IT Equipment Maintenance & Tracking System

A dissertation submitted for the Degree of Master of Information Technology

P. A. D. U. Athukorala
University of Colombo School of Computing
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ABSTRACT

Ceylon Petroleum Storage Terminals Limited (CPSTL) is the common user facility company established to facilitate the petroleum storage & distribution activities in Sri Lanka. CPSTL serve around one thousand retail outlets island-wide owned by Ceylon Petroleum Corporation and Lanka Indian Oil Corporation PLC to meet the energy demand of the retail consumers in the country and the large number of bulk consumers in various industrial sectors involved in the economic development process. Two main installations supported by 11 bulk depots, which are involved in the storage and distribution network, with around 3000 employees actively participating in various activities of the company.

CPSTL use more than 500 personal computers, laptop, printers and scanners to smoothly run their process. Information Systems (IS) function is responsible for purchasing and maintaining IT equipment for CPSTL. IS function keeps all details (item location details, complain details, maintenance details, etc.) about IT equipment in physical files, Therefore they cannot give accurate reports about IT equipment using those physical files and takes more time to prepare it.

The key objective of designing and developing IT based system for IT equipment maintenance was to reduce the effort for report generation and increase accuracy of reports and also monitoring complaint and item status online. This system has been designed as a web based application. Therefore all functions of CPSTL could access through local area network and wide area network. This system uses PHP and MySQL database for implement functionalities and HTML5, JavaScript, jQuery, Ajax and Bootstrap framework for the frontend development. Morris chart and google chart use to develop MIS reports.

This system has gone through the testing phase including user acceptance testing. These testing part used positive and negative test scenarios for ensure functionalities of the system working correctly. The user evaluation helps to ensure that proposed system met the all requirements and objectives of the client.

ACKNOWLEDGEMENTS

I take this opportunity to express my gratitude and deep regards to my supervisor Dr. Lakshman Jayaratne, University of Colombo School of Computing for his guidance and monitoring through the completion of the dissertation and also the staff members of the University of Colombo School of Computing.

I may also thanks to Mr. Janak Dharmaprema manager of IS function and Mrs. Sakunthala Ekanayake deputy manager of IS function to give me the opportunity to develop this project and provide their valuable information to their respective fields. Finally I am grateful for my wife, my parents, family members and friends for their constant encouragement without which this assignment would not have been possible.

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LIST OF ABBREVIATIONS

Abbreviation	Name
CPSTL	Ceylon Petroleum Storage Terminals Limited
IS	Information Systems
IT	Information Technology
STO	Stock Transport Orders
IP	Internet Protocol
PC	Personal Computer
MIS	Management Information System
ET	Equipment Transfer
PHP	Personal Home Page
PO	Purchase Order

CHAPTER 1 INTRODUCTION

1.1. Background

Ceylon Petroleum Storage Terminals Limited (CPSTL) is a company engaged in bulk petroleum storage and distribution activities with state of the art infrastructure facilities for management of downstream product handling in Sri Lanka. They serve around one thousand retail outlets island wide owned by Ceylon Petroleum Corporation and Lanka Indian Oil Corporation to meet the energy demand of the retail consumers in the country and the large number of bulk consumers in various industrial sectors involved in the economic development process. They have two main installations which supported by 12 bulk depots, which are involved in the storage and distribution network, with around 3000 employees actively participating in various activities of the company.

CPSTL "Information Systems" function (IS) is responsible for purchasing, repairing and maintaining of IT equipment, which use in all functions and depots.

1.2. Motivation

The inspiration to develop a web based system for IT equipment inventory and work order management for CPSTL is to increase the efficiency, effectiveness and productivity of the whole process. Existing manual process had noticeable critical issues and system users were facing many difficulties in such working environment. Also lot of fraudulent activities taking place and accuracy of the output of manual system was lower than expected level. In addition to that the top level management also not satisfied with the existing outcome.

It is also noted that in several instances, IT equipment's users were dissatisfied about service given by IS function due to the prevailing manual system. This will be affected to the productivity of the CPSTL. By considering all the stated above, it was decided to build a web based system to provide efficient service.

1.3. Problem domain

CPSTL IS function is responsible for all purchasing and maintenance of IT equipment's. When purchasing IT equipment, they raise purchase requisition for purchasing request coming from all functions of CPSTL. They accept purchasing request by using requester clarifications. After purchasing, supplier hand over all IT equipment to IS function. Then IS

function log received items details in a log book and send those items to requested user function using manual equipment transfer note.

CPSTL IS function has separate team to handle IT equipment faults. Most of complains are coming through telephone. If they cannot solve the problem through telephone line, they have to visit the location and solve the problem. Otherwise they request to send item to IS function. They log those complains in log book.

Due to that manual process, they are facing many problems. Some of major problems are,

i. Some important details are not recorded. Such that warranty details, equipment model, purchasing date, etc.. due to that reason they facing difficulties to claim warranty.
ii. Due that manual process, current location of item cannot trace and also cannot find which IT equipment are in exact location or function. Therefor they cannot do physical inventory.
iii. Computer configuration details are not recorded. Therefor internal parts of IT equipment can be steal or replace with broken parts.
iv. Due to difficulty of finding repair history of particular equipment, some management decisions cannot taken. For example they want to ban purchasing of one brand due to high maintenance cost. They cannot do that because they haven't evidence.
v. There are no records maintained for installed software details, IP address used, Operating system details of particular computer. Therefor computer technicians are facing problems when formatting computer. They don't know which software to installed.
vi. CPSTL sign agreement for IT equipment maintenance with outside vendor. They do major repairs, broken parts replacements in computers and printers. If they cannot repair or need more time to repair, they give replacement for that item. Computer clerk record those details in log books. Due to that record keeping process computer clerk cannot give accurate report for items which already in vendor.
vii. Take more time to prepare reports.

Due to above problems, they need a computer system to improve their efficiency and productivity. Further it helps to managers to take decision quickly and accurately using MIS reports generated by system.

1.4. Goals and Objectives

IT Equipment maintenance & Tracking system is proposed to maintain all details of IT equipment in web based environment by providing user friendly environment for users to facilitate the process in an efficient manner. Reduce manual documents and provide facility to view equipment history, location, configuration details, status and so many summery reports. Below points are mentioned as goals and objectives of implementing the IT Equipment maintenance & Tracking system for CPSTL.

- Developed fully functioned web based IT Equipment maintenance & Tracking system.
- Maintain 100% accurate IT equipment inventory.
- Maintain 100% accurate repair history for all IT equipment.
- Reduce time taken to generate reports and increase accuracy of the reports.
- Utilize work load by monitoring activities of computer technicians.
- Reduce unnecessary work load to the employees.

1.5. Project Scope

IT Equipment maintenance & Tracking system is proposed to implement in Web Based environment using PHP programing language and MySQL database with below functionalities.

- Maintaining User Authorization
- Maintaining Parts Category master
- Maintaining Parts features / characteristics master
- Maintaining IT equipment parts master
- Maintaining IT equipment category master
- Maintaining IT equipment master
- Maintaining Software master
- Maintaining Location/function master
- Mapping parts, software, location and maintaining IP address to IT equipment
- Maintaining & printing IT equipment maintenance request
- Maintaining IT equipment maintenance details
- Maintaining equipment transfers

- Maintaining equipment included in service & maintenance agreement.
- Generate MIS reports (IT Equipment maintenance history report, IT Equipment Ageing report, Location wise IT equipment details, IT equipment Transfer Details report, IT equipment (PC & Laptops) software, IP address and other details, etc.)

1.6. Structure of the thesis

Chapter 1 – Introduction

This provides the overview of the project in a way that motivates the reader while defining the problem clearly and briefly with the objectives and scope of the project.

Chapter 2 – Background

Background study carried out to compare with available similar systems, specifications and variations of the system.

Chapter 3 – Analysis and Design

Requirement Gathering, Analyzing and Designing techniques are discussed. Functional and non-functional requirements of the system will also be included.

Chapter 4 - Implementaion

This chapter include the aspects such as selection of implementation technology (languages, platforms frameworks, platforms etc.) and the justification for the choices.

Chapter 5: Evaluation and Testing

This is an important chapter of the dissertation which presents the user evaluation and testing of the application.

Chapter 6: Conclusion and Future Work

This chapter summarizes the work, discusses its findings and contributions, points out limitations of the current work, and also outlines directions for future research.

CHAPTER 2 BACKGROUND

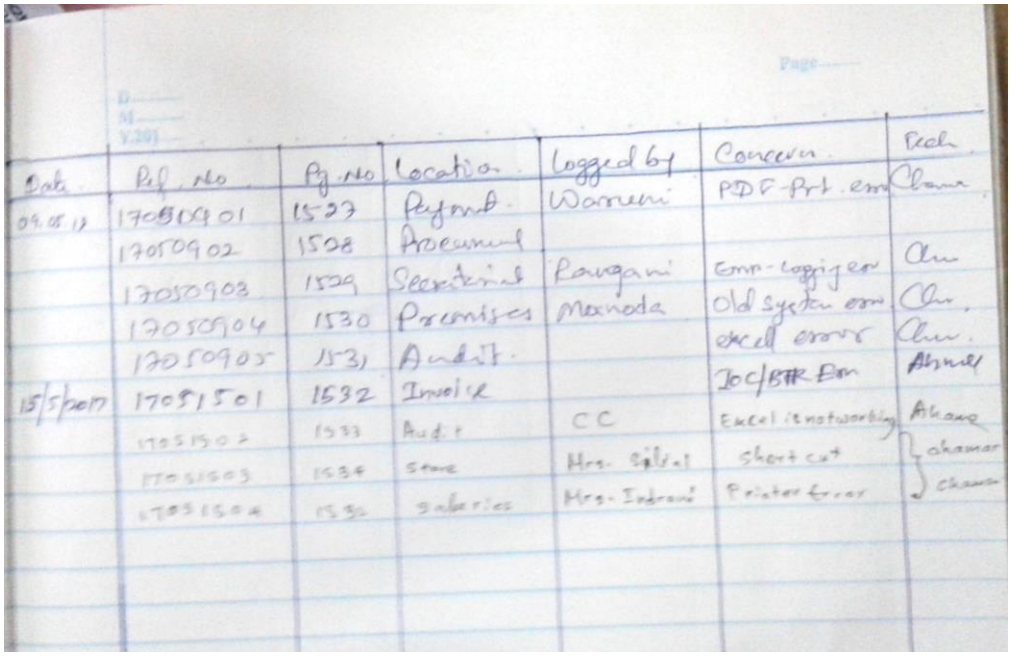
2.1. Business Process

- IT Equipment Purchasing process

All new IT equipment requirements of any function is requested from IS function through a letter signed by relevant head of function. That letter contains Item Description and Internal Order (IO) numbers which want to create purchase requisition (PR). Then considering the request letter, IS function employee creates PR and sends it to procurement function. After the procurement process, supplier delivers the items to IS function. Then IS function technician checks those new items and accept receipt if there is no issue. If new item is laptop or desktop computer, then technician installs user requested software, printer drivers and assign IP address to the PC. After that he marks asset numbers and transfers to relevant function using equipment transfer (ET) form.

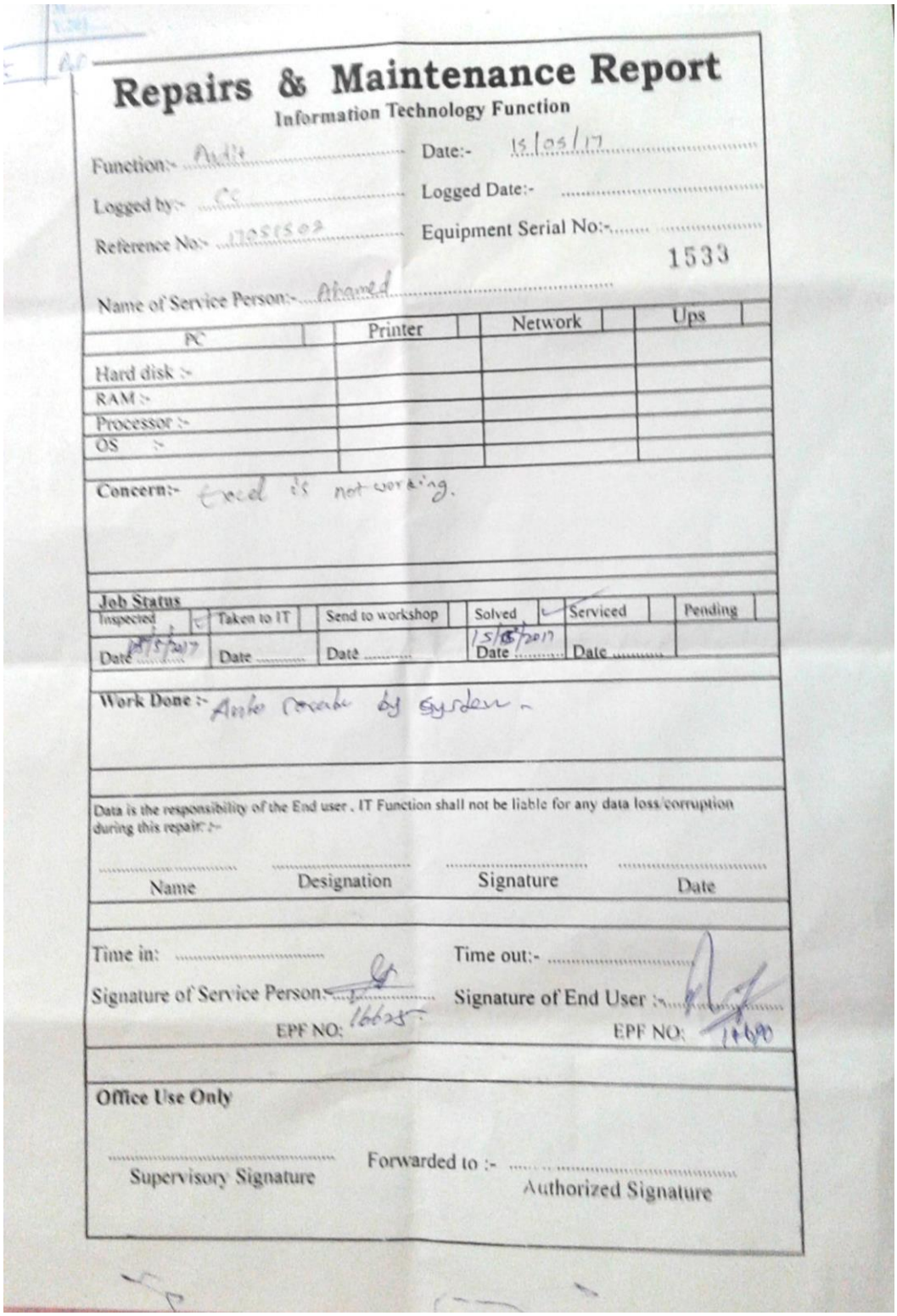
- PC, Printer and Scanner repairing Process

When IT equipment is broken, user calls to IS function and tries to solve over the phone. If it is unable to solve the problem, then computer clerk logs the issue in CR book and raise a "Repair & maintenance" form.



Date	Ref. No	Pg. No	Location	Logged by	Concern	Resolved
09.05.17	17050901	1527	Payment	Warnemi	PDF-Prt. error	Cleared
	17050902	1528	Procurement			
	17050903	1529	Secretariat	Rangani	Error-Logging on	Cleared
	17050904	1530	Premises	Manoda	Old System error	Cleared
	17050905	1531	Audit		excell error	Cleared
15/5/2017	17051501	1532	Invoice		IOC/BTR Error	Ahmed
	17051502	1533	Audit	CC	Excel is not working	Akram
	17051503	1534	Store	Mrs. Silva	short cut	shanmugam
	17051504	1535	Salaries	Mrs. Indrani	Printer error	Chamara

Figure 2-1 Complain log book



Repairs & Maintenance Report

Information Technology Function

Function:- Audit Date:- 15/05/17

Logged by:- CC Logged Date:-

Reference No:- 1705502 Equipment Serial No:-

1533

Name of Service Person:- Ahamed

PC	Printer	Network	Ups
Hard disk :-			
RAM :-			
Processor :-			
OS :-			

Concern:- Excel is not working.

Job Status

Inspected	Taken to IT	Send to workshop	Solved	Serviced	Pending
Date 15/5/2017	Date	Date	Date 15/5/2017	Date	

Work Done :- Anto remote by system -

Data is the responsibility of the End user . IT Function shall not be liable for any data loss/corruption during this repair :-

Name Designation Signature Date

Time in: Time out:-

Signature of Service Person: Signature of End User :-

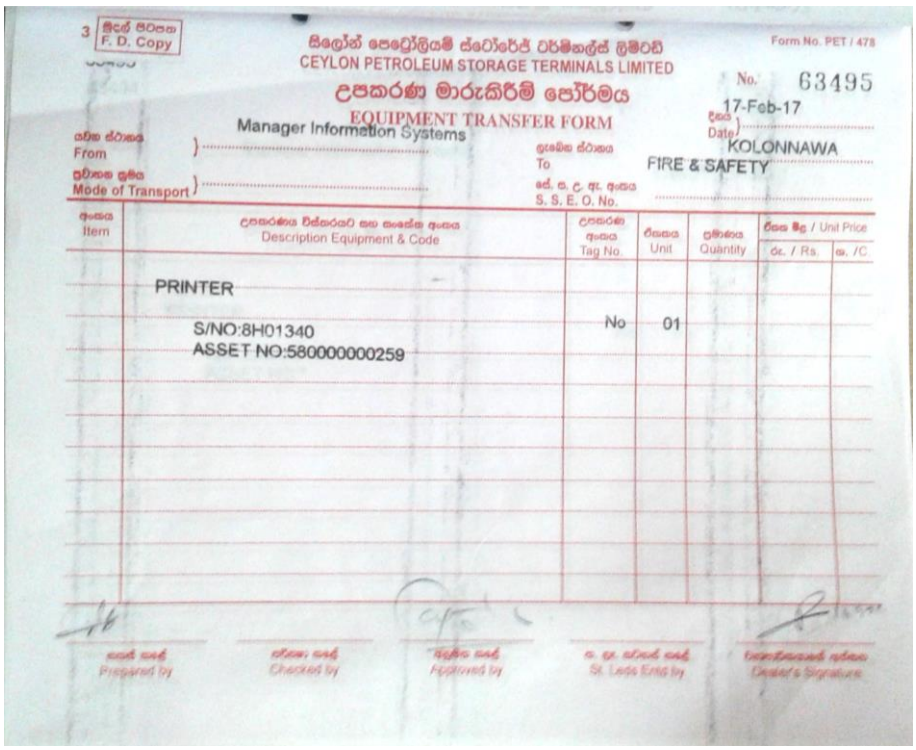
EPF NO: 16625 EPF NO: 14690

Office Use Only

Supervisory Signature Forwarded to :- Authorized Signature

Figure 2-2 Repair and Maintenance Form for completed job

If user is from depot, they have to send an equipment to kolonnawa IS function. if user is from kolonnawa, then technician goes to user location and check the issue. If technician need more time to solve the issue he requests to send it to IS function. Then user sends broken IT equipment to IS function using ET form.



3 F. D. Copy

සිලෝන් පෙට්‍රෝලියම් ස්ටෝරේජ් ටර්මිනල්ස් ලිමිටඩ්
CEYLON PETROLEUM STORAGE TERMINALS LIMITED

Form No. PET / 478

No. 63495

උපකරණ මාරුකිරීම් පෝරමය
EQUIPMENT TRANSFER FORM

Date 17-Feb-17

From Manager Information Systems

To KOLONNAWA FIRE & SAFETY

Mode of Transport

S. S. E. O. No.

Item	Description Equipment & Code	Tag No.	Unit	Quantity	Unit Price Rs.	Unit Price C.
	PRINTER S/NO:8H01340 ASSET NO:580000000259	No	01			

Prepared by | Checked by | Approved by | St. Less Exd by | Owner's Signature

Figure 2-3 Equipment Transfer Form

If user needs replacement and resources are available in IS function, then technician send the replacement for broken equipment to user using equipment transfer form. If broken equipment (Desktop computer, Laptop) has software or operating system problem, computer technician fixes the issue. If it is hardware failure and it has warranty, then inform the issue of item to supplier through email. If there is no warranty, then inform it to annual service & maintenance agreement partner. Then they come and correct the issue. If they cannot correct the issue, they carry equipment and send back similar equipment or same equipment by fixing the issue. To send equipment outside, needs to get gate pass document.

2.2. Review and Alternatives

There are several systems found in Internet which related to my proposed system.

Eg. Fixd Software [1], Manwinwin software [2]

The above systems have following features.

- Management of equipment / Asset pools
- Maintenance Management
- Inventory management
- Analysis, reports and maintenance indicators

2.2.1. About Fixd Software

Fixd is web based asset and work order management software. Fixd mainly focused on work, asset, inventory, people and knowledge. Task and schedule maintenance are included in "work". User creation is included in People. Reports are included in knowledge.

In Fixd software system we can create materials and assets. Also Fixd software support to create asset using material. That means material is component of the asset. But we can add only one component to the asset.

