

## DESIGN AND DEVELOPMENT OF A MULTIMEDIA LEARNING SYSTEM FOR TEACHING C++ IN COMPUTER SCIENCE

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### ABSTRACT

*Advancement in Technology has played a vital role in improving and evolving every facet of human living. The learning environment is not an exception. With the introduction of the Internet, and several new inventions and technologies especially in the communication and computer systems' field, there is a need to enhance teaching and educational methods through the utilization of those technologies which may improve the abilities of educators to present information in an interactive and media enhanced formats relative to traditional methods. Multimedia Learning Systems provide flexibility as well as a collaborative approach to learning, decreased cost of education for learners and proper time usage for instructors. It provides a major benefit over the traditional approach to C++ Instruction. This paper is the analysis, design and implementation of a Multimedia Learning System for C++ Class in Computer Science. This project was designed to help students learning through multimedia platforms, which include videos, audios, animations, graphics representation, and documents. The methodology used in developing the system is Structured System Analysis and Design Methodology (SSADM) because it divides the system into phases. The system was developed using PHP Scripting Language as the server side language and MySQL as the Database for the system. The designed system will help to educate students more on programming with C++. It is designed to meet the active learning preferences of C++ learners and can also be used as a supporting tool for other courses.*

**Keywords:** Learning. Web based System, ICT, Multimedia System, Interactive Learning

### 1. INTRODUCTION

Advancement in Technology has played a vital role in improving and evolving every facet of human living. The learning environment is not an exception, considering the improvement in the quality of educational content delivery; knowledge representations; overcoming time and distance constraints (Hamada, 2013). Multimedia Learning System (MMLS) is a web-based courseware delivery engine that utilizes multimedia to enhance the teaching and learning process, with a 'virtual teacher within a virtual classroom'. One of the primary considerations in designing the MMLS is the inclusion of features that add value to students learning by incorporating elements of interactivity. These particular virtues of the MMLS allow instructors to interact with the system and with learners, and vice versa. Interactive learning with live-action video, audio, graphics, feedback, expert advice and question and answer aim to keep the learners engaged, i.e. captivate and retain learners' interest. It represents a move towards active learning and can be used as a constantly available learning resource for learners. Both instructors and learners play an active role in the education process.

There are many web-based learning and e-learning systems available on the Internet, but they provide only the same plain hypertext pages to all students regardless of individual ability. In many current web-based courses, the course material is still implicitly oriented for a traditional on-campus audience consisting of homogeneous, well prepared and well-motivated students. However, web-based courses are used by a much wider variety of students than any campus-based courses. These learners may have very different goals, backgrounds, knowledge level and capabilities. A web-based course designed for a specific group of students, like a traditional course, may not fit other students. Therefore the course material needs to be flexible so

that different students may get different materials and an order of presentation that depends upon their own characteristics.

The usage of Multimedia Learning System (MMLS) methods and tools is getting more and more important at universities. This is because of the rapidly changing situation there today. Students demand a higher quality and efficiency in teaching. One example is the centralized storage of documents and resources for courses, another one is the demand for continuous self-assessments to control the personal learning progress.

There are at least two reasons driving the advances of Multimedia Learning System (MMLS). First, MMLS applications are typically used by much more heterogeneous students than any standalone computer-based learning application. Any web-based learning system that is designed for a specific group of students may not suit other students. Second, generally the student of web based educational hypermedia is working without any assistance from teachers, as would be the case in a traditional classroom situation.

According to Huitt (2003), the learning process is complex and may be influenced by many factors including student characteristics. There are many student characteristics that are related to the learning process; among others are: prior knowledge, intelligence, study habits, age, gender, motivation, learning style, cognitive development, socio-emotional development, moral and character development. The student model should therefore accommodate these factors as much as possible in order for the MMLS to adapt accurately to the student's needs. One of the current problems with MMLS is that most systems are capable of considering only a limited number of student characteristics for the adaptation (Carro, 2002).

