IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

Author: Mr. Mehmed Yüksel
DFKI GmbH, Robotics Innovation Center, Germany

Mrs. Wiebke Brinkmann
DFKI Robotics Innovation Center Bremen, Germany
Mr. Hilmi Dogu Kücüker
DFKI GmbH, Robotics Innovation Center, Germany
Mr. Zhongqian Zhao
DFKI GmbH, Robotics Innovation Center, Germany
Mr. Leon Spies
FH Aachen University of Applied Sciences, Germany
Mr. Joel Gützlaff
FH Aachen University of Applied Sciences, Germany
Mr. Felix Glinka
DFKI GmbH, Robotics Innovation Center, Germany
Mr. Siddhant Shete
DFKI GmbH, Robotics Innovation Center, Germany
Mr. Andreas Bresser
DFKI GmbH, Robotics Innovation Center, Germany
Mr. Uman Imran
DFKI GmbH, Robotics Innovation Center, Germany
Mr. Jakob Wehnes
DFKI GmbH, Robotics Innovation Center, Germany
Mr. Utku Akinci
DFKI GmbH, Robotics Innovation Center, Germany
Prof. Markus Czupalla
University of Applied Sciences Aachen (FH Aachen), Germany

DEVELOPMENT OF A SEMI-AUTONOMOUS MICROROVER FOR LUNAR NIGHT SURVIVAL

Abstract

In the last two decades, lunar exploration for scientific research and in situ resource utilization has revived again since its first inception in late 1960s. Previously, such missions were performed by national agencies, but in the last decade private organizations have also emerged in the lunar exploration programmes especially after the Google Lunar X Prize. Lunar rovers play an important role in exploring and traversing the complex lunar surface. One of the challenges for such exploration missions is to navigate autonomously through the hostile lunar environment. The design is driven by low-power, limited mass, and the required capability of surviving the lunar surface extreme temperatures and radiation.

The project SAMLER-KI (Semi-autonomous micro rover for lunar exploration using artificial intelligence) aims to open the potential for future micro rover missions. Thus, the focus is on conceptual design of a micro rover with a higher level of autonomy and the capability of survival of lunar nights.

This paper presents the progress and innovations in the technical design as well as improvements in

the mission parameters of the developed microrover. The SAMLER-KI rover shall traverse the mission trajectory semi-autonomously and get scientific data by onboard sensors and payload instruments.

Furthermore, the paper describes the change of the current landing site and trajectory towards the Reiner Gamma region of the lunar surface due to the consideration of factors like lunar pits, slope, and sun angle. The details of the design parameters for different subsystems presented in this paper include the design of the locomotion system as well as the design and analyses of the structural and electrical power system. Further, the design of guidance, navigation, and control subsystems critical for semi-autonomous navigation are presented, as well as analyses of the thermal control system, including an assessment of thermal control methods crucial for lunar night survivability. The rover is capable of housing payloads of up to 1U, which is based on CubeSat standard.

The paper concludes with initial test results of selected subsystem development models.