DESIGN AND IMPLEMENTATION OF AN ONLINE SOFTWARE LABORATORY LOGBOOK

BY

ABDULLAHI BELLO

CST/18/SWE/00122

FEBRUARY, 2024

DESIGN AND IMPLEMENTATION OF AN ONLINE SOFTWARE LABORATORY LOGBOOK

BY

ABDULLAHI BELLO

CST/18/SWE/00122

A PROJECT SUBMITTED TO THE DEPARTMENT OF SOFTWARE ENGINEERING, BAYERO UNIVERSITY KANO, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR'S DEGREE IN SOFTWARE ENGINEERING

FEBRUARY, 2024

CERTIFICATION

This is to certify that the project report titled "Design and Implementation of an Online Laboratory Logbook" has been carried out by Abdullahi Bello with registration number CST/18/SWE/00122 under the supervision of Assoc. Prof. Kabir Umar. The content within this report is unique, and it has not been presented for evaluation in any other academic context or examination.

Assoc. Prof. Kabir Umar
Project Supervisor

_____
Signature and Date

Buhari Ubale
Project Coordinator

_____
Signature and Date

Assoc. Prof. Kabir Umar
Head of Department

_____
Signature and Date

Prof. Rashid Husain
External Examiner

_____
Signature and Date

DEDICATION

I dedicate this project, "Online Laboratory Logbook," to the beloved Prophet Muhammad (SAW), the guiding light of compassion, wisdom, and inspiration. His teachings continue to illuminate our path and serve as a source of strength and resilience.

To my parents, whose unwavering support and sacrifices have shaped my journey through education. Your love, encouragement, and sacrifices have been the cornerstone of my success. This achievement is a testament to the values you instilled in me.

To my friends, companions in both joy and challenge, your camaraderie has added richness to my academic pursuits. Your encouragement and shared experiences have made this journey more meaningful.

This project is a humble expression of gratitude to these exceptional individuals whose love, support, and inspiration have been integral to my academic endeavors. May the guidance continue to illuminate my path in all future endeavors.

ACKNOWLEDGEMENT

I extend my heartfelt gratitude to the individuals whose unwavering contributions have played a pivotal role in the successful completion of this project. Foremost among them are my parents, Muhammad Bello and Faiza Muhammad. Their enduring love, unwavering support, and sacrifices throughout my academic journey have been the cornerstone of my achievements. I am forever appreciative of their constant encouragement, belief in my abilities, and the sacrifices that have fueled my accomplishments. The values they have instilled in me continue to guide my path.

I also express sincere thanks to my dear siblings, whose steadfast support and motivation have been indispensable throughout my journey. Our shared bond and the memories we've created together are cherished aspects of my academic experience.

My gratitude extends to my friends, the pillars of my support system. Late-night study sessions and endless discussions have not only enriched our knowledge but have also created enduring memories that I deeply value.

Special appreciation goes to my supervisor, Assoc. Prof. Kabir Umar, whose guidance, expertise, and support have been instrumental throughout the project. His invaluable insights, constructive feedback, and mentorship have significantly shaped the trajectory of this research.

I acknowledge Dr. Mohammad Hassan, my level coordinator, for his unwavering guidance throughout our academic journey. His commitment to our academic growth and dedication to our success have been motivating forces behind the completion of our studies.

To my lecturers, I express gratitude for their knowledge and dedication, which have played a vital role in my academic development. Their thought-provoking lectures and challenging assignments have broadened my horizons and enriched my understanding of the subject matter.

Lastly, my appreciation goes to everyone who has been part of this academic journey. The opportunities I have had and the lessons I have learned along the way are treasures that I hold dear. Thank you all for being integral parts of my life and for your steadfast support.

I am forever grateful for the contributions you have made.

Table of Contents

List of Tables

Table of Figures

ABSTRACT

The Software Laboratory Logbook System project aims to develop a comprehensive system for managing laboratory activities and records within a software laboratory environment. The system provides a platform for students to record and retrieve logs of activities. Through the implementation of various features and functionalities, the system aims to streamline the process of managing laboratory activities, enhance documentation practices, and improve overall efficiency within the software laboratory setting.

The project follows an agile methodology, allowing for iterative development and continuous improvement based on user feedback. Requirements for the system were elicited through consultation with laboratory staff, analysis of existing logbook practices, and discussions with stakeholders to ensure alignment with user needs and laboratory requirements.

Use case diagrams were utilized for requirement analysis, providing a visual representation of the system's functionalities and user interactions. The system's implementation utilizes a combination of web-based technologies, leveraging HTML, CSS, JavaScript, and Python programming language. The Django framework is adopted to provide a robust architecture for building scalable and maintainable web applications. Visual Studio code serves as the primary integrated development environment (IDE), offering a comprehensive set of tools for efficient development and debugging.

The system's data management is handled using the Sqlite3 database, enabling efficient storage and retrieval of laboratory records. To ensure the quality and reliability of the system, a comprehensive testing strategy is employed. Unit testing is conducted to validate the functionality of individual components, while integration testing focuses on evaluating the interactions between different modules. System testing is performed to validate the overall behavior and performance of the system, and usability testing is conducted to assess the system's user-friendliness and effectiveness in a laboratory environment.

CHAPTER 1

1.1 INTRODUCTION

This chapter covers; background of the study, problem statement, aim and objectives, purpose, scope and limitation of the study and definition of Terms.

1.2 BACKGROUND OF STUDY

A logbook is an official record booklet that is issued by the university to the student to keep record of important activities usually practical, conducted in the laboratory as well as assignment given throughout a particular semester. The students record and submit the activities/tasks given to them and the lecturer will view each task, grade and give remarks to students according to their grades. (ALIYU et al, 2022).

In today's digital era, technology has revolutionized the way education is imparted. One such innovation in the field of computing is the introduction of online laboratory log books. These log books provide a platform for students to fill and submit assigned tasks virtually, ranging from programming exercises to code labs. Moreover this online system enables lecturers to grade and provide feedback on the students' submitted activities or tasks.

The concept of online laboratory logbooks has evolved alongside the digital transformation of scientific research. While paper logbooks have served science faithfully for centuries, their limitations became increasingly apparent with the growing complexity of research and the need for collaboration and data sharing (Barr, Nabir & Somerville, 2020).

The proposed project titled “Online Laboratory Logbook” is a mobile application use for storage, and retrieval of student laboratory record, it is developed for the department of Software Engineering, Bayero University Kano.

The logbook also gives a means of retracing past experiments and verifying their accountability. The need for the logbook cannot be over emphasized. Scientists need to keep a record of their doings in order to remember and report what has been done. Student and professional bodies use logbook on regular intervals, (Meerkerk, 2017).

Traditionally, a logbook is a record of an event or events such as ship’s navigation, air flight, inventions; teachers’ events in the classroom etc. logbooks have been in existence since the invention of ships and the need for navigation came into existence. Today’s logbooks have diverse uses since all aspects of human endeavor need a form of reference or storage media. In less than twenty years the habits of logbook use has changed radically (O’Pecko, 2020).

The department of Software Engineering in Bayero University Kano has its own departmental laboratory which has been undergoing or using a manual process, which is using of laboratory logbook in order to keep track of the students' activities. To manage individual students' progress, there is a hard copy booklet that will be given to each and every student for his/her record keeping, which is expected to be filled and submitted as part of their assessment. Part of what they will be filling may include activities such as hands on practical and coding exercises given to the students by their lecturer.

Every student is expected to keep record of the activities undergoing in the laboratory throughout the period of the semester and submit such records to his/her lecturer for assessment. The lecturer is expected to monitor the student's weekly progress of work and append his/her remark for works actually done by the student (Elsafi & Al Awad, 2023).
This project is intended to automate the logbook recording activities taking place within the laboratory setting.
The electronic logbook will consist of various interfaces, these interfaces will be accessed by various individuals whose roles will be explicitly defined. There will be interfaces for students and lecturer, each with their activities.

1.3 PROBLEM STATEMENT

The purpose of the log book is for student to record his/her activities and tasks undertaken during practical classes in the laboratory. Students must complete relevant entry of the log book at the end of every practical class before leaving the laboratory. Log book must be endorsed by lecturer at the end of every week. The log book should be submitted to the course lecturer at the end of the semester.

In the context of this project, the focus is on addressing critical challenges related to the recording, management, and evaluation of student activities done in the laboratory during practical classes.

The current system, which relies on manual logbook entries at the end of each practical class, poses several issues that need to be addressed, such as; Limited accessibility among students due to the physical nature of handwritten logs. Data may easily get damage or lost. Lack of Efficiency and Timeliness.

1.4 AIMS AND OBJECTIVES

1.4.1 AIMS

The primary aim of this project is to develop an online laboratory logbook that can be used to record activities within the laboratory settings.

1.4.2 OBJECTIVES:

- To design and implement a web base Laboratory Logbook using a Django web framework which is built on python programming language.
- To evaluate the implemented software system via usability testing.
- To incorporate data storage and retrieval functionalities.

1.5 SIGNIFICANCE OF THE STUDY

The study of the usability of electronic logbook for students is of paramount importance considering the number of problems that will be solved in the event of a successful adaptation of such logbooks. Some of the problems associated with paper logbook are already stated in the problem statement. Everything is going digital with the advent of ubiquitous computing and the Nigerian society should not be an exception. To change a society requires a change in the manner of perception and handling of issues by the academic community.

1.6 SCOPE AND LIMITATION OF THE STUDY

1.6.1 SCOPE

This project focuses on developing the core functionalities of an online laboratory logbook for software engineering student which may include data storage and retrieval, with some basic calculation for the final grading/assessment.

1.6.2 LIMITATIONS

Advanced functionalities like version control, AI-powered code analysis or integration with specific development environments can be explored in future extensions.

1.7 DEFINITION OF TERMS

- Logbook: can be referred to as an official record booklet issued by the university to students for recording important activities, both practical and assignments, conducted in the laboratory throughout a particular semester.
- Online Laboratory Log Books: Digital platforms that allow students to virtually fill and submit assigned tasks, ranging from programming exercises to code labs. It enables lecturers to grade and provide feedback on submitted activities or tasks.
- Usability Testing: Evaluation process to assess the ease of use and user satisfaction with the implemented software system.

- Ubiquitous Computing: The concept of computing everywhere, enabling anytime, anywhere connectivity and access to information.
- Core Functionalities: Essential features and operations that form the foundation of the online laboratory logbook, including data storage, retrieval, and basic calculation for grading/assessment.

CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

The literature review explores existing research and developments in the field of laboratory logbooks, particularly in the context of educational institutions and the adaptation of digital solutions. This chapter provides a comprehensive overview of studies related to online logbooks, exploring how online logbooks tackle the shortcomings of the traditional paper base logbooks, usability, and advancements in technology that support educational processes.

A structured table-based analysis dissects each paper's objectives, methodology and findings. This is aimed at:

- Understand different LLB types, goals, and research methods.
- Identify LLB strengths and weaknesses, informing future tool improvements.
- Uncover critical gaps and untapped opportunities for more intuitive, impactful, and student-centric LLBs.

2.2. LABORATORY LOGBOOK

A **logbook** (or **log book**) is a record used to record states, events, or conditions applicable to complex machines or the personnel who operate them. Logbooks are commonly associated with the operation of aircraft, nuclear plants, particle accelerators, and ships (among other applications).

The term *logbook* originated with the ship's log, a maritime record of important events in the management, operation, and navigation of a ship. The captain was responsible for keeping a log, as a minimum, of navigational wind, speed, direction and position.

Logbooks play a vital role in educational institutions by facilitating various aspects of teaching, learning, administration, and research. Logbooks that are commonly used in educational settings are:

Laboratory Logbook: In science or engineering disciplines, laboratory logbooks are used to record experiments, observations, procedures, and results. These logbooks are crucial for documenting scientific research, ensuring reproducibility, and maintaining laboratory safety standards.

Training Logbook: In vocational or professional training programs, students often maintain training logbooks to document their progress, skills acquired, tasks performed, and feedback received during practical training sessions or internships.

Field Trip Logbook: When students go on field trips or educational excursions, a field trip logbook may be used to record details such as date, destination, purpose, itinerary, attendance, and any significant observations or findings during the trip.

