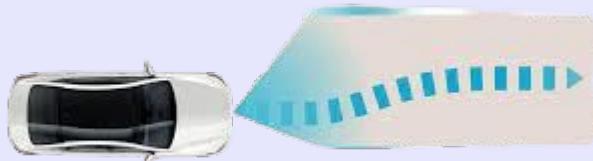

Lane Following Contributions on Autonomous Navigation

IoTeam

Challenging Task Context

Computer Vision System implementation enabled for the detection and tracking of lanes using a stereoscopic camera; as a mean to contribute in the autonomous navigation required tasks to carry on the AMR TEC2 platform.



Order of the Day

01. Project Management

Applied tools and process reinforcement Strategies.

02. Support Systems

Manufactured structures for utilized equipment and circuits (PCBs).

03. Live Data Monitoring

Via Amazon Web Services and Grafana usage.

04. Obstacle Detection

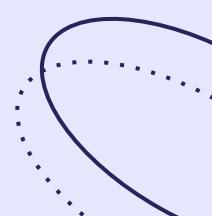
Pure YOLO [COCO dataset] implementation for object identification.

05. Pothole Detection

Trained YOLO implementation for negative obstacles identification.

06. Lane Detection

Pix2Pix AI lane detection, image processing, control tasks, and integration proposal for autonomous navigation.

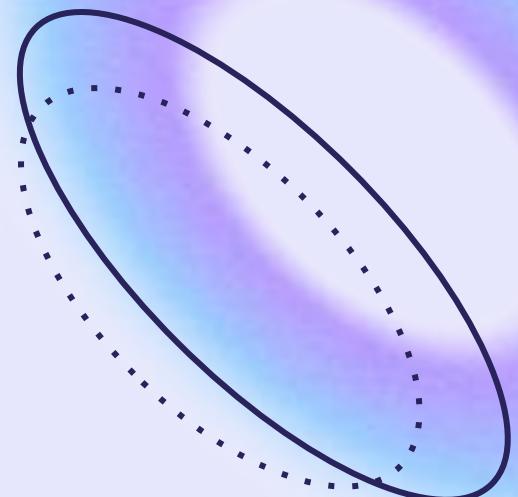


01.

Project

Management Tools

Module 04



Work teams for the year ahead

The screenshot shows a project management interface. On the left, a 'List' view displays a large number of tasks under various categories like 'Lane Following', 'Autonomous Vehicles', and 'ML'. One task, 'Lane Following', is highlighted with a yellow background and has a detailed description and checklist. On the right, a specific task card for 'Lane Following' is shown, featuring a title, description, checklist, and a 'Details' section.

Actividad	Situación	Ambientes	Investigación
Theoretical Background	What are the keys (2) to migrate the technology to a Smart Factory? What are the main challenges to migrate the technology to a Smart and Medium Enterprise? What are the main challenges to migrate the technology to an automotive industry to address an Smart factory?	(Project) Industry Research SystemB Data Analytics, and AI/CloudSecurity	What is the main challenge to migrate the technology to a Smart Factory? What is the main challenge to migrate the technology to a Smart and Medium Enterprise? What is the main challenge to migrate the technology to an automotive industry to address an Smart factory?
According to your background and previous experience, which research questions apply to the AMR based on Figure 1, including research areas?	• Lane Following • Edge Computing • Machine Learning • Data Analytics • CloudSecurity	• Lane Following • Edge Computing • Machine Learning • Data Analytics • CloudSecurity	Este punto lo tienen que dividir para que permitan se desplieguen en aspectos específicos, pero con los mismos objetivos de investigación juntos para no trastornar el desarrollo.
Conclusions	Individuals	Individuals	What topics covered by the papers related to the IROS competition challenge (AMR) are the most interesting (your pick)?
Date/Time	01/09/2023 09:00	01/09/2023 09:00	01/09/2023 09:00
Section	Section A	Section B	Section C
Comments	None	None	None

