

Virtual Computer Laboratory A worked Sample-APB Simulator

Okoro U.R, Omotosho O.J, Egunjobi P.O, Dike A.S and Obasa B.O

Abstract— The field of Virtual Reality has made Education so interesting as it introduces a balance between Explicit Knowledge (introduced by normal theory class setting) and Tacit Knowledge (knowledge gained by practical carried out in laboratories). Virtual Reality (VR) is an artificial environment created with computer hardware and software, which presents users with hands-on experience while learning technical know-hows of a particular device in the real world. Virtual Laboratories enhances accessibility to simulated equipment and reduces cost and maintenance of physical laboratories facilities. The outcome of this work is APB- 3-D virtual laboratory, which presents students and lecturers with a virtual world/World on Windows (WoW) practical class sessions on computer hardware repairs and troubleshooting. APB strikes a balance between concrete learning and virtual classroom experience with the sole aim of combating lack of laboratory experience and lack of laboratory facilities as major challenges in developing countries such as Nigeria.

Keywords- A+, Game, Simulation, Virtual Computing (VC), Virtual Laboratory (VL), Virtual Reality (VR) , World-on-Windows (WoW)

1 INTRODUCTION

The expenses of using physical laboratory can be a burden to institutions because the expenses incurred in maintaining a physical lab is higher than a virtual lab. Hence, Virtual laboratories were created to allow many users access them in real time.

In technical education, laboratories are important environments for student learning. High setup and maintenance costs make it challenging to provide laboratory Facilities at institutions where budgets and technical expertise are limited [1]. In response, “virtual laboratories” have been developed to address these challenges.

In VL, students interact with an experiment or activity which is remote from the student or which has no immediate reality. The latter part of the definition may seem to imply that a virtual laboratory can have no physical reality behind it at all. Laboratory experience is a key factor in technical and scientific education.

Virtual laboratories have been proposed to reduce cost and simplify maintenance of lab facilities while still providing students with access to real systems. It is important to determine if such virtual labs are still effective for student learning. Imagine that one can gain knowledge and skills by social interactions in virtual worlds. Virtual laboratory are presented as a solution to distance learning because they offer to students the possibility to interact and practice the content of the course with their laptops, cellphones that is a lively and enriched way to learn [2].

In technical education, laboratories are important environments for student learning. The challenges been faced include:

1. Financial strength to facilitate the set up and maintenance of the laboratories
2. Poor or Faulty lab equipment
3. Poor expertise skills
4. Curriculum design

A+, pronounced A plus, is the name of a process, developed by the Computing Technology Industry Association (CompTIA), a large trade group, that certifies individuals for knowledge about and competency in installing, maintaining, customizing, and operating personal computers [3]. Core elements of A+ certification criterion include knowledge of computer anatomy, which is why many experts suggest that those pursuing this credential practice assembling and disassembling a physical computer.

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2 VIRTUAL WORLD AND EDUCATION

In the contemporary societies known as the "Information Societies", the way individuals reach information, their styles of learning and styles of applying information have rather changed compared to traditional societies. In the last quarter of the 20th century, important developments seen in data processing, rapid changes that can be called computer revolution have caused education systems to undergo a complete transformation taking but traditional forms. One thing that should be noted is that in as much as information technology is dominantly present in the educational sector, the whole economy and the various other sectors will be affected. Education has the leading role among social institutions which will be most affected by increasingly changing process of information society [3].

Computers are one of the most important technological tools which are made use of in educational and instructional processes as they appeal to more senses unlike other technological tools in that they are able to make abstract and complicated concepts concrete digitally because of their extensive multimedia properties. Computers are also vital in the measuring and evaluating of student's knowledge and giving feedback, observing activities and performances of students independent of time and environment. Learning is also supported with materials such as graphics, pictures, animations, and sounds.

3 Objectives of the Study

The general objective of this work is to provide a virtual environment for teaching and learning A+ technique.

