ANIMATED SCIENCE LESSONS FOR ORDINARY LEVEL STUDENTS

BY

GROUP NUMBER

EL12-02

A Project Report Submitted to The Faculty of Science in Partial Fulfillment of The Requirements for The Award of Bachelor of Science in Computer Science of Gulu University.

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Declaration

We EL-12 2, hereby declare to the best of our knowledge that no part of this work has ever been submitted for the award of any qualification in this or any other University.

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ABSTRACT

The importance of laboratory experiments in science education is well accepted. Although such experiments and law's are part of the curriculum, commonly encountered problems in developing countries (like Uganda) are: a) availability of infrastructure (which differs from place to place), b) maintenance of the laboratories (which has substantial implications on the results) and c) consistent explanation methodology (which depends primarily on the lab instructors).

Animation is an effective way of augmenting the learning of lab experiments. Two dimensional (2D) animations is widely prevalent, and has been shown to be successful in many areas. Advent of three dimensional (3D) animations has expanded the possibilities and scope of the content in many ways. 3D animation not only continues to have the advantages offered by 2D, like interactivity and re-usability, but also adds a whole new dimension of visualization possibilities. These include cross sections (to show the internal construction or assembly of an object), walkthroughs (synthesized video travel within the object) and different viewing angles (views that may not possible in real world).

3D animation has been used in eLearning in different domains but high cost of proprietary tools and scarcity of trained personnel for the content creation has not extended the reach as expected. Cheaper and more user friendly solutions are certainly required for wide accessibility, especially for developing countries. Blender (www.blender.org) is a popular Open source 3D animation package, typically used for entertainment domain. It is free and is available for various platforms viz Windows, Apple, and Linux. However, we did not find much literature on using Blender for eLearning animations.

In this paper we examine the suitability of Blender for content creation in eLearning. We present a methodology as well as a case study, of using Blender to create eLearning content for science experiments and law's explanation. The experiments and laws selected are preparation of sulpur dioxide, oxygen, hydrogen, nitrogen, 3D daniels cell, 3D plant cell and law's such as Newton's law of motions from the curriculum of O level science. This experiment is suitable for the usage of 3D animation because of two main factors: (i) The complex assembly of different components, and (ii) The size of the actual apparatus, varies from 4-16 feet, it is expensive for replication in smaller institutions and incomplete or few equipments.

We found that Blender has most of the desired features to create the eLearning 3D animation. Students who viewed the content found it useful and enjoyed working with it. We were also able to export the 3D models to an open source repository. We believe that the proposed methodology can be: (i) used to scale the 3D animated content creation of lab experiments, and (ii) adopted by other institutions elsewhere.

Contents

List of Figures

List of acronyms

ASLO	Animated Science Lessons for Ordinary Level.
HTML	Hypertext mark Language
MySQL	My Query Language
GUI	Graphical User Interface
VGA	Video Graphic Array(Adapter)
RAM	Random Acess Memory

Chapter 1

Introduction

Most public secondary schools in Uganda whether rural or urban based have access to computers, this has been made through own investment or support by government through Uganda Communication Commission (UCC). Against this background therefore, developing computer application that support learning is a step in the right direction. This project aims at develop animations for teaching of science concepts in secondary schools to enhance a faster comprehension of science concepts by students.

1.1 Background

Animation history began with a simple mechanical toy called the "Thaumatrope". This optical toy was in wide circulation in Europe and America in the 19th Century. The toy was very simple - a paper disc attached to two pieces of string. Each side of the disk had a drawing, classic being one side a bird, the other a cage. The disk was twirled by twisting the strings between the fingers. This produced an effect of blending the two images together; the bird was in the cage. This perceptual phenomenon is known as the "persistence of vision". Our eyes hold on to images for slightly longer than they are actually projected. Rather than a blur we perceive the images as a continuous picture. The high failure rate in science particularly at the ordinary level could be linked to number of reasons such as: irrational fear for science, teaching theory without practical exposure, abstractness of science concept, and poor background. The results of these are low interest to science subject leading to higher failure rates. At the same time, declaration of compulsory science subject at ordinary level in an environment of the high phobia for science as subject has even escalated failure rates despite the popular cyber schools programs for virtue lab in secondary schools. More innovative ways of concurrently addressing interest and failure rates in science subject are definitely needed. To this end, there is need for animated solution for illustrating abstract science concept for easier comprehension by the claim that animated elicits the highest rate of information retention, resulting in shorter learning time. There is some evidence from observational research that many students prefer to make use of animations in the learning process (Kehoe and Stasko, 1996).

1.2 Problem Statement

Ideally the current system of teaching science subjects in secondary schools has made performance of students not to be up to date due to little exposure of students to practical concepts and lots of theory. Due to these, there is need for animated solution for illustrating an abstract science concept for easier comprehension by the claim that animated elicits the highest rate of information retention, resulting in shorter learning time.

1.3 Main Objectives

This project aims to develop animation for teaching of science concept in secondary schools in order to enhance faster comprehension of sciences concepts by students.

1.4 Specific Objectives

- Review literature on ICT tools for learning in order to develop requirements for the new learning tool basing on animation.
- Design the standalone tool based on the identified requirements.
- Develop the tool based on the design in second objective.
- Evaluate effectiveness of the learning tool developed by engaging secondary students.

1.5 Scope.

Our project focuses on the use of animation as a mean of showing and explaining O'level science's concept and lessons to students, of which our major area of study will be practical part of chemistry, newton's law in physics and Cells in Biology.

1.6 Significance.

This study focuses on development of content that is animated science lessons. The assumption here is that most public secondary schools in Uganda whether rural or urban based have access to computers, this has been made through own investment or support by government. Therefore the significance are listed as follow;

- To enable students gain interest in sciences as the world is becoming more of science.
- To expose students to observe what takes place practically on ground in sciences.
- To increase the rate at which students understand and quicker learning sciences.

Chapter 2

Literature review

2.1 State-of-the-art

Animated lessons are an important component of science education. Hands on sessions in a science offer an experience of handling the actual components and performing the processes in person contributing significantly to student learning (Hofstein and Lunetta 1982). In developing countries such as Uganda, the most common problems faced in setting up of a laboratory are: quality of infrastructure, availability of skilled manpower, and maintenance issues.

