INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

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Smart Connected Car

Innovative Project
5 ISS - 2021

INNOVATIVE SMART SYSTEMS

Introduction & Context

Some **problems** related to changing cars on a regular basis :

- Making a car costs **a lot of Energy**.
- Changing cars can have a **significant cost**.

How to keep one's car longer, without being deprived of the options available to the new generations of autonomous cars, that are beginning to arrive on the market ?

Our Solution

Design a kit to transform old cars into smart connected cars.

Market Study & Specification

KIT **Adaptable** & **Ergonomic**

Line Assist

Environmental impact

Road sign recognition

Various sensors

Driving Environmental Analysis

Comfort & Security

Air Quality Index :
Carbon monoxide **CO**

Température = 23 ° and 25 ° C

Humidity = 40% and 60%

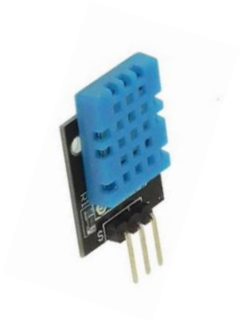
Driving Environmental Analysis

DHT11 : Humidity & temperature

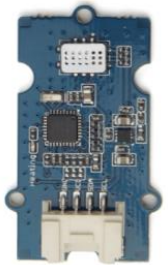
MQ2 : Smoke , CO etc..

Groove Multi-channel gas Sensor (I2C)

ESP32 : BLE cp needs I2C protocol

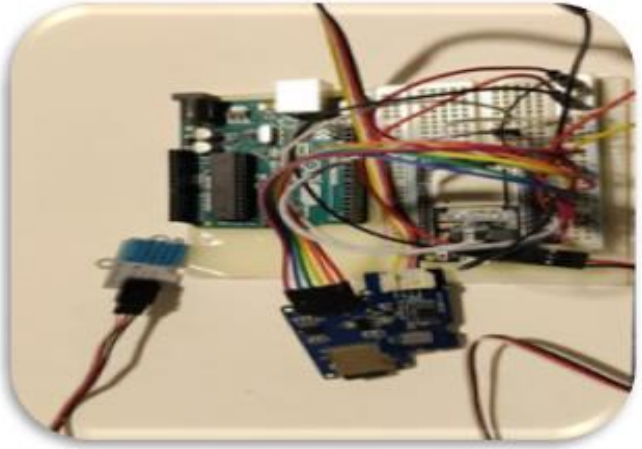


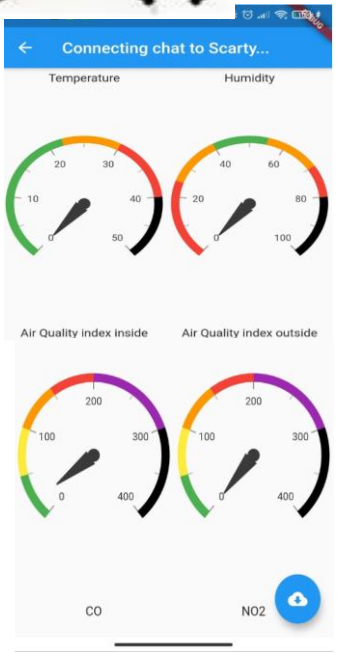
we don't use it.
-Delay in the delivery of BM



