



# Masters Project Final Report

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<b>Student Name</b>	M. I. W Cooray		
<b>Registration No. &amp; Index No.</b>	2013/MIT/011		13550112
<b>Supervisor's Name</b>	Mr. G. Kapila. A. Dias		
<b>Please Circle the appropriate</b>	<b>Master's Program</b>		<b>Type</b>
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Inventory Management and  
Sales Management System  
for Kolden Tea International

**M. I. W. COORAY**

**2017**



# Inventory Management and Sales Management System for Kolden Tea International

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

**M. I. W. COORAY**  
**University of Colombo School of Computing**  
**2017**



## 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: M. I. W Cooray

Registration Number: 2013/MIT/011

Index Number: 13550112

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Signature:

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This is to certify that this thesis is based on the work of Ms. M.I.W.Cooray under my supervision. The thesis has been prepared according to the format stipulated and is of acceptable standard.

Certified by:

Supervisor Name: Mr. G. Kapila. A. Dias

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Signature:

Date:

## ABSTRACT

Information technology has converted the whole world into such state that most of the processes in every industry highly depend on IT systems and has become automated to get the best out of them. The developed Inventory Management and Sales Management System (IMSM) will be very useful to Kolden Tea international company in enhancing their day-to-day operations.

Kolden Tea is a small-scale business who distributes tea products to corporate sector and they do not use any automated system for managing inventory, sales, clients and HR functions. Currently all the processes are done using excel sheets. Payment calculations, invoicing and maintaining stock re-order level are done manually. Sometimes the current practice shows wrong figures on the available stocks due to not updated sales. When delivering tea orders there is no proper way to cross check required tea packs with availability. Employee personal files for are being maintained and a manual document is used to record the attendance. Useful reports are being prepared by management but this requires a lot of time to refer the documents and excel sheets. As a solution to overcome these issues IMSM system was proposed.

IMSM system handles all sales and inventory/stocks related processes and reduces the impact on the service quality resulting from inconsistent data. This system minimize the manual work done by the employees and all the files and documents are replaced with a well structured data base. IMSM system supports the management of the company for their decisions, based on the unambiguous information in the database. The efficiency of the new system is greater and same will be the base for a better service of the system users. All functional, non-functional and system requirements of the system were properly analyzed and an object oriented 'Design' solution for the problem was identified. Microsoft Visual Studio 2010 with .NET Framework and Microsoft SQL Server 2008 were selected for implementing the system. C# was used as the programming language and SQL has been used as the database language. All the critical functionalities have been thoroughly tested using black box and white box testing. Test plan was developed after considering all the modules and functions. Test cases for each module were planned and results were validated with requirements. User evaluation has been done by the several actual users at various access levels. IMSM system provides a centralized system and can be accessible by any authorized user and fulfills the purpose of the project. After a critical analysis, the developed IMSM system can be considered as a satisfactory level project which meets all the expected requirements of our client as well as the standards of the MIT degree program.

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# TABLE OF CONTENTS

DECLARATION.....	i
ABSTRACT .....	ii
ACKNOWLEDGEMENTS .....	iii
TABLE OF CONTENTS .....	iv
LIST OF FIGURES .....	vii
LIST OF TABLES .....	viii
LIST OF ABBREVIATIONS .....	ix
CHAPTER 1: INTRODUCTION.....	1
1.1. Introduction to the Client.....	1
1.2. Manual System .....	1
1.3. Motivation for Project.....	2
1.4. Aims and Objectives of the Project .....	3
1.5. Scope of the Project .....	4
1.6. Structure of the Dissertation .....	4
CHAPTER 2: BACKGROUND.....	6
2.1 Introduction .....	6
2.2 Literature Review .....	6
2.3 Critical Review of Similar Systems Available .....	7
2.3.1 SalesBinder [www.salesbinder.com].....	7
2.3.2 Stitch Labs [www.stitchlabs.com].....	8
2.4 Summary.....	8
CHAPTER 3: SYSTEM ANALYSIS .....	9
3.1 System Analysis Introduction.....	9
3.2 Use of Fact Finding Techniques.....	9
3.3 Problems Encountered During Analysis .....	9
3.4 Use Case Diagram For The Current System .....	10
3.5 Requirements of The System.....	11
3.5.1 Functional Requirements.....	11

3.5.2 Non-functional Requirements.....	12
3.6 System Users .....	13
3.7 Summary.....	14
CHAPTER 4: SYSTEM DESIGN .....	15
4.1 System Design Introduction .....	15
4.2 Evaluation Of Alternative Design Solutions .....	15
4.3 Design of IMSM System In Detail.....	16
4.3.1 Design Tools And Techniques .....	16
4.3.2 Architectural Design.....	17
4.3.3 Functional Design.....	18
4.4 Summary.....	33
CHAPTER 5: IMPLEMENTATION .....	34
5.1 Introduction for Implementation .....	34
5.2 Implementation Environment.....	34
5.3 Implementation procedure.....	35
5.4 System Structure and the Modules .....	36
5.5 User Interfaces .....	37
5.5.1 Login page.....	37
5.5.2 Add a new employee user interface.....	38
5.5.3 Add a new tea product user interface .....	39
5.5.4 Error messages and notifications.....	40
5.6 Reused Methods .....	41
5.6.1 generateNextID() method.....	41
5.7 Summary.....	41
CHAPTER 6: USER EVALUATION AND TESTING .....	42
6.1 Introduction .....	42
6.2 Testing process and test plan.....	42
6.3 Testing stages .....	43
6.5 Test items.....	44
6.6 Test Cases.....	45
6.7 Test Data and Test Results .....	46
6.8 User Evaluation .....	52



6.8.1 Usability Testing .....	53
6.8.2 User Acceptance Testing .....	53
6.8.2 Analysis of the Questionnaire.....	54
6.8 Summary.....	55
CHAPTER 7: CONCLUSION AND FUTURE WORK.....	56
7.1 Introduction .....	56
7.2 Conclusion.....	56
7. 2 Challenges and problems encountered .....	57
7.3 Limitations of the current work .....	58
7.4 Lessons learnt .....	58
7.5 Future improvements.....	59
7.6 Summary.....	60
REFERENCES .....	61
APPENDIX .....	63
Appendix A - Use Case Narratives.....	63
Appendix B - Design Diagrams.....	67
Appendix C - User Interfaces .....	70
Appendix D - User Evaluation Form / Questionnaire .....	73
Appendix E - Test Cases .....	77
Appendix F - Test Cases With Test Results.....	80
Appendix G - Analysis On The Questionnaire.....	85

## LIST OF FIGURES

Figure 1 - Use case diagram for the current system .....	10
Figure 2- Architectural Design of IMSM system.....	17
Figure 3 - High level use case diagram .....	19
Figure 4 - Detailed use case diagram for Mange employees.....	20
Figure 5 - Detailed use case diagram for Manage clients.....	21
Figure 6 - Detailed use case diagram for Manage inventory.....	22
Figure 7 - Detailed use case diagram for Manage sales .....	22
Figure 8 - Detailed use case diagram for Manage attendance.....	23
Figure 9 - Class diagram for IMSM system .....	30
Figure 10 - Activity diagram for login .....	31
Figure 11 - Activity diagram for the search use case .....	32
Figure 12 - Rational Unified Process Methodology.....	36
Figure 13 - Structure of the IMSM system.....	37
Figure 14 - Login page .....	38
Figure 15 - Add a new employee user interface.....	39
Figure 16 - Add a new product user interface .....	40
Figure 17 - Information message.....	40
Figure 18 - 5.7 Error message .....	41
Figure 19 - User friendliness of IMSM system .....	54
Figure 20 - Speed of the IMSM system.....	55
Figure 21 - Activity diagram for 'view registered employee' use case.....	67
Figure 22 - Activity diagram for 'add a new product' use case .....	68
Figure 23 - Sequence diagram for 'login' use case .....	69
Figure 24 - Home page .....	70
Figure 25 - 'Manage employees' page .....	71
Figure 26 - 'Change my password' page.....	71
Figure 27 - 'Add a new client' page .....	72
Figure 28 - Use of error messages .....	85
Figure 29 - Displaying the error messages at appropriate places .....	85
Figure 30 - Accuracy of given information.....	86
Figure 31 - How well organize the information of the system.....	86
Figure 32 - Helpfulness of the 'help manual' .....	87
Figure 33 - Character size of the system .....	87
Figure 34 - Colors used in the system .....	88
Figure 35 - Navigation through the system .....	88
Figure 36 - Performance of software.....	89
Figure 37 - Rating the entire system.....	89

## LIST OF TABLES

Table 1 - Functional Requirements .....	12
Table 2 - Users privileges on the system tasks .....	14
Table 3 - Use case narrative for 'Login' .....	24
Table 4 - Use case narrative for 'Register new employee' .....	25
Table 5 - Use case narrative for 'Add a new sale' .....	26
Table 6 - Use case narrative for 'View attendance report' .....	27
Table 7 - Use case narrative for 'Search' .....	28
Table 8 - Implementation Environment.....	35
Table 9 - Test items of IMSM system .....	45
Table 10 - Test cases for Login test item .....	46
Table 11 - 'Login with valid credentials' test case .....	47
Table 12 - 'Login with invalid username' test case .....	48
Table 13 - 'Login with invalid username' test case .....	48
Table 14 - 'Login with invalid username' test case .....	49
Table 15 - 'Login with blank username' test case .....	50
Table 16 - 'Login with blank password' test case .....	51
Table 17 - 'Login with blank password' test case .....	52
Table 18 - Use case narrative for ' Change user password ' .....	63
Table 19 - Use case narrative for 'Add a new product' .....	64
Table 20 - Use case narrative for 'View a registered employee' .....	65
Table 21 - Use case narrative for 'Generate a report' use case .....	66
Table 22 - Test cases for 'Change password' test item .....	77
Table 23 - Test cases for 'Add a new user' test item.....	78
Table 24 - Test cases for 'Add a new user' test item.....	79
Table 25 - 'Change password with blank spaces in the password fields' test case .....	80
Table 26 - 'Change password with the same old password' test case .....	81
Table 27 - 'Change password with a new password but keep the other field blank' test case .....	82
Table 28 - 'Change password with two different new passwords' test case .....	83
Table 29 - 'Use a new password and retype the same password' test case .....	84

## LIST OF ABBREVIATIONS

HR	-	Human Resources
IMSM system	-	Inventory Management and Sales Management System
UML	-	Unified Modeling Language
OO	-	Object Oriented
WWW	-	World Wide Web
RUP	-	Rational Unified Process
IT	-	Information Technology
SQL	-	Structured Query Language

# CHAPTER 1: INTRODUCTION

## 1.1. Introduction to the Client

The proposed Inventory management and Sales management System will be developed for Kolden Tea International Company. Kolden Tea International Company has been established as a tea packaging and distribution Company based on the accomplishment of tea needs in Sri Lanka. This company was started in year 2014 and now being managed by a four-director board. As of now ten employees are working under the company including sales team and supervisors. The Company goal is to build long term relationships with clients and provide exceptional customer services by pursuing business through innovative product range.

They provide “Kolden Tea” products for corporate sector by providing large, small and medium quantities in bulk or individual as per the client’s requirements.

Currently the inventory and sales are being managed through manual files and excel sheets based documents. Even though Kolden Tea International is a small scale business, they are highly concerned in standardizing their processes and they are in a need to upgrade current processes to improve the efficiency of the service. As a result of the discussions with the directors of the company the Inventory management and Sales management System was proposed.

## 1.2. Manual System

Kolden Tea International is a small-scale business who distributes Tea products to corporate sector. Currently they do not use any computerized system to perform the processes which includes inventory management, sales management, managing clients and HR functions.

They purchases leaf tea from outside factories in bulk and the packing of tea is done though an out sourced company.

According to the requirement they request for the packed tea and maintain sufficient stock for the orders. They maintain the re-order level using an excel based report. Kolden Tea targets mainly on cooperate sector and maintain a clients base.

In order to deliver the daily and monthly tea orders they maintain a report to check to whom the order to be delivered and on which date.

When delivering the orders, a common invoice template will be used for the payment collection. Payment may be collected on the same date or within two weeks of the order. Sales team will also promote the tea products for the new clients. In order to do same, sales team will first make an appointment with the client and based on the requirement, samples will be provided.

They maintain personal files for each employee and a manual document is used to record the attendance. The management of Kolden Tea company prepares a number of useful reports on daily and monthly basis. They use the information collected in excel sheets in order to summarize and prepare required reports.

### 1.3.Motivation for Project

Information systems perform an important role for most of the operational works in present since a proper maintenance of the efficiency and effectiveness of the functions is highly required by all the organizations. Even though Kolden Tea International is a small scale business, it consists of several main functions which are highly important for the success of the business.

Currently all of the processes related to inventory and sales are done using excel sheets and paper notes. Payment calculations and preparing invoices for leaf tea purchases and sales are done through manual calculations. Maintaining re-order level in the stock is done manually and sometimes the current practice shows wrong figure on the available stock due to not updated sales. As they target on cooperate sector, when delivering the daily/monthly tea requirements, it is a requirement to have a system to check the required total tea packs on daily / monthly basis and to check whom to deliver on which date. Personal files for each employee are being maintained and a manual document is used to record the attendance.

Many useful reports are prepared by management and team on daily and monthly but this requires a lot of time to go through the documents and excel sheets to prepare each management report.

As a solution to overcome such issues in these processes, the Inventory management and Sales management System was proposed. This system will replace most the paper work and will minimize the time spent for each function. It will support the director board, sales team and supervisors to perform the functions accurately with a less amount of time which will result in providing a better service by the employees. In summery Inventory management and Sales management System will provide a better solution for the current processes as well as a suitable assignment for the MIT individual project for which I could apply the theories and knowledge which have been obtained throughout the degree program.

#### 1.4. Aims and Objectives of the Project

Main objective of this project is to implement a computerized/on-screen system to handle all the functionalities related to sales and inventory currently done in the company. This will help to remove the manual work done by the employees. The new system will reduce the impact on their service quality resulting from inconsistent data. This system will help to minimize the manual work done by the employees and all the files and documents will be replaced with a well-structured data base. Inventory management and Sales management system will support the management of the company for their decisions, based on the unambiguous and precise information in the database. The efficiency of the new system will be greater and same will be the base for a better service of the system users.

The proposed system will facilitate to handle all ongoing functionalities which are in the Kolden Tea Company. This system will help to,

- Minimize time and paperwork in the current processes
- Provide a platform to control the inventory, sales and purchases
- Provide a system to easily access the previous transactions which helps the auditing process

- Maintain up-to-date and accurate information of the processes and transactions.
- Provide a platform to easily generate management reports
- Reduce data redundancy

### 1.5.Scope of the Project

Proposed system will provide a platform to the employees to manage the same processes in an effective manner.

- System will allow the users to manage the inventory, re-ordering process and sales process.
- Users will be able to calculate the payments and print the invoices directly from the system.
- System will allow the users to maintain the clients' details and employee details.
- System will allow the users to maintain the attendance of the employees accurately.
- Users will be able to check the amount of tea packets to be delivered on daily / monthly basis and to check whom to deliver on which date.
- Management will be able to generate required daily/ monthly reports through the system.

### 1.6.Structure of the Dissertation

This is the first chapter of the dissertation which provides an overview of the project. This chapter will elaborate the aims, objectives of the project, motivation for the project and the scope involved.

Second chapter of the report, 'Background' will provide a critical review of similar systems available and technologies available to implement this system. This chapter will further analyze the advantages and limitations of such available similar systems.

Third chapter which is 'System Analysis' will describe all functional, non-functional and system requirements of the proposed system in detail. Information gathered and analyzing of the existing process will also be presented here.



Fourth Chapter will elaborate the 'Design' solution for the problem. Design of this system will be systematically described in this chapter with the relevant diagrams.

Fifth chapter of the report, 'Implementation' will describe overall implementation of the system. Activities carried out during implementing the system including hardware and software used, tools, techniques and methods followed will be described here.

Sixth chapter 'User Evaluation and Testing' will include testing process, testing techniques, test cases, actual data used and results, various kinds of error messages and user evaluation. Results of the tests will also be critically analyzed here.

As the final chapter, chapter seven 'Conclusion and Future Work' will discuss whether the objectives of the project could be achieved. This chapter includes the results of the project, lessons learnt, limitations of the current work and the suggestions for future improvements.

# CHAPTER 2: BACKGROUND

## 2.1 Introduction

This chapter will discuss the background information of the Inventory management and Sales management System. Since sales management and inventory management are widely concerned processes in the business environment, several similar systems available could be identified. In this chapter selected systems will be reviewed.

## 2.2 Literature Review

Proper management of inventory and sales is crucial for any commercial business and with the growth of technology, many options are available for most of the business to automate their processes.

From the past inventory control and sales control has been very important processes hence there was always a requirement from the merchants to find a better system to manage inventory and sales. For many years the only option was record keeping through hand written notes which was an inefficient and erroneous way of handling the inventory and sales. With the increase use of computer in the mid 1990's, companies started researching on implementing inventory management software. The technology advanced into a broad inventory management solutions by early 2000s. And now even small size businesses can easily find inventory and sales management software solutions to meet their needs.

At present many different software solutions has been invented to support inventory, orders, sales processes, and deliveries. Also many useful reports documents, work orders etc. can be generated through these solutions. 'TradeGecko' [9] is the leading inventory management system in the market at the moment and TradeGecko is considered as the best among the lot of commercial solutions based on its key features. Zoho Inventory [10] is another top rated commercial software in the industry for sales and inventory management. One considerable feature of this solution is, it enables businesses to automate order and inventory management and track their delivery. This is an ideal solution for any size of business.

This also integrates with popular shipping systems and cloud retailers expanding its value further. Apart from these two top solutions, a number of commercial software could be identified while analyzing the industry.

The requirement of the Kolden Tea international is to find a proper solution to manage their day to day sales and inventory. Even though many solutions are available in the market, several disadvantages could be highlighted when considering adapting an available software which will be discussed in next section.

## 2.3 Critical Review of Similar Systems Available

### 2.3.1 SalesBinder [[www.salesbinder.com](http://www.salesbinder.com)]

SalesBinder software system is a feature-full system for the discussed solution. It is online inventory management software that provides with all the basic tools needed to manage inventory, customers, invoices, suppliers, and purchase orders. It also provides the opportunity to record sales prospects and estimates and then automatically convert them to customers and invoices. SalesBinder is a product of Krave Media Group.

A small business with limited needs such as Kolden Tea International can choose this software and do the required processes while medium or larger businesses can also customize things using SalesBinder.

When considering the cost, SalesBinder has four pricing plans, including a free version which is a plus point compared to many other online systems. But the drawback is the free version will be limited for 100 records. The free version is more suitable to use as a test account rather than practically using for a business. For larger businesses that need a more robust, extensive version can go for another paid custom plan according to [4].

Another restriction of the system is an Internet access is mandatory to use this tool. Few design issues of the interfaces could be identified when adding variations for inventory items. Also as explained, even though SalesBinder offers a free version with all options, the records limitation will make this system not suitable option for the requirements.

### 2.3.2 Stitch Labs [www.stitchlabs.com]

Stitch is a cloud-based SaaS (Software as a Service) application designed to process inventory, billing, accounting, shipping, and e-commerce operations. This does not have a free version but several different pricing plans are available to choose from. However a free trail is offered for anyone who wishes to purchase this application. Stitch is also will be operated online only. One advantage of this application is being able to access via most mobile devices.

When evaluating the design of ' Stitch ', one noticeable feature could be identified which is the great interface that is clean and understating. This application also provides tutorials on each page when one goes step-by-step through all the basic tasks. Another very useful feature which could be identified was the Integrations with many popular eCommerce websites such as Amazon, eBay and BigCommerce. One can import all their products, orders, and customer information from these websites into Stitch application. When one sells something on an eCommerce website, it updates the inventory levels in Stitch and vice versa explained in [3]. This is a very useful and innovative feature compared to most of similar solutions as this integration will allow one to make their business global.

When reviewing the customer experiences few negative features could be identified. One is poor functionality outside the United States. Several users' complaints could be found regarding the operating issues of 'Stitch' with its lack of currency conversion facility. Another major drawback is 'Stitch' does not automatically adjust for refunds made through sales channels. This requires the system users to manually update both inventory and accounting records. This limitation adds a lot of manual work and leaves a huge risk for errors.