In such conditions, using multimedia based eLearning to augment the lab experiments is an attractive solution. Additionally, multimedia could also enrich and improve the learning experience (Ellis 2001). Multimedia based eLearning typically comprises of videos shot with cameras (camera videos) or created through animation. These mediums can facilitate visual communication. They are able to show change over time, are portable, and can be interactive. Most researchers agree that these solutions cannot replace the instructors, but they can be certainly used as additional aid for the students to understand the concepts (Ellis 2001, Mackensie and Jansen 1998).

Camera videos are preferred in certain domains where reality of the visuals would be more convincing for the students. For example, in the experiment of a litmus paper changing color, a video would be more convincing rather than an animated clip, since the video establishes that no image manipulation gimmick has been attempted. On the other hand camera video is not adequate in examples like: separating hydrogen from water or melting of metals in a furnace. Such experiments that need to show objects that cannot be captured by cameras, or cannot be perceived by the naked eye, or have extremely inaccessible view points, find a suitable medium in animation. In this paper we restrict our discussion to animation.

Animation provides the ability to add motion to static diagrams (given in books). Two dimensional (2D) animations are widely prevalent, and has been shown to be successful in many areas (Selmer, Kraft, Moros, & Colton 2007). Advent of three dimensional (3D) animations has expanded the possibilities and scope of the content in many ways. 3D animation not only continues to have the advantages offered by 2D, like interactivity and reusability, but also adds a whole new dimension of visualization possibilities. It makes it feasible to go beyond the flat view and see the experiments/models from any angle. For example: Internal organs of human body right up to micro/nano level of DNA strands, walkthrough of a solar system and cross sections of mechanical engine. We focus on 3D animation in this paper.

Content creation with 3D animation is often a costly proposition. The cost of proprietary software, high end hardware to support 3D graphic display in real time, and need for trained personnel, make it a costly medium (Beilla, Luther 2007). Hence the reach of 3D animations in eLearning has not proliferated as expected, especially in developing countries.

2.2 Related Systems

There are a number of learning applications that are animated learning ranging from 2D to 3D animation such as MyEdutale and Tech4Learning to more specilised ones. This section focuses on the latter.

2.2.1 MyEdutale

MyEdutale based on a local folktale "The Crane that Rewards Good Deeds" to help motivate socio-cultural awareness among children. The software consists of a 2D animated story, and activity modules of games, maze, puzzles and quiz. Evaluation was carried out in a study involving 30 children ages from five to twelve years old. The questionnaire used consists of 31 questions measuring usability construct of satisfaction, ease of use and effectiveness. Findings indicated that 92% respondents were satisfied using the software, 93% reported that it is easy to use, while 95% agreed that the software is effective in delivering the intended values through the story and reinforced via activity modules. Observation of respondents interacting with MyEdutale showed that girls were more engaged and concentrated more on the story while boys were more interested in the games/activity modules. Findings from this research indicated that a well-designed edutainment software can be used effectively for educating as well entertaining children. (http://doi.ieeecomputersociety.org/10.1109/ICCIT.2008.368)

2.2.2 Tech4Learning

It's an educational software that delivers effective professional learning programs, which helps transform classrooms into learning environments where students are actively engaged in the curriculum, create original products, and share ideas and expertise with their communities. (http://www.tech4learning.com/)

2.2.3 The Smart School applications

It brings the benefit of technology to the educators and administrators. This also allows the young ones to get familiar with the ICT world – using tools such as personal computers, scanners, printers, multimedia products, TV/videos, etc. at a much earlier stage in life. They get to appreciate the power of the Internet and multimedia applications, which can make learning more interesting and enriching. This will in turn result in them becoming more technology savvy. (http://www.msc.com.my/topic/Empowering+Learning).

2.2.4 Ugandan Context

In the Ugandan context, animations are commonly used in advertisement but little has been use in educational purposes. Cyber School is a premier provider of quality educational services offering world-class solutions to enhance the online educational environment globally.The one-stop-site for development, e-learning, communication solutions, Cyber School Technology Solutions works with experienced educators and technocrats across the globe in designing and developing digital educational resources, portals and learning management systems for improved communication and easy access to syllabus-specific lessons on Science and Mathematics. Be it digital content on 3D, online tutoring services, ICT courses or School Online Information Systems, all our products, educational tools, training and support material and services are well-researched and tested, providing appropriate solutions to achieve student success at all levels. (http://www.cyberschooltech.co.ug/)

In Uganda there is only one animation studio which is called Crossroads Digital Media Ltd, it specializes in 3D computer animation and their recent work are on advertisement for companies. Animation is a new industry in developing countries like Uganda so governmental, non-governmental organizations and corporate companies are all looking for something new and also learning institution are looking forward to instinct deeper understanding to their learners using animation.

Chapter 3

Methodology

This section includes all the methods, techniques and rules use in the design and implementation of the system.

3.1 System study

This project is about animation in science education, in order to understand you need to review the literature available and seek opinions that are available.

3.1.1 Interviews

We interviewed education students of Gulu university since they have some knowledge in animation and video tutorial, hence this has been useful to help us know what to animate and do it.

3.1.2 Focus groups

We involved the use of students - teacher especially those who are pursuing science education and have interfaced with various learning material to help us to review or analyze this project. For instance they helped us in creating the storyboard that is, a detailed storyboard was planned for the experiment, based on the given text and the demonstration by the lab instructor. The storyboard included motivation for the experiments, introduction of the apparatus and components, the actual procedure for performing the experiments, and lastly section for conclusions. All these sections are drawn in a storyboard with details of the timing, visual contents, and the narrative (script for the voiceover) to be added.

3.1.3 Literature Review

The literature review has been drawn from the existing animated learning lessons and this has enabled us to value what other researcher's worked and their weaknesses, and as a result, it has helped us come up with something to implement. For example, we tried to make our animation simple, understandable and entertaining to watch.

3.2 System Development

This section illustrates the actual realization of the system as far as its interaction with animated lessons, students and teachers are concerned. Our contents creation methodology (derived from standard 3D content creation process) is divided into three main phases:

1. Pre-production phase: This involved collection of the required data and planning of the animation procedure based on the complexity of modeling, animation and rendering involved.

2. Production phase: This was sub-divided into modeling, texturing, lighting and animation steps that are described subsequently.

