Procurement Tracker

For

MG Medicals (Pvt) Ltd.

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DECLARATION

I certify that this dissertation does not incorporate, without acknowledgement, any material previously submitted for a degree or diploma in any university and to the best of my knowledge and belief, it does not contain any material previously published or written by another person or myself except where due reference is made in the text, I also hereby give consent for my dissertation, if accepted, to be made available for photocopying and for interlibrary loans and for the title and abstract to be made available to outside organizations.

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ABSTRACT

MG Medicals (Pvt) Ltd was founded in 2002 with the vision of bringing superior quality surgical, medical, laboratory equipment and rehabilitation aids to the market.

At present this company uses the MS Office package for keeping track of the procurement, inventory and payments related information.

The company is in the process of extending its services into a wider range of products it is sometimes very difficult to provide information quickly for the management, with the current manual process. It is mainly because of the information is kept in many places and some of them are being duplicated and some of the information is inconsistent with each other and therefore it is not so user-friendly. Additionally, due to the inadequate security controls some of the key information is being vulnerable to unauthorized access.

This Procurement Tracker software will eliminate the drawbacks and difficulties in the present way of working and provide more efficient support to the company.

In this system, mainly four modules were included. The Purchasing Module gives the functionalities such as creating a Purchase Request, Manage Orders, RFQ and generating Purchase Orders. In the Items Module, it includes GRN-Inventory, GRN-Fixed Asset, Fixed Asset Register, Maintenance, Movements and Disposal functionalities. The Reports Module gives a number of reports and the Admin Module consist of specific functionalities for system administration.

This system was developed by using PHP (Hypertext Preprocessor) which is a server side scripting language but without using any frameworks.

MySQL was used for the database management and for the frontend user interfaces, Atlant Front-End Template which is a free, responsive template, was used. Also, JavaScript and jQuery libraries were used as the frontend scripting language.

The system was implemented using the Model–view–controller (MVC) architecture, which is a pattern of dividing the software application into three interconnected parts.

For the development of the UML diagrams 'StarUML' was used. NetBeans and NotePad++ were used as the IDE (Integrated Development Environment).

ACKNOWLEDGEMENT

I would like to take this opportunity to thank all the people who helped and supported me in completing this project. Especially, I would like to express my gratitude to the BIT Coordinator and the staff of the UCSC for giving us this opportunity to follow this recognized degree programme and providing us with their guidance throughout the programme.

Special thanks to Mr. Gratian Almeda - Director and Mr. Broney Almeda - General Manager of MG Medicals, for giving me the opportunity to do this project for the company.

My deepest gratitude to Mr. Fayaz Thahir for being my project supervisor and for his guidance throughout the completion of this project.

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CSS	–	Cascading Style Sheets
DBMS	–	Database Management System
HTML	–	Hypertext Mark-up Language
PHP	–	Hypertext Pre- processor
PDF	–	Portable Document Format
RUP	–	Rational Unified Process
SQL	–	Structured Query Language
UML	–	Unified Modeling Language
URL	–	Uniform Resource Locator
XAMPP	–	Cross-Platform Apache MySQL PHP and Perl

CHAPTER 1: INTRODUCTION

MG Medicals (Pvt) Ltd has been founded in 2002 with the vision of bringing superior quality surgical, medical, laboratory equipment and rehabilitation aids to the market.

At present the company uses the MS Office package to keeping track of the procurement, inventory and payments related information.

The company is in the process of extending its services into a wider range of products it is sometimes very difficult to provide information quickly for the management, with the current manual process.

This Procurement Tracker software will eliminate the drawbacks and difficulties in the present way of working and provide more efficient support to the company.

The current manual process consumes more resources, time and sometimes it is difficult to present the required information quickly for the management.

1.1   Motivation for Project

The way of working in the present manual process sometimes seems to be inefficient and difficult for the management to get the required information quickly as they must rely heavily on the Logistics and Finance Staff.

The successful implementation of this project will increase the efficiency of the procurement management process in the company and therefore, this new system will help the management team to find the required information in a self-service manner.

By implementing such a project, it has given me the opportunity of applying my theoretical knowledge gained throughout the degree programme to a real-world problem in a much practical way.

1.2 Objectives of the project

The main objective of the project is to increase the efficiency and effectiveness of the Logistics department and provide management information in an accurately, completely and timely manner.

Here is a list of objectives of the project:

- To provide a system which helps to maintain and manage procurement details efficiently and increase the availability of the information and improve the efficiency of the current manual system in managing the information.
- Generate reports and let the decision makers to take effective decisions.
- The system should be as simple as possible, so that an employee with average computer skills would be able to use it after a quick training.
- Generate timely reports and charts.

Critical functionalities for the project:

1. System security and User Management
2. Optimum performance
3. Management Reports
- System Installation guide and test cases

1.3 Scope of the project

The proposed computer system will enable to track all the procurement related information in MG Medicals. It would meet the functional and non-functional requirements of the company, where it will be helping with the day to day activities relating to Procurement Management and it will provide necessary reports for the users.

The scope of the project is limited to,

- User management
- Purchase Order processing
- GRN entries
- Inventory monitoring
- Payment processing

- Reports and charts
- Alerts and notifications

In future enhancement, it can be addressed the Inventory Forecasting and Budgeting modules.

1.4   Structure of the Dissertation

This dissertation consists of six main chapters, which brings the details of the flow on how this project was carried out.

The Analysis chapter includes the current ways of working and what are the drawbacks of them and what are the functional and non-functional requirements for the new computerized system. Next the Design chapter elaborates the overall system designing with relevant diagrams and it includes the design methodologies of the system, tools which were used during this phase. Also, it reveals the user interfaces, databases, components, and modules that address the specified requirements.

Implementation Chapter describes the entire system development process which includes software tools that are used in the implementation environment, the development of the user interfaces, coding of the modules, databases, and etcetera. The Evaluation chapter describes a various testing process which focuses on validating and verifying whether the developed computer system meets the requirements. This includes the unit test, integration tests, and the user acceptance tests.

Finally, the Conclusion chapter which concludes the dissertation by summarizing the achievements, lessons learnt during the project and suggestions for the future enhancements that can be done to the system.

CHAPTER 2: ANALYSIS

2.1 Introduction

This chapter describes how the detailed requirements were analyzed that includes current ways of working and what are drawbacks in them and what are the requirements for the new computerized system and requirement analysis techniques that have been used to capture the functional and non-functional requirements.

The outcome of this stage would be,

- Determine the scope of the project
- Determine the requirements of the system
- Determine the criteria for acceptance
- Potential risks

2.2 Project Goal

The goal of this project is to provide a quality software solution for the organization which covers the identified project scope with the customer satisfaction. Any information System can be examined in terms of four building blocks.

- ***Data*** : The raw material used to create useful information.
- ***Processes*** : The activities that carry out the mission.
- ***Interfaces*** : How the system interacts with people.
- ***Geography*** : Where data is stored, processes & interfaces happen.

2.3 Requirement Gathering Techniques

Requirement gathering is a vital role in system analysis. The capacity & quality of gathering and analysing the requirements will determine the quality of the final product. To collect information about a system, requirements, and preferences, it is usually done through interviews, questionnaires, research and other techniques. This is also known as fact-finding, information gathering or data collection.

There are mainly seven fact-finding techniques in use,

1. Study & sampling of existing documentation, forms and databases.
2. Research and site visit.
3. Observation of the work environment.
4. Questionnaires
5. Interviews
6. Joint Application Development (JAD)
7. Rapid Application Development (RAD)

In this project, following data collection techniques were used.

- Interviews
- Documents and Reports reference
- Observation

Interviewing is the most useful and common technique in the fact gathering process. In this project, it was mainly interviewed the Purchasing Officer, Finance Officer and the General Manager.

Additionally, more facts were gathered by referring the 'Procurement Policy' documentation and the word documents, spreadsheets which is in use for purchasing information tracking.

In addition to that, some more information was collected through observing the ways of working, including how the process is carried out starting from placing the purchase orders, receiving items and recording up to the final stage.

2.4 Analyzing the current manual system

The Figure 2.1 shows the existing manual system that the company. The main drawback of the manual system is the manager should depend on several reports from each functional person to have a clear picture on the situation and take a decision. It is a very time consuming process.
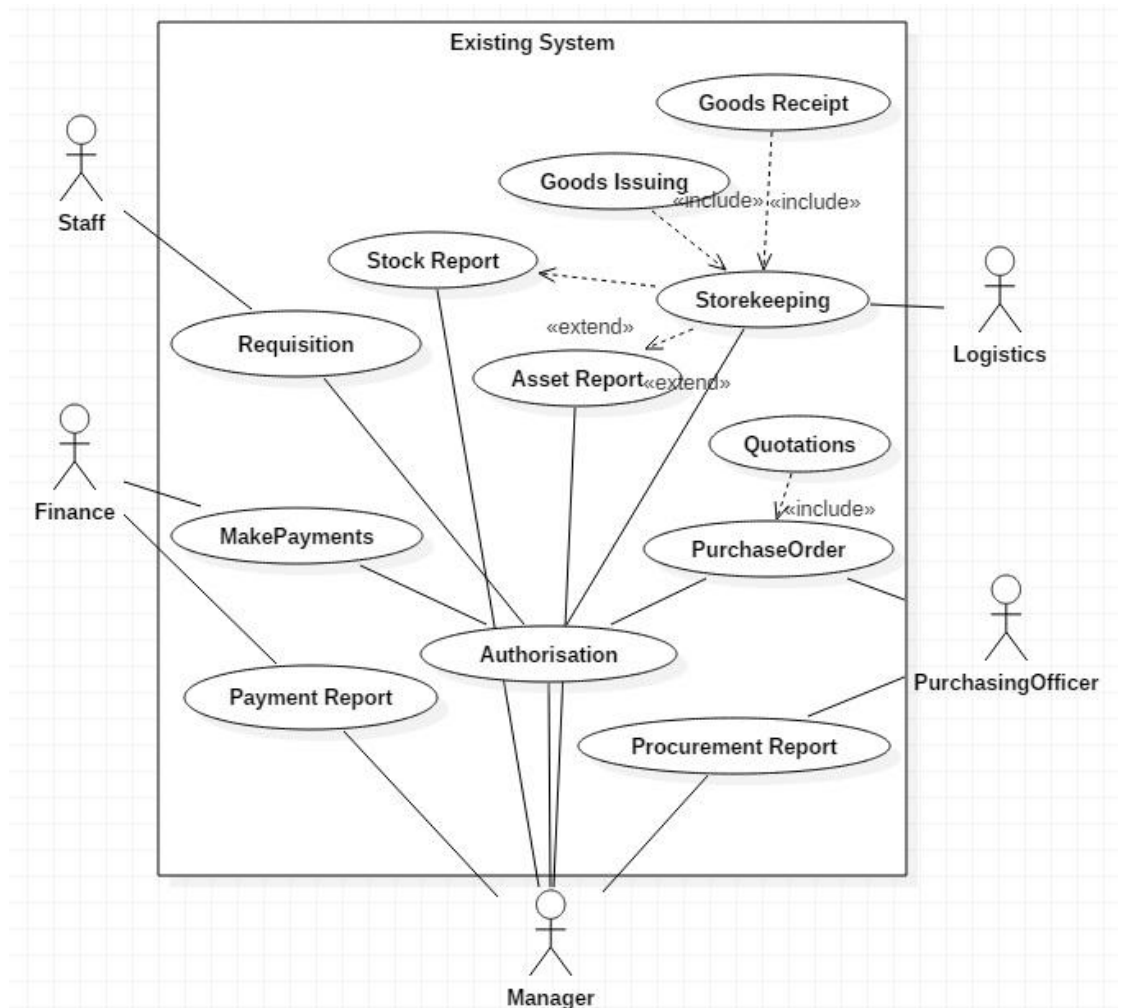

Figure 2.1: Use case diagram of the manual system

2.5 Existing similar systems

A cloud based Procurement solution. Manage Suppliers and Contracts, receive automated alerts of key dates, monitor risk, manage workload and store files and messages - all in one place – company-wide. Gatekeeper's suite of reporting, collaboration and alert tools make Supplier and Contract management easy and effective.

In the positive side, getting data into Gatekeeper has been simple and the benefits have far exceeded our original objectives. The dashboards in Gatekeeper provide such a clear view of our data so we can be proactive, renewing contracts on better terms and cancelling contracts we do not need well in advance. Gatekeeper is simple to use and when some help or guidance is needed, support is always available online in their Live Chat feature [1].

On the negative side, this software includes some unnecessary features that are the company will never use but still the company will have to pay in dollars which will be costing around Rs. 810,000 per year!

Starting Price: $450.00/month

Purchase Order System is a complete cloud based system that streamlines the way the organization buys goods & services.

But on the negative side there are almost no feedback messages to indicate success or error. When error, it does not indicate clearly where the error is or take focus to that field. It is not customizable - user cannot control which columns to include, nor control column widths on printed Purchase Order(PO).

Same for lists of PO's, Suppliers and Products. User has no choice of number format, and numbers are left-aligned instead of right-aligned and cannot be changed. It is very difficult to match with invoice if there are differences in amount and comes up a meaningless message. No error message warning about this being a cancelled PO.

On the plus side, it has a good approval system, PO's can be sent directly to supplier on approval. Quotes or any other literature can be uploaded and attached to a PO [1].

This software includes some unnecessary features and the company will need to pay in dollars which will be costing around Rs. 19,800 per year per user!

Starting Price: $11.00/month/user
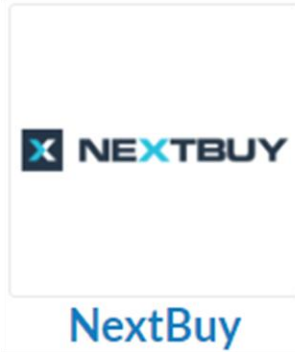
NextBuy is an innovative purchasing platform which supports Supplier Relationship Management (SRM). It is flexible architecture that enables quick & easy adjustments to users' requirements and the type of business they run. Nextbuy offers the complete P2P process in one platform.

All modules are working seamlessly and are perfect integrated. The reporting function helps us to analyze the KPIs and provides a complete business intelligence for our purchasing decisions. We could use Nextbuy right away without any implementation. This was a key factor why we selected this solution [1].

Similarly, the negative side is, this software includes some unnecessary features and the company will have to pay in dollars which will be costing around Rs 45,000 per year per user!

Starting Price: Light User $4 Full User $25 /month/user

In today's market, there are many proprietary software and some open-source software available but these solutions comes with unnecessary features and some of the mandatory features are not available as per the requirements. Therefore, the client has decided to go for the customized software based on the organization's policies and their specific requirements.

