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DESIGN AND DEVELOPMENT OF A WIRED STUDENT STUDY MANAGEMENT SYSTEM FOR THE UNIVERSITY OF CALABAR – DEPARTMENT OF PHYSICS

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Abstract

The Wired Student Study Management System for the University of Calabar – Physics Department is a comprehensive web-based platform, designed and implemented to improve and streamline the management of student studies in the Physics Department at the University of Calabar. It provides a centralized hub of information and resources, empowering students to make informed decisions and excel in their academic pursuits by offering course recommendations, and access to past examination questions to enhance students' academic performance and overall satisfaction. The system was developed using WordPress, PHP, and JavaScript in designing the front end, MYSQL to create the databases at the backend and will be implemented on the internet, accessed on any operating device, either desktop or mobile device connected to the internet.

Key Words: Design, Development, Student Study Management System (SSMS), Web-based platform, Wired platform, and Online platform.

1.0 Introduction

In this modern age, it is widely accepted that technology impacts all aspects of society [1, 2]. The importance of technology in education cannot be ignored it is safe to say that with the onset of computers in education, it has become easier for teachers to impart knowledge and for students to acquire it, the integration of technology has not only become imperative but transformative [3, 4, 5, 6].

The field of education is continuously influenced by new initiatives, reform acts, promising research, and technologies [7]. The 1986 vision of technology in the education of the study was more far-reaching than simply putting computers in schools as teaching machines. Technology is one of the most powerful influences in today's educational scene [8, 9]. As modern technologies emerge, several advancements shape study management and academic performance [10]. These advancements aim

to create more efficient and personalized learning experiences, fostering improved academic performance and student success [11, 12].

Student Study Management System (SSMS) is an innovative web-based platform designed to address the needs of students from various academic years to manage their studies effectively [13, 14, 15, 16]. It encompasses coordinating academic resources, course information, program requirements, and student engagement to optimize the learning journey [17, 18]. This comprehensive approach ensures that students navigate their academic path effectively and maximize their potential for success.

A management Information system is a set of systems that helps managers make better decisions [19, 20, 21]. SSMS is regarded as a management information system. A general lack of information and organization causes students not to be prepared for class, which in turn causes failing grades. Disorganized students not only suffer from failing grades but also experience added stress and poor self-esteem issues [22].

The education sector is adopting digital innovations to improve the learning experience as students often struggle to navigate through complex course structures, understand program requirements, and access relevant study materials [23]. The University of Calabar (UNICAL) is a prominent institution of higher learning that was set up as a Campus of the University of Nigeria, Nsukka in 1973 [24]. Since it was founded, the university has developed into a centre of academic excellence, and a hub for research, serving as a catalyst for education and development with the mission to produce highly qualified graduates and scholars in their area of study with theoretical, practical, and entrepreneurial abilities for the working world. The Department of Physics was one of the departments in the Faculty of Science that was established. The Department runs three major programmes leading to the award of a Bachelor of Science Degree in Physics, Applied Geophysics, and Electronics (formerly called Electronics and Computer Technology) [24]. The Department of Physics, as a vital part of the university, plays a crucial role in how its students' progress academically and advance scientific knowledge.

Students seeking clarity on their academic pathways may frequently encounter difficulties inside the Department of Physics due to the complex web of course structures and program requirements. The demand for an understandable system that enables students to quickly grasp the complexities of their academic pursuits is increasing as the academic landscape becomes more complex. Such a system can give students instant access to crucial course information, program requirements, and study resources outside of the realm of conventional methods.

Following the challenges identified in the university system, such as students not understanding the specific courses they need to register for in each academic year, access to comprehensive study materials, and availability to past examination questions for

various courses all compound to create a challenge in students making informed decisions and excelling in their academic pursuits. The existing reliance on conventional departmental handbooks for course offerings and program requirements has drawbacks in terms of accessibility and real-time updating.

The project, "Design and Development of a Wired Student Study Management System" emerged as a response to this demand. Envisioned as a powerful digital ally, this project aims to reduce the difficulties of academic navigation and offer Department of Physics students a user-friendly online platform to understand, plan, and manage their academic journey. With a dynamic user interface that adapts to the students' changing academic needs, the envisioned online student study management system goes beyond the conventional handbook. It grants them immediate access to essential course information, program requirements, and study materials, fostering a comprehensive understanding of their academic trajectory.

2.0 METHODOLOGY

2.1 System Design and Model

System modeling is the process of developing an abstract representation of a system, which helps understand the various components and interactions within a system. The design and development of a Student Study Management System (SSMS) is a complex and critical process, as it involves creating a comprehensive software solution to support various aspects of educational institutions.

2.1.1 SSMS Model

Models help the analyst to understand the functionality of the system. Student Study Management System (SSMS) is a web-based platform that is designed and modeled with standard tools of software engineering. The model adopted for this system is the Iterative model. Fig. 1 shows the SSMS model.

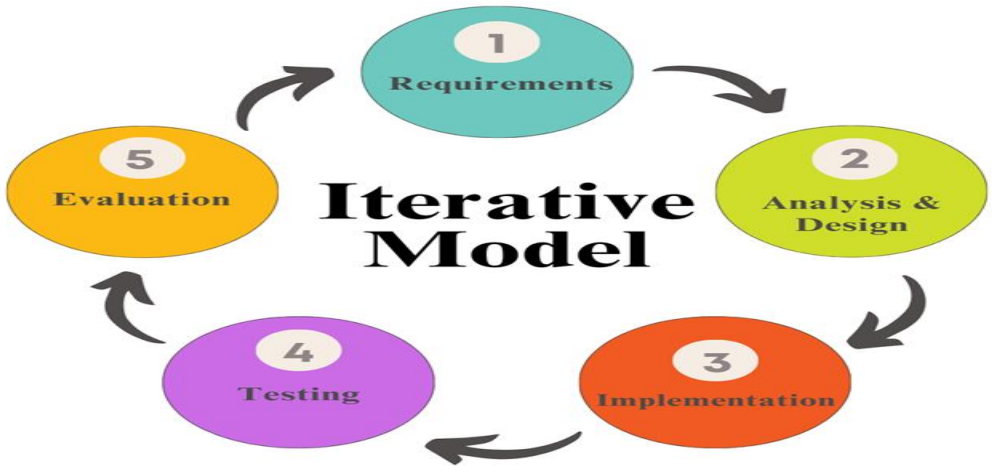

Figure 1 SSMS model

2.1.2 Phases of SSMS model

The Phases of the SSMS model are:

Requirements Phase: In this initial phase, a thorough understanding of the requirements and goals of the SSMS is established. The requirements phase includes:

1. Conducting interviews and surveys with students to gather user requirements.
2. Document the features and functionalities expected from the system, such as study material management, progress tracking, and any specific requirements unique to the educational context.

Analysis and Design Phase: The system design phase translates the requirements into a concrete plan based on the gathered requirements. It involves creating the system architecture and specifying the components and modules of the SSMS. The design phase includes:

· Architectural design: Defining the system's structure, components, and relationships.

· Database design: Designing the database schema to store required student-study-related information.

· User interface design: Creating an intuitive and user-friendly interface for students.

Implementation Phase: The Implementation phase is where the actual programming and coding of the SSMS take place. Skilled software developers and programmers are responsible for creating a system according to the design specifications. Key activities in the implementation phase include:

· Writing code to implement the system's functionalities.

· Developing the database management system.

· Integrating security measures to protect student data.

Testing Phase: Before deploying the SSMS, rigorous testing is conducted to ensure that it functions correctly and meets the defined requirements. The testing phase includes:

· Unit testing: Testing individual components and modules.

· Integration testing: Ensuring that different parts of the system work together as intended.

· User acceptance testing: Let end-users evaluate the system for usability and functionality.

Evaluation Phase: Gather feedback from users to understand their experiences with the system. The evaluation phase includes:

· Conduct feedback sessions regarding usability, functionality, and any potential issues.

· Analyze the system’s performance in terms of responsiveness, scalability, and reliability.

· Evaluate the impact and efficiency of the system in facilitating effective study management.

2.2 Use Case Diagram

A use case is described in terms of a sequence of interactions between some actors and the system by which the system provides a service to the actors. Each use case then captures a piece of functional requirements for some users. All the use case together describes the overall functional requirements of the system. The first step in requirement capture is to capture requirements as use cases. In the Student Study Management System, there are two (2) actors, which are: students and admin.

Figs. 2 to 4 show all actors, the student use case diagram, and the admin use case diagram respectively.