Following figure (figure 2.4) shows material creation in fixd software

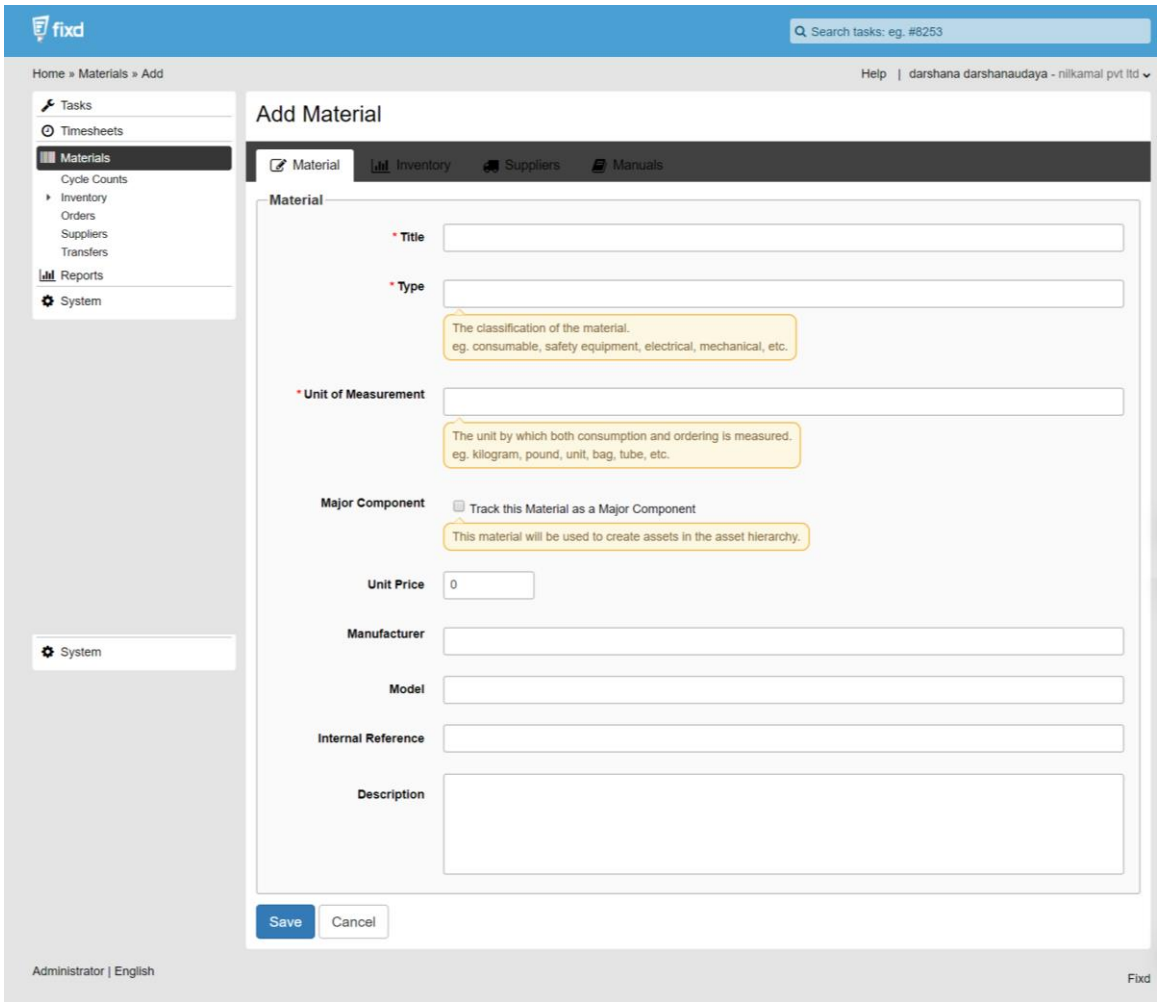


Figure 2-4 Material creation in fixd software

Following figure (figure 2.5) shows asset creation in fixd software

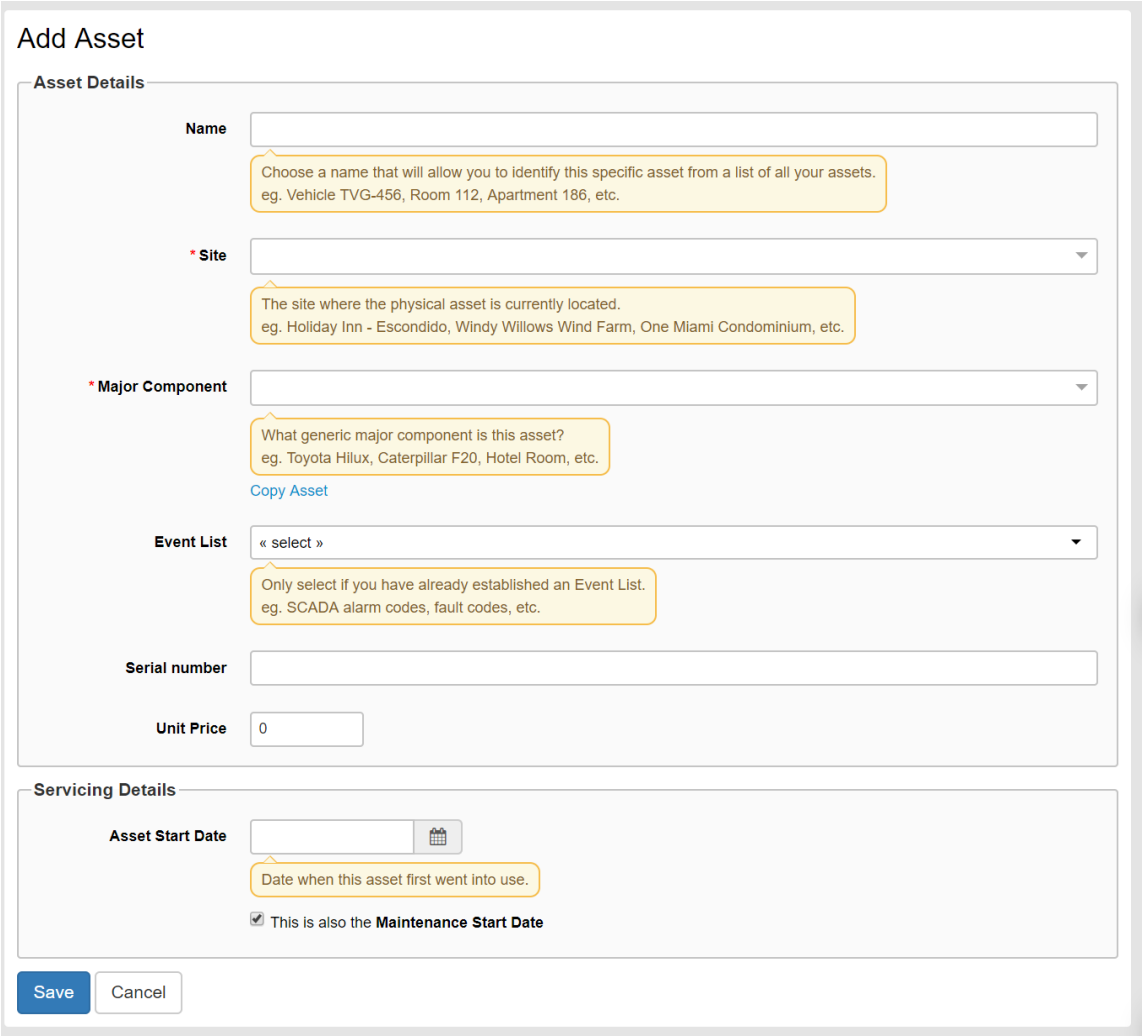


Figure 2-5 Asset creation in fixd software

According to above figures (figure 2-4 and figure 2-5) there are unwanted input fields and some important fields which need by CPSTL are not there. For example screen size of monitor, capacity of RAM. Therefor those material and asset creation need new development to achieve CPSTL requirement.

Using Fixd software we can create task as shown in following figure. After that we can assign several technicians for this task and allocate time period to do that task. Then we can add labour hours and materials which want to complete this task.

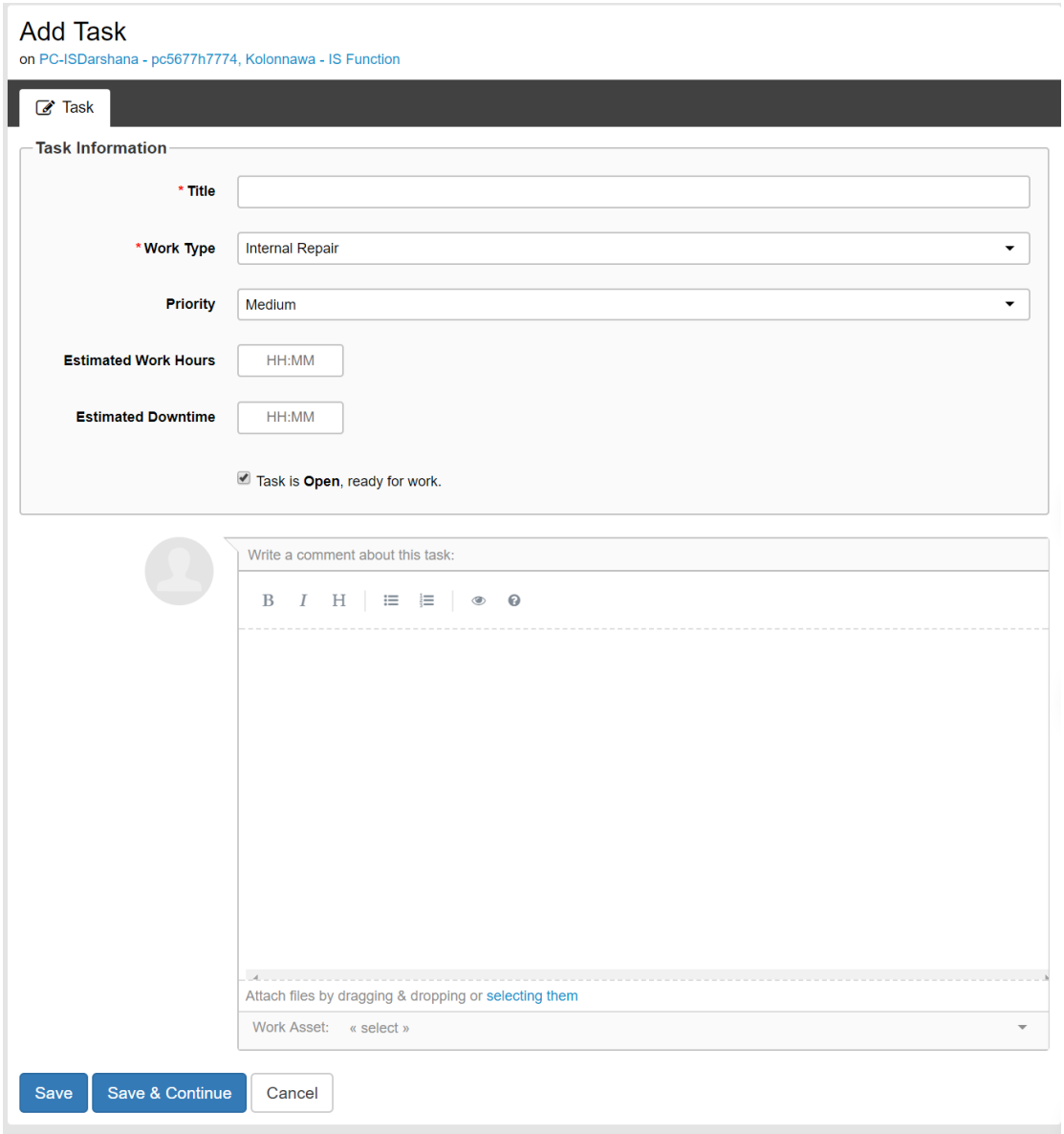


Figure 2-6 Add Task in fixd software

We can generate asset history report (figure 2-7) using fixd software as follows. This report shows all asset transfer details and its' repair history.

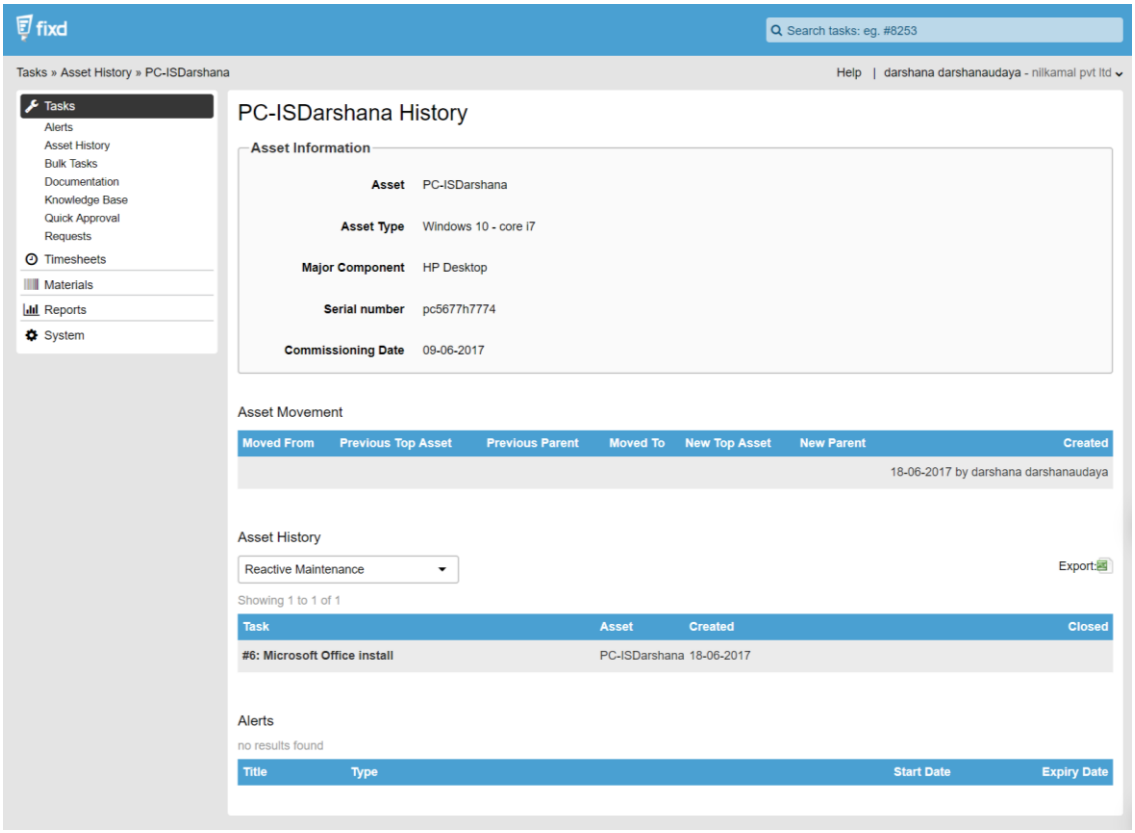


Figure 2-7 Asset History report in fixd software

And also we can generate task status report using fixd software as follows (figure 2-8), this task status reports shows all activities involve to do particular task.

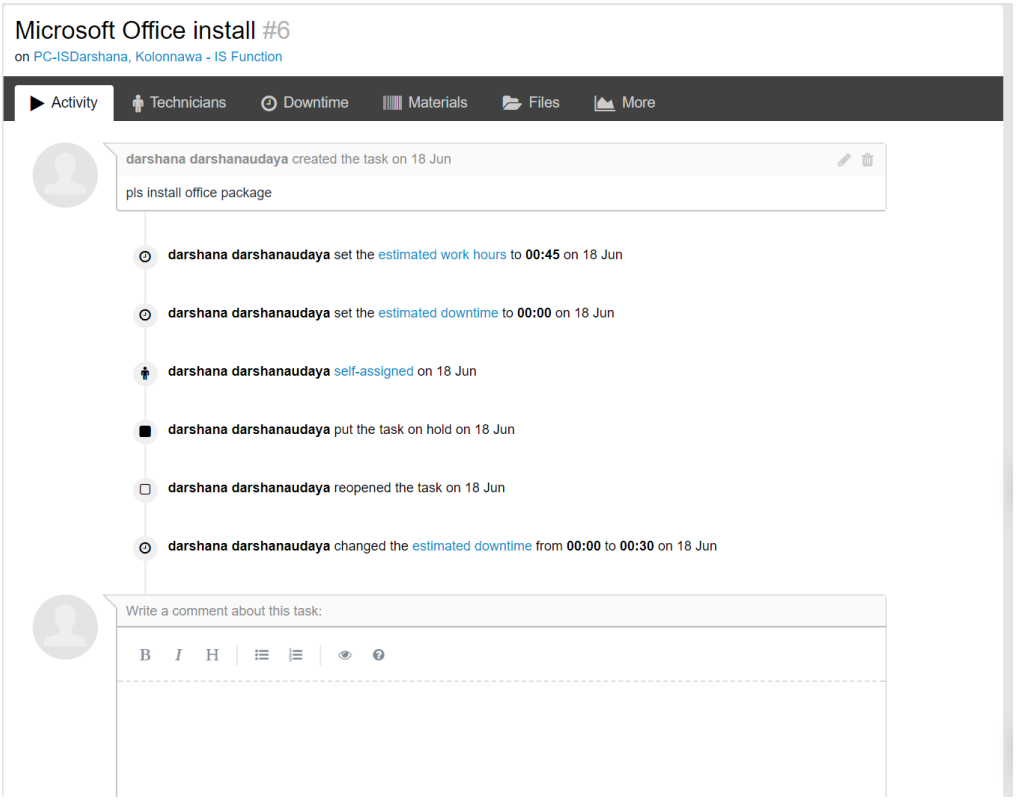


Figure 2-8 Task Status in fixd software

Technician details of above task as follows.

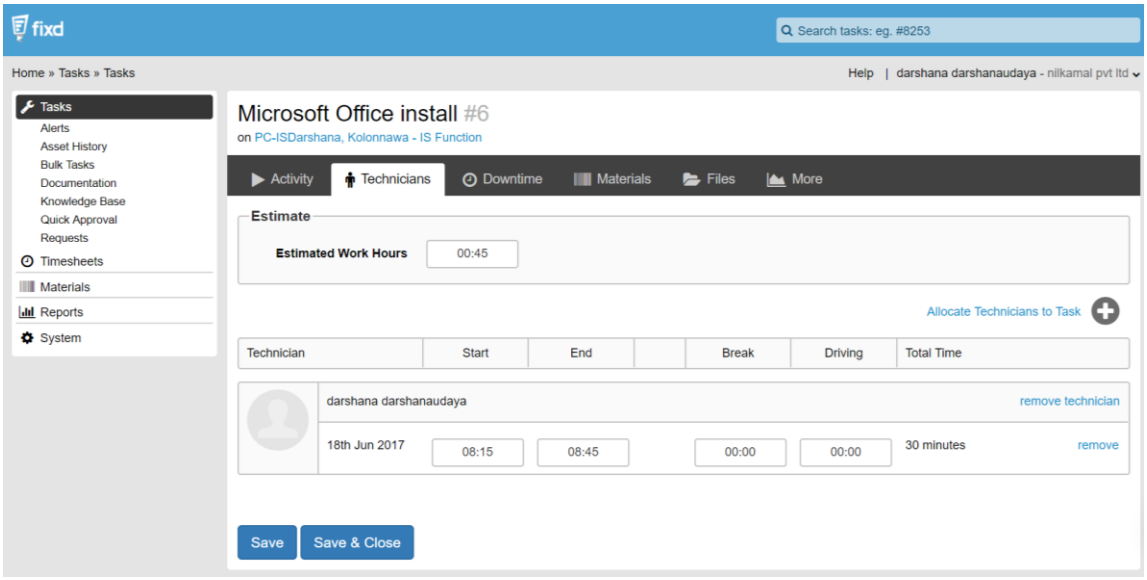


Figure 2-9 Technician Details in fixd software

The above facilities are available in fixd software and it cost $29 per month as a licence fee. However, fixd software system did not full fill the CPSTL requirements. It is not providing facility to maintain computer software details, annual agreements details, complain

and Computer configuration details etc. Therefore, CPSTL needs their own system to full fill their requirements.

2.2.2. About ManWinWin Software

Navaltik Management owns ManWinWin Software maintenance management solutions , currently in its 5th generation. There are 2 categories of this software, ManWinWin Express and ManWinWin web.

ManWinWin Express is installed in the users PCs or in an application server and the database is installed in an SQL Server. This solution is suitable for operation in a local network with several users working in the same database, sharing real time information. There are two option to purchase this software, an annual license (Use-IT) or lifetime license (Keep-IT).

ManWinWin Web, SaaS (Software as a Service) Solution is an integrated service for providing software applications to end users without requiring the end user (client) to install and run the application on their own computer or network. ManWinWin web is hosted remotely in powerful servers and accessed safely by the end user through an internet connection. Because the software is hosted remotely, users have no costs with additional hardware and no trouble with installations, maintenance or updates. There are two options SAAS corporate and SAAS professional for licensing ManWinWin web. ManWinWin software has following features.

- Dashboard
- Equipment list
- Maintenance requests
- Maintenance work orders
- Work order records
- Work order reporting
- Materials / Spare parts list
- Materials / stock outs
- Man-hours records
- Third-party services records

ManWinWin software has not covered some major functionalities of required system. Such as software details, agreement details and item configuration details. Therefore this system is need more changes to fulfil the CPSTL requirement and CPSTL have to pay for it.