3. Post-production phase: This involved rendering the animated content and uploading it into our online repositories.

We explained the methodology details, using an illustrative example of Newton's law's of motion using simple commonly known objects. And, Other lab experiments which are part of the curriculum for the ordinary level chemistry like preparation of gases (hydrogen, nitrogen, sulphur dioxide and others. The students have difficulty in visualizing the actual assembly and the motion of the fluids by referring to the 2D diagram. The experiment is conducted real time, and it becomes difficult to register the details of the flow.

We will explain this experiment using the experiment manual. It is a PDF document consisting of a detailed description of the procedure, the chemical equations and a labeled diagram of the apparatus. We were curious to explore the effectiveness of using 3D animated models to explain the laboratory experiments. We were also interested in the other benefits like anytime access to the content, ease of portability, etc.

Chapter 4

System design and implementation.

This chapter describes a detailed system design and implementation for Animated Science Lessons for ordinary level and further illustrates its requirements.

4.1 Pre-Production Phase

4.1.1 Collection of data

Once the subject area was finalized, the process started with collecting data (in various forms) about the experiments to be animated. This has been in the form of text, scientific diagrams, actual images, videos (to explain the process), and meeting students and lab instructors in person to understand the process. The various forms of data were useful in subsequent phases for different purposes. For example; The text, diagrams and the equations in the manual guide (UG lab manual, 2008) served as a technically correct input to start the 3D content creation. To get more clarity of the visual aspects, we photographed and video-graphed the laboratory apparatus from various angles, and captured their details.

4.1.2 Planning for the content creation

The planning of the entire animation process was started when data collection was completed. Typically, creating animation using 3D software was a long process with interdependent phases. It was important to plan for the chronology of the phases to avoid duplication, delays or compatibility issues in the finished models. The planning phase also helped the animation artists to model the components of the sections in a way that they can be assembled at the time of animation. The main steps involved in the planning phase are:

1. Create the storyboard: A detailed storyboard was planned for the experiments, based on the given texts and the demonstrations by the lab instructor. The storyboard included motivation for the experiments, introduction of the apparatus and the components, the actual procedure for performing the experiment, and a last section for inferences and conclusions. All the sections are drawn in a storyboard with details of the timing, visual contents, and the narrative (script for the voiceover) to be added.

2. Record the script for the voiceover: The script decided for the voiceover was then recorded by a voiceover artist, with the duration as indicated in the storyboard.

3. Assess the modeling type: Modeling has common units like faces, edges and vertices. The types of modeling in Blender are: (i) Objects: Working with objects as a whole, (ii) Meshes: Working with the mesh that defines the shape of an object, (iii) Curves: Using Curves to model and to control objects, and (iv) Surfaces: Modeling a NURBS surface. For our experiments and other animations we have applied most of these modeling techniques.

4. Standardize the modeling type: Standardization decides the consistency of various parameters and interoperability of objects. In the assembly phase, the different models have been joined to create the complete apparatus. At this juncture, it was very important to have uniformity in the thickness of all the objects. Hence, during planning, a generic decision has been taken in this regard.

5. Decide the assembly point: The assembly point is a point when the modeling is complete, with the wireframe mesh created for all the objects. Additional modeling, to join components, was done after the assembly.

6. Assess and create textures and materials: The necessary textures and materials were taken from the available libraries, or created afresh (in case of non availability).

7. Decide the animation style: The animation style can range from fully realistic to just the key details. In case of our eLearning animations, clarity of motion is critical. Directional arrows are preferred to explain the flow in the concept. The common types of animation are based on: keyframes, motion curves and paths. In Blender, the first two systems are integrated in a single one, the IPO (InterPOlation) system which is used in our case-study.

8. Deciding the level of interactivity: The level of interactivity can range from simple switch on/off buttons to a complex type which can control the parameters of the components. The interactivity planned in this phase, was useful for the subsequent phases like modeling, animation and rendering. Interactivity was planned keeping the end user in mind. It can be the students or the lab instructors. Note that, the pattern of interactivity is different for each user group.

9. Select the rendering options: Rendering converts a model into an image either by simulating light transport to get photorealistic images, or by applying some kind of style as in non-photorealistic rendering. Rendering phase has many options: (i) whether it is to be a continuous video, or (ii) it is to be an interactive animation content, or (ii) both. For a continuous video the options are the compression, bitrate and the resolution, and for the interactive content the options are about the operating systems etc.

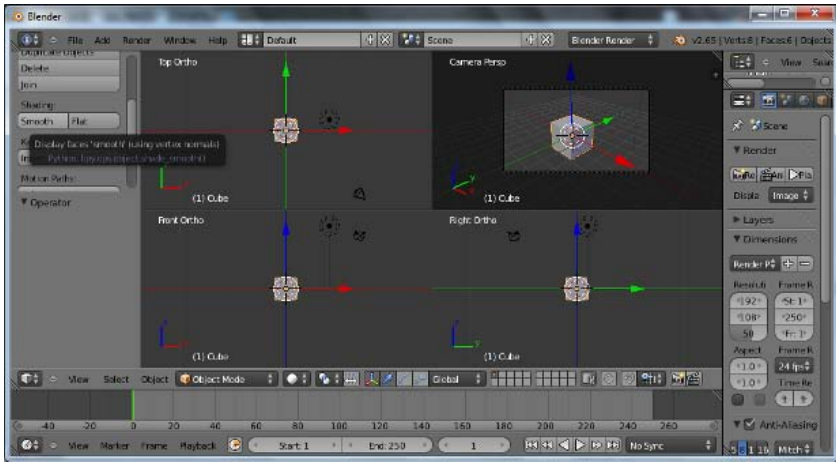
4.2 Production Phase

4.2.1 Modeling

3D modeling is the process of developing a mathematical, wireframe representation of any three-dimensional object. The modeling stage has the following steps:

1. Make a list of objects to be modeled.

2. For each object, use the available photographs as reference for images in the respective viewports of Blender (top, front, side, or isometric). Figure 4.1 shows the ‘all views’ of the modeling screen.



Display faces 'smooth' (using vertex normals)
Python: bpy.ops.object.shade_smooth()

Figure 4.1: Four view points in blender

3. Start with the available basic shapes (using the photos). For example: flask can be created using a ‘circle’ as the basic shape (see Figure 4.2).

