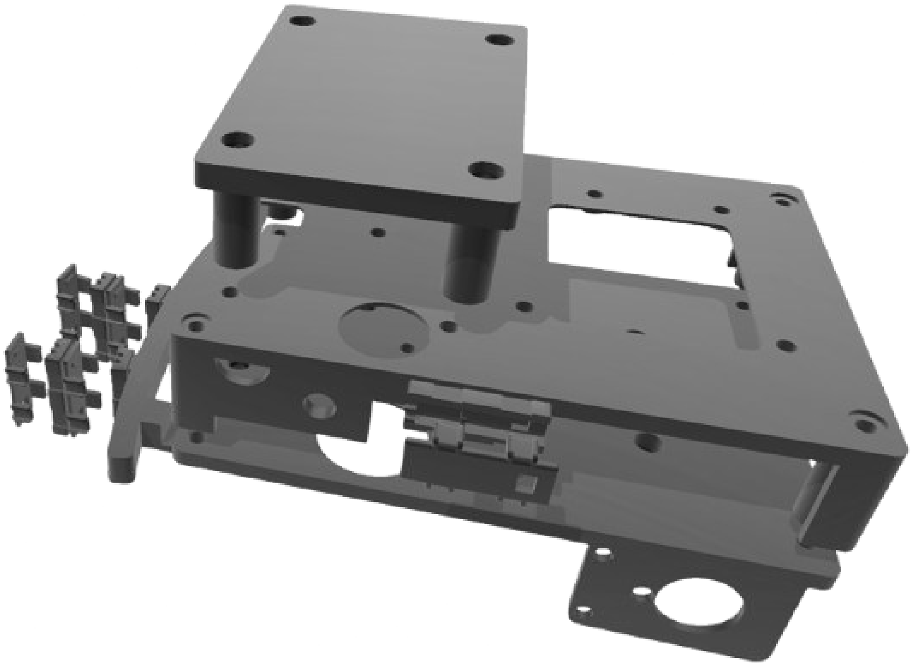
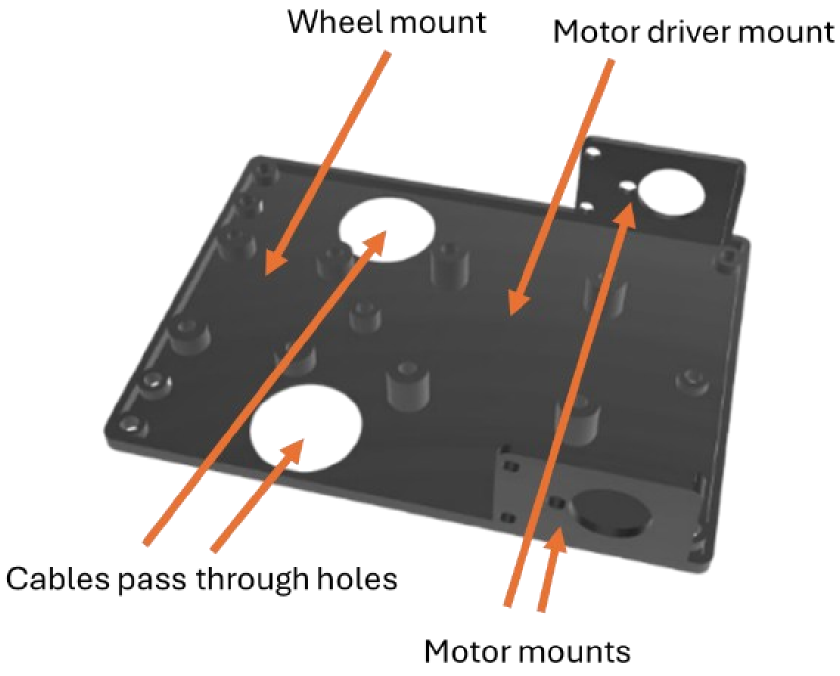
Robust Mechatronics



