

## **ABSTRACT**

The education system of federal universities in Nigeria has been greatly impacted by the reduction in teaching staff because of the treatment given by the government. This has negatively impacted the efficiency of the existing lecturing style. As the number of lecturers is decreasing, the student-to-lecturer ratio is also on the rise. The existing style of teaching, such as the use of paper for tests and assignments, as well as the dissemination of information from the lecturer to the students taking the course, has become inadequate, labor-intensive, and time-consuming.

This project presents an alternative approach to the traditional style of teaching, and while it encourages the strengths of the existing teaching style, such as in-person teaching, it aims to reduce the stress and time consumption that the traditional style brings for both lecturers and students.

In this project, an e-learning system, specifically a learning management system (LMS), was proposed. The LMS addresses the growing student-to-lecturer ratio by providing a platform for efficient resource sharing, online assessments, and flexible course delivery. Instructors would have the ability to share resources, conduct tests and assignments on one platform, and potentially host lectures that could be attended by the students taking the course. The students also stand to benefit from features such as assignment and test submission functionality as well as easy access to course materials. The implementation scope of this project is the Computer Science Department, University of Benin.

The learning management system was designed using the Flutter framework and the Dart programming language. The software developed was also tested to ensure it met its expected goals and objectives.



# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 Overview**

According to Li, Lau, and Dharmendran (2009), e-learning is the delivery of a course, training, or educational program through electronic transmission. This involves improving in-person instruction on campus by using computers and the World Wide Web in the classroom; improving distance learning (on or off campus); providing print and computer-based resources for individual and group study; and providing instruction exclusively online. This combination has resulted in a significant increase in the amount of text-based and online classroom information available to all students, whether via learning resources, email correspondence with instructors or tutors, or other e-learning tools. In recent decades, there has been a significant growth in the use of information and communication technologies (ICT) for educational objectives. Additionally, the widespread use of network technologies has led to significant modifications in e-learning methodologies. (Kahiigi and others, 2008).

Online learning involves using a computer to access learning materials and other helpful resources, such as technology, computer-based education, and computer-based training. Information and data are sent using the e-learning system via text messages, emails, and other electronic communication channels (Katz, 1998, 2000; Trentin, 1997). Whether they are in the comfort of their bedroom, living room, or even a moving automobile, students, also known as e-learners, will be listening to lectures on their computers just as they would in a traditional classroom. The use of e-learning

gives educational institutions and their students/learners considerable flexibility in terms of distribution and receiving of learning materials at any time and location. Smedley (1910).

## **1.2 Background Study**

With the growth in the Nigerian youth population and an increase in demand for higher education, it is unavoidable that there would be a growth in the class population of Nigerian universities. However, the current state of tertiary education is one faced with numerous challenges including inadequate infrastructure, limited access to quality education and lack of transparency in the educational system.

Considering this, while the student population is increasing, the number of teaching staff is either stable or reducing because of factors such as lack of payment of salaries and resignation of lecturers (*Ibrahim Ramalan, 2023*). Considering this, the traditional way of lecturing is no longer as efficient as it used to be because of the increase in the number of students assigned to just one lecturer.

The traditional way of lecturing is laced with a lot of issues, from the use of excessive papers for assignment and test purposes to the process of marking them by the lecturer, which can be tedious and stressful. Such a tedious marking process can lead to error in grading and compilation of results and because paper sheets have to be discarded, there is no history of such tests for revisions and other possible purposes. To combat these issues, this project focuses on the implementation and utilization of an e-learning platform to harness its benefits.

E-learning tools remove the need for paper for taking tests and submitting assignments. It also provides a good platform for dissemination of course materials from the lecturers to the students

in a very efficient way while still providing history and access to past test records for revision purposes and performance evaluation.

This project's purpose is rooted in the design and implementation of a learning management system (an e-learning tool) made for University of Benin, specifically the Department of Computer Science. While there are many commercial LMS online, it is not easy to customize it for the use of Nigerian institutions.

### **1.3 Motivation**

The need for a very efficient way to disseminate information from the Lecturers to the students offering the course, as well as give tests and assignments, has become a lot more relevant. In tertiary education, especially federal universities, the large student population can affect effective learning experience for each student. This means we have to leverage existing technologies so as to provide a less stressful yet effective means of lecturing.

### **1.4 Statement of the Problem**

The current state of education in Nigeria is one laced with a lot of challenges, as lecturers are leaving the university system for “greener pastures” because of the unpalatable treatment of the academic staff (*Ibrahim Ramalan, 2023*). This results in an increase in the student-to-lecturer ratio, as the number of students admitted each year has not been negatively affected by this.

A major concern with this development is the fact that the efficiency of lecturing would be greatly reduced as the same method that has been employed before cannot be used properly now. Lecturers would be discouraged from properly evaluating students with the use of tools such as tests and assignments because of the tedious grading process. This leads to poor assimilation by the students.

Additionally, if the lecturers can give and grade the tests and assignments since they are done on papers that would have to be discarded later, performance evaluation would prove impossible. In view of this, an efficient and reliable learning style is needed in the university system.

### **1.5 Aims and Objectives**

The aim of this project is to provide an efficient means of lecturing for the University of Benin, specifically the Department of Computer Science, through the development of a learning management system, that aims to augment the already existing system.

This proposed system aims to achieve the following objectives:

1. Creation of a Learning Management System that allows students to take tests and submit assignments easily.
2. Development of a system that augments, not completely replaces, existing lecturing styles.
3. Reduction in the use of papers for tests and assignments, which would not allow for performance tracking and proper record-keeping.
4. Development of a system that helps lecturers' grade and monitor performance of the class easily.
5. To help the lecturer easily share important information with all the students taking the course at the same time.

### **1.6 Scope and Limitations of Project**

The scope of this study is limited to the design and implementation of a web-based Learning Management System. The study is limited to the University of Benin, Department of Computer

Science. However, the study would be helpful in the design and implementation of an LMS in other Nigerian universities.

### **1.7 Significance of the Project**

As a result of the large population of the Department of Computer Science at the University of Benin and the need to improve lecturing situations, this Learning management system will help realize the following:

1. It would provide an efficient means for the lecturers to grade tests, as well as keep track of these test records for future use.
2. It would help track the performance of the students in their specific course areas, so they know which areas they are lacking.
3. As there is history, students would still be able to look up tests, assignment questions, and answers to use for revision purposes.
4. With easy marking, especially for quiz-graded tests, lecturers would be encouraged to give evaluation tests to students.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

This chapter seeks to provide an insight into the concept of e-learning. It goes to look at the historical overview of the use of electronic transmission to help in learning around the world. It also looks at the evolution of e-learning as well as the introduction of e-learning in Nigeria. It went further to go into understanding Learning management systems and its current trends. Finally, the challenges of integrating learning management systems in Nigerian Universities is seen. A summary of the entire chapter is used to close the chapter.

#### **2.1 An insight into e-Learning**

The concept of e-learning has existed since around the 1840s. However, the first mention of e-learning was when Educator Elliot Masie first mentioned it during the CBS systems seminar in 1999 (Keegan, 2020). Fundamentally, e-learning is the process of learning using tools provided by information and communication technology (ICT). It refers to “the use of ICTs, i.e. Information and communication technology, to enhance and support teaching and learning process” (Madaki, 2021). E-learning is “understood to as a type of learning within the framework of which the acquisition and the use of knowledge is distributed and facilitated by electronic devices” (Klement M and Dostal J, 2012). It is a broad term which encompasses all forms of electronically supported delivery of knowledge from teachers to students. It ranges from the way students use email to access course work online while following a course on campus to programs offered entirely online. Lectures may be in the form of texts, audio, audio-visuals or a blend of all of them.



e-Learning is not a new concept to tertiary universities, and some are even using it for their distance education programmes. It includes computer-based learning, virtual learning, online classrooms, etc, where contents are delivered via Network, audio, or video tapes and satellite TV (Madaki, 2021). Though not a new concept in Nigeria, the adoption of e-Learning in tertiary institution is not as rapid as expected (Kuliya M and Usman S 2020). Various factors such as unstable electricity, high cost of data tariff, inadequate IT skills has been identified as some major issues faces in the implementation of e-learning platform in Nigeria (Ugochukwu-Ibe, I.M. and Ibeke, E, 2021)

## **2.2 Types of E-learning**

There are various types of e-learning. It includes:

1. **Synchronous e-learning:** This is also known as instructor-led e-learning. Here, the learners are required to be present at the same time from wherever they are around the world. It often involves videoconferencing and online chats. This avoids the issues of social isolation and poor relationships between teachers and students, as well as between the students and each other (Madaki, 2021).
2. **Asynchronous e-learning** is also known as self-paced or self-directed e-learning. Here, each student is not required to be online at the same time. The students study independently from each other, regardless of their locations or the time of access to the course resources. Though this supports social isolation, it allows the students to learn at their own pace and structure their learning patterns (Madaki, 2021).
3. **Fixed E-learning:** Here, the content used during the learning process is the same regardless of the who is taking the course. The resources are usually predefined by the lecturers and

are not adaptable to the student's preferences. This is usually what is employed in schools and classrooms (Madaki, 2021).