Tareas	Fecha Límite	Módulo	A. Carga	Apoyo	Descripción
CLASE JUEVES 03	RET0	Mel	Oscar y Mel		Terminar de corregir lo necesario para que sea entregable el código de detección de cartón.
CLASE JUEVES 03	RET0	Mel	Oscar y Mel		Generar un diagrama de flujo/seqüencia para el código del código de detección de cartón, para que sea más fácil de entender.
CLASE JUEVES 03	TOÑO	Mel	Maria y Oscar		Determinar un uso que tenga sentido y no utilice la cámara 10 veces al minuto.
CLASE JUEVES 03	TOÑO	Mel	Maria y Oscar		Generar un diagrama de flujo/seqüencia para el código de detección de cartón.
CLASE JUEVES 03	TOÑO	Mel	Maria y Oscar		Primer experimento para los entrenamientos del modelo de diseño.
CLASE JUEVES 03	TOÑO	Mel	Maria y Oscar		Generar un diagrama de flujo/seqüencia para probar el modelo de red neuronal de los tres tipos.
CLASE JUEVES 03	TOÑO	Mel	Maria y Oscar		Segundo experimento para probar el modelo de red neuronal de los tres tipos.
CLASE JUEVES 03	TOÑO	Mel	Maria y Oscar		Tercer experimento para probar el modelo de red neuronal de los tres tipos.
CLASE MARTES 03	RET0	Luis	Irene		Entregar y pedir a Oscar y Mel que revisen el código de detección de cartón y lo corrijan.
CLASE MARTES 03	RET0	Luis	Irene		Entregar y pedir a Oscar y Mel que revisen el código de detección de cartón y lo corrijan.
CLASE TORO MARTES 03	RET0	TOÑO	TOÑO		Entregar y pedir a Oscar y Mel que revisen el código de detección de cartón y lo corrijan.
MIERCOLES JUEVES 03	RET0	Scar	Luis e Irene		Entregar y pedir a Oscar y Mel que revisen el código de detección de cartón y lo corrijan.
JUEVES 03	RET0	Oscar	Mel		Investigar sobre algoritmos behavioral cloning y engine que puedan ser de utilidad y como funcionan.
TO DEFINE	RET0	Mel	TO DEFINE		Algoritmo con rule of porting de UGAR para TOAM.
JUEVES 03	TOÑO	Mel	Irene e Mel		Entrenamiento de modelos Mel, en edge impulse de acuerdo a escenario propuesto en MyRF.

Class 1

Pre-programmed activities.

Evidenced through project binnacle.
Click-Up based organization.

Class 2

External-to-project activities.

Internal organization format.

Class 3

Brief tasks.

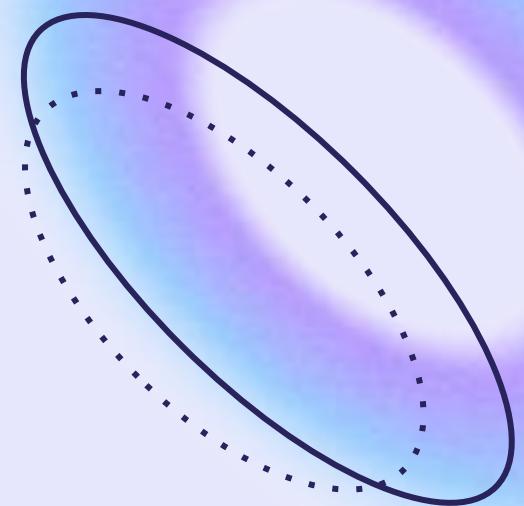
To do list internal format.

02.