2.6 Functional requirements

Below stated are the functional requirements in brief that the system will provide.

- User management:
    - According to the user privileges, it controls the access to the modules.
    - Admin User will have access to all the functional areas in the system.
    - Admin User can create or terminate the user accounts, update the database tables.
- Purchase Order processing:
    - Purchasing Officer will have access to this component.
- GRN entries
    - The Logistics Officer will be able to access this component and update the GRN entries.
- Inventory monitoring
- Asset monitoring
- Maintenance history
- Reports and chart
- Alerts and notifications

Reporting:

Reporting Functionality will include standard system reports that can easily be generated by the users. System will also support ad-hoc reports, queries, and be able to access data in summary or in detail and supporting documentation on-line and will support downloading of reports, screen data and documents into user defined formats and output formats (i.e. Excel, PDF).

- Full Data Extract report is available in PDF format, where it gives all most all the information about the Assets.

2.7 Non-Functional requirements

2.7.1 Availability

The system must be available 100% for the user whenever they try to access it.

2.7.2 Usability

The user interfaces of the system should be simple and self-explanatory so that it can be easily understood by the ordinary people since most of the users are experiencing this system for the first time. In addition, there will be online support provided and a soft copy of the user guide is available for reference.

2.7.3 Extendibility

The system must be designed and developed, in way where it can be extended upon future requirements.

2.7.4 Performance / Time

Processing time: The document processing time taken should be within few seconds. Since document processing unit can be various, the processing time is different. A progress bar will be shown for the document processing.

Response time: This system needs a much quicker time than a typical web application.

As a simulation of traditional web processor is required, the user needs an instant response like offline system.

CHAPTER 3: DESIGN

3.1 Introduction

Software design is the process by which an agent creates a specification of a software artifact, intended to accomplish goals, using a set of primitive components and subject to constraints. Software design may refer to either "all the activities involved in conceptualizing, framing, implementing, commissioning, and ultimately modifying complex systems" or "the activity following requirements specification and before programming, in a stylized software engineering process."

Software design usually involves problem-solving and planning a software solution. This includes both a low-level component and algorithm design and a high-level, architecture design.

The purpose of System Design is to create a technical solution that satisfies the functional requirements for the system. At this point in the project lifecycle there should be a Functional Specification, written primarily in business terminology, containing a complete description of the operational needs of the various organizational entities that will use the new system. The challenge is to translate all this information into Technical Specifications that accurately describe the design of the system and that can be used as input to System Construction [2].

3.1.1 Architectural Design

The architectural design of a system emphasizes on the design of the systems architecture which describes the structure, behavior, and more views of that system and analysis.

3.1.2 Logical Design

The logical design of a system pertains to an abstract representation of the data flows, inputs and outputs of the system. This is often conducted via modeling, using an over-abstract (and sometimes graphical) model of the actual system. In the context of systems, designs are included. Logical design includes entity-relationship diagrams (ER diagrams).

3.1.3 **Physical Design**

The physical design relates to the actual input and output processes of the system. This is explained in terms of how data is input into a system, how it is verified/authenticated, how it is processed, and how it is displayed. In physical design, the following requirements about the system are decided.

1. Input requirement
2. Output requirements
3. Storage requirements
4. Processing requirements
5. System control and backup or recovery

The physical portion of systems design can generally be broken down into three sub-tasks:

1. User Interface Design
2. Data Design
3. Process Design

User Interface Design is concerned with how users add information to the system and with how the system presents information back to them. Data Design is concerned with how the data is represented and stored within the system. Finally, Process Design is concerned with how data moves through the system, and with how and where it is validated, secured and/or transformed as it flows into, through and out of the system. At the end of the systems design phase, documentation describing the three sub-tasks is produced and made available for use in the next phase.

Physical design, in this context, does not refer to the tangible physical design of an information system. For the designing of this project, the following diagrams were used.

3.1.4 **Use Case Diagram**

A **use case diagram** at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well [3].

This system has six user groups, each with its own set of privileges and responsibilities: Staff User, Manager, Logistics, Finance, Purchasing Officer, Administrator.

Most of the users in this system will be a member of the staff user group.

Administrators have all the privileges of data entry operators. In addition, administrators can add, modify, and terminate users within the system. They also could manage user accounts. Administrators have the responsibility of maintaining the integrity of the database by ensuring that the entries in the database correspond to what is physically owned, as well as updating the database's base tables, taking file backups. Especially they have the rights to delete orders, items, etc.

The manager user group has more privilege than the staff user group, where they could approve the requisitions and generate their budget reports.

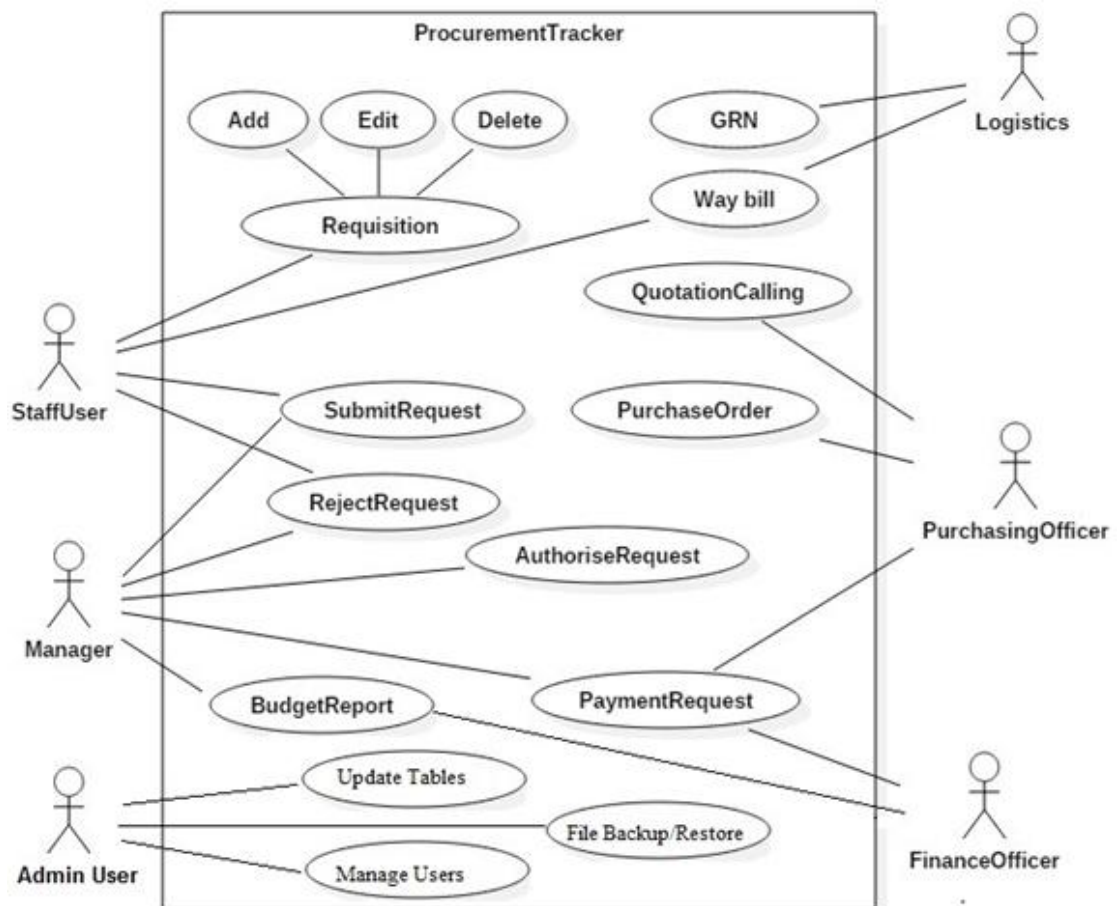The Figure 3.1 shows the top level use case diagram of the proposed system.

Figure 3.1: Top level use case diagram

The following Figure 3.2 shows the use case diagram for the Purchasing Module.

In the Purchasing Module, the staff member will initially create the Purchase request and it will appear under the Manager Orders page where the Manager could either reject the request or authorize it. The authorized purchase requests will be available for the Purchasing Officer to create the RFQ (Quotation calling) and then after selecting the potential supplier they can create the Purchase Order.

More information can be found in the APPENDIX B - Design Documentation.
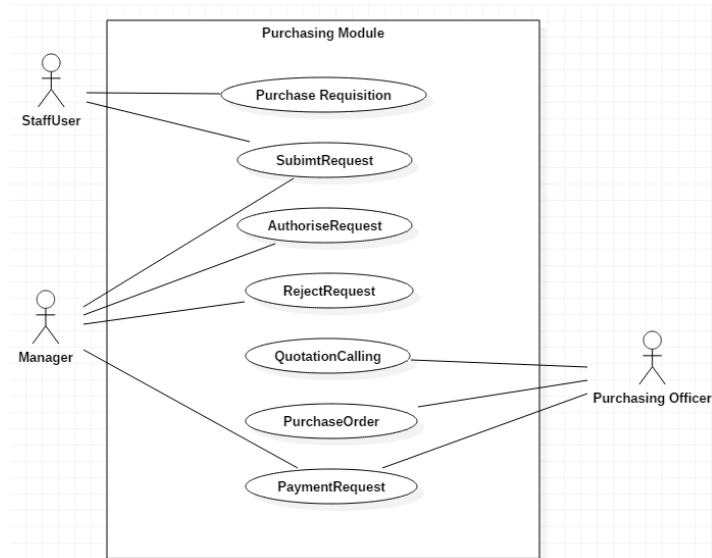

Figure 3.2: Purchasing Module use case diagram

The Figure 3.3 shows the use case diagram for the Items Module.

In this Module the Logistics Officer can add the GRN entry and then issue the items to the staff by creating a Waybill entry. Additionally, they will keep the record of Maintenance, Movements and Disposal of Assets.
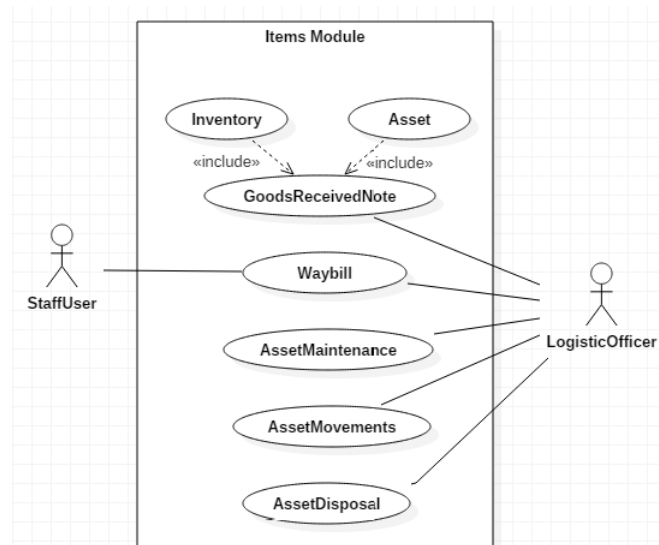

Figure 3.3: Items Module use case diagram

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Below shown Figure 3.4 depicts the use case diagram for the Admin Module.

The Administrator can create new Users and assign them into required user groups. Also it is possible to edit or terminate the user access.

In addition to that the Administrator can create and edit the Locations, Supplier Information, Custodian, Asset Types, Maintenance Person information and send notification to the users.

Administrator are the responsible person to create and restore the data backups on the system.
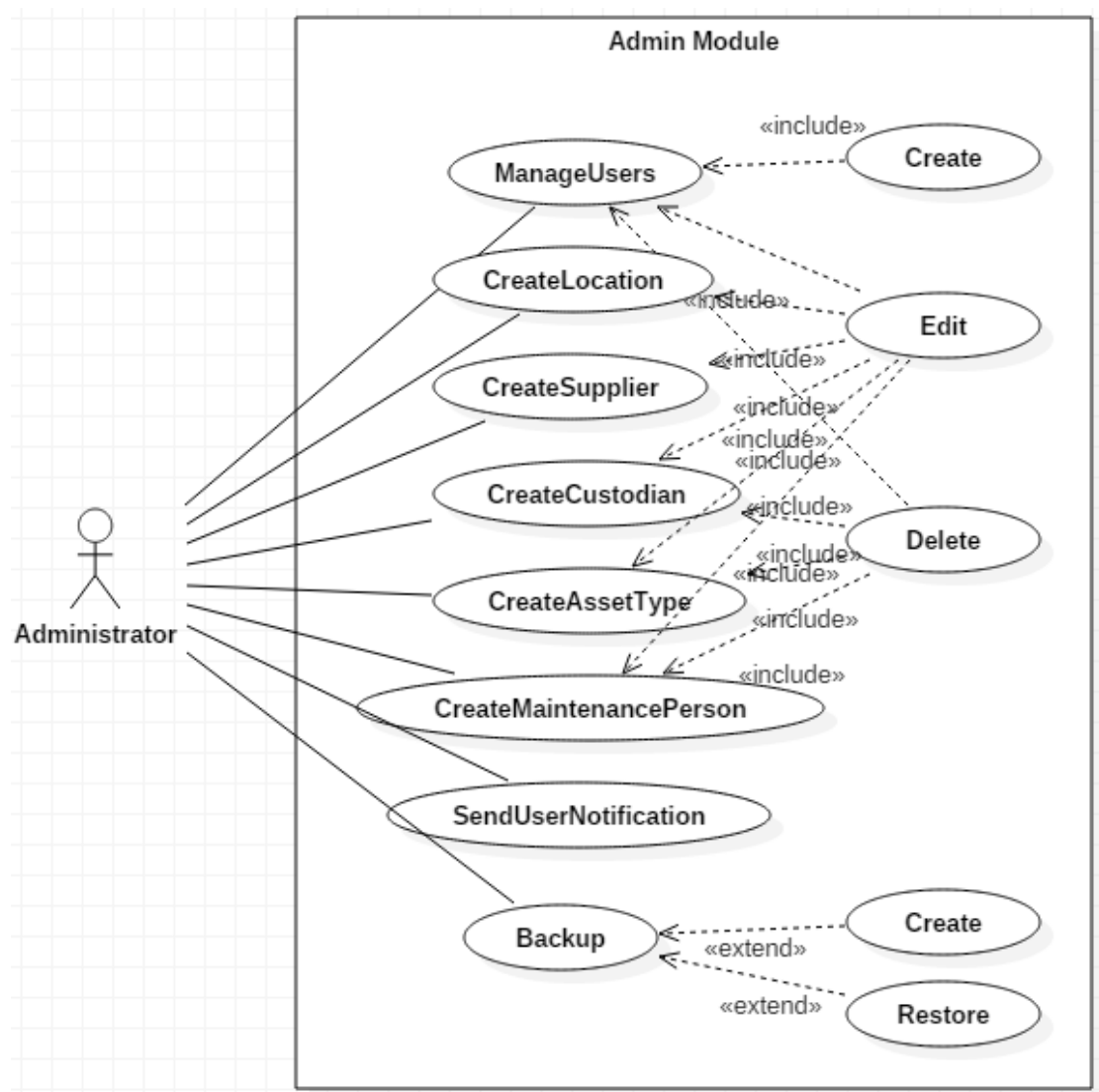
Figure 3.4: Admin Module use case diagram

3.1.5 Class Diagram

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects [4].

