INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Tricycle Project
Dick Dastardly
Crystal Ball

Review

09/11/2021

-Sprint 1-

Pierre Calmettes
Romain Choulot
Yixia Liu
Gautier Martin
Nikita Mikhin
Valentin Piqueras

Yassine Ariba
Guillaume Auriol
Elodie Chanthery
Barbara Moore
Didier Le Botlan

Presentation plan

- Project Purpose
- Sprint 1
- Camera
- LIDAR
- Tests and performances
- Sprint 2

Project Purpose

A tricycle with multiple integrated sensors and actuators. It is conscious of its surrounding.

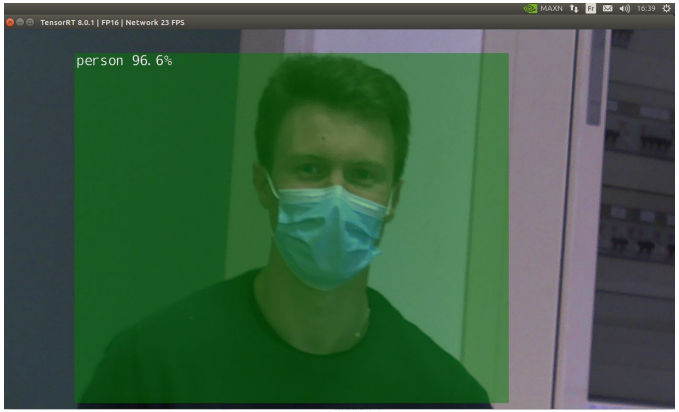
Road Safety + Less stressful driving + Ecological

- Equip a car with sensors and using **AI** algorithms to assist the driver
- **Warn** in case of danger

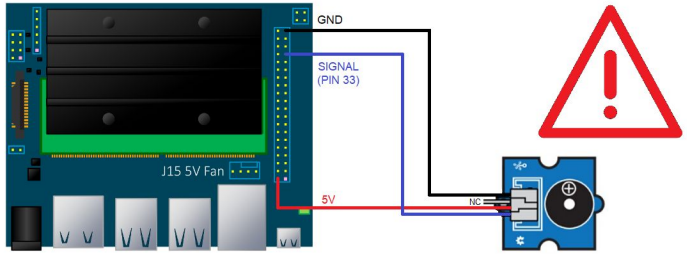
- Identify road signs, people walking on the sidewalk or on the road, cyclists, etc
- Avoid personal injury or material damage
- React faster than humans
- Automation of conditional driving

Sprint 1 (objectives) - Camera

Recognition ?



Raise an alarm !