Driving Environmental Analysis

IDE

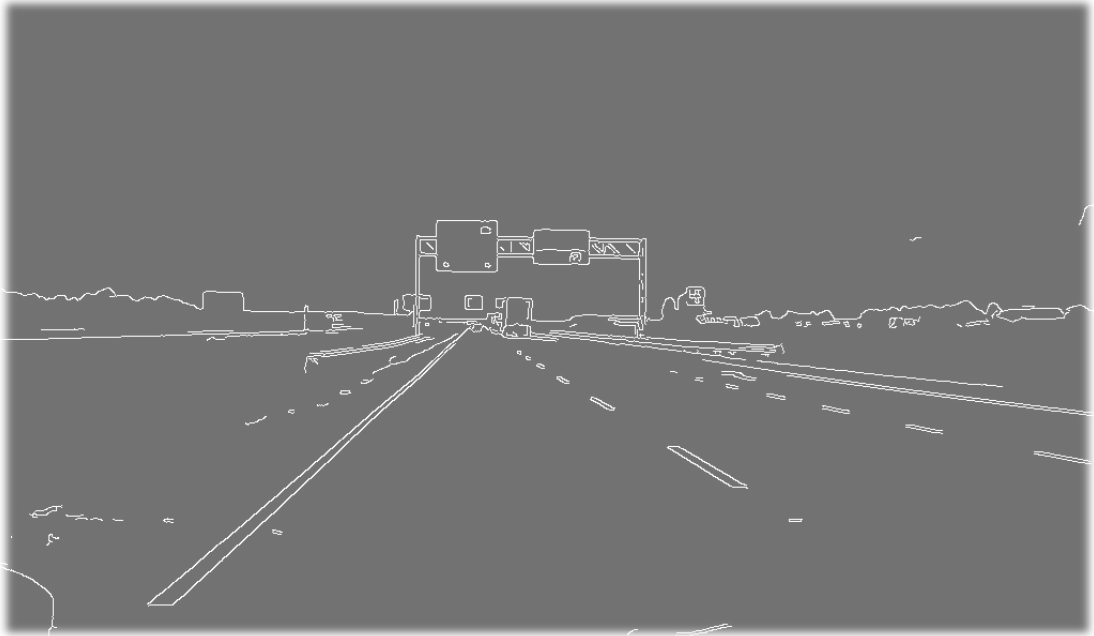




Possible future improvement

Lign Assist Algorithm

How to allow the driver to refocus on the road when he turns too much on one side from his way ?



Our Solution

Define the outlines of an image with the help of the luminosity difference between two pixels and detect the lines.

Image Processing for **Line Assist**
TOOL BOX

```
capteur1=cv2.Canny(gray1, th1, th2)
```

spyder OpenCV python

Lign Assist Algorithm

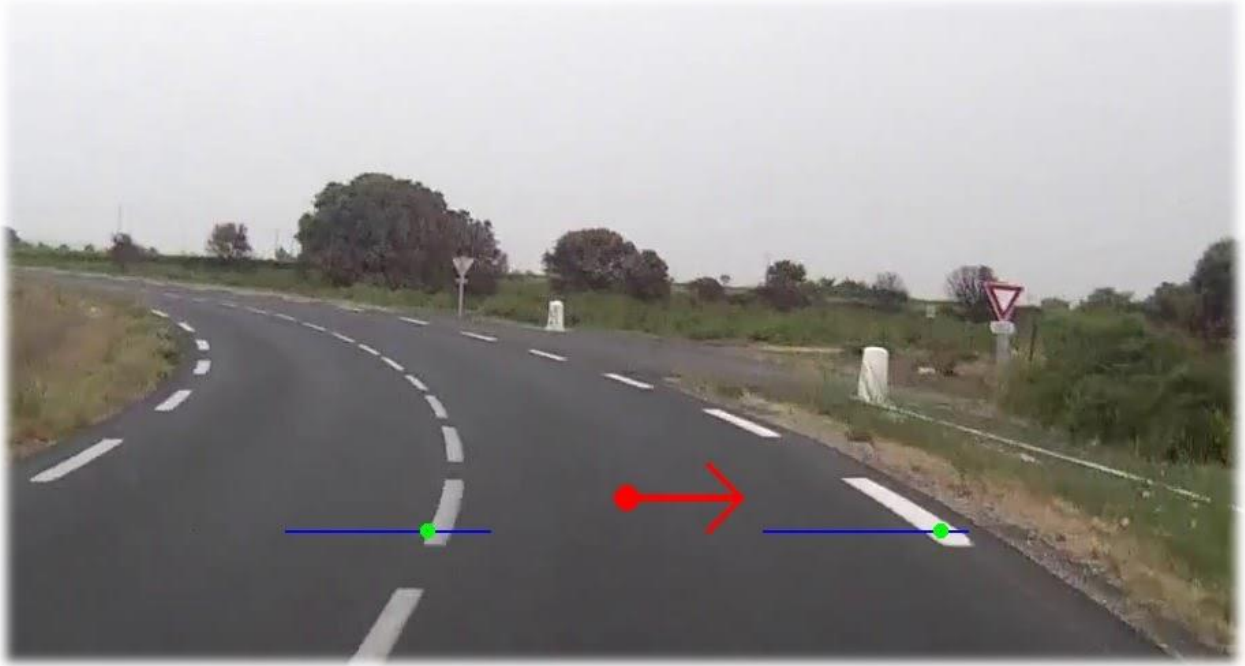
Two detection areas : one to the left of the screen and another to the right.

