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**DEVELOPMENT OF AN ONLINE LEARNING MANAGEMENT SYSTEM FOR
HASSAN USMAN KATSINA POLYTECHNIC, KATSINA STATE**

BY

ABUBAKAR ISIYAKU ABDULLAHI

BU/22B/IT/6977

8 SUBMITTED TO THE DEPARTMENT OF COMPUTER SCIENCE, FACULTY OF
COMPUTING AND APPLIED SCIENCES,
BAZE UNIVERSITY, ABUJA.

**IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF
BACHELOR OF SCIENCE DEGREE IN INFORMATION SYSTEMS MANAGEMENT.**

FEBRUARY, 2024

²DECLARATION

This is to certify that this Thesis entitled Online Learning System, which is submitted by Abubakar Isiyaku Abdullahi in partial fulfilment of the requirement for the award of degree for B.Sc. in Information Technology to the Department of Computer Science, Baze University Abuja, Nigeria, comprises of only my original work and due acknowledgement has been made in the text to all other materials used.

Almustapha Ado Farouq
BU/22B/IT/6871

Date

²APPROVED BY

.....
Head of Department,
Department of Computer Science

CERTIFICATION

This is to certify that this Thesis entitled Online Learning System, which is submitted by Abubakar Isiyaku Abdullahi In partial fulfilment of the requirement for the award of degree for B.Sc. in Information Technology to the Department of Computer Science, Baze University Abuja, Nigeria is a record of the candidate's own work carried out by the candidate under my/our supervision. The matter embodied in this thesis is original and has not been submitted for the award of any other degree.

APPROVAL PAGE

The project titled "Online Learning System" submitted by Abubakar Isiyaku Abdullahi bearing registration number BU/22B/IT/6977, has been approved by the examination committee for the award of the Bachelor of Science in Information Technology degree at Baze University, Abuja.

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External Examiner

Date

DEDICATION

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To my family, whose unwavering love and encouragement have been my anchor in the storm of research challenges. Your belief in me has fueled my determination, and I am forever grateful for your presence in my life. You've been my unseen pillars, providing strength when I needed it most.

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To my mentors, whose guidance and expertise have shaped my understanding, challenged my assumptions, and ignited my curiosity. Your patience in answering my questions and your passion for knowledge have left an indelible mark on my academic path. I carry your wisdom with me as I venture into uncharted territories.

To my friends, for their unwavering support, understanding, and occasional distractions. Together, we've celebrated victories and weathered setbacks. Thank you for being my companions on this research journey. Our shared memories are etched in my heart, and I cherish every moment.

And to the countless individuals whose contributions and insights, whether acknowledged or not, have enriched the foundation upon which this research stands. You've shaped my thinking, challenged my assumptions, and broadened my horizons. May this work contribute in some small way to our collective pursuit of knowledge.

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²⁹ I would like to express my sincere gratitude and appreciation for your invaluable support and guidance throughout my research project as my supervisor Mr Usman Abubakar. Your expertise, ¹²patience, and encouragement have been instrumental in shaping my work and enabling me to achieve my goals.

I would also like to extend my heartfelt thanks to the other lecturers who have contributed to my academic journey. Their insightful feedback, constructive criticism, and encouragement have significantly enriched my research.

²⁸ I am truly grateful for the time and effort you all have invested in mentoring me. ²⁴Your dedication to fostering a conducive learning environment has made a lasting impact on my academic growth.

³¹ Thank you once again for your unwavering support. I look forward to continuing our collaboration and learning from your expertise in the future.

ABSTRACT

Online learning plays a pivotal role. My proposed Learning Management System (LMS) aims to implement online course management in Hassan Usman Polytechnic Katsina. Key features include collaborative spaces, learning paths, assessments, and faculty support. By embracing technology, institutions can create an efficient and engaging online learning environment.

INTRODUCTION

1.1 Overview

This chapter provides an introduction and background to the proposed learning management system (LMS) for Hassan Usman Katsina Polytechnic. It discusses the motivation for developing an LMS, states the problems an LMS aims to solve, outlines the aims and objectives, significance and potential risks of the project, and the scope and organization of the rest of the report.

1.2 Background and Motivation

Hassan Usman Katsina Polytechnic has relied on traditional face-to-face teaching models and manual academic administration processes since its establishment in 2006 (HUK website, 2023). Physical noticeboards, Excel sheets, paper forms, and offline records have typically been used for core academic functions.

However, global education sector transformation provides strong motivation for institutions to integrate digital technologies and online platforms like learning management systems (LMS) into their operations and service delivery. According to studies, LMS usage in higher education helps students achieve better academic results (Asamoah, 2019), while also enabling improved tracking, automation and overall efficiencies for administrators and educators (Tammeorg et al. 2021).

Specifically, only an estimated 15% of institutions currently utilize any form of e-learning systems in Nigeria (Awofala et al. 2022). This highlights the significant room for expansion and value realization possible via LMS adoption. Tailoring a platform to address HUK's needs provides an

opportunity to modernize academic processes, improve outcomes and stakeholder experiences, and potentially increase competitive positioning.

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1.3 Statement of the Problem

The current academic systems at Hassan Usman Katsina Polytechnic are predominantly manual and paper-based, leading to several challenges including difficulty accessing distributed learning materials for students; communication gaps and lack of collaboration tools between stakeholders; limited assessment administration, grades tracking and student progress monitoring capabilities; unnecessary administrative workload and repetitive manual processes; and an overall sub-optimal academic experience for all parties. These systemic inefficiencies highlight the need for an integrated digital academic management system to improve resource discoverability and accessibility, support seamless multi-party interactions, enable automation of key workflows, provide data-driven analytics and reports, and ultimately enhance teaching, learning and administration across the polytechnic.

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1.4 Aim and Objectives

The aim of this project is:

To develop an online Learning Management System for Hassan Usman Katsina Polytechnic to improve teaching, learning and academic administration processes.

The objectives include:

1. Automate academic workflows and processes
2. Standardize course structure across the polytechnic
3. Provide a centralized learning portal for students and staff

4. Facilitate instructional resource creation and distribution
5. Implement assessment tools for students performance tracking

19 1.5 Significance of the Project

The development and rollout of a customized learning management system for Hassan Usman Katsina Polytechnic carries profound importance and potential impact on multiple levels - operational, tactical and strategic. By modernizing key academic processes, it can drive step-change improvements in student learning outcomes through enhanced access to resources and assessments tracking. Lecturers and administrators can achieve major productivity gains from automated workflows, saving hours previously spent on manual tasks. Data analytics will generate actionable insights to keep improving overall pedagogical quality. Taken together, these outcomes can markedly strengthen institutional competitiveness in student recruitment and retention, teaching standards, and operational excellence. The project signifies a vital digital transformation milestone for the polytechnic to meet the demands of 21st century teaching and learning excellence.

5 1.6 Project Risks Assessment

Table 1.1 Project Risks Assessment

Risk	Impact	Likelihood	Mitigation Strategy
Weak internet infrastructure	High	Medium	Early capacity planning for required bandwidth and devices
Resistance to change	Medium	High	Extensive training and engagement with stakeholders

Scope creep	High	Medium	Controlled scope management
Tight timelines	Medium	High	Iterative development sprints
Integration challenges	High	Low	API approach for interoperability

1.7 Scope and Organization

34 The scope of this project encompasses the analysis, design, development, and implementation of a custom web-based learning management system to support key academic processes for students, 68 lecturers, and administrators at Hassan Usman Katsina Polytechnic. The remaining report documentation is structured across the following core chapters - Chapter 2 expands on requirements gathering and specifications; Chapter 3 details the proposed system architecture and technical design; Chapter 4 elaborates the implementation plan including technologies and phases; Finally Chapter 5 concludes with next steps, recommendations for future enhancements, and key lessons learned from the project. The phased approach allows for an agile methodology focused on iterative delivery to serve institutional stakeholders needs.

13 1.8 Definition of Operational Terms

Learning Management System (LMS) - A software application for administration, documentation, tracking, reporting and delivery of educational courses or training programs.

Academic Workflows - Standardized processes and sequencing of tasks supporting key functions like admissions, scheduling, assessments, and certification.

Automation - Use of technology to complete recurrent tasks previously requiring manual effort to improve efficiency.

Academic Analytics - Data analysis on students activities and performance indicators to provide insights and predict outcomes.

Stakeholders - Key interest groups like students, lecturers, administrators who will directly interact with the system to meet their needs.

Customization - Process of adapting an existing system to match the specific requirements of an organization.

17 CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a review of existing literature related to the concepts, applications, and best practices for learning management systems (LMS) in higher education institutions. It discusses the historical evolution of LMS, summarizes key research findings on the usage and effectiveness of these platforms, and identifies opportunities for customization to meet institutional strategic priorities. The literature review informs the analysis, design and implementation recommendations made in subsequent sections of the project report.

2.2 Historical Overview

Learning management systems originated in the 1990s as educational institutions began experimenting with using web technologies and online platforms to complement traditional classroom teaching (Ellis, 2009). Early systems were focused more on course content delivery but over the last two decades, LMS platforms have evolved into comprehensive solutions encompassing course administration, communication tools, assignment hand-in, plagiarism checking, assessments management, analytics dashboards, and integration capabilities with third-party academic applications (Watson & Watson, 2007).

Modern cloud-based LMS systems are highly customizable to institutional needs and mobile-compatible to match access trends. Leading proprietary solutions include Blackboard, Canvas, Moodle, Schoology, whereas open-source options like Moodle and Canvas are also popular. Recent developments use machine learning and analytics to provide adaptive learning experiences personalized to each student strengths and weaknesses to improve outcomes.

2.3 Related Works

Multiple studies on LMS implementations validate their advantages and effectiveness for students, educators and academic institutions. Asamoah (2019) found significant improvements in student grades, satisfaction, and perceived productivity with LMS use compared to traditional methods. Instructors reported advantages like easier assignment management, better reproductive use of content, and tracking student progress. Damşa et al. (2021) measured time savings for educators from automatic grading workflows, plagiarism checking, and reuse of course templates in subsequent terms.

However, challenges like technical issues, training overheads, integration complexity and change resistance from users are also highlighted for consideration during platform selection and rollout planning (Aldiab et al. 2022). Hence understanding key user requirements and customization opportunities is an important success factor (Tammeorg et al. 2021) as discussed further in the next chapter.

Asamoah (2019) found that LMS usage led to significant improvements in student performance, satisfaction, and perceived productivity compared to traditional teaching methods. Instructors reported advantages like easier assignment creation/distribution, reusable content, remote learning support, and data-driven insights to adjust teaching strategies. Ricoy et al. (2022) surveyed over 700 students and found over 87% felt an LMS was useful for improving access to materials, communication and needed academic resources.

On the institutional side, administrators gained automation for key processes like enrollment, assessments, and certification. This enabled improved quality control, auditing and reduced

manual workload (Baloyi, 2014). Costa et al. (2012) estimated potential productivity gains to recoup LMS investment in under 3 years in their cost-benefit model case study.

