



# COMPUTERIZED LABORATORY MANAGEMENT SYSTEM USING RADIO-FREQUENCY IDENTIFICATION FOR AEMILIANUM COLLEGE INC.

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**Abstract.** Computer laboratory still matters even though many students have gadgets and devices to study, conduct research, etc. But it cannot be denied that there are still students who do not have their laptops or gadget to perform their activities with the help of computers and the internet.

The Computerized Laboratory Management System using Radio-Frequency Identification is a big help in the school. The system provided assistance in managing students' schedules. When the student's RFID tag is tapped on the scanner, the schedule to access the laboratory services is displayed. Students can only use the schedule set by the Admin or the Instructor. In this way, it will be known who is scheduled in the laboratory and no unauthorized person can switch on and off the computer units inside the laboratory. The job can only be performed by the in charge with the assistance of the developed system. Therefore, it is easy to determine who is responsible for destroying or losing any paraphernalia of computer units in the laboratory. The school also saved energy because only those with a schedule can utilize the laboratory.

The Computerized Laboratory Management System using RFID was developed using Agile development methodology and evaluated using ISO 25010 by the evaluators - IT experts, the laboratory in charge, and students. The system's weighted mean is 3.50 in the evaluation. Thus, the system can be installed, utilized, and serve its purpose.

*Key Words: Aemilianum College Inc., Capstone Project, Computer Laboratory, Management System, Radio Frequency Identification, RFID*

## INTRODUCTION

The advent of technology is an integral part of the educational system. Accurate scheduling, keeping track of student attendance, and maintaining an inventory of materials received are all seen to be factored into how well an academic institution runs. The adoption of automated, secure monitoring, scheduling, and management system for students and institutions encourages them to raise their academic standards. The traditional way of performing such operations is time-consuming. Numerous conventional approaches to student management systems resulted in time consumption, an increase in labor force requirements, and duplication of effort.

Therefore, it is necessary to reduce the delay time and use an information technology management system to automatically monitor student attendance, schedules, and record inventories in order to help maintain attendance, schedules, and material inventories.

According to Lopez, et al., (2017), the development of a Digital Management System for a Higher Education Institution provides administrative staff with tools to facilitate data management, monitoring, and access to relevant information for academic decision making leading to a positive impact on the performance of the university by reducing response times. Because of this, automated data centralization, efficient generation of reports, and effective way to support decision-making are evident.

In support of digital management, automated technologies such as biometrics, QR codes, and Radio Frequency Identification (RFID) systems are evidently used to improve efficiency in the work process. RFID identifies and keeps track of objects such as goods, animals, or people. It uses radio waves to communicate data from an electronic tag, also known as an RFID tag or label, to an RFID reader. The use of this technology in institutions makes and keep daily transaction faster and easier. Radio Frequency Identification, a "contactless technology," has grown in popularity because it can quickly scan a number of devices, is user-friendly, and has additional security features. Due to these traits, RFID is seen as the barcode's prospective replacement and might either supplement or replace it.

According to Karygiannis, et al., (2017), RFID systems have readers that wirelessly communicate with the tags to identify the item connected to each tag and possibly read or update additional information stored on the tag. This communication can occur without an optical line of sight and over greater distances than other Automatic Identification and Data

Capture Technologies (AIDC), adding this to a more secure system. RFID technologies support a wide range of applications—everything from asset management and tracking to access control and automated payment.

Due to the fact that students are familiar with the technology they will learn better in a technology-based environment. The adaptation of an automated system is vital because the use of technology in education contributes a lot to the pedagogical aspects in which the application of ICT will lead to an efficient process with the help and support from the institution. With this, the researcher suggests creating a secured laboratory management system utilizing RFID technology in this study. System software and a prototype are employed in this research, both of which are significantly dependent on an RFID tag and reader.

The proposed system enabled users to maintain an accurate record of users, schedules, and inventory of materials in the computer laboratory of Aemilianum College Inc., using RFID technology. The system monitored users' attendance, prevented users who aren't scheduled to use the computer laboratory, and find inventory if materials are either missing or not present. In addition to offering useful tracking, this proposed system protected computer tools and materials from theft and enabled a more effective inventory review.

In line with this, this research posed a great value to the College, paperless transactions when entering and exiting the computer laboratory. Unauthorized users were allowed to enter by abiding only by the scheduled time preferred for each user account, and the monitoring and tracking of materials going in and out of the computer laboratory were available.