4. **Adaptive E-learning:** Unlike fixed e-learning, here, the course materials are redesigned to adapt to each individual student. Though more effective than fixed e-learning, it is difficult to plan and accomplish (Madaki, 2021).

### 2.3 Evolution of e-learning

E-learning, as we know it today, has certainly improved the quality of learning and education in general. How e-learning came to be is, however, not known by many people. Who were the pioneers, what was the idea behind it and how did it come to be is still unknown to so many of its users. The aim of this section is to expose the evolution of e-learning, from its known inception until date.

**1. Stenography (1840s):** Wotton-under-Edge Instructor Isaac Pitman taught his students stenography, or shorthand, by mail (Leerbeleving, n.d.). He would usually mail his students assignments to them and then, his students would send to him through mail their tasks to be graded. Professionals such as journalists and secretaries that had to take note often implemented his writing style which was optimized for speed.

**2. Automatic Teacher (1924):** This was an assessment device created by Professor Sidney Pressey of Ohio University's Department of Educational Psychology ("The History of E-Learning," 2017). It was an examination device that looked like a typewriter and answered multiple-choice questions. There were four choices to choose from for each of the questions. Until the correct answer is selected, the machine will not go to the next question. That way, students could check the accuracy

of their answers. Regrettably, the lack of interest and commitment by the instructors to the Pressey machine led to its failure.

**3. GLIDER (1954):** This was a teaching machine developed by a Harvard Professor BF Skinner. It allowed for the facilitation of programmed instructions by schools to their student. It appeared like a box containing a series of questions. The questions appeared through a small window and could be answered through writing down on paper. Students who got the correct answer would get commended and then go to the next stage. Unlike the Automatic Teacher developed by Professor Siney that was proposed to test students, this machine was made to teach student.

**4. Computer Based Education (1960s):** At this point, the history of learning management systems comes into play. At this time, Programmed Logic for Automated Teaching Operations (PLATO) was invented for University of Illinois students by Daniel Alpert and Don Bitzer. It, however, became widely used by schools all over the area. In 1966, Professor Patrick Suppes and Richard Atkinson utilized computers to teach maths and reading at Palo Alto elementary schools. In the same time, Bernard Luskin, a renowned media psychologist, introduced teaching machines in schools in partnership with Stanford engineers (Keegan, 2020).

In 1968, the University of Alberta's Department of Medicine in the US was the first to offer online courses, teaching a large class of learners using the IBM 1500 network. The system helped instructors send course materials, organize documents, as well as access tasks remotely. It is arguable the earliest method of contemporary online learning in the history of e-learning platforms (Keegan, 2020).

**4. Internet-Based Courses (1976):** The Cyclops whiteboard system, which enabled teleconferencing, was created by the UK's Open University. The university introduced its first online classes through CICERO with 3 courses. Coastline Community College became the world's first totally remote community college in 1976. It currently provides on-campus instruction across it multiple 'mini campuses' at the college (Keegan, 2020).

**5. Learning Management System (LMS, 1990s):** In the early 1990s, some schools were built to provide online education only, and this helped to lessen the expenses of distance learning. It made use of the internet to make education accessible to people who are unable to access schools because of factors such as scheduling conflicts and geographical constraints. LMS began gaining popularity in 1995, and schools used it to keep track of student records, tests, and grades. Over 17,000 schools have employed Blackboard's software as of the year 2014 (Keegan 2020).

**6. Massive Open Online Course (MOOC, 2000s):** In 2001, the Massachusetts institute of Technology (MIT) created the Open Courseware project where courses and assignments from well recognized lecturers were included. It included over 40 courses with various video lectures as well as tasks (Keegan, 2020). In 2010, there came a rise in learning via social media such as Facebook, YouTube, etc. In 2012, there was the emergence of one of the world's largest online learning platforms, Coursera developed by Stanford Universities' Andrew NG and Daphne Koller. Around this time, there was also the emergence of Udacity and edX which were two more successful online learning platforms. This gave the year 2012 the label 'Year of the Massive Open Online Course (MOOC)' (Tamm, 2019). The switch to e-learning became more prominent in 2020 during the COVID-19 pandemic which showed the advantages and flexibility in the use of e-learning (Keegan, 2020).

## **2.4 History of e-learning in Nigeria**

With a population of over 140 million (NPC, 2007), a landmass of about 923,768 square kilometers, and more than 274 ethnic groups, Nigeria is the most populated country in Sub-Saharan Africa. The population's education comes at a great social and financial cost, particularly in view of the finite resources and growing demand. Nigeria needs to find appropriate and affordable ways to meet the enormous unmet demand because of the country's growing population, the rising demand for education at all levels, the challenges of funding education through traditional face-to-face classroom bound mode, and the imperative need to provide education for all regardless of environmental, social, or cultural circumstances. According to Jegede and Sadeq (2003), all these new developments highlight the need for an extensive search for more reliable, safe, dependable, effective, successful, and economically advantageous educational solutions. Remote learning is the most obvious choice to meet these objectives. In terms of increasing education, e-learning is not a new trend in many parts of the world. It is now being utilized by several institutions in Nigeria to support lifelong learning and distant education (D.E.). It all comes down to studying with the aid of computers. Few government-owned institutions in Nigeria employ ICT infrastructure of any kind to run their academic activities, and for some, e-learning remains an unattainable ideal because of a lack of ICT equipment. Benefits of Nigeria's e-learning adoption include improved options for individualized learning, easier access to learning opportunities, time and location convenience, a wider range of learning resources available, and the introduction of more potent cognitive tools. Ajadi et al. (2008) claim that students who are employed in the majority gain from the usage of e-learning in education, especially at Nigeria's national open university.

## **2.5 Learning Management Systems**

LMS can be traced back to the 1960s. However, the first web-based LMS, named Cecil, was launched in 1996 (Sheridan et al., 2002). According to Loon and Teasley (2009), learning management systems are web-based systems that enable instructors and students to share materials, submit and return assignments, and communicate online. LMS are software applications, mostly web-based applications, that allow for the organization, sharing, and delivery of learning content between the instructor and the student.

## **2.6 Trends of Learning Management Systems**

With the improvement in technology and rapid changes in e-learning technology, there are many Learning Management System trends and more still to come. Some of the current trends of LMS are:

1. **Personalized Learning Environment (PLE):** PLE refers to various tools, software and systems that give the students control to direct their own learning. With the advancement of artificial intelligence, by analyzing each learner's behavior, unique experiences for the learner can be created. The data collected is used to determine the learners' preferences to create a more efficient pathway thus creating a personalized learning experience for the learner.
2. **Immersive Learning With Augmented Reality and Virtual Reality:** Augmented reality is an interactive experience that combines the real world with computer generated content. It brings in computer generated visuals into the real world. Virtual Reality is a simulated experience that gives the user an immersive feel of a virtual world by utilizing 3D near-eye displays and pose tracking. With AR, classrooms and online education becomes more

interactive as virtual examples can be used to explain concepts. Also, with VR, the learners can experience a concept being taught up close without being in the direct location.

3. **Nano Learning:** The attention span of a student is a key component when it comes to effective learning. It is easier to understand a lecture when it is short and precise as compared to when it is long. Nano learning has to do with breaking down a long lecture into bit sized chunks of information that is easier to assimilate. E-learning opts for nano learning.
4. **Talent LMS:** Talent management determines learners' present skill levels and areas for improvement. One tool for presenting courses is an LMS. Traditionally, talent management and LMS have operated apart from one another. Talent management and learning management system integration can help learners' close skill gaps and enhance their job-related competencies. Learning management systems may now propose new training courses based on the requirements and abilities of their users thanks to the integration of talent management into the LMS, which is another recent development (Bhatia, 2014).
5. **LMS Gamification:** Universities and educational research organizations are seeing a rise in the "gamification" of courses. Games are made to be enjoyable, educational, and satisfying for the player. LMS gamification is required to pique students' attention and maybe achieve learning objectives. Using games to inspire and engage students is an intriguing technique to improve learning management systems. It has been shown that learners generally adopt the games well. Future research focuses on measuring learners' satisfaction and learning levels when they use games to supplement their education (Souza-Concilio & Pacheco, Holman et al., 2013).

6. **Mobile LMS:** There's a trend toward LMSs having mobile learning capabilities. This enables students to access their course materials on mobile devices and continue their education. Future mobile devices must enable response systems, personal notification systems, mobile content, and LMS access. To determine the efficacy of learning, performance, and system quality, further study is required to analyze how video courses are used with mobile devices (Specht & Klemke, 2013; McIntosh, 2014).