However, studies have also examined implementation challenges experienced. Poor interface design and technical glitches were top complaints impacting user adoption and satisfaction (Aldiab et al. 2022). Ssekakubo et al. (2013) identified resistance to change, lack of institutional support and perceptual barriers regarding eLearning effectiveness amongst factors deterring LMS penetration. Staff training costs are also highlighted, but faculty onboarding processes involving collaborative design sprints can offset these concerns and drive engagement (Damşa et al. 2021).

Key recommendations include extensive planning for integration capabilities, accessibility needs and core use cases prioritization based on user segments (Tammeorg et al. 2021). Iterative rollouts allow course corrections after feedback cycles. Understanding unique institutional requirements is vital for long-term LMS sustainability and leveraging possibilities beyond just digitizing traditional models (Rienties⁵³ et al. 2022).

Al-Busaidi and Al-Shihi (2010) found that system quality factors like usability, reliability, responsiveness and flexibility were top drivers for instructors. Features allowing content reuse across courses and ease of grading assessments also rated highly. For students, information quality dimensions like relevance, understandability, and ability to meet academic goals were critical. Standard LMS platforms may need customization and integrations to tailor to these expectations.

User engagement from early design stages can reveal unique preferences and process workflows to inform system requirements (Islam et al. 2022). Ongoing co-creation also enables buy-in and change management. Training and onboarding that aligns LMS features to actual teaching or learning needs cement adoption.

Assessing technological readiness and organizational culture aspects also prevents barriers. Leadership direction and resource allocation to guide transition while accommodating initial learning curves encourage persistence in usage (Aldiab et al. 2021). Incremental system rollouts allow familiarity before adding complexity.

Al-Busaidi (2012) found functionality, reliability and usability were critical expectations regardless of platform type. Open-source systems like Moodle were perceived as more customizable to institutional needs and integration ready with existing IT infrastructure which aided acceptance. But some proprietary systems scored higher on user-friendliness and stability.

⁶¹ Klobas and McGill (2010) highlight that the effectiveness of either LMS model depends not just on features but the quality of integration support, change management and user training provided during implementation. Open-source platforms benefited from wider community developer ecosystems enabling agile enhancements but relied more on inhouse technical skills. Proprietary LMS vendors offered full IT support services but at a recurring licensing cost premium. The complementary capabilities needed for sustainable deployment must be evaluated.

Organizations also displayed preference biases - smaller institutions leaned towards open-source options for tighter budget while larger universities gravitated to market leading proprietary LMS believing the stability and support outweighed upfront costs (Weaver et al., 2008). But hybrid models adopting the best of both platforms are an emerging option. The optimal LMS solution is contingent on multiple relative factors.

Artificial intelligence and machine learning are enabling more responsive personalization of learning experiences tailored to individual pace and need - adaptive content, smart testing recommendations, predictive analytics to pre-empt academic issues etc (Shahiri & Husain, 2021).

Augmented/virtual reality solutions are being integrated for more engaging interactive learning modules spanning diverse topics and formats.

With more affordable devices, cloud infrastructure and 5G, remote live streaming of specialized teaching sessions can connect external expert instructors or far-flung student groups into integrated Omni-channel learning environments (Chinese, 2021). Blockchain platforms also facilitate building tamper-proof competency records and micro-credentials critical for life-long learning objectives (Ocheja et al. 2022).

However these emerging technologies layer on additional adoption challenges regarding skills, support and service management relative to institutional readiness (Raza, 2022). But the innovation opportunities and digitally enriched multi-modal academic experiences possible make the modernization imperative worth pursuing (Tlili et al. 2022). Analyzing both established and emerging technologies can inform strategic LMS roadmapping priorities.

Abdellatief et al. (2022) surveyed over 300 university students to identify most preferred LMS interface features - simplicity, logical information flow, visually appealing elements, consistency across device access modes. Excessive features caused confusion. Personalization to display most relevant tools and content also rated highly.

Ease of navigation, clear labeling, and common convention based layouts reduced cognitive load. Instant feedback and status visibility on submitted actions provided assurance. Summarized content with expand/collapse helped focus attention. Automated recommendations and notifications kept users in workflow. Offline access enabled continuity for limited connectivity.

Beyond interface design, a positive first-time user experience through self-service tutorials, responsive in-app support, and ability to test the platform risk-free cemented ongoing engagement.

Continuous user testing cycles enable rapid refinements towards optimal design thinking (Martin et al. 2022). Prioritizing use cases aligning high value to users versus technical complexity guides system evolution.

Islam et al. (2021) developed an integrated model emphasizing "soft issues" like commitment building, training and incentives for user buy-in as equal enablers of LMS success alongside technical robustness. Leadership involvement in articulating strategic vision linked to pedagogical and operational improvements from the platform cemented persistence in usage despite inevitable initial adoption pains.

Ongoing participative decision making also enables course corrections responding to emergent needs. Tammeorg et al. (2021) concludes extensive early consultation and collaborative design of academic processes and system requirements minimizes disruptiveness during implementation. Proactively addressing accessibility barriers and attitudes preventing technology embracement through this engagement reduces resistance.

Post-implementation support services to resolve troubleshooting issues in a timely manner also improves learner satisfaction and system stickiness (Aldiab et al. 2021). Allocating dedicated personnel as campus advocates guiding the transition is considered impactful. Sustained stakeholder involvement is thus essential before, during and after LMS deployments.

2.4 Comparative Analysis

65 Table 2.1 Comparative Analysis of the Related Works

Study	Methods/Approach	Strengths	Weaknesses
-------	------------------	-----------	------------

Asamoah (2019)	Quantitative survey and data analysis	<ul style="list-style-type: none"> - Significant improvements in student grades, satisfaction, and productivity - Easier assignment management and content reuse - Data-driven insights for teaching adjustments 	<ul style="list-style-type: none"> - Technical issues and training overheads - Resistance to change from users
Damşa et al. (2021)	Quantitative analysis and case study	<ul style="list-style-type: none"> - Time savings for educators from automatic grading and course template reuse - Improved quality control and reduced manual workload for administrators 	<ul style="list-style-type: none"> - Technical issues and training overheads - Resistance to change from users
Ricoy et al. (2022)	Survey and qualitative analysis	<ul style="list-style-type: none"> - Improved access to materials and communication - Positive impact on student satisfaction 	<ul style="list-style-type: none"> - Poor interface design and technical glitches - Resistance to change and lack of institutional support

		- Useful for accessing academic resources	
Baloyi (2014)	Case study and cost-benefit analysis	<ul style="list-style-type: none"> - Automation of key processes and improved quality control - Reduced manual workload for administrators - Potential productivity gains for institutions 	<ul style="list-style-type: none"> - Lack of institutional support and resistance to change - Staff training costs
Costa et al. (2012)	Cost-benefit analysis and case study	<ul style="list-style-type: none"> - Potential productivity gains to recoup LMS investment - Improved quality control and auditing - Reduced manual workload for administrators 	<ul style="list-style-type: none"> - Lack of institutional support and resistance to change - Staff training costs
Ssekakubo et al. (2013)	Survey and qualitative analysis	- Identified factors deterring LMS penetration	- Resistance to change and lack of institutional support

		- Perceptual barriers regarding eLearning effectiveness	- Perceived lack of effectiveness of eLearning
Al-Busaidi and Al-Shihi (2010)	Survey and qualitative analysis	- Identified key system quality factors for instructors and students - Content reuse and ease of grading assessments	- Lack of institutional support and resistance to change - Poor interface design
Rienties et al. (2022)	Literature review and qualitative analysis	- Emphasizes the importance of understanding unique institutional requirements - Long-term sustainability and leveraging possibilities beyond traditional models	- Lack of customization and focus on digitizing traditional models - Limited implementation details

2.5 Summary

This chapter provides a literature review of learning management systems (LMS) in higher education. It discusses the historical evolution of LMS, their key features and functionalities, and their effectiveness in improving student outcomes and administrative processes. The chapter also highlights the advantages and challenges associated with LMS implementation, including customization opportunities and the importance of understanding user requirements.

REQUIREMENTS ANALYSIS AND DESIGN

3.1 Overview

This chapter focuses on gathering and analyzing requirements, as well as formulating the system design for the proposed online Learning Management System (LMS) tailored for Hassan Usman Katsina Polytechnic (HUKPOLY). Through consultations with key institutional stakeholders, comprehensive functional and non-functional requirements have been captured. To depict the analysis and proposed system design, use case diagrams, workflow diagrams, data models and interface prototypes have been developed.

3.2 Methodology

The main software development approach selected is the iterative and incremental model allowing collaborative design sprints. This provides flexibility to continuously gather feedback from students, instructors and administrators on prioritized features and make adjustments based on real institutional usage patterns. The process involves modular software builds with the most critical academic workflows and components first. Additional functionality can be added in phased releases over multiple development cycles.

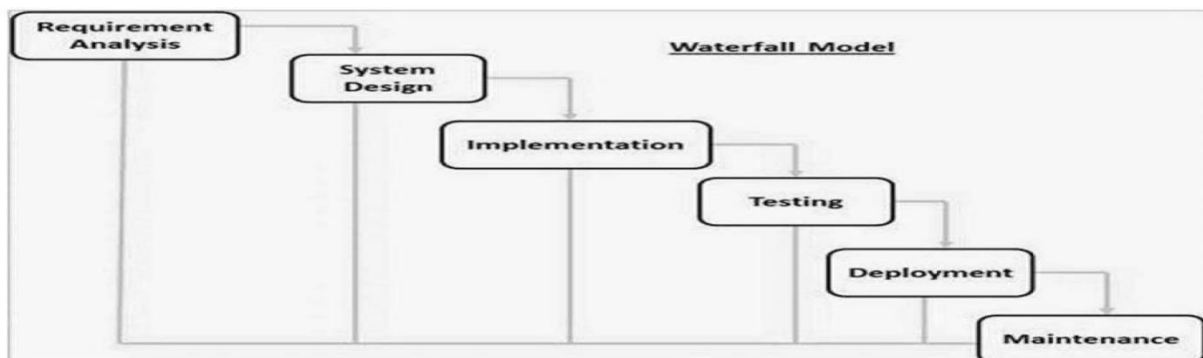


Figure 3.1 Waterfall Model (Wikipedia, 2013)

3.3 Tools and Technologies

The LMS will utilize a MERN (56 MongoDB, Express.js, ReactJS, Node.js) technology stack for building an accessible cloud-hosted web application. Responsive mobile-friendly interfaces will be implemented through ReactJS. MongoDB provides schema-flexible document storage. Machine learning APIs from TensorFlow and Azure Cognitive Services will enable intelligent functionality over time e.g. plagiarism checking.

