

**ASSET MANAGEMENT & VEHICLE  
MANAGEMENT SYSTEM FOR FONTERRA  
BRANDS LANKA (PVT) LTD**

**D.G. SANJEEWA BUDDIKA**

**2018**

## **Declaration**

The thesis is my original work and has not been submitted previously for a degree at this or any other university/institute.

To the best of my knowledge it does not contain any material published or written by another person, except as acknowledged in the text.

Student Name: D.G.Sanjeewa Buddika

Registration Number: 2015/MIT/012

Index Number: 15550121

---

Signature:

Date:

This is to certify that this thesis is based on the work of

Mr.D.G.S.Buddika

under my supervision. The thesis has been prepared according to the format stipulated and is of acceptable standard.

Certified by:

Supervisor Name: Prof. Kodikara

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Signature:

Date:



**ASSET MANAGEMENT & VEHICLE  
MANAGEMENT SYSTEM FOR  
FONTERRA BRANDS LANKA (PVT)  
LTD**

**A dissertation submitted for the Degree of Master of  
Information Technology**

**D.G.S. BUDDIKA**

**University of Colombo School of Computing**

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## **Abstract**

Asset Management and Vehicle management is one aspects of business that enhance company performance. Fonterra Brands Lanka (Pvt) Ltd uses manual Asset Management System (Excel Based) which have caused data inconsistencies, difficulty in creating reports on time to take accurate managerial decisions as well as controlling activities. The Objective of the project is to develop a computerized information system to manage Asset and Vehicle management to reduce their manual work as well as produce reports on time to for efficient and effective decision making.

A comprehensive requirement gathering was conducted using interviews and observation. Three and two-tier architecture used as system architecture. Windows based application is developed with C#.net programming language to achieve the system Objectives.

Test case are designed executed and recorded the test result to evaluate the system outcomes.

As a conclusion this Asset and Vehicle management system is designed and implemented to gain the benefits as expected of the organization. By using this system business can manage their information in proper manner and Admin and transport clerk can provide better service to employees without any delay. The system is cover comprehensive areas such as issue log maintaining, sending email alerts to respective users reminding their outs standing task and system allow to send some emails through system itself, etc.



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## **CHAPTER 1: Introduction**

Technology has been advancing very fast. With it the complexity of IT infrastructure too. Different companies and organizations look forward to again competitive advantage at the same time. The complexity of IT-infrastructure must be solved somehow.

Fonterra Co-operative Group Ltd, generally known as Fonterra, is New Zealand's largest company by turnover. A cooperative, Fonterra is owned by approximately 12,000 farmers throughout the country. It is the sixth-largest dairy company in the world, and the most influential by far when it comes to determining international dairy trade, handling over a third of all international dairy trade.

Fonterra Brands Lanka (Pvt) Ltd (FBL) is the business partner of Fonterra Co-operative Group Ltd, in Sri Lanka. Its head office and the factory is situated in Biyagama. FBL produces range of products such as Newdale yoghurt, Newdale curd, Newdale liquid products etc. It is also the authorized distributor of products of Fonterra Co-operative Group Ltd, with the likes of Anchor, Ratthi, Anlene, Pedia Pro, etc. All together FBL has own 52 products on its portfolio.

FBL has 3 major distribution channels to distribute their products to consumers, such as General Trade (GT), Modern Trade (MT) and Food Service (FS). General Trade Look after all Large , small groceries in island wide and they covered 90000+ retailers in island wide. Modern trade look after all supermarket chains in sri lanka such as Keels, Cargills, Arpico, Lanka Sathosa ,etc. Finally, Food Service look after all Hotel chains in Sri Lanka. To handle this operations FBL has 79 Consignment Agent and 5 Distributor locations in island wide.

To keep stability operation FBL has 750 employee base and 550 employees working in FBL biyagama factory and 200 employees situated in different Consignment Agent locations in island wide. Out of 750 employees, 350 employees are office category and other 400 employees are attaching production flow. Office category employees using company provided Vehicles, Desktops and Laptops to manage their works.

In the operation side FBL has 2 operation such as dry and chilled and they categorise products also in to above mentioned categories. For dry items Consignment Agent has to provide their vehicle to collect dry good from FBL and for chilled goods FBL arrange their own chiller tucks to distribute chilled items in island wide.

Fonterra Brands Lanka has in their asset pool over 175 vehicles and 350 Laptops and Desktops 30+ printers 350 Tabs with mobile printers presently.

Currently all the IT assets handle by Fonterra local IS team and Vehicles handle by HR and Transport team. To maintain asset allocation, deallocation and disposal FBL does not have system. Currently everything handle by manually and recorded all details manually in books.

The current way is obsolete and consistently experience failures and is not supported further. This has resulted in lack of accurate information that is required for decision making and monitoring.

The proposed new solution will provide better monitoring and administration of all assets. This also will make available real time for decision making.

## **1.1 Problem Description**

Due to the manual system used every process is based on excel work, human fault rate is high, the process and the tracing asset and vehicle records losses were not possible, and there was no efficient recoding the system. More time taken to process some tasks related to asset order handling, vehicle repairing and maintenance, on time vehicle services etc. There can be delay on these process due to insufficient information available on one place. It will impact to asset refresh on time and vehicle services on time this may cause to Customer satisfaction as well as Employee satisfaction.

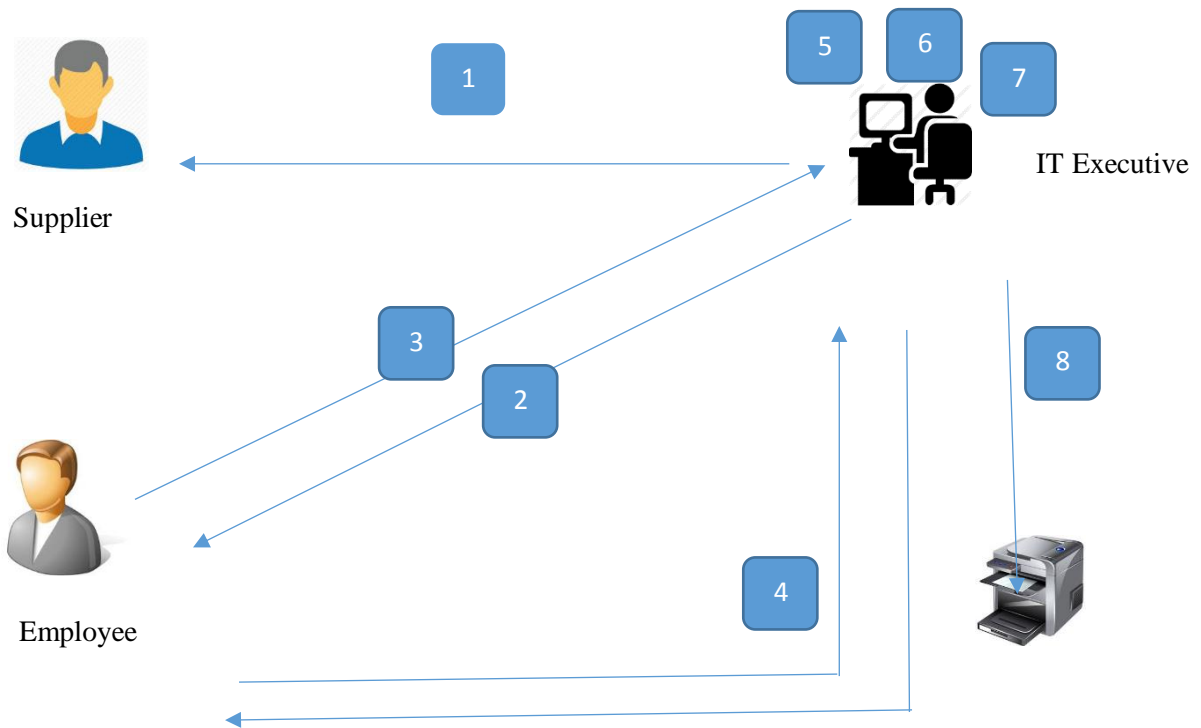


Figure 1.1: Existing process for Asset Management

1	Raise an Order to Purchase New Laptops or Desktop for New Recruitments and the Asset Refresh (Refresh is happening once assets meets end of life. If Laptop complete 3 years and Desktop complete 4 years and Printer complete 5 years.)
2	Allocate Assets to Employee.
3	Return the Asset when Employee resign from the Company.
4	Allocate the Loan assets to Employee.

5	Maintain Asset Registry and Tracking Assets Movements.
6	Request asset disposal from HR Department.
7	Maintain Accessories Information.
8	Printer Preventive Maintenance.

Table 1.1 Existing Process for Asset Management

The above Figure (Figure 1.1.) illustrate the current manual process in the company. Every asset movements are handling through the manually based on excel sheet. The activities perform by manually explained in below table (Figure 1.2). Currently management cannot get correct information in given time, because the person who manage the excel sheet and asset management process needs to manually create a report for requirement basis. There can be lots of human errors while creating reports.

## 1.2 Problem of Existing Process (Asset Management)

- As information is kept manually, retrieving the particular information can take long time, which resulted inconsistencies, where important information may not be readily available at the correct time. Therefore, all the decision which need to be made at a particular time will be delayed and it is difficult to run the Asset Information report accurately.
- Employee dissatisfaction can also be a problem, since it takes a longer time to refresh their assets. That can be a problem to perform their job well.

- It is difficult to create reports for quick decision making, since all information is recoded manual excel sheet. Therefore, decision making process get delayed, and the Finance Department is in trouble to make any financial decisions.
- No Proper asset maintenance information available such as database. All the information kept in a excel sheets, where information can be lost due to human error.
- No proper backups are taken of the excel documents when file was corrupted information get lost.
- There is no electronic approval process maintain for allocate, deallocate and dispose the assets.

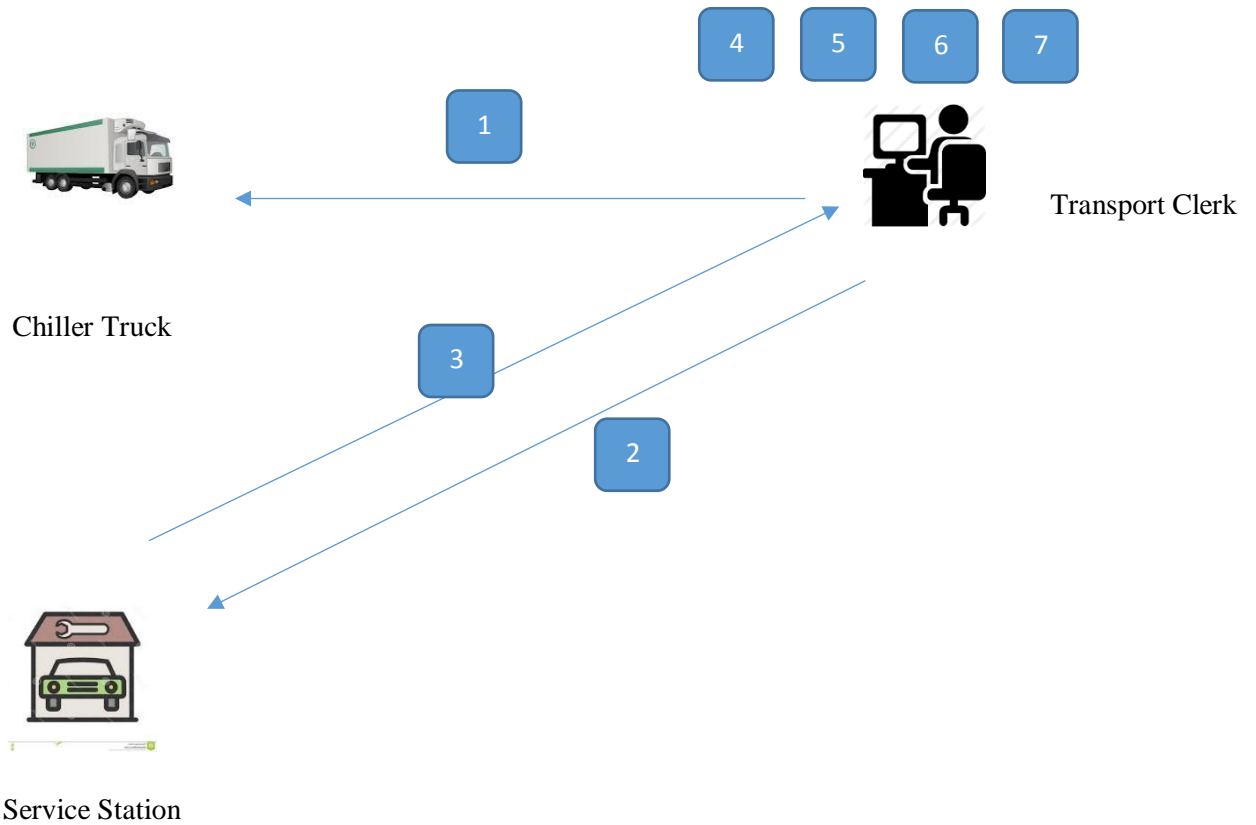


Figure 1.2: Existing Process for Vehicle Management

1	Maintain Chiller Truck Information.
2	Assign Vehicle to Service and Repairs.
3	Update Service Details and Repair Details in Manually in the Excel sheet.
4	Maintain Fuel Records.
5	Maintain Asset Registry and Tracking Assets Movements.
6	Provide Monthly Report for Management.
7	Vehicle allocation and Deallocation to Drivers.

Table 1.2 Existing Process for Vehicle Management

### **1.3 Problem of existing process (Vehicle management)**

- Employee dissatisfaction can also be a problem, because there can be a situation employee cannot provide proper information to the business.
- It is difficult to creating reports for decision making quickly, since all information is recoded manual in excel sheet. Cannot see the consolidated information as management required.
- Cannot Trak the Fuel information accurately.
- There is no popper vehicle history maintain.
- There is no electronic approval process for get the approvals of Vehicle Service and repair.

### **1.4 Motivation**

As explained section 1.3 and 1.4 there are many short coming in the current manual process. The existing problems lead to poor decision making, inefficiencies which lead to poor customer satisfaction. Therefore, it is important to address these issues.

### **1.5 Objective of the system**

- To provide a system which captures all assets movements (Laptops, Desktops, Printers, Tabs, company cars, delivery vehicles, employees owned vehicles, etc).
- Provide clear visibility on assets movements.
- Reduce Operational complexity of managing this information manually.
- Eliminate the paper base work.



- Provide accurate information to management to make some correct decisions.
- Streamline Vehicle Management Process and managing all the history records of vehicle.
- Provide benefits to transport and HR division by generating reminders for service, licence, and insurance
- Provide benefits to IS and HR division by generating reminders for asset Refresh / Dispose and Service the Assets.

## **1.6 Scope of the system**

System is designed for internal users and this system will contain key module such as Administration module, Master data module, Asset management module, Vehicle management module, Vehicle running details module, Vehicle insurance module, Management report Module and Work flow module.

Administration module contains several sub modules such as create user profile, User role management and user role allocation module.

Master data module manage several master data such as Assets, Vehicles, Employee, and Department, Insurance Company, Service Station and Supplier.

Asset management module handles asset allocation and de allocation, Asset disposal, Loan asset Management, Asset health index.

Vehicle Management module contains several sub module such as Vehicle running details , Vehicle allocation, Vehicle Insurance details , Vehicle Expense Module and Vehicle Service details module.

Management Report Module will be generated asset related reports and vehicle management reports. Asset management reports module includes Asset List based on different status (Allocated/ Deallocated / Dispose), Pending Refresh List, Asset Disposal List, and Asset Movement. Vehicle management reports module includes periodic vehicle snapshot report, Fleet Management Cost report and Vehicle Running status report.

## **1.7 Development methodology**

For develop this system I have used iterative software model. Because I cannot exactly build the system using user requirements there can be a change during the development phase, Therefore I decided to go with iterative software development model.

## **1.8 Structure of dissertation**

The first chapter defines the problem and consist of the Objective, Scope and limitation of the project.

The second chapter comprises of the Background information and the Literature review compared with existing projects. This clearly explains the advantages and disadvantages between existing projects and proposed project.

The third and fourth chapters are Analysis and design and contains two sub topics; Analysis and Design, The Analysis section contains functions and non-functions while the design section contains architectural designs likes use cases, class diagram and sequence diagrams.

The fifth chapter is Implementation, and includes the project deliverable dates and completion date. This section contains system implementation including sample source code.

The sixth chapter focus on testing and customer evaluation whether system meets customer requirement and achieve expected goals and objectives.