3.1 The Specific objectives are:

1. To identify the technical problems faced by teachers and students in the area of A+ and hardware classes
2. To model a virtual lab for teaching the A+ technical know-how as pertains to coupling a system unit
3. To instantiate the virtual environment using design mechanics to evaluate impact

This first phase of this study is focused on a basic lab session limited to coupling the Systems Unit of a Personal Computer (PC) using a System Unit as case study.

4 Review of Existing System

In order to critically understand the problem domain, research was carried out in the area of Virtual Reality, Virtual Computing, Virtual Laboratory and Simulation using the model shown below. The authors of this project proposed the

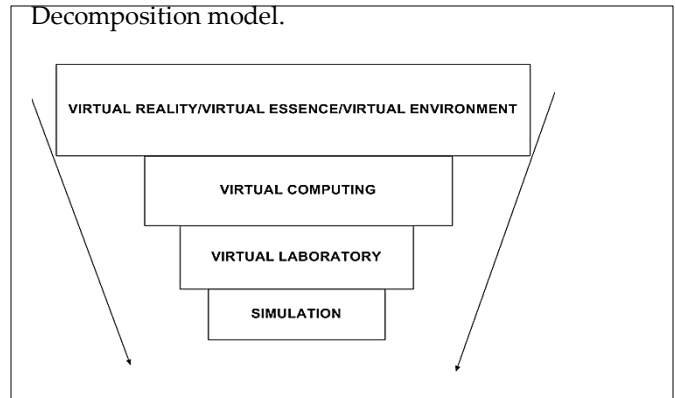


Fig 1- The Decomposition Model as proposed by the authors of this research work

In the computing community, these two words- Virtual Reality and Virtual Environment- are often used interchangeably. These words appear to be more popular and mostly used by people more than other synonymous ones like virtual world, synthetic experience, etc. It should however be noted that these words mean the same thing. Below are some of the definitions of these words:

1. Real-time interactive graphics with three-dimensional models, combined with a display technology that gives the user the immersion in the model world and direct manipulation. [4]
2. Computer simulations that use 3-D graphics and devices such as the Data Glove to allow the user to interact with the simulation. [5]
3. Virtual reality refers to immersive, interactive, multi-sensory, and viewer-centred, three-dimensional computer generated environments and the combination of technologies required building these environments. [6]

VR is a computer-synthesized, three-dimensional environment in which a plurality of human participants, appropriately interfaced, may engage and manipulate simulated physical elements in the environment and, in some forms, may engage and interact with representations of other humans, past, present or fictional, or with invented creatures . It is a computer-based

technology for simulating visual auditory and other sensory aspects of complex environments. VR incorporates 3-D technologies that give a real-life illusion. VR creates a simulation of real-life situation. A key feature of VR is real-time interactivity where the computer is able to detect user inputs and instantaneously modify the virtual world in accordance with user interactions. VR environments often consist of technological hardware including computers, head-mounted displays (HMDs), eye phones, and motion-sensing data gloves.

VR is a way for humans to visualize, manipulate, and interact with computers and extremely complex data. It is an artificial environment created with computer hardware and software and presented to the user in such a way that it appears and feels like a real environment.

5 Virtual Computing

Virtual computing which some people often refer to as Virtual Reality (VR) involves development of a computer generated virtual environment intended to simulate the real world. An emerging computer visualization technology allows users to experience a strong sense of reality in a computer-generated environment. Coming back to the educational scene, students use the computer for different purposes, which includes amongst other things - to complete assignments, and interact with instructors and other students. Many colleges and universities, notably private institutions owned and run by private bodies are financially buoyant to provide computing laboratories for student use—typically distributed across campus locations, containing dozens to hundreds of computers, and providing both general- and special purpose software applications. Campus computing labs provide many benefits to students including enabling them to avoid hardware and software purchase, maintenance, and administration [2]. Conversely, campus-computing labs are a considerable expense to educational institutions, and their operation, maintenance, and administration is complex.