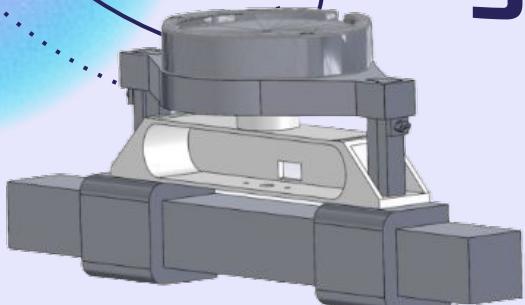
Supporting Systems

Manufacturing

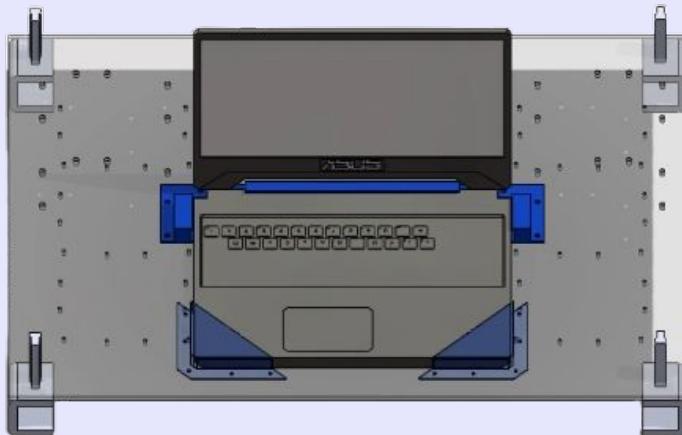
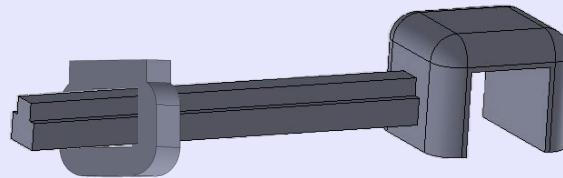
Module 01



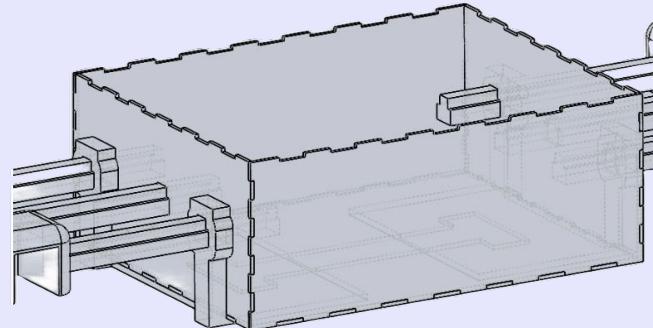
Supporting Structures CAD Modelling



ZED 2 Cam + Velodyne Puck LiDAR

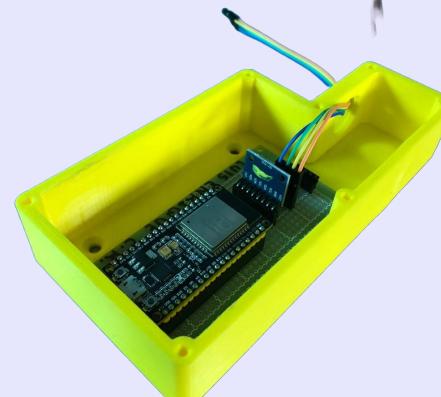
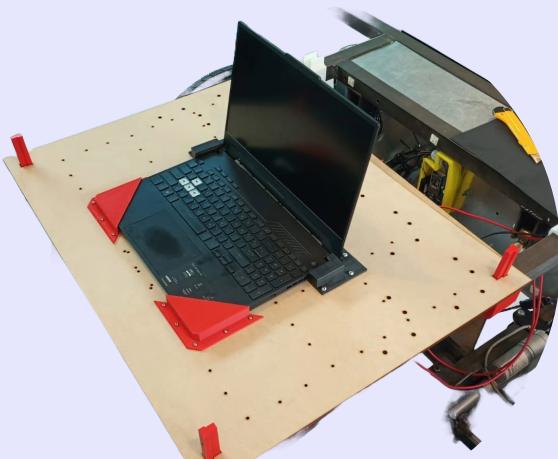
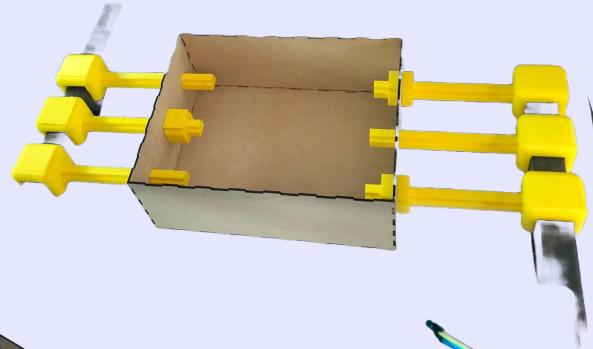