## 2.7 Challenges of Integrating E-learning in Tertiary Institutions in Nigeria

The adoption of e-learning in Nigeria has been faced with a lot of problems. Some of the problems include:

1. **Lack of constant electricity:** The current state of electricity in Nigeria is nowhere near adequate and as electronic devices are used for e-learning, electricity is of utmost importance.
2. **Internet Connectivity:** With the current price in data tariff, it is expensive to access the internet which can hamper the use of the e-learning platform.
3. **Technical Understanding:** The utilization of the e-learning platform would require some degree of learning how the platform works. This can be challenging for some people.
4. **Adoption and Acceptance of software:** It is not always easy to adapt to changes and since e-learning adopts a new way of learning, it could be daunting to use.

As much as these challenges exist, the benefits outweigh completely the challenges.



## **2.8 Summary**

The advancement in technology has helped in the growth of e-learning and its approaches. E-learning has advanced from simply being a means of transmission of information to students, to offering learners access to on-demand resources. This chapter shows the evolution of e-learning and a brief history of how e-learning came into existence. It also touched on the trends of learning management system and the challenges of implementing e-learning in tertiary institutions in Nigeria.

## **CHAPTER THREE**

### **SYSTEM ANALYSIS AND DESIGN**

This chapter gives an insight into the model used in the development process. It also gives an overview of the design and analysis of the system used. This chapter would also cover the application architecture of the software.

#### **3.1 System Analysis**

System analysis is a very important aspect of software development. It entails understanding how an existing system works to accomplish the objective for which it exists. Here, a system is analyzed to understand the components of an existing system, diagnosing the problems of the existing system, and then using the information to recommend improvements that should be made when developing the new system.

#### **3.2 Constraints of Traditional Lecturing Methods**

The aim of this project is to tackle the issues of the traditional lecturing style. The following are some of the observed problems associated with the existing lecturing style:

1. The process of marking and grading tests and assignments written on a piece of paper can be tedious and error prone.
2. Because of the large population, it is not easy to monitor the performance of the students in the classes. Therefore, knowing how well a concept is taught is understood is almost impossible.

3. Since papers used for tests and assignments would have to be discarded later to avoid cluttering, revision and review of tests by the students and lecturers would prove impossible.
4. Organizing paper tests for a large population can waste space and time in the long run.
5. Since there is a large population of students, lecturers would be discouraged from giving tests and assignments, as grading would be extremely stressful and time-wasting.

As much as the traditional lecturing style has a lot of disadvantages, its greatest strength lies in the close relationship between the lecturers and the students, as well as the relationship between students

### **3.3 Features of Proposed System**

The proposed system is called **Chronos LMS**. It is an e-learning tool that combines the strength of the traditional teaching style (such as in-class lectures) and e-Learning together to provide a better learning method. Having identified the limitations and constraints of the existing system, the features the proposed system is expected to have include:

1. The ability of lecturers to give tests (both theory and multiple choice) and assignments.
2. **Performance Tracking:** It would enable students and lecturers to monitor performance in a particular course.
3. **Provision of Test History:** It would be able to provide test history to both students and lecturers for revision and other purposes.
4. Ability of students to answer tests and assignments on the platform.
5. Resources would be able to be shared by the lecturers, which would be accessible to the students for download.

6. Admin would be able to monitor the performance of the students in each course taken by them.
7. The admin would be able to control who is able to access the platform as a lecturer.

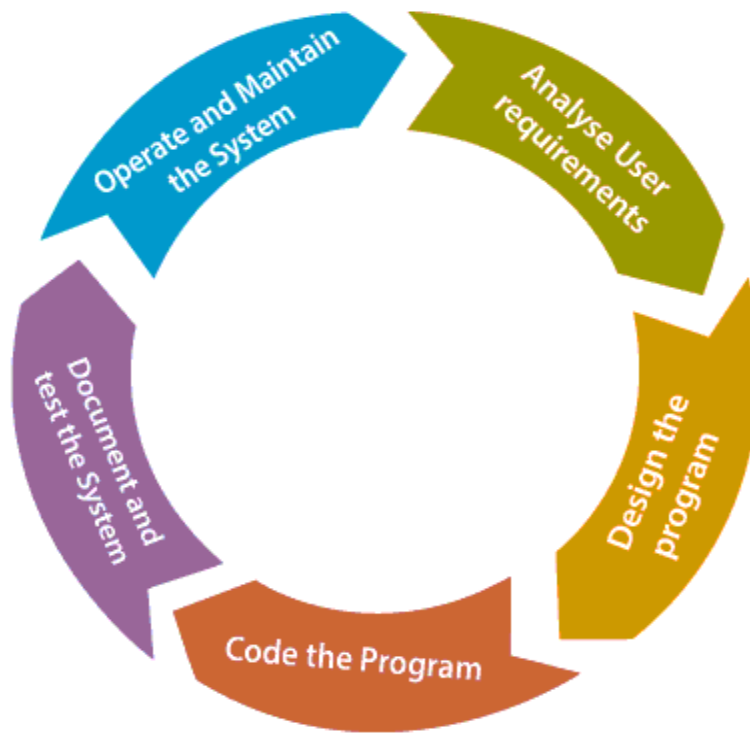
### 3.4 Design Methodology

The proposed model used for this application was the Agile method. Agile software development is a software development methodology that prioritizes flexibility, collaboration and customer satisfaction. It is an interactive and incremental approach that emphasizes the delivery of a working product as fast and as frequent as possible (Agile Software Development – Software Engineering | GeekForGeeks, 2024). Products are released in phases or versions which are tested to see if the proposed system requirements are met. This is continued until a concrete final version is produced.

The agile model consists fundamentally of 5 phases. These phases are carried out with each iteration. The phases of agile model are:

1. **Requirement gathering and analysis:** In this phase, the requirement of the software is defined. The time and effort needed to build the project is also defined and explained. The user requirements of the software are a set of functionalities and constraints that the end user expects from the system. They are gathered and analyzed for their validity and the possibility of incorporating these requirements into the software being developed is examined.
2. **Design:** When the goals and objectives of the software is identified, the user flow diagram or the high-level UML diagram is designed. This design is based off the requirements established from the above phase. System design helps in specifying the hardware and system requirements as well as helping in defining the overall system architecture.

3. **Implementation:** When the requirements have been defined and the design started, the developers begin to work on the product. The aim of the developers and designers is to deploy the working product within the estimated time. The product would go into various stages of improvement, so it includes simple, minimal functionality.



**Fig. 3.1: Agile Software Development Process**

4. **Testing and deployment:** At this phase, a working product has been made. The product is then tested to see if it meets the requirements established in the first phase, and then it is deployed for use.
5. **Operation and maintenance:** After the release of the product, the development team receives feedback from the users after real world usage. This feedback would give the development team insight into how the software fares and changes that need to be made to the software in future releases.

### **3.4.1 Advantages of the Agile Model**

1. It allows for quick release of products as it prioritizes product release in the quickest and most efficient way.
2. Users and customers can see the result quickly and check whether it satisfies their needs and requirements.

### **3.4.2 Disadvantages of the Agile Model**

1. With further corrections and changes, there is a high possibility of the project crossing the expected delivery time.
2. Because of consistent iterations, it may be hard to estimate the development costs.