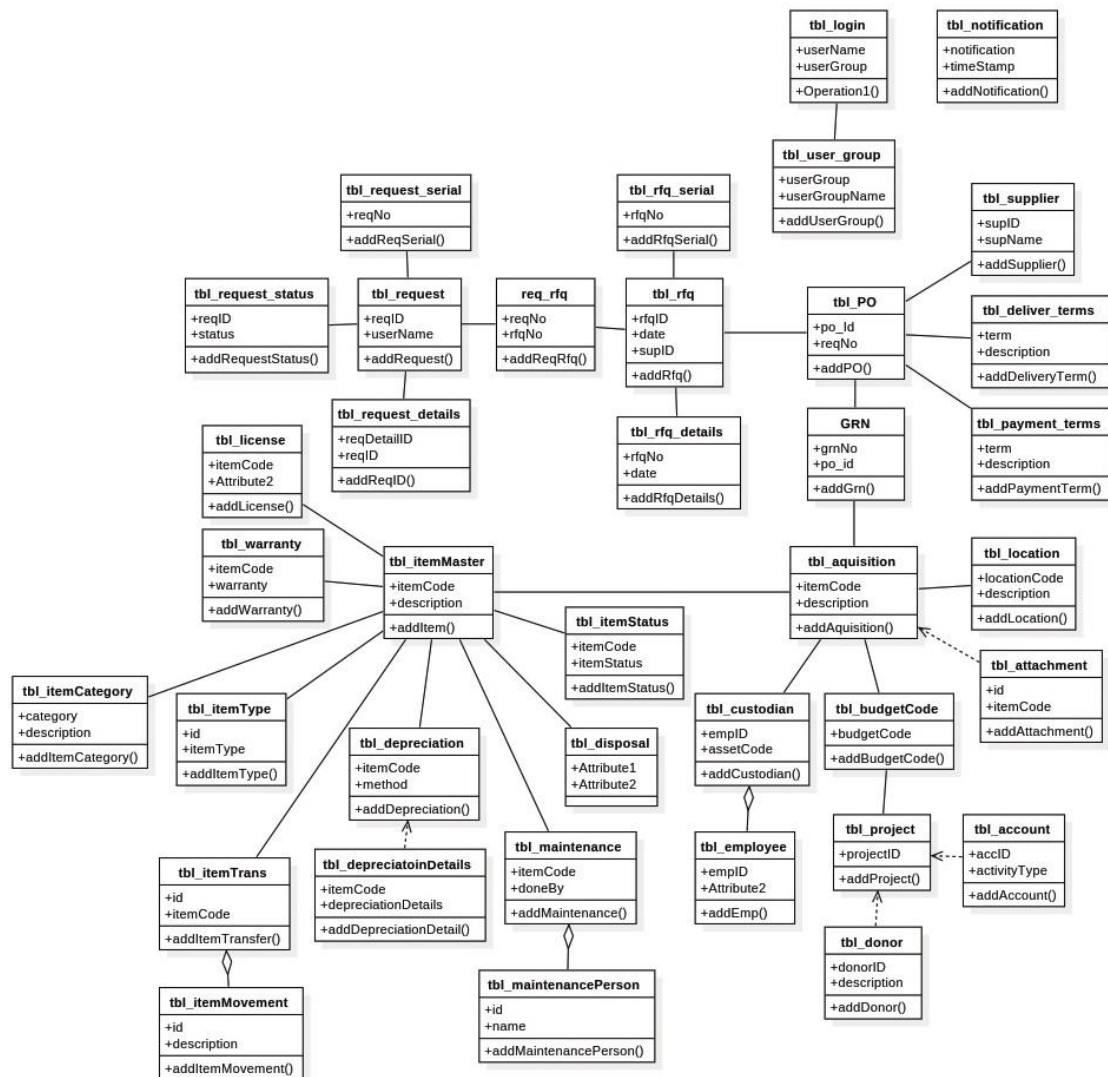Below shown Figure 3.5 depicts the Class diagram for this system.

Figure 3.5: Class diagram

3.1.6 Normalization of Database

For this project, it was normalized up to the Third Normal form only.

But briefly explaining the term 'Database Normalization' is a technique of organizing the data in the database. A normalization is a systematic approach of decomposing tables to eliminate data redundancy and undesirable characteristics like Insertion, Update, and Deletion Anomalies [5].

First Normal Form (1NF)

As per First Normal Form, no two Rows of data must contain a repeating group of information.

Second Normal Form (2NF)

As per the Second Normal Form, there must not be any partial dependency of any column on the primary key.

Third Normal Form (3NF)

Third Normal form applies that every non-prime attribute of the table must be dependent on the primary key, or we can say that there should not be the case that a non-prime attribute is determined by another non-prime attribute.

Boyce and Codd Normal Form (BCNF)

Boyce and Codd Normal Form is a higher version of the Third Normal form.

3.1.7 Entity Relationship Diagram (ERD)

An entity–relationship model (ER model) describes inter-related things of interest in a specific domain of knowledge. An ER model is composed of entity types (which classify the things of interest) and specifies relationships that can exist between instances of those entity types. In software engineering, an ER model is commonly formed to represent things that a business needs to remember in order to perform business processes. Consequently, the ER model becomes an abstract data model that defines a data or information structure that can be implemented in a database, typically a relational database [6].

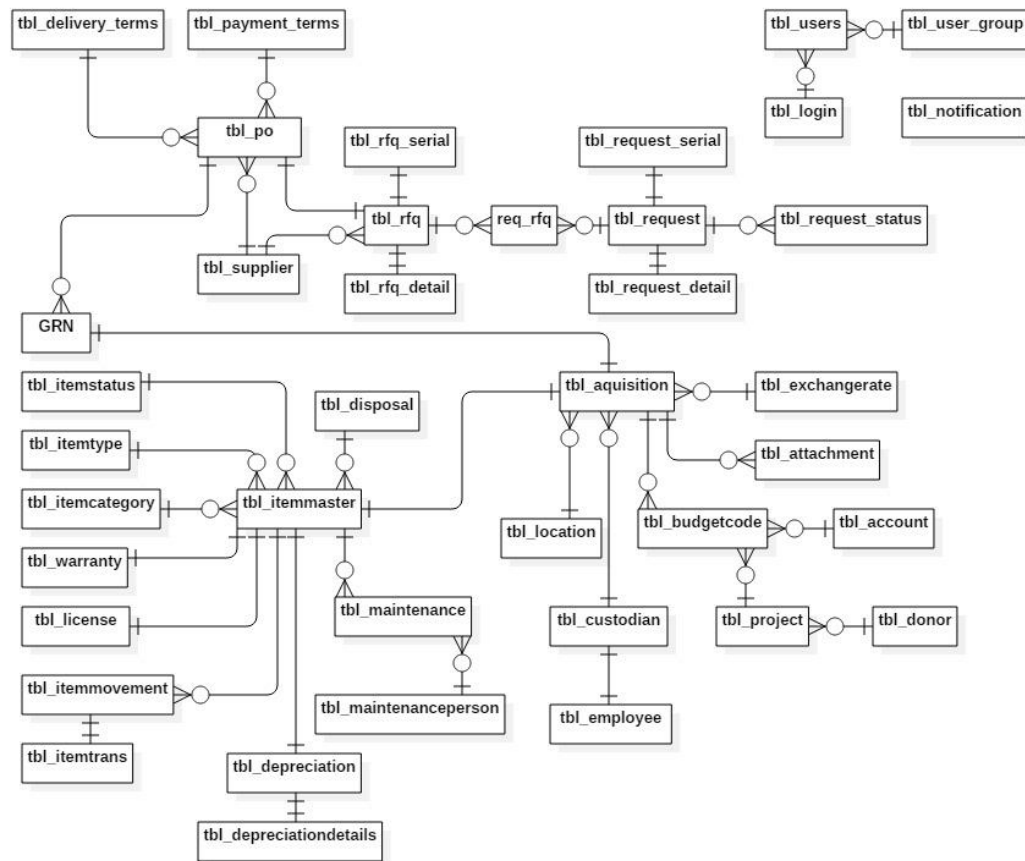The ER diagram which was designed for this system is shown below in the Figure 3.6

Figure 3.6: Database Diagram (ERD)

3.1.8 Activity Diagram

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams are intended to model both computational and organizational processes. Activity diagrams may be regarded as a form of flowchart. Typical flowchart techniques lack constructs for expressing concurrency. However, the join and split symbols in activity diagrams only resolve this for simple cases; the meaning of the model is not clear when they are arbitrarily combined with decisions or loops. The Figure 3.7 shows the Activity diagram of the system.
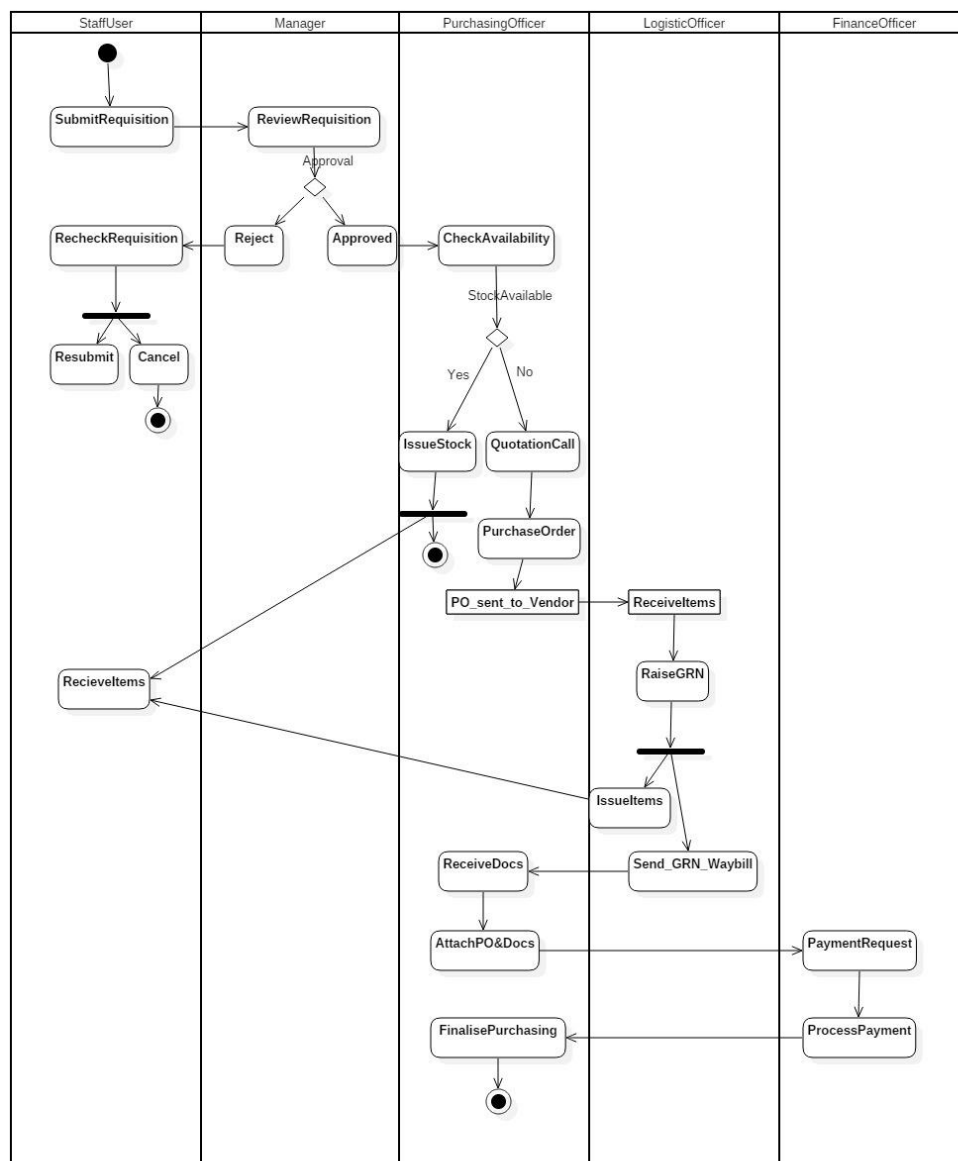

Figure 3.7: Activity Diagram

3.2   Software Development Methodology

3.2.1. Introduction

A software development methodology or system development methodology in software engineering is a framework that is used to structure, plan, and control the process of developing an information system.

There are the following methodologies:

- Agile Software Development
- Crystal Methods
- Dynamic Systems Development Model (DSDM)
- Extreme Programming (XP)
- Feature Driven Development (FDD)
- Joint Application Development (JAD)
- Lean Development (LD)
- Rapid Application Development (RAD)
- Rational Unified Process (RUP)
- Scrum
- Spiral
- Systems Development Life Cycle (SDLC)
- Waterfall (a.k.a. Traditional)

By comparing all the above methodologies and studying the requirements of the project, Rational Unified Process (RUP) was selected as the best methodology for this system.

The RUP is an iterative software development process framework created by the Rational Software Corporation, a division of IBM since 2003. RUP is not a single concrete prescriptive process, but rather an adaptable process framework, intended to be tailored by the development organizations and software project teams that will select the elements of the process that are appropriate for their needs. RUP is a specific implementation of the Unified Process.