Find a way to raise an alarm

Find and implement a recognition algorithm on the Jetson Nano

Raise the alarm each time the camera detects a human

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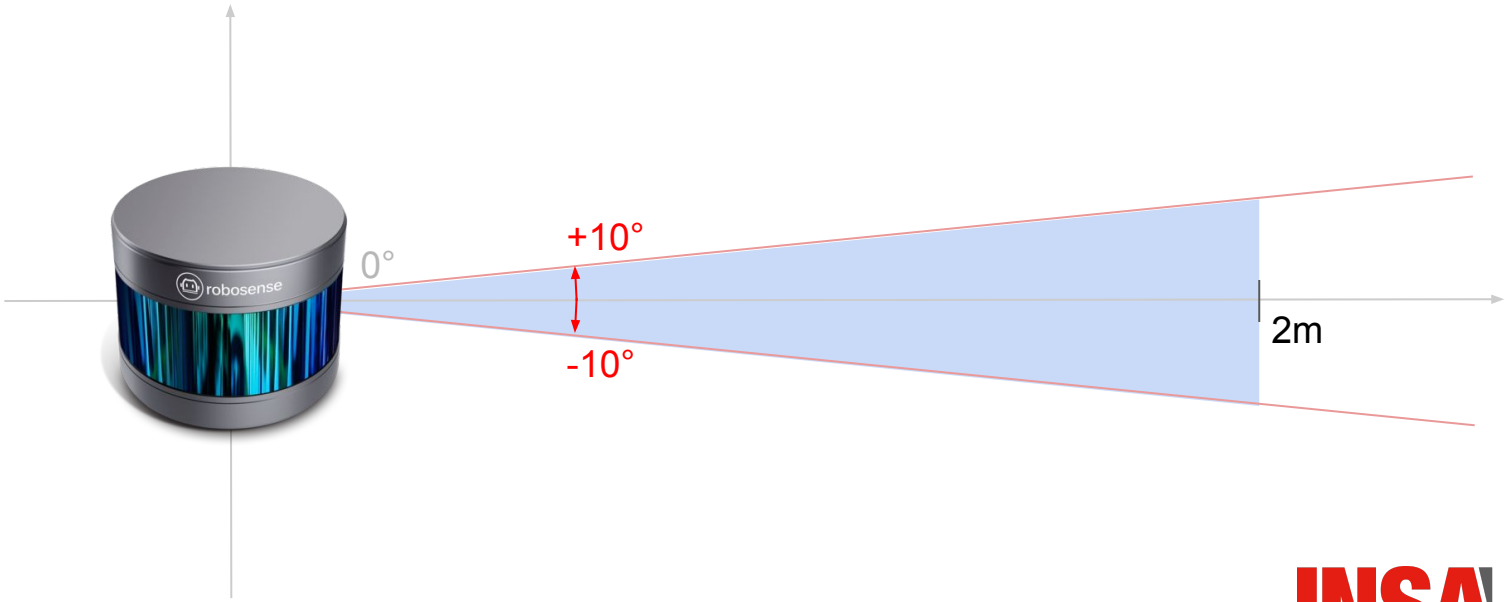
Sprint 1 (objectives) - LIDAR

Detect an object in the blue zone

- azimuth between -10° to +10°
- distance less than 2 m

Print a message (e.g. “object detected”) on the computer screen



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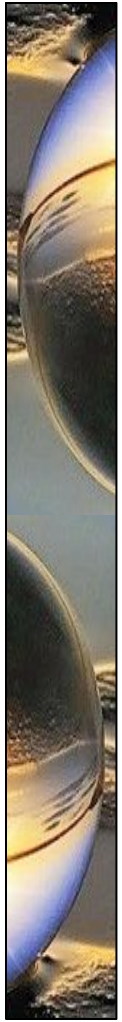
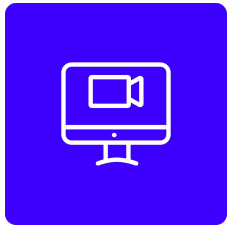


Camera

Stories : Use an AI to detect object and alert if a person is detected

Preliminary work



Display the video output of the camera

Getting started with ROS

Camera

Stories : Use an AI to detect object and alert if a person is detected

Tutorial to use pretrained neural network for computer vision on the Jetson

jetson-inference

Multiple libraries and models to do classification, detection and segmentation on videos and images
Made by Dustin Franklin

jetson-gpio

A Python library that enables the use of Jetson's GPIOs

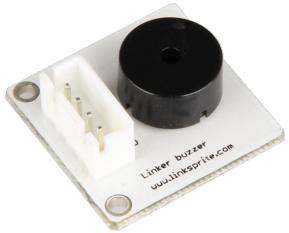
Camera

Stories : Use an AI to detect object and alert if a person is detected

Python Script

DetectNet

Pretrained Neural Network



PWM Buzzer on the GPIO

Documentation on Git (script + README with commands and electronic scheme)

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Camera

DEMO

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Obtention of usable numeric data from the LIDAR

Raw data sent by the sensor

0xffee34c400820e
00830d...

Capturing and identification

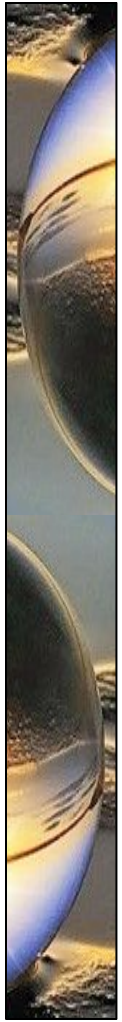
Captured hex data with **identified sections** of azimut, distances and reflectivity for layers (1 to 16)

0xffee34c400820e
00830d...

