1							
2	AS09800517	AUTOBASI	0	0.03	0	1870.021	2898
3	AS5010013	EMPTY CA	0	0.83	0	34.6944	46
4	AS5010014	EMPTY CA	0	0.64	0	37.7083	50
5	AS5010015	EMPTY CA	0	0.99	0	100	130
6	AS9880081	LESONAL I	0	0.03	0	1281.233	1992
7	ASBMA004 1L	INTERSWI	0	0.03	0	1148.61	1212.06
8	ASCARCOLOR	CAR COLO	0	0.03	0	55.1541	95
9	ASCLD260	INTERLAC	0	0.03	0	9224.578	12000
10	ASCLF384	INTERLAC	0	0.02	0	7500	9750
11	ASCLF684	INTERIAC	0	0.03	0	294.16	11492
12	ASCLS665	INTERLAC	0	0.03	0	294.16	310.41
13	ASECS740	INTERGAR	0	0.03	0	400.61	422.74
14	ASEGA088 1L	INTERGAR	0	0.03	0	352.99	372.49
15	ASEPA001 1L	INTERGAR	0	0.03	0	386.6	407.96
16	ASEPA530	INTERGAR	0	0.03	0	8200	10660

Product excel Upload



Product excel Upload

- Point of sale.

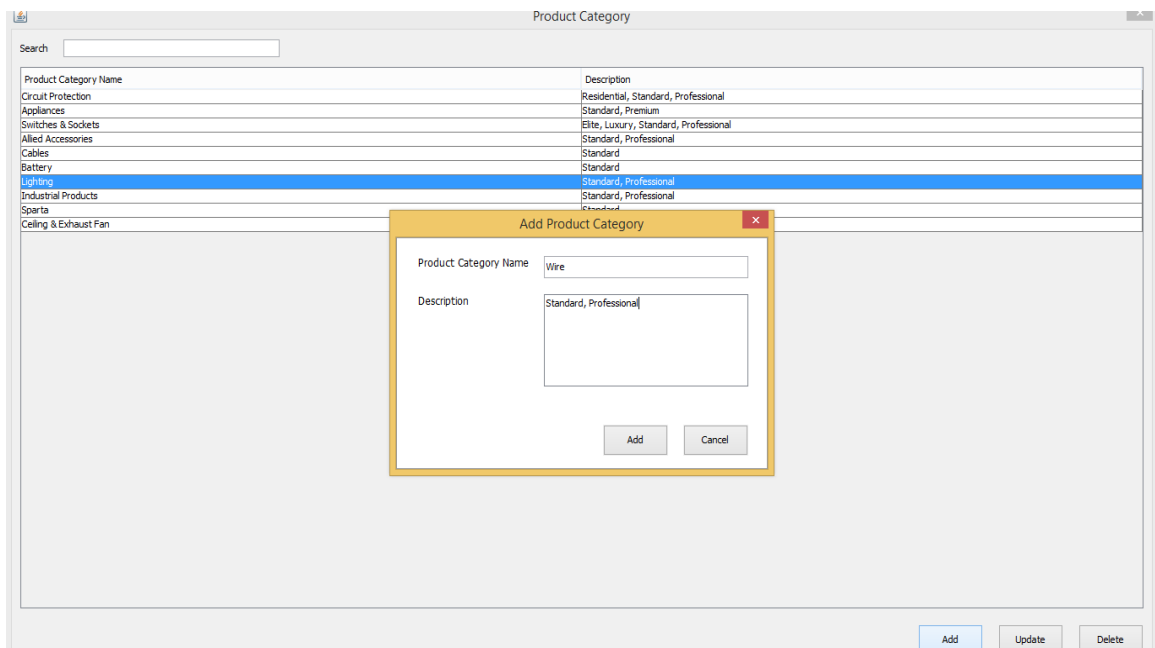
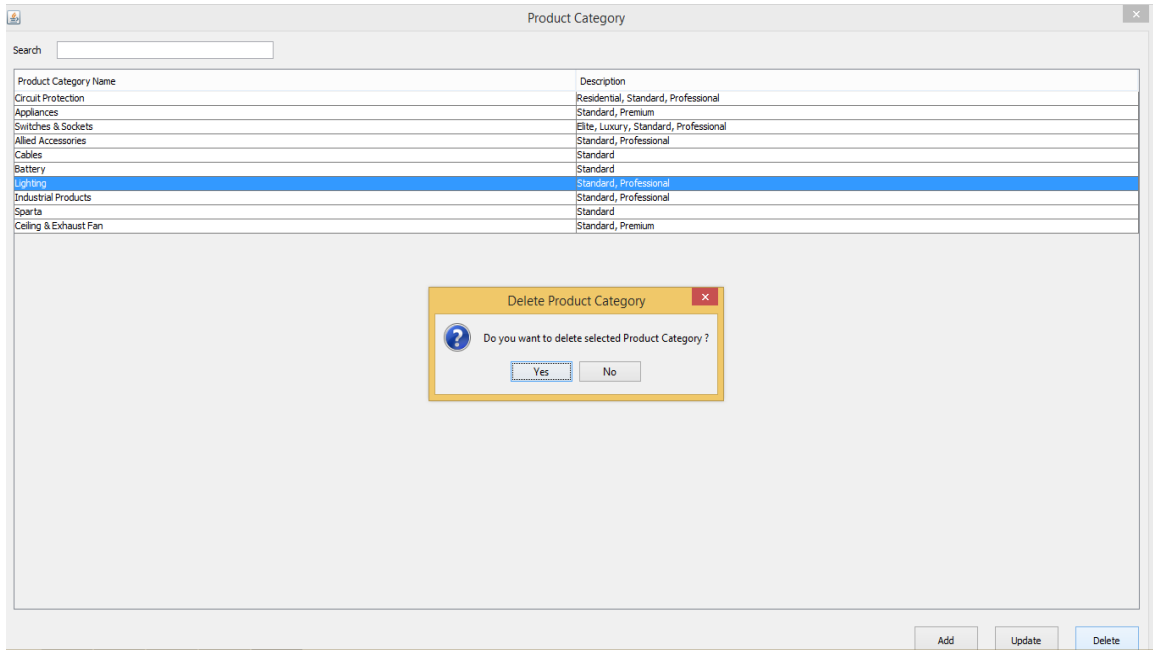
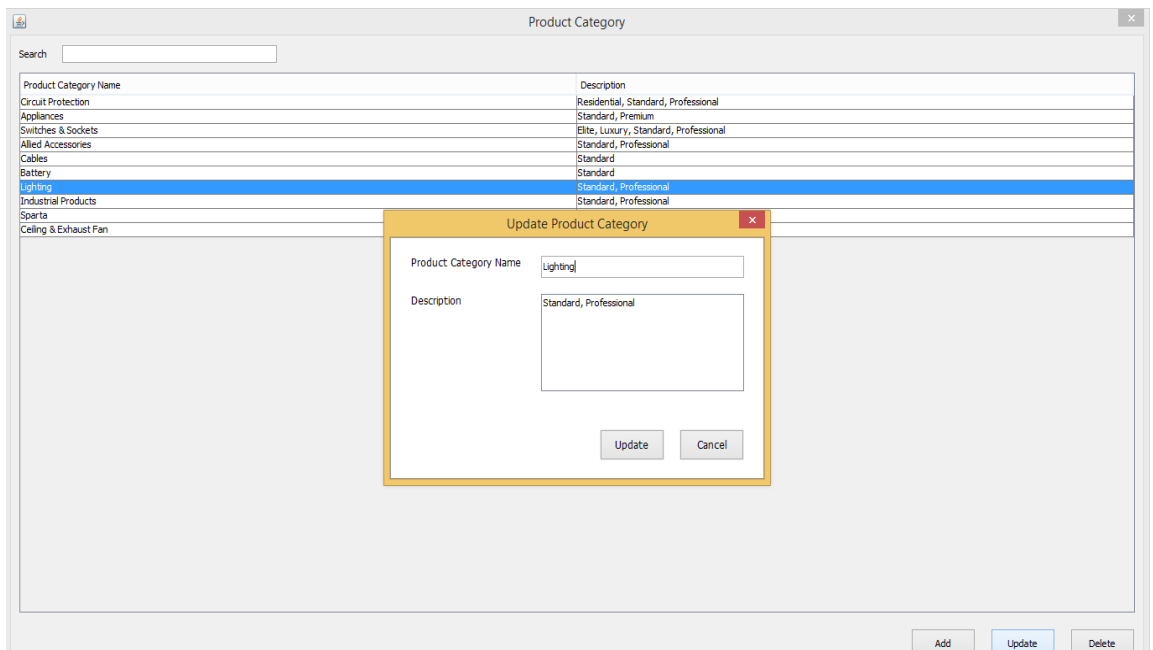


