Interactive Virtual Classroom

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Received 30 November 2017
Revised 15 December 2016; Accepted 25 December 2017

Abstract: Developing virtual classroom training doesn’t have to a chore. In fact, once you know each of the steps involved in the process, you can create deliverables that effectively improve employee skills and job performance, regardless of the subject matter. Even dreaded compliance training can become an engaging and exciting experience for your audience.

Keywords: The development education, ICT, information technology, learning, interactive virtual.Simple, powerful tools for collaborative learning.

1. Introduction

Present world has become technical drastically. Education also includes its features for to cope the global objectives. This educational technology called virtual education by which everybody can get the accessible education. Virtual education or we can say it gives a new definition to portable education. Virtual education is completely based on electronic, which is needed the eligibility of higher technical user. Therefore, this paper purposes to provide the knowledge about the virtualization of education and required feature for its implication. Pairing visuals with detailed explanations that are thought provoking is always a good idea, especially if you want to boost employee engagement. This is due to the fact that it can spark discussion, as employees will be encouraged to interact with the subject matter and their colleagues, remotely or otherwise. To trigger employee discussion, you may want to integrate some form of online collaboration.

2. Augmented reality

Virtual Reality (VR) or Virtual Environments (VE). Using a typical VR system a user can move and interact within a computer-simulated environment commonly referred to as a virtual environment. VE technologies immerse a user inside a synthetic environment. In contrast, AR’s main characteristic is that it enhances information, from the real world using computer-generated objects, onto the user’s world-view. The ideal AR system will be able to compose computer-generated images or videos with the real world in real time in such a way that the user cannot tell the difference. Vallino states, “An augmented reality system could be considered the ultimate immersive system. The user cannot become more immersed in the real world” [1]. On the other hand the two most important drawbacks that current AR systems face, concern robust registration of the real world with the virtual world in real time and accurate sensing of the
user in the real world—both the subject of current research efforts.

Advances in computer technology in recent years has facilitated the study of augmented reality systems and evolved many new applications on a variety of application domains. Typical applications in which AR has been applied are: manufacturing, maintenance and repair, medical, military, collaborative interior design, entertainment, cultural heritage and fashion design. One of the earliest applications of AR is in military training of helicopter pilots. Using specially designed head mounted displays (HMDs) graphical navigation and flight information is superimposed upon the pilot’s view of the real environment during the flight [4]. Another example of using AR is for live training concerning ground combat vehicles. This simulation was performed interactively and allowed the soldiers to see virtual objects (vehicles) on a virtual simulated battlefield [2]. Given the success of AR so far, we would like to consider how AR could benefit teaching and learning of the top-down design methodology. The need emerges because classroom instruction is sometimes insufficient, the design methodology is complex, and often limits the range of experience [3]. However, before we consider using AR to support teaching and learning of topdown design methodology is a powerful technology trend that is happening now. The trend is already underway and the outlook is that it will grow very rapidly. Educators owe it to themselves and their institutions to examine the opportunity very closely and see when and how they can start taking advantage of this exciting capability. Virtualization lets your IT staff deliver better service at lower cost and with greater security and reliability. To find out if your network can benefit from virtualization, ask yourself the following questions:

- Do you want to improve student performance by allowing student-owned devices to connect to the network?
- Do you want to extend the useful life of existing lab and classroom PCs?

- Does your IT staff spend a large portion of its time visiting school sites to perform maintenance on labs or classroom PC?

2.1. Potential benefits

When investigating the potential benefits of using an AR system in a teaching and learning environment we are considering two issues: the effect it has on the teaching and learning process, and the consequence of introducing new advanced technology in the classroom. Considering this some potential benefits are:

- Provision of tools that enable the fast and efficient generation and dissemination of learning material, and a set of virtual scenarios and support materials that students can control and interact with.
- Provision of virtual multimedia course notes that are particularly interesting and stimulating, as they can be immediately made available in the virtual environment. Students can build their own presentations.
- Reduction of printed material, although the option for the student to print out a presentation could exist.
- Simplify the teacher’s task in providing much more stimulating teaching materials.
- Enables team working, which is essential when working in industry. Developing team skills is an essential part of the learning process.

