Computer Laboratory Management System

A Project Research Proposal
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Chapter 1

INTRODUCTION

This chapter provides a synopsis of the system under study, the Computer Laboratory Management and Maintenance System. This study's existing issues have enabled it to be improved. In addition, it covers the necessity for each feature of the Computer Laboratory Management and Maintenance System in addition to the study's aim, goals, constraints, and scope.

Project Context

A computer lab is a cluster of computers that usually are networked and available for use by the public. Labs frequently are found in public buildings such as libraries, schools such as colleges and universities, community centers and some large churches that have many parishioners. Almost all computer labs offer users access to the Internet and provide software that students can use to do research and complete their homework or that others [Harvey, S. 2023]. Lab computers and software

allowed students to complete course assignments or learn new programs. The uses of technology for teaching have evolved, however, and so must the design and configuration of computer labs — they must transform into flexible, technology-enhanced spaces for maximum effectiveness.[Blink, C. 2009]

Not having a computer laboratory management system is also a problem in other countries. Lack of computer facilities, poor computer: student ratio, need for efficient laboratory management and personnel, and an overcrowded environment are the problems encountered in the existing computer laboratories. [Siossan, R 2007].

Every laboratory when having a quality management system (QMS) to operate optimally will end utilizing all equipment to their full potential. All laboratory materials will end up longer lifetimes which makes the university saving more budget in the long term. The consequences of poor quality can be severe - both for the laboratory and its users. Some of the prominent consequences of poor quality management in a laboratory setting include misdiagnosis, delayed diagnosis, unnecessary treatment, and treatment complications. These consequences, in some cases, can lead to fatalities. That means a laboratory can be unsafe

for students. [Anderson, A 2022]. Laboratories must maintain complicated workflows and often employ a variety of laboratory data management systems, such as a Laboratory Information Management System (LIMS). A laboratory must juggle complex data, equipment, system access, labeling, sample tracking, and essential communications within the lab, just to name a few. Your laboratory's equipment is likely the single biggest investment at your lab and absolutely critical to your workflows. Keeping all equipment calibrated, and conducting maintenance on a regular schedule, can be difficult to keep track of. Failing to maintain your equipment could result in equipment failure, costing your lab additional money and time. [Third Wave Analytics , 2022]

In one assessment study of a Private HEI in Isabela revealed that participants also found some problems associated with the computer laboratory moderately serious. The researcher proposed that computer engineering be equipped with a stable internet connection, fully-functional software, and increase the number of computers to accommodate large class sizes. While rated as having a good status, the repair of computer systems and equipment, yearly acquisition of new equipment, and the

number of qualified laboratory technicians or assistants should be addressed too for improvement purposes. [Fernando, E 2019]

In another study in finding out the Effectiveness of the Computer and Internet Literacy Project in Public High Schools of Tarlac Province. Findings showed that the beneficiary schools encountered problems in project implementation. These problems include hardware failure, difficulty on the use of software packages, lack of follow-up on capability building, no available internet connection, limited access to the laboratory, and lack of repair/maintenance of the equipment in the laboratory. Despite these problems, however, the project was rated by the teachers as very satisfactory in terms of project administration, project components, and project delivery system. [Lorenzo, A 2016]

In the Philippines, in accordance with the pertinent provisions of Republic Act (RA) No. 10533, otherwise known as "Enhanced Basic Education Act of 2013". The DepED shall include among others, in this midterm report, the following key metrics of access to and quality of basic education but not limited to, computer and science laboratories. The HEI shall conform with the support facilities required for the laboratory courses.

Sufficient functional equipment to allow every student to perform all basic laboratory exercises. A Personnel maintenance preferably with a valid and appropriate license of equipment. inventory of equipment to maintain and update annually. Containing the following information. name of the item, quantity on hand, operational status, year of purchase, original purchase price. There shall be an adequate, secured, and appropriately ventilated storage room in the school/college. Each school shall have a program for laboratory safety which includes an annual training program for laboratory safety, secured and well ventilated , fire extinguishers with proper specifications required by the National Fire Code. Laboratory References shall be made available for use by all students in all engineering/technology laboratory courses. Appropriate safety warnings, procedures and equipment lists. [CHED CMO No. 86, 2017]

Based on the foregoing, it is therefore desirable to provide an access control and monitoring system, which accordingly can systemize the knowledge of the laboratory in-charge such that common problems like broken monitor, unfunctional peripheral and etc. can be detected, isolated and fixed by generating a report before such problems become

critical.A lot of students were complaining to the laboratory in-charge when workstations inside the laboratory were not working (Kumar, V., & Sharma, R. 2012).

Statement of the Problem

This study is intended to develop a website application for the University of Nueva Caceres (UNC) Computer Studies Department to improve the laboratory equipment management and maintenance system.

This study will address the following:

1. What information requirements are needed to develop a Computer laboratory management system?
2. What components and features are required to build a Computer laboratory management system?
3. What is the user effectiveness level for the University of Nueva Caceres' Computer laboratory management system?

The Objective of the Study

The main objective of this project is to develop and provide an IT solution for Computer Laboratory Equipment Management. To enhance the overall standard of service for maintaining and managing equipment inside the Computer Laboratory. These goals for the study were particularly focused on:

1. Find out what information requirements required for designing and creating a Computer laboratory management system for the University of Nueva Caceres.
2. Identify and create the necessary modules and features for the design and development of a Computer laboratory management system specifically customized for equipments in the University of Nueva Caceres
3. Assess the effectiveness and acceptance of the user in implementing a Computer laboratory management system

Purpose and Description

The purpose of this study is to develop a system for managing and maintaining the computer lab equipment at the University of Nueva Caceres. The method attempts to make it easier to maintain and organize equipment in an effective manner. Equipment management is the methodical process used to track, manage, and increase the estimated lifespan of equipment. The University of Nueva Caceres currently lacks an effective system for tracking assets and inventory. Inefficiencies, reduced production, and higher maintenance expenses may result from this. By using a computer laboratory equipment management and maintenance system, you may increase productivity, decrease downtime, increase equipment longevity, and make better-informed maintenance and replacement decisions. The following people are among those who will gain from this research:

ICT Office Personnel. The ICT Office Personnel is responsible for maintaing hardware, software and technical issues. To ensure the lab's functionality and efficiency. Developing a Computer

Laboratory Management System can ensure that ICT Office Personnels can handle equipment on how they are being used effectively and allocate resources more efficiently. Access to usage and maintenance data helps in better budget allocation for repairs, replacements, and new equipment purchases.

Student Assistant. Helping them quickly locate and input inventory of equipment inside the laboratory. The system records assigned student assistants in the laboratory equipment and when. This fosters a sense of responsibility among student assistants to ensure proper usage and timely return.