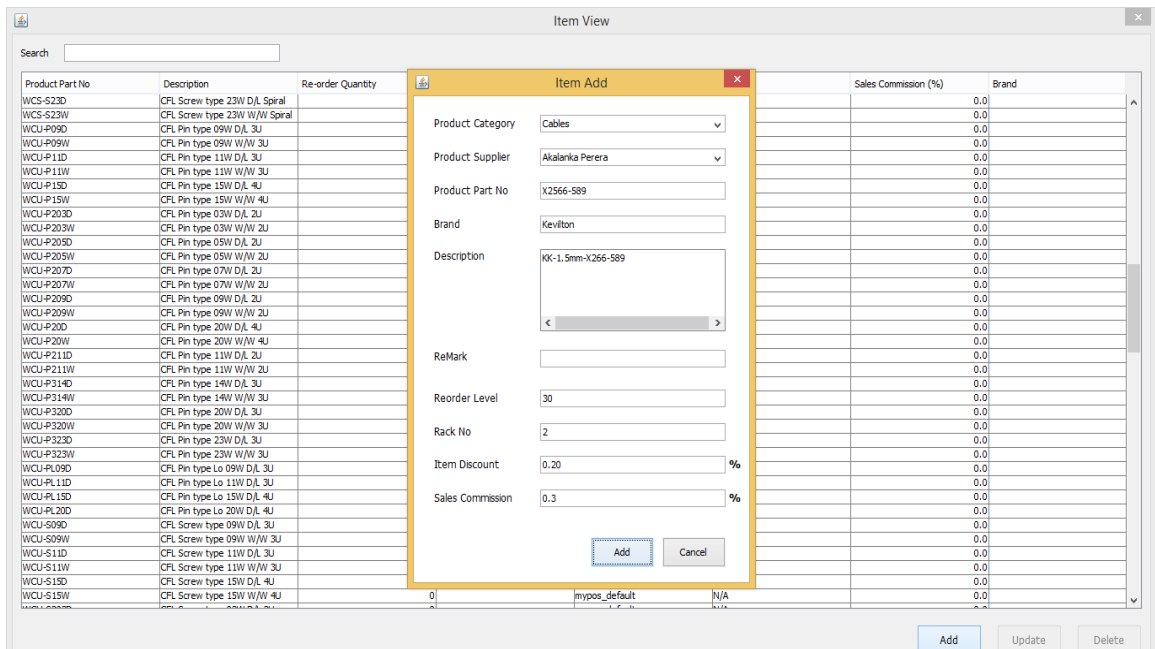
Figure 5.2.1 Add product category



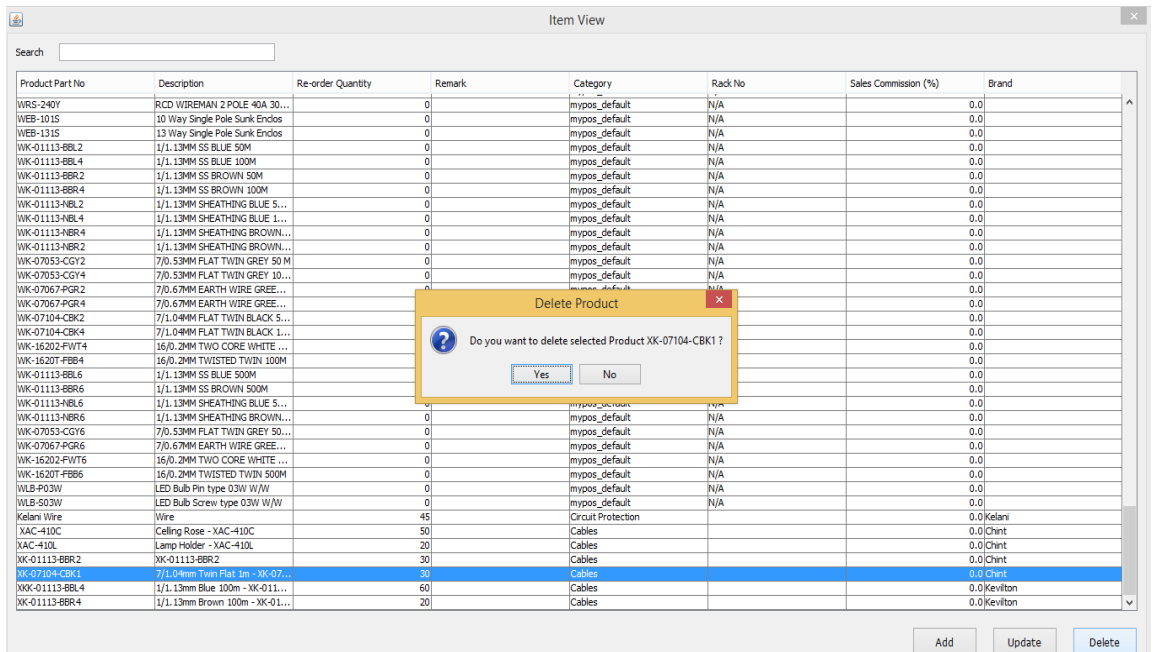
Delete product category



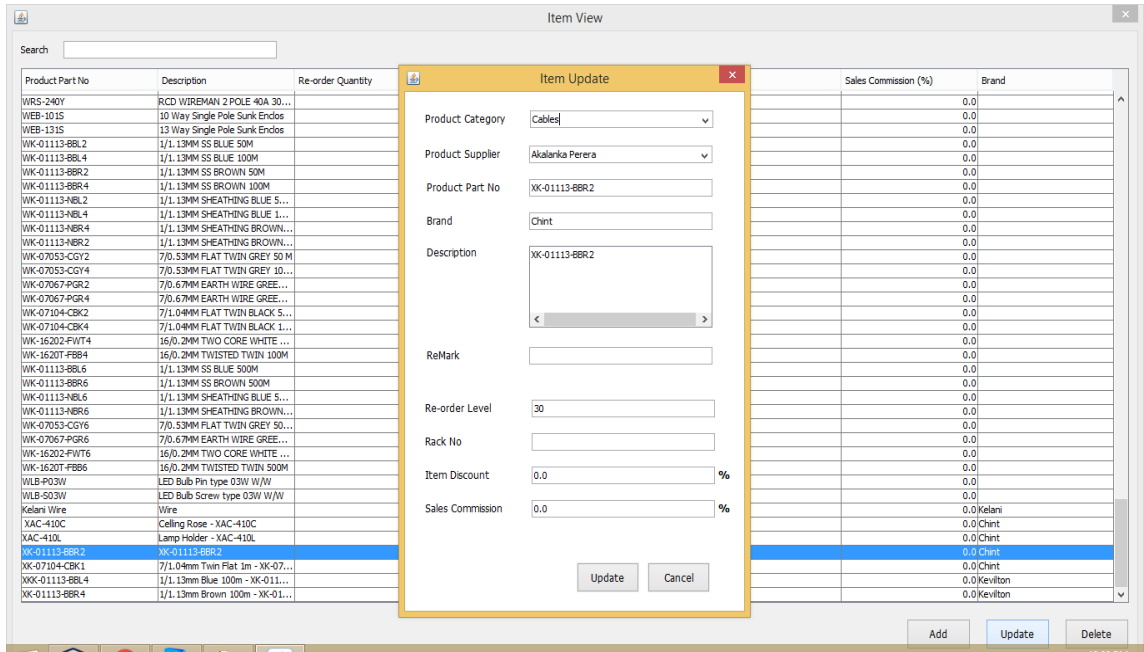
Update Product Category



Add Products



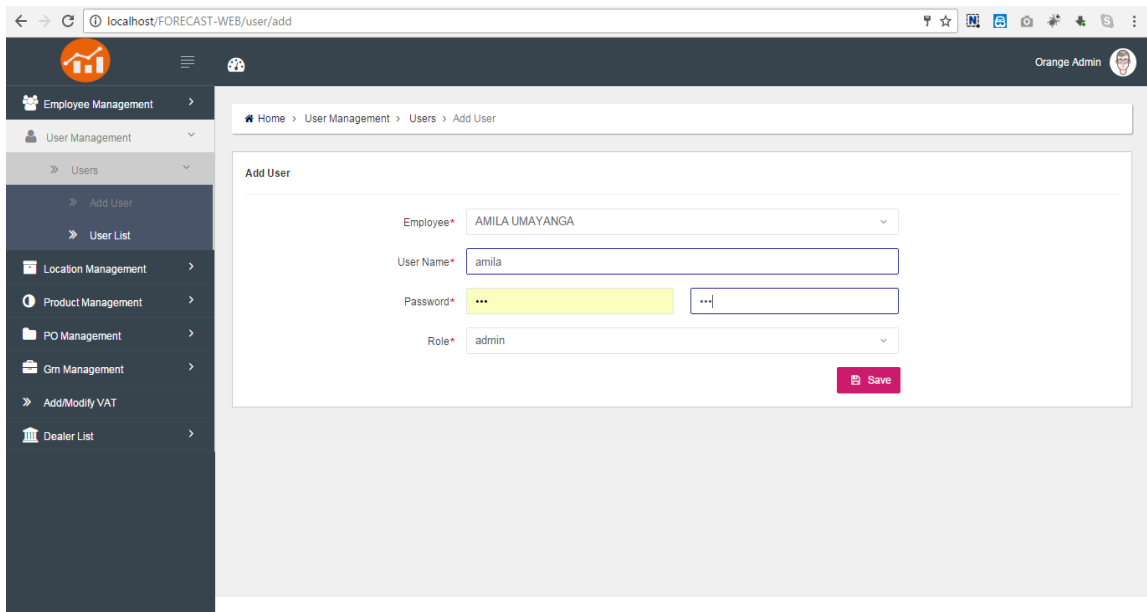
Delete Product



