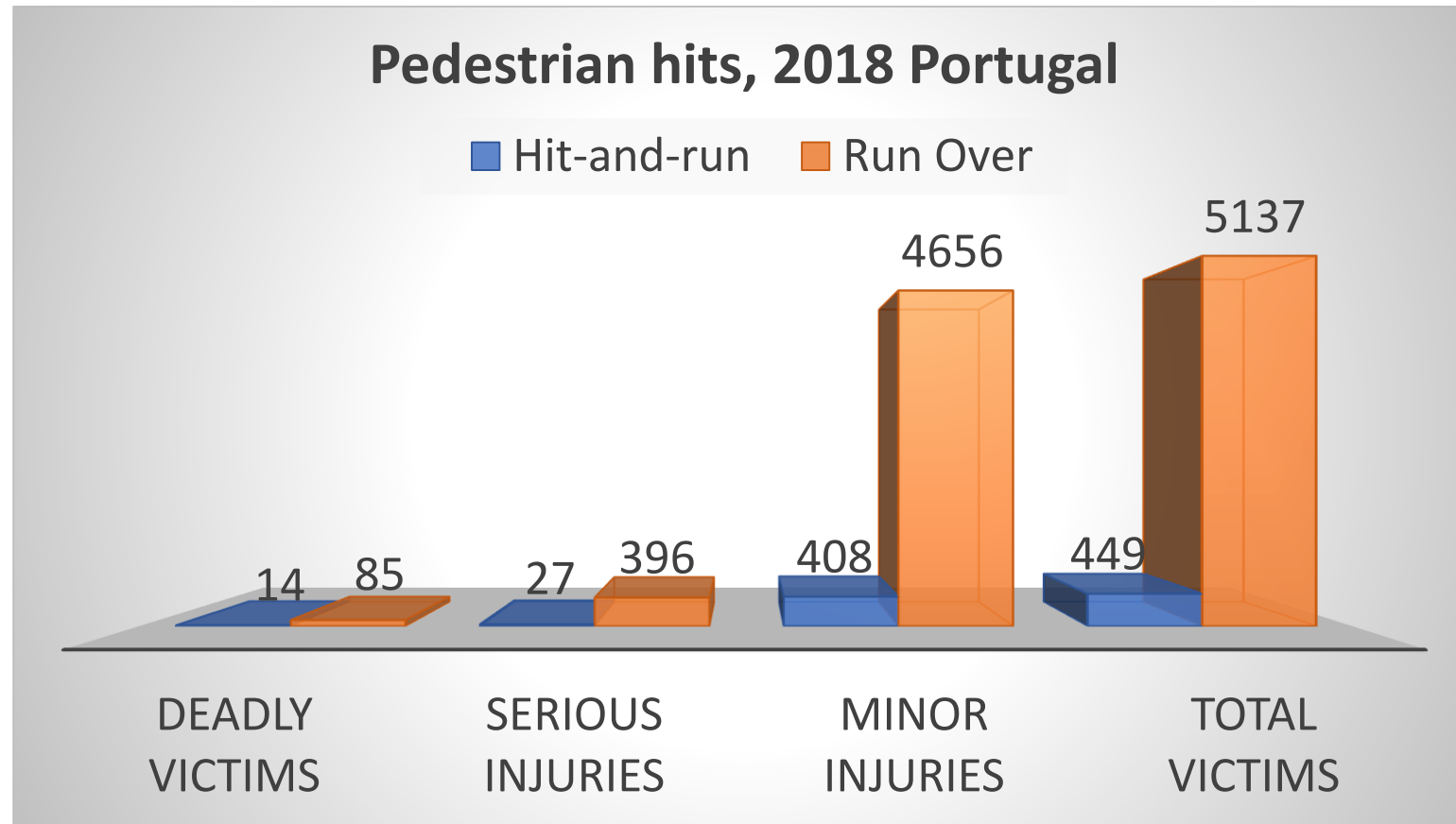# New Generation Pedestrian Crossing

AmiEs'2019
11-14 September, 2019
Coimbra, Portugal

R. Bandeira, J. Fonseca, J. Macedo
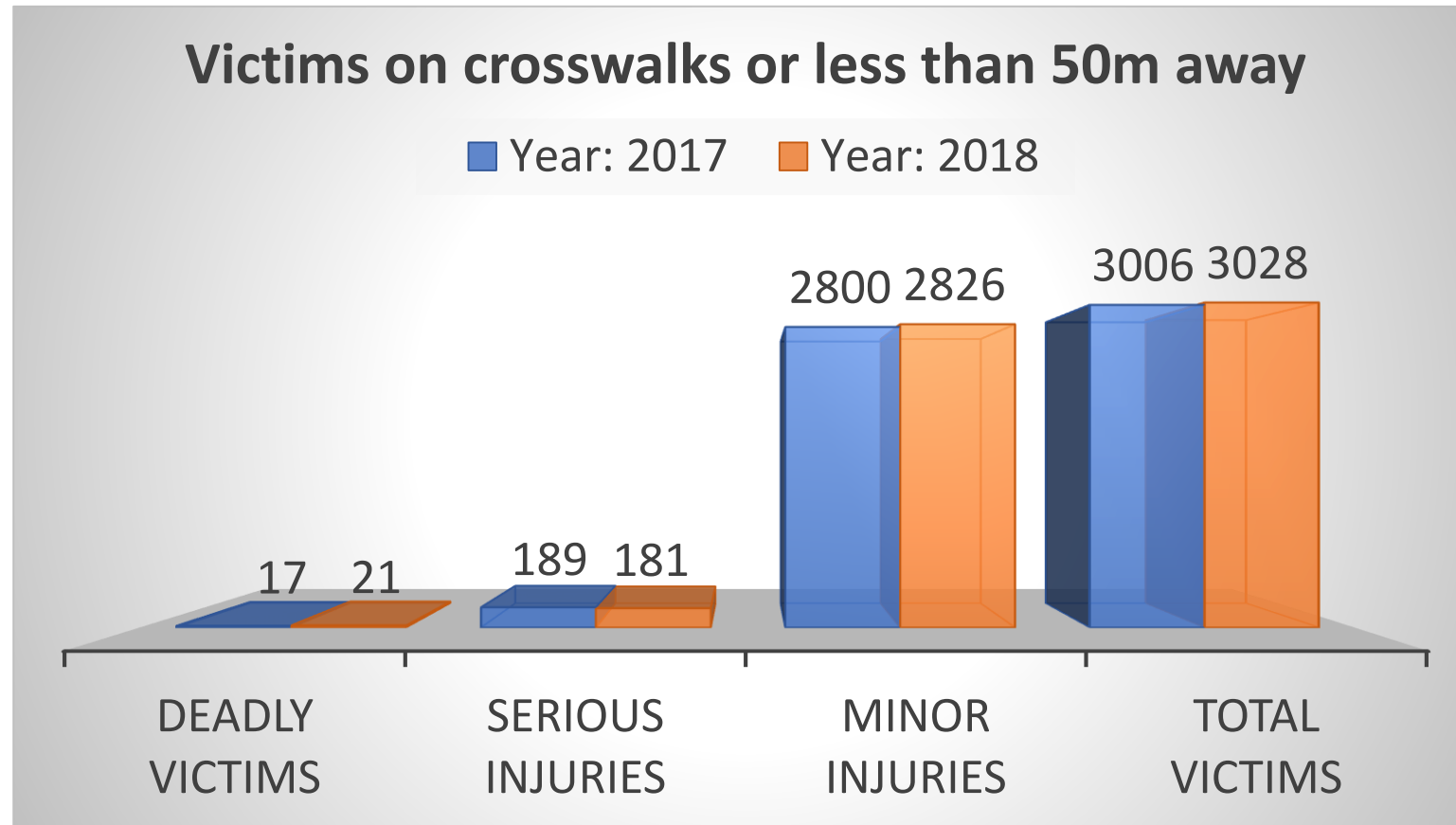
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Motivation

Pedestrian hits, 2018 Portugal

Hit-and-run   Run Over

	Hit-and-run	Run Over
DEADLY VICTIMS	14	85
SERIOUS INJURIES	27	396
MINOR INJURIES	408	4656
TOTAL VICTIMS	449	5137

Data Source: http://www.ansr.pt/Estatisticas/RelatoriosDeSinistralidade/Pages/default.aspx
[accessed: Aug. 07, 2019]

Motivation

Victims on crosswalks or less than 50m away

■ Year: 2017   ■ Year: 2018

	DEADLY VICTIMS	SERIOUS INJURIES	MINOR INJURIES	TOTAL VICTIMS
Year: 2017	17	189	2800	3006
Year: 2018	21	181	2826	3028

Data Source: http://www.ansr.pt/Estatisticas/RelatoriosDeSinistralidade/Pages/default.aspx
[accessed: Aug. 07, 2019]

