Mobile Robot
Risk Assessment Report

Risk Assessment Report

This document outlines the risk assessment process and results for the current project/operation. The goal is to identify, analyze, and evaluate potential risks to minimize their negative impact.

Risk Assessment Matrix

The risk score is calculated by multiplying the Likelihood and Impact ratings.

Likelihood (L)	Description	Impact (I)	Description	Risk Score (R) = L x I	Risk Level
1	Rare	1	Insignificant	1-2	Low
2	Unlikely	2	Minor	3-6	Medium
3	Moderate	3	Moderate	7-12	High
4	Likely	4	Major	13-16	Extreme
5	Almost Certain	5	Catastrophic		

General Identified Risks

The following table details the risks identified, their assigned Likelihood and Impact ratings, and the resulting Risk Score.

Risk ID	Risk Description	Likelihood (L)	Impact (I)	Risk Score (R)	Level	Mitigation Strategy
R001	Odometry Drift / Heading Loss	4	4	16	Extreme	Implement sensor fusion combining wheel encoders with the IMU for heading stabilization. Tune the kinematic controller to handle slip.

R002	Vision System Failure (Lighting/Blur)	3	5	15	Extreme	Stop the robot completely before scanning the QR code. Implement auto-exposure in the camera pipeline and validate the perception approach on varied recorded data.
R003	Track Boundary Collisions	3	3	9	High	Implement lane detection via camera. Add proximity/ToF sensors as optional backups. Note that boundary crossings incur a -3 point penalty, and collisions -5 points.
R004	Unstable PID (oscillation)	4	3	12	High	Structured tuning + real-time data logging
R005	State machine logic bug/hang	2	5	10	High	Simulation testing + timeout "fail-safe" states
R006	Communication failure between modules	3	4	12	High	Heartbeat timeout + watchdog timer implementation
R007	Weight exceeds 10kg limit	1	5	5	Medium	Continuous mass tracking in CAD BOM
R008	Dimensions exceed folded limit	1	5	5	Medium	Virtual envelope verification in CAD
R009	Late integration failure	4	4	16	Critical	Mandatory weekly subsystem integration tests

Power & Electronics

Identified Risks in Power & Electronics

The following table details the risks identified, their assigned Likelihood and Impact ratings, and the resulting Risk Score.

Risk ID	Risk Description	Likelihood (L)	Impact (I)	Risk Score (R)	Mitigation Strategy
R001	Short Circuits / Exposed Wiring	2	5	10	Use proper harnessing, strain relief, and cable management. Ensure all PCBs are fixed inside an enclosure with insulated terminals

R002	Battery Over-Discharge	3	5	15	PMS undervoltage lockout
R003	Battery Over-Charge	2	4	8	Certified charging module
R004	Battery overcurrent	4	3	12	Main fuse + PMS protection
R005	Reverse polarity	3	4	12	Reverse polarity protection diodes or MOSFETs on custom PCBs
R006	Charging while running	4	4	16	Charge interlock + labeling
R007	Communication Bus Interference	4	3	12	Use twisted-pair cables for data lines, keep logic wires away from high-current motor wires, and implement a software "heartbeat" to detect connection drops
R008	Main Fuse Blowing Mid-Run	3	4	12	Calculate total peak stall current for all drive and arm motors. Select a correctly rated main fuse and verify margins during Phase 3 simulation
R009	BMS failure	2	4	8	Qualified components
R010	Uneven power routing	4	4	16	Proper power planes
R011	High inrush current	3	5	15	Soft-start / NTC
R012	Ground loop / poor return	3	5	15	Star grounding scheme
R013	Regulator overheating	4	4	16	Thermal design + heatsinking
R014	High output ripple	2	5	10	LC filtering + decoupling
R015	Regulator dropout	3	5	15	Proper headroom design
R016	Wrong regulator sizing	2	6	12	Power budget margin 30%
R017	PCB trace overheating	3	5	15	Wide copper pours
R018	Connector overheating	3	5	15	Proper current rating
R019	Fuse improperly rated	2	4	8	Correct fuse sizing

Electromechanical

Mechanical Risks

Risk ID	Risk Description	Likelihood (L)	Impact (I)	Risk Score (R)	Risk Level	Mitigation Strategy
R001	Chassis bending under load	3	4	12	High	Perform structural estimation, add ribs, use thicker plate
R002	High center of gravity (battery placement)	3	5	15	Extreme	Mount battery at lowest point, widen base footprint
R003	Wheel misalignment	4	4	16	Extreme	slotted adjustment holes
R004	Loose fasteners due to vibration	4	3	12	High	Lock nuts, threadlocker

Electromechanical Risks

Risk ID	Risk Description	Likelihood (L)	Impact (I)	Risk Score (R)	Risk Level	Mitigation Strategy
R005	Motor undersized (torque insufficient)	3	5	15	Extreme	Full torque calculation including (friction + margin)
R006	Wheel slipping (low friction rollers)	4	4	16	Extreme	Use rubber omni wheels, control acceleration ramp
R007	Unequal motor speeds → rotation drift	4	4	16	Extreme	Closed-loop control using encoders
R008	Overheating motor drivers	2	4	8	High	Proper Powertrain evaluation and circuit regulation