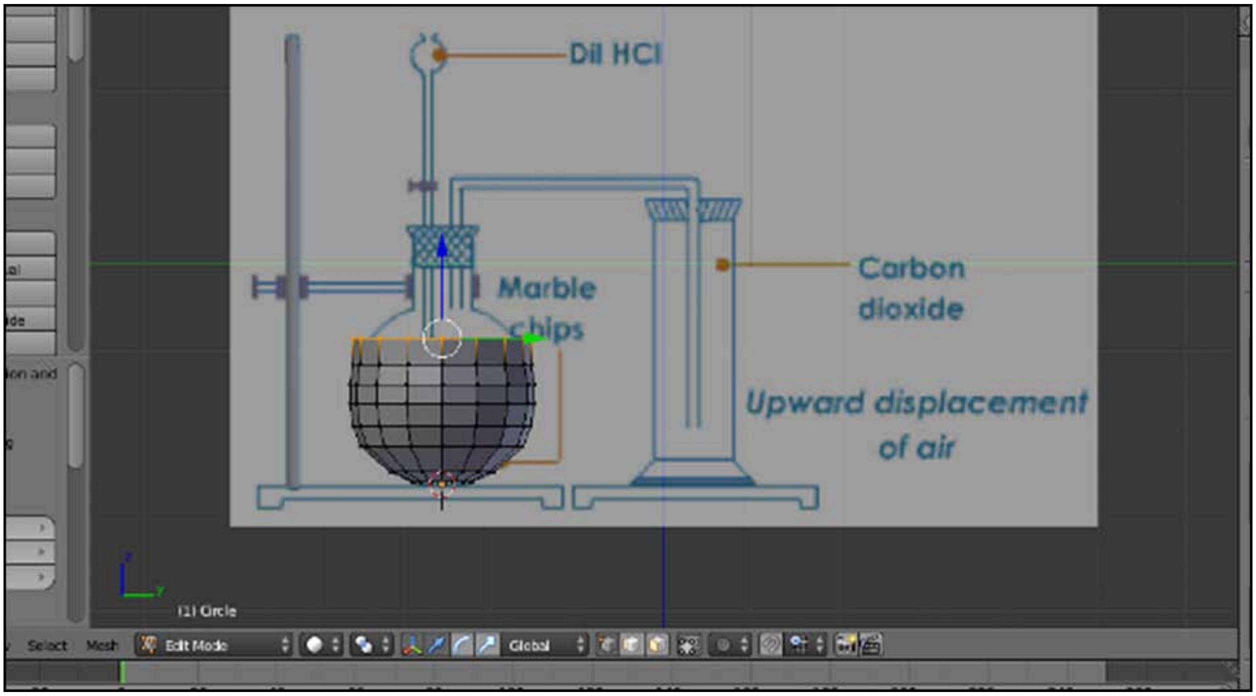


Figure 4.2: using circle to model

4. Use transformation controls in Blender like extrude, taper, scale, and rotate etc to get the desired shape for the object.
5. Use the different viewports in Blender while modeling the object to ensure that all the details are captured.
6. Use parameters (faces, edges or vertices) as planned to get the appropriate finish of the object. The smoothness of the object depends on the number of details used. On one hand, when more number of details are used it results in a smoother finish. On the other hand, more number of details makes the 3D file heavy in terms of the calculations. Example: A cylinder created with 8 faces would show a box type finish (with a small file size), as compared to a 36 or 72 faced cylinder when you use cube divide(with a big file size). Hence it is necessary to balance the number of details required and the file size to be handled.

7. Test render the portion modeled. This is useful to check the quality and the accuracy of the modeled object for example, check the figures below.

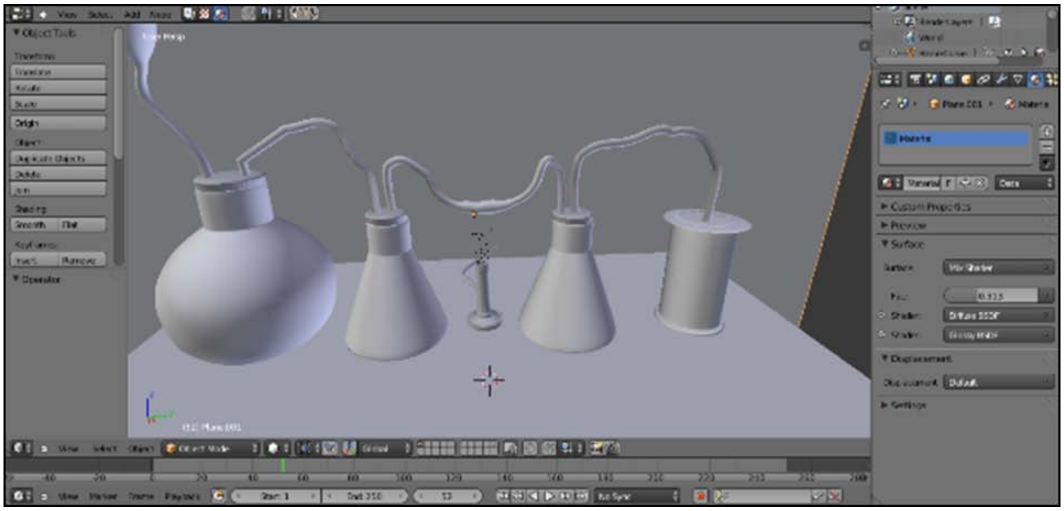


Figure 4.3: Models without rendering

Figure shown below(Figure 4.4) represents a fully rendered models

Figure 4.4: After rendering the previous figure

- Repeat steps from 2 to 5 for each object in the list.

Some of the points we kept in mind while modeling are:

- Use ‘Hide objects’ option in Blender. This was useful for simplifying the clutter while working on concentric objects, such as the flasks shown in Figure 4.2
- Use ’color code’ option. This was useful for identifying the objects or group of objects easily.
- Use a clear labeling and naming scheme for all the modeled objects. This feature was useful later, at the time of assembly, when the models are to be merged.
- Ensure uniformity of thickness of the objects. This made it easier in the assembly section, when the objects are joined. Once the modeling of objects was completed, we proceed to the Assembly phase, described below

4.2.2 Assembly

Assembly is the process of joining the models created to form various apparatus. The important steps in the assembly section are:

1. Join the relevant models as suggested in the photographs. This was an important task, as the rest of the animation depends on it. The joining should be done in a way, that the joint should not leave any marks on the inner or the outer surfaces. Example: We start with the innermost objects, and join them with the outer ones. Figure 2b shows two models getting assembled.

