Engaging Students in Parallel and Distributed Computing Learning by Games Design using Unity

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Abstract—Parallel and distributed computing (PDC) is increasingly important in science and engineering discipline, yet many computer science curriculum especially in the early college years either do not provide students with adequate PDC components, or there are pedagogical challenges for students to learn PDC concepts. Meanwhile, educational games has become an important teaching tool in a wide variety of disciplines. We plan to integrate more PDC concepts in our game design courses. Our experiences indicates that (1) students tirelessly strive to understand the PDC concepts in order to design game challenges and (2) The virtual reality immersion experience is enormously engaging and fun.

I. INTRODUCTION AND MOTIVATION

The emerging parallel and distributed computing paradigm in science and engineering is a fast-growing discipline and have been penetrating into and interacting with almost every aspect of our daily life. However, we found that very few early courses expose the PDC concepts to our students. Students also need opportunities to apply innovative thinking derived from PDC concepts to problem solving in an attractive and fun way. The potential of 3D multi-player games would become a unique and engaging PDC teaching platform as it can bear student learning objectives under multiple levels with increasing difficulties, allow repeated practices for proficiency, adapt to personal learning pace and background as well as keep track of the progress with the strength and weakness for each student [1]. Therefore, we plan to enhance our current game course to help students learn more PDC concepts at both undergraduate and graduate levels.

II. GAME COURSE DESCRIPTION

The entire class consisting of several groups is assigned to design and build a role-play adventure educational game using game development tools including Blender [2] and Unity [3]. A world map was designed (as shown in Figure 1a) which contains multiple levels on each continent. Each team is responsible for the development of one level of the game. A sample student project interface developed in Unity is shown in Figure 1b which illustrates the challenge of navigation and searching for a robot. Collaboration among different teams is critical to ensure the consistence for level advancement. There are several phases from design to model and to prototype, namely game concept, PDC topics, story and characters,

(a) Game World Map.

(b) Robot Navigation and Searching Gameplay.

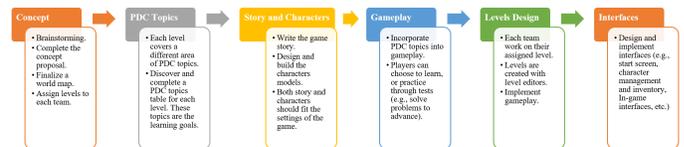Fig. 1. Game Design: World Map and a Sample Challenge Interface.

Fig. 2. PDC Educational Game Design Phases.

gameplay, level design, and interface design as shown in Figure 2. PDC topics such as multi-thread, synchronization, group communication, election, and consensus will be covered. The scenario of the game is that all players are trapped in a virtual world in VR and cannot get out. The players need to navigate the world, learn the key PDC concepts, and use the acquired knowledge to grab resources, solve puzzles, and overcome obstacles to escape traps.

III. OUR EXPERIENCE AND FUTURE WORK

We observed that most students find the courses exciting. They need to study the PDC topics thoroughly in order to design the challenges. More and more CS students including non-CS majors are registered. Students not only learn game design and development but also study PDC techniques. We feel that this PDC-oriented game course should be a two-semester sequence course in order to provide in-depth discussion on essential PDC concepts and game development tools.

REFERENCES

[1] M. Overmars, "Teaching computer science through game design". Computers, vol. 37, issue 4, pp. 81-83. April 2004.
[2] Blender. https://www.blender.org/.
[3] Unity. https://unity3d.com/.

Budget for Travel to 2018 EduHPC workshop

Airfare: $400   (Round trip between Newark and Dallas)
Hotel: $428   (Two nights from Nov. 10th to Nov. 12th)
Meals: $210   ($70 per day for three days)
Uber: $80   (Between home and Newark airport at $40 one trip)
Shuttle: $60   (Between Dallas airport and hotel)

Total: $1,178