Figure 2 Actors

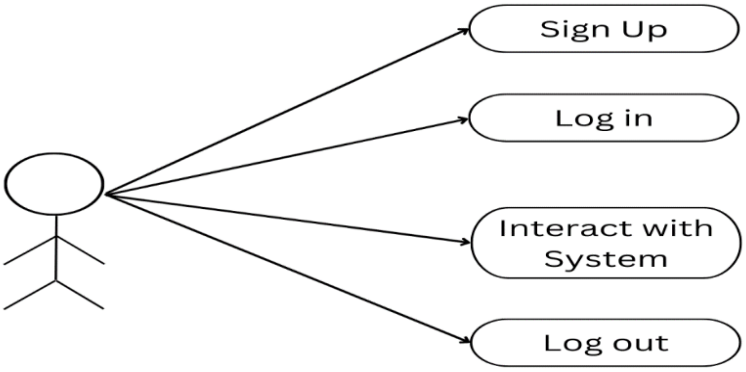

Figure 3 Student use case diagram

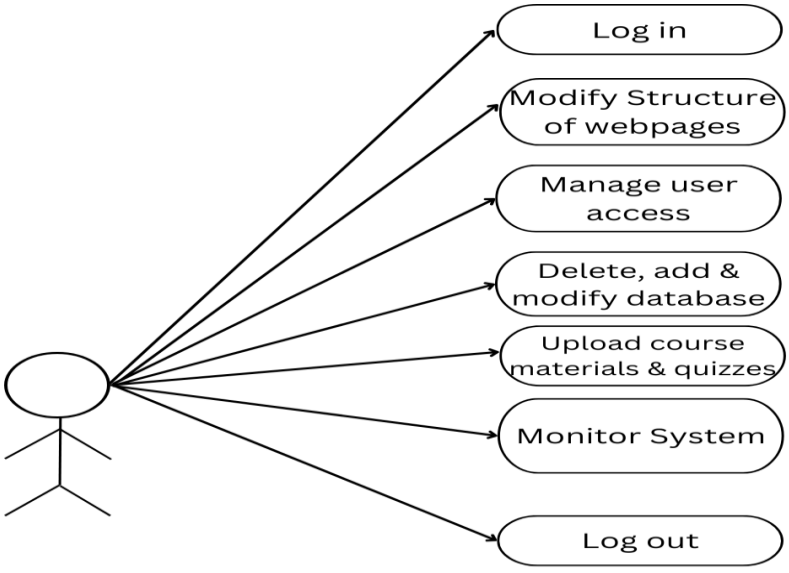

Figure 4 Admin use case diagram
Students

All students in the student study management system can;

- Sign up
- Log in
- Interact with the system
- Log out

Admin

Admin can do the following tasks;

- Log in
- Modify the structure of web pages
- Manage user access
- Delete, add & modify database
- Upload course materials & quizzes
- Monitor system
- Log out

2.3 Student Study Management System Workflow

Student study management system workflow refers to the sequence of steps or processes that students follow to navigate and interact with the system throughout their academic journey. Fig. 5 shows the student study management system workflow.

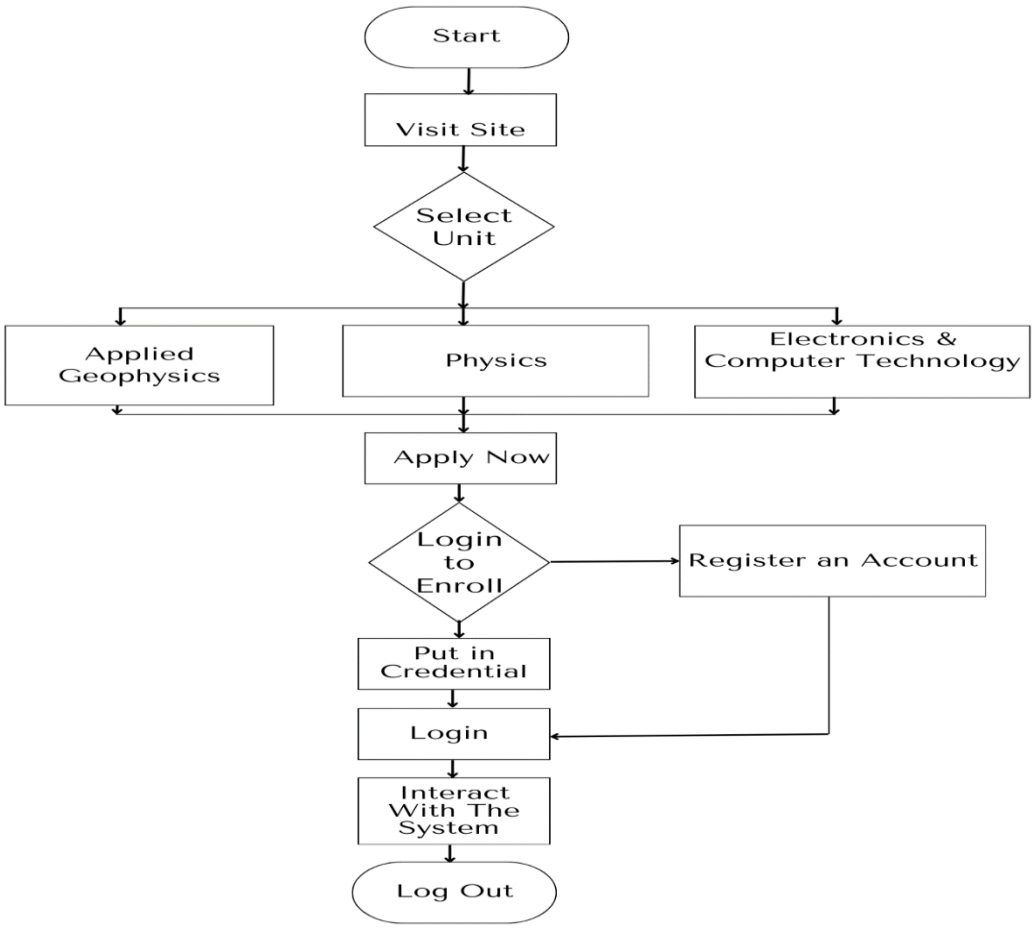

Figure 5 Student study management system workflow

2.4 Database Design and Schema

Designing the database and schema for a Student Study Management System (SSMS) involves structuring the database to efficiently store, manage, and retrieve various types of student-related data. The database schema outlines the structure of the database, including tables, relationships, and constraints. Figs. 6 and 7 show the database schema for course and curriculum and the database schema for enrollment and registration respectively.

2.4.1 Entities in the Database Schema

Students: Contains personal information, contact details, enrollment status, academic history, and associated data unique to each student.

Courses and Curriculum: Stores information related to courses, curriculum details, class schedules, and course materials.

Enrollment and Registration: Records related to student enrollment, course registrations, academic advising, and academic progression.

Figure 6 Database schema for course and curriculum

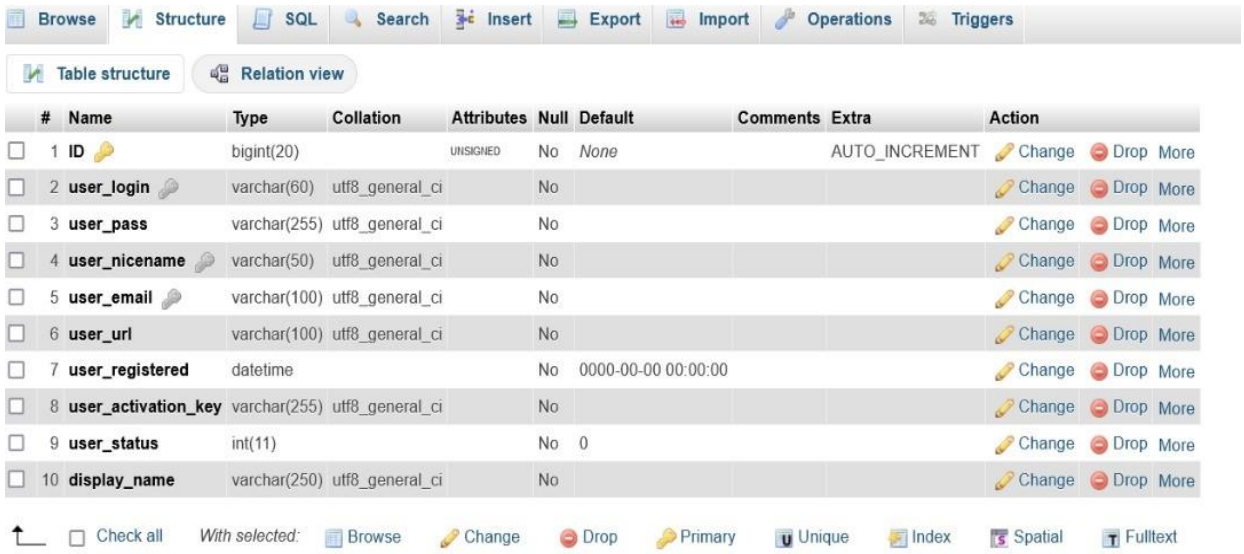

Figure 7 Database schema for enrollment and registration

2.4.2 Database Tables and Relationships

Students Table: Includes fields like UserID (Primary Key), Name, Email Address, Username, etc.