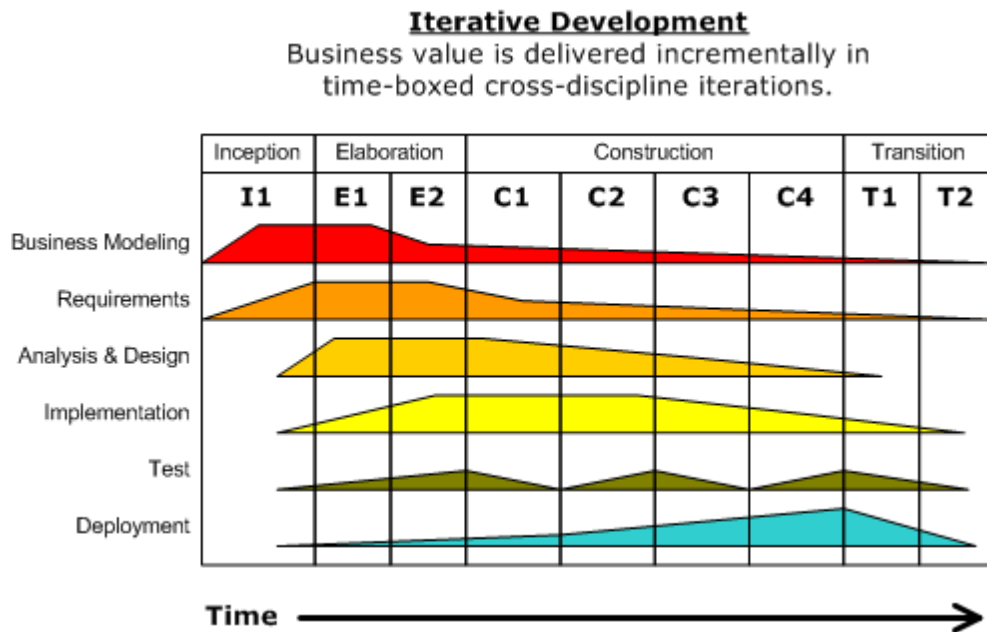The following Figure 3.8 shows this concept in a pictorial manner.

Figure 3.8: Iterative Development

3.2.2 Inception

In this stage, the project's business case is stated and the team decides if the project is worth doing or if it is even possible. It is important to the process to first formulate the scope of the project and determine what resources will be needed.

3.2.3 Elaboration

In this stage, the developers take a closer look at the project to determine its architecture foundation and to evaluate the architecture in relation to the project. This stage is important to the RUP because it is here that developers analyze the risks associated with changing the scope of the project or adding new technologies along the way.

3.2.4 Construction

In this stage, the development of the project is completed. The application design is finished and the source code is written. It is at this stage that the software is tested to determine if the project has met its goal laid out in the inception phase.

3.2.5 Transition

In this stage, any fine-tuning is performed. Any final adjustments can be based on user feedback, usability or installation.

3.3   Alternative Solutions

The alternative solutions to the system can be divided into several categories.

- **Improving the current legacy system**

The easiest solution is to keep the legacy system with some minor changes in the way of working and improving the paper work. By selecting this solution client will not totally be increasing the efficiency in the process because they must still depend on several paperwork.

- **Moving to a Commercial Software**

By purchasing a commercial software can increase the efficiency of the business process. But this software can be very costly.

And the main issue with these software, because it comes with a several unnecessary features and some of the required features required by the company are not included in these packages and it can be costlier to customize the software to fit for the purpose.

- **Getting a free software from the internet**

Since this is a free software there will be a cost benefit for the company when comparing to the commercial software.

But similarly, to the commercial ones this free software too includes some unnecessary features and it can also consist some errors that are cannot be easily fixed.

3.4 Reason for selecting a Web Based Solution

The following reasons show that why this system was implement as a web based solution.

- System can be accessible from the outside of the office.
- It is platform independent and therefore it can be used in almost all the computers.
- No special hardware / software requirements are there.
- Web based system maintenance is much easier than the standalone software.

3.5 User Interface Design

User interface design or user interface engineering is the design of websites, computers, appliances, machines, mobile communication devices, and software applications with the focus on the user's experience and interaction. The goal of user interface design is to make the user's interaction as simple and efficient as possible, in terms of accomplishing user goals. In this project, the main concern was to keep the User interfaces much simple as possible while maintaining its user-friendliness.

To ensure this objective, the following facts were considered:

- Consistent and clear views (screens)

- Clear and readable Fonts and sizes

- Colour combination

- Easy navigations

- Providing Tool Tips, Warning and Error messages

In the following pages, starting from Figure 3.9 and rest of the figures describes the user interfaces in details.

<u>**Sample User Interfaces**</u>

<u>**Homepage**</u>

- The User Interfaces are designed with both 'tiled links' and 'usual menu links'. Users can use them according to their preferences.
- On the Home page, there are four tiles on this screen and by selecting a tile user can access different areas of the system.
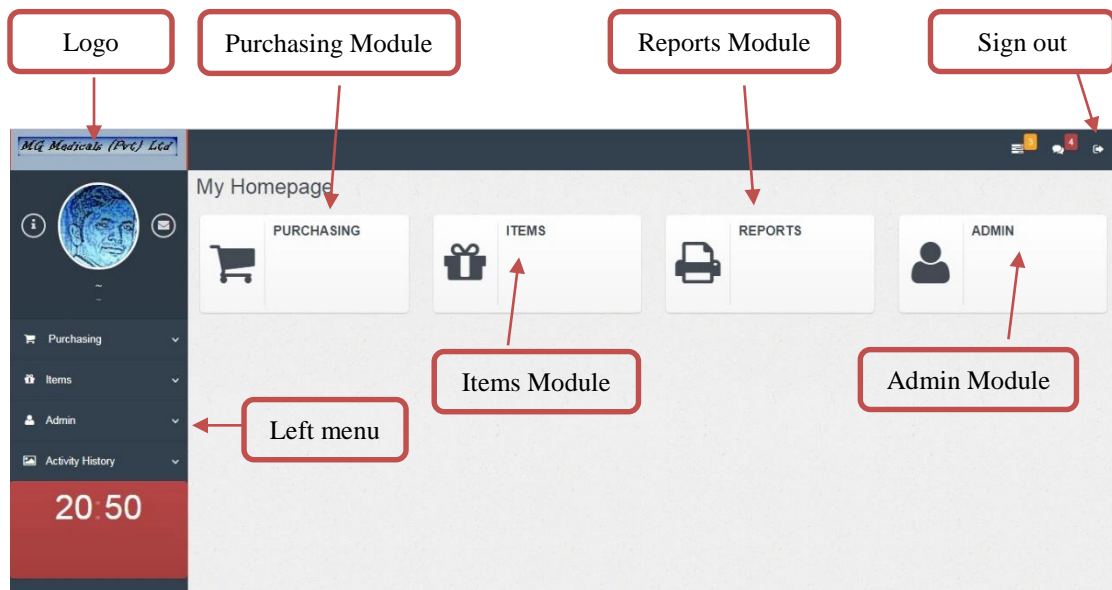- Left menu will also have links to the pages. Figure 3.9 shows the Homepage.

Figure 3.9: Homepage

<u>**Purchasing Index page**</u>

- Following Figure 3.10 depicts the Index page of the Purchasing module.
- There are four tiles, namely Purchase Request, Manage Orders, RFQ and PO.
- Depending on the access levels, some tiles will not be visible for some users.
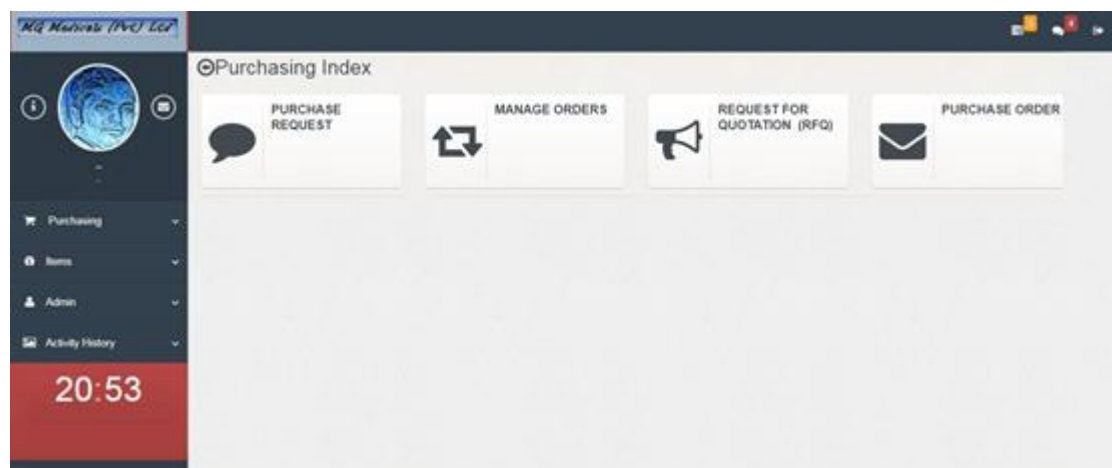

Figure 3.10: Purchasing Index

Items Index Page

- Following Figure 3.11 shows the Items Index page.
- This page has six tiles in there.
- GRN-Fixed Asset: The Capital Items can be recorded as Fixed Assets.
- GRN-Inventory: This can be used for the inventory items.
- Fixed Asset Register: All Items will be displayed in a table.
- Maintenance: Repairs and service will be recorded in here.
- Movements: Asset Transfers between locations will be recorded here.
- Disposal: All the Fixed Asset disposals can be recorded here.

Figure 3.11: Items Index Page

Admin Index Page

- This page will be accessible only to the Admin User.
- The main base tables will be controlled through this page.
- User accounts will be managed from here.
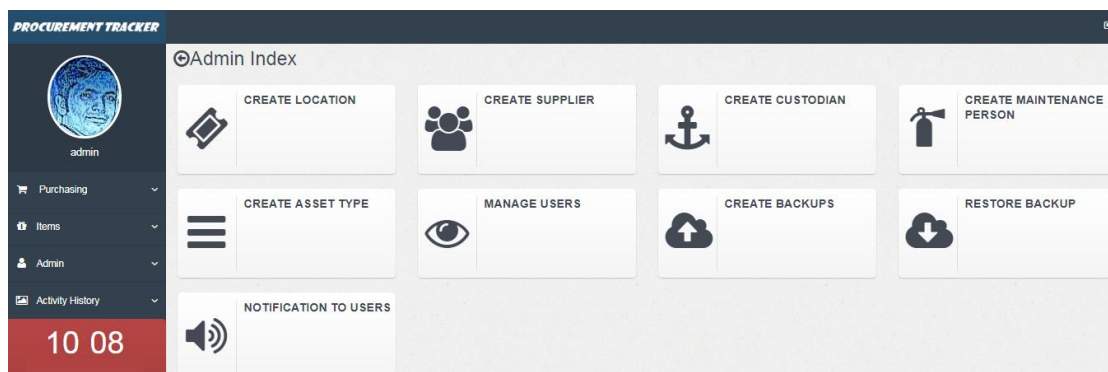- Below Figure 3.12 shows the screenshot of the Admin Index Page.

Figure 3.12: Admin Index Page

CHAPTER 4: IMPLEMENTATION

Project Implementation is the process where we get a working software system.

This phase is a very challenging one when comparing to the other phases of the Project development life cycle. Therefore, an incremental and iterative life cycle is the best solution.

This chapter shows the major code segments, the tools and techniques, reused components and the development environment that was used in the system implementation.

4.1 Hardware and Software Requirements

The system has been developed using the following languages and technologies,

Software Requirement:

- Microsoft Windows XP or Windows 7

- PHP (PHP: Hypertext Pre-processor) 5.6.24

- Apache (XAMPP) 2.4.23

- MySQL 5.5.32

- phpMyAdmin 4.5.1

- HTML (Hyper Text Markup Language) 5.0

- CSS (Cascading Style Sheets) 3.0

- Javascript and jQuery

- Google Chrome 54.0

Hardware Requirement:

- Intel(R) Core i3 processor or a latest

- 4 GB of free disk space

- 2 GB RAM

4.2   Development Tools and Technologies

For the development of this system, PHP which is an object-oriented, a server-side scripting language was used. In addition to that MySQL was used as the database management system. HTML was used along with the JavaScript and jQuery for web page development, traversal and manipulation, event handling, animation and to work across a multitude of browsers. CSS (Cascading Style Sheets) was used to control the layout of the web pages and as the source code editors NetBeans IDE and Notepad ++ were used [7].

4.3 Code features

For this project, the "MVC software design pattern" was used.

Model–view–controller (MVC) is a software architectural pattern for implementing user interfaces on computers. It divides a given software application into three interconnected parts, to separate internal representations of information from the ways that information is presented to or accepted from the user.

Basically, the Controller will be playing the main role in this pattern and the user will be always dealing with it [8].
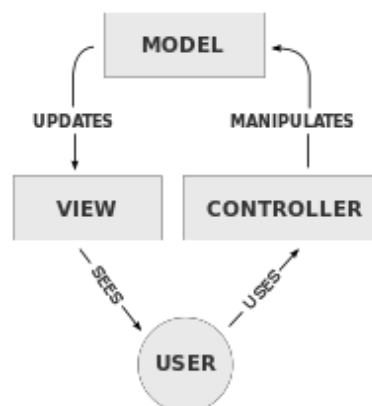
Below shown Figure 4.1 depicts how this pattern works.

Figure 4.1: MVC Pattern

Major Code Snippets

The following code snippets will briefly describe their functionalities and the way of working within the system.

User Verification Process

```php
<?php
require_once '../../control/config.php';
$login_username = $_POST['login_username'];
$login_passwordI = md5($_POST['login_password']);

try {
    $sql = 'SELECT login_username, login_password, login_group FROM tbl_login WHERE login_username=:login_username';
    $stmt = $conn->prepare($sql);
    $stmt->execute(array(':login_username' => $login_username));
    $result = $stmt->fetchAll();

    if (count($result)) {   // chk username
        $row = $result[0];
        $login_passwordDB = ($row['login_password']);

        if ($login_passwordDB == $login_passwordI) {   // chk pwd
            $_SESSION['username'] = $row['login_username'];
            $_SESSION['login_group'] = $row['login_group'];
            echo "'Welcome to Procurement Tracker !'";
            header("Location: ../../view/home/home.php");

        } else {
            echo "Please check your user name and password!";  //pwd
        }
    } else {
        echo "Please check your user name and password!";  // user
    }
} catch (Exception $ex) {

    echo "'Login Error !";
}
```

4.4   Reused existing code

When implementing this system, some of the codes were taken from the internet.

- ATLANT template for admin dashboards and control panels. It is a responsive HTML template that is based on the CSS framework Bootstrap-3 [9].
- DataTables plug-in for Pagination, instant search, and multi-column ordering
- DropzoneJS for drag'n'drop file uploads with image previews [9].

CHAPTER 5: EVALUATION

5.1 Introduction

Evaluation is a systematic determination of a subject's merit, worth and significance, using criteria governed by a set of standards. It can assist an organization, program, project or any other intervention or initiative to assess any aim, realizable concept/proposal, or any alternative, to help in decision-making; or to ascertain the degree of achievement or value regarding the aim and objectives and results of any such action that has been completed.

Software testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test. Software testing can also provide an objective, independent view of the software to allow the business to appreciate and understand the risks of software implementation. Test techniques include, but are not limited to, the process of executing a program or application with the intent of finding software bugs (errors or other defects).