Laboratory Custodian. Custodians can efficiently manage equipment. Able to track and make sure all equipment are clean, functioning properly and request maintenance for any repairs. Leading to a smoother workflow. The system's tracking capabilities enable technical teams to address issues promptly.

Scope and Delimitations

The primary objective of this project is to design and implement a Computer Laboratory Management System for the University of Nueva Caceres. The scope of the research is limited to the particular institution and does not include other Universities within Naga City, Camarines Sur. The researchers aim to conceptualize and create a system that will facilitate the effective management of equipment within the University of Nueva Caceres.

These platforms will be specifically designed to efficiently manage equipment inside the Computer Laboratories. The system will be responsible for the management of many essential data categories, such as Asset Management, Maintenance Scheduling, Issue Reporting, Inventory Tracking, and Budget Management. This study will solely focus on utilizing internal data sources from the laboratories inside the University of Nueva Caceres. The achievement of the system's desired result is entirely dependent on the provided data.

Limitations of the Study

The study primarily centers on managing equipment in the computer laboratories in the University of Nueva Caceres. The researcher will be unable to obtain access to the confidential pre-existing records of the Computer Laboratory Equipment. Moreover, the proposed system will not encompass any external sources of information beyond the computer laboratories in the University of Nueva Caceres. Such as other Universities and outside computer laboratories. Furthermore, the system will only grant access to individuals who have been duly authorized, such as Student Assistants, Instructors, Facilities Managers, and Technical Staffs. Access shall not be allowed to anyone who are not associated with the office or do not possess work-related obligations.

Definitions of Terms

The following terms are defined in order to give a clear understanding of the terms used in the study. Computer laboratory: A room or area equipped with computers and other

related equipment for the use of students, researchers, or other individuals.

Computer Laboratory Custodian:

A Computer Laboratory Custodian is an individual responsible for the care, maintenance, and oversight of a computer laboratory's physical space, equipment, and resources. Their primary role is to ensure that the laboratory environment is conducive to learning, research, and efficient usage by students, faculty, or staff. Duties of a computer laboratory custodian may include managing hardware and software resources, maintaining the cleanliness and organization of the lab, providing technical assistance to users, troubleshooting minor technical issues, and coordinating with IT personnel for more complex problems.

Student Assistant:

A student assistant, particularly in a computer laboratory, refers to a student who is hired to provide support and assistance to the instructor or professor in managing the lab's operations and resources. Their responsibilities typically include helping with equipment setup, maintenance, and repairs, as well as assisting other students in using the lab facilities

effectively. They may also play a role in monitoring attendance and maintaining an inventory of equipment.

Computer Laboratory:

A computer laboratory used for student learning in a university is a dedicated space equipped with computer systems, software, and educational resources to facilitate academic activities, research, and practical learning experiences. It serves as an environment where university students can access technology tools and resources to enhance their understanding of various subjects, develop technical skills, and engage in hands-on learning.

Downtime Minimization:

Strategies and practices aimed at reducing the duration and impact of equipment failures or maintenance on lab availability.

Chapter 2

Review of Related Literature

This chapter discusses the technological foundation, various publications, investigations, projects, computer laboratory management, and maintenance, as well as a synthesis of relevant research. This chapter specifically focuses on discussing computer laboratory management and maintenance, further exploring the value of computer laboratory management and maintenance systems, reviewing prior research on computer laboratory management and maintenance, and discussing related Computer Laboratory Management and Maintenance Systems. In order to progress the study of the Computer Laboratory Management and Maintenance System, it is vital to identify research gaps, suggest areas for further investigation, and identify significant emerging trends.

Technical Background

The goal of the system is to manage and oversee the Computer Laboratory Equipment in the University of Nueva Caceres. A Computer Laboratory Management and Maintenance Systems is a software that allows inventory of equipment (serial number, model, specifications), able to request maintenance for specific equipment, and budget allocation and tracking (new parts, costs, maintenance requests) [Teachmint, 2016]. A laboratory is defined as a place of work, i.e buildings, structures, or rooms equipped with instruments to perform scientific work such as research, demonstrations, and discussions[Government Regulation No.5 of 1980]. The main and supporting equipment that should be in the computer lab, include the computer unit, desk, and chair where to put the computer and user seat, instructor/teacher desk, whiteboard/whiteboard. While in the supporting equipment that is, network system, LCD screen, LCD projector, cabinet/cabinet, AC/fan [2]. [Regulation of the Minister of National Education. No 24 of 2007].

Modern asset management systems allow school administrations to drive common logistical tasks without disruption, but further, they facilitate improved learning for students. These solutions enhance school productivity significantly and help overcome key challenges faced by schools in handling IT equipment [EZOFfice Inventory 2022]. Managing these assets is an essential part of a school's obligation. Using equipment management software makes managing these assets easier and more efficient. [Assetbots 2022]. This particular system has the capability to cater to the operational needs of end-users, namely in terms of data gathering and storage. These aspects pose significant challenges in their present conventional approach to managing collected data.

The purpose of implementing an asset management solution in primary schools, secondary schools, and other education facilities is to maximize and track the usability of school equipment, Ensure the availability of assets from projectors, air conditioning, computers, and speakers. With Asset Management Software, schools are able to reduce spending on the replacement of lost or stolen assets. While also accurately tracking spending across all departments [CompareSoft 2023].

In addition to managing the equipment inside the laboratory, the system will also handle reporting for broken equipment, and request maintenance job orders to technical staff. Efficient lab equipment is crucial for making sure these goals continue to be met. There are various reasons why lab equipment and facilities need to be maintained and cleaned. [Waddel, B. 2019]

Equipment inventory management (EIM) is the process of tracking and controlling assets, from acquisition to disposal. By keeping tabs on this information in real-time, companies are provided invaluable insights into their asset’s performance that could help improve operations and financial efficiency.With equipment inventory management software, organizations have increased visibility of their assets at any given time while streamlining the management processes and increasing economic efficiencies.All these features enable businesses to save time, money, and resources while managing their assets more accurately.[Brightly, 2022]. The proposed system will have an inventory management system for equipment in the computer laboratory in the University of Nueva Caceres. By collecting all the equipment in the laboratory, the inventory management can track, manage, and maintain all physical assets.

