ECE
ÉCOLE D'INGÉNIEURS
ENGINEERING SCHOOL

Challenge UTAC

ECE Paris

Open test : Collision avoidance

UTAC

Table of contents

1- Team presentation
2- Context
3- Goals
4- Initial condition
5- Conception
6- Development
7- Results
8- Final state
9- Perspectives

1- Team presentation

Guy MBOSSO MBOSSO - Embedded systems student

Jae Yun JUN KIM - Mentor

Naila BOUCHEMAL - Mentor

Olivier CHESNAIS - Supervisor

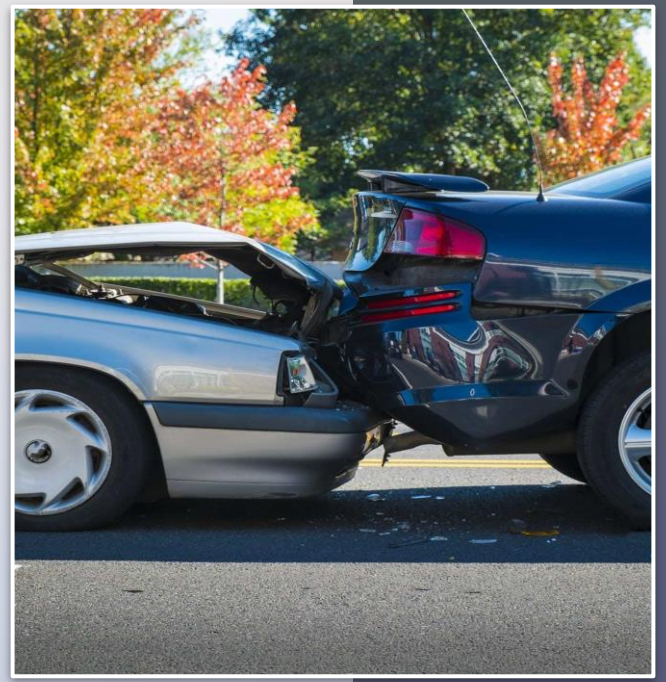
Luc BOURGEOIS - Expert

2- Context

Rate of rear collision is around 29%

Project for road security

Autonomous vehicle and security



3- Goals

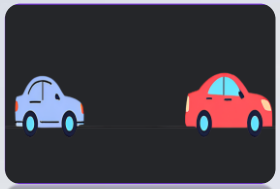
- Create a simulation environment to simulate a sudden braking situation
- Design an automatic braking system to avoid a collision when braking hard.
- Measure vehicle reaction time under different conditions
- Speed control recommendation system, considering vehicle speeds, inter-vehicular distance, and weather conditions

4- Initial condition

This project has not inherited any previous work.

