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

Author: Mr. Mikhael Sayat
University of Auckland, New Zealand, mikhael.sayat@auckland.ac.nz

Ms. Rungkaew Sammavuthichai
Space Generation Advisory Council (SGAC), Thailand, rungkaew.sammavuthichai@gmail.com
Ms. Harini Shanika Wijeratne
Sri Lanka, wijeratneharini@gmail.com
Ms. Sarinya Jitklongsub
King Mongkut's University of Technology Thonburi, Thailand, sarinya.j@mail.kmutt.ac.th
Ms. Priyanka Ghatole
Space Generation Advisory Council (SGAC), India, priyankaghatole1997@gmail.com
Mr. Bernard Isaiah Lo
Space Generation Advisory Council (SGAC), The Philippines, bernardisaiah.lo@spacegeneration.org

QUANTUM TECHNOLOGY, ARTIFICIAL INTELLIGENCE, MACHINE LEARNING, AND ADDITIVE MANUFACTURING IN THE ASIA-PACIFIC FOR MARS EXPLORATION

Abstract

After almost 50 years since humans last ventured beyond low-earth orbit in the Apollo 17 mission to the Moon, the recent zeitgeist of space privatisation in the 2010s and 2020s has brought a new age of space accessibility, with Mars being widely considered as the next milestone in human space exploration. However, this novel and ambitious task of sending humans to Mars to eventually establish a permanent human presence comes with many unprecedented challenges. For example, conducting routine operations and scientific experiments as well as building Martian habitation for humans necessitates the need for cutting-edge technologies.

In this paper, we propose three developing technologies which are potential to facilitate those mentioned activities on Mars: (1) quantum technology; (2) artificial intelligence and machine learning; and, (3) additive manufacturing. While these technologies may not have been originally developed for space applications, we put forth the idea that they could essentially contribute to the long-term sustainability of Mars exploration, specifically for communication interlinks, surface mobilisation, and scientific investigations. Quantum technology offers state-of-the-art unconditionally-secure communications and computing at the highest speed known – the speed of light. It would enable information transfer of confidential data in experiments as well as provide an opportunity to establish ground-breaking, advanced, secure, and high-speed networks surpassing the current capabilities on Earth. Secondly, artificial intelligence (AI) and machine learning (ML) would aid in the execution of experiments as well as in the processing and interpretation of raw data. Once trained, these technologies can be used to predict and identify uncharted Martian environments at higher efficiencies. Furthermore, the development of intelligent robotics through AI and ML will remove the human need for any arduous and low-level tasks. AI and ML can also be employed in civil foundations (e.g. electric power distribution) to allow for a more efficient and innovative civilisation. Lastly, additive manufacturing offers an efficient way not only to rapidly erect civil structures for habitation, but also to precisely manufacture various medical and scientific instruments on an as-needed basis. In combination with in-situ resource utilisation, additive manufacturing effectively contributes to the development of civil structures.

The three proposed technologies are in various stages of development by institutions across the world. However, Asia-Pacific countries are also involved in their development. Therefore the possibility for the region to contribute to the modern space age by further exploring these technologies and applications is also demonstrated in this paper.