This work aims at design and implementation of a Multimedia Learning System (MMLS) for teaching C++ in Computer Science. This system will solve a lot of problem which includes (i) Difficulty in understanding C++ programming using pen and paper because code does not work on paper (ii) In ability to see physical or by illustrations on how to write C++ codes (iii) Most of the existing system uses texts and manual approach to the system (iv) Inability for lecturers to teach efficiently using black boards. The main specific function which must be implemented is students' learning with videos, audios, pictures, animations, slide, etc. The system objectives are (i) To design an online pages where students' from both distant and nearer can learning using Videos, audios, pictures, and documents. (ii) To design a secured and dynamic MMLS system for both students and lecturers. This site provides avenue for file sharing. (iii) This system allow students to communicate with their lecturers any point in time by dropping messages to their page.

## **2. Literature Review**

There are several research works relating to technological-aided learning including; multimedia learning, e-learning, mobile learning, game learning and virtual reality learning. Overall, these forms of learning provide support to the traditional classroom pedagogical approach, and bring more effectiveness and efficiency into the learning environment.

### **2.1 Concept of Multimedia Technology**

Multimedia is the combination of various digital media types such as text, images, sound and video, into an integrated multi-sensory interactive application or presentation to convey a message or information to learners (Neo and Neo, 2001). Multimedia technology is the underlying technology for all other forms of technological-aided learning. Furthermore, multimedia technology provides an effective and innovative teaching and learning strategy in a learning environment. Multimedia technology creates a multi-sensory experience for learners and stimulates active participation in the learning process, as opposed to learners being passive participants in an educational content (traditional approach). Moreover, it enhances creativity,

critical thinking, and analytical problem solving skills of the learner, providing them with a competitive edge (Hamada, 2013).

## 2.2 Web Technologies

According to O'Reilly (2007), Web 2.0 is characterized by trusting users as code developers, harnessing collective intelligence, and leveraging the long tail through customer self-service. The slogan of the so-called read/write Web is "the user is the content." Alexander (2006) noted two features of Web 2.0: micro content and social media, Cuene (2005) distinguished Web 1.0 and Web 2.0 from the user perspective: Web 1.0 comprises static web pages, whereas Web 2.0 refers to shared content among web users. Human-computer interaction changed between Web 1.0 and 2.0. In Web 1.0, users merely read web pages, but in Web 2.0, users actively contribute. Because of the increasing contributions of users, the level of collective intelligence and amount of reusable dynamic content has increased. Engaging with content establishes a sense of community, empowerment, and ownership among users. When appropriate systems and tools are available, amateurs can surpass professionals in knowledge; Wikipedia is a widely recognized example of this phenomenon <sup>(8)</sup>. Web 2.0 encourages users to interact with other users, a feature that numerous theorists consider fundamental to e-learning (Barsky, 2006). Interaction encourages deep and active learning engagement, builds learning communities, and enables learners to provide feedback to teachers (Koory, 2003). Scholars have recently reported associations between teacher-learner interaction in online learning and increased levels of student motivation (Koory, 2003).

## 2.4 Concept of E-Learning

E-learning refers to an electronic form of learning that is delivered using electronic devices such as computers via communication channels (Gutierra, 2015). E-learning enables virtual learning from any geographical location with a computer or mobile device and an Internet connection (Epignesis, 2014). E-learning is not only limited to the education sector, it can positively improve the corporate, government and healthcare sectors. The fundamental aspects of e-learning include organizational, technological, curriculum design, instructional design and e-learning course delivery. E-learning is not a mere technical exercise; it requires new pedagogical models in which tutors and learners need to be sufficiently prepared for, in order to create a successful e-learning environment. Tutors need appropriate online tutoring skills in order to explore and maximize the designed environment. Furthermore, according to (McPherson&Nunes, 2008, the critical factors that affect the success of e-learning delivery in Higher Education programme are: facilitator's attributes and experience for e-tutoring; implementing relevant delivery model, including compatible modes of communication, tutoring, evaluation and assessment; support and training for tutors and learners (e-tutoring and e-skills development respectively); and inspirational leadership involving the role of educational institutes' management to facilitate e-learning.