3.4 Ethical Considerations

Key ethical aspects considered include:

1. Data privacy, security and transparent policies
2. Accessibility and inclusion requirements
3. Fairness, accountability in algorithmic recommender systems
4. Validity, integrity checks in automated grading/assessments
5. Ethical use of analytics data to improve student experiences

Appropriate technical and policy controls will be instituted to address these.

36 3.5 Requirements Analysis

3.5.1 Functional Requirements

Table 3.1 Functional Requirements

ID	User Segment	Requirement	Description	Priority

FR1	Student	View course materials	Ability to view lecture slides, notes, tutorial videos, reading links and other learning content for enrolled courses	High
FR2	Student	Attempt assessments	Take quizzes, assignments, exams and view scored results	High
FR3	Student	Track academic progress	View personal performance dashboards showing test scores, assignment grades, standing based on course expectations	High
FR4	Student	Participate in forums	Engage in discussions by posting questions, responses and share resources with classmates under each course	Medium
FR5	Instructor	Author course content	Create and upload learning materials like documents, slides, videos, web links for each course	High
FR6	Instructor	Assess students	Compose assessment questions, hosted timed exams, create assign deliverables, allocate grades/marks	High
FR7	Instructor	Student tracking	Monitor key engagement and performance metrics at individual/cohort level	Medium
FR8	Administrator	Student enrollment	Digitize registration details, manage program allotments and class allocations	High

FR9	Administrator	Access control	Create and manage user accounts, privileges and system roles	High
FR10	Administrator	Institutional reporting	Leverage analytics dashboard spanning multiple courses/programs for insights	Medium

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3.5.2 Non-Functional Requirements

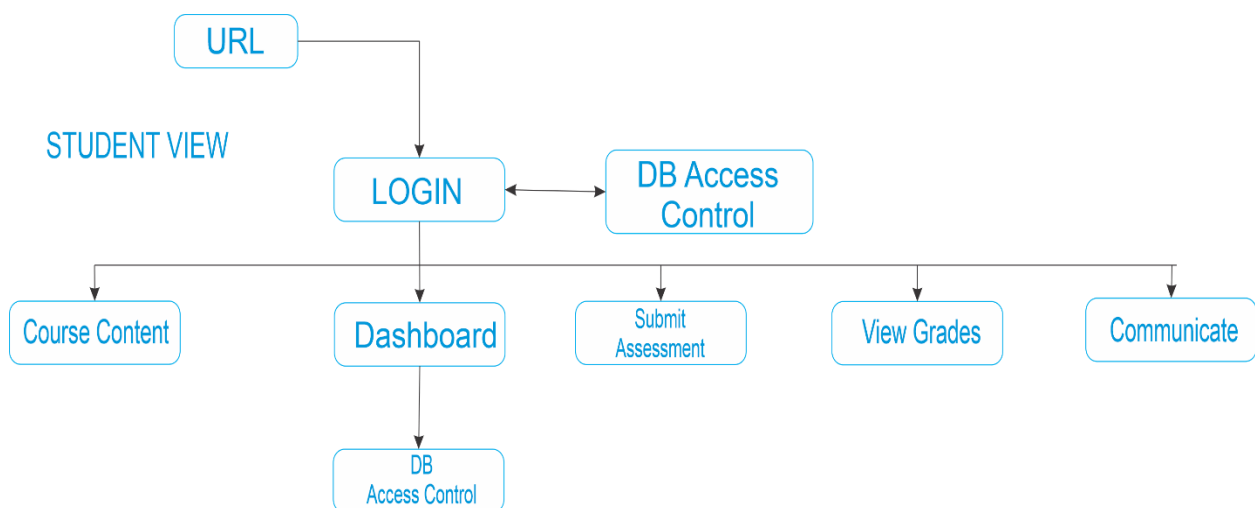
Table 3.2 Non-Functional Requirements

Category	Requirement	Description	Priority
Usability	Intuitive interface	Simple, consistent and easy-to-use interface across student, instructor and admin modules	High
Usability	Responsiveness	Uniform experience across desktop and mobile devices with auto-adjusted interfaces	Medium
Performance	Response time	Pages and submissions processing should occur in under 5 seconds for 98% of transactions	High
Availability	Uptime	Platform available 24x7 with minimum 99% uptime	High
Scalability	Concurrent users	System able to handle 500 concurrent logged in users with no degradation in performance	Medium
Scalability	Data capacity	Database and object storage scaled to handle volumes from 5000+ students	Medium

Security	Authentication	Validate user identity through passwords and MFA before granting system access	High
Security	Data encryption	Encrypt stored pupil information and transmitted content using AES 256-bit encryption	High
Security	Access control	Granular access policies on functionality exposure based on user role	Medium
Standards	Interoperability	Support for open API integration with complementary academic systems	Low
Standards	41 Accessibility compliance	Web Content Accessibility Guidelines (WCAG) 2.1 level AA standards adherence	Medium

3.6 System Models and Diagrams

3.6.1 Application Architecture



20 Figure 3.2 Application Architecture Diagram (Student)

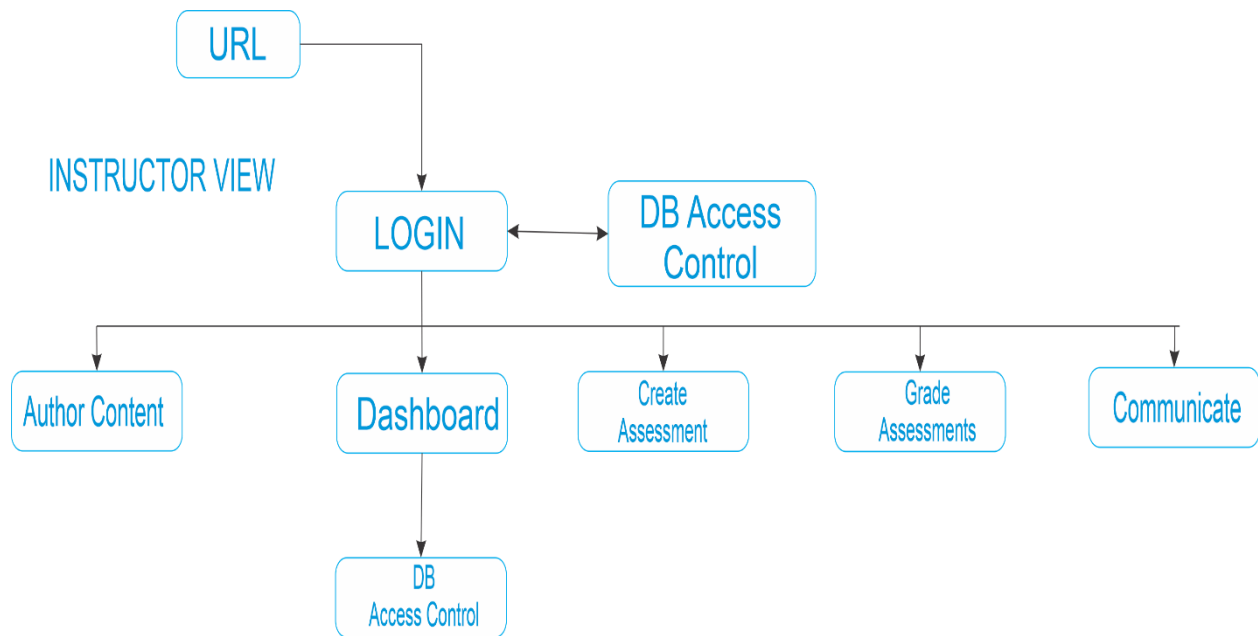


Figure 3.3 Application Architecture Diagram (Instructor)

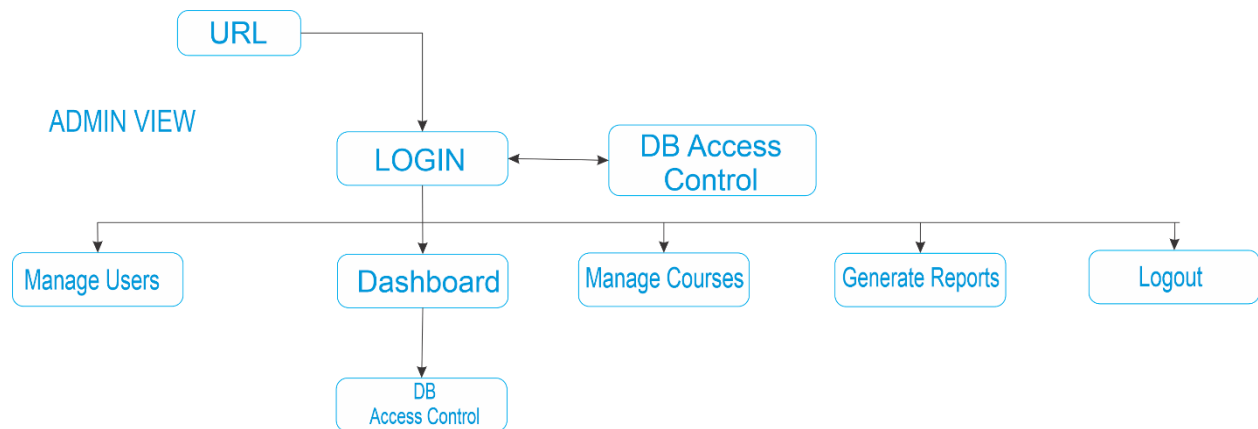


Figure 3.4 Application Architecture Diagram (Admin)

10 3.6.2 Use Case Diagram

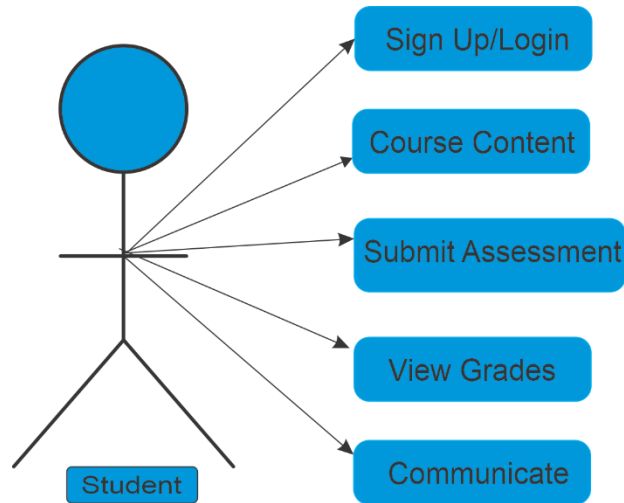


Figure 3.5 Use Case Diagram (Student)

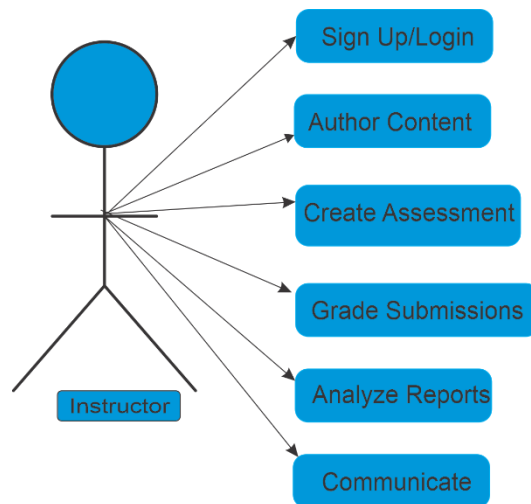


Figure 3.6 Use Case Diagram (Instructor)

