MIE444 - Sample Proposals

Prepared: October 2022

The following are snapshots from past projects that highlight the expectations for the proposal.

Things to consider while preparing the document:

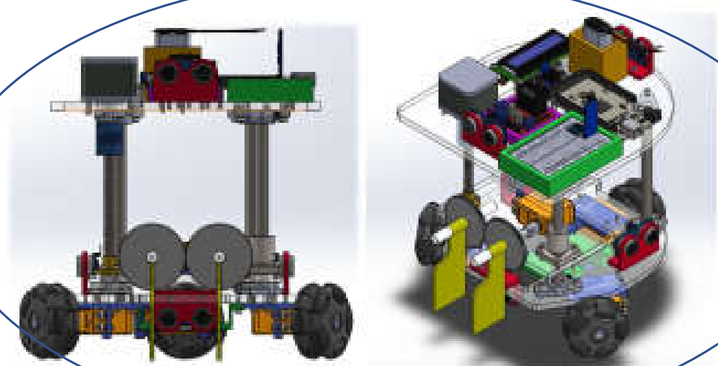
- The proposal should be complete with all the mechanical and electrical components necessary to build the rover.
- Maze solving strategy must be provided as pseudocode/flow chart or by diagrams. The strategy will influence component selections and sensor placement.
- You are not bound by your proposed design and can make radical modifications throughout the prototyping process.
- Try to communicate the proposal clearly and concisely.
- Make sure the diagrams are easy to read. You shouldn’t have blurry figures like the ones provided in this document ☺
- Exclude the cost of fasteners, 3d printing, shipping from Canadian sources only (include shipping from sources in US or China)

0. Proposal

PROPOSAL

MIE 444: Mechatronics Principles

Due:



Placing your robot on the main page is a nice touch

Group Members	Student Numbers

0. Table of Contents

Table of Contents

1. Project Requirements

1.1 Tasks

The rover should

- Travel 20' in the maze without collision (**milestone1**)

  • • •

1.2 Function requirements

To perform the expected tasks, the rover should

- Avoid collisions

  • • •

1.3 Design constraints

The rover must

- Be less than 5lbs and smaller than 12"x12"x12"

  • • •

You are not required to complete all the project requirements. You can set a goal that is below a score of 100%. For example, you can decide to not try and localize from random orientation, but rather, require that the rover is parallel to the walls, or has a known starting orientation.

2. Detailed Rover Design - Mechanical

CAD Model

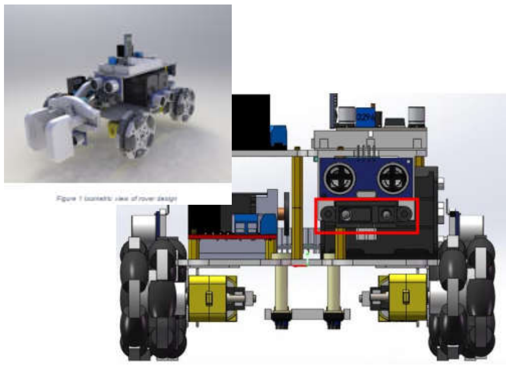


Figure 7 IR sensor added to verify distance to the obstacle in the main direction of move

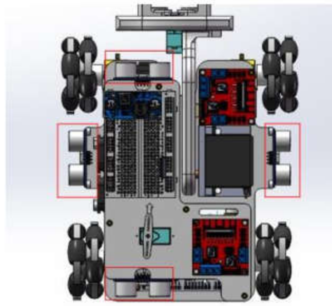
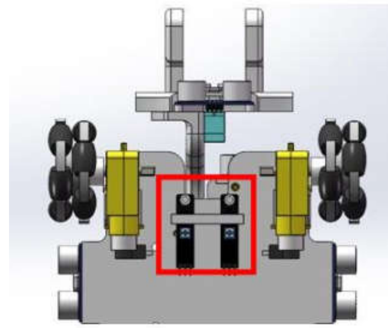


