Exaltation of Students’ Learning Ability through Virtual Environment

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Abstract— The evolution of the technology takes the education to next level, where it makes the learning process more attractive and interesting. The Virtual Reality plays an important role in this evolution. The main aim of this work is to enhance the learning ability in students through virtual environment by developing an education based game. In this work, the virtual reality device-Wiimote has been used for the learning process, and also for answering the questions in the different levels of game. The learning process also involves the speech synthesis. This helps the blind people to learn without others help and it also motivates even the average students to participate more actively in the learning process. The game has been further divided as easy, medium and difficult levels. So the learning ability of each student can be easily tested and further steps can be taken in order to motivate them, and to optimize their learning skill. Thus, this work motivates the students for learning and to exalt their learning ability.

Index Terms— Speech Synthesis, Virtual Environment, Virtual Reality, Wiimote.

1 INTRODUCTION

Game based learning is an instructional method that incorporates educational content or learning principles into video games with the goal of engaging learners. The use of this method in the field of natural science and technology has increasingly been the object of study in recent years. Learning through digital games not only increase motivation, active learning, and provide individual learning opportunities, but also reduces the learning pressure of learners. Virtual Reality (VR) is a powerful and more promising tool in education because their unique technological characteristics differentiate them from other applications. Virtual reality is basically characterized by three ideas, which include the immersion, interaction and imagination. All these three factors permit the individual to participate more actively in the learning process without any distractions. VR devices are not only used for games and education, but also for the training process, which reduces the cost of equipments and also avoids the wastage of the products. VR devices are mostly used in military and medical training. In the medical field, when the training has to be given for the individuals in the field of biological cell injection. Then it involves more wastage of cells, because of the restrictions of the cells, where one cell cannot be used for another time, and also all the equipments used for these training are more costly. So, when the training is given for the individuals under the virtual environment, it adds more advantage, where they can undergo the training for multiple number of times than in the real-time and can avoid the wastage, by reusing the virtual objects.

The main motivation behind this work is that, when the learning process is made along with the pictures than with the words, it adds more advantage, and also increases the memory power of the students. It also gives more clarity to the students about the concepts.

2 LITERATURE SURVEY

Abdul-Hadi G. Abulrub et al. [1] explained the virtual reality principle and demonstrated it through the real life case studies of how the innovative technology can be employed to produce creative learning and training virtual environments. Sandra Dutra Piovesan et al. [2] developed the software for education, which has a subjects of Formal Language that involves Automatons, Regular Expressions and Minimization of Automatons, interacting directly with the object in 3D, where it makes the subject more interesting to the students and also makes the learning easy. The importance of VR in education and mainly the importance and advantages of training in Military using VR tools have been explained by Joseph Psotka et al [3], Jiangfan Feng et al. [4] explained the necessity of applying VR technology in GIS education and through the case studies such as Geographic Process Simulation and Virtual Campus, suggested that the education is not limited to the class room. Chih-Hsiao Tsai et al. [5] proposed a system to facilitate and motivate learners by providing realistic 3D-visual materials and also evaluated the effects of specific operating experiences. The results of usability and learnability of cubic net assisted learning system by using Kinect sensor has been given. Ali Rahimi et al. [6] proposed the method in order to find the attitude and the feeling of Iranian EFL teachers regarding VR, and its impacts on Iranian language learning community in three levels of personal attitudes, technical issues, and pedagogical aspects. Veljko B. Petrovic et al. [7] discussed about the usage of Wii Peripherals for facilitating learning process in CS education, which helps the students to approach the problems in a creative way. Joao Gameiro et al. [8] developed the game based learning environment, where the sign language is learned using the Kinect, which has been mainly proposed for the listeners of deaf persons. Evgenia Boutsika et al. [9] used the Kinect as a learning auxiliary tool for teaching children with autism, in order to improve the behavior of children, such as making positive statements to each other.

2.1 Virtual Reality

Virtual Reality has three I’s, they are immersion, interaction and imagination. The immersion sensation of being in an environment, can be a purely mental state or can be accomplished through physical means. Physical immersion involves bodily entering into
a medium, synthetic stimulus of the body’s senses via the use of technology, this does not imply all senses or that the entire body is immersed. Mental immersion state of being deeply engaged, suspension of disbelief, involvement.

![Figure 2: Explanation of Acid Rain through Picture](image)

Imagination includes the exploring of a virtual environment, where it describes how much the individual gets involved in his work. If the user took part of the virtual environment (VE) and can interfere directly in result of the application, the user can navigate on the VE in a passive or active way. Interaction includes manipulation of virtual objects by the user. Devices that make this sensation are gloves.

### 3 PROPOSED WORK

Visualization is a key element in the learning process, where picture is worth a thousand words. So in order to improve the memory, the texts are given along with the pictures for each concepts. It consists of two parts: learning mode and test mode. In the learning mode, the concepts from different subjects such as history, geography and physics are explained, by using the pictures. The Speech Synthesis plays here an important role, where the machine generates the spoken language as the output for the written input. So it helps even the blind people to learn easily without others help. In the test mode, students need to answer the questions with the Wiimote, which is converted as an Air mouse, with the help of the GlovePie. Since this process acts similar to playing a game, students will actively participate in the learning process, without any learning pressure. This kind of education will lift the level of education to one step higher in the future, if it has been implemented in all the schools.