Test the assembly, for the open holes, or leakages by creating some fluid inside it.

4.2.3 Texturing and Lighting

Texturing is the process of applying a bitmap image to the surface of a model. Appropriate textures are created and applied to the models, based on the details of the data collected. Sometimes, the complexity of models was a deterrent factor, especially with textures like glass or shiny metal. The complete assembled structure of the components of the experiment is the starting point for texturing. The steps involved in texturing phase are:

1. Change the default material to the required material for the object. Select from the available list of materials, or create a new one to suit the requirement of the object .

2. Fine tune the parameters of the material applied, to achieve the desired effect. The effects are transparency, viscosity, ray transform, reflectivity index etc. Example: In faradays experiment, the texture of glass flasks needed to have some transparency. Some points to be kept in mind while texturing are:

- Texture and lighting are interdependent. Some textures may reflect after the lighting, so it was necessary to check whether the selected texture was suitable for the object after lighting also.

- Ensure that the texture used was covering the object fully, in all direction.

Lighting is the process of illuminating the entire model by adding various light sources. Lighting has been applied carefully, in order to have clear visibility of the objects and the motions in experiment or animation. The different types of lights in Blender are: Lamp, Sun, Spot, Hemi and Area. The steps to create lighting in a Blender scene are:

1. Add a light, at a suitable position, so that the emitter is able to light up the required area.

2. Set the level of illumination intensity, density and shadow parameters, to enable the viewer to see the action clearly.

3. Repeat steps 1 and 2 with different light types and positions till the desired effect is achieved.

4. Add multiple lights by repeating steps 1-3 till the entire action area is suitably lit. these are some points we kept in mind while lighting;

- Select the correct type of light. Example: Smaller light may make it dark, and high intensity light may increase brightness, resulting in non visibility of the action.

- Pay attention to the shadow settings, as it may create dark patches in the action area.

4.2.4 Animation

Animation is the process of adding motion to the static models created. Animation follows the sequence of events according to the description in the lab manual. Blender Game Engine supports animation of various objects through the different programming logics like collision detection, fluid dynamics etc. The important steps to be followed in the animation phase are:

- Study the experiment by analyzing the recorded video and by talking to the lab instructors, to understand the motion of the components.
- Use the available animation presets in the Blender Game Engine module, to start the animation.
- Edit the properties to achieve the desired motion effects.
- Use the 'Baking' option in Blender to test the actual flow of the fluids.
- Assign properties of 'obstacles' to the various components to drive the fluid in the desired direction, at the desired speed. Example: Glass walls of the tubes have to act as obstacles; otherwise the fluid may come out from the tube.

At the end of the production phase, we have a fully textured model with lighting and animation. Now, we need to add interactivity and export it to various formats, which are done in the next phase.

4.3 Post-Production Phase

4.3.1 Adding interactivity

Interactivity allows the users to choose the sequence of actions and settings of parameters. Blender game engine can be used to create the desired level of interactivity, based on the instructor's requirement. The important steps of adding interactivity are:

1. Select the relevant object/solid/fluid to assign the motion.

2. Add a new Sensor, Controller and Actuator with the 'Add' buttons in each column.
3. Edit the settings of the components in the Game Logic window to achieve the specific requirement.
4. Apply the appropriate settings to the other moving entities and check the collisions with the other entities.
5. Insert the recorded audio of the narrative, at proper cue points, using the tools provided.
6. Render the output of this to get an interactive audio-video self extracting file, which is independent of the operating systems.

4.3.2 Reviewing the animation

Review the output to ensure that (i) The experiment is depicted correctly, and (ii) The design goals have been met. The steps to be followed are:

1. Check the 3D animated content with the detailed script of the experiment.
2. Check the boundary conditions of the various parameters of the components used to ensure that there is no distortion.
3. Check the important viewing angles for the experiment (front, side, top and isometric) to confirm the correctness of the 3D animated content.

For the chosen illustrative example of faradays experiment, the design goals have been met as follows:

1. The fully assembled 3D model, complete with texturing and lighting fulfils the first design goal of offering clarity to the user by creating the experiment in 3D .
2. The animation created using fluid dynamics as per the requirement of the script of the experiment fulfils the second design goal.
3. The interactive content based on the requirements, suffices the third design goal.

4.3.3 User testing and feedback

The interactive content created was tested by getting feedback from the faculty and students as follows:

1. Get faculty and students to use the 3D content and see the virtual experiment.
2. Document their experiences and difficulties during the virtual 3D lab experiment.
3. Take the necessary corrective actions to further refine the content.

4.3.4 Final rendering and sharing

These involved the following steps:

1. Refine the animation based on the feedback from the users.
2. Render the refined animation in different formats. Example: The interactive medium would require a stand alone, real-time interactive animation file which is able to run on any platform. The second and commonly used format is the animated video. Choose the appropriate settings to render the video file.
3. List the individual models, textures, materials which are reusable. Render these models in respective file formats. Upload them to open source repositories such as our interface ASLO for users interaction

4.4 Physical specification and system requirements

This section specifies the hardware and software requirements for the Animated Science lessons for Ordinary Level Students (ASLO).

4.4.1 Hardware requirements

This system/software is specified to run blelnder on computers with the following specifications:

- A computer with at least 2.1 GHz of processing speed.
- A computer with at least 2GB (Minimal size), 8 GB(Average size) or 16 GB(Production size) of RAM size. contact the first Reference for more information.
- The computer hard disk space should have at least 50 GB of free space.
- The computer monitor should be with a good VGA card to support graphics(OpenGL Graphics Card with 1 GB RAM) for average size.

4.4.2 Software requirements

This section specifies some of the tools used during development of the project, and they include:

- The system basically requires Windows environment (in our case) to run i.e. Upper versions of Windows and all other platforms.
- Blender was also used to produce our video output to be uploaded.
- PHP and HTML languages were used for
- JavaScript to allow fuctionality of our online repository.
- MYSQL for creating the database.
- We used Macromedia Dreamweaver 8 software package as the compiler for implementing the system.

