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A STUDY OF ARTIFICIAL INTELLIGENCE TECHNIQUES FOR 3D VIRTUAL WORLD

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ABSTRACT:
This article investigates the feasibility of using 3D Virtual Learning Environments (3D VLEs) like Second Life to facilitate the development of e-learning Project Innovations for students that make use of 3D Virtual Design ideas and programming. In a 3D virtual learning environment (VLE), this means using programming and coding to generate bots (artificial intelligence robotic avatars). In addition, 3D virtual learning environments (VLEs) can be augmented with holographic platforms (holodecks) that can be used to create a variety of classroom and environmental settings to support e-learning and teach students how to employ this method to create immersive 3D projects, such as 3D catalogues and exhibitions. These holodecks might also be used for interactive debates and lectures, as well as role-playing and modelling exercises.
KEYWORDS: 3D Virtual Worlds, Artificial intelligence, Bots, E-Learning, Blended Learning, Teaching Learning Innovation, Second Life

INTRODUCTION

More than a decade after its birth [1], 3D Virtual Learning Environments (3DVLEs) have hosted several digital counterparts of prestigious universities like Harvard and Cambridge. Improved student engagement, satisfaction, and success may be attributed to the usage of these digital media across a wide range of subject areas [2]. Real-time voice chat, textual dialogues, and multimedia presentations [3] are all possible in 3D VLEs where students and instructors interact via avatars. In light of this, it is crucial to weigh the benefits of adapting the mode of e-learning delivery to various settings. Researchers like Prensky [4] and Oblinger and Oblinger [5] have identified the emergence of digitally influenced generations of students, variously dubbed "Digital Natives," "Games Generation," and "Millenials," as a likely reason for the imminent encouragement of students to use game-like 3D VLEs like Second Life, Active Worlds, and others to improve their learning. Wang et al. [6] believe they will be crucial in the development of future e-learning because they may assist students go from theoretical understanding to practical application, or "learning by doing" [7].

The term "Animated Pedagogical Agents" [8] describes a new trend in the field of education. This uses the avatars of the students, who are physically present in the classroom, to provide an engaging and dynamic face-to-face interface and set of activities [9]. According to Mikropoulos and Natsis [10], the Constructivist theoretical paradigm seems to be the foundation for the vast majority of 3D VLEs. Technology "may not directly cause learning to occur but may enable specialised activities that itself may result in learning," as Dalgarno and

Lee [11] put it. As such, the following sections will defend Jonassen's seven constructivist principles [12] as proof that the constructivist paradigm is correct:

1. Offer a variety of representations of the actual world.
2. Spend your time creating new information rather than rehashing old
3. Realize meaningful endeavours
4. Give students the opportunity to learn from real-world scenarios
5. Encourage introspective practises
6. Facilitate the development of expertise that is both situational and subject-specific
7. Foster cooperative bargaining

This study's chosen and proposed pedagogical models foster, via project work, the development of students' subjectivist, experientially-informed knowledge. Therefore, the constructivist method of education, as opposed to the behaviourist method of learning [13], which emphasises the acquisition of information in an objective and passive fashion. The process of trying to make sense of one's experiences is fundamental to the learning process. Teachers, therefore, are not lecturers but rather facilitators who design lessons to encourage students to engage in a shared, independent quest for knowledge [14, 15]. If the aforesaid technology possibilities pan out, this might become considerably larger. This is consistent with the developmental approach on education, which emphasises students' own learning and discovery via "cultivating ways of thinking" [16]. Therefore, from a developmental viewpoint, pupils are helped rather than given answers to their problems. It is difficult to create a unified learning support service that I considers the pedagogical requirements of 3D VLEs, (ii) responds to usability and web 2.0 concerns raised by the deployment of a social learning network, and (iii) explores the ways in which 3D VLEs interact with the various delivery mechanisms for educational content. The primary focus of developers of intelligent 3D VLEs has so far been on the development of instructional materials for use in virtual classrooms.