In Aemilianum College Inc., a manual laboratory management system is being practiced, where the users of the computer laboratory are required to log their time in and out of the laboratory. With regards to using this traditional way, the delay time is not reduced, the manual schedule of the computer laboratory is still being utilized, and keeping track of laboratory tools and materials is still paper-based. There are times when the professor needs to resort to something by adjusting his/her computer laboratory schedule because of duplication. The school doesn't have the necessary software that can be used to automate the system. Therefore, the school should be transparent with these needs. These observations may have serious implications when it comes to the use of digital systems in higher education institutions.

The researcher justified that by developing a Computerized Laboratory Management System using RFID for Aemilianum College Inc. can help the institution perform better. It allowed management of accounts for both instructors and students, use of RFID system for logging in and out of the computer laboratory, accurate auto-timer for specific laboratory scheduled time, only those users with exact scheduled time are allowed to enter the laboratory, and monitoring of available tools and materials is a feature of the system. The implementation of the system using RFID reduced the delay time when entering and exiting the laboratory compared when using a pen and paper attendance sheet, unauthorized use of the laboratory is monitored because of the auto-timer feature of the system, and management of reports were accessed easily by using the collected inventory data. The use of this technology paved the way for quality education, learners, and institution.

For an institution like Aemilianum College Inc. that offers technological courses, a Computer Laboratory is needed to maintain its day-to-day operations. Considering that there are various classes and sections that need to use the computer laboratory, accurate

schedules for each user are necessary to prevent unauthorized access. Basically, the computer laboratory of the college needs a system where they can easily accept users by abiding by the correct schedule and a system where computer materials are kept track of.

A Computerized Laboratory Management System is a way to have an effective and efficient process when entering and exiting the computer laboratory. Laboratory Managers can easily create schedules and generate the reports needed. By implementing the proposed system, the students and employees will be provided with an RFID tag.

The Computerized Laboratory Management System using RFID for Aemilianum College Inc. can help the institution in automated attendance monitoring, scheduling, and inventory of tools and materials without the need for a logbook for a manual time in and out. In accordance with the nature of the process, the majority of systems are made computerized, Radio Frequency Identification (RFID) is recognized as one of the most practical and usable in real-time deployment. Therefore, secured RFID-based management has been created to address the issue of attendance, monitoring, scheduling, and management of laboratory tools and materials.

This study dealt with the development of a Computerized Laboratory Management System using RFID for Aemilianum College Inc. It is aimed to provide an electronic process using a wireless ID system to search, identify, track, communicate, and transmit digital data. The primary goal of the study is to develop a general strategy for tracking individuals and items entering and leaving the computer laboratory and creating a desired schedule for every user with an auto-timer feature which means only those users with a specific schedule to enter the laboratory will be the only ones to be allowed to enter the laboratory. Currently, the laboratory administrator oversees the laboratory schedule manually throughout each class. For the tools and materials, a log book must be completed in order to record the details of the information. The proposed study will generate reports of the following: attendance of users, schedule of both instructors and students, and inventory of tools and materials.

### **Specific Objectives**

Specifically, the study aimed to:

1. Determine the existing ways of computer laboratory management in the Aemilianum College Inc.
2. Design and develop a Computerized Laboratory Management System using RFID for Aemilianum College Inc. with the following features:
  - 2.1 Student and Laboratory Instructor Profile Registration
  - 2.2 Laboratory Scheduling
  - 2.3 Auto-timer for specific laboratory scheduled time
  - 2.4 Anti-unauthorized use of laboratory
  - 2.5 Edit/Delete/Update Features
  - 2.6 Inventory Module
  - 2.7 Report Module
3. To evaluate the Application of Multiple Technologies in a Cloud-Based Voting System for Aemilianum College Inc. using the industry software quality model – the ISO 25010 evaluation tool in terms of:
  - 3.1 Functional suitability
  - 3.2 Performance efficiency
  - 3.3 Compatibility

- 3.4 Usability
- 3.5 Reliability
- 3.6 Security
- 3.7 Maintainability
- 3.8 Portability

## **Plan**

Project planning involved comprehensive mapping and organizing of project goals, tasks, schedules, and resources before doing any activities involved in designing and developing a system. The first thing the researchers did were talk to the target end-user to ask about problems encountered in their daily transactions that need to be solved to provide a correct and effective service. The goal was to facilitate the provision of these services to satisfy clients.