- We also used Mozilla Firefox and google chrome for running the system.
- Wamp Server was used for implementing and running the system

4.5 System design

In this section, we describe the theory upon which the system was built. It includes the conceptual design models, context diagram and flow chart diagram.

4.5.1 Conceptual design

This phase involves modeling of the underlying students being supported by the system in discussion. It is concerned with the way data about video lessons are handled by the animation teams when making decisions; shown in Figure 4.1

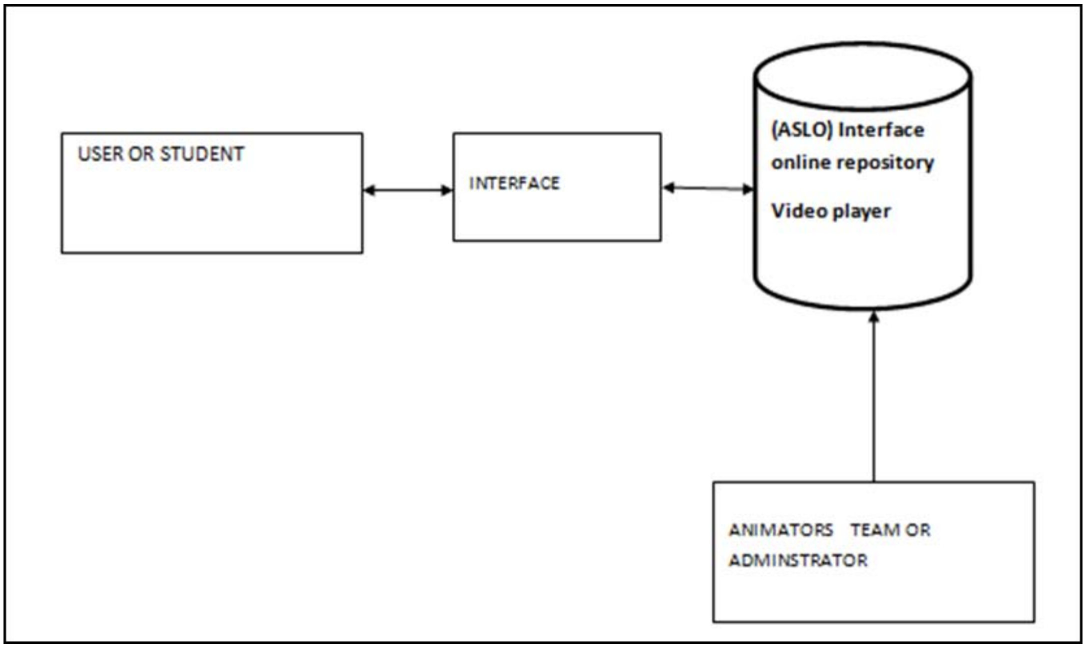


Figure 4.5: conceptual design

4.5.2 context diagram

In our project, the user who is labelled STUDENT can search for a lesson and watch on the respository interface. The Animation teams can upload the output videos to the respository. these is shown Figure 4.2

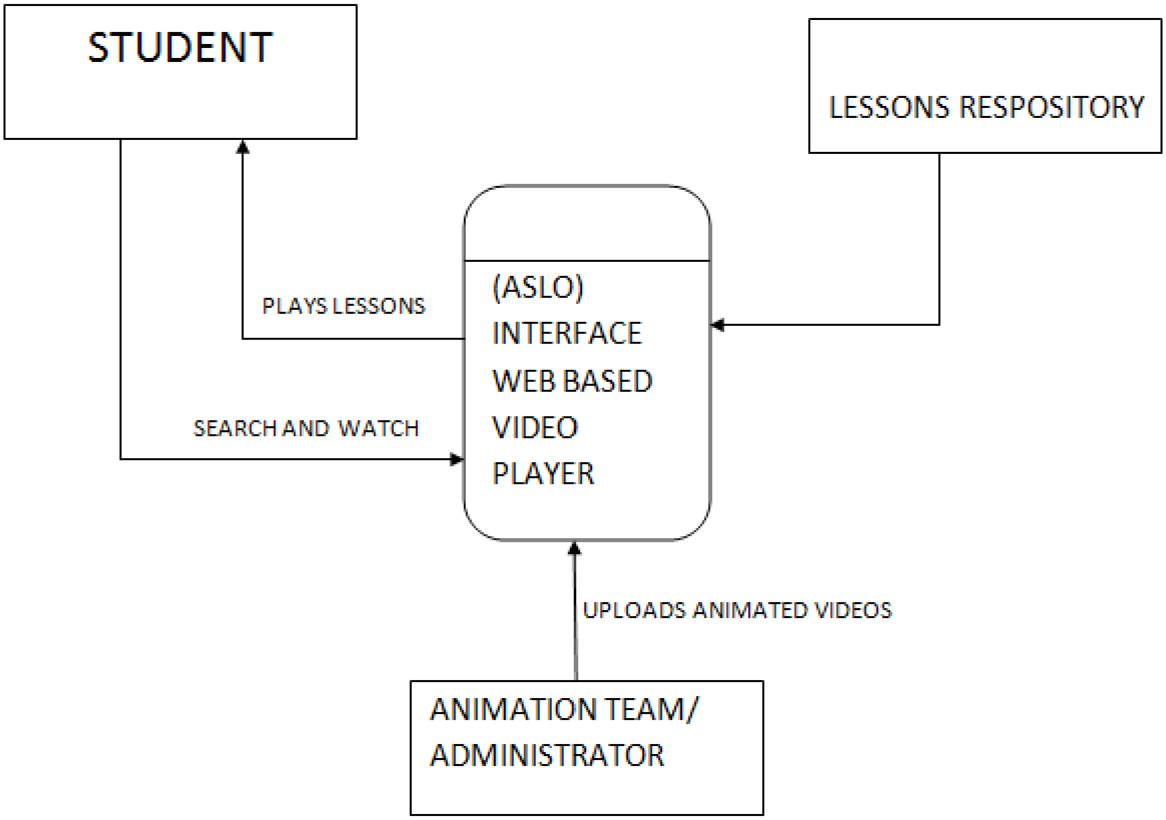


Figure 4.6: context Diagram

4.5.3 Flow chart Diagram of the video players interface

This phase of modeling was designed specifically to elaborate the relational hierarchy about how the system supports its users and clearly shows how information flows chronologically, shown in the figure below.