Among students on a typical campus, laptops have become nearly as common as cell phones and MP3 players [3]. Some schools require laptop ownership, with specified configuration requirements, by students though such a requirement is unrealistic in many public schools. Unfortunately, for campus administrators, the rise

of laptop and other computer ownership among students has not eliminated the need for campus computing laboratories. Reasons for the continued need include the lack of computer ownership among some student populations, lack of raw computing power in many student-owned computers, need for standardized software and hardware configurations to support some educational activities, and the cost and complexity of many specialized software applications [2]

Virtualization plays a major role in helping the organizations to reduce the operational cost, and still ensuring improved efficiency, better utilization and flexibility of existing hardware; says Patrick Lin, Senior director of Product Management for VMware"

6 Gamification and its relevance to design

Gamification, or the incorporation of game elements into non-game settings, provides an opportunity to help schools solve these difficult problems and help foster student engagement and encouragement. Games and game-like elements have begun to invade the real world. Gamification, defined as the use of game mechanics, dynamics, and frameworks to promote desired behaviors, has found its way into domains like education, marketing, health and fitness, with analysts predicting that it will become a multi-billion dollar industry by 2015 [7]. Some visionaries, like game designer Jesse Schell, envision a kind of "gamepocalypse"; a hypothetical future in which everything in daily life becomes gamified [7].

Educational Gamification proposes the use of game-like rule systems, player experiences, and cultural roles to shape learners' behavior. To understand the potential of Gamification, the following techniques are considered in the design of a virtual computer laboratory:

6.1 Cognitive

Games provide complex systems of rules for players to explore through active experimentation and discovery. For example, the apparently simple mobile game Angry Birds asks players to knock down towers by launching birds out of a slingshot. Players must experiment with the game to figure out the physical properties of different tower materials, the ballistics of the slingshot, and the structural weaknesses of each tower. They launch birds, observe the results, plan their next moves, and execute those plans. In short, players' desire to beat each level makes them small-scale

experimental physicists. More broadly stated, games guide players through the mastery process and keep them engaged with potentially difficult tasks [8].

These techniques, applied to schools, can transform student perspectives on learning. Students in schools are often told what to do without understanding the larger benefits of the work. Gamification gives students clear, actionable tasks and promises them immediate rewards instead of vague long-term benefit.

6.2 Emotional

Games invoke a range of powerful emotions, from curiosity to frustration to joy [9]. They provide many positive emotional experiences, such as optimism and pride [10]. Crucially, they also help players persist through negative emotional experiences and even transform them into positive ones. The most dramatic example of emotional transformation in a game is around the issue of failure. Because games involve repeated experimentation, they also involve repeated failure. In fact, for many games, the only way to learn how to play the game is to fail at it repeatedly, learning something each time [9]. Games maintain this positive relationship with failure by making feedback cycles rapid and keeping the stakes low. The former means players can keep trying until they succeed; the latter means they risk very little by doing so. In schools, on the other hand, the stakes of failure are high and the feedback cycles long. Students have few opportunities to try, and when they do, it is high stakes. Little wonder that students experience anxiety, not anticipation, when offered the chance to fail [8].

Gamification offers the promise of resilience in the face of failure, by reframing failure as a necessary part of learning. Gamification can shorten feedback cycles, give learners low-stakes ways to assess their own capabilities, and create an environment in which effort, not mastery, is rewarded. Students, in turn, can learn to see failure as an opportunity, instead of becoming helpless, fearful or overwhelmed [7].

7 COMPTIA A+ SIMULATOR

The CompTIA A+ Simulator is the most common existing A+ Simulator, which is presently being used in few countries in Europe and South America for teaching Computer Hardware and

Systems Assembly. From a personal review on the existing simulators, the below short coming were highlighted as it pertains to developing countries

Gaps

- a. It is web based and it cannot work in a developing country that is low on network readiness index e.g. environment, usage.
- b. The CompTIA system allows users to only work with few computer parts
- c. It is relatively costly to purchase the software.

Hence, this work has taken into focus the peculiarity of the studying environment and merges with the global standard. It is not an online-based world and makes it easier to be adopted in developing countries and schools who cannot afford the expensive CompTIA and CISCO online based simulation labs.

