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Design and Development of an Online Assets Inventory Management System (AIMS)

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Abstract: *In the age of today, organizations face tremendous challenge in monitoring efficiently the whereabouts, quantity, working condition, depreciation and maintenance status of things of value in their organization. This problem is faced not only by large organizations but also the medium and some smaller organizations. Those things of value known as assets are kept in records by means of inventory. The need to monitor constantly these records of assets cannot be over emphasized as efficient management of the assets inventory of any organization helps maximize the organization's value by making fixed and intangible assets to be easier to locate, more reliable and efficient.*

This employs tracking the whereabouts, quantity, working condition, depreciation and maintenance status of assets. This is to have at all times, a detailed list of all assets in the organization displaying their description, serial number, acquisition cost, inventory number, respective location, working condition (status) amongst others. This overcomes the manual-based spreadsheet system, which is characterized by error(s), loss of data, varying reports or results at stages involved in the manual-based spreadsheet system.

In this paper, top-down design methodology was used to profers solution to the problem using a number of tools such as PHP and MySQL for the developmental phase. The application was tested and evaluated for usability and functionality using appropriate test data. The front end provides an interactive means for the user of the system to input information into the database. The database (back end) provides a detailed record of all assets in the organization displaying their description, serial number, acquisition cost, inventory number, respective location, working condition (status) amongst others. The complete web-based system could be used from any terminal with internet access. Also, functionality such as updating assets' details and adding new locations and offices to the database are all possible through the web interface.

Keywords: Assets, Inventory, Management, Online, Spreadsheet, Record.

1. Introduction

Asset management involves comprehensive and structured approach to the long term management of assets as tools for the efficient and effective delivery of community benefit [1]. For an organization to manage its assets efficiently all assets owned by the organization must be registered and recorded in the organization's assets inventory. The assets inventory contains not only the names and serial numbers of the assets but also the location of the asset in the organization, its working condition, depreciation value, maintenance status and inventory number amongst other information the organization wishes to capture. Ujongbakuto (2014) described Assets Inventory Management as any system that monitors and maintains things of value to an entity or group. It may apply to both tangible assets such as buildings and to intangible concepts such as intellectual property and goodwill. It is a systematic process of deploying, operating, maintaining, upgrading, and disposing of assets cost-effectively.

The basic financial purpose of an organization is to maximize its value. An inventory management system should also contribute to realization of this basic aim. Many current asset management models currently found in financial management literature were constructed with the assumption of book profit maximization as basic aim. However these models could lack what relates to another organization, i.e., maximization of enterprise value [9]. Efficient management of the assets inventory of any organization maximizes the organization's value and makes assets easier to locate and manage.

The system employed in managing the assets inventory varies from organization to organization. Some organizations make use of the spreadsheet system to keep track of the assets they own. This method of assets management is time wasting and is prone to errors that the personnel may not even be aware he made. Other organizations make use of Assets Inventory Management software which automates the manual spreadsheet system. These softwares vary from organization to organization based upon the requirement of each individual organization. The requirement includes the size of the organization and the volume of they own. What makes this proposed system unique is the Tickets upgrade. With the addition of ticketing, problems arising with assets can be raised and monitored by all users of the system with ease.

The manual system employed by organizations involve the physical movement of their audit staff from office to office manually count the assets residing in each office before entering them into the spreadsheet. This method wastes time, is characterized by errors and it is difficult to keep inventory

records updated if assets are transferred often. An outdated assets inventory register allows for the presence of ghost assets (this refers to assets that are still on record although they are no longer being used). Sometimes, ghost assets are sold off by employees in secret while in other cases are stashed away somewhere. Although these assets are no longer being used, the organization still pays for maintenance and insurance on some of them. Furthermore, as the number of asset acquisitions grows, it becomes increasingly impractical and more difficult to track the location, working status, transfers, disposals and adjustments to these assets. To ensure an accurate, well-detailed, up-to-date and secure database of assets present in an organization, an alternative is to use a web-based inventory management system where records can be digitally archived, thereby reducing filing activity at the end of each term's end [8].