To detect the presence of an outline or not.

Lign Assist Algorithm

Arrow : on the center of the screen

To tell to the driver to shift on one side of the road.



Lign Assist Algorithm

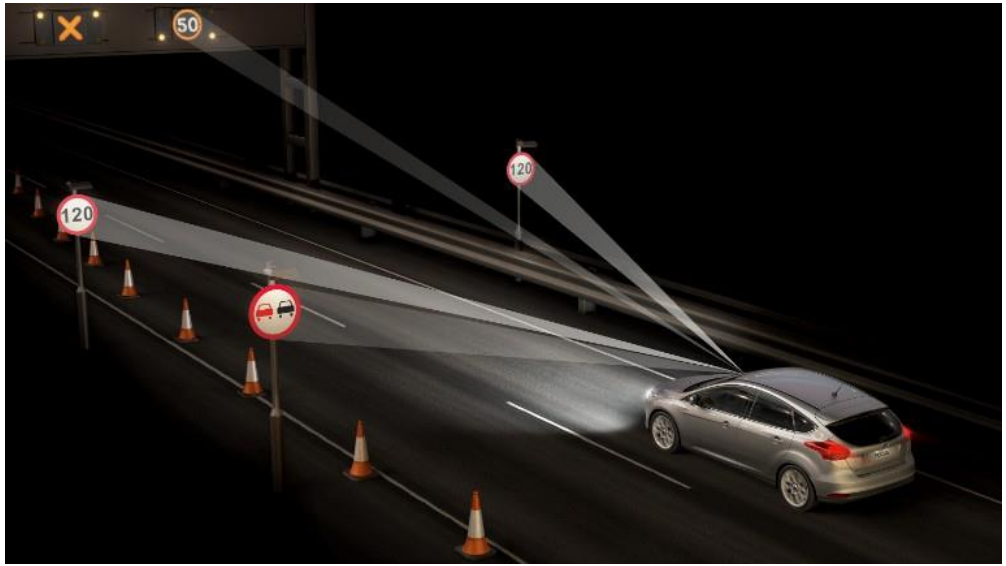
Test on video streams

The results are quite conclusive with by night and with bad weather too.

INNOVATIVE SMART SYSTEMS

Traffic Sign Detection Algorithm

How to provide the driver with simplified access to information on the road ?



Our Solution

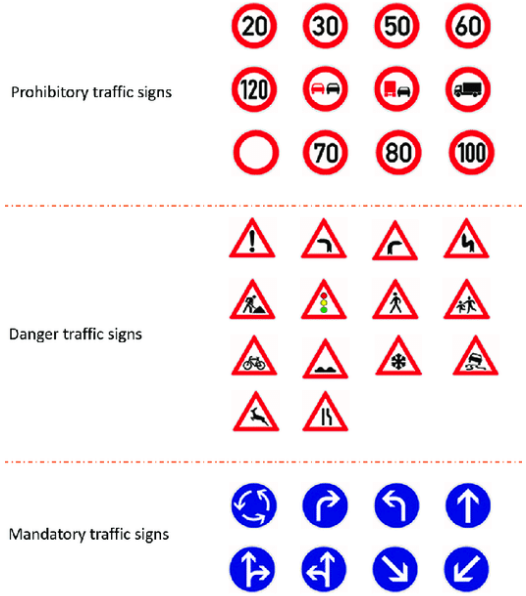
Deploy a neural network trained to detect and recognize road signs to warn of upcoming dangers or rule changes.