The chapter seven is about the conclusion and challenges faced and learning out comes.  
On conclusion of this project it can be stated that the application has effectively met its  
initial objectives identified at the outset of the project

## **CHAPTER 2: Literature Review**

### **2.1 Importance of automating asset and vehicle Management system**

Management Information system designates a specific category of information systems serving management level functions. Its provide managers with reports or with online access to the organisation current Assets and vehicle information and historical records. Largely they serve the functions of planning, controlling and decision making at management level as well as make low level employees satisfaction. They can manage their work and generate accurate and efficient reports through the system. There are well documented advantages of good information system.[1]

The debate arises whether a customised solution or a commercial product should be used in order to maintain Information at Fonterra Brands Lanka (Pvt) Ltd. It , therefore , becomes necessary to judge the pros and cons of some commercial product available in the market that the author researched.

### **2.2 Evaluation of the commercial products under research**

The various IT- Maintenance software available in the market that may be interest are the Nimbus, GP Ma Te, Novell Zenworks 3.2 ,Syslist ,Asset Management System and Symantec.

## Nimbus Software:

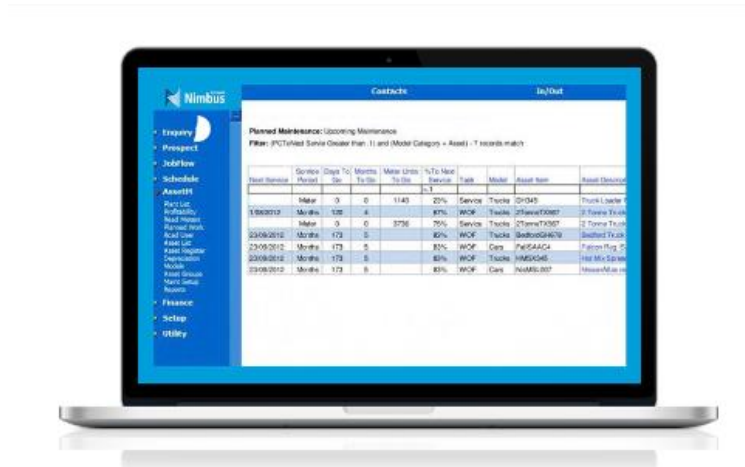


Figure 2.1: Nimbus Software

Nimbus Asset Management works seamlessly with company's work flow regimen. Asset reports provide great information to ensure managing work effectively and completing compliance issues.

Nimbus maintain a ledger of all assets. Preventive maintenance task generates jobs for planned work. Jobs for reactive work can also be opened against asset tasks. Recording jobs against assets enables to create plant profitability reports demonstrating gross profit and cost per unit of use.

### Pros

Nimbus software is suited to managing wide variety of IT equipment like servers, network, switches, routers, emails and graphical display. [1]

### Cons

Nimbus software is rather sophisticated. At Fonterra, the Asset maintenance need is more hardware like Desktops, Laptops, Monitors, Printers and Vehicles etc.

## GP Ma Te



Figure 2.2: GP Ma Te Software

EAMS (Enterprise Asset Management Software) solutions are tools used to better enable your organization to optimize the availability, performance and cost of ownership of your assets. These tools exceed traditional CMMS (Computerized Maintenance Management System) systems by bringing together and integrating all aspects of asset management, not only at one site, but throughout the enterprise.

### Pros

GP Ma Te software suited to supporting maintenance by work orders to which a lot of task can be assigned.[2]

### Cons

GP Mate requires a lot of man power. Here in Fonterra only 2 employees the author has only been assigned to do the job of asset maintenance and vehicle maintenance.

## Novell Zenworks 3.2 and Symantec

Inventory Management involves collecting hardware and software inventory information from managed workstation. This inventory information is scanned and stored in database, which the network administrator can access to manage the workstation.

Novell Zenworks for Desktops lets gather complete hardware and software inventory information in to centralized database. The network administrator can query the inventory information of the managed workstation from Console One.

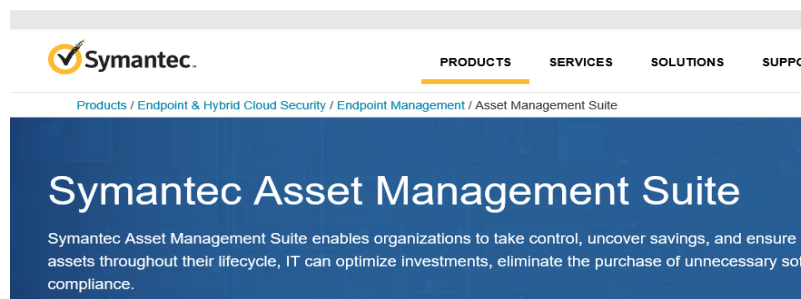


Figure 2.3: Symantec Software

Symantec Asset Management Suite enables organization to take control, uncover savings, and ensure compliance of IT assets. With an accurate picture of assets throughout their life cycle, IT can optimize investments, eliminate the purchase of unnecessary software and avoid penalties and fines due to non-compliance.

### Pros

Novell Zenworks manages small-sized software well. Symantec Ghost manages big-sized software efficiently.

### Cons

It becomes a complex system to utilize system to utilize both Symantec Ghost and Novell Zenworks for managing big and small-sized software separately. At Fonterra Asset and Vehicle management requirement is not only for software but also hardware and Vehicle management system.

Syslist



Figure 2.4: Stylus Software

Stylist is web based Mac and PC computer inventory and helpdesk solution that tracks computers, network hardware and software.

Pros

Syslist can quickly search the organization's inventory for useful information such as serial numbers, IP addresses or list of PCs with a given software type installed. Syslist is uniquely built to accommodate non-PC data such as, information on telephone system, office material manually into inventory data base.

Cons

While Syslist does not support Unix and Linux environment, it does not support vehicle management system.

### **Asset Management System**

Pros

Asset Management System (AMS) is good tool for supporting the management of IT infrastructure like computers, Monitors, printers and software installation. [3]



## Cons

AMS lacks the ability to support heterogeneous networking in Mac environment and input non-PC data such as, information on telephone system, office material manually into the inventory database.

All the asset software provides low asset maintenance costs, especially Snow Inventory, Manage Soft, Syslist, Asset manager and Maximo Main control. GP Mate is the only software to support maintenance by work orders [2]. Software such as Nimbus, Symantec Ghost, Novell Zenworks ,Snow Inventory support maintenance by network distribution while software such as IT asset management . All the software has inventory support, historical reporting and problem reporting options. While only Nimbus offers service level agreement [1].

Based on above comparison Syslist is the ideal winner to meet most of IT-Maintenance requirements at Fonterra because not only does it support management of Asset but it also captures Vehicle maintenance modules.

Based on Fonterra requirement above mentioned commercial software does not suits to their requirement. Therefore, they decided to go with customised software which supports their operation as well as their convenient.

## **CHAPTER 3: Requirement Analysis**

### **3.1 Fact finding techniques**

Fact finding is very essential task of a project because it can be used to find information need to continue our project. To collect data, three data collection techniques here mainly used as follows,

- Observation
- Interviews
- Reference

#### **3.1.1 Observation**

This project is based on Asset and Vehicle Management system for Fonterra Brands Lanka (Pvt) Ltd, therefore should have to identify how current manual process is working hence identify current process. The place observed is FBL, Currently FBL has 2 executives to manage Vehicle and Asset Management. I have listed in below their current activities they are performing to manage assets and Vehicle.

IT Executive

01. Update Asset Details
02. Allocate /De allocate Asset to Employee
03. Maintain spare assets
04. Monitor Preventive maintenance
05. Dispose assets
06. Issue Loan assets
07. Prepare a refresh list
08. Prepare a report
09. Maintain Supplier information's

## Transport Executive

01. Update New Vehicle to the system
02. Allocate /De allocate Vehicle to Drivers
03. Maintain Vehicle pool
04. Vehicle Services
05. Maintain Vehicle running record.
06. Prepare reports
07. Maintain Supplier information's

## Administrator

01. Add, Delete and Edit Employee master
02. Add Edit and Delete Departments
03. New User Creation

## **3.2 Functional and non-functional requirements**

### **3.2.1 Functional requirements**

The system will also need to store information about users who log in to system and the system will allow accessing the system according to their privileges.

System will allow relevant user to view a list of all the assets and vehicles in the FBL. When new Asset or vehicle purchase, The IT executive will update the system by adding new asset and vehicle in the system. If a new employee join to the company HR will send a request to IT executive to allocate new machine to new employee. Then IT executive will allocate new machine to employee and update the system.

System will need to store supplier information from whom company purchase the Computers and vehicles, this is very important to claim the warranty.

System will maintain all assets details such as purchase date, warranty period, service information and if there is any break down or fault reported system will keep the history of that incident and at any given time the user can retrieve that asset history and its movements.

System will maintain vehicle running details and it's maintain history as well as service details this information will be updated by the transport clerk or executive.

System will provide facility to see what are the computers going to be end of life and how many computers needs to be replace within given time period. Based on this IT executive can raise the Purchase order to supplier.

System shall allow administrator to create users and assign access roles to the user profiles.

System will have electronic approval process to get the managers approvals for vehicle services and repairs.

IT executive and Transport executive must be able to generate reports which facilitate the process of keeping a check on the current Asset status.

### **3.2.2 Non-functional requirements**

The following non-functional requirements should be satisfied by the proposed system.

#### **Usability**

System shall provide user friendly interfaces and ability to learn the system quickly. Therefore, average user learning must be less.

#### **Security**

System shall identify the users with the correct user name and password and system will keep record of user last login data and time.

### **Validation and accuracy of data**

All the submitted form details must be validated at the front end and suitable error or warning message should be displayed. The system shall also be robust, reliable and error free with all functions implemented correctly and no obvious bugs visible.

#### **Reliability**

The system has to be very reliable due to importance of data and the damages incorrect or incomplete data can do.

#### **Availability**

The system is available 100% and user used 24 hrs and 365 days a year.

### 3.3 High level use case diagram

#### 3.3.1 Use case for Administrator

The diagram shows combination of all different use cases and tells how different entities communicates.