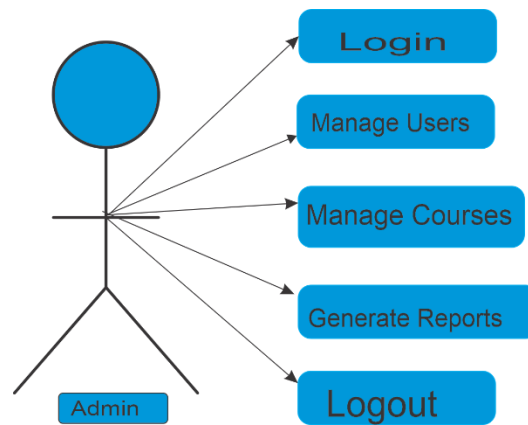


Figure 3.7 Use Case Diagram (Admin)

3.6.3 Entity Relationship Diagram

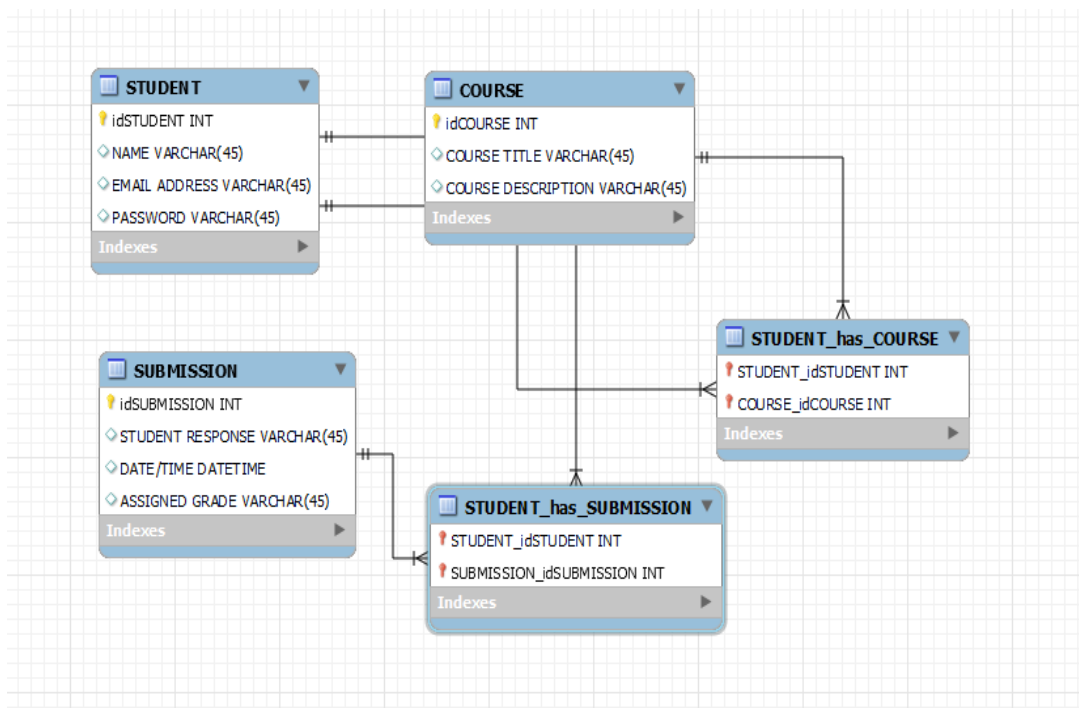


Figure 3.8 Entity Relationship Diagram

30 3.6.4 Activity Diagram

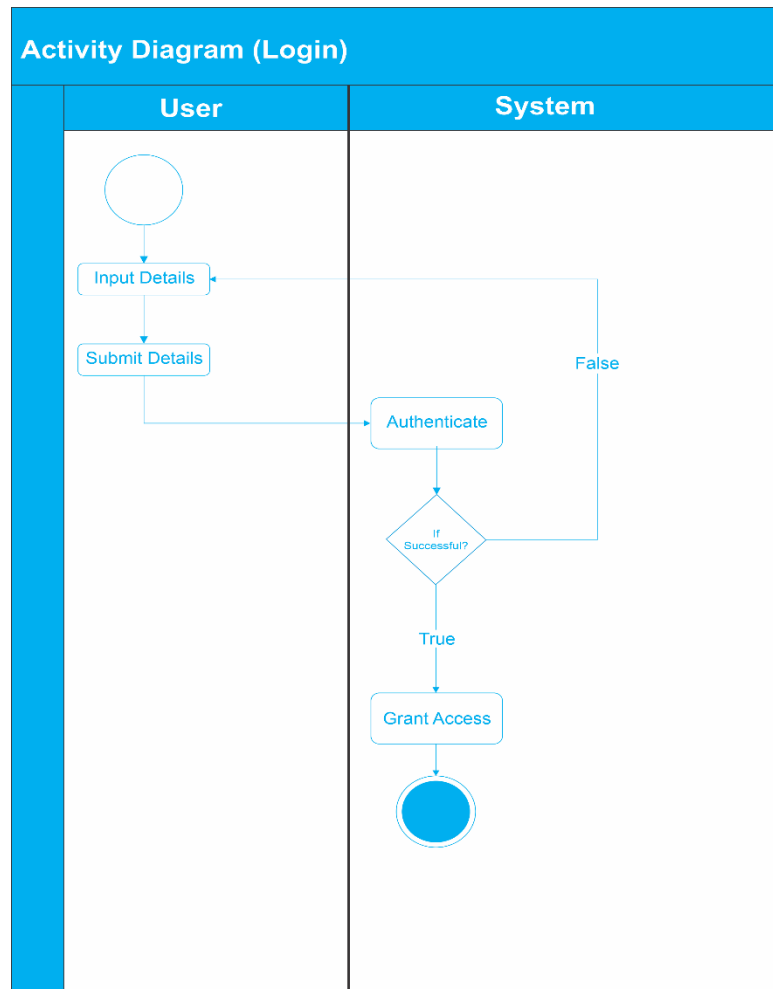


Figure 3.9 Activity Diagram-Login

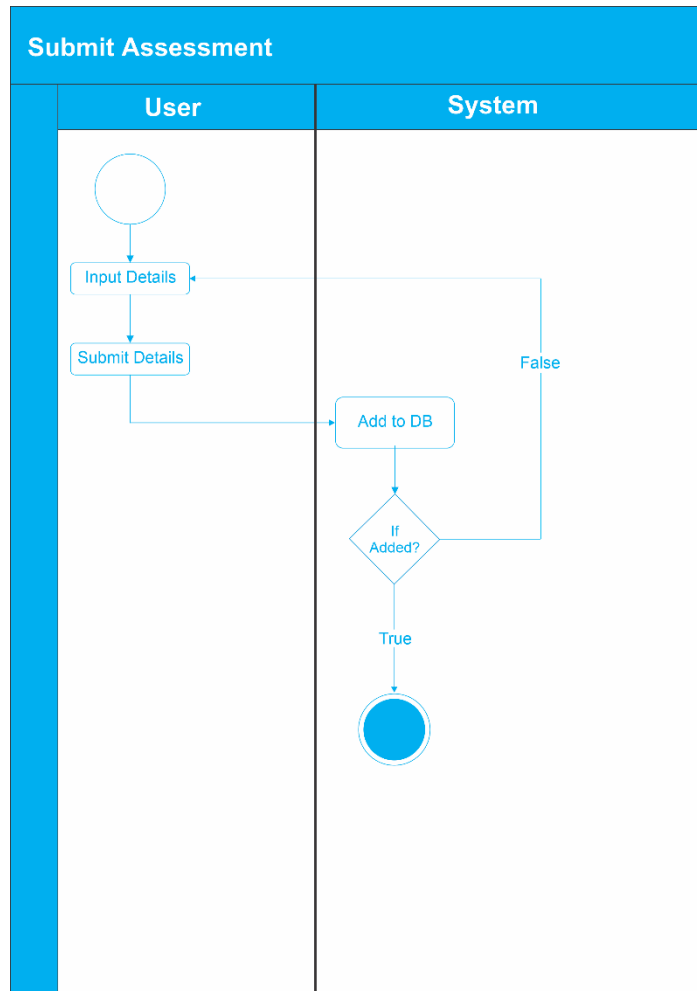


Figure 3.10 Activity Diagram-Submit Assessment

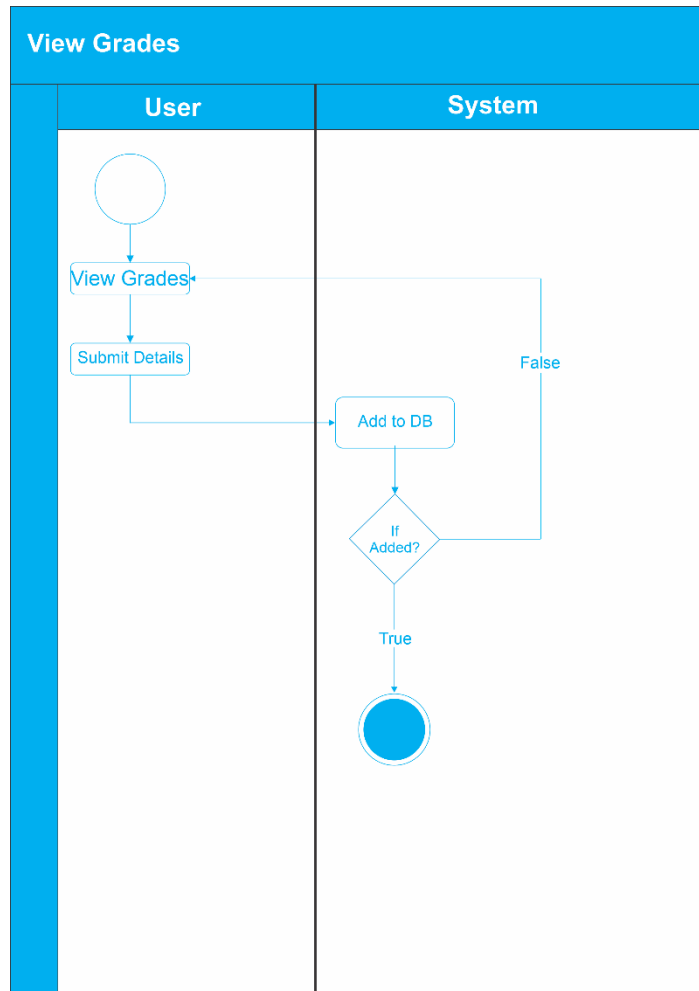
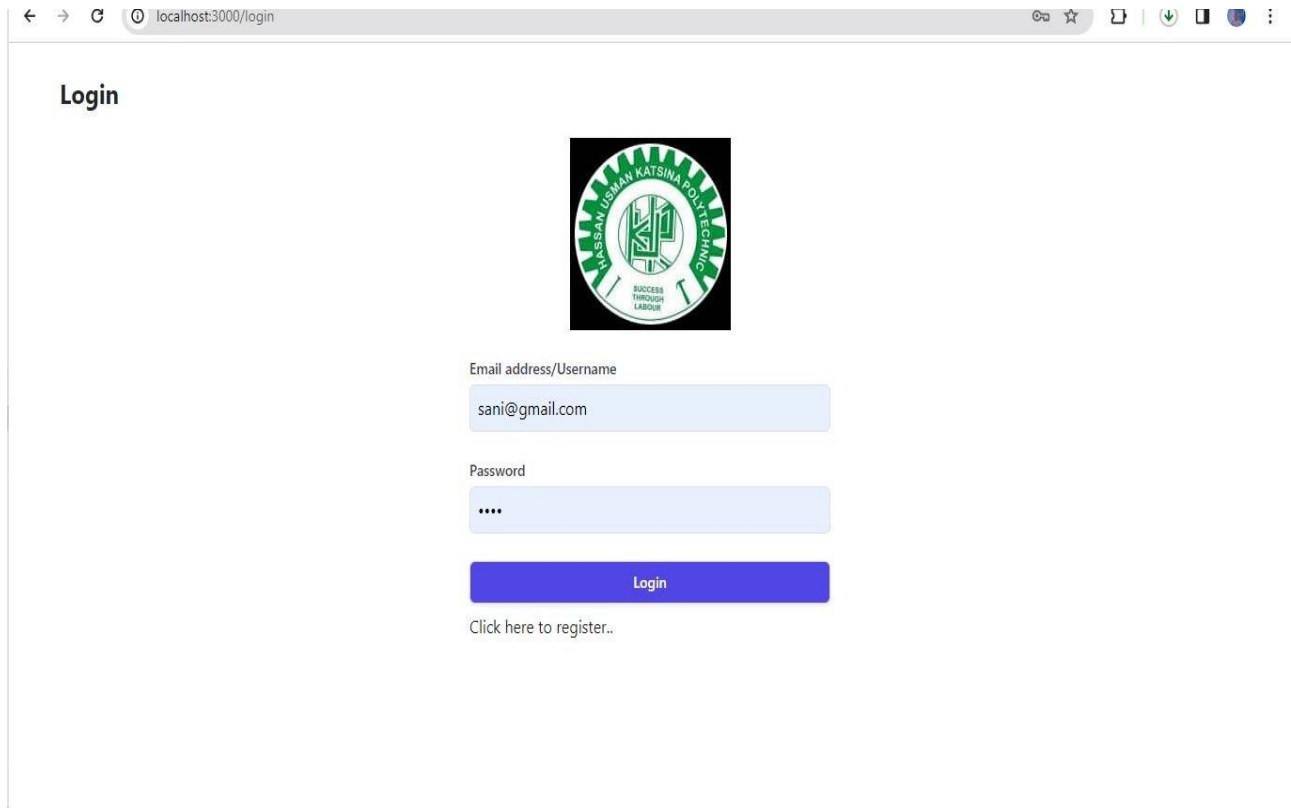


Figure 3.11 Activity Diagram- View Grades

3.9 User Interface Design



The screenshot shows a web browser window with the address bar displaying 'localhost:3000/login'. The page content includes a title 'Login' in the top left. In the center is the logo of KASSAN USMAN KATSINA POLYTECHNIC, which is a circular emblem with a green border and a white center containing a stylized 'K' and 'P'. Below the logo, there are two input fields: 'Email address/Username' with the text 'sani@gmail.com' and 'Password' with four dots. A blue button labeled 'Login' is positioned below the password field. At the bottom, there is a link that says 'Click here to register..'. The browser's address bar and various icons are visible at the top of the window.

Figure 3.12 Login

The login process begins with the user accessing the login page of the Learning Management System. Figure 3.12 illustrates the login interface where the user enters their credentials, including a username and password. After entering the credentials, the user clicks the "Login" button. The system then verifies the provided credentials against the stored user data in the database. If the credentials are valid, the user is granted access to the system and proceeds to the main dashboard. However, if the credentials are invalid, an error message is displayed to indicate that the login attempt has failed.

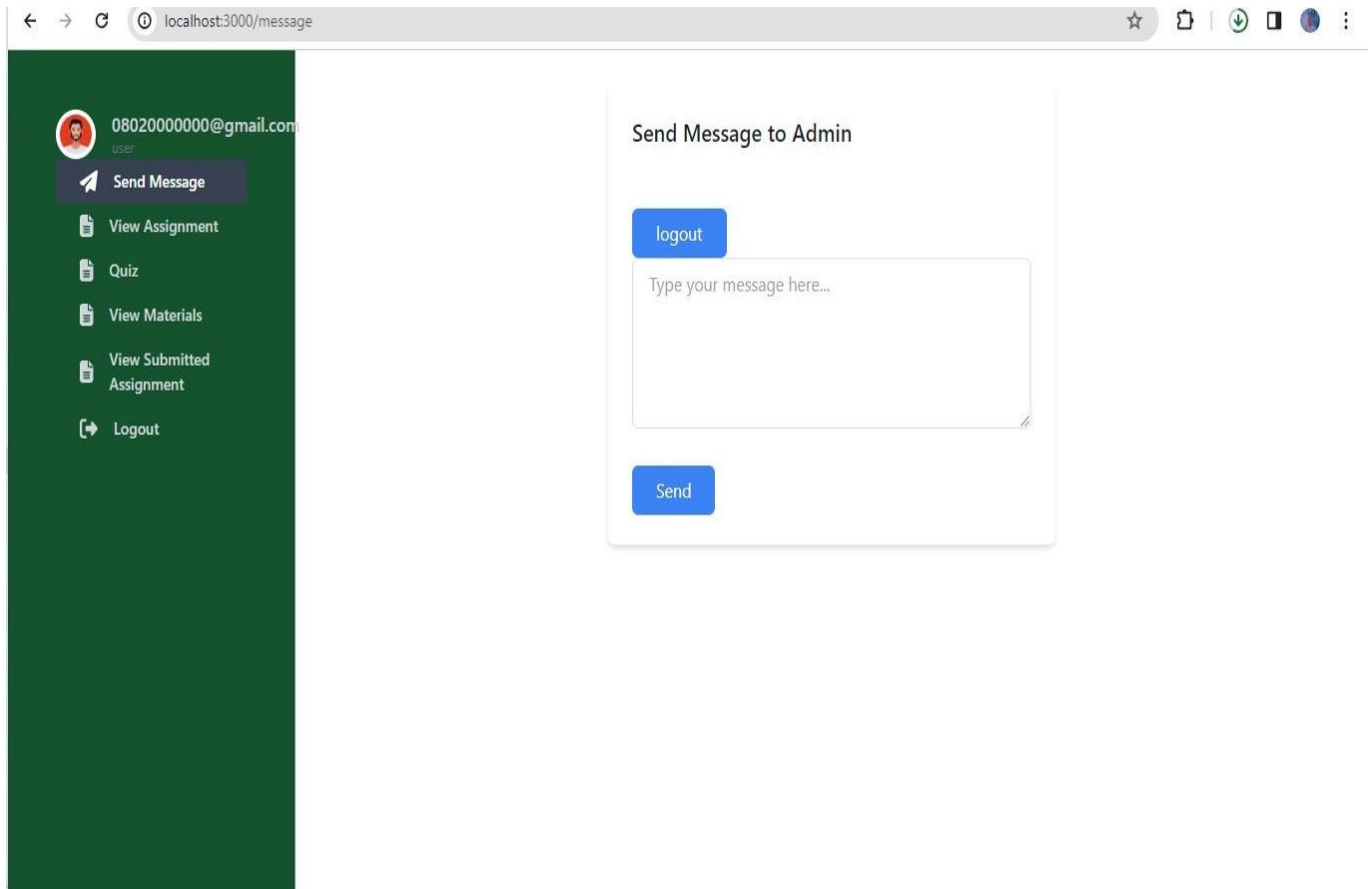


Figure 3.13 Send Message