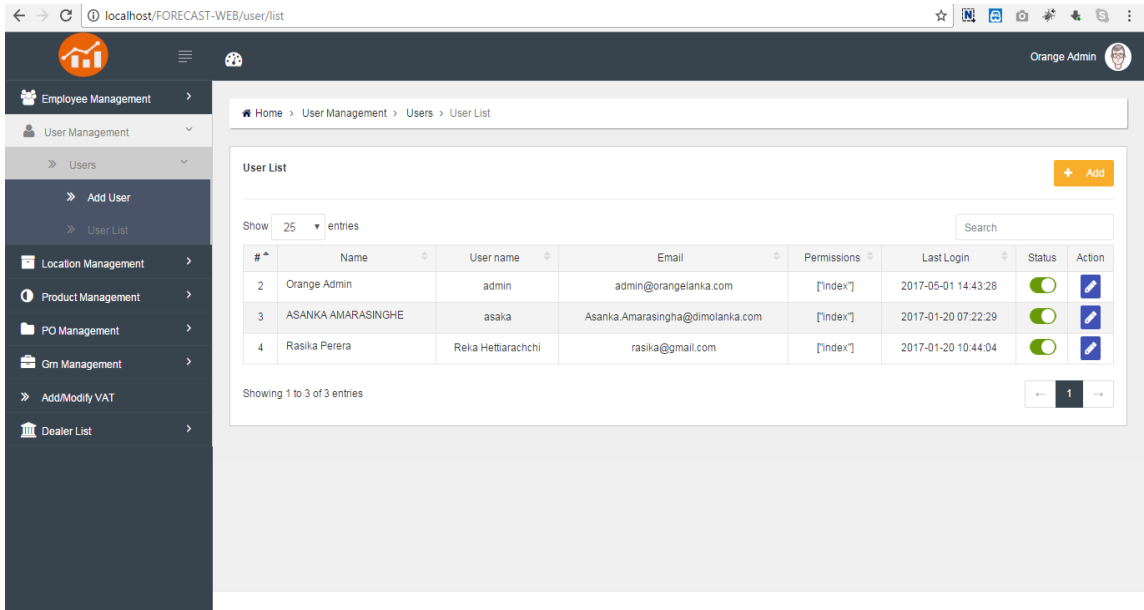
Product Update

VI. User and User Type Management Modules

- Cloud application.

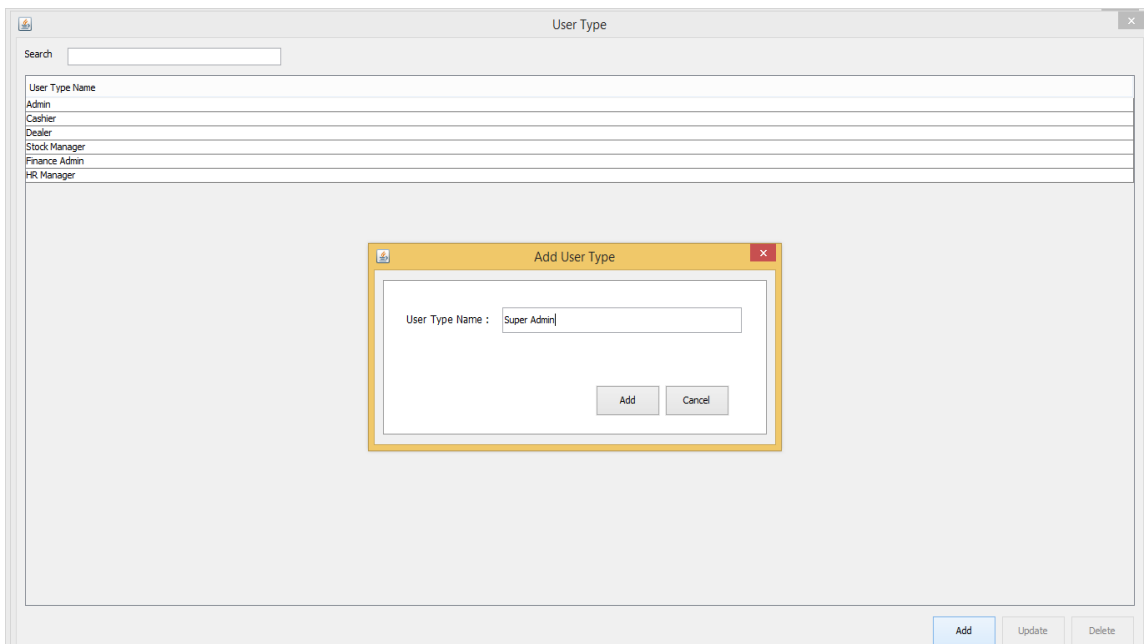


Add User

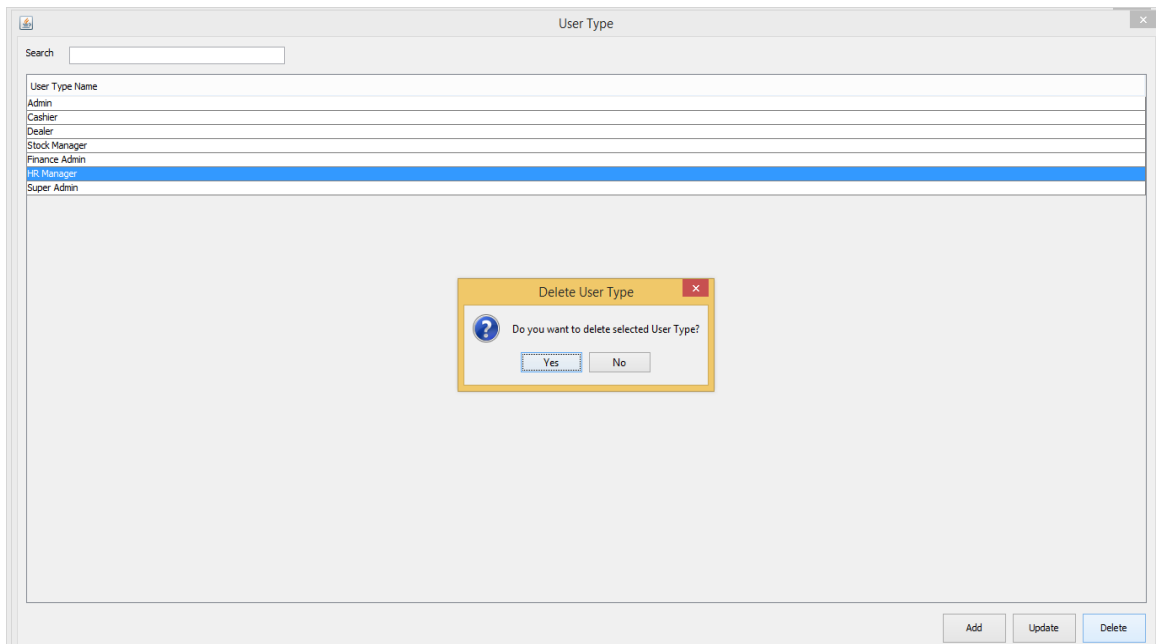


User List

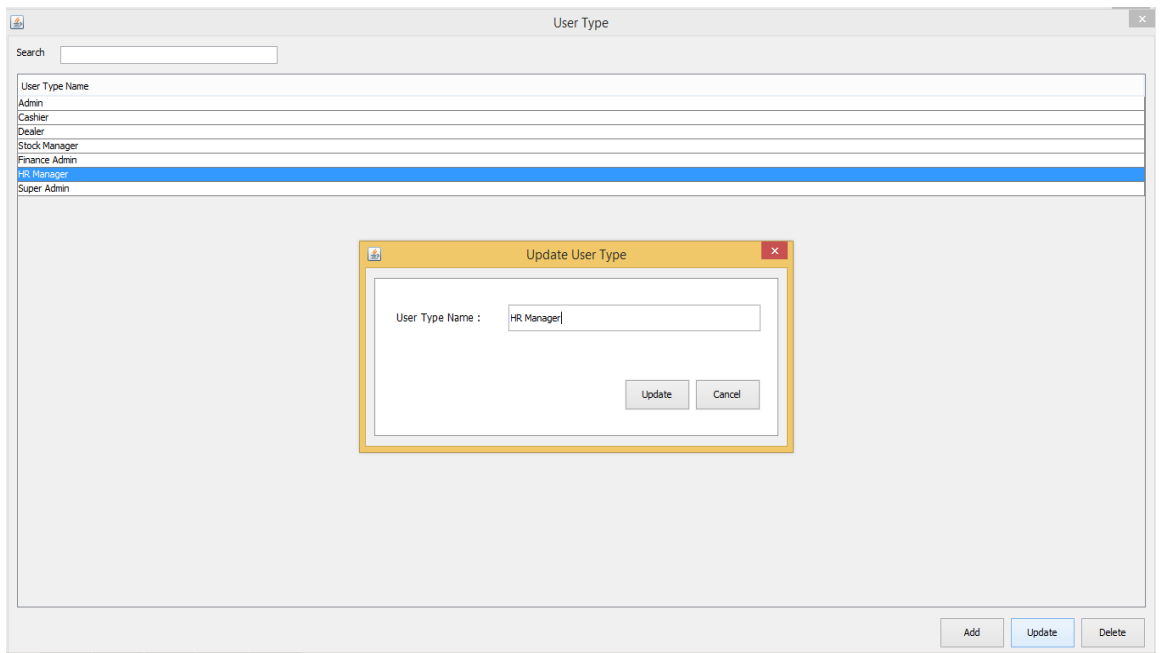
- Point of Sale.