2. Existing Systems

There are lots of Assets Management softwares developed in the last decade till date.

2.1 Kaizen Software Solutions

From information gathered from the software proprietor's website, this software solution for assets inventory management makes it possible for organizations to track the assets they have, where they are, how much they cost, and more. Organizations can use existing barcodes or create their own to check in and check out assets (including tools and equipment) to employees. This software solution only takes a few minutes to download and install. It has the following functionality [7];

- **Check in and check out assets**

With Kaizen's Asset Manager solution, you can check out computers and equipment to employees and always know who to call when you need an item returned. A due date can be set during the checkout process, and then run reports to find the overdue assets [7].

- **Track the fixed assets in your business**

Whether you need help keeping track of where your assets are, or if you simply need a better accounting of what you have and how much it is worth, Asset Manager can track it all. Owner's manuals, pictures, notes and more can be attached to your service records, which can be looked up again in one place whenever needed in the future [7].

- **Track service, vendors, and contacts**

When servicing an item, you can track the service instructions, tips and tricks, vendors, and contacts in your database. If the item needs to be serviced again, you'll have all the information you need right at your fingertips. You can find the items quickly using a barcode scanner or a quick search [7].

2.2 Novo Solutions Asset Management Software

According to information contained on their website, keeping track of assets can be a challenge to organizations, both large and small. Knowing what assets you have, where they are located, when they were purchased, if they are still in use, etc. is critical to any organization. Assets can be moved to other locations, get reassigned to other people, get replaced, etc. Accurate assets information can be produced when Management wants reports about asset allocation, usage and service history. Also, accurate data for tracking inventory and calculating depreciation is provided. The Novo Asset Management Software is an extremely flexible solution that can be used as an IT asset management system or a fixed asset management solution to help you gain and maintain control of assets' information. NOVO's asset management software is available as a standalone tool or as part of the Novo Service Desk Suite [11].

NOVO's Asset Management Software Benefits:

- **Improve Organization/Control**: This software solution takes the guess work out of where your assets are located, who is using them, etc.
- **Reduce Time Spent Managing & Maintaining Assets**: Complete flexibility/configurability allows any asset information to be tracked. When combined with the completely integrated Novo Help Desk Software you can see which assets are requiring the most repair/service and have a better feel of when to replace them [11].
- **Empower Your Help Desk/Service Desk Staff**: Help Desk staff can respond more effectively to end user trouble calls when they have access to detailed asset information (including installed software and hardware) [11].

2.3 SysAid Solutions

According to the software proprietor, SysAid Free Asset Management Software is the ideal for smaller organizations with fewer than 100 computers. If your organization requires more than what Free Edition offers, the Pro Edition of SysAid Asset Management Software may be the solution for your assets management [16].

With SysAid free Asset Management software, you'll be able to:

- View the hardware, software, and manufacturer details of your computers, printers, and network assets
- List, sort, and search through your network's computers, printers, and network elements
- Remote control to all devices on your network
- Print reports on your network's inventory, hardware and software, catalog items, and more
- Stay informed about every change in your inventory with automatic notifications
- Receive a lifetime of free upgrades and support from SysAid's Online Community [16].

3. Methodology

Due to the complexity of this software project, the kind of design approach to use was carefully chosen in order to present modules simple enough for the user. Therefore the top-down design method which is mostly used in software development because of its simplicity was adopted. An overview of the system was first formulated, specifying but not detailing any first-level subsystems. Each subsystem is then refined in yet greater detail, sometimes in many additional subsystem levels, until the entire specification is reduced to base elements.

The following hardware and software resources were required for the system development.

- ❖ A computer running Wamp Server. This will be used for prototype development, and will run both the graphical front-end and database end. This computer

must have Internet access for connection to the remote MySQL database back-end.

- ❖ The development platform is Windows operating system with internal Bluetooth module with a local testing server installed (Apache).
- ❖ Adobe Dreamweaver CS6. This allows for writing the articles of the system with little worries about the graphical outlay of the web application.
- ❖ Macromedia flash for the design.