Transformation in understandable units

Distance (in meters), **Reflectivity** (number out of 255) for an **azimuth** (in degrees)

Azimut : 135.08 °
Distance layer 1 : 1.30 m
Reflectivity layer 1 : 14
Distance layer 2 : 1.31 m
Reflectivity layer 2 : 13
etc...



LIDAR

LIDAR Data analysis

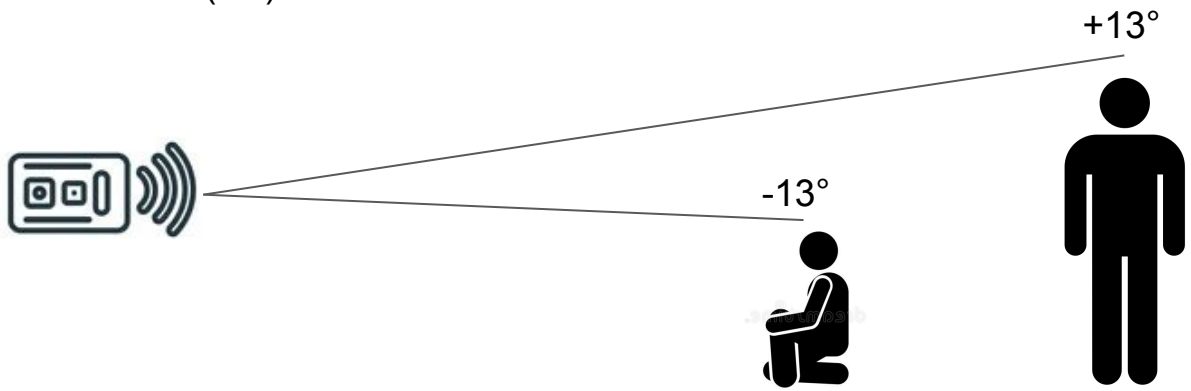
2D array, *tab_distance[channel][azimuth]*

Allows us to have the distance of all the points given by the lidar, which is 360° and 16 channels

tab_distance	Azimuth (°)	0	1	2	3	...	360
Channel		124	98	116	198	...	19
1		87	16	173	23	...	7
2		135	225	107	10	...	112
3		160	33	42	67	...	117
4		202	178	115	105	...	32
5		172	4	110	4	...	201
6		250	109	86	198	...	125
7		35	218	107	86	...	165
8		102	10	181	142	...	164
9		248	151	82	171	...	81
10		89	45	226	211	...	174
11		136	65	83	231	...	99
12		202	141	216	121	...	126
13		34	236	158	229	...	47
14		92	223	161	246	...	182
15		133	128	34	234	...	149
16		74	109	233	114	...	136

LIDAR Data analysis and obstacle detection

The program is able to detect an obstacle and recognize if it is a tall obstacle (adult person) or a short obstacle (kid)

