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

Author: Mr. Sanath Kumar Naik L
CSIR-National Aerospace Laboratories (CSIR-NAL), India

Ms. SHAMBHAVI A S
Defence Research and Development Organization (DRDO), India
Mr. Prabhanjan Manjunath
Manipal Institute of Technology, India
Mr. TEJAS NARESH REDDY
AgniKul Cosmos, India
Mr. Amaranath Siddaraddi
Nitte Meenakshi Institute of Technology, India
Dr. SRIKANTH H V
Nitte Meenakshi Institute Of Technology., India
Dr. Prahalad N Tengli
Nitte Meenakshi Institute of Technology, India
Mr. Amit S Herkal
Nitte Meenakshi Institute of Technology, India
Mr. Rohan Shinde
Manipal Institute of Technology, India
Mr. Vivekananda N
Nitte Meenakshi Institute of Technology, India
Ms. Shreya S
Student, India

AVSAROM : AUTONOMOUS DECISION-MAKING SWARM UAVS FOR MARS EXPLORATION.

Abstract

In the quest for extraterrestrial exploration, the challenges of navigating a swarm of unmanned aerial vehicles (UAVs) named AVSAROM(Aerial Vehicle Swarm and Reconnaissance of Mars) on Mars demand innovative solutions. This abstract introduces a sophisticated waypoint navigation algorithm designed for Martian remote sensing, addressing the complexities of the Martian environment. The algorithm utilizes decentralized decision-making, dynamic path planning, collision avoidance, and effective communication protocols to coordinate the intelligent functioning of the AVSAROM. Decentralized decision-making empowers each UAV within the AVSAROM to navigate autonomously, leveraging local observations and interactions with neighboring UAVs. Dynamic path planning ensures adaptability to the diverse Martian landscape, accommodating steep slopes and unpredictable weather. Collision avoidance mechanisms are integrated, adjusting trajectories in real time to prevent collisions within the AVSAROM. Robust communication protocols facilitate seamless information exchange, which is crucial for coordinated movements and data sharing. The algorithm's optimization focus enhances AVSAROM's exploration efficiency. By minimizing redundant data collection, maximizing coverage, and prioritizing high-value areas for remote sensing, it contributes significantly to the scientific output of the mission. The algorithm's integration promises to advance Mars exploration and remote sensing missions by ensuring the synchronized and intelligent operation of the AVSAROM. Operational phases for both the primary UAV and the secondary UAV

are delineated. The primary UAV undergoes four stages: detachment, coasting, landing, and attachment. Simultaneously, the secondary UAVs engage in three phases: detachment, waypoint maneuvering, and attachment. Altitude serves as a critical parameter, dictating precise points for detachment. Terrain mapping simulations play a pivotal role in optimizing navigation strategies, providing a virtual environment for testing and refining the algorithm. A mathematical model tailored for scenarios where the primary UAV ensures a controlled and seamless attachment process. Various sensors such as datalinks, communication sensors, terrain mapping sensors, and environment monitoring sensors, facilitate real-time data exchange and informed decision-making during AVSAROM operations. The AVSAROM Path, a dynamic waypoint determination algorithm, enhances adaptability to complex terrains. Considering obstacles, environmental conditions, and energy efficiency, this concept significantly contributes to the overall efficiency and success of UAV navigation on Mars. In conclusion, the presented algorithm and operational framework mark a groundbreaking solution for Martian exploration challenges. By integrating cutting-edge technologies and addressing the intricacies of the Martian environment, this waypoint navigation algorithm stands as a milestone in advancing the capabilities of UAV swarms for extraterrestrial exploration and scientific discovery.