Attendance Logbook: This logbook is used by teachers or administrative staff to record the attendance of students. It typically includes fields such as student names, date, class/section, and remarks for absenteeism or tardiness.

Library Logbook: Library staff may use logbooks to record transactions such as book loans, returns, reservations, fines, and queries from library users. These logbooks help in managing library resources and tracking circulation statistics.

Equipment Logbook: Educational institutions often maintain logbooks for equipment or facilities usage. For example, a computer lab may have an equipment logbook to track the usage of computers by students or staff, maintenance activities, and any issues encountered.

Teacher's Logbook: Teachers may keep logbooks to plan lessons, document teaching strategies, track student progress, record assessments, and reflect on their teaching practices. These logbooks support professional development and accountability.

Assessment Logbook: Assessment logbooks are used to document assessment activities such as grading, feedback provided to students, exam administration, and academic integrity cases. They help ensure fairness, consistency, and transparency in assessment processes.

Project Logbook: In project-based learning or research projects, students may maintain project logbooks to record project objectives, timelines, tasks, challenges, solutions, and outcomes. These logbooks support project management and documentation.

Personal Development Logbook: Some educational institutions encourage students to maintain personal development logbooks to set goals, track achievements, reflect on learning experiences, and plan future activities. These logbooks promote self-awareness and lifelong learning skills.

Logbooks are versatile tools that provide a structured way to record information. They help in maintaining accurate records, tracking progress, and providing a historical account of activities. The format and content of a logbook can vary based on the specific needs and requirements of the context in which it is used.

Before the introduction of automation, laboratory logbooks in the context of software engineering were manual records meticulously maintained for documentation of activities within the software laboratory settings. These logbooks served as essential tools for maintaining transparency and accountability of record of activities that take place in the laboratory. The following is a general overview of how logbooks operated before automation:

In their physical format, software engineering logbooks were often hard copy notebooks with pre-allocated sections or columns to capture specific information. These sections typically included details such as date, activity, tasks, problems encountered and lesson learnt. The manual entry process was a fundamental aspect of logbook maintenance. Students were required to manually record their activities, code changes, testing procedures, and any relevant observations using pens or pencils. This manual process, while prone to errors and time-consuming, was the primary method for systematically documenting student progress. Structured entries within the logbooks were tailored to the specific needs of the software engineering laboratory. The logbook also served as a historical reference, offering a detailed account of past activities.

Laboratory logbooks in the realm of software engineering played a vital role in systematically documenting and organizing activities within the software laboratory. While automation has since streamlined many of these processes, the manual logbook tradition provided a foundation for accountability, and historical reference of activities as well as the topics covered.

2.3. EXISTING AUTOMATED LABORATORY LOGBOOK SYSTEM

Samed et al (2022) introduces the E-Logbook System for Postgraduate Research Students (EPRES), aiming to replace manual logbooks with an electronic platform that enhances data quality and systematically monitors postgraduate students' research activities. Following an adapted agile model and the Eight Golden Rules for Interface Design theory, the system features modules for registration, activity recording, report generation, and monitoring. The supervisor and postgraduate officer interfaces enable tracking stud gent progress and generating reports. The research identifies challenges with manual logbooks, emphasizing the need for a systematic monitoring system, and concludes that EPRES effectively addresses these issues, contributing to improved progress monitoring, timely research completion, and overall benefits for supervisors, students, and postgraduate officers.

Gertsenberger, Moshkin, Chebotov (2019) discusses the development and implementation of an electronic logbook for the BM@N experiment within the NICA project at the Joint Institute

for Nuclear Research. The objective is to automate the recording process during experiment runs, capturing crucial information for understanding collision events. The methodology involves creating a Web-based platform with a C++ database interface, integrating it with the central experiment database. Additional services, such as email notifications and FreeIPA authorization, enhance functionality. Findings indicate the platform's relevance and success, providing efficient logbook management and data access. The system's successful testing prompts plans for expansion into future experiments, emphasizing its importance for the NICA project's overall success. Detailed information is available on the BM@N official website.

Weng et al (2023) the research focuses on the digitalization of engineers' logbooks, seeking to enhance the traditional paper-based system by developing a real-time mobile application. The primary objective is to create a visual e-logbook using Swift programming language, SwiftUI framework, and XCode as the main Integrated Development Environment (IDE). The study includes case studies to evaluate the effectiveness of the visual e-logbook, comparing it to conventional paper logbooks. Results indicate that the implemented application has considerable potential in engineering design projects, offering improved systematic recording and real-time accessibility of design activities. Feedback from case studies highlights the need for additional features such as search and filtering options, collaborative functionalities, and reminder functions to further enhance the application's utility for engineers.

Thompson (2021) the feasibility study aimed to create a functional surgical logbook tool using the iOS Shortcuts app, integrating minimum and extended audit data sets recommended by the Royal Australasian College of Surgeons. The research found that the iOS Operation Note shortcut effectively collected accurate data for surgical audits. Data entry averaged 65 seconds for the minimum data set and 135 seconds for the extended data set, demonstrating efficiency. The study highlighted the iOS Shortcuts app's utility in developing medical data collection tools and offered a free, rapid, and customizable alternative for recording surgical operations, complications, and demographic data, making it a valuable resource for surgical trainees and consultants.

Holland (2018) explores the implementation of electronic engineering logbooks in diverse courses within the electrical engineering undergraduate curriculum at the Milwaukee School of Engineering. Junior faculty members share their experiences, drawing from a range of courses that cover prescriptive procedures to open-ended design projects. With each faculty member having industry experience, the paper delves into the advantages and disadvantages of

electronic logbooks. The findings contribute to a broader understanding of the implications of transitioning from traditional paper logbooks to electronic documentation methods in engineering education.

Sulistijono, Pradana, Hasbi (2020) details the creation of a web-based laboratory system using PHP and MySQL, tailored for SMA Pasundan 8 in Bandung, Indonesia. The main aim is to simplify laboratory procedures by managing user data, equipment transactions, and schedules. The application, developed through PHP and MySQL, successfully achieves its objectives, streamlining practical work in the laboratory. The findings emphasize the system's effectiveness in handling user data, equipment borrowing, and scheduling. The conclusion suggests future development avenues, including incorporating different programming bases and expanding the system's functionalities for a more comprehensive reporting system and additional features. The application is recognized as a valuable tool for users to monitor laboratory development.

Urcelay-Olabarria et al (2017) aims to enhance traditional Physics Degree laboratory sessions by introducing the Jupyter Notebook as an electronic laboratory logbook. The objective is to integrate theory, data handling, processing, and presentation within a single platform. The methodology involves implementing the Jupyter Notebook in laboratory sessions, observing its impact on student efficiency and engagement. The findings indicate that the tool effectively merges different aspects of the sessions, allowing for interactive data exploration, simulation of variants, and proposal of new experiments. The Jupyter Notebook proves to be motivational, providing immediate, visual, and shareable results, optimizing the focus of laboratory sessions on obtaining data and exploring variations.

Alfaro et al (2022) outlines the design, development, and preliminary testing of the MAR Lab app, a mobile augmented reality (MAR) application created for hands-on learning of a titration experiment in high-school and undergraduate chemistry courses. It incorporates domain-specific features like a logbook, graphical representations, and practical hints. The app was tested with 15 participants from Belgian high schools and universities. Results indicate positive user reception, with users appreciating design elements and reporting "good" usability (SUS score 72.8, SD = 14.0). The reason for including this application in my literature is that a logbook is a component of this application.

Abdul Hamid (2022) designed for year 3 students at the Faculty of Arts and Social Sciences (FAS) at University Tun Abdul Rahman (UTAR), serves the objective of aiding students in

initiating and developing their final year projects by providing a systematic approach to creating weekly activity reports, following the discussions with supervisors. Utilizing the Prototype model, the web-based system employs tools such as Brackets, Notepad, XAMPP, and phpMyAdmin, with four key modules facilitating login, user registration, activity report generation, and student group assignment to supervisors. System tests confirm the functionality's alignment with expectations, and user acceptance tests indicate high satisfaction among respondents, affirming the system's effectiveness in enhancing communication and information dissemination among students, supervisors, and coordinators. The reason for incorporating this paper is the ability of the system to keep track of weekly activity reports.

Monasky (2016) explores the significance of lab notebooks in scientific research, focusing on their traditional role as handwritten records and the emerging trend of electronic lab notebooks (ELNs). It describes the essential characteristics of paper lab notebooks, emphasizing their importance as legal documents and collaborative tools. The findings underscore meticulous note-taking practices, the permanence of entries, and the role of lab notebooks in patent claims and defending research claims against fraud allegations. The article sets the stage for a detailed discussion on ELNs in Part 2 of the series.

Mukaromah et al (2018) the study aimed to enhance laboratory management by developing an information system for systematically recording the entry and activities of visitors, including students and lecturers. The primary focus was on analyzing and designing a laboratory Logbook to capture crucial data such as items in and out, student engagements, and lecturer activities during research. The study employed the Iconix Process with the Unified Modeling Language (UML) approach for a systematic and visual understanding of the laboratory Logbook. Subsequently, the details about the application's functionality were not explicitly provided, the study successfully completed the analysis and design phase, marking progress toward the practical implementation of the designed laboratory Logbook system. The findings underscore the comprehensive approach to addressing the challenges in laboratory management, aligning with the study's objectives.

Table 2. 1: Literature review table

S/N	Study	Objective	Methodology	Findings
1	Designing an Electronic Logbook System for Monitoring Postgraduate Research Students Progress. Muhammad Arif Haikal Samed, Rashidah Mokhtar, Norulhidayah Isa, Mazlyda Abd Rahman, Azrina Suhaimi(2022)	The primary objective of the project is to develop a real-time system for monitoring postgraduate students' research activities. The study identifies issues with the current manual recording process, such as lack of systematic monitoring, potential data loss, and inefficiencies in tracking progress.	The development of the ESPRES system follows the Agile Model, consisting of six phases: planning, analysis, design, development, testing, and release. The study involves studying existing systems, conducting interviews with real users, analyzing requirements, designing the database and user interface, and implementing the system using PHP, HTML, and MySQL.	The ESPRES system is presented as a web-based platform designed for postgraduate research students. It allows students to record research activities, including meetings with supervisors and hours spent on research.
2	DEVELOPMENT OF THE ELECTRONIC LOGBOOK FOR THE	The primary objective of this study was	Implemented a web interface for shift operators and	Implemented a web interface for shift operators and

	BM@N EXPERIMENT AT NICA K.V. Gertsenberger, A.A. Moshkin , A.I. Chebotov (2019)	to develop an electronic logbook system for the BM@N experiment, a fixed target experiment within the NICA project at the Joint Institute for Nuclear Research. The aim was to automate the process of recording and managing information during experiment runs. The electronic logbook was designed to capture shift crew entries regarding operating modes of	collaboration members to add, update, and search logbook entries. The methods employed involved the development of an online electronic logbook system, utilizing a specialized web service and application programming interface (API) for storing and accessing data. The system facilitated the recording of real-time information by shift members, ensuring convenient viewing, managing, and searching for the required information within the logbook. A C++ database interface was implemented to provide unified access to logbook data for both online and offline systems of the experiment. Auxiliary services, including email notifications and FreeIPA authorization, were	collaboration members to add, update, and search logbook entries. The findings indicate that the developed e-Log platform for the BM@N experiment is essential for its successful operation. The web-based interface provides convenient logbook viewing and management for administrators, shift operators, and users. The C++ database interface ensures unified access to logbook data for both online and offline systems, facilitating data transfer to the central experiment database for offline event analysis. Additional services, such as email notifications and FreeIPA authorization, were successfully implemented, enhancing the functionality and user experience. The electronic

		various systems, detector conditions, and different types of events occurring during particle collision events. Additionally, the integration of the online electronic logbook with the central experiment database was a crucial objective to enhance data utilization for processing and physics analysis.	developed to enhance the functionality and user convenience of the e-Log platform.	logbook platform underwent successful testing, and future plans include expanding the system for use in the MPD experiment of the NICA project, emphasizing the significance of such information systems for the successful operation of NICA experiments.
3	A Visual Real-Time Mobile E-Logbook System to Capture Design Activities,	The research aims to explore the potential of digitalizing engineers'	The study employs a development-oriented approach, utilizing Swift programming language, SwiftUI framework, and	The results indicate that the visual e-logbook has substantial potential in engineering design projects, serving as a