Figure 4 One ultrasonic sensor in each direction of the rover: front, back, left and right



re 6 Line following sensors mounted below the bottom chassis board

Drive System

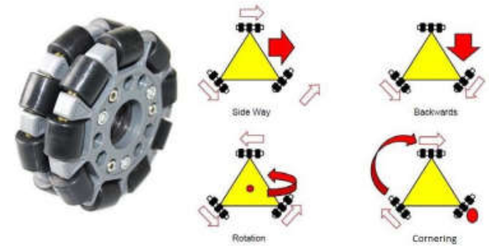


Figure 2.1.1 - Top View of Omni Wheels Placements & Orientations, and Degrees of Freedom [2]

Block Detection

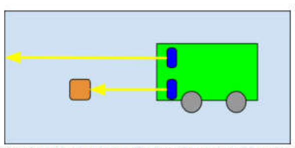


Figure 2.4.1 - Side view: The bottom ultrasonic sensor sensing a smaller distance than the top when a block is in front of it

Gripper System

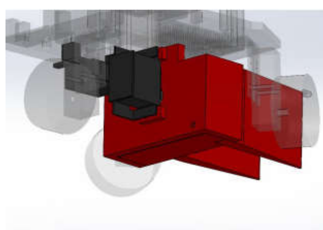


Figure 2.2.4 - Back view of gripper mechanism

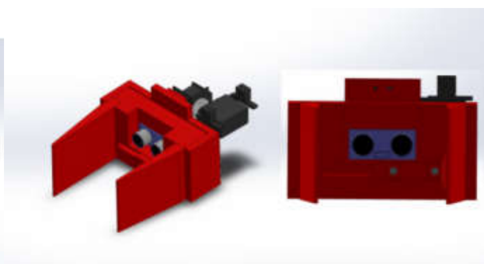


Figure 2.2.3 - Front view of gripper mechanism

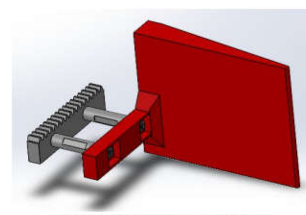


Figure 2.2.1 - Rack and left gripper arm fixed together

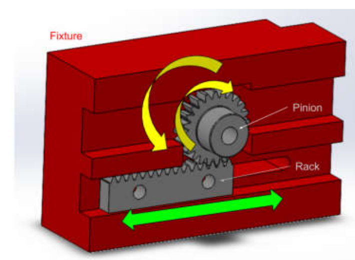


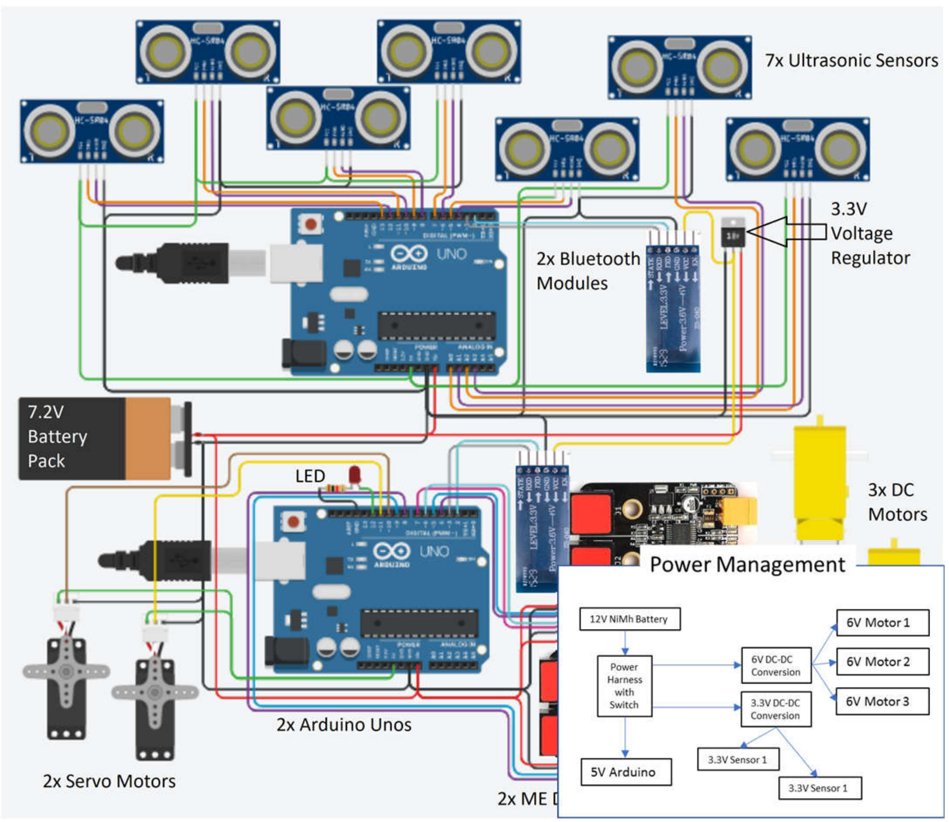
Figure 2.2.2 - Actuation mechanism of gripper arm