## 2.4 Summary

This chapter summarizes the background information of the system and also critically analysis the similar systems available. In the next chapter a detailed analysis of the system will be provided and requirements expected from the system will be discussed.

## CHAPTER 3: SYSTEM ANALYSIS

### 3.1 System Analysis Introduction

System analysis can be considered as a very important stage of a system development which will help to identify the role of the proposed system, how it does interact with external entities and it will provide the input to the system design by identifying the requirements. Since the objective of this phase is to study the current process, a sufficient amount of time was allocated and several fact finding techniques were used accordingly in order to gather all the requirements for the system. This chapter will elaborate the techniques used for analysis and all the requirements including functional, non-functional and documentation requirements expected from the system.

### 3.2 Use of Fact Finding Techniques

In order to gather the requirements questionnaires, observation of the environment, sampling the existing documentation, interviewing the users and PACT analysis were used. First few interviews were conducted with the directors to gather basic information about the company then a much time was allocated to conduct interviews with employees. Also observation of the working environment was really helpful to identify the functional and non-functional requirements of the system. Some existing documentations such as invoices, excel sheet based documents use by the company for their processes and accounts could also be referred to gain a clear idea about their processes. A questionnaire was also prepared for the users to gather some requirements.

### 3.3 Problems Encountered During Analysis

Few difficulties were encountered during analysis but most of the techniques used were very successful. Since it was difficult to conduct interviews with every employee during one day due to the busy work schedule, interviews were carried out for few days.

Also for some processes, requirements gathered were not clear so had to conduct a second interview along with the documents referring. A medium level effort was carried out to collect the real and complete picture of the existing system. It could not be observed how the interaction is with Tea purchasing factory and packing company but relevant documents could be referred.

### 3.4 Use Case Diagram For The Current System

Functionalities of the current system can be summarized according to the use case diagram in Figure 1.

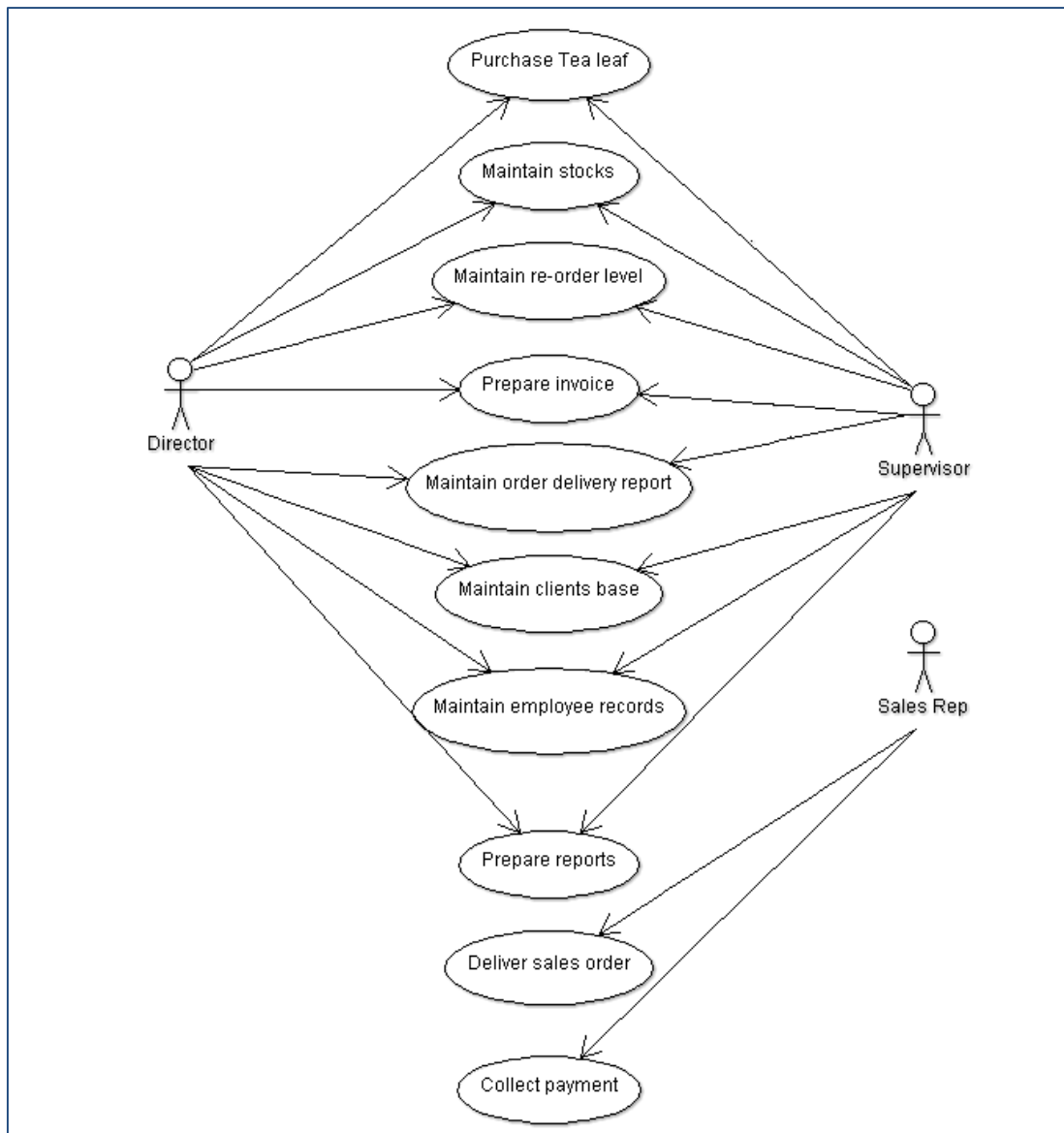


Figure 1 - Use case diagram for the current system

## 3.5 Requirements of The System

The project requirements mainly consist of the requirements related to the development of the project and those which will affect the overall project. This will cover the functional requirements and nonfunctional requirements gathered through system analysis.

### 3.5.1 Functional Requirements

Table1 provides detailed functional requirements of the IMSM system.

Login requirements	<ul style="list-style-type: none"><li>– System should allow the users to log-in to the system by entering relevant username and password.</li><li>– System should identify the user logged-in and should allow the particular functionalities to be performed according to their privileges and user level.</li></ul>
Employees and clients registration	<ul style="list-style-type: none"><li>– Authorized users should be able to register new employees and save their details in the data base.</li><li>– Authorized users should be able to register new clients in the data base.</li><li>– Authorized users should be able to view and modify the information of the registered employees.</li><li>– Authorized users should be able to view and modify the information of the registered clients.</li></ul>
Stock control	<ul style="list-style-type: none"><li>– Users should be able to view and update the current stock level.</li><li>– Users should be able to add new products to the stock.</li><li>– Users should be able to modify and delete products from the stock when necessary.</li></ul>
Sales management	<ul style="list-style-type: none"><li>– Users should be able to add new sales orders for a client though the system.</li><li>– Users should be able to view existing sale records.</li><li>– Users should be able to modify or delete existing sale orders before making the payment.</li></ul>

	<ul style="list-style-type: none"> <li>- Users should be able to create and print invoices for the sale orders.</li> <li>- Users should be able to search records of sales and clients using the system</li> </ul>
Attendance handling	<ul style="list-style-type: none"> <li>- Users should be able to mark attendance of the employees through the system.</li> </ul>
Management reports	<ul style="list-style-type: none"> <li>- Authorized users should be able to generate reports of the clients / employees and products available in the system.</li> <li>- Authorized users should be able to generate reports of the sales transactions for a given criteria.</li> <li>- Should be able to view attendance report based on different criteria</li> </ul>

**Table 1 - Functional Requirements**

### 3.5.2 Non-functional Requirements

#### 1. Security

Login requirements - access levels must be defined in order to allow functions to the authorized users

Password requirements - system should allow user to change the password when required.

#### 2. Capacity

Storage - system should be provided with a sufficient capacity of storage

#### 3. Usability

Look and feel standards - Interfaces should be developed in a user friendly manner and standard screen layouts and colors must be used.

#### 4. Respond time

Respond time of the system should be minimum. After requesting a result by the user, the outcome should be received soon.



## 5. Documentation

User documentation with screen shots and simple guidelines must be provided for the user's support.

### 3.6 System Users

Different users who will be using the IMSM system will be described here.

1. Director - Owners of the Kolden Tea company. The company is currently being handled by four directors.
2. Supervisor - Supervisor is responsible of coordinating the work to be done within the sales team and employee attendance management.
3. Sales Representative - Sales team consists of several sales representatives. They perform several tasks such as visit clients to demonstrate the products, show samples and take orders and report to employers on sales.

According to the processes of the IMSM system, the privileges of each user group can be further explained as per table 2.

Process	User Role		
	Director	Supervisor	Sales Representative
Add / manage users	√		
Change user password	√	√	√
Register new employees	√		
Register new clients	√	√	
View registered employees	√		
Modify/ delete registered employees	√		
View registered clients	√	√	√
Modify registered clients	√	√	
View current stock level	√	√	√
Update current stock level	√		
Add new products to the stock	√	√	
Modify and delete products in stock	√	√	
Add new sales orders for a client	√	√	√
View existing sale records.	√	√	√
Modify or delete existing sale orders before making the payment	√	√	√
Create and print invoices for the sale orders	√	√	√
Search records of sales and clients	√	√	√
Mark attendance of the employees	√		
Generate reports of the clients / employees and products available in the system	√		
Generate reports of the sales transactions for a given criteria	√		
View attendance report based on different criteria	√		

Table 2 - Users privileges on the system tasks

### 3.7 Summary

This chapter summarizes the techniques used for analysis and all the requirements including functional, non-functional and documentation requirements expected from the system. Detailed design solution for the system will be explained in the next chapter.

## CHAPTER 4: SYSTEM DESIGN

### 4.1 System Design Introduction

System design can be defined as the process of demonstrating the methodical approach to the design of the solution which will satisfy the requirements summarized in the system analyze phase. In the stage of system design, requirements gathered by analyzing the current process have been taken into consideration and have come out with a high level design as the solution for the problem. It has then further divided into several low level design solutions in the form of UML diagrams.

### 4.2 Evaluation Of Alternative Design Solutions

In order to select an appropriate design solution for the system several designs were studied. One design solution for the IMSM system is to develop the system based on cloud computing. This method will provide the service by another company and users can access the system over the Internet. This does not require any hardware or software to install at the working area in order to use the system. If the system is developed to access over the internet users will have the advantage to access the system from where they are. Which means client of IMSM system will need a reliable, high-speed, broadband Internet connection functioning the whole time they are working. This reason makes this solution impractical for the proposed system design.

Another feasible way of designing the proposed system is as a client–server model which is a distributed application structure. If the system is developed based on a client -server model the application, clients and servers will be communicating over a computer network on separate hardware. One main advantage of using this architecture is only one server will be used centrally where that all the clients will be accessed according to [2]. Even though this is a better solution for the system, one mandatory requirement for this model is to have network connection and multiple computers which is a limitation at client's premises.

Hence considering all the factors and available and feasible solutions, the system is designed to implement as a standalone application which will be operated in a single computer. Due to the limitations of the personal computers and the requirement of network connection was limited at the client's premises, this architecture was selected. A standalone model can work without any network connection compared to client server model which requires a network connection to operate the system.

### 4.3 Design of IMSM System In Detail

#### 4.3.1 Design Tools And Techniques

In order to develop a design solution for the system two main methodologies could be identified. One way of designing the system would be using the structured methodology. Another approach for software design is object-oriented methodology (OO) which is now being used widely. After analyzing the two methods, object-oriented methodology has been selected as the most suitable way of designing the system.

Object-oriented methodology uses a set of diagramming techniques known as Unified Modeling Language (UML). OO approach focuses on three architectural views of a system, functional, static and dynamic. Functional view describes the external behaviors of the system in the user's perspective. Use case diagrams will be used to explain the functional view. Static view is described using classes, attributes, methods relationships and messages. Class diagram and object diagrams will be used to explain the static view. Dynamic view will be represented using sequence diagrams, collaboration diagrams and state chart diagrams as stated in [1].

Object-oriented methodology has been selected for the system design hence Unified Modeling Language (UML) will be used as the modeling language to document the object oriented design of IMSM system.

As the design tool 'ArgoUml' was selected which closely follows the UML standards to design the required diagrams for the IMSM system. ArgoUml tool is a freeware available online.

### 4.3.2 Architectural Design

Architectural design involves identifying the major components of the system and the communications between these components. The system is designed to implement as a standalone application which will be operated in a single computer. This system does not require connecting to a database server over network which will be installed in the same machine. Figure 2 illustrates the architectural design of the IMSM system.

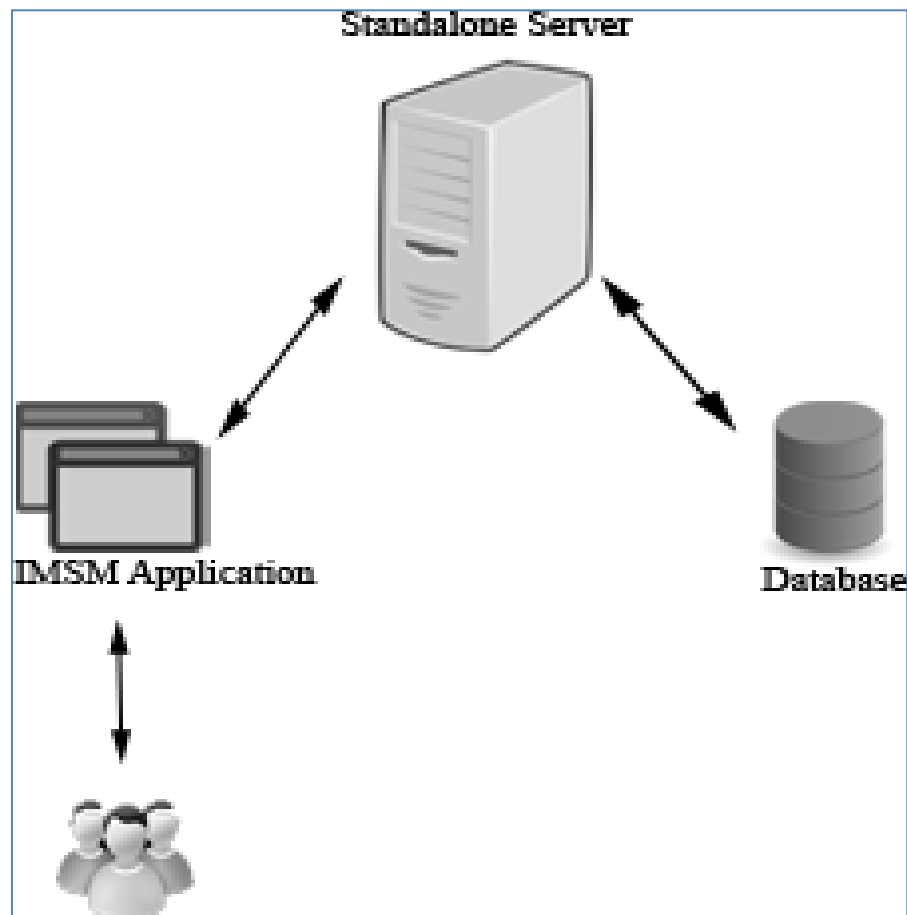


Figure 2- Architectural Design of IMSM system

### 4.3.3 Functional Design

Requirements identified at the system analysis phase will be represented using Unified Modeling Language (UML). Different diagrams will be used to describe different views in high level system definition. Several diagrams will be demonstrated under component design including use case diagram, class diagram and activity diagram.

#### 4.3.3.1 Use case diagram

High level use case diagram provides a basic idea of the main functionalities of IMSM system and same will demonstrate how the system will be organized. Structure of the IMSM system is designed by dividing the whole system into several modules. Figure 3 provides the high level use case diagram of the IMSM system which will be further divided into sub modules.

Manage employees, manage clients, manage inventory, manage sales and manage attendance use cases in this high level use card diagram will be further divided and login, change user password, search and generate Reports use cases will remain same. Three actors of the system will be director, supervisor and sales representative.

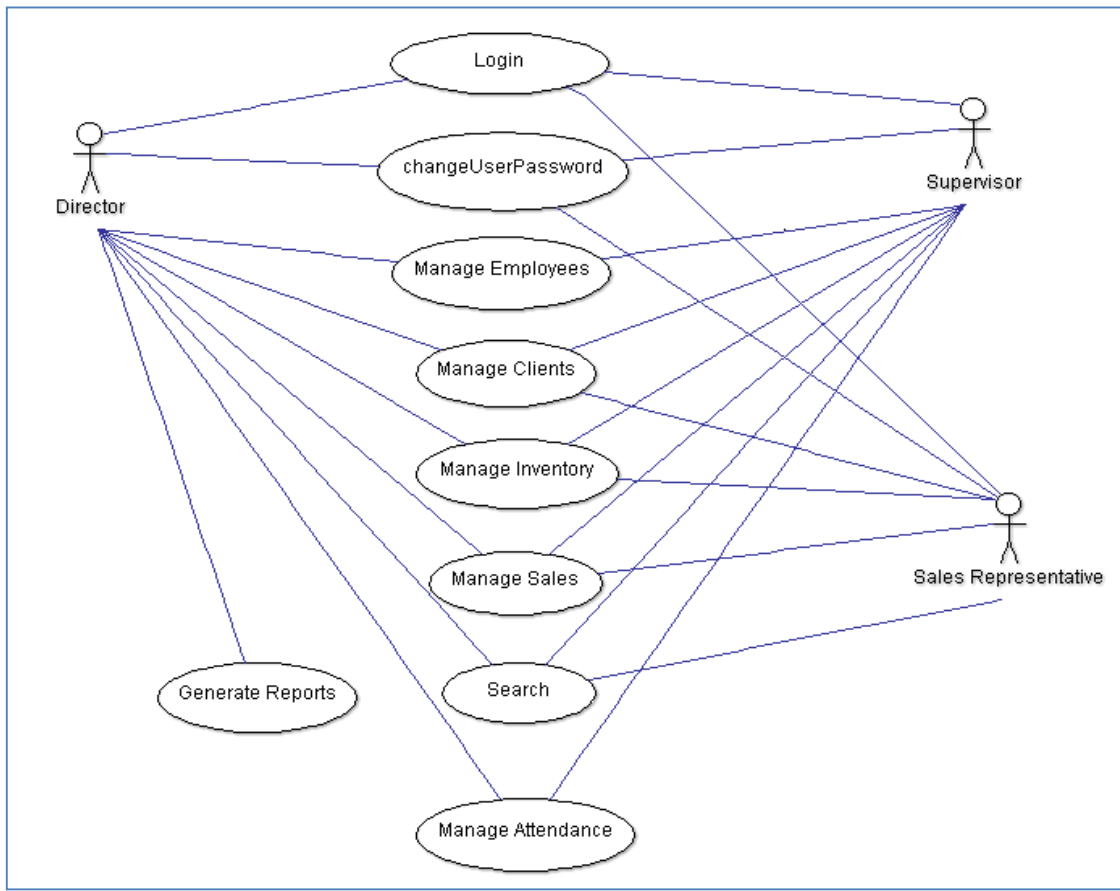


Figure 3 - High level use case diagram

#### 4.3.3.1.1 Login

Users can login to the system by entering their username and password. System can be accessed by three user types who are 'director', 'supervisor' and 'sales representative'. According to the user type the privileges of the IMSM system will be enabled. Separate user names and passwords will be allocated to each user. When log in to the system user should provide the credentials in correct format. System will check username and password and if they are accurate the main menu of the system will be presented to the user.

#### 4.3.3.1.2 Change user password

Users can change their password once they are successfully logged in to the IMSM system. Once the password is changed user can use this new password from the next log-in session.

#### 4.3.3.1.3 Manage employees

Manage employees use case is further divided into four use cases. This module will be controlled by directors and supervisors only. Figure 4 provides the detail use case diagram for manage employees.