7.1 FEATURES OF THE PROPOSED VIRTUAL LABORATORY

1. Virtual Computer Laboratory can be downloaded and used individually. They also offer remote experiment monitoring and control, online laboratory notebooks, enhanced security, collaboration opportunities, and cross-platform compatibility.
2. Virtual problems enable researchers to look at the best sensors to deal with a real-world issue.
3. Although nothing can replace hands-on work and physical demonstrations, it is not always possible to do everything in the physical world because of cost and time limitations.
4. A virtual experiment can run at the same time as a physical test using the same location and configuration, and it will generate the same data.
5. Although results may not always be 100 percent accurate, a virtual tool to simulate well-established technologies in different areas would at least provide a useful warning light. A virtual environment is a good place to identify defects and measure exactly what is needed.
6. The virtual environment allows a user to speed up time in the virtual world. This

allows a user to run a test and produce results faster.

7. A virtual laboratory provides an opportunity to look at different perspectives and come up with a uniform solution.
8. A virtual system offers a convenient way of experimenting with many sensor locations and types.

8 DESIGN MODEL

The Design model used for this work is the Incremental Model. The software process model may be defined as a simplified description of a software process, which provides process frameworks that may be extended and adapted to create more specific software engineering processes.

9 APB A+ SIMULATOR MODEL AND USE CASE DIAGRAMS

A use case diagram herewith represents functionality by APB in terms of actors, target, and cross-dependencies between actors and targets. In other words, it represents every case action or activity. Certain scenario has been used to specify behaviour by description.

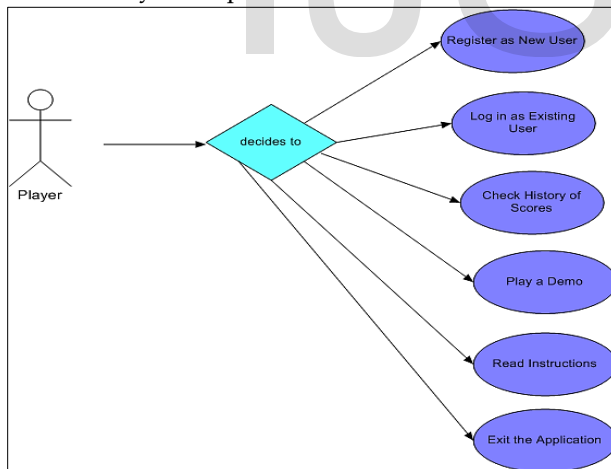


Figure 2- Player Case Diagram for the Main Menu



Figure 3: The Main Menu/Login Page

Above is the use case and interface design for the welcome page or the main menu, which shows the basic activities that can be carried out by any user. The user is expected to login with details, which must have been committed to the database while registering. The Username is the student matric number. Each of these activities is further explained with the Player case diagrams below:

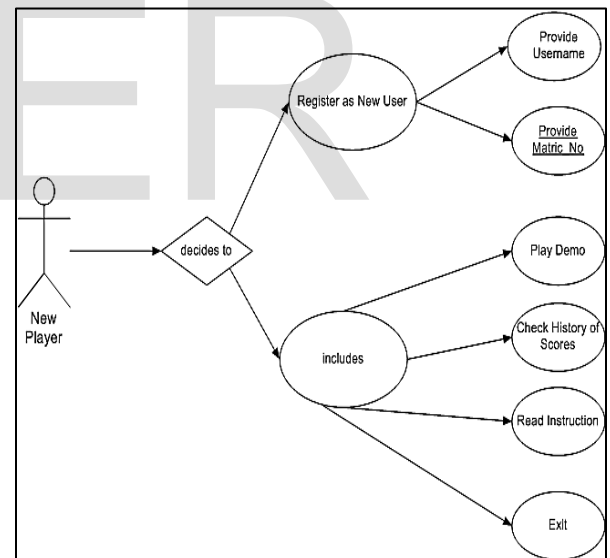


Figure 4: Player Case Diagram for a New User

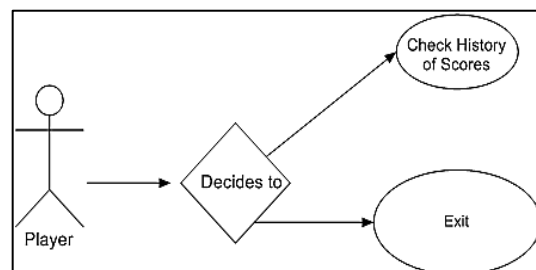


Figure 5: Player Case diagram for checking history

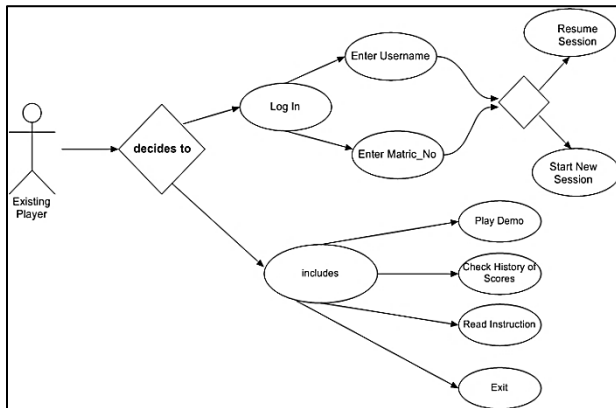


Figure 6: Player Case diagram for an existing player

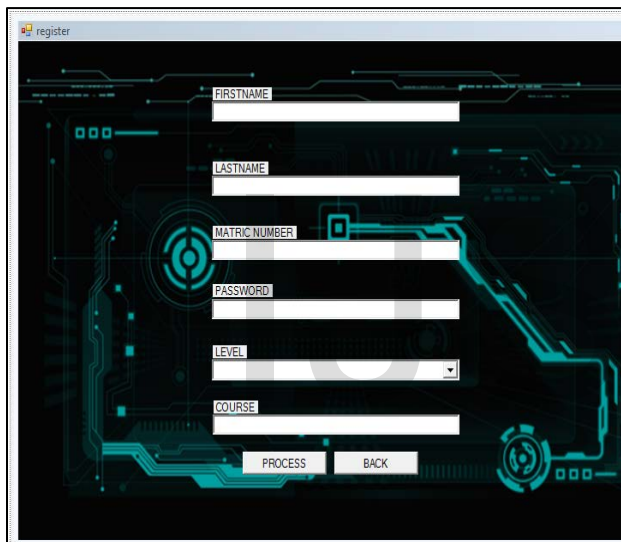


Figure 7: System revealing registration procedure

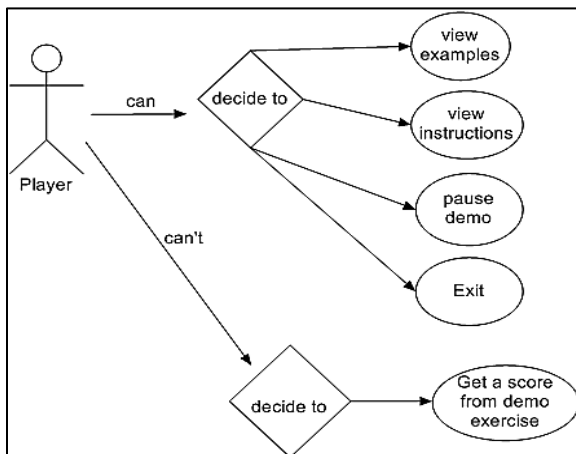


Figure 8: Player Case diagram for Viewing Demo

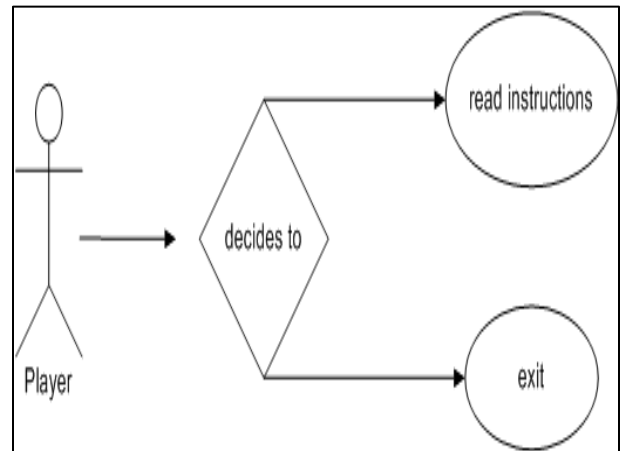


Figure 9: Player Case diagram for reading instructions



Figure 10: Snapshot of the system revealing the interface

Key

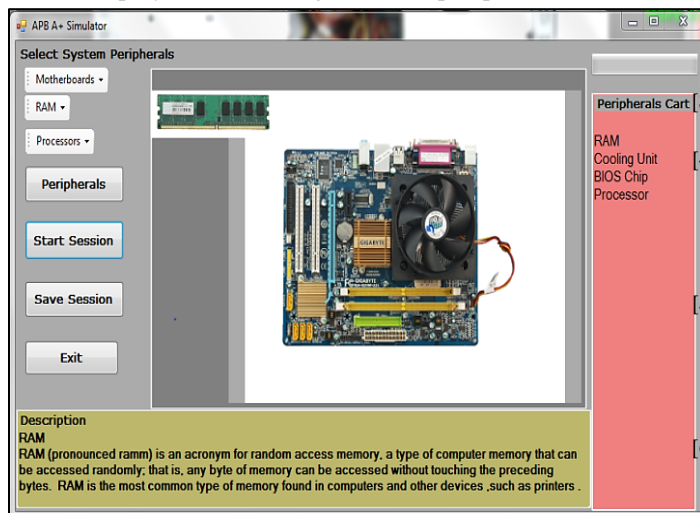
1. System parts
2. Progress bar
3. Activity/Working Area
4. Selected Peripherals Cart
5. Device Description
6. Vault

The Interface above is what the system should look like upon successful log in. The parts marked or numbered are explained below as pointed out by the key:

1. This is the part of the interface where the user gets to choose from a variety of computer peripherals and types, which are in drop-down item boxes. Here is where the various parts

which are available for the completion of the puzzle are listed and made available for the drag and drop operation.

2. This is the progress bar. As the user picks peripherals and fix on (3), the progress bar shows the level of success or completion attained. This allows the player ascertain his/her level of success or failure in the exercise. When the progress bar becomes completely full (green color), it means that the exercise has been completed.
3. The Working/Activity Area is the portion of the interface where the coupling of the peripherals is done. The part that must have been dragged using the drag action of a mouse, is dropped on this particular area of the interface. It is suffice to say that the only part where there is major activity is the Working Area.