Web Development Technologies to be adopted comprises of:

- PHP
- HTML (Hypertext Markup Language)
- MySQL

4. Developmental Tools

4.1 Front End Design

A suitable programming environment needs to be selected for system development. The chosen languages should be capable of developing a graphical user interface to display suitable output to the end users. The chosen language should include support for object-oriented implementations. Booch (1998) stated that 'Each object can be viewed as an independent little machine with a distinct role or responsibility'. As the system will comprise of several components implementing via an object oriented language would allow for more efficient data parsing through each component.

Developing an application using a high level object-oriented language enables more flexibility, making complex programming simpler than coding in low level languages. This would fulfill the extensibility requirement of the framework, making it easier to adapt and modify in the future. There are many programming and scripting languages available which meet these criteria. Some of these are analyzed below.

4.1.1 PHP

As a derivation of Perl, PHP, is a server side, user interactive, programming language, works nearly in on all platforms. We can say that it is a general purpose scripting language. It can be embedded into html. It can use various databases such as MySQL, SQL, Oracle, MS SQL etc. Also contains many server interfaces. Open source is one of the best specifications of PHP. Among several frameworks, the most popular one is zen [13]. PHP is a general-purpose scripting language that is especially suited to server-side web development where PHP generally runs on a web server. Any PHP code in a requested file is executed by the PHP runtime, usually to create dynamic web page content or dynamic images used on web sites or elsewhere. PHP is used to generate information from the server through HTML contact. This means it is not fully functional unless coupled with HTML. PHP serves as an intermediary code between a user and the server, hence PHP is mostly used to collect information coming from the user through HTML interface and then decrypt to a language understood by the server. PHP also collects information from database and modifies it into something understandable by the user.

4.1.2 JavaScript

JavaScript is a scripting language used to enable programmatic access to computational objects within a host environment. It is generally used to implement dynamic web sites [4]. It is a web scripting language that stays at the surface of an interface. Javascripts unlike PHP only operate within web browser. JavaScript's are first executed whenever the system is run and hosts the application until all conditions are satisfied before PHP or any other server side scripting language can begin execution.

4.1.3 CSS

Quercus S. (2014) described Cascading Style Sheets (CSS) as a style sheet language used to depict the look and format of a document written in a markup language. It is a fundamental specification of the web and is used by almost all websites to outline their presentation. Its sole purpose is for beautification (such as coloring, structuring and modeling) of the interface. It works alongside HTML and can be written in two ways i.e. either as a separate /external file or within the same body as HTML

4.2 Back End Design (Database)

This comprises of both Functional and Non-Functional requirements. The functional requirement for the proposed Assets Inventory Management System is a web based application, which means it has a web based platform. Perl Hypertext Pre-processor (PHP) has been used as the technology in developing this application. The database query language used in this application is the Structured Query Language (SQL). As established by Gilmore, W. J. (2010), PHP has been used as the development language and MySQL as the backend database for the system's main engine. These two technologies have been selected based on their capabilities, flexibility and modularity in developing an online system as recommended by Lerdorf, R. et al (2008). Because this system is a web-based application, PHP rather than client-based application languages such as C or Java language has been put to use.

The Non-Functional Requirements of the proposed software application is expected to have certain properties which would ensure its productivity; amongst these properties are reliability, consistency and accuracy. This application has been tested to pass these requirements.

4.2.1 MS SQL Server

SQL Server developed by Microsoft**,** is their more expensive but more robust alternative to MS Access. MS SQL Server is more commonly used by businesses for small to medium sized databases. MS SQL Server is a powerful database with a lot of functionality and it also has built in security features. There are free 'express versions' of MS SQL Server that can be downloaded for free; however these versions offer less in functionality [18]. MS SQL Server utilizes Transact-SQL as its primary query language. MS SQL Server allows procedures to be stored within the database similar to MS Access queries. This reduces network traffic as only variables are sent to the database along with the corresponding procedure to be used and not entire queries. This is particularly useful for queries which will be used regularly. This is also a benefit for the security of the system as it does not allow SQL injection attacks [10]. Similar to MS Access, MS SQL Server only

works on Windows based systems which may be restrictive for users. A major disadvantage of MS SQL Server is that it is very expensive and not commonly used by web hosts.