VIRTUAL ENVIRONMENT TOOLS

It stands to reason that, given the vast range of methods required to power this suite of cutting-edge technologies, tools and development environments may play a crucial role in the advancement of the field, just as they have in the creation of other complex systems. We describe a number of the obstacles that must be surmounted, such as those connected to the complexity of the features to be implemented and the degree of abstraction at which this help is provided.

1 The Level of Support

The scene-graph format previously mentioned is used by VE toolkits at a higher degree of abstraction. Since graphical primitives are often represented as a collection of polygons via leaf nodes in the scenegraph, this is a practical means of describing the graphical properties of objects. Such primitives are then joined to group nodes in order to form more complicated graphical objects.

2 Incorporating Knowledge Representation

It has been claimed that VE toolkit designers should consider including explicit knowledge representation capabilities, an area where AI has much to offer. This would help to ensure that many existing knowledge representation wheels are not reinvented (West and Hubbold, 1998). The contemporary VE toolkits are graphical because they are easier to use and because they cater to the user's visual perspective. This is due to the fact that the user object associated with the VE is granted special treatment by the infrastructure. Despite its popularity, animation is often implemented within fixed designer-set pathways (with automated interpolation between way-points). This is in contrast to the case when virtual sensors enable autonomous object motion. While many virtual environment (VE) toolkits do feature sensors, they are often used to detect human interaction, such as by sounding an alarm when a wall is hit or by producing events in response to a mouse-click, rather than to simulate the sensing that a robot would do. Depending on the toolkit, adding AI-like behaviour often involves direct programming in C++ or Java. However, C++ is the norm for many commercial toolkits.

3 Interactions with Complex Properties

Another problem with the interactions between an item and a VE emerges if we want to give VE objects more complicated qualities than only their visual appearance. Classical visual interaction occurs between a VE object and a VE user, and includes the item's texture, lighting effects, and degree of detail as seen by the user. The only way for items in a regular VE to visually interact with one another is if one obscures the view of another. The issue that has to be answered is what proportion of these interactions should be driven by the thing itself, and what proportion should be driven by the environment in which the object is situated. The issue has not been satisfactorily addressed as of yet. An option is to include the item's attributes and the information required to understand their interactions with their surroundings within the thing itself. To avoid having the virtual actor learn anything new, the IMPROV system uses what Goldberg terms "inverse causality,".

VIRTUAL WORLDS

Researchers in the subject of artificial life often have considerably loftier goals than those in the fields of virtual environments (VE) and artificial intelligence (AI), both of which are advancing towards intelligent virtual environments (IVEs) in order to add certain bits of functionality. Among them is the development of virtual environments that can support digital life and have consistent physical rules that may or may not be analogous to the physical laws of the actual world. Some consider Active Worlds and similar distributed interactive virtual environments to be a starting point for the creation of such worlds, since they provide a kind of virtual laboratory in which to study artificial life and the autonomous interaction of various kinds of AL with virtual ones over time. In contrast to the focus on genotypes that dominates genetic algorithm research, a phenotype-level examination of evolution and the phenotype-level ramifications of certain genetic data sets would be possible in a virtual environment. Among the first works in this paradigm was Sims's block creatures, whose genus-level specifications call for a wide variety of blocky organisms connected by movable joints (Sims, 1995). Muscles provide signals to these joints through circuits that are themselves regulated by a dynamic network of functions. These block creatures live in a virtual environment with a virtual physics system, which allows them to develop locomotion skills. Technosphere, an online virtual environment where artificial organisms may be built and run, represents a more modern approach (Prophet, 1996). Living things need food, water, shelter, movement, combat, and mating; after death (or being killed), their corpses decay. Users of this virtual environment prefer to make carnivores rather than herbivores, according to data, which leads to an ecologically precarious situation. Much work has been put into creating aesthetically appealing natural scenery (landscape and vegetation) in TechnoSphere, with features like trees created using fractals rather than polygons to reflect this emphasis on aesthetics. Since real-time rendering is not possible in TechnoSphere (off-line animations are created instead), customers get periodic emails updating them on the development of their creations.