Image Processing for **Traffic Signs Detection**
TOOL BOX

Traffic Sign Detection Algorithm

Get a dataset

GTSDB (900 images, up to 6 signs/image 3 categories)



model	mAP	parameters	flops	memory_mb	total_exec_millis
Faster R-CNN Resnet 50	91.52	43337242	533575386662	5256.454615	104.0363553
Faster R-CNN Resnet 101	95.08	62381593	625779295782	6134.705805	123.2729175
Faster R-CNN Inception V2	90.62	12891249	120621363525	2175.206857	58.53338971
Faster R-CNN Inception Resnet V2	95.77	59412281	1837544257834	18250.446008	442.2206796
R-FCN Resnet 101	95.15	64594585	269898731281	3509.75153	85.45207971
SSD Mobilenet	61.64	5572809	2300721483	94.696119	15.14525
SSD Inception V2	66.10	13474849	7594247747	284.512918	23.74428378
YOLO V2	78.83	50588958	62780021160	1318.108256	21.4810122

Get a model

Comparing mAP, Memory, total execution time :

R-FCN Resnet 101

INNOVATIVE SMART SYSTEMS

Traffic Sign Detection Algorithm

Bounding boxes : Around the detected signs

It is written on it the recognized category as well as the percentage of reliability

Mobile Application

Why use a mobile application ?

What is the purpose of the mobile application?

Why Flutter ?

Affordable

Convenient

Easy updates & debug

Compatible

Helpful

Powerful

Native **Hybrid**

Web

Mobile Application

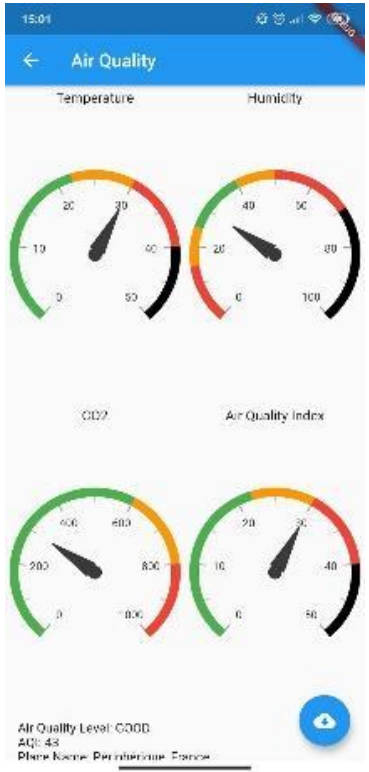
Main **characteristics** :

- Easy to use interface
- Clear colors and buttons
- Easy bluetooth connection
- Built-in hardware use