Information research

Safety distance



Coulomb friction

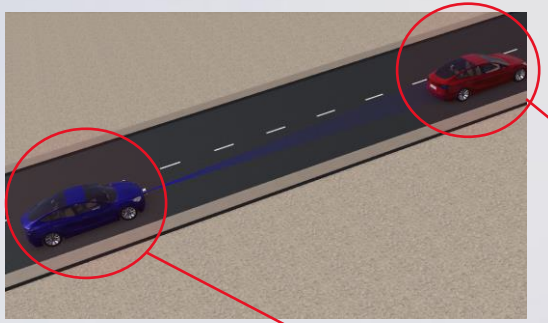
Speed limitation

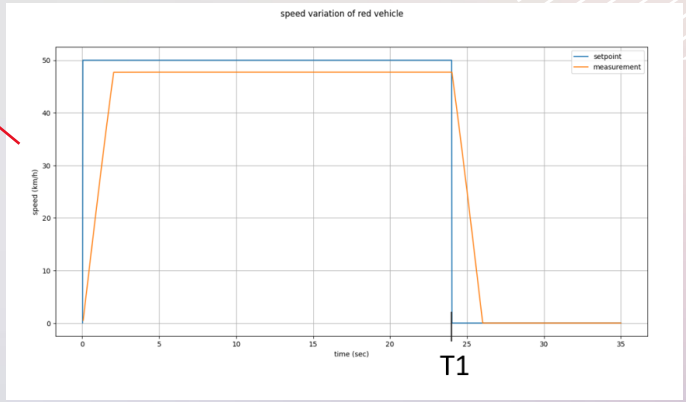
5- Conception

Reaction time

$Tr1 = T2 - T1$

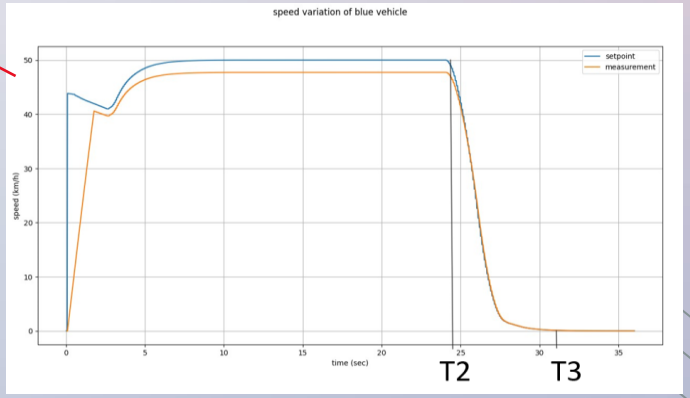
$Tr2 = T3 - T2$





Control law

$$V_{control} = V_{initial} - k_p . (D - d_{measured})$$



Braking condition

$$d_{measured} < \frac{\text{safety distance}}{2}$$

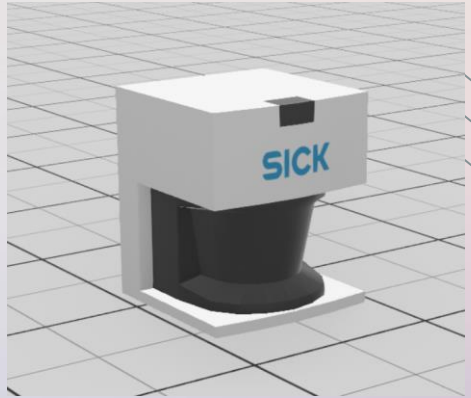
6- Development

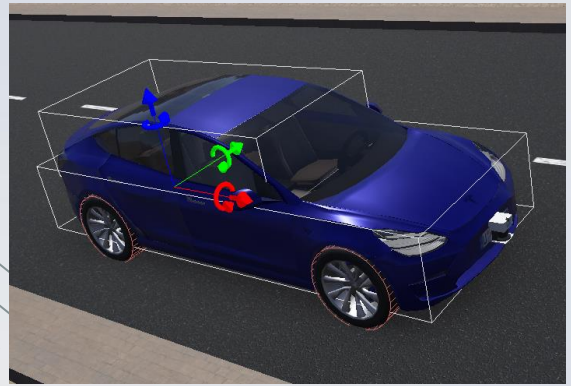
Tools

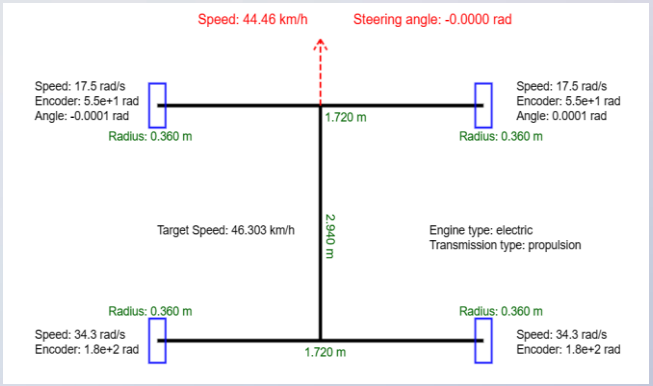
- Webots
- Lidar SICK LMS 291
- Python
- ODE (Open Dynamic Engine)