	Decisions, and Ideas for Engineers Kok Weng Ng, Yun Ching Tan, JianBang Liu & Mei Choo Ang (2023)	logbooks by transforming the traditional paper-based logbook into a real-time mobile application. The primary objective is to redesign and develop a visual e-logbook that enhances the systematic capture, organization, and accessibility of engineers' design activities, decisions, and ideas.	XCode as the primary Integrated Development Environment (IDE) to create the visual e-logbook application. Case studies are conducted to test the implemented visual e-logbook, assessing its effectiveness in comparison to traditional paper logbooks. The methodology involves feedback collection from users to identify areas for improvement and future implementation.	viable replacement for paper logbooks. The application demonstrates enhanced systematic logging and real-time accessibility of design activities. Case study feedback suggests that additional functionalities such as search and filtering options, collaborative features, and reminder functions could further improve the application's utility in engineering contexts
4	Utilization of the iOS Shortcuts App to Generate a Surgical Logbook Tool: Feasibility Study Daniel Thompson(2021)	This feasibility study details the creation of a free, effective surgical logbook tool with the iOS Shortcuts app and investigates the time investment required to	Using the iOS Shortcuts app, we created a shortcut "Operation Note," which collects surgical logbook data by using the minimum and extended audit data sets recommended by the Royal Australasian College of Surgeons. We practically assessed the	The iOS Operation Note shortcut demonstrated its utility by collecting accurate and valuable data for surgical audits. The average time for data entry was 65 seconds per case for the minimum data set and 135 seconds for the extended data set, with a statistically significant

		maintain a surgical logbook with this tool. In addition, we investigate the potential utility of the Shortcuts app in creating medical data collection tools.	feasibility of the tool, assessing the time requirement for entry, accuracy, and completeness of the entered data.	mean difference of 68 seconds (P<.001; 95% CI 61.6-77.7). The findings highlight the efficiency and customizability of the iOS Operation Note shortcut as a free and rapid alternative to existing logbook apps for recording surgical operations, complications, and demographic data.
5	A Review of Electronic Engineering Logbooks Throughout the Electrical Engineering Curriculum. Steven S Holland, Jennifer L Bonniwell, Joshua David Carl (2018)	Explore the use of electronic notebooks in a range of electrical engineering courses at the Milwaukee School of Engineering, fr om freshman to senior year	Faculty members' experiences and observations from implementing electronic notebooks in their courses.	Simple archiving and sharing: Easy storage, retrieval, and sharing of technical work compared to paper notebooks. Improved collaboration: They offer better access to notes for individual engineers and facilitate project transfer between engineers.
6	Web-Based Application of High School Laboratory Administration: Case	Facilitate registration, bo rrowing, return ing, and	Design of the web application using Yii2 Framework and MySQL database	Suggestions for future development include expanding reports, integrating

	Study at SMA Pasundan 8, Bandung, Indonesia Sulistijono Sulistijono, Mahir Pradana and Imanuddin Hasbi(2020)	scheduling of laboratory equipment and materials.		fines system, and tracking attendance.
7	Jupyter Notebook as the Physics Experimental Laboratory's Logbook First Approach. Irene Urcelay-Olabarria, Ruth Lazkoz, Jon Urrestilla, Aritz Leonardo, Josu M. Igartua(2017)	Develop a general-purpose tool for laboratory sessions across various disciplines.	Analyzed the benefits and advantages of using Jupyter Notebook in comparison to traditional laboratory practices.	Promotes computational skills and data analysis competencies. Cultivates independent learning and autonomous work habits.
8	Mobile Augmented Reality Laboratory for Learning Acid−BaseTitration. Jessica Lizeth Domínguez Alfaro**,** Stefanie Gantois, Jonas Blattgerste, Robin De Croon, Katrien Verbert,Thies P	Develop a tool for students to practice laboratory skills remotely.	Iterative design process with expert panel and prototyping.	The app received positive feedback for its design elements like the logbook and multiple-choice questions.

	feiffer, and Peter Van Puyvelde (2022)			
9	Development of e-logbook System for Undergraduate Students of the Faculty of Arts and Social Science (FAS), University Tun Abdul Rahman (UTAR) Lee, J., & Norhamreeza Abdul Hamid. (2022)	The objectives of the project include providing assistance to year 3 students in the initiation and creation of their final year projects.	The e-logbook System is developed using Brackets, Notepad, and XAMPP software, with phpMyAdmin employed for managing system databases. The development approach follows the Prototype model, allowing for iterative enhancements.	The study concludes that the e-logbook System effectively achieves its intended objectives based on various tests. System function tests related to storing and manipulating user details, report data, and notification data show that the actual output aligns with the expected output.
10	A Newbie's Guide to Using an Electronic Lab Notebook Part 1: The Basic Lab Notebook. Stephanie Monasky(2016)	Introduce the concept of electronic lab notebooks (ELNs).	Visual aids are utilized to illustrate ELN software platforms.	Paper lab notebooks have served as the gold standard for lab documentation for generations.
11	Analysis and Design Logbook Information Systems	The primary objective of this study was to address the	The methods employed in this study involved the analysis and design phase, utilizing the	The findings of this study culminated in the successful completion of the analysis and design

	Siti Mukaromah, Prisa Marga Kusumantara, Agung Brastama Putra, Arista Pratama,Siti Mukaromah(2018).	challenges associated with laboratory management by developing an information system for recording the entry and activities of visitors, including students and lecturers. The specific focus was on the analysis and design of a laboratory Logbook to systematically capture data such as items in and out, students engaged in scheduled lab work or free practicum, and lecturer activities during research.	Iconix Process with the Unified Modeling Language (UML) approach. The emphasis was on employing a systematic and visual process for understanding, documenting, and designing the laboratory Logbook. Subsequently, the study proceeded to the application development process using Visual Studio .Net 2005, ensuring a practical implementation of the designed system.	phase using the Iconix Process with the UML approach. This process laid the foundation for the subsequent application development phase, which utilized Visual Studio .Net 2005. While the specific details of the application's functionality and features were not explicitly mentioned, the conclusion indicates that the study progressed to the practical stage of implementing the designed laboratory Logbook system. The findings imply a comprehensive approach to addressing the need for an information system in laboratory management, aligning with the study's objectives.

2.4. REVIEW OF RELATED ONLINE LABORATORY LOGBOOK

Samed et al (2022) introduces the E-Logbook System for Postgraduate Research Students (EPRES), aiming to replace manual logbooks with an electronic platform that enhances data quality and systematically monitors postgraduate students' research activities. Following an adapted agile model and the Eight Golden Rules for Interface Design theory, the system features modules for registration, activity recording, report generation, and monitoring. The supervisor and postgraduate officer interfaces enable tracking stud gent progress and generating reports. The research identifies challenges with manual logbooks, emphasizing the need for a systematic monitoring system, and concludes that EPRES effectively addresses these issues, contributing to improved progress monitoring, timely research completion, and overall benefits for supervisors, students, and postgraduate officers.

Gertsenberger, Moshkin, Chebotov (2019) discusses the development and implementation of an electronic logbook for the BM@N experiment within the NICA project at the Joint Institute for Nuclear Research. The objective is to automate the recording process during experiment runs, capturing crucial information for understanding collision events. The methodology involves creating a Web-based platform with a C++ database interface, integrating it with the central experiment database. Additional services, such as email notifications and FreeIPA authorization, enhance functionality. Findings indicate the platform's relevance and success, providing efficient logbook management and data access. The system's successful testing prompts plans for expansion into future experiments, emphasizing its importance for the NICA project's overall success. Detailed information is available on the BM@N official website.

Weng et al (2023) the research focuses on the digitalization of engineers' logbooks, seeking to enhance the traditional paper-based system by developing a real-time mobile application. The primary objective is to create a visual e-logbook using Swift programming language, SwiftUI framework, and XCode as the main Integrated Development Environment (IDE). The study includes case studies to evaluate the effectiveness of the visual e-logbook, comparing it to conventional paper logbooks. Results indicate that the implemented application has considerable potential in engineering design projects, offering improved systematic recording and real-time accessibility of design activities. Feedback from case studies highlights the need for additional features such as search and filtering options, collaborative functionalities, and reminder functions to further enhance the application's utility for engineers.

Thompson (2021) the feasibility study aimed to create a functional surgical logbook tool using the iOS Shortcuts app, integrating minimum and extended audit data sets recommended by the Royal Australasian College of Surgeons. The research found that the iOS Operation Note shortcut effectively collected accurate data for surgical audits. Data entry averaged 65 seconds for the minimum data set and 135 seconds for the extended data set, demonstrating efficiency. The study highlighted the iOS Shortcuts app's utility in developing medical data collection tools and offered a free, rapid, and customizable alternative for recording surgical operations, complications, and demographic data, making it a valuable resource for surgical trainees and consultants.

Holland (2018) explores the implementation of electronic engineering logbooks in diverse courses within the electrical engineering undergraduate curriculum at the Milwaukee School of Engineering. Junior faculty members share their experiences, drawing from a range of courses that cover prescriptive procedures to open-ended design projects. With each faculty member having industry experience, the paper delves into the advantages and disadvantages of electronic logbooks. The findings contribute to a broader understanding of the implications of transitioning from traditional paper logbooks to electronic documentation methods in engineering education.

2.5 CHAPTER SUMMARY

The literature review provide an overview of existing research and literature relevant to online laboratory logbooks. It covers various aspects, including the historical context of laboratory logbooks, the evolution of logbook practices, the challenges faced with traditional paper-based logbooks, and the emergence of online solutions. The review may explore studies and projects that have implemented online logbooks, discussing their objectives, methodologies, and findings. Additionally, it might delve into the benefits and drawbacks associated with transitioning to online logbooks, such as improved accessibility, and record keeping. Overall, the literature review aims to establish the context for the current project, highlighting gaps in the existing knowledge that the undergraduate study seeks to address.

CHAPTER 3: METHODOLOGY

3.1. INTRODUCTION

This provides a comprehensive overview of the development methods employed to achieve the objectives for the design and implementation of an online laboratory logbook. It outlines the systematic approach and procedures undertaken to gather relevant data, analyze information, and develop the proposed system.

The primary goal of this section is to present a clear and detailed explanation of the methodology utilized, ensuring the transparency and reliability of the project's research process. By following a structured methodology, the project aims to ensure the validity and reliability of the findings, as well as the effectiveness of the system design and implementation.

3.2. PROJECT WORKFLOW

The project workflow consists of several key stages that outline the step-by-step process of developing and implementing the system. This workflow ensures a structured and organized approach to project execution. Agile development is an iterative and incremental approach to software development that focuses on flexibility, collaboration, and continuous improvement. Figure 3.1 describes each stage of the workflow.

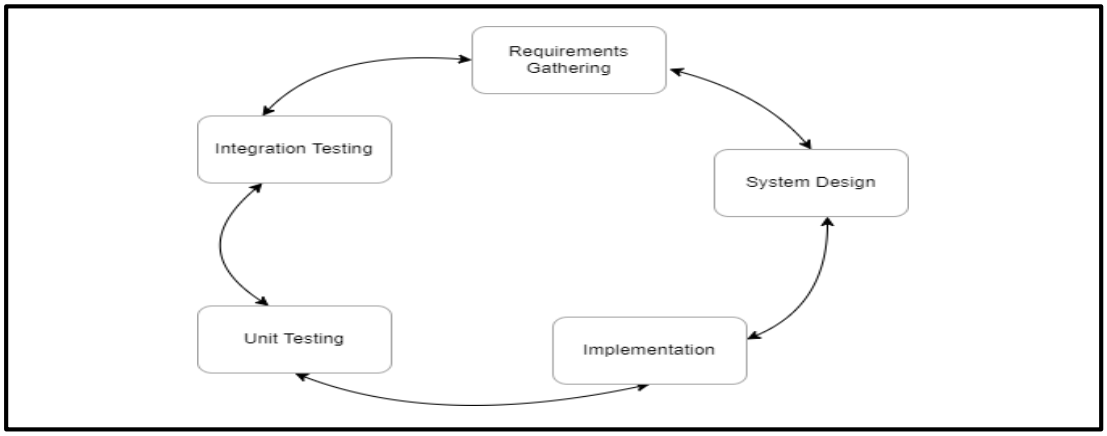


Figure 3. 1: Project workflow diagram

Following is the description of each stage of the workflow in detail:

Requirement Analysis:
This phase involves gathering, analyzing, and documenting requirements for the online laboratory logbook system. It includes identifying the needs and expectations of users, stakeholders, and the system itself. Activities involved may include conducting interviews with potential users and stakeholders, creating use cases, defining functional and non-functional requirements, prioritizing requirements, and creating requirement documents such as a Software Requirements Specification (SRS) document.