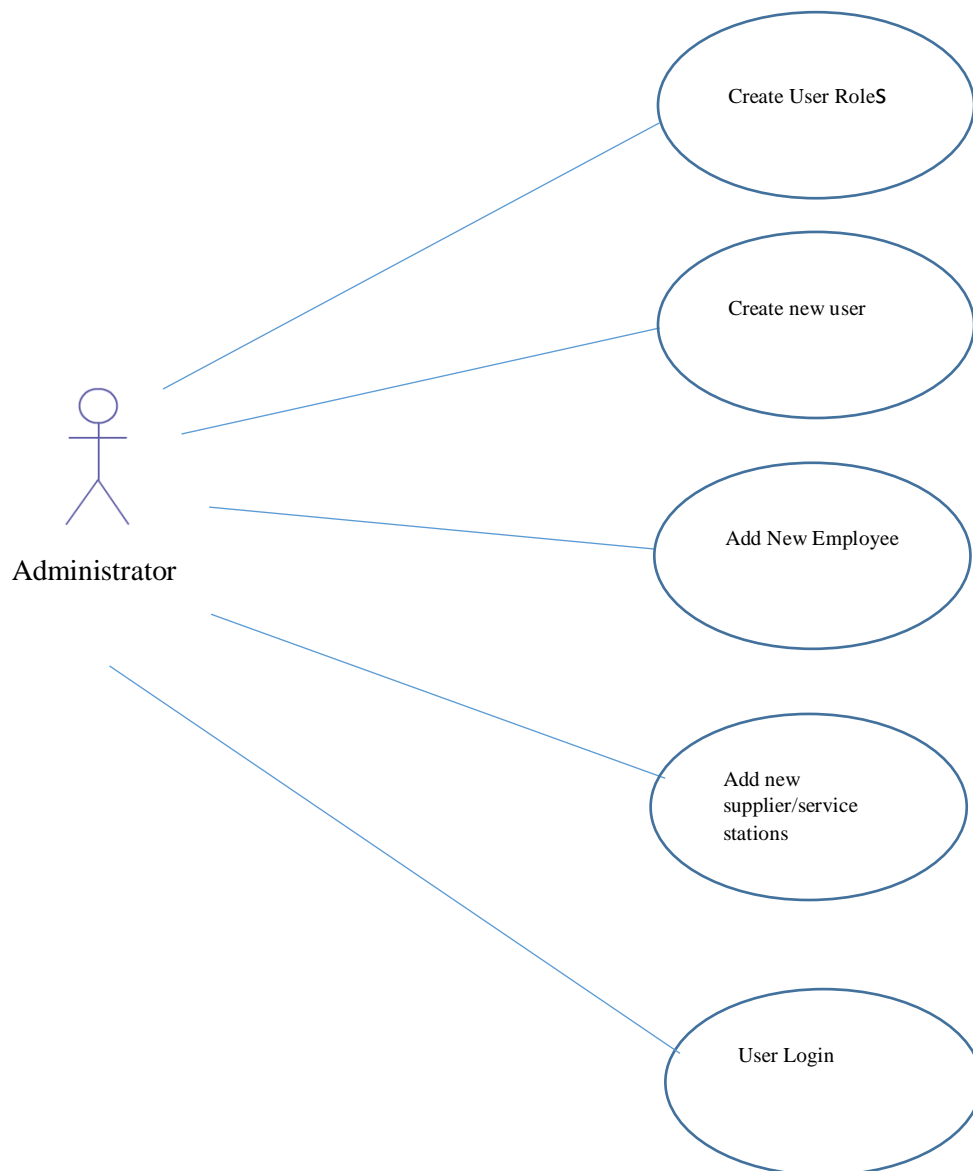


Figure 3.1: Use Case -Administrator

### 3.3.2 Use case for IT executive

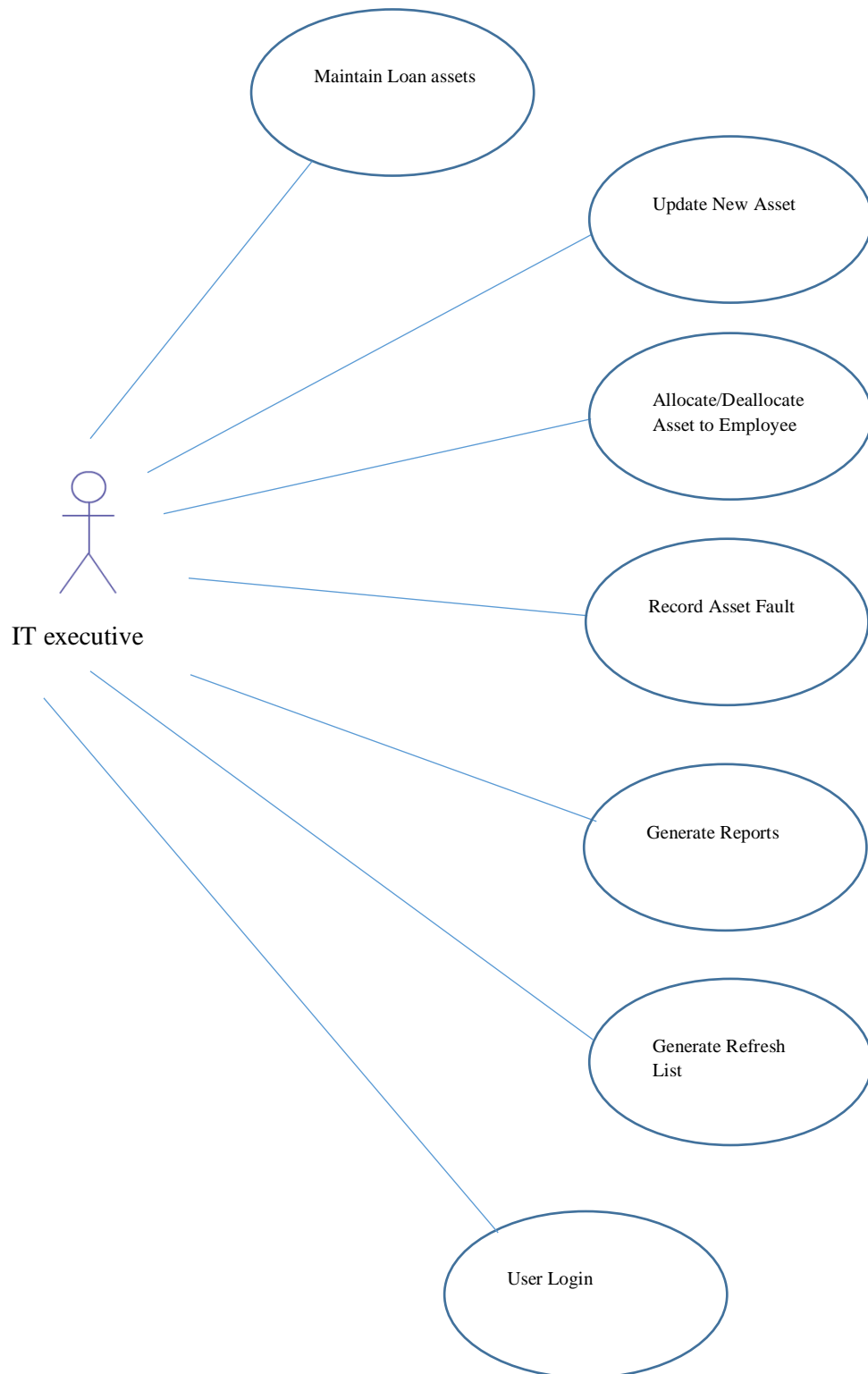


Figure 3.2: Use Case –IT Executive

### 3.3.3 Use case for Transport executive

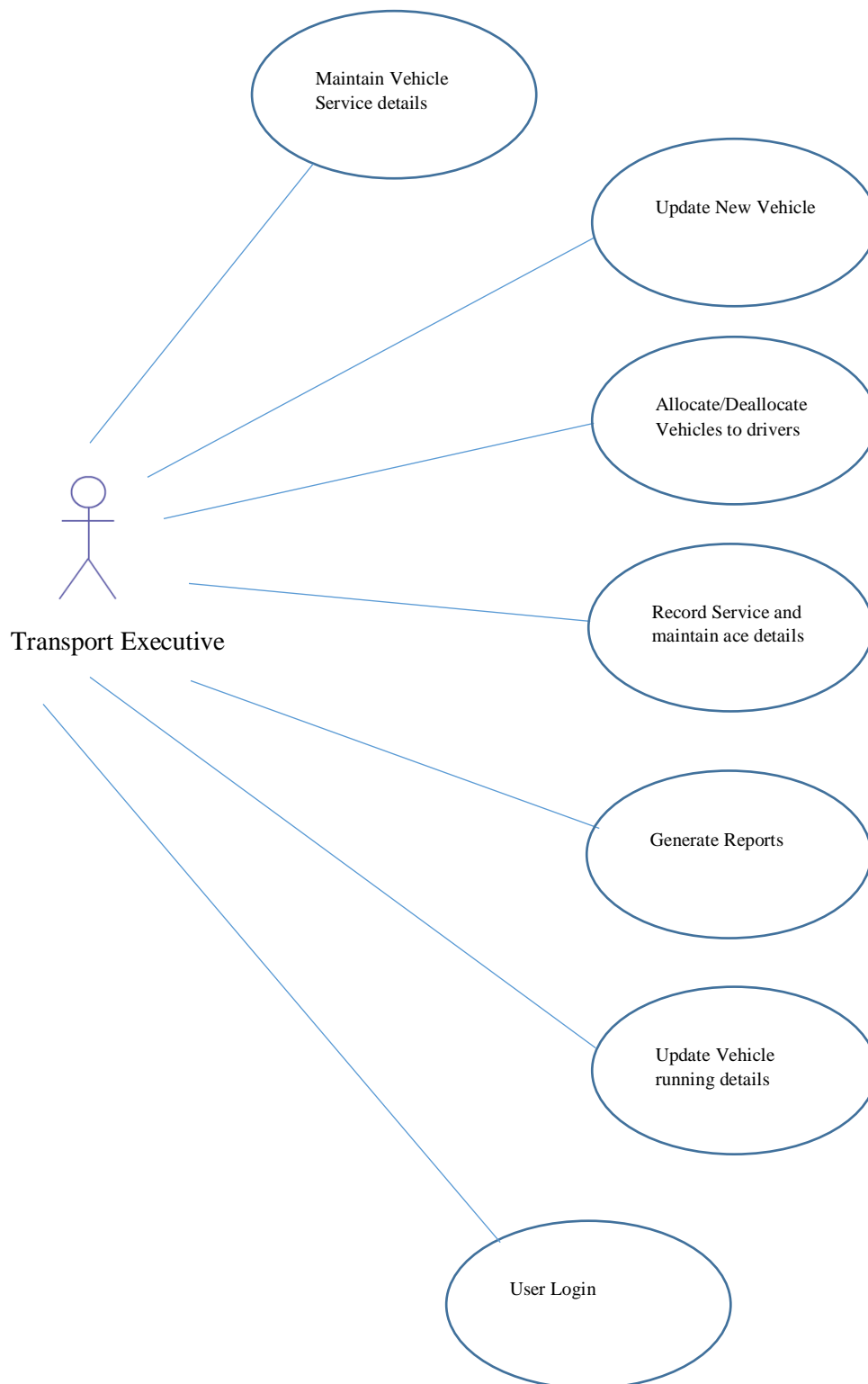


Figure 3.3: Use Case –Transport Executive



Administrator – System administrator responsible for creating user logins / add new service station / suppliers and employees in the system. He is having primary responsibility to access a setting module in the system. Once above data created in the system all other users can access those data in the system.

<b>Use Case ID</b>	<b>User Login</b>
Description	User Login to the System
Primary Actor	Administrator / IT executive / Transport Clerk
Pre - Conditions	N/A
Main Scenario	01. Enter User ID and Password 02. Click Log on Button
Post Conditions	System should successfully navigate to main menu.
Alternative Scenario	01. System will display error message when either user id or password invalid. 02. Click <OK> button 03. Rest the fields

Table 3.1 Use Case – User Login

Create New User – When request comes from HR department to administrator can create a User based on provided information. Once user create in the system new user can login to system provided user name and password by an administrator.

<b>Use Case ID</b>	<b>Create New User</b>
Description	Create New User in the system
Primary Actor	Administrator
Pre - Conditions	User must be created as employee in the system
Main Scenario	01. Enter New user name 02. Enter default password
Post Conditions	System should successfully create new user.
Alternative Scenario	01. System will display error message when employee number not available in the system.

Table 3.2 Use Case – Create New User

Add New Employee/Supplier /Service Station - When request comes from HR department to administrator can create an Employee based on provided information. Once Employee create in the system that will available other modules to assign. Supplier and Service station creation will inform by HR admin manager with relevant information. Without creating suppliers and service station in the system cannot update vehicle service details and asset details in the system.

<b>Use Case ID</b>	<b>Add New Employee/Supplier/ Service Station</b>
Description	Create New Employee / Supplier or Service station in the system.
Primary Actor	Administrator
Pre - Conditions	N/A
Main Scenario	01. Fill the form with requested information. 02. Click save button
Post Conditions	System should successfully save the record.
Alternative Scenario	System will display error message when mandatory fields are not filled.

Table 3.3 Use Case – Add New Employee/Supplier/Service Station

IT Executive / Transport Clerk – The primary responsibility of these 2 users are to be to perform below activities

Maintain Loan assets - In Fonterra not all the employees having desktops or laptops, out of 750 employees only 300 employees using desktops and laptops. Therefore, some requests are coming from different department to issue a loan asset for some employees to use for certain period. Because of this IT department needs to keep a record of those requests and issue temporary laptop or desktop to nominated user. In new system IT executive can update the system and issue an asset to user.

<b>Use Case ID</b>	<b>Maintain Loan Assets</b>
Description	Maintain loan assets
Primary Actor	IT executive
Pre - Conditions	Assets need to be update as loan asset in the system
Main Scenario	01. Navigate to Loan asset form. 02. Search Asset type as “Loan” 03. Select the asset which is going to give as loan. 04. Update the user and change the status to “Allocated”. 05. Save the record.
Post Conditions	System should successfully save the record.
Alternative Scenario	System will display error message when assets are not available for given as loan.

Table 3.4 Use Case – Maintain Loan Assets

Enter New Assets and Vehicle to the system – Once new vehicle or new asset purchased from Fonterra IT executive / Transport Clerk needs to be update the new asset in the system with required information. Once this was update other users can use those assets to enter the transaction in the system.

<b>Use Case ID</b>	<b>Update New Assets / Vehicle</b>
Description	Enter New Assets and Vehicle to the system
Primary Actor	IT executive / Transport Clerk
Pre - Conditions	N/A
Main Scenario	01. Navigate to New Asset Form. 02. Enter all required information. 03. Save the record.
Post Conditions	System should successfully save the record.
Alternative Scenario	System will display error message when mandatory fields are not filled.

Table 3.5 Use Case – Update New Asset / Vehicle

Allocate Assets and vehicle to employee – Once IT department get the request from HR department IT executive will issue a Laptop or desktop based on the request. Those information needs to be update in the system with installed date. Base on that asset life get stared and calculate the next refresh date. Same process will follow the transport clerk for new vehicle allocation.

Deallocate Assets and vehicle to employee – Once Employee resign from the company employee has to hand over his laptop / desktop or vehicle to the company. At that time IT executive or transport clerk need to deallocate the asset from employee and change the asset status as “Spare”. Once status become a spare IT executive or transport clerk can assign same assets to new request.

<b>Use Case ID</b>	<b>Allocate and Deallocate Assets/Vehicle</b>
Description	Allocate and Deallocate Assets and vehicle to employee
Primary Actor	IT executive / Transport Clerk
Pre - Conditions	User must be created as employee in the system
Main Scenario	01. Navigate to asset allocation and deallocation form. 03. Search Asset type as “New” for Allocation and Employee Number for de allocation. 04. Select the asset/vehicle which is going to allocate or deallocate. 05. Update the user and change the status to “Allocated” or new allocation. And change the status as “pending allocation” as deallocation. 06. Save the record.
Post Conditions	System should successfully save the record.
Alternative Scenario	

Table 3.6 Use Case – Allocate and Deallocate Asset/Vehicle

Record Assets Fault- There are some situations users are complaining about their laptops and desktop faults. Then IT executive and Transport clerk will record those queries in the system and maintain an issue log. End of the day or week they can run a report and see whether all

reported issues are fixed or still open. Then they can follow up with vendor or relevant parties regarding the fault or issue.

<b>Use Case ID</b>	<b>Record Assets Fault</b>
Description	Update the asset history
Primary Actor	IT executive / Transport Clerk
Pre - Conditions	Asset Needs to be available in the system.
Main Scenario	01. Navigate to “Fault reporting” form. 02. Search the asset by using “Asset ID” or Vehicle Number. 03. Select the asset or vehicle number. 04. Recorded the fault.
Post Conditions	System should successfully save the record.
Alternative Scenario	

Table 3.7 Use Case – Record Assets Faults

Generate reports – There are some reports available in the system both IT executive and transport clerk can run and view the reports on time.

<b>Use Case ID</b>	<b>Generate Report</b>
Description	User Login to the System
Primary Actor	IT executive / Transport Clerk
Pre - Conditions	N/A
Main Scenario	Navigate to Report Module and select the report needs to be generated. Select required filters to be generate the report.
Post Conditions	System will display the report.
Alternative Scenario	System will display error message when either report is not available to run or no data to be displayed.

Table 3.8 Use Case – Generate Reports

Generate Refresh List – This is one of the main important report available in the system. Based on this report Fonterra will order Assets for next year refresh. Because life time of a

desktop is 4 years and laptop is 3 years. Every year there are some users getting to refresh their assets. This is applicable for Printers and vehicles as well. Printers getting refresh on every 5 years and light vehicles getting refresh on 7 years.

<b>Use Case ID</b>	<b>Generate Refresh List</b>
Description	Generate Asset refresh list
Primary Actor	IT executive
Pre - Conditions	All assets need to be updated with purchase date, installed date and the warranty period.
Main Scenario	<ol style="list-style-type: none"> <li>01. Navigate to Report Module.</li> <li>02. Select the report called “Asset Refresh”</li> <li>03. Select the date.</li> <li>04. Generate the list of assets going be end of life to that date.</li> </ol>
Post Conditions	System will display the report.
Alternative Scenario	System will display error message when either report is not available to run or no data to be displayed.

Table 3.9 Use Case – Generate Asset Refresh List

Vehicle Running Details – Transport clerk will keep a record of all Lorries running details in the system. Drivers need to provide Fuel payment slips with vehicle mileage to transport division every week. Based on that transport clerk will feed those data to the system and generate the report base on fuel station to make the payment.

<b>Use Case ID</b>	<b>Vehicle Running Details</b>
Description	Maintain Vehicle running details in the system.
Primary Actor	Transport Clerk
Pre - Conditions	Vehicle needs to be available in the system with start meter reading.
Main Scenario	<ol style="list-style-type: none"> <li>01. Navigate to Vehicle running detail form.</li> <li>02. Select the Vehicle to be updated.</li> </ol>

	03. Enter required data. 04. Save the record.
Post Conditions	System will save the record.
Alternative Scenario	System itself calculate the running details and save it record level.

Table 3.10 Use Case – Vehicle Running Details

Vehicle Service Details update – Transport clerk will keep a record of all Lorrie’s service details in the system. Drivers need to provide service payment slips with vehicle mileage to transport division every service. Based on that transport clerk will feed those data to the system and generate the report base on vehicle to make a management decision.

<b>Use Case ID</b>	<b>Vehicle Service Details Update</b>
Description	Vehicle service details update.
Primary Actor	Transport Clerk
Pre - Conditions	Vehicle needs to be available in the system with start meter reading.
Main Scenario	01. Navigate to Vehicle Service detail form. 02. Select the Vehicle to be updated. 03. Enter required data. 04. Save the record.
Post Conditions	System will display the report.
Alternative Scenario	System itself calculate next service mileage and save it in the record level

Table 3.11 Use Case – Vehicle Service Details Update

## **CHAPTER 4: Design**

### **4.1 System development methodologies and justification**

Software methodology is an essential part of the project, because a methodology should be appropriate to a system scope and specification. Inappropriate methodology can lead project to a failure. Therefore, basic research has to be done before selecting a suitable methodology for the project. Mainly there are 5 types of software development methodologies they are

- Waterfall method
- Spiral model
- Prototyping

#### **4.4.1 Waterfall model**

According to Pressman R. S. (1997) Waterfall model proposes a methodical, sequential approach to software development that designs with the system level and progresses through analysis, design, coding, testing, and implementation.

#### **4.4.2 Spiral model**

According to Pressman R. S. (1997) the spiral model is an evolutionary software process model that couples the iterative steps of prototyping with the controlled and systematic aspects of linear sequential model. It provides the potential for rapid development of incremental version of the software in the spiral model the software is developed in a series of incremental releases. In the early iteration the incremental release might be a prototype and during later iterations more complete versions of the system are produced.

#### **4.4.3 Prototyping model**

Prototyping is mainly using in software industry as development methodology, the propose of prototyping is review end users /clients of the software to evaluate proposal for the design of the eventual product by actually trying them out, rather than having to interpret and evaluate the design based on descriptions. Prototyping is modern substitute for the waterfall model of development. In prototyping method, it each pass through the cycle should entail small changes as new features are added, until finally all requirements are met.

According to Pressman R. S. (1997) the prototype paradigm starts with requirements collecting. Steps concerned in this process are defining the overall objectives for the software.



According to Pressman R. S. (1997) there are three types of Prototypes,

#### **4.4.3.1 Evolutionary prototyping**

Evolutionary prototyping is a life cycle model in which the system been developed as it move through the project. As first stage basic parts of the system is developed and get approval from the customer then prototype is then confirmed to be developed based on the feedback that is reserved if customer satisfy that final product will be created based on the prototype.

#### **4.4.3.2 Throwaway prototyping**

First develop prototype and get customer's feedback and requirements. Once the requirements have been identified the system is developed using another development methodology.

#### **4.4.3.3 Incremental prototyping**

In incremental prototype interface design and external features of the project can be done first and then all the core process of project is create each prototype. When the system is first segmented in to increments and each increment is completed once after another. The final output is done after all the prototypes are finished.

#### **4.4.4 Justification of the selected method**

In software development prototyping software methodology software designer and implementer can obtain feedback from the end users early in the project that mean this methodology allows steady project progress. In prototyping methodology, it pre- define the project requirements and project risk plan. So, when analysing one prototyping stage results those results can have used effectively in next prototyping stage after the stage. The prototyping is an iterative process, and each prototype developed added to the final overall functionality of the system. Prototyping is guide the development of the project in line with the user's requirements proved to be effective.

#### **4.4.5 Process of prototyping**

The application of the above software process model, to the Asset and Vehicle management project can be outlined as follows,

- Defining System deliverables  
The main deliverable of this project is software application.