## **3.5 Proposed System Architecture**

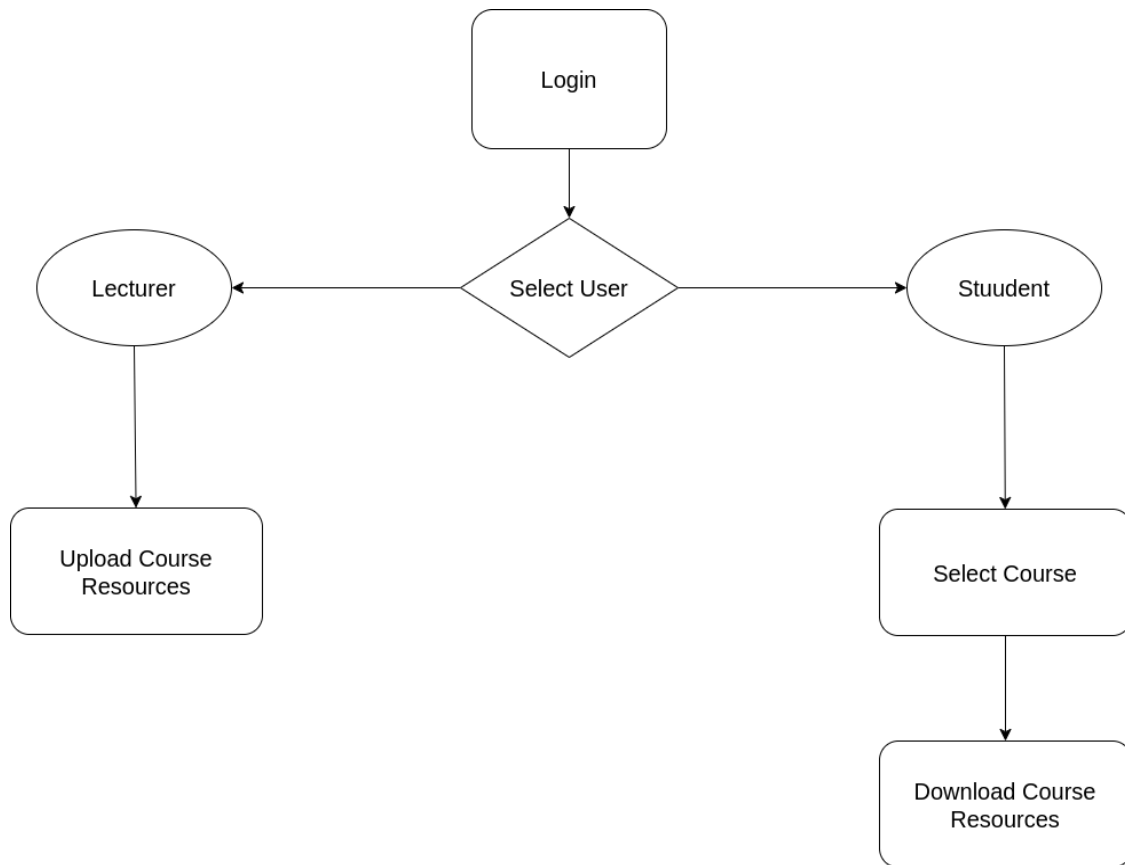
Chronos LMS is a web application that would allow lecturers to create and post resources, tests, and assignments, which would be stored in an online database. It would also allow students to access the resources as well as provide answers for the tests and assignments. Google Firebase is going to be used as the backend cloud server, as it allows for the utilization of things like authentication and cloud database storage. The web application is going to be hosted using Netlify.

There are three major aspects of the Chronos LMS:

1. **Authentication:** A user can either register as a student or lecturer. Registration as a student is simple and straight-forward. However, for the lecturer, the admin would have to authorize the lecturer's account before access to the dashboard is given. This is done to

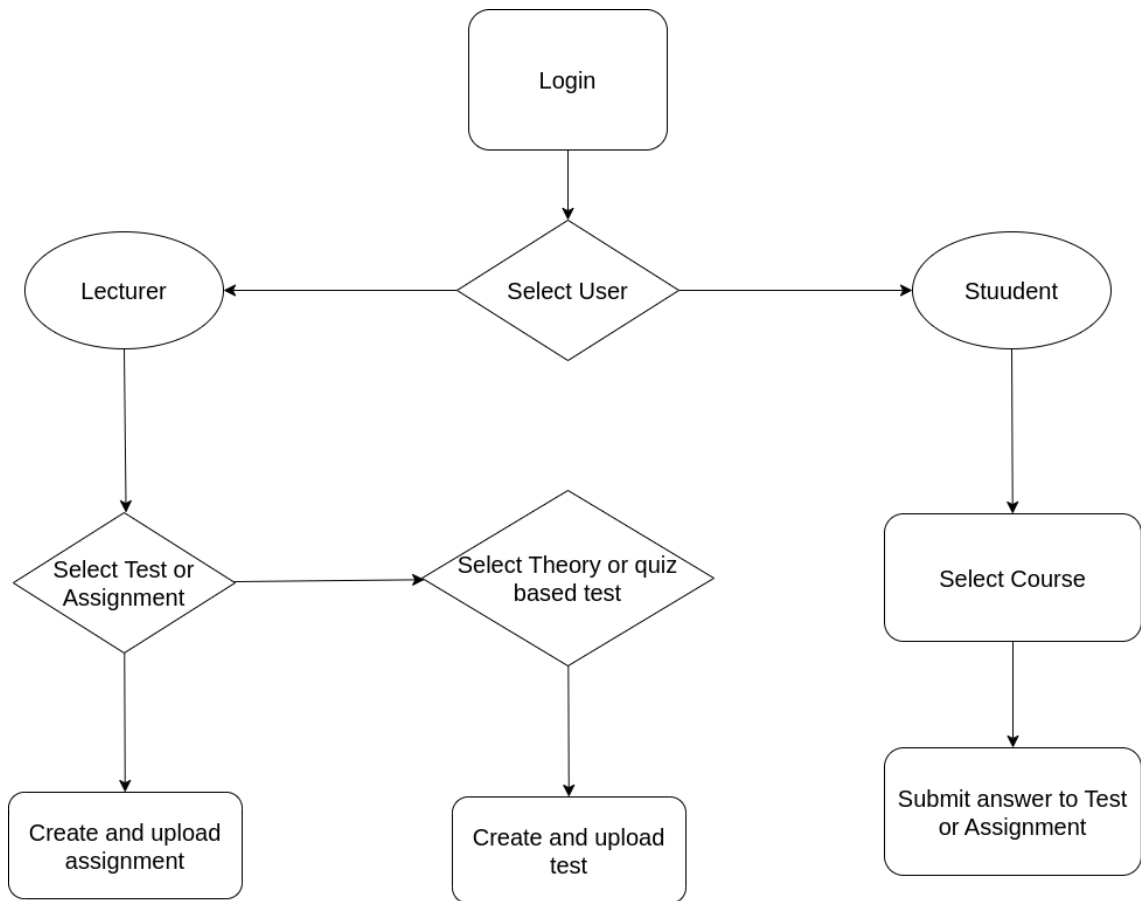
prevent just anybody from applying as a lecturer on the system. So, when a lecturer has created his/her account, a request is sent to the admin to validate the lecturer's account and verify the information. Once the admin verifies the lecturer, then the lecturer is given access to the dashboard, where they can manage tests, assignments and resources

2. **Storage and access of resources:** The lecturer can upload resources that would be stored in the database. These resources can be accessed by the students who have registered for that course. Fig. 3.1 shows how this flow happens.



**Fig 3.2: User flow of resource upload and download**

3. **Creation and storage of tests and assignments:** This is the last major aspect of Chronos LMS. They can create a test (which can be quiz based or theory based) or an assignment. The tests and assignments are stored in the database. On the student side, they can take the tests once they see the notifications and their replies would be accessible by the lecturer. Once answers are received and marked by the lecturer, the scores and corrections (if any) are released to the student. **Fig. 3.2** shows this flow:



**Fig. 3.3: User flow diagram for test creation and submission**



After registration and login, the lecturer can create and delete tests and assignments, as well as upload and delete course resources. The lecturer also can mark and score the responses of the students. The students on the other hand can access and answer the tests and assignments created by the lecturer and can also download the resources already uploaded. However, the students are not able to upload the resources themselves.

### **3.6 System Design**

System design is a crucial phase of software development. System design is the process of planning a new system to replace or complement the already existing system. It aims to address the limitations of the old systems, while meeting the goals as defined in the system analysis phase. Here, the system architecture is defined, and the interfaces are designed in line with the requirements gotten from the system analysis phase.

### **3.7 System Design Tools**

In the creation and communication of the architectural diagrams, plans and specifications of the proposed system, some tools are employed to aid the design process. These tools are known as system design tools. The system components as well as their interactions with each other can be shown visually with the help of these tools. There are diverse types of system design tools including:

1. **Unified Modelling Language (UML):** UML is a standard notation for describing the structure and behavior of systems using diagrams. The UML tools are system design tools that support the creation and editing of UML diagrams such as state diagrams, sequence diagrams, etc.

2. Wireframing: This is the process of creating low fidelity (low-fi) sketches of the user interface systems.
3. System flowchart.

They are used mostly in combination with one another.

### **3.8 System Design Tool: Unified Modelling Language (UML)**

Unified Modelling Tool (UML) is a standard notation, not a programming language, used to visualize, specify, construct and document software systems. It primarily uses a collection of diagrams built up by a set of symbols and notations to visualize the way a system has been designed.