**Benefits of E-Learning:** In addition to the benefits of multimedia learning, e-learning stimulates; individual interest, intellectual curiosities and enhances the cognitive skills of learners (Hamada, 2013). The following are other benefits of e-learning: E-learning offers flexibility so that learners can learn at their own pace. It is relevant to the learner's environment and makes learning more fun and interesting. Overcomes geographical and time constraints; learning can take place anywhere and anytime. Cost effective as it is relatively more affordable than the traditional face-to-face learning, considering the cost of textbooks, printing course materials, presentations, transportation for both students and lecturers etc. Virtual and interactive learning uses interactive multimedia contents and resources to facilitate learning. Ease of learning adapted to suit individual learners, who have a unique style of learning. E-

learning provides convenience in learning. Remote access and connection to ‘virtual’ classroom via communication technology, hence it removes distance barrier to learning. Access to unlimited online resources e.g. journals, databases, periodicals, online library repositories etc.

## 2.5 E-learning Model

E-learning models have evolved from models that emphasized the role of technology in providing information and knowledge to models focus on pedagogical issues. In this section, we will present the six step model for delivering a quality e-learning which consider the sociality, technology and pedagogy in planning and implementation of eLearning.

## 2.6 Overview of Multimedia Learning System

The use of multimedia in teaching and learning presents challenges to institutions of higher learning. Multimedia refers to any computer-mediated software or interactive application that integrates text, color, graphical images, animation, audio sound, and full motion video in a single application. Multimedia learning systems consist of animation and narration, which offer a potentially venue for improving student understanding (Mayer and Moreno, 2002). Aimed to complement and supplement the teaching process and leaning materials, Multimedia University (MMU) has spearhead the initiative towards a multimedia learning environment by developing a new interactive teaching tool, i.e. the Multimedia Learning System (MMLS).

The growing development of technology-mediated learning systems has led to ‘flexible delivery’ and ‘virtual learning’, which has created a whole new learning environment that enables learners to take charge of their own educational experiences. Experts expound that multimedia enhances learning, and the used of it in an online education is increasing (Quintana, 1996).Najjar (1996) reviewed numerous studies and found that ‘learning was higher when information was presented via computer-based multimedia systems than traditional classroom lectures’. However, there appears to be a concern about sustaining interactivity within a web-based learning system. Interactive experience for the user, i.e. instructors and learners is defined as ‘a multi-dimensional, multi-sensory interweave of self-directed reading, viewing, listening, and interacting, through activities such as exploring, searching, manipulating, writing, linking, creating, juxtaposing, and editing (Wilson, 1992).’

## 2.7 Interactivity between Instructor and System

Interactivity between instructor and the system is made possible with the Upload Course Content and Progress Monitoring Windows.

### 2.7.1 Management of Course Content

Once of the province for instructor and system interaction is the management of course content. New courses need to be registered in order to allow the learners to access them and course contents need to be uploaded for learners to view them. The MMLS eases the burden of the instructors in registering and uploading by having an attractive user friendly and interactive interface and step-by-step. The four icons on the “Upload File” window are

- i. Upload File, which allows instructors to upload their files
- ii. Change Slide Info, which allows instructor to edit the content of the uploaded files
- iii. Q&A, which allows instructors to post questions and/or answers
- iv. Delete Lesson, which allows instructors to delete a particular lesson

## 3. Proposed System and Implementation

The proposed Multimedia Learning System for teaching programming in C++ is a web based application that is developed for universities/Schools to advance their learning methods. This project allows computer science students to study online and communicate with their lecturers using multimedia platforms. The System will provide the following advantages when implemented: Lower costs, Faster delivery, Increased reach, Personalized training experience, Learning times reduced, Consistent delivery, Expert knowledge, Proof of completion and certification.

