AUI-Mechatronics Challenge

Fall 2023

Introduction:

Welcome to the Mechatronics Challenge! As aspiring members of our Mechatronics Team, you will be facing a unique problem that will test your problem-solving skills and creativity. This challenge is divided into 2 main parts: (1) Programming, (2) Mechanical & Electrical. **You are required to choose one part**. Before you submit your file, make sure to read these instructions carefully.

Submission Requirements:

Submission requirements are specified for each part of the challenge.

Evaluation Criteria:

Your submission will be evaluated based on the following criteria:

Algorithmic Creativity, **Efficiency**, **Correctness**, **documentation**

Part 1: Programming Part:

"Am I going to Reach It?"

Imagine our robot positioned in a 2D grid, initially at the (0, 0) position. The robot follows a series of instructions "***S"*** denoted by the characters 'L' for left, 'R' for right, 'U' for up, and 'D' for down.

The robot executes ***S*** infinitely and may stop at any instruction. Our Mechatronics Team wonders if this robot can reach its final goal point (x_{final}, y_{final}) from its starting position.

write pseudocode or code (preferred) using any programming language. Your algorithm should take the following inputs:

- x_{final}: An integer representing the x-coordinate of the goal point.
- y_{final}: An integer representing the y-coordinate of the goal point.
- ***S***: string containing the four characters as specified above.

Your algorithm should output either "Possible" if the robot can reach the goal or "Impossible" if it cannot Your algorithm must be highly generic, capable of handling any case, including special cases. It's better to test your algorithm with some examples. you may use the ones below or generate yours and compare the results.

Examples:

- Input:
  - 3
  - 2
  - URR
- Output: Possible
- Input:
  - -1
  - 1000000000
  - LRRLU
- Output: Possible

Explanation for the first example: We can do the following operations to reach the goal: (0,0) → (0,1) → (1,1) → (2,1) → (2,2) → (3,2). So Possible

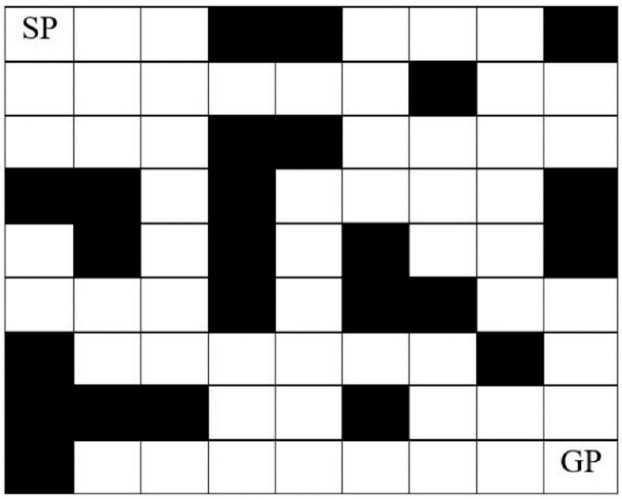
- Input:
  - 1
  - 2
  - RU
- Output: Impossible

Submission Instructions:

Please, submit your algorithm (Pseudocode or programming code) in a file, including a clear description (You can do it in a separate Word file if you prefer) of your pseudocode or code, explaining the steps and how you arrived at the solution. If you have any questions or uncertainties about the problem, please email us for clarification.

Part 2: Mechanical Part & Electrical Part:

While Designing a Robot the Mechanical & Electrical part plays a crucial role in making the robot intelligent, enabling it to process sensor data, control its movements, and make decisions. This section outlines the Mechanical and electrical components and systems needed for a maze robot. The robot is placed in a maze and needs to navigate to reach the Goal Point from a Start Point. In this part, you are not required to implement anything related to pathing or the algorithm to solve the maze.



2.1 Challenge Components:

1. **Chassis and Wheel-Based Mobility:**

    - Design a sturdy chassis that incorporates wheels for mobility. The choice of wheels, such as omni wheels, differential wheels, or customized designs, should maximize maneuverability, allowing the robot to move seamlessly in different directions.

The robot's objective is to reach a specified destination while avoiding collisions with obstacles, using its wheel-based mobility.

2. **Microcontroller or Microprocessor**:

    - Choose a suitable microcontroller or microprocessor to serve as your robot's brain.

3. **Motor Controllers**:

    a. Depending on your choice of motors and wheels", select appropriate motor controllers to drive and control the robot's movements.

4. **Sensors**:

    a. Provide sensors that can enable obstacle detection and discuss the feasibility of implementing those sensors.

5. **Documentation:**

    a. Document your electrical design thoroughly, including schematics, circuit diagrams, wiring diagrams, and a bill of materials.

    b. Provide clear instructions on how to assemble and troubleshoot the electrical components.

2.2 Challenge Instructions:

Please submit your robot design in a comprehensive PDF document or presentation format. Your submission should include the following:

- A written description of your robot, including its purpose, and design features. We want to see your vision come to life on paper.

- Create CAD models to illustrate the mechanical components, sensors, and their integration into the robot's design, emphasizing the importance of wheel-based mobility.

- Any additional sketches or diagrams that aid in understanding your design (**walk us through the way you think and tackle problems!**).

"*Please note that in this challenge, the emphasis is not solely on arriving at the correct answer; rather, we highly value your commitment and effort in tackling the problem. Therefore, Feel free to submit what you were able to solve, and consider this challenge as an opportunity for growth and learning.*"

Good Luck!