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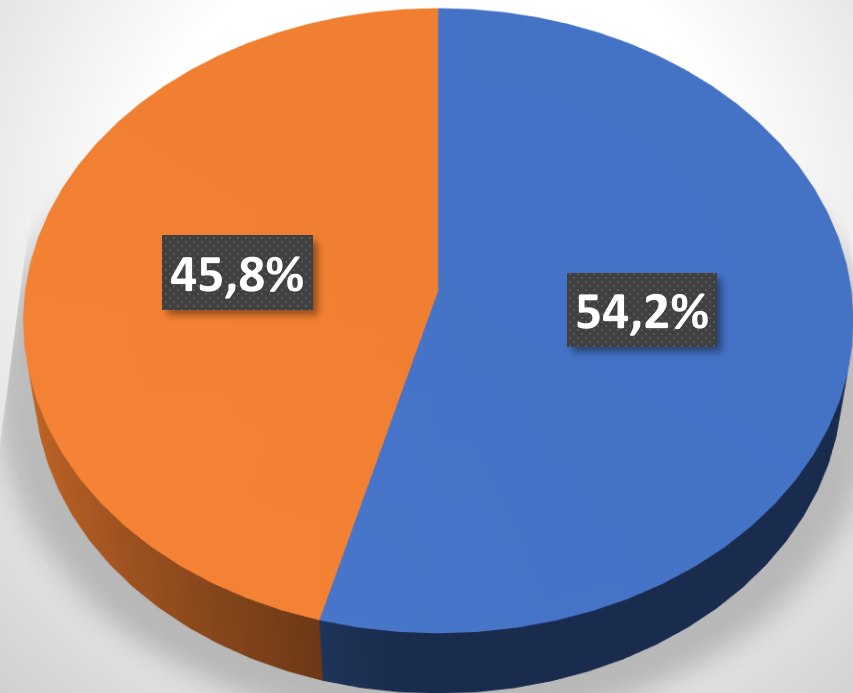instituto de
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Motivation

Near to crosswalks we have:

- 21.2% of the deaths

- 42.7% of the serious injuries

- 55.8% of the minor injuries

Total accidents involving pedestrians, 2018 Portugal

■ Crosswalks   ■ Other places

45,8%   54,2%

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New problems

Smombie = Smartphone + Zombie

Pedestrians accustomed to noisy internal combustion engines

Retrieved from: http://mattalltrades.blogspot.com/2016/04/city-embeds-traffic-signals-to-alert.html

Retrieved from: http://kiwiev.com/taking-the-electric-car-skiing/

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Objectives

Avoid hazardous situations near crosswalks
- Poor visibility
- Speeding vehicles
- Distracted pedestrians

Alert everyone involved
- Lighting projection over the road;
- Audible signals for blind people;
- Information panel with speed;

Keep it simple to install

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Retrieved from: http://www.llumtraffic.com/actualitat/page/0

Similar Projects

Lights on the road
Pressure sensors
Infrared sensors
Cameras
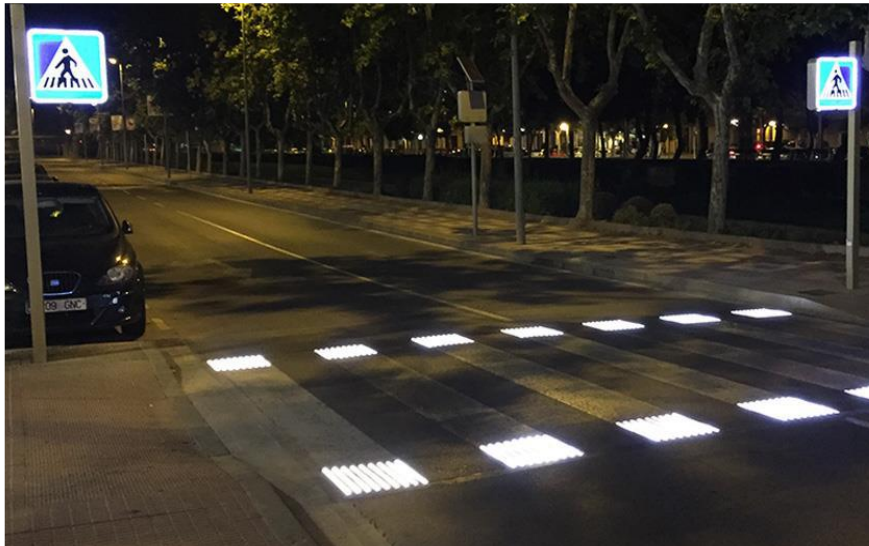
Retrieved from: https://www.cm-guimaraes.pt/pages/1418?news_id=3738

Retrieved from: https://www.theverge.com/2017/2/15/14621968/lightlines-protect-distracted-smartphone-users