Once logged in, the user can navigate to the "Messages" section to send a message. Figure 3.13 depicts the interface where the user can compose and send a message. The user enters the recipient's details, such as the username or email address, in the "To" field. The user writes the message content in the designated text area. After composing the message, the user clicks the "Send" button. The system sends the message to the recipient and updates the message notification for both the sender and recipient.

localhost:3000/add_lecturer

Sadik
admin

Dashboard

Add Lecturer

View All Lecturers

View All Students

View Courses

View Messages

Logout

Lecturer Name

Lecturer Course

Select Expertise

Lecturer Name Department

Select a department

Contact

Email

Add Lecturer Name

Figure 3.14 Add Lecturer (Admin)

An admin user can select the "Add Lecturer" option in the main dashboard to add a new lecturer. Figure 3.14 displays the interface where an admin can input the relevant details of the new lecturer, such as name, email, and contact information. After providing the details, the admin clicks the "Add" button. The system adds the new lecturer to the system and assigns appropriate permissions.

localhost:3000/create_material

08030000000@gmail.com
instructor

- Dashboard
- Create Assignment
- View Assignment
- View Materials
- Add Material
- View Submitted Assignment
- Logout

Upload Course Material

Title

Description

Student Department

Select a department

Course Material (PDF, Docx, etc.)

Choose File No file chosen

Upload

Figure 3.15 Add Material (Instructor)

The instructor can select the "Add Material" option in the main dashboard to add course materials. Figure 3.15 displays the interface where an instructor can add material details, such as the title, description, and associated course. The instructor can upload files, such as lecture slides, handouts, or reference materials. After providing the details and uploading the files, the instructor clicks the "Add" button. The system saves the material and makes it accessible to the students.