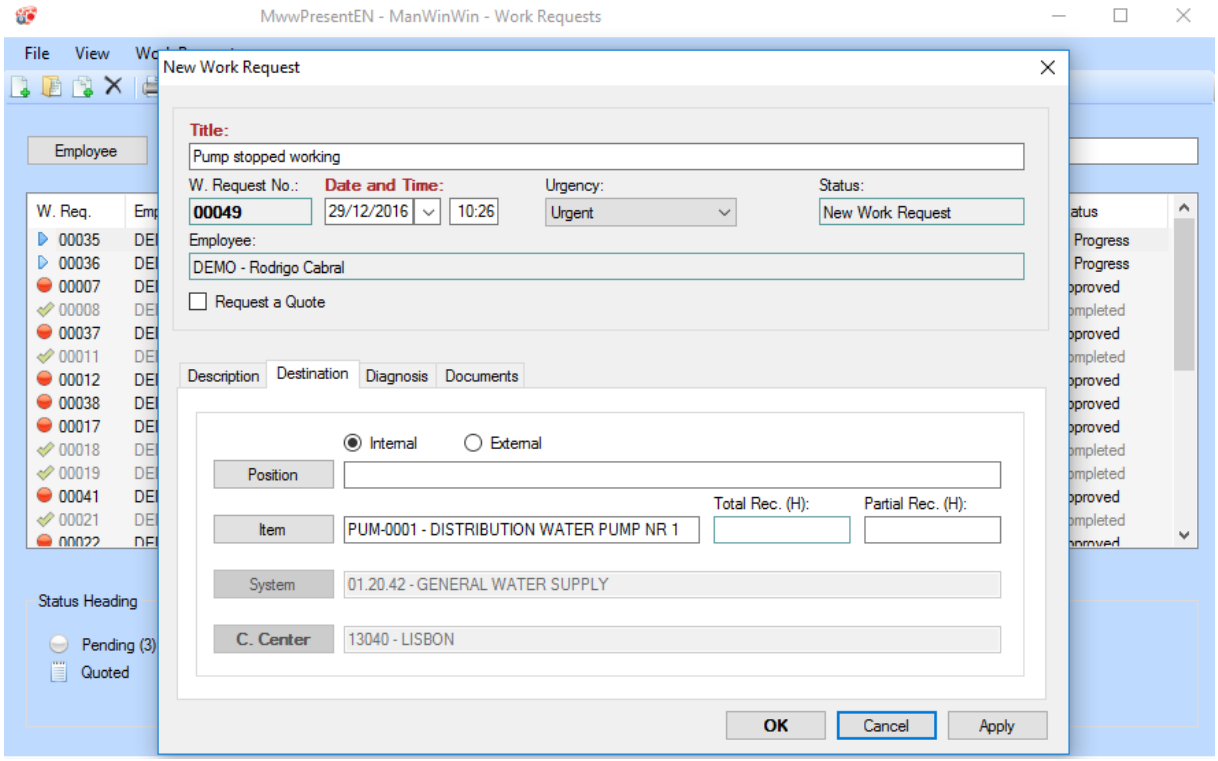


Figure 2-10 Work Request of ManWinWin software

CHAPTER 3 ANALYSIS AND DESIGN

Analysis has to do a major role in software development life cycle. Before converting a manually driven process in to a computerized system it is very important to get a vivid idea about problem domain and the user requirements.

3.1. Requirement Gathering and Analysis

Understanding fully what a project will deliver is critical to its success. So it was little bit difficult to get rid from the ambiguity of the requirements. Had to allocate a considerable time for this phase and needs to be done it in a structured manner.

Followed the below set of standard techniques to gather requirements.

Observation.

The analyst can either participate or can watch how the work is carried out inside the company. This was very important because it help to allocate weights and priorities to various kinds of daily functionalities.

Inspection of existing documentation.

Studied the existing Repair & Maintenance reports, complain log book and Outside repair log book which help to provide information on developing the new system.

One-on-one interviews

Collect information from the computer clerk, computer technician, System Engineer and Information Systems Manager through face-to-face interaction. Carried out unstructured interviews and structured interviews according to the situation.

Structured Interviews - Pre-defined specific set of questions are there to ask from the interviewee.

Unstructured Interviews - Only a general goal or subject in mind. Questions may vary from one individual to the other.

3.1.1. Functional Requirement

1. **User Management module**
    a) User Creation – System administrator can create users and set initial password for log into system.
    b) Grant Authorization – System administrator can grant authorization for users according their role in the system.
    c) Change password – giving facility to users for change their passwords.
2. **System configuration module**
    a) Item Category maintain
    b) Item features / Characteristics maintain
    c) Parts Category maintain
    d) Parts features / Characteristics maintain
    e) Mapping Item Category & Parts Category
    f) Location maintain
3. **Item Management module**
    a) Item Creation – this will facilitate to create items
    b) Change Item – using this any item changes can be done
    c) View Item – any user can view item using serial number or asset number
    d) Issue Item – this will help to issue items.
    e) Item transfer – used to transfer item between two locations
4. **Complain management module**
    a) Raise Complain – users can complain about any issue in IT equipment
    b) View complain – user can view complain details and status details about complain
5. **Work order management module**
    a) System Engineer or computer clerk assign technician for complain to investigate the issue in item.
    b) After correcting the issue in item, computer clerk or technician enter job details into the system and close the complaint. (time taken to correct the issue, issue details)
    c) If issue is not in an item and technician cannot solve, then technician can assign other person to look that issue. Eg. Network issues handle by network engineers.

6. **IT equipment service & maintenance agreement management module**
    a) Maintaining annual service and maintenance agreement with serial numbers of items included to the agreement.
    b) Remind renewal dates of annual service and maintenance agreement.
7. **Report generation module**
    a) Item maintenance History Report
    b) Location wise item details report
    c) Item aging report
    d) Technician wise Performance evaluation report

3.1.2. Non-Functional Requirements

- **Effectiveness** - System should directly affect with the current procedures of the IT equipment maintenance section of Information Systems function.
- **Performance** – The system should not take long time to save items and work orders. Website should load very quickly, else the users get annoyed.
- **Reliability** – Information which contains in the system should be accurate. Usually measured as a percentage.
- **User Friendliness** – Interacting with the system should be easy for the users and interfaces of system should not confused any user.
- **Availability** – Web site should be available whenever the customer need.
- **Quality** – System should maintain the quality of the services at all the phases.

3.2. System Design

3.2.1. Usecase Diagram for proposed system

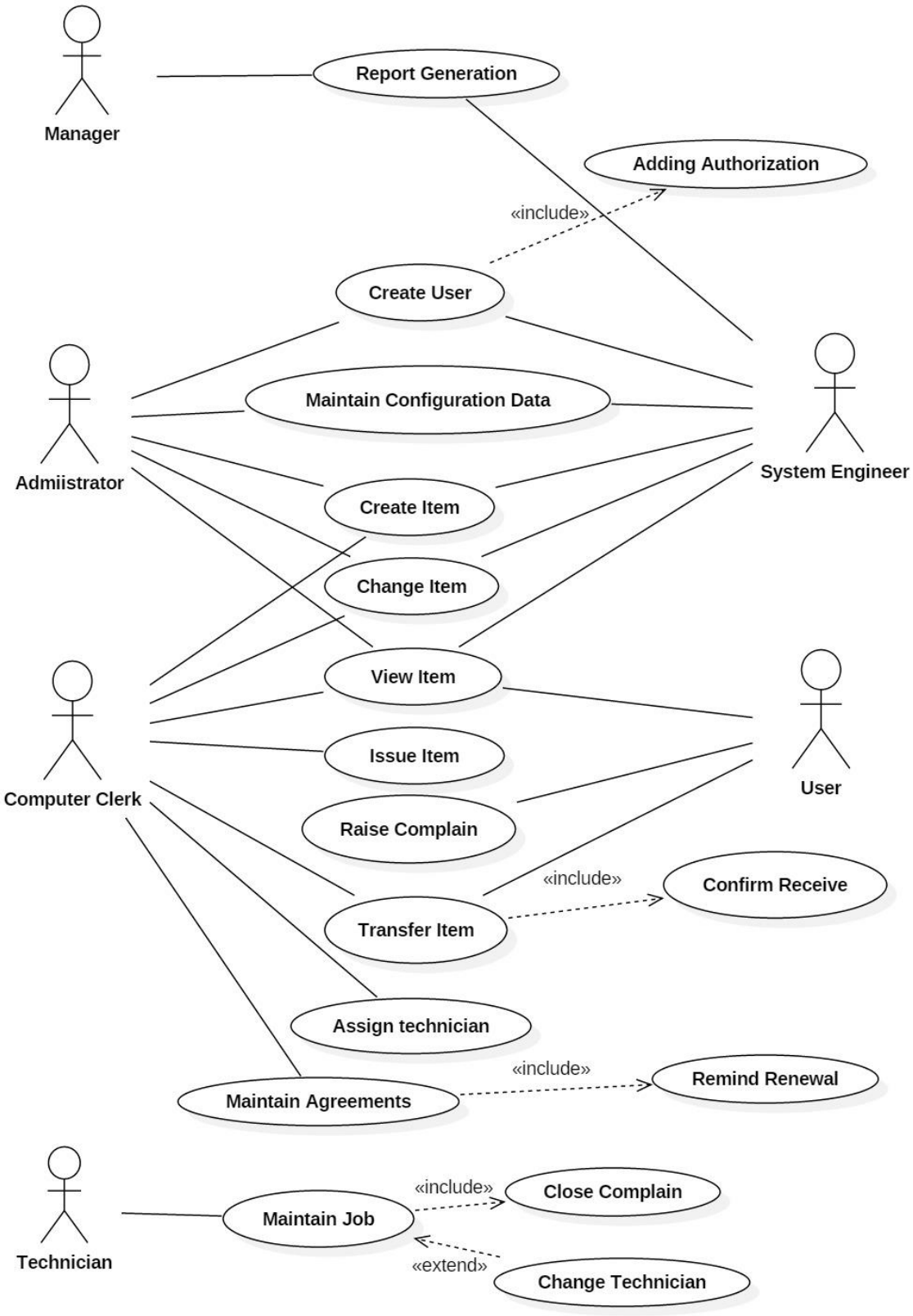


Figure 3-1 Usecase Diagram

3.2.2. Class diagram for proposed system

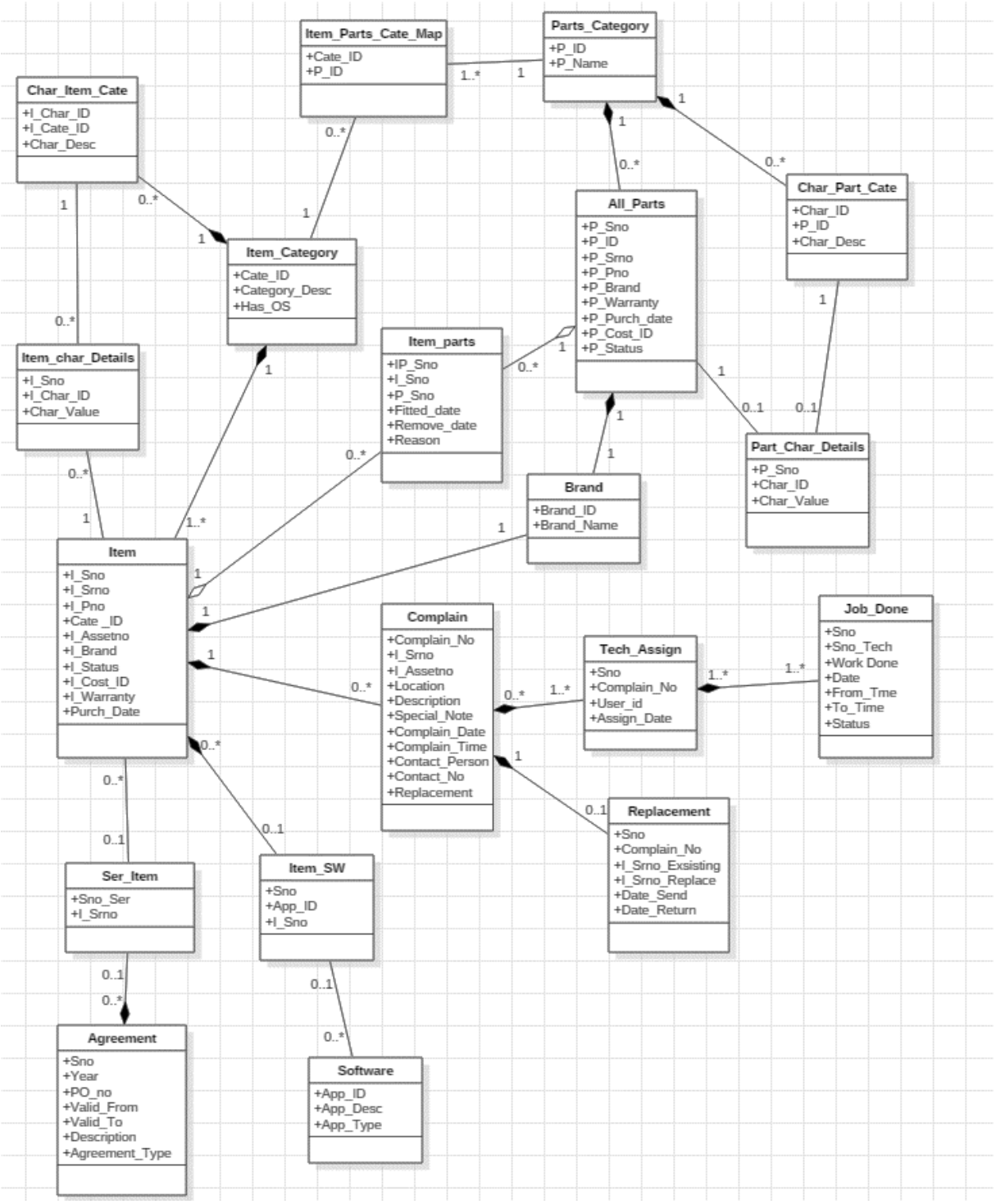


Figure 3-2 Class Diagram For Proposed System

3.2.3. Sequence Diagram for Technician Assign to Complain

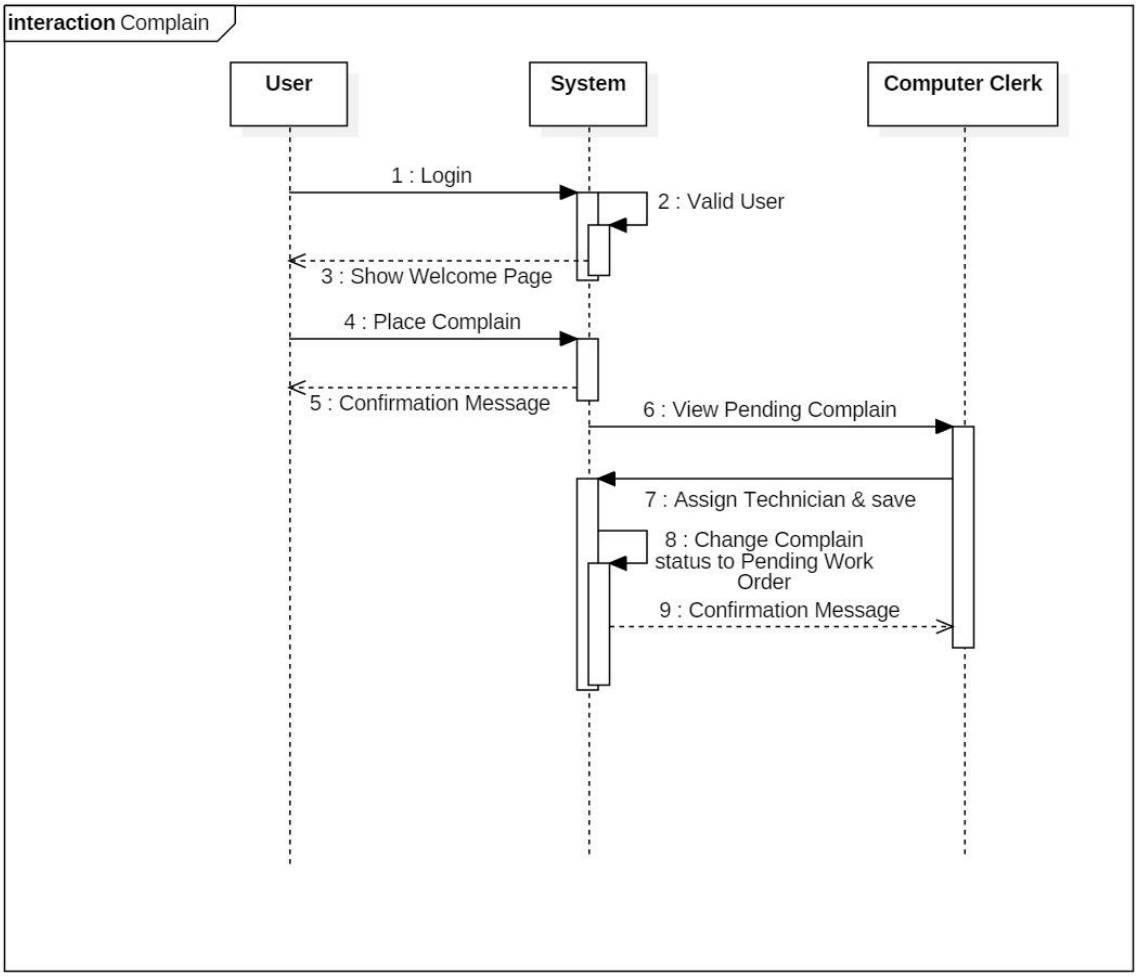


Figure 3-3 Sequence Diagram for Technician Assign to Complain

3.2.4. Activity Diagram for Technician Assign to Complain

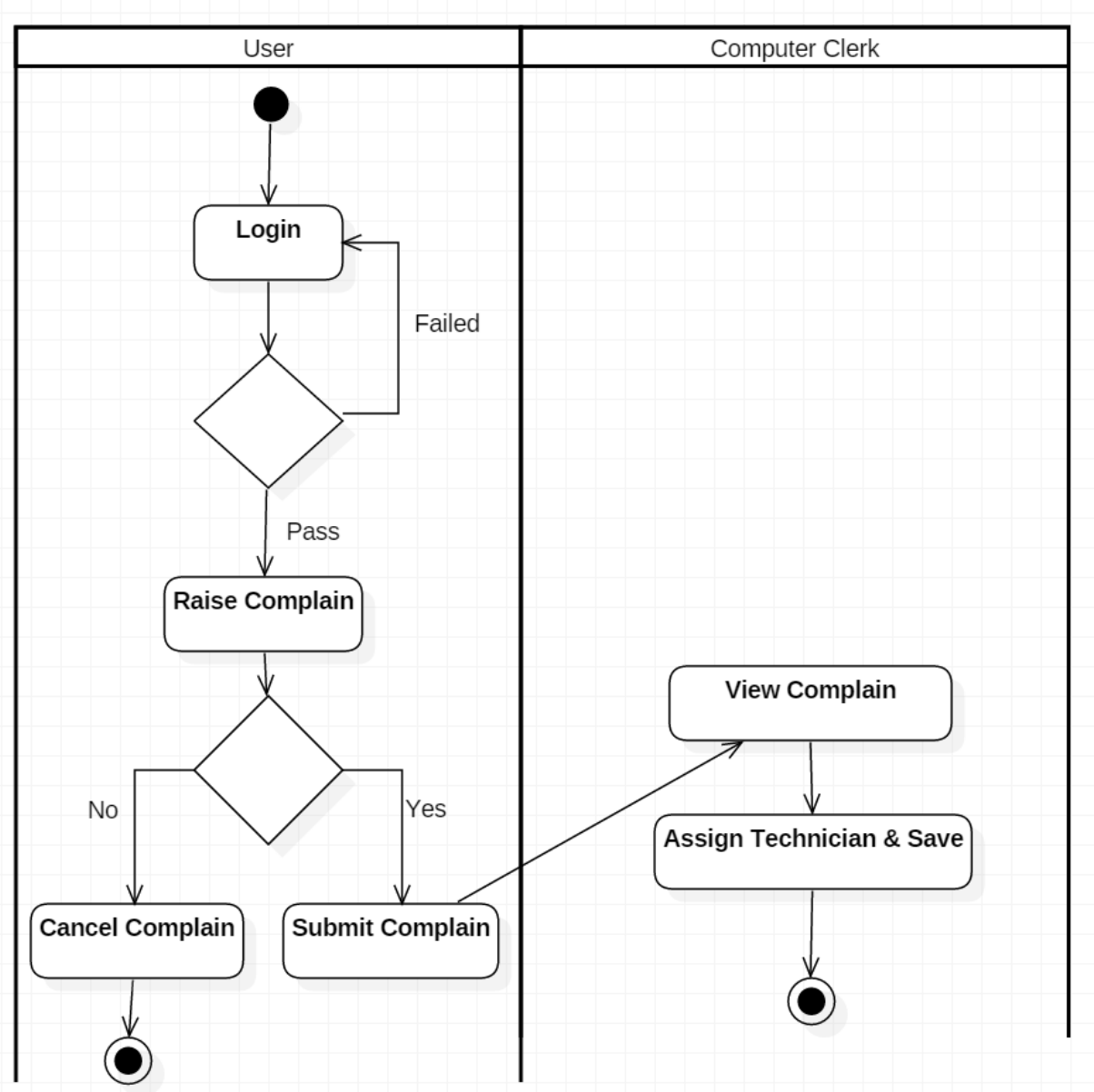


Figure 3-4 Activity Diagram for Assign Technician to Complain

CHAPTER 4 Implementation

4.1. Implementation methodology

This chapter describes the process and phases of implementation of the system. Selection of an implementation technology depended on set of key considerations

- Cost of the software and software licensing fee
- Initial and maintaining cost for the hardware tools
- Accessibility
- IT literacy of the end user
- Ambiguity of set of requirements.

Incremental implementation method had to select as the execution procedure due to above considerations. A prototype is developed as the initial state and modules and functionalities are added gradually to the same prototype model.

4.2. Hardware and Software implementation of the system

Hardware Requirements-

CPSTL has already maintained server as web server for their intranet and also they have good network between depots and kolonnawa terminal. So there is no any cost for hardware requirements.