Missing functionalities

- Data base
- Automated connexion
- Dynamic control

Mobile Application

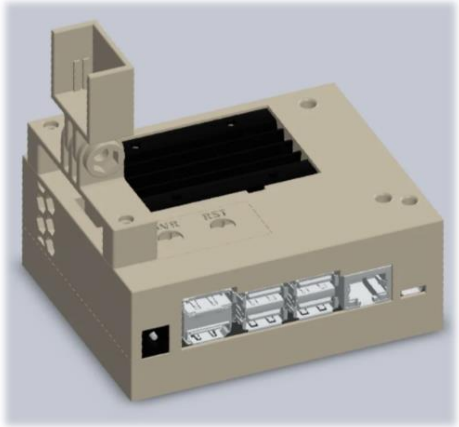


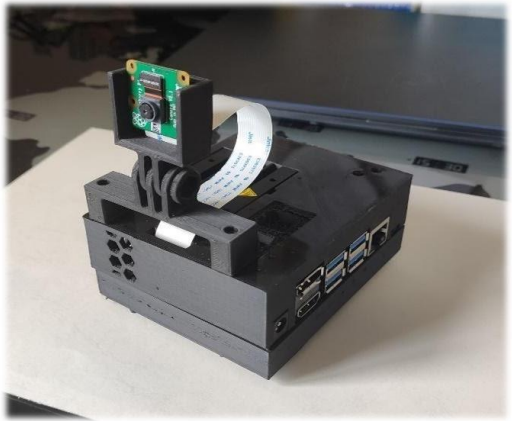
Functionalities

- Air Quality
- Driving Style
- Fuel Consumption
- Parking helper
- Traffic signs *
- Line assist *
- Alert list *
- Settings *

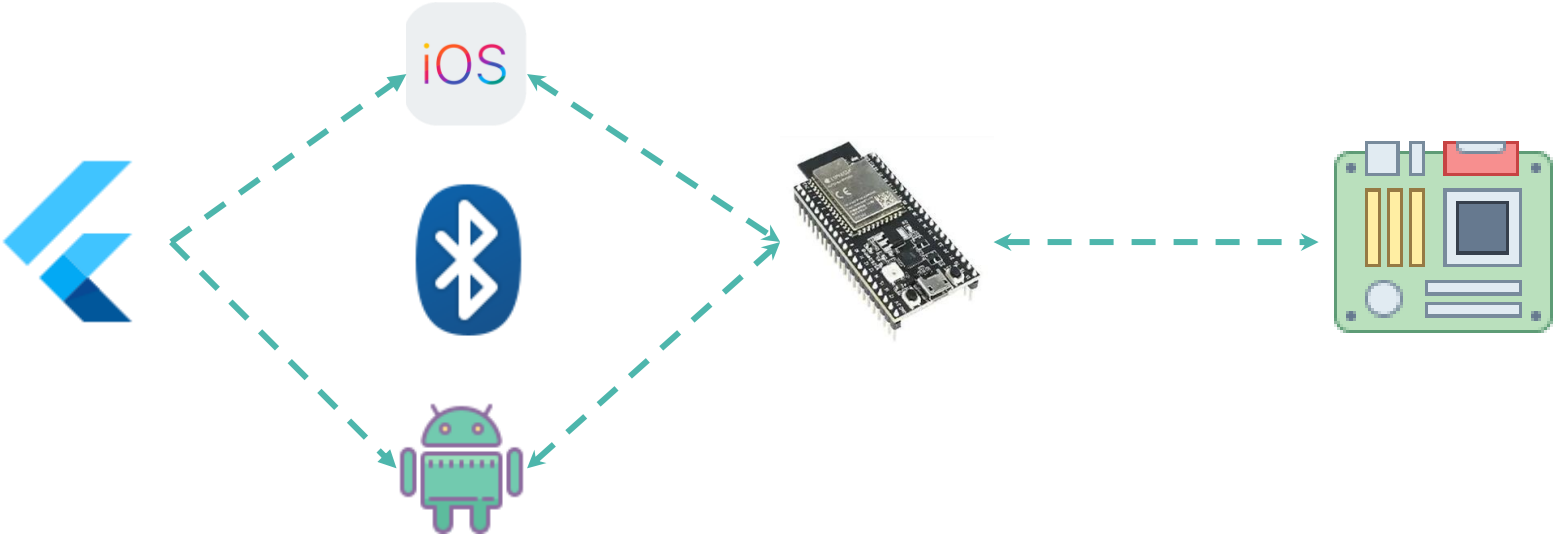
Case

- Practical
- Convenient
- Full Ajustable
- Affordable





Bluetooth communication



Project Management

Progress Management

Adapt to changes and material delays

Problem Management

Loss of a colleague

Team Management

Task repartition according to skills

Conclusion

Thank you for your attention !

Questions ?

GitLab

Demonstration part ...