Scheduled maintenance refers to maintenance tasks that are assigned to a technician with a given deadline. It includes inspections, servicing, adjustments, and planned shutdowns. The tasks can be performed as one-off jobs or at regular intervals. This aims to minimize equipment failure, maintenance backlogs, and reactive maintenance. It also allows for better resource allocation. This maintenance plan refers to deciding when maintenance tasks will be completed and by whom. Unlike planned maintenance, scheduled maintenance doesn’t require complex work and equipment behavior forecasting. A task falls into this category when an issue has been identified, assigned to a technician, and given a deadline for completion.[Eisner, C. 2022]. The proposed system includes requesting scheduled maintenance on all equipment. To make sure all equipment is functioning properly and reduce downtime of equipment. The system is able to assign specific technical staff on the designated equipment. The proposed system is also able to display the current status of each job order and equipment.

Budgeting is one of the most important tasks of the finance department. A budget is an organizational tool that is used for planning and controlling finances within the organization. Budgets are guidelines for future plans of action expressed in

financial terms for a set time duration. Managers can use budgets to monitor and plan for changes in business processes. The budgeting process also allows managers to find effective solutions for issues when they arise. Budgets provide a historical reference to be used for future planning. Having a clear financial budget communicates the organizational goals to individual employees. Once individual employees become aware of organizational goals, plans, and initiatives, they become more accountable for implementing them. A clear budget refines organizational goals and reflects realistic resource availability. [cflow 2023]. The system will manage a comprehensive breakdown of how the budget is being used in the equipment management system. This data plays an important role especially in maintaining and requesting job orders/replacements. The Finance team will be able to track and see how the total budget flows and being utilized to all equipment. By having a complete comprehensive breakdown of the budget, the technical staff, facilities managers, and finance team will have access to information and create budget transparency. To ensure accountability and efficient resource management.

A web-based application is any program that is accessed over a network connection using HTTP, rather than existing within a device's memory. Web-based applications often run inside a web browser. However, web-based applications also may be client-based, where a small part of the program is downloaded to a user's desktop, but processing is done over the internet on an external server.[Rouse, M. 2023].

The proponents intend to use Firebase, as a Backend-as-a-Service (Baas). It provides developers with a variety of tools and services to help them develop quality apps, grow their user base, and earn profit. It is built on Google's infrastructure. Key features are authentication, realtime database, hosting, and notifications. [Educative 2023].

Indeed, Firebase is a less technical and time-saving alternative to writing full-fledged backend code for dynamic apps.Also want to consider leveraging this tool if you eventually wish to host and manage your app in the cloud. Being serverless, Firebase removes the need to worry about the technicalities of cloud server configuration [Omisola, I 2021].

Bootstrap is a huge collection of reusable pieces of code which can be quite handy to the developers. It is a

Frontend-Development Framework, written in HTML, CSS, and JavaScript. Bootstrap enables designers and developers to build completely responsive websites quickly.[Board Infinity 2023]. It enhances the development process by offering resources such as templates and themes, which can be customized according to the project needs. This will help the proponents design the layout of the system as they will have less time doing creating the user interface/front-end of the web-based application.

Compared to desktop applications, web-based applications provide a whole range of business advantages. These applications can be accessed from any computer through the internet, instead of having to be individually installed on each computer that you wish to access it from.[Khamooshi, P 2021]. Firebase allows a team consisting of front-end developers only to build apps quickly. This approach is possible because Firebase takes care of the backend development functions such as storage, authentication, analytics, notifications, and others. The platform also gives access to several ready-made services, so a development team doesn’t have to waste time writing boilerplate codes or start coding the backend from scratch. [Clark, J 2023].

Bootstrap offers many advantages for web designers and developers, such as saving time and effort by providing ready-made components and styles that can be customized and combined. It also ensures consistency and compatibility, as it follows a standard design and coding convention, and uses a mobile-first approach. Additionally, Bootstrap supports accessibility and performance, as it follows web accessibility guidelines and best practices, and uses a modular and lightweight structure to improve the speed and performance of your website.

The comparative study done by [Elowen Briar, 2020] immersed in the innovation of computer labs in various universities has been of focus. The administration, organization, and use of computer labs will be improved by this integrated software solution, which will also considerably improve administrators' management procedures and students' learning experiences. The study helped unravel data in comparison with diversified university statistics.

With that as foundation, it supports the research done by Gretter (2015) that states that the management of a computer lab's environment and security, network upkeep, software and

hardware updates, and the use of multimedia software are all included in the curriculum. The management of a computer lab is very challenging because despite the high number of computers in the lab, the vast majority of students are enrolled in different majors. focuses on the favorable correlation between effective administration of computer lab resources and increased student happiness and better academic results. Administrators can easily organize classes using the system's user-friendly interface, allot specific time slots to courses, and maximize the availability of computers and software resources. By eliminating scheduling conflicts and cutting down on wait times, this guarantees that every kid has fair access to necessary resources.

In connection with this, Ainsley (2018) takes on a crucial but essential role in the domain of Computer Laboratory Management System (CLMS.) In the conducted study, the Collection evaluation involves a meticulous assessment undertaken by administrators to gauge the continued relevance and alignment of individual items within the lab's resources.The characteristics of a fundamental LMS are highlighted, along with how they may enhance evaluation quality, boost verification, and increase efficiency. This also showed the installation of these

innovations may assist laboratory staff, promote good laboratory practices, and eventually boost efficiency and decrease administrative work. Improvements to these systems are presented.The primary objective is to ensure that these items effectively serve the evolving needs and requirements of users. Particularly significant within an academic environment, this process revolves around determining if the items within the collection adequately support ongoing research endeavors and align with the curricular demands.

Efficient inventory management and meticulous maintenance practices lie at the heart of effective computer laboratory management, exerting a profound impact on the overall functionality and success of the facility. With a well-structured inventory system in place, lab administrators can effortlessly monitor and manage computer hardware, software, and peripherals, ensuring that essential resources are readily available when needed. Moreover, the marriage of inventory management with regular maintenance activities contributes to the longevity and reliability of the lab's infrastructure. This proactive approach reduces the risk of hardware failures and technical glitches, which could otherwise disrupt lab activities and hinder the educational experience. Additionally, keeping

software applications up to date through effective inventory-linked maintenance ensures that the lab remains secure against potential cyber threats, safeguarding sensitive data and preserving the integrity of the lab's operations. [Warschauer, M. 2015].

At the core of effective budgeting lies the ability to allocate resources in a manner that optimally supports the core mission of the computer laboratory. Modern CLMSs require a continuous influx of financial support to acquire, upgrade, and maintain state-of-the-art hardware, software licenses, and peripherals. Adequate funding facilitates the acquisition of cutting-edge technology that aligns with the rapidly evolving landscape of educational tools. Furthermore, it ensures that students, faculty, and researchers have access to the latest resources, fostering an environment of technological proficiency and innovation. [Svetlana, D. 2022]

To execute, maintain, and improve dealerships' inventory planning, inventory management systems were developed. The correct technology can significantly help your inventory management efforts. Dealers who use inventory management systems see faster vehicle turns and a greater ROI than dealers who

don't. This tactic really aids in producing a successful result (Zierden, 2009).