The second action taken by the researchers was to conceptualize possible solutions. He also looked at the development needs. He also listened to the suggestions of his clients and other IT professionals. When it was formed, they laid out the plan and made a schedule to be a guide so that the activities to be done could be systematic.

## **Requirements**

System requirements were the configuration that a system must have in order for a hardware or software application to run smoothly and efficiently. Failure to meet these requirements can result in the installation or performance problems. The researchers prepared everything needed for the development. The researchers double-checked that the materials (hardware and software) were present. It is a must that everything is intact.

Developing the Laboratory Management System securing the RFID is quite rare. In this study, the RFID was ordered through the online market and ensured to reach before the development. It was bought in advance and was available before the scheduled development. Everything went well with the preparation of all the requirements, so the development of the proposed system started on time.

## **User Design**

The researchers made designs to be executed in the development process. Every details were defined, analyzed, and validated. Preparing the entity relationship diagrams provided a visual starting point for database design that can also be used to help determine information system requirements throughout an organization. An entity relationship diagram describes how entities relate to each other.

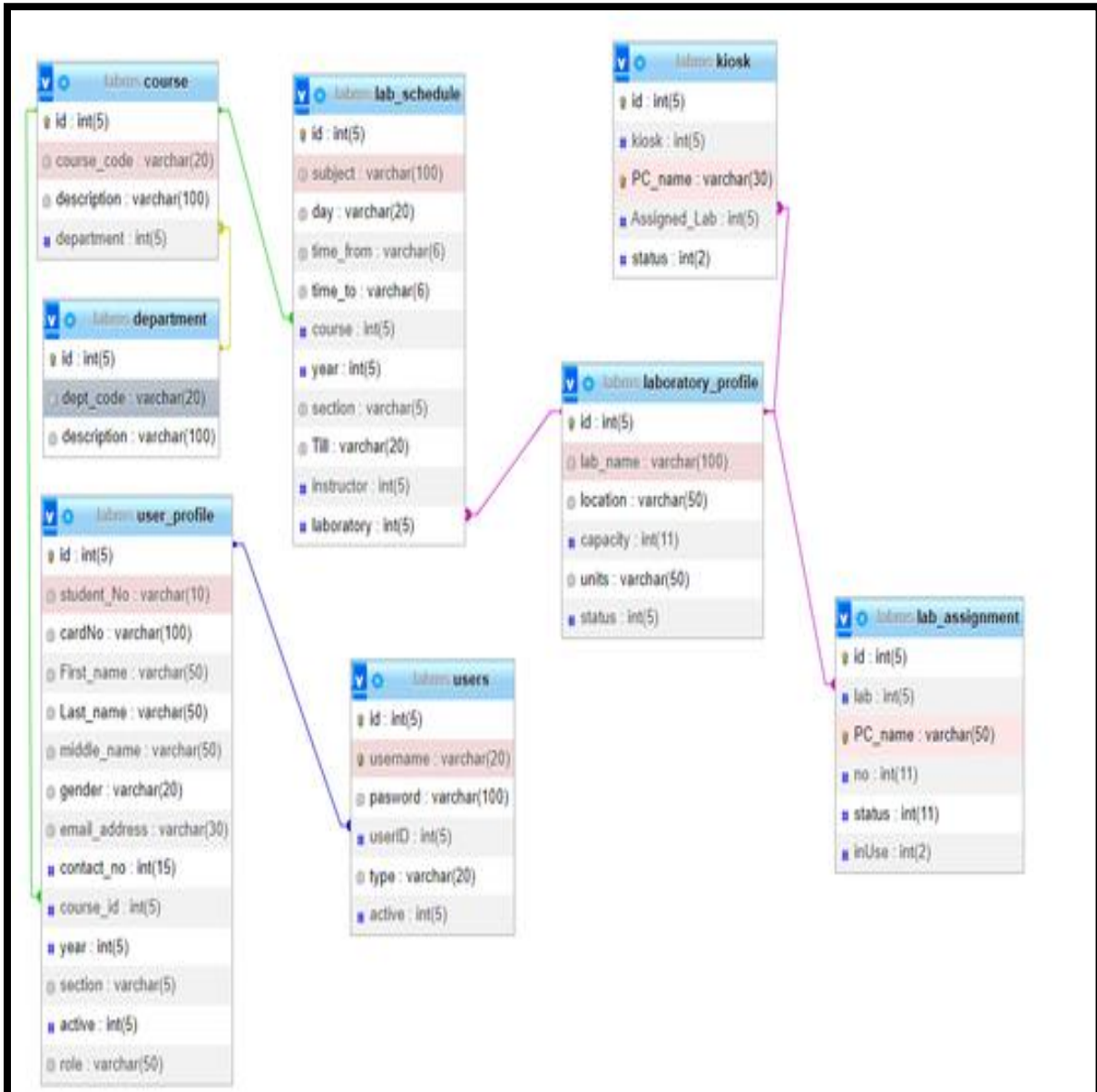
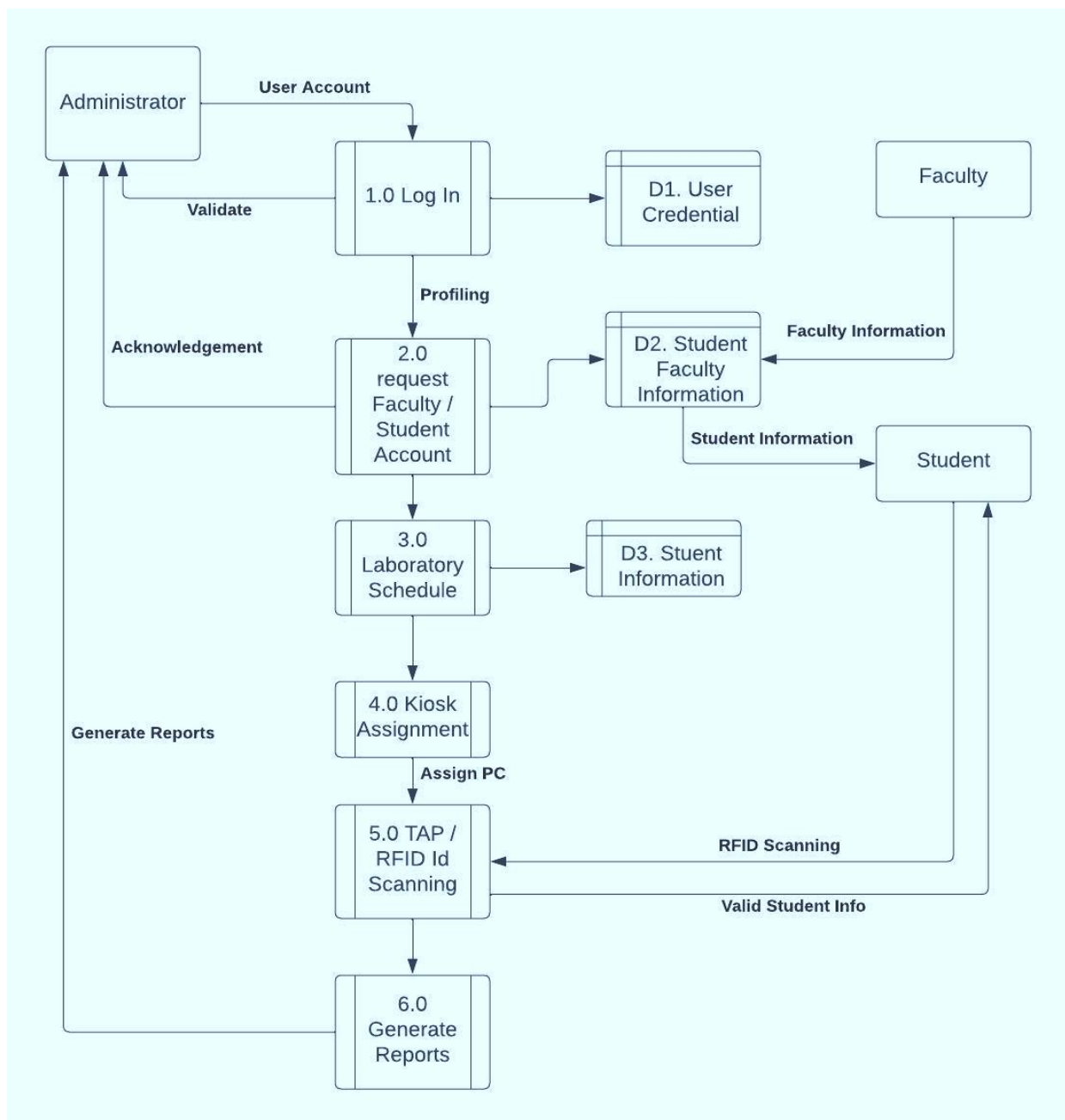


Figure 4.1 – Proposed System's ERD

Figure 1 showed the Entity Relationship Diagram (ERD) of the proposed system. It gave a snapshot of how these entities relate to each other.

