UNIVERSITY OF PADOVA

DEPARTMENT OF INFORMATION ENGINEERING

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

Robotics & Control 2 (R&C2)

Laurea Magistrale in Control Systems Engineering (II year - I semester)

Angelo Cenedese

Lecture NN – Project presentation

A.Y.2025-26

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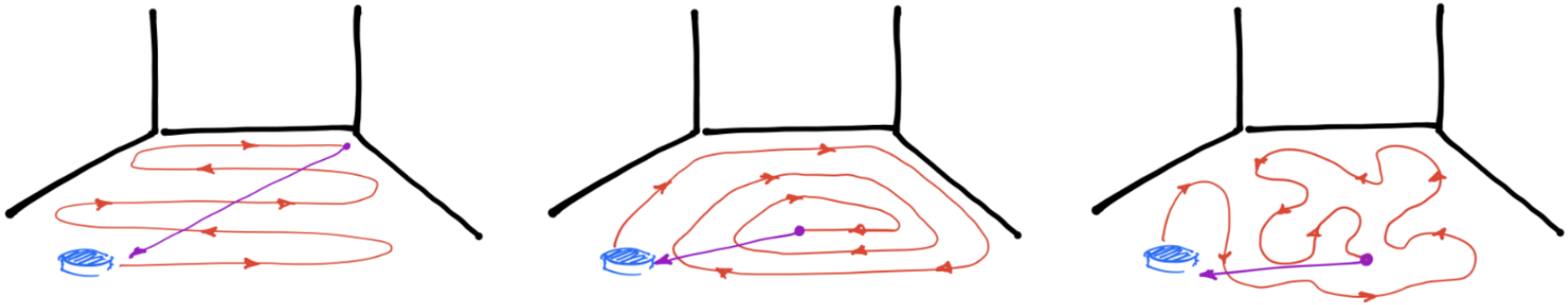
Group14	Bresolin Riccardo	Trubian Lorenzo	Kusal Dilan Gunarathne	

2022 – The "roomba challenge"

- **Problem:** ***A simple mobile robot has to navigate a room environment for a cleaning task and come back to the docking station to recharge***

You will have to deal with the control of a unicycle robot in a room, with:

- **Phase 1:** path tracking task starting from the docking station position.
- **Phase 2:** parking task to the docking station.

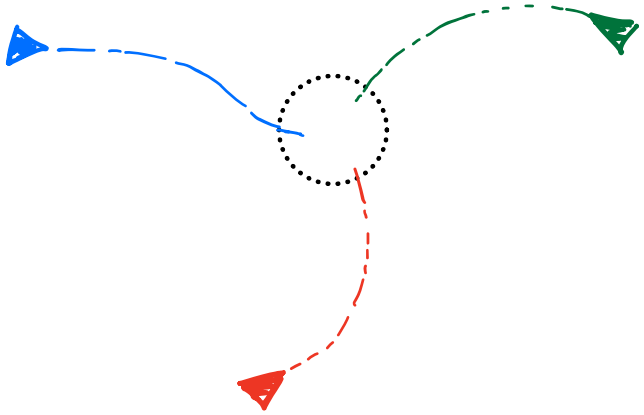


2023 – The "rendez-vous and tracking challenge"

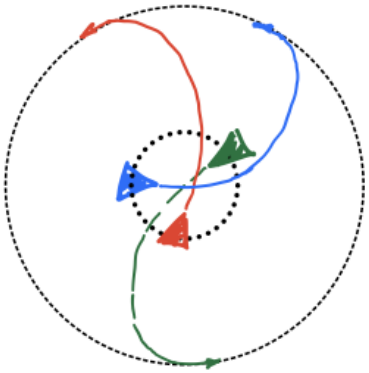
- **Problem:** ***A set of mobile robots have to agree on a rendez-vous position and, when they are in proximity to the rendez-vous point, they start a tracking task on a circular trajectory***

You will have to deal with the control of three unicycle robots in an open space, with:

- **Phase 1:** consensus protocol to solve the rendez-vous problem
- **Phase 2:** regulation task from the initial position to the rendez-vous destination
- **Phase 3:** tracking task along a circular trajectory