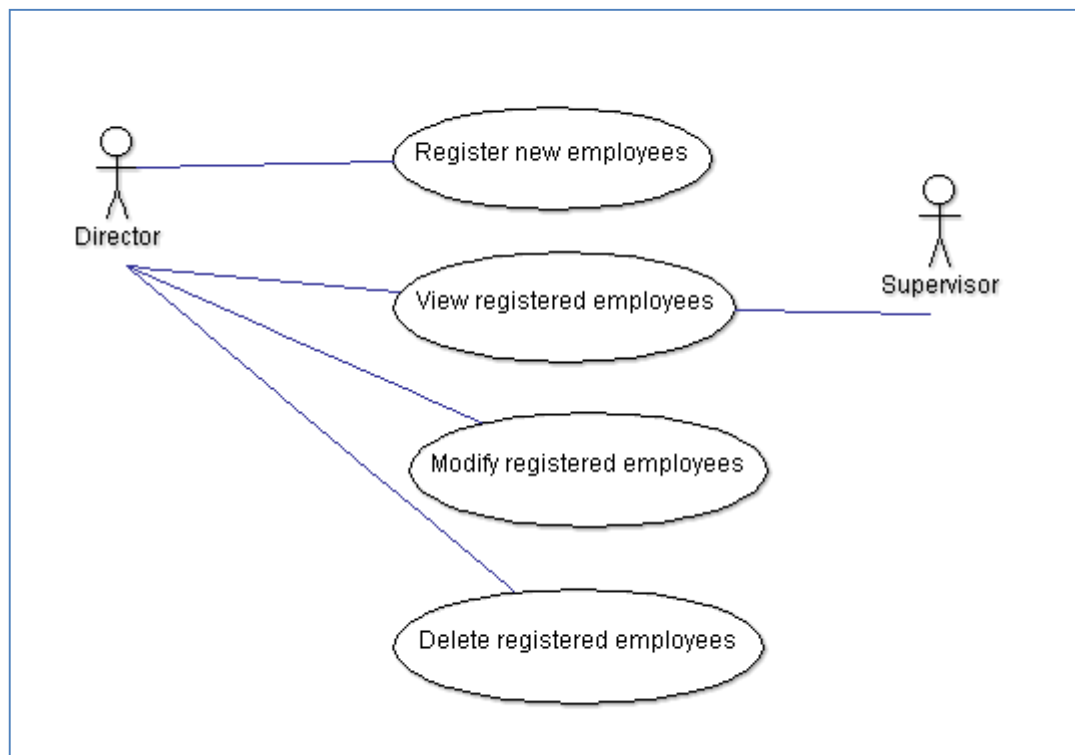


Figure 4 - Detailed use case diagram for Manage employees



#### 4.3.3.1.4 Manage clients

Manage clients use case is further divided into four use cases. Figure 5 provides the detail use case diagram for manage clients.

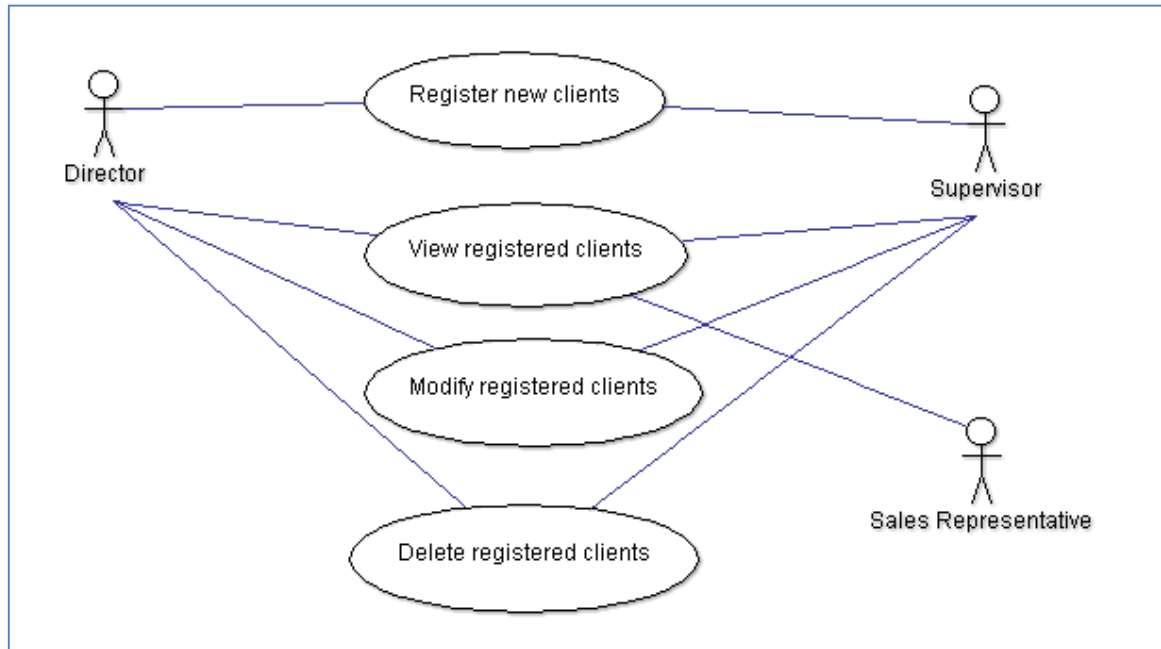


Figure 5 - Detailed use case diagram for Manage clients

#### 4.3.3.1.5 Manage inventory

Manage inventory use case is further divided into five use cases. Detailed use case diagram for manage inventory is given in the figure 6.

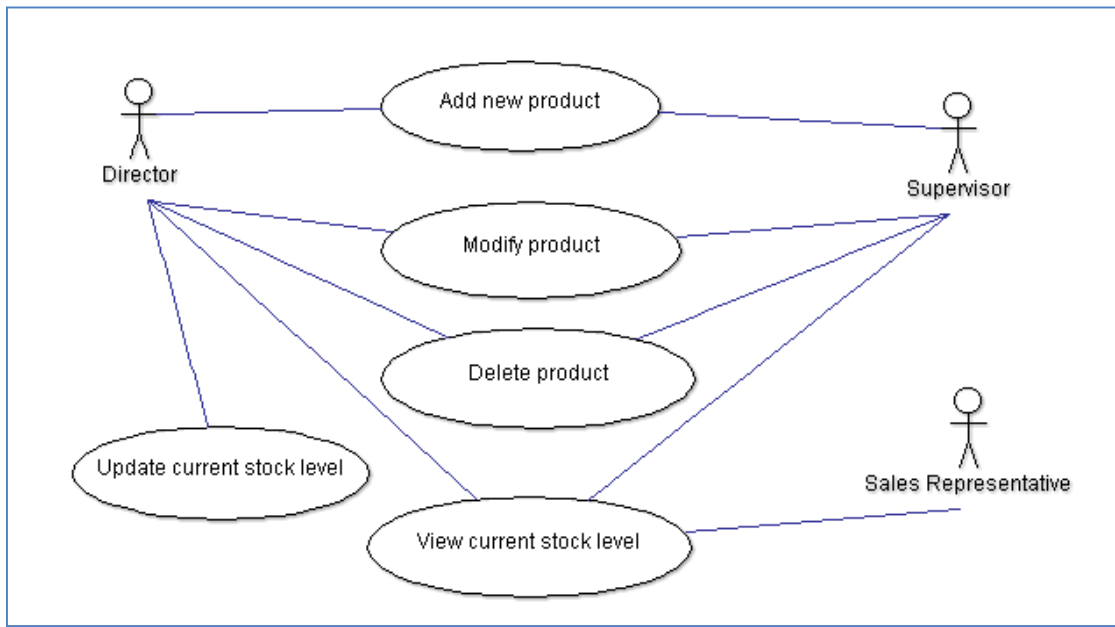


Figure 6 - Detailed use case diagram for Manage inventory

#### 4.3.3.1.6 Manage sales

Manage sales use case is further divided into five use cases. Figure 7 provides the detail use case diagram for manage sales.

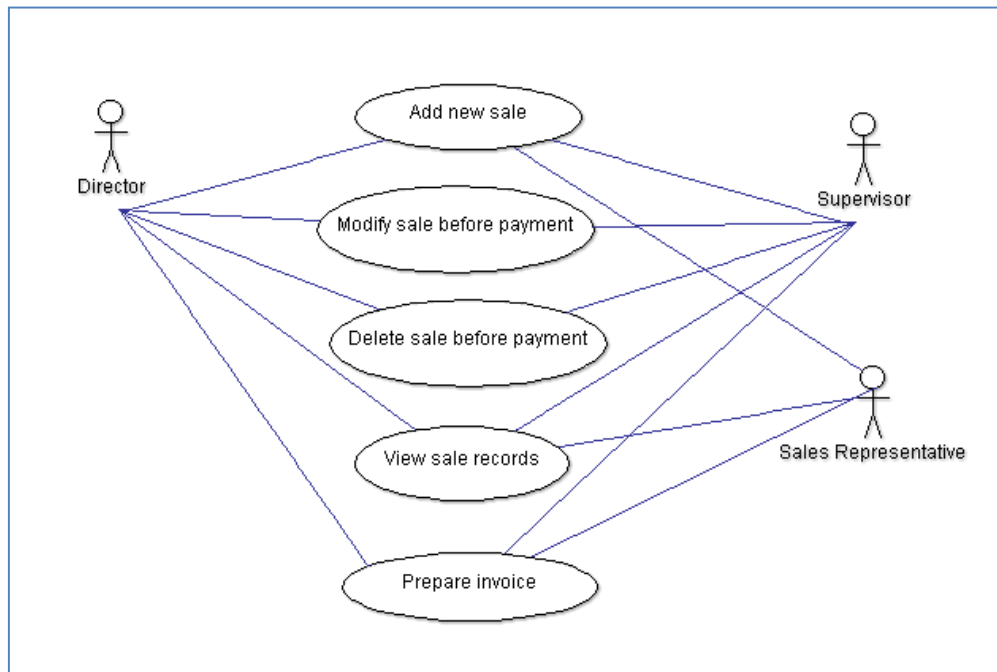


Figure 7 - Detailed use case diagram for Manage sales

#### 4.3.3.1.7 Manage attendance

Manage attendance use case is further divided into two use cases. Figure 8 provides the detail use case diagram for manage attendance.

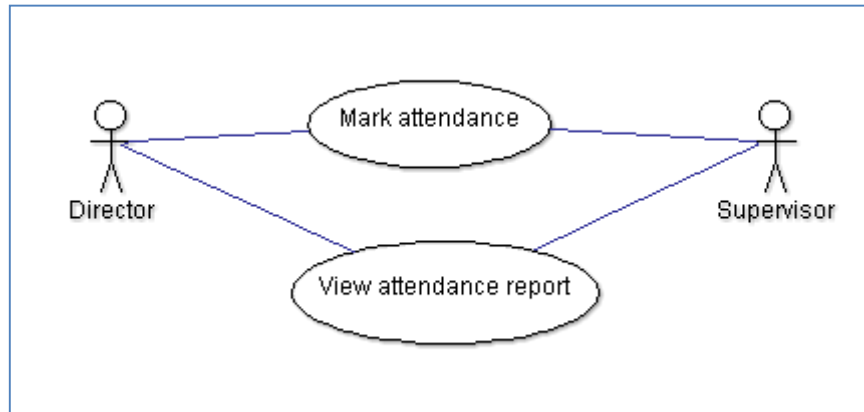


Figure 8 - Detailed use case diagram for Manage attendance

#### 4.3.3.1.8 Search

Searching records of sales and clients will be covered by this function. Searching is allowed to all types of users.

#### 4.3.3.1.9 Generate reports

Preparing management reports is an existing process of Kolden Tea Company but due to the limitation of structured information and a proper system, the reports were barely prepared. Generate reports module will allow authorized users to easily generate management reports at any time.

#### 4.3.3.2 Use Case Narratives

Use case narration is a textual representation of the course of events encountered when an actor is interacting with the system. In-detail description of use cases can be illustrated as follows.

Use case narrative for 'Login' use case is given in the Table 3.

<b>Use Case ID</b>	<b>01</b>		
<b>Use Case Name</b>	Login		
<b>Created by</b>	M.I.W Cooray	<b>Last Update by</b>	M.I.W Cooray
<b>Created Date</b>	15-08-2016	<b>Last Revision Date</b>	15-08-2016
<b>Actors</b>	Director , Supervisor, Sales Representative		
<b>Description</b>	Login to IMSM system		
<b>Preconditions</b>	<ol style="list-style-type: none"> <li>1. System should be properly installed and should operate without any issue.</li> <li>2. An account must have been created for the user with a username and a password.</li> </ol>		
<b>Main Scenario</b>	<ol style="list-style-type: none"> <li>1. User starts the IMSM system and enters the username and password given.</li> <li>2. System validates the user credentials.</li> <li>3. 'Director' will be given the full access to the IMSM system.</li> <li>4. 'Supervisors' and 'Sales Representative' will be given a limited access according to the user type.</li> </ol>		
<b>Post conditions</b>	User Successfully login to the IMSM system.		
<b>Alternative Scenario</b>	<p>User validation will be unsuccessful</p> <ol style="list-style-type: none"> <li>1. When the user has provided an invalid username and/or password, system will provide an error message</li> </ol>		

Table 3 - Use case narrative for 'Login'

Use case narrative for 'Register new employee' use case is given in the Table 4.

<b>Use Case ID</b>	02		
<b>Use Case Name</b>	Register new employee		
<b>Created by</b>	M.I.W Cooray	<b>Last Update by</b>	M.I.W Cooray
<b>Created Date</b>	15-08-2016	<b>Last Revision Date</b>	15-08-2016
<b>Actors</b>	Director		
<b>Description</b>	Director creates a new account for an employee		
<b>Preconditions</b>	<ol style="list-style-type: none"> <li>1. System should be properly installed and should operate without any issue.</li> <li>2. An account for director must have been created and the user with 'Director' user type must have logged in to the system</li> </ol>		
<b>Main Scenario</b>	<ol style="list-style-type: none"> <li>1. User clicks on the new employee registration option in the menu.</li> <li>2. System opens the interface which has the complete process for registration.</li> <li>3. User fills the necessary information and click on submit button.</li> <li>4. System checks the data validity and if valid system will create a new account for the employee.</li> </ol>		
<b>Post conditions</b>	Successfully creates a new employee account in the IMSM system.		
<b>Alternative Scenario</b>	<ol style="list-style-type: none"> <li>1. When the user provides invalid information, system will gives a notification or a proper error message.</li> <li>2. When the user is trying to register an existing user, system will notify same and will not allow to complete the process.</li> </ol>		

Table 4 - Use case narrative for 'Register new employee'

Use case narrative for 'Add a new sale' use case is given in the Table 5.

<b>Use Case ID</b>	03		
<b>Use Case Name</b>	Add a new sale		
<b>Created by</b>	M.I.W Cooray	<b>Last Update by</b>	M.I.W Cooray
<b>Created Date</b>	15-08-2016	<b>Last Revision Date</b>	15-08-2016
<b>Actors</b>	Director , Supervisor, Sales Representative		
<b>Description</b>	User adds a new sale record to the system		
<b>Preconditions</b>	<ol style="list-style-type: none"> <li>1. System should be properly installed and should operate without any issue.</li> <li>2. An account for the user must have been created and the user must have logged in to the system</li> <li>3. The client relevant to the sale must have been registered to the system.</li> <li>4. The product/s of the sales order must have added to the system.</li> <li>5. The relevant product must have an available stock level in the system.</li> </ol>		
<b>Main Scenario</b>	<ol style="list-style-type: none"> <li>1. User clicks on the new sales order option in the menu.</li> <li>2. System opens the interface which has the complete process to add the sales order.</li> <li>3. User fills the necessary information of the client and product and click on submit button.</li> <li>4. System checks the data validity and if valid system will create a new sales order.</li> </ol>		
<b>Post conditions</b>	User Successfully adds a new sales order to the IMSM system.		
<b>Alternative Scenario</b>	<ol style="list-style-type: none"> <li>1. When the user provides invalid information, system will gives a notification or a proper error message.</li> <li>2. When the user is trying to add a not existing client or a product, system will notify same with a proper error message and system will not allow to add the sale.</li> <li>3. When user tries to add a product which does not have a sufficient stock, user will be notified on same and system will not allow adding the sale.</li> </ol>		

Table 5 - Use case narrative for 'Add a new sale'

Use case narrative for 'View attendance report' use case is given in the Table 6.

<b>Use Case ID</b>	04		
<b>Use Case Name</b>	View attendance report		
<b>Created by</b>	M.I.W Cooray	<b>Last Update by</b>	M.I.W Cooray
<b>Created Date</b>	15-08-2016	<b>Last Revision Date</b>	15-08-2016
<b>Actors</b>	Director , Supervisor		
<b>Description</b>	User views the attendance of the employees from the IMSM system		
<b>Preconditions</b>	<ol style="list-style-type: none"> <li>1. System should be properly installed and should operate without any issue.</li> <li>2. An account for the user as a 'director' or as a 'supervisor' must have been created and the user must have logged in to the system</li> <li>3. Employees must have registered to the system and daily attendance must have marked in the system.</li> </ol>		
<b>Main Scenario</b>	<ol style="list-style-type: none"> <li>1. User clicks on the ' View attendance report ' option in the menu.</li> <li>2. System opens the interface which has the complete process to generate the attendance report.</li> <li>3. User selects the required date range and required options for the report and click to submit.</li> <li>4. System checks the database and generates the attendance report from the IMSM system.</li> </ol>		
<b>Post conditions</b>	User Successfully generates an attendance report from IMSM system.		
<b>Alternative Scenario</b>	<ol style="list-style-type: none"> <li>1. If there are no results for the request, system will notify same to the user.</li> </ol>		

Table 6 - Use case narrative for 'View attendance report'

Use case narrative for 'Search' use case is given in the Table 7.

<b>Use Case ID</b>	03		
<b>Use Case Name</b>	Search		
<b>Created by</b>	M.I.W Cooray	<b>Last Update by</b>	M.I.W Cooray
<b>Created Date</b>	15-08-2016	<b>Last Revision Date</b>	15-08-2016
<b>Actors</b>	Director , Supervisor, Sales Representative		
<b>Description</b>	User searches for sale or a client in the system		
<b>Preconditions</b>	<ol style="list-style-type: none"> <li>1. System should be properly installed and should operate without any issue.</li> <li>2. An account for the user must have been created and the user must have logged in to the system.</li> <li>3. The client or the sale order must have been added to the system.</li> </ol>		
<b>Main Scenario</b>	<ol style="list-style-type: none"> <li>1. User clicks on the search option in the menu.</li> <li>2. System opens the interface which has the complete process to search a sale order or a client.</li> <li>3. User selects the search category, enter key words and submit.</li> <li>4. System will check for the key word/s entered and if found, the results will be displayed</li> </ol>		
<b>Post conditions</b>	Search results will be displayed in the system.		
<b>Alternative Scenario</b>	<ol style="list-style-type: none"> <li>1. If there are no results for the request <ul style="list-style-type: none"> <li>– system will inform same to the using a notification</li> <li>– User will be directed to enter a different key word for new search.</li> </ul> </li> </ol>		

Table 7 - Use case narrative for 'Search'

Please refer Appendix A for more Use case narratives.



#### 4.3.3.3 Class Diagram for IMSM System

Class diagram represents the static view of a system and it describes the attributes and operations of a class and also the constraints imposed on the system. The class diagram will analysis and design of the static view of a system and describe responsibilities of a system.

Figure 9 provides the class diagram designed for IMSM system.