· Courses Table: Contains CourseID (Primary Key), Course Name, Schedule, and other related course details.

· Enrollment Table: Establishes a relationship between Students and Courses using foreign keys (UserID, CourseID) to represent which students are enrolled in which courses.

2.4.3 Relationships Between Tables

· Students are related to Courses through the Enrollment table, representing which students are enrolled in which courses.

2.4.4 Data Integrity and Constraints

Primary Keys: Each table has a primary key (e.g., UserID, CourseID) to uniquely identify records.

Foreign Keys: Used to establish relationships between tables. For instance, the UserID in the Enrollment table references the student's table.

Constraints: Implementing constraints like unique constraints, not-null constraints, and data type constraints to ensure data accuracy and consistency.

2.4.5 Normalization and Optimization

The database schema is designed using normalization techniques to minimize redundancy and optimize data storage. This involves breaking data into smaller, related tables to eliminate data redundancy and improve efficiency.

2.5 Tools and Technology

In the development of a Student Study Management System, various technologies are commonly used to create a dynamic, interactive, and data-driven web application. The following development tools and technology chosen for this study are:

2.5.1 PHP Hypertext Preprocessor

The PHP Hypertext Preprocessor (PHP) is a recursive acronym for "PHP: Hypertext Preprocessor". It is a programming language that allows web developers to create dynamic content that interacts with databases. PHP is a server-side scripting language that is embedded in HTML. It is used to manage dynamic content, databases, session tracking, and even build commerce sites. It is integrated with several popular databases, including MySQL, Oracle, and Microsoft SQL Server.

2.5.2 JavaScript

JavaScript is a versatile and widely- used programming language that primarily runs in web browsers, enabling interactive and dynamic content on websites. It is a key component of web development and plays a crucial role in enhancing the user experience by adding interactivity, responsiveness, and dynamic behavior to web pages.

2.5.3 Structured Query Language

Structured Query Language is a domain-specific language used in programming and designed for managing and manipulating relational databases. SQL is used to interact with relational database management systems (RDBMS) like MySQL, Microsoft SQL Server, Oracle, and others.

2.5.4 WordPress

WordPress is a popular and open-source content management system (CMS) that empowers users to build and manage websites easily. It was created as a tool to publish blogs but has evolved to support publishing other web content, including more traditional websites, mailing lists and internet forums, media galleries, membership sites, learning management systems, and online stores.

2.5.5 Domain and Hosting

The domain name used for the system is myphysicsstudy.com.ng it was acquired on A2 Hosting. Domain hosting service refers to the service provided by a company or service provider that allows individuals and organizations to make their websites accessible on the internet. This involves renting space on a server to store website files, databases, and other content, and associating a domain name with that server's IP address.

The domain and hosting package used for this system comes with the following features and benefits:

- It has unlimited storage space
- It has unlimited bandwidth space
- Unlimited email accounts can be created
- Allows unlimited sub-domain extension
- Allows unlimited sub-domain extension
- Allows unlimited MYSQL database creation

2.6 Features and Functionality of SSMS

Course Guidance: The SSMS provides personalized course recommendations based on the student's academic program, year of study, and individual progress. To achieve this, the system will incorporate a database of all available courses and their associated program requirements. Upon login, students will be required to input their program and year of study. The system will then generate

a list of courses that the student needs to register for to fulfill their program requirements. The SSMS will also track the student's progress and adjust the recommendations accordingly. This feature ensures that students register for the right courses, plan their studies effectively, and stay on track to graduate on time.

Past Questions Database: The SSMS provides a comprehensive database of past examination questions for various courses. This feature enables students to practice for exams effectively, gain familiarity with exam formats and types of questions that may be asked, and identify areas of improvement.

Personalized Dashboard: The SSMS has a personalized dashboard for each student, where they can view their course recommendations, progress, and performance. The dashboard will also display upcoming assignments, exams, and deadlines, ensuring that students stay on track with their studies. This feature gives students a comprehensive overview of their academic journey, enables them to plan effectively, and helps them stay organized and motivated.

User Management: The SSMS has a user management feature that allows administrators to manage user accounts, including creating new accounts, deleting accounts, and modifying access rights. This feature ensures that only authorized individuals have access to the platform and that the system is secure and well-maintained.

2.7 Security and Privacy Measures

Security and privacy are paramount in the development and operation of a Student Study Management System (SSMS) to safeguard sensitive student information and maintain user trust. Implementing robust security and privacy measures is essential. Here are key considerations:

2.7.1 Data Encryption

Data in Transit: Use secure communication protocols (e.g., HTTPS) to encrypt data as it travels between the user's device and the server to prevent eavesdropping.

Data at Rest: Encrypt stored data to protect it from unauthorized access, especially sensitive information like student records.

2.7.2 Access Control

Role-Based Access Control: Implement role-based access control (RBAC) to ensure that users can only access the data and features relevant to their roles (students, teachers, administrators, parents).

Strong Authentication: Enforce strong password policies, two-factor authentication, and password reset procedures to secure user accounts.

2.7.3 Data Backups

Perform regular data backups and ensure disaster recovery procedures are in place to prevent data loss.

2.7.4 Vulnerability Management

Conduct regular vulnerability scans and patch system vulnerabilities to reduce the attack surface.

3.0 IMPLEMENTATION AND TESTING

3.1 System Implementation

System implementation is the phase in the system development life cycle where the designed system is translated into code, tested for functionality, and made operational. This is carried out by utilizing the right methodology that fits the specified procedure for resolving the current difficulties. This chapter describes how the SSMS was implemented and tested.

3.2 Database Implementation

The foundation of the system lies in a well-structured database. During implementation, a robust architecture was established to efficiently store and manage student data, course details, and other pertinent information. My Structured Query Language Database Management System (MYSQL DBMS) was used to create the SSMS database to mitigate the risk of data loss, and redundancy and improve data integrity. Tables were normalized by use of "Primary keys" to uniquely identify each entry in the database and the "foreign key" to show the relationship by linking different tables.

3.3 User Interface Development

The user interface (UI) development of a Student Study Management System (SSMS) is a critical factor in ensuring that the system is efficient, user-friendly, and capable of meeting the diverse needs of students. Crafting an intuitive and visually appealing user interface is paramount.

3.3.1 SSMS Home Page Interface

The Home Page Interface of the Student Study Management System captions students to start their career in the Physics department, provides an overview of the University of Calabar, and facilitates quick navigation to their academic units or majors. Fig. 8 shows the SSMS homepage interface.