According to the article "Azteca Food Craves Inventory Management System," producers and distributors still conduct daily business using a paper-based inventory system and other manual procedures. [J.McDowell. 2015]. To maintain market dominance, new technology must be adopted. Azteca previously employed a paper-based system that called for line supervisors and employees to collect data with clipboards at the end of shift. However, that system wasn't up to par with the global company's warehousing and distribution requirements. As a result, the old system hampered business operations and had a detrimental effect on the bottom line because it took too long to handle the volume of goods that Azteca produced and distributed to consumers around the world.

Inventory management can help to improve research productivity by providing researchers with the equipment they need when they need it. By tracking the availability of equipment, managers can ensure that researchers have access to the equipment they need to conduct their research. This can help

to improve research productivity and the overall output of the laboratory. [Fayyaz, M. 2022].

At the time, RV Empire Incorporated used a manual sales and inventory system, which frequently made tracking the products bought and sold and completing transactions problematic. Additionally, due to insufficient security measures, the company's reports, customer information, and transaction records were vulnerable to unauthorized alterations. The time needed for these activities would be greatly decreased because of the computerized system's correct calculation of sales transactions. Additionally, RV Empire Incorporated encountered difficulties successfully overseeing their products, which confused the personnel. This would be addressed by the suggested system's inclusion of a module that not only keeps track of transactions but also the products involved, enabling the manager to easily keep an eye on them.

Related Systems

Inventory management in a healthcare system needs to be compatible with its operations and critical characteristics

ensuring minimization of inventory-related cost as well as maximization of service level with a significant reduction in the price of treatment and wastage of resources.[Saha, E 2019]

impact of a warehouse management system on supply chain performance that provides less resources effort, more efficient, and reliable inventory management system. The supply chain procedures carried out in the warehouse were reviewed before customizing a software that can handle the necessary transactions. The software was tested for enhancing the work flow and providing a timely and efficient handling. [Atieh, A 2016]

Proposes a comprehensive methodology for the development of a humanitarian emergency management framework based on the real-time tracking of emergency supplies and demands through the use of RFID technology integrated with a multi-commodity stochastic humanitarian inventory management model (MC-SHIC) [Ozguven, E. 2013]

Because of the complex structure of the spare parts supply chain, the conventional approaches, which do not consider the relationships between decision factors globally, cannot achieve

the optimal performance. Therefore, this paper aims to develop an enhanced fuzzy neural network (EFNN) based decision support system for managing automobile spares inventory in a central warehouse. In this system, the EFNN is utilized for forecasting the demand for spare parts.[Li, S.G. 2008]

This study is therefore important to build up a system to predict possible forthcoming inventory. This study surveyed experts to identify key issues associated with inventory management in the food-processing-and- distribution industry, and analyzed sequential patterns to find rules based on analytical results from the survey. [Liang, C.C. 2013]

When a software system critical for an organization exhibits a problem during its operation, it is relevant to fix it in a short period of time, to avoid serious economic losses. The problem is therefore noticed by the organization in charge of the maintenance, and it should be correctly and quickly dispatched to the right maintenance team. We propose to automatically classify incoming maintenance requests (also said tickets), routing them to specialized maintenance teams.[Gradara, S 2021].

Medical equipment maintenance in Jordan lacks an objective prioritization system; consequently, the system is not sensitive to the impact of equipment downtime on patient morbidity and mortality. The system proved highly efficient in minimizing equipment downtime based on healthcare delivery capacity, and, consequently, patient outcome. Additionally, a preventive maintenance optimization module and an equipment quality control system are incorporated. [Hamdi, N 2010]

In order to increase the reliability and therefore capacity of the industrial plants in their quest for world-class maintenance. However, if a strategy is to be effective, it must be supported with an invaluable resource, information. In the present work, the role of computerized maintenance management systems (CMMSs) is discussed as a powerful tool necessary for obtaining information from raw data and support the decision-making process
[Fernandez, O. 2023]

Due to the different equipment and instruments in a construction lab, effective maintenance management can be very challenging. These tools and equipment must conduct tests with a high degree of precision and accuracy. In a construction lab, maintenance

personnel typically create physical copies of the results of inspections and maintenance. As a result, there are frequent issues with data re-entry and information access during the maintenance process. [Cheng Lin, Y 2013]

Depending on its use, equipment, whether sophisticated or simple in operation and design, will inevitably fail and break down. It is imperative that maintenance processes exist in any firm where manufacturing is the core activity. Not only does equipment maintenance need to be scheduled, but production planning and scheduling must also take the possibility and likelihood of breakdowns and business interruption into account. This essay looks at the theoretical underpinnings of various maintenance management approaches currently in use in global industry. These tactics support the maintenance function and allow for the optimization of the maintenance process. [CD O'Donoghue 2004]

A practical value of budget management system is analyzed and discussed. For the sake of overall management company, we build a comprehensive budget management system based on business, and with the office platform, contract management, reimbursement, other related effectively business integrated financial management and control system. [Ma, S 2016]

Developed a water budget management system (WBMS) that downloads climate data and calculates a water budget. A geodatabase was designed to support the WBMS. Finally, the WBMS was tested for mapping fire potential in Mississippi.[Choi, J 2013]

Full mathematical derivation of the binary integer programming problem is shown in terms of budget constraints only and in terms of both budget and percentage of poor assets (PPA) constraints. An alternative approach including the PPA constraint is therefore suggested along with a new practical way of reducing the search space based on the statistical bootstrap approach. [Abukhalil, Y 2021]

The proposed system can serve as a tool to assist end-use residential consumers for their load and budget managements in real-time pricing environments, like Illinois (the state where 4.5 million consumers can participate in such program). Other features can further add-on to enhance the proposed system to better reach end-use consumers (e.g., home security and surveillance system).[Tiptipakorn, S. 2008]

The development of a prototype web-based system for budget offices of State Universities and Colleges is the primary goal of this study. In providing a vivid view of the existing budget offices' processes, graphic presentations of the budget process cycle, and flowchart of the budget execution process performed. As a result, under the old system, significant flaws in the transactions conducted surfaced. [Capucao, J. 2020]

Proposes a system that is based on a QR code, which is being displayed for students during or at the beginning of each lecture. The students will need to scan the code in order to confirm their attendance. The paper explains the high level implementation details of the proposed system. It also discusses how the system verifies student identity to eliminate false registrations. [Masalha, F 2014]