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Similar Projects

Retrieved from: https://www.techspot.com/news/71330-smart-crossing-system-warns-drivers-phone-addicted-pedestrians.html
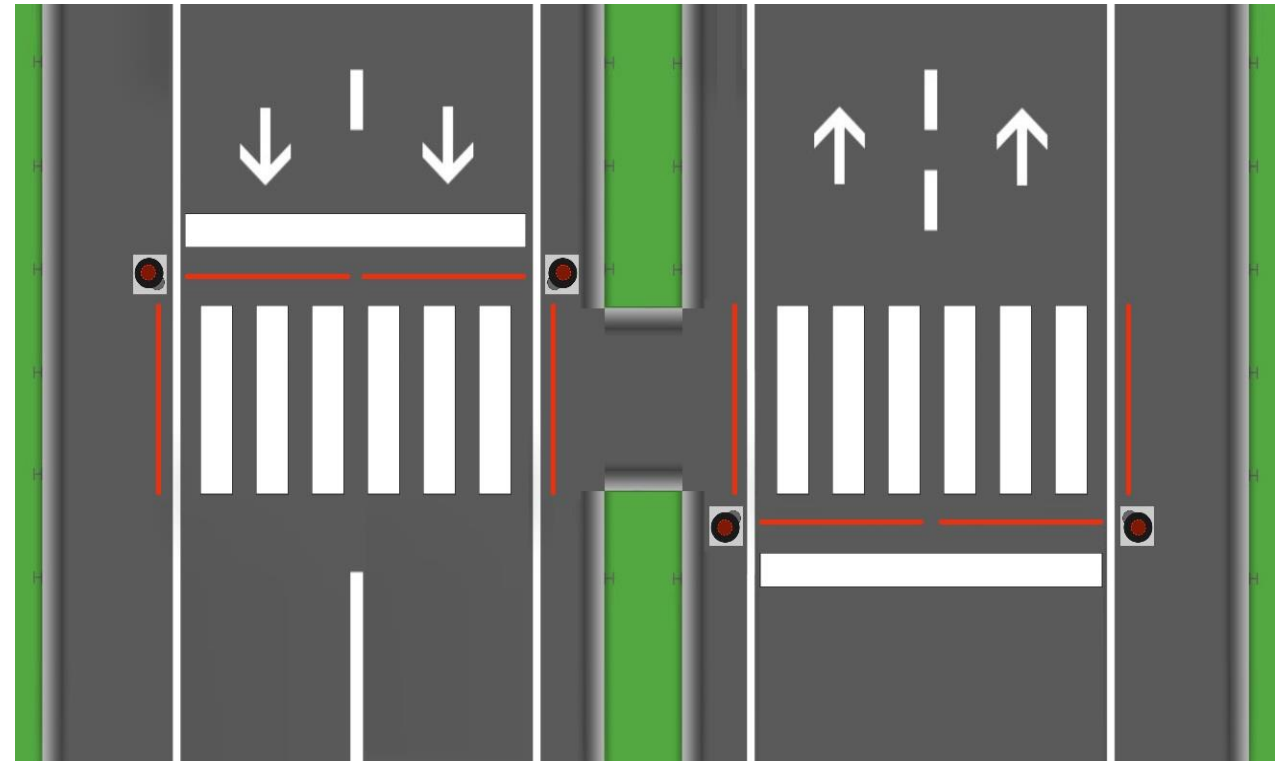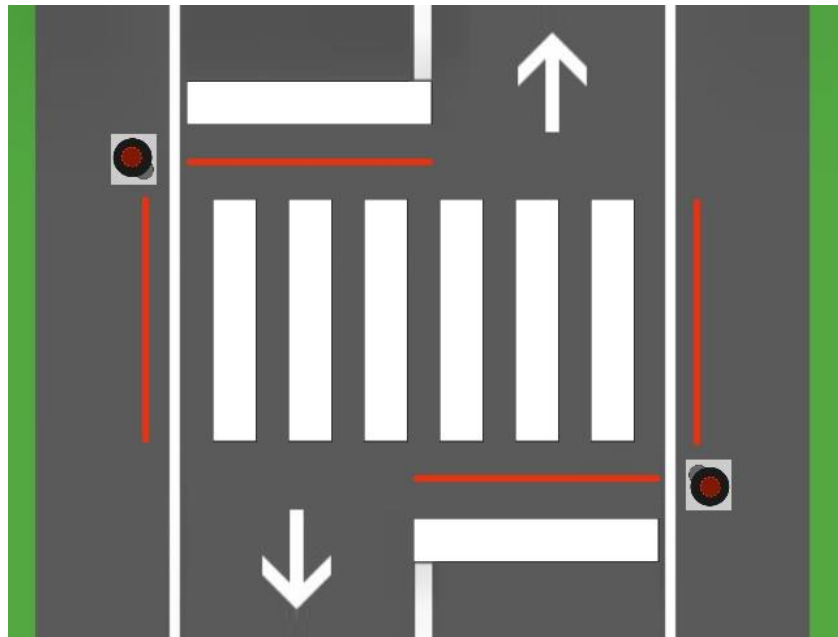

Retrieved from: https://www.reuters.com/article/us-southkorea-smartphones-crossing/south-korea-radar-and-thermal-camera-system-warns-smartphone-zombies-of-traffic-idUSKCN1R0029