For Web Server & set up Network

- Intel Core i3 Processor
- 4 GB RAM (minimum)
- 80 GB Hard disk (minimum)
- Keyboard / mouse / monitor 15”
- Hub / Switch / Router
- Network Card
- Network Cables & Connectors
- UPS (uninterrupted power supply)

For Client computers

- Intel Pentium IV with 500MHz speed
- 512 MB RAM (minimum)
- 40GB Hard disk (minimum)
- Keyboard / mouse / monitor 15”
- Network Card
- UPS (uninterrupted power supply)

Software Requirements

- Microsoft Windows Xp or above.
- WAMP Server 2.0 or above
- Internet explorer or relevant browser.

Development tools used

- WAMP Server
- Adobe photoshop cs4
- Sublime Text used as PHP editor

Technologies used.

- Apache – Used as a web server software
- PHP – Used to do modifications to web pages
- HTML - Used to do modifications to web pages
- CSS / Bootstrap – Used to develop colorful & interactive web pages
- JavaScript / Ajax – Used for form validation and design interactive web pages
- MySQL – to develop the database

4.3. Design Pattern

Module design pattern is used to developed “IT Equipment Maintenance & Tracking System”. In software engineering, the module pattern is a design pattern used to implement the concept of software modules, defined by modular programming.

Using this concept, web page is divided into 5 modules. They are “header”, “topbar”, “sidebar”, “body” and “footer”. “header”, “topbar”, “sidebar” and “footer” modules are common for all web pages. “Body” module is changed according to function of each pages.

4.4.Appearance of major functionalities

Below are the major user interfaces which were designed according to the user requirements.

4.4.1. Welcome Page

After successful login, welcome page is appear. It has top bar, side bar, body and footer. Top bar contains company logo, company name, User Name and Alerts. Side bar contains System name, item search box and menu items. This menu items permission is restricted according to user role. Administrator welcome login is given below. He has all th authorization of the system.

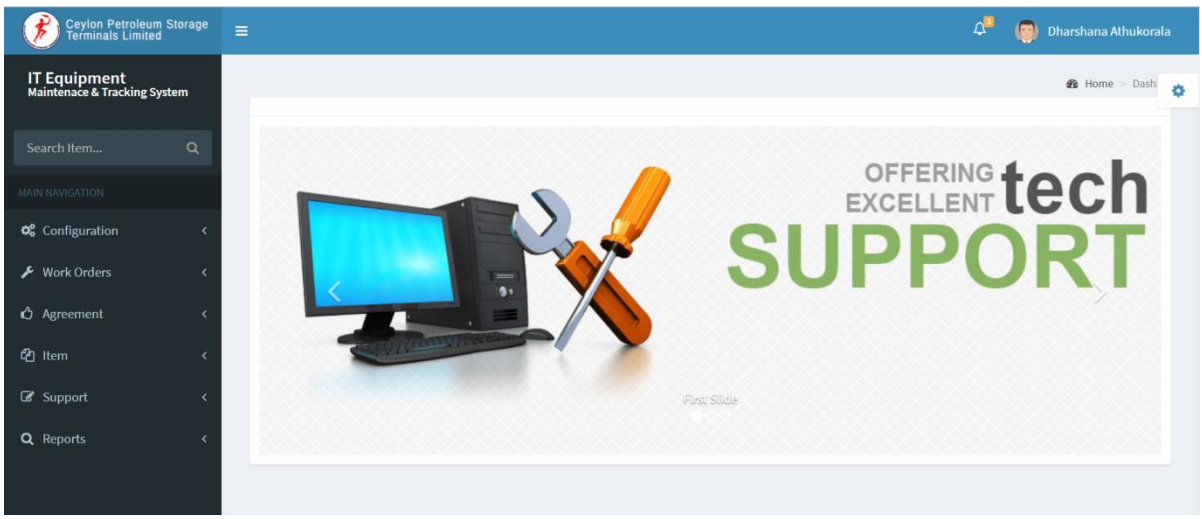


Figure 4-1 Welcome Page

4.4.2. Item Creation

In this system, item is the most important object because of the following reasons.

- Item has its' own characteristics. Such as Desktop computer has computer name, IP Address, Model name, no of USB ports etc..
- Item has several parts (figure 4-2). For example desktop computer has RAM, VGA, Hard disk, Mother board, power supply unit but Printer has printer head, cartridge etc..

Figure 4-2 Structure of system Unit

- Item Parts also has so many characteristics. RAM has characteristics like Size, Type.

According to above requirement, IT Equipment maintenance & Tracking system was designed to handle any item with that complexity.

In this system user has to select item category first because required details are changed according to item category. All the item categories has common details such as, serial no, product no, asset no, item manufacture, purchase date, warranty period, item location and item condition. This details are shown after selecting item category and also parts name are displayed to select.

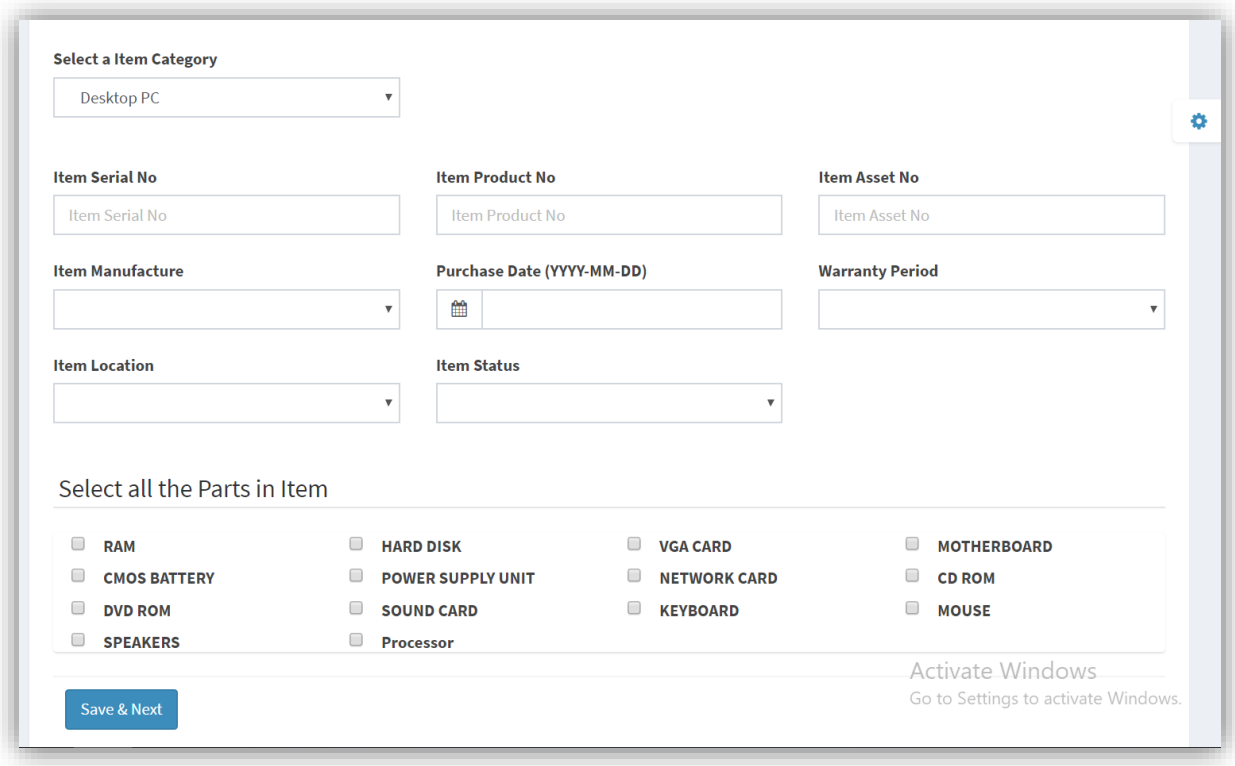


Figure 4-3 First window of item creation

According parts selected by user next page is displayed and requesting to enter parts details as follows.

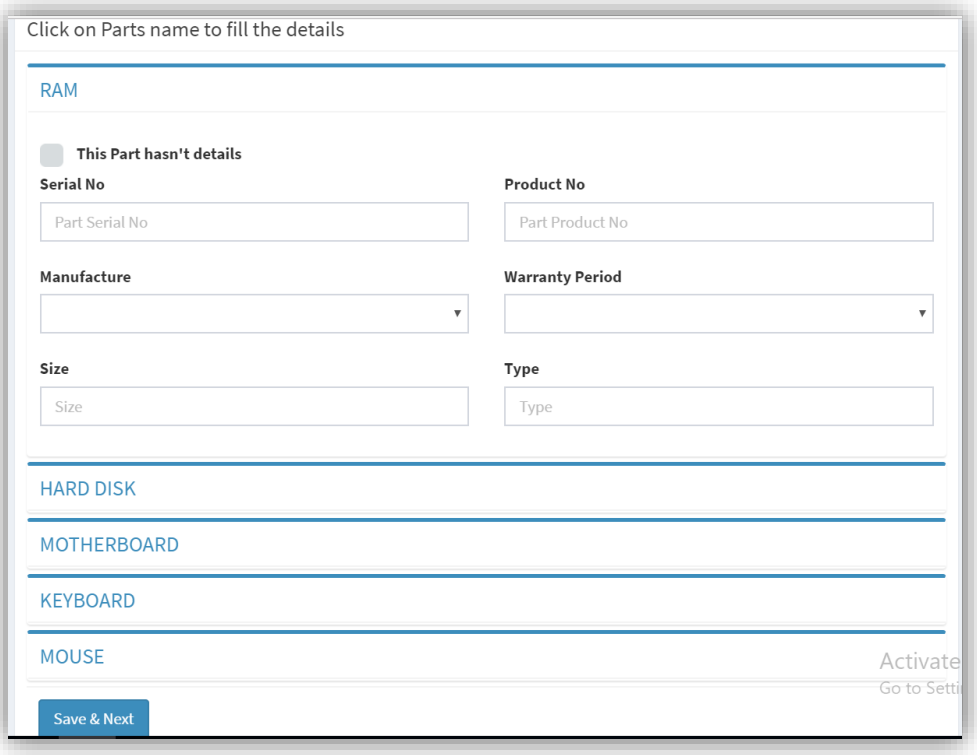


Figure 4-4 Item Parts form

Here collapsible group is used to get parts details. That parts are vary according to user selection and item category. Also input fields are changed according to parts. So it is very difficult to get save details of item parts. Following code is used to generate parts form.

```
<?php
    require('config.php');

    $Cate_ID = $_POST["Cate_ID"];
    $queryy = "SELECT P_ID, P_Name FROM v_item_part where Cate_ID =" . $Cate_ID;
    $result1 = mysqli_query($con, $queryy);

    if(mysqli_num_rows($result1)>0) {
        while($row1 = mysqli_fetch_assoc($result1)) {
            $ChkName = "chk" . $row1["P_ID"];
            // To get user tick parts
            if(isset($_POST[$ChkName]) && $_POST[$ChkName] = 'on'){

                $_SESSION["P_ID"] = $row1["P_ID"];
?>
                <div class="panel box box-primary">
                    <div class="box-header with-border">
                    <h4 class="box-title">
                    <!-- Creating collapse group for part-->
                        <a data-toggle="collapse" data-parent="#accordion" href= <?php echo "'#collapse".$row1["P_ID"
                            ]."'"; ?> >
                        <!-- Display collapse group part name-->
                        <?php echo $row1["P_Name"]; ?>
                        </a>
                    </h4>
                    </div>

                    <div id=<?php echo "'collapse".$row1["P_ID"]."'"; ?>  class="panel-collapse collapse">
                        <div class="box-body">
                        <!-- Display input box to get Parts details -->
                        <?php require('addPartsInItem.php'); ?>
                        </div>
                    </div>
                </div>
```

Figure 4-5 Cording for Item Parts form

Following code in “addPartsInItem.php” generate label and textbox to enter characteristics of parts you added in parts configuration

```
<?php
    // getting characteristics of the part
    $queryz = "SELECT Char_ID, Char_Desc FROM char_part where P_ID =" . $_SESSION["P_ID"];
    $result = mysqli_query($con, $queryz);

    if(mysqli_num_rows($result)>0) {
        $i = -1;
        //design inerface with two columns
        while($row = mysqli_fetch_assoc($result)) {
            $i += 1;
            if($i%2==0 && $i!=0){
            ?>
                </div><br/>
                <div Class ="row">
            <?php
            }
?>
            <!-- Display label and text box for characteristic -->
            <div class="col-sm-6">
                <label for="<?php echo "Var" . $row["Char_ID"]; ?>"><?php echo $row["Char_Desc"]; ?></label>
                <input type='text' size='50' maxlength='50' class="form-control" name='<?php echo "Var" . $row["
                    Char_ID"]; ?>' autocomplete="off" value="" id="<?php echo "Var" . $i; ?>" placeholder="<?php
                    echo $row["Char_Desc"]; ?>"/>
            </div>
<?php
        }
    }
?>
```

Figure 4-6 Code for generate interface for parts characteristics

After saving parts form next screen request item characteristics / features details and operating system details if item has.

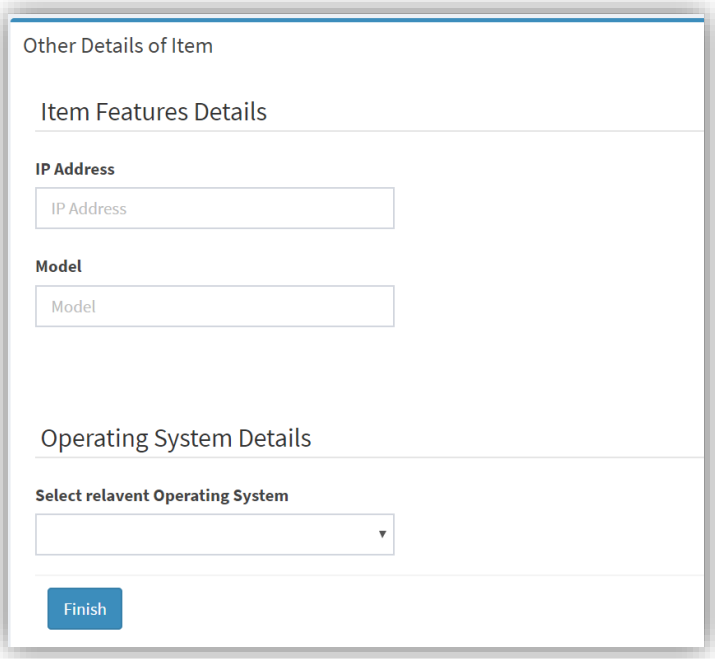


Figure 4-7 Form of Item features

Maintain Work Order

Following Screen is related to initial screen of work order maintain page. This page contains forms to maintain work done, adding parts, removing parts, view work done and maintain item software details.

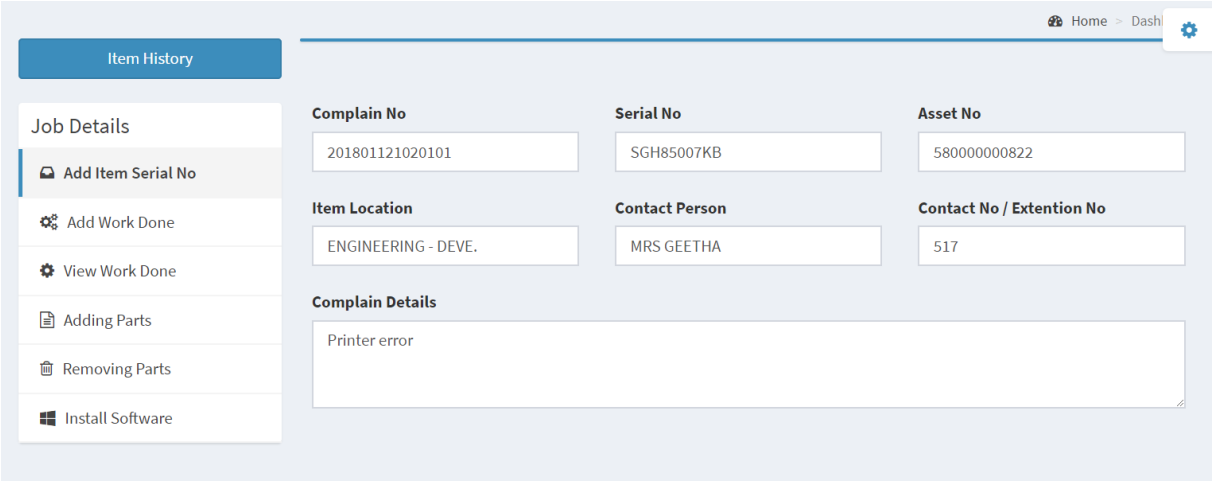


Figure 4-8 Work Order maintain page

CHAPTER 5 EVALUATION AND TESTING

Success of an every project is relay on the testing process. It aims at determining whether the promises about the product by the supplier and the needs of the customer are met on an acceptable level. This chapter describes the process of verifying and validating the system with a structured predefined manner.

5.1. Testing

Testing process includes verification and validation. Verification is done at all the stages of system development to check whether system is developed correctly. Validation is done after implementation on the executable system to check the system requirements given by the clients at the initial stages against the features of the final system.

5.1.1. Unit Testing

Unit Testing of software applications is done during the development (coding) of an application. The objective of Unit Testing is to isolate a section of code and verify its correctness. When I'm developing this system I have tested every functions and modules functionality immediately after coding done. It was help me to correcting issues before user testing. So it was minimize the major issues and helped to increase user satisfaction.

5.1.2. Integrated Testing

Integrated testing technique and acceptance testing will be used at the last phase. Modules are combined and tested as group in multiple ways. In this context, a unit is defined as the smallest testable part of the system. Integration testing can expose problems with the interfaces among program components before trouble occurs in real-world program execution.

5.1.3. User Acceptance Test

User acceptance testing will go in line with the implementation of the system. Manual process also go parallel with the preliminary implementation stage and system will be tested by the exact end user. Most of the time minor changes will capture at this stage. Testing process is almost done at the end of this stage.

5.2. Test Plan and Test Cases

In general a test plan consists with test cases, test schedules, test objectives and testing strategies. Among the above mentioned parts test cases play very crucial role in the process of evaluating the test plan. A test plan mainly contains the following components. Test Case ID, Functionality to be tested, testing procedure, test data, expected results and the priority should be given to a particular test case. All test data should be selected based on the specification for black box testing and all the individual system modules should be tested against number of test cases. Refer Appendix B for all test cases and its' result.

5.3. User Evaluation

In order to collect data for the evaluation process, sample has to identify. Sample was selected according to user level define in the system. This sample was included One Manager, two deputy managers, System Administrator, two technician, Computer clerk and three normal users. This evaluation form was given after the system training. Refer below table (Table 1) for the summery of user evaluation result.

No	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1	This system fulfills the IT equipment maintenance and location tracking requirement.	4	6	0	0	0
2	Users can understand the system easily.	7	3	0	0	0
3	This system response quickly.	5	3	2	0	0
4	This system interfaces are very attractive.	8	2	0	0	0
5	Users can navigate through the system easily.	4	5	1	0	0
6	System error messages help to understand, what was the mistake.	5	4	1	0	0
7	This system reports help to make decisions quickly.	6	2	2	0	0
8	This system increases efficiency and productivity of IS function.	8	2	0	0	0

Table 1 – User Evaluation Results

According evaluation result (refer Table 1), there is no any negative feedback. That means they happy with new system.

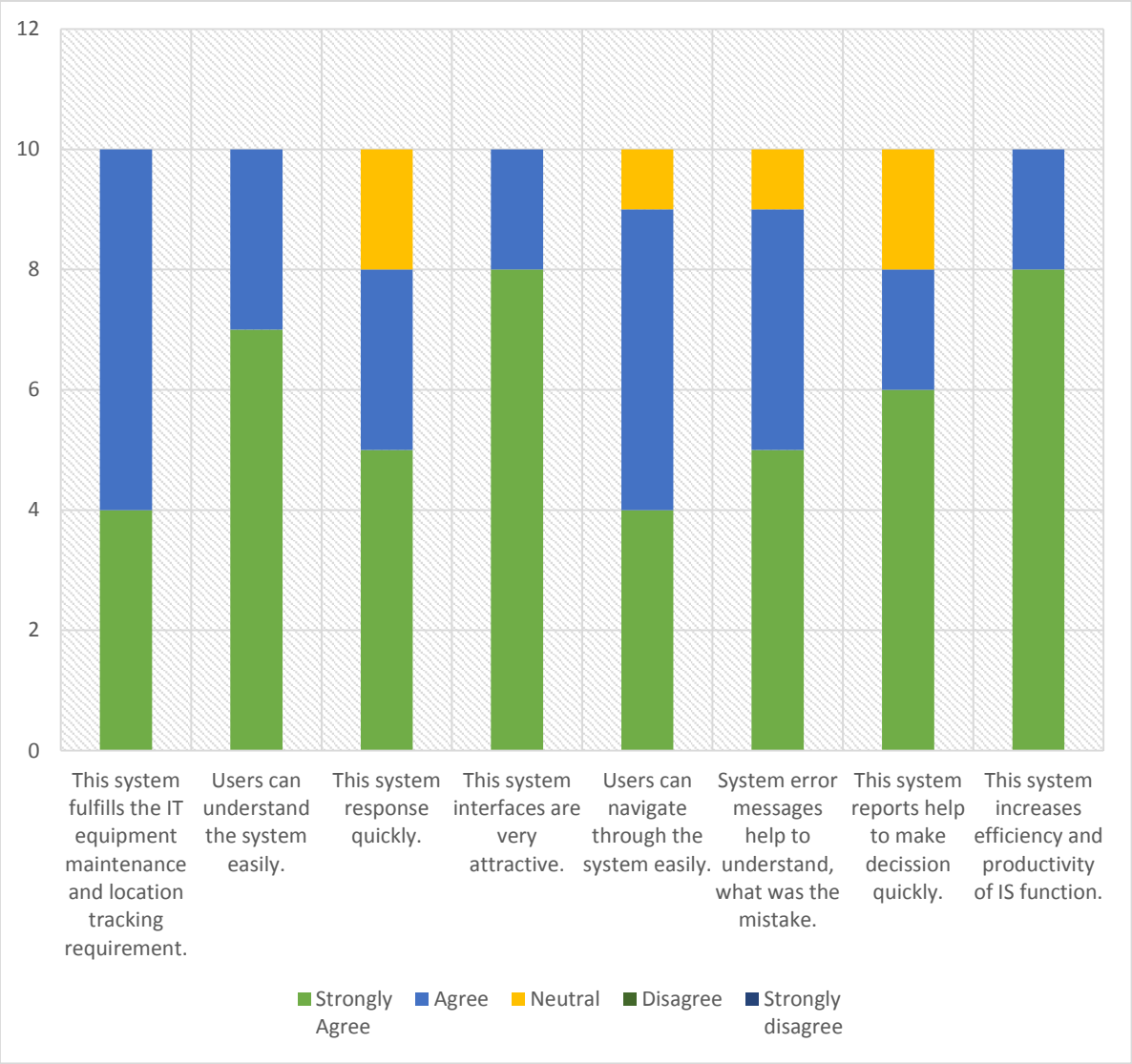


Figure 5-1 User Evaluation results

According that result they accept the "PC Maintenance & Tracking System" and they happy about it. 80% of users satisfied about reports generate from the system and other 20% was neutral. Initially some PCs took more time to load system due to some operating system configuration. That was the key that 20% of users were given neutral for system response time.