(a) Phase 1-2

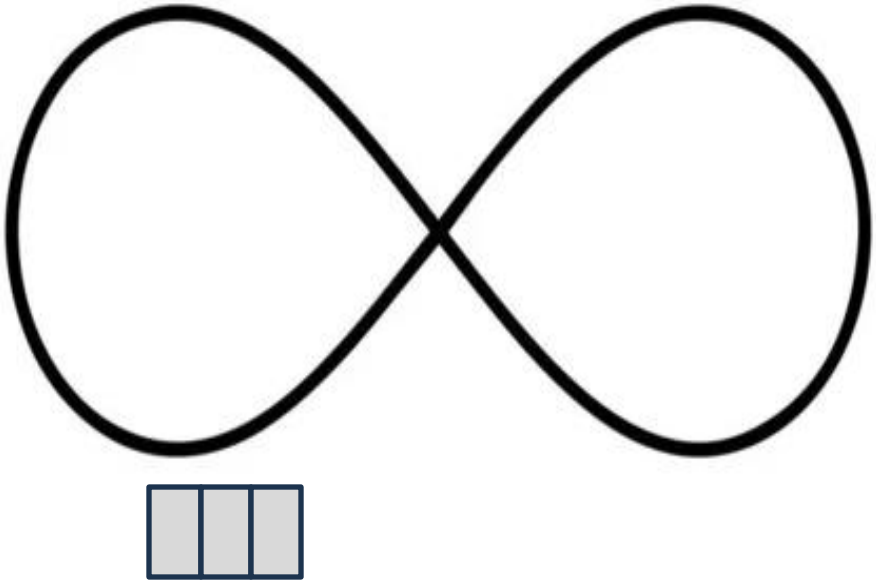


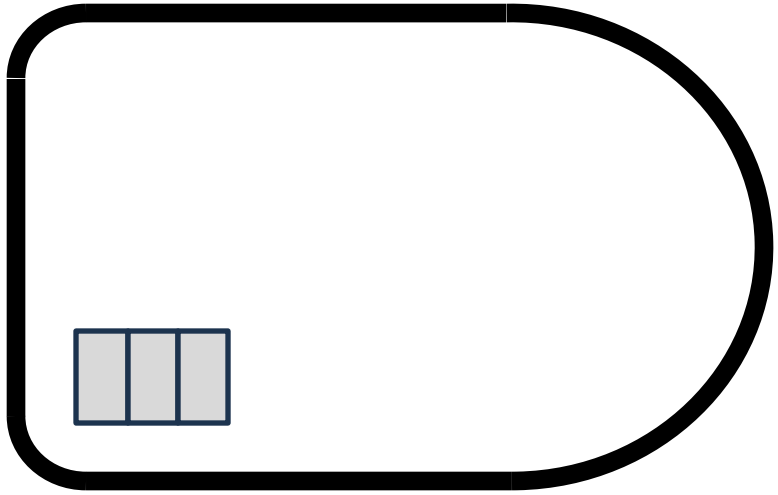
(b) Phase 3

2024 – The “urban mobility challenge”

- **Problem:** ***An AGV has to travel along a closed circuit avoiding the other AGVs that are parked along the path; at the completion of one lap, the AGV has to get off the circuit and park at the box***

  - **Phase 1:** definition of the scenario with choice and characterization of the path (trajectory to be tracked) and positioning of the box



