ELECTRICAL TEAM TRAINING

TASK 7

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PREFACE

Years had passed since they had successfully nurtured the small green plant back to life. Earth was showing signs of healing, but it was still burdened by vast heaps of discarded trash and pollution. WALL-E and EVE knew that their work was far from over.

One day, as they explored a particularly polluted area, the idea struck them like lightning—why not create a Mobile robotic to clean up the planet more efficiently? With WALL-E's resourcefulness and EVE's advanced technology, they set out to design the ultimate solution: the Autonomous Planet Cleaner (APC).

The APC was a marvel of innovation. It was equipped with powerful vacuuming systems, waste sorting mechanisms, and state-of-the-art sensors for detecting and cleaning up various types of waste. Its design mirrored WALL-E's sturdy and reliable build while incorporating EVE's sleek and efficient technology.

TASK7.1- Cytron vacuum

About

To enhance the cleaning efficiency and waste collection capabilities of the **Autonomous Planet Cleaner (APC)** machine, WALL-E and EVE embarked on the development of a specialized component: a high-performance DC brushed suction system. This system was meticulously designed and engineered to harness the power of direct current (DC) motors, enabling the APC to effectively and efficiently vacuum and collect various types of waste and debris encountered during its mission to clean and restore the planet.

DC Brushed Suction

Requirement

- Control this **DC Brushed Motor** using Cytron (which is a DC brushed motor driver) with Arduino.
- Implement a software soft start filter using **Exponential smoothing** Filter
- Does this motor suitable for this application?

Dual Channel Cytron

Output

- (.ino) file added to **Group repo**
- Markdown file to document your work and to **answer the Question**
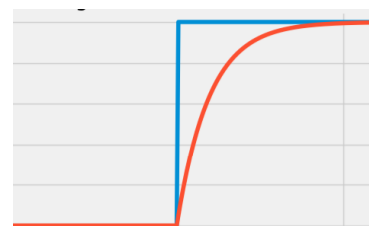
Exponential Smoothing effect

Appendix

- **Motor Basics**
  - [Motors - YouTube](#)
- **Cytron**
  - [Controlling 10A DC Motor Driver Using Arduino Nano (cytron.io)](#)
  - [Cytron MDD10A: How to use it with Arduino - YouTube](#)
- **Exponential Smoothing:**
  - [Introduction to Filters - YouTube](#)
  - [Exponential smoothing - Wikipedia](#)

TASK7.2-Magic of PID

About

In our pursuit of greater automation and precision in the cleaning process for the **Autonomous Planet Cleaner (APC) machine**, we have recognized the immense potential of incorporating a **Proportional-Integral-Derivative (PID)** control algorithm. By implementing PID control, we aim to elevate the level of automation within the APC, allowing it to **autonomously** and **intelligently adjust** its cleaning actions based on real-time **feedback** from its sensors and **environmental conditions**. This advancement not only enhances the APC's cleaning efficiency but also empowers it to adapt seamlessly to varying terrain and waste types, thereby furthering our mission to restore the planet with the utmost effectiveness and sustainability.

Requirement

- If you have **a flow meter** that measures the **flow rate** in the **cleaner hose**, implement PID that makes suction mechanism clean at rate **90 CFM (cubic feet per meter)**
- **(BONUS)** Make this code more general by implementing **class for PID**, and document it using **Doxygen**
-

Output

- (.ino) file added to **Group repo** and it's documentation in **MD**

Appendix

PID:
- [What Is PID Control? | Understanding PID Control, Part 1 - YouTube](#)

C++ OOP
- [How to Write a C++ Class - YouTube](#)

Doxygen:
- [Technical Documentation - YouTube](#)