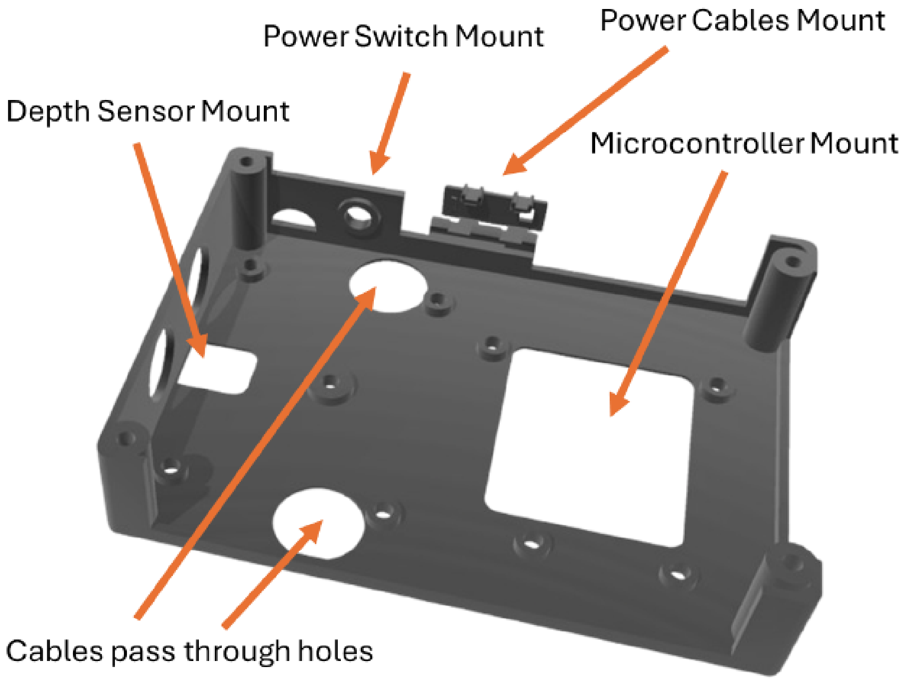
Dr Loukas Bampis, Assistant Professor
Mechatronics & Systems Automation Lab