PEDAGOGICAL SCENARIOS

Since Second Life was designed for its residents to generate their own content, there is a plethora of room for originality there. It is possible to make solid or hollow inanimate objects and then set scripts on them to give them certain repeated animations or to give them Artificial Intelligence (AI) knowledge of the activities and events around them, enabling them to respond appropriately to different stimuli. Second Life's avatars and other virtual objects may move and interact with their surroundings thanks to scripts written in the Linden Scripting Language (LSL). These computer programmes are often referred to as "bots." Scripts placed on items that are subsequently linked to an avatar may cause the avatar to move, talk, and do other activities. Bots may detect the presence of other avatars, pose inquiries, respond with canned responses, follow, lead, or find other avatars, activate or deactivate other items, play recorded animations in reaction to various stimuli, gather data, etc.

In this study, we tested out two distinct types of robots called Pandorabots and Pikkubots. These were utilised in tandem with a simulated "holodeck," as will be seen below:

- Pandorabots are a kind of programmable artificial intelligence that can be created and released on any website, including 3D VLEs like Second Life. Pandorabots support the newest version of the AIML markup language, which is used to explain the information they know. They are valuable because they can be easily programmed to respond in a predetermined way to a variety of queries and phrases, and they can be used with almost any virtual reality platform.
- PikkuBots are programmable avatars in Second Life that can be operated robotically. PikkuBot will keep the user's inactive "Second Life" avatars active when the user is away from their computer. This programme is often installed on its own server. The PikkuBot can be taught to do several tasks. Once the bot is ready to go, it will follow the rules you establish for it. An in-game instant messaging discussion, a command line at the bottom of the bot's user interface, or a scripting engine in the game that executes the command when the bot steps on an object are all viable options for communicating short sentences to the bot. The server used by the robots sends information about the state of the virtual world to the characters' avatars through network connections. When a bot detects an actionable cue in its environment, it sends that information back to the server, which in turn executes the action and makes the character move, talk, etc.
- Holodecks are virtual reality systems that can "rez," or materialize/create, an immersive new world in which the avatar may interact, taking on the look of any 3D VLE object using scripts. This might be used to provide students access to a number of other worlds or realities.

RELATED WORKS

In the words of Sok Ying Liaw et al (2023), The goals of this study were to (1) discuss the creation of an unique artificial intelligence-enabled virtual reality simulation (AI-enabled VRS) and (2) assess the skills and experiences of nursing students while interacting with an AI

physician. University nursing students were invited to participate in the 2-hour VRS powered by artificial intelligence. Knowledge and confidence in participants' ability to communicate were tested both before and after the workshop. They were given questionnaires to fill out so researchers could learn more about their impressions of the VR setting and the virtual physician. Five separate focus groups were held to get more detailed feedback on the students' educational experiences.
Dogs of the Bonsai Regiment, et etc (2022), The major purpose of this analysis is to provide an overview of modern CAD and its applications, as well as to speculate on the field's potential future developments. This article is based on a comprehensive literature analysis of journal articles that examines a broad range of probable CAD-related studies. The article discusses the advantages of introducing AI into CAD systems, the applications of CAD in augmented reality and 3D printing, and concludes with a short overview of the challenges that are driving CAD forward.
By Ertan Turan and others (2019), Incorporating AI characters with embodied intelligence into a virtual setting provides a rare chance to test the validity of this hypothesis. In this research, we present a Virtual Island with a novel user interaction mechanism built on fuzzy rules. From the vantage point of the eagle, we have employed fuzzy techniques to programme AI-based animals with a wide range of possible behaviours. In this virtual scenario, an eagle soars over the skies above Chios. The ground AI is activated when other animals reach a certain radius at a predetermined pace. It evaluates its state of health, its personality type, and its degree of self-assurance before deciding how to act. Another in-project element is a flock of non-AI sparrows that have been strategically positioned over the island to let the player feel his speed. As a result, a Unity 3D simulation was built and evaluated with the Fuzzy Tactics in use.
Mr. Ryan Antel, et al (2022), A medical librarian designed the search strategy that was executed across 7 different online resources. Only one reviewer participated in the selection process for the articles. Articles highlighted how patients, their families, and the surgical team may employ AI or VR to better communicate potential risks during surgery. New research is developing on how artificial intelligence and virtual reality might be used to improve the dialogue between surgeons and their patients about surgical risks. The use of AI and VR has the ability to tailor doctor-patient discussions on surgical risk to the unique characteristics of each patient and the specifics of each healthcare setting.

