Lunar ROADSTER (Robotic Operator for Autonomous Development of Surface Trails and Exploration Routes)

"Starting with a foothold on the Moon, we pave the way to the cosmos"



Software: Localization Test (T09)



Software: Navigation Stack (T11)



Software: Navigation Stack (T11)



Software: Tool Planner



- Ground plane is fit using RANSAC
- Point cloud is modified to clamp small height values to 0 to allow accurate source and sink node detection

Software: Tool Planner



Software: Tool Planner



- Tool Planner integrated with FSM
- Next Task: Tuning Map and Planner to get the desired outputs
- Error: Source and sink volume mismatch (partially environment, partially thresholding)

Software: FSM (T13)



Software: Active Mapping Stack (T08)



- Active mapping stack completed
 - Integrates with localization to give global elevation map
- Local elevation map is also implemented (not shown)

Software: Active Mapping Stack (T08)

Global elevation map can optionally be initialized with preloaded point cloud map from FARO scan



Hardware: Sensor Mounted (T10)



- RealSense camera mounted at {X, Y, Z, R, P, Y} = {0.5, 0, 0.6, 0, -30, 0} from base_link
- FOV is clear of the dozer blade
- Extrusion does not affect total station localizing the prism
- Triangle bracket mount is sturdy

Hardware: E-Box Assembled (T07)





Hardware: Quality Assurance (T14)





- Fixed loose connections
- Re-crimped and re-soldered worn out connections
- Fixed rear steering motor by drilling through the shaft and using a dowel

pin to hold the pinion in place.

Hardware: Wheels Printed and Test (T06)



Risk Management

Diele ID		Diak Ouman	Diek Tures			Technical,			
RISKID	RISK LITTE	RISK Owner	RISK Type:			Logistics			
R31	Localization Accuracy	Team	5						
Description	1	Date Added							
T he set of a		04/02/2025	P00 4						
offsets during movement		Date Updated	kelih 3				\otimes		
		04/02/2025	Li	2					
Consequence						\bigcirc			
May prevent the robot from reaching the goal location, blocking the transition to the tool planner and					1	2	3	4	5
affecting grading						nsequence			
							Date		
Action/Mile	stone	Success Criteria	Date Planned			Implemented			
Tune EKF parameters and ensure synchronized motor speeds for accurate odometry Successfully localize the moon yard durin movement					04/02/2025				

Risk Management

Risk ID	Risk Title	Risk Owner	Risk Type:			Logistics			
R31	Navigation and Tool Planner Stack Integration	Team							
Description		Date Added		5					
Navigation a	ind tool planners use differently processed costmaps	04/04/2025	poor	4					
generated fr	om the point cloud. As the navigation package requires	Date Updated	kelih	3					
have to mod	a specific format and in a sequence, the tool planner will lified and tuned accordingly.	04/04/2025	Li	2		\frown	\otimes		
Consequence						\oplus			
Errors in manipulation of sand, leading to sub-par grading					1 2 3 Consec				
Action/Mile	stone	Success Criteria	Date Planned				Date Implemented		
Extensive te	sting and tuning	Successfully tune parameters and integrate navigation and tool planner stack	04/05/2025						
Minimize dif navigation s	ferences between the maps used by tool planner and tack by setting the correct map frame in the point cloud	One ground truth map frame	04/01/2025				04/01/2025		

Issues Log

Issue ID	Date Initiated	Date Resolved	Participants	Description	Options	Resolution	Justification	
109	03/19/2025		Boxiang Fu Bhaswanth Ayapilla	Global localization flies off during testing	1. Try different localization technique rather than using robot_localization package 2. Debug	Debugged and updated TX2 code so that it publishes data with respect to the correct frame (map)	Global localization frame does not fly off anymore. Localization is fixed	
110	04/07/2025	04/07/2025	Team	Rear motor rotating in the wrong direction	 Recheck wiring (hardware) Recheck motor command sign convention (software) 	Switched power cable at the motor controller terminals	This changes the rotation direction of the motor	

THANKS!

Team Lunar ROADSTER