- Design system architecture
 

The system architecture provides the early establishments in the process, will act as a framework to guide and focus the system development. The system architecture is describing in more details in below.
- Specify system increment
 

During this phase, the increments of the system are specified and each increment will deliver a subset of the user requirements as outlined in the overall design. The specification of each increment will describe the set of components that makes up the particular increment.
- Build system increment
 

During this phase each increment will be developed according to the increment specification and within the established framework. Once each increment is built, a unit testing will be carried out to ensure the functional and technical quality of the system. Details of implementing increments, is described in next chapter.

  - System Increment 1: Develop GUI
  - System Increment 2: Develop the database
  - System Increment 3: Integrated database and develop GUI
  - System Increment 4: Develop report module
- Integrate the increment
 

Once each increment is built and tested, it will be integrated with other implemented increments, in order to facilitate the gradual evolution of the system.
- Deliver final system
 

Once all increments and integration are completed then the system give to the users and do the testing part using unit and integration testing Important or adjustments identified through user feedback, which do not require major system changes. Then finally the system ready to deliver to the customer or if there any changes then re do the adjustments and again the process will run.

## 4.5 High level architecture

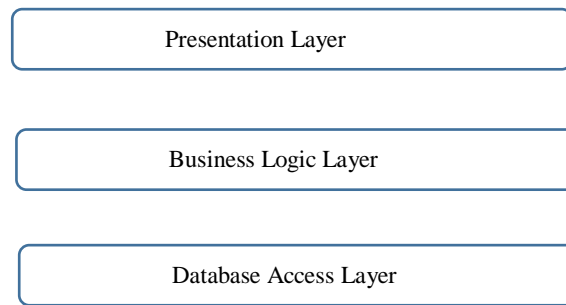


Figure 4.1: Three Tier Architecture

Three-layer architecture is displayed in figure 3.4 is proposed for this system. Layer indicates logical separation of component, such as having different namespaces and classes for the data base access layer, Business Logic layer and Presentation layer.

Business logic layer (BLL) works bridge between presentation layer (PL) and data access layer (DL). All the user values received from the presentation layer are being passed to BBL. The results received from DAL are in row data in data table format. Data transfer object is a class with contents GET and SET methods. It is mainly used to pass data from one class to another. It's directly connected with BLL and PL. BBL is most important class in the whole architecture because it mainly contains all business logic of the program.

PL is the only layer which directly connected with the user. PL is mainly used for getting user data and then passing to BLL for further procedure, and when data received from the DAL then it's responsible to represent values in appropriate form which user ca understand.

DAL contains all the SQL queries and connection string to the database.

The major reason for proposing this architecture for this project is that all business logic can be define once within BLL and then shared by any number of components within PL. Any changes to business rules can be placed in one place and it can be use instantly throughout whole application.

It is possible to make changes on the PL without affecting the two layers.

When the bug or exception is occurred, it is easy to find weather it is occurred in BLL or DAL and do the needful modification because of having a logical separation of components.

The architecture is supported for superior performance for medium to high volume environment.

The below figure 4.1 represent high level system architecture for proposed system.

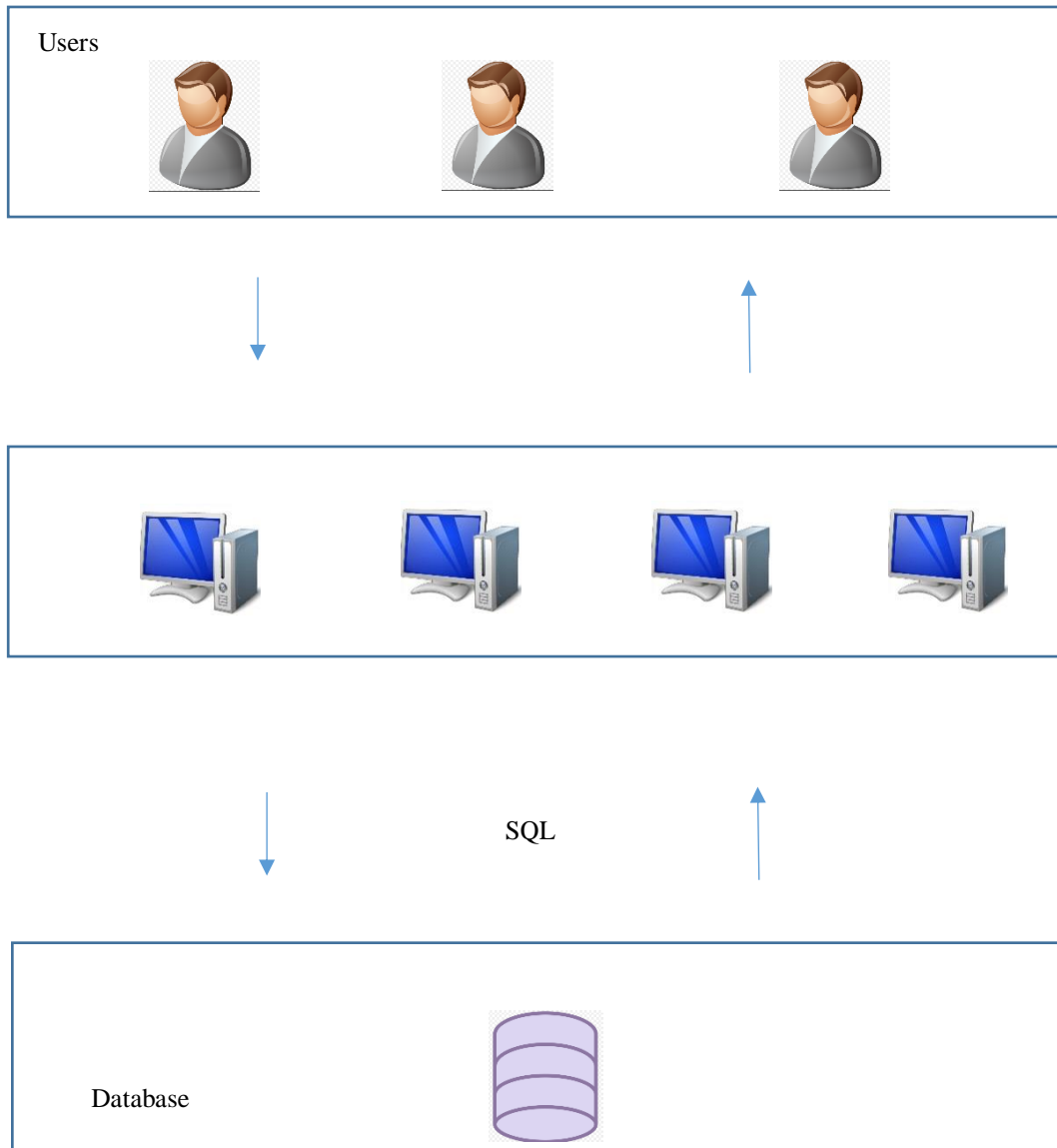


Figure 4.2: High-level System Architecture

The major reason for using this architecture is that the client-server solution allows multiple user access the database at the same time as long as they are accessing data in different parts of the database. One other huge benefit is that the server is processing data that allows the client to work on the presentation and business logic only. This means that the client and the server sharing work load and by scaling the server to more powerful than the client. Therefore, this architecture provides good security and more scalable faster execution

## 4.7 System architecture

System architecture is really important because it provide communication flow between front and back side of the application. In system architecture it gives clear understanding between relationship and component of the system.

This an application architecture is depicted in figure 4.3. It provides inputs to the system from Graphical user interface (GUI) and output to the GUI. In this diagram it provides clear overall application architecture once so it's really understandable and give clear picture to the implementation stage.

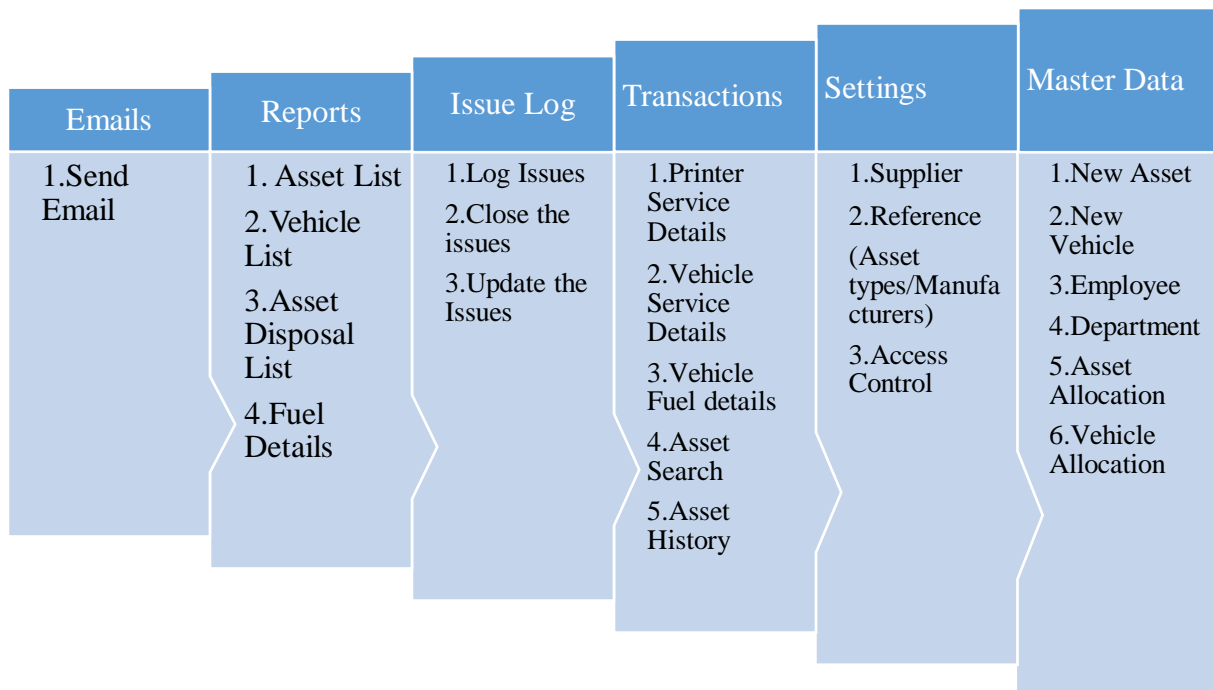


Figure 4.3: System Architecture

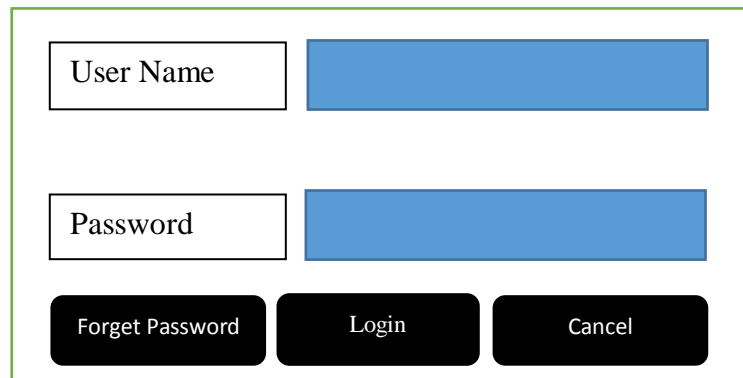
## 4.8 Modules in the system.

Modules of this system are created according to the system architecture. The system architecture is shown in figure 4.3. The modules of the system are,

- Verify access
- Administrator control (Master Data)
- Asset Movement Handling
- Asset Service Details Maintain
- Issue and Defects handing module
- Communication Module
- Report Module

### 4.8.1 Verify access (Login screen)

In this first user needs to login to Fonterra brands lanka asset management and vehicle management system will check user name and password is valid or invalid one. If it is valid then system allows to login to the system else system will throw warning message.



The image shows a user login form with a light green border. It contains two input fields: 'User Name' and 'Password', each with a blue placeholder. Below the fields are three buttons: 'Forget Password', 'Login', and 'Cancel'.

Figure 4.4: User Login

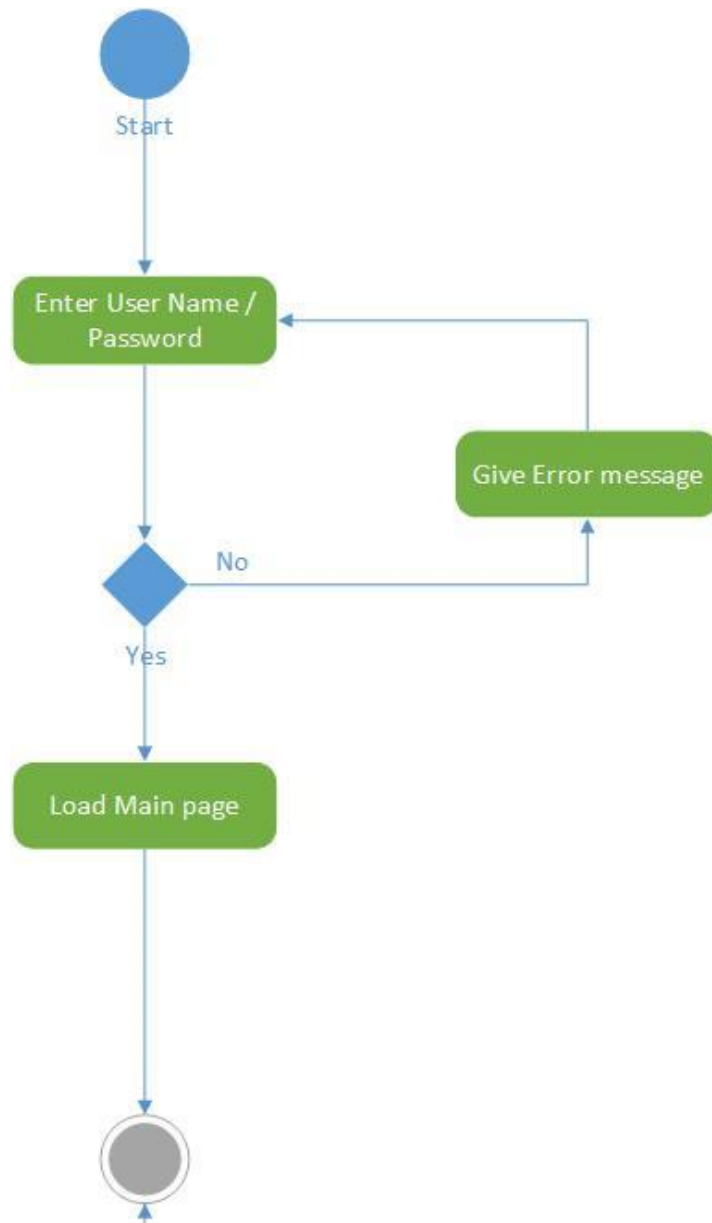


Figure 4.5: Activity Diagram for Login Screen

### 4.8.2 Admin console

Admin control is the place that can-do changes to this system in admin panel mainly can access the master data and Setting modules in the system. There are different types of master data master data available in the system such as assets details, vehicle details, user details, departments, etc. Every transaction in the system linked with master data.



### 4.8.2.1 Master data

Below activity diagram shows some of master data modules going to be implement in the system. System will validate entered data currently available in the system if it is system will display an error message, otherwise it will save in the system.

