

# Holographic Augmented Reality Visualization Interface for Exploration

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Based on Wichita's wheat harvesting nickname, Harvesters, Wichita State University NASA SUITS (Spacesuit User Interface Technologies for Students) team Harvestars proposed the integrated system H. A. R. V. I. E. (Holographic Augmented Reality Visualization Interface for Exploration) to prepare for the next Artemis moon landing. This design solution will assist astronauts with elevated demands of the lunar surface through navigation, terrain sensing, and an optimal display of suit status elements. Considering environmental constraints, the system architecture promotes efficient cross modal communication between the mission control center, other astronauts, and the user interface. Hands-free modality options are utilized such as gaze and speech recognition. To promote spatial learning, waypoint markers are displayed both in an allocentric world view map and egocentric first-person viewpoint. Spatial mapping, using depth sensing and 3D modeling, will read changes in displacement and elevation, and calculate the user's height to categorize hazardous objects. For pathfinding, our navigational system will create a directional arrow with the use of A\* algorithm combined with spatial anchors. In the case of emergencies, distress beacons with color coded warning messages are displayed on navigational maps and displays. Throughout the design process, we conducted heuristic evaluations and Streamlined Cognitive Walkthroughs on a low fidelity prototype. Then, we implemented H.A.R.V.I.E into the HoloLens 2 and utilized the Rapid Iterative Testing & Evaluation method for human-in-the-loop testing. Our interface serves as a novel approach to enhance how astronauts navigate on missions using augmented reality. Final in-person testing will be conducted at NASA's Johnson Space Center.