Sprint 3 Review

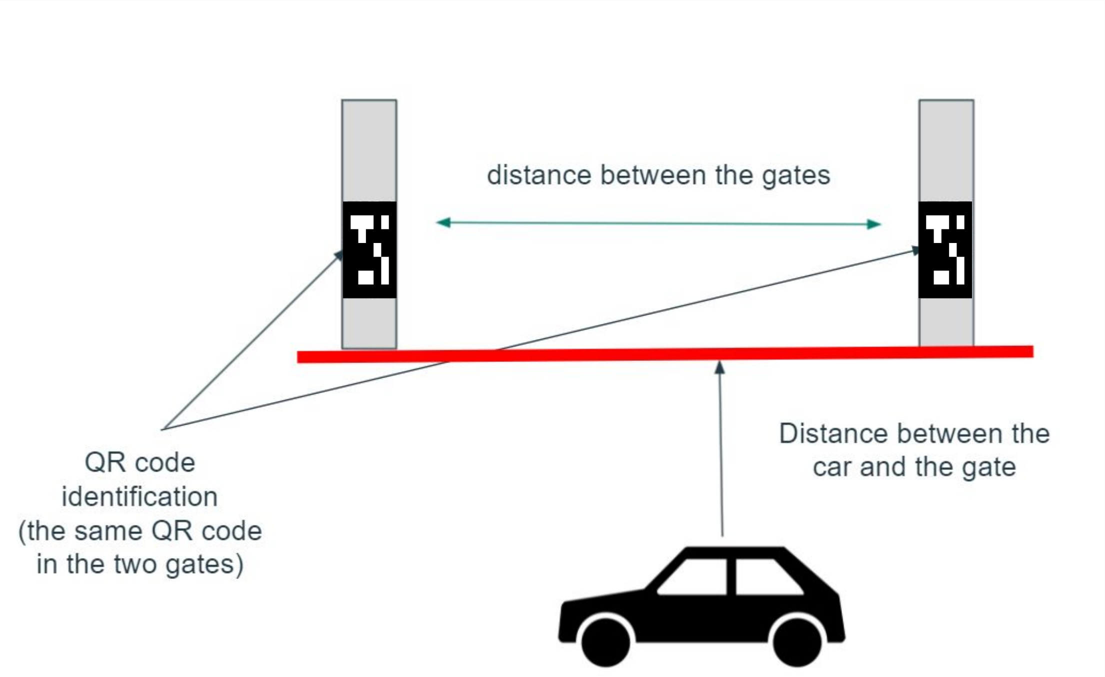
BURTON Nidishlall,
CHOUIYA Asmae,
EL HACHIMI Asmae,
MARTY Axel,
PIQUES Nicolas,
RAMIARA Maxime

Yankee Doodle Pigeon

INSA TOULOUSE

Contents

Reminder of the objectives of the project



Sprint 3

Reminder of the sprint 3 ’s objectives

From sprint 2 :

Communication between the Rasberry and the Nucleo for the remote control

From sprint 3 :

Manual control of the car

Theory about the calculation of the path to a gate at any location

Project organization

- Gate detection using camera :
  - Asmae El Hachimi
  - Maxime Ramiara

- The remote control :
  - Asma Chouiya
  - Axel Marty

- Theory about the calculation of the path to a gate :
  - Nidishlall Burton
  - Asmae El Hachimi
  - Maxime Ramiara
  - Nicolas Piques

- ROS :
  - Nicolas Piques

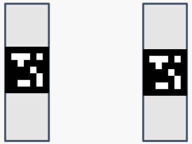
Camera: Gate detection

1) **Gate identification**
2) **QR codes position**
3) Tests
4) Demonstration

<u>Tools used :</u> OpenCV and **Aruco** libraries

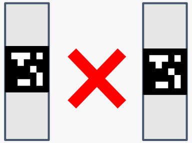
Gate identification :

- Detection of **two identical QR codes**
- Each **pair of QR codes** represents a gate
- Identify the gate with **the right ID**

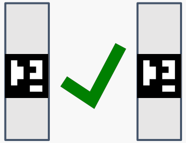


*A gate : **same** QR code !*

"I want to go to warehouse ID 10"