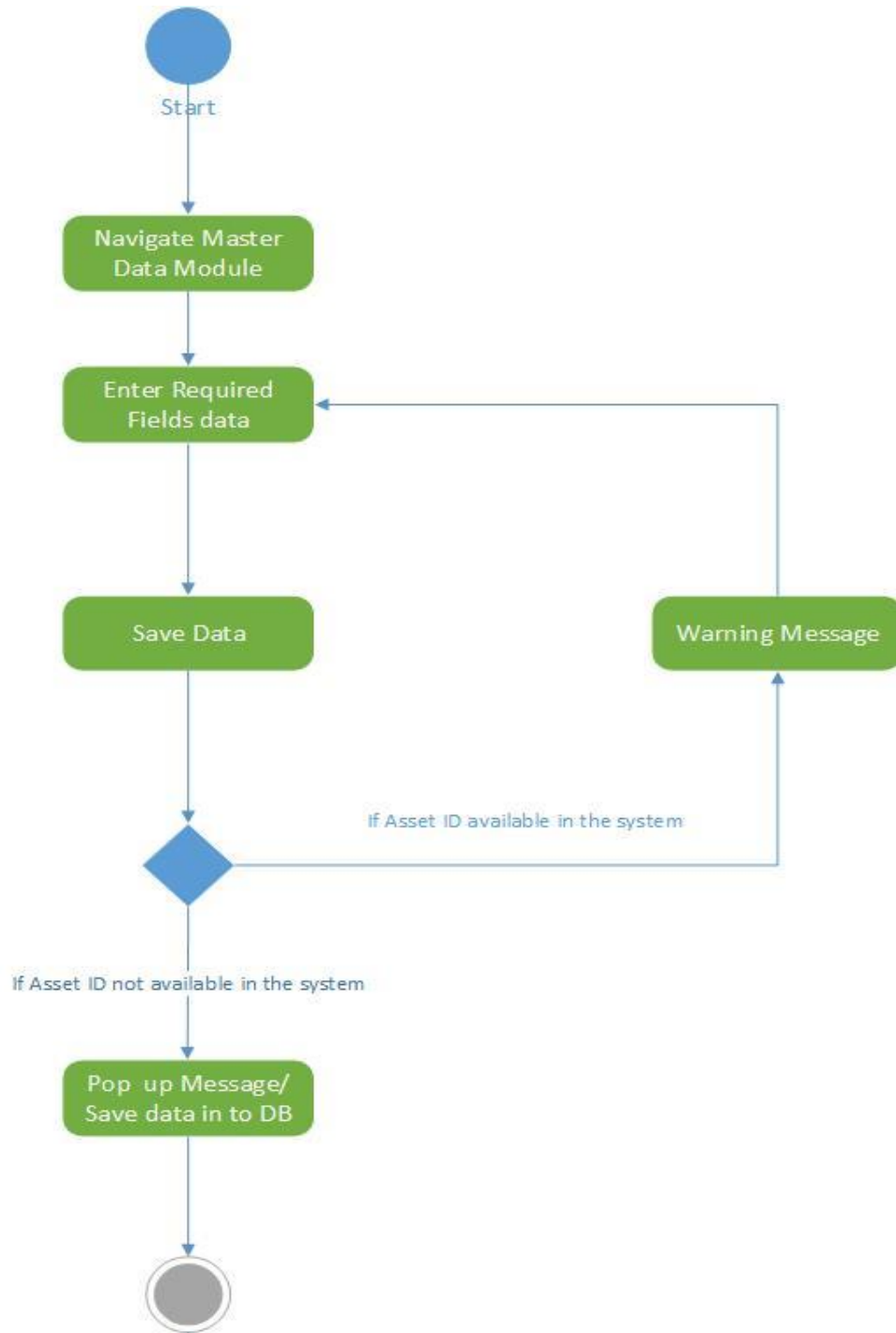


Figure 4.6: Activity Diagram for Asset Master

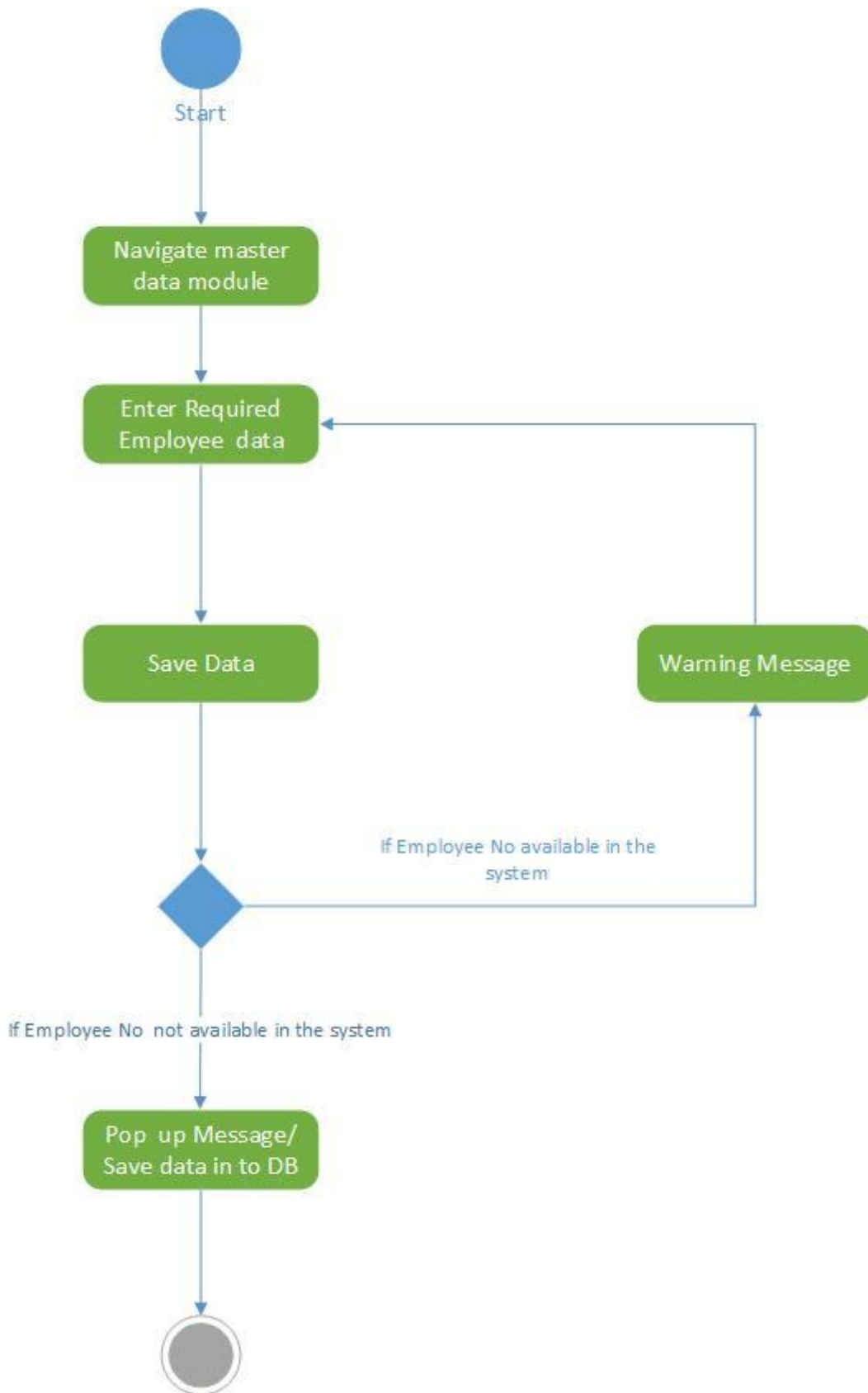


Figure 4.7: Activity Diagram for Employee Master

### 4.8.2.2 Setting module

This module mainly used to maintain supplier details and service station details. Based on this data Printer service and Vehicle service details can be update in the system. The following Activity diagram will display that.

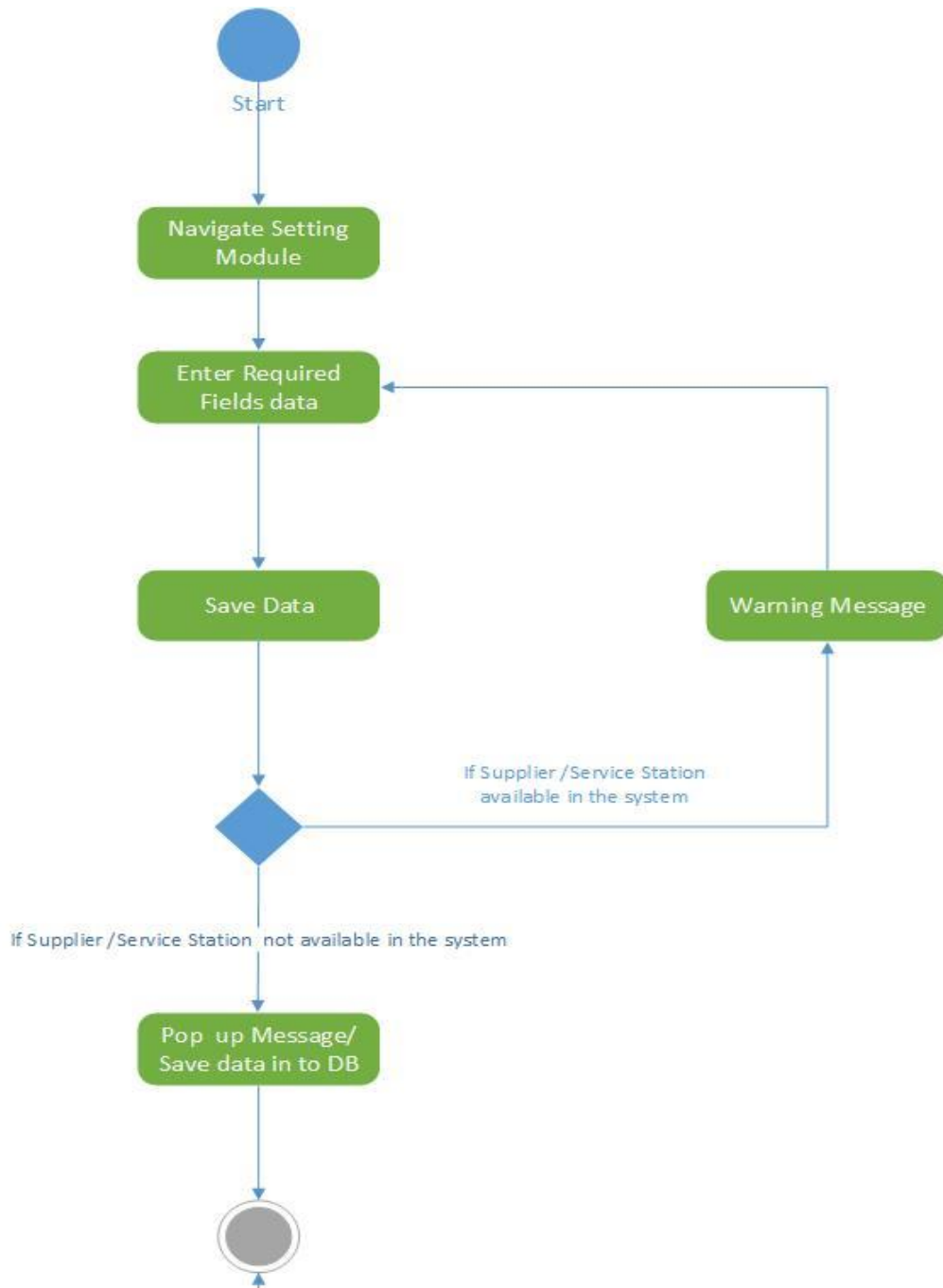


Figure 4.8: Activity Diagram for Settings Service Station

## 4.9 Database design

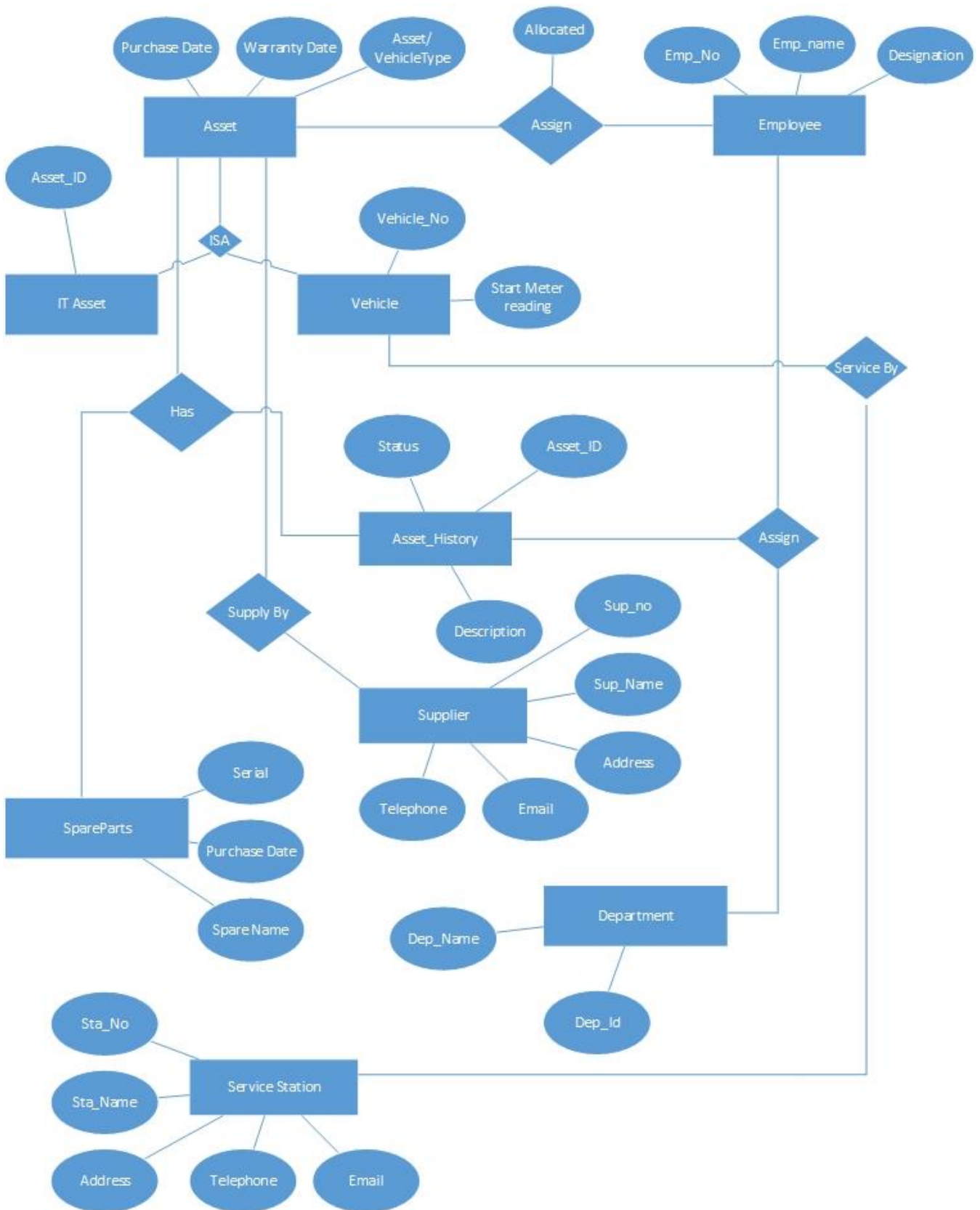


Figure 4.9: Conceptual Design –ER Diagram

## **CHAPTER 5: Implementation**

This chapter describe the most important part of the project which is implementation of the system. The logical design converted in to physical design and it is then implemented development back ground, tools, language and standard used during the development phase. Hardware and software requirements are discussed here.

### **5.1 Environment**

The implementation environment selected considering number of factors. Some of these factors are advanced development features which help development faster and easier, support for multiple language development user-friendliness of the environment. A personal computer selected to support the selected environment software. Visual studio Frame work used as development environment frame work and C#.net used as programming language. In order to implement backend or the data base used SQL server management studio. Below will describe each environment separately.

### **5.2 Selecting software**

#### **C#.net for programming**

Fonterra using windows as their operating system and it is managed by New Zealand IS team and Sri Lanka cannot use any other operating system except windows. Therefor microsoft visual studio has selected frame work and C#.net used as programming language. Because client wanted to have windows based application and they are restricted use or install web based application.

Initial requirement to install this application in 2 or 3 clients machines and install data base in one networked machine and access the system.

#### **Microsoft SQL server**

Microsoft SQL server management studio use to create data base as it is compatible with visual studio .Net frame work.

#### **Crystal reports**

According to the FBL they wanted to have different reports to be design in the system, therefore crystal report software used to design the reports and then it was linked to the system.

## **5.3 Hardware and Software Requirement**

### **Hardware Requirement**

Core i5 or Higher Processor Machine

2 GB or Higher Memory

512 MB minimum VGA

Intranet Network Connection

Internet connection

### **Software Requirement**

Microsoft Visual Studio 2015 Frame work

SQL server management studio

Crystal report viewer

Windows Operating system

## **5.4 Implementation of Database**

In database implementation database, tables were created. In database master tables and transaction table created is such a manner. Master data table names were started with prefix of Mast and followed by table name (“Mast\_TableName”) and transactions table names were started with prefix of Txn (Txn\_TableName”) and settings table names started with prefix of Sett (Sett\_TableName). Using that it is easy to identify Master, Transactions and setting tables uniquely.

## **5.2 System Development Plan**

The system development plan is according to the considering system development methodology that use to implement FBL asset and vehicle management application. There are four increments are discussing in the following sections.

## 5.2.1 System Increment 1: Develop GUI

Before creates core functions in the system creating GUI is easy to capture the overall application. Because while creating GUI can identify what is the outcome of this system. GUI of this application created from C#.net. It contains 25 Forms. All the GUI using for feed the data to the system and there is no any background images used during the development stage. Based on user requirement only main GUI is having a background image it was provided by the business. All GUI's were built in simple manner and it is very user friendly.