System Design:This phase involves designing the architecture and structure of the online laboratory logbook system based on the gathered requirements. It includes defining the system's components, modules, interfaces, and data structures.

Activities that takes place may include creating system architecture diagrams, designing database schemas, defining user interfaces (UI) design, creating flowcharts or UML diagrams to illustrate system behavior, and producing design documents such as a System Design Document (SDD).

Implementation:This phase involves actual coding or programming of the online laboratory logbook system based on the defined requirements and design. It includes translating design specifications into executable code.
Activities that takes place here include writing source code, creating database tables and queries, implementing user interfaces, integrating third-party libraries or frameworks if necessary, and following coding standards and best practices.

Unit Testing:This phase involves testing individual units or components of the online laboratory logbook system in isolation to ensure they function correctly and meet their specifications.
Activities that takes place here include writing and executing unit tests for each module or component, verifying that each unit behaves as expected, identifying and fixing defects, and ensuring code coverage to validate that all parts of the code are tested.

Integration Testing:This phase involves testing the interaction and integration between different modules or components of the online laboratory logbook system to ensure they work together as intended.
Activities that takes place here include integrating various modules or components, executing integration tests to validate interactions between them, verifying data flow and communication between different parts of the system, identifying and resolving integration issues, and ensuring overall system functionality.

3.3. SYSTEM DEVELOPMENT MODEL

I have opted to utilize the Agile development model as the preferred approach for this laboratory logbook project. This choice is based on the advantages it provides. The Agile model provides a flexible and iterative framework that promotes collaboration, adaptability, and continuous enhancement, aligning well with the dynamic requirements of the online laboratory logbook. Here are some key advantages of agile development:

1. Flexibility: Agile methodologies, such as Scrum and Kanban, prioritize adaptability and responsiveness to change. This flexibility allows teams to adjust project requirements, features, and priorities based on feedback and evolving business needs.

2. Incremental Delivery: Agile development focuses on delivering working software in small, incremental iterations known as sprints or iterations. This iterative approach enables stakeholders to see tangible progress and provides opportunities for early feedback and course correction.

3. Stakeholder Collaboration: Agile methodologies emphasize collaboration and communication among team members, stakeholders, and customers. Regular meetings, such as daily stand-ups and sprint reviews, facilitate transparency, alignment, and continuous improvement.

4. Customer Satisfaction: Agile development prioritizes delivering value to customers by focusing on their needs and priorities. By involving customers throughout the development process and delivering working software frequently, agile teams can ensure that the final product meets or exceeds customer expectations.

5. Faster Time to Market: Agile development promotes rapid and frequent releases of software, allowing teams to deliver valuable features to market more quickly. This accelerated time to market enables

organizations to respond to market changes, gain a competitive edge, and capture market opportunities more effectively.

6. Risk Mitigation: Agile methodologies emphasize early and continuous testing, validation, and feedback, which helps identify and address issues and risks early in the development process. By embracing change and addressing risks iteratively, agile teams can minimize project risks and increase project success rates.

7. Continuous Improvement: Agile methodologies encourage a culture of continuous improvement, where teams reflect on their processes, identify areas for improvement, and implement changes incrementally. This focus on continuous learning and adaptation enables teams to become more efficient, effective, and resilient over time.

Overall, agile development promotes collaboration, flexibility, customer-centricity, and adaptability, enabling teams to deliver high-quality software that meets customer needs and business objectives more effectively.

Choosing Agile as the system development model enables harnessing its benefits for a more streamlined and productive development journey. With Agile's emphasis on user-centricity, iterative development cycles, adaptability to evolving requirements, collaborative atmosphere, and commitment to ongoing enhancements, it closely aligns with the project's goals of building an online laboratory logbook platform. This approach ensures the system meets user expectations, encourages engagement, and facilitates optimal learning experiences.

3.4. ANALYSIS OF PROPOSED AND EXISTING SYSTEM

3.4.1. DESCRIPTION OF EXISTING SYSTEM

Currently, the institution relies on manual methods for managing laboratory activities due to the absence of a dedicated software system. The manual process involves using physical logbooks where students and instructors record various laboratory activities, such as lab exercises and any other assignments that may be given. Each entry in the logbook is handwritten, making the process labor-intensive and susceptible to errors. As there is no centralized system in place, retrieving historical data or analyzing trends becomes challenging. Additionally, the manual logbooks lack features such as search functionality, data analysis tools, and user authentication, which are essential for efficient laboratory management. Therefore, the institution recognizes the need for a digital laboratory logbook system to streamline operations, improve data accuracy, and enhance overall efficiency in managing laboratory activities.

3.4.2. DESCRIPTION OF THE PROPOSE SYSTEM

The "Online Laboratory Logbook" is a web-based application designed to streamline the management of software laboratory activities for students and instructors. It provides a centralized platform for recording, tracking, and managing various aspects of laboratory sessions and assignments.

3.4.3. REQUIREMENT ELICITATION

Requirement elicitation is the process of gathering, identifying, and documenting the needs, expectations, and specifications of stakeholders for a particular system or project. It involves systematically collecting information from various sources, such as users, clients, domain experts, and other relevant stakeholders, to understand the problem domain and define the requirements that the system must meet.

Requirement elicitation techniques may include interviews, surveys, workshops, observations, document analysis, prototyping, and brainstorming sessions.

1. **Observation:**

Observation was utilized to acquire understanding of the prevailing practices among both students and lecturers. The project team observed various facets such as classroom interactions, group work sessions, and discussions with the aim of comprehending the process of logging activities. Through observing the behaviors of students, communication dynamics, and the obstacles encountered in logging activities, valuable insights were gleaned to guide the design of the new system.

2. Document Analysis:

Document analysis entails scrutinizing the current documents, including the physical laboratory logbook for the software engineering department, to pinpoint precise requirements and limitations. Through this analysis, I attained a more profound comprehension of the anticipated standards, directives, and rules pertaining to the laboratory logbook within the educational institution. This examination facilitated the assurance that the proposed system adheres to the institutional framework and stipulations.

3. Brainstorming:

Stakeholder brainstorming sessions, which encompassed students and lecturers, served as a forum for participants to exchange ideas, viewpoints, and anticipated functionalities concerning the laboratory logbook system. These collaborative gatherings facilitated open discourse and imaginative ideation, leading to the identification of diverse requirements and potential system attributes. Through this collaborative process, innovative concepts emerged, shaping the system's design and functionality.

The combination of observation, document analysis, and brainstorming techniques for requirement gathering offers a holistic approach that enriches the understanding of a system's needs. Observation provides real-world insights into user behaviors, while document analysis offers historical context and institutional knowledge. Brainstorming fosters creative thinking and stakeholder collaboration. By leveraging these techniques together, stakeholders gain a comprehensive perspective, validate findings, and mitigate risks associated with relying on a single method. Enhanced stakeholder involvement and optimized requirement gathering efforts result in a robust set of requirements that align closely with the system's objectives, ensuring a successful outcome for the project.

3.4.4. REQUIREMENT DEFINITION

Functional Requirements

1. User Registration and Authentication:
    a. Staffs and students are allowed to register an account with their credentials
    b. Staffs and students are authenticated during login to ensure secure access to the system.
2. Logbook entry Creation:
    a. Students are allowed to submit their logs of activities.
    b. Students are allowed to view submitted logs.
    c. Staffs are allowed to view and assess submitted logs.

Non-functional Requirements

1. User Interface:
    a. Design user-friendly interface with a responsive layout to ensure accessibility across different devices.
    b. Use appropriate color schemes, typography, and visual elements to enhance the user experience.
2. Security:
    a. Encrypt sensitive user information such as users password.

3. Performance:
    a. Optimize the system for efficient performance, ensuring quick response times and minimal downtime.
    b. Handle concurrent user interactions and large data volumes effectively.

3.4.5. REQUIREMENT ANALYSIS

The requirement analysis phase of this project focuses on analyzing the gathered requirements of the proposed system. This includes understanding, classifying, organizing, classifying, prioritizing and negotiating the needs and expectations of the users, stakeholders, and the overall project goals.

The use case diagram of Figure 3.2 in page 22 shows the 15 functionalities, 3 users and their relationships of the proposed system. The functionalities are describe bellow:

1. REGISTER AS NEW USER
This involves the user account creation for both staffs and students.

Actors: Staffs and Student

Pre-Conditions: First name, middle name, last name, unique username and strong password.

Post Conditions: If registration is successful, a new user account is created

Basic Flow:

i. User provide first name, middle name, last name, email, and password.
ii. Client side validation will check if the email is valid, and password match with the confirm password and user click sign up button.
iii. System validate if the username is unique.

Alternate Flow

i. User provide the required information (e.g names, email, password, etc).
ii. Client side validation will check if the email is valid, and password match with the confirm password and user click sign up button. iii. System validate is the username is unique.
iv. If validation failed, error message is sent to user

2. LOGIN
This involves sign in or getting authenticated as an existing user
Actors: Staff, Student, Admin
Pre-Conditions: User must be registered
Post Conditions: If login is successful, the user will be navigated to his/her profile page, otherwise error message is displayed to the user
Basic Flow:
i. User provide username and password.

ii. System checks if a user with the same username and password exist
iii. If user exist, user logged in to system and navigate to profile page.

Alternate Flow

i. User provide username and password.
ii. System checks if a user with the same username and password exist
iii. If user is not found, error message is displayed to the user.

Figure 3.2 shows a use case diagram.

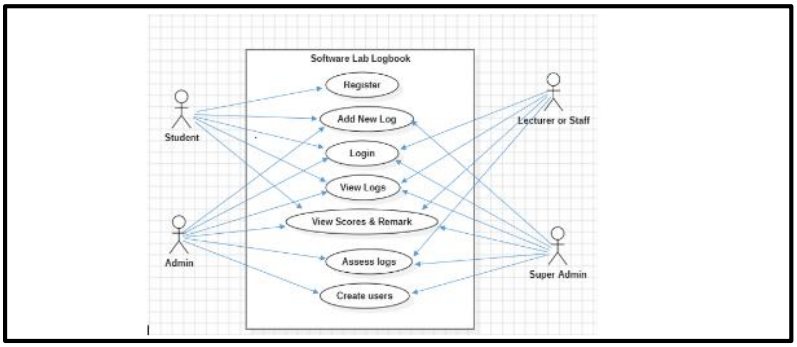


Figure 3. 2: Use case diagram

3.5. SYSTEM DESIGN

The following section describes the proposed system, shows the flow of activities using activity diagram and the architecture of the system using class diagram.

3.5.1. DESCRIPTION OF PROPOSED SYSTEM

The proposed system, titled "online Laboratory Logbook" is designed to revolutionize the way students keep track of their logbooks as well as the way staff assess their students. It aims to provide an integrated platform that enhances the record keeping of activities, and facilitates accurate grading.

Figure 3.3 shows the Activity diagram describing the activities, steps and flow of using the proposed system.