4.2.2 MySQL

MySQL is a free open source relational database management system. MySQL is the most popular open source database due to its high performance [5]. It is compatible with many operating systems including Windows, Linux and Mac allowing users to customize the database system to their needs. It can also handle large amounts of data and provides security through user authorization and access privileges [17].

MySQL was initially designed for use on the Internet and is highly popular. However, it is also gaining popularity for non-web based applications due to its high performance and functionality. Database design is also relatively simple in MySQL, which may be an advantage in this project as more time could be spent on designing and developing the actual application. A downside of MySQL is that it is not ideal if you require foreign key references [6], which for this project will not be required.

4.2.3 phpMyAdmin

phpMyAdmin is a software, coded with PHP. The main function of this software is to manage MySQL database through Internet. It can create databases, add/edit/delete tables, run SQL queries, manage user authorization and manage field keys are some of the features [20]. This is used to show the database schema like those of users, inventory, locations, supplier and ticket.

5. Proposed System

The new system is designed to solve problems affecting the manual system in use. It is designed to be used electronically thereby relieving the staff of the University from much stress as experienced in the manual system.This system will perform the analyses and storing of information either automatically or interactively. It will make use of online access to Internet.
The proposed system will also have some other features like:

- Accuracy in the handling of data.
- Fast rate of operation and excellent response time
- Flexibility (i.e.) it can be accessed at any time.
- Easy way of backup or duplicating data in diskettes in case of data loss.
- Better storage and faster retrieval system.
- Accessibility from any part of the world.

With the addition of ticketing, issues that usually arise with assets can be raised and monitored across all channels with ease. This allows for improved maintenance of an organization's asset as the Administrator is constantly reminded there is an unresolved ticket.

5.1 System Design

Prior to any design operation, the requirements to be satisfied must be specified. Design of the proposed system involves assessing data needed to be stored in the database (data analysis). This is then normalized into tables to demonstrate the relationships in an entity-relationship diagram [3].

5.1.1 Database Design

The database is created using mySQL. The database Structure is as follows (Table 1):

Table 1: Assets database table

Field name	*Data type*	*Length*	*Default value*
Id	Int	10	Auto increment (pk)
Name	Varchar	255	
Description	Text		
Supplier_id	Int	10	
Configuration_type_id	Int	10	
Usement_flag	Int	10	
Configuration_icon	Varchar	255	
Manufacturer_id	Int	10	
Delivery_date	Date		
Order_date	Date		
Warranty_start_date	Date		
Warranty_duration	Int	10	

5.1.2 Database Schema

Figure 1 depicts the database schema. It contains components that make up the system. These components include location, manufacturer, period, report, ticket and user.

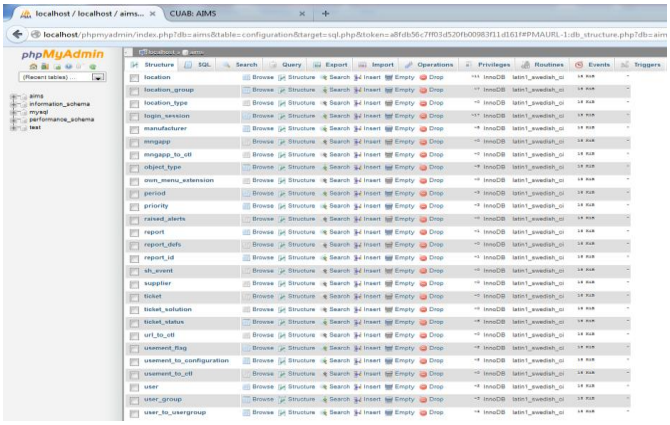

Figure 1: Database Schema

6. System Architecture

The database design is one of the important components of this system. For the system to be flexible, the user interface must be carefully examined and simply designed. Based on analysis of information gathered, it is essential to develop a graphical user interface (GUI) for the Assets Inventory Management System. For this reason, a Cascading Style Sheet (CSS) for the User Interface has been put to use to meet user requirement.