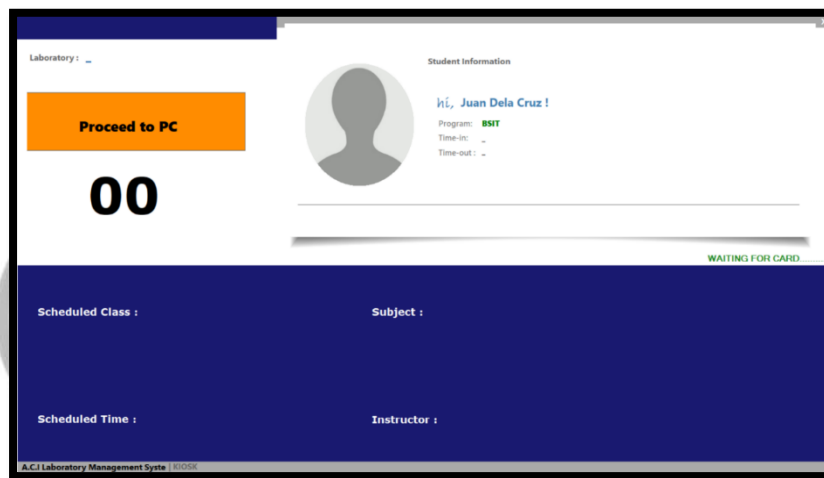


**Figure 2 - Data Flow Diagram**

Figure 2 displayed the way of representing the flow of data of the proposed system. It gave information about the inputs and outputs of each entity and the process itself.

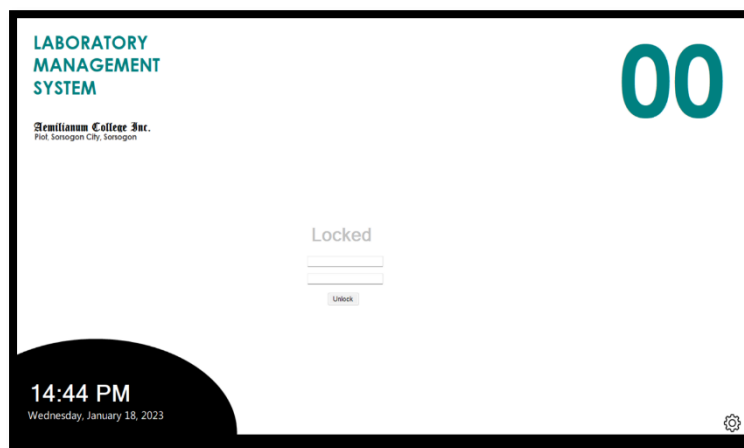
## Development

The purpose of developing the proposed system was to provide solutions to problems and implement the objectives set. In developing the proposed project, analyses matter to ensure its usefulness.