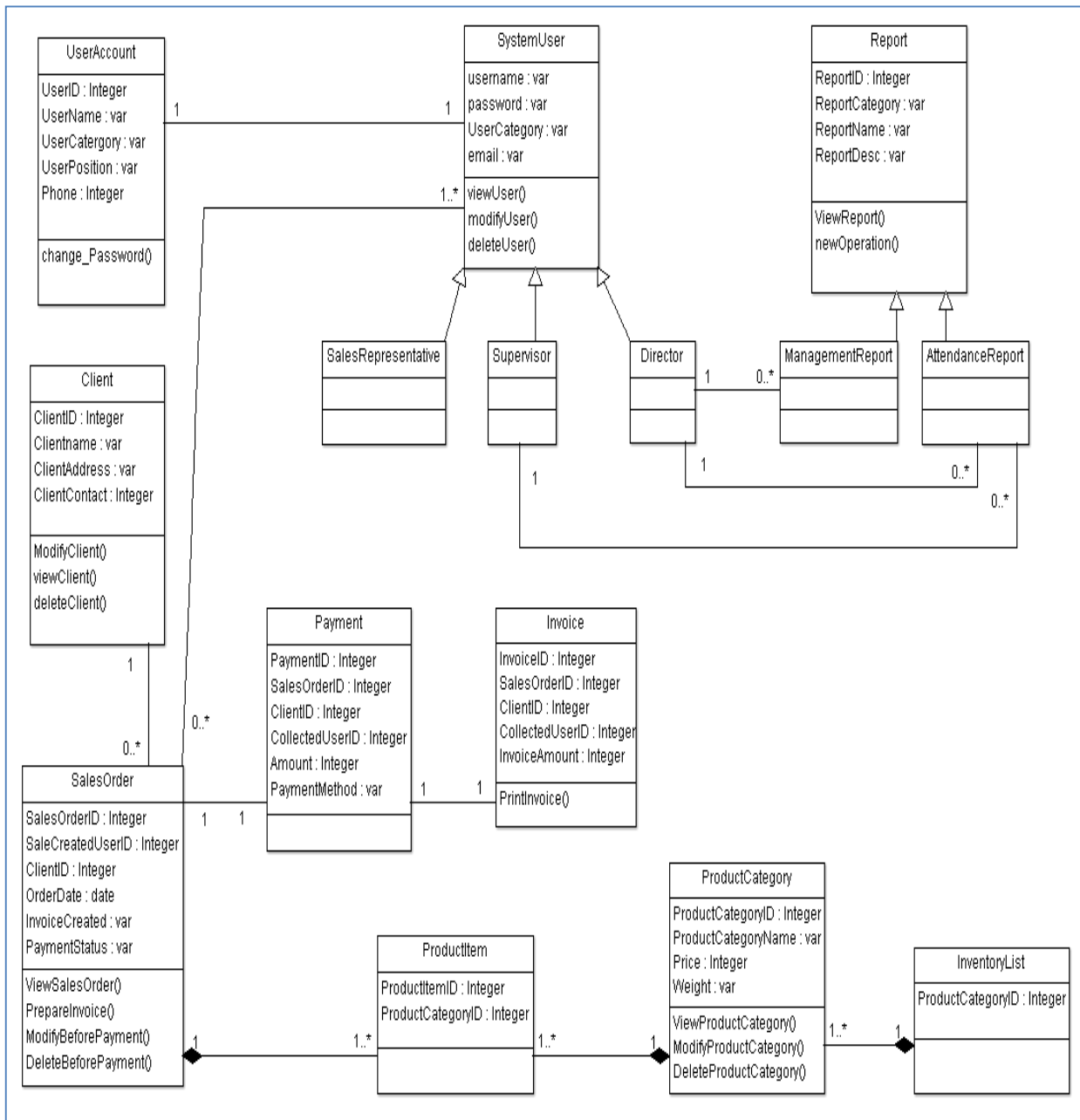


Figure 9 - Class diagram for IMSM system

#### 4.3.3.4 Activity Diagram

An activity diagram visually presents a series of actions or flow of control in a system. Activity diagrams describe the actual state of activities of a system by showing all the sequence of activities performed. Also these diagrams can show activities that are conditional or parallel.

Figure 10 depicts the activity diagram for the login use case.

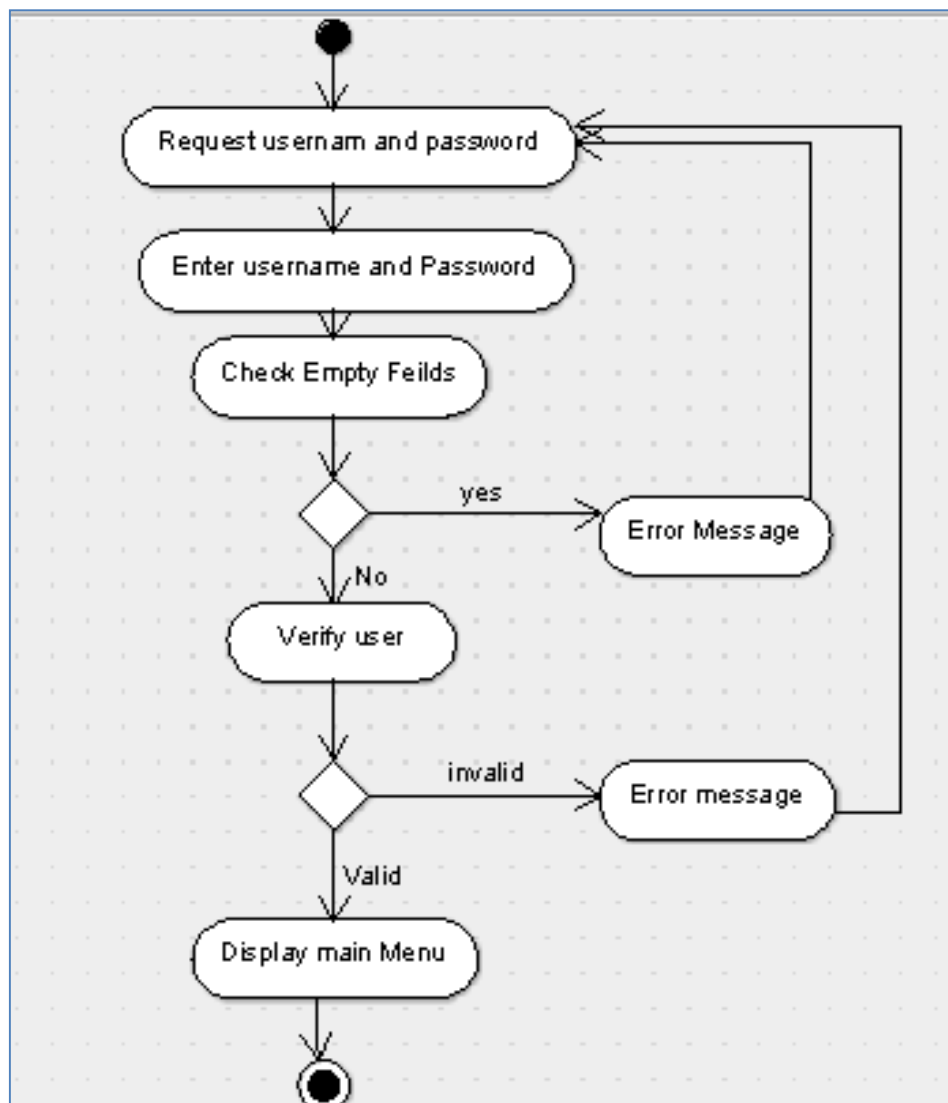


Figure 10 - Activity diagram for login

Figure 11 shows the activity diagram for the search use case.

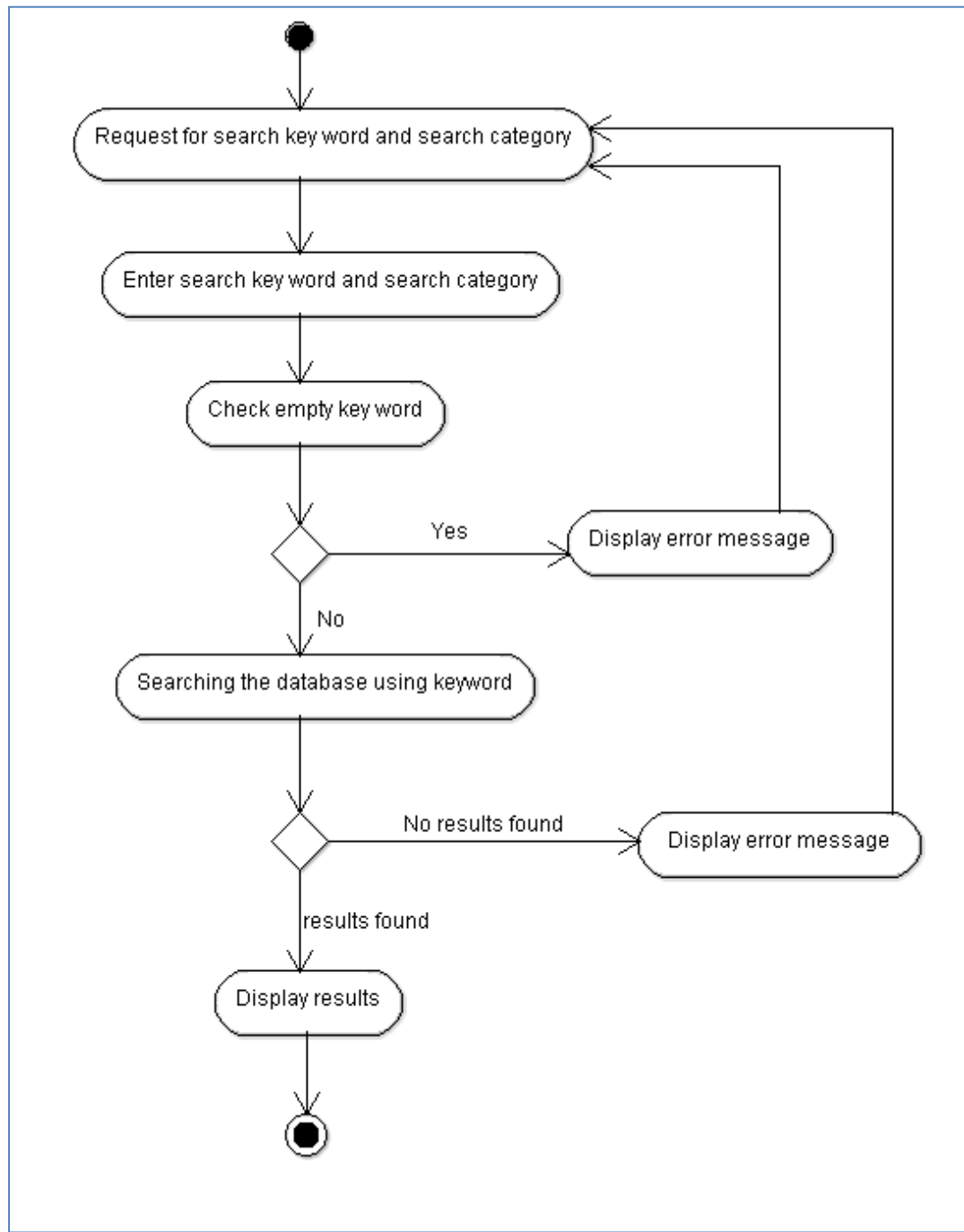


Figure 11 - Activity diagram for the search use case

Please refer Appendix B for more design diagrams.

## 4.4 Summary

This chapter summarizes design solution for the problem in detail along with tools, techniques used and high level diagrams. In the next chapter the implementation environment and the implementation process will be discussed.

## CHAPTER 5: IMPLEMENTATION

### 5.1 Introduction for Implementation

This chapter consist of the implementation process of the system including implementation environment, implementation procedures, structure of the system with selected user interfaces. Any reused modules will also be discussed here.

### 5.2 Implementation Environment

Development of the system was carried out using a personal notebook and the hardware and software were carefully chosen as in the Table 5.2.1. Most of the software and tools used during implementation were free and open source.

Microsoft Visual Studio 2010 (Express edition) which is an integrated development environment (IDE) from developed by Microsoft Corporation was used as the central development environment. This software has been used to develop the graphical user interfaces of the application with .NET Framework. Microsoft SQL Server 2008 was selected to manage the database of the system. This is a relational database management system (RDBMS) developed by Microsoft Corporation. Although this is a proprietary software, freeware edition is also available. SQL Server Management Studio which is a software tool launched with Microsoft SQL Server, was used to configure and manage all components within Microsoft SQL Server.

C#(C Sharp) was selected as the programming language which is a simple, structured and object-oriented programming language. SQL (Structured Query Language) has been used to manage the data in the SQL database and perform the functions between the application and the database. Programming languages, software tools and hardware used during implementation are summarized in the Table 8.

Main languages	
Programming language	C# (C Sharp)
Database language	SQL
Software used for the implementation	
Code development(IDE)	Microsoft Visual Studio 2010 (Express edition) Net Framework - 2.0
Database management	Microsoft SQL Server2008 SQL Server Management Studio
Image editing software	Adobe Photoshop cs4
Hardware used for the implementation	
Computer(laptop)	Intel core i3 CPU - 2.4 GHz 6GB RAM 200 GB Hard Disk space
Operating system	Windows 7 Ultimate (64 bit)

**Table 8 - Implementation Environment**

### 5.3 Implementation procedure

Functionalities of the current system was well studied and all functional and non functional requirements was gathered at the first stage of the process. Considering the selected scope of the system and duration the Rational Unified Process Methodology was selected to implement the IMSM system.

RUP an object-oriented development methodology and separates process into four different stages. Figure 12 shows the four stages in detail.

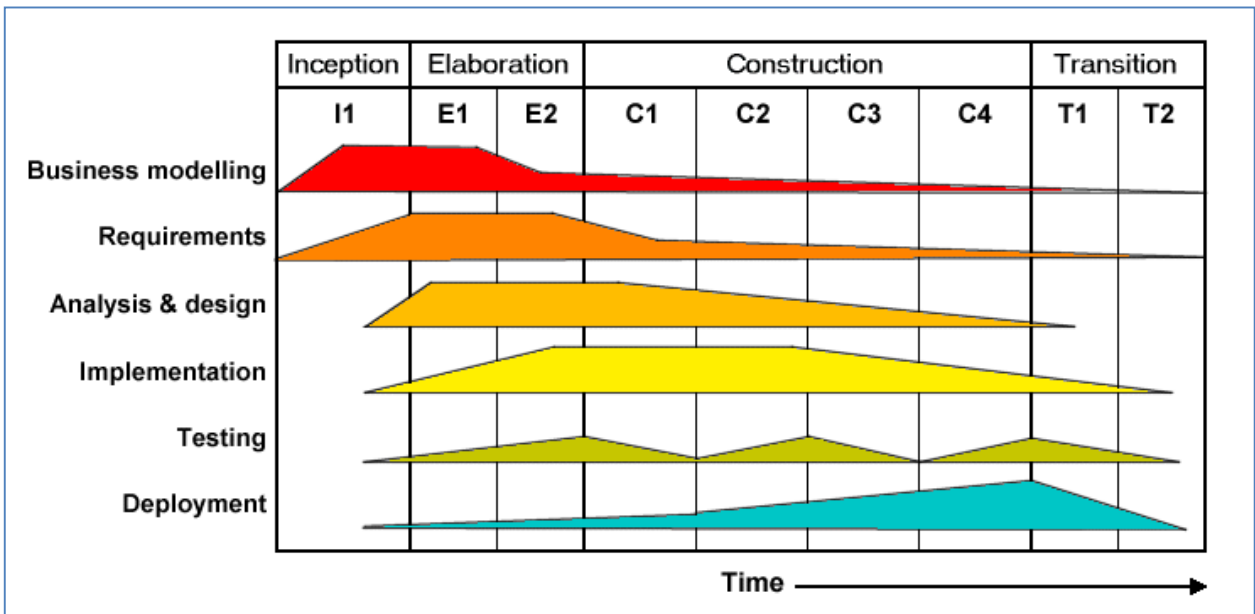


Figure 12 - Rational Unified Process Methodology

According to [5] In the inception phase, developers define the scope of the project and its business case; in the elaboration phase, developers analyze the project's needs in greater detail and define its architectural foundation; in the construction phase, developers create the application design and source code; and in the transition phase, developers deliver the system to users.

#### 5.4 System Structure and the Modules

IMSM system can be accessed by three types of users: Director, Supervisor and Sales Representative who will have different access levels. Initial view of the system will be the Login page and this will guide user to enter to the login details and have the access to the Home page. User will be verified at the login page and according to the privileges of the user type, Home page functions will be assigned. Structure of the system is shown in figure 13.



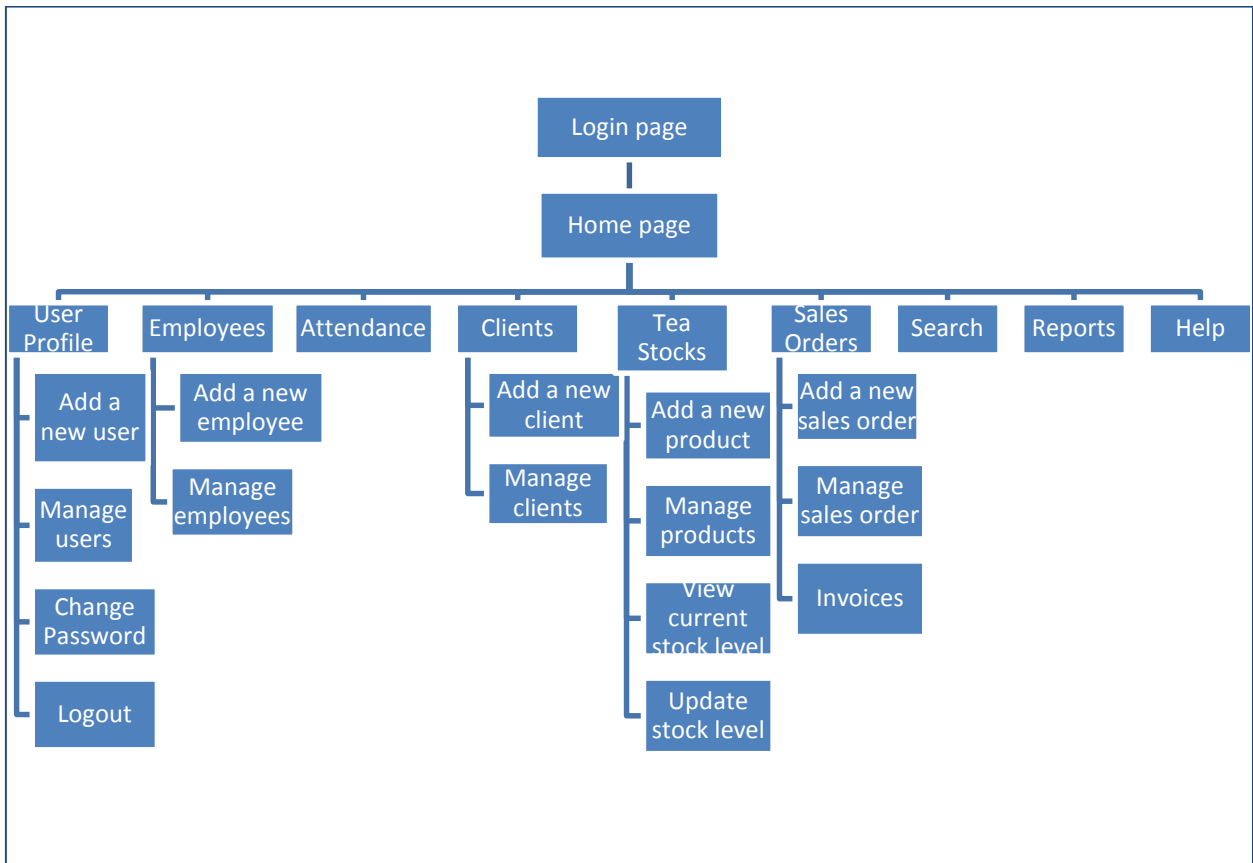


Figure 13 - Structure of the IMSM system

## 5.5 User Interfaces

User interfaces of the system have been designed in a user friendly manner so it will help users to learn the system fast and use it efficiently.

### 5.5.1 Login page

Login page is the first user interface which will be appeared when accessing the IMSM system. Figure 14 shows the login page of the system. Users can login to the system by entering the given username and password to this form. If users provide invalid credentials, necessary error messages will be prompt by the system. If not, users will be directed to the home page.



Figure 14 - Login page

### 5.5.2 Add a new employee user interface

Figure 15 shows the user interface which will add a new employee to the system.

## Add a new employee

You can create a new employee here. Please fill all the required fields to create a new employee.

Employee Number

First Name  Last Name

Mail address 1

Mail address 2

City

Date of Birth

Gender  Male  Female

Contact number

Designation  Date joined

Figure 15 - Add a new employee user interface

### 5.5.3 Add a new tea product user interface

Figure 16 shows the user interface which will add a tea product to the system.