5.2 Test Strategy

Software testing methods are traditionally divided into white-box and black-box testing.

White-box testing (also known as clear box testing, glass box testing, transparent box testing, and structural testing) tests internal structures or workings of a program, as opposed to the functionality exposed to the end-user.

Black-box testing treats the software as a "black box", examining functionality without any knowledge of internal implementation. The tester is only aware of what the software is supposed to do, not how it does it.

5.3   Test Levels

Tests are frequently grouped by where they are added in the software development process, or by the level of specificity of the test [10].

- **Unit testing**

This is also known as component testing refers to tests that verify the functionality of a specific section of code, usually at the function level.

- **Integration testing**

This refers to the testing in which a group of components are combined to produce an output.

- **System testing**

System testing tests a completely integrated system to verify that it meets its requirements.

- **User Acceptance testing**

This testing is usually done by the users to ensure that the delivered software meets the requirements and expectations of the customer.

For this system, only two levels of testing were used. Those are System testing and User Acceptance testing.

5.4   Test Plan and Test Cases

A test plan is a documentation describing the scope, approach, objectives, resources, and schedule of a software testing effort. It identifies the items to be tested, items not be tested, who will do the testing, the test approach followed, what will be the pass/fail criteria, training needs for team, the testing schedule etc. The Test Plan for the system is shown in the Table 5.1.

A test case is a documentation which specifies input values, expected output and the preconditions for executing the test.

Test Plan

Introduction

This test plan describes the testing approach of the Procurement Tracker software. This includes,

- Test Strategy: Objectives, entry / exit criteria, creation of test cases, scheduling, etc.

- Execution Strategy: Describes the test execution steps, identify and fix defects.

- Test Management: Handling the logistics of the test.

TEST STRATEGY

Objectives

- To verify that the functionality of Procurement Tracker software works according to the client's requirements.

- Testing will be performed as a black box testing.

- Expected deliverables of the test are:
    - ✓ A usable software and a set of stable test scripts.

Requisites

- Pre-loaded sample data must be available before starting the functional testing.

- All the defects will be recorded in a serial order on a shared Spreadsheet.

- Defects will be reported with a screenshot.

- Test cases will be developed by Purchasing Officer, Logistics Officer, Manager and the Administrator.

- User Acceptance Test will be done by the end users.

Scope and Levels of Testing

Exploration testing

- At the first level of testing, the user will be exploring the system without any test scripts or documentation.

- At this stage the first level navigation, Purchasing, Items, Reports and Admin modules will be focused.

Functional testing

- This will be carried out by entering the data and validating the output from the system.
- This will be performed to check the functionalities of the system.
- Functional testing will be done after the Exploration testing is completed.
- This will begin with testing the functions of the Admin Module. Then Purchasing Module will be tested. Next is the Items Module and finally the Reports Module will be tested.

User Acceptance Test (UAT)

- UAT is performed by the end users
- This allows the end users to do a final review of the system before it goes alive.
- This will be performed after completing the Exploration testing and Functional testing.
- After successful completion of the UAT only the software can be released for live usage.
- Firstly, the Purchasing Module be tested and then the Items Module and finally the Reports Module will be tested.

EXECUTION STRATEGY

Entry and Exit Criteria

- Entry and exit criteria are flexible benchmarks.
- The desirable conditions in order to start test execution is called as the entry criteria.
- The desirable conditions that need to be met in order to proceed with the implementation is called as the exit criteria.

Validation and Defect Management

- Tester must execute all the test script and also they can do additional testing if required.
- Defects found during the testing will be categorized as follows.

Severity	Impact
Critical	• If the defect is critical enough to crash the system, cause file corruption or data loss.
High	• If the defect causes a lack of vital program functionality.
Medium	• If the defect degrades the quality of the system or it prevents other areas of the system from being tested.
Low	• If the defect has a minimum impact on the system use.

TEST MANAGEMENT PROCESS

- A shared Spreadsheet will be used as the Test Management Tool.
- All the Test cases, test results must be updated in the Spreadsheet.
- Tester will directly access their respective assigned test cases and update the status of each executed step.
- Any defect encountered will be recorded against the Test case.
- During the defect fixing stage, the defects will be re-assigned back to the tester to verify whether defect is fixed. They must update the status of the Test case after completing the re-testing.

Table 5.1: Test Plan

5.4.1 Test cases for user login

The test cases for the User Login are shown in the following Table 5.2.

ID	Test Description	Test Case	Expected Results	Priority
1	Login validation	Enter the correct username and password	Successfully logon to the system and direct to the Homepage.	High
2	Login validation	Enter an incorrect username and password	Redirect to the Login page and prompt the error message "Please check your username and password!"	High
3	Logout	Press the Logout button and select 'Yes'	Close the session , Log out the system and return back to Login page	Medium
4	Logout	Press the Logout button and select 'No'	Redirect to the Homepage and continue the session	Medium

Table 5.2: Test Cases-User Login

5.4.2 Test cases for GRN-Fixed Asset page

The test cases for the GRN-Fixed Asset entry, are shown in the following Table 5.3.

ID	Test Description	Test Case	Expected Results	Priority
1	GRN Fixed Asset-Item's Information Tab testing	Click the Items Tile and then click the GRN Fixed Asset tile	Load the GRN Fixed Asset page	High
2	Mandatory field testing	Leave the Description field and try to save	This is a mandatory field, therefore record must not be saved if the field is blank.	Medium
3	Drop-down list testing	Click Asset Type	Show all the available Asset Types in the drop- down list	Low
4	Drop-down list testing	Click Asset Status	Show all the available Asset Statuses in the drop-down list	Low
5	Add Image testing	Attach an image, Select Files button	• Open a browsing window. • Allow to select an image file • jpg, jpeg, png, gif • File size 100 kb	Medium
6	Additional fields will available for IT Assets	Check the IT Asset checkbox	Show the License Type, License No, License Expiration fields	Medium
7	Acquisition Tab testing	Click on Date of Acquisition field	A calendar will appear and enable the user to select the date	Medium
8	Drop-down list testing	Click Supplier list	Show all the available Suppliers in the drop- down list	Low
9	Input box testing	Click inside the GRN/Delivery Note field	Accept alpha-numeric characters	Low
10	Input box testing	Click inside the Purchase Order field	Accept alpha-numeric characters	Low

11	Additional fields will available for Warranty Applicable items	Click the Warranty checkbox	Three new fields will appear. • Warranty Month: Accepts a Numeric value • Warranty Start: A Calendar will appear to select a date • Warranty End: This will automatically fills in	Medium
12	Location Tab testing	Click Location list	Show all the available Locations in the drop-down list	Low
13	Drop-down list testing	Click Custodian list	Show all the Custodians in the drop-down list	Low
14	Finance Tab testing	Calculate Depreciation	• Prompt an error message if 'Cost Local Currency' is empty. • If the required fields are filled in, calculate the depreciation based upon Cost Local Currency, Method, Starting Date, Life Time, Salvage Value • Display the calculated depreciation in a grid view	High
15	Attachment Tab testing	Attachments	• Open a browsing window. • Allow to select document or spreadsheet file • Pdf, doc, docx, xls, xlsx, jpg, jpeg, png, gif\are accepted	Medium
16	Saving	Click Save Button	Save the record in the database if all the required filled.	High

Table 5.3: Test Cases-GRN Fixed Asset

5.2.1 User Evaluation

User Feedback Form for Procurement Tracker System

No:	Question	Very Good	Good	Average	Poor
2	Name of the User: *Anton Dilash*		User Role: *Procurement Officer*		
1	User Friendliness	✓			
2	Interfaces		✓		
3	Colour Scheme			✓	
4	Character readability		✓		
5	System Navigation		✓		
6	Functionalities	✓	✓		
7	Learning curve		✓		
8	Responsiveness		✓		
9	User privileges	✓			
10	Understandability of system messages		✓		
11	Overall feedback of the system		✓		
12	Any other suggestions / comments about the system?	on going Procurement, completed Procurement or need to be Printed out in detail.			

Signature

Figure 5.1: User Acceptance test result

CHAPTER 6: CONCLUSION

6.1 Summary

MG Medicals (Pvt) Ltd is becoming one of the leading suppliers of superior quality surgical, medical, laboratory equipment and rehabilitation aids to the market.

Since the incorporation of the company, MG Medical has significantly improved their business but anyway to further improvements and to take competitive advantage in the market, they are focusing on the new technology.

6.2 Critical Assessment

Before implementing this Procurement Management System, company was using the MS Office package to keep track of the procurement, inventory and payments related information and therefore they faced many issues with that. But now they are carrying out their day to day activities relating to the procurement management very efficiently. During the requirement analysis process client's requirements were gathered carefully and in addition to that some of the functionalities were added upon the change requests made by client. The main functional requirements were Purchase Order processing, GRN entries, Inventory and Asset monitoring, Asset maintenance history, Reports, User security controls, etcetera, and this system has fulfilled all the requirements.

By looking at the test results and the client's feedback, it is noted that client is very much satisfied with this system.

6.3 Lesson Learnt

During this project, I gained a wealth of knowledge in PHP, JavaScript, jQuery, CSS, MVC architecture and many more development tools and techniques.

Further to that, while working on this project it helped me a lot to develop my technical skills as well as intellectual skills.

While doing the Evaluation phase, it gave opportunity to learn about how to develop the test cases for a system and how to do testing.

Writing of this dissertation gave me the knowledge of how to design a technical report as well as writing it in a professional manner.

In addition to that while working on this project I had to communicate with different types of people and the people in different positions in the company where it gave me the opportunity to develop my interpersonal skills as well.

6.4   Future Improvements

This System can be improved by adding new features such as, including a Barcode reader module to this program, we could reduce the manual data entry work significantly.

Also, this system can be enhanced by interconnecting to an Inventory Control system so that the overall usability will be improved.

Additionally, this system can be deployed on a more sophisticated server and therefore it will help improving the efficiency of the system.

By providing more reports, it will be more helpful for the management decisions.

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Appendix A: System Documentation

This documentation will show the steps on how to install the Procurement Tracker System onto a computer. This includes the software and hardware requirements for this system.

Step: 1

Software Requirements	Recommendation
Operating System	Microsoft Windows XP or Windows 7
Server software	XAMPP Version (5.6.24) or Separate Installation of Apache 2.4.23 / MySQL 5.5.32 / PHP 5.6.24 / phpMyAdmin 4.5.1/ OpenSSL 1.0.2 / XAMPP Control Panel 3.2.2
Web Browser	Google Chrome or Windows Internet Explorer

Table A.1: Software Requirement

Hardware Requirements	Recommendation
Processor	Intel(R) Core(TM) i3 processor
Hard Disk	20 GB of free disk space
Memory	2 GB RAM
Display	1024 x 768 pixel Monitor

Table A.2: Hardware Requirement

Step: 2

Installing Server Software (XAMPP)

Note: Installation process may require Administrator Level Access.

Download the "XAMPP for Windows" from http://www.apachefriends.org official website. Install it onto the **C:** drive of the computer.

Install the Web Browsers

Internet Explorer will be available with the Windows operating system. You may download the Chrome Browser from the internet http://www.google.com.

Step: 3

Files Extraction

Open the CD and copy the supplied folder into the directory path

"C:\xampp\htdocs\" on your computer.

Step: 4

Server startup and Database Installation

From the Windows 'Start', 'All Programs', open the XAMPP Control Panel
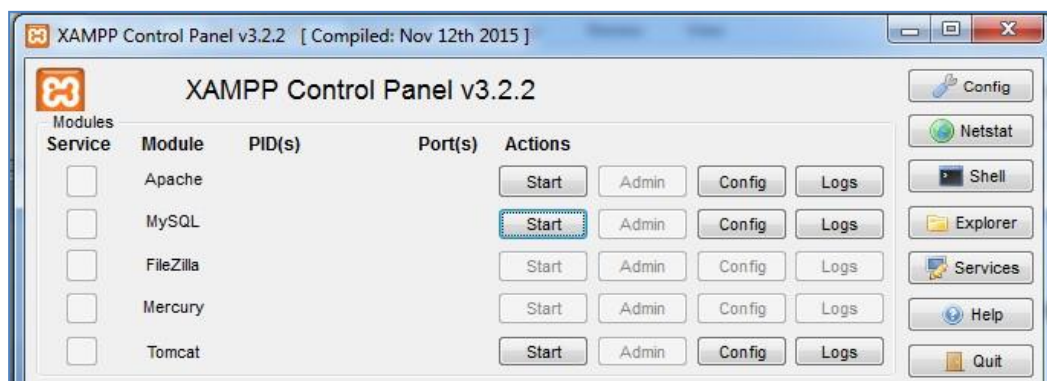
Figure A.1: XAMPP Control Panel

- Click on the 'Start' button for MySQL

- Click on the 'Start' button for Apache

- You may minimize or close the control panel

- Open a web browser and type the URL http://localhost/phpmyadmin
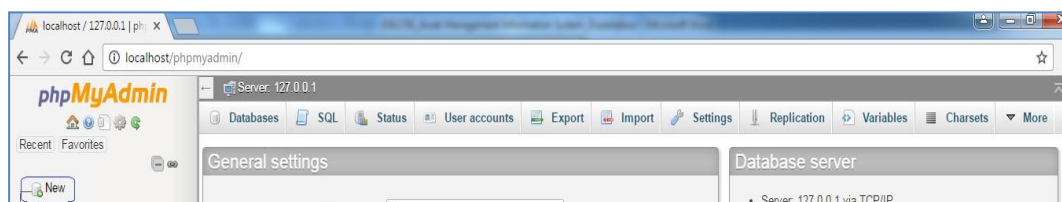
Figure A.2: phpMyAdmin interface

- Enter the Username and Password (if you have set them earlier).