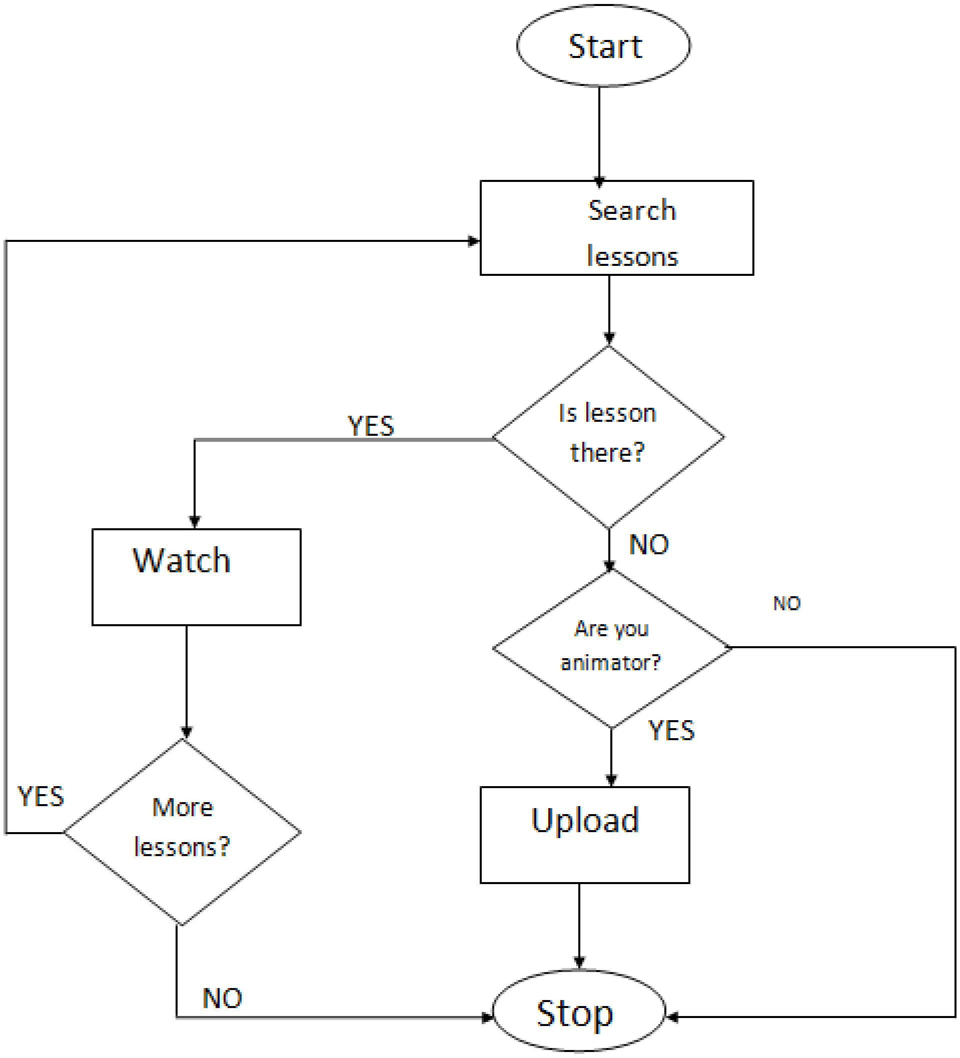


Figure 4.7: Flow Chart

Chapter 5

Discussion and Presentation of Results

5.1 Introduction

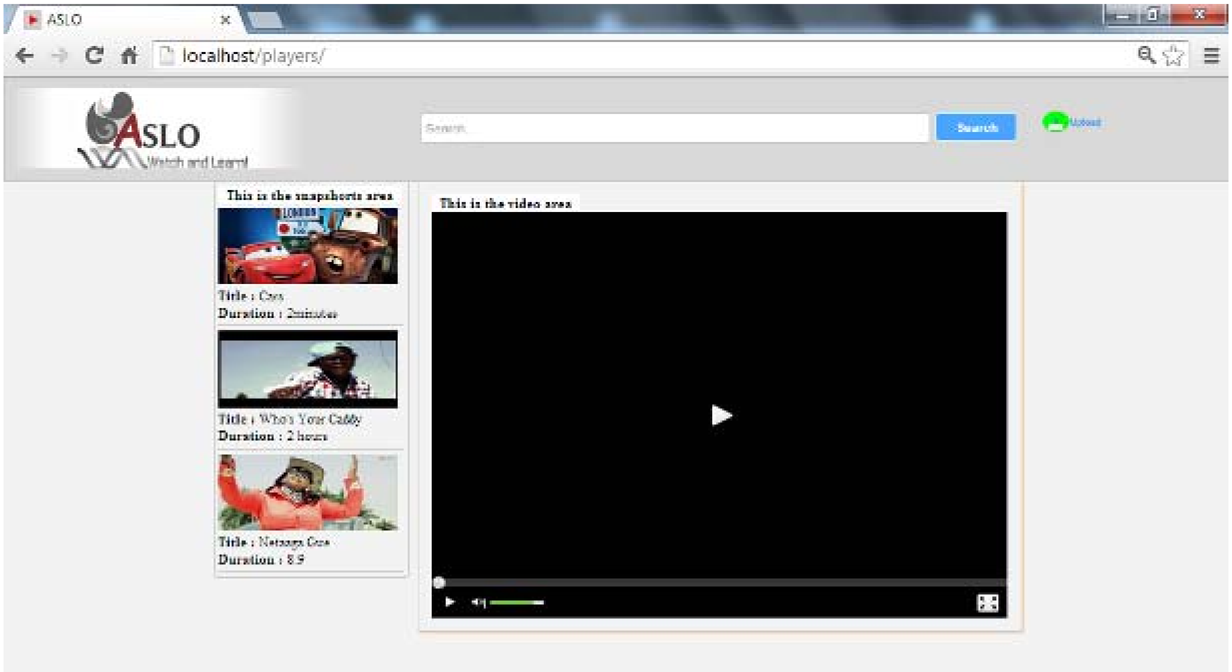
This chapter contains results of the study and describes the system development, implementation and presentation of the design solution of the Animated Science lessons for Ordinary Level Students (ASLO) to meet the user requirements. It also shows the various screen shots of the forms and reports.