Processing Unit



Current Inverter

Supporting Structures Manufacture

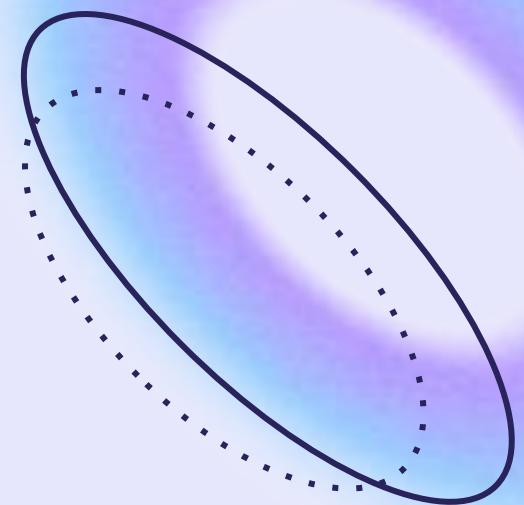


*Developed changes to show later.**

03.

Live Data Monitoring

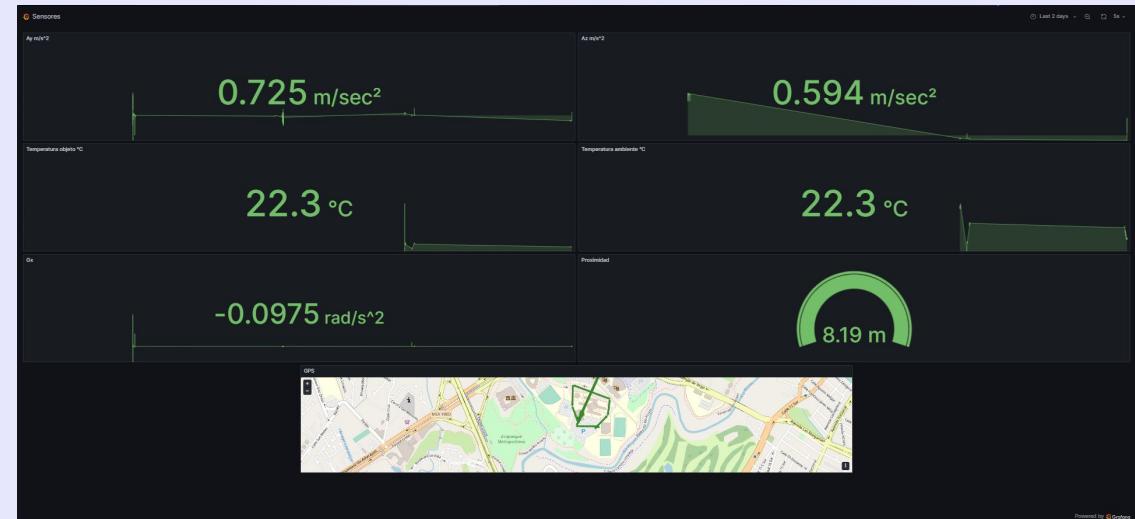
Module 02



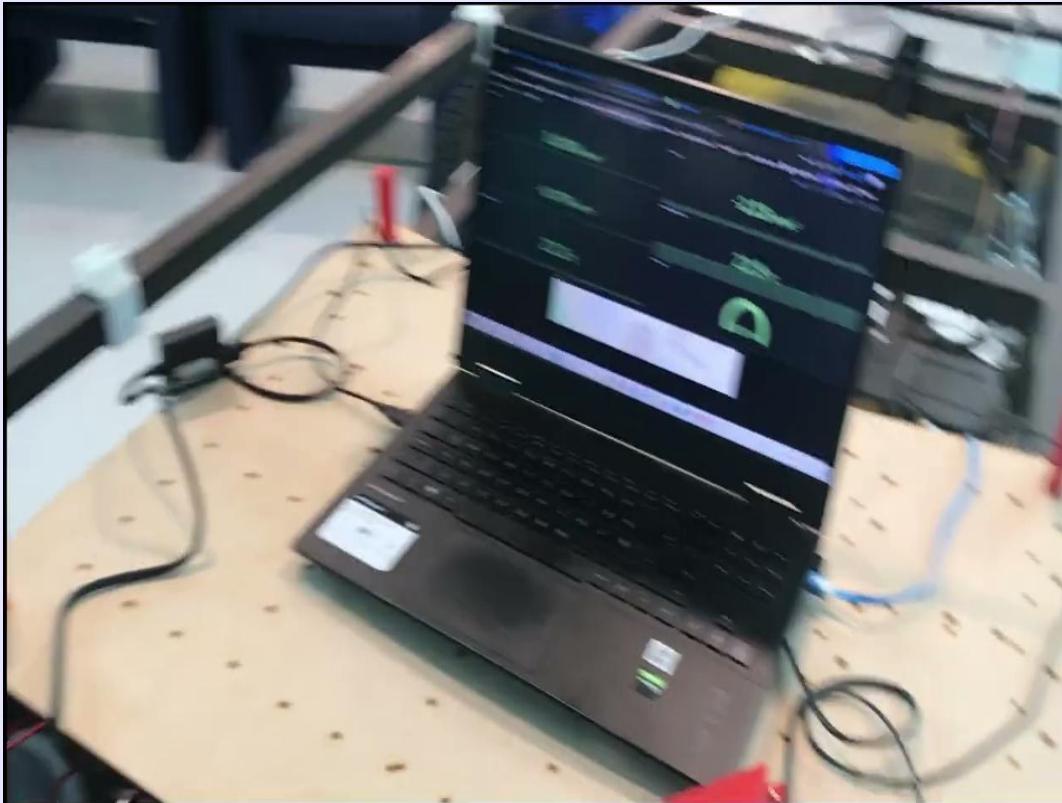
Live Data Monitoring



Grafana



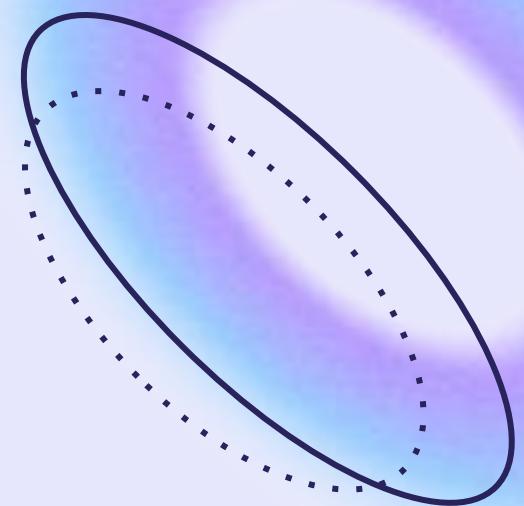
Demonstration



04.