### **3.9 UML - Use Case Diagram**

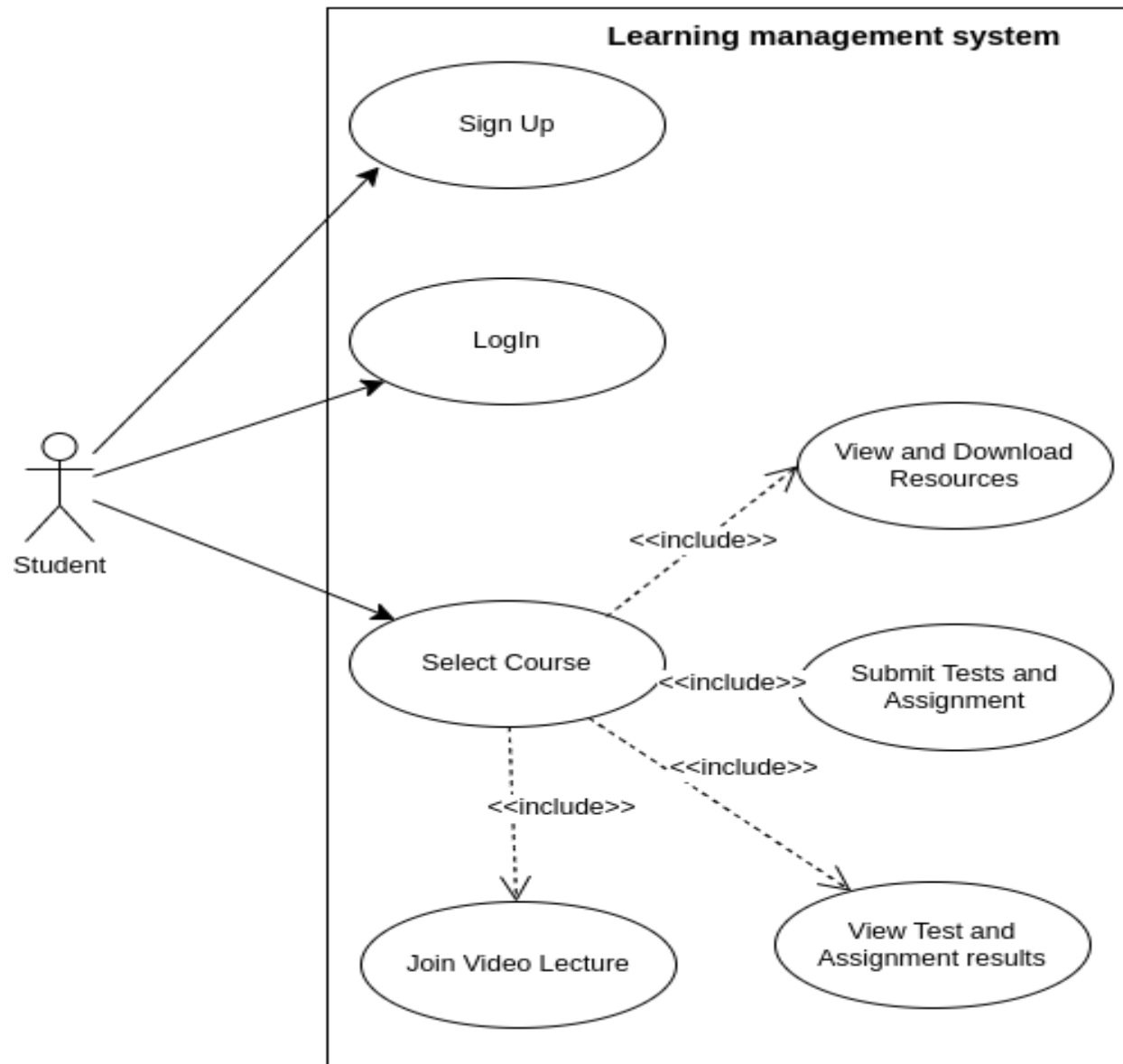
To model the dynamic behavior (the behavior of the system when it is in operation) of a system, UML uses diagrams. One such diagram used is the **use case diagram**. A use case diagram is used to show the interaction of the system developed and its components with the actors (user or other systems). It gives us a high-level view of what the component of a system does from the actor's perspective without going into implementation details.

To draw a use case diagram, some notations (symbols) are used. They are:

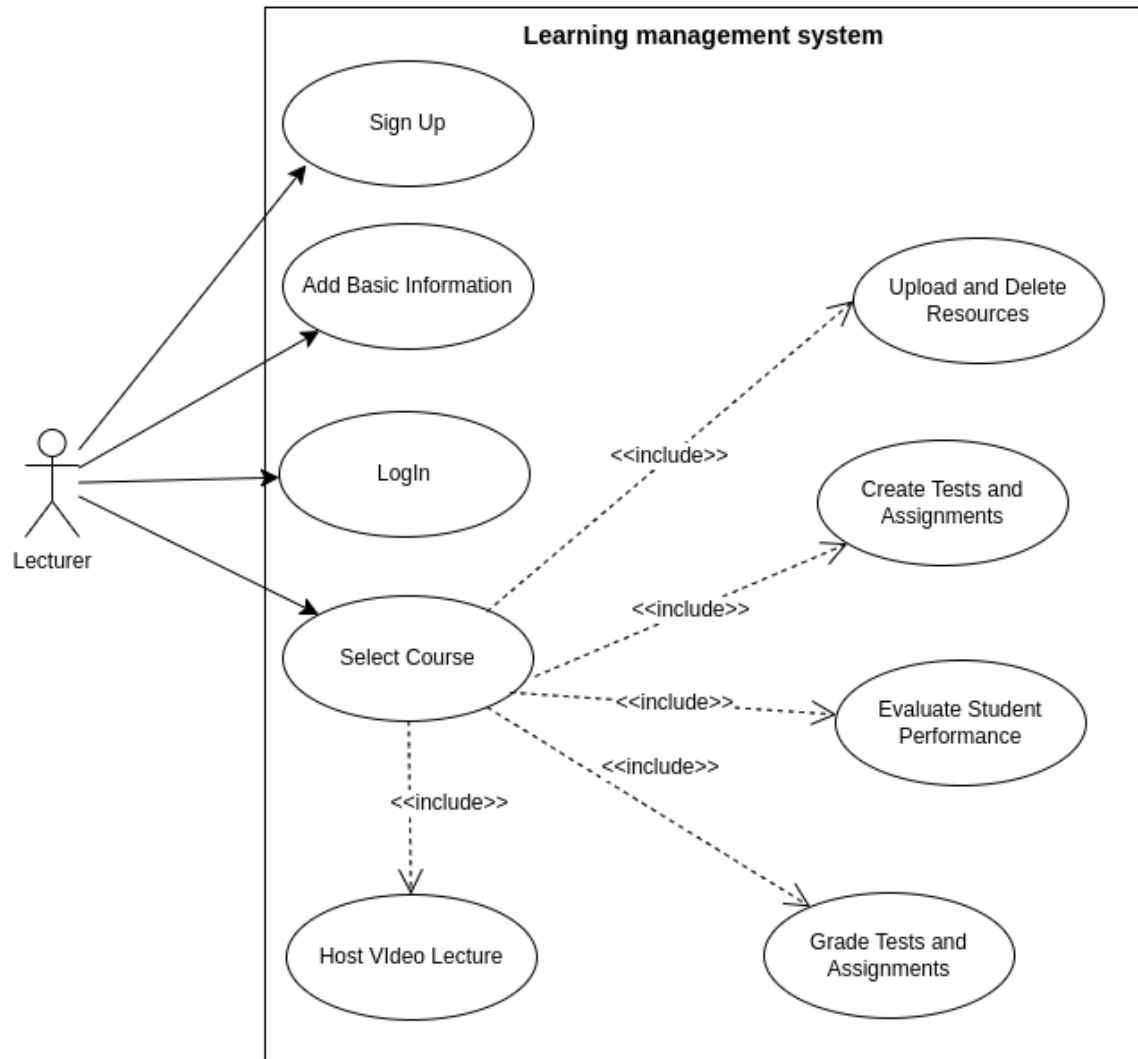
1. **Actors:** These are entities that interact with the system. It includes human users, other internal or external applications, or hardware devices. They are usually represented using stick figures.

2. **Use Cases:** These are the things the system can do. It usually depicts the actions that the actors can perform using the system. It is usually represented by ovals.
3. **System Boundary:** This shows the scope of the system that has been modelled. Here, what is within the system and what is outside is defined clearly. It is usually depicted using a rectangular box that encapsulates all the use cases of the system.
4. **Relationships:** This shows the interactions between the actors and use cases. Some key types of relationships are  
**Association Relationship** which represents the interaction between an actor and a use case. It is depicted by a line drawn to connect the actor to the use case.  
**Include Relationship** which shows that a use case includes the functionality of another use case. It is depicted by a dashed arrow with the keyword 'include' drawn from a use case to the use case whose functionality is being included.  
**Extend Relationship** shows that under certain conditions, a use case can be extended by another use case. It is depicted by a dashed arrow with the keyword 'extend'.