Include text describing/summarizing the mechanical designs decisions, placement of components, assembly process, etc. What happens if you need to debug or replace components, is there anything about your design that makes for easy repair?

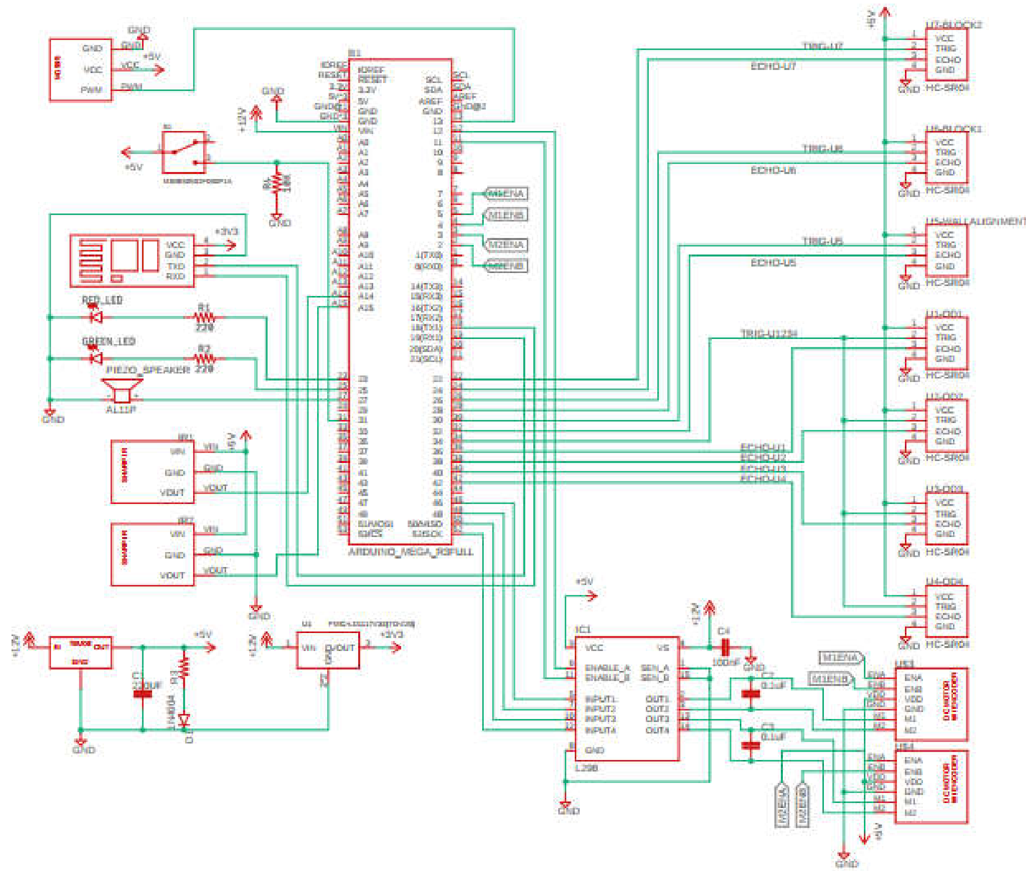
2. Detailed Rover Design - Schematic

Option 1 → and/or → **Option 2**

(Block/Wiring Diagram – e.g., Fritzing or PowerPoint)