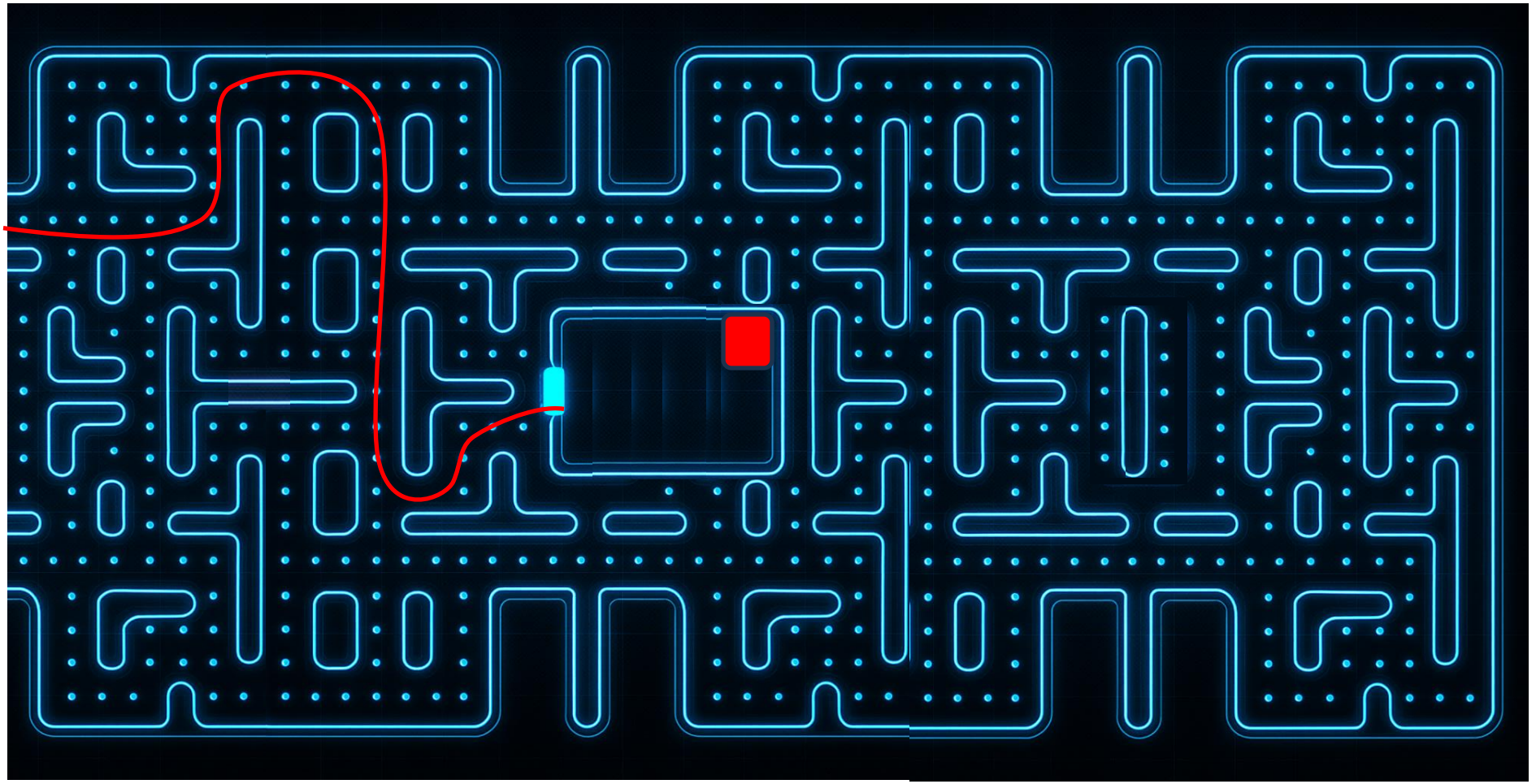


2025 – The “PAC-MAN challenge”

Pac-Man was created in 1979 by Toru Iwatani and first released by Namco in 1980 in the 1980 arcade game.
In the game, the player guides the yellow Pac-Man through a maze to eat all the Pac-Dots while avoiding the four colorful ghosts: Blinky, Pinky, Inky, and Clyde

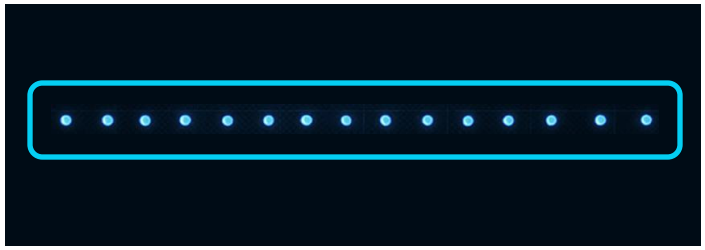
2025 – The "PAC-MAN challenge"