- From the left menu, click the 'New' link and create an empty database named "mgm" and click the 'Create' button.
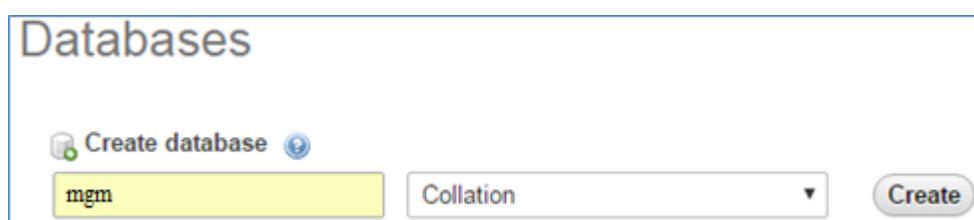
Figure A.3: phpMyAdmin – Create database

- From the menu bar, navigate to the "Import" tab and click "Choose file" button.
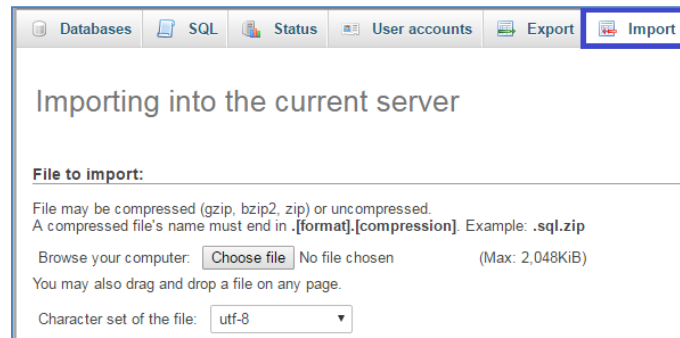
Figure A.4: phpMyAdmin interface

- Browse the CD and select the "mgm.sql" file.
- Then click "GO" button which is located at the bottom of the page.
- Now the database will be created on your computer.

Step: 5

Launching the system

- Check whether XAMPP is running; on the taskbar, you will see icon. Or you may follow the Step 4.
- Open a web browser and type the URL http://localhost/mgm and press "Enter" key to run the system.
- Refer the Appendix-C, User Documentation for detailed information on how to operate the system.

Appendix B: Design Documentation

Use case diagrams and descriptions
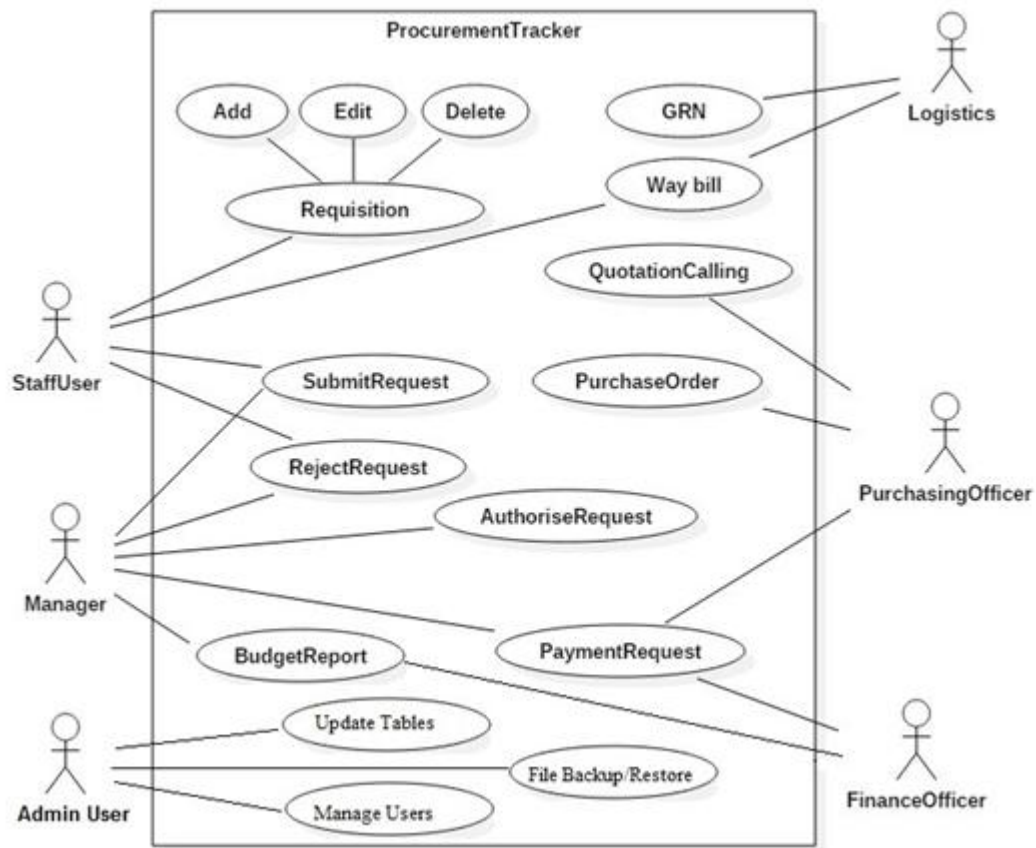
Figure B.1: Top Level Use case diagram

Use case name	Login
Actors	Administrator, Manager, Staff User, Logistician, Purchasing Officer, Finance Officer
Description	Log in to the system, using the username and password (Authentication of the users.)
Pre-conditions	
• User must have an active account	
Post-conditions	
• Logged in to the system • The accessible pages will be determined by the User Group of the User	

Use case for Administrator
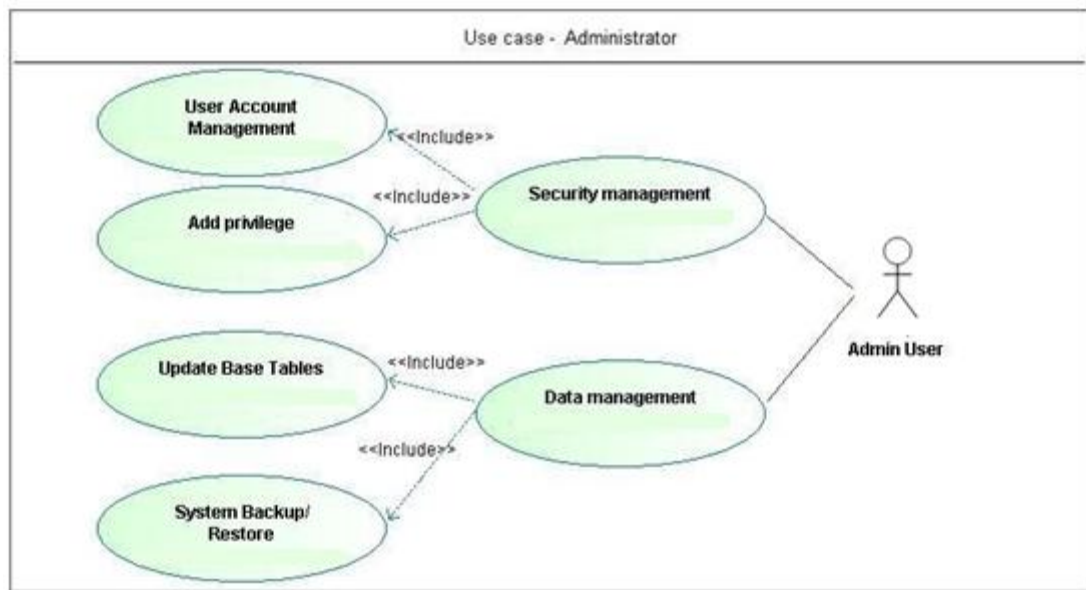
Figure B.2: Use case diagram for Admin User

Use case name	Security Management –User Accounts
Actors	Administrator
Description	Administrator will manage user accounts
Pre-conditions	

- Signed in as administrator

Post-conditions	

- Will be creating new user accounts for the other categories of users

- Add / Edit privileges for the user accounts.

- Terminate User accounts

Use case name	Data Management -Update base table
Actors	Administrator
Description	Administrator will add or edit the base table details
Pre-conditions	

- Signed in as administrator

Post-conditions	

- Information entered by the administrator is appropriately saved in the database

Appendix C: User Documentation

The user documentation will provide an overview of the system and describe how to use the system step by step.

Login page

- Open a web browser and type in the URL http://localhost/mgm and press "Enter" key to run the system.
- At the startup, the login page (index page) of the system will appear.
- The user must enter their User ID and the Password here. If the credentials were correct then the user will be allowed to enter the system.
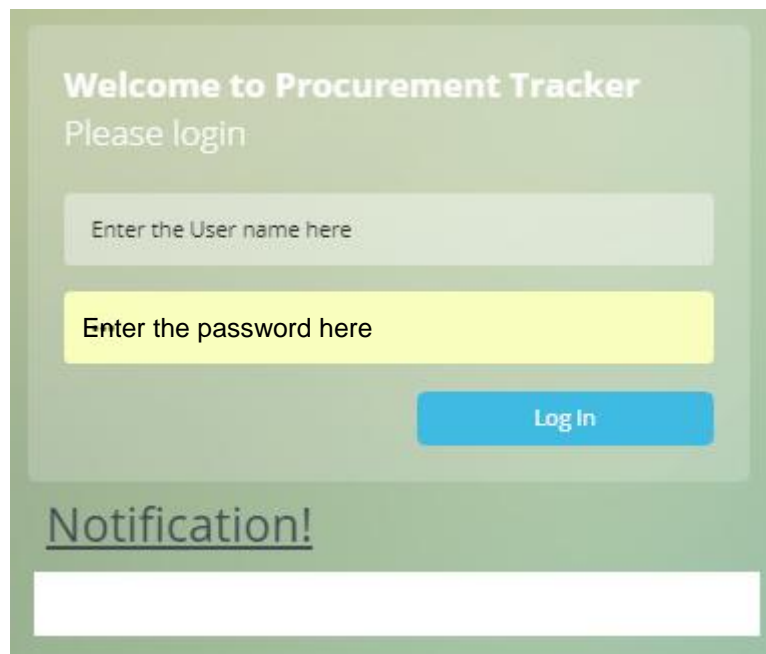
Figure C.1: Login Page

- If the login information was incorrect the user will be redirected back to the Login page with an error message. Figure C.2 shows the screenshot of this.
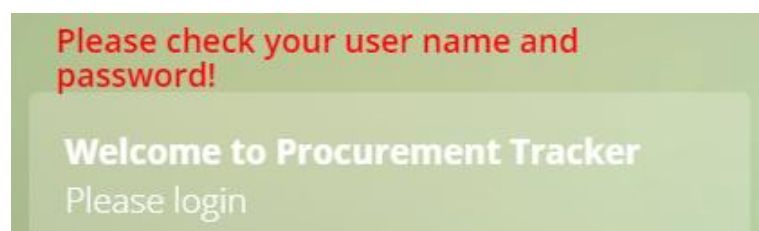
Figure C.2: Login Page – with the error message

Homepage

- On the Home page, there are four tiles on this screen and by selecting a tile you can access different areas of the system.
- According to the user privileges, some of the tiles will be hidden.
- By selecting a tile, you will be directed to the module.
- Left menu will also have links to the pages.
- By clicking on the logo, you can return-back to the Homepage.
- Below Figure C.3 shows the screenshot of the Homepage.
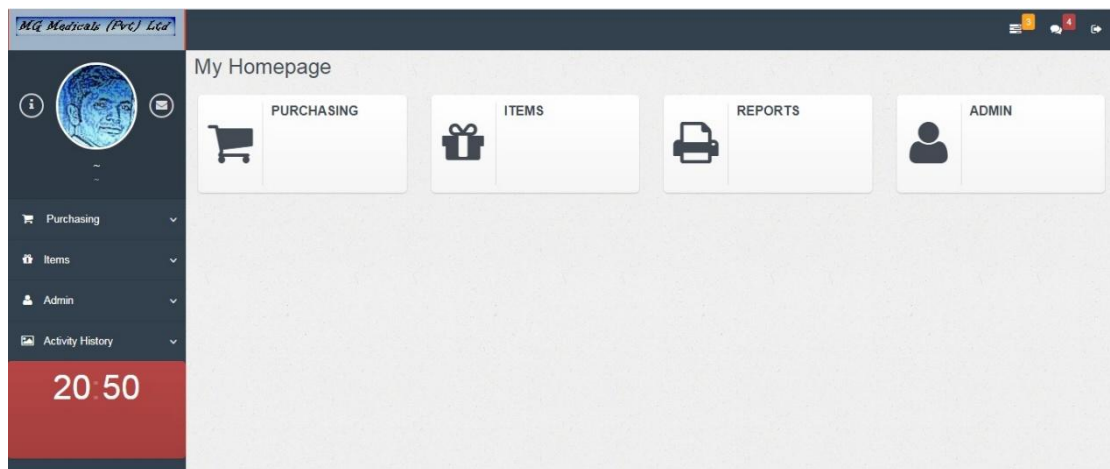
Figure C.3: Homepage

Purchasing Module

- Figure C.4 shows the Purchasing Module's index page.
- General staff login will show only the 'Purchase Request' tile.
- The Manager can approve or reject the requests via 'Manage Orders' tile.
- The Purchasing Officer will have access to three tiles except the 'Manage Orders' tile.
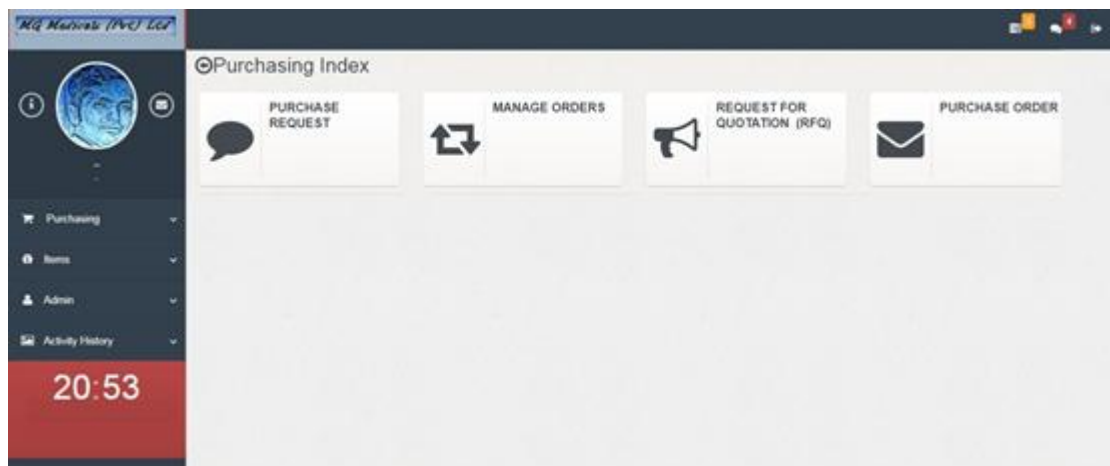
Figure C.4: Purchasing Index

<u>Purchase Request form</u>

- This is accessible to all the staffs.

- When the staffs need any items to be purchased, they will create a Purchase
  Request on the system.

- New rows can be added into the form according to the requirement.

- The requester can save the request by clicking on the 'Request Now' button.

- Saved requested will appear on the approvers notification list.

- When the Purchase Request is approved, then it will be ready for issuing the
  RFQ or Purchase Orders.

- Figure C.5 shows the screenshot of the Purchase Request Form.

Figure C.5: Purchase Request

<u>Manage Orders</u>

- This page is accessible to the Managers only.