Wrong gate : ID 5



Right gate : ID 10

QR codes position :

- Calculate the **center of each aruco marker**
- Sending back the **position** of the centers
- Calculate **the position of the center** point **between** the aruco codes -> path calculation

Camera: Gate detection

1) Camera calibration
2) Tracking
3) **Tests**
4) **Demonstration**

Demonstration :

- **Camera** connected by USB to the jetson
- **Choice** of a gate
- **Tracking** and differentiation
- **Detection** of the gate and **identifying** it
- Draw a **rectangle** between the gates and draw the **center** of the gate

Acceptance tests :

- <u>Test 1 :</u> Distance of **2 m from the QR code**
- <u>Test 2 :</u> Delay of detection **less than 500 ms**

Remote control mode

Context :

- control the car in emergency cases

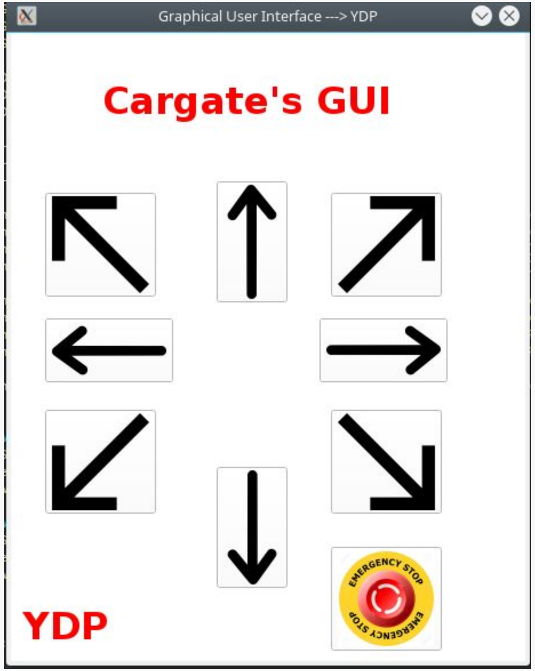
Objectives :

- control the car via the GUI

Remote control mode

1) Context and objectives
2) **GUI**
3) Manual control
4) Tests
5) Demonstration

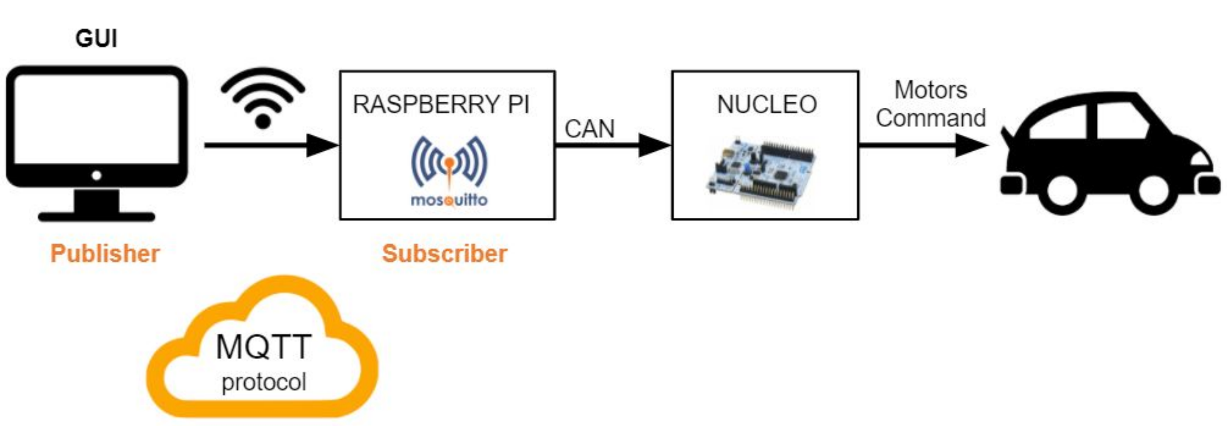
Graphical User Interface



Remote control mode

1) Context and objectives
2) GUI
3) **Manual control**
4) Tests
5) Demonstration

Communication between GUI and the car



Remote control mode

1) Context and objectives
2) GUI
3) Manual control
4) **Tests**
5) **Demonstration**