Analyzes the method of QR-Code recognition, password method-the existing user-authentication technique, smart card, biometrics and voice recognition and so on and then designs a new user-authentication technique. It has the advantages in view that it will simply the process of authentication and contract the disadvantages, such as brute force attack, man-in the-middle

attack, and keyboard hacking, which may occur in other authentication [Gon Kim, Y 2014]

A user can use Secure QR Code (SQRC) technology to keep information secured and hidden. In this paper, we propose a novel SQRC system which will allow sharing authentic personal confidential information by means of QR code verification using RSA digital signature algorithm and also allow authorizing the information by means of QR code validation using RSA public key cryptographic algorithm.[Ahamed, Md 2014]

The development of a secure door lock system by utilizing Quick Response (QR) technology and Raspberry Pi processor for accessing the university laboratory or classroom where the authorized person will also be able to monitor who have accessed to the classroom or laboratory. The data logging system is developed to track the ingoing and outgoing activities when accessing the security door from the web-based website server. [Fauzi, A 2022]

Recording the data on the product package in the form of a quick response two-dimensional barcode (QR code) in key points of the product’s life cycle. For efficient functioning of the proposed

system, it is essential to ensure fast and reliable operation through proper placement of the QR code on the package during production, and fast and easy data reading by the product consumer. [Tarjan, L 2014]

Synthesis

In this chapter, the literature, studies, and systems related to the proposed project are all found to be related to the present research. The project revolves around the development of a Computer Laboratory Management and Maintenance System. The proposed project represents a significant advancement in computer laboratory management, building upon a range of related studies, literatures, and systems. Elowen Briar's comparative study highlights the need for innovation in university computer labs, emphasizing the improvement of administration, organization, and student learning experiences through integrated software solutions [Briar E.,2020]. Gretter's research reinforces the importance of effective management encompassing security, network upkeep, and software updates [Gretter, 2015]. The research identifies a positive link between efficient resource administration and enhanced student outcomes. Ainsley's study underlines the significance of continuous

evaluation and alignment of lab resources to evolving needs, while Warschauer stresses the role of inventory management and maintenance in ensuring lab functionality and security.

The project also draws inspiration from various other domains. Zierden reveals the benefits of inventory management systems in dealerships, indicating improved ROI and vehicle turnover [Zierden, 2009]. McDowell's study emphasizes the necessity of technology adoption in inventory systems for businesses to remain competitive [McDowell, 2015]. Fayyaz focuses on how inventory management enhances research productivity, while Svetlana asserts that budget allocation is vital for maintaining cutting-edge resources in computer labs [Fayyan, 2022] and [Svetlana, 2022].

The synthesis incorporates systems from diverse fields. Saha discusses healthcare inventory management's impact on cost and service levels [Saha, 2019]. Atieh highlights the benefits of a warehouse management system in supply chain efficiency [Atieh, 2016]. Ozguven combines RFID technology with an inventory management model for humanitarian emergencies [Ozguven, 2013]. Li proposes an enhanced fuzzy neural network for automotive spares inventory management [Li 2008]. Gradara

introduces an automated ticket classification system for software maintenance. Fernandez explores computerized maintenance management systems for effective decision-making [Gradara, 2021] and [Fernandez, 2023].

These studies collectively support the originality of the proposed project, indicating that it builds upon existing research while integrating innovative concepts. The project not only addresses the specific challenges of computer laboratory management but also draws lessons from diverse contexts, underscoring the importance of efficient inventory management, maintenance, budget allocation, and technological integration. This synthesis establishes that the proposed project is a well-founded continuation and improvement, offering valuable contributions to the field of computer laboratory management.

CHAPTER 3
METHODOLOGY

Methodology

This chapter presents the methodology for software development, which will be employed to collect adequate data that forms the foundation for the system's development. The selected approach was thoroughly examined in this study, with each stage being described and its application in suggesting the research being demonstrated. This chapter provides an overview

of the methodologies employed for data collection, presentation, and analysis in order to address the research objectives and issues. Additionally, it discusses the sources of information utilized in the study.

Software Development Methodology

Figure 1. Feature Driven Development Methodology [Jory MacKay 2019]

Feature Driven Development Methodology

FDD is an incremental and iterative software development process. a software development procedure that follows the guidelines of the agile manifesto. Goal was to build the domain object model, high-level characteristics, and scope, which would then be utilized to organize, create, create, and test specific demands and activities. according to the general category to which they belonged [Inflectra, 2020]. The feature-driven development paradigm was chosen by proponents because they designed to build a big system. This approach makes it simpler for the advocates to address issues and monitor development and outcomes, enabling them to plan improved system functionality that is more thorough.

Stage 0 Data Gathering. The first level in FDD is to construct a clear, not unusual place know-how of the target market and their needs in addition to to correctly realize the task's content material and context [Lynn, 2021]. The task's supporters gathered all of the stipulations at some stage in

this phase. The proponents spoke with the UNC Computer Laboratory Office, the UNC ICT Office, and the UNC Technical Office to examine extra approximately the techniques they undergo before, at some stage in, and after the proposed task is applied and following an computer laboratory management and maintenance. At this point, the proponents accrued all vital statistics, each fundamental and minor, consisting of little by little process, a pattern control, request, harm shape and etc., critical routes, and an in depth rationalization of ways they protect reports, pattern statistics and bureaucracy for every laboratory that uses them for reports, and people wished statistics whilst reporting a request, harm and etc.. on how they manage and preserve their statistics.

Develop an Overall Model. In this phase, it defines the overall mission, scope and business objectives of the system being developed and then, create business domain models of the system, starting with individual components or subsystems and then consolidated into a complete model [Inflectra, 2020] and as it develops and as the team learns, details will be added [Lynn, 2021]. In this phase, the proponents created the models of the system. This includes the definition of problems and objectives, creation of the system overview, database design, software

models, and the system design. At this stage, the proponents created the following: list of requirements, system overview, database design, system models and designs.

Build a Features List. Knowledge gathered during the initial modeling is used to identify a list of features by functionally decomposing the domain model into subject areas [Inflectra, 2020]. In this phase, the proponents used the requirements to generate the list of features. At this phase, the proponents completed the following system modules and features, such as for a web application: inventory management, inventory tracking, issue reporting, scheduled maintenance, and budget management. For the mobile application: QR Code Scanning for Inventory, Issue Reporting, and Scheduled Maintenance.

Plan by Feature. During the planning stage, all team members participated in feature evaluation with each development stage in mind. The complexity assessment was then used to determine the order in which each feature will be implemented [Lynn, 2021]. During this phase, the proponents evaluated all of the features. They then determined the order in which the features would be implemented. At this phase, the proponents have determined which features will be developed first.