RESEARCH METHODOLOGY

In the beginning, it might be intimidating to stand on the wide plane of a virtual environment and try to order your pieces to produce a unified visual statement. Don't worry; the situation can be tackled piece by piece. By referring to Wikipedia's exhaustive list of design components and principles, this section demonstrates a set of interrelationships between 3D objects that result in intuitive compositions or arrangements in the virtual world.

Algorithm steps

(1) Obtain the current pixel values of the CTU, and use the texture complexity equation to determine the texture's level of difficulty.
(2) Use the texture complexity classification interval to identify the CTU group.

(3) If the CTU category is 1, only depths 2 and 3 are explored; if the CTU category is 5, only depths 0 and 1 are explored; if the CTU category is 2, 3, or 4, the average depth of the matching reference CTU is calculated.

(4) A CU is then subdivided into subsets according on the estimated depth of the water below.

BLOCK DIAGRAM

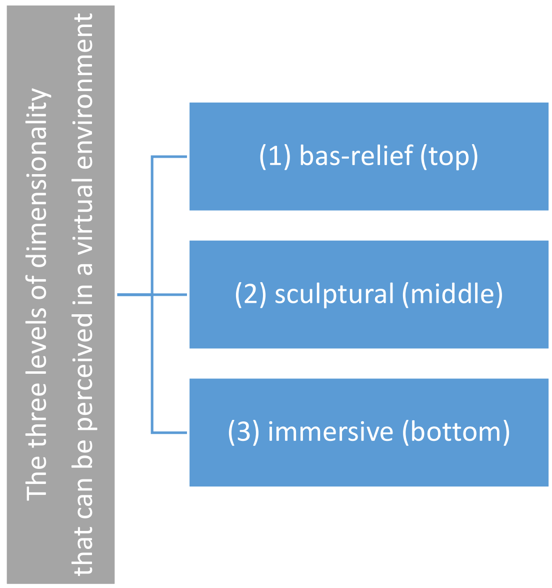

Figure 1: 3D Virtual learning Environments (refer Figure 2)

Defining the level of dimensionality: Maybe you've been to a show on a typical proscenium stage and noticed that the actors sometimes walk off the edge of the stage, breaking the fourth wall. At times when audience engagement is encouraged, the seats on three sides of the stage are filled (thus the name "three-quarters thrust stage"). Inspired by the Roman Coliseum, our arena stage completely encloses the performance (or chariot racing, in this case) for a more immersive experience.

Establishing unity

Establishing visual unity is a crucial technique for building a powerful composition. Proximity, or the "closeness," of the components might serve to tie the composition together. Closely spaced objects tend to be interpreted as a whole by the human eye. Check out the jumbled assortment of items on each side of the gap in Figure 1.