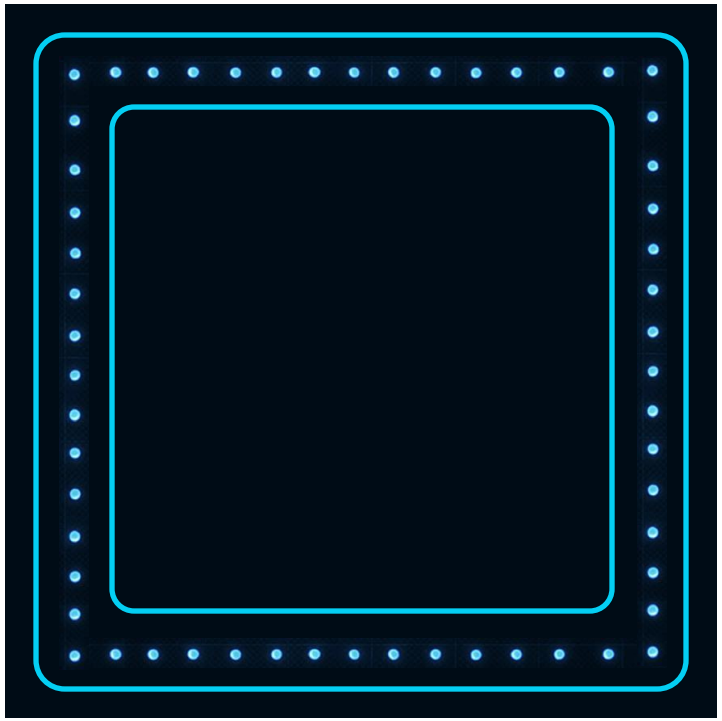
- **Problem:** ***drive PACMAN through the maze to reach a central area, where it has to park in the box***
  - **Phase 1:** definition of the scenario with choice and characterization of the path (trajectory to be tracked) and positioning of the box



2025 – The "PAC-MAN challenge"

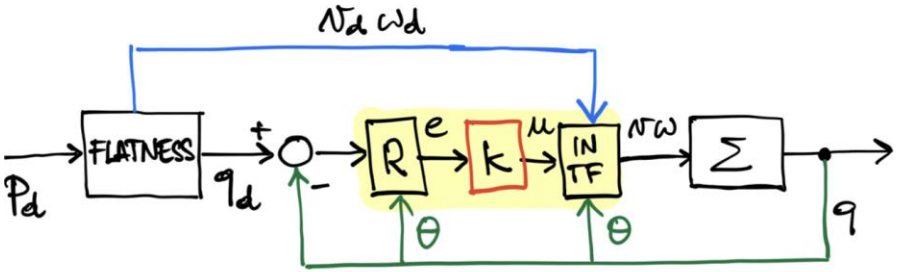
- **Problem:** ***drive PACMAN through the maze to reach a central area, where it has to park in the box***
  - **Phase 2:** definition of the simplified scenarios to perform tuning