Design by Feature. A chief programmer determined the features that were planned and built. The programmer also identified the participating class owners and feature teams, as well as the feature priorities. Before proceeding, the entire team had a design review at the end of the design stage [Lynn, 2021]. The first feature to be developed has been identified by the proponents during this phase. Other features can be subdivided into smaller components to make tasks more manageable. At this phase, the proponents created a process flow chart for each application, data flow diagram, databases, system design, and a mockup design.

Build by Feature. This phase involves putting in place all of the elements required to support the design. User interfaces, as well as components mentioned in the technical design, were produced here, and a feature prototype was created. After the unit had been tested, examined, and approved, the feature could be promoted to the main build. Any feature that took more than two weeks to develop and created was broken down into smaller features until it fulfills the two-week criterion [lynn, 2021]. The proponents began developing the feature during this phase. Those features that are still too large to fit into the two-week

time frame have already been divided into smaller sections. At this phase, the proponents completed the following: frontend design and backend of the feature, as well as testing the feature's results.

Requirement Gathering Methods

In this phase, the researchers will utilize conventional and efficacious techniques for data collection, encompassing interviews, observation, and document analysis. The proponents seek to employ recognized methodologies in order to collect complete and precise data that will serve as the basis for the creation of an effective and customized Computer Laboratory Equipment Management and Maintenance System.

Interview. An interview is a discussion or conversation between a potential employer and a candidate. It is a selection process designed that helps an employer understand the skills, scrutinize their personality and character traits and check the domain knowledge. In this formal meeting, the employer asks questions to get information from a candidate. Interviews happen during the last phase of the recruitment process and help companies select a suitable candidate for a job role.[Indeed 2023]. The selected research methodology, namely the interview, demonstrated its efficacy as the most optimal way for information collection in the context of this study on Barangay Development Planning. By means of conducting interviews, it is possible to acquire a thorough comprehension of how the process is effectively managed, thereby facilitating an in-depth discussion of the subject matter. The successful implementation of this approach necessitates active involvement with the Technical Staffs, Student Assistants, and Facility Managers. As well as thorough inquiry from both the researcher and the target clients. Through the implementation of these interviews, the researcher aims to get significant perspectives about the procedures and techniques utilized in managing the equipment inside the Computer Laboratory.

Observation. Refers to a method in which researchers study the ongoing behavior of their participants (or subjects). This is different from techniques such as interviews or questionnaires because observations are a study of what subjects do instead of what they say. Observation is a primary research method. Primary research involves personally collecting the data or information being studied. This is the opposite of the secondary research method, where researchers choose to study data that has already been collected before their study begins. [Study Smarter, 2023]. The researcher will utilize the observation method to observe and document the natural workflow occurring within the Computer Laboratory and how Technical Staff handle inventory and maintenance of equipment.

Document Analysis. Document or Documentary analysis is a social research method and is an important research tool in its own right and is an invaluable part of most schemes of triangulation. It refers to the various procedures involved in analyzing and interpreting data generated from the examination of documents and records relevant to a particular study. In other words, documentary work involves reading lots of written material (it helps to scan the documents onto a computer and use a qualitative analysis package). [Dr. Cath 2011]. This

methodology proves to be highly advantageous in facilitating the researcher's comprehension and classification of material derived from the IT Staffs and Student Assistants, who possess relevant experiences pertaining to the subject matter at hand. The researcher evaluates the quality and relevance of the documents they utilize in order to ascertain their potential value for the study. The study aims to critically analyze and evaluate the traditional methods and protocols employed in the production and implementation of a Computer Laboratory Equipment Management and Maintenance System.

Sources of Information

This section will include a comprehensive analysis of several sources of information required for the project. The researcher intends to conduct interviews with individuals possessing expertise and authority in the field of Equipment Management and Maintenance procedures. This approach will be advantageous for researchers as it facilitates the collection of pertinent information that can contribute to the comprehension and advancement of their concept.

Dean of Computer Studies. The Dean of Computer Studies is in charge of both the academic and business parts of the school. They have a big-picture view of the computer lab's role in the school and can give helpful advice about how the budget is spent, how strategies are planned, and what the lab's overall vision is. The Dean's point of view is very important for knowing the long-term goals and priorities for managing and maintaining equipment.

Faculty Professors of Computer Studies

In the computer studies department, the training and research are done directly by the faculty. During their classes and studies, they use the lab equipment a lot. These teachers can give useful feedback on how easy the equipment is to use, how well it works, and where it falls short. Their feedback can help figure out what specific needs and improvements need to be made to the maintenance system in order for it to support academic activities well.

Student Assistants

Student assistants of the Computer Studies Department often help instructors/professors in the laboratory. They handle the

attendance log sheet of the students. and other technical problems in the computer lab needed by the professor. They use the tools every day and know how to use it well. These student assistants can give real-world feedback on the equipment's condition, usual problems, and how easy it is to use. Their ideas can help us figure out how the main people who use the lab feel and what problems they face.

Laboratory Custodian

The people who work in repair are in charge of making sure that the lab equipment works well. They know how to fix things technically and have first-hand experience with machine repairs, maintenance schedules, and past performance data. Their knowledge can put light on how reliable the equipment is, what causes it to break down most often, and what preventive steps are needed to make the equipment last longer.