## 5.2.2 System increment 2: Create data base and tables

As per above explanation SQL server management studio software has used to develop database and its table structure. In creating tables in Database as explained on above it used common method to identify each table from table name. Refer the below of some codes were used to creates tables in database.

### Sample Master Table

```
Create table Mast_Asset (Asset_No nvarchar(50) Not Null,  
Serial_Number nvarchar(50),  
Asset_Type nvarchar(50) ,  
Asset_Model nvarchar(50),  
Supplier nvarchar(50),  
PO nvarchar(50),  
Capex_ID nvarchar(50), Start_Meter_Reading nvarchar(50), Purchased_Date nvarchar(50) )
```

Table 5.1 Implementation – Sample Master Table

### Sample Transaction Table

```
Create table Txn_Vehicle_Service (  
Vehicle_No nvarchar(50) Not Null ,Service_Date nvarchar(50),Service_Station  
nvarchar(Max),Employee_No nvarchar(Max),meterreading integer,Comments nvarchar(50))
```

Table 5.2 Implementation – Sample Transaction Table

### Sample Setting Table

```
Create table Set_ServiceStation  
(Station_No nvarchar(50) primary key,Service_St_Name nvarchar(50),Service_Station_Add  
nvarchar(Max),Contact_Person nvarchar)
```

Table 5.3 Implementation – Sample Master Table

### 5.2.3 System Increment 3: Code the project and link with Database

In this phase completed coding part of the project. System was implemented using C#.net. Here used different Combo boxes, Data Grids, Text boxes, Buttons to display the data and save the data. Most important part of the coding is the validation of data inputs. There are different mechanics and the techniques used to validate data inputs. Such as login page restricted to enter special characters as user name or password to eliminate SQL injection attacks.

All the data inputs with validated Null values and make to display pop up based on the invalid data inputs. All the new data inputs validate with existing data available in the table to eliminate the duplicate records savings. For that in the system used separate validation techniques.

### 5.2.4 System Increment 4: Design and develop the reports and link with application

With this system client wants to have different type of reports to be analyzed the data in different angles. Therefore, initial stage they required to have basic report set, such as Asset List, Vehicle list, Printer service details list, Vehicle Running record report. To develop these report crystal report used. Frist report was designed through crystal report and finally linked with windows



forms using Crystal report viewer. Benefit of doing this way is client can request changes in existing reports then it is very easy to modify the report and put it in to report folder rather changing the whole coding in the system.

Data binding of the report is handling through the system itself.

## **CHAPTER 6: Testing and evaluation**

After implement the system need to test the system because it reviews the system development and implementation of the system based on the design and development. In this chapter it will review the logical flow of the system and check weather is the system is working properly according to the implementation steps.

The development methodology of the system is incremental prototyping. According to the implementation chapter there are four increments for this system. In this project can test the system after each increment, or end of the development. The advantage is doing testing after increment is can identify errors of after each increment and fix them before starting next increment. The test plan for this application describe below sections.

### **6.1 Test plan**

The test plan for Asset Management and Vehicle management system is mainly divide in to two sections.

#### **6.1.1. Unit testing**

Unit testing is carried out during development phase while developing each module, to determine that each module is working as required. The basic idea is test sub modules while it is creating. Unit testing is going to each increment of this system and check the outcome. From this can figured out errors in the sub modules.

#### **6.1.2. Integration testing**

Integration testing is mainly dividing in two sub categories.

##### **6.1.2.1. Module integration testing**

This is for checking the communication flow of the system. After developed the module of the system in this review whether the communication between the modules are done properly.

### **6.1.2.2. Overall system testing**

When complete all the modules of the systems have to check overall communication and the final. From this stage can test the whole system once.

### **6.2 Testing strategy: Unit testing**

The main aspects of unit testing are check the module and sub module are working correctly and arrange the flow of each module.

### **6.3 Test results**

Test results recoded as Not Executed, Pass, Fail and Re-Open. When the test case is not executed with the system then “Not Executed” status is use. When the test case is executed and then gets the expected result as actual result then used “Pass” status. If it is not get the expected results as actual result then used status “Fail”. Defect is logged for failed test case. Once bug or defect is fixed and execute the test case again and get the expected results.

## 6.4 Test cases

Test Case ID	FBLAMVM_T001
Description	Test User Login
Precondition	Make sure user already created in the system with user name and password.
Steps	Navigate to Login page.
Test Data	<ol style="list-style-type: none"> <li>01. Enter User Name and Wrong Password</li> <li>02. Enter Wrong User Name and Correct Password</li> <li>03. Keep the User Name and Password blank.</li> <li>04. Keep the User Name blank and Correct Password.</li> <li>05. Correct User Name Blank Password.</li> <li>06. Both User name and Password Blank.</li> </ol>
Expected Out comes	<p>"User Name Cannot Be Blank"</p> <p>"Password Cannot Be Blank"</p> <p>"Check Your User Name Or Password"</p>
Actual Out comes	<p>"User Name Cannot Be Blank"</p> <p>"Password Cannot Be Blank"</p> <p>"Check Your User Name Or Password"</p>
Test Result	Pass
Comments	
Defect ID	

Table 6.1 Testing – User Login

Test Case ID	FBLAMVM_T002
Description	Test User Login
Precondition	Make sure user already created in the system with user name and password.
Steps	Navigate to Login page.
Test Data	Enter Correct User Name and Password
Expected Out comes	“Successfully Login”
Actual Out comes	“Successfully Login”
Test Result	Pass
Comments	
Defect ID	

Table 6.2 Testing – User Login

Test Case ID	FBLAMVM_T003
Description	New Asset Creation
Precondition	
Steps	Navigate to New Asset Module.
Test Data	Try to save without filling mandatory Fields
Expected Out comes	“Mandatory fields cannot be blank”
Actual Out comes	“Mandatory fields cannot be blank”
Test Result	Pass
Comments	
Defect ID	

Table 6.3 Testing – New Asset Creation

Test Case ID	FBLAMVM_T003.1
Description	New Asset Creation
Precondition	Asset Number should not available on the Data base.
Steps	Navigate to New Asset Module.
Test Data	Try to save filling all mandatory Fields
Expected Out comes	“Added New Asset Details Successfully”
Actual Out comes	“Added New Asset Details Successfully” and Load all records to below grid
Test Result	Pass
Comments	
Defect ID	

Table 6.4 Testing – New Asset Creation

Test Case ID	FBLAMVM_T003.2
Description	New Asset Creation using registered asset ID
Precondition	Asset Number should available on the Data base.
Steps	Navigate to New Asset Module.
Test Data	Try to save filling all mandatory Fields with existing asset number.
Expected Out comes	“Asset Number Already Exist”
Actual Out comes	“Asset Number Already Exist”
Test Result	Pass
Comments	
Defect ID	

Table 6.5 Testing – New Asset Creation with registered ID

Test Case ID	FBLAMVM_T003.3
Description	Test Exit button in New Asset Creation Module
Precondition	
Steps	Navigate to New Asset Module.
Test Data	Click “Exit” Button
Expected Out comes	Navigate to Main Page
Actual Out comes	Navigate to Main Page
Test Result	Pass
Comments	
Defect ID	

Table 6.6 Testing – New Asset Creation Exit Button

Test Case ID	FBLAMVM_T004
Description	New Vehicle Creation
Precondition	Vehicle Number should not available on the Data base.
Steps	Navigate to New Vehicle Module.
Test Data	Try to save without filling mandatory fields
Expected Out comes	“Mandatory fields cannot be blank”
Actual Out comes	“Mandatory fields cannot be blank”
Test Result	Pass
Comments	
Defect ID	

Table 6.7 Testing – New Vehicle Creation

Test Case ID	FBLAMVM_T004.1
Description	New Vehicle Creation
Precondition	Vehicle Number should not available on the Data base.
Steps	Navigate to New Vehicle Module.
Test Data	Try to save filling all mandatory fields
Expected Out comes	“Added New Vehicle Successfully” and display new record in below grid.
Actual Out comes	“Added New Vehicle Successfully” and displayed new record in below grid.
Test Result	Pass
Comments	
Defect ID	

Table 6.8 Testing – New Vehicle Creation

Test Case ID	FBLAMVM_T004.2
Description	New Vehicle Creation using existing vehicle number
Precondition	Vehicle Number should be available on the Data base.
Steps	Navigate to New Vehicle Module.
Test Data	Try to save filling all mandatory fields with existing vehicle number.
Expected Out comes	“Vehicle Already Exist”
Actual Out comes	“Vehicle Already Exist”
Test Result	Pass
Comments	
Defect ID	

Table 6.9 Testing – New Vehicle Creation with existing ID



Test Case ID	FBLAMVM_T004.3
Description	Test Exit button in New Vehicle Creation Module
Precondition	
Steps	Navigate to New Vehicle Module.
Test Data	Click “Exit” Button
Expected Out comes	Navigate to Main Page
Actual Out comes	Navigate to Main Page
Test Result	Pass
Comments	
Defect ID	

Table 6.10 Testing – New Vehicle Creation Exit Button

Test Case ID	FBLAMVM_T005
Description	New Employee Creation
Precondition	Employee number should not be existing on data base
Steps	Navigate New Employee Creation Form
Test Data	Try to save the record without entering all mandatory fields.
Expected Out comes	“Mandatory Fields cannot be blank”
Actual Out comes	“Mandatory Fields cannot be blank”
Test Result	Pass
Comments	
Defect ID	

Table 6.11 Testing – New Employee Creation

Test Case ID	FBLAMVM_T005.1
Description	New Employee Creation using existing employee number.
Precondition	Employee number should be exist on data base
Steps	Navigate New Employee Creation Form
Test Data	Try to save the record with entering all mandatory fields with existing employee number.
Expected Out comes	“Employee Number Already Exist”
Actual Out comes	“Employee Number Already Exist”
Test Result	Pass
Comments	
Defect ID	

Table 6.12 Testing – New Employee Creation with registered employee number

Test Case ID	FBLAMVM_T005.2
Description	New Employee Creation
Precondition	Employee number should not be exist on data base
Steps	Navigate New Employee Creation Form
Test Data	Try to save the record without entering all mandatory fields.
Expected Out comes	“Added New Employee Details Successfully”
Actual Out comes	“Added New Employee Details Successfully”
Test Result	Pass
Comments	
Defect ID	

Table 6.13 Testing – New Employee Creation with new employee number

Test Case ID	FBLAMVM_T004.3
Description	Test Exit button in New Employee Creation Module
Precondition	
Steps	Navigate to New Employee Creation Module.
Test Data	Click “Exit” Button
Expected Out comes	Navigate to Main Page
Actual Out comes	Navigate to Main Page
Test Result	Pass
Comments	
Defect ID	

Table 6.14 Testing – New Employee Creation Exit Button

Test Case ID	FBLAMVM_T006
Description	New Department Creation
Precondition	Department No should not be exist on data base
Steps	Navigate to Department Module
Test Data	Try to save record without filling all data fields
Expected Out comes	“Mandatory Field cannot be blank”
Actual Out comes	“Mandatory Field cannot be blank”
Test Result	Pass
Comments	
Defect ID	

Table 6.15 Testing – New Department Creation

Test Case ID	FBLAMVM_T006.1
Description	New Department Creation
Precondition	Department No should not be exist on data base
Steps	Navigate to Department Module
Test Data	Fill all data fields and save the record.
Expected Out comes	“Add New Department Details Successfully”
Actual Out comes	“Add New Department Details Successfully”
Test Result	Pass
Comments	
Defect ID	

Table 6.16 Testing – New Department Creation

Test Case ID	FBLAMVM_T006.2
Description	New Department Creation
Precondition	Department No should be exist on data base
Steps	Navigate to Department Module
Test Data	Fill all data fields with existing department no and save the record.
Expected Out comes	“Department Number Already exist”
Actual Out comes	“Department Number Already exist”
Test Result	Pass
Comments	
Defect ID	

Table 6.17 Testing – New Department Creation with existing Vehicle No

Test Case ID	FBLAMVM_T006.3
Description	Test Exit button in New Department Creation Module
Precondition	
Steps	Navigate to New Department Creation Module.
Test Data	Click “Exit” Button
Expected Out comes	Navigate to Main Page
Actual Out comes	Navigate to Main Page
Test Result	Pass
Comments	
Defect ID	

Table 6.18 Testing – New Department Creation Exit button

Test Case ID	FBLAMVM_T007
Description	Asset Allocation
Precondition	Asset / Department /Employee Should be available in the system.
Steps	Navigate Asset Allocation module and select Asset ID / Department / Employee and fill other data. Press “Save” button.
Test Data	Needs to fill all required data
Expected Out comes	“Updated Asset Details Successfully”
Actual Out comes	“Updated Asset Details Successfully” and display new record in below grid.
Test Result	Pass
Comments	
Defect ID	

Table 6.19 Testing – Asset Allocation

Test Case ID	FBLAMVM_T008
Description	Vehicle Allocation
Precondition	<p>01. Vehicle Number and Employee should be available on the system.</p> <p>02. Vehicle Status should not be allocated.</p>
Steps	Navigate vehicle allocation module and fill required data. Press "Save" button.
Test Data	Vehicle Number, Employee Number, Asset Allocation Start date.
Expected Out comes	<p>01. Once Vehicle Number select vehicle model needs to be display on label.</p> <p>02. Once Employee Number select employee name needs to be display.</p> <p>03. "Vehicle Allocated Successfully" message needs to be display.</p>
Actual Out comes	<p>01. Once Vehicle Number select vehicle model displayed.</p> <p>02. Once Employee Number select employee name displayed.</p> <p>03. "Vehicle allocated successfully" message displayed.</p>
Test Result	Pass
Comments	
Defect ID	

Table 6.20 Testing –Vehicle Allocation

Test Case ID	FBLAMVM_T008.1
Description	Vehicle Allocation – Try to update Vehicle in “Allocated” status with another Employee.
Precondition	<ol style="list-style-type: none"> <li>01. Vehicle Number and Employee should be available on the system.</li> <li>02. Vehicle Status should be “Allocated”.</li> </ol>
Steps	Navigate vehicle allocation module and fill required data. Press “Save” button.
Test Data	Vehicle Number, Employee Number, Asset Allocation Start date.
Expected Out comes	<ol style="list-style-type: none"> <li>01. Once Vehicle Number select vehicle model needs to be display on label.</li> <li>02. Once Employee Number select employee name needs to be display.</li> <li>03. "Vehicle Already Allocated, First Deallocate it", "Warning...!" message needs to be display.</li> </ol>
Actual Out comes	<ol style="list-style-type: none"> <li>01. Once Vehicle Number select vehicle model displayed.</li> <li>02. Once Employee Number select employee name displayed.</li> <li>03. "Vehicle Already Allocated, First Deallocate it", "Warning...!" message needs to be display.</li> </ol>
Test Result	Pass
Comments	
Defect ID	

Table 6.21 Testing –Vehicle Allocation with allocated vehicle

Test Case ID	FBLAMVM_T008.2
Description	Test Vehicle “Deallocation” Button
Precondition	
Steps	Press “Deallocate” button
Test Data	
Expected Out comes	Navigate to Vehicle De allocation Form.
Actual Out comes	Navigated to Vehicle De allocation form.
Test Result	Pass
Comments	
Defect ID	

Table 6.22 Testing –Vehicle Deallocation Button

Test Case ID	FBLAMVM_T008.3
Description	Test Vehicle “Deallocation” module
Precondition	Vehicle should be available in the system status with “Allocated”
Steps	01. Select the Vehicle Number from drop down menu. 02. Press “save” button
Test Data	
Expected Out comes	“Vehicle Deallocated Successfully”
Actual Out comes	“Vehicle Deallocated Successfully”
Test Result	Pass
Comments	
Defect ID	

Table 6.23 Testing –Vehicle Deallocation



Test Case ID	FBLAMVM_T008.4
Description	Test Vehicle "Deallocation" module "Exit" button.
Precondition	
Steps	Press "Exit" button.
Test Data	
Expected Out comes	01. Navigate to "Asset Allocation" Form. 02. Display "Deallocated" record in below grid.
Actual Out comes	01. Navigated "Asset Allocation" form. 02. Displayed the record in the grid
Test Result	Pass
Comments	
Defect ID	

Table 6.24 Testing –Vehicle Deallocation Exit Button

Test Case ID	FBLAMVM_T009
Description	Printer Service Details
Precondition	01. Printer should be registered in the system 02. Printer should be allocated to department
Steps	01. Navigate Printer Service Details form 02. Select the Printer ID from drop down menu. 03. Select the Service date. 04. Select Supplier name 05. Enter engineer name
Test Data	Select the one of the printer id available on the drop down menu.
Expected Out comes	"Service Details Saved Successfully"
Actual Out comes	"Service Details Saved Successfully"

