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Virtual Reality Training with Earthmoving Machinery

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Group 2: Emily Busby, Logan JAHNKE, and Matthew Mooney

Virtual reality is mainly thought as a cool way to play games; however, it is a great tool for training people in dangerous fields (medical, industrial, etc.). Virtual reality is useful in training simulations because a person can be trained in how to handle stressful and potentially life-threating activities in a safe and controlled environment. “Virtual reality technology is based on computer graphics, which can build virtual scenes and items to be manipulated by the user through input devices, and to be seen, heard, touched, even smelled through output devices, and the user can feel high immersion during the interaction” (Head-mounted display, 1). Heavy machinery is very dangerous to operate and require copious amounts of training. Earth moving machinery are very common on construction sites, and they contribute to a large amount of workplace injuries because the operate has not been properly trained. Training people to use earthmoving machinery is dangerous, so it would be useful and lifesaving to train people using VR techniques.

Earthmoving machinery is very dangerous to operate. It has been noted that “a majority of the earthmoving equipment related accidents results in fatality” (Worker Safety and injury, 7). There have been numerous studies to show the true extent that earthmoving machinery can cause. A study from 2018 showed the excavators alone caused 298 injuries. Further inspection would show that 122 of the 298 injuries were nonfatal while the other 176 were fatal. “It was observed that lack of adequate safety training was a factor in considerably more fatal cases (35.5%) than nonfatal cases (9.9%)” (Worker Safety and injury, 5).

“Due to the intrinsic properties of VR-to offer almost real-world experience in harmless virtual environment- it is born to be a perfect tool for training…” (Head-mounted display, 1). Training with virtual reality has been shown to be useful and have a better impact on the safety of training all together. It allows people to be trained for dangerous possibly life-threatening activities in a safe controlled environment that would not cause harm to others. In fields where handwork is important, “haptic feedback is used within VR to train tactile skills, making VR especially useful for learning physical skills where feeling and touch are important” (An overview of self-adaptive tech, 7). Haptic feedback is a useful tool for training in virtual reality because it can help show the user how the task will feel in real life, or it could show the user the mistakes they are making.

“Hydraulic excavators are widely used in construction, agricultural, forestry, and mining industries, due to their kinematic flexibility and high-power density. The excavator operation is mostly executed by skillful operators who manipulate hydraulic joysticks to drive multiple links. Because of harsh working environment and physical fatigue from long working time, the excavator operation is avoided. Also, the excavator operation by the intuition of the operator always includes potential risk caused by lack of skill and mistakes” (Virtual Excavator Simulator, 1). Virtual reality simulators for excavators have already been created and have resulted great findings. ADD MORE

Virtual reality is more than just a toy for the average household. It is becoming more of a tool to help train people for difficult and potentially life-threatening jobs. Virtual reality training has become more valuable that the European Commission has funded copious amounts of money to industrial VR training (€900K in 2008, €1.4M in 2011, and €9M in 2013). (An overview of self-adaptive tech, 13). Virtual reality should be used to help train people to safely learn how to operate earthmoving machinery.

Sources

Kazan, Emrah, and Mumtaz A. Usmen. “Worker Safety and Injury Severity Analysis of

Earthmoving Equipment Accidents.” Journal of Safety Research, vol. 65, June 2018, pp.

73–81.

Nam, Yun-Joo, and Myeong-Kwan Park. “Virtual Excavator Simulator Featuring HILS and

Haptic Joysticks.” Journal of Mechanical Science and Technology, no. 1, 2015, p. 397-

407.

So, Joey C. Y., et al. “Better Retention of Skill Operating a Simulated Hydraulic Excavator After

Part-Task Than After Whole-Task Training.” Human Factors, vol. 55, no. 2, Apr. 2013,

pp. 449–460.

Vaughan, Neil, et al. “An Overview of Self-Adaptive Technologies within Virtual Reality

Training.” Computer Science Review, vol. 22, Jan. 2016, p. 65 - 87.

Zhang, Hui. “Head-Mounted Display-Based Intuitive Virtual Reality Training System for the

Mining Industry.” International Journal of Mining Science and Technology, vol. 27, no.

4, July 2017, pp. 717–722.