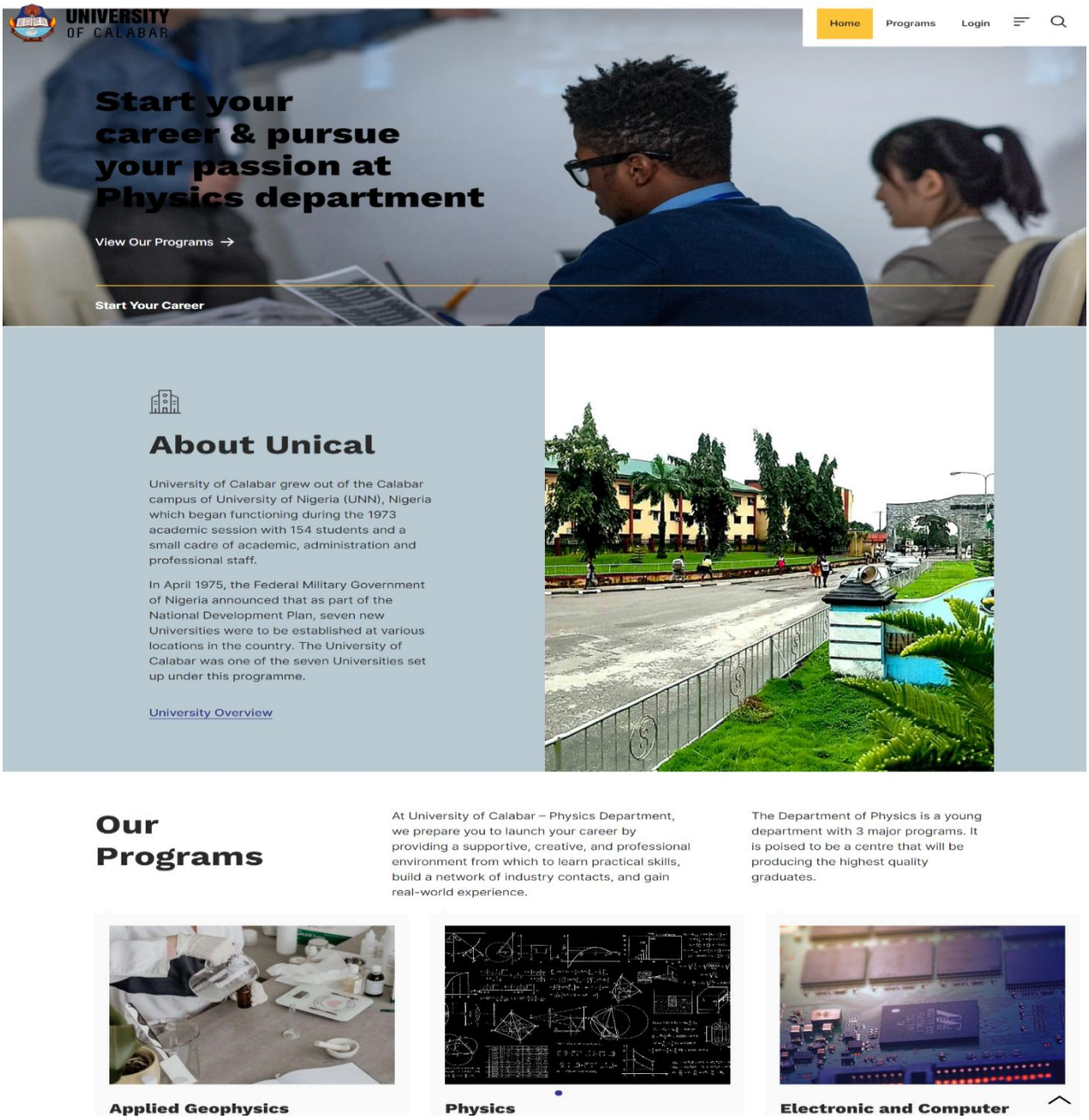

Figure 8 SSMS home page interface

3.3.2 Specified Academic Unit Interface

The Physics Department consists of three (3) academic units. The specified academic unit interface gives an overview, program learning outcome, career opportunities, duration, and course requirements for each of the academic units. It also provides students with the icon to apply for that specified academic unit to effectively manage their studies. Figs. 9 to 11 show the specified academic unit interface for Electronic and Computer Technology, Physics, and Applied Geophysics respectively.