### 3.1 System Architecture

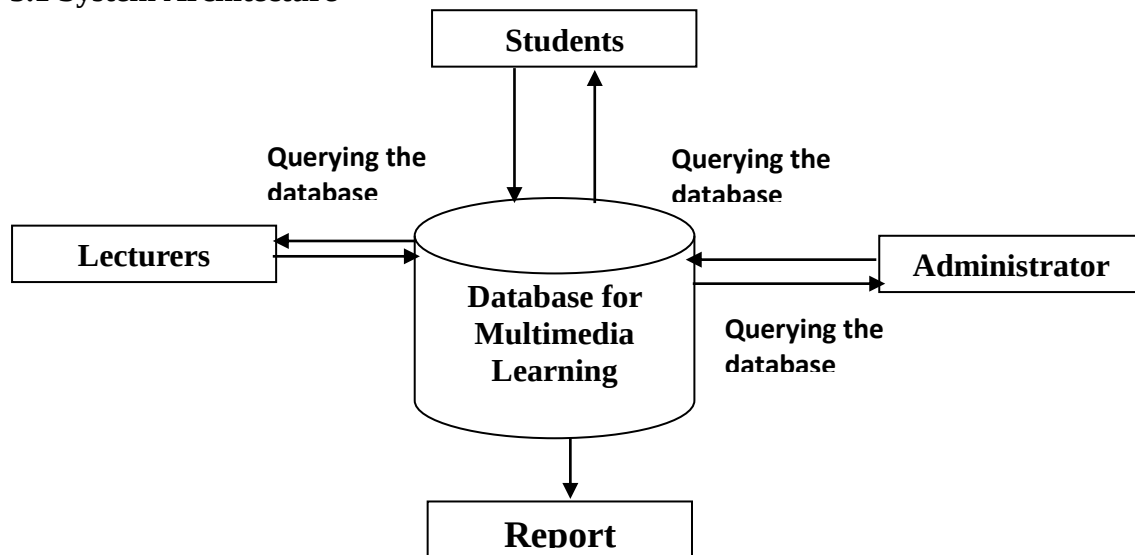


Figure 3.1 Architecture of the System

### 3.2 System Implementation

The system implementation shows how the proposed system modules will function and work to solve the problems identified by the researcher at the introduction part of this research work. The new system was designed with the view to make changes in Nigerian University education system. The objectives include: (1) To design a good interface website that gives quality education to the students through Internet. (2) To develop a web portal that brings education to the doorsteps of every individual using technology. (3) To create an avenue of allowing students to make in suggestions to the management of the operation of a learning organization. (4) Supervising and controlling the learning process of learners effectively. (5) To develop a site that show lessons on video formats, audio formats, graphics formats and animation forma

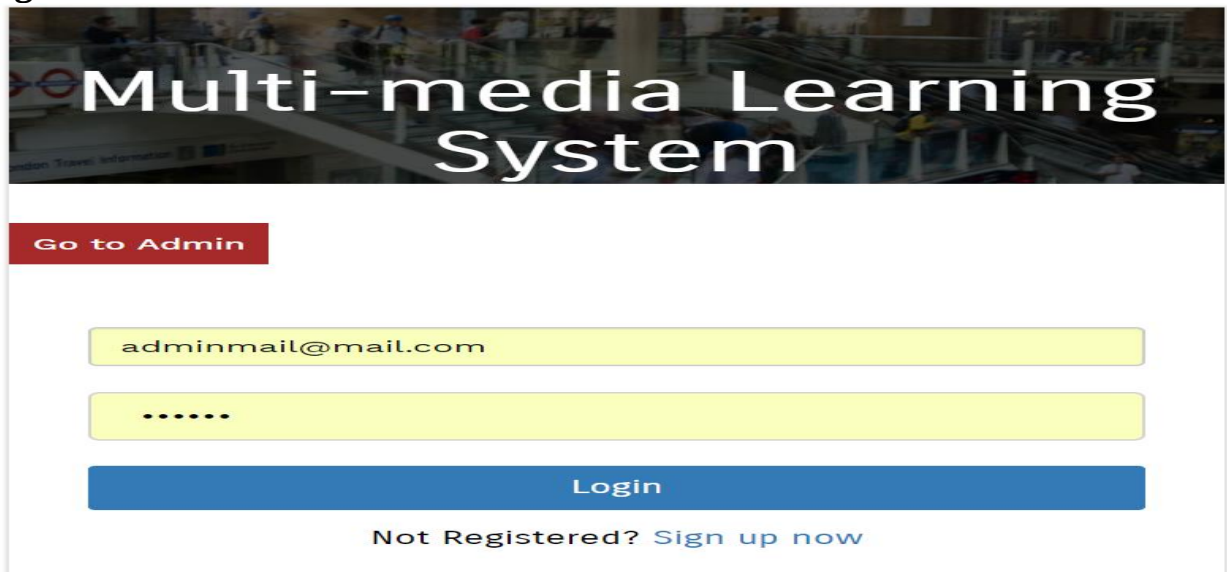
### 3.3 Algorithm of Implementation

1. Start
2. Login with username and password
3. Is login correct? If Yes then go to 3 else 4
4. Upload Lesson files
5. Create Courses
6. View files
7. View Report Data
8. Stop
7. Start
8. Login with username and password
3. Is login correct? If Yes then go to 4 else 8