**Add a new Tea Product**

Product ID

Product Name

Description

Unit

Sales price per unit (Rs.)

Initial Stock Quantity (In units)

Re-order point (In units)

**Manufacturer and cost**

Manufacturer name

Order cost per unit (Rs.)

Added date

Figure 16 - Add a new product user interface

#### 5.5.4 Error messages and notifications

A variety of notifications, error and warning messages will be displayed as pop up screens to the users between the processes of IMSM system. Information in the message boxes have been included in a way to ensure that user is guided accurately when necessary. Sample information message is shown in figure 17 and a sample error message is shown in figure 18.

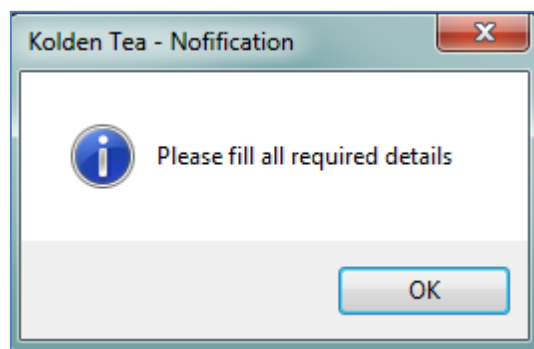


Figure 17 - Information message

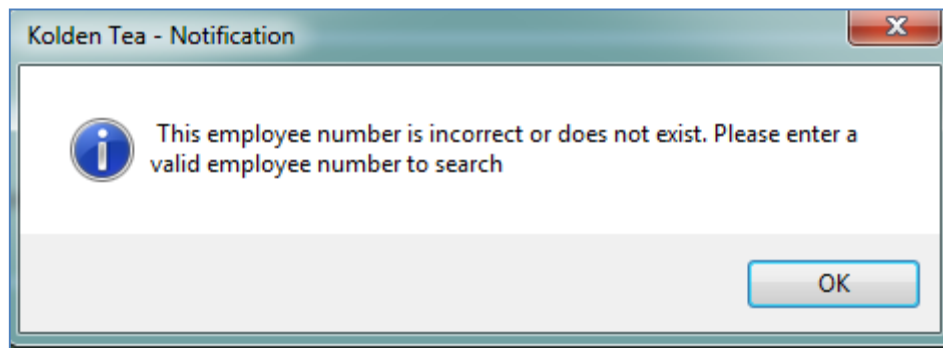


Figure 18 - 5.7 Error message

Please refer Appendix C for more Interfaces.

## 5.6 Reused Methods

### 5.6.1 generateNextID() method

This method is used in add a new client and add a new employee modules and will be used to check the database and generate the next highest number of the ID field.

## 5.7 Summary

This chapter summarizes the implementation process of the system including implementation environment, implementation procedures and the structure of the system. Next chapter summarizes the testing process, test plan and testing techniques used during the system testing phase.

## CHAPTER 6: USER EVALUATION AND TESTING

### 6.1 Introduction

Evaluation and testing of a software product includes testing the whole system by developers and end-users to make sure the system provides the required functionality and the system meets all the client's requirements. This chapter provides the detailed evaluation on how the testing process was carried out using testing techniques. Also critical evaluation of test results and end user testing analysis will be given in this chapter.

### 6.2 Testing process and test plan

A test plan is an approach which contains the scope, resources, and schedule of planned testing activities. This is a practice used to analyze and find the defects in a software system. Test items, features to be tested, the testing tasks, who will do each task, and any risks requiring contingency planning will be identified by a test plan. This is used to make sure that a unit can function both effectively and efficiently.

IMSM system was tested thoroughly and a four-stage testing plan was conducted to make sure the accuracy of functionalities. Verification and validation was also done at every stages of system development. The stages of the testing process will be discussed later in this chapter.

Testing of each item and module was performed in unit testing and integrated testing and was done parallely with the development of the system. Unit testing of each items was done after the completion of developing the particular unit. Subsequently the complete module was tested according to the integrated testing technique. With the completion developing and testing of all modules, system testing was performed considering the system as one unit.

## 6.3 Testing stages

### 6.3.1 Unit testing

In this stage each individual component of the system will be tested. In object-oriented programming an interface or a class is usually considered as a unit. The purpose of unit testing is to separate each component of the system and check whether the individual units are performing accurately. It is not expected to catch the error in the system through Unit testing. It only tests the functionality of the each individual unit/component only.

### 6.3.2 Integrated testing

In the stage of integration testing, individual units or components will be combined and tested as a module. In integration testing, individual units which have been checked by unit testing will be combined in a larger groups to apply the testing. The main purpose of integration testing is to check for any errors after integrating individual units and to confirm the expected functionality of the modules.

### 6.3.3 System testing

System testing is a stage where the complete, integrated system is tested to evaluate the system's fulfillment with the requirements. The objective of system testing is to ensure that each module which was recognized during unit testing interacts with one another as designed. In this stage the testing process is concerned with discovering any errors which will be resulted from unexpected interactions between modules and system components.

### 6.3.4 Acceptance testing

This is the final stage in the testing process before the system is accepted for operational use in real environment. Acceptance testing is also known as user acceptance testing (UAT), end-user testing, site testing or field testing. Acceptance testing is performed by the actual system users. This is performed to obtain the confirmation that the system meets all the requirements as agreed.

Acceptance testing will be performed at client's location involving several users with different access levels. Acceptance testing will be useful to identify any problems which may occur while running in the actual environment using actual data. This will help to ensure whether the performance of the system is acceptable for the real use.

Please refer Appendix - D for user evaluation form

## 6.4 Testing techniques used

### 6.4.1 White box testing

'White box testing' technique will be use to test the internal structures of an application. White box testing is also known as open box testing and glass box testing. White box testing is performed by looking at the source code to detect any possible failures using suitable input data. The testing technique will be effective only if the developer knows what the testing module is supposed to do and to find out if the program deviate from its planned objectives.

### 6.4.2 Black box testing

'Black box testing' will be used to look at what are the available inputs for an application and what are the expected outputs are that should result from each input. Various types of inputs such as randomly generated inputs, invalid inputs, null inputs etc will be used while using this technique. 'Black box testing' is generally performed by an external person who does not have an idea about the system (non-technical) and this will help to identify any contradictions in actual system and the specifications according to [6].

## 6.5 Test items

Testing of the entire IMSM system was done according to the above elaborated testing stages and techniques. Test items with the relevant modules are listed in table 9 which were used for the testing process.



Test Module	Test Item
Login	Login
Manage user	Add a new user Manage users Change Password Logout
Manage employees	Add a new employee Manage employees
Manage clients	Add a new client Manage clients
Manage inventory	Add a new product Manage products View current stock level Update stock level
Manage sales	Add a new sales order Manage sales order Invoices
Manage attendance	Mark attendance
Search	Search
Generate reports	All reports
Help	Help manual

Table 9 - Test items of IMSM system

## 6.6 Test Cases

A test case is a detailed process that completely tests a feature or a part of a feature and plays the role of evaluating the test plan. A test case will include description of testing, expected output, actual output and the status of testing (whether the test is pass or fail).

Test cases for Login test item is given in the Table 10. Through these cases a variety of scenarios will be checked such as the accuracy of credentials, possibility of entering incorrect data, possibility of entering blank data etc.

Test case ID	Test Case	Test Case Description	Expected output	Priority
1	Login with Valid credentials	Enter valid username and allocated password to login	User should be allowed to access Home page	High
2	Login with Invalid username	Enter incorrect username and allocated password to login	System should provide a suitable error message	High
3	Login with Invalid password	Enter valid username and an incorrect password to login	System should provide a suitable error message	High
4	Login with blank credentials	Keep username and password fields blank and login	System should provide a suitable error message	High
5	Login with blank username	Keep username field blank and enter password and login	System should provide a suitable error message	High
6	Login with blank password	Enter username and keep password field blank and login	System should provide a suitable error message	High
7	Login with a deactivated username and allocated password	Enter username which is deactivated and allocated password to login	System should provide a suitable error message	High

Table 10 - Test cases for Login test item

Please refer Appendix - E for more test cases of IMSM system.

## 6.7 Test Data and Test Results

Test data can be defined as a set of data used to test the functionality of a system. Test data are produced by the tester or by a module or a function which supports the tester in performing the test plan . In order to perform the testing during the development stage, dummy data was used and for system testing and user acceptance testing actual data was gathered from client's premises.

Test data were selected based on specific requirements to check the accuracy of the functions and to check the system's ability to validate data and prompt suitable error messages.

Table 11 shows the test case for Test case ID -1 which was used to test the login form when performed with valid credentials.


<b>Test Case ID</b>		1	
<b>Tested Component</b>		Login Page	
<b>Module Name</b>		Login Module	
<b>Test Case</b>		Login with valid credentials	
<b>Test Case Description</b>		Enter valid username and allocated password to login	
<b>Expected Output</b>		User should be allowed to access Home page	
<b>Step</b>	<b>Actions and Test Data</b>	<b>Actual Output</b>	<b>Status</b>
1	Access login page		Pass
2	Enter a valid username and password		
3	Click on login button		

Table 11 - 'Login with valid credentials' test case

Table 12 shows the test case for Test case ID - 2 which was used to test the login form when performed with invalid username.


<b>Test Case ID</b>		2	
<b>Tested Component</b>		Login Page	
<b>Module Name</b>		Login Module	
<b>Test Case</b>		Login with Invalid username	
<b>Test Case Description</b>		Enter incorrect username and allocated password to login	
<b>Expected Output</b>		System should provide a suitable error message	
<b>Step</b>	<b>Actions and Test Data</b>	<b>Actual Output</b>	<b>Status</b>
1	Access login page		Pass
2	Enter an incorrect username and a valid password		
3	Click on login button		

Table 12 - 'Login with invalid username' test case

Table 13 shows the test case for Test case ID - 3 which was used to test the login form when performed with invalid password.

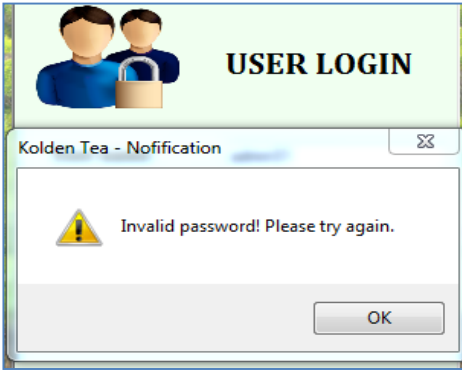
<b>Test Case ID</b>		3	
<b>Tested Component</b>		Login Page	
<b>Module Name</b>		Login Module	
<b>Test Case</b>		Login with Invalid password	
<b>Test Case Description</b>		Enter a valid username and an incorrect password to login	
<b>Expected Output</b>		System should provide a suitable error message	
Step	Actions and Test Data	Actual Output	Status
1	Access login page		Pass
2	Enter a valid username and an incorrect password		
3	Click on login button		

Table 13 - 'Login with invalid username' test case

Table 14 shows the test case for Test case ID - 4 which was used to test the login form when performed with blank credentials.


<b>Test Case ID</b>		4	
<b>Tested Component</b>		Login Page	
<b>Module Name</b>		Login Module	
<b>Test Case</b>		Login with blank credentials	
<b>Test Case Description</b>		Keep username and password fields blank and login	
<b>Expected Output</b>		System should provide a suitable error message	
<b>Step</b>	<b>Actions and Test Data</b>	<b>Actual Output</b>	<b>Status</b>
1	Access login page		Pass
2	Keep username and password fields blank		
3	Click on login button		

Table 14 - 'Login with invalid username' test case

Table 15 shows the test case for Test case ID - 5 which was used to test the login form when performed with blank username field.


<b>Test Case ID</b>		5	
<b>Tested Component</b>		Login Page	
<b>Module Name</b>		Login Module	
<b>Test Case</b>		Login with blank username	
<b>Test Case Description</b>		Keep username field blank and enter password and login	
<b>Expected Output</b>		System should provide a suitable error message	
Step	Actions and Test Data	Actual Output	Status
1	Access login page		Pass
2	Keep username field blank and only enter a valid password		
3	Click on login button		

Table 15 - 'Login with blank username' test case

Table 16 shows the test case for Test case ID - 6 which was used to test the login form when performed with blank password field.


<b>Test Case ID</b>		6	
<b>Tested Component</b>		Login Page	
<b>Module Name</b>		Login Module	
<b>Test Case</b>		Login with blank password	
<b>Test Case Description</b>		Keep username and password fields blank and login	
<b>Expected Output</b>		System should provide a suitable error message	
<b>Step</b>	<b>Actions and Test Data</b>	<b>Actual Output</b>	<b>Status</b>
1	Access login page		Pass
2	Enter a valid username and keep the password field blank		
3	Click on login button		

Table 16 - 'Login with blank password' test case

Table 17 shows the test case for Test case ID - 7 which was used to test the login form when performed with a deactivated username.


<b>Test Case ID</b>		7	
<b>Tested Component</b>		Login Page	
<b>Module Name</b>		Login Module	
<b>Test Case</b>		Login with a deactivated username and allocated password	
<b>Test Case Description</b>		Enter username which is deactivated and allocated password to login	
<b>Expected Output</b>		System should provide a suitable error message	
Step	Actions and Test Data	Actual Output	Status
1	Access login page		Pass
2	Enter a deactivated username and a valid password		
3	Click on login button		

Table 17 - 'Login with blank password' test case

Please refer Appendix - F for more test cases with test results.

## 6.8 User Evaluation

User evaluation will be conducted to evaluate a system by testing it with actual users and actual data. 'User evaluation' according to [7] focuses on how well users can study and use a system to achieve their goals. Acceptance testing which is the last stage of the testing process will be done during user evaluation.



## 6.8.1 Usability Testing

'Usability' according to [8] is the scale to which a software can be used by specified clients to achieve quantified objectives with effectiveness, efficiency, and satisfaction in a quantified context of use.

In simple terms, usability means the quality of the user experience when they interact with the developed system. Usability is a combination of factors such as below according to [7].

- |                              |   |
|------------------------------|---|
| Easy to learn design         | - How much effort the user need to spend in understanding the architecture and navigation of the system                 |
| Efficiency of use            | - How simple it is to use the system and how fast an experienced user can finish the tasks                              |
| Ease of learning             | -How fast a user who has never seen the user interface before, can accomplish basic tasks                               |
| Memorability                 | - After using the system, if a user can remember enough to use it effectively in future visits                          |
| Error frequency and severity | - How often users make errors while using the system, how serious the errors are, and how users recover from the errors |
| Subjective satisfaction      | - If the user likes using the system  |

## 6.8.2 User Acceptance Testing

User evaluation / user acceptance testing of the IMSM system was carried out at the client's premises with the participation of the several user who will have different access levels to the system. A user evaluation form was provided to each of them to capture user's experience on the system and to gather any comments which was very help in improving the system.

Results obtained through the user evaluation was satisfactory a thorough analysis of each scenario is given below.

Please refer Appendix - D for the Questionnaire used to evaluate the IMSM system

## 6.8.2 Analysis of the Questionnaire

### User friendliness of the system interfaces

Figure 19 demonstrates the user friendliness of the IMSM system according to the actual user's feedback.

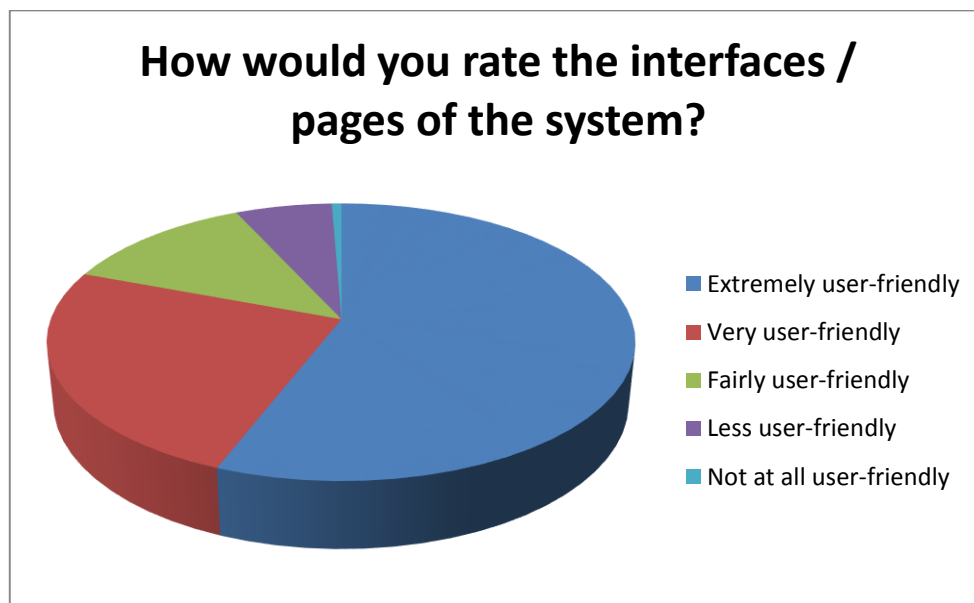


Figure 19 - User friendliness of IMSM system

According to the above evaluation on the friendliness of user interfaces it could be realized that interfaces are built in a very user-friendly manner and only a less percentage of users have experienced less and no user-friendliness in the system. Those experiences were discussed with the relevant users and the issues were identified and were used to improve the system further.

## Speed of Software

Figure 20 demonstrates the speed of the IMSM system according to the actual user's feedback.

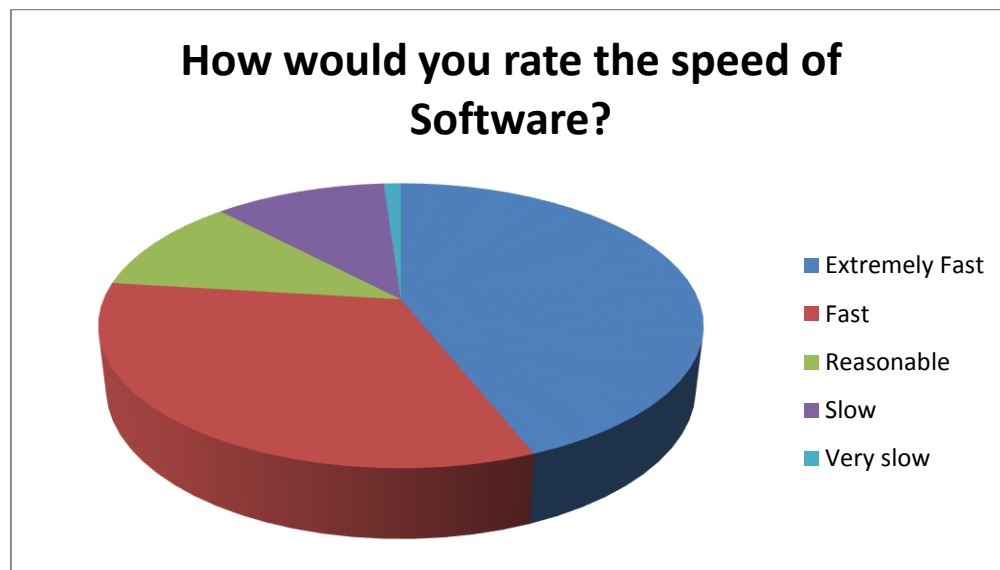


Figure 20 - Speed of the IMSM system

According to the above evaluation on the speed of user system it could be realized that the system is performing well enough. Few comments could be noted in experiencing slow performance in the system which was be due to slow performance of personal computers/laptops used for the testing and the interactions between the application and the database server. However these experiences were discussed with the relevant users and the issues were identified and were used to improve the system speed.

Please refer Appendix G for further analysis on questionnaire given to users.

## 6.8 Summary

This chapter summarizes all the testing process, test plan and testing techniques used during the system testing phase with tested items, test cases and user evaluation on the system. The results of the project with directions for future work will be critically analyzed the next chapter.

## CHAPTER 7: CONCLUSION AND FUTURE WORK

### 7.1 Introduction

This chapter will review the objectives of the system, how they have been achieved, objectives could not be achieved and a critical analysis of the results of the project with directions for future work.