Assignment

Provided Equipment



Bottom Base

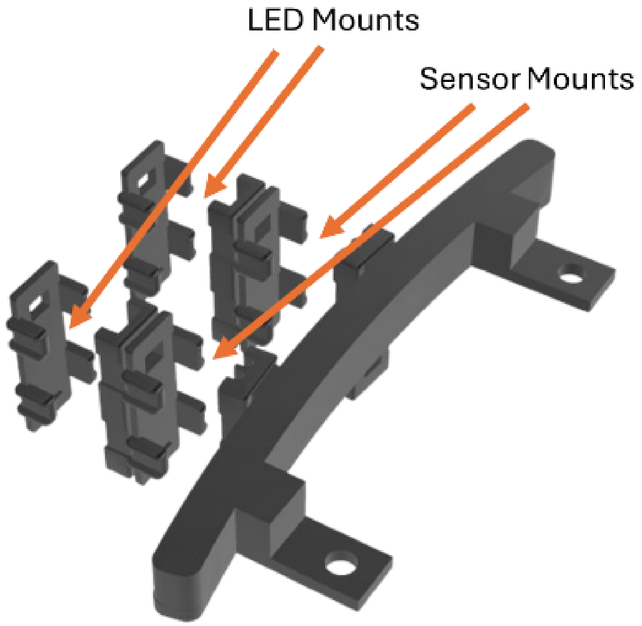


Top Base

Assignment

Provided Equipment

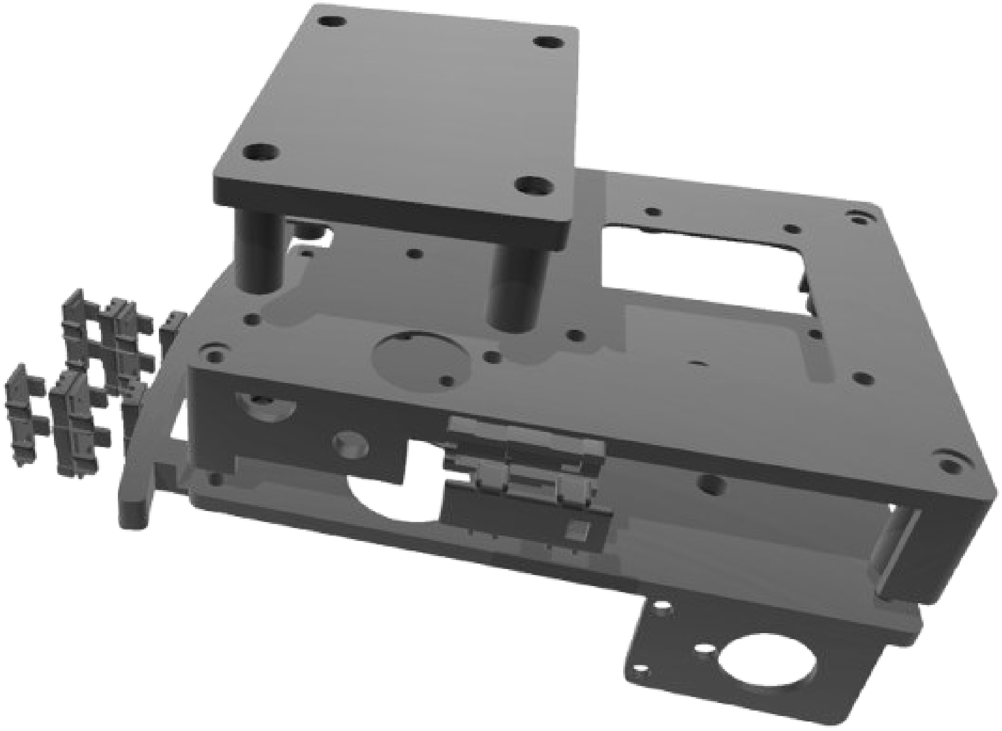
Breadboard Base



Bumper Base

Assignment

Provided Equipment



Complete platform

Assignment

Provided Equipment

- 2 DC motors with wheels
- 1 DC motor driver
- Battery case, AAx6
- Power adapter with cable plug (to be used instead of the batteries)
- 1 Depth Sensor, HC-SR04
- Arduino Uno (compatible) microcontroller
- USB type B cable
- 2 breadboards
- 1 multimeter
- Various cables

Assignment

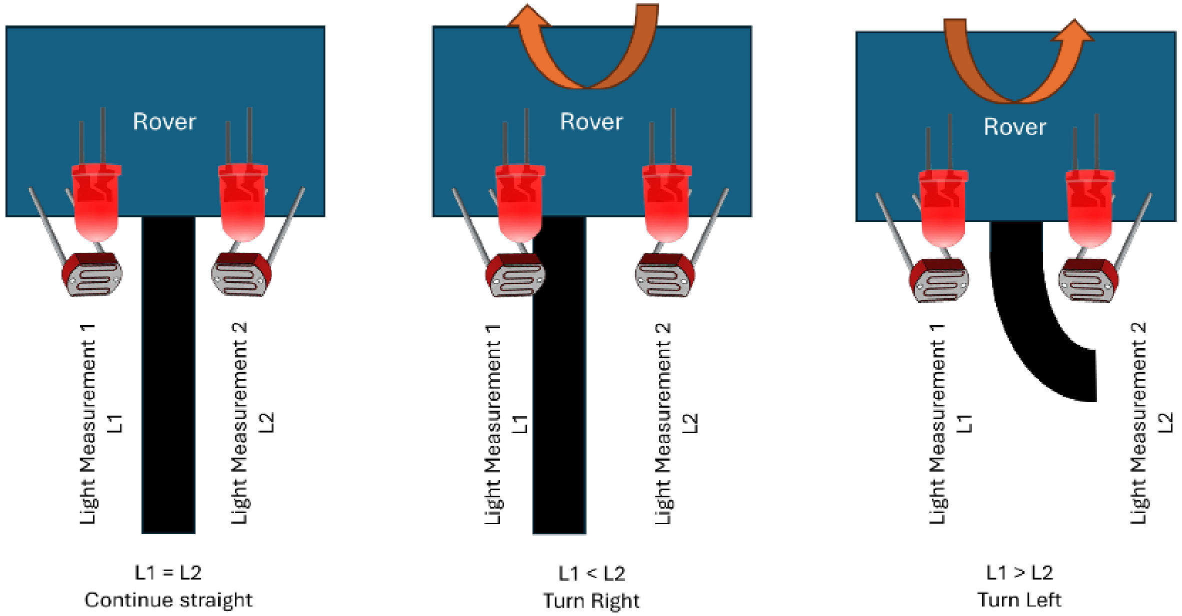
Provided Equipment

- 1 line-following kit:
  - 1 Voltage Comparator, LM393
  - 1 IC Socket, 8-pin
  - 2 Electrolytic Capacitors, 100uF
  - 2 Adjustable Resistors, 10KΩ
  - 2 Resistors, 3.3KΩ
  - 4 Resistors, 51Ω
  - 2 Resistors, 1KΩ
  - 2 Resistors 10Ω
  - 2 Photoresistors (LDR), CDS5
  - 2 LEDs, 3mm
  - 2 LEDs, 5mm
  - 2 Triode PNP Transistors, 8550
  - 1 Switch
  - 2 Reduction Motor, JD3-100
  - 1 PCB
  - 1 Battery Case, AAx2