4. Go to Options
5. Option A – Admin
6. Option B - Stud
7. View Report Data

### 3.4 Input Specification

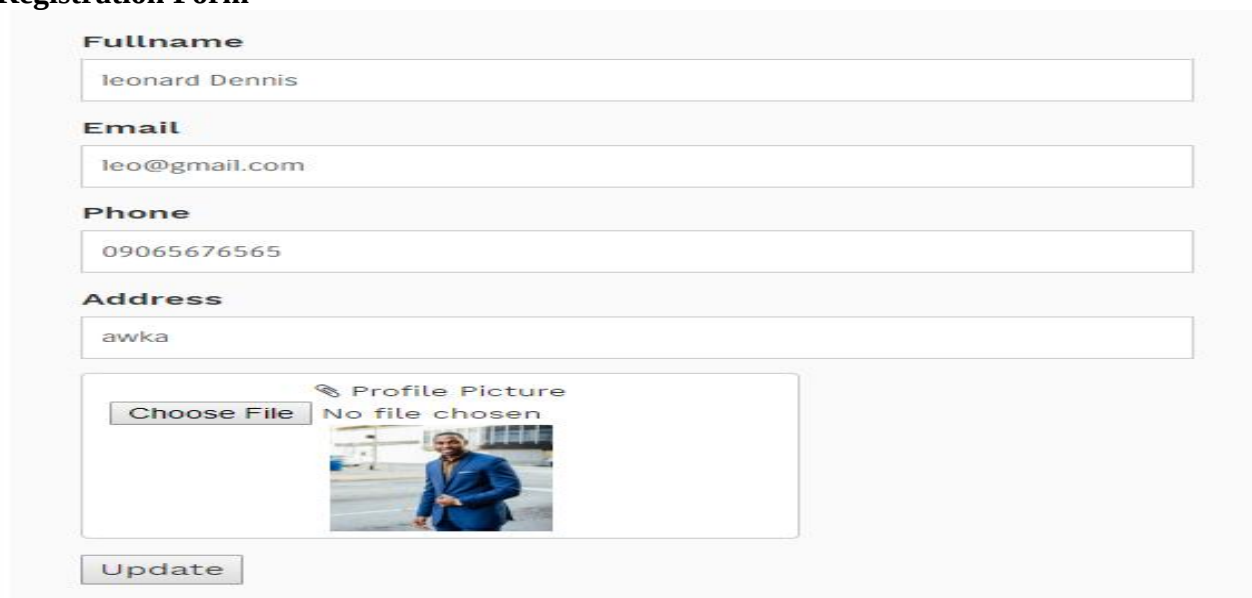
#### Login Form



The screenshot shows the login interface for the 'Multi-media Learning System'. At the top, there's a header with the system name over a background image of a library. Below the header, there's a red button labeled 'Go to Admin'. The main login area contains two yellow input fields: the first for the email address, which is pre-filled with 'adminmail@mail.com', and the second for the password, which is masked with dots. Below these fields is a blue 'Login' button. At the bottom of the login area, there's a link that says 'Not Registered? Sign up now'.