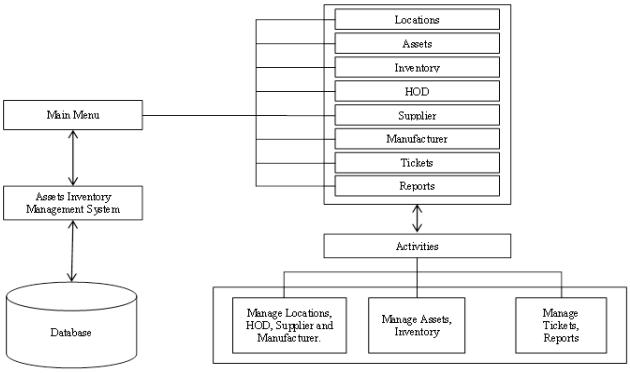

Figure 2: System Functionality

Analyzing the system functionality (Figure 2), the proposed system is in direct communication with the database as well as the main menu (user interface). The Main Menu contains the modules displayed after a successful login. The modules under the Main Menu include Locations, Assets, Inventory, HOD, Supplier and Manufacturer, Tickets and Reports. Activities refer to the actions that can be carried out on each module of the proposed Assets Inventory Management System under the Main Menu. These actions include management of Locations, HOD, Supplier, Manufacturer, Assets, Inventory, Tickets and Reports.

The **Locations** module handles creation and maintenance of environments where the assets are located. These locations can be added and updated when need be.

The **Assets** module handles how the asset items are created and assigned to a location already created in the database.

The **Inventory** module is used by the Store Officer to track the volume of stock left in the store. This notifies the user what stock need to be reordered and those that are still in abundance.

The **HOD** module is of high importance through which an administrator can create users (employees) to gain access into the system, or delete edit user's information users from the system allowing users the ability to control the Activities in the Main Menu.

The **Supplier** module deals with the creation and maintenance of personnel who are in charge of supplying assets to an organization when needed.

The **Manufacturer** module is used for the creation and maintenance of manufacturers of various assets.

The **Tickets** module is used to raise issues that arise during asset management by so that they can be monitored and resolved on time.

The **Reports** module generates a summary of all assets available in respective locations or in the organization at large.

7. Operational Flow

The system flowchart (figure 3) is used to illustrate the work flow of the Assets Inventory Management System. When the website hosting the web-based system is opened, the Login Page pops up. The registered user is required to input his/her username and password. In a situation where the submitted username or password or both doesn't match one in the database, the user is denied access to the system and asked to login again or contact the system administrator. Upon submitting credential that match the one in the database, the user is granted access to the system and can proceed to access the Main Menu. From the Main Menu, the user can perform activities such as assets' registrations, asset tracking and generate asset report according to user rights. After successful completion, the users can then logout of the system.

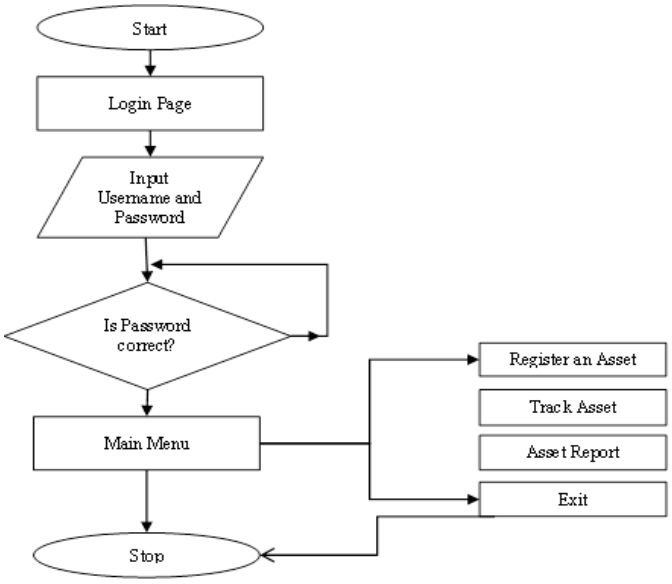

Figure 3: System Flowchart

7.1 Output Interface

Figure 4 shows the user interface for the System. The upper panel contains the modules present in the system. The left pane contains the locations contained in the organization. The locations are grouped and can be broken down into respective units. The centre of the figure shows the assets that are available in a unit. Asset name, inventory number, operation status are amongst the information displayed in this view.