Lidar characteristics

1 layer lidar
Range: up to 80 m
View: up to 180 degrees

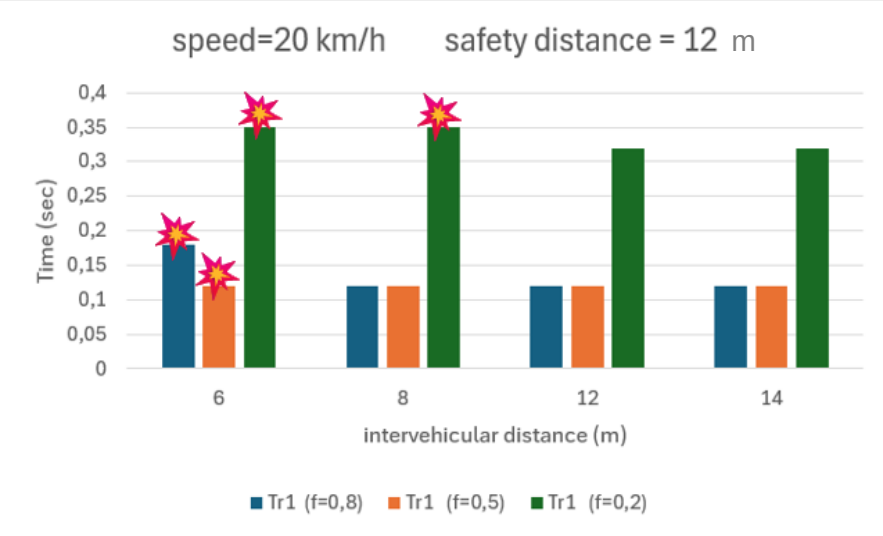




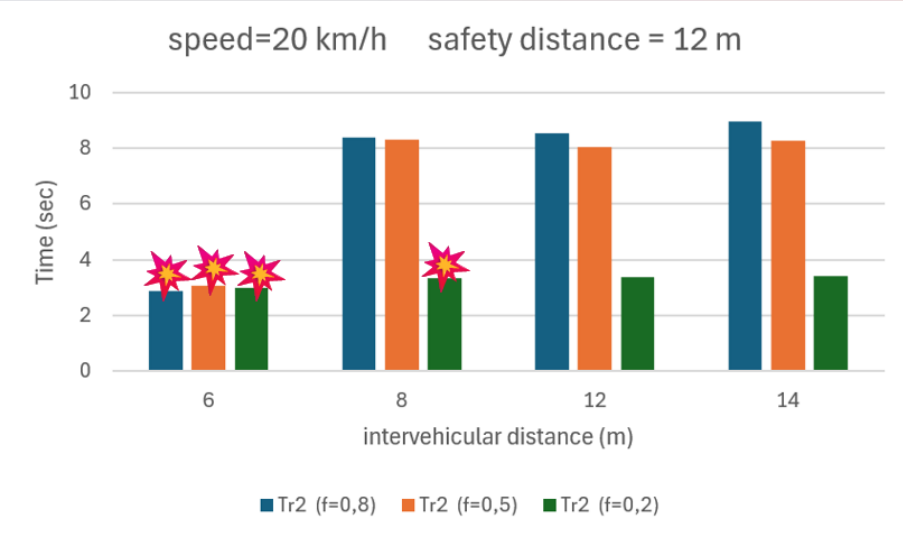


7- Results

Tr1 measurement



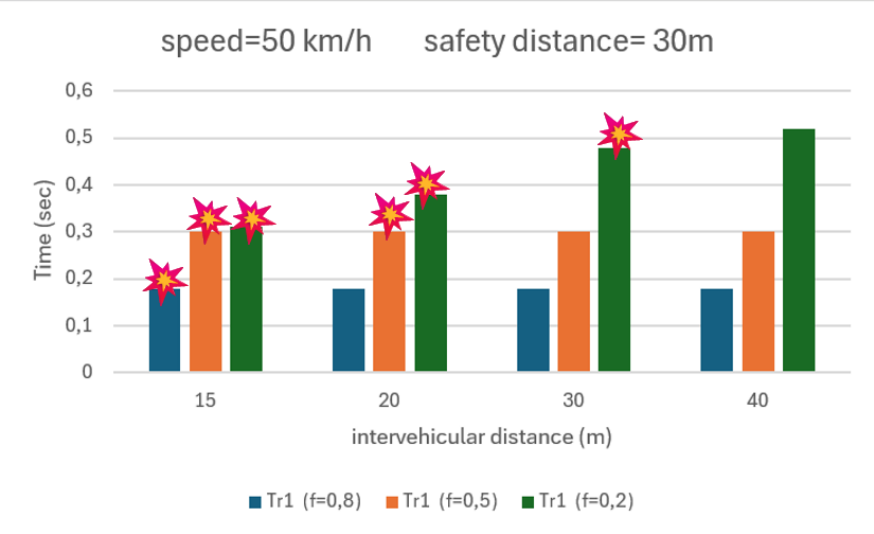
Tr2 measurement



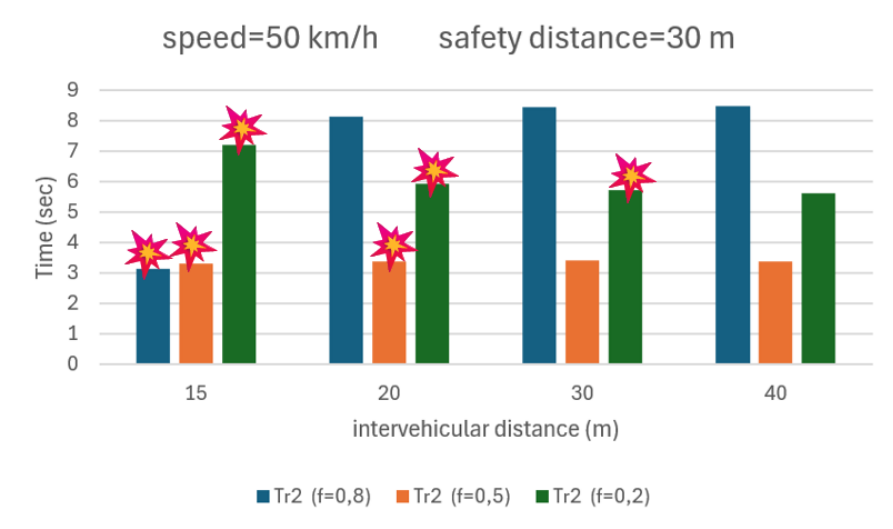
: Collision
: f = 0,8
: f = 0,5
: f = 0,2

