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ENHANCING THE HUMAN-MACHINE INTERFACE USING VISR- AN INTERACTIVE 3D VISUALIZATION/ DESENSITIZATION TRAINING TOOL IN A VARIABLE GRAVITY MODEL

Abstract

The human body is used to a 1-G environment and behaves differently in lower gravity. Mars gravity is about 1/3rd of Earth's, and Extra Vehicular Activities using rovers and spacesuits will be challenging. Lower gravity planetary environments with distinctive terrain require trained space explorers with interactive human-machine compatibility. Current available visualization methods, such as Oculus Rift goggles, can be adapted to display a generalized view of planetary surface featuring a visual 3-D interface, yet lacking an 'actual' immersive environment due to the lack of lower gravity conditions. In order to better understand human behavior in alternate environments, it is important to study the psycho-physiological components of a subject in a real-time immersive environment. With the potential to perfect planetary EVA procedures and address vital human factors associated with space planetary exploration, our team is working on a concept called VISR (Visual Immersion for Simulated Robotics) system.

VISR provides an immersive 3-D planetary Virtual Reality model utilizing high performance computing, image processing, and 3-D rendering. The software manipulates image processing speed with a variable gravity parameter as an input. VISR is compatible with multiple planetary bodies and asteroids whereas the current system applications are limited to the space station and Mars. The device assists in the study of psycho-physiological effects (human limbs – eye coordination) associated with deep-space travel and low gravity environments. Mars has a vast, geologically complex terrain with existing environments models allowing topographical visualization. VISR users experience these features in an immersive and interactive environment enhancing human performance in real situations, and assisting scientists and mission planners in system and mission design. VISR integrates the UND developed planetary suit NDX-2, currently used as a simulation facility for 'Astronaut training', human factors and related Psycho-physiological studies.

The system design includes different phases such as development of terrain maps, and their integration with visual device sensor, development of a model which can locate and import physical planetary parameters from available databases, varying the speed of image output to the user by manipulating the gravity parameter, and integrating it with already developed terrain models. This device can be further used to feed real-time physiological performance data to a separate sensor based system, and study the related effects on human subjects.

VISR will be an effective tool which would equip the researchers, mission planners and space travelers for future planetary manned missions.