ICT Office Personnel

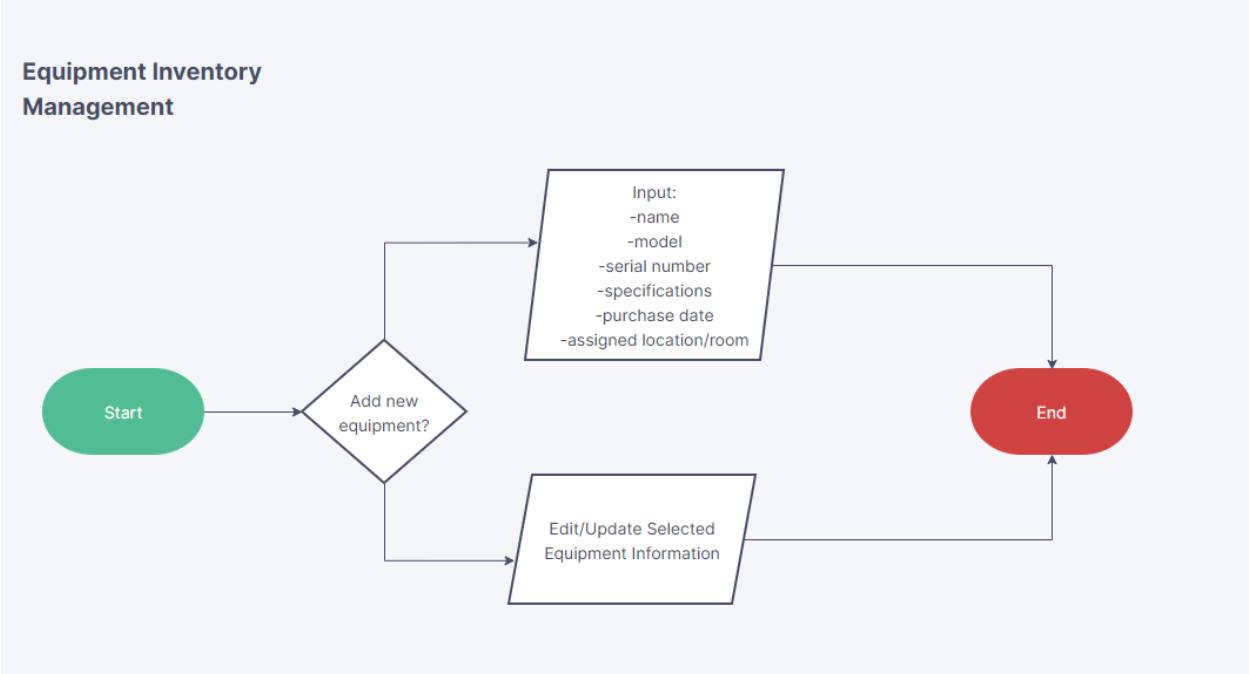
Technical staff members are typically well-versed in the operation, maintenance, and troubleshooting of the specific

equipment and systems in the computer laboratory. They possess valuable insights and deep technical knowledge that is essential for effectively managing and maintaining the equipment.

Technical office Personnel

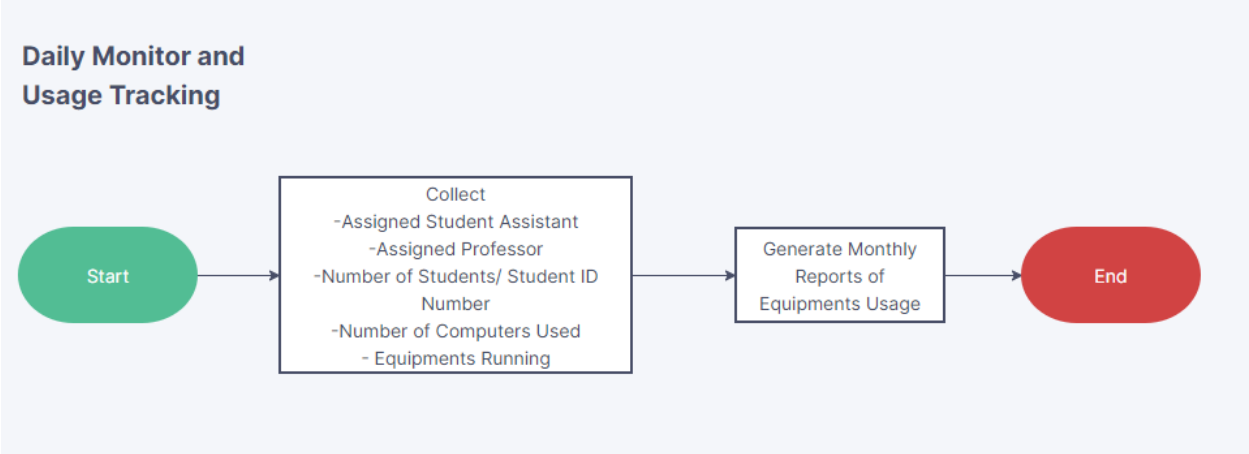
Process Flow Diagram

1. Equipment Inventory



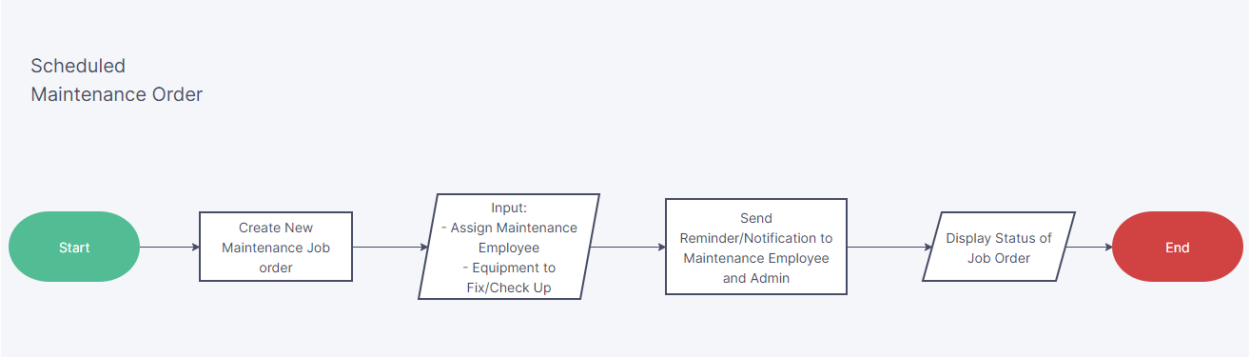
The diagram above shows the operations that are involved in the Equipment Inventory Process. The condition of the equipment, software license up to date, and monitor inventory levels in real time throughout the day.

2. Monitor and Usage Tracking



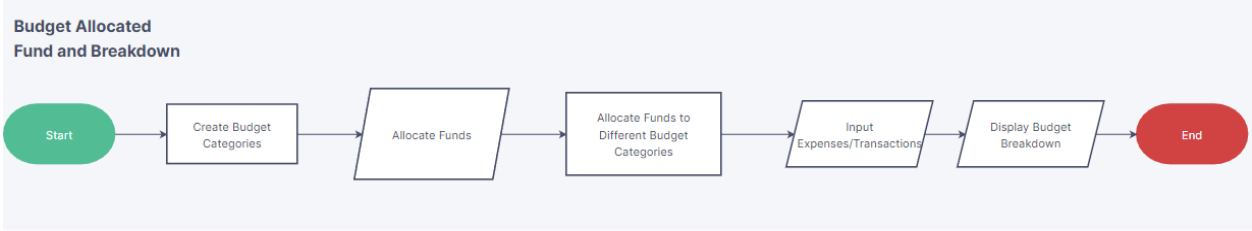
The diagram above shows the operations that are involved in the Monitor and Usage Tracking process. It is the process of collecting and analyzing data about the use of the laboratory's equipment and software to improve the efficiency and effectiveness of the laboratory and to make informed decisions about the allocation of resources.