2.2. Technological Issues

It is important to consider the technological issues when introducing AR to the teaching and learning process. For example, the system must:

- Be simple and robust.
- Enable the teacher to input information in a simple and effective manner.
- Enable easy interaction between users.
- Make complex procedures transparent to the user.
- Be cost effective. Ideally, such system should be built from off-the-shelf components, thereby reducing costs. It is generally accepted that a major reason for using virtual technology is related to costs.
3. Virtual Interactive Teaching Environment

Having considered augmented reality, virtual design, benefits, technology issues and where to exploit it, we propose an augmented reality environment called the Virtual Interactive Teaching Environment (VITE), which is aimed at improving the teaching of electronic systems design. The benefits of using AR are clear for applications related to,

**Operating system–level virtualization**

In this case the virtualization layer sits between the operating system and the application programs that run on the operating system. The virtual machine runs applications, or sets of applications, that are written for the particular operating system being virtualized.

![Simulating VR activity increases the ability to stimulate the learner's senses.](image)

**High-level language virtual machines**

In high-level language virtual machines, the virtualization layer sits as an application program on top of an operating system. The layer exports an abstraction of the virtual machine that can run programs written and compiled to the particular abstract machine definition. Any program written in the high-level language and compiled for this virtual machine will run in it[4].

Learners can experience and completely reduce the body, think flexibly when immersed in the subject, curriculum or seminar. At the same time, the multi-senses will be activated with unprecedented efficiency for previous classes.

When the multi-senses are stimulated for the game may not be considered. But teachers have to consider carefully when entering the classroom: what program is used VR. Limiting the excitement to bring learners back to the curriculum, not stopping abruptly the enjoyment will be a shortcoming in thinking and resistance to the next lesson.

3.1. The VITE teaching model

VITE exploits a horizontal teaching model as opposed to a vertical teaching model. We define vertical teaching models as being specific to one discipline, e.g. teaching methods in an engineering context, see Figure 4. Here we see that the subject taught is defined as vertical because a single teacher would coordinate lectures, workshops and laboratories based around a single subject. Example subjects might be the teaching of Java programming, or...
VHDL or business studies. Thus, vertical models are defined for specific subjects, and are often different depending on the teacher, with different environments for each subject.

We define horizontal teaching models as being more flexible allowing not only the teaching of single subject areas but also for cross-disciplinary teaching. For example, we may wish to teach top down design with VHDL with this horizontal teaching model, but allow the option to access teaching media from other related disciplines.

This would be ideal for implementing a group project that required software, hardware and a business approach taught concurrently.

Our horizontal model is aimed at the broader teaching community, and is rendered possible by virtual technologies such as augmented reality. In other words, AR technology provides a common cross-disciplinary and interactive environment for teaching.

3.2. Database multimedia functionalities

The VITE architecture is particularly suited for teaching as it enables teachers to input information in an easy and powerful way. XML is now widely recognised as being the data description language of choice. Using XML non-programmers can easily describe data and information using custom and predefined tags. For example, there exists an already pre-defined set of XML tags called the Synchronised Multimedia Interface Language (SMIL) that describes multimedia content information and how to synchronise the information in a multimedia presentation [5]. We can adapt SMIL to describe part of the VMC information. Further, work is currently being done on X-VRML—the XML Virtual Reality Modelling Language—that can be adapted to describe the 3D and AR aspects of the VMC information [6]. The teachers existing material, i.e. the notes described in section 2.1 above, are now described in an XML file, with appropriate custom defined XML tags associated with all the different textual and pictorial descriptions or data, e.g. as a minimum each section of the notes would have an XML meta tag. This XML
file is added to the database. XML style sheets are used to transform this data into specific 2D or 3D behaviour that will be performed on elements—text, pictures, multimedia objects, such as avatars, etc.—within the database. This approach could also enable the teacher to build simple models out of basic elements within the database. Because each element corresponds to a XML meta tag, a new XML file can be generated from selected elements to make a new multimedia presentation within VITE. Thus, the database will typically consist of XML descriptions of 2D and 3D objects including behavioural information, text information, and voice data. Our approach to data description using XML greatly simplifies the interaction between the teacher and the system. VITE provides the following major multimedia functionalities:

- Access to all relevant books, notes and other useful text, images or 3D objects that describe top down design. The content is stored as XML descriptions in the database and visualised in 3D using XSL style sheets.
- Visualisation of ready-made electronic design models, rendered in real time in a realistic manner.
- Avatars to perform predefined or custom presentations and provide answers to a student queries.
- Tutorials on the use of the AR hardware, e.g. virtual displays, gloves, etc.
- Tutorials on the use of the AR software, which is responsible for robust registration and tracking.

3.3. Top Down Design with VHDL Example

As mentioned, we wish to improve the teaching of top down design using VHDL methodology. Students are required to design a simple digital component, see section Using VITE the teaching and learning process, including the Esperan Multimedia tutorials is delivered in an augmented reality environment where the student uses optical see-through glasses to switch their vision between the VMC information and the existing EDA tool design flows. The student will visualise in 2D and 3D all material, including the design assignment, together with the VHDL principles (notes, books, tips, etc.), which are overlaid in three dimensions in front of each student during all the laboratory sessions. Furthermore, avatars—an avatar is a graphical representation of a user, e.g. demonstrator, in the virtual environment that will respond to queries from the student—are used instead of demonstrators to illustrate examples, such as VHDL coding principles and other relevant information. The student can request information from the avatar that will initiate a dialog with the student to refine the question. For example, the avatar may ask the student how they want to visualise the information, e.g. as 3D or as text. The avatar will then make an XML formatted query on the database.

Example: Build a grid and map in space

The ElevationGrip tag allows you to build a grid made up of points of a certain height in space. This tag is useful for building networks or terrain. Construction images are placed in the space of the OXYZ plane. The starting point is the origin, the remaining points that make up the grid must be in the positive direction of the OX axis avf OZ.

Color, colorPerVexter, convex, solid have the same properties as mentioned above.

- xDimension contains the number of points inside the grid on the X axis.
- zDimension contains points inside the grid on the Z axis.
- xSpacing is the distance of two consecutive points in the direction of the X axis.
- zSpacing is the distance of two consecutive points in the direction of the Z axis.
- height contains a list of height values for each point in the grid.

These points are calculated in order from left to right from top to bottom.
Figure. An example is the robotic arm program that is assembling the robot.

Which is parsed into a set of XSL tags and an SQL query. The XSL tags select the appropriate style sheet that will translate the query results into the appropriate display medium, e.g., HTML on a browser, VRML in the AR display, or even simple text formatted for print. Further, there are several avatars dedicated to different queries.

Figure. An example of a robot arm program is painting.

Here is a practical program with the robot arm. With the robotic arm of the industry, the practical experience for school hours is not possible because of the cost of the multi million dollars. But with this program using VR technology, learners can fully experience, understand and control industrial robot arm for various tasks such as car assembly, painting ...

With a 6-arm robot arm, each joint is easily controlled in four different directions for flexible movement. For learners to learn as they learn and play, learn how to operate a robotic arm, learn the robot control arm close to the actual control buttons but not too pressure on the learner. Easy to understand and study hours, give the comments and analysis later class.

4. Conclusions

We believe that more complex electronic system designs could be attempted that would be impossible to do with the current teaching methodology. The only disadvantage is the cost but our proposed system is much more cost effectiveness than a fully VR immersive system.

It offers the teacher the ability to use more sophisticated techniques that enable better user interaction with teaching materials and complex EDA tools. It gives students a high degree of flexibility and understanding of the teaching materials by providing them in an interactive and augmented way. We believe that a VE will provide a rewarding learning experience that is otherwise difficult to obtain.

References

[1] Syed M. Ahmed, Quality Culture
[3] European University Association, Examining Quality Culture:
[9] link.springer.com/chapter/10.1007%2F978-3-642-30433-0_20