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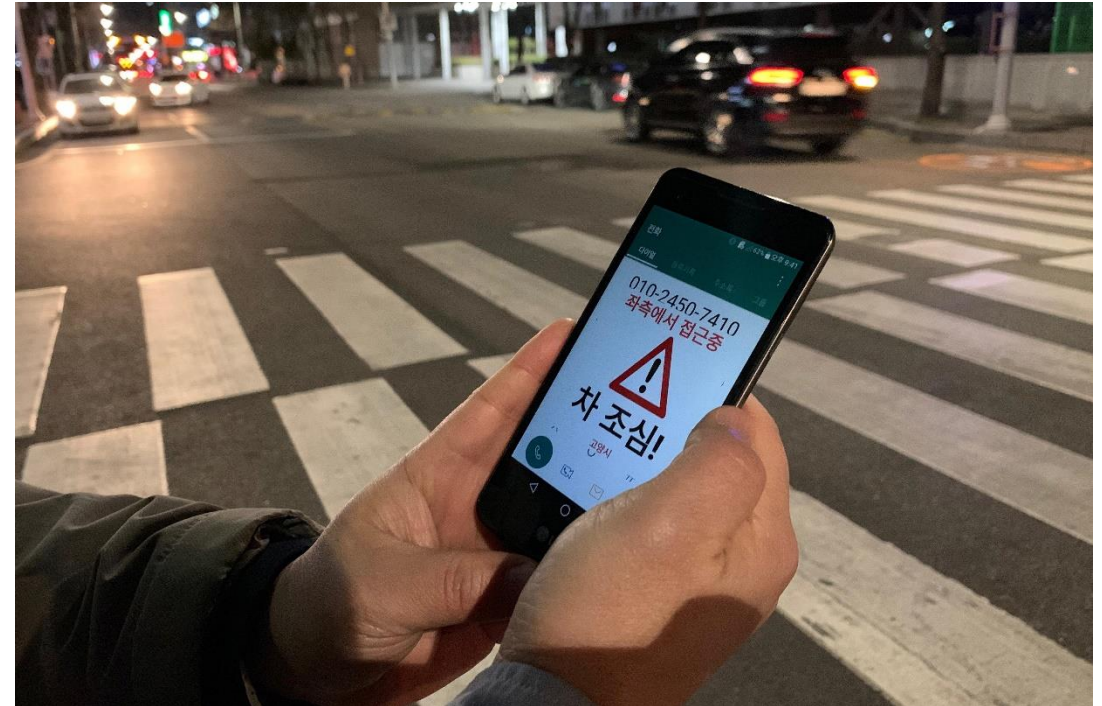
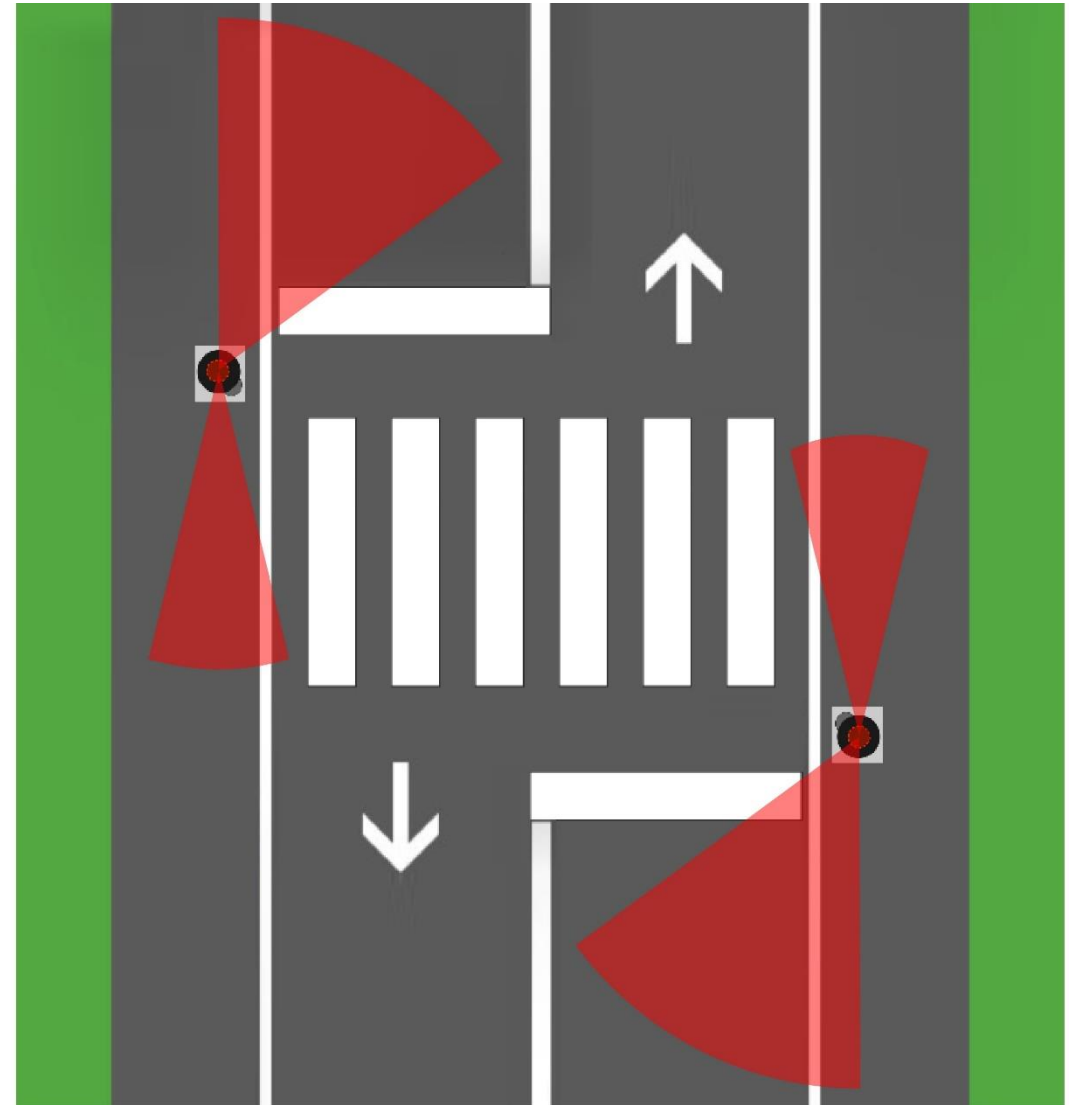# Our Solution