Figure 3.2: Login form

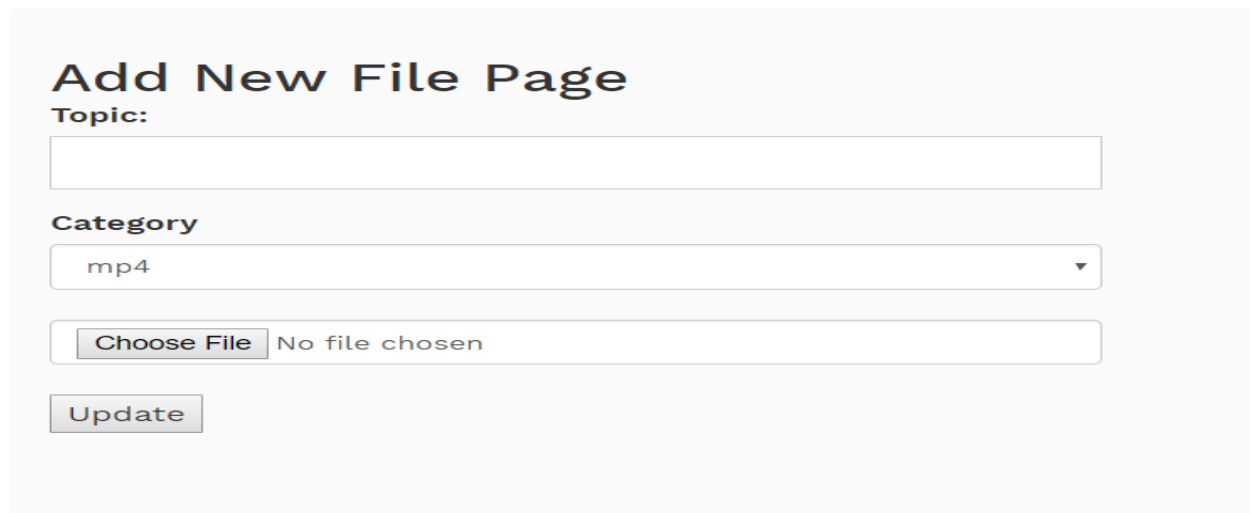
#### Registration Form



The screenshot displays the registration form. It features several input fields: 'Fullname' with the value 'leonard Dennis', 'Email' with 'leo@gmail.com', 'Phone' with '09065676565', and 'Address' with 'awka'. Below these fields is a section for a profile picture, which includes a 'Choose File' button, a 'Profile Picture' label, and a 'No file chosen' status. A small thumbnail of a man in a blue suit is visible next to the file selection area. At the bottom of the form is an 'Update' button.

Figure 3.3 Registration Form

#### Uploading File Form



**Add New File Page**

**Topic:**

**Category**

mp4 ▼

**Choose File** No file chosen

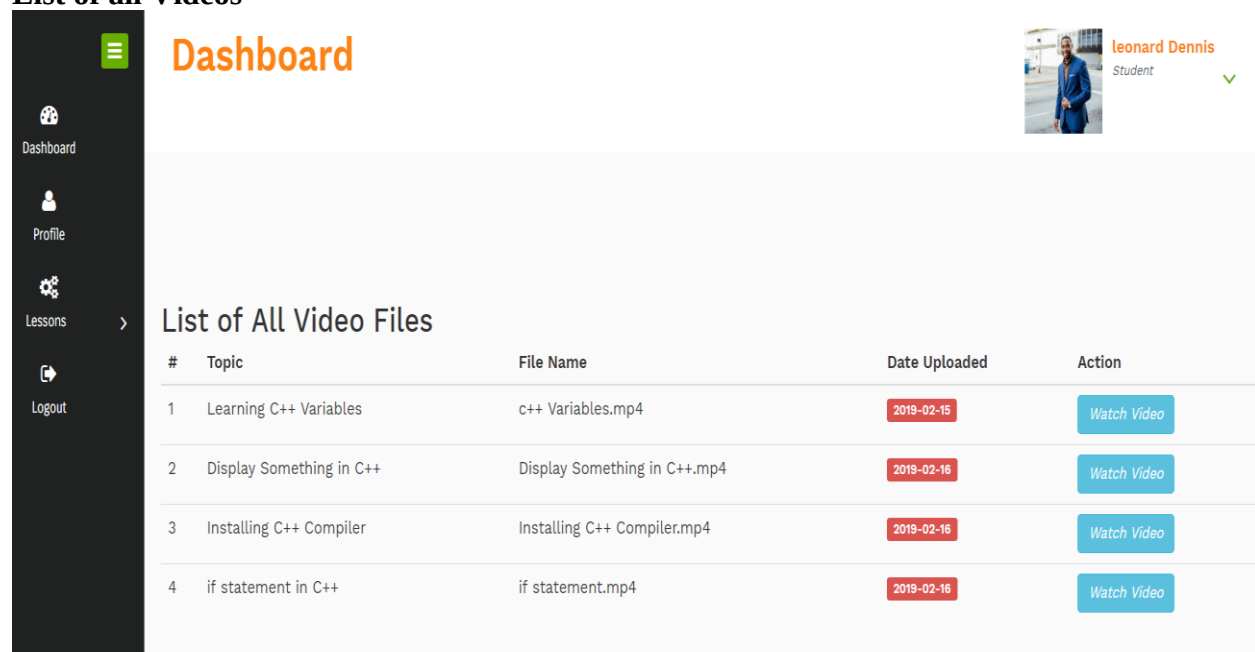
**Update**

Figure 3.4 Uploading Form

### Output Design

Here, the program displays the information of registered students and also gives access to multimedia learning system platform.