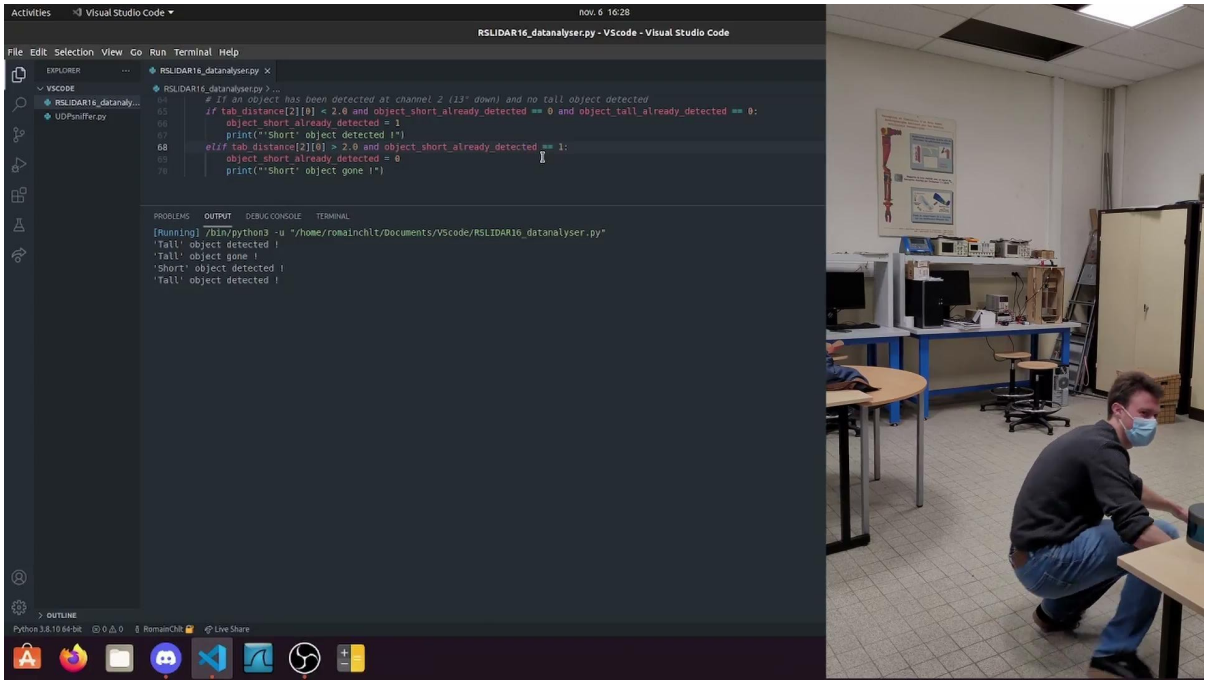


‘Tall’ object : 13° up
‘Short’ object : 13° down

Conditions for detection : distance < 2 m and azimut 0º

LIDAR

DEMO



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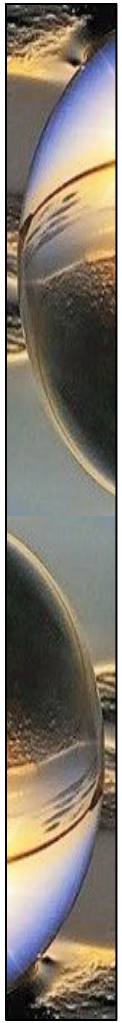


Tests and performances

CAMERA

What we want to know

- Quality of object recognition
- Quantity of objects recognized at the same time

Test

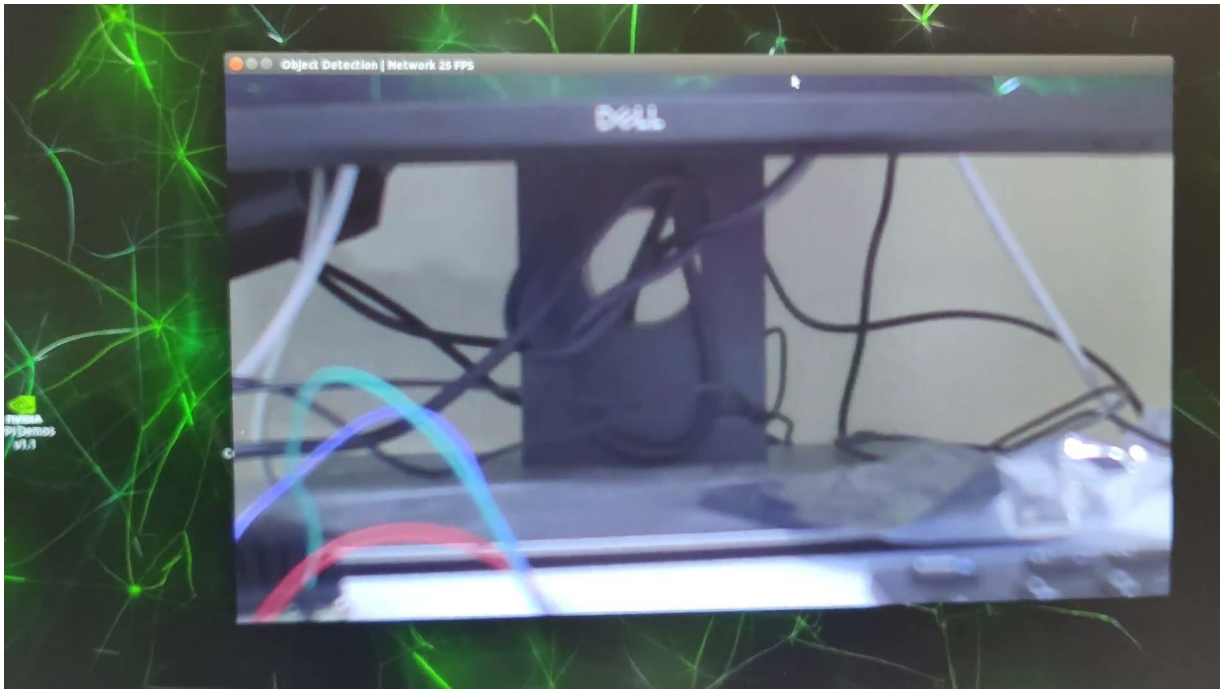
- The camera can recognize the type of an object among various objects
- Alert when detect humain
- Percentage of certainty
- The camera can detect and recognize the whole team and the objects next to it