The use case diagram for the proposed system is given below:



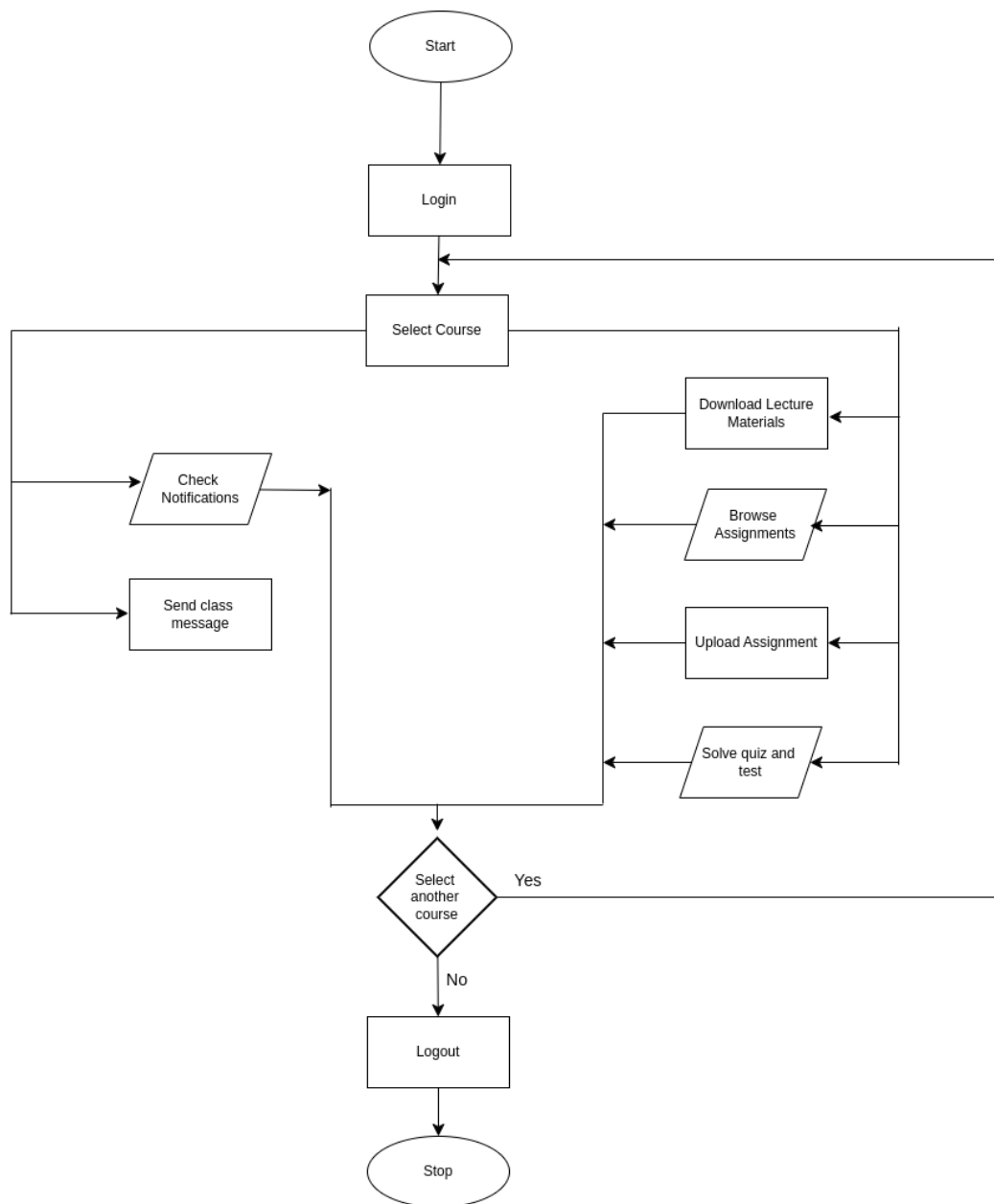
**Fig. 3.4:** Use case diagram for student



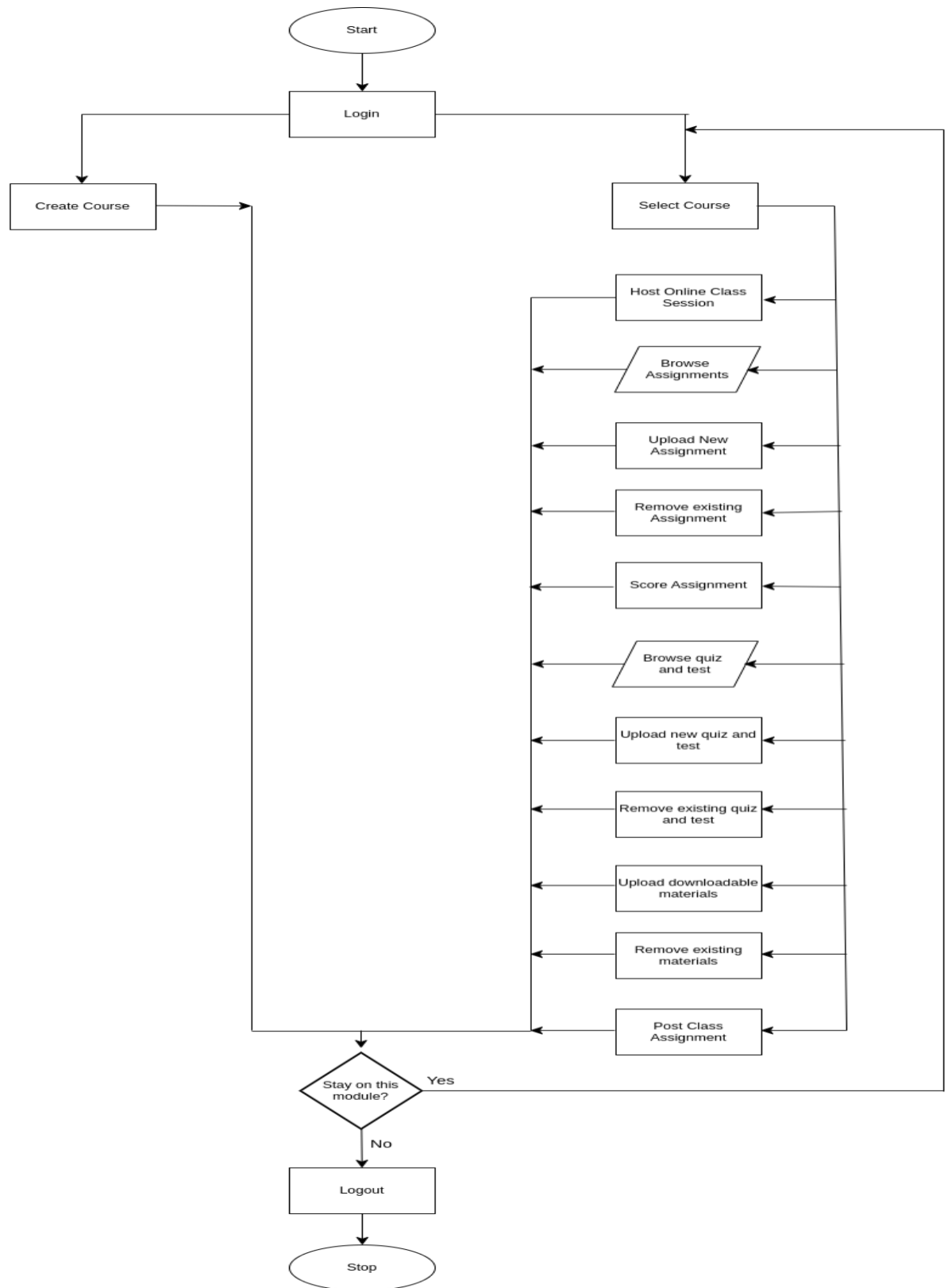
**Fig. 3.5: Use case diagram for lecturer**

As shown in Fig. 3.3, the student can sign up, login and after the course has been selected, the student can join a video lecture, submit assignments, take tests and download resources if available. On the other hand, the lecturer can perform the authentication functions as well as host video lectures, create and grade tests and assignments, evaluate the students' performance and upload resources.

### 3.6 Flowchart Design for User Interaction



**Fig. 3.5: Dataflow diagram for Student**



**Fig. 3.6: Dataflow diagram for Lecturer**

### **3.8 Summary**

The usage of the Agile model for development ensured that the application met the system requirement while releasing tangible changes in a short amount of time. This chapter also showed the use-case diagrams of the application as well as the dataflow diagram which shows how a user can interact with the software and the required functionality for the product to be considered complete.



## CHAPTER FOUR

### SYSTEM IMPLEMENTATION AND DOCUMENTATION

This chapter explores the implementation of the Chronos Learning Management System. It focuses on the front-end and cloud integration of the complete system. In this chapter, a lot of details about the implementation process, such as the choice of framework, programming language used and the programming environment used, are exposed.