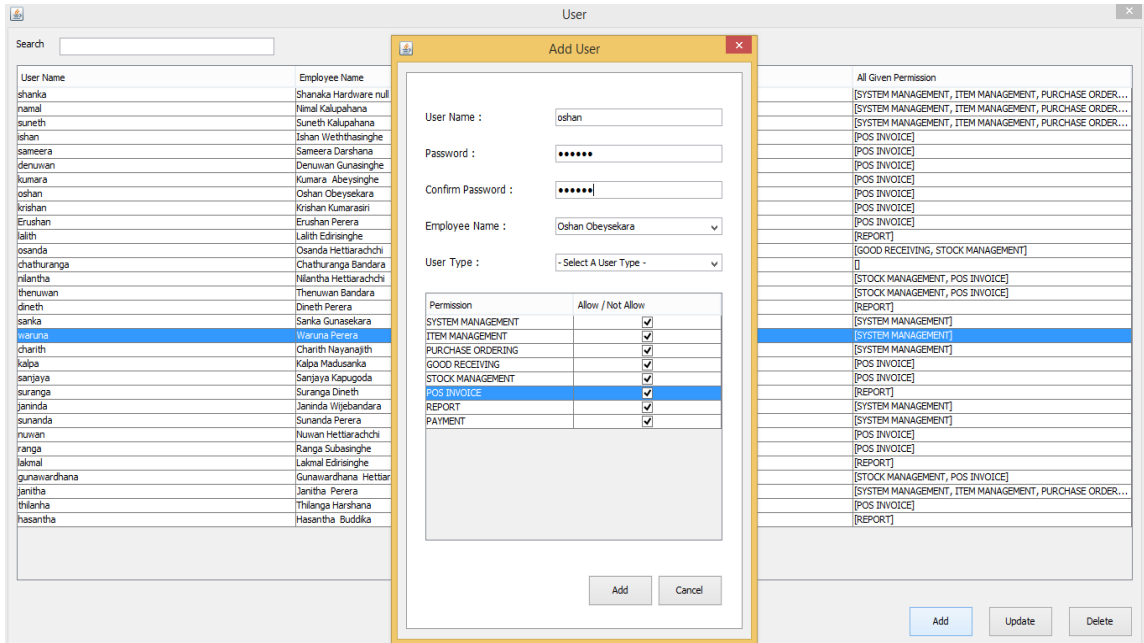
Add User Type



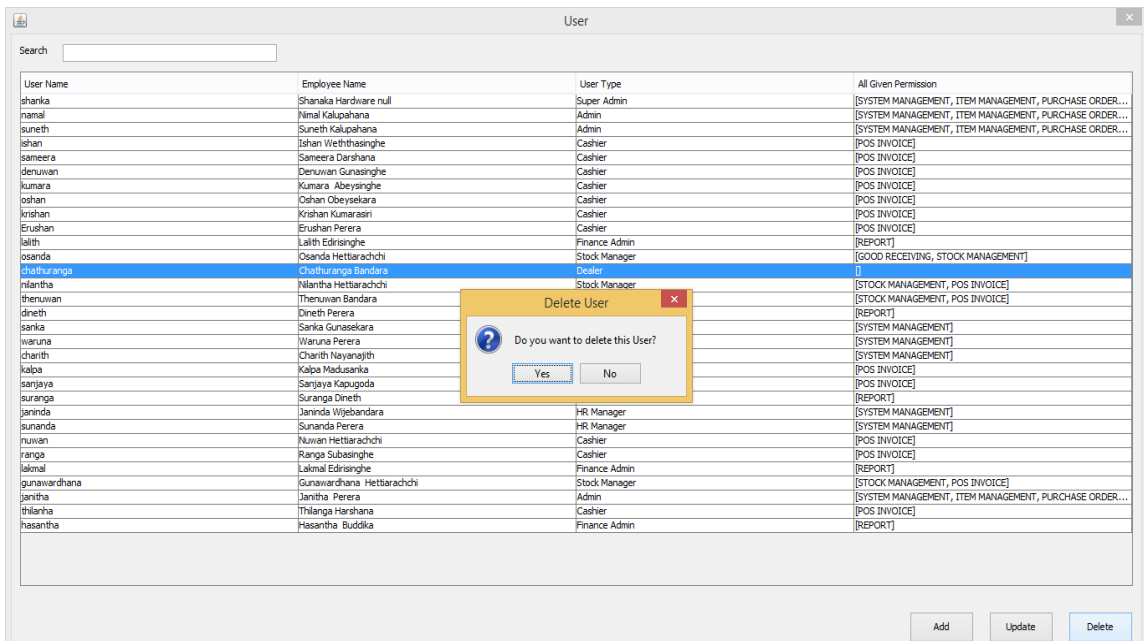
Delete User Types



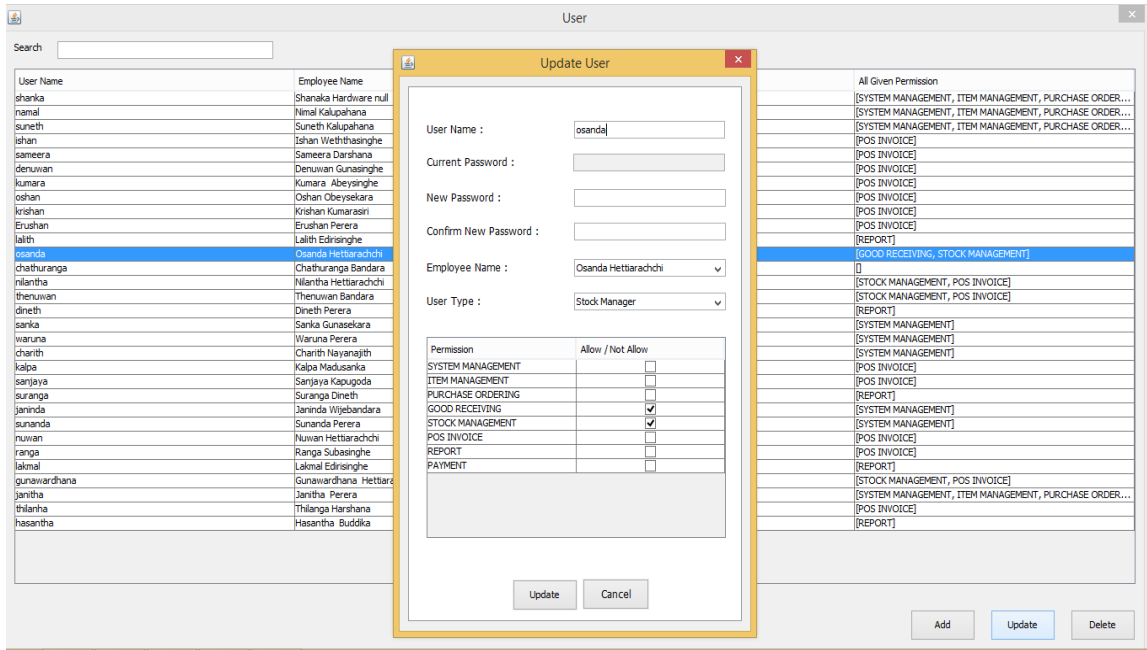
Update User Type



Add User



