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FUSING LIDAR AND SCIENTIFIC DATA TO CREATE A MULTIPURPOSE VIRTUAL REALTY TOOL FOR PLANETARY CAVE MISSION OPERATIONS

Abstract

Over the past several years, NASA's BRAILLE* Team has mapped 9 caves at Lava Beds National Monument (N. CA, USA) using FARO S70 and M70 LIDAR instruments. In parallel with these efforts, our team of Scientists, Engineers, and digital media experts has created a virtual reality (VR) utility from the collected datasets. Our product is a remote observation aid for Scientists and allows for public viewing of hard-to-reach locations. In the future, our application could be applied to planetary exploration missions as an improved medium through which Scientists and the public can observe extra-terrestrial environments. Our VR utility will be tested in multiple BRAILLE-JPL robotic mission operations during 2021 field deployments at Lava Beds.

We developed our VR toolkit using data collected from Valentine Cave, the site of BRAILLE's 2018 Mars Analog Mission. A NASA Ames rover (KRex/CaveR) collected color Realsense imagery during fixed-distance transect operations along one of the cave walls, generating a mosaic with feature resolution to 0.2 mm. A remote science team identified points of interest within the cave, which were targeted for additional scientific interrogation. Afterwards, a group of cave Scientists completed the same target-selection exercise, in person, photographing their selections and marking their sites. Their target site locations were scanned using LiDAR.

To create our utility, we aligned LiDAR files to generate point-cloud maps, which were rendered into a 3D mesh using the Cloud Compare software package. The meshes were then imported into Blender, an open-source graphics toolset, and finally into Unity, a game engine development software used to generate multiplatform games, which allowed our team to prepare the meshes for use in a VR headset.

Our VR experience allows users to visit Valentine Cave and explore features of interest, in situ, denoted in VR with orbs color-matched to each Scientist. The user can highlight a sphere to reveal details about a feature they chose to learn more about. NASA has developed a similar, augmented reality tool for the Mars Science Laboratory mission data using the Microsoft HoloLens, albeit with significantly greater time and resources.

Data collected via robotic exploration is not a substitute for the insights gleaned through in-person expeditions. VR allows users to approach these live experiences, enhancing the quality of observations and the interpretation of local surroundings.

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