Test Result	Pass
Comments	
Defect ID	

Table 6.25 Testing –Printer Service Details

Test Case ID	FBLAMVM_T009.1
Description	Printer Service Details
Precondition	
Steps	Without entering any field press the “Save” button.
Test Data	
Expected Out comes	"Mandatory Field Cannot Be Blank"
Actual Out comes	"Mandatory Field Cannot Be Blank"
Test Result	Pass
Comments	
Defect ID	

Table 6.26 Testing –Vehicle Service Details Save Button

Test Case ID	FBLAMVM_T0010
Description	Vehicle Service Details
Precondition	Vehicle Number, Diver and service station should be available in the system.
Steps	Navigate to Vehicle Service Details form
Test Data	Try to save without entering data
Expected Out comes	“Mandatory Field Cannot Be Blank”
Actual Out comes	“Mandatory Field Cannot Be Blank”
Test Result	Pass
Comments	
Defect ID	

Table 6.27 Testing –Vehicle Service Details

Test Case ID	FBLAMVM_T0010.1
Description	Vehicle Service Details
Precondition	Vehicle Number, Diver and service station should be available in the system.
Steps	Navigate to Vehicle Service Details form
Test Data	Fill all required fields and press “Save” Button.
Expected Out comes	“Vehicle Service Details Saved Successfully”
Actual Out comes	“Vehicle Service Details Saved Successfully”
Test Result	Pass
Comments	
Defect ID	

Table 6.28 Testing –Vehicle Service Details Save Button

Test Case ID	FBLAMVM_T0010.2
Description	Vehicle Service Details
Precondition	Vehicle Number, Diver and service station should be available in the system.
Steps	Navigate to Vehicle Service Details form
Test Data	Try to save record with less mileage from last record.
Expected Out comes	“Invalid Meter reading”
Actual Out comes	“Invalid Meter reading”
Test Result	Pass
Comments	
Defect ID	

Table 6.29 Testing –Vehicle Service Details Meter Reading

Test Case ID	FBLAMVM_T0010.3
Description	Vehicle Service Details
Precondition	
Steps	Navigate to Vehicle Service Details form
Test Data	Press “Exit” Button
Expected Out comes	Navigate to Main Form
Actual Out comes	Navigated to Main form
Test Result	Pass
Comments	
Defect ID	

Table 6.30 Testing –Vehicle Service Details Navigation

Test Case ID	FBLAMVM_T0011
Description	Asset Search
Precondition	Asset Numbers Should be available on the drop down menu
Steps	Navigate to Asset Search Form
Test Data	Select the Asset Number from drop down menu.
Expected Out comes	Display Asset details on below grid
Actual Out comes	Displayed Asset details on below grid
Test Result	Pass
Comments	
Defect ID	

Table 6.31 Testing –Asset Search

Test Case ID	FBLAMVM_T0012
Description	Vehicle Service Details
Precondition	
Steps	Navigate to Asset Search form
Test Data	Press “Exit” Button
Expected Out comes	Navigate to Main Form
Actual Out comes	Navigated to Main form
Test Result	Pass
Comments	
Defect ID	

Table 6.32 Testing –Vehicle Service Details Exit Button

Test Case ID	FBLAMVM_T0013
Description	Asset History
Precondition	Asset Numbers should be available on the system
Steps	Select the Asset number from drop down menu.
Test Data	Select one asset and press “Search” Button.
Expected Out comes	Need to display all asset transaction on below grid.
Actual Out comes	Displayed all details in below grid
Test Result	Pass
Comments	
Defect ID	

Table 6.33 Testing –Asset History Search

Test Case ID	FBLAMVM_T0014
Description	Asset History
Precondition	
Steps	Navigate to Asset History form
Test Data	Press "Exit" Button
Expected Out comes	Navigate to Main Form
Actual Out comes	Navigated to Main form
Test Result	Pass
Comments	
Defect ID	

Table 6.34 Testing –Asset History Exit Button

## 6.5 User acceptance testing

This section will describe the evaluation of the system users who are currently work with the system. I have prepared the questioner based on 3 main areas, such as requirement, GUI and Other areas which needs to improve.

The questionnaire contained a combination of multiple choice questions and open questions requiring free-text input aimed to measure the user's subjective satisfaction with the system and to gather business and market information. The multiple-choice questions allowed subjects to rate on two scales (Yes /No).

Below are the results of the multiple-choice questions for usability and functionality information.

To get the evaluation there were 10 users involved and all 10 given their responds positively.

From these results collected through the dedicated questionnaires, the following conclusions can be drawn:

(1) Based on 1 Questions answer cover the user requirements have generally received positive ratings as they have been answered by Yes and No pertaining to the positive side of choices on the scale, meaning that there was no major frustration regarding requirements implemented with the system and interface layout. But there are some areas to be improve in the system.

(2) In terms of functionality, the second part of the questioner consist of GUI (Graphical User Interfaces) design and the error handling the system. Users are satisfied with the current appearance and error handling in the new system. Business wanted to have fast switching in between two forms.

(3) Two thirds section will contain any other comments or enhancements needs to be done in the system in futures stages. User gave good suggestions under this.

Finally, user has to mention his overall rating of the delivered system, generally I have received major rating has "Good".

Therefore, by implementing this system to the organisation end users are satisfied with that and it will help them to do their job easily and accurately.

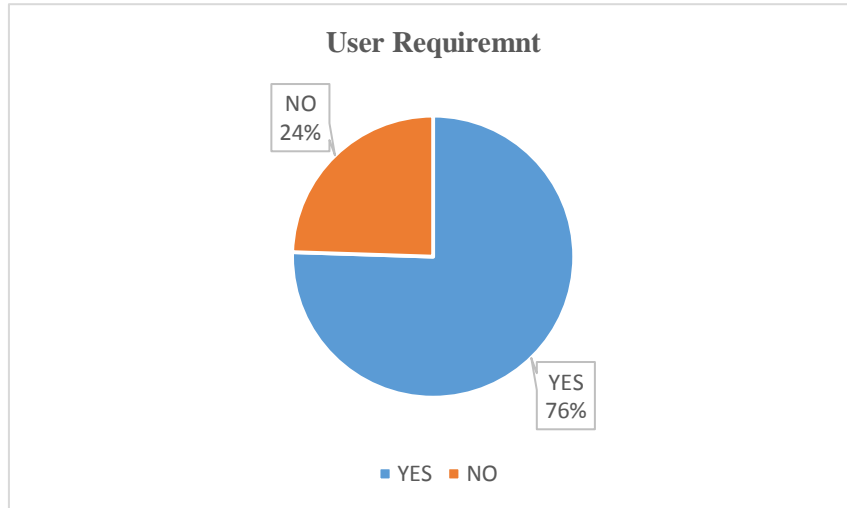


Figure 6.1: User requirement satisfaction

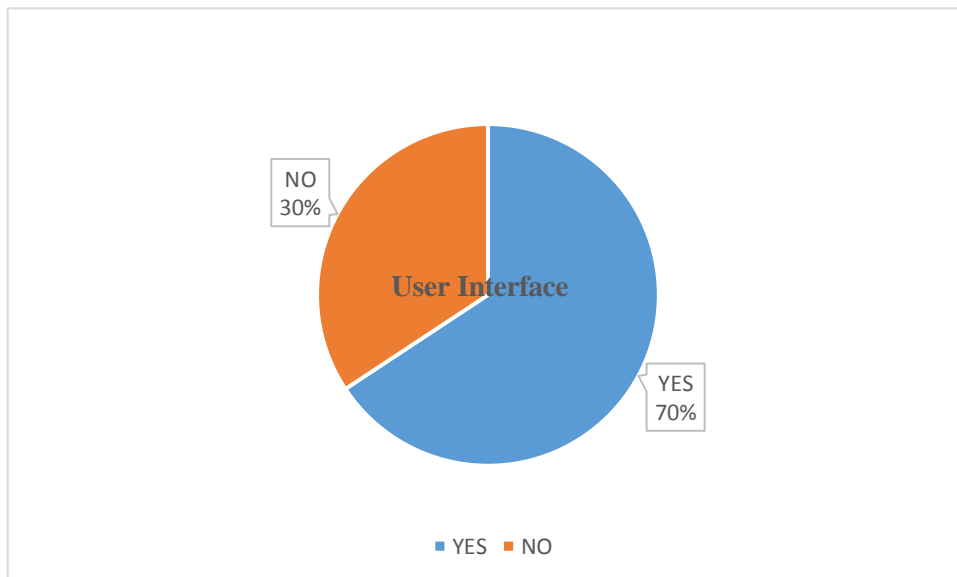


Figure 6.2: User interface satisfaction



## **CHAPTER 7: Conclusion**

### **7.1 Introduction**

This is the final chapter of the dissertation text and it will conclude the dissertation with a critical evaluation of the final results of the system and suggestions for future enhancements. This Chapter also describe the problems encountered and lessons learnt during the project work.

### **7.2 Project assessment**

For the project to be success, it should meet all the user requirements and fullfill all the objectives. The need for Asset management and Vehicle management system was identified after a careful evaluation of the problem domain. The project started with gathering and understanding the requirement of the users. Then suitable software development life cycle was chosen and the project work was carried out further to gain the expected output of at the end.

### **7.3. Critical appraisal**

The proposed system was included to carry out work efficiently and effectively. At the end of the system was successfully implemented to adhere all the requirements of the users and thereby goals and objectives defined at the beginning. A considerable amount of time was taken to fully understand the requirements which were gathered from FBL IS division and Transport division staff and the existing manual work was closely observed. Various information gathering techniques such as interviews, Observation and Prototyping were used and reviewed to validate and verify software requirement specification.

This system comparing with several system solutions was considered and implemented as standalone system with SQL server data base. To identify each and every function different personal carried out currently, used UML diagrams such as Use Case and activity diagrams. Identify each and every entity relationship used ER diagram.

The system was thoroughly tested using different test cases and test data it was described under testing and evaluation chapter on above. The entire test results were agreed with

expected results. Based on test results system specification verification was carried out and found out that the system is consistent with the specification.

#### **7.4 Problems encountered**

- Main problem encountered during the project is FBL regional IS team does not allow to implement local system and all systems are regionally developed. But getting the approvals of develop the system in locally would be a great challenge. Anyhow FBL got the confirmation from their regional IS team to develop standalone system with SQL back end to run locally without connecting to their VPN.
- Time is the main problem as time taken for some of stages were more than as scheduled previously feasibility study and the problem definition.
- Another main problem is scope creep – The tendency for project scope to keep getting better and bigger. Lack of user involvement leads to scope creep of the project.
- Analysing and extracting useful information from gathered requirements to design the system was challenging and time consuming.
- During the development some major functions had to be changed as FBL requested for an implementation in two separate stages which was time consuming.

#### **7.4 Lessons learnt**

- Obtain an excellent knowledge in Visual C#.net with SQL server environment.
- Learnt how the project management should be carried out in order to complete the project successfully achieving the project goals on time.
- Within the given constraints such as scope, time, cost how to implement a successful project was learnt.
- Gain comprehensive understanding on the system development life cycle and how the process is applied to real problem.

## 7.5 Future enhancements

The proposed system was completed by achieving the functional requirements defined by users with in limited time constraints. Some of feature enhancements that can be made are as follows.

01. User Role and their access – as expected on phase 1 it couldn't be implemented the user level and role creations. This was communicated to FBL IT manager and he was agreed to have that module in Phase 2. Because currently they expected to use the system by IT department and run it next 3 months and fix all the gaps and bugs encounter during that period.
02. Additional Reports – as expected on phase 1 delivered all reports they required. But FBL wants more reports other than the delivered reports. So we agreed to develop additional reports during the phase 2.
03. Log automatic circulation system – In phase 1 system was delivered with basic email functionality, but they wanted to have inbuilt email systems for log circulation process which bind with the Log category. This was agreed to develop during the phase 2.

## References

- [1] Nimbus Software <http://www.nimbus.co.nz/features/asset-management/>
- [2] GT Ma Te <http://www.gpsonline.com/>
- [3] Novell Zenworks 3.2 <https://www.novell.com/>
- [4] J.Kreutzkaamp, L. Hagge, E. Deffur, A. Gellrich, B. Schulz (2003), Experience with an IT Asset Management System (pdf), Electronic Report, Desy, Hamburg, Accessed August 2004  
<http://www.enggjournals.com/ijcse/doc/IJCSE10-02-04-87.pdf>
- [5] Sommerville, 2000 “Software Engineering”, 6<sup>th</sup> Edition, By Ian Sommerville, ISBN 8I-7808-497-X