CHAPTER 6 CONCLUSION AND FUTURE WORK

The conclusion chapter here illustrates a total overview of the developed system with its constraints, achievements and draw backs. And this will summarize the author's reflection on the whole project work including a critical appraisal on the successes and limitations of project approach and the development of system itself.

6.1. Lesson Learned

IT equipment maintenance & tracking system project helped me to gain new knowledge about analyzing, designing, developing and implementing of software projects practically. A few set of problems were encountered at the developing stages and found suitable solutions to overcome them. Some of them are design level and also some of the requirements need to change slightly.

In the initial requirement gathering process they agreed to raised complain with item serial number or asset number. However after implementation they want to raise complain without serial number because it was difficult to find. So system was changed to accept complain without serial number and added facility to add serial number when maintaining work order.

In system design stage, it was very hard to design database for item because of its' complexity. Also interface design for item was very hard and it was taken more time to design it. Due to this is web application, it was taken more time to design interfaces. Sometimes some JavaScript files were not executed as preferred.

In Data migration process, there were problems to find details of items. Such that item purchase date, warranty information, asset numbers and part serial number. So it is affected to some reports generated from the system.

6.2. Critical Assessment of the project

The task in hand was to build a web based IT equipment maintenance and tracking system for CPSTL. The main objective of the system was to reduce their manual work and provide good service for all function of CPSTL. There are several work order management system on the web for purchase. But CPSTL requirement was not fulfill by those system. Those system design targeting common work order process. Therefor there are more unnecessary input fields and user interfaces are very complex. Also those system reports are not fulfill the CPSTL requirement. Therefore those system need more changes to do for fulfill CPSTL requirement. That is very expensive. Due to that reason, it was very cost effective if they can develop it in internally. Then IT equipment maintenance and tracking system was developed and all the requirements in the user specification were fulfill at the end of the project. The user evaluation test results showed that the users were satisfied with how the system functioned. This was the main achievement of the project.

6.3. Future Enhancement

Currently “IT Equipment maintenance & Tracking System” hasn’t any alert informing system. Like SMS or Email. Because every employee of CPSTL haven’t email id and very limited person has email id and internet connection. So SMS alert system is the best method for CPSTL and I hope to do it in future. Also Event calendar will help to schedule IT equipment service maintenance dates and system administrator can monitor it. Therefor it will implement in future. Also like to enhance the system to get user feedback of service given by IT team. It will helps to improve their service by identifying problems.

REFERENCES

[1]“ Fixd Software “ [Online]. Available: https://app.fixd.io [Accessed: 06-June-2017].

[2]“ ManWinWin Software “ [Online]. Available: https://manwinwin.com/en/homepage [Accessed: 06-June-2017].

[3]“ Bootstrapt Popup “ [Online].
Available: https://www.w3schools.com/bootstrap/bootstrap_modal.asp [Accessed: 06-Sep-2017].

[4]“Datepicker” [Online]. Available: https://jqueryui.com/datepicker [Accessed: 29-Oct-2017].

[5]“ Collapsible table “ [Online]. Available: https://www.bootply.com/GGAMvot45f [Accessed: 05-Nov-2017].

[6]“Pass value to Modal” [Online].
Available: https://stackoverflow.com/questions/10626885/passing-data-to-a-bootstrap-modal
[Accessed: 03-Dec-2017].

[7]“Back Button – PHP” [Online]. Available: https://www.w3schools.com/jsref/met_his_back.asp
[Accessed: 10-Dec-2017].

Appendix A User Manual

How to Open “IT Equipment Maintenance & Tracking System”

- Open any web browser application you have. (eg. internet explorer, Firefox or Google chrome)
- Then type “10.10.13.100/pcrepair “ in address bar and press enter.
- After that you get login page of “IT Equipment Maintenance & Tracking System”.
- Now enter your Username and Password. Then click on Login button. After successful

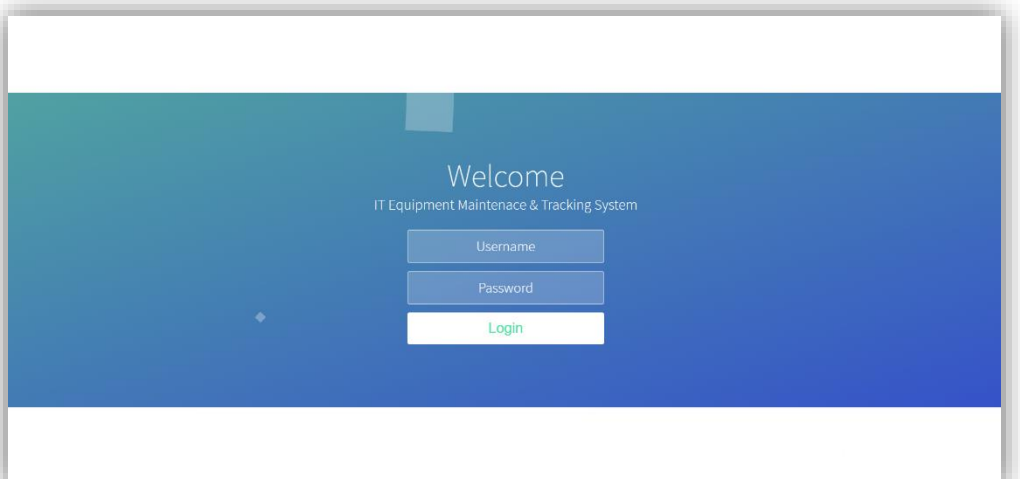


Figure A-1 Login Page

login you will get welcome page.

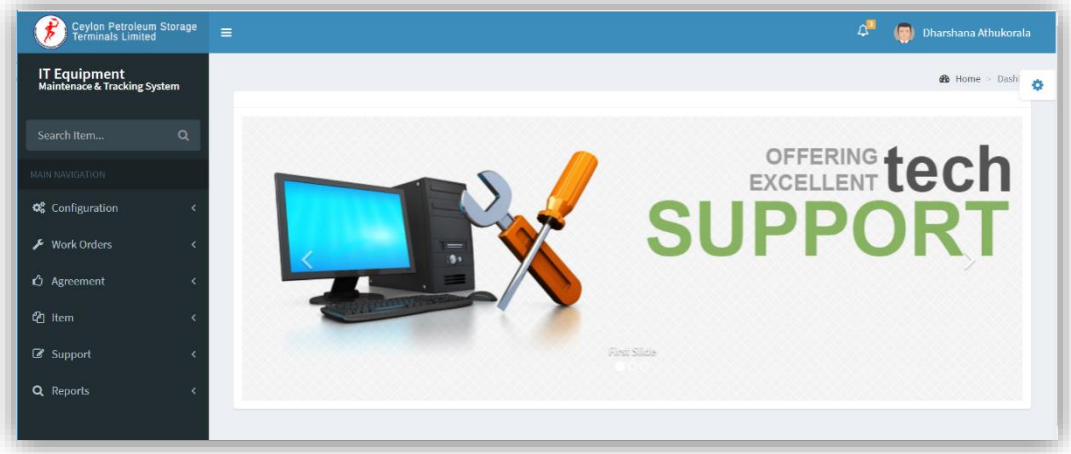


Figure A-2 Welcome Page

How to add Item

- First click on “Item” in menu bar and then click on “Item Creation” in sub menu. Then you will get following screen.

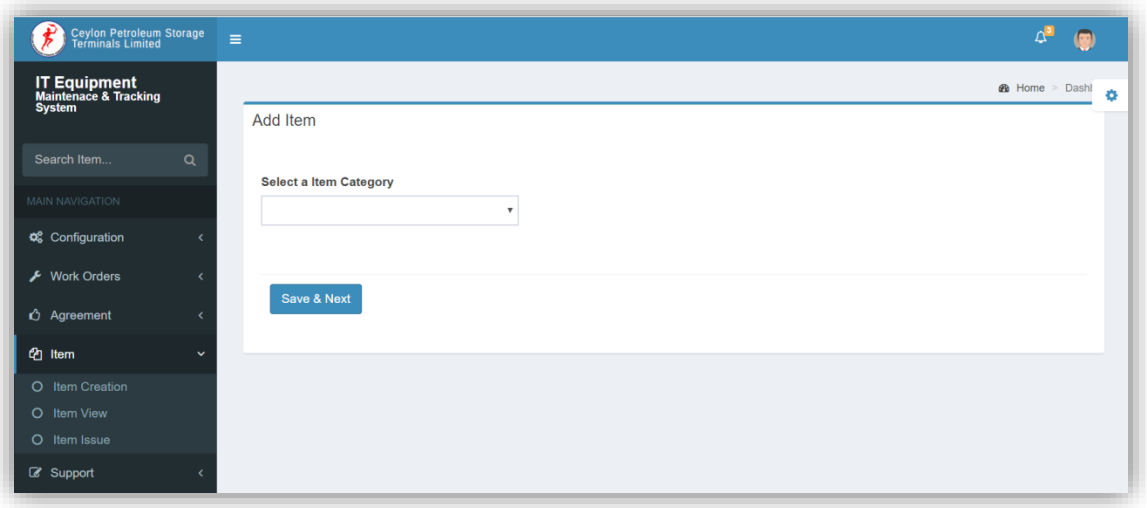


Figure A-3 Item Creation page

- Now select item category of the item you going to add from drop down list.

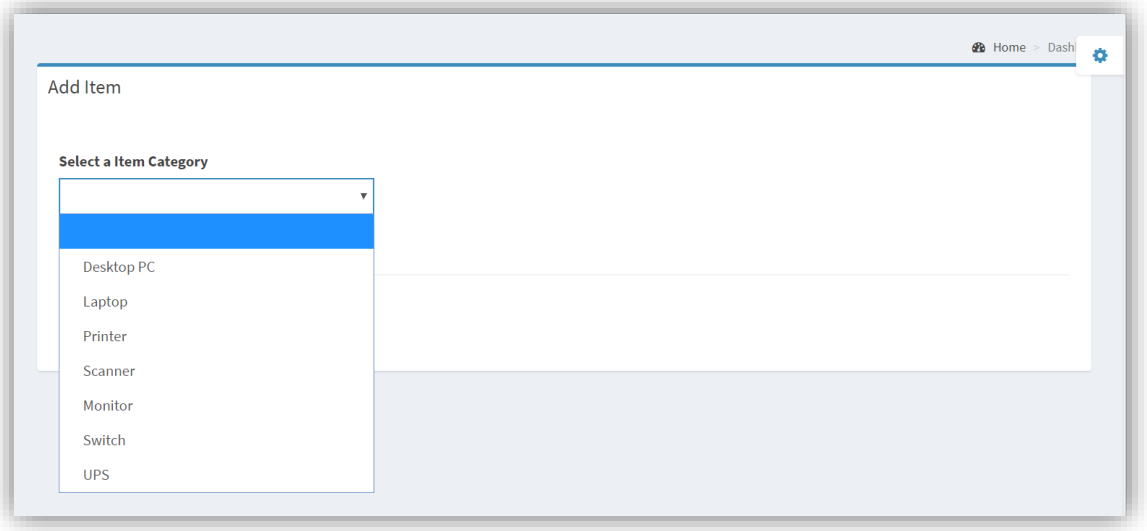


Figure A-4 selecting item category

- After selecting relevant item category, system ask some basic item details as follows.

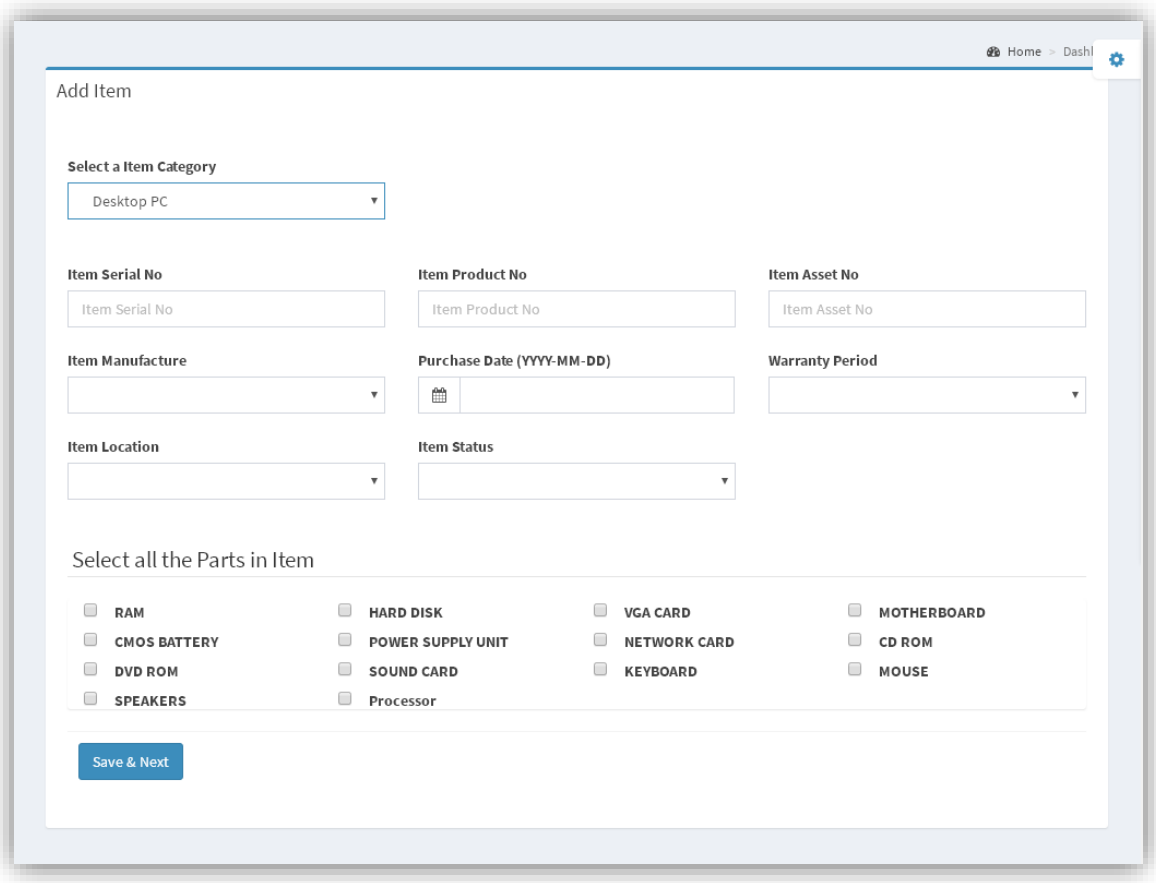


Figure A-5 Basic Item details

- Then fill the relevant details and press "Save & Next" button.
- In next screen system request item parts details which you selected in previous screen.

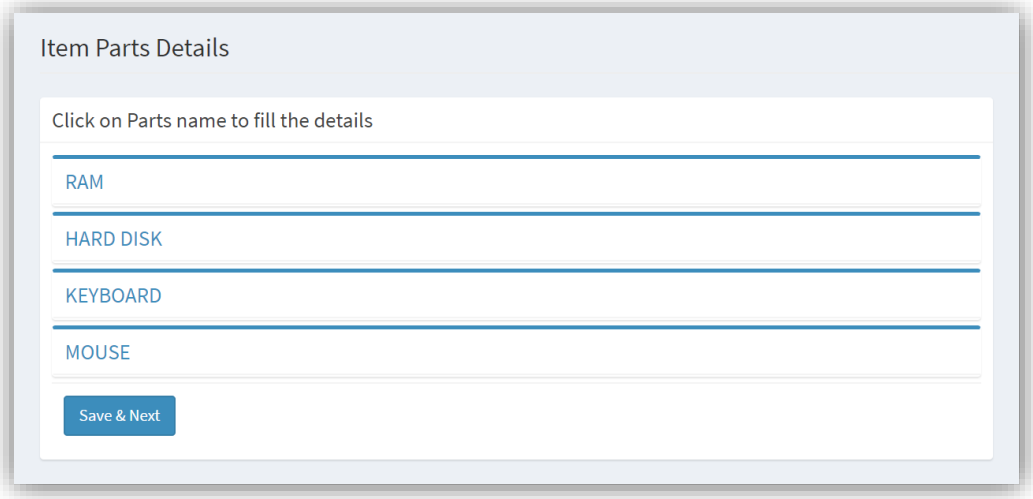


Figure A-6 Requesting parts details

- To add parts details click on part name. Then part details form will load as follows.

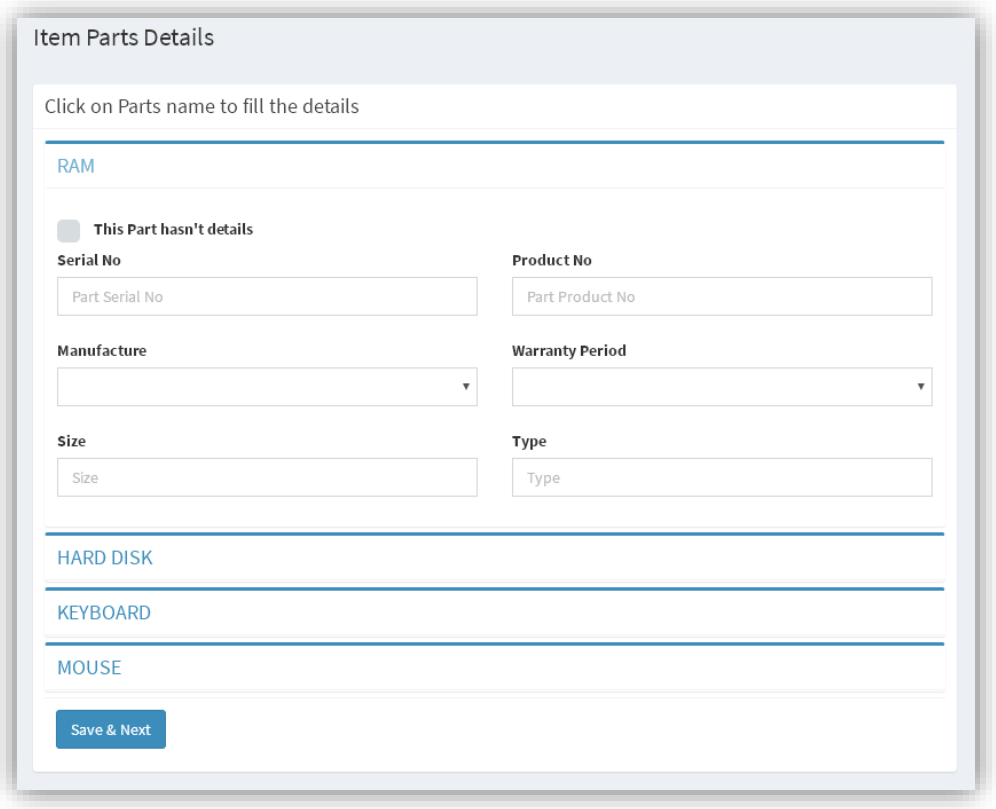


Figure A-7 Part details form

- After completing parts details click on "Save & Next" button.
- In next screen you will asked to fill item special feature details and operating system details if it has.