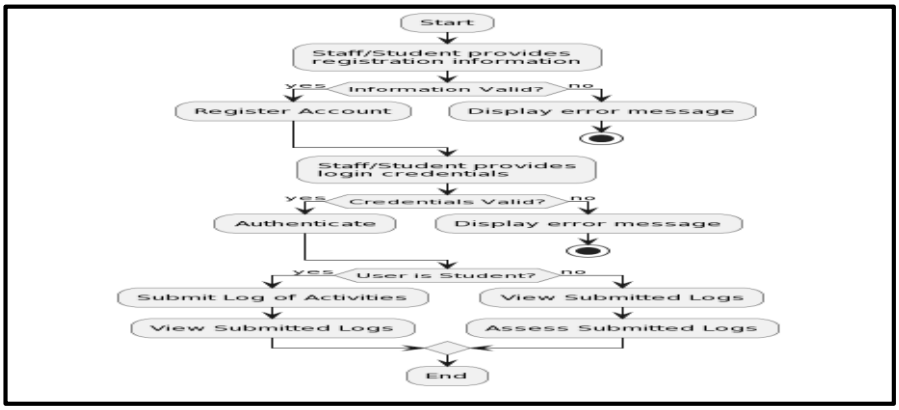


Figure 3. 3: Activity diagram

3.5.2. ARCHITECTURE AND DATABASE DESIGN

A class diagram is a type of structural diagram in software engineering that represents the static structure and relationships among classes in a system. It illustrates the classes, their attributes, methods, and associations with other classes.

Figure 3.4 shows the class diagram describing the architecture and database structure of the system. Each class represent a table in the database with arrows connecting them describing the relationship and associations between them.

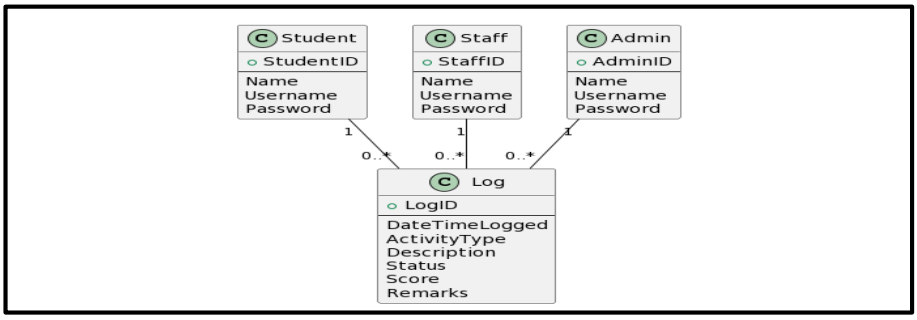


Figure 3. 4: Class diagram

Figure 3.5 shows an entity relationship diagram of the system.

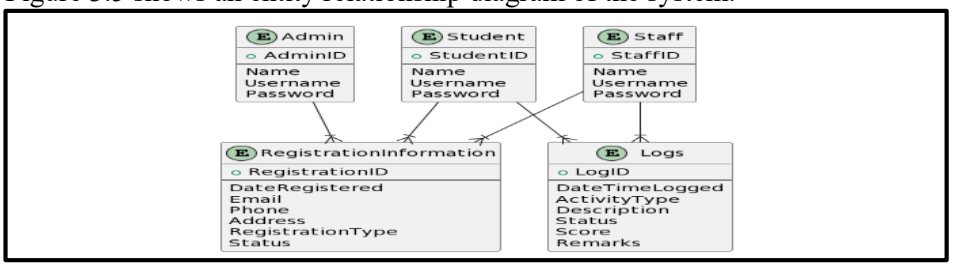


Figure 3. 5: Entity Relationship(ER) diagram

3.6. CHAPTER SUMMARY

This chapter outlines the systematic approach and procedures for designing and implementing a Software Laboratory Logbook System. The system aims to facilitate efficient logging of activities conducted in software laboratory sessions.

The project will embrace agile methodologies to foster flexibility and responsiveness to users' needs. Agile principles will guide the iterative development process, allowing for continuous improvement and adaptation to changing requirements. Regular feedback loops will be established to ensure stakeholder involvement and satisfaction.

Requirement gathering will involve a combination of observation, document analysis, and brainstorming sessions. Observation sessions will entail observing current practices in software laboratory sessions, while document analysis will involve examining existing logbook formats and guidelines. Brainstorming sessions

with stakeholders, including students and staff, will be conducted to gather input and ideas for system requirements.

Use case diagrams will be utilized to model the interactions and functionalities of the software laboratory logbook system. These diagrams will provide a visual representation of the system's requirements, facilitating a comprehensive understanding of user actions and system responses. Key features and functionalities, such as user registration, login, log submission, and log viewing, will be identified and incorporated into the system.

Activity diagrams will describe the behavior and flow of the software laboratory logbook system. These diagrams will illustrate the step-by-step processes and activities involved in the system's operation, including the registration process, login process, log submission process, and log viewing process. Activity diagrams will enhance understanding of the system's workflow and user navigation.

Class diagrams will be employed for the architecture and database design of the software laboratory logbook system. These diagrams will represent the structure and relationships between different entities, such as classes, objects, attributes, and methods. Class diagrams will aid in the identification and organization of system components, ensuring a coherent and efficient system architecture and database design.

The systematic approach outlined in this chapter ensures the efficient design and implementation of the Software Laboratory Logbook System. By adopting agile methodologies and leveraging various modeling techniques, the project aims to deliver a high-quality system that supports effective record keeping and retrieval among students and staff in the software engineering department.

CHAPTER 4: IMPLEMENTATION AND TESTING

4.1. INTRODUCTION

This chapter focuses on the practical execution of the online laboratory logbook. It outlines the steps taken to transform the design and requirements into a fully functional system and describes the comprehensive testing process to ensure the system's reliability and functionality.

The primary objective of this chapter is to provide an overview of the implementation approach, tools, technologies, and frameworks used in developing the system. It also highlights the importance of rigorous testing to identify and rectify any potential issues or errors before the system is deployed.

The implementation phase involves the translation of the system design into actual code. This includes the development of the system components such as the registration, login, and profile pages as well as their respective functionality. The chosen technologies and frameworks play a crucial role in this process, providing the necessary tools and resources to build a robust and efficient system.

Following the implementation, the testing phase aims to ensure that the system meets the specified requirements and functions as intended. Various testing techniques, such as unit testing, integration testing, and system testing, are employed to validate the system's functionality, performance, security, and user experience. The testing phase is essential for identifying and resolving any issues or bugs that may affect the system's usability or reliability.

4.2. IMPLEMENTATION

This section describes the process and tools used for implementing the proposed system and also the different screens of the implemented system.

4.2.1. IMPLEMENTATION TOOLS

In the development of the online laboratory logbook, various tools and technologies were utilized to ensure an efficient and effective implementation process. Table 4.1outlines the key tools and technologies employed during the implementation phase.

Table 4. 1: Development tools

S/N	**CATEGORY**	**SOFTWARE USED**
1	**Operating System**	Windows 10
2	**Integrated Development Environment**	Visual Studio Code
3	**Frameworks**	Django and Tailwind CSS
4	**Programming Languages**	Python, HTML, CSS, JavaScript
5	**Database**	Sqlite3 Database
6	**Web browser**	Microsoft Edge, Google Chrome, etc.

By leveraging these tools and technologies, I was able to build a dynamic and user-friendly online laboratory logbook. The combination of HTML, CSS, and JavaScript enabled the development of a visually appealing and interactive user interface. The Django web framework facilitated the separation of concerns and the creation of a well-structured web application. Visual Studio Code provided an efficient development environment, while Sqlite3 ensured reliable data storage and retrieval.

The careful selection and utilization of these implementation tools were instrumental in creating a robust and functional system that promotes record keeping of the laboratory activities for students.

4.2.2. ALGORITHMS OF MAJOR FUNCTIONALITY

The online laboratory logbook system incorporates functionalities to facilitate seamless record keeping and retrieval for users. This section provides a brief introduction to the algorithms used in implementing these key functionalities. The algorithms outlined below serve as a foundation for the subsequent implementation of the system's features.

Figure 4.1shows the algorithm for new user registration to the system.

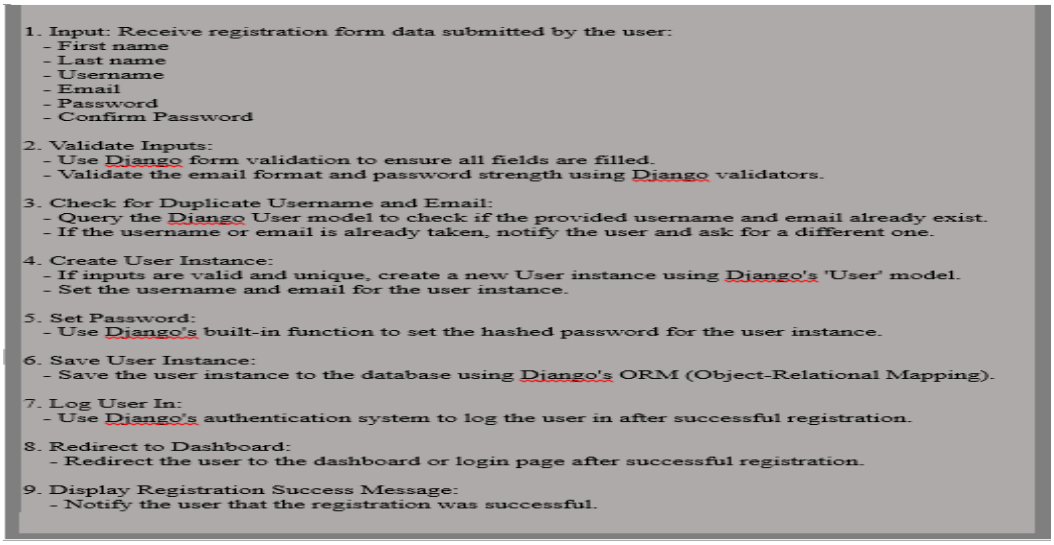


Figure 4. 1: User registration algorithm

Figure 4.2 shows the algorithm creating/adding a new log activity.

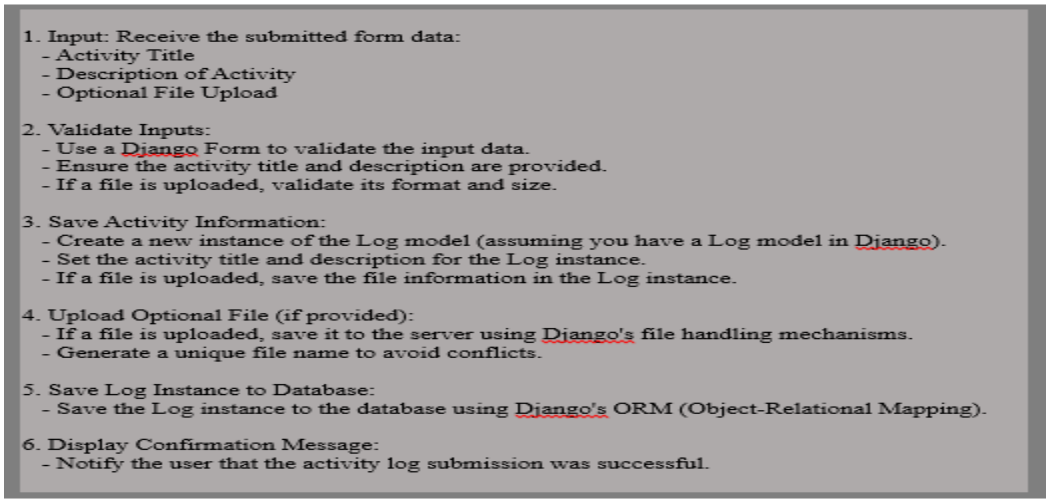


Figure 4. 2: Activity Log Creation algorithm

Figure 4.3shows the algorithm for assessing student activities, only student are allowed to add activity log.

```
1. Input
   - List of student activities with logs.
   - Staff details.
   - Criteria for scoring activities.

2. Initialization
   - Authenticate staff.
   - Display list of student activities with logs.

3. Loop through activities
   - For each activity in the list:
     - Display activity details and logs.
     - Prompt staff to give a score and remarks for the activity.
     - Validate the score (e.g., within a predefined range).
     - Save the score and remarks for the activity.
     - Move to the next activity.

4. Review and Finalize
   - Display the summary of scores and remarks given by the staff for each activity.
   - Allow staff to make changes if necessary.
   - Confirm and save the assessment data.
```

Figure 4. 3: Student Assessment algorithm

Figure 4.4shows the algorithm for user login, it is the same for all users of the system.

```
1. Input:
   - Username
   - Password

2. User Authentication:
   - Receive the username and password from the user.
   - Check if the username exists in the system.
   - If the username exists:
      - Retrieve the corresponding password associated with the username.
      - Compare the entered password with the stored password.
      - If the passwords match:
         - Grant access and proceed to the user's dashboard.
      - If the passwords do not match:
         - Display an error message indicating incorrect password.
   - If the username does not exist:
      - Display an error message indicating invalid username.

3. End
```

Figure 4. 4: Login algorithm

4.2.3. DESCRIPTION OF SYSTEM OPERATION

This section provides a description of the various screens and functionalities of the online laboratory logbook system. It outlines the user interactions and step-by-step processes involved in using the system.