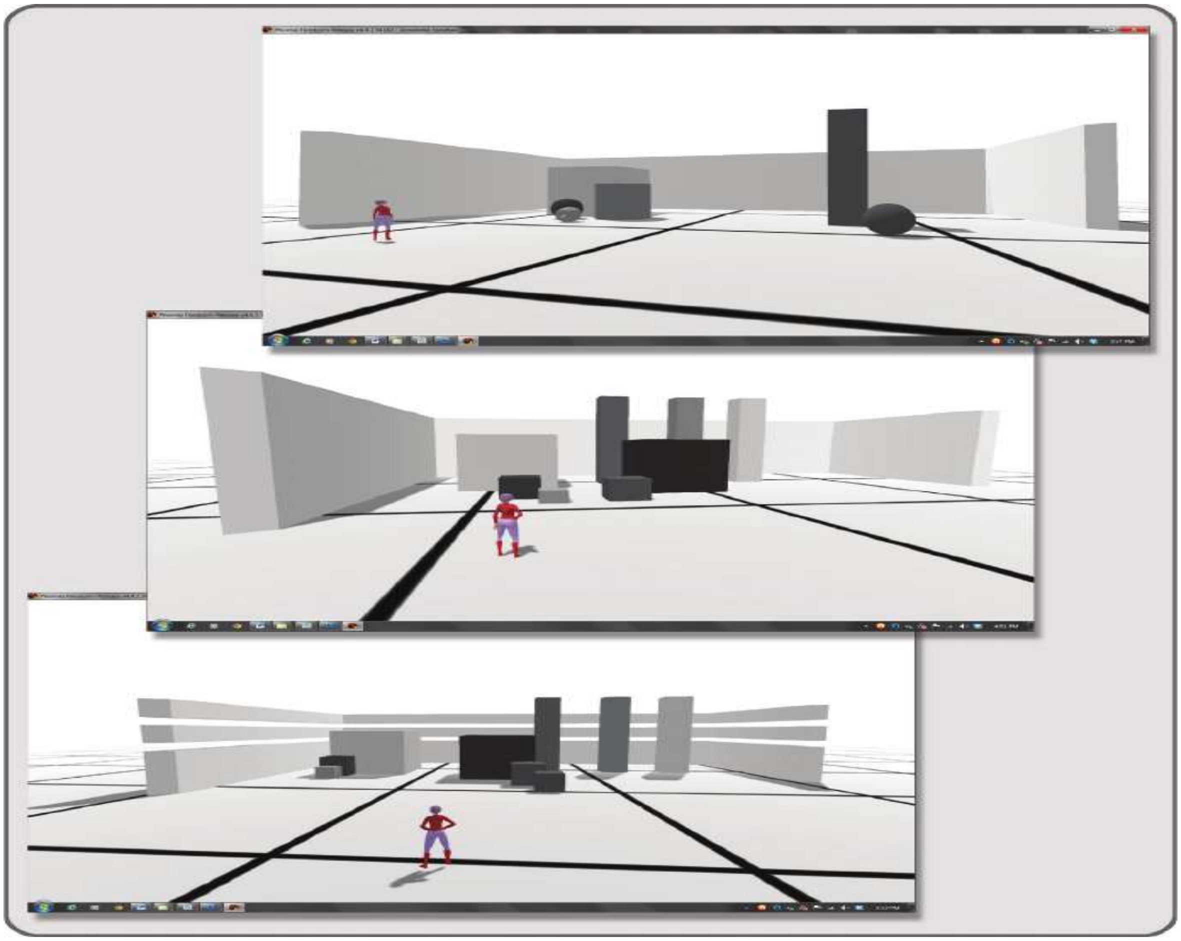

Figure 2: A look at three instances of unified design in OpenSim.

Balance

There are several sorts of equilibrium. Symmetry, asymmetry, and radial symmetry are the three most typical types of spatial equilibrium that you will encounter. Finding the fulcrum, or "tipping point," is essential for maintaining stability. Symmetrical compositions, like a seesaw, have a centre of gravity where the relative weights of all the parts are equal. If the composition is in symmetrical balance, the point of symmetry will be in the middle of a line drawn between the left and right halves, but if it is radially symmetrical, it will be at the intersection of all lines of sight.

Scale

An important source of kinetic tension in any visual composition is the interplay between the avatar and the static elements of the environment. It's fun to experiment with new dimensions of scale. Like Claes Oldenburg's enormous clothespin in the middle of Philadelphia, you may take something normally modest and build it up to a massive shape. Naturally, doing so in a virtual Philadelphia is a lot less difficult and needs a lot less public expenditure.