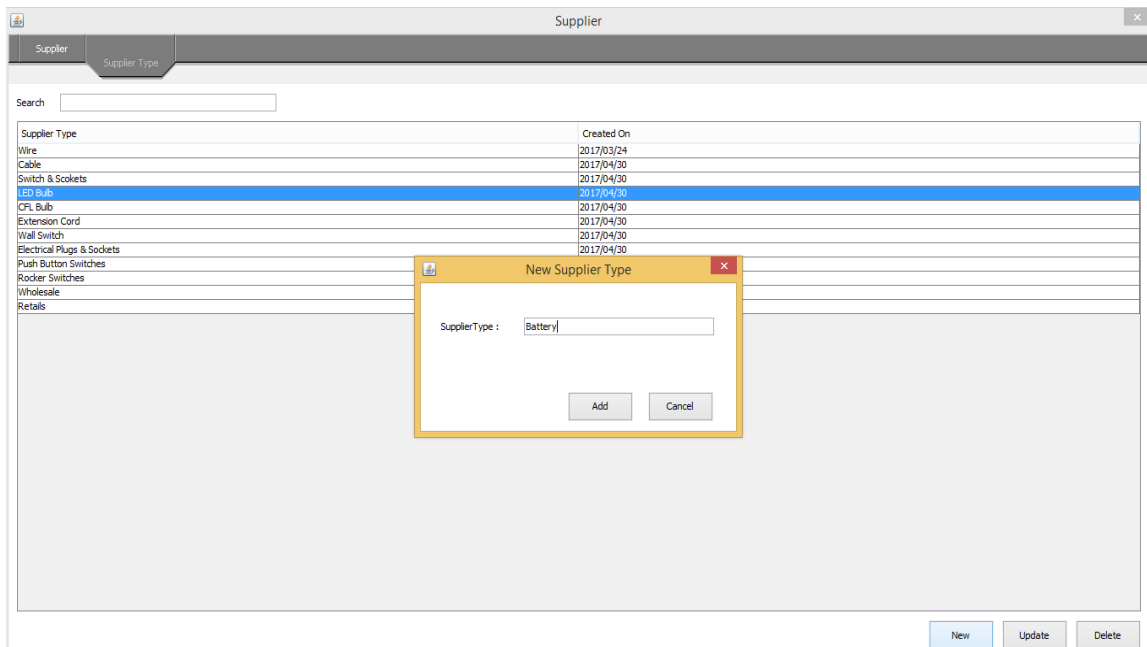
Delete User



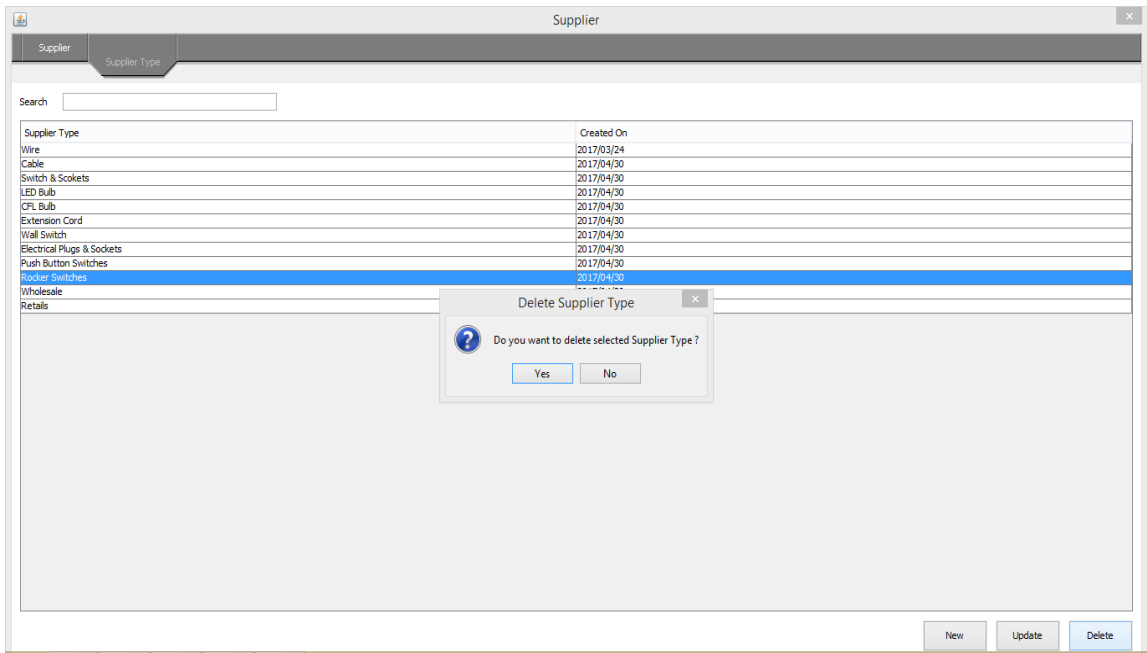
Update User

VII. Supplier Management Module

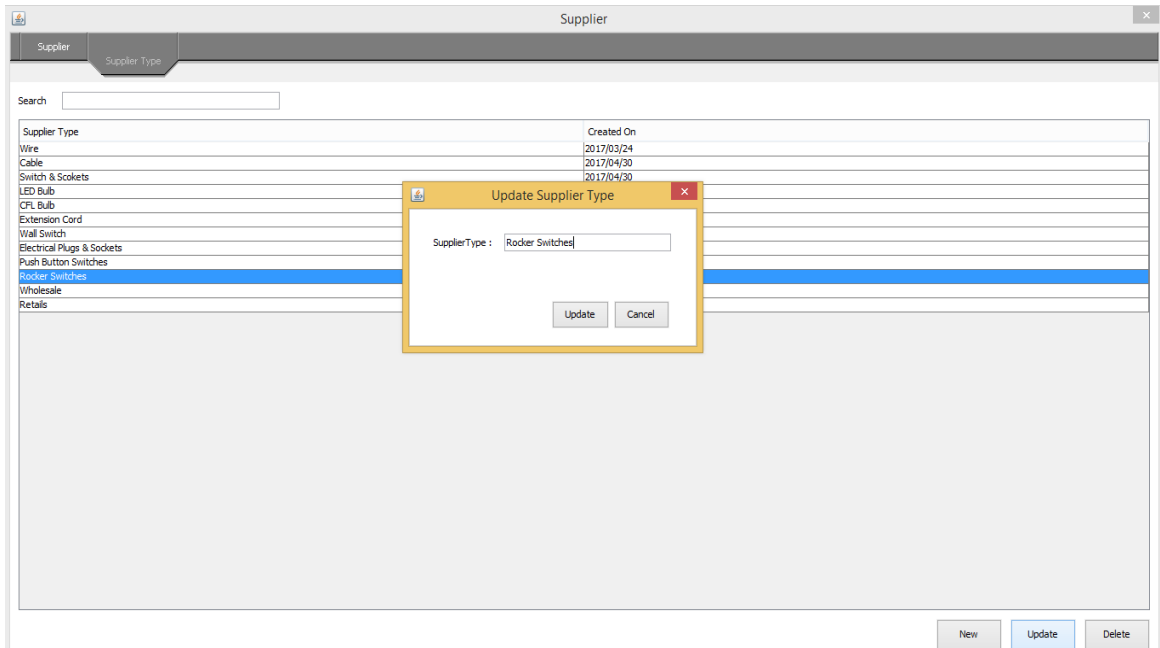
- Point of Sale.