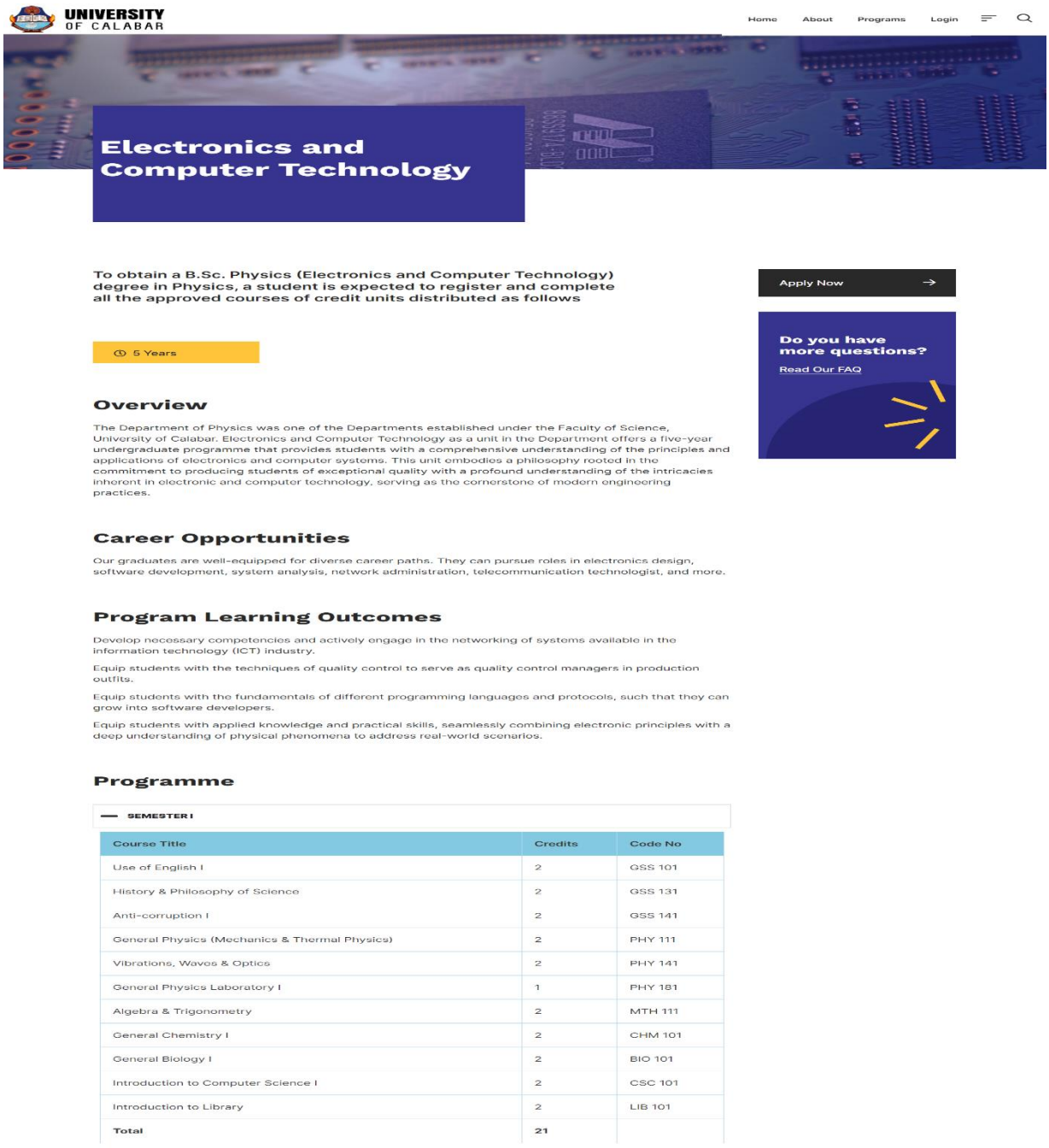

Figure 9 Electronics and Computer Technology interface

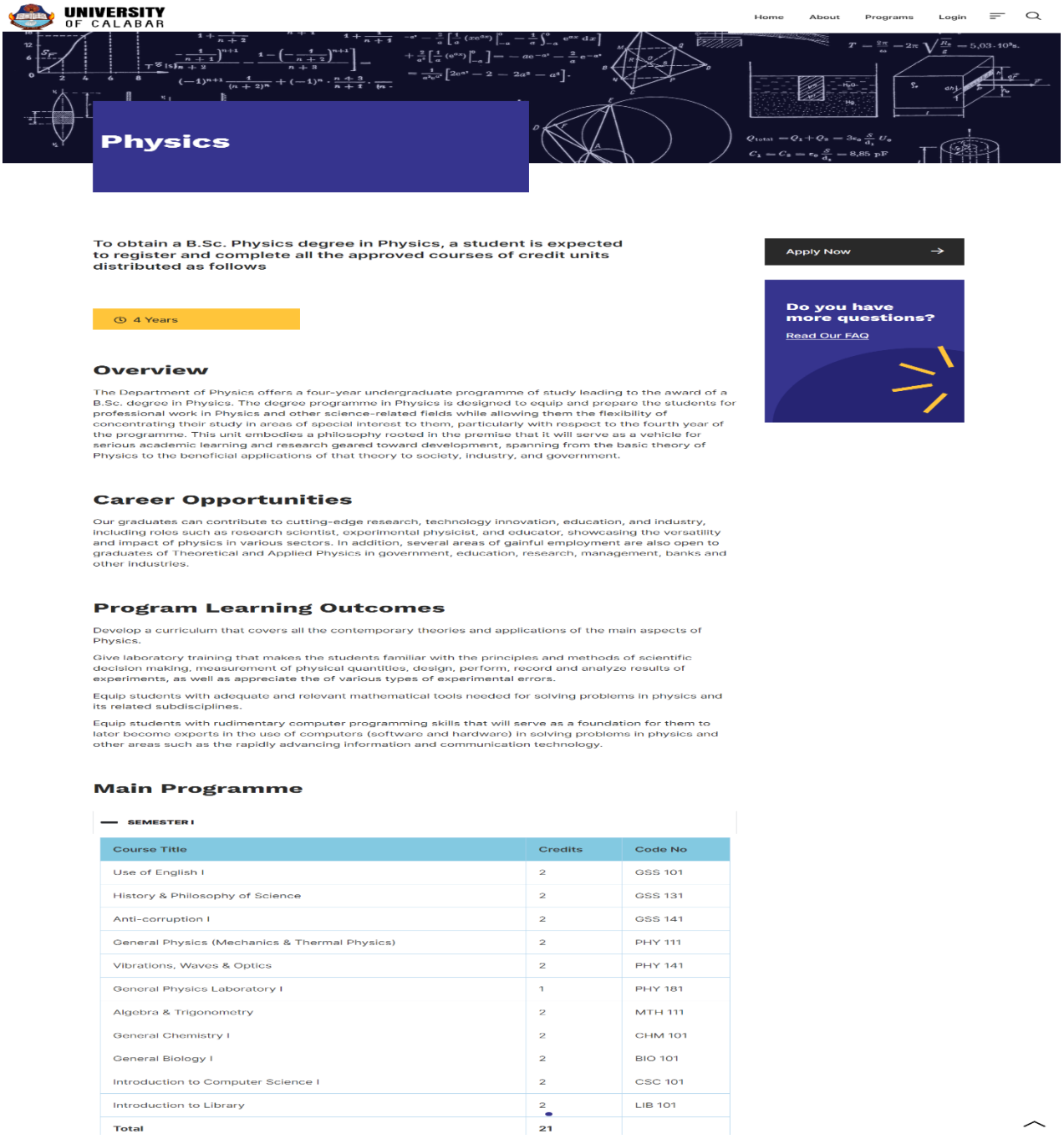

Figure 10 Physics interface

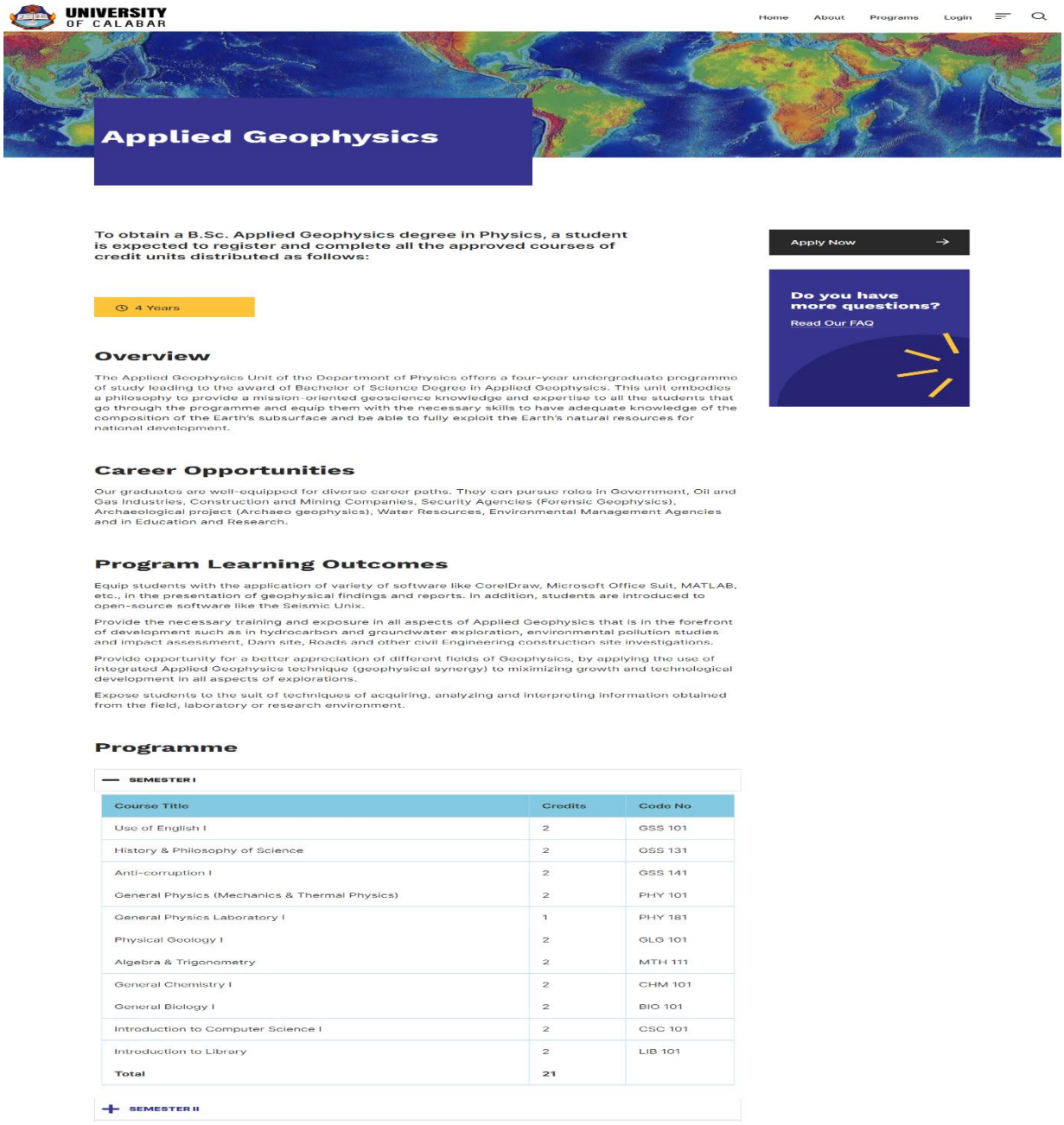

Figure 11 Applied Geophysics interface

3.3.3 Registration Interface

For a student to effectively manage their studies, they must register an account for a particular academic unit. The system provides an interface for students to register an account. Fig. 12 shows the registration interface.