Assignment

Exercise 1

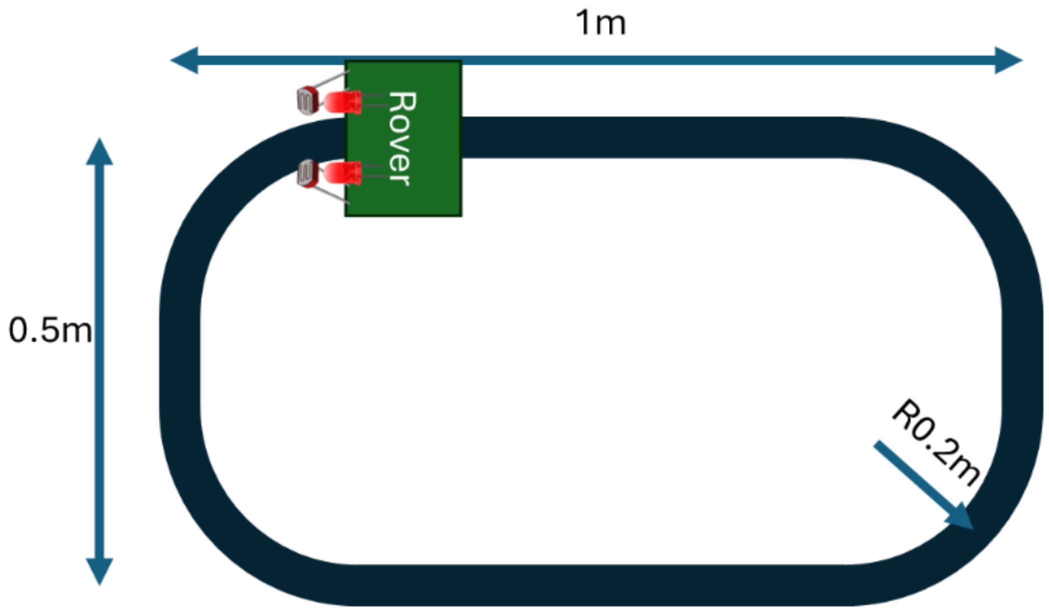
Using the available electronics components, implement a system that automatically follows a black line on a white surface, without the use of a microcontroller. Use the electronics components of the line following kit and measure the light reflected from each LED. The less light measured by an the LDRs, the closer that LDR is to the black line. Based on those measurements, try to keep the black line between the two LDRs by controlling the DC motors and turning the platform accordingly.



Assignment

Exercise 1

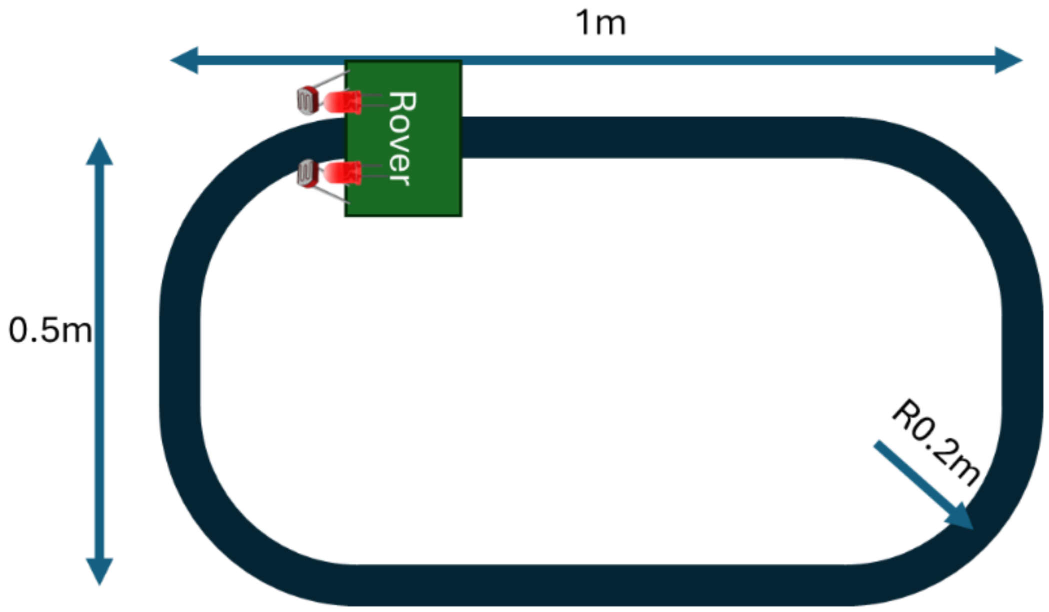
Use the following setup and measure the percentage of correctly performed loops of the track and the time required for performing a single successful loop.