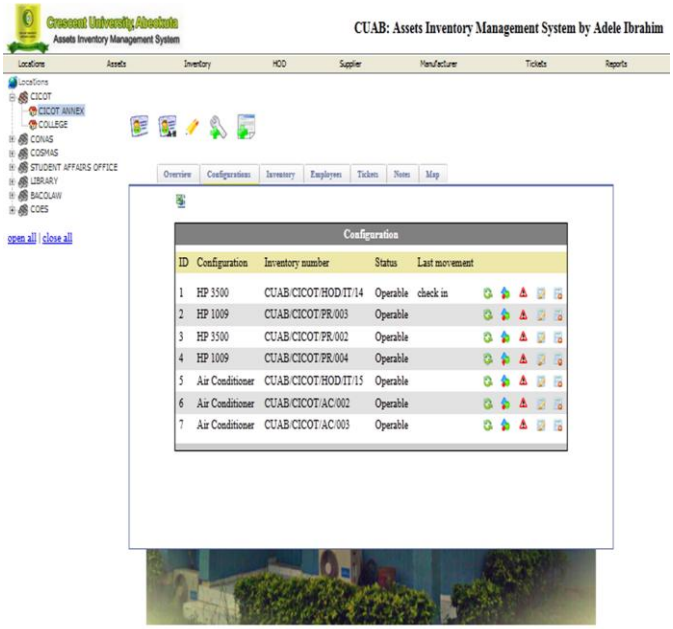

Figure 4: Output Interface

8. Recommendation

Based upon review of existing software solutions, it was found that all of the previous software systems performed the assets inventory management task only within the system it was installed on. Improvement is therefore provided by creating an assets inventory management solution that would run online and is not restricted to the system it is installed on. The system developed will provide a detailed record of all assets in the organization displaying their description, serial number, acquisition cost, inventory number, respective location, working condition (status) amongst others and will be online. This means that the system can be accessed 24hours a day all week long. Also, staff of the organization would be able to access the system from any location or device that has internet access.

The system helps to;

- Increase accuracy of assets inventory: The system will more efficiently gather and maintain accurate and uniform information on all assets.
- Eliminate time wastage: The system helps recover the time wasted to track and monitor the status of assets in the university.
- Avoid unnecessary purchases: The system helps increase control over spending money on purchasing new assets by reassigning and utilizing idle assets instead of purchasing new ones.
- Improve audit support: The system facilitates better audits tests since inventory can be recorded more accurately, assets are easily tracked and maintained thus the inventory is updated constantly. Audit support is increased because assets are constantly and efficiently tracked.

Siong, S et al (2008) made it known that the creation of a web based, minimal cost, user-friendly inventory system for stock availability can effectively track the level of re-order of finished products immediately, thereby lowering inventory management cost and minimizing forecasting error.

9. Conclusion

The Online Assets Inventory Management System has been created to reduce human errors and to increase efficiency. The main focus of this paper is to lessen human efforts and enhance efficiency. The maintenance of the records is made efficient, as all the records are stored in the database, through which data can be retrieved easily. The navigation control which has been provided in all the interface allows the users to navigate through the large amount of records easily. If the numbers of records are very large, then the user can type in the search field to get limited results.

The Staff are assigned a unique id, so that they can be accessed correctly and easily. This paper has also been able to automate the Assets Inventory Management process, by bringing all operations to an online media, for ease of access. The problems, which existed in the manual system such as varying reports in assets spreadsheet, presence of ghost assets, and wastage of time are taken care of using this system. The automation of the Assets Inventory Management will not only improve the efficiency but will also reduce human stress thereby indirectly improving human recourses and learning process. The addition of tickets further provides for tracking and repair of assets with faults thereby eliminating the cost of purchasing new ones.

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