4. The peripherals cart is where the user can see the various parts that he or she has picked and used in the course of work. (For which a maximum of 20 parts will be defined). Once a particular peripheral has been correctly affixed, it appears in the peripherals cart to inform of the player that there is no need searching for a peripheral that has already been fixed.
5. The description box is meant to explain the parts and their uses to the user as they are picked. For instance, if a user picks a MiniATX motherboard, an explanation of that motherboard is made available in the description box.
6. The Parts is where players are allowed to get a comprehensive list of the parts of the system component, their description, specification, functionality, and uses. This will help improve the players' knowledge of these peripherals.



10 Conclusion

In order to enhance virtual computing, system such as the APB A+ Simulator can be introduced to various institutions of higher standard. Students do not have to rely on long hours of lectures within the boundary of a laboratory where at the end of the day they (student) won't be able to carry out solid practical. So with the aid of our APB system, student or the users can engage themselves with practical to test their knowledge after understanding the theory aspect in their various classrooms anywhere and anytime, even in the comfort of their homes. This increases the zeal to learn as it eradicates the usual "boring routine" of sitting in classrooms most of the time without doing anything or without laying hands on the system.

Students can have unlimited access to various peripheral parts such motherboards, ram(s), fan(s), hard-drives, CMOS battery etc. student can also have the opportunity to retake a practical class unlike the real lab whereby once a system is damage it will cost the school to replace them. Also even participate in intellectual discussions online. Thus, the APB should be introduced to the Nigerian educational system in order to increase the learning interest of students and give rise to outstanding youths who will play a role in the society.

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