- When the 'Purchase Request Form' is saved, it will appear in the Manage
  Orders page.

- Manager can either approve or reject the requests.

- Following Figure C.6 shows the Manage Orders page.
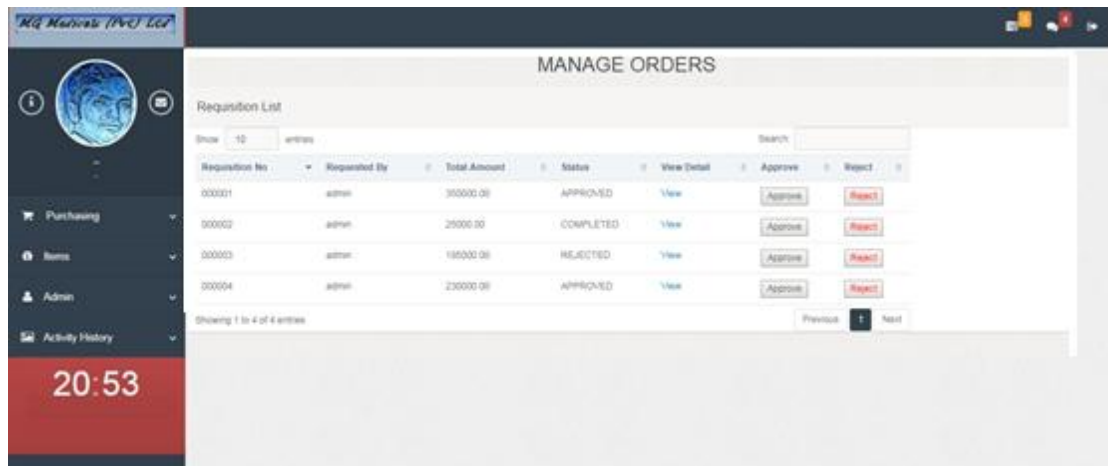
Figure C.6: Manage Orders

Request for Quotation (RFQ)

- This page is accessible to the Purchasing Offier only.

- Only the approved Purchase Request numbers can be selected in this page.

- When the 'Resuest No' is selected on the form, the relevant request will appear in this page but without the estimated prices.

- Purchasing Offier can modify the description and the quantity if necessary.

- After saving the RFQ, a PDF report can be generated.

- Figure C.7 shows the Request for Quotation (RFQ) page.

Figure C.7: Request for Quotation

Purchase Order

- After selecting the potential 'supplier' via comparing the quotations, a Purchase Order will create be created.

- Purchasing Offier can modify the description, price and the quantity if necessary.

- After saving the Purchase Order, a pdf document can be generated.

- Purchasing Offier should send that pdf document to the supplier.

- Figure C.8 shows the Purchase Order (PO) page.

Figure C.8: Purchase Order

Items Index Page

- GRN-Fixed Asset: The Capital Items can be recorded as Fixed Assets.

- GRN-Inventory: This can be used for the inventory items.

- Fixed Asset Register: All Items will be displayed in a table.

- Maintenance: Repairs and service will be recorded in here.

- Movements: Asset Transfers between locations will be recorded here.

- Disposal: All the Fixed Asset disposals can be recorded here.

- Figure C.9 shows the Items Index page.

Figure C.9: Items Index Page

GRN-Inventory Page
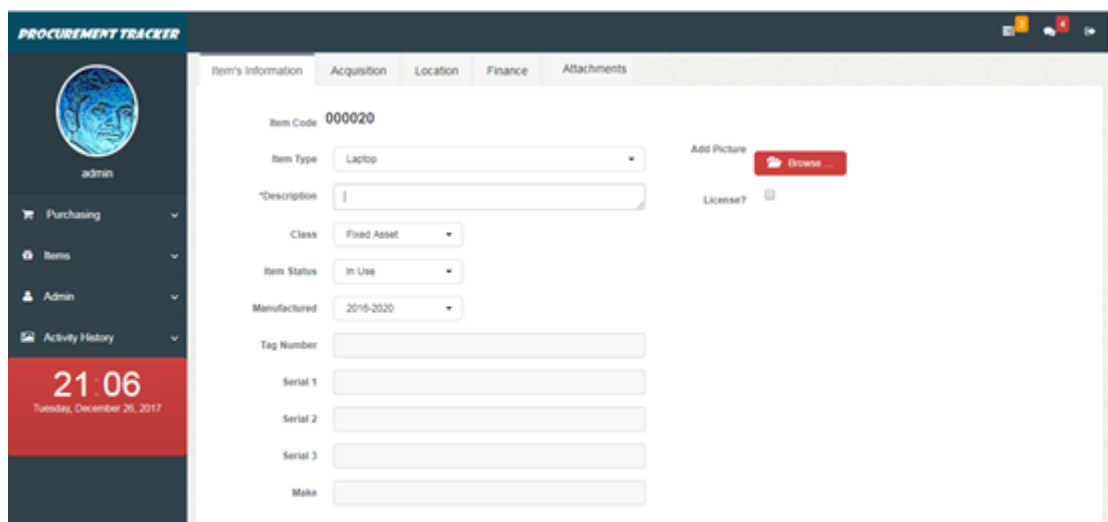
- Some items can be recorded as an Inventory.

- Items that are considered as consumables or that are not recognized as a Capital Asset will be recorded here.

- First it is required to select the Purchase Order number. System will be recording all the purchases against the PO numbers.

- There are some options to be selected according to the supporting documents that was received with the items. Such as a Way bill, Invoice, Delivery note, or other document.

- Also, some more options are there to select for the internal reference purpose. Such as whether it is a Part shipment or Completion of the Order.

- Received quantities and the price can be recorded in the items grid. If there are any discrepancies it should be recorded in the next column with comments.

- Figure C.10 shows the GRN-Inventory page.

Figure C.10: GRN-Inventory Page

GRN-Fixed Asset Page

- Items that are with high value or having a life span of over one year will be recorded as a Fixed Assets.

- On the first tab, it is required to enter the item's physical information.

- The second tab is the Acquisition, where it is required to enter the details about the supplier, warranty period and terms.

- On the Location tab, it will be recorded the where the asset is currently placed in and who is the responsible person of that.

- On the Finance tab, it can be recorded the cost of the acquisition and the asset depreciation related information.

- On the Attachment tab, it is possible to attached the scanned copies of the supporting documents, that are useful for the future reference.

- Figure C.11 shows the GRN-Fixed Asset page.

Figure C.11: GRN-Fixed Asset Page

Fixed Asset Register

- In this page, all the Fixed Assets will be listed in a grid format.

- Using the 'View' link, it is possible to open the asset's details page.

- The data that are already being entered the asset details can be edited through the View link.

- When the asset is disposed, it will not appear in this page.

- Figure C.12 shows the screenshot of the Fixed Asset Register page.

Figure C.12: Fixed Asset Register Page

Fixed Asset Maintenence

- Asset maintenance related information will be recorded in here.
- Needs to be selected the Item Code from the list.
- The date, maintenance done by whom and the details of the maintenance will be recorded.
- Maintenance history will be appearing at the bottom of the page.
- Figure C.13 shows the screenshot of the Fixed Asset Maintenance page.

Figure C.13: Fixed Asset Maintenance Page

Fixed Asset Movements-Update Info

- When there is a change in the Location or the custodian , it would be recorded in here.

- The effective date, new custodian and more comments are mainly captured.

- Figure C.14 shows the screenshot of the Fixed Asset Movements page.

Figure C.14: Fixed Asset Movements-Update Info Page

Fixed Asset Disposal

- At the end of useful life of the asset or if it cannot be used any more, the asset will be disposed from the asset list.

- Firstly, the asset needs to be selected from the Item Code list

- Date of the disposal, Disposal method, Sale value, Receiver's name, reference document number and if there are any comments will be recorder in this page.

- Figure C.15 shows the screenshot of the Fixed Asset Disposal page.

Figure C.15: Fixed Asset Disposal Page

Reports Module

- In this module, there are several reports available.
- Full Data Extract Report: This will include key information about the asset.
- Acquisition Details Report: This will show the item purchase related information.
- Purchase Request: The purchase request form can be printed through this.
- Request for Quotation: A report can be generated based on the given RFQ number.
- Waybill: When the asset was issued to a staff member this will be generated.
- Goods Received Note: This can be generated after creating the GRN on the system.
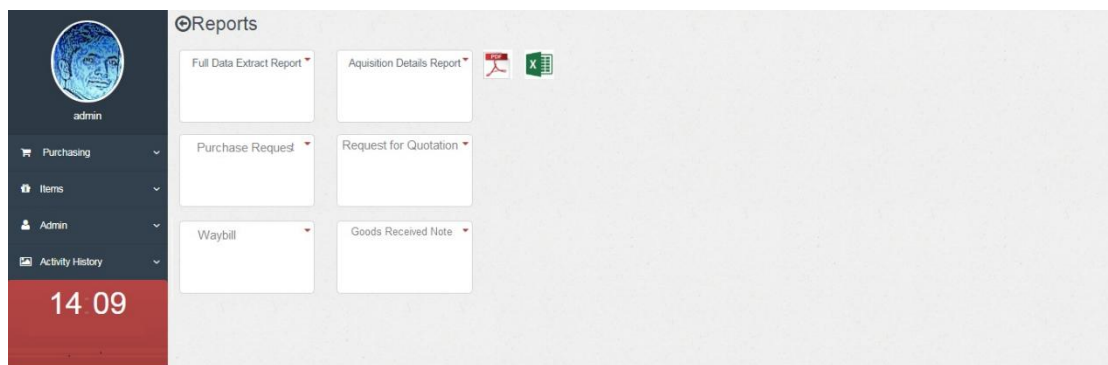- Figure C.16 shows the screenshot of the Reports Module page

Figure C.16: Reports Page

Admin Module

- The Figure C.17 shows the screenshot of the Admin Module's Index page.
- This module is accessible only to the Administrator.
- This will be used for setting up some database configurations and control the system. The drop-down / lookup values can be added or inactivated through this.
  - Create or Edit Locations
  - Create or Edit Supplier
  - Create or Edit Custodian (person responsible for an asset)
  - Create or Edit Maintenance
  - Create or Edit Asset Type
  - Manage User Accounts (Create, Edit or Terminating accounts)
  - Create Backup / Restore files
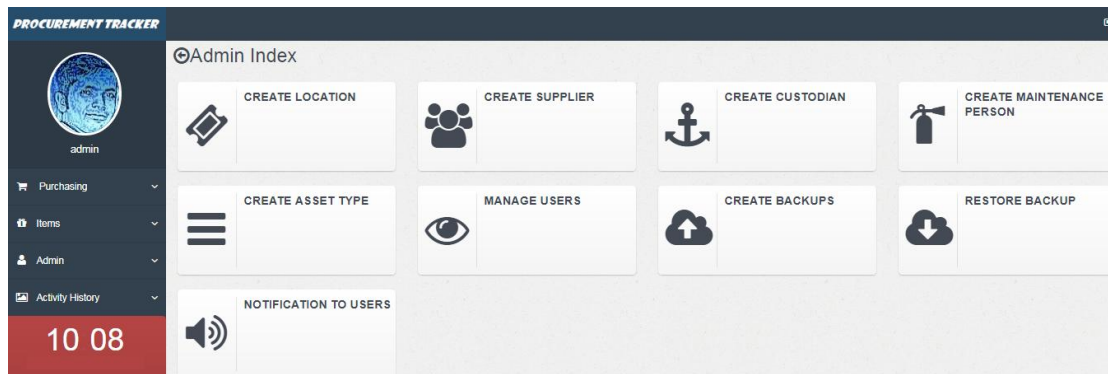 - Send notifications to all the users

Figure C.17: Admin Index Page

Create Location

- To create a new Location, first enter a location code as per the given standard.

- Location Code must begin with three uppercase letters followed by two numeric.

- Enter the other fields and save the record.

- To edit the Location information, select the code from the grid below.

- The Figure C.18 shows the screenshot of the Create Location page.

Figure C.18: Create Location Page

Create Supplier

- This page gives the option to create or edit the Supplier information.

- First it is required to enter the name of the Supplier.

- Ender the address, contact person, phone number, email, etc. and save the record.

- Once the code is created all the Suppliers will be appearing on list which is found at the bottom of the page.

- To edit or inactivate a Supplier, first it should be select the code from the list and save the changes.

- The following Figure C.19 shows the screenshot of the Create Supplier page

Figure C.19: Create Supplier Page

Create Custodian

- This page is where we can create/edit the Custodian information.

- Enter the Name, Designation, Effective Date and the Status and save it.

- All the custodians will be appearing in a list at the bottom of the page.

- The people who are in the list can be found in the Fixed Asset entry page.

- Figure C.20 shows the screenshot of the Create Custodian page.

Figure C.20: Create Custodian Page

Create Maintenance Person

- This page is where we can create/edit the Maintenance Person.
- Enter the Name, Expertise, Effective Date and the Status. The system will generate an ID for each person while saving.
- All the 'maintenance person' will be appearing in a list at the bottom of the page.
- Figure C.21 shows the screenshot of the Create Maintenance Person page.

Figure C.21: Create Maintenance Person Page

Create Asset Type

- On this page, it is possible to create /edit the Asset Types
- When adding a new Asset into the system, these types can be chosen from the drop-down list.
- Figure C.22 shows the screenshot of the Create Asset Type page.

Figure C.22: Create Asset Type Page

Manage User Accounts

- This is the page where the User IDs will be created.

- Here it is required to add The Username, Password and the User group.

- User Groups are assigned with a permission list and therefore the Users will be able to access only the relevant pages according to their user group.

- All the Users will be appearing at the list at the bottom of the page.

- The Admin can terminate the user access to the system through the Edit link in the list at the bottom the page.

- Figure C.23 shows the screenshot of the Manage User Accounts page.

Figure C.23: Manage User Accounts

Create / Restore Backup

- There are two tiles (links) available for creating and restoring the file backups.

- When creating the backups, the system will ask for a destination to be chosen, where the Admin can save the files in the appropriate location.

- Similarly, when restoring the backup, it is possible to select the location from where we can get it.