Dominance

Any item that want to stand out from the crowd must possess the right degree of overscale traits, occupy a central position in the composition, and attract more focus to itself than the other elements present. The prominent item prevents the viewer's attention from wandering off in the same way as hierarchy and asymmetrical balance do.

Movement

Your eyes' instinctive motion when you look at a new 3D shape will provide information about the shape's interior com-positional movement. Compositional movement may also be defined as the way in which the design uses the arrangement of forms, shapes, symbols, colours, and lines to direct the viewer's eye around and through the composition. For kinetic 3D designs with moving elements that circle or change locations in space, figure 3 demonstrates the challenge of merging spatial movement with an ever-changing compositional movement.

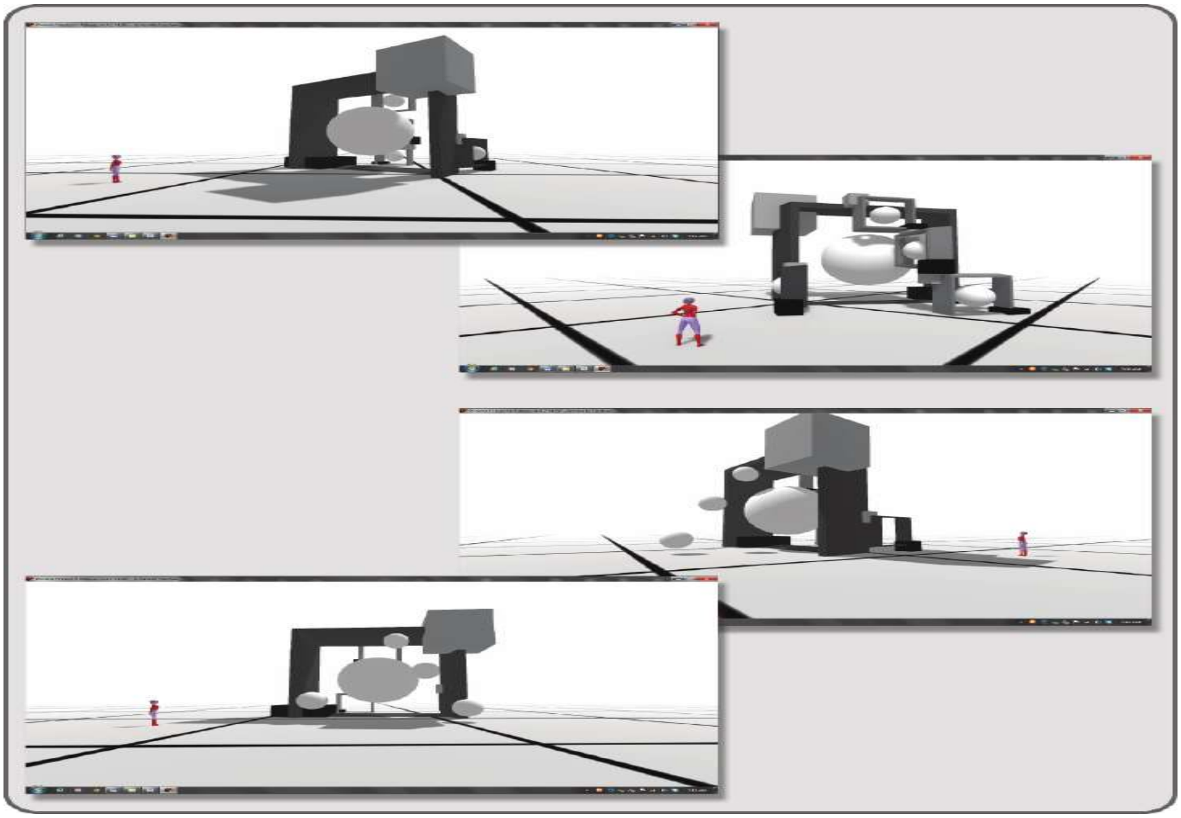

Figure 3: Screenshots illustrate two types of composition that are possible in a virtual world, taken from the OpenSim programme.