**Figure 3 - Kiosk**

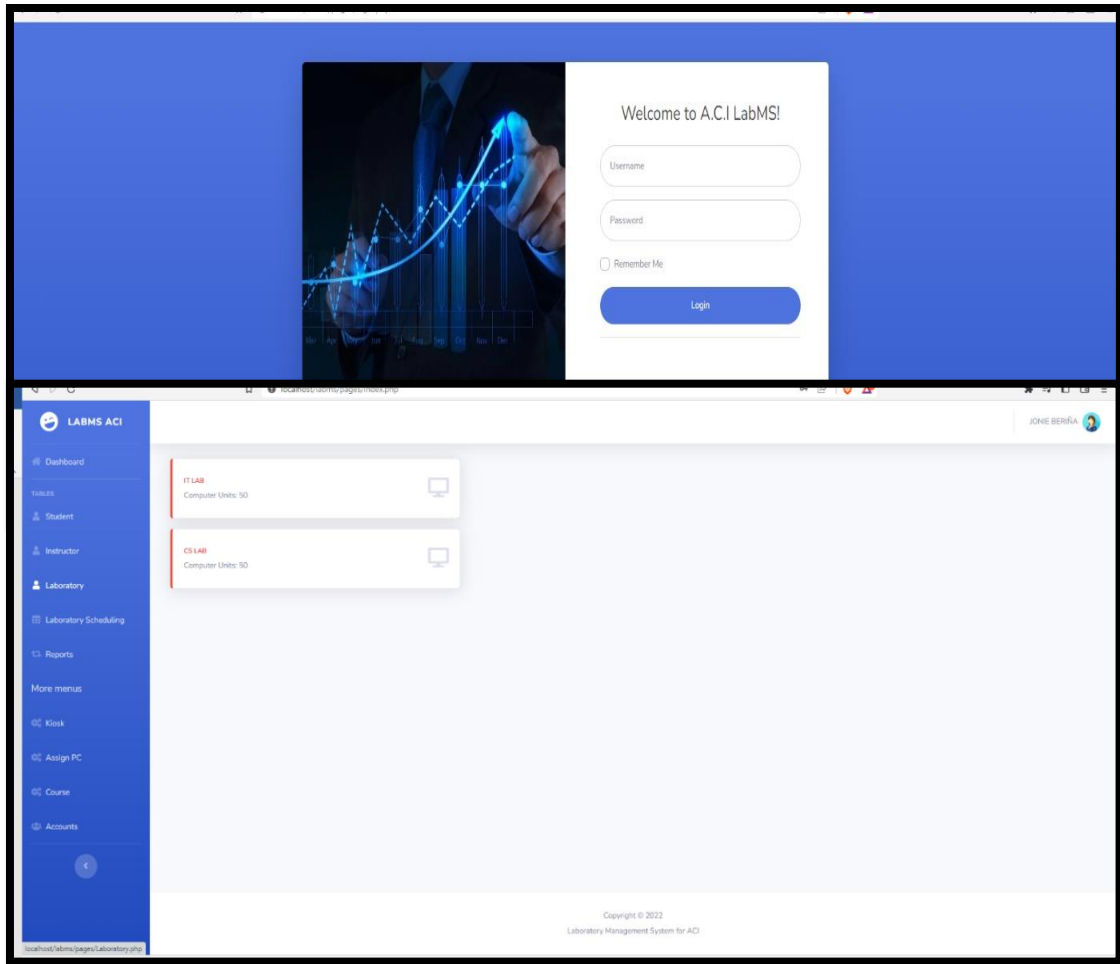
Figure 4.3 displayed the Kiosk of the system - an interactive terminal that provides access to information and applications.





**Figure 4 – Screen Locker**

Figure 4 showed the Screen Locker of the proposed system. It provided an important extra layer of security. Each time user wants to unlock the system it will require a password.



**Figure 5 – The Administrator's Interface**

Figure 5 showed the Administrator's Interface where the Admin process all configuration operations of the system.

## Testing

After the system development, the researcher tested the quality of the project. He made a schedule for testing the output. There were three (3) sets of evaluators he invited:

two (2) laboratory in-charge, ten (10) IT experts, and twenty (20) students. The group evaluated how the various components of the system interact together in the full.

The different modules comprising the system were tested for implementation and taking into consideration all of the required components were present and were presented to the evaluators, wherein the result is "more than what is expected". Moreover, an interval using a scale was used to show the description and interpretation of the average response in the system.

### **Summary of Findings**

The following findings were obtained from the study:

1. The ACI computer laboratory was manually managed by a System administrator and does not have a computer laboratory management system yet.
2. With the proposed system, the management of the computer laboratory was upgraded. Through the system, the student can access the laboratory at the time scheduled.
3. The system was developed and evaluated by three (3) sets of evaluators and it was found "more than what is expected" in all its aspects.

### **Conclusion**

Based on the findings of this study the following conclusions are formulated:

1. The developed system will help the System Administrator to manage the users of the computer laboratory.
2. The developed system is a great help in conducting laboratory activities.
3. Because it passed the system evaluation using ISO 25010, the developed system may be installed and serve its purpose.

### **Recommendations**

Based on the conclusions, the following recommendation is hereby offered:

1. The developed system may be utilized in managing a computer laboratory system with the supervision of the System administrator.
2. The proposed system assists laboratory users if utilized in conducting laboratory activities.
3. The developed system may be installed and utilized in the laboratory rooms.

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