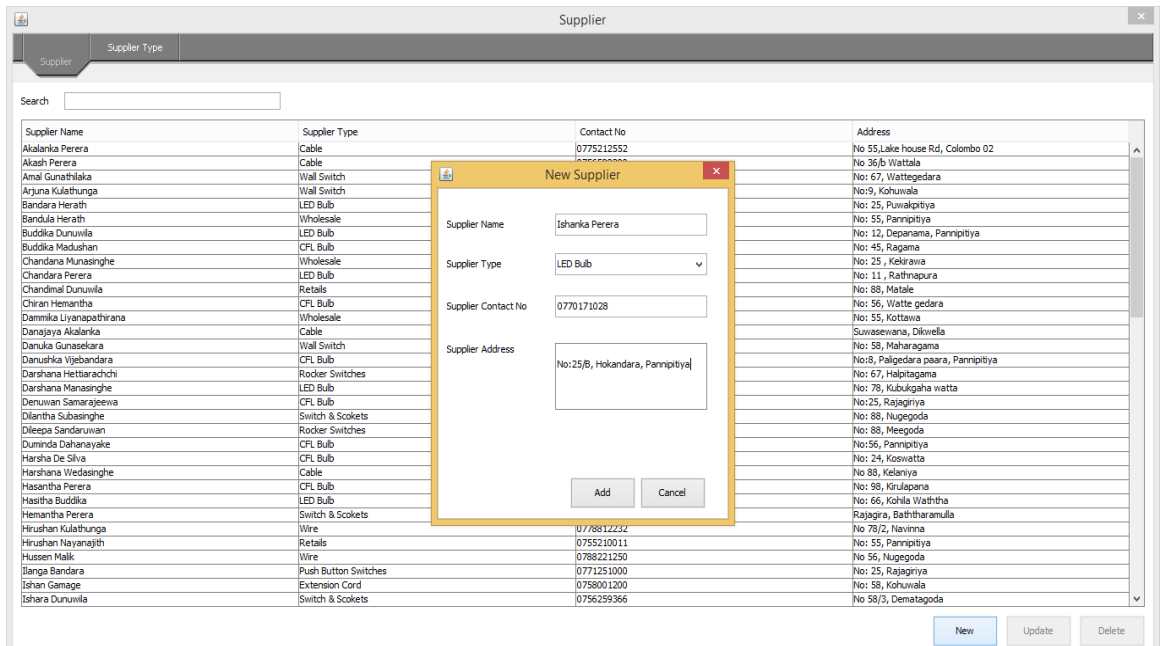
Add supplier Type



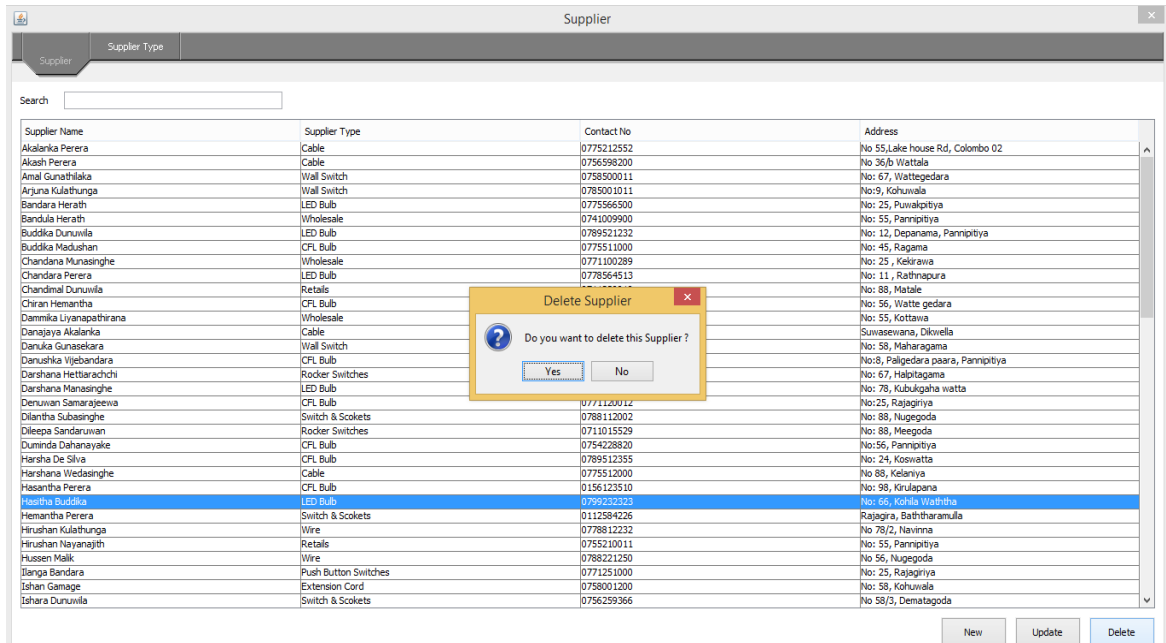
Delete Supplier Type



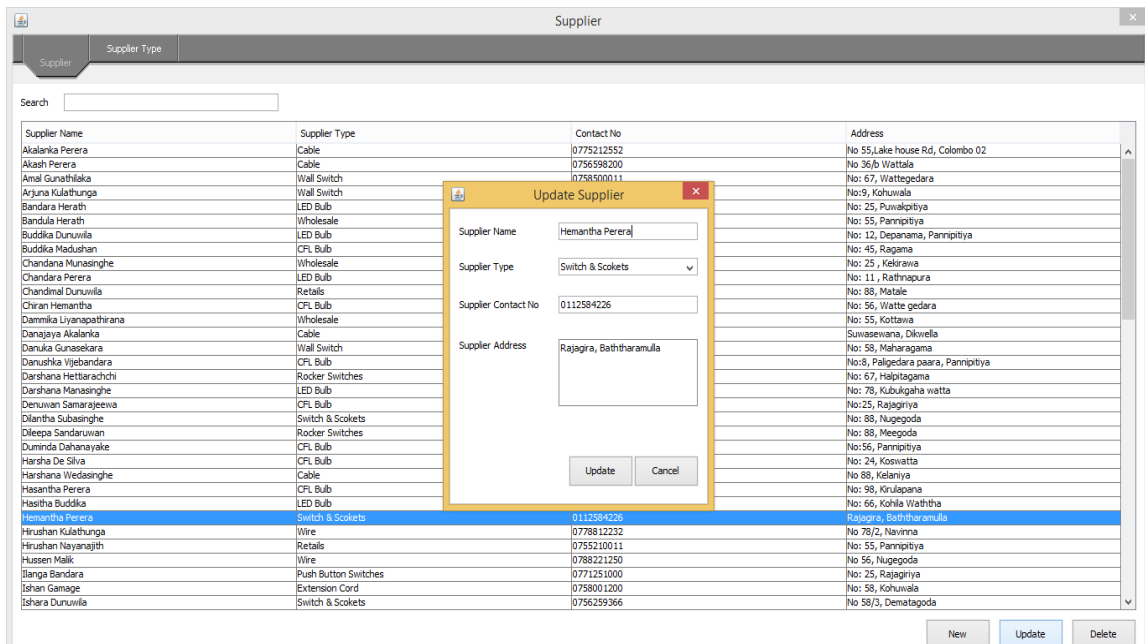
Update supplier type



Add new supplier



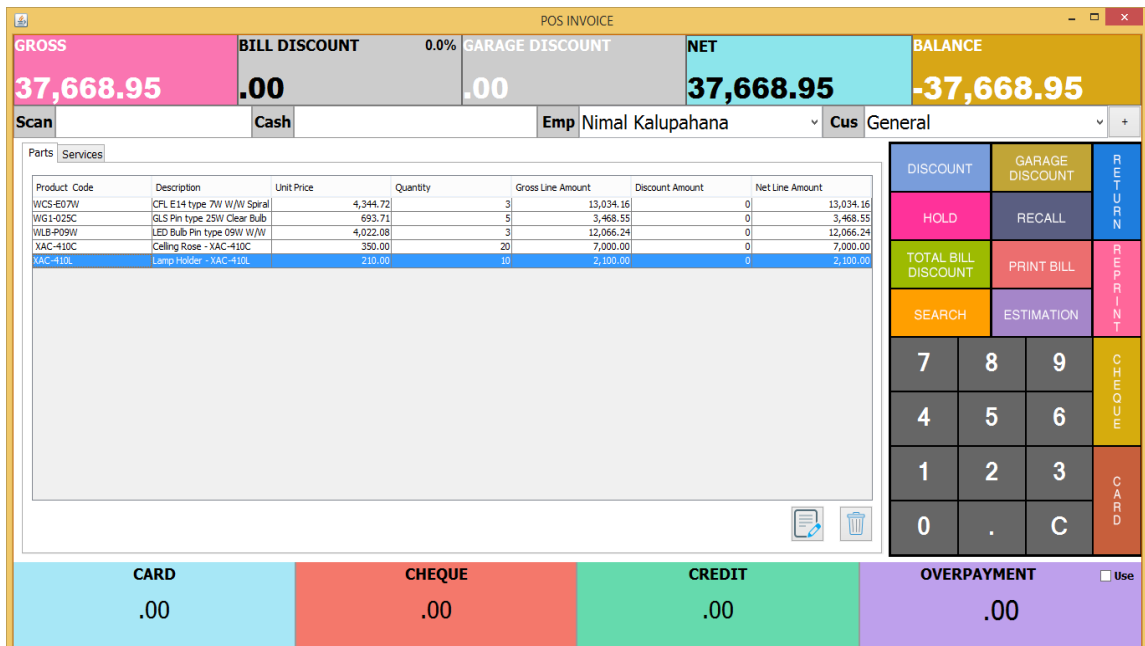
Delete supplier



Update supplier

VIII. Sales and invoicing module

- Point Of sale.



Add Invoice

POS INVOICE

Product And Service Search

GROSS
37,668.95

BALANCE
-37,668.95

Parts Services

Search: [] Category: ALL

Part No	Description	Category	Current Price	Previous Price	Available Qty	Discount	Rack No
WLB-P07W	LED Bulb Pin type...	mypos_default	513.87	0.00	10	0.0	N/A
WLB-P09D	LED Bulb Pin type...	mypos_default	2,055.45	0.00	15	0.0	N/A
WLB-G03D	LED Bulb Screw t...	mypos_default	2,569.32	0.00	1	0.0	N/A
WLB-S05D	LED Bulb Screw t...	mypos_default	144.78	0.00	1	0.0	N/A
WLB-S05W	LED Bulb Screw t...	mypos_default	2,312.39	0.00	3	0.0	N/A
WLB-S07D	LED Bulb Screw t...	mypos_default	2,055.45	0.00	2	0.0	N/A
WLB-S07W	LED Bulb Screw t...	mypos_default	4,735.25	0.00	7	0.0	N/A
WLB-S09D	LED Bulb Screw t...	mypos_default	3,247.60	0.00	2	0.0	N/A
WLB-S09W	LED Bulb Screw t...	mypos_default	11,952.47	0.00	2	0.0	N/A
Kelani Wire	Wire	Circuit Protection	550.00	0.00	440	0.0	
XX-01113-8BR2	XX-01113-8BR2	Cables	220.00	0.00	3500	0.0	
XX-01113-8BR4	1/1.13mm Brown ...	Cables	350.00	0.00	1000	0.0	
XX-07104-CBK1	7/1.04mm Twin FL...	Cables	450.00	0.00	4000	0.0	
XXK-01113-8BL4	1/1.13mm Blue L...	Cables	295.00	0.00	5000	0.0	

