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Author: Mr. David Smith
ILEWG "EuroMoonMars", United Kingdom

Prof. Bernard Foing
ILEWG "EuroMoonMars", The Netherlands
Mrs. Jara Pascual
ILEWG "EuroMoonMars", The Netherlands
Dr. IOANA-ROXANA PERRIER
Institute of Polytechnic Science and Aeronautics (IPSA), France

A COMPUTER VISION TOOL FOR ENHANCING SURFACE EVA SAFETY AND EFFICIENCY

Abstract

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This paper proposes an EVA vision system using machine learning to support astronauts during surface EVA. Building on the work presented first as a software proof-of-concept at IAC 2021 (IAC-21,E2,3-GTS.4,14,x67020) and then as a developed hardware solution at IAC 2022 (IAC-22,A1,7,15,x74144), this paper extends that work to include more hardware testing in a novel environment. The system consists of an OAK-D AI-powered lightweight camera device installed with custom machine learning algorithms trained to monitor astronauts during EVA activity. Having previously been evaluated during a lunar analogue simulation in Iceland, this paper will discuss results of testing during the upcoming ICEE.Space (previously affiliated with EuroMoonMars) Martian analogue mission in July 2023, taking place in subterranean caves in Santander, Spain. As this system was initially tested on subterranean lava-tube systems in Iceland, simulating the lunar environment, this is a natural next step to examine the robustness of the vision system when operating in the new surroundings of a Martian environment. As the software component of the system is based on machine learning, being able to generalise well when predicting in new environments is a key indicator of performance. The tool will be assessed in its ability to support EVA astronauts in their experimentation and exploration. It will be used directly for astronaut monitoring, as well as navigation and monitoring of local environment features such as topographical landmarks, habitat structures and life support systems. Once tested, the system could act as a tool to greatly enhance the safety and efficiency of EVAs and accelerate the pace of robot-assisted human space exploration.