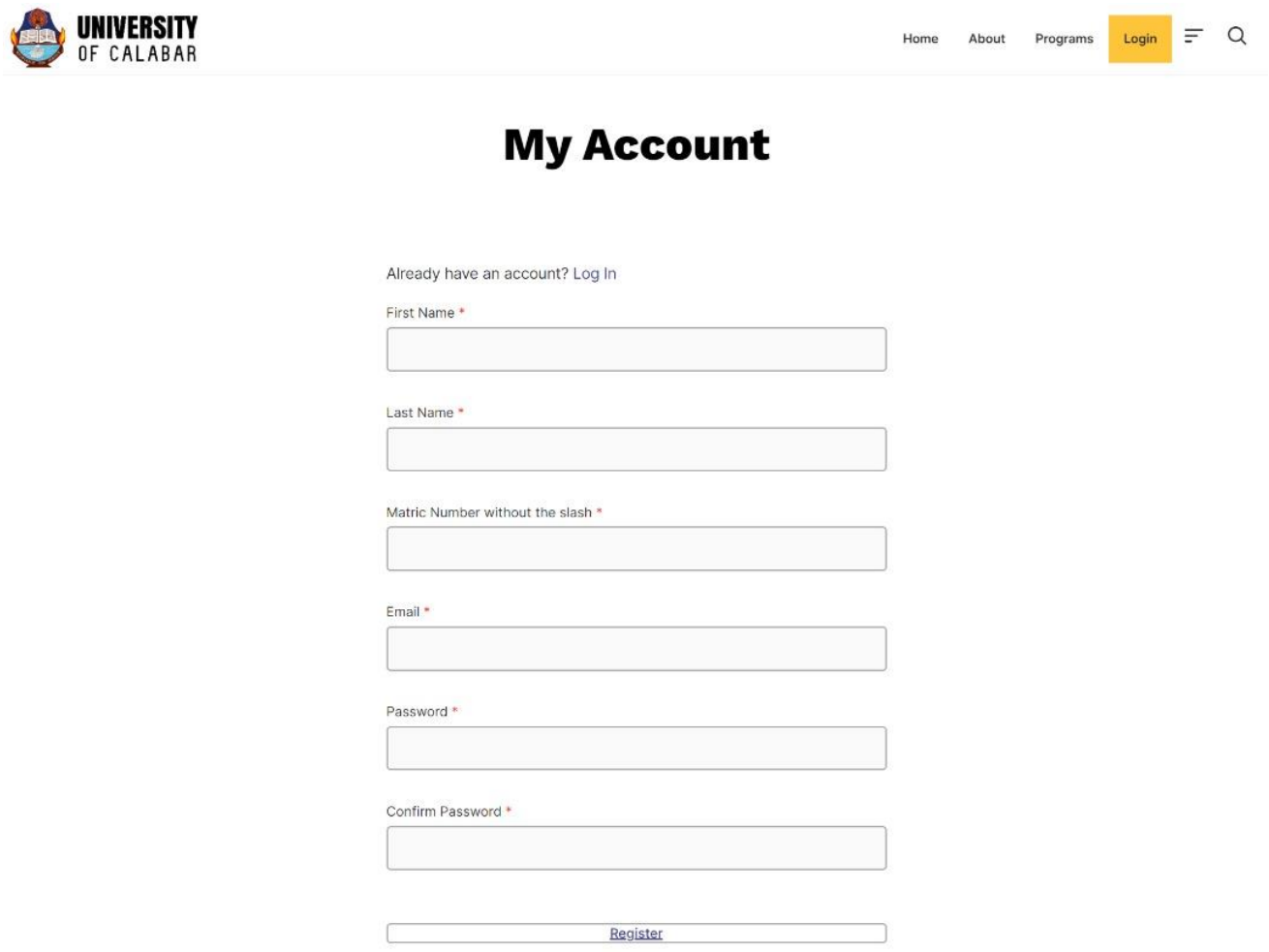

Figure 12 Registration interface

3.3.4 Login Interface

The Login interface is the first step towards academic exploration. It provides an option for new users to register an account while existing users log in with their email address and password. The login interface also has a "Remember me" option to help returning users stay logged in on trusted devices, streamlining future access, and a "Lost Your Password" option to help students recover their accounts when they forget their passwords. Fig. 13 shows the login interface.

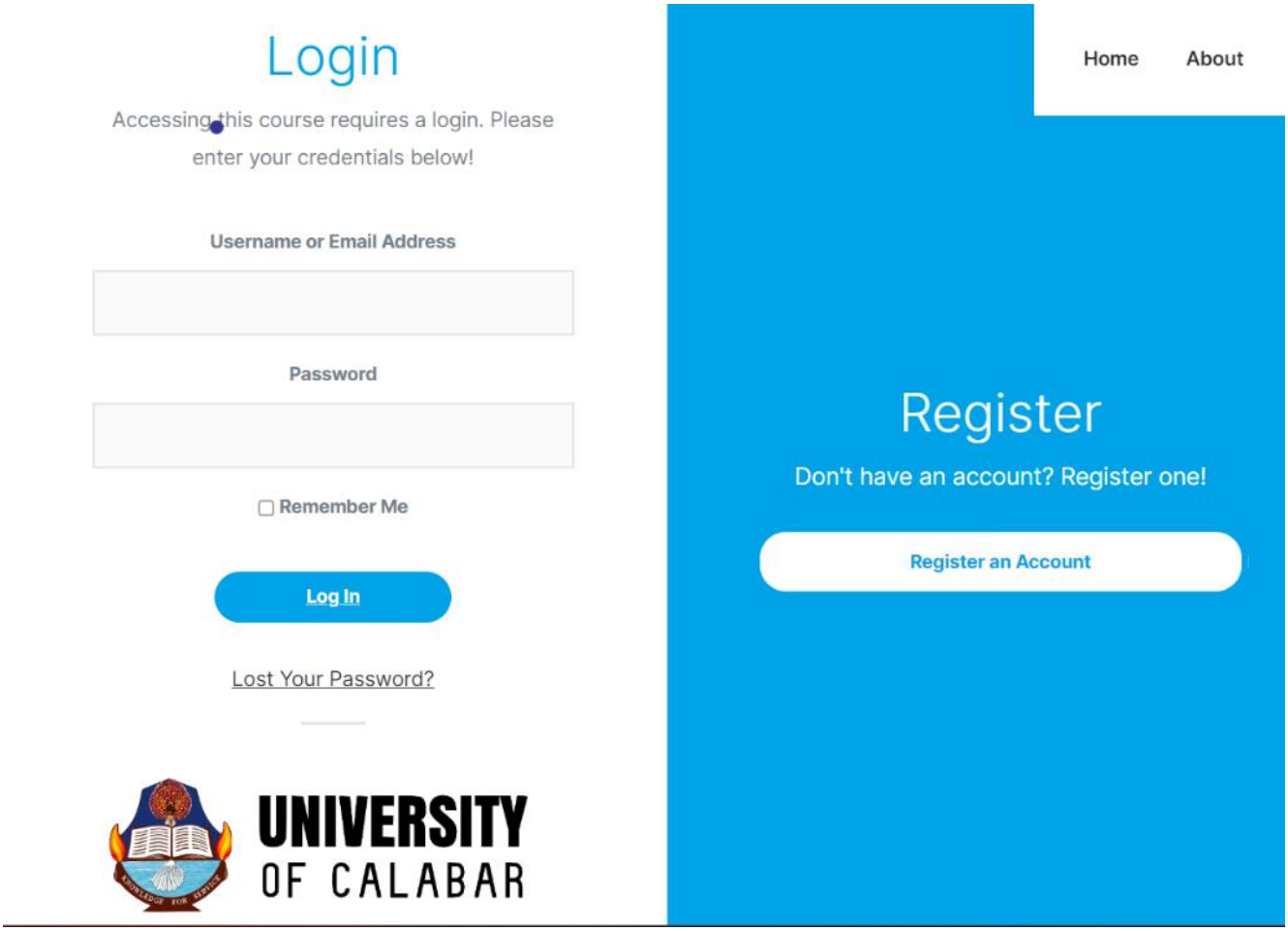

Figure 13 Login interface

3.3.5 Dashboard Interface

The dashboard interface offers students a quick and comprehensive overview of their academic progress. Figs. 14 and 15 show the dashboard and the course structure interface respectively.