## Appendix: A: User Interfaces

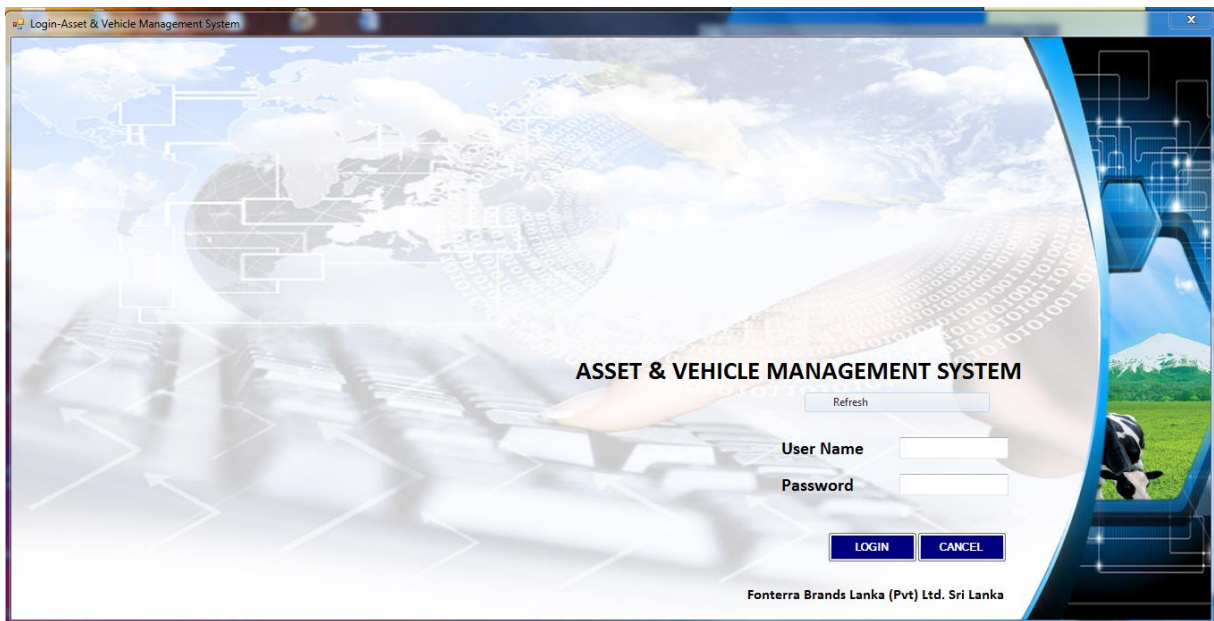


Figure A.1: User Login Screen



Figure A.2: Main Screen

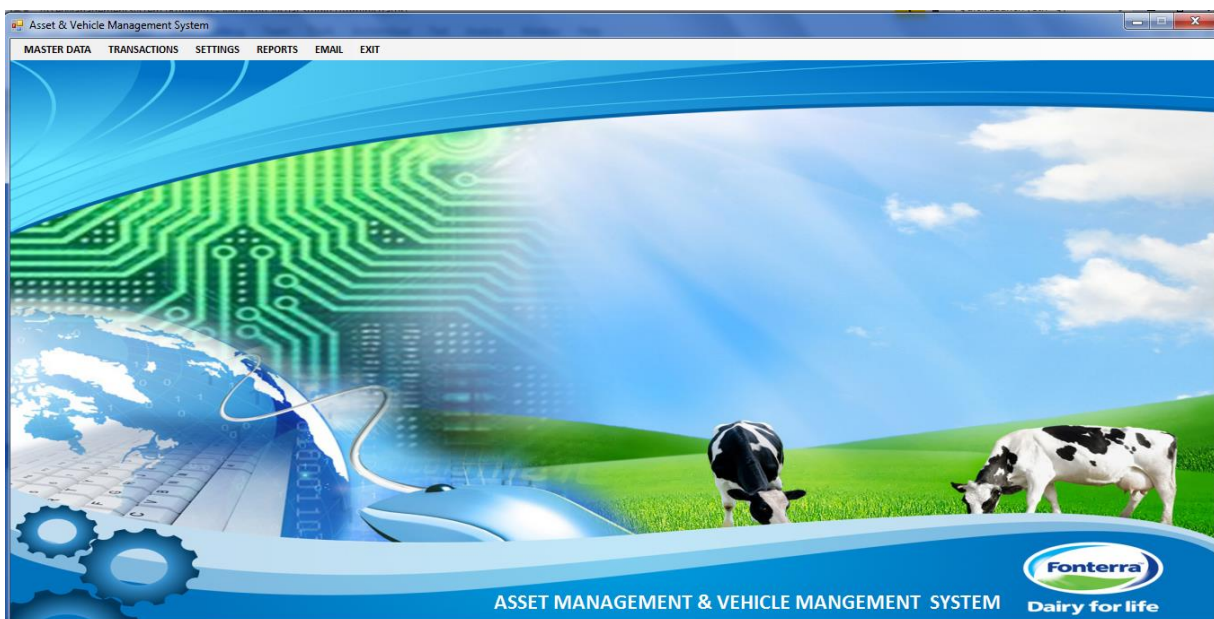


Figure A.3: Main Screen

AddNewHardware

ASSET NUMBER \*

SERIAL NUMBER \*

ASSET MODEL\*

PURCHASING DATE \* 6/02/2018

ASSET TYPE \* LAPTOP

SUPPLIER / MANUFACTURER\*

PO NUMBER \*

CAPEX ID

\* Indicates Mandatory Fields

SAVE EXIT

Asset_No	Serial_Number	Asset_Type	Asset_Model	Supplier	PO	Capex_ID	Start_Meter_Readir	Purchased_Date
5678	79	PRINTER	E6410	SoftLogic Trading	7888	11	0	1/08/2011
5675	456	MONITOR	E630	Metropolitan Com...	67	-	0	1/08/2011
5680	79	VEHICLE	E6410	TOYOTA	7888	11	0	1/08/2011
KX-1083	ASBDCFR	VEHICLE	CAR	TOYOTA	25000		0	17/03/2011
KC-1065	L56789	VEHICLE	CAB	TATA	12346		0	13/12/2017
KL-1050	12LKHR1	VEHICLE	CAB	BMW		0	15678	25/08/2011
4052343	CX-PR13	PRINTER	Cannon	Metropolitan Com...	98900	35666	0	1/08/2011
78999	3578902	LAPTOP	HP ELIT	Metropolitan Com...	1000045	56779	0	1/08/2011
456789	HP ELITE	LAPTOP	4367890	Metropolitan Com...	678909	12455	0	1/08/2011
KX-1063	ABX1056	VEHICLE	CAB	HYUNDAI		0	45000	4/01/2018
4105679	GDSKBN-013	LAPTOP	HP310	SoftLoaic Tradina	1235678	678	0	6/02/2018

Figure A.4: Master Data – New Asset

Add Employee

Employee Number\*

Employee Name\*

GUID\*

Department\*

Location\*

\* Denotes Mandatory Fields

SAVE EXIT

Emp_No	Emp_Name	Department	Floor_Location	GUID
020366	Chaminda Bandara	Information System	3 rd Floor	Buddikas
020367	Sanjeewa Buddika	Information System	3 rd Floor	Buddikas
020546	Ruvendra Gunas...	Human Resource	Ground Floor	Gunasena
*				

Figure A.5: Master Data – New Employee

IT Asset Allocation

Asset Tag ID

Employee Number

Department

Date Of Installed

Date Of Refreshed

Status

Asset Type

Employee Name

Location

GUID

Request Number

SAVE EXIT

	Asset_No	Asset_Model	Asset_Type	Dep_No	Department	Emp_No	Emp_Name	status
▶	5678	E6410	PRINTER	D001	Information System	020367	Sanjeewa Buddika	Allocated
	78999	HP ELIT	LAPTOP	D002	Information System	020367	Sanjeewa Buddika	Allocated
	4052343	Cannon	PRINTER	D001	Human Resource	020546	Ruvendra Gunas...	Allocated
*								

Figure A.6: Master Data – Asset Allocation

Vehicle Allocation

VEHICLE NUMBER \*

EMPLOYEE NUMBER \*

ALLOCATION START DATE

\* Indicates Mandatory Fields

VEHICLE DETAILS label3

DRIVER NAME label4

SAVE DEALLOCATE EXIT

	Asset_No	Emp_No	Start_Date	status	Transaction_Date
▶	KC-1065	020366	13/12/2017	DEALLOCATED	13.12.2017
	KC-1065	020366	25/08/2011	DEALLOCATED	05.01.2018
	KX-1083	020366	19/08/2011	DEALLOCATED	05.01.2018
	KC-1065	020367	5/01/2018	ALLOCATED	05.01.2018
*					

Figure A.7: Transaction – Vehicle Allocation

Printer\_Service\_Detail

Printer Asset ID\*  Printer Model Model

Service Date 13/12/2017 Department Department

Supplier Name\*

Engineer Name\*

Comments/Notes

\* Denotes Mandotory Fields

SAVE EXIT

	Asset_No	Service_Date	Supplier_Name	Engineer_Name	Comments
▶	5678	15/12/2017	Metropolitan Com...	Sanjeewa	Printer Has been ...
	5678	29/12/2017	Metropolitan Com...	Sachintha Gama...	Change the Tonn...
*					

Figure A.8: Transaction - Printer Service Details

VehicleServiceDetails

Vehicle Number\*  Vehicle Model Model

Service Date\* 13/12/2017

Service Station Name\*

Driver \*  Driver Name Driver Name

Meter Reading\*

Remarks

\* Denotes Mandotory Fields

SAVE EXIT

	Vehicle_No	Service_Date	Service_Station	Employee_No	meterreading	Comments
▶	KC-1065	5/01/2018	Biyagama Servic...	020546	25000	First Service
	KC-1065	5/01/2018	Biyagama Servic...	020546	25600	second Service
*						

Figure A.9: Transaction - Vehicle Service Detail



The screenshot shows a window titled "FuelConsumptionDetails" with a yellow background. It contains the following fields:

- Vehicle No**: A dropdown menu.
- Month**: A dropdown menu.
- Start Meter Reading**: A text input field.
- Bill Number**: A text input field.
- Filling Station Name**: A dropdown menu.
- KM Done**: A text input field.
- Comments**: A large text area.
- Vehicle Type**: A dropdown menu.
- Year**: A dropdown menu.
- End Meter Reading**: A text input field.
- Bill Date**: A date picker showing "6/02/2018".
- No Of Liters**: A text input field.

At the bottom right, there are two buttons: "SAVE" and "EXIT". Below the "Comments" field is a large empty rectangular box.

Figure A.10: Transaction – Fuel Consumption Detail

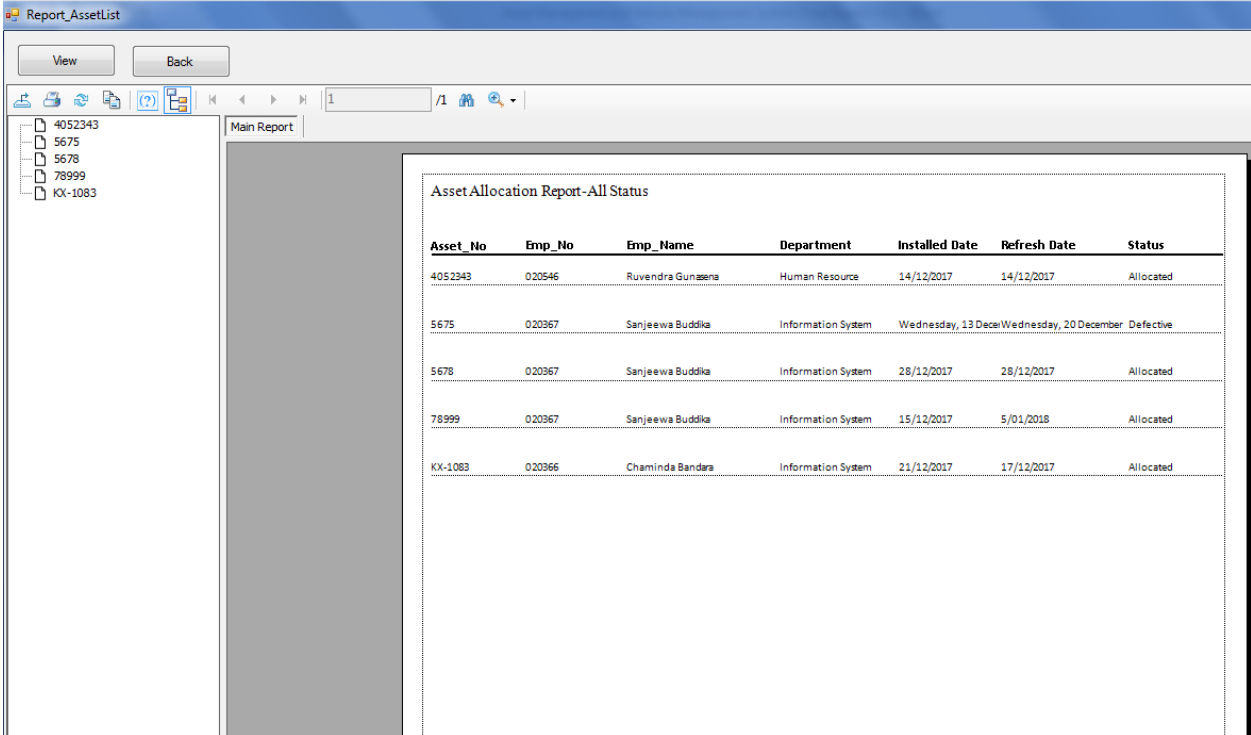
The screenshot shows a window titled "User\_Account\_Creation" with a yellow background. It contains the following fields:

- Employee Name\***: A dropdown menu.
- User ID \***: A dropdown menu.
- Password\***: A text input field.
- Confirm Password\***: A text input field.

At the bottom left, there is a red asterisk followed by the text "\* Denotes Mandotory Fields". At the bottom right, there are two buttons: "SAVE" and "EXIT".

Figure A.11: Setting - User Account Creation

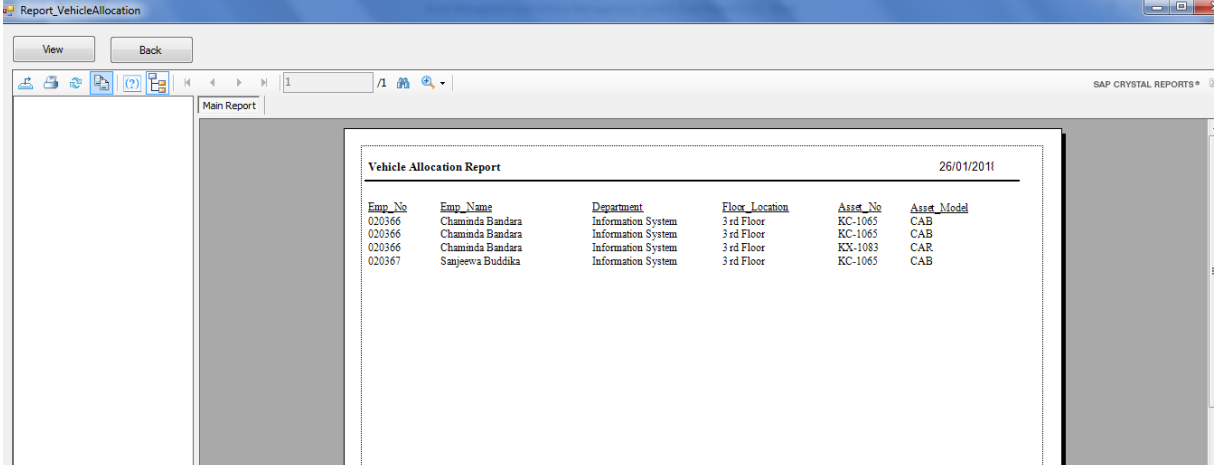
## Appendix: B: Reports and communications



The screenshot shows a SAP Crystal Reports window titled 'Report\_AssetList'. The main report area displays a table titled 'Asset Allocation Report-All Status'. The table has seven columns: Asset\_No, Emp\_No, Emp\_Name, Department, Installed Date, Refresh Date, and Status. The data is as follows:

Asset_No	Emp_No	Emp_Name	Department	Installed Date	Refresh Date	Status
4052343	020546	Ruvendra Gunasena	Human Resource	14/12/2017	14/12/2017	Allocated
5675	020367	Sanjeewa Buddika	Information System	Wednesday, 13 Dec	Wednesday, 20 December	Defective
5678	020367	Sanjeewa Buddika	Information System	28/12/2017	28/12/2017	Allocated
78999	020367	Sanjeewa Buddika	Information System	15/12/2017	5/01/2018	Allocated
KX-1083	020366	Chaminda Bandara	Information System	21/12/2017	17/12/2017	Allocated

Figure B.1: Reports – Asset List



The screenshot shows a SAP Crystal Reports window titled 'Report\_VehicleAllocation'. The main report area displays a table titled 'Vehicle Allocation Report' with a date of 26/01/2011. The table has six columns: Emp\_No, Emp\_Name, Department, Floor\_Location, Asset\_No, and Asset\_Model. The data is as follows:

Emp_No	Emp_Name	Department	Floor_Location	Asset_No	Asset_Model
020366	Chaminda Bandara	Information System	3 rd Floor	KC-1065	CAB
020366	Chaminda Bandara	Information System	3 rd Floor	KC-1065	CAB
020366	Chaminda Bandara	Information System	3 rd Floor	KX-1083	CAR
020367	Sanjeewa Buddika	Information System	3 rd Floor	KC-1065	CAB

Figure B.2: Reports – Vehicle Allocation List

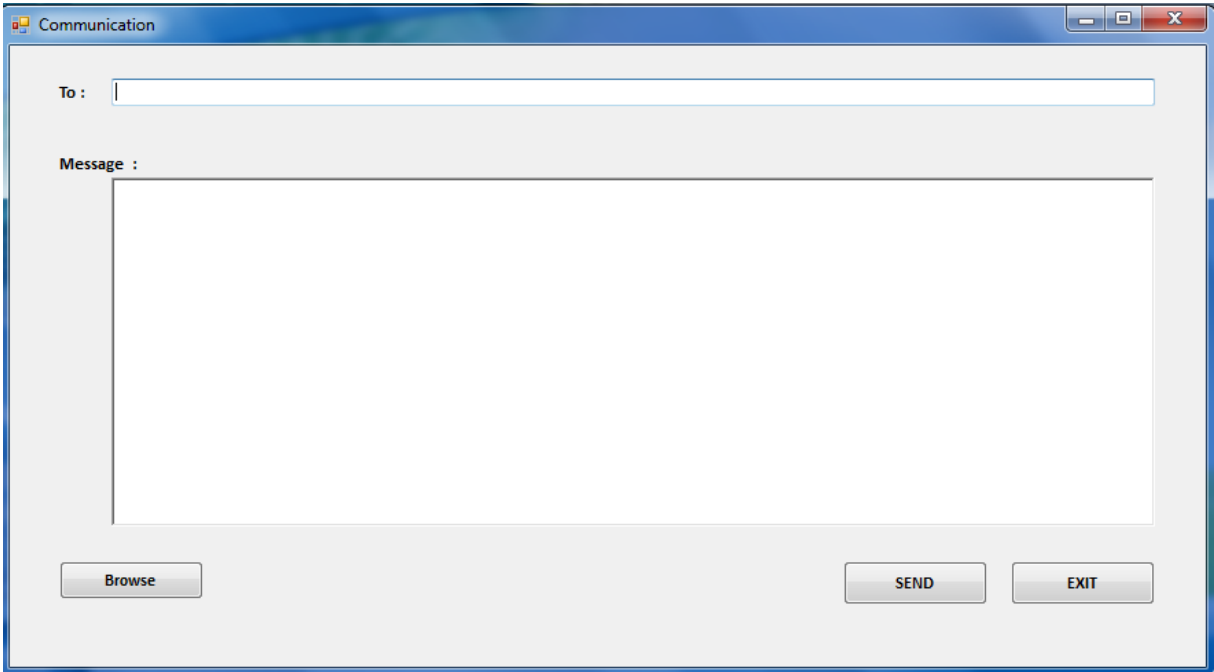


Figure B.3: Communication – Email

## **Appendix: C: User Evaluation Feed Back**