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Author: Ms. Riley Schnee
University of Michigan, United States, rischnee@umich.edu

Ms. Rupal Nigam
University of Michigan, United States, rupaln@umich.edu
Mr. Sahil Farishta
University of Michigan, United States, sahilf@umich.edu
Mr. Cesar Mu
University of Michigan, United States, cesarmu@umich.edu
Ms. Emily Rassel
University of Michigan, United States, e.rassel99@gmail.com

AUGMENTED TOOLKIT FOR LUNAR ASTRONAUTS AND SCIENTISTS (ATLAS)

Abstract

As NASA and the rest of the world prepares to return to the Moon in pursuit of science, there is a need for advanced technology development for EVA (extravehicular activity) procedures. To ensure astronauts are well-equipped for lunar surface exploration and the high demands of an unknown environment, it is essential to develop systems that exploit the advantages of human-computer interactions. NASA's Exploration Extravehicular Activity Mobility Unit (xEMU) outlines the requirements for a visual display system that would optimize the effectiveness of EVAs [1]. Augmented reality (AR), which superimposes digital content on the user's view of the physical world, is a next-generation tool with the potential to revolutionize and streamline EVA missions.

The Augmented Toolkit for Lunar Astronauts and Scientists (ATLAS) is an AR system on the Microsoft Hololens that is designed to be a tool for astronauts on lunar expeditions. The modular system provides seamless access to relevant data and information without unwanted intrusions through the use of protocols. Each protocol is catered to a particular aspect of the EVA life cycle, including pre-operational mission planning, suit preparation, sample collection operations, repair guidance, emergency warnings, and abort procedures. In addition, there is a system interaction training protocol to teach astronauts how to utilize the system.

While the astronaut is on a lunar EVA, they are given navigation assistance, access to vital information, and tools to aid in sample collection and rover repairs. In case of emergencies, warnings and a pre-loaded abort protocol can be utilized to help the astronaut return to safety. With color-coded information levels, redundancy measures using QR codes, and simple hand and voice interactions, the astronauts can intuitively use the system without inhibiting their mission. Additionally, the Mission Control Center (MCC), has the authority to update mission tasks at any point, monitor biometrics, and communicate with the astronaut. The MCC is designed to support off-site mission planners and scientists, as well as handle and store data. It is comprised of user interfaces for flight controller review and servers for data security. The team will be testing this system and tailored workflow with a wide range of users, including former astronauts and current NASA flight controllers, to assess its effectiveness.

References: [1] Ross A., Rhodes R., and McFarland S. (2019) ICES 49, report 185.