IMPLEMENTATION

The "Dream Environment" project is a good illustration of the intersection of digital creativity and design modelling. To better understand how parts of architecture from various time periods (such as Ancient Egyptian, Chinese, Indian, Roman, and Classical) developed, this was designed to enable students to switch between different architectural styles in a 3D environment. Prototypes of the buildings would be designed and then placed onto a Holodeck (a popular brand name in this category is "Horizon Holodeck"). From a pop-up menu in Second Life, the learner or teacher may choose whatever virtual setting he likes. If the student selects an era, a Pikkubot costumed for that time period will emerge and deliver knowledge about the building's architecture and design while also engaging in two-way dialogue with the student. It might also be used to rez a courtroom for forensics research and practice.

Figure 4. Pikkubots and student avatars interacting

Figure 4 depicts one such study called "Obedient Patient," in which bots are used to simulate patients and are taught to react in predetermined ways to virtual types of examinations performed by the avatars of SL medical students. A hospital's emergency room may be rezzed on a holodeck for this purpose. In addition, 3D speech recognition may be utilised to give the answering bot a range of distinct personalities.

Figure 5. Posing as a virtual patient, Pikkubot

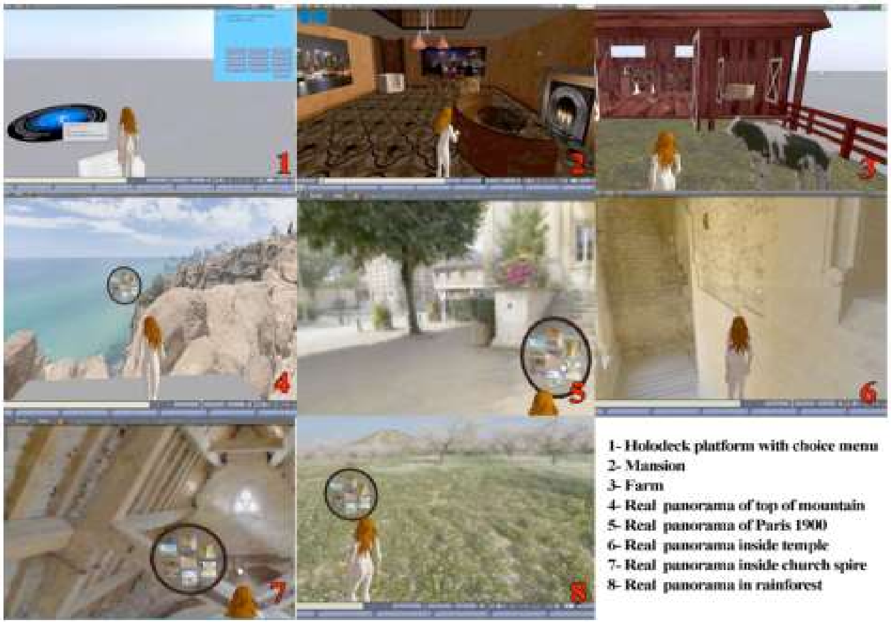

Figure 6. Options menu inside the holodeck allows for the rezzing of many virtual worlds.

It's no surprise that "3D Catalogue" was voted as the most popular student project. Developing a full-featured software where a user may interact with a Pikkubot over topics such as housing (homes for sale or rent) and lodging (hotels) is required (representing an agent). By entering the desired square footage, number of bedrooms, budget, etc., the user is presented with a holodeck's worth of model homes to peruse (Figure 7). That might be the basis of a successful online service for a real-world company.

Figure 7. Holodeck demonstrating by reserving whole structures for display

CONCLUSION

This study demonstrates how 3D virtual worlds may deliver surroundings that can react automatically and interactively with their users via the development of an AI bot and holodeck system. The system's versatility allows for the development of an infinite number of projects that may be used to design interesting and interactive lessons for students. As was indicated, future studies should focus on refining and simplifying the system before testing it with undergraduate and graduate students in higher education. To maximize the benefits of technology-enhanced education, researchers are also looking into the feasibility of including reflective behavior in bot behaviors.

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