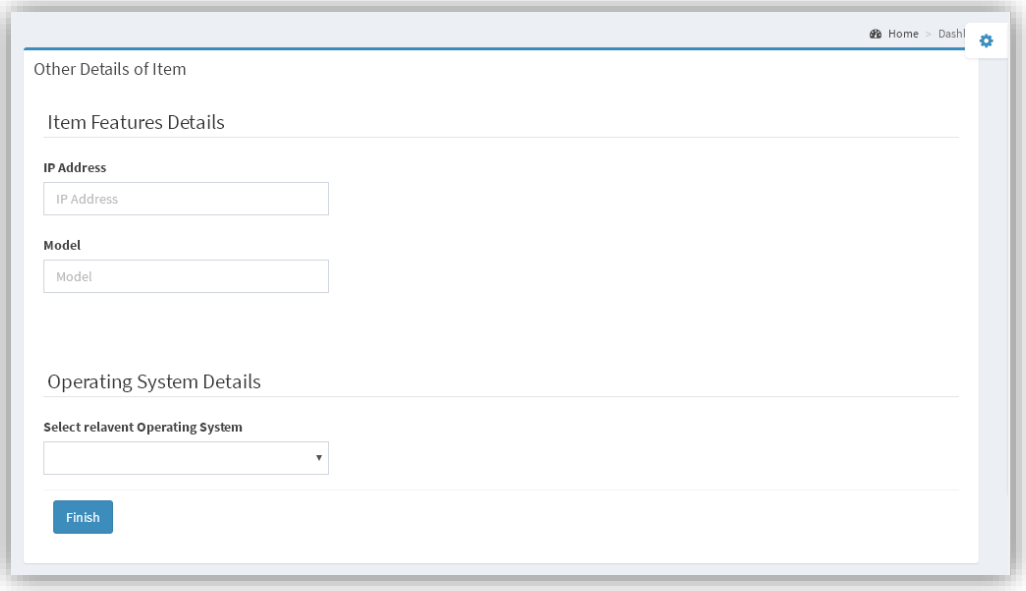


Figure A-8 Features of Item

- After that click finish button. Then you will get following message.

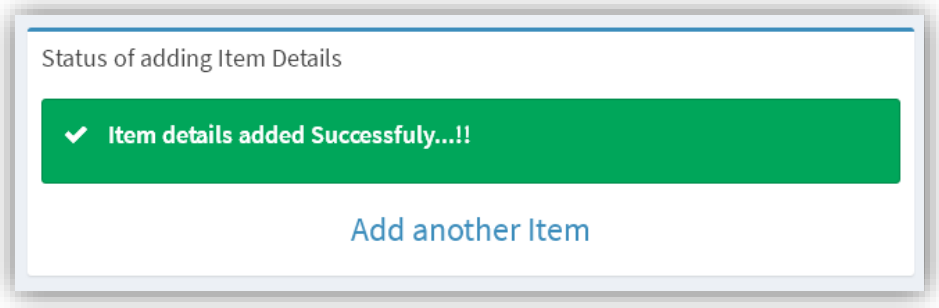


Figure A-9 Status of add item

How to make a Complain

- Click on “Support” menu and next click on “Raise Complain”. Then you will get following screen.

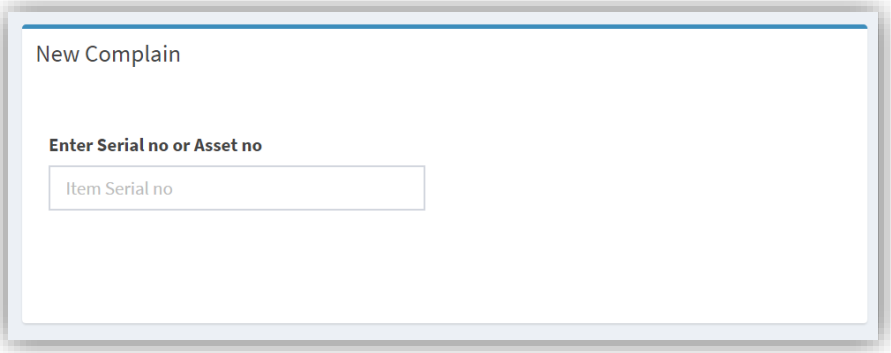


Figure A-10 Raise Complain

- Now enter Serial number or Asset number and press enter key. Then value you entered is correct, screen will be changed as follows. Right hand side window display some basic details of the item. It will help complainer to identify value he entered is correct.

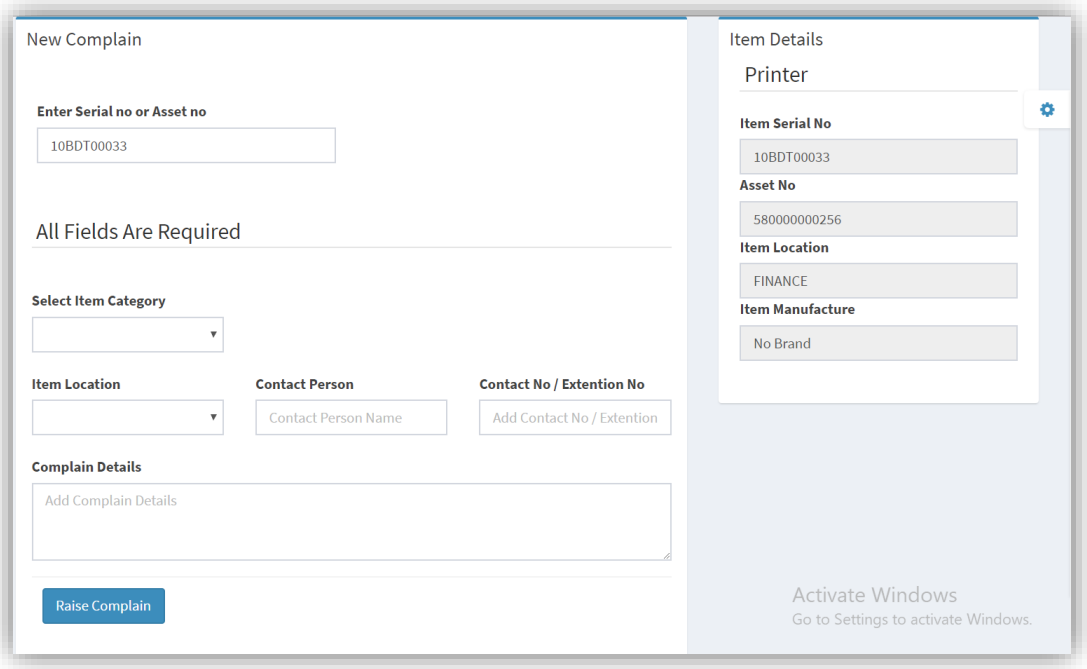


Figure A-11 Complain Form

- Now fill the requested details and press "Raise Complain" button. After that you will get following confirmation message.

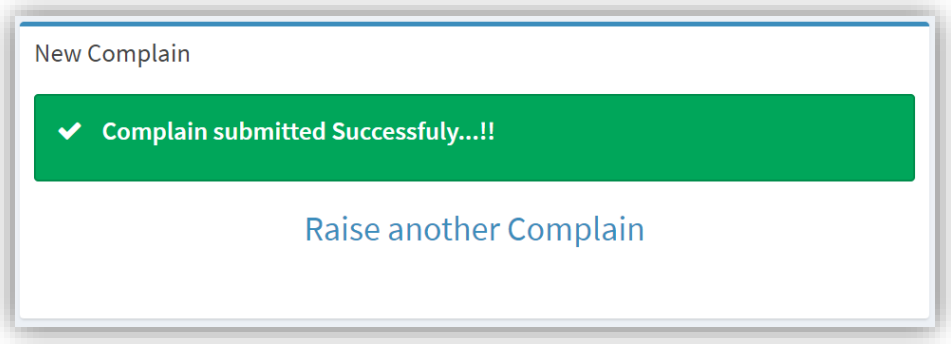


Figure A-12 Complain Status

How to view pending complains & assign technician

(How to Create Work Order)

- Click on “Work Orders” menu & then click on “Pending Complains” sub menu. Now you will get following page.

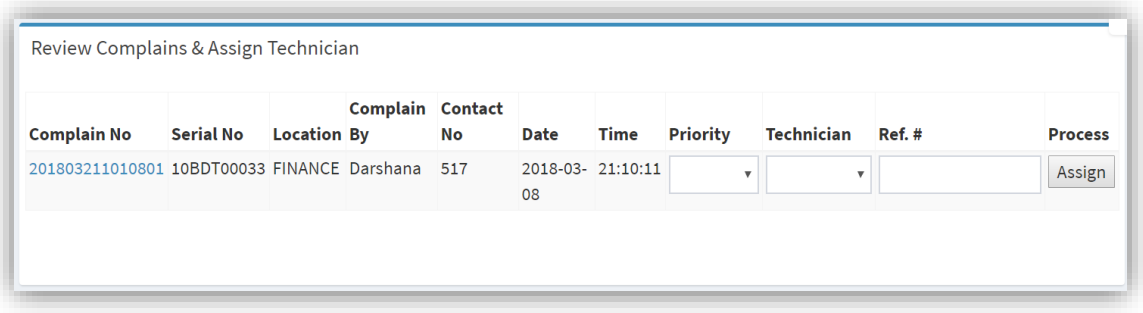


Figure A-13 Pending complain report

- Now set the priority level and assign technician. Then you have reference number, add it and press “Assign” button.
- Then you will get following confirmation message, if it is successfully saved.

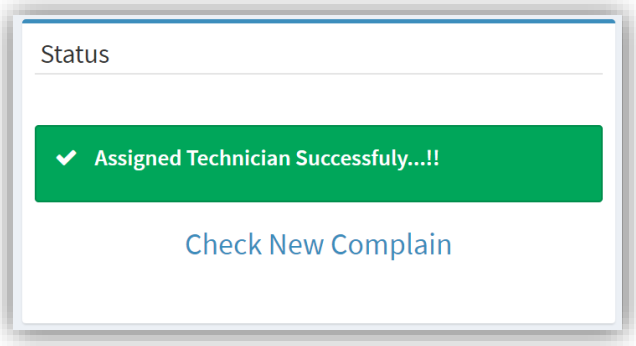


Figure A-14 Status of Assigned technician

How to maintain a work order

- Click on “Work Orders” in side menu bar and then click on “Pending Work Orders”.
- After that you will get following report of pending work orders.

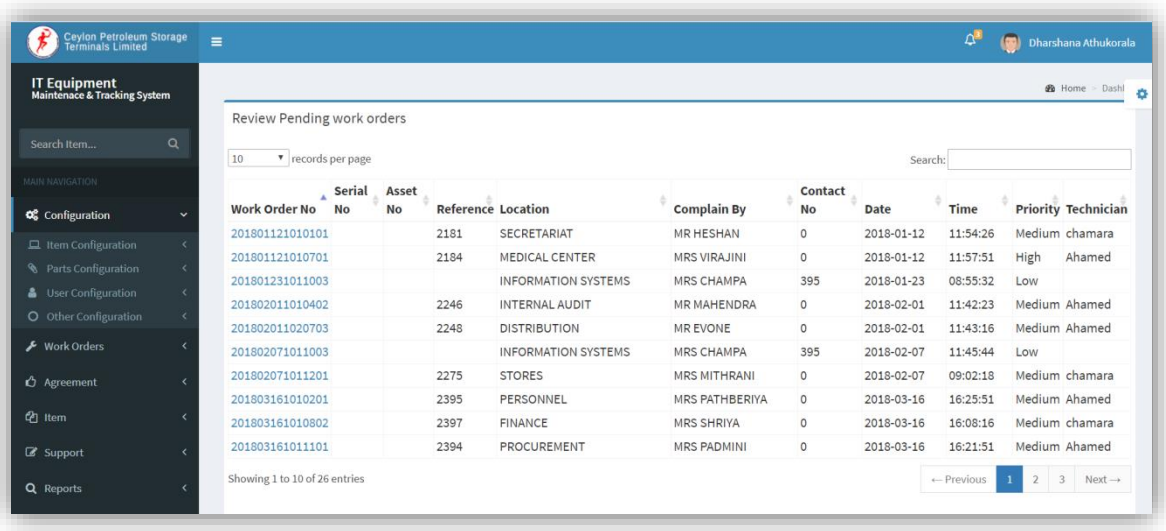


Figure A-15 Pending Work Orders

- By using Search option or page navigation, you can find the work order which you going to add details.
- After find correct work order, click on work order no to view & add details.
- Now you get following page.

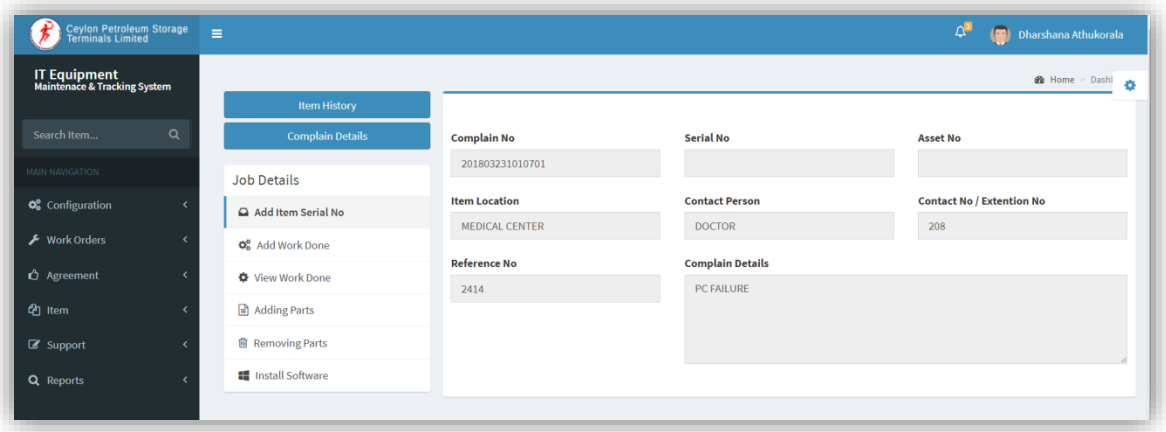


Figure A-16 Maintain Work order

- To add job details click on “Add Work Done” button. Then you will get following pop-up window.

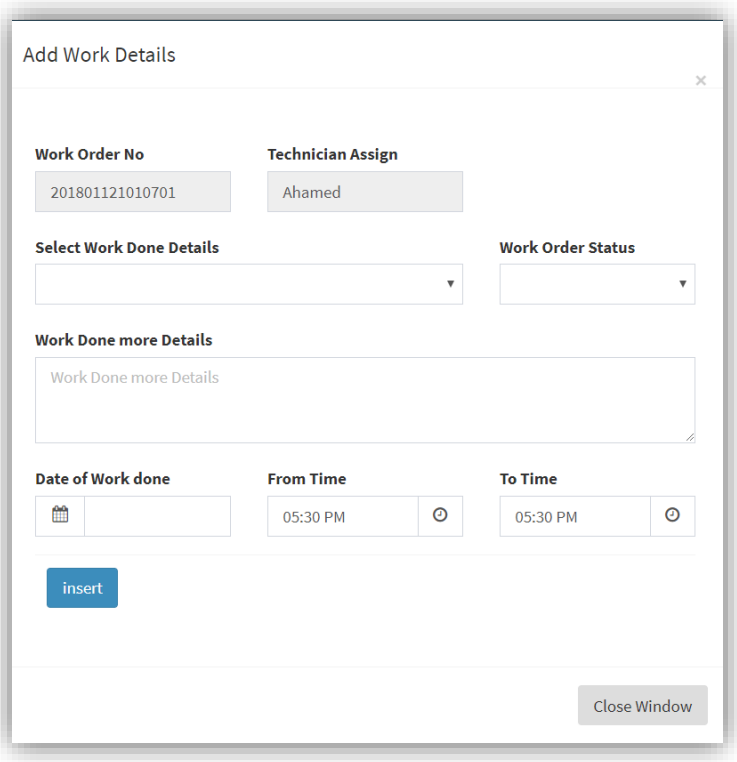


Figure A-17 Add Work Done

- Now add “Work done more details”, “Work Order Status”, “Date” and time period. After that press “insert” button.
- If you want to view job details of this work order, press “view work done” button. Then you will get following work done details report.

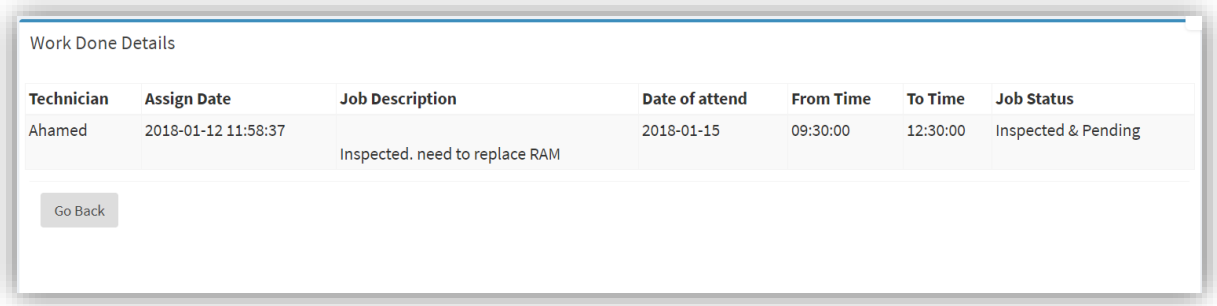


Figure A-18 Job Details of Work order

- After viewing details for work done press “Go Back” button.
- Now click on “Adding Parts” button, if you replace part of the item. Following screen will appear when you click “Adding Parts” button.

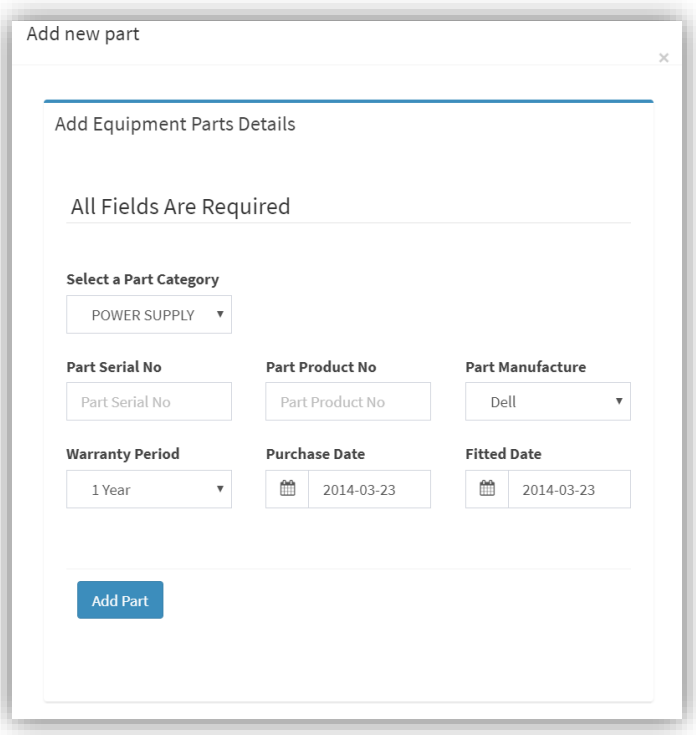


Figure A-19 Add Part

- After that you want to remove damage parts from item. To do that click on "Remove parts" button. Then following screen will appear.

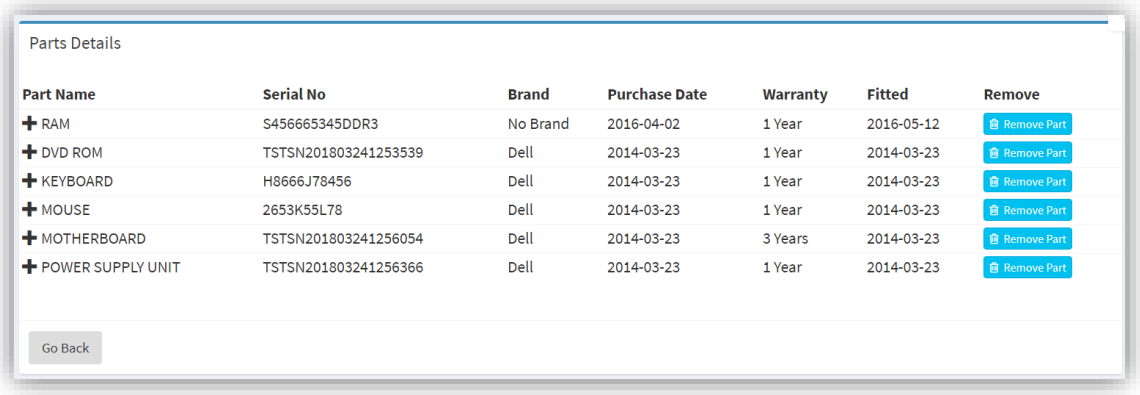


Figure A-20 Removing Parts

- To remove damage part from item click on "Remove Part" button. If you want to view more details of part click + icon.
- When you click on "Remove Part" button following pop-up window will appear.

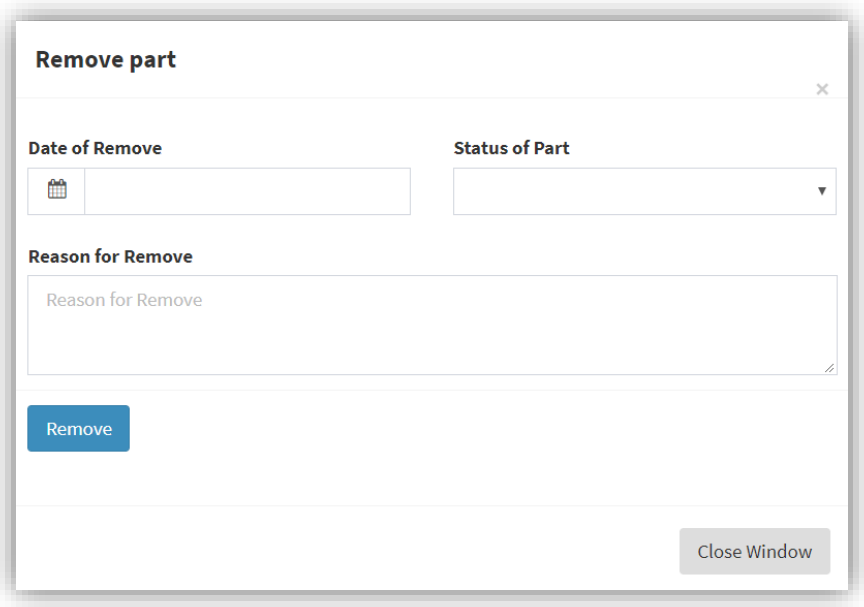


Figure A-21 Form of requesting reason for removing parts

- After filling details press “Remove” button.
- After removing parts, press “Go Back” button to go previous page.
- If item has operating system, you can maintain operating system details and application software details by using “Install Software” button.