Performances

- Alert until there is no one left
- Percentage of certainty >95% when the whole body is photographed
- Able to recognize ≥ 6 pers + 1 chair + 1 box
- Mistake of recognition but able to correct itself in 1 second

Tests and performances

CAMERA



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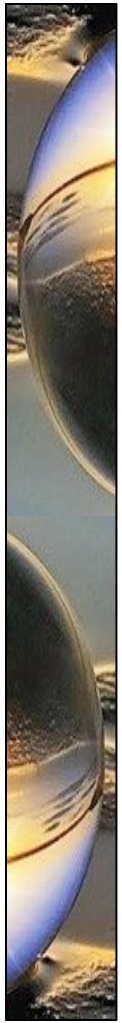


Tests and performances

LIDAR

What we want to know

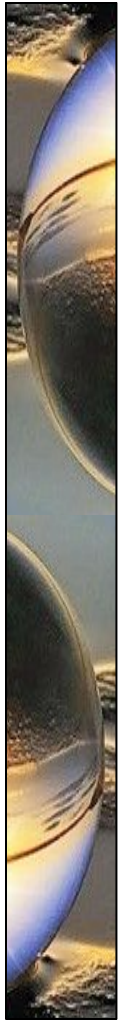
- Distance of an object from the LIDAR at azimuth 0°

Tests

- An array of distance data is generated
- An obstacle in less than 2 meters is detected
- It can be recognized as a short or a tall object

Performances

- Detection time less than 1 second
- Distinction between ‘tall’ (>1.5m) and ‘short’ object (≈ 1m)



Sprint 2

CAMERA

Stories

List everything the algorithm can recognize

Train the algorithm for the missing elements

Eliminate the ‘False Positives’

Use the algorithm in the ROS environment

Tests & Demos : same test as Sprint 1 with ROS, detect the missing elements and avoid false positives

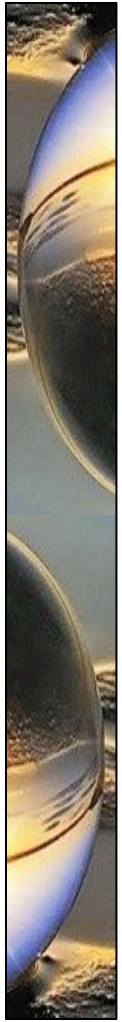
Sprint 2

LIDAR

Stories

- Extend the azimuth to 360°
- Use the LIDAR with the Jetson
- Alarm when an object is detected with a buzzer

Tests & Demos : same test as Sprint 1, but 360° and use the Jetson and a buzzer to print



CONCLUSION

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Thank you for your attention

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