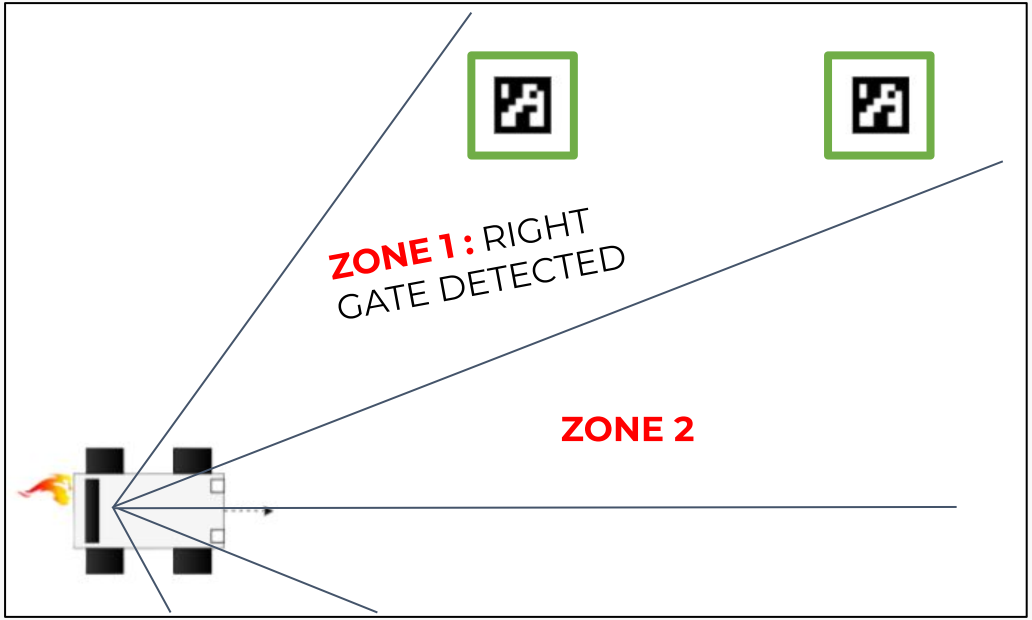
Acceptance tests :

- Test 1 : manual control with a range of **0 to 25 m**
- Test 2 : response time **< 1 s**

Theory of trajectory calculation

1) **Step 1 : QR detection using the camera**
2) Step 2 : Distances control using the Lidar
3) Step 3 : Gate calibration using the camera
4) Step 4 : Gate crossed acknowledgement using the Lidar