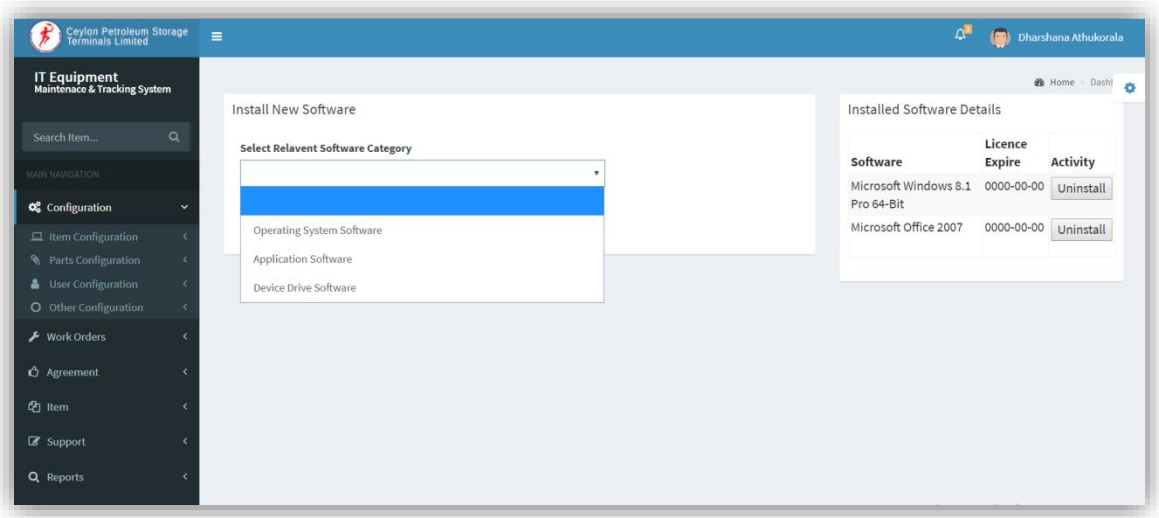


Figure A-22 Maintaining Software details

- To add new software, select relevant software category then relevant software will display below. Now press add button to add new software details.
- All installed software details are shown in right hand side.
- To remove installed software, press “Uninstall” button.

How to View Closed Work Orders

- Click on “Work Orders” in side menu bar and then click on “Closed Work Orders”. Then you will get following report of closed work orders.

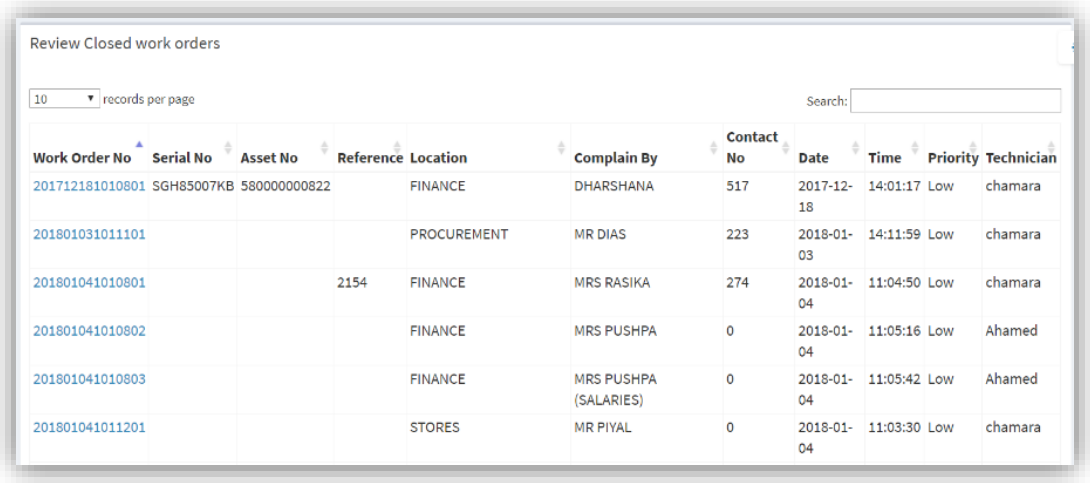


Figure A-23 Closed Work Orders

- Now click on work order number, then closed work order open as follows.

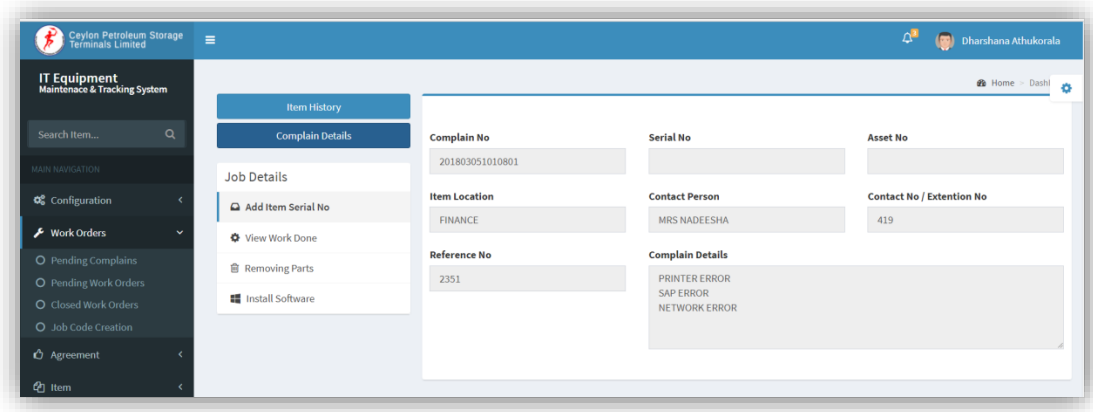


Figure A-24 Closed Work Order Details

- Now you can view details of closed work order.

How to view item

- Click on “Item” menu in side menu bar and next click on “Item View” link. Then you will get following page.

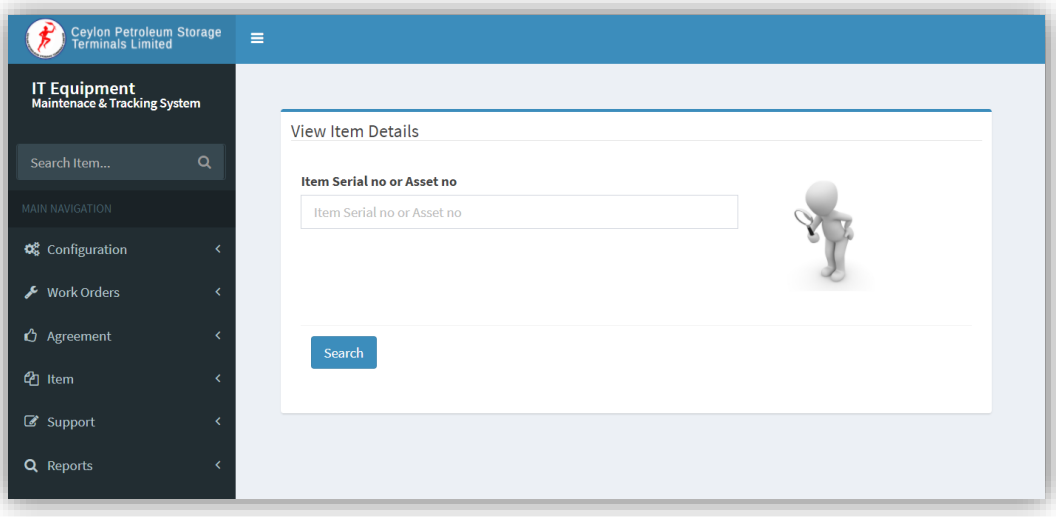


Figure A-25 Item View

- Now enter item serial no or asset no and click on “Search” button to view details of item.
- Then you will get following screen which include all details of item.

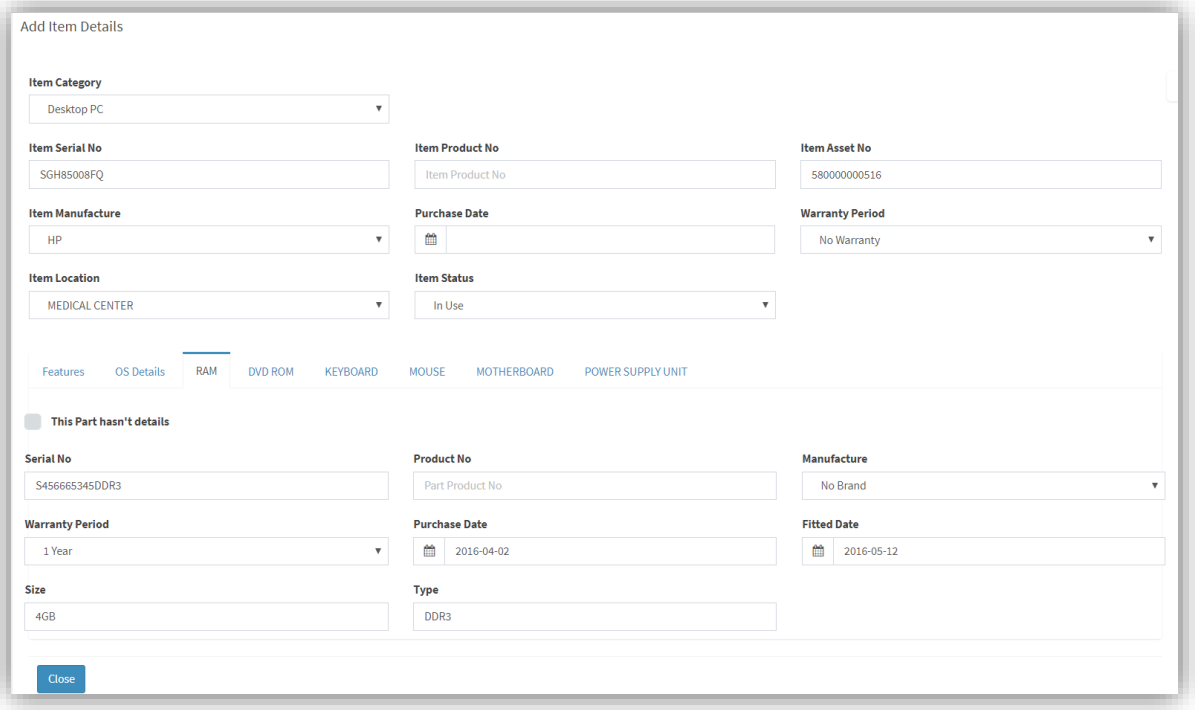


Figure A-26 View Item Details

How to Issue / Transfer item

- Click on “Item” in side menu and next click on “Item Issue” in sub menu.
- Then Item issue form will display as follows.

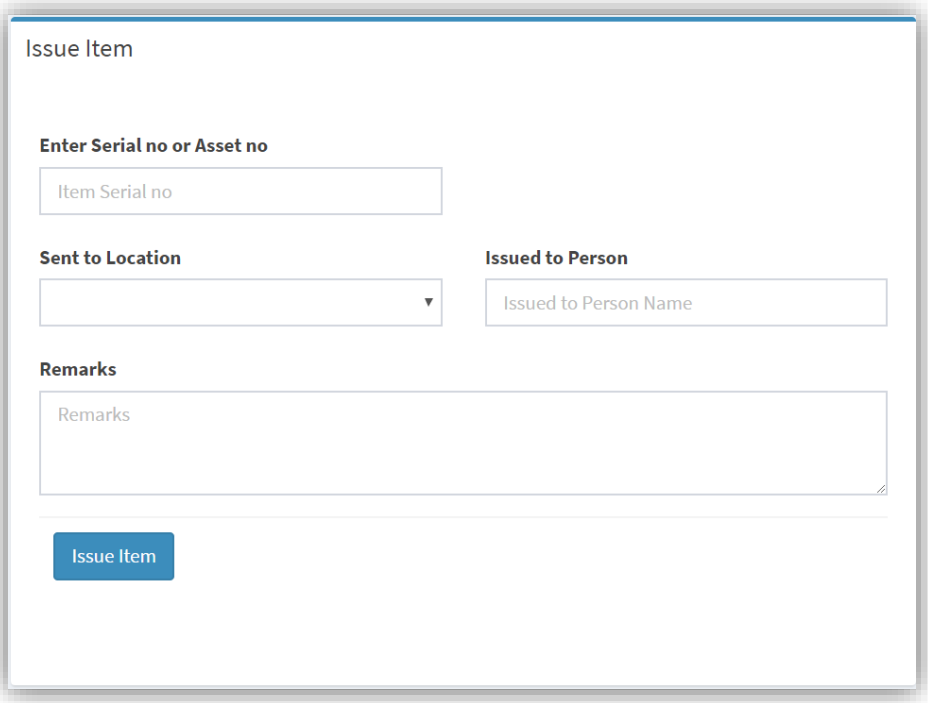


Figure A-27 Item issue form

- After filling required details press “Issue Item” button. Then you will get following confirmation message.

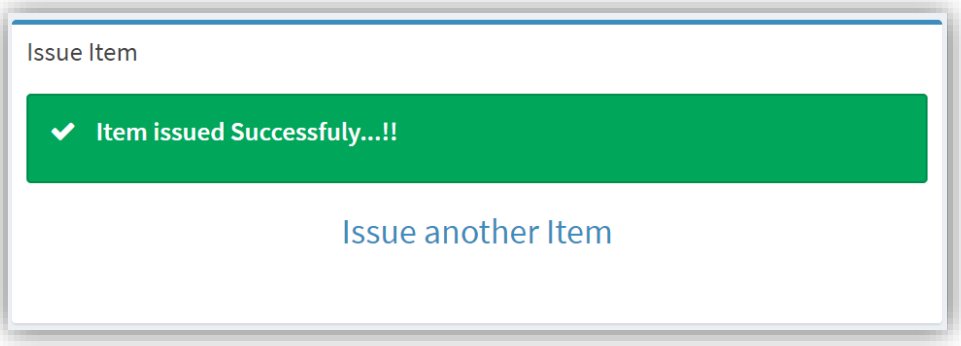


Figure A-28 Confirmation of Item issue

How to Add Agreement details

- Click on “Agreement” in side menu bar and next click on “Add Agreement” sub menu item. Then you will get following screen.

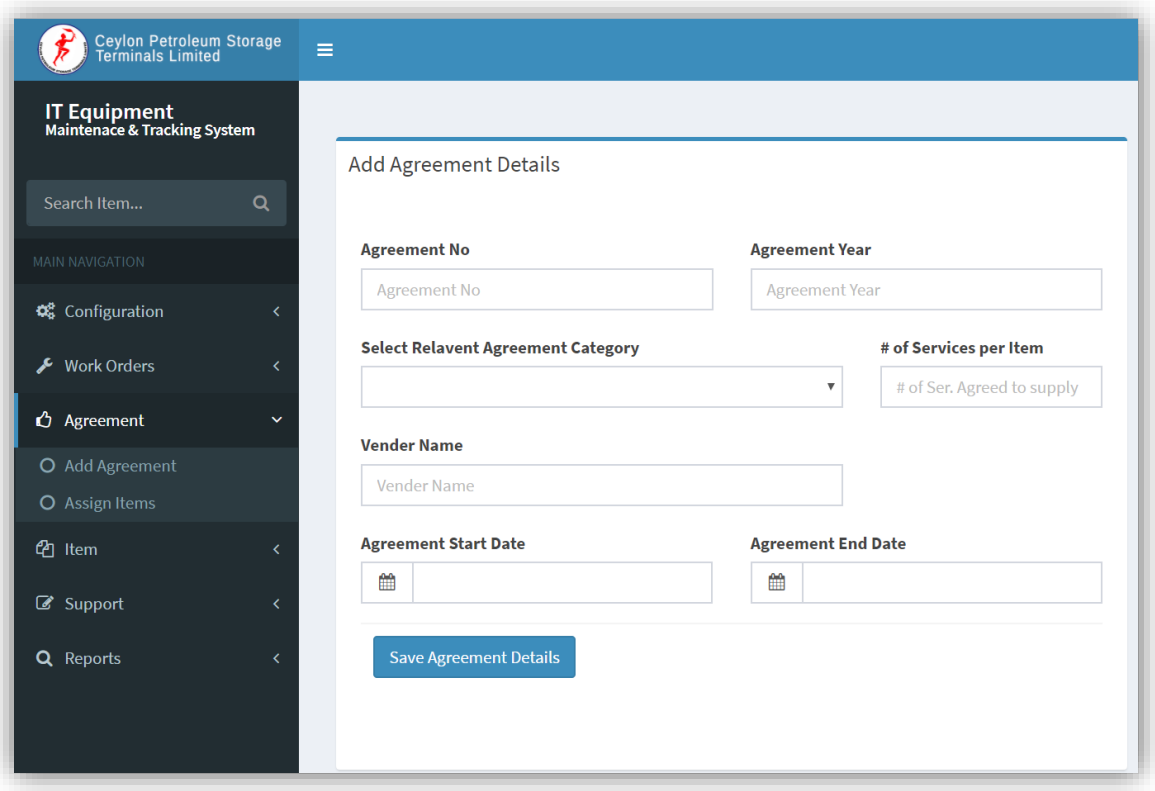


Figure A-29 Add Agreement form

- Now filled the required details and press “Save Agreement Details” button. Then you will get following confirmation message.

Figure A-30 Confirmation of Add Agreements Details

How to add Item which include to Agreement

- Click on “Agreement” in left side menu and click “Assign Items” sub menu item.
- Now select relevant agreement and tick items which include to agreement and press “Add selected” button to assign those items.

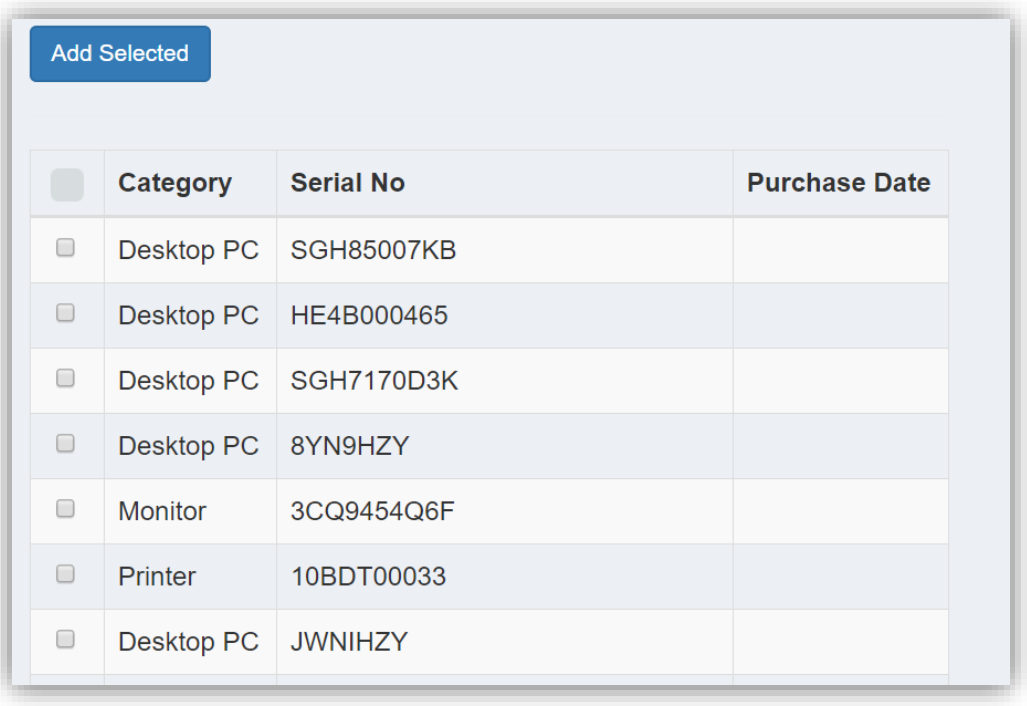


Figure A-31 Assign Items to Agreement

System Configuration

How to Create Item Category

- Click on “Configuration” in left side menu and then click on “Item Configuration” and then click on “Item Category”. Now you will get following screen.