Qty: 0 Current Price Previous Price

click on search

General

DISCOUNT GARAGE DISCOUNT RETURN

HOLD RECALL

TOTAL BILL DISCOUNT PRINT BILL REPRINT

SEARCH ESTIMATION

7 8 9 CHEQUE

4 5 6

1 2 3 CARD

0 . C

OVERPAYMENT Use
.00

Search Item for invoice

POS INVOICE

GROSS 37,668.95 **BILL DISCOUNT** 0.00 **GARAGE DISCOUNT** 0.00 **NET** 37,668.95 **BALANCE** -37,668.95

Scan

Cash

Card Payment

Bank: Commercial Bank

Card Type: Visa

Card No: 102010201020

Amount (Rs): 37668.95

Save Clear

7 8 9

4 5 6

1 2 3

0 . C

CREDIT .00

General

DISCOUNT GARAGE DISCOUNT RETURN

HOLD RECALL

TOTAL BILL DISCOUNT PRINT BILL REPRINT

SEARCH ESTIMATION

7 8 9 CHEQUE

4 5 6

1 2 3 CARD

0 . C

OVERPAYMENT Use
.00

CARD .00

Make Payment

POS INVOICE

GROSS 37,668.95	BILL DISCOUNT .00	GARAGE DISCOUNT .00	NET 37,668.95	BALANCE -37,668.95
---------------------------	-----------------------------	-------------------------------	-------------------------	------------------------------

Scan Cash Emp Nimal Kalupahana Cus General

Product Code	Description	Unit
WCS-E07W	CFL E14 type 7W W/W Spiral	
WG1-025C	GLS Pin type 25W Clear Bulb	
WLB-P09W	LED Bulb Pin type 09W W/W	
XAC-410C	Ceiling Rose - XAC-410C	
XAC-410L	Lamp Holder - XAC-410L	

Invoice List	No	Product	U.Price	Qty	Discount	Line Total
INV_29_00001						
INV_29_00002						
INV_29_00003						
INV_29_00004	1	WG1-025C	34.68	2	0.0	69.36
INV_29_00005	2	WG1-025CM	10.0	4	0.0	40.0
INV_29_00006	3	WG1-025CM	10.0	6	0.0	60.0

Click on Reprint

View Invoice

DISCOUNT	GARAGE DISCOUNT	RETURN
HOLD	RECALL	REPRINT
TOTAL BILL DISCOUNT	PRINT BILL	REPRINT
SEARCH	ESTIMATION	CHEQUE
7	8	9
4	5	6
1	2	3
0	.	C
CARD	CHEQUE	CREDIT
.00	.00	.00
OVERPAYMENT		Use
.00		

View invoices

Auto Mart Service Station & Caean Park
 No : 270, Kandy Road, Godapola, BeliyoaKandy
 TEL :11111111

CUSTOMER NAME : General CASHIER : Shanaka INVOICE NO : INV_29_00004 DATE : Mar 26, 2017

#	PART NO/ DESCRIPTION	QTY	UNIT PRICE (Rs)	DISCOUNT (Rs)	AMOUNT(Rs)
1	WG1-025C GLS Pin type 25W Clear Bulb	2	34.68	0.00	69.36
2	WG1-025CM GLS Pin type 25W Clear Bulb	4	10.00	0.00	40.00
3	WG1-025CM GLS Pin type 25W Clear Bulb	6	10.00	0.00	60.00
No of Item(s) 3		12	54.68	0.00	169.36
GROSS (RS)		169.36	ITEM DISCOUNT (RS)	0.00	NET AMOUNT
TOTAL NET		169.36	PAID AMOUNT(RS)	200.00	BALANCE (RS)
					0.00

Page 1 of 1

Print invoice

IX. Stock Management Module

- Point Of sale.

Stock View Form

Search Category **ALL**

Part No	Description	Category	Buying Price	Current Price	Previous Price	Available Qty
WCS-E05D	CFL E14 TYPE 5W D/L SPI...	mypos_default	13,154.92	16,443.64	0.00	2
WCS-E05W	CFL E14 type 5W W/W Spiral	mypos_default	2,055.45	2,569.32	0.00	15
WCS-E07D	CFL E14 type 7W D/L Spiral	mypos_default	1,107.89	1,384.86	0.00	11
WCS-E07W	CFL E14 type 7W W/W Spiral	mypos_default	3,475.78	4,344.72	0.00	9
WCS-E09D	CFL E14 type 9W D/L Spiral	mypos_default	1,233.27	1,541.59	0.00	26
WCS-E09W	CFL E14 type 9W W/W Spiral	mypos_default	1,490.74	1,863.43	0.00	8
WCS-E11D	CFL E14 type 11W D/L Spiral	mypos_default	4,633.06	5,791.33	0.00	3
WCS-E11W	CFL E14 type 11W W/W S...	mypos_default	15,037.40	18,796.75	0.00	2
WCS-P05D	CFL Pin type 5W D/L Spiral	mypos_default	12,295.73	15,369.66	0.00	1
WCS-P05W	CFL Pin type 5W W/W Spiral	mypos_default	11,775.70	14,719.62	0.00	1
WG1-025C	GLS Pin type 25W Clear Bulb	mypos_default	27.75	34.68	6,937.16	189
WG1-025CM	GLS Pin type 25W Clear Bulb	mypos_default	7.70	10.00	0.00	24
WG1-040C	GLS Pin type 40W Clear Bulb	mypos_default	6,400.44	8,000.55	0.00	3
WG1-040CM	GLS Pin type 40W Clear Bulb	mypos_default	5,138.64	6,423.30	0.00	2
WG1-060C	GLS Pin type 60W Clear Bulb	mypos_default	1,725.00	2,300.00	0.00	3
WG1-060CM	GLS Pin type 60W Clear Bulb	mypos_default	2,162.34	2,702.93	0.00	6
WG1-075C	GLS Pin type 75W Clear Bulb	mypos_default	2,589.87	3,237.34	0.00	2
WG1-075CM	GLS Pin type 75W Clear Bulb	mypos_default	3,940.30	4,925.38	0.00	3
WG1-100C	GLS Pin type 100W Clear B...	mypos_default	230.00	345.00	0.00	0
WG1-100CM	GLS Pin type 100W Clear B...	mypos_default	1,605.35	2,006.69	0.00	9
WG2-025CM	GLS Screw type 25W Clear...	mypos_default	7,749.07	9,686.33	0.00	4
WG2-040CM	GLS Screw type 40W Clear...	mypos_default	3,681.31	4,601.64	0.00	5
WG2-060CM	GLS Screw type 60W Clear...	mypos_default	3,239.39	4,049.24	0.00	11
WG2-075CM	GLS Screw type 75W Clear...	mypos_default	4,894.04	6,117.55	0.00	5
WG2-100CM	GLS Screw type 100W Cle...	mypos_default	1,233.27	1,541.59	0.00	4
WLB-P03D	LED Bulb Pin type 03W D/L	mypos_default	3,288.72	4,110.90	0.00	8
WLB-P05D	LED Bulb Pin Type 05W D/L	mypos_default	1,644.30	2,055.38	0.00	5
WLB-P05W	LED Bulb Pin type 05W W/W	mypos_default	3,288.62	4,110.78	0.00	5
WLB-P07D	LED Bulb Pin type 07W D/L	mypos_default	3,083.18	3,853.98	0.00	4
WLB-P07W	LED Bulb Pin type 07W W/W	mypos_default	411.09	513.87	0.00	10
WLB-P09D	LED Bulb Pin type 09W D/L	mypos_default	1,644.36	2,055.45	0.00	15
WLB-P09W	LED Bulb Pin type 09W W/W	mypos_default	3,217.67	4,072.08	0.00	23

Current stock view in POS system

X. Service Module

- Point of sale.

Service

Service Type

Search

Service Type	Created On
Residential	2017/04/30
Commercial	2017/04/30
Industrial	2017/04/30
Emergency	2017/04/30
Remo	2017/04/30
Facility Maintenance	2017/04/30

New Service Type

Service Type : remodeling

Add Cancel

New Update Delete

Add New Service Type

The screenshot shows the 'Service' application window with a 'New Service' dialog box open. The dialog box contains the following fields:

- Service Name: Service Upgrade
- Service Type: Emergency
- Service Code: E0120
- Service Cost (Rs): 2900
- Service Charge (Rs): 1520
- Service Discount (%): 0.30

The background table lists various services with columns for Service Name, Service Type, Service Code, Service Cost (Rs), Service Charge (Rs), Service Discount (%), and Created On. The 'New' button is visible at the bottom right of the application window.