5.2 Discussion of Results

This section considered the functionality of the developed system and how it interacts with users.

Home page of our video player (ASLO). (see figure 5.1)

Home page can be accessed by anyone with no restrictions. it allows users to browse for their specific lesson and watch. Upload is ment for only the admininistrators.



Title : Cars
Duration : 2minutes

Title : Who's Your Caddy
Duration : 2 hours

Title : Netaaga Cox
Duration : 8.9

Figure 5.1: ASLO video player resitory

The figure 5.2 presents how the Animation team uploads their output to the repository.

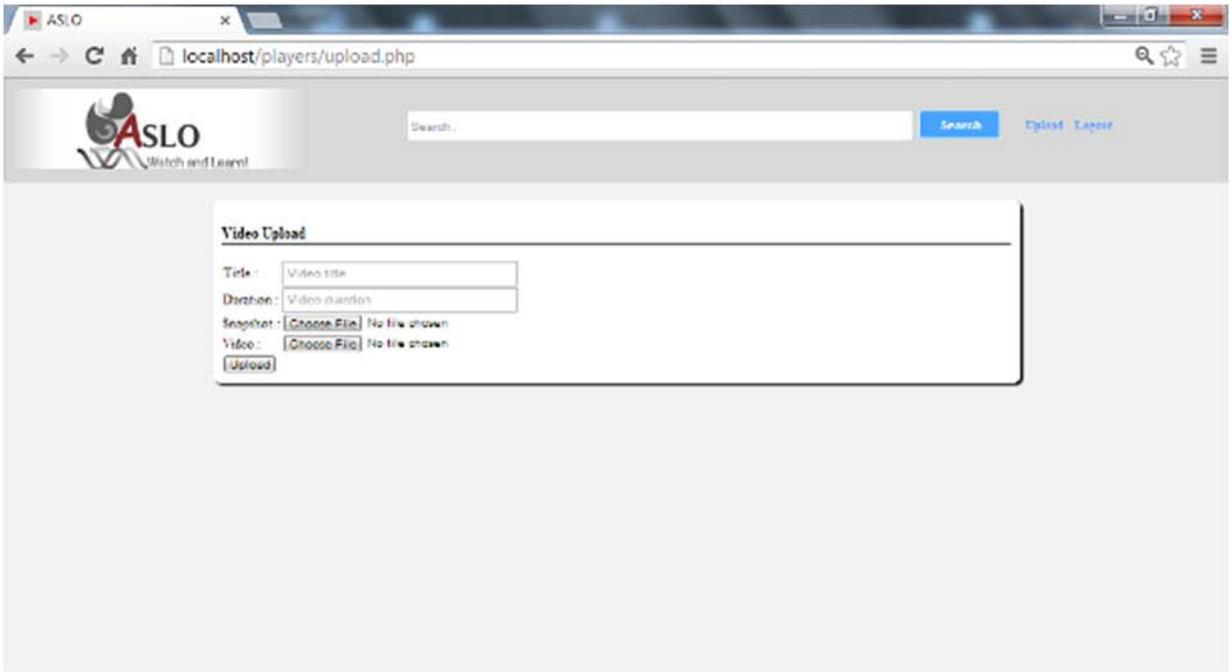
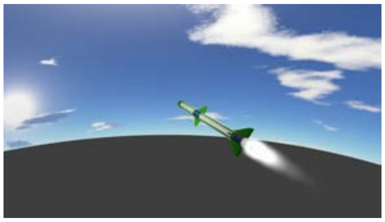


Figure 5.2: Uploading Page

Figure 5.2 presents samples of video snapshoots of our output.



(a) newtons third laws of motion

(b) preparation of hydrogren

(c) preparation of sulphur dioxide

Figure 5.3: output videos

Chapter 6

Discussion, Recommendations Conclusion

6.1 Discussions.

The chosen animations proved to be an appropriate selection for investigating the suitability of Blender for 3D animations. The starting point was just a text describing the details of the procedure along with a diagram of the apparatus. Our methodology used to create this virtual experiment succeeded in achieving the design goals stated.

The decision of using 3D for our animations was justified by the faculty instructor, and the students in unison. The instructors were particularly happy for the multiple viewpoints to explain the intricate steps in the process.

The students were excited about the new medium, and found it easier to visualize the experiments and apparatus using animation as compared to the diagram. We also found that 3D enabled lab sessions have excited students towards lab experiments.

Challenges;

We were pleasantly surprised to find that Blender Game engine could handle water falling; however it required alot of understanding and a small significant programming effort.

The users interface of Blender created an awkward block in the initial stages and it took us 4-5 months to learn and use the various options. Creating a correct and visually appealing animation was a challenge.

And last but not least, our challenge was acquiring a computer system with all the needed averaged requirements in times we wanted to use them resulting into few but short video output.

6.2 Recommendation.

Learning animation is joyful but was quite tedious to achieve a long-lengthed video output in a short period due to the above challenges.

we recommend fellow animator we opt to take further implementation on our system (project) to produce more relevent outputs, advance on our ALSO interface in that, it shall allow interractions, access to complaints and comments. To achieve this, The subjected Animators are to get early access to an averaged computer system in time.

With the above recommendations, we highly agree that our systems functionality can be improved and addressed.

6.3 Conclusion.

With all the above, we found that Blender is definitely useful for animation in the eLearning domain. It has all the necessary components to enable an animator to model, apply texture and animate almost any object. It has most of the features comparable to commercial, proprietary, high end and mid range 3D softwares such as mesh collision detection, LBM fluid dynamics, Bullet rigid body dynamics, particle system etc. Blender's ability to deploy the programming logic to the different ingredients in the experiment like water, glass and other chemicals is an important asset to be explored. We found it useful to have a team of animators with knowledge of three diversified backgrounds like Geometic drawing, Fine Art and computer science which amplified the visual communication and the programming aspects of the final product.

The Blender game engine allows the creation of stand-alone, real-time applications ranging from architectural visualization to video game construction. Adapting its features to build more advanced experiments for eLearning is of great value.

Finally, we are studying the use of Blender for more detailed lab experiments in various domains.

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