### 7.2 Conclusion

When revising the objectives of Inventory management and sales management(IMSM) system developed for Kolden Tea International small scale company, the system was required to develop in a way to perform all the current functionalities of the ongoing processes and to include some additional features such as generating helpful reports, search etc. Authorized users can access the system and can manage users, employees and clients in a effective manner. Tea, which is the main product of this company can be managed by the authorized system by adding various categories of items, modifying them when necessary and managing the current tea stock level which is an essential fact when managing day to day sales. Users can create sales orders though the system and are able to manage them until the end of the sales and invoicing process. Management can check the stock level instantly before placing a sales order which will eliminate accepting unrealistic orders or management can prepare early by refilling the stocks to accommodate the order which was a drawback of the current process and a major requirement for the system.

Apart from the main processes authorized users can add new employees, new users to the system and manage them according to the requirements. The attendance also can be recorded through the system and later reports can be generated which will be useful for month end evaluations and salary processing.

Searching, an additional yet a useful feature has been developed in the system to give an extra value to the current system. Whatever the information users need to find can be search through this module.

A variety of reports have been set for the use of management which will be useful in assessing their inventory, sales and other aspects such as auditing. Help manual is accessible in system to ensure that the users can learn more in using the system.

In summary, IMSM system provides a computerized and a centralized system to which can be accessible any authorized user and this system reduces the paper work done by the employees which fulfill the purpose of the project. By analyzing the overall test results and the user feedback gathered at the user evaluation, the developed IMSM system can be considered as a satisfactory level project which meets all the expected requirements of our client as well as the standards of the MIT degree program.

## 7. 2 Challenges and problems encountered

Few issues encountered during the ‘requirements gathering’ process as was bit difficult to speak to each user during their working time and sometimes they were not available. Hence had to spend more days than allocated, to gather all necessary details and requirements. Designing the high-level use case diagram took more time than expected as the requirements were not clear enough in some processes.

IMSM system was initially discussed to implement using multiple personal computers but due to limitations in providing multiple recourses, it was decided to provide one personal computer. Then the system was designed and implemented to work as a standalone application which will operate in a single computer. Insufficiency of knowledge in the selected languages such as C# and SQL lead the development process to spend more time than scheduled for learning the technologies thoroughly. Allocated time for different modules and processes changed narrowly due to various reasons. In general the process went smoothly yet working with the schedule was a challenge throughout the project.

### 7.3 Limitations of the current work

IMSM system has been developed integrating several main modules but according to the usability testing there were minor issues in the speed of the system and the response back time issues. Hence the fine tuning of the modules and the hardware environment upgrades are required to overcome this limitation. The IMSM system working as a standalone system due to the resource limitation in the client's premises and is accessible through the installed computer only.

Only a limited number of reports can be generated through the current system which can be improved with more and different management reports. Also the current system was not designed to implement the back end process of buying tea packs from tea manufactures since this will expand the current scope due to having a separate process of sales orders, invoices, supplies and different set of functionalities.

### 7.4 Lessons learnt

Implementing an individual project with the guidance of the MIT degree is itself an enormous experience I have obtain specially being a non-IT professional with less on hand experience. Familiarity in selecting a suitable project with a realistic and acceptable scope, experience in gathering all functional and nonfunctional requirements from different stake holders, preparing questionnaires, interviewing analyzing the feasibility etc. could be achieved with this project. The whole process of this system implementation has trained me in tasks such as to meet the scope as proposed, working with a planned schedule, working within the deadline, scope management and meeting the objectives and goals, deal with the stakeholders and overall experience in all the stages of the software development life cycle.

Achieved the practice in developing a system as an individual and acquired a clear and confident knowledge of all phases. Also this project guided me on writing a report in a standard manner, to develop technical and non-technical documentations for a system.

Gained knowledge in configuring required software and databases and also a practical knowledge could be obtained by working with commercial systems such as Visual Studio and MS SQL server. Expertise of applying OO designing, UML designing to a system, hands on experience in using programming and database languages such as C#.NET and SQL in real life, testing procedures and experience in writing a report in a standard manner and developing technical and non-technical documentations for a system can also be stated as major lessons learnt throughout the process.

## 7.5 Future improvements

The IMSM system was completed according to the scope and the time. However the system can be improved further for a greater product. Due to the limitations of the time and the scope of the individual project of the MIT degree program only a considerable scope was accepted covered but future improvements for this product can be suggested as follows for anyone who will be interested in expanding the system.

The developed system contains several main modules which helps to conduct current processes. According to the usability testing there were minor issues in the speed of the system. Hence fine tuning the modules and improving the speed and the efficient in response time can be proposed as suggestions for future improvements.

Only a limited number of reports can be generated through the current system hence as an improvement it can be suggested to include more management reports with a variety. This can be further modified as graphical reports with graphs and charts which will be very effective for analyzing.

The IMSM system is working as a standalone system due to the resource limitation in the client's premises and is accessible through the installed computer only. Hence this can be developed as a web based system which will be accessible from anywhere which will be an added value for the system.

If the web base system was developed, a mobile version of the system (a mobile app) can be suggested as another improvement. These suggestion can be a major developments hence a thorough study of feasibility is recommended.

Also the current system was not designed to implement the back end process of buying tea from manufactures which will have a separate process of sales orders, invoices, a separate set of suppliers and functionalities. One can implement these modules and then it can be integrated with IMSM system.

Further the system can be expanded to send email and SMS notifications to clients for settling invoices and for the management to notify on low stock levels and sales order deliveries. So that the users does not have to log in to the system for such manual checking. Also the current system does not provide security for passwords of system users hence this can be suggested as a security in implementing password encrypting mechanisms.

## 7.6 Summary

This chapter summarizes the critical analysis of the work carried out throughout the process and identifies the lessons learnt, limitations of the current work and future improvements.



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## APPENDIX

### Appendix A - Use Case Narratives

Use case narrative for 'Change user password' use case is given in the Table 18.

<b>Use Case ID</b>	02		
<b>Use Case Name</b>	Change user password		
<b>Created by</b>	M.I.W Cooray	<b>Last Update by</b>	M.I.W Cooray
<b>Created Date</b>	20-08-2016	<b>Last Revision Date</b>	20-08-2016
<b>Actors</b>	Director, Supervisor, Sales Representative		
<b>Description</b>	User changes the account's current password		
<b>Preconditions</b>	<ol style="list-style-type: none"> <li>1. System should be properly installed and should operate without any issue.</li> <li>2. An account for the user must have been created and the user must have logged in to the system</li> </ol>		
<b>Main Scenario</b>	<ol style="list-style-type: none"> <li>1. User clicks the change my password option in the menu.</li> <li>2. System opens the interface which has the complete process for changing the user's password.</li> <li>3. User fills the 'new password' field and 'confirm new password' field with the same new password and click on 'change my password' button.</li> <li>4. System checks the data validity and if valid system will save the new password for the user.</li> </ol>		
<b>Post conditions</b>	Successfully creates a new password for the user in the IMSM system.		
<b>Alternative Scenario</b>	<ol style="list-style-type: none"> <li>1. When the user provides blank, mismatching or same old password as a new password, system will gives a notification or a proper error message.</li> </ol>		

Table 18 - Use case narrative for ' Change user password '

Use case narrative for 'Add a new product' use case is given in the Table 19

<b>Use Case ID</b>	<b>03</b>		
<b>Use Case Name</b>	Add a new product		
<b>Created by</b>	M.I.W Cooray	<b>Last Update by</b>	M.I.W Cooray
<b>Created Date</b>	20-08-2016	<b>Last Revision Date</b>	20-08-2016
<b>Actors</b>	Director , Supervisor		
<b>Description</b>	User adds a new tea product to the system		
<b>Preconditions</b>	<ol style="list-style-type: none"> <li>1. System should be properly installed and should operate without any issue.</li> <li>2. An account for the user (Director or a Supervisor) must have been created and the user must have logged in to the system</li> </ol>		
<b>Main Scenario</b>	<ol style="list-style-type: none"> <li>1. User clicks on the add a new product option in the menu.</li> <li>2. System opens the interface which has the complete process to add the new tea product.</li> <li>3. User fills the necessary information of the tea product and product and click on 'Add' button.</li> <li>4. System checks the data validity and if valid system will create a new product in the database.</li> </ol>		
<b>Post conditions</b>	User successfully adds a new tea product to the IMSM system.		
<b>Alternative Scenario</b>	<ol style="list-style-type: none"> <li>1. When the user provides invalid or blank information, system will gives a notification or a proper error message.</li> </ol>		

Table 19 - Use case narrative for 'Add a new product'

**Use case narrative for 'View a registered employee' use case is given in the Table 20**

<b>Use Case ID</b>	<b>03</b>		
<b>Use Case Name</b>	View a registered employee		
<b>Created by</b>	M.I.W Cooray	<b>Last Update by</b>	M.I.W Cooray
<b>Created Date</b>	20-08-2016	<b>Last Revision Date</b>	20-08-2016
<b>Actors</b>	Director , Supervisor		
<b>Description</b>	User views a registered employee record in the system		
<b>Preconditions</b>	<ol style="list-style-type: none"> <li>1. System should be properly installed and should operate without any issue.</li> <li>2. An account for the user (Director or a Supervisor) must have been created and the user must have logged in to the system</li> <li>3. Employee record must have been added to the system data base.</li> </ol>		
<b>Main Scenario</b>	<ol style="list-style-type: none"> <li>1. User clicks on the 'Manage employees' option in the menu.</li> <li>2. System opens the interface which has the complete process to view and modify a registered employee record</li> <li>3. User insert the employee number and click on 'Search' button.</li> <li>4. System checks the entered employee record and if it exists, system will display the saves information of the employee. .</li> </ol>		
<b>Post conditions</b>	User views the information reordered for this employee and user can proceed to modify the employee record.		
<b>Alternative Scenario</b>	<ol style="list-style-type: none"> <li>1. When the user provides invalid, not existing or blank employee number, system will gives a notification or a proper error message.</li> </ol>		

**Table 20 - Use case narrative for 'View a registered employee'**

**Use case narrative for 'Generate a report' use case is given in the Table 21**

<b>Use Case ID</b>	<b>03</b>		
<b>Use Case Name</b>	Generate a report		
<b>Created by</b>	M.I.W Cooray	<b>Last Update by</b>	M.I.W Cooray
<b>Created Date</b>	20-08-2016	<b>Last Revision Date</b>	20-08-2016
<b>Actors</b>	Director		
<b>Description</b>	User generates a report in the system		
<b>Preconditions</b>	<ol style="list-style-type: none"> <li>1. System should be properly installed and should operate without any issue.</li> <li>2. An account for the user (Director) must have been created and the user must have logged in to the system</li> </ol>		
<b>Main Scenario</b>	<ol style="list-style-type: none"> <li>1. User selects the type of report from the menu</li> <li>2. System opens the interface which has the complete process to generate the report</li> <li>3. User selects the relevant criteria for the report and click on 'generate report' button.</li> <li>4. System checks the search criteria entered by the user and if records exists, system will generate the report.</li> </ol>		
<b>Post conditions</b>	The report is created successfully and the user can save or print the report.		
<b>Alternative Scenario</b>	<ol style="list-style-type: none"> <li>1. When there are no records to create a report, system will gives a notification or a proper error message.</li> </ol>		

**Table 21 - Use case narrative for 'Generate a report' use case**

## Appendix B - Design Diagrams

Figure 21 shows the activity diagram for the 'view registered employee' use case.

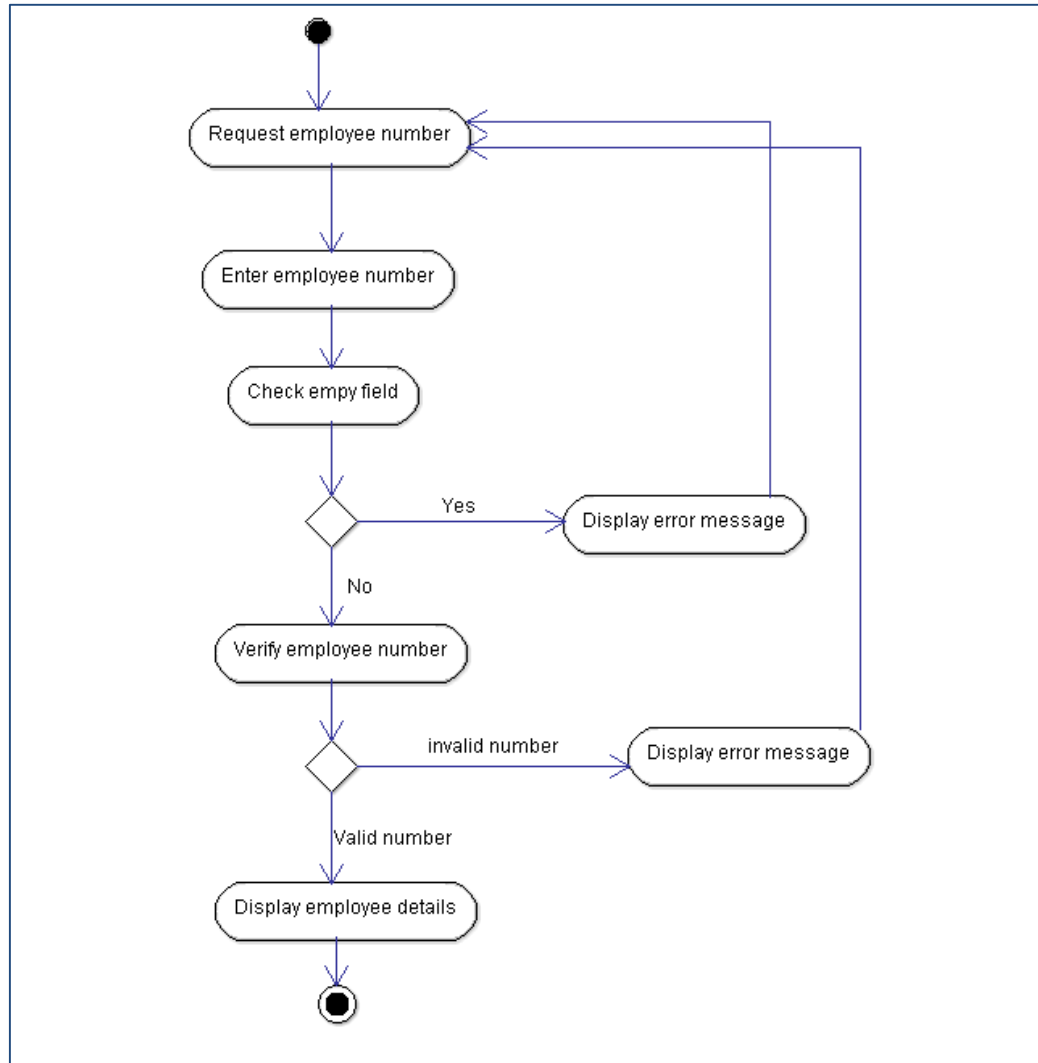


Figure 21 - Activity diagram for 'view registered employee' use case

Figure 22 shows the activity diagram for the 'add a new product' use case.

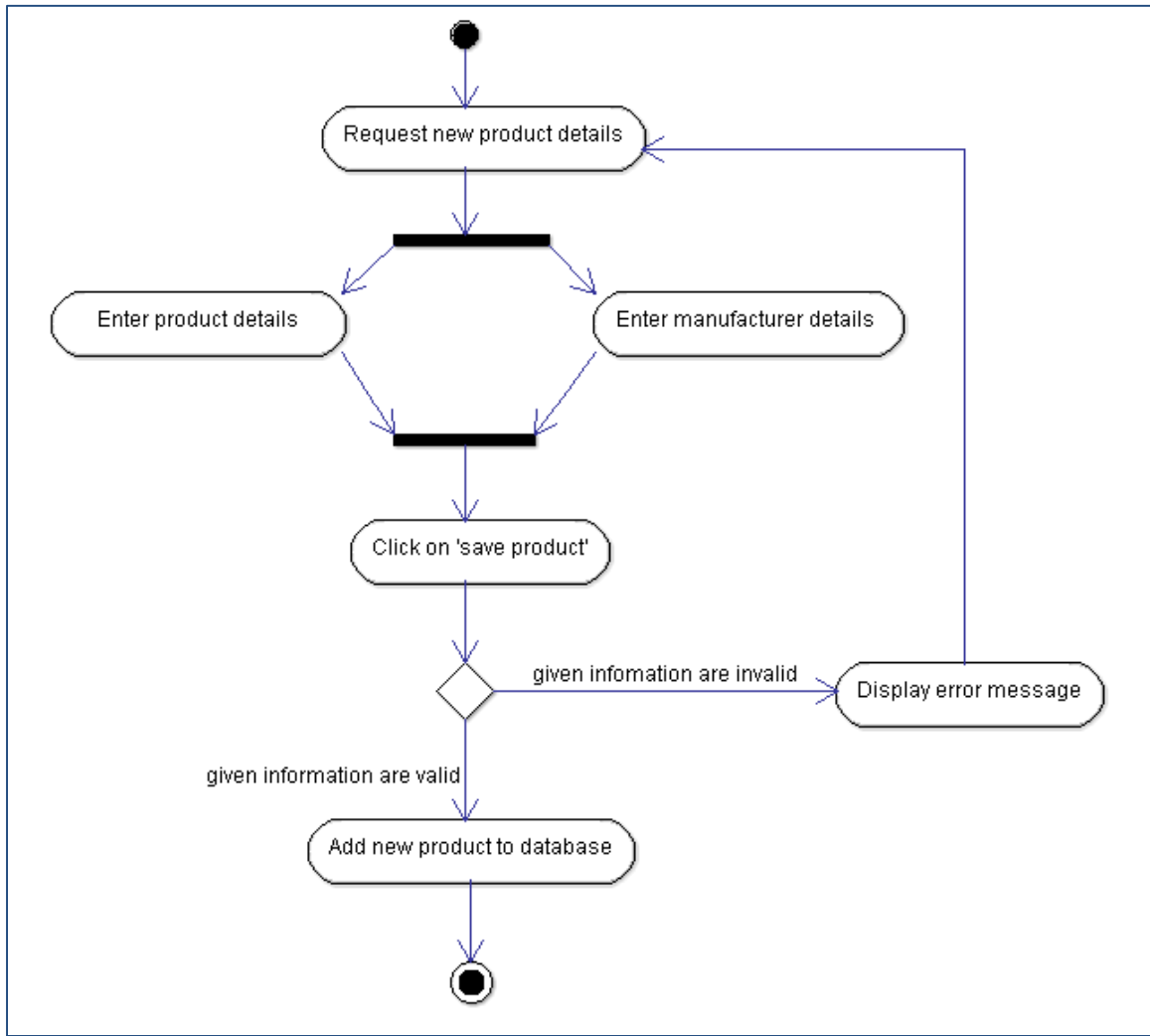


Figure 22 - Activity diagram for 'add a new product' use case



Figure 23 shows the sequence diagram for the 'login' use case.