Add service

The screenshot shows the 'Service' application window with an 'Update Service' dialog box open. The dialog box contains the following fields:

- Service Name: Neon and florescent repairs
- Service Type: Industrial
- Service Code: 1008
- Service Cost (Rs): 58000
- Service Charge (Rs): 45000
- Service Discount (%): 0

The background table lists various services with columns for Service Name, Service Type, Service Code, Service Cost (Rs), Service Charge (Rs), Service Discount (%), and Created On. The 'Update' button is visible at the bottom right of the application window.

Update Services

Service	
Service Type	
Search	<input type="text"/>
Service Type	Created On
Residential	2017/04/30
Commercial	2017/04/30
Industrial	2017/04/30
Emergency	2017/04/30
Remodeling	2017/04/30
Facility Maintenance	2017/04/30

Services List

Appendix B – Important Coding Parts

```
162
163
164 public void getProductFromServer(int count) {
165
166     final SyncList resObjects = new SyncList();
167     resObjects.setTypeOfElement(Product.class.getSimpleName());
168     syncResultList.add(resObjects);
169
170     String tokenFromMetaData = functionController.getTokenFromMetaData();
171     String lastDownloadedTimestamp = functionController.getLastDownloadedTimestamp(AppConstance.DOWNLOAD_DATA_TYPE_ALL_PRODUCT);
172     if (lastDownloadedTimestamp != null) {
173         if ("empty".equals(lastDownloadedTimestamp)) {
174             lastDownloadedTimestamp = "0";
175         }
176     }
177
178     try {
179
180         Call<ProductsPojo> loadRepo = ApiClient.get().loadRepo(tokenFromMetaData, lastDownloadedTimestamp, count);
181         Response<ProductsPojo> response = loadRepo.execute();
182
183         if (response.isSuccessful()) {
184             resObjects.setSuccessOrFail("1");
185             resObjects.setTotalCount(String.valueOf(response.body().getProducts().size()));
186             if (response.body().getProducts().size() == 0) {
187                 resObjects.setTotalCount("1");
188                 syncNotification(resObjects, "All Products Are Already Updated.....", "0", "0");
189                 executedMethodCount++;
190                 functionController.setLastDownloadedTimestamp(AppConstance.DOWNLOAD_DATA_TYPE_ALL_PRODUCT, response.body().getTimestamp());
191                 return;
192             }
193
194             int insertCount = 0;
195             int updateCount = 0;
196             Integer productCatId = productCategoryController.getProductCatIdForDimoWeb("mypos_default");
197             Integer supplierId = supplierController.getSupplierIdforDimoWebProduct("mypos_default");
```

Download products form server

```

21  /**
22  *
23  *   @author User
24  *   @created 2016-06-09
25  */
26  @Entity
27  @Table(name = "mypos_grn")
28  public class Grn {
29
30      @Id
31      @GeneratedValue(strategy = GenerationType.IDENTITY)
32      @Column(name = "ID")
33      private Long grn_Id;
34
35      @Column(name = "GRN_ID")
36      private Integer grnId;
37
38      @Column(name = "GRN_NO")
39      private String grnNo;
40
41      @ManyToOne(fetch = FetchType.LAZY)
42      @JoinColumn(name = "Po_ID")
43      private Po po;
44
45      @ManyToOne(fetch = FetchType.LAZY)
46      @JoinColumn(name = "SUPPLIER_ID")
47      private Supplier supplier;
48

```

Hibernate entity class

```

919
920  public boolean update(Product obj) {
921      Date date = new Date();
922      obj.setUpdatedAt(date);
923      return super.update(obj); //To change body of generated methods, choose Tools | Template
924  }
925
926  public boolean save(Product obj) {
927      Date date = new Date();
928      obj.setCreatedAt(date);
929      obj.setStatus(1);
930      return super.save(obj); //To change body of generated methods, choose Tools | Template
931  }

```

Save and update users via hibernate ORM

Appendix C - Test Cases

System Login

ID	Function	Testing Procedure	Expected Output	Test Priority
Common Functions				
1.	Logging into the system	Enter invalid username or password	An error message will indicate the error	High
2.	Logging into the system	Enter valid Username and password	User will be logged in to the system and logged in to	High
3.	Logout From the system	Click the logout button	User will be logged out and Redirect to the login	High
4	Change password	Fill the form for password change	Invalid values for the current password	High
5.	Unauthorized access to page(without login in)	A user try in to login through the URL to a page without login in	The user will be redirected to the login page	High

Dealer, Customer Profile Management				
6	Adding an existing customer	Entering details of a customer who is already registered	A error should occur	Medium
7	Adding customer with Invalid details	The required fields are empty	Error message should appear on relevant fields	Medium
8	Add a new customer with valid details	Entering a new Customer	New customer should be added to the system	High
9	Editing an existing customer	Editing an existing customer with invalid details	Error message should appear	High

Sales	Module			
10	Should be able to get a list of customers	Entering an existing customers first 3 letter	A list of customers should be listed	High
11	Should be able to add a customer if he does not exist	Click add new customer button.	Should directed to add new customer form	High
12	Item code should be automatically populated	Select the product name from the product list	Once selected automatically the item code should be loaded	High
13	Entering invalid sales details	Entering a string in quantity field	It should popup an error message	High
14	Adding empty fields	Trying to add item to the invoice with blank fields	It should popup and error	High
15	Adding the same item repeatedly	Trying to add same product and quantity twice into the invoice	It should prompt an error	Medium
16	Submitting with empty fields	Trying to submit ODO meter readings with empty fields	It should not allow to submit	High
17	Adding invalid data	Trying to add invalid meter reading	Should prompt an error	Medium
18	Adding an empty return data	Trying to add empty fields as returned products	It should popup and error	Medium
19	Adding the same entry repeatedly	Trying to add previously added returned product detail again	It should not allow to add the return detail	Medium
20	Print daily report	Click print report	The report should be displayed	Low

Product Module				
21	Adding an existing product Name	Trying to add an existing Item name to the	It should not allow to Submit/Error should be displayed	High
22	Adding an existing item code	Prompting to add an already registered item code	Should prompt an error	High
23	Submitting empty fields	Adding a product with empty fields	Should show an error message	Medium
24	Adding a product	Adding a product with valid details	A success message should appear	High
25	Adding product category	Adding a new product category	The category should be added	Medium
26	Editing product with valid details	Updating an existing product's detail	The success message should appear	Medium
27	Deleting a product	Deleting an existing product from the system	A alert should be appear before deletion	High

Stock Management				
28	Adding stock details	Trying to add invalid details into the form	Should show an error message	High
29	Adding stock details	Adding valid details to the form	A success message should be appeared	Medium
30	View orders	View pending orders submitted by the user	I should only show pending order placed by the user	Low
31	Cancel an order	Click cancel order button	The status should be change to cancelled	Medium
32	Approve order	Click approve button	The status should be changed to approved	Medium
33	Reject an order	Click Reject button	The status should be changed to rejected	Medium

Unit Amount Controller				
34	Updating yearly target	Click Save target button	A success message should appear	High
35	Add unit price for fuel	Prompting to submit empty fields	An error message should appear	Medium
36	Adding valid fuel price	Adding a valid amount	Should show a success message	Low
37	Editing a products commission percentage	Trying to empty the field and submit	It should not allow to submit	Medium

User Management				
38	Add existing user	Trying to add details of an existing user	Prompts an Error message	Medium
39	Add a user	Prompting to submit empty fields	An error message should be appeared	Medium
40	Add a user	Entering a new Employee with valid details	The user should be added and a success message should be appeared	High
41	Editing a user	Updating a user details with valid details	The user details should be updated message should be updated a success message should be appeared	Medium
42	Delete a user	Prompting to delete a user by clicking delete button	A confirmation alert should be alerted before deleting	High
43	Add User Group	Adding a new user group	A success message should be alerted	Medium

Admin Module				
44	Take Backup	Click take backup button	The database should be downloaded as an sql file	High
45	Restore	Clicking restore button without selecting the file path	It should prompt an error message	Medium
46	Restore	Selecting a valid file path And clicking restore button	The database should be restored and a success message should be appeared	High

High Level Test Cases

Test Data and Test Results

Test Case ID		1		
Tested Component		System Login		
Module Name		User Management		
Test Case Description				
No	Test Case	Expected Output	Actual Output	Status
01	Entering invalid username and/or password	Display an Error message		Pass
			Invalid username or password!	
02	Entering empty username	Display an Error message	Please enter the Username!	Pass
03	Entering empty password	Display an Error message	Please enter the Password!	Pass
04	Entering empty username and password	Display an Error message	Please enter the Username and Password!	Pass
05	Entering a valid username	Redirect to the Dashboard	Redirected to the Dashboard	Pass

Test Case ID		7		
Tested Component		Adding a customer with invalid details		
Module Name		Dealer, Customer Profile Management		
Test Case Description				
No	Test Case	Expected Output	Actual Output	Status
01	Entering an already existing customer and a valid customer name	Display a message and the submit button should be disabled	Customer Exist	Pass
			Customer Name Already Exist	
			User name available	
			Customer Name Available	