First, Figure 4.5 shows the landing page of the system, this is the first interface every user sees and interact with when he/she get to the system.

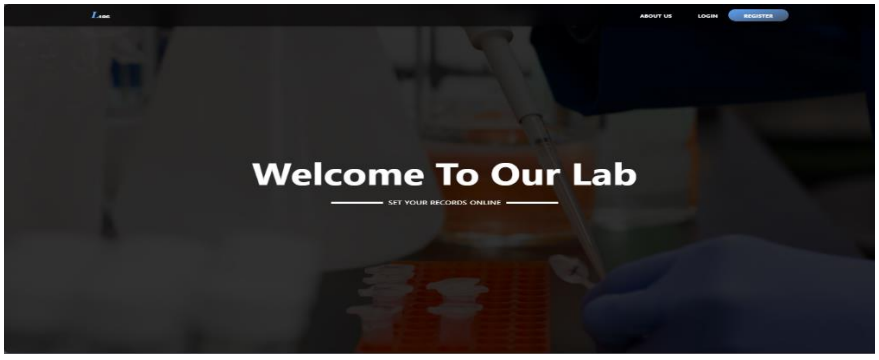


Figure 4. 5: Landing/Home Page

Figure 4.6 shows the sign in page of the system requiring the user's name and password. The page also contain a link to the registration page for new users.

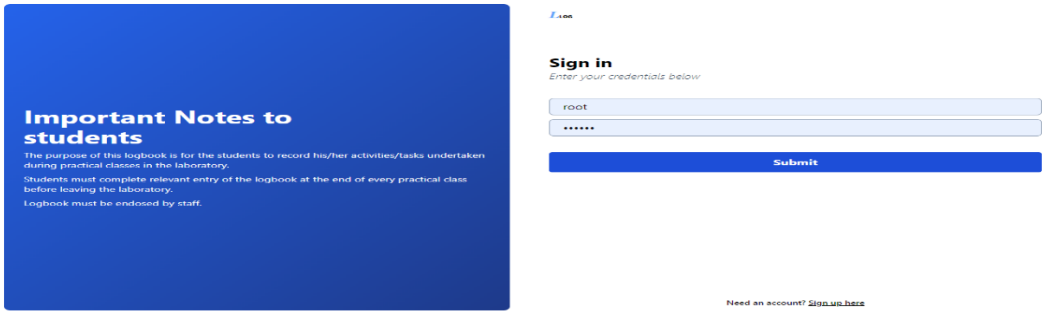


Figure 4. 6: Login/Sign in Page

Figure 4.7 shows the Registration page which requires first name, last name, username, email address, strong password and repeat password. Also contains link to login page if user is not new to the system.

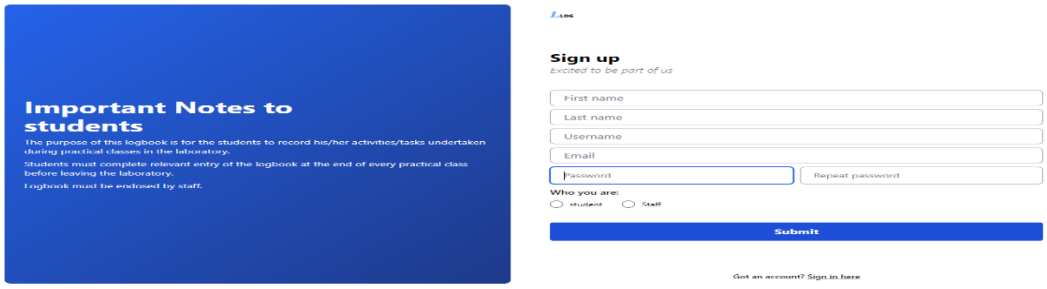


Figure 4. 7: Registration/Sign up Page

Figure 4.8 shows the Admin dashboard, which is where the admin user will be redirected to after he/she has signed in. There you will find the type of users, list of users and their records.

The admin can create any type of user, he/she can add record, delete record, modify record as well as assessing student activities.

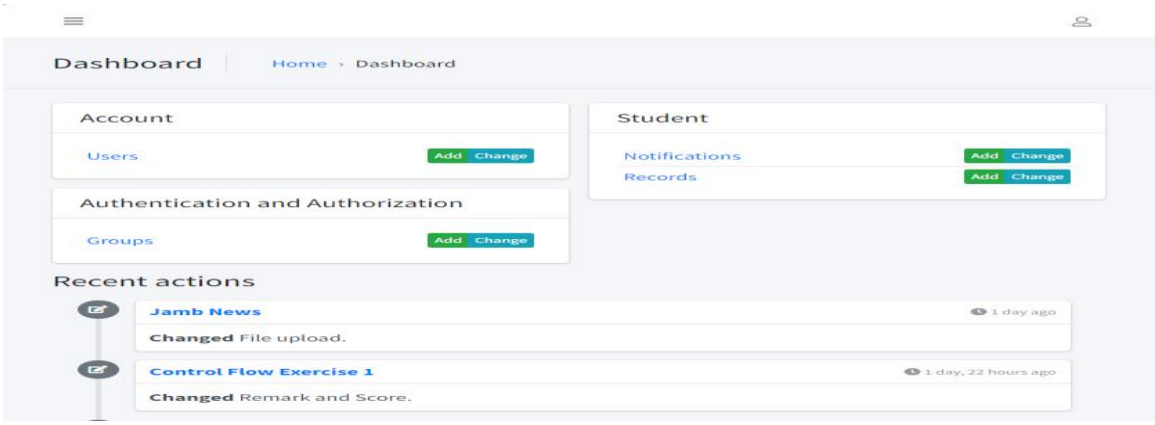


Figure 4. 8: Admin Dashboard Page

Figure 4.9 shows the staff dashboard, this is the page that the staff is redirected to when he/she signs into the system. This page has today's records at the top which contain the record of activities that are just added today. And below today's records there is a lists of registered students.

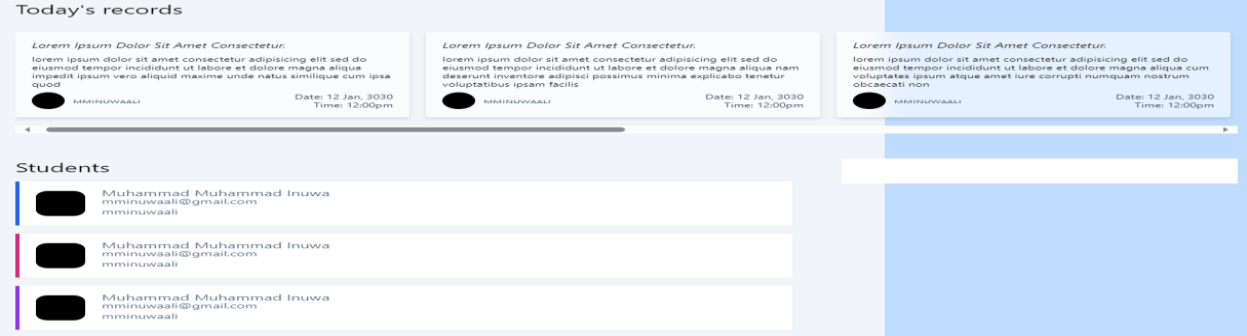


Figure 4. 9: Staff Dashboard Page

Figure 4.10 shows the student dashboard, this is the first page which the student get in touch with after successful login authentication. This page has today's records by the left side of the page, other logs at the middle of the page and notification of recent assessed activities by the right. On the base screen which is colored blue has some buttons by the left side, the buttons include logo, new log and exit button.

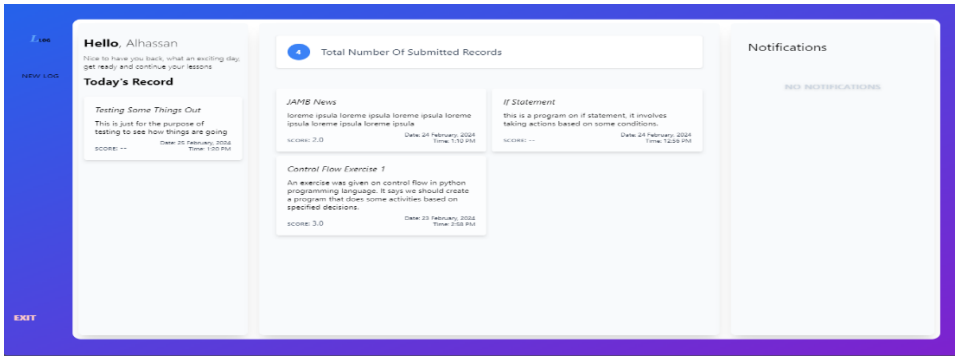


Figure 4. 10: Student Dashboard Page

Figure 4.11 shows the new activity page, which contains title, description, upload file inputs and a create button which submit the activity.

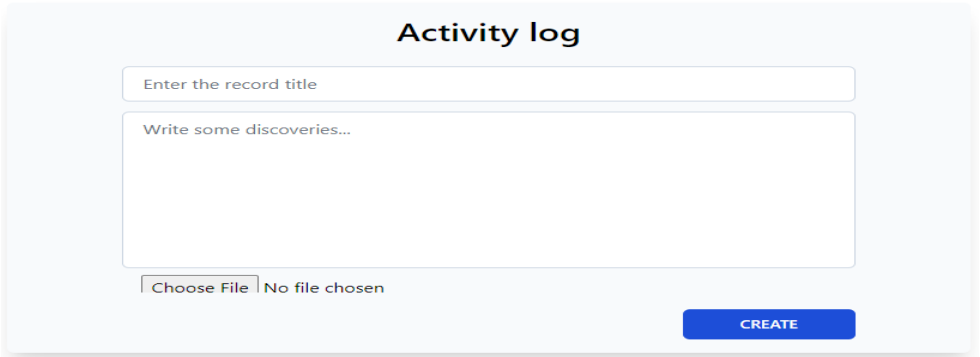


Figure 4. 11: Student Dashboard Page

4.3. TESTING

4.3.1. TESTING STRATEGIES

The Testing Strategy adopted is the Use Case testing, which focuses on deriving test cases from the system's use cases. This approach ensures that the system's functionality is thoroughly validated based on real-life scenarios and user interactions.

The Use Case testing strategy involves the following steps:

1. Use Case Identification: I identify and analyzes the use cases defined in the system requirements. Use cases represent the various actions and interactions that users can perform within the system. Each identified use case represents a specific functionality or feature that needs to be tested.
2. Use Case Prioritization: The use cases are prioritized based on their importance and impact on the system. Critical and frequently used use cases are given higher priority, ensuring that they receive more testing focus. This prioritization helps allocate testing resources effectively and ensure that the most critical functionalities are thoroughly tested.
3. Use Case Flow Analysis: I then analyzes the flow of events within each use case. I identify the possible paths, user actions, system responses, and expected outcomes. This analysis helps in understanding the behavior of the system during different use case scenarios and identifying potential test scenarios.
4. Test Case Generation: Test cases are derived from the identified use cases and their respective flows. Each test case represents a specific scenario or interaction that needs to be validated. Test cases cover both positive and negative scenarios, boundary values, and alternative paths within the use case flows. Test data and inputs are carefully selected to ensure comprehensive test coverage.
5. Test Case Execution: The generated test cases are executed, following the defined test procedures. I simulate user interactions based on the use case flows, entering appropriate inputs, and verifying the system's responses. I validate that the system behaves as expected, produces the correct outputs, and handles errors and exceptions appropriately.