Step 1 : QR Code detection using the camera

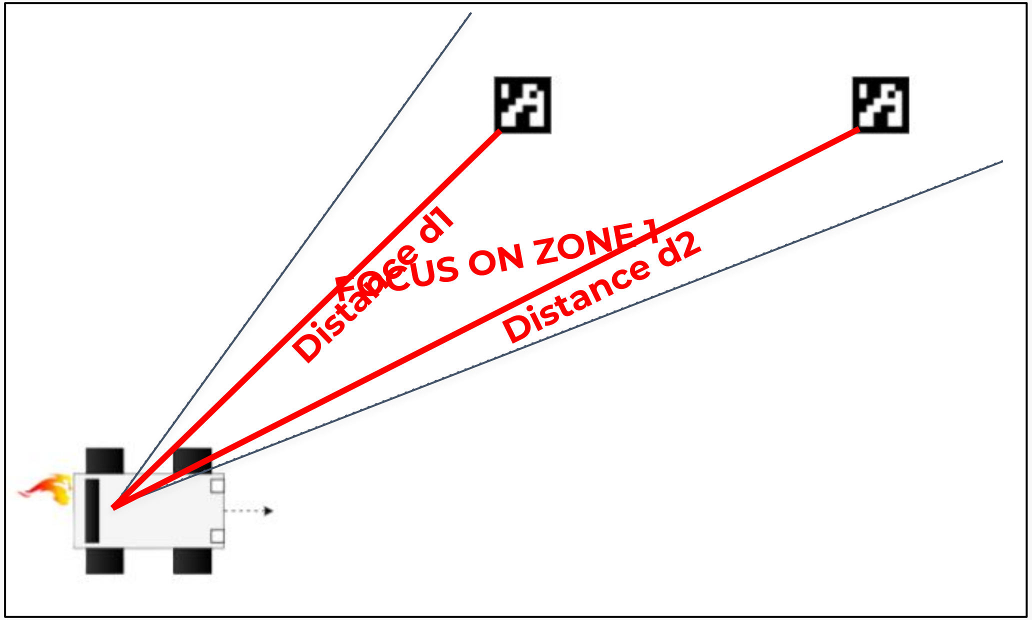


=> The zone of detection will be used for the next step

Theory of trajectory calculation

1) Step 1 : QR detection using the camera
2) **Step 2 : Distances control using the Lidar**
3) Step 3 : Gate calibration using the camera
4) Step 4 : Gate crossed acknowledgement using the Lidar

Step 2 : Distances control using the Lidar



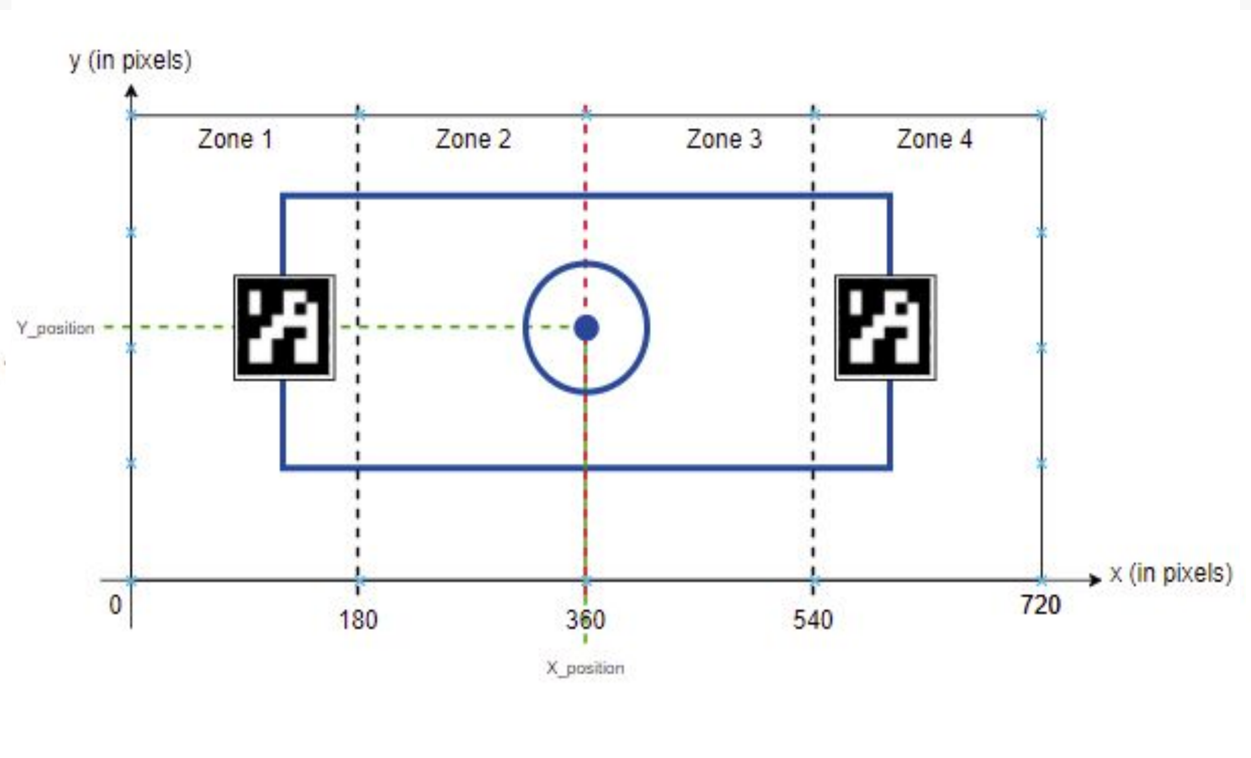
=> distances control : $|d1 - d2| = 0$ (ideal)