7- Results

Tr1 measurement



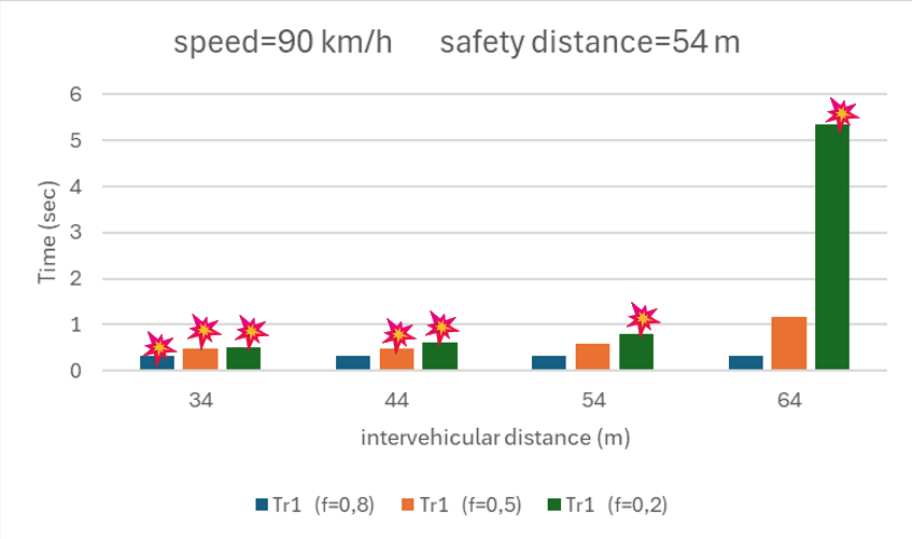
Tr2 measurement



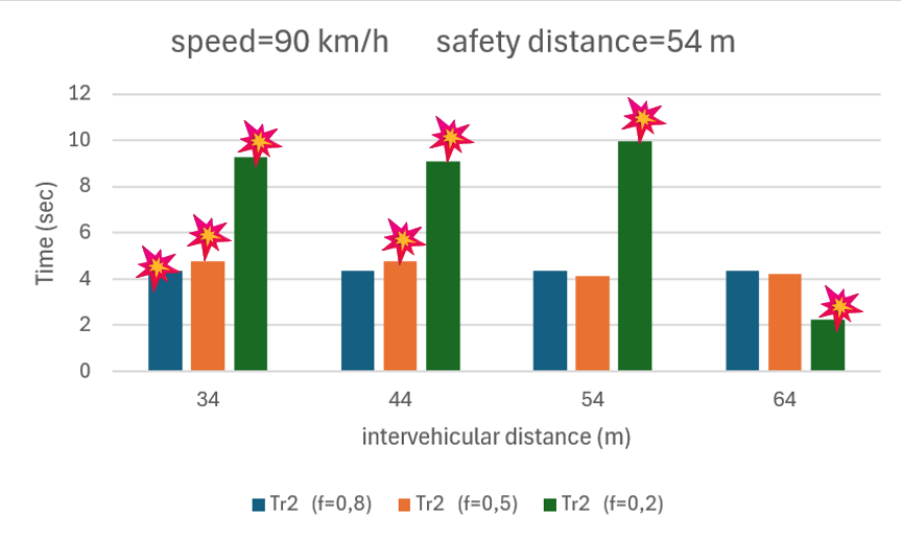
: Collision
: f = 0,8
: f = 0,5
: f = 0,2

7- Results

Tr1 measurement



Tr2 measurement



: Collision
: f = 0,8
: f = 0,5
: f = 0,2

8- Final state

- Simulation allowing to observe a braking scenario in various conditions
- Measurement of vehicle reaction time under different conditions
- Functional automatic braking system
- Recommendation system for autonomous vehicles

9- Perspectives

- Improving vehicle perception
- Consider other scenarios, such as changing lanes
- Use of more sophisticated controllers

Thank you !