Adapted for 1 or 2 lane roads.

Our Solution

Pedestrian detection:
- Neural Network – *You Only Look Once (YOLO)*
- Running in a raspberry with an acceleration library for multi-core

Speed detection:
- Radar - *Stalker Stationary Speed Sensor II*
- Tracks up to 10 vehicles simultaneously in both directions

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Operation

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Advantages

Speed tracking
- Warning not only vehicles, but also pedestrians

Fight the "new problems"
- Using led projection on the road

No need for main road interventions
- Just 2 poles with all systems embedded

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Advantages

Share of traffic information
- In line with the smart cities concept

Optimization of passage times
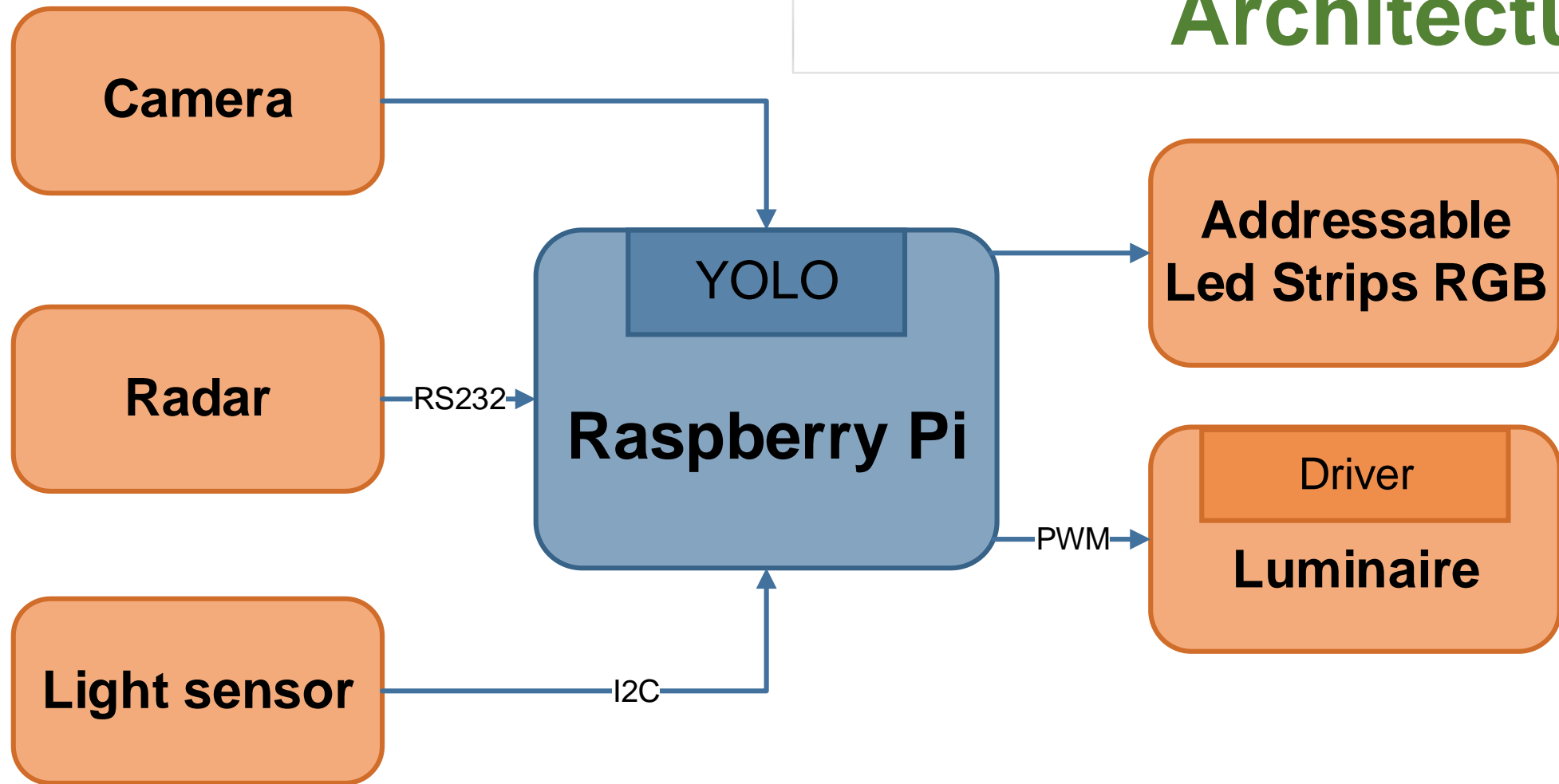- According to the flow of people