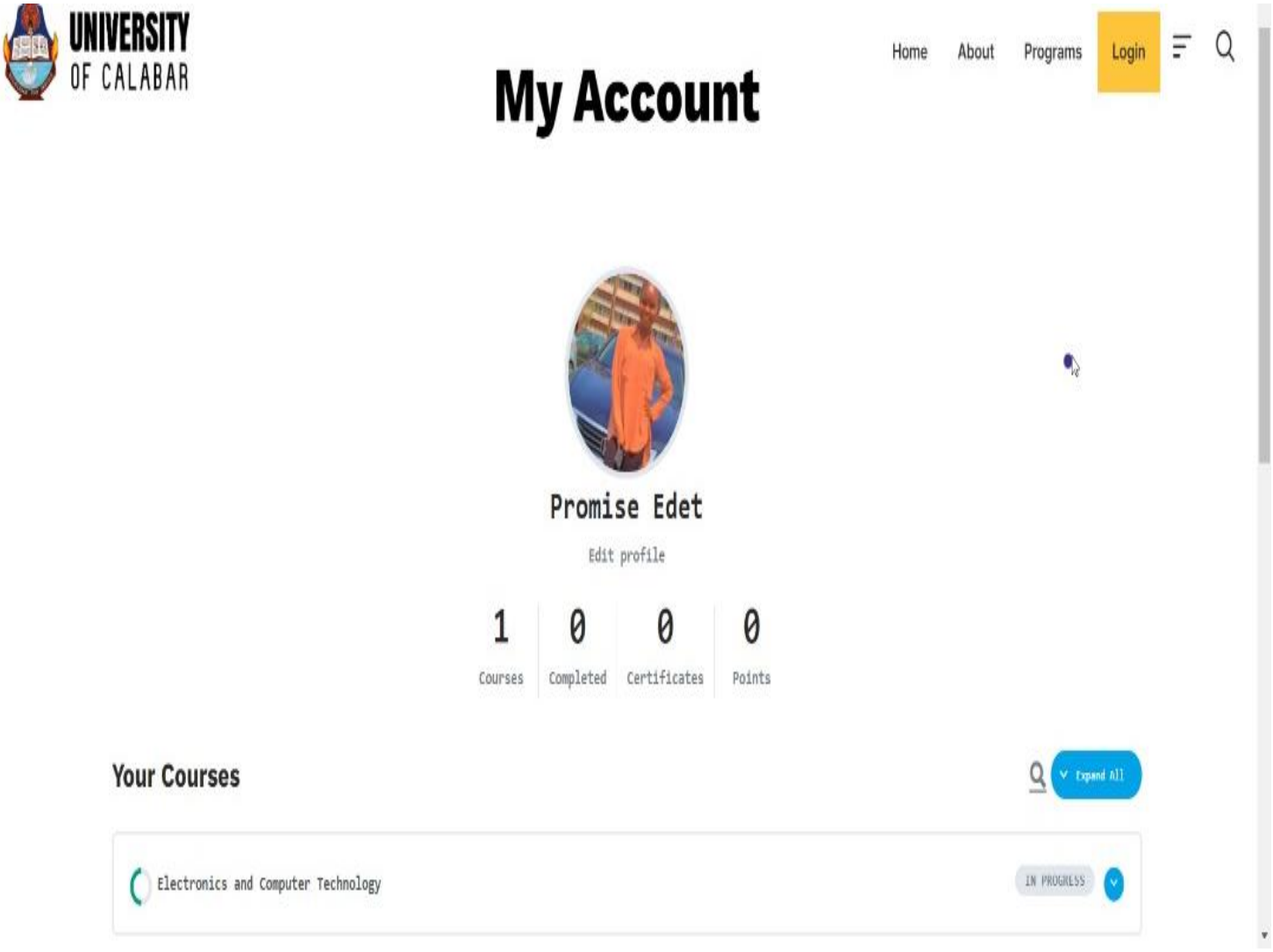

Figure 14 Dashboard interface

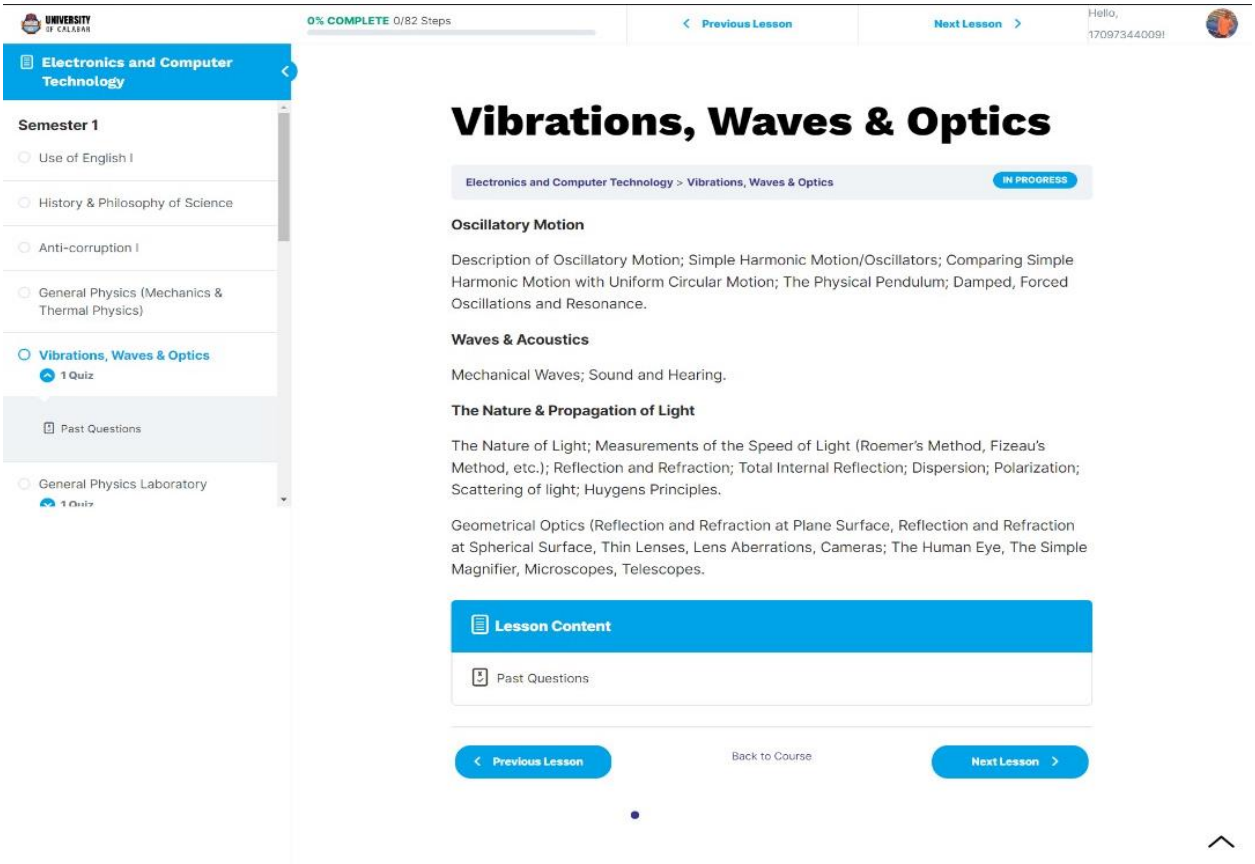

Figure 15 Course structure interface

3.4 System Testing

System testing for a Student Study Management System involves thoroughly evaluating the entire system to ensure it meets specified requirements and functions as expected. Below are some of the tests carried out on the SSMS.

3.4.1 Responsiveness Testing

This involves validating the system's responsiveness across various devices such as desktops, laptops, and smartphones to confirm the interface adapts appropriately for different devices, and testing the system on popular browsers such as Chrome, Edge, and Firefox.

3.4.2 User Authentication

User authentication is the process of verifying the identity of a user, before granting access to the system. When a user logs in with the wrong username or password, the login fails with the message "invalid username or password" and takes the user back to the login page. Fig. 16 shows the authentication interface.

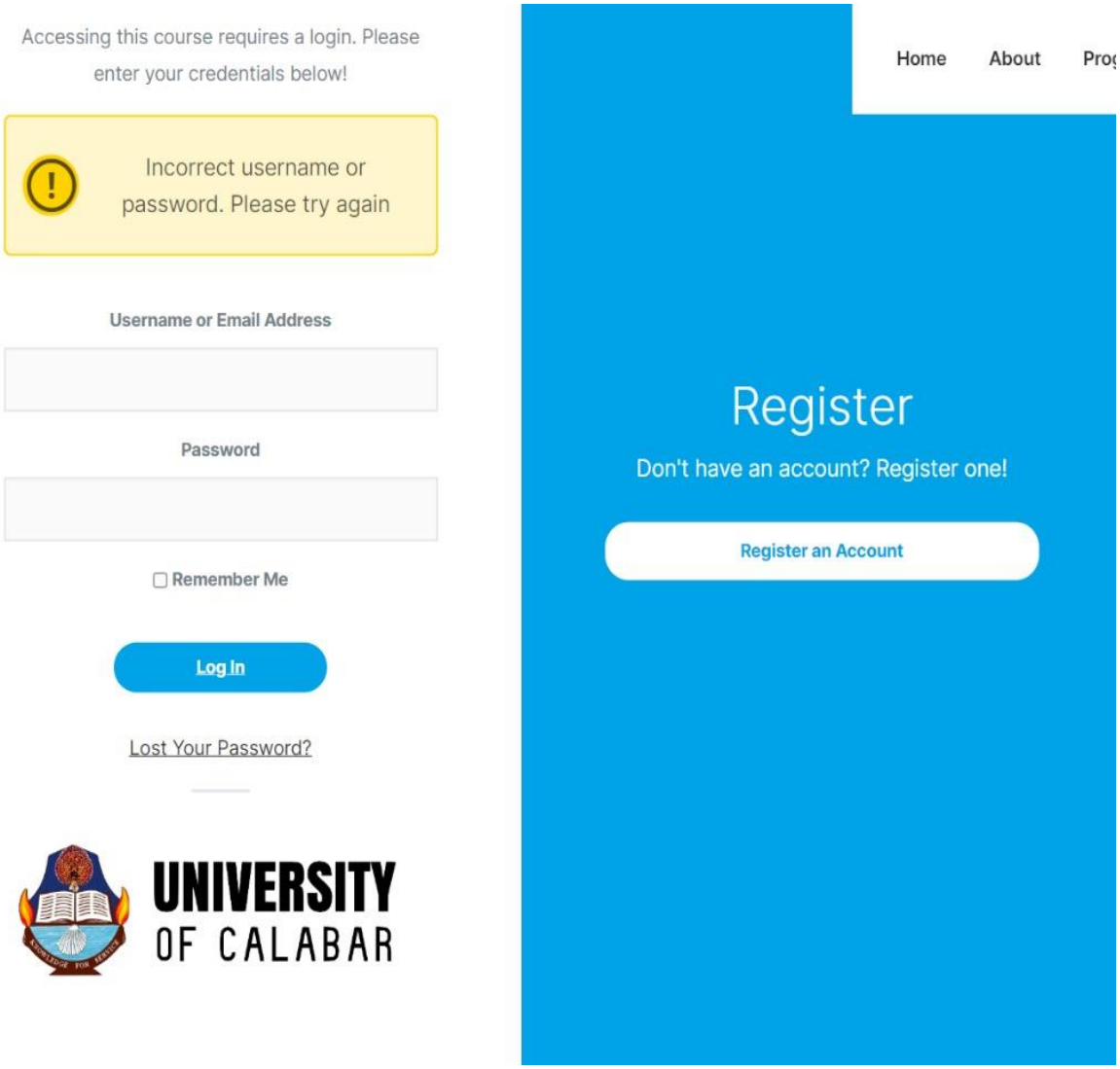

Figure 16 Authentication interface

3.4.3 Password Validation

Implementing strong password validation is crucial for enhancing the security of user accounts and protecting sensitive information. The system was implemented to accept passwords that have at least twelve characters long and contain, upper and lower case letters, numbers, and symbols like !, &, $. Fig. 17 shows the validation of passwords in the SSMS.

