Lunar Roving Adventure: A Serious VR Game of Lunar Exploration Missions

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Abstract—In this work, we present a serious VR game named “Lunar Roving Adventure” that simulates the activities of lunar exploration missions. This game is based on the historical events of the Apollo 16 mission in the 1970s, in which astronauts landed on the Moon and drove the lunar rover. The goal of this game is to increase players’ interest in space science and motivate them to learn more about the lunar exploration missions. The game is composed of three playing phases: planning, preparing, and driving, as shown in Fig. 1. In the planning phase, the player is guided to create the driving route by placing tokens on a 3D lunar terrain map. When all tokens are placed correctly, he or she will be asked to calculate the travel time based on the given distance and maximum speed. In the preparing phase, the player selects a subset of devices from the inventory and then loads them onto the lunar rover for the later use on the route. In the driving phase, the player drives the rover through all the stop stations to the end of the route. The lunar terrain is converted from Lunar Reconnaissance Orbiter (LRO) data. During the driving, the player operates a navigation system to determine the driving direction, control the rover's speed, and avoid overheating. As shown in Fig. 2, the player operates the navigation devices through the control console on the rover. With the immersive view provided by the HMD, the player can move his or her head closer to the control console to check readings on the devices, just like what astronauts would do when driving the lunar rover. The real lunar rover uses a T-shaped steering controller for driving. This controller, as a mechanical part of the control console, is located between two seats. It was operated by the astronaut sitting on the left seat. To simulate this steering control, our game uses a flight stick as the input device for driving as depicted in Fig. 2.

Keywords—Virtual Reality; Serious Game; Educational; Lunar Exploration.

Fig. 1 Screenshots of the gameview. From left to right are the planning phase, the preparing phase, and the driving phase.

Fig. 2 The left one is the player reading the navigation devices in the control console, and the right one is the operation with the flight stick to bring up the mini-map.

Video Link: https://youtu.be/hra9i0hxHrE. This video shows the basic game concept and gameplay.