- The Figure C.24 shows the Create Backup and the Restore Backup Tiles.
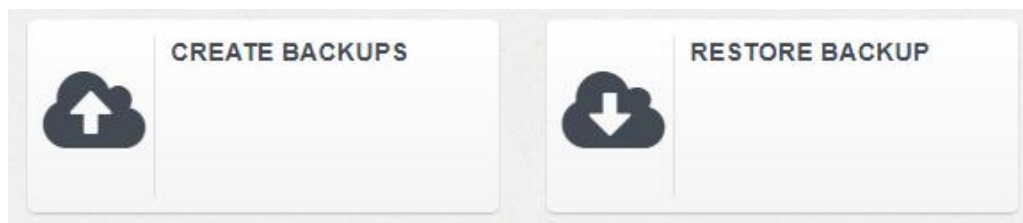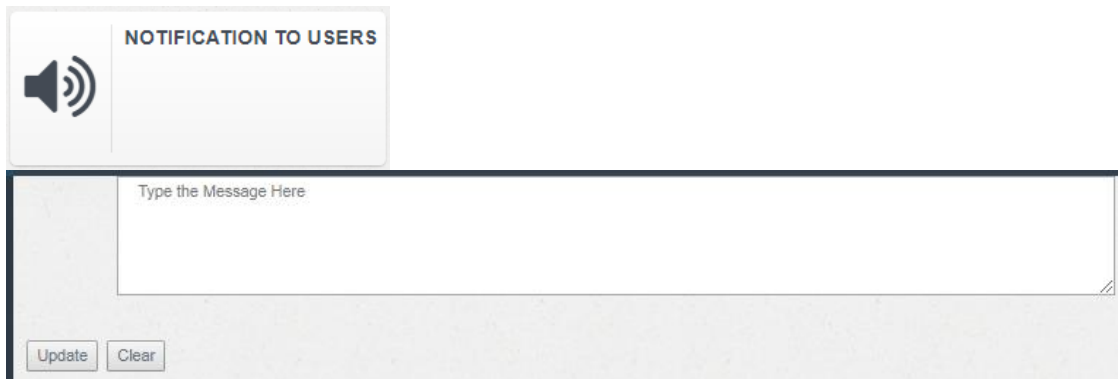
Figure C.24: Create and Restore Backup

Send Notifications to the Users

- To send out a common notification to all the users, the Admin can use this component.

- When clicked on the 'Notification to Users' tile, there will be appearing a text area to enter the message.

- The message will be appearing on the login page where all the Users can see.

- The Figure C.25 shows the Send Notifications to the Users page.

Figure C.25: Notifications to the Users

Appendix D: Management Reports

Full Data Extract Report

There are two types of formats are available. One is PDF and the other one is Excel.
Figure D.1 shows the report which gives the key information of the Fixed Assets in
the company.

Full Data Extract Report

ID	Description	Type	Make	Tag No	Serial1	Cost-LKR	AquisitionDate	Supplier	Custodian	Location	Place/Room
000001	T480	Laptop	Lenovo	tag001	LGN001	150000	2017-10-25	Thakral One	Grushi	COL01	First Floor
000002	Think Centre	Desktop PC	Lenovo	tag002	QWE002	150000	2017-10-27	John Keells	Elangho	COL01	Ground Floor
000003	T470	Laptop	Lenovo	tag003	RTY003	150000	2017-10-27	John Keells	Grushi	COL01	Ground Floor
000004	Toshiba E Studio 235	Photocopier	Toshiba	tag004	TSB004	350000	2017-10-29	John Keells		COL01	Ground Floor
000005	Think Centre	Desktop PC	Lenovo	tag005	TSE005	150000	2017-10-27	John Keells	Suba	COL01	Ground Floor
000006	Samsung S7	MobilePhone	Samsung	tag006	SMG006	100000	2017-10-27	Abans PLC		COL01	Ground Floor
000007	Toshiba E Studio 335	Photocopier	Toshiba	tag007	TSR007	300000	2017-10-28	Metropolitant		COL01	Ground Floor
000008	T420	Laptop	Lenovo	tag008	TRS008	150000	2017-10-28	Metropolitant		COL01	First Floor
000009	Samsung S7 PLUS	MobilePhone	Samsung	tag009	SMG009	80000	2017-10-28	Abans PLC		COL01	Ground Floor
000010	T450	Laptop	Lenovo	tag010	TRS010	150000	2017-10-28	Metropolitant		COL01	Ground Floor
000011	Think Vision	Desktop PC	Lenovo	tag011	LNV011	150000	2017-10-28	John Keells	Elangho	COL01	Ground Floor
000012	Centric 2"	WaterPump	Jinasena	tag012	JNS012	50000	2017-10-28	Singer Mega	Grushi	COL01	Ground Floor
000013	Sony S7800 30mp	DigitalCamera	Sony	tag013	SNY013	40000	2017-10-28	John Keells		COL01	Ground Floor
000014	HP R4500	Scanner	HP	tag014	HP014	60000	2017-10-28	Trident Coperation Ltd		COL01	Ground Floor
000015	T470	Laptop	Lenovo	tag015	LNV015	150000	2017-10-28	John Keells		COL01	Ground Floor
000016	T470	Laptop	Lenovo	tag016	LNR016	150000	2017-10-28	John Keells		COL01	Ground Floor
000017	T450 , core i5	Laptop	Lenovo	tag017	L-PC0ARMZN	150000	2017-11-08	Thakral One	Elangho	COL01	Ground Floor

Figure D.1: Full Data Extract Report

Purchase Request Form Report

- Once the Purchase Request is saved on the system it is possible to generate
  this report.

PURCHASE REQUEST

SR No: COL/001	Project Budget Code:	Deliver Items to: COLOMBO
Requested by: GOHILAN		
Location: COLOMBO	Date Required:	Currency: LKR

Line No	Description (Details specification including dimensions/ Make /model/ Part Number and any other requirement)	Quantity	Unit (e.g. Pos/ box of 10)	Budget line	Estimated Unit cost	Estimated line total
01	OCV 005 VISITER CHAIR	01	NOS		7987.50	7987.50
Notes:				Total:		7987.50

Technical Approval:	Budget Holder Approval:	Accepted By Logistics: ☐ YES ☐ NO
Signature:	Signature:	Signature: (when Yes):
Name:	Name:	Name:
Position:	Position:	Position:
Date:	Date:	Date:

Figure D.2: Purchase Request Form Report

Appendix E: Test Results

Add Items Page
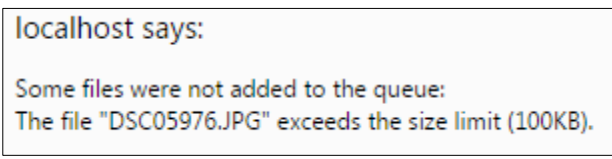
ID	Test Case	Expected Output	Results
1	Prompt an error message if tried to 'Sign In' without User ID and/or Password.	Prompts error	Pass
2	Prompt an error message if the User ID and/or Password were wrong.	Prompts error Please check your user name and password!	Pass
3	Click on the ⏏' icon on the top right side of the Homepage and click 'Yes' to "Log out?" button	Logged out of the system	Pass
4	When clicked the Select File button, it should allow to browse and select the image file	Allowing to choose an image file within the 100kb	Pass
5	When clicked the Select File button, and if chosen a file other than allowed size, it should prompt a warning message	Warning message appears localhost says: Some files were not added to the queue: The file "DSC05976.JPG" exceeds the size limit (100KB).	Pass
6	If the 'License' checkbox is selected, then License Type, License No and License Expiration fields should appear	License Type, License No and License Expiration fields will appear	Pass

Table E.1: Test Cases-Add Items

Purchasing Page
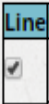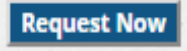
ID	Test Case	Expected Output	Results
1	Click on the Purchasing Tile and then click on the Purchase Request Tile	Purchase Request Form will open	Pass
2	Complete the first line of request and press the button to add another row	A new row will be added into the request	Pass
3	Click on the checkbox at the beginig of the row and click on the button at the end of the row, to delete the row.	The selected row will be deleted	Pass
5	Press the button to save the record.	System will check if the budget code is provided. If the budget code does not exist, then it will focus on the field and the record will not be saved, until the user enters the budget line	Pass

Table E.2: Test Cases - Purchasing

Appendix F: Code Listings

An overview of the codes is given in this Appendix. The complete system code is stored in the CD-ROM for reference.

JavaScript function for depreciation calculation

The following code will do the depreciation calculation for the Fixed Assets.

It will initially create an empty table to show the calculated values and then start collecting the values for the process. Before starting the calculation, it will do some validation checking and if anything was wrong it will prompt an error message.

```javascript
function calcDepreciation(){

    $('#depTable tbody').empty();  // create an empty table

    var localCost =$('#localCost').val();                    // collect the variables
    var depStartingDate =$('#depStartingDate').val();
    var stYear = new Date().getFullYear();
    var lifetime =$('#lifetime').val();
    var salvageValue =$('#salvageValue').val();

    if (salvageValue > localCost) {
            alert("Residual value cannot be more than purchased value!");
            $('#salvageValue').focus();
            return false;
    }     // Check if the residual value is higher than purchasing value

    if (lifetime == null || lifetime == "" ) {
            alert("Lifetime is required!");
            $('#lifetime').focus();
            return false;
    }  // Check if the Asset life time is null or left blank

    if (lifetime >20) {
            alert("Life Time cannot be more than 20 years!");
            $('#lifetime').focus();
            return false;
    }  // Check if the Asset life time is more than standard life period

    if (localCost == null || localCost== "" ) {
            alert("Cost Local Currency' is required!");
            $('#localCost').focus();
            return false;   // Check if the Purchasing value is null
        }else{

            var depAccumlatedData= new Array().

            var depStBookVal=localCost;
```

PHP code for Add Items

The following code snippet will be collect the values from the Add Items user interface page and store them into the variables to store them in the database tables.

- First this will use the common Configuration file, where it will get access to the database connection.

- Collect the data into the variables

- Additional values will be collected if the Asset has the License information.

```php
require_once '../../control/config.php';

$itemCode=intval($_POST['itemCode']);
$itemType = $_POST['itemType'];
$description = $_POST['description'];
$manufactured = $_POST['manufactured'];
$assetTagNo = $_POST['assetTagNo'];
$serial1 = $_POST['serial1'];
$serial2 = $_POST['serial2'];
$serial3 = $_POST['serial3'];
$make = $_POST['make'];
$class = $_POST['class'];
$itemStatus = $_POST['itemStatus'];
$licenseApplicable = $_POST['licenseApplicable'];
$licenseType = $_POST['licenseType'];
$licenseNo = $_POST['licenseNo'];
$licenseExpiration = $_POST['licenseExpiration'];
$completeStatus = $_POST['completeStatus'];
$deleteStatus=0;

    if (isset($_POST['licenseApplicable'])) {
        $licenseApplicable= "1";
    } else {
        $licenseApplicable= "0";
    }

$aquisitionDate = $_POST['aquisitionDate'];
$supplier = $_POST['supplier'];
```

- When saving the record, the following code snippet will control them in a 'Transaction clause' to assure that all the data will be stored in all the relevant files accurately and maintain the consistency of the database.

```php
try {
    // if user press Save perform insert
    if (isset($_POST['AddItem'])) {

        $conn->beginTransaction();
        //-----------------------------------Updates the Item Master file

        $sql = 'INSERT INTO tbl_itemmaster(itemCode, description, itemType, class,
                . 'VALUES(:itemCode, :description, :itemType, :class, :assetTagNo,

        $stmt = $conn->prepare($sql);
        $stmt->execute(array(
            'itemCode' => $itemCode,
            'description' => $description,
            'itemType' => $itemType,
            'class' => $class,
            'assetTagNo' => $assetTagNo,
            'serial1' => $serial1,
            'serial2' => $serial2,
            'serial3' => $serial3,
            'localCost' => $localCost,
            'itemStatus' => $itemStatus,
            'manufactured' => $manufactured,
            'make' => $make,
            'licenseApplicable' => $licenseApplicable,
            'deleteStatus' => $deleteStatus,
            'completeStatus' => $completeStatus
        ));
```

HTML & PHP code for Item Register Table View

- The following code is responsible for viewing the Items Register.
- It has got HTML and embedded PHP code within it, where the HTML will generate the Table view and while the PHP will get the data from the database.

```html
<div class="panel panel-default">
    <div class="panel-heading">
        <h3 class="panel-title">Item View</h3>
    </div>
    <div class="panel-body">
        <table class="table datatable">
            <thead>
                <tr>
                    <th>ID</th>
                    <th>Description</th>
                    <th>Type</th>
                    <th>Category</th>
                    <th>Class</th>
                    <th>TagNo</th>
                    <th>Serial-1</th>
                    <th>Action</th>
                </tr>
            </thead>
            <tbody>
                <?php
                $sql = 'SELECT * FROM tbl_itemmaster';
                $stmt = $conn->prepare($sql);
                $stmt->execute(array());
                while ($row = $stmt->fetch(PDO::FETCH_NUM)) {
                    ?>

                    <tr>
                        <td><?php echo $row[0];?></td>
                        <td><?php echo $row[1];?></td>
                        <td><?php echo $row[2];?></td>
                        <td><?php echo $row[3];?></td>
                        <td><?php echo $row[4];?></td>
                        <td><?php echo $row[5];?></td>
                        <td><?php echo $row[7];?></td>
                        <td> <a href=EditItem.php?itemCode=<?php echo $row[0];?>> View</a> </td>
                    </tr>
                <?php } ?>
            </tbody>
```

Appendix G: Client Certificate

01/11/2017

BIT Coordinator

University of Colombo School of Computing

Colombo - 7

Dear Sir,

INVENTORY TRACKER FOR MG MEDICALS (PVT) LTD

This is to certify that Mr. Mohamed Fazal (BIT Registration No: R030279) has successfully
delivered the above-mentioned software system to the company.

Thank you

Yours faithfully

F. B. Almeda

General Manager

MG Medicals (Pvt) Ltd.

GLOSSARY

MySQL

Structured Query Language (SQL) is a programming language designed for managing data in relational database management system and MySQL is a variation of the language.

PHP

PHP: Hypertext Preprocessor (PHP) is a server-side scripting language designed for web based system development to produce dynamic web pages.

Apache

A web server software developed by the Apache Software Foundation, which is available for free and it can run PHP scripts.

AJAX

Asynchronous JavaScript and XML (AJAX) is a program of exchanging data with a server and update parts of a web page without reloading the whole page.

Responsive Web Design

Responsive web design is a process of designing and building websites to provide better accessibility and optimal viewing experience to the user.

With the growing trend of smartphones and tablets, it has become almost unavoidable to ignore the optimization of sites for mobile devices. Responsive web design is a preferable alternative and an efficient way to target a wide range of devices with much fewer efforts.

Responsive layouts automatically adjust and adapt to any device screen size, whether it is a desktop, a laptop, a tablet, or a mobile phone [11].

Anomalies

Without normalization, many problems can occur when trying to load an integrated conceptual model into the **DBMS**. These **problems** arise from relations that are generated directly from user views are called **anomalies**. There are three types of anomalies: update, deletion and insertion anomalies [12].