#### 3.1 Combining the Concepts with the picture

Initially the concepts are taken from the books such as history and science, and for those concepts the related pictures are gathered. Then in the learning process, the concepts are explained along with the pictures through the speech synthesis. So when something is learnt along with the pictures, it makes the individual to have in memory for a long time, where it also gives the clear clarification to the concepts.

#### 3.2 Speech Synthesis

Speech synthesis is achieved with the help of the Free Text to Speech Software. In this FreeTTS software, the Prosody analysis process has been considered. Prosody analysis processes the sentence structure, words and phonemes to find the appropriate prosody for the sentence. Anything that is a source of text that needs to be spoken with FreeTTS is first converted into a FreeTTS Speakable, which is an interface. This implementation will wrap the most common input forms as a FreeTTS Speakable. A FreeTTS Speakable is given to a voice to be spoken. The Voice is the primary customization point for FreeTTS. Language, speaker, and algorithm customizations can all be performed by extending the voice. A Voice will accept a FreeTTS Speakable via the Voice.speak method and process, where the Voice converts a FreeTTS Speakable into a series of Utterances. The rules for breaking a FreeTTS Speakable into an Utterance is generally language dependent. For instance, an English Voice may choose to break a FreeTTS Speakable into Utterances based upon sentence breaks. As the Voice generates each Utterance, a series of UtteranceProcessors processes the Utterance. Each Voice defines its own set of UtteranceProcessors. This is the primary method of customizing Voice behavior. Typically each UtteranceProcessor will run in turn, annotating or modifying the Utterance with information. Once all Utterance processing has been applied, the Voice sends the Utterance to the AudioOutputUtteranceProcessor. The AudioOutput processor may run in a separate thread to allow Utterance processing to overlap with audio output. So by this process, speech synthesis takes place. This implementation of speech synthesis helps the blind people to learn the subject without others help.

#### 3.3 Wiimote as Air Mouse

Wiimote is a VR device that permits the user to interact with and manipulate items on the screen. In this work, its feature has been enhanced by converting it as an air mouse. Wiimote has been converted to the Air Mouse with the help of the GlovePie. GlovePie is a free Programmable Input Emulator, where it allows to link the Wiimote to the laptop. Initially the Wiimote is connected to the laptop, using the Bluetooth. When the Wiimote gets paired with the laptop, with the help of Glovepie, it has been converted as a mouse. Here the Wiimote has been used as the mouse, for selecting the objects in the virtual environment for the learning process and also for answering the questions in the test process. This makes the students to actively participate in the learning and test process, since this part is similar to playing the game with device, students never feel pressure in the learning.

### 4 CASE STUDY

#### 4.1 Acid Rain

In order to explain the concepts of acid rain, initially the student is allowed to burn the fossil fuel such as coal in the virtual environment, with the help of the Wiimote, just by selecting it. When this burns, the student experiences the vibrating effect in their hand, which is produced by the Wiimote, so when burning the coal, it releases the Sulphur dioxide and nitrogen oxides into the air. These substances can rise very high into the atmosphere, where they mix and react with water, oxygen, and other chemicals to form more acidic pollutants, known as acid rain. All these contents which has been given in the text, will be converted as speech during the learning process. Thus the student
4.2 Crack in the Rock
Rocks gradually wear away, which is called as weathering. There are three types of weathering, from that physical weathering has been taken into account. Here the freeze-thaw process in the physical weathering has been explained along with the picture, user interaction and speech output in the virtual environment.

In the first figure, water gets into the crack in a rock. In the second, the water freezes and expands, where it makes the crack bigger. In the third, water get further into the crack, making it larger. This process of freezing and thawing can continue until the crack becomes so big that a piece of rock falls off, which has been shown in the fourth figure. For the learning process, the virtual object such as rock has been created. Then the student is allowed to pour the water to the certain limit in the rock through the Wiimote, initially for the first step(by selecting the button), after exceeding certain limit, the rock breaks automatically. So when the student is directly involving in this process with the help of the interaction, these concepts will remain in their memory for long time and also it forces them to learn more without any learning pressure.

4.3 Gravity Concept through Simulation
Gravity is the force that attracts two bodies toward each other, the force that causes apples to fall toward the ground and the planets to orbit the sun. The more massive an object is, the stronger its gravitational pull. Thus the concept of gravity has been explained here along with the simulations.

The Zero gravity is that, which includes the condition of apparent weightlessness occurring when a body in a gravitational field moves in such a way as to counter balance its gravitational force. For example, the astronauts orbiting earth in a space station experiences zero gravity because the spacecraft continuously accelerates in its orbit in order to prevent it from being pulled into the atmosphere. This acceleration is referred to as the centrifugal force, that counter balances the gravity exactly. Considering this example, the simulation is shown in the fig-4, here the ball remains orbiting, where it gives the complete explanation about the above concept.

5 CONCLUSION
In this paper, the importance of virtual reality in education has been explained along with the case study. This game based learning provides the concepts to the students more accurately, and also it delivers the concepts clearly to the blind people because of the speech synthesis, where it helps them to learn without others help. Thus when this virtual reality based education has been implemented in the schools, it will lift the education level one step higher in the future.

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