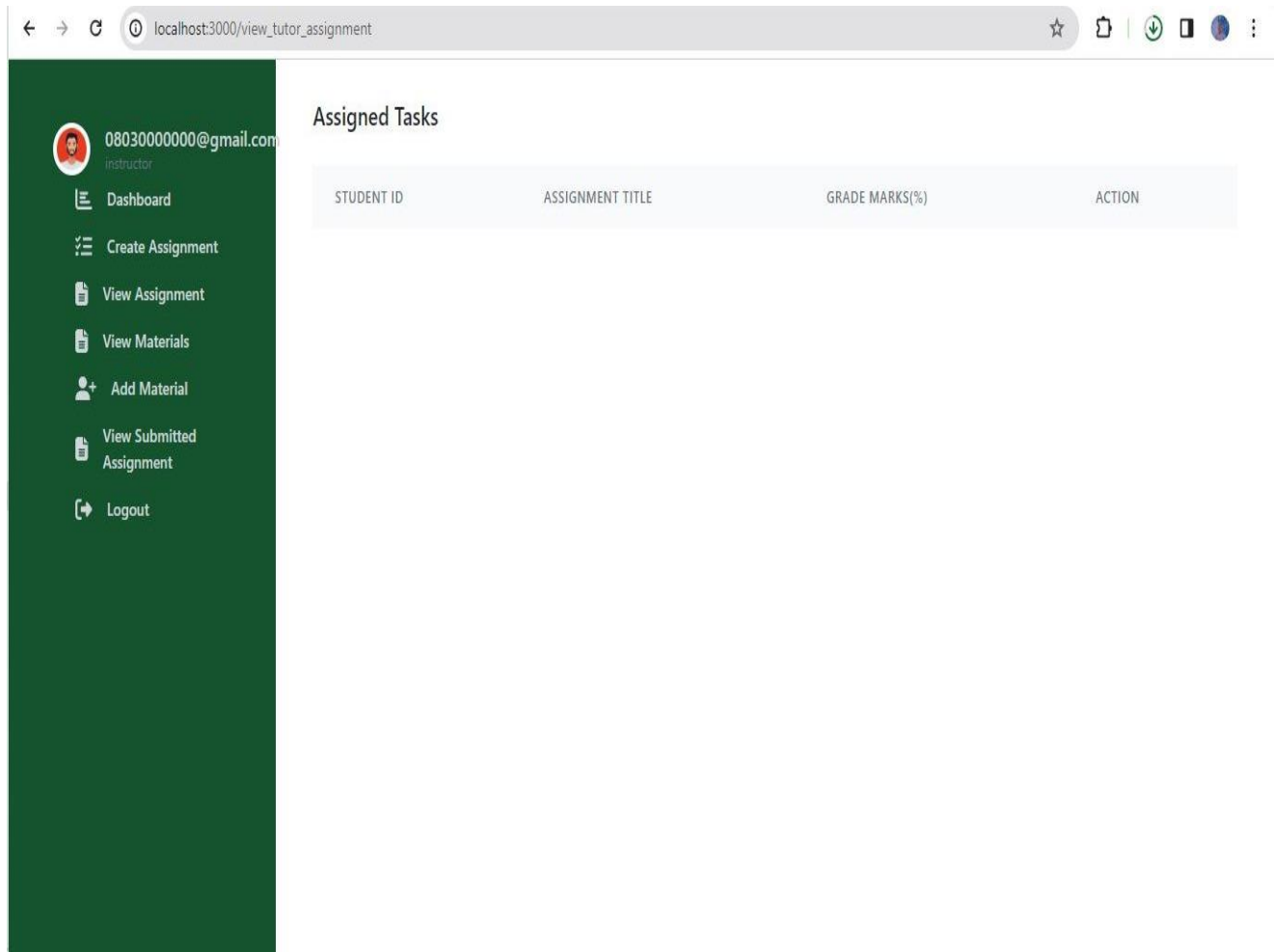


Figure 3.16 View Assignment (Instructor)

To view assignments, ⁹ the instructor can select the "View Assignment" option in the main dashboard. Figure 3.16 illustrates the interface where an instructor can see a list of ⁵⁸ assignments with details such as the title, due date, and number of submissions. By clicking on a specific assignment, the instructor can view the submissions and evaluate them as necessary.

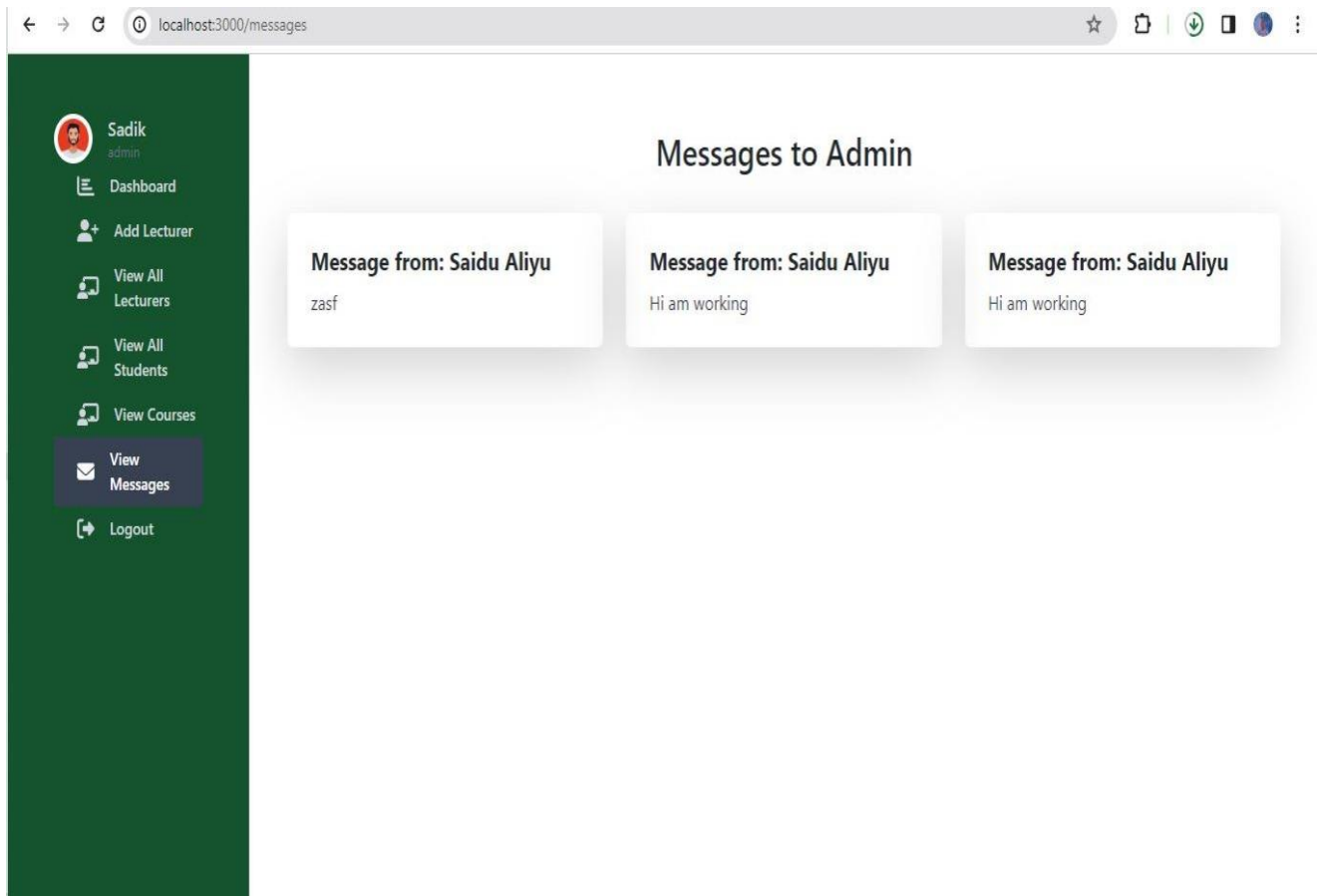


Figure 3.17 View Messages

62 In the main dashboard of the Learning Management System, the user can select the "Messages" option. Figure 3.17 illustrates the interface where a user can view received messages. The interface displays a list of received messages, organized by sender, subject, and date. The user can quickly scan through the list to identify the messages of interest. By clicking on a specific message, the user can access its content and read the message in detail. The interface may also provide options to reply to the message or perform other actions, such as marking the message as read or deleting it. Users can navigate between different messages using navigation buttons or pagination if there are multiple pages of messages. This allows users to efficiently manage their messages and stay updated with important communications within the Learning Management System.

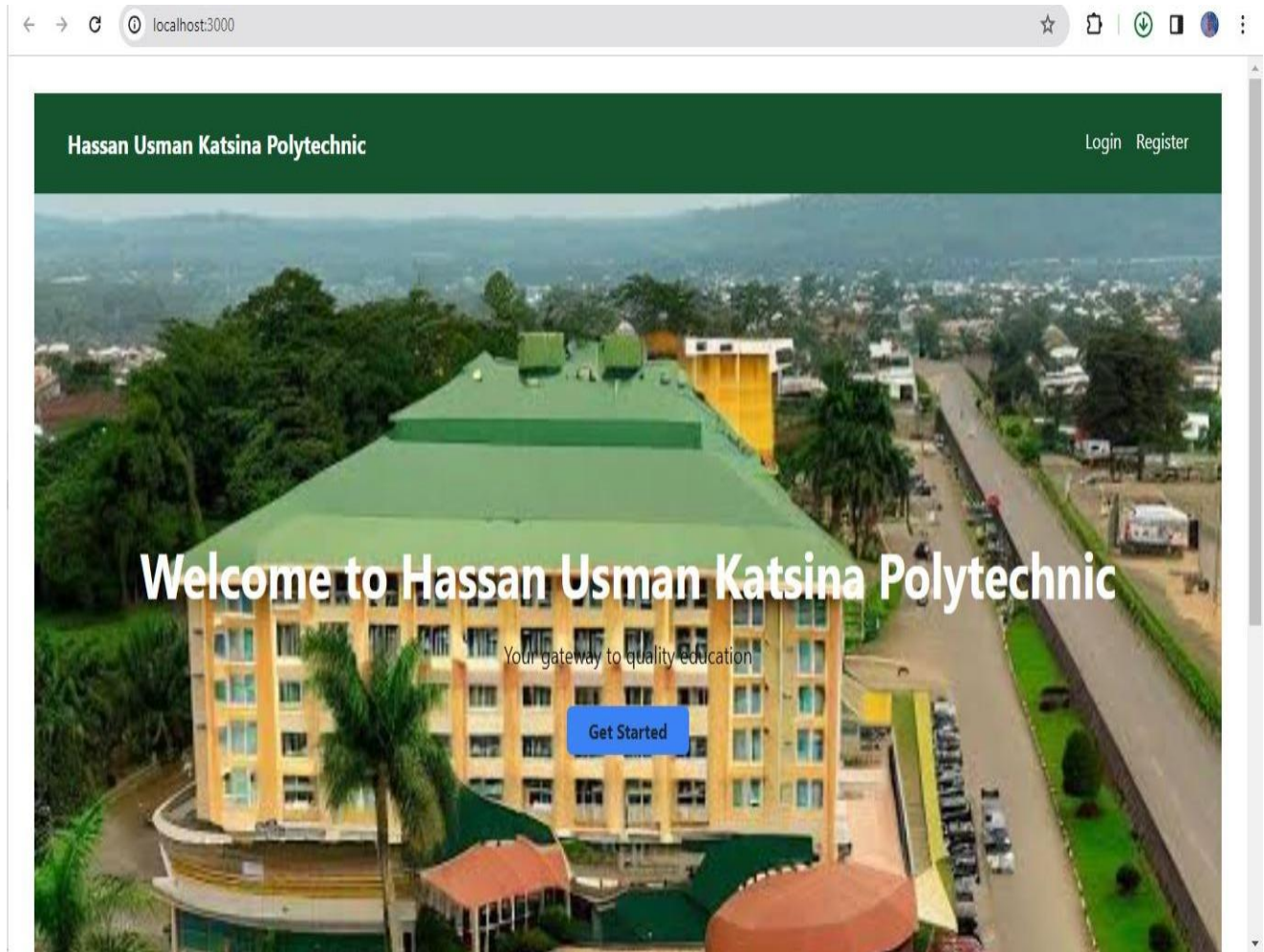


Figure 3.18 Home Page

When users log in to the Learning Management System, they are directed to the home page or main dashboard. The home page serves as the central hub where users can access various features and functionalities of the LMS. Figure 3.18 illustrates a hypothetical home page interface for the LMS. The home page provides an overview of important information and activities related to the user's courses and interactions within the system. It may include components such as a personalized welcome message, upcoming deadlines, notifications, course announcements, and a navigation menu.

