Project of using Web-based Virtual Reality and Augmented Reality in Education

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Abstract—My project mainly focused on the affordance of Virtual Reality and Augmented Reality in education, targeting web-based framework.

Index Terms—Web-based, Virtual Reality, Augmented Reality, Technology Acceptance Model, Education

I. SUMMARY

In [1], we propose a framework and a setup for presenting complex models for curriculum contents in both augmented reality and virtual reality environment. After constructing some three-dimensional models representing real world objects such as trees, stones, rivers, dams, and buildings, our workflow uses the Unity engine in combination with Virtual Reality headset devices to create interactive applications for both Virtual Reality and Augmented Reality environments to support students understanding the curriculum contents through their surrounding. Typical challenges are addressed when creating 3D curriculum contents, integrating these models into Unity and solutions are proposed where possible. The overall structure of the project is described with some functionalities added to Unity for visualization and interaction with the models.

A further step was investigated in [2]. Virtual Reality (VR) content development tools are in continuous production by both enthusiastic researchers and software development companies. Yet, learners could benefit from participating in this development, not only for learning vital programming skills, but also in skills in creativity and collaboration. Web-based VR (WebVR) has emerged as a platform-independent framework that permits individuals (with little to no prior programming experience) to create immersive and interactive VR applications. Yet, the success of WebVR relies on students' technological acceptance, the intersectionality of perceived utility and ease of use. In order to determine the effectiveness of the emerging tool for learners of varied experience levels, this paper presents a case study of 38 students who were tasked with creating WebVR ‘dream’ houses. Results showed that students were accepting of the technology by not only learning and implementing WebVR in a short time (one month), but were also capable of demonstrating creativity and problem-solving skills with classroom supports (i.e., pre-project presentations, online discussions, exemplary projects, and TA support). Results as well as recommendations, lessons learned, and further research are addressed.

The previous study was extended in [3]. Web-based virtual reality (VR) development tools are in ubiquitous use by software developers, and now, university (undergraduate) students, to move beyond using, to creating new and energizing VR content. Web-based VR (WebVR), among other libraries and frameworks, have risen as a low-cost platform for users to create rich and intuitive VR content and applications. However, the success of WebVR as an instructional tool relies on post-secondary students technological acceptance (TA), the intersectionality of a user’s perceived utility (PU) and perceived ease of use (PEOU, or convenience) with said technological tool. Yet, there is a dearth of exploratory studies of students’ experiences with the AR/VR development technologies to infer their TA. To ascertain the viability of WebVR tools for software engineering undergraduates in the classroom, this paper presents a 3-case contextual investigation of 38 undergraduate students tasked with creating VR content. In each use case, students were provided increasing freedom in their VR content development parameters. Results indicated that students demonstrated elements of technological acceptance in their selection of webVR and other platforms, and not only successfully creating rich and robust VR content (PU), but also executing these projects in a short period (PEOU). Other positive externalities observed were students exhibitions of soft skills (e.g. creativity, critical thinking) and different modes of demonstrating coding knowledge, which suggest further study. Discussed are the lessons learned from the WebVR and VR/AR interventions and recommendations for WebVR instruction. This work may be helpful for both learners and teachers using VR/AR in selecting, designing, and developing coursework materials, tools, and libraries.

In recent years, Unmanned Aerial Vehicle (UAV) has been used extensively in various applications from entertainment, virtual tourism to construction, mining, agriculture. Navigation, path planning, and image acquisition are the main tasks in administering these aerial devices in accordance with real-time object tracking for affordable aerial vehicles. Aircraft crash is one of the most critical issues due to the uncontrolled environment and signal loss that cause the aerial vehicle to hit the buildings on its returning mode. Furthermore, real-time image processing, such as object tracking, has not yet been exploited for a low-cost aerial vehicle. This paper [4] proposes a prototype embedded in a Web-based application.
called DroneVR to mitigate the aforementioned issues. The virtual reality environment was reconstructed based on the real-world fly data (OpenStreetMap) in which path planning and navigation were carried out. Gaussian Mixture Model was used to extract foreground and detect a moving object. Kalman Filter method was then applied to predict and keep track of object’s motion. Perceived ease of use was investigated with a small sample size users to improve the simulator.