3. Equipment Scheduled Maintenance Tracking



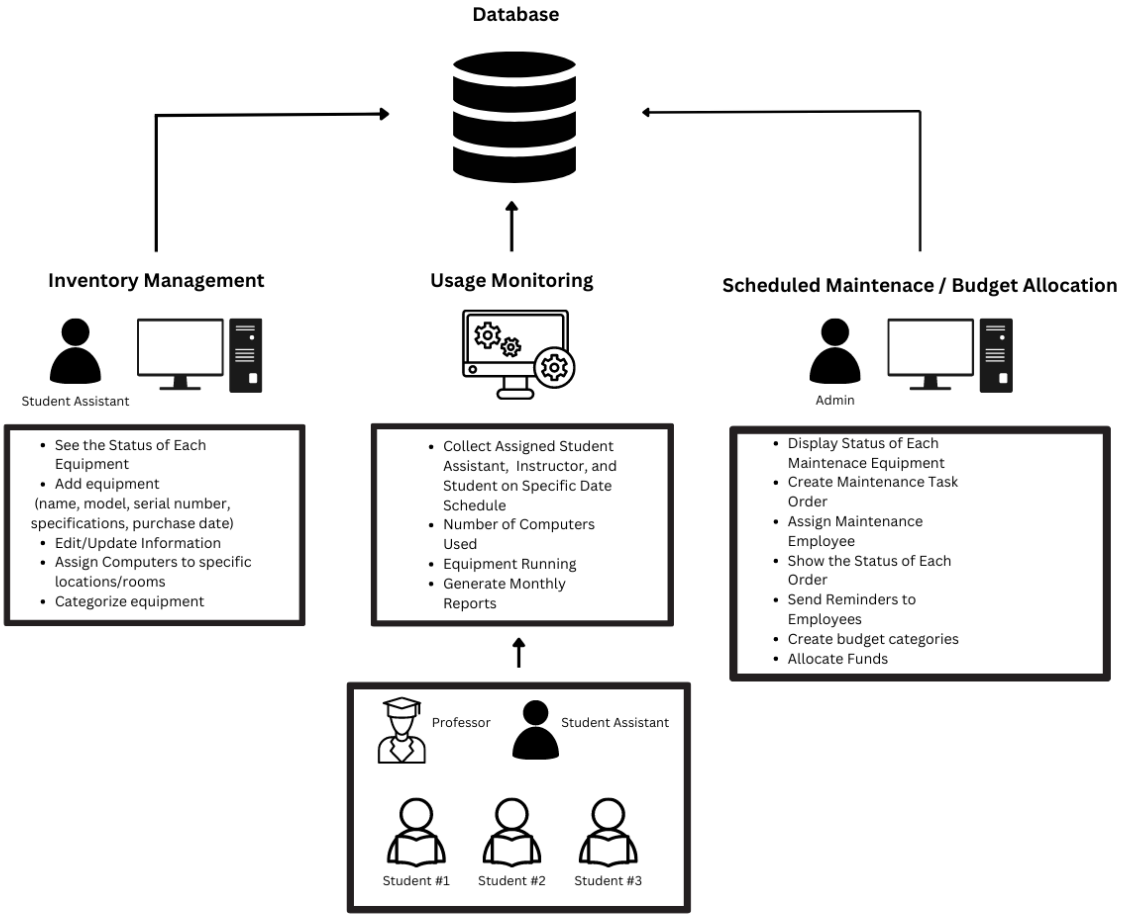
The diagram above shows the operations that involve the Equipment Scheduled Maintenance Tracking process. It is the process to track the scheduled maintenance intervals for each piece of equipment, the responsible person for performing the maintenance, and the status of the maintenance.

4. Budget Allocation and Tracking



The diagram above shows the operations that involve the Budget Allocation and Tracking process. The total budget for laboratory, individual budget items, actual expenses incurred for each budget item, and the variance between the budgeted and actual expenses.

System Overview



System Requirements

A. Functional Requirements

1. Operation/Transaction

1.1 Equipment Inventory

1.1.2 The system should allow admins to add new equipment to the inventory with details such as equipment name, model, serial number, specifications, and purchase date.

1.1.3 Users should be able to edit and update equipment information as needed.

1.1.4 The system should support the categorization of equipment (e.g., computers, monitors, printers, and peripherals).

1.1.5 The system should track the status of each equipment item, indicating whether it is available for use, reserved, under maintenance, or in repair.

1.1.6 The system should facilitate where these equipment are assigned and keep a record of the assigned personnel for tracking purposes.

1.2 Monitor and Usage Tracking

1.2.1 The system should record user logins, logouts, and session durations to track the time spent by each user in the computer laboratory.

1.2.2 The system should monitor the applications used by each user during their session, capturing information about which software and tools were accessed.

1.2.3 The system should detect and record idle time when a user is not actively using the computer, to differentiate between active and idle session durations.

1.2.4 The system should generate reports and analytics on user activities, providing insights into application usage patterns and popular websites accessed.

1.3 Equipment Scheduled Maintenance

1.3.1 The system should allow administrators to create maintenance tasks for each equipment item in the inventory.

1.3.2 The system should send automated reminders to administrators and maintenance employees before scheduled maintenance tasks are due.

1.3.3 The system should enable administrators to assign maintenance tasks to specific maintenance employees or external service providers.

1.3.4 The system should track the status of each maintenance task, indicating whether it is pending, in progress, or completed.

1.3.5 The system should maintain a history log for each equipment item, recording past maintenance tasks, dates, and any issues identified during previous maintenance.

1.3.6 The system should generate reports on scheduled maintenance tasks, completed maintenance, and equipment performance over time.

1.4 Budget Allocation and Tracking

1.4.1 Authorized users should be able to create and define budget categories, sub-categories, and allocation periods.

1.4.2 Users should be able to allocate funds to different budget categories and sub-categories.

1.4.3 Users should be able to input expenses and transactions accurately.

B. Non-Functional Requirements

1. Usability

1.1 Graphical User Interface

- All application pages must have a consistent appearance and feel thanks to the system.
- The system shall provide a digital image for
- each equipment, equipment manager, and student.
- The system must offer toolbars and icons.
- The system must display a dashboard of currently available, borrowed, and under maintained equipment.

1.2 Accessibility

- The system should have different privileges and access depending on the account type
- The system should be easy to use/user friendly

2. Performance

- The product needs to be integrated into a software program.
- The hardware of the client or customer will have an impact on performance.
- The bandwidth of the client's internet connection will have an impact on the performance as well.

3. Security

- Conforms with industry standards for security to safeguard sensitive user data and stop unauthorized access. When necessary, implement safe authentication and encryption techniques.

4. Error Handling/Validations

- Implement validation cues and clear, informative error messages. When users make errors or input mistakes, the system should clearly express the problems and provide instructions on how to fix them.

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