- use of a PID controller

Theory of trajectory calculation

1) Step 1 : QR detection using the camera
2) Step 2 : Distances control using the Lidar
3) **Step 3 : Gate calibration using the camera**
4) Step 4 : Gate crossed acknowledgement using the Lidar

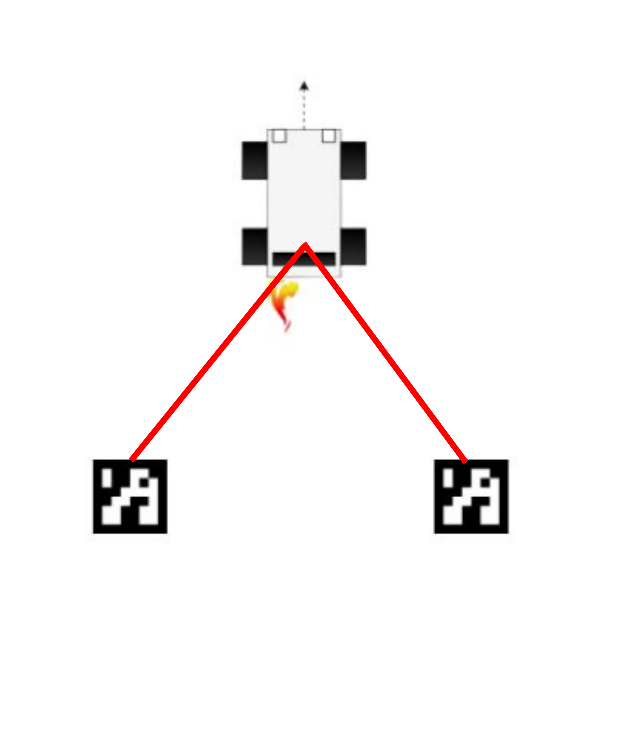
Step 3 : Gate calibration using the camera



Theory of trajectory calculation

1) Step 1 : QR detection using the camera
2) Step 2 : Distances control using the Lidar
3) Step 3 : Gate calibration using the camera
4) **Step 4 : Gate crossed acknowledgement using the Lidar**

Step 4 : Gate crossed acknowledgement using the Lidar



Sprint results

Sprint successes :

- Detection of a gate and get it’s center
- Manual control mode
- Finding theoretical methods for trajectory calculation

Sprint 4

Sprint 4

1) **Sprint 4 ’s objectives**
2) **The planned tasks**
3) Acceptance tests
4) Demonstrations planification

Objectives :

- **Priority 1 :** The calculation of the path to a gate at any location
- **Priority 2 :** Set a priorities management between the autonomous state and the manual state

Tasks :

- Manual control to autonomous control management (Axel Marty, Asma Chouiya)
- Distances control using the Lidar and Gate crossed acknowledgement using the Lidar (Nidishlall Burton, Nicolas Piques)
- Gate calibration and QR Code detection using the camera (Asmae El Hachimi, Maxime Ramiara)

Sprint 4

Test 1: Implement and test by **simulation** the trajectory tracking with **PID** corrector

- **5% of precision** from the center of the gate

Test 2: Manual control during an autonomous movement

- Recovery time **< 500 ms**

Sprint 4

1) Sprint 4 ’s objectives
2) The planned tasks
3) Acceptance tests
4) **Demonstrations planification**

Demonstrations :