#### 4.1 Software Implementation Tools

Some tools used in the implementation of the software are given below:

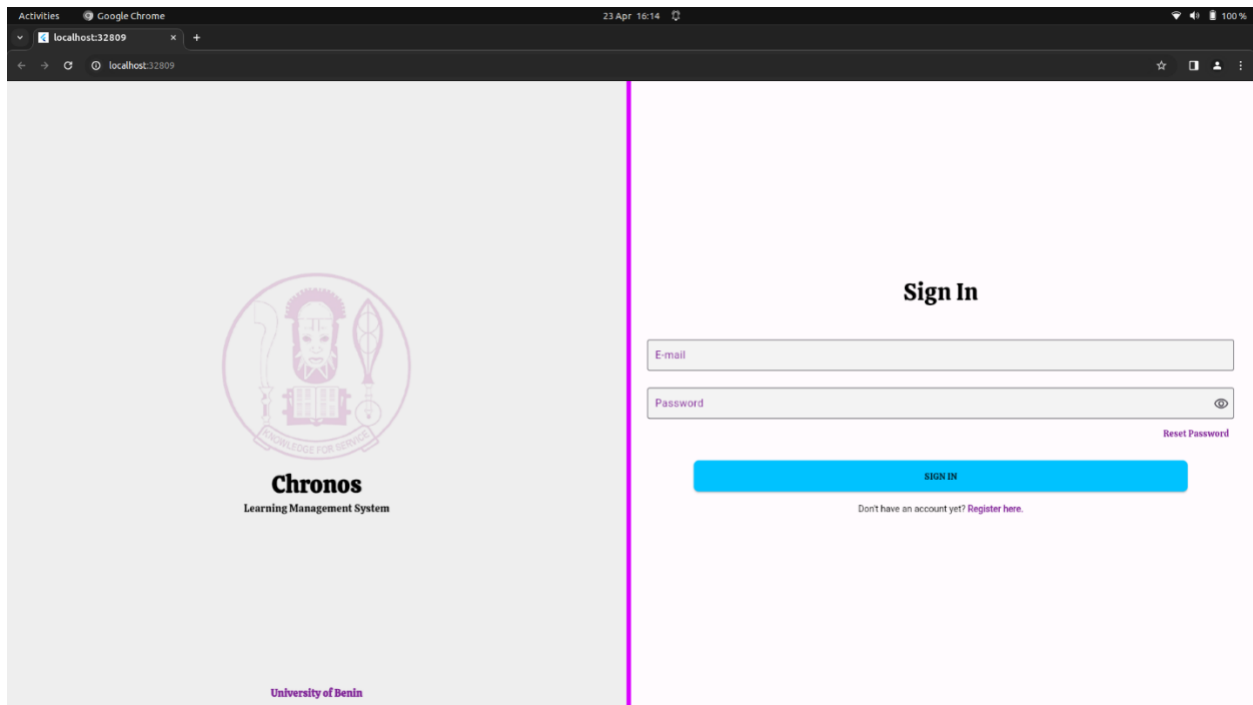
1. **Programming Language:** The programming language used is dart. Dart was used to create both the frontend (using Flutter) and backend of the software.
2. **Implementation Framework:** A framework is a group of code built to simplify and abstract a lot of details in the creation of software products. The use of a framework speeds up the process of software creation and allows developers to focus on the major functionality of their application. The major framework used in this project is the Flutter framework. It is used to build cross-platform applications, allowing the applications built to run on diverse operating systems.
3. **Development Tools:** For the development of this software, Visual studio code (widely known as VS Code) was used as the code editor. It is an open-source code editor developed and maintained by Microsoft. For maintaining versions of the application, Git and GitHub were used as the version control system. Git is a version control system, while GitHub is a cloud storage for git repositories.

4. **Deployment Platforms:** This software is a web application and was deployed using Netlify.
5. **Operating System:** The software was built on the ubuntu OS, a distro of Linux.

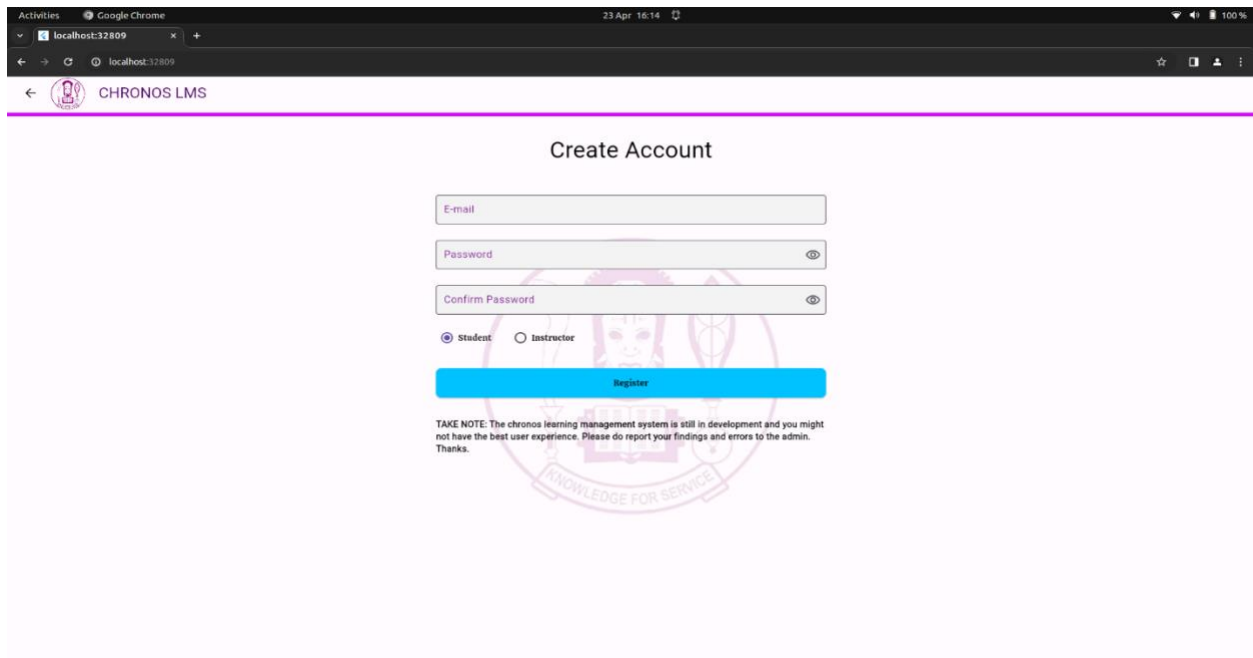
## 4.2 Main Features

The key features that make up the system are shown below:

1. **Authentication:** For the authentication, Google's firebase authentication was used to implement the functionality. If a user has an account, and the authentication is successful, the user's details are fetched from the cloud database. (which in this case is Google's cloud firestore). If the user is a lecturer, it goes to the lecturer's dashboard; otherwise, it goes to the user's dashboard. If the user does not have an account, they can also create an account. Any wrong type of input put into the text fields would be flagged as an error.



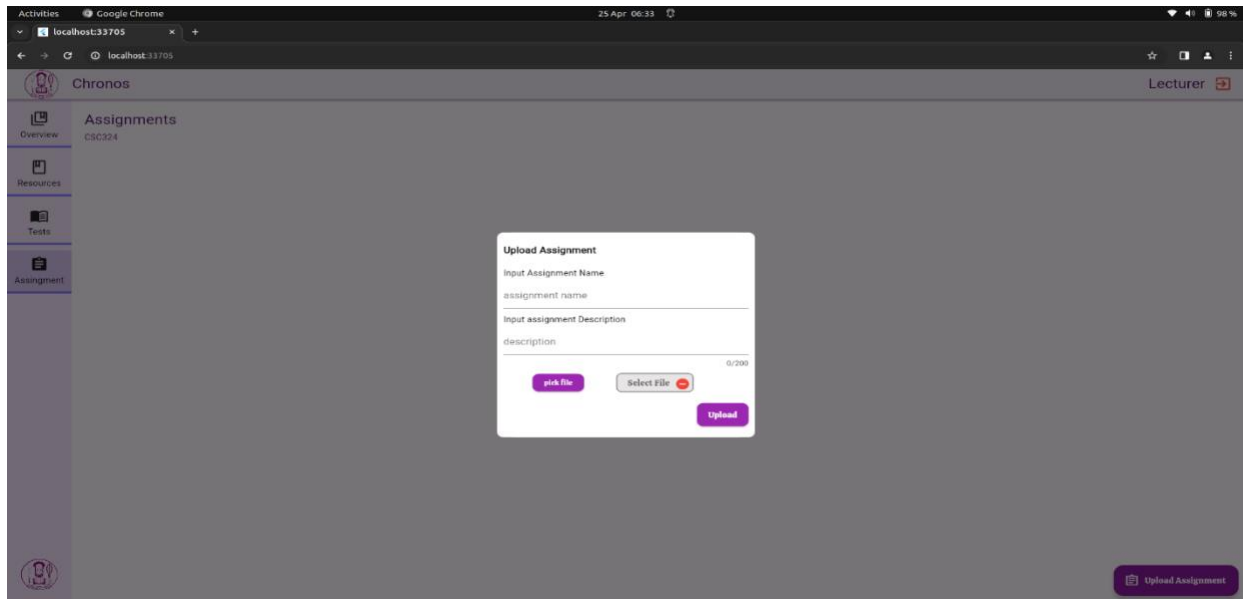
**Fig. 4.1: Sign In Page**



**Fig. 4.2: Sign Up Page**

2. **Uploading of assignment:** The lecturer can upload and delete assignments in his course.

