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ENHANCING LUNAR EVA EXPLORATION THROUGH VIRTUAL MAPPING, MISSION  
PLANNING, AND TRAINING

**Abstract**

The success of lunar space missions relies on extensive planning and training before launching spacecraft and astronauts to the Moon. To this end, this scientific paper proposes a novel approach for simulating human lunar exploration missions using virtual reality. The approach is based on the utilization of 3D mapping drone imagery, rover imagery, and 360 views of human landing sites to compose a virtual world where future lunar space missions can be practiced. Specifically, we focus on a mission that was performed by analog astronauts in Flagstaff, Arizona, which was selected for its geological similarity to the lunar surface.

To achieve this goal, we combined the 3D mapping drone imagery with rover imagery to create a highly detailed and accurate virtual landscape. We then integrated 360 views of the Flagstaff site to create an immersive environment that closely resembles the lunar surface. This virtual world was then made accessible to a group of analog astronauts who were tasked with performing simulated extra-vehicular activities (EVAs) and collecting rock samples. The analog astronauts provided feedback on the simulation and reported a high level of immersion and realism in the virtual environment.

The benefits of this approach are numerous. By allowing astronauts to practice lunar EVAs in a realistic virtual environment, the risk of injury or death during actual missions is reduced. Additionally, the cost of training is lowered as there is no need to send astronauts to the Moon to practice EVAs. Furthermore, the virtual environment allows for the exploration of different scenarios, such as emergency situations, that are difficult or impossible to simulate on the Moon. Finally, this approach can be utilized to increase public interest in space exploration by providing a highly immersive and realistic experience of lunar exploration to the general public.

In conclusion, the proposed approach of utilizing 3D mapping drone imagery, rover imagery, and 360 views of human landing sites to compose a virtual world for lunar EVAs is a promising tool for the future of space exploration. It provides an accurate and immersive simulation of the lunar surface that can be used to train astronauts, simulate different scenarios, and increase public interest in space exploration. The successful application of this approach in a Flagstaff analog mission suggests that it can be effectively utilized in future lunar exploration missions.