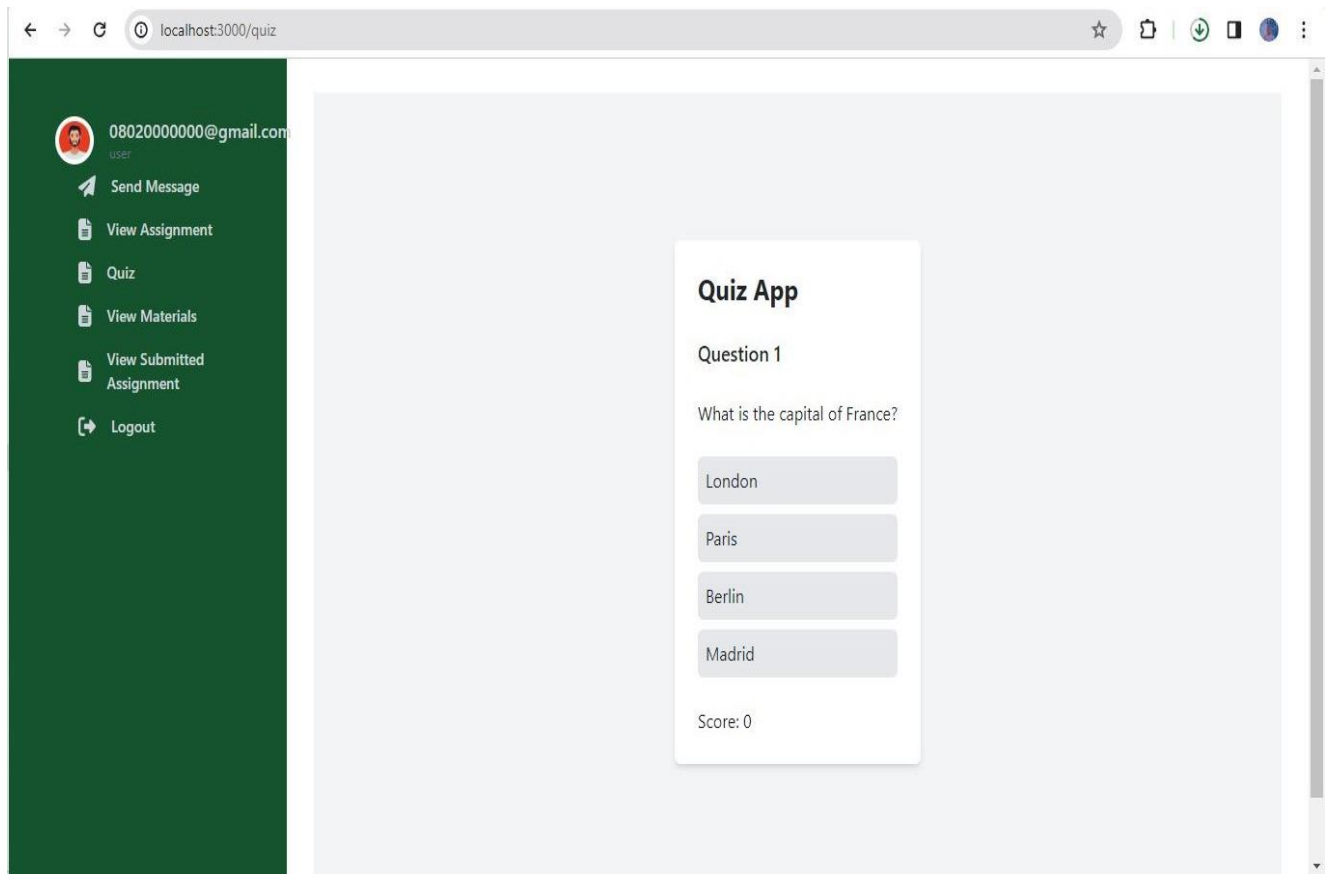


Figure 3.20 Quiz

To take a quiz in the Learning Management System, the user can navigate to the "Quizzes" section, which may be accessible through the main dashboard or a dedicated menu option. Figure 3.20 illustrates the interface where users can access quizzes. The interface displays a list of available quizzes, organized by course or topic. The user can select a specific quiz from the list by clicking on its title. Upon entering the quiz, the user is presented with the quiz questions and answer options. The user can read the questions carefully and select the appropriate answers by clicking on the corresponding checkboxes, radio buttons, or dropdown menus, depending on the question format. The interface may also include a timer to track the remaining time for completing the quiz. After answering all the questions, the user can submit the quiz by clicking the "Submit" or "Finish" button. The system then evaluates the user's responses, calculates the score, and provides feedback on the results, which may include the total score, individual question scores, and correct answers.

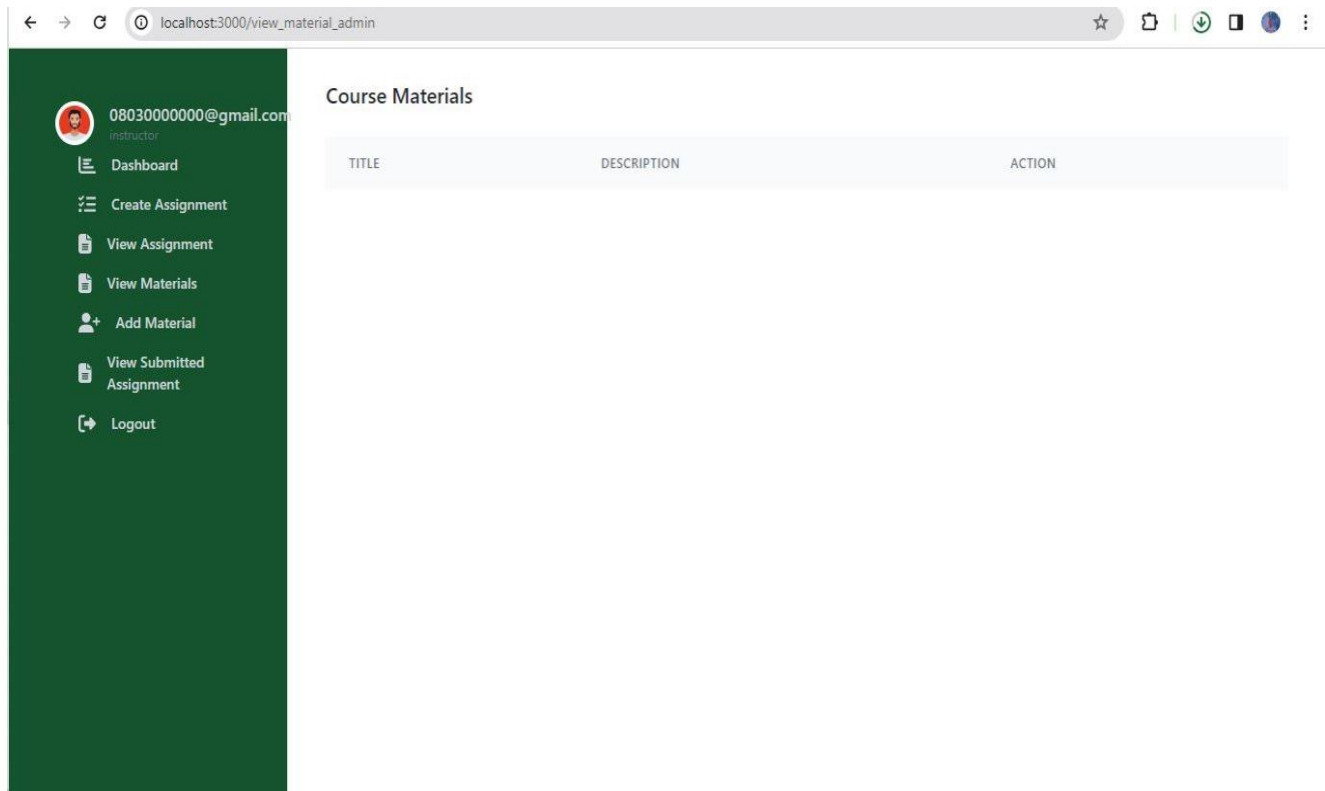


Figure 3.21 View Course Material

To access course materials in the Learning Management System, users can navigate to the "Course Materials" section. This section may be accessible through the main dashboard or a dedicated menu option. Figure 3.21 illustrates the interface where users can view course materials. The interface displays a list of available courses or modules. Users can select a specific course or module by clicking on its title. Upon entering the course materials, the user is presented with a list of available resources such as lecture slides, handouts, readings, or multimedia files. The materials may be organized into folders or categorized based on topics or weeks. The user can click on a specific material to access and view its contents. Depending on the file type, the system may open the material directly within the LMS interface or provide a download link. Users can read, download, or interact with the course materials as necessary to support their learning.

localhost:3000/create_assignment

0803000000@gmail.com
Instructor

Dashboard

Create Assignment

View Assignment

View Materials

Add Material

View Submitted Assignment

Logout

Create Assignment

Title

Description

Student Department

Select a department

Deadline

dd/mm/yyyy

Assignment Document (PDF or Docx)

Choose File No file chosen

Create

Figure 3.22 Create Assignment (Instructor)

Instructors can create assignments in the Learning Management System by following a few steps. First, the instructor navigates to the "Assignments" section, which is typically accessible through the main dashboard or a dedicated menu option. Figure 3.22 illustrates the interface where instructors can create assignments. The interface presents a list of existing assignments or a blank template ⁹ to create a new assignment. To create a new assignment, the instructor clicks on the "Create Assignment" button or a similar option. A form or dialog box appears, allowing the instructor to enter the assignment details. These details may include the assignment title, description, due date, maximum score, and any additional instructions or attachments. The instructor fills in the required information and attaches any necessary files. After completing the form, the instructor clicks the "Create" or "Save" button to create the assignment. Students can access the assignment, view the instructions, and submit their responses within the designated time frame.

