

## Autonomous Lunar Surface Mapping and Resource Detection for the LOOK 2026 Competition

**Abstract:** The exploration of the lunar surface presents significant challenges due to the lack of Global Navigation Satellite Systems, harsh lighting conditions, and complex terrain. The LOOK competition (Lunar rObOt Konkurransen), organized by the Norwegian Space Cluster, tasks student teams with building robots capable of mapping the lunar surface and identifying critical resources. This project aims to leverage the state-of-the-art ANYmal quadrupedal platform and the Unipilot autonomy module available at the Autonomous Robots Lab to create a competitive entry for the June 2027 competition. The research will focus on the integration of elevation mapping and real-time object detection to navigate and characterize a simulated lunar environment. By utilizing existing inspection cameras and advanced sensing suites, the student will develop a mission logic capable of autonomous exploration and resource localization. This work provides a unique opportunity to apply systems engineering and robotics expertise to a national competition with high visibility in the Norwegian space sector.



### Tasks:

- Study the LOOK competition rules, technical requirements, and the specific mapping challenges associated with lunar analog environments.
- Perform system integration of the ANYmal quadruped with the UniPilot autonomy module ([https://github.com/ntnu-arl/unified\\_autonomy\\_stack](https://github.com/ntnu-arl/unified_autonomy_stack)) and onboard cameras.
- Implement and tune the Robot Centric Elevation Mapping framework ([https://github.com/anybotics/elevation\\_mapping](https://github.com/anybotics/elevation_mapping)) to generate high resolution hazard maps.
- Develop a vision based detection pipeline to identify and localize lunar resources or geological anomalies using onboard sensors.
- Design a high level state machine or mission coordinator to manage transitions between exploration, mapping, and resource identification phases.
- Validate the integrated system through field testing in lunar analog terrains to prepare for the national competition in June 2027.

**Literature (indicative):**

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