Applicable to any type of crosswalks
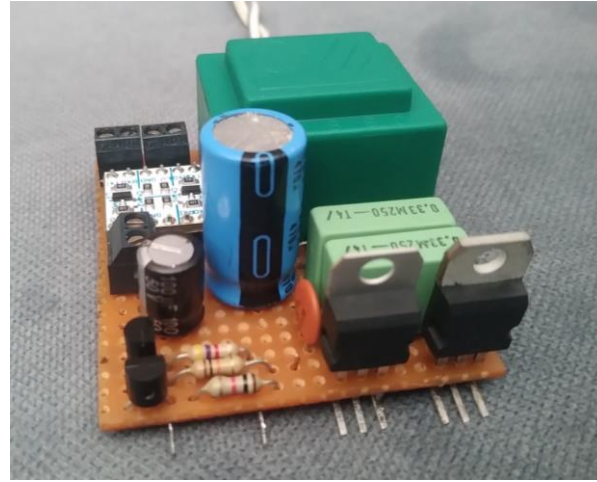- Ideal for schools, temporary crossings, …

Retrieved from: http://www.crosswalksafety.ca/opportunity-awareness/

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Architecture

Camera

Radar

Light sensor

Raspberry Pi

YOLO

RS232

I2C

Addressable Led Strips RGB

Driver

Luminaire

PWM

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Prototype

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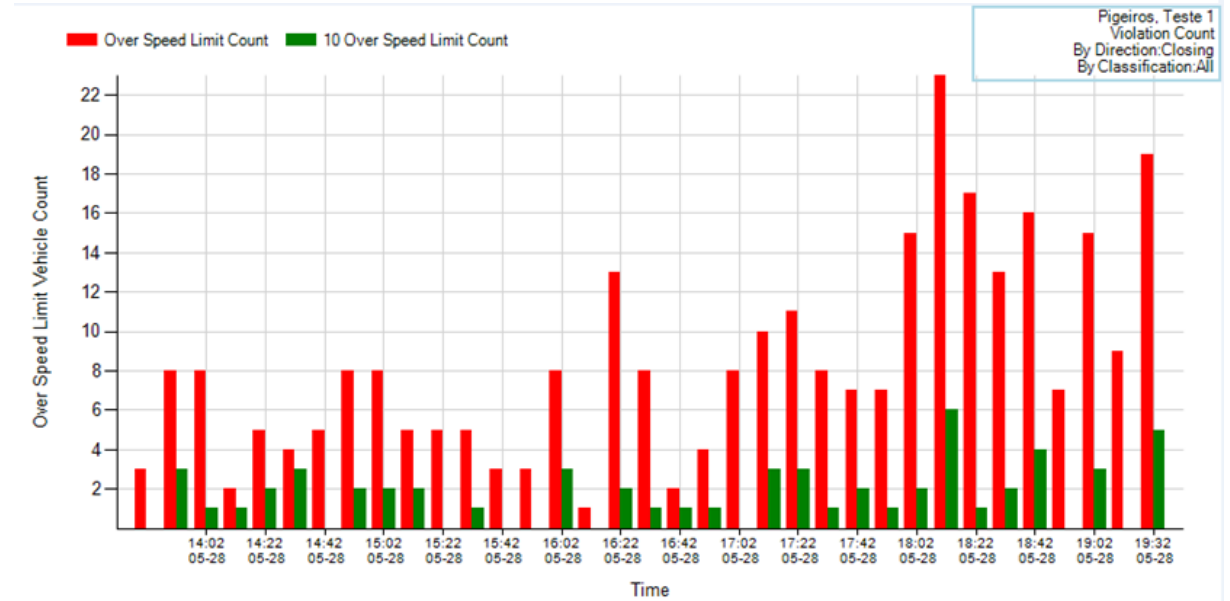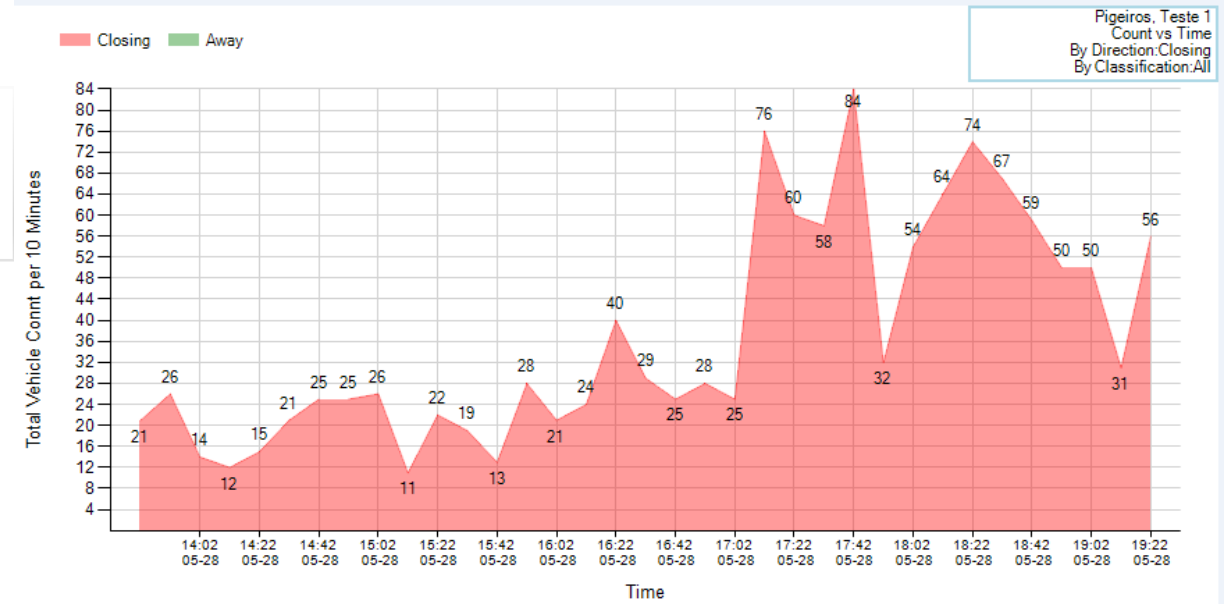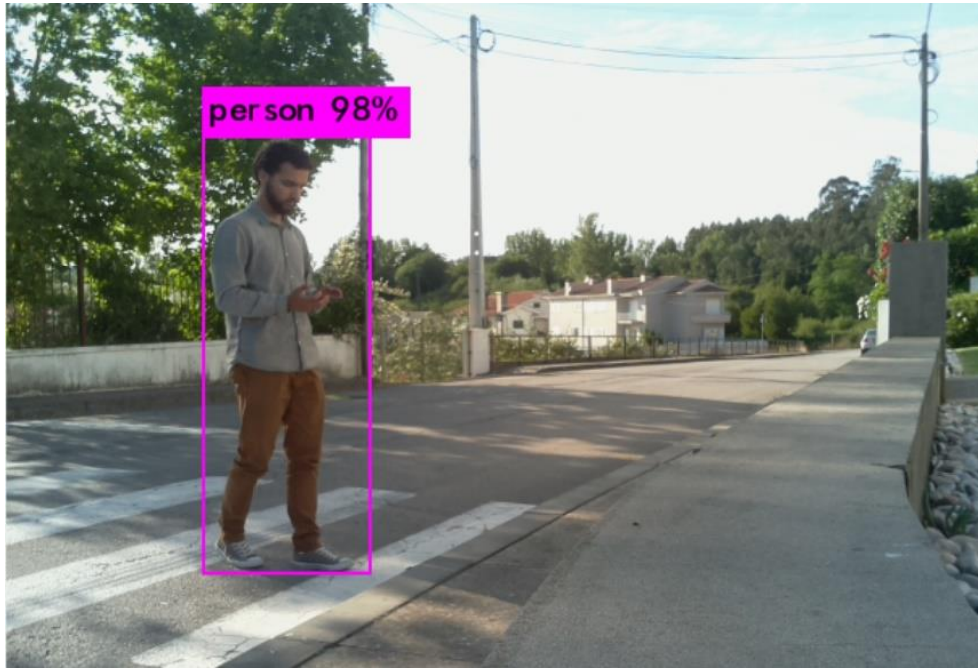instituto de
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Prototype

Dimensions:
- Structure   – 300.0 x 11.0 x 0.5 cm
- Radar   – 11.2 x 9.9 x 4.0 cm
- Luminaire – 47.4 x 23.8 x 10.0 cm
- Led strips – 26.7 x 1.0 x 0.2 cm

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Implementation

Tests

Radar:
- Radar Capabilities – 1285 vehicles (count, classification, speed)
- Vehicle count as they are lost – 241 vehicles (92% accuracy)

Neural Network:
- Use of measures such as IoU and average losses
- Detection in multiple environments (controlled and uncontrolled environments, during the day and the night)

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Challenges

Limits of the pedestrian detection area
- Predict if the person really wants to cross

Neural network processing speed
- RAM and CPU speed limitations of the board

Camera maintenance
- Over time, dirt can cover the camera lens

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Ongoing and Future Work

General system testing in different atmospheric conditions

Improvement of the neural network

LoRa or wireless communication between poles

Study the possibility of adding solar panels

Design and safety tests for led projection (Physics department)

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Thanks for your time

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