By adopting the Use Case testing strategy, the online laboratory logbook system can be thoroughly tested based on real-world user scenarios and interactions. This approach ensures that the system behaves as intended, covers the critical functionalities, and meets the users' expectations. The systematic and structured nature of the Use Case testing strategy helps in

efficient test case generation and comprehensive test coverage, contributing to the overall quality and reliability of the system.

4.3.2. UNIT TESTING

Unit testing is an essential component of the testing process for the online laboratory logbook system. It involves testing individual units of code, such as functions, methods, or classes, to ensure their correctness and functionality. This section outlines the approach and methods used for unit testing in the project.

By conducting a comprehensive unit testing the system ensures the quality and reliability of individual units of code, contributing to the overall stability and effectiveness of the system.

Table 4.2 outline the test cases and results after conducting the test.

Table 4. 2: Unit testing Test cases

ID	DESCRIPTION	STEPS	INPUT	EXPECTED OUTPUT	ACTUAL OUTPUT	RESULT
TC-U-01	Test user registration method	Write an xUnit tests and run	Valid user details	Success message	Success message	PASS
			Invalid User Details	Error message	Error message	
TC-U-02	Test user login method		Valid username & password	Success message	Success message	PASS
			Invalid username & password or Invalid (username /password)	Error message	Error message	
TC-U-	Test add new activity method		Title & description input fields	Success message	Success message	PASS

03			Empty title and or description input field	Error message	Error message	
TC-U-04	Test activity assessment method		Remark and or valid score	Success message	Success message	PASS
			Remark and or invalid score	Error message	Error message	

4.3.3. INTEGRATION TESTING

Integration testing is a crucial phase in the testing process. It focuses on testing the interaction and integration between different components or modules of the system. Table 4.3 outlines the test cases used for integration testing in the project.

Table 4. 3: Test cases for integration tests

ID	DESCRIPTION	STEPS	INPUT	EXPECTED OUTPUT	ACTUAL OUTPUT	RESULT
TC-I-01	Test user registration	Integrated registration form	Valid user credentials	User registration success message and user will be navigated to login page	"You have successfully registered!"	PASS
			User credentials with an existing username	"User with the same username exist"	"User with the same username exist"	
TC-I-02	Test user login	Click on the Login button in the landing page	Correct username and password	"Login successful" and redirect to respective user dashboard"	"Login successful" and redirect to respective user dashboard"	PASS
			Wrong username and/or password	"Invalid credentials"	"Invalid credentials"	

TC-I-03	Test new activity creation	Click on New Log button	Write the title & description of the log with an optional file attachment and click on create button	Displays success message and return to user dashboard and the new added log will be displayed under today's log	"Successfully added a new log"	PASS
TC-I-04	Test activity assessment	Click on an activity of a student	Write a remark and score for the activity and click on submit	Record saved and return to the staff dashboard	Record saved and return to the staff dashboard	PASS

By conducting tthe integration testing, the online laboratory logbook project ensures that different components/modules work together seamlessly, enabling the smooth flow of data and functionality across the system. This contributes to the overall reliability and effectiveness of the system.

4.3.4. SYSTEM TESTING

System testing is a crucial phase in the testing process for the laboratory logbook project. It focuses on evaluating the entire system as a whole to ensure that it meets the specified requirements and functions as intended. This section provides a detailed description of the system testing done in the project.

Test Environment Setup

A dedicated test environment is set up to replicate the production environment as closely as possible. This includes deploying the necessary software, configuring databases, and establishing the required infrastructure components. The purpose is to create an environment where the system can be tested under real-world conditions.

Functional Testing

Functional testing focuses on verifying that each individual function of the system works as expected. The system is validated against the defined functional requirements and verifies that all features and functionalities are implemented correctly. This includes testing user registration, login, adding of new activity functionality, and other key system functionalities.

Error Handling and Exception Testing

The system is subjected to various error conditions and exceptional scenarios to test its error handling and exception handling mechanisms. I intentionally introduces invalid inputs, boundary conditions, and other error scenarios to ensure that the system identifies and handles errors gracefully, providing appropriate error messages and fallback mechanisms.

By conducting thorough system testing, the online laboratory logbook system ensures that the system meets the desired functionality, performance, and usability standards. It helps identify and address any issues or defects before the system is deployed, ensuring a high-quality and reliable solution for users.

4.3.5. USABILITY TESTING

Usability testing is a critical component of the testing process for the online laboratory logbook system. It focuses on evaluating the system's ease of use, efficiency, and user satisfaction. This section provides a detailed description of the usability testing approach used in the project.

The primary objectives of usability testing are to assess the system's user-friendliness, identify usability issues, and gather feedback from real users. The testing aims to ensure that the system is intuitive, easy to navigate, and provides a positive user experience.

A controlled testing environment is created to conduct usability testing. I ensures that the environment closely represents the actual user environment, including the hardware and software configurations. This helps provide realistic testing conditions.

Representative users who match the system's target audience are selected as test participants. They may include end-users, domain experts, or stakeholders who have a good understanding of the system's purpose and requirements. The participants' demographics, expertise, and experience are considered to ensure a diverse and representative user group.

Test scenarios are created to simulate real-world user interactions with the system. These scenarios cover various tasks, workflows, and user journeys within the system. The scenarios are designed to evaluate different features, functions, and user interfaces to provide comprehensive coverage of the system's usability aspects.

During the usability testing sessions, each participant is provided with the test scenarios and asked to perform the assigned tasks using the system. I observed and records the participants' interactions, noting any usability issues, difficulties, or confusion they encounter. The participants are encouraged to think aloud, express their thoughts, and provide feedback throughout the testing process.

Usability metrics are defined to evaluate the system's usability. These metrics may include task completion time, error rates, user satisfaction ratings, ease of use ratings, and learnability assessments. I collect quantitative and qualitative data to assess the system's usability against these metrics.

The data collected during usability testing is analyzed to identify recurring usability issues, common pain points, and areas for improvement.

By conducting comprehensive usability testing, the online laboratory logbook system ensures that the system is user-friendly, intuitive, and provides a positive user experience. It helps identify usability issues, gather user feedback, and make informed design decisions to optimize the system's usability and enhance user satisfaction.

Table 4. 4: shows the usability test result

S/N	Questions	Yes (%)	No (%)	Cumulative (%)
1	I think I would like to use this application	90	10	100
2	Was it easy to create account?	95	5	100
3	Was viewing logs and their remark easy?	100	0	100
4	Was adding new log easy?	100	0	100
5	Was it easy to assess student?	100	0	100
6	Are you happy with your overall experience using the system	95	5	100

4.4. CHAPTER SUMMARY

This chapter focuses on the practical aspects of developing and testing the online laboratory logbook system. It provides a detailed overview of the tools, technologies, methodologies, and testing strategies employed during the project.

The implementation phase involved the use of HTML, CSS, JavaScript, and Python programming languages, along with the Django web framework. The Visual Studio code facilitated the coding and development process, while the sqlite3 database was chosen for data storage. The agile methodology was adopted, allowing for flexibility and collaboration throughout the development lifecycle.

Testing played a crucial role in ensuring the system's quality and reliability. Different types of testing were conducted. Unit testing focused on validating individual components, integration testing verified the integration between modules, and system testing assessed the overall functionality and performance of the system. Usability testing evaluated the system's user-friendliness and efficiency.

The chapter highlights the significance of each testing phase and emphasizes their contribution to the system's success. It ensures that the implementation process was thorough, considering both functionality and user experience.

In conclusion, the "Implementation and Testing" chapter provides a comprehensive account of the development and testing efforts for the online laboratory logbook system. It demonstrates the careful selection of tools and technologies, adherence to the agile methodology, and the systematic testing approach employed to deliver a robust and user-friendly system.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. SUMMARY

The online laboratory logbook system aimed to revolutionize the way students and lecturers record and interact with the laboratory logbook. This comprehensive summary encapsulates the project's key components, including the problem statement, objectives, methodology, implementation, and testing are all covered in this document.

The project began with an in-depth literature review, exploring existing systems and studies on online laboratory logbook, and laboratory management system. Many authors provided some valuable insights on the design and evaluation of an online laboratory logbook system. The review formed the foundation for understanding the theoretical underpinnings and best practices in the field.

In the requirement engineering phase, a systematic approach was followed to elicit, analyze, and document the project's requirements. Techniques such as observation, document analysis, and brainstorming sessions were employed to gather information from stakeholders. The objective was to identify the needs and expectations of users, administrators, and other system stakeholders. The requirements were carefully documented and prioritized to guide the subsequent stages of system development.

The project aimed to address the inefficiencies and limitations of existing laboratory logbook. Users often struggled with outdated interfaces, cumbersome processes, and limited functionality, hindering effective recording of activities.

The primary objectives of the project were to develop a cutting-edge online laboratory logbook system that fosters seamless recording of activities. The system aimed to be user-centric, scalable, and adaptable to students as well as their staff.

The project embraced an agile methodology, allowing for iterative development and flexibility. Requirements were elicited through a combination of observation, document analysis, and brainstorming sessions with stakeholders. Use case diagrams and activity diagrams were used to analyze requirements and visualize the system's flow and behavior.

The system was implemented using a combination of HTML, CSS, JavaScript, and Python programming languages, leveraging the power of the Django web framework. Visual Studio code, a light weight robust integrated development environment, provided a seamless development experience. The implementation focused on creating an intuitive and aesthetically pleasing user interface, incorporating an activity record keeping.

Rigorous testing was conducted to ensure the system's functionality, reliability, and performance. Various testing strategies, including unit testing, integration testing, system testing, and usability testing, were employed. Test cases were generated based on use case scenarios, critical functionalities, and real-life user interactions to ensure comprehensive coverage and identify any potential issues.

5.2. CONCLUSION

The online laboratory logbook project has reached its culmination, providing an easy and user friendly record keeping system. This comprehensive conclusion highlights the key achievements, implications, and future directions of the project.

The project successfully achieved its primary objectives of designing, developing, and implementing an online laboratory logbook system. Through extensive research, requirement engineering, system design, and meticulous testing, the project team has created a robust and user-centric platform that facilitates seamless activity record keeping.

The project has made a significant contribution to the student of software engineering as well as their tutors. The extensive literature review served as the foundation for understanding the theoretical underpinnings and best practices in the domain. By incorporating insights from existing research, the project has developed a system that aligns with industry standards and addresses the identified gaps in laboratory activity record keeping. Additionally the system allow staff to assess students' activities virtually.

The implemented system has the potential to drive significant improvements to software engineering department by adding performance to the process of activity record keeping. The system empowers students to leverage collective expertise, leading to increased innovation, productivity, and efficiency. The system provides a centralized platform that enables effective storage, retrieval, and activity assessment, thereby enhancing the students' performance effectively.

Usability testing played a critical role in ensuring that the system is intuitive, user friendly, and meets the expectations of its users. The positive feedback received from users during the testing phase validates the efforts put into designing an interface that is easy to navigate, visually appealing, and supports a seamless user experience. The system's usability and user satisfaction are crucial factors in driving its adoption and long-term success.

Throughout the project lifecycle, various challenges were encountered, including technical complexities, time constraints, and resource limitations. However, these challenges provided valuable learning experiences for me, fostering adaptability, problem-solving skills, and effective project management. The lessons learned during this project can serve as a foundation for future endeavors, enabling smoother execution and improved outcomes.

The online laboratory logbook system has the potential to make a substantial impact to Bayero University Kano particularly the department of software engineering where it is implemented. It can also be useful to other institutions across the country, especially within those institutions that possess software laboratory.

In conclusion, the project has successfully delivered a robust, user-centric platform that promotes effective storage and retrieval of activities. Through diligent research, requirement engineering, system design, implementation, and testing, the project team has created a solution that addresses the needs and challenges of hard copy laboratory logbook in a contemporary context. The system's impact on organizational performance, user satisfaction, and the potential for future

enhancements solidify its value and relevance in the ever-evolving landscape of online record keeping and retrieval.