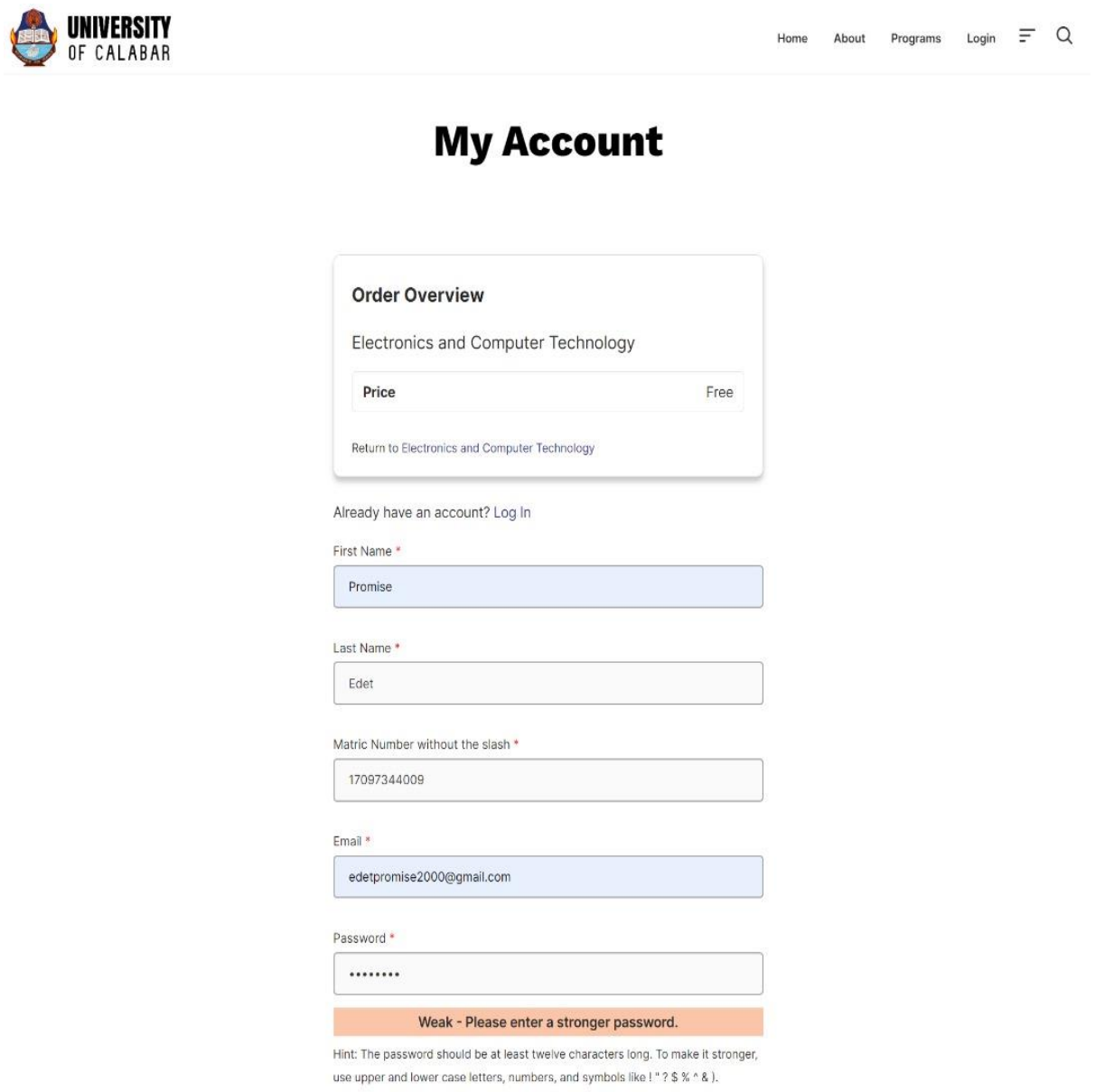

Figure 17 Validation of password in the SSMS

4.0 DISCUSSION

In this section, we distill and analyze the essential elements of the Student Study Management System (SSMS) as presented in the methodology and implementation sections (2.0 and 3.0), elucidating their significance in the broader context of educational technology and system design.

4.1 Overview of the SSMS Design and Methodology

The SSMS embodies a structured and iterative approach to system design, beginning with a thorough requirements gathering phase and culminating in rigorous testing and evaluation. The methodology outlined employs standard software engineering practices, emphasizing the

importance of understanding user needs through direct engagement (interviews and surveys) and systematically translating those requirements into functional specifications. This human-centered approach not only fosters user buy-in but also ensures that the system is aligned with actual student and institutional needs.

4.2 Phased Development Approach

The adoption of the iterative model is advantageous in managing complexity within the SSMS development. Each phase—requirements gathering, analysis and design, implementation, testing, and evaluation—serves to incrementally advance the project, allowing for adaptive refinements based on iterative feedback. Such a phased approach enables:

-Flexibility: Adjustments can be made as new insights are gathered, ensuring the software remains relevant and responsive to user needs.

- Risk Mitigation: By incorporating testing and user feedback at various stages, potential issues can be identified and addressed early in the development cycle, minimizing functional discrepancies at launch.

4.3 Use Case and Workflow Modeling

The use case analysis clearly delineates the roles of different actors (students and administrators), establishing clear functional boundaries and responsibilities within the SSMS. The workflow elucidates the student journey through the system, enhancing clarity around user interactions and expected outcomes. This intentional modeling not only lays the groundwork for intuitive system navigation but also aids in the identification of essential features that fulfill user requirements, such as course guidance, past question databases, and personalized dashboards.

4.4 Database Backbone

A pivotal aspect of the SSMS is its robust database design, structured to maintain data integrity while facilitating efficient access and management of student records, course information, and enrollment details. The choice of using MySQL as the database management system further enhances reliability and scalability, crucial for an educational platform expected to handle varying loads. The implementation of normalization techniques ensures a streamlined database structure, reducing redundancy and optimizing query performance, ultimately contributing to a more efficient system.

4.5 User Interface Development

The design of the user interface (UI) emerges as a core component of the SSMS, reflecting a critical investment in user experience. Each interface (home page, registration, login, dashboard) is crafted to be approachable and informative, by integrating informative visuals alongside functional elements. The implementation of features like "remember me" and "password recovery" directly addresses user comfort and accessibility, fostering an environment conducive to learning. These UX-focused enhancements underscore the importance of creating interfaces that not only function well technically but also resonate on a psychological level with users.

4.6 System Testing and Security Architecture

In the realization of the SSMS, testing is an indispensable phase that underpins quality assurance. The outlined tests—including responsiveness, user authentication, and password validation—are essential in validating the integrity of the system and ensuring that it meets security standards expected in academic environments. Given the sensitive nature of student data, the discussion surrounding security measures, from data encryption to access controls, showcases a comprehensive approach to safeguarding user information.

4.7 Final Thoughts

Overall, the development of the Student Study Management System serves as a representative case study in the use of best practices in educational software development. By prioritizing user-centered design, employing a structured methodology, and incorporating stringent security measures, the SSMS is positioned not only to meet current educational demands but also to adapt to future challenges within the landscape of e-learning. Future iterations may further benefit from incorporating advanced analytics and AI features, optimizing personalized learning experiences and enhancing overall educational efficacy.

5.0 CONCLUSION

The Student Study Management System (SSMS) has been successfully developed. The system marks a significant advancement in addressing the challenges faced by students managing their academic journey within the Department of Physics, University of Calabar. By providing features such as personalized course guidance, a past questions database, and a comprehensive dashboard, the SSMS caters to the specific needs of students, offering them a centralized platform for effective study management.

6.0 RECOMMENDATIONS

Based on the successful development and implementation of the Student Study Management System (SSMS), the following recommendations are suggested to further enhance the system's effectiveness:

1. It is recommended to conduct regular reviews and update the system to reflect any changes in academic structures, programs, or requirements.
2. Explore advanced security features such as multi-factor authentication to enhance data protection.
3. It will be very necessary to collaborate the SSMS with e-learning platforms to seamlessly integrate online courses and supplementary learning materials.
4. Also, system maintenance should be ensured to maximize continued access to the system.

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