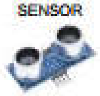
(Circuit Schematic – e.g., Eagle/Altium)



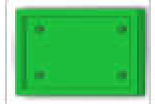
Include text describing/summarizing the electrical wiring and component selections – battery power management

3. Bill of Materials

Electronics

PART NUMBER	DESCRIPTION	QTY.	WEIGHT (GRAMS) PER 1 PIECE	PRICE($) PER 1 PIECE	SOURCE	PURPOSE
CUSTOM DESIGNED ACRYLIC PARTS (note: weight was determined using SolidWorks mass properties, and price was taken as $0.0365/g using acrylic from Amazon)						
I2C BOARD	I2c BOARD FOR LCD DISPLAY 	1	34.5	7.95	CANADA ROBOTIX	DISPLAY
LCD DISPLAY	LCD DISPLAY 	1	**Weight included in i2c**	**Price included in i2c**	CANADA ROBOTIX	DISPLAY
HC-SR04-	ULTRASONIC SENSOR 	5	2	1.13	MYHAL	SENSOR
IR SENSOR	IR SENSOR 	4	5	0.78	MYHAL	SENSOR
NEMA 17	STEPPER MOTOR 	1	290	13.59	MYHAL	GRIPPER

3D Printing / Laser Cutting

CUSTOM DESIGNED 3D PRINTED PARTS (note: weight was determined using 3D printing slicing software, and price was taken as $0.01995/g using filament from 3dprintingcanada.com)						
CLAM-102	BREADBOARD MOUNT 	1	33	0.66	3D PRINTED (PLA, 20% INFILL)	MOUNTING
CLAM-103	ULTRASONIC MOUNT 	5	5	0.1	3D PRINTED (PLA, 20% INFILL)	MOUNTING
CLAM-104	MOTOR MOUNT 	4	6	0.12	3D PRINTED (PLA, 20% INFILL)	MOUNTING
CLAM-105	LINE SENSOR MOUNT 	2	7	0.14	3D PRINTED (PLA, 20% INFILL)	MOUNTING
CLAM-106	BATTERY MOUNT 	1	18	0.36	3D PRINTED (PLA, 20% INFILL)	MOUNTING

Total = $275.45 < $300

Make sure to provide your CAD files including .stl (3d printing) and .dxf (laser cutting)

4. Maze Solving Strategy

Flow chart or pseudocode is a great way to describe your localization algorithm.

