IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

Author: Mr. Leonardo Turchi
European Space Agency (ESA), Italy

Dr. Claudio Pernechele
INAF - Istituto Nazionale di AstroFisica, Italy
Dr. Riccardo Pozzobon
University of Padua, Italy
Mr. Leonardo Facchini
ESA, European Astronaut Centre (EAC), Germany

OMNICAM: BIFOCAL PANORAMIC CAMERA FOR HUMAN AND ROBOTIC EXPLORATION

Abstract

Situational awareness is the key for maximizing the return of any operation, both for scientific or engineering assessments. Spaceclick and INAF propose the OMNICAM, a novel camera system which can capture surroundings and an optically magnified portion of the panorama with a single lens and sensor. The Bifocal Panoramic Lens (BPL) (designed by INAF researchers [1] is a lens capable of warping a panoramic Field-of-View (FoV) of 360 x 100 and simultaneously a round FoV of 20 in high-resolution. The panoramic portion is always available for monitoring surrounding assets and the OMNICAM makes use of a pan/tilt mechanism to provide users of orientation capabilities for the magnified portion of the FoV. The small number of systems in OMNICAM leads to an overall reduction of weight and power consumption/complexity of redundant electronics. An ad-hoc developed software allows wireless remote control from ground control rooms and takes care of automatic de-warping of the captured frames, for producing fully nominal (flat) pictures of the surroundings, and additional pictures for the magnified pointed areas. Images taken by the OMNICAM's at different points of view can be used in combination with MapNCloud – another Spaceclick project – to enable high resolution photogrammetric distance rendering, hence providing 3D objects for VR/AR applications. OMNICAM are envisaged to be deployed either on tripod-like supports or anchored to rovers. In both cases, the system embeds a networking board and could also act as disruption tolerant data retransmission station. The OMNICAM prototype has been field tested in the ESA PANGAEA geological field training for astronauts in November 2021, where was used for remote monitoring of field science operations [2]. The BPL has been modified and implemented in an ESA CDF study for robotic lunar caves exploration (Daedalus) [3][4], and funded through EU-SME-Instrument for a small-sats poly-functional sensor (POLIFEMO)[5]. The camera lens, sensor and boards employed are compatible with space grading, and currently at TRL 3, which we would rise in the next. The concept has been proposed to ESA to support the next human exploration challenges, to our knowledge there is no similar camera system setup which can capture such extended FoV with a single camera sensor. OMNICAM is therefore a unique device in the international context.

[1]Pernechele C. (2016), OptExpr, 24(5), 5014 [2]Turchi L. (2021), 52thLPSC 1118 [3]Borrmann D.. (2021), 52thLPSC 2073 [4]Pozzobon R. (2021), 52thLPSC 1886 [5]Pernechele C. (2018), Adv. in Space Research