In recent years, with the development of modern technology, Virtual Reality (VR) has been proven as an effective means for entertaining and encouraging learning processes. Users immerse themselves in a 3D environment to experience situations that are very difficult or impossible to encounter in real life, such as volcanoes, ancient buildings, or events on a battlefield. Augmented Reality (AR), on the other hand, takes a different approach by allowing users to remain in their physical world while virtual objects are overlaid on physical ones. In education and tourism, VR and AR are becoming platforms for student learning and tourist attractions. Although several studies have been conducted to promote cultural preservation, they are mostly focused on VR for historical building visualization. The use of AR for simulating an event is relatively uncommon, especially for a battlefield simulation. This paper [5] presents a work-in-progress, specifically a web-based AR application that enables both students and tourists to witness a series of battlefield events occurring at the Battle of Palmito Ranch, located near Brownsville, Texas. With markers embedded directly into the printed map, users can experience the last battle of the Civil War in the US.

With the advancement of modern technologies, Virtual Reality plays an essential role for training rescuers, particularly for disaster savers employing simulation training. By wholly immersed in the virtual environment, rescuers are capable of practicing the required skills without being threatened of their lives before experiencing the real world situation. This paper [6] presented a work-in-progress Virtual Reality application called VRescuer to help trainees get used to various disaster circumstances. A scenario of a city was created with an ambulance rescuer and several rescuees in the scene. The intelligent ambulance rescuer was introduced as a rescuer/guider to automatically search and find the optimal paths for saving all rescuees. The trainee can interfere in the rescuing process by placing obstacles or adding more rescuees along the ways which cause the rescue agent to re-route the paths. The VRescuer was implemented in Unity3D with an Oculus Rift device, and it was assessed by twenty users to improve the proposed application.

The fast-growing number of high-performance computer processor and hand-held devices have paved the way for the development of Virtual Reality and Augmented Reality in terms of hardware and software in the education sector. The question of whether students can adopt these new technologies is not fully addressed. Answering this question thus plays an essential role for instructors and course designers [7]. The objectives of this study are: (1) to investigate the feasibility of the Virtual Reality/Augmented Reality development for undergraduate students, and (2) to highlight some practical challenges when creating and sharing Virtual Reality and Augmented Reality applications from student’s perspective. Study design for the coursework was given with detail. During a 16-week long, 63 Virtual Reality/Augmented Reality applications were created from a variety of topics and various development tools. 43 survey questions are prepared and administered to students for each phase of the projects to address technical difficulties. The exploration method was used for data analysis.

Answer Set Programming (ASP) is a dominant programming paradigm in Knowledge Representation. It is used to build intelligent agents – knowledge-intensive software systems capable of exhibiting intelligent behaviors. It is found that ASP can also be used to teach computer science in middle and high schools. However, the current ASP systems do not provide direct support for a programmer to produce an intelligent agent that a general user can directly interact with, which may greatly compromise the potential attraction of ASP to the secondary school students. In this paper, we propose a Virtual Reality (VR) programming environment called VRASP [8] that allows a student to produce an avatar (agent) in a virtual world that is able to answer questions in spoken natural language from a general user. The VR application is accessible from anywhere so that the students’ friends can interact with the agent. As a result, it gives the students a feeling of achievement and thus encourages them to solve problems using ASP. VRASP was evaluated with 10 users. Results of these studies show that students are able to communicate with the environment intuitively with an accuracy of 78%.

Various efforts are used to preserve American history including relying on formal education, distributing information (text, video or visual aids) on social channels, displaying artifacts in historical centers or more recently, virtual reality applications posted on a shared medium. However, many of the newly developed applications are designed specifically for dedicated hardware rather than for a broad audience, thus creating a barrier for disseminating cultural values. In this paper, we propose a web-based Augmented Reality (AR) application, namely PalmitoAR [9], which provides an intuitive way of observing one of the most significant historical Civil War battlefields, Palmito Ranch Battlefield located in Cameron County, Texas. The proposed AR application is designed to resurrect a series of events through (i) a printed map of Palmito Ranch with embedded markers that enables viewers to experience the battle without being present at the site, (ii) a mobile device with a WebGL supported browser that allows 3D contents to be rendered, and (iii) an AR library (A-Frame.io) that enables enthusiasts to recreate similar work. Our methodology strongly relies on the benefits of a simple, robust algorithm for AR marker recognition to position 3D models in a specific context and time. As a result, the proposed AR application is complementary to existing work and provides a seamless experience for a wide range of viewers. We evaluated and improved the application with the help of twenty-six users to gather perspectives on the specific benefits of employing AR in learning about battlefields and
reenactment. The technology acceptance model was adapted to access an individual’s acceptance of information technology.

REFERENCES