5.3. LIMITATIONS

While the online laboratory logbook system has been designed and implemented with great care and attention to detail, it is essential to acknowledge certain limitations that may impact its functionality and effectiveness. The following limitations should be considered:

1. Lack of profile Customization features: The developed system may have limitations in terms of customization options. Users may not have extensive control over the system's appearance, layout, or features. This limitation can restrict the system's adaptability to specific branding guidelines.
2. Lack of Profile Image upload feature: Another limitation of the developed system is the absence of profile image upload feature for users. This means that users cannot upload their images.
3. Lack of Integrated Development Environment (IDE): Another limitation of the developed system is the absence of an IDE for student practice. The system does not incorporate an IDE within the system.
4. Lack of integrated version control system: Another limitation of the developed system is the absence of an integrated version control system for student to collaborate within themselves. The system does not incorporate any integrated version control system.
5. Inability to separate or section students under different staffs: Another limitation of the developed system is that student can be assessed by any staffs. Sectioning the student into different divisions will ease and make assessment faster.

Recognizing these limitations is crucial for managing expectations and identifying potential areas for future enhancements. It is important to assess these limitations in the context of the system's overall functionality and evaluate their impact on the institution’s specific needs and requirements. By understanding these limitations, institutions can make informed decisions and explore appropriate strategies to mitigate or address these constraints.

5.4. RECOMMENDATION

Throughout the course of this project, I have successfully developed an online laboratory logbook system that facilitates information storage and retrieval. As we conclude this project, based on the

limitations outlined above I can identify areas where future enhancements and improvements can be made to further optimize the system's functionality and user experience.

Recommendations for Future Enhancements:

1. Implement User Profile customization feature: I recommend integrating a feature for user profile customization. This will enable users to change the looking of their profile to suit their liking.
2. Integration of an Integrated Development Environment (IDE): Another area that required is the integration of built-in Integrated Development Environment within the system.
3. Integration of integrated version control system: This area also is required because it will aid student in helping one another which facilitate knowledge sharing.

In conclusion, the developed system titled online laboratory logbook serves as a valuable tool for storage and retrieval of log of activities. However, there are areas where the system can be further enhanced to address its limitations and meet evolving users' needs. By incorporating version control system, integrated development environment, and profile customization capabilities, the system will become more robust, efficient, and adaptable. These recommendations pave the way for future development, ensuring that the system continues to meet the dynamic demands of the laboratory logbook system in the digital age.

REFERENCES

SHUAIBU ALIYU, A., MUAZU, A., & MUHAMMAD, I. (2022). MITIGATING CHALLENGES OF STUDENT'S INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES) THROUGH INFORMATION COMMUNICATION TECHNOLOGY. *WATARI Multidisciplinary Journal of Science & Technology Education*, *6*(1), 114-121. Retrieved from http://watarijournal.com/index.php/WATARI/article/view/234

M. Barr, S. W. Nabir and D. Somerville, "Online Delivery of Intensive Software Engineering Education during the COVID-19 Pandemic," *2020 IEEE 32nd Conference on Software Engineering Education and Training (CSEE&T)*, Munich, Germany, 2020, pp. 1-6, doi: 10.1109/CSEET49119.2020.9206196

Edwin van Meerkerk (2017). Teacher Logbooks and Professional Development: A Tool for Assessing Transformative Learning Processes. Faculty of Arts, Department of Arts and Culture Studies, Radboud University, PO box 9103, 6500 HD Nijmegen, The Netherlands. Email: e.vanmeerkerk@let.ru.nl

O'Pecko, P. J. (2020). Using ships' logbooks to document the changing natural world. Parks Stewardship Forum, 36(3). http://dx.doi.org/10.5070/P536349842 Retrieved from https://escholarship.org/uc/item/9cc6j1vh

Abdelwahed Elsafi, Yousif Al Awad, (2023). Promoting engagement in online courses: What strategies can we learn from three highly rated MOOCS.

Jessica Lizeth Domínguez Alfaro, Stefanie Gantois, Jonas Blattgerste, Robin De Croon, Katrien Verbert, Thies, and Peter Van Puyvelde (2022). Mobile Augmented Reality Laboratory for Learning Acid–Base Titration.

Lee, J., & Norhamreeza Abdul Hamid. (2022). Development of e-logbook System for Undergraduate Students of the Faculty of Arts and Social Science (FAS), University Tun Abdul Rahman (UTAR). *Applied Information Technology And Computer Science*, *3*(2), 1113–1129. Retrieved from https://publisher.uthm.edu.my/periodicals/index.php/aitcs/article/view/7628

Muhammad Arif Haikal Samed, Rashidah Mokhtar, Norulhidayah Isa, Mazlyda Abd Rahman, Azrina Suhaimi (2022). Designing an Electronic Logbook System for Monitoring Postgraduate Research Students Progress.

Sulistijono Sulistijono, Mahir Pradana and Imanuddin Hasbi (2020). Web-Based Application of High School Laboratory Administration: Case Study at SMA Pasundan 8, Bandung, Indonesia.

K.V. Gertsenberger, A.A. Moshkin, A.I. Chebotov (2019). DEVELOPMENT OF THE ELECTRONIC LOGBOOK FOR THE BM@N EXPERIMENT AT NICA

Holland, S. S., & Bonniwell, J. L., & Carl, J. D. (2018, June), *A Review of Electronic Engineering Logbooks Throughout the Electrical Engineering Curriculum* Paper presented at 2018 ASEE Annual Conference & Exposition , Salt Lake City, Utah. 10.18260/1-2—29720.

Urcelay-Olabarria I., Lazkoz R., Urrestilla J., Leonardo A. and Igartua J. (2017). Jupyter Notebook as the Physics Experimental Laboratory's Logbook - First Approach . In *Proceedings of the 9th International Conference on Computer Supported Education - Volume 1: CSEDU,* ISBN 978-989-758-239-4, pages 458-463. DOI: 10.5220/0006352104580463.

Stephanie Monasky (2016). A Newbie's Guide to Using an Electronic Lab Notebook Part 1: The Basic Lab Notebook. Retrieved from https://axial.acs.org/chemistry-education/newbies-guide-electronic-lab-notebook

Siti Mukaromah, Prisa Marga Kusumantara, Agung Brastama Putra, Arista Pratama(2018). Analysis and Design Logbook Information Systems. Dept. of Information System, Faculty of Computer Science, Universitas Pembangunan Nasional “Veteran” Jawa Timur Surabaya, Indonesia.

Kok Weng Ng, Yun Ching Tan, JianBang Liu & Mei Choo Ang(2023). A Visual Real-Time Mobile E-Logbook System to Capture Design Activities, Decisions, and Ideas for Engineers.

Daniel Thompson (2021). Utilization of the IOS Shortcuts App to Generate a Surgical Logbook Tool: Feasibility Study. MBBS, Department of Vascular Surgery, St Vincent's Hospital Melbourne, 41 Victoria Pde, Fitzroy, 3065, Australia.

CODES OF MAJOR FUNCTIONALITY

```python
def register_view(request):
    if request.method == "POST":
        role = request.POST.get("role")
        form = forms.RegisterForm(request.POST)

        if form.is_valid():
            user = form.save()

            if role:
                group, _ = Group.objects.get_or_create(name=role)
                user.groups.add(group)

            return redirect("account:login-view")

        request.session['form_data'] = form.data
        for key, value in form.errors.items():
            messages.error(request, f"{key}: {value}")
            return redirect("account:register-view")
    return render(request, "account/register.html")
```

Figure B. 1: User Registration method

```python
def login_view(request):
    if request.method == "POST":
        user = auth.authenticate(
            request,
            username=request.POST.get("username"),
            password=request.POST.get("password"),
        )

        if user:
            auth.login(request, user)
            return redirect("landing:index-view")

        messages.error(request, "Invalid credentials")
        return redirect("account:login-view")

    return render(request, "account/login.html")
```

Figure B. 2: User Login method

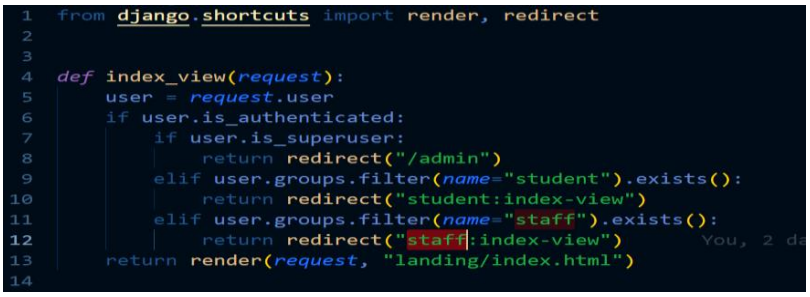
```python
from django.contrib import messages
from . import forms
    You, 2 days ago • added upload file to the log activity creatio
def create_view(request):
    if request.method == "POST":
        form = forms.RecordForm(request.POST, request.FILES)  # Includ
        if form.is_valid():
            instance = form.save(commit=False)  # Don't save the form

            instance.user = request.user
            instance.save()

            messages.success(request, "Log Added Successfully!")
            return redirect("student:index-view")

        messages.error(request, "Failed to save record")
        return redirect("student:create-view")
    else:
        form = forms.RecordForm()  # If the request method is not POST
    return render(request, "student/create.html", {"form": form})
```

Figure B. 3: User Registration method

```python
from . import models, forms
from django.contrib import messages
from django.utils.timezone import now
from django.shortcuts import render, redirect


def index_view(request):
    total = models.Record.objects.filter(user=request.user)

    others = total.exclude(created_at__date=now().date())
    current = total.filter(user=request.user, created_at__date=now().d

    notifications = models.Notification.objects.filter(user=request.us

    context = {"current": current, "others": others, "total": total, '
    return render(request, "student/index.html", context)
```

Figure B. 4: Student Dashboard method

Figure B.5 shows the view of the landing page implementation



```
from django.shortcuts import render, redirect


def index_view(request):
    user = request.user
    if user.is_authenticated:
        if user.is_superuser:
            return redirect("/admin")
        elif user.groups.filter(name="student").exists():
            return redirect("student:index-view")
        elif user.groups.filter(name="staff").exists():
            return redirect("staff:index-view")
    return render(request, "landing/index.html")

```

Figure B. 5: Landing page method

LIST OF ALL TEST CASES

Table D.1: *List of all test cases*

ID	DESCRIPTION	STEPS	INPUT	EXPECTED OUTPUT	ACTUAL OUTPUT	RESULT
TC-U-01	Test user registration method	Write an xUnit tests and run	Valid user details	Success message	Success message	PASS
			Invalid User Details	Error message	Error message	
TC-U-02	Test user login method		Valid username & password	Success message	Success message	PASS
			Invalid username & password or Invalid (username /password)	Error message	Error message	
TC-U-03	Test add new activity method		Title & description input fields	Success message	Success message	PASS
			Empty title and or description input field	Error message	Error message	

TC-U-04	Test activity assessment method		Remark and or valid score	Success message	Success message	PASS
			Remark and or invalid score	Error message	Error message	
TC-I-01	Test user registration	Integrated registration form	Valid user credentials	User registration success message and user will be navigated to login page	"You have successfully registered!"	PASS
			User credentials with an existing username	"User with the same username exist"	"User with the same username exist"	
TC-I-02	Test user login	Click on the Login button in the landing page	Correct username and password	"Login successful" and redirect to respective user dashboard"	"Login successful" and redirect to respective user dashboard"	PASS
			Wrong username and/or password	"Invalid credentials"	"Invalid credentials"	
TC-I-03	Test new activity creation	Click on New Log button	Write the title & description of the log with an optional file attachment and click on create button	Displays success message and return to user dashboard and the new added log will be displayed under today's log	"Successfully added a new log"	PASS
TC-I-04	Test activity assessment	Click on an activity of a student	Write a remark and score for the activity and click on submit	Record saved and return to the staff dashboard	Record saved and return to the staff dashboard	PASS