TBD

3D Stereo Immersive Environment Utlizing Mobile Devices / Peripherals

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EXECUTIVE SUMMARY

This project expands upon some of the FY23 IRAD funded "Full Lunar Surface Simulation Platform" (FLS-SP) derived technologies. The results have demonstrated a low-cost, compact, immersive technology that supports training, interaction, mission planning, and other man-in-loop activities in simulated environments called “3D Stereo Immersion Environment Utilizing Mobile Devices” (3D SIEUMD). These activities will become crucial for safety and mission, planning, and assurance in the Artemis program, as well as future commercial crew programs. The FLS-SP enabled the visualization of simulated lunar surface operations for rovers, landers, habitation, and EVA. The 3D SIEUMD technology allows for NASA S&MA experts, tasked with defining safety protocols and procedures, to interact in an immersive environment without expensive immersion gear. Reduction of the overall safety risk by immersing safety concepts into the design and engineering phase for very small cost is accomplished even before hardware is deployed to the lunar surface.

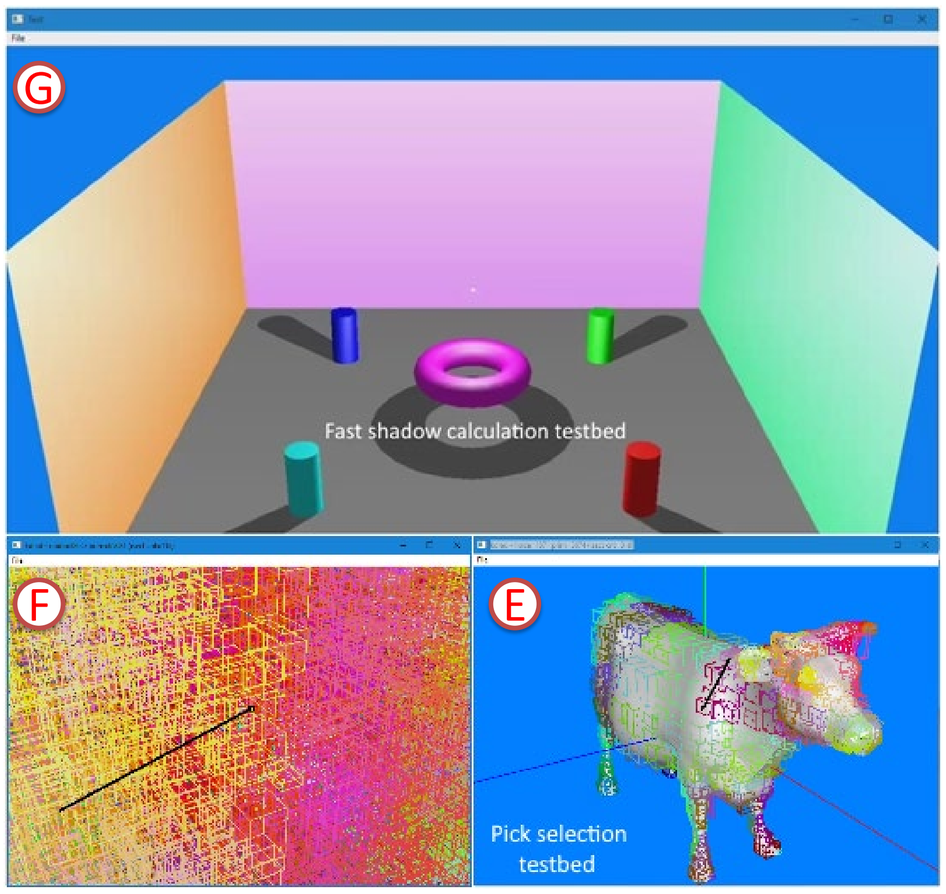
INNOVATION & BENEFITS

The new capabilities developed in FY24 allow all potential users, including safety experts, engineers, human factors personnel, etc. to make use of cellular platforms to immerse in a virtual environment. This is typically done with expensive, and proprietary, VR/AR hardware which often makes use of licensed gaming engine technology that only changes, but becomes historically more expensive. To avoid this potential pitfalls, NASA owned tools and methodologies were developed to exploit low-cost, widely available, COTS, cellular and mobile technologies. Cell phones have advantages that make them ideal for this purpose: fast 3D GPUs, high-res displays, and sensors, which can determine orientation. In the future, this will allow for highly distributed, collaborative, efforts for lunar (as well as Martian) missions, including EVA in space. This concept / tooling is used successfully by the Department of Defense for combined operations and will be paramount in mitigating potential risks in IVA, EVA, and overall mission planning.

COLLABORATION

1. SMA DUE Council, JSC code NE Director, JSC S&MA directorate institutional support
2. Nathan Vassberg, M2M SMA Mgr., SRP support and feedback on utility of approach and capabilities
3. Sam Lawrence, JSC, Technical advisor; JSC lead lunar exploration scientist and planetary data expert
4. Tom Duncavage, TMPC commissioner Houston, Advisor; DoD expert on immersive, distributed simulation
5. Ion Center (Rice University), invitation to share technology at a NASA Tech Talk Symposium as well as a presentation to the Local Visual Technology / Innovation Group

Innovation and Implementation



In-progress and future roadmap

OUTCOMES & INFUSION

- A small test platform was created to determine the feasibility of building an immersive, head mounted display system with an Android device.
- (A) Software that utilizes the internal accelerometer sensor, and magnetometer sensor to produce a 3-DOF head orientation (Yaw/Pitch/Roll) was developed.
- (B) The test phone and software were paired with a low-cost headset (Google cardboard based) with adjustable optics and the results were positive.
- (C) A prototype Bluetooth remote control tool was created that offers inexpensive support for interaction, motion tracking, and gesturing.
- (D) Both immersive headset and Bluetooth remote capabilities were used in an immersive 6-DOF Android simulated environment of the ISS.
- (E) A platform (based on K-d tree algorithms) for user pick selection of models in high polygon count 3D environments was implemented.
- A novel algorithm that reduced the noise in Android phone based sensors was devised and selected for addition to the NASA Technology Transfer System.

NEXT STEPS

- The stereo immersive environment project was selected to participate as a panelist on the "Foundational Lunar Exploration" session at the SpaceCom / Space Congress conference in January 2025.
- The immersive stereo environment will be added to the FLS-SP toolset, and also included in the FY23 SAIC commercial crew lander topple study.
- (F) The pick-selection prototype is being explored as a solution for both viewer-object and object-object collision detection / avoidance
- (G) The intersection calculations used in the pick/select process have been evaluated for simple luminance estimation (ray casting/tracing) and shadow computation and that work will move into an implementation phase.

LINKS

Immersive ISS simulation with 6-DOF interaction
https://www.youtube.com/watch/t3CV-0DR5ZU

Real-time sensor filter algorithm with Android accelerometer/magnetometer
https://www.youtube.com/watch/biBlfizaFvM

Test-bed algorithm for high-speed user pick-selection
https://www.youtube.com/watch/ZXUjSufcqmM

Test-bed for shadow algorithms
https://www.youtube.com/watch/gh-0EoAK3JA

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