Assignment

Exercise 2

Using Exercise 1 as a basis, improve the implemented system using the available microcontroller. Make any necessary adjustments to control the speed of the rover through the provided DC motor driver. Make the same measurements as in Exercise 1 for the same setup and highlight any advantage (or disadvantage) that the use of the microcontroller may induce.



Assignment

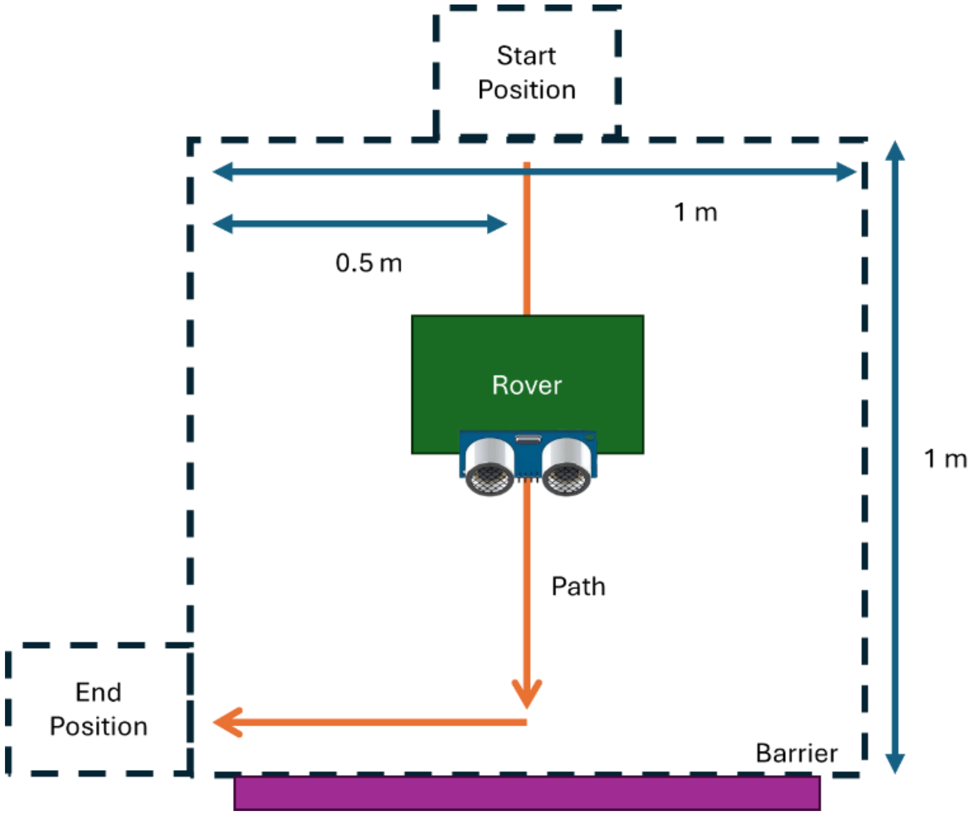
Exercise 3

Implement a system that can control the rover to execute a sharp turn to the right when reaching a dead-end to its straight path. Utilize the provided distance sensor to measure the distance of the platform from a potential barrier. Implement the RANSAC method to improve the accuracy of the measured distance or make predictions. Your goal should be for the platform to travel as fast as possible and as close as possible to the path’s end, while appropriately adjusting its speed through the available DC motor driver.

Assignment

Exercise 3

Use the following setup and measure the minimum distance from the barrier that the rover reached while successfully avoiding collision. Also measure the time required for the robot to reach the exit.



Assignment

Evaluation

- Write a report describing your interpretation, approach (or approaches) to solution, and results for each one of the above exercises.

  Your report should contain circuit diagrams, schematic diagrams, figures, and any other means you deem necessary to explain your work.

- Prepare a set of slides which you will present in 15min, as part of your final evaluation. In addition to the above, those slides can also include video files depicting the developed systems in action.
- Organize and submit an Arduino IDE project folder for each one of the Exercises 2 and 3.

All the above should be uploaded at eclass at least 2 days before your final evaluation.