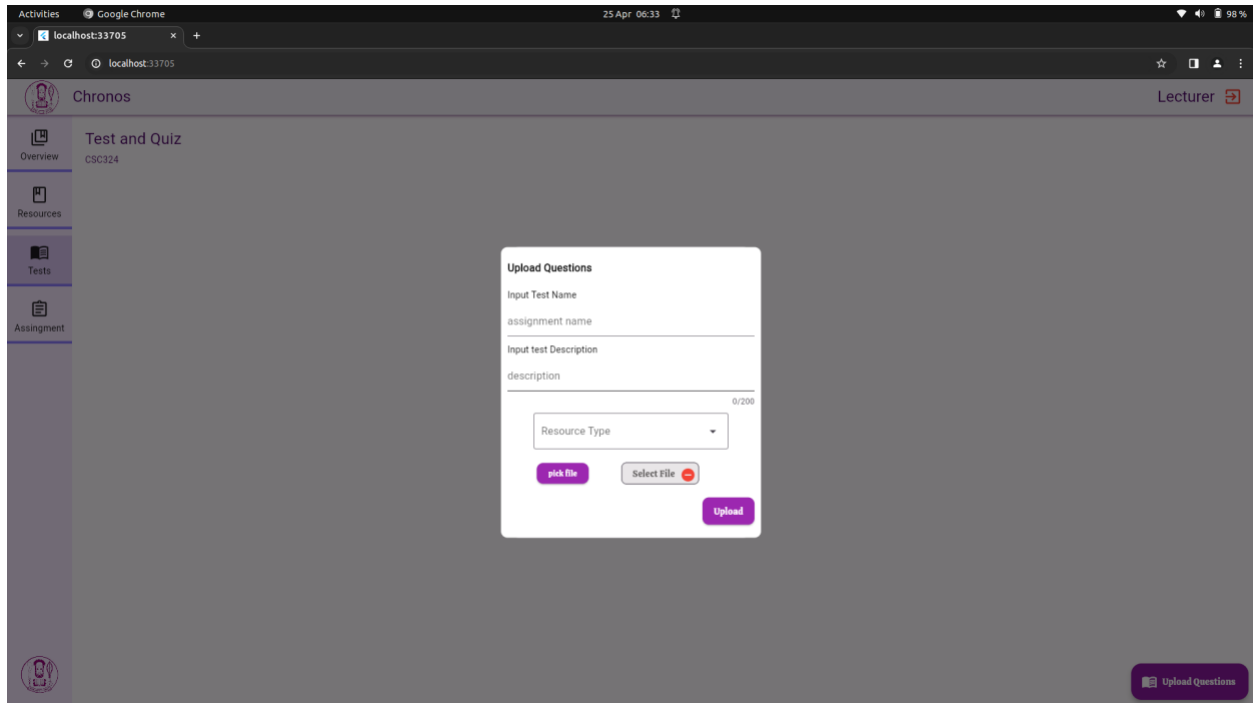
The lecturer provides the name, description and the assignment file. This is then stored in the database for download by the student.



**Fig. 4.3: Assignment Upload Page**

3. **Uploading of quizzes and tests:** The lecturer can upload and delete tests in his course.

Just like the assignments, the lecturer can upload test questions to the database which the student can then answer and upload their submissions back to the database.



**Fig. 4.3: Assignment Upload Page**

## **CHAPTER FIVE**

### **SUMMARY AND CONCLUSION**

#### **5.1 Summary**

This project documented the development and implementation of a Learning Management System (LMS) for the Computer Science department at the University of Benin. The LMS addresses the limitations of traditional teaching methods by providing a platform for online learning activities. It allows instructors to deliver course materials, assign tasks, and receive submissions electronically.

Chapter one introduced the challenges of the existing system and outlined the project's goals. Chapter two reviewed the history and evolution of e-learning technologies. Chapter three described the system model, design, architecture, and compared the current state with the proposed LMS. Chapter four detailed the development tools and system documentation. Finally, we have a summary and conclusion on the project topic.

#### **5.2 Conclusion**

The Learning Management System is a web-based software that provides a host of functionalities, as mentioned in previous chapters. The system was developed using a cloud database (Google Cloud Platform) to manage the user information (lecturers, students, admins), as well as the courses and their properties.

The system has been made to tackle the current problems highlighted in chapter 1 of this work as well as other foreseeable challenges. However, as learning is dynamic with the change in

technology devices, it might not be able to handle some future challenges. Possible challenges that may occur include:

- **Scalability:** The current cost of maintaining the LMS for a department might increase significantly for university-wide deployment. Unforeseen expenses may arise when catering to students with limited technological resources.

Other challenges, apart from the mentioned, exist but would show effect with time.

### 5.3 Future Considerations

There are still a lot of features that can be incorporated into this application. This includes:

1. **Mobile Application:** Development of a mobile companion application to facilitate learning on mobile devices.
2. **Video Conferencing:** Integrate real-time video conferencing capabilities.
3. **Accessibility Features:** Implement accessibility features like text-to-speech functionality.

### 5.4 Recommendations

The proposed system, when implemented properly, has the potential to enhance the learning experience for students. A more refined user interface and experience can also be provided to improve the usability of the software for the users.

## REFERENCES

- Ajadi, T., et al. (2008). E-learning and Distance Education in Nigeria. *The Turkish Online Journal of Education Technology*.
- Bhatia, V. (2014). Discourse variation in professional contexts. In V. Bhatia & S. Bremner (Eds.), *The Routledge Handbook of Language and Professional Communication* (pp. 6-10). Routledge.
- Bouchrika, I. (2024, April 17). History of eLearning: Evolution from Stenography to Modern 2024 LMS Platforms. Retrieved on April 22, 2023, from Research.com: <https://research.com/education/history-of-elearning>.
- ICDTranslation Admin. (2017). The History of E-Learning. Retrieved on April 22, 2023, from ICDTranslation: <http://icdtranslation.com/history-of-elearning/>
- Jegede, O. J. (2004). Evolving a national policy on distance education. "An agenda for Implementation". *Education Today*, 8(3), 14–29.
- Kahiigi, E. K., Ekenberg, L., Hansson, H., Tusubira, F. F., & Danielson, M. (2008). Exploring the e-learning state of the art. *The Electronic Journal of E-Learning*, 6(2), 77–88.
- Keegan, L. (2020). Complete History of E-Learning From 1923 – Present Day. Retrieved April 20, 2023, from Skillscounter: <https://skillscounter.com/history-of-elearning/>
- Klement, M., & Dostal, J. (2012). E-learning in tertiary education from students' point of view.
- Kulia, M., & Usman, S. (2020). Perceptions of E-learning among undergraduates and academic staff of higher educational institutions in north-eastern Nigeria.
- Li, F. W., Lau, R. W., & Dharmendran, P. (2009). A three-tier profiling framework for adaptive e-learning. *Proceedings of the 8th International Conference on Advances in Web Based Learning*, Aachen.
- Lonn, S., & Teasley, S. D. (2009). Teaching and learning in the social context: A meta-analysis of service learning's effects on academic, personal, social, and citizenship outcomes.
- Madaki, A., Nkom, J. S., & Yaya, F. B. (2021). A review of benefits and challenges of e-learning in tertiary institutions. *JEAPP Online Journal*, 1(1), Article 020.
- Ramalan, I. (2023). Japa syndrome: VCs, ASUU decry mass exodus of Nigerian lecturers, say 'quality of university degrees in jeopardy.' Retrieved April 24, 2024, from Daily Times: <https://dailynigerian.com/japa-vcs-asuu-decry/>.



Sheridan, L., Davies, G. M., & Boon, J. (2001). Stalking: Perceptions and prevalence. *Journal of Interpersonal Violence*, 16(2), 151–167.

SimTutor. (2019). A Short History of E-Learning. Retrieved on April 22, 2023, from SimTutor: <https://www.simtutor.com/blog/posts/2019/january/a-short-history-of-elearning/>

Smedley, J. K. (2010). Modeling the impact of knowledge management using technology, 23, 233–250.

Splintll. History of E-Learning. Retrieved April 25, 2024, from Splintll: <https://www.splintt.nl/en/history-of-elearning/>.

Trentin, B. (1997). The role of schools and teachers in the construction of social democracy.

Ugochukwu-Ibe, I. M., & Ibeke, E. (2021). E-learning and COVID-19: The Nigerian experience: Challenges of teaching technical courses in tertiary institutions.