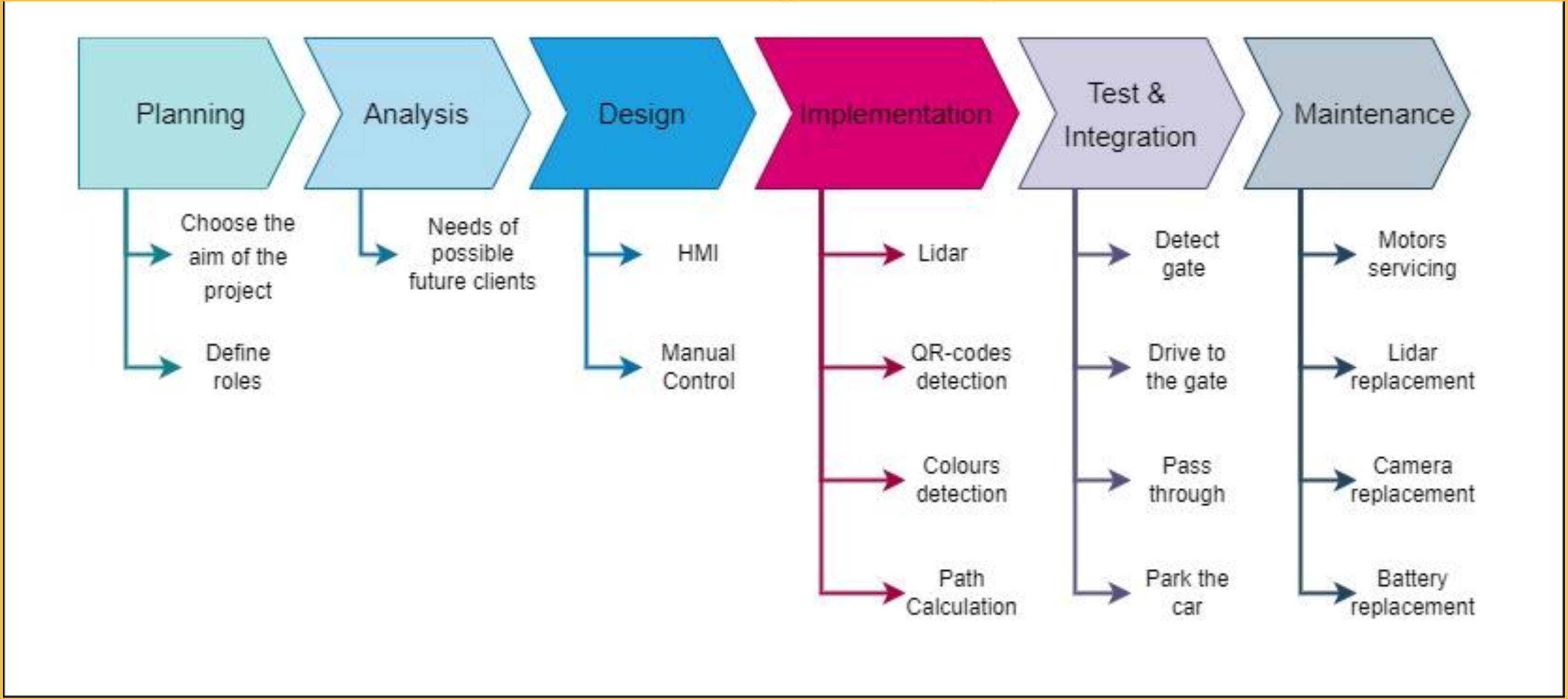
- The car is able to cross a gate in a simple situation (step 3 and 4 will be showcased)
- The car can be manually controlled during an autonomous movement

Sprint 3 :
Risk Assessment and Scrum Master analysis

FMECA

Component	Failure modes	Causes	Effects	Detection	Frequency	Severity	Criticality
GUI	Wifi problem	Long distance between the computer and the raspberry.	Loss of connection to the car.	Unable to move the car	2	6	**12**
LIDAR	Miscalculation of a distance	- Defective equipment - Unknown obstacle	- Path calculation distorted - Unintended car move	- Absurd values into the Jetson program - Absurd path calculation - Variance of data too high	5	3	**15**
CAMERA	Focus problem	-Defective equipment -Presence of dust	-Gate detection impossible	Aruco codes undetectable	2	3	**6**
NUCLEO	Steering problems	Programming errors	- Dysfunction of the remote control - unreliable path following	random moves	5	7	**35**
RASPBERRY	Communication problem with the Jetson and PC	-Defective equipment -Bad contact between Raspberry and Pi Can	-Loss of communication with GUI	Unable to move the car and there is no link between the lidar and the camera	4	5	**20**
JETSON	Communication problem with the sensors	-Defective equipment -Loss of power	Loss of data on Lidar and Camera	Unable to take decision on path calculation	4	5	**20**

Software Development life cycle



Scrum Master Analysis

Team Chemistry :

- **Overbooked :**
  - Reduce Workload
    => reducing the sprint objectives
  - Work on risk assessments instead of practical objectives and demonstrations
- **Excellent working environment :**
  - ability to adapt to new working groups and tasks

Thanks !

Any Questions?