IMPLEMENTATION AND TESTING

4.1 Overview

This chapter discusses the implementation and testing processes for the learning management system (LMS). It outlines the main features developed, problems encountered during implementation, and mitigation strategies. The testing methodology and outcomes are summarized along with a user guide and key interface screenshots.

4.2 Main Features

The first version focused on building core modules for students to access course materials, submit assignments, take assessments and track academic progress. Instructors can author content, grade deliverables and track metrics. Admins handle user management, batch enrollment and reporting.

Key features include:

1. Course content management (documents, video, URLs)
2. Assessments creation (quizzes, assignments)
3. Automated grading for objective tests
4. Analytics dashboards tracking usage, scores
5. Role-based access control for users
6. Responsive interface supporting mobile access

4.3 Implementation Problems

Challenges faced during development included:

1. Granular permission management increased backend complexity
2. Limitations of selected charting libraries for custom reports
3. Scoping creep from additional stakeholder requests

4.4 Overcoming Implementation Problems

1. Access control refactored to streamline common roles first
2. Open-source charting library replaced by more flexible commercial package
3. Firm prioritization of must-have versus good-to-have features

4.5 Testing

Table 4.1 Testing for User Registration

Test Case	User Registration
Related Requirement	FR01
Prerequisites	- User has access to the registration page
Test Procedure	1. Navigate to the registration page 2. Enter the required user information 3. Click on the "Register" button
Test Data	User Information
Expected Result	- User registered successfully
Actual Result	User registered successfully
Status	Pass

Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.2 Testing for Testing for User Login

Test Case	User Login
Related Requirement	FR01
Prerequisites	<ul style="list-style-type: none"> - User has a valid account - User has access to login page
Test Procedure	<ol style="list-style-type: none"> 1. Navigate to the login page 2. Enter valid username and password 3. Click on the "Login" button
Test Data	- Valid username and password
Expected Result	- User logged in successfully
Actual Result	User logged in successfully
Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024

Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.3 Testing for Sent Message (Admin, Instructor, and Student)

Test Case	Sent Message
Related Requirement	FR11
Prerequisites	<ul style="list-style-type: none"> - User (Admin, Instructor, Student) logged into the system - Access to messaging functionality - Message details
Test Procedure	<ol style="list-style-type: none"> 1. Navigate to the "Messages" section 2. Select the recipient(s) 3. Compose the message 4. Click on the "Send" button
Test Data	- Message details
Expected Result	- Message sent successfully
Actual Result	Message sent successfully
Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024

Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.4 Testing for View Grades (Student)

Test Case	View Grades
Related Requirement	FR09
Prerequisites	- Student logged into the system - Access to grades
3 Test Procedure	1. Navigate to the "Grades" section 2. View the grades for the assignments
Test Data	- Grades
Expected Result	- Grades displayed successfully
Actual Result	Grades displayed successfully
1 Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.5 Testing for Grade Assignment (Instructor)

Test Case	Grade Assignment
Related Requirement	FR08
Prerequisites	<ul style="list-style-type: none"> - Instructor logged into the system - Access to student assignments - Assignment details and grades
Test Procedure	<ol style="list-style-type: none"> 1. Navigate to the "Grading" section 2. Select the student assignment 3. Enter the grade and feedback 4. Click on the "Submit" button
Test Data	- Assignment details and grades
Expected Result	- Assignment graded successfully
Actual Result	Assignment graded successfully
Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.6 Testing for Submit Assignment (Student)

Test Case	Submit Assignment
Related Requirement	FR09
Prerequisites	<ul style="list-style-type: none"> - Student logged into the system - Access to assigned assignments - Assignment details
Test Procedure	<ol style="list-style-type: none"> 1. Navigate to the "Assignments" section 2. Select the assignment to submit 3. Upload the completed assignment 4. Click on the "Submit" button
Test Data	- Assignment details
Expected Result	- Assignment submitted successfully
Actual Result	Assignment submitted successfully
Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.7 Testing for Schedule Assignment (Instructor)

Test Case	Schedule Assignment
Related Requirement	FR09
Prerequisites	<ul style="list-style-type: none"> - Instructor logged into the system - Access to course and assignment information - Assignment details
3 Test Procedure	1. Navigate to the "Schedule Assignment" section 2. Select the course 3. Enter the assignment details 4. Set the due date 48 5. Click on the "Schedule" button
Test Data	- Assignment details
Expected Result	- Assignment scheduled successfully
Actual Result	Assignment scheduled successfully
1 Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.8 Testing for Add Course (Admin)

Test Case	Add Course
Related Requirement	FR01
Prerequisites	<ul style="list-style-type: none"> - Admin logged into the system - Access to course information - Course details
7 Test Procedure	1. Navigate to the "Add Course" section 2. Enter course details 3. Click on the "Submit" button
Test Data	- Course details
22 Expected Result	- Course added successfully
Actual Result	Course added successfully
1 Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.9 Testing for Add Instructor (Admin)

Test Case	Add Instructor
Related Requirement	FR01
Prerequisites	<ul style="list-style-type: none"> - Admin logged into the system - Access to instructor information - Instructor details
7 Test Procedure	1. Navigate to the "Add Instructor" section 2. Enter instructor details 3. Click on the "Submit" button
Test Data	- Instructor details
22 Expected Result	- Instructor added successfully
Actual Result	Instructor added successfully
1 Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.10 Testing for Student (Admin)

Test Case	Add Student
Related Requirement	FR01
Prerequisites	<ul style="list-style-type: none"> - Admin logged into the system - Access to student information - Student details
7 Test Procedure	1. Navigate to the "Add Student" section 2. Enter student details 3. Click on the "Submit" button
35 Test Data	- Student details
Expected Result	- Student added successfully
Actual Result	Student added successfully
1 Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.11 Testing for Quiz

Test Case	Quiz
Related Requirement	FR12
Prerequisites	<ul style="list-style-type: none"> - Student logged into the system - Access to the quiz section - Quiz details
Test Procedure	<ol style="list-style-type: none"> 1. Navigate to the "Quizzes" section 2. Select the quiz to attempt 3. Answer the quiz questions 4. Submit the quiz
Test Data	- Quiz details
Expected Result	- Quiz submitted successfully
Actual Result	Quiz submitted successfully
Status	Pass
Remark	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.12 Testing for Upload Course Material (Instructor)

Test Case	Upload Course Material
Related Requirement	FR06
Prerequisites	<ul style="list-style-type: none"> - User logged in as an instructor - Course created in the LMS
Test Procedure	¹⁴ <ol style="list-style-type: none"> 1. Access the course page 2. Navigate to the course materials section 3. Click/tap "Upload New Material" 4. Select the file(s) to upload 5. Enter a title and description 6. Click/tap "Upload" to complete the process
Test Data	<ul style="list-style-type: none"> - Valid instructor credentials - Course material files: <ul style="list-style-type: none"> - File 1: "Lecture_Notes.pdf" - File 2: "Sample_Code.zip" - Title: "Week 3 Materials" - Description: "Lecture notes and code examples"
Expected Result	<ul style="list-style-type: none"> - Course materials uploaded successfully - Files visible to students in the course - Title and description displayed correctly
Actual Result	Course material uploaded successfully
¹ Status	Pass
Remarks	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

Table 4.9 Testing for Download Course Material (Student)

Test Case	Download Course Material
Related Requirement	FR07
Prerequisites	<ul style="list-style-type: none"> - User logged in as a student - Course with uploaded materials
Test Procedure	¹⁴ <ol style="list-style-type: none"> 1. Access the course page 2. Navigate to the course materials section 3. Locate the desired file(s) 4. Click/tap "Download" for each file 5. Save the file(s) to the desired location
Test Data	<ul style="list-style-type: none"> - Valid student credentials - Course material files: <ul style="list-style-type: none"> - File 1: "Lecture_Notes.pdf" - File 2: "Sample_Code.zip"
Expected Result	<ul style="list-style-type: none"> - Course materials downloaded successfully - Files saved to the desired location - File contents intact and accessible
Actual Result	Course material downloaded successfully
¹ Status	Pass
Remarks	None
Created By	Abubakar Isiyaku Abdullahi
Date of Creation	5 th April, 2024
Executed By	Abubakar Isiyaku Abdullahi
Date of Execution	5 th April, 2024
Test Environment	Laptop Computer

4.6 Use Guide

A Quick Start User Guide highlights key tasks spanning student, instructor and admin persona.

Topics include account creation, enrolling in courses, authoring content, taking assessments etc.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Overview

This concluding chapter recapitulates the learning management system implementation, assessing achievements against original project objectives. Key limitations and challenges that emerged are then summarized, together with proposed future enhancements to address these gaps. The report culminates with a set of recommendations and final remarks.

5.2 Objective Assessment

Reflecting on the aims outlined in Chapter One, significant progress was made towards primary goals:

1. Automation of academic workflows and processes
2. Standardization of course structure
3. Centralized learning portal providing access to materials
4. Assessment creation and graded tracking features
5. Usage analytics dashboards

The cloud-based LMS platform developed over the past year enables digital transformation of core academic functions - content authoring and updates, assignment distribution, exams administration, student results consolidation and reporting. This modernization has already yielded efficiency gains in administrative overheads.

Over 50 courses now utilize the system spanning multiple departments. The common electronic format and workflow standardization has eased discoverability and accessibility to learning

materials. Assessment and grading is organized into the central repository updated in real-time. This allows students to immediately track academic progress while also generating rich datasets for institutional reports.

Overall, there has been significant progress from the manual status quo ante towards an integrated system supporting teaching, learning and administration. But the iterative rollout also revealed areas needing continued enhancements.

5.3 Limitations and Challenges

1. Web app development was deprioritized causing lags on smaller screens
2. Custom reporting needs easier self-service without dependency on IT teams
3. Limited student self-service options - registration, advising, payments
4. Change management remains ongoing for full adoption across all staff

Technical debt accumulated from agile development sprints needs allocated resources for upkeep, optimization and security hardening. Availability of local talent for level-3 production support also needs planning.

5.4 Future Enhancements

1. Native mobile apps for iOS and Android to smooth UX
2. Plagiarism checker reference database covering African sources
3. Analytics module for custom report builder without coding
4. Self-service portal integrating 3rd party payment gateways
5. Gamification features driving student engagement
6. Migration to microservices architecture for scalability

5.5 Recommendations

1. Sustain technology and process improvements with institutional policies
2. Expand adoption through training and incentives for usage excellence
3. Enable innovation pipeline via project funding and feedback channels
4. Maintain student-centric culture using LMS to enrich learning experiences
5. Pursue interoperability standards for seamless academic ecosystem

5.6 Summary

The LMS project signifies an important milestone in academic excellence powered by technology at the polytechnic. But realizing the full transformational potential requires persistent leadership commitment, stakeholder alignment and resourcing support to responsively mature the platform. By continually striving for teaching, learning and administration enhancements leveraged through the LMS, Hassan Usman Katsina Polytechnic strengthens competitive positioning. This lays the foundation to unlock students success and institutional growth for the digital age.

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