### List of all Videos



**Dashboard**

leonard Dennis  
Student ✓

**List of All Video Files**

| # | Topic                    | File Name                    | Date Uploaded | Action                      |
|---|--------------------------|------------------------------|---------------|-----------------------------|
| 1 | Learning C++ Variables   | c++ Variables.mp4            | 2019-02-15    | <a href="#">Watch Video</a> |
| 2 | Display Something in C++ | Display Something in C++.mp4 | 2019-02-16    | <a href="#">Watch Video</a> |
| 3 | Installing C++ Compiler  | Installing C++ Compiler.mp4  | 2019-02-16    | <a href="#">Watch Video</a> |
| 4 | if statement in C++      | if statement.mp4             | 2019-02-16    | <a href="#">Watch Video</a> |

Figure 3.5. List of all Videos

### List of all Audios

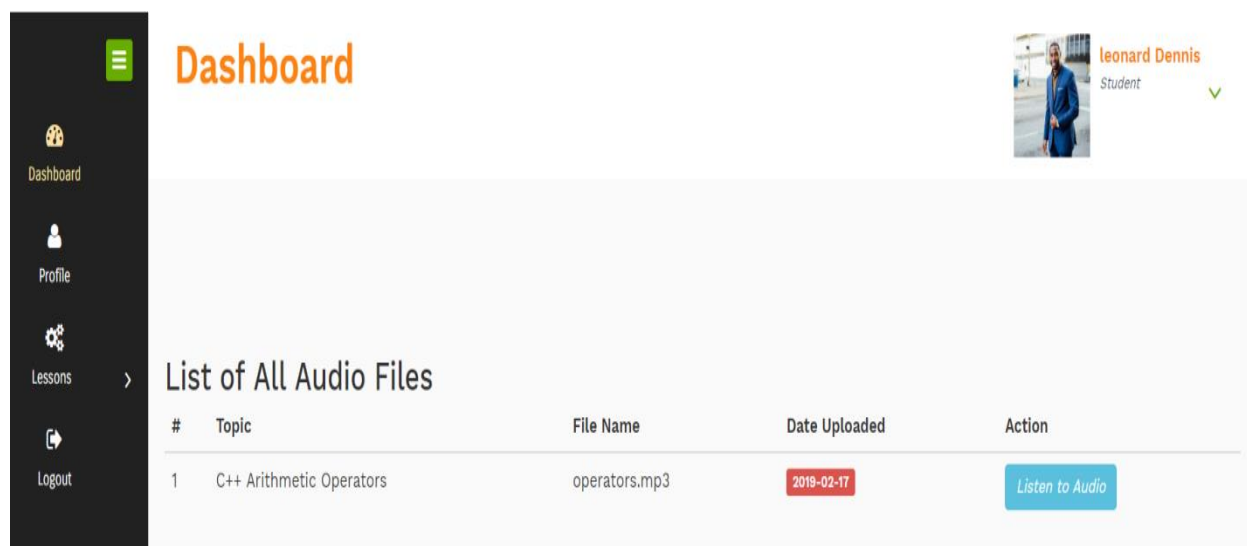


**Figure 3.6. List of audio Files**

### 3.5 Evaluation

All modules of the multimedia learning system were tested to ensure that they worked as was expected. All the input modules were tested for input data validation and data input collection. All modules were found to be accepting data and performing proper data validation. The output modules were tested to ensure that the data entered in the input module were displayed from the database correctly. All output modules displayed data as was expected.