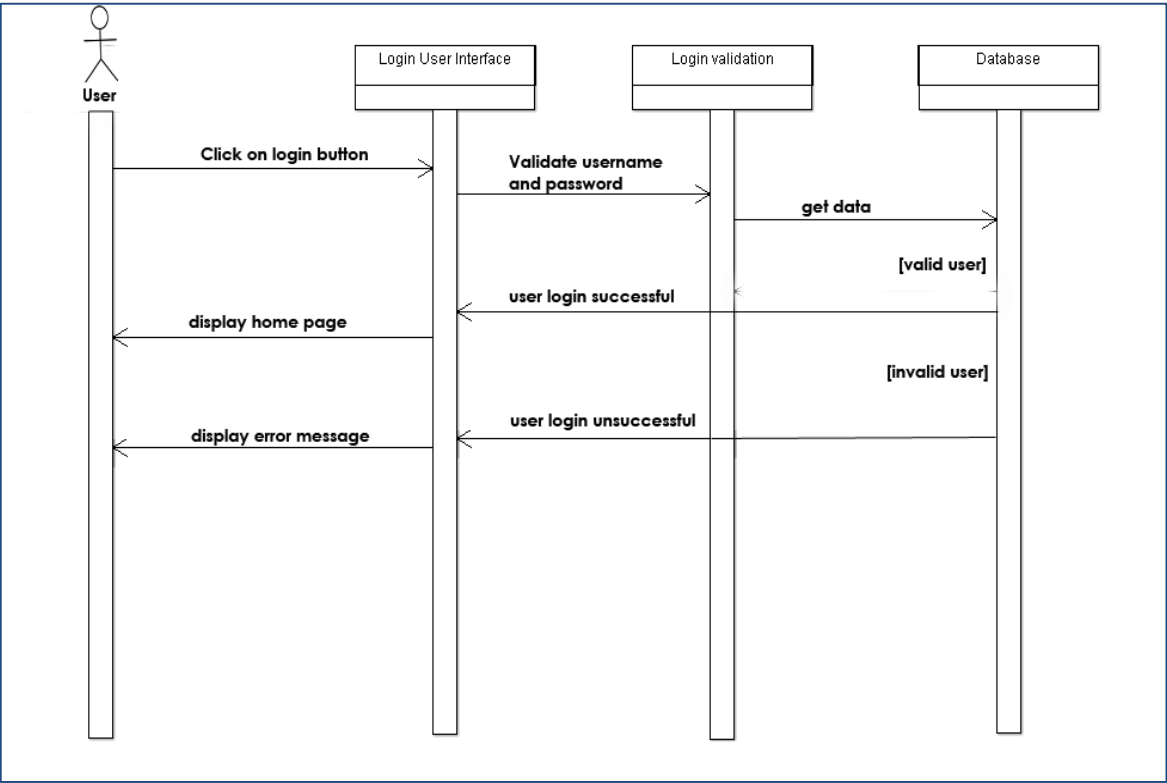


Figure 23 - Sequence diagram for 'login' use case

## Appendix C - User Interfaces

Figure 24 shows the user interface of the home page which will be displayed to all users after the login.

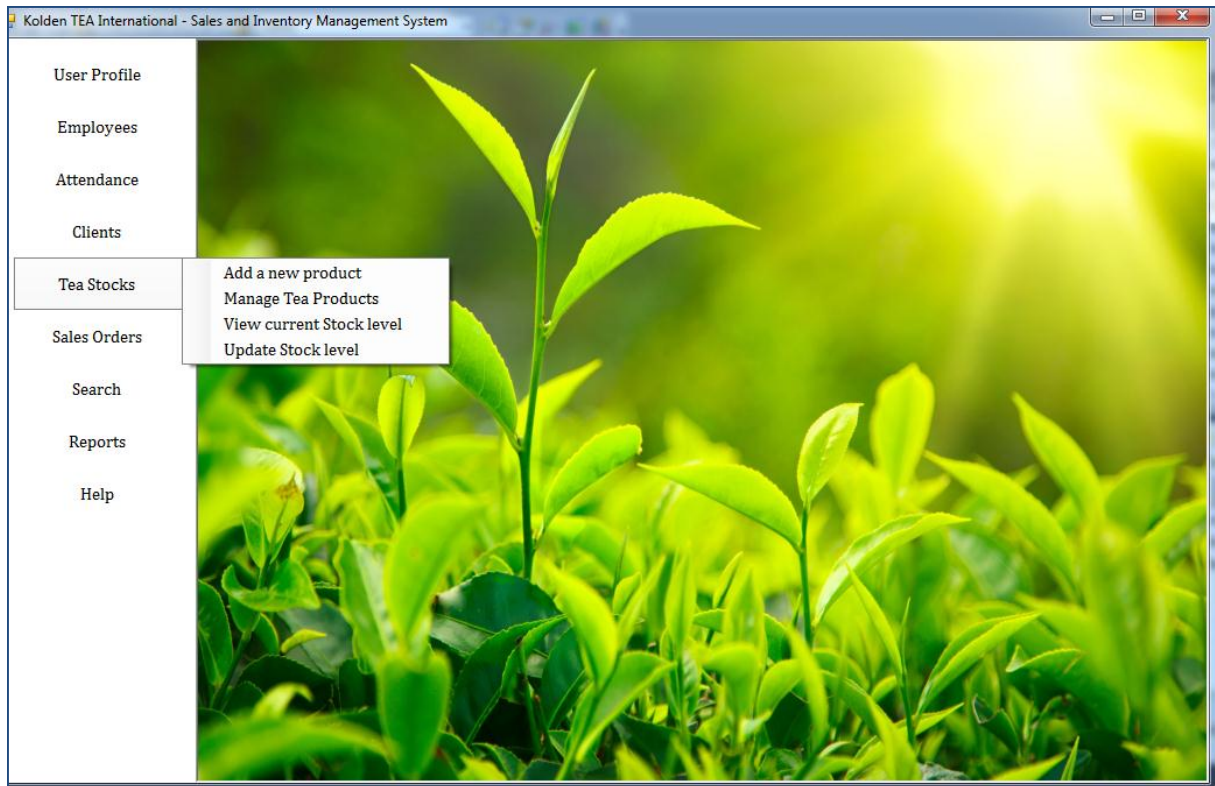


Figure 24 - Home page

Figure 25 shows the user interface of the 'manage employees' page which will be used to modify employee information or to delete the employee.

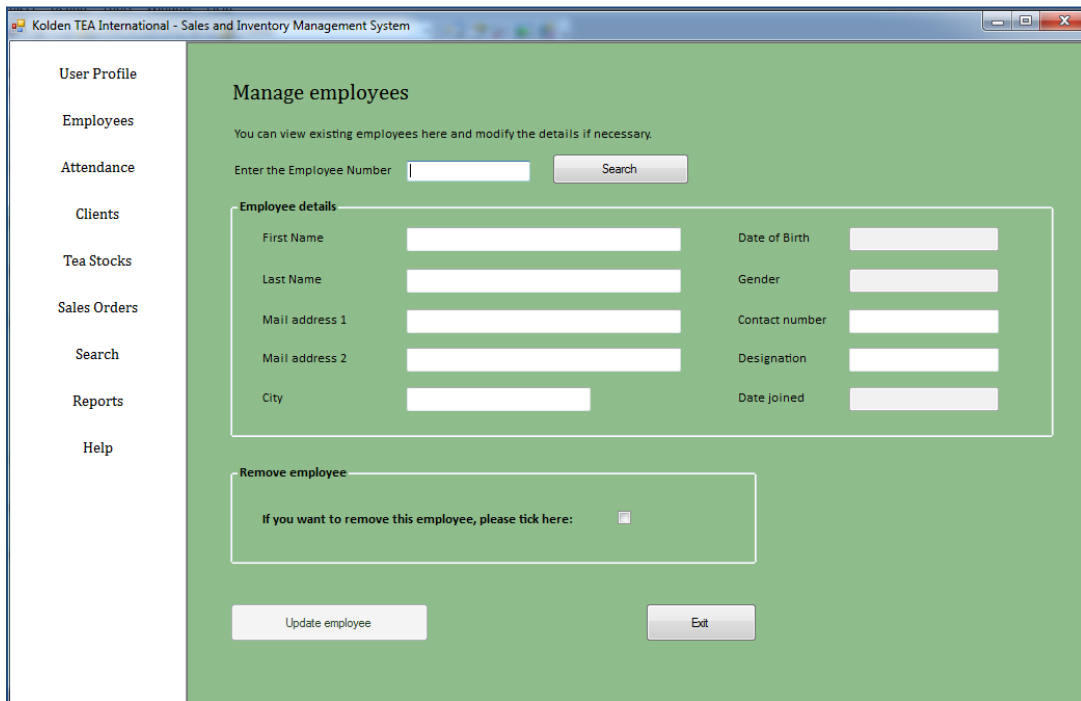


Figure 25 - 'Manage employees' page

Figure 26 shows the user interface of the 'change my password' page.

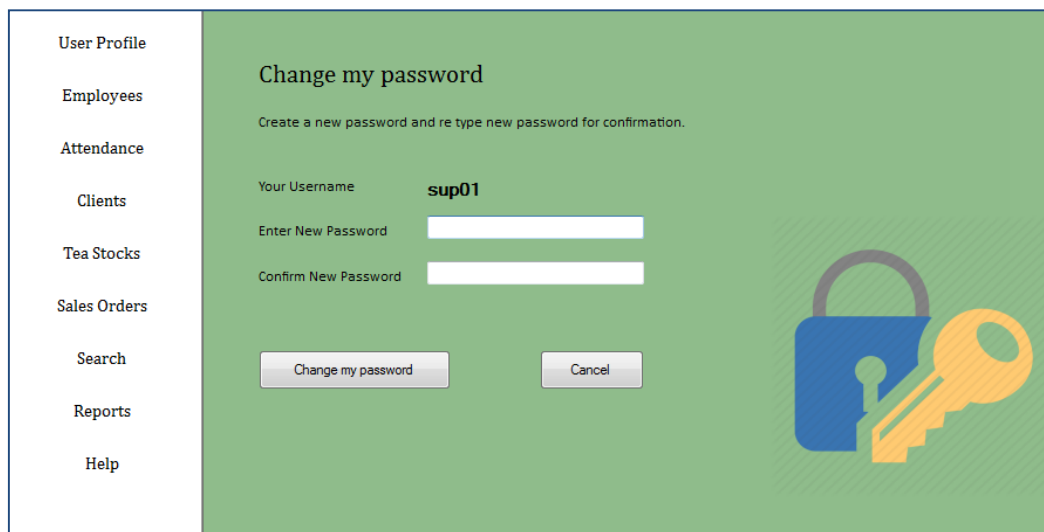


Figure 26 - 'Change my password' page

Figure 27 shows the user interface used to add a new client to the system database.

The screenshot displays a web application window titled "Kolden TEA International - Sales and Inventory Management System". On the left is a vertical sidebar with the following menu items: User Profile, Employees, Attendance, Clients, Tea Stocks, Sales Orders, Search, Reports, and Help. The main content area has a green background and is titled "Add a new Client". Below the title is a sub-header: "You can register a new client here. Please fill all the required fields to create a new client." The form contains the following fields and controls:

- Client ID: Text input field containing "1004".
- Client's category: Radio buttons for "Company" (selected) and "Individual".
- Client's Name: Text input field.
- Email: Text input field.
- Contact number: Text input field.
- Contact person (only if a company): Text input field.
- Designation (only if a company): Text input field.
- Billing address section (enclosed in a white box):
  - Address line 1: Text input field.
  - Address line 2: Text input field.
  - City: Text input field.

At the bottom of the form are two buttons: "Submit" and "Exit".

Figure 27 - 'Add a new client' page

## Appendix D - User Evaluation Form / Questionnaire

Your Name -

Designation -

Please tick on the appropriate box.

Age (in years)       18 – 25       26 – 30       31 – 40       40 - 50       Above 50

Educational Level     G.C.E. O/L       G.C.E. A/L     Degree Holder

Master Degree       Other

Working Experience  Less than 1 year     1 – 2 Years     2 – 5 Years       Over 5 Years

1. How would you rate the interfaces / pages of the system?

Extremely user-friendly

Very user-friendly

Fairly user-friendly

Less user-friendly

Not at all user-friendly

2. How would you rate the speed of Software?

Extremely Fast

Fast

Reasonable

Slow

Very slow

3. Were the Error messages helpful while using the system?

Yes they were very helpful

Sometimes they were helpful

No

4. Were the Error messages displayed at the appropriate places?

Yes

Sometimes

No

5. How would you feel about accuracy of given information through the system?

Very accurate

Not accurate

6. Was the information in the software application well organized?

Yes

Up to some extent

No

7. How helpful is the 'Help manual' of our software?

Extremely helpful

Very helpful

Fairly helpful

Less helpful

Not at all helpful

8. How would you rate the reading of characters on the screen

Good character size

Small

- Too small
- Too large

9. How would you rate the colors used in the system? Were the used colors disturbing or helpful?

- Colors are ok
- Colors are not ok
- Need to improve
- No Idea

10. Is it easy to navigate through the system?

- Yes
- No
- No Idea

11. Are you satisfied with the performance of software?

- Extremely satisfied
- Very satisfied
- Fairly satisfied
- Slightly dissatisfied
- Very dissatisfied

12. How would you rate the entire system?

- Excellent
- very good
- Good except few issues
- Need to improve

Poor / difficult to use

13. Any suggestions to improve our software?

Date -

Signature -



## Appendix E - Test Cases

Test cases for 'Change Password' test item is given in the Table 22.

Test case ID	Test Case	Test Case Description	Expected output	Priority
8	Change password with Blank spaces in the password fields	Use blank spaces for password fields and try to change the password	System should provide a suitable error message	High
9	Change password with the same old password	Enter the previously used password as the new password and try to change the password	System should provide a suitable error message	High
10	Change password with a new password but keep the other field blank	Enter a new password in the first but keep the field 'confirm password' blank and try to change the password	System should provide a suitable error message	High
11	Change password with two different new passwords	Enter a new password in the first field but entering a different character set in second field and try to change the password	System should provide a suitable error message	High
12	Use a new password and retype the same password	Enter a new password in the first field and enter the same password in the second field and try to change the password	Successfully changes user password as the newly entered password and a proper confirmation message should be displayed	High

Table 22 - Test cases for 'Change password' test item

Test cases for ' Add a new user' test item is given in the Table 23.

Test case ID	Test Case	Test Case Description	Expected output	Priority
13	All fields blank and create a new user	Use blank spaces for all fields and try to create a new user	System should provide a suitable error message	High
14	'First name' blank and all other fields valid and create a new user	Keep 'First name' blank and set all other fields with valid values and try to create a new user	System should provide a suitable error message	High
15	'Last name' blank and all other fields valid and create a new user	Keep 'Last name' blank and set all other fields with valid values and try to create a new user	System should provide a suitable error message	High
16	'New password' field blank and all other fields valid and create a new user	Keep 'New password' blank and set all other fields with valid values and try to create a new user	System should provide a suitable error message	High
17	'Confirm password' field blank and all other fields valid and create a new user	Keep 'Confirm password' blank and set all other fields with valid values and try to create a new user	System should provide a suitable error message	High
18	Select no user category and all other fields valid and create a new user	Set all fields with valid values and keep user category without selecting any option and try to create a new user	System should provide a suitable error message	High
19	Enter an existing username and all other fields valid and create a new user	Enter an already existing username in the data base and set all other fields with valid values and try to create a new user	System should provide a suitable error message	High
20	Enter mismatching new passwords and all other fields valid and create a new user	Enter two different passwords and set all other fields with valid values and try to create a new user	System should provide a suitable error message	High
21	All fields valid and create a new user	Enter valid values to all fields and try to create a new user	Successfully creates a new user and a proper confirmation message should be displayed	High

Table 23 - Test cases for 'Add a new user' test item

Test cases for 'Add a new product' test item is given in the Table 24.

Test case ID	Test Case	Test Case Description	Expected output	Priority
22	All fields blank and create a new product	Use blank spaces for all fields and try create a new tea product	System should provide a suitable error message	High
23	'Product Name' blank and all other fields valid and create a new product	Keep 'Product Name' blank and set all other fields with valid values and try to create a new tea product	System should provide a suitable error message	High
24	'Unit' blank and all other fields valid and create a new product	Keep 'Unit' without selecting anything and set all other fields with valid values and try to create a new tea product	System should provide a suitable error message	High
25	'Sales price' blank and all other fields valid and create a new product	Keep 'Sales price' blank and set all other fields with valid values and try to create a new tea product	System should provide a suitable error message	High
26	'Initial stock quantity' blank and all other fields valid and create a new product	Keep 'Initial stock quantity' blank and set all other fields with valid values and try to create a new tea product	System should provide a suitable error message	High
27	'Reorder point' blank and all other fields valid and create a new product	Keep 'Reorder point' blank and set all other fields with valid values and try to create a new tea product	System should provide a suitable error message	High
28	'Manufacturer name' blank and all other fields valid and create a new product	Keep 'Manufacturer name' blank and set all other fields with valid values and try to create a new tea product	System should provide a suitable error message	High
29	'Order cost' blank and all other fields valid and create a new product	Keep 'Order cost' blank and set all other fields with valid values and try to create a new tea product	System should provide a suitable error message	High
30	All fields valid and create a new product	Enter valid values to all fields and try to create a new tea product	Successfully creates a new tea product and a proper confirmation message should be displayed	High

Table 24 - Test cases for 'Add a new user' test item

## Appendix F - Test Cases With Test Results

Table 25 shows the test case for Test case ID - 8 which was used to test the 'change user password' when performed with blank spaces.

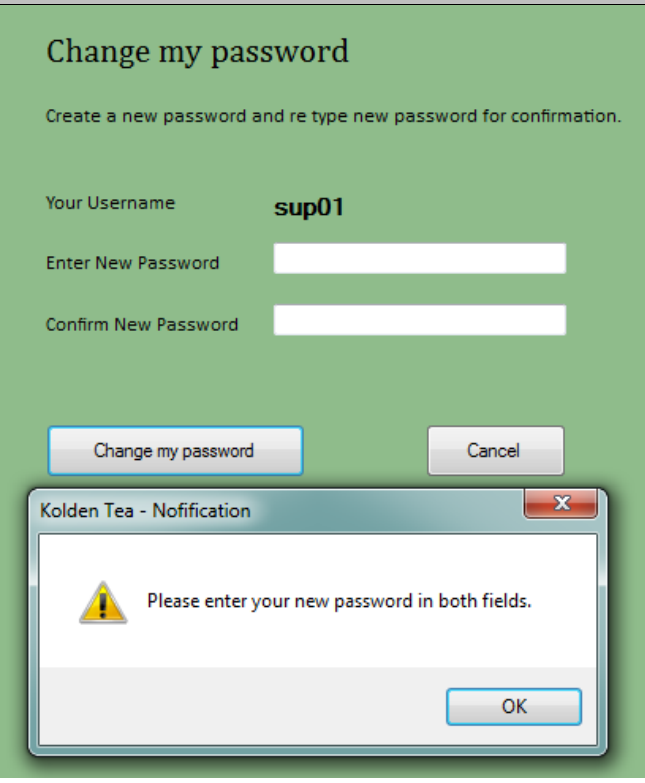
<b>Test Case ID</b>		8	
<b>Tested Component</b>		Change my password Page	
<b>Module Name</b>		User profile Module	
<b>Test Case</b>		Change password with blank spaces in the password fields	
<b>Test Case Description</b>		Use blank spaces for password fields and try to change the password	
<b>Expected Output</b>		System should provide a suitable error message	
<b>Step</b>	<b>Actions and Test Data</b>	<b>Actual Output</b>	<b>Status</b>
1	Access 'Change my password' page		Pass
2	Keep password fields blank without entering anything		
3	Click on 'change my password' button		

Table 25 - 'Change password with blank spaces in the password fields' test case

Table 26 shows the test case for Test case ID - 9 which was used to test the 'change user password' when performed with old password.

<b>Test Case ID</b>		9	
<b>Tested Component</b>		Change my password Page	
<b>Module Name</b>		User profile Module	
<b>Test Case</b>		Change password with the same old password	
<b>Test Case Description</b>		Enter the previously used password as the new password and try to change the password	
<b>Expected Output</b>		System should provide a suitable error message	
<b>Step</b>	<b>Actions and Test Data</b>	<b>Actual Output</b>	<b>Status</b>
1	Access 'Change my password' page		Pass
2	Enter the old password in password fields		
3	Click on 'change my password' button		

Table 26 - 'Change password with the same old password' test case

Table 27 shows the test case for Test case ID - 10 which was used to test the 'change user password' when performed with a new password.

<b>Test Case ID</b>		10	
<b>Tested Component</b>		Change my password Page	
<b>Module Name</b>		User profile Module	
<b>Test Case</b>		Change password with a new password but keep the other field blank	
<b>Test Case Description</b>		Enter a new password in the first but keep the field 'confirm password' blank and try to change the password.	
<b>Expected Output</b>		System should provide a suitable error message	
<b>Step</b>	<b>Actions and Test Data</b>	<b>Actual Output</b>	<b>Status</b>
1	Access 'Change my password' page		Pass
2	Enter a new password and keep the second field blank		
3	Click on 'change my password' button		

Table 27 - 'Change password with a new password but keep the other field blank' test case

Table 28 shows the test case for Test case ID - 11 which was used to test the 'change user password' when performed with two different new passwords.