TASK7.3- Hero of Mobility

About

Recognizing the need for **improved mobility and maneuverability** in the ongoing mission to clean and restore the planet, WALL-E and EVE jointly decided to integrate omni wheels into the design of the Autonomous Planet Cleaner (APC). **These omni wheels, renowned for their multidirectional movement** capabilities, promised to revolutionize the APC's mobility, allowing it to navigate diverse and challenging terrains with unprecedented ease and agility. This innovative

upgrade was set to enhance the APC's effectiveness in reaching remote cleanup sites and tackling complex environmental obstacles, further solidifying their commitment to nurturing Earth back to its former glory.
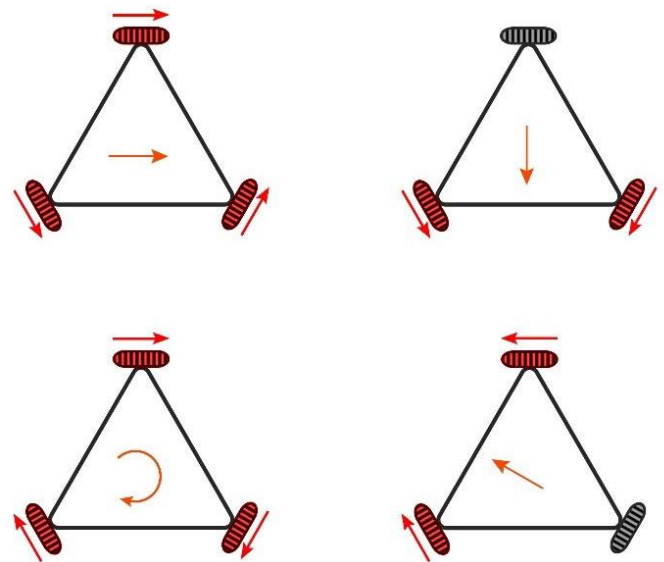
Requirement

- Drive the **Kinematic model** for this wheel configuration
- Create a Python Simulation of the movement of that robot that includes:
  - o Take **(Vx, Vy, omega)** and return the angular velocity on each motor
  - o Drive each motor using a Cytron driver, (assume PWM=RPM)
  - o Create **positional PID Control** that takes the target position and executes an instruction to got to this position
  - o **(BONUS)** Convert from the **local frame** of robot to the **global frame** of the world using a **rotational matrix**
  - o **(BONUS)** Make animation using matplotlib for this simulation

Θ1 = 0

Θ2 = 120
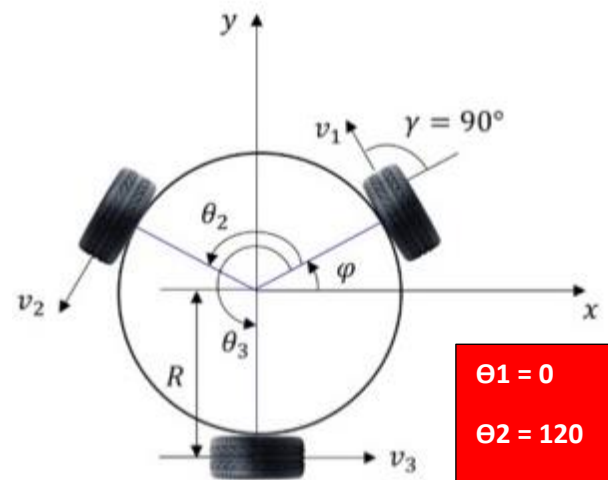
Θ3 = 240

R= 20cm

Output

- (.txt or md) that include derivation of the kinematic model
- (.py) file that includes the simulation

Appendix

Omni-Wheels:
- – (PDF) Three omni-directional wheels control on a mobile robot (researchgate.net)
- – HOWTO Design a 3-Wheels Holonomic Robot: The Theory - YouTube

Kinematics:
- – mod01lec03 - Introduction to Mobile Robot Kinematics - YouTube

Managerial Notes

- Try to use productivity tools such as **Notion** and **Trello** to organize the task
- Use **Kanban board view** to display your status
- Try to exploit **GitHub** to organize and control the tasks efficiently with your Colleagues
- Try to make daily updates on what you reach in your task to make a healthy collaborative group (update could be voice or text)
- It's better to break each task into small sections to be more approachable
- Try to create documentation for your colleagues to increase productivity, (documentation could be text or vlog on what you have done)
- We suggest having a standup meeting to think with each other
- Try to exploit some of the **Agile mindset** to increase collaboration

Appendix

- Agile:
  - [Project Management - YouTube](#)
  - [Agile Management | Google Project Management Certificate - YouTube](#)
- Notion:
  - [Notion - YouTube](#)
  - [Welcome to Notion Projects - YouTube](#)
  - [Notion Projects - YouTube](#)