Project Proposal
Group 4
Derek True, Stephen Martin, Shaan Nagra, Mohnish Sao, Gavin Timmons
CSE 4643/6643 (AI Robotics)
October 22, 2025

Title:
Robot Vacuum

Team Members:
Derek True
Stephen Martin
Shaan Nagra
Mohnish Sao
Gavin Timmons

Scope:
We propose simulating a robot "vacuum" robots in Gazebo that maximize floor coverage while respecting height clearance. The robot will use a depth-based clearance map to decide where it can pass under furniture will and avoid low obstacles. The robot will execute its assigned path using Nav2, reporting coverage %, time, and collisions. Priority will focus on object detection, navigation, and maximum floor coverage. To the extent time allows for any additional components, we may simulate battery usage and charging and/or sensors for spending more time on detected high traffic areas.

Software/Libraries:
Although subject to refinements as necessary, we expect the following libraries may be used: ROS 2 (Humble), Gazebo Classic, TurtleBot3 simulation, Nav2, RViz.

Will build the following custom nodes: clearance mapper, coverage planner, executors, metrics.

Timeline:

- **October 31:** Build room world, add furniture; spawn robot; visualize clearance map.
- **November 12:** Implement coverage planner and executors; collect metrics.
- **December 9:** Tune parameters; run trials; record demo and finalize report.

Division of Labor:

Stage 1 — Environment & Navigation Setup (Due Oct 31)

- Group A (3) – Nav2 bring-up, TB3 model/namespaces, waypoint test:
  Derek, Mohnish, Stephen

- Group B (2) – Gazebo room + furniture, LiDAR/depth config, clearance viz:
  Shaan, Gavin

Stage 2 — Coverage Logic & Execution (Due Nov 12)

- Group A (3) – Coverage planner (lawnmower), waypoint generation, executors: Stephen, Gavin, Shaan

- Group B (2) – Clearance mapper (depth→height grid), integration, logging: Derek, Mohnish

Stage 3 — Tuning, Metrics & Reporting (Due Dec 9)

- Group A (3) – Metrics/plots, report, slides, demo video creation: Derek, Shaan, Mohnish

- Group B (2) – Parameter tuning, trial runs, reproducible launch/documentation: Stephen, Gavin

Deliverables:
Launch/world files, code, coverage plots, metrics CSV, 1-min demo video, final report.