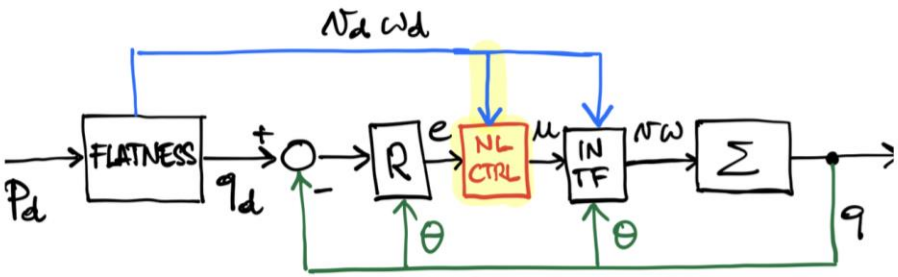


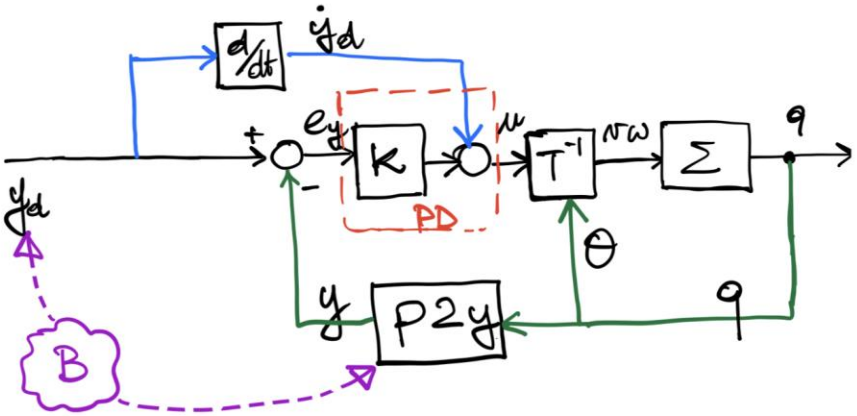


2025 – The "PAC-MAN challenge"

- **Problem:** ***drive PACMAN through the maze to reach a central area, where it has to park in the box***
  - **Phase 3:** tracking task along a closed trajectory

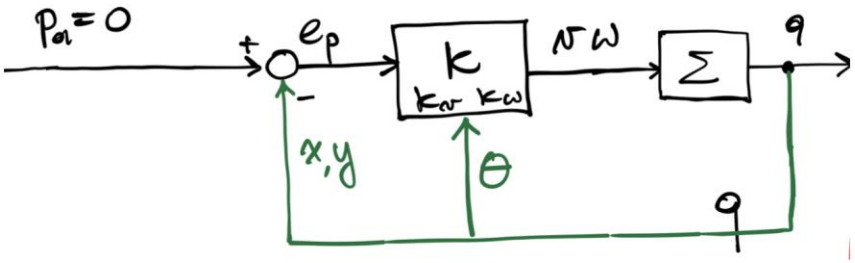


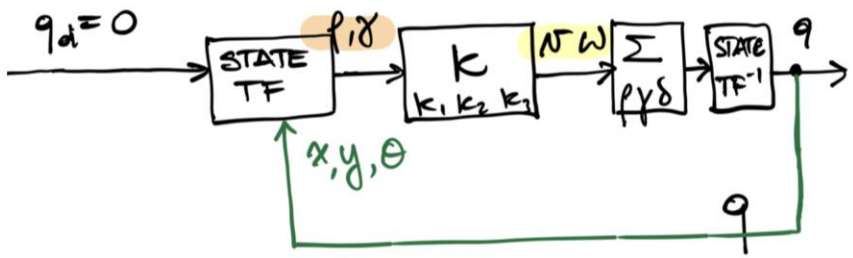


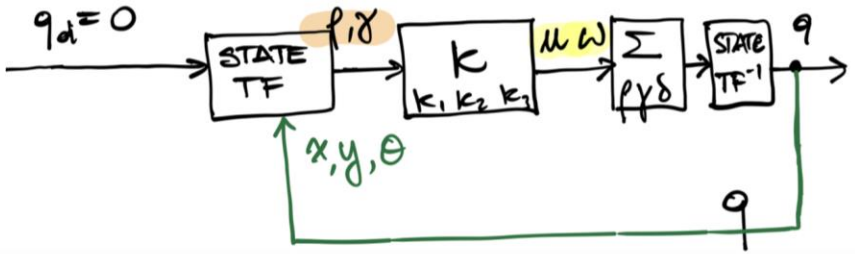


2025 – The "PAC-MAN challenge"

- **Problem:** ***drive PACMAN through the maze to reach a central area, where it has to park in the box***
  - **Phase 4:** regulation task from the trajectory point to the box







Implementation notes:

Patch zero

```
function inputs = fcn(velocities,err)

d = 1/sqrt(2);
a = 10;
vd = velocities(1);
wd = velocities(2);

k1 = 2*d*a;

if abs(vd) < 1e-4
        if vd >= 0
                vd = 1e-4;
        else
                vd = -1e-4;
        end
end

k2 = (a^2 - wd^2)/vd;
k3 = k1;
k = [-k1,0,0;
0,-k2,-k3];


inputs = k*err;
```