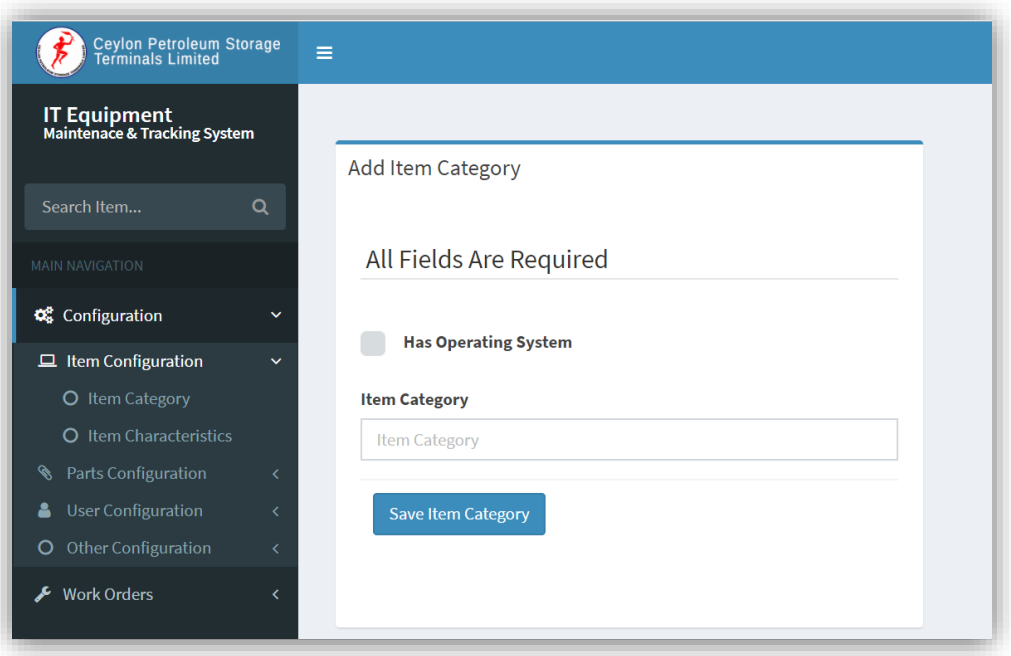


Figure A-32 Create Item Category

- If item has operating system, tick “Has Operating System” checkbox.
- Now give a name for item category and press “Save Item Category” button.

How to Create Item Characteristics

- Click on “Configuration” in left side menu and then click on “Item Configuration” and then click on “Item Characteristics”. Now you will get following screen.

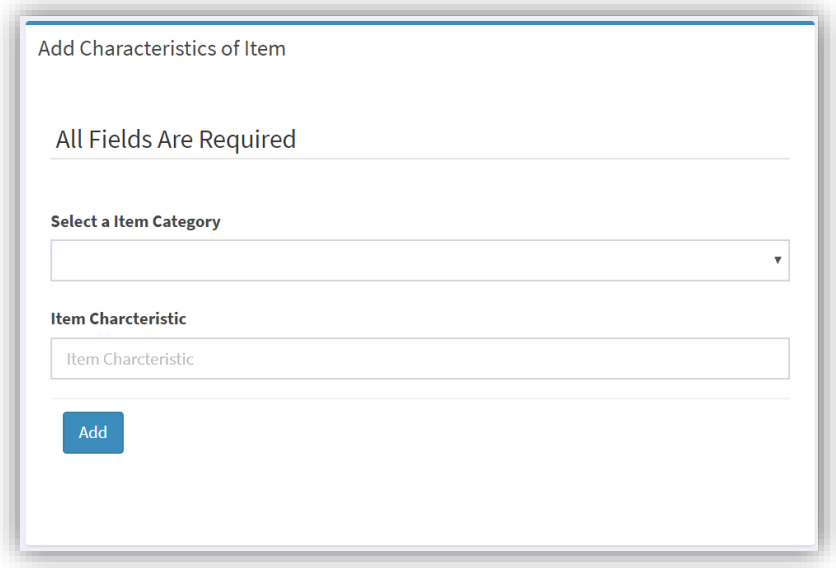


Figure A-33 Add Item Characteristics

- Now select relevant item category and enter characteristics or special feature of item you want to save.
- Then press "Add" button.

How to create part category

- Click on "Configuration" in left side menu and then click on "Parts Configuration" and then click on "Parts Category". Now you will get following screen.

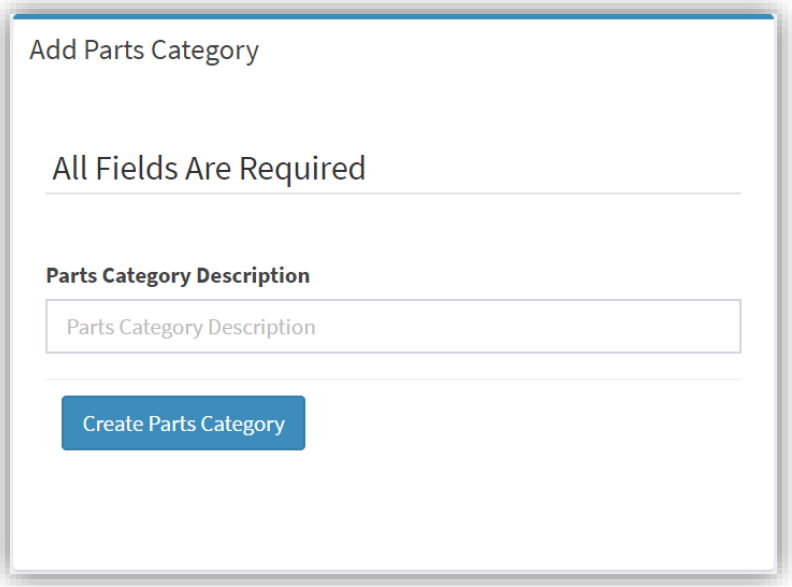


Figure A-34 Create Parts Category

- Now enter name for parts category and press “Create Parts Category” button.

How to create parts characteristics

- Click on “Configuration” in left side menu and then click on “Parts Configuration” and then click on “Parts Characteristics”. Now you will get following screen.

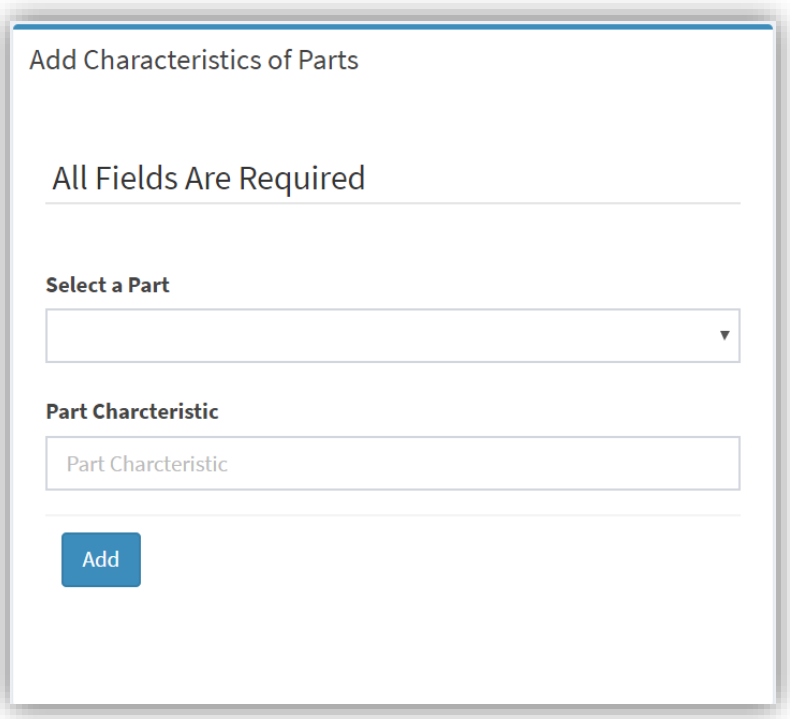


Figure A-35 Add Parts Characteristics

- Now select relevant parts category and enter characteristics or special feature of part you want to save.
- For example RAM has size and type, bus speed characteristics
- Then press “Add” button.

Mapping item and parts

- Click on “Map Item & Parts” link in “Configuration” menu => “Parts Configuration” sub menu.
- Then you will get following screen.

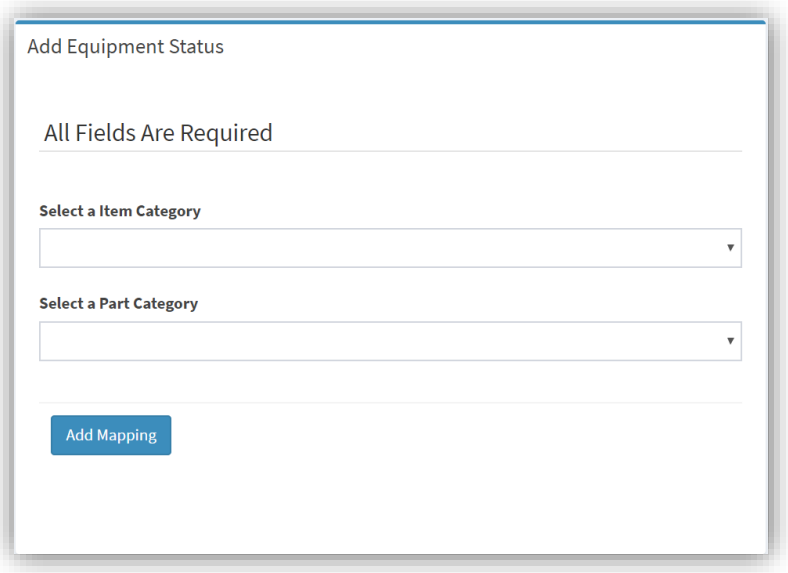


Figure A-36 Map item & Parts form

- Now select item category and parts category to mapped. Then press “Add Mapping” button. All mapped parts are display in tabular format as follows.

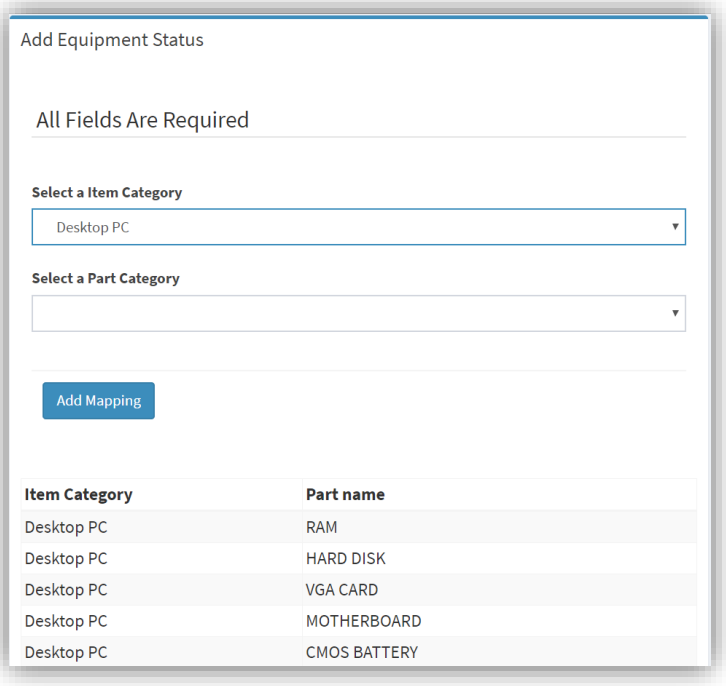


Figure A-37 Details of mapped parts

How to create user logins

- Go to “Configuration” => “User Configuration” => “User Creation”
- Then you get following screen.

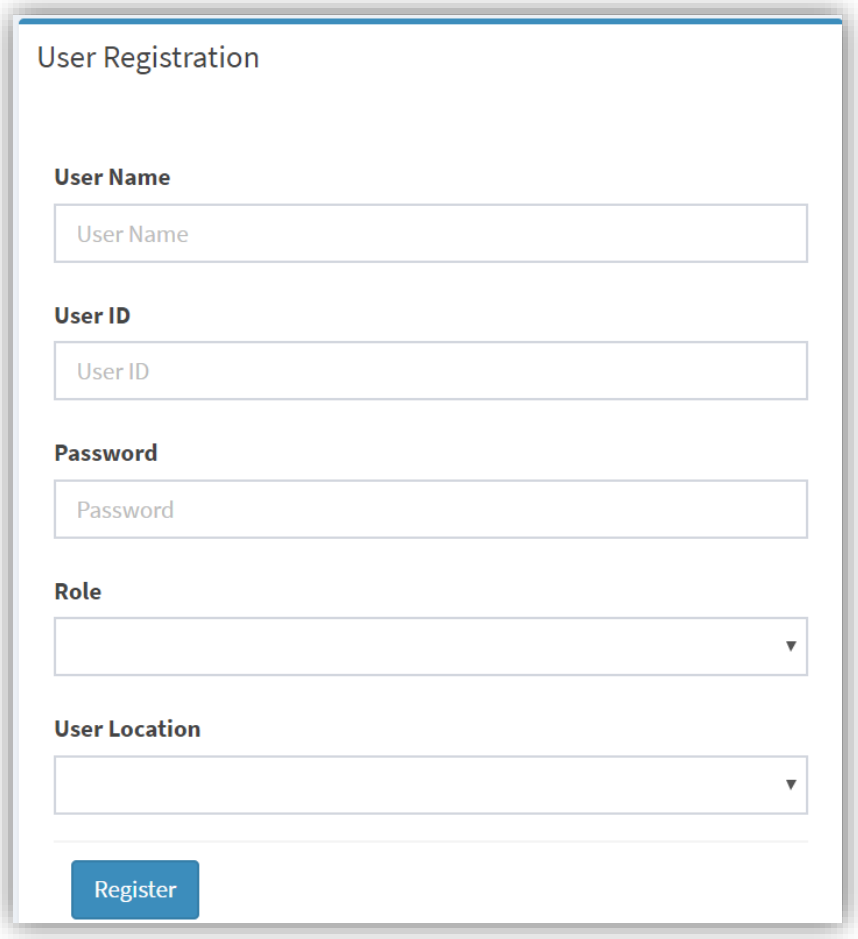


Figure A-38 User Creation form

- Now give “User Name”, “User ID”, “Password” and select “Role” and “User Location” from drop down list.
- After that press “Register” button.

Appendix B Test cases

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
User Registration					
01.	Create User	click on Configuration -> User Configuration -> User Creation then enter user name, user id, role, location & password. Next click on Register button.	"Successfully Register" message will appear	Medium	Ok
02.	Create User Without User ID	Fill other details except user id and click on register button	Error message will display	High	Ok
03.	Create User Without Password	Fill other details except password and click on register button	Error message will display	High	Ok

Table B-1 User Registration Test Case

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
User Login					
04.	Try to Access pages without login	go to url http://localhost/pcrepair/viewItem.php	Login Page appear	High	Ok
05.	Log with valid user id & password	enter valid user id & password	Display welcome page & your user name will appear in right top corner	High	Ok
06.	Log with valid user id & invalid password	enter valid user id & invalid password	Login page appear again	High	Ok
07.	Log with invalid user id & valid password	enter invalid user id & valid password	Login page appear again	High	Ok
08.	Log without user id & password	click login without user id & password	Login page appear again	High	Ok

Table B-2 User Login Test Case

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
Item Configuration					
09.	Add Item Category	click on Configuration -> Item Configuration -> Item Category Then enter category name & if item needs operating system to run, tick "Has operating system". Then click on "Save Item Category" button.	Successfully Saved message will appear	High	Ok
10.	Add Item Characteristics	click on Configuration -> Item Configuration -> Item Characteristics Then select Item Category and enter characteristics type. Then click on "Add" button	After selecting Item category, all existing characteristics type of selected item will be display below. After click add "Successfully Saved" message will appear	High	Ok
11.	Add Part Category	click on Configuration -> Parts Configuration -> Parts Category Then enter parts category description & click on "Create Part Category" button.	Successfully Saved message will appear	High	Ok
12.	Add Parts Characteristics	click on Configuration -> Parts Configuration -> Parts Characteristics Then select Part Category and enter Part characteristics type. Then click on "Add" button	After selecting Parts category, all existing characteristics type of selected part will be display below. After click add "Successfully Saved" message will appear	High	Ok

13.	Map Item & its' Parts	click on Configuration -> Parts Configuration -> Map Item & Parts After selecting Item Category and Part Category click on "Add Mapping" button.	After selecting Item category, all existing mapped parts category will be display below. After click "add Mapping" button "Successfully Saved" message will appear	High	Ok
14.	Mapping same item & parts again	select already mapped item category & part category. After that click on "Add Mapping" button.	Error message will display	High	Ok
15.	Adding Brand Names	click on Configuration -> Other Configuration -> Item / Parts Manufacture Enter Manufacture name & click on "Save Manufacture" button.	Successfully Saved message will appear	Medium	Ok
16.	Adding Location	click on Configuration -> Other Configuration -> Location Details Enter Location ID & description & click on "Save Location" button.	Successfully Saved message will appear	Medium	Ok
17.	Adding new location for existing location id	Enter existing location id & new location description. After that click on "Save Location" button.	Error message will display	High	Ok
18.	Add Software Details	click on Configuration -> Other Configuration -> Software Details Select software category and enter software name, version details and license validity time period. After that click on "Save Software Details" button.	Successfully Saved message will appear	Medium	Ok

Table B-3 Item Configuration Test Case

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
Item Creation					
19.	Create Item	Click on Item -> Item Creation	Appear new page with item category drop down	Medium	Ok
20.	Create Item	Select Item Category	Display input box for Item Serial no, Product no, Asset no, Manufacture, purchase date, warranty period, Item status & location. Also display check box with parts name which you mapped earlier.	High	Ok
21.	Create Item	Enter relevant details and tick parts attached to the item. After that click "Save & Next" button.	next page display all the parts you tick earlier. When you click on part name it will scroll down and asking basic details of part and its' characteristics.	High	Ok
22.	Create Item	Enter parts details and click on "Save & Next" button.	New screen will appear and asking to enter item characteristics and operating system details if it has.	High	Ok
23.	Create Item	Enter Item characteristics details and operating system details and click "Finish" button.	Successfully Saved message will appear	High	Ok
24.	Create item with existing serial number	Select Item Category and enter existing serial number and other details. After that click on "Save & Next" button	Error message will appear	High	Ok

Table B-4 Item Creation Test Case

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
Search Item					
25.	Search existing Item	Click on Item -> Item View Enter existing item serial no or asset no and click on "Search" button.	Display item details	Medium	Ok
26.	Search unexciting Item	Click on Item -> Item View Enter invalid serial no or asset no and click on "Search" button.	Error message will appear	Medium	Ok

Table B-5 Search Item Test Case

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
Issue Item					
27.	Issue valid item	Click on Item -> Item Issue Enter existing item serial no, Location sent, issued person details and remarks. Then click on "Issue Item" button	Successfully Issued message will appear	Medium	Ok
28.	Issue invalid item	Click on Item -> Item Issue Enter invalid serial no, Location sent, issued person details and remarks. Then click on "Issue Item" button	Error message will appear	High	Ok

Table B-6 Issue Item Test Case

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
Raise Complain					
29.	Raise complain for valid item	Click on Support -> Raise Complain Enter valid serial no or asset no & press enter key	Display basic details of item in right hand side and display complain request form below the serial no input box	High	Ok

30.	Raise complain for valid item	Fill the complaint request form and click on "Raise Complain" button.	Successfully send message will appear	High	Ok
31.	Raise complain for invalid item	Click on Support -> Raise Complain Enter invalid serial no or asset no & press enter key	Error message will appear	High	Ok
32.	Raise complain without item serial no	Click on Support -> Raise Complain without serial Fill the form and click on "Raise Complain"	Successfully send message will appear	High	Ok

Table B-7 Raise Complain Test Case

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
Review pending complain and assign technician					
33.	Review pending complain	Click on Work Orders -> Pending Complain	Show all pending complains in Tabular form	Medium	Ok
34.	Assign Technician	Select relevant complain from list and set priority level, technician and reference no. After that click on assign button.	Successfully Saved message will appear	Medium	Ok

Table B-8 Review pending complain & assign technician test case

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
Maintain Work Orders					
35.	View Pending Work Orders	Click on Work Orders -> Pending Work Orders	Display all pending work orders in tabular format	Medium	Ok
36.	View details of Pending Work Order	Click on Work Order no	display work order maintain form	Medium	Ok

37.	Adding Serial no of complained item which not initially added	Click on "Add item serial no"	Insert Item serial no pop up form will appear	Medium	Ok
38.	Adding Serial no of complained item which not initially added	Enter item serial no & click on insert button	Successfully Saved message will appear	Medium	Ok
39.	Adding Work done details to work order	Click on "Add Work Done"	Add Work details pop up will appear	High	Ok
40.	Adding Work done details to work order	Select Work done from drop down list. Select current status of work order and additional details of work done. Select date of work done and duration. After that click "Insert" button.	Successfully Saved message will appear	High	Ok
41.	View Work Done Details	Click on "View Work Done"	Display work done details report	High	Ok
42.	Adding Parts to item	Click on "Adding Parts"	Adding parts form will pop up	High	Ok
43.	Adding Parts to item	Fill the form and click on "Add Part"	Successfully Saved message will appear	High	Ok
44.	Removing broken parts	Click on "Removing Parts"	All fitted parts of the item will display	High	Ok
45.	Removing broken parts	Click on "Remove Part" button	Display Remove Part form	High	Ok
46.	Removing broken parts	Enter remove date, reason and status of part and click on "Remove" button	Successfully Removed message will appear	High	Ok
47.	Adding Software installation details	Click on "Install Software"	new page load with already installed software and drop down of software category	Medium	Ok

48.	Adding Software installation details	Select Software Category	According to selected software category, display all available software details	Medium	Ok
49.	Adding Software installation details	Click install button to add software	Display it in installed software	Medium	Ok
50.	Uninstall Software	Click on uninstall button in installed software	Remove Software details from installed software list	Medium	Ok

Table B-9 Maintain Work Order Test Case

Test Case ID	Functionality	Procedure	Expected Output	Priority	Result
Create Agreement					
51.	Create Agreement	Click on Agreement -> Add Agreement Fill the required filled and click on "Save Agreement Details" button	Successfully Saved message will appear	Medium	Ok

Table B-10 Create Agreement Test Case