Flow Chart

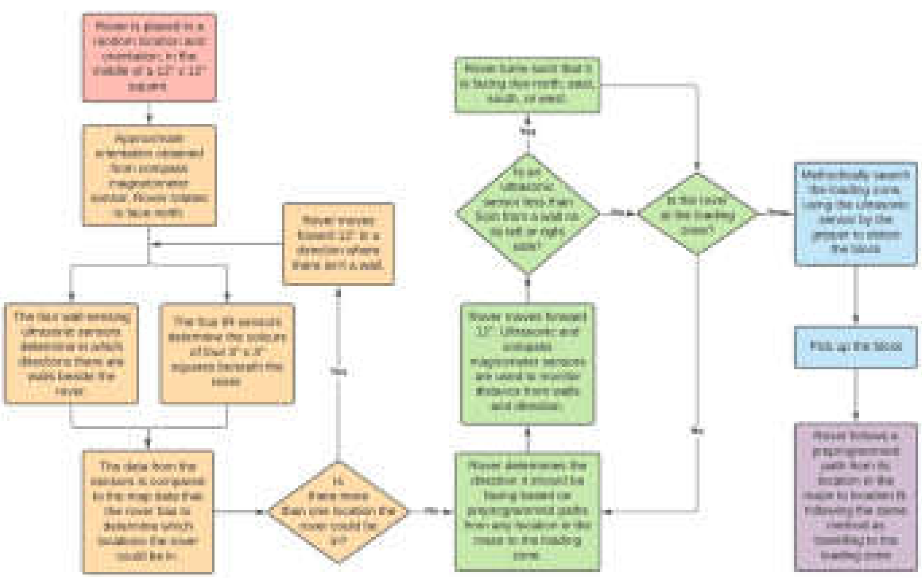
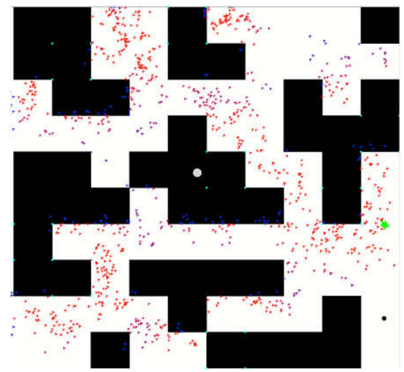
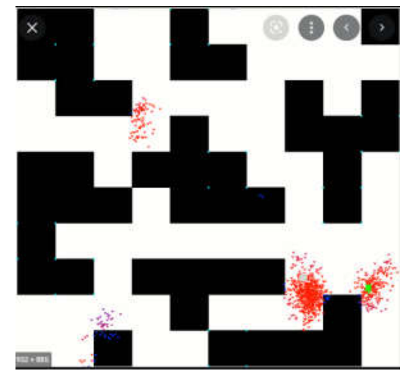


Figure 20 - Maze Solving Strategy Flowchart

Diagrams





Include text describing/summarizing the localization algorithm you intend to use. What type of algorithm are you using (e.g., Histogram Localization, Kalman Filter, Monte Carlo / Particle Filters, Hard coded, some hybrid…). What are the sensors used, how is the sensor data going to be processed/modeled.
Why do you think this is a good choice? Where are you going to run the algorithm?

5. Contribution Table

Proposal/Design Contribution

Report	Project Requirements	100%			
	Detailed Rover Design		33%	33%	33%
	Bill of Materials	25%	25%	25%	25%
	Maze Solving Strategy		100%		
	Editing/ Revision	25%	25%	25%	25%
CAD	Premade Component Compilation	33%		33%	33%
	Custom component design	50%			50%
	Gripper Mechanism		100%		
	Final Assembly				100%
	Drawings				100%
Electrical schematic				100%	
Video		75%	25%		

Project Work Distribution

Deliverable	Section	Student Names			
Milestone 1 (Plan)	Low level data acquisition and processing	100%			
	Communication between rover and PC		33%	33%	33%
	High level data processing	25%	25%	25%	25%
	Rover motion control		100%		
	Rover location visualization				
	Script compiling	25%	25%	25%	25%
Milestone 2 (Plan)	Starting point localization	33%		33%	33%
	Indicator control (1)				
	Block location detection	50%			50%
	Gripper control (1)		100%		
	Script compiling				
Milestone 3 (Plan)	Gripper control (2)				100%
	Indicator control (2)				100%
	Shortest path finding			100%	
	Script compiling	75%	25%		

Consider using project management software (e.g., Trello) to track team progress. Pick a communication platform (e.g., WhatsApp, WeChat, Facebook, etc.). What if someone misses a deadline? You should consider the risks in your current distribution of work and make sure there is a primary and secondary for each project task.

6. Video Presentation

Imagine you're a start-up proposing a solution to our autonomous rover delivery task and the client has to pick one of 20 solutions.

Your presentation should address some of the following questions:

- What makes your design special?
- What are some challenges that you'll need to overcome?
- Why is your design likely to succeed where others may not?
- How have you allocated the project work?

kickstarter.com has some great start-up presentations that you can use for inspiration.