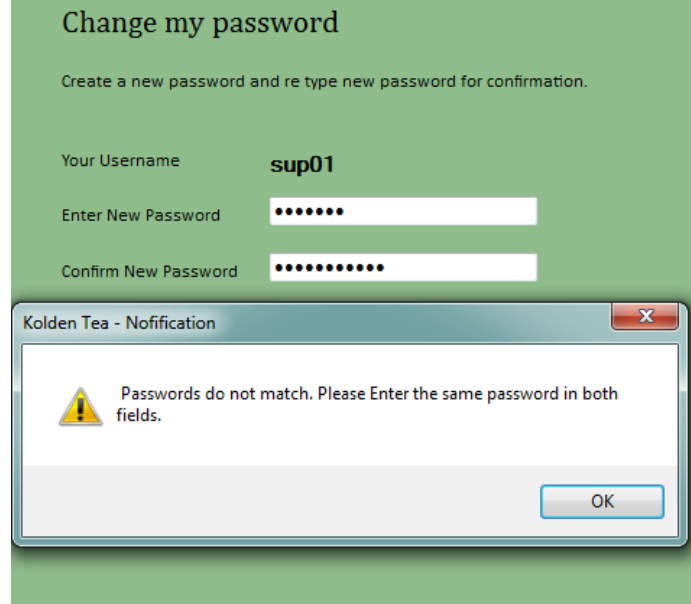
<b>Test Case ID</b>		11	
<b>Tested Component</b>		Change my password Page	
<b>Module Name</b>		User profile Module	
<b>Test Case</b>		Change password with two different new passwords	
<b>Test Case Description</b>		Enter a new password in the first field but enter a different character set in second field and try to change the password	
<b>Expected Output</b>		System should provide a suitable error message	
<b>Step</b>	<b>Actions and Test Data</b>	<b>Actual Output</b>	<b>Status</b>
1	Access 'Change my password' page		Pass
2	Enter a new password in the first field and enter a different password in the second field		
3	Click on 'change my password' button		

Table 28 - 'Change password with two different new passwords' test case

Table 29 shows the test case for Test case ID - 12 which was used to test the 'change user password' when performed with two same new passwords.


<b>Test Case ID</b>		12	
<b>Tested Component</b>		Change my password Page	
<b>Module Name</b>		User profile Module	
<b>Test Case</b>		Use a new password and retype the same password	
<b>Test Case Description</b>		Enter a new password in the first field and enter the same password in the second field and try to change the password	
<b>Expected Output</b>		Successfully changes user password as the newly entered password and a proper confirmation message should be displayed	
<b>Step</b>	<b>Actions and Test Data</b>	<b>Actual Output</b>	<b>Status</b>
1	Access 'Change my password' page		Pass
2	Enter a new password in both password fields		
3	Click on 'change my password' button		

Table 29 - 'Use a new password and retype the same password' test case



## Appendix G - Analysis On The Questionnaire

### Use of error messages

Figure 28 demonstrates how helpful were the error messages while using the IMSM system according to the actual user's feedback.

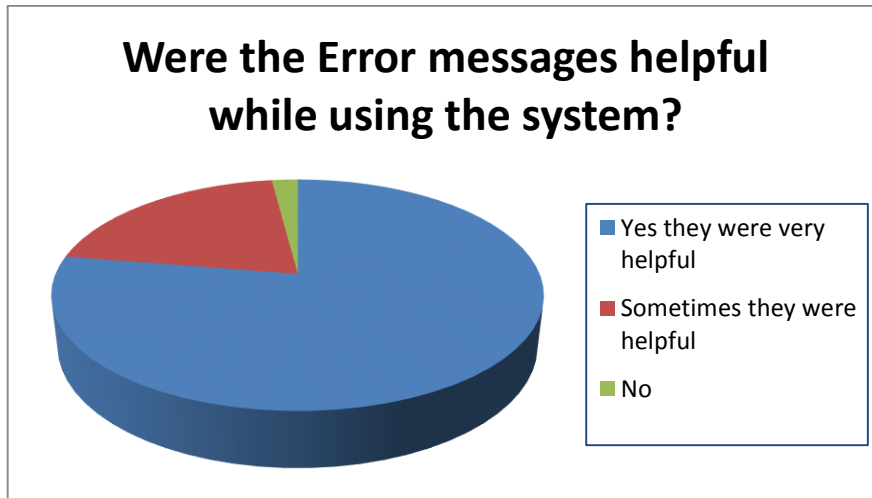


Figure 28 - Use of error messages

### Displaying the error messages at appropriate places

Figure 29 demonstrates the whether the error messages were displayed at proper places according to the actual user's feedback.



Figure 29 - Displaying the error messages at appropriate places

### Accuracy of given information

Figure 30 demonstrates the accuracy of given information through the system, according to the actual user's feedback.

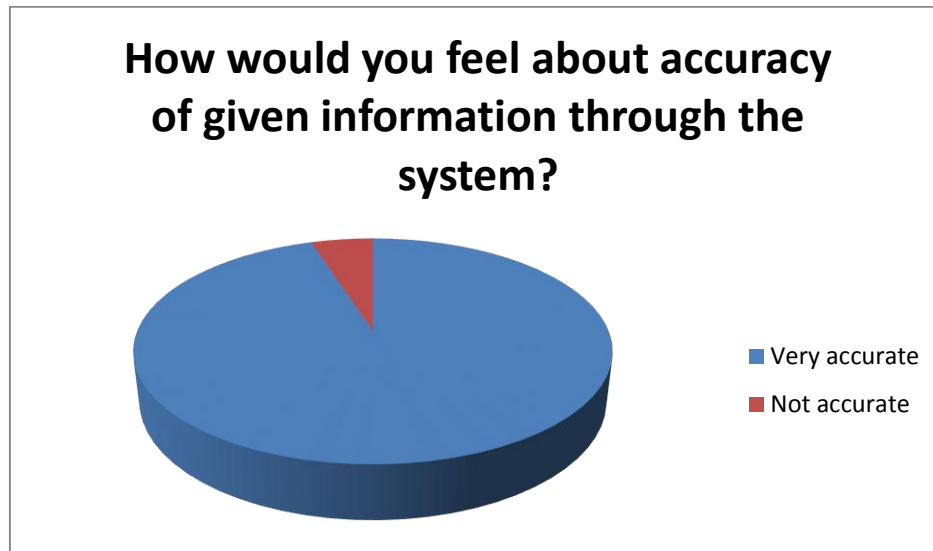


Figure 30 - Accuracy of given information

### How well organize the information of the system

Figure 31 demonstrates how well organize the information of the IMSM system according to the actual user's feedback.

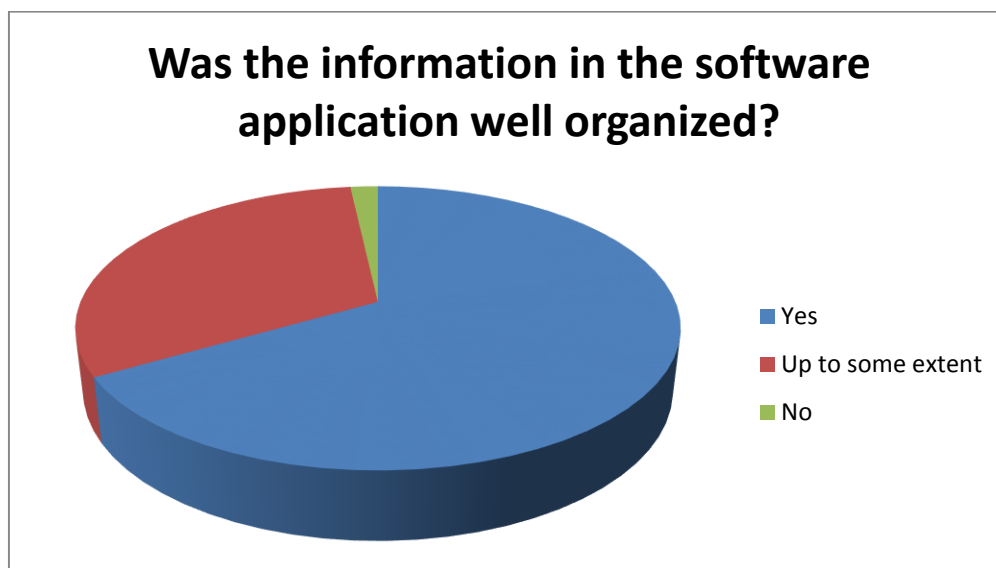


Figure 31 - How well organize the information of the system

### Helpfulness of the 'help manual'

Figure 32 demonstrates how helpful was the provided 'help manual' to the users, according to the actual user's feedback.

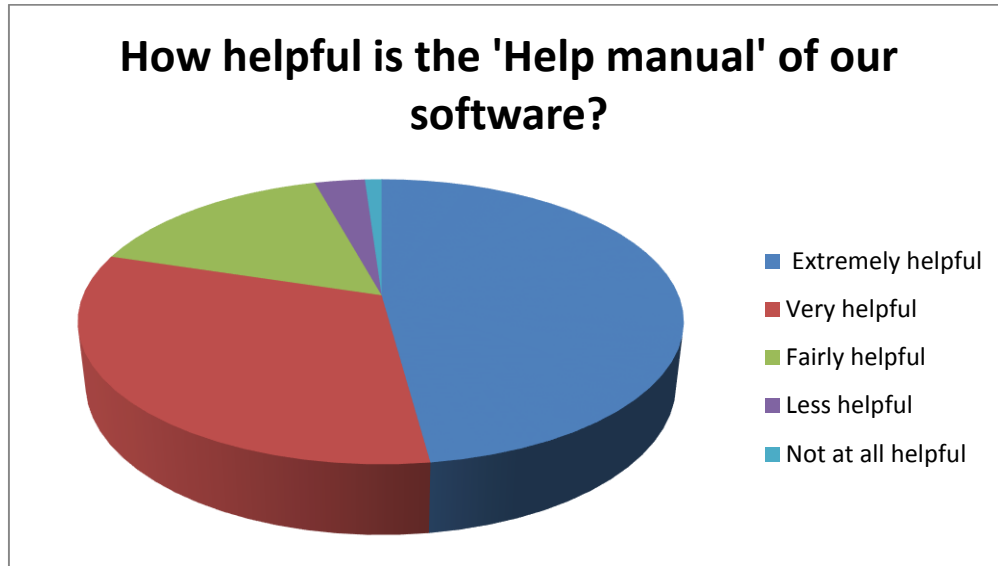


Figure 32 - Helpfulness of the 'help manual'

### Character size of the system

Figure 33 demonstrates user's experience of the character size used in the system interfaces.

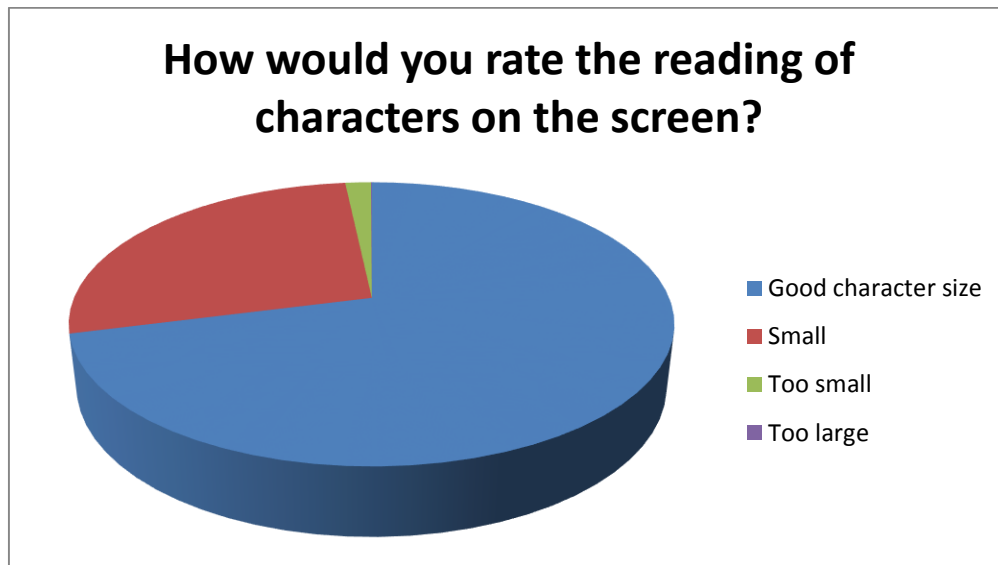


Figure 33 - Character size of the system

### Colors used in the system

Figure 34 demonstrates the user's thought about the colors used in the system interfaces.

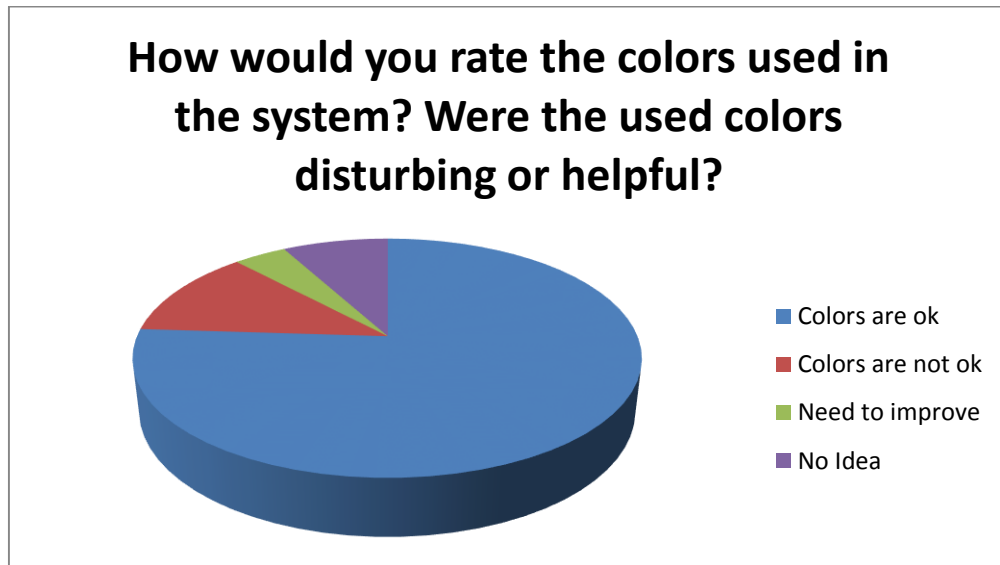


Figure 34 - Colors used in the system

### Navigation through the system

Figure 35 demonstrates the user experience of navigating through the system, according to the actual user's feedback.

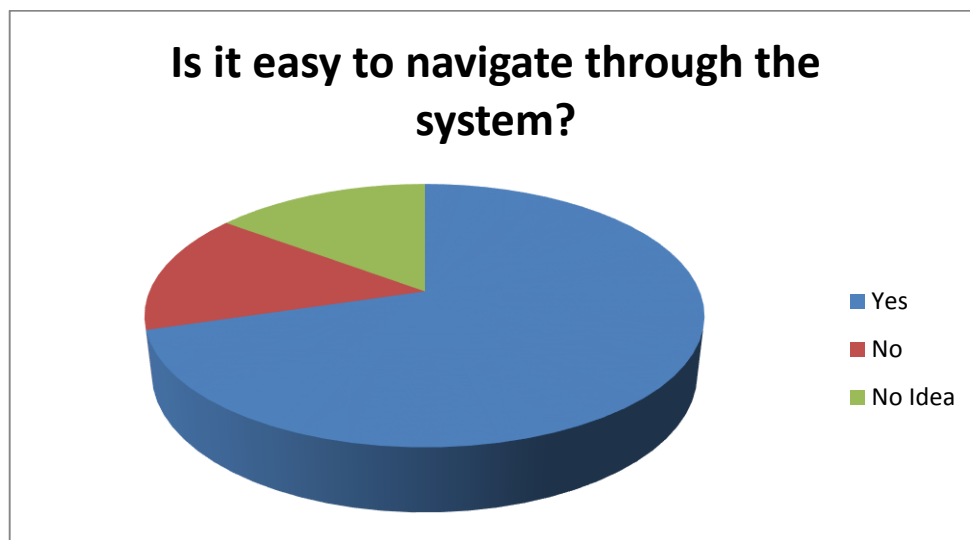


Figure 35 - Navigation through the system

## Performance of software

Figure 36 demonstrates how satisfy the users are regarding the performance of the software.

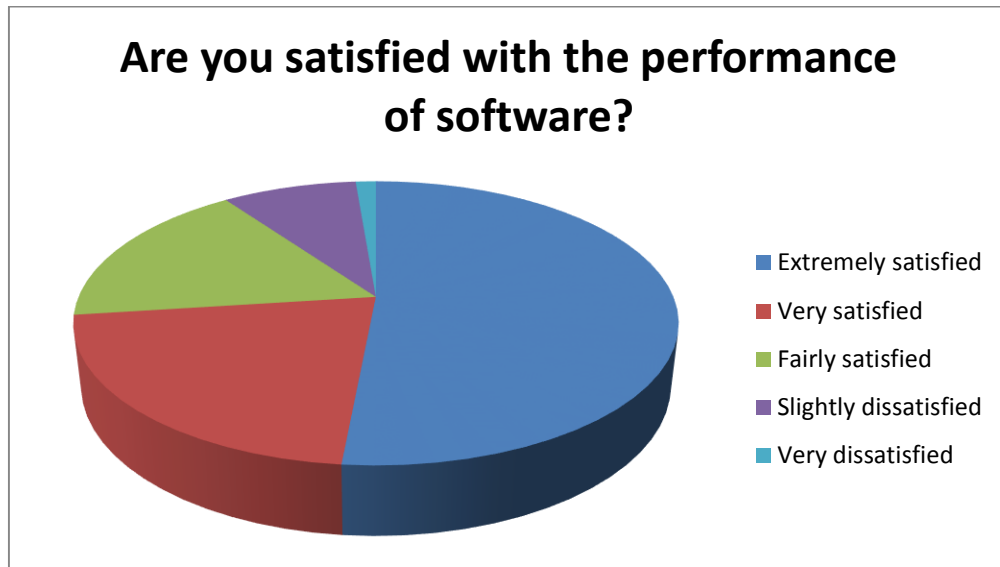


Figure 36 - Performance of software

## Rating the entire system

Figure 37 demonstrates the overall users' rating for the IMSM system.

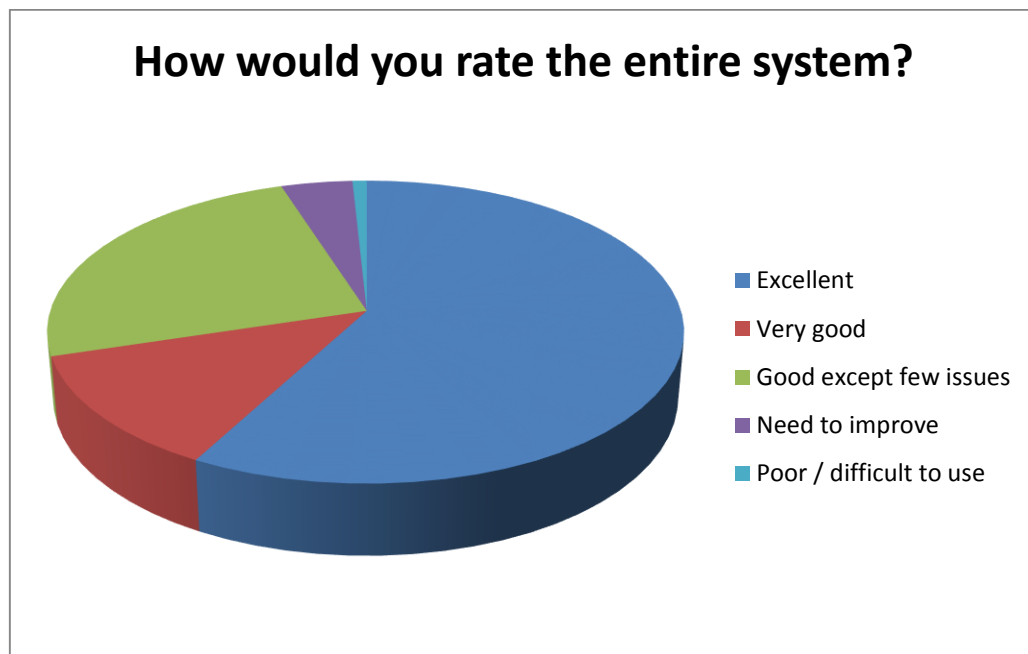


Figure 37 - Rating the entire system