## 4. CONCLUSION

The aim of multimedia learning system for teaching C++ programming in universities is to reduce the work lag time and learning, which the conventional educational system does not offer. The international trends and evolution show that the technology have involves everywhere and familiarization with it is essential for all and especially for the tomorrow's citizens and employees. So it is necessary for the learner to come in contact with new technologies, to learn how to use it and to exploit the possibilities it gives. Through multimedia learning system for Nigeria universities systems, the contact and the familiarization become the natural and pleasant way for learners. In order words, this new system has contributed its own quota to the system of education by making the following possible:

1. By reducing the lag-time of learning process and productivity.
2. It will allow knowledge to be henceforth open and accessible.
3. It will help the instructors to see technology as a tool that will help then make their work easy and better and not an enemy that has come to burden them with more responsibilities
4. It will allow instructors to do less work, which will last long
5. This system makes learning (distance learning) be as efficient as the "face to face" teaching.
6. It will improve total communication between teachers and learners on-line.
7. It increases learner's confidence on the program.
8. The quality and the plentitude of the application, catalytic role in the creation of positive thinking about on-line educational experience.
9. It maintains the interest of learners
10. Apart from the contribution that new system will offer, it consists of more features, which the former system doesn't have, thus making it very interactive to use even as a new user to the system.

## Reference

- Alexander, B. (2006). Web 2.0: A new wave of innovation for teaching and learning? *EDUCAUSE Review*, pg32–4
- Barsky, E. (2006). Introducing Web 2.0: RSS trends for health librarians. *Journal of Canadian Health Library Association*, pg, 7–8.
- Carro, R. (2002, July). *Adaptive hypermedia in education: New considerations and trends*. Paper presented at the 6th World Multi-conference on Systemic, Cybernetics and informatics, Orlando, Florida.
- Cuene, J. (2005). Web 2.0: Is it a whole new internet? [Presentation slides]. Retrieved 2 February, 2019, from <http://cuene.typepad.com/MiMA.1.ppt>
- Epignosis LLC. (2014). e-learning Concepts, Trends, Applications. Book, 5. Retrieved from <http://www.talentlms.com/elearning/elearning-101-jan2014- v1.1.pdf>
- Gutierrez, K. (2015). Understanding The Difference Between eLearning and mLearning. Retrieved from <http://info.shiftlearning.com/blog/differencebetween-elearning-and-mlearning>.
- Hamada, M. (2013). E-learning: New technology, applications and future trends. E-Learning: New Technology, Applications and Future Trends. Retrieved from <http://www.scopus.com/inward/record.url?eid=2-s2.0-84892919329&partnerID=tZOTx3y1>
- Huitt, W. (2003). A transactional model of the teaching/learning process. *Educational Psychology Interactive*, Valdosta, GA: Valdosta State University. Retrieved [19 February 2019] from <http://chiron.valdosta.edu/whuitt/materials/tchlrnmd.html>
- Koory, M. A. (2003). Differences in learning outcomes for the online and F2F versions of "An introduction to Shakespeare". *Journal of Asynchronous Learning Networks*, pg, 18–35
- Mayer, Richard E. & Moreno, Roxana. (2002). Aids to Computer-based Multimedia Learning. In *Learning and Instruction*, volume 12, 107-119.
- McPherson, M. A., & Nunes, J. M. (2008). Critical issues for e-learning delivery: What may seem obvious is not always put into practice. *Journal of Computer Assisted Learning*, 24(5), 433–445. <https://doi.org/10.1111/j.1365-2729.2008.00281.x>
- Najjar, L.J. (1996). Multimedia information and learning. In *Journal of Educational Multimedia and Hypermedia*, 5, 129-150
- Neo, M., & Neo, K. T. K. (2001). Innovative teaching : Using multimedia in a problem-based learning environment. *Educational Technology & Society*, 4(4), 19–31. Retrieved from [http://www.ifets.info/journals/4\\_4/neo.html](http://www.ifets.info/journals/4_4/neo.html)
- O'Reilly, T. (2007). What is Web 2.0: Design patterns and business models for the next generation of software? *Communications & Strategies*, pg, 17–37.
- Quintana, Yuri. (1996). *Evaluating the Value and Effectiveness of Internet- Based Learning*. INET96 Proceedings. Montreal, Canada.
- Wilson, K. (1992). Discussion on two multimedia R &D projects: The Palenque Project and the Interactive Video Project of the Museum Education Consortium. In M. Girdin (Ed.), *Interactive Multimedia Learning Environments* (pp.186-196). Berlin: Springer-Verlag.