Obstacle Detection Using YOLO

Module 03

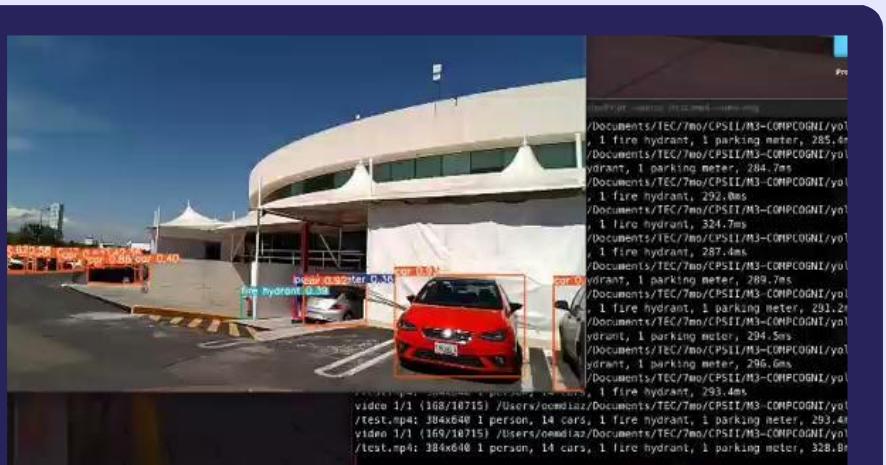


Desktop software

Based on pre-trained COCO dataset.

Presented:

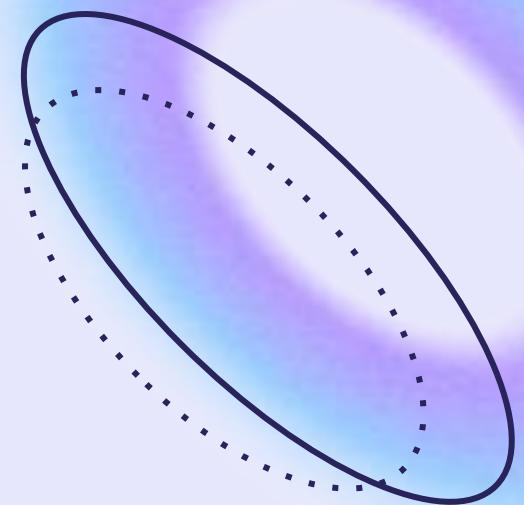
- 91.51% Accuracy.
- 0.0944 Standard Deviation



05.

Pothole Detection Using YOLO

Challenge Project



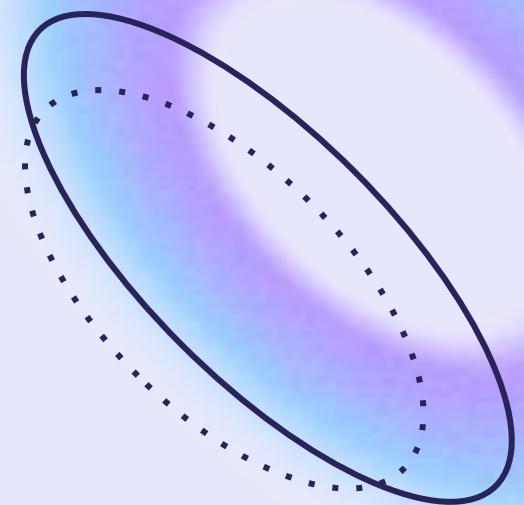
Pothole Detection Demonstration



06.

Lane Detection

Challenge Project



Autonomous-Manual Control

```
if(sbus_rx.Read()){  
    sbusFlag = true;  
    data = sbus_rx.data();  
    Serial.println(data.ch[7]);  
    //Serial.println(data.ch[8]);  
    if (data.ch[4]<980){  
        valorFreno = 179;  
        valorEnable = 0;  
    }else if (data.ch[4]>1000){  
        valorEnable = 1;  
        if (data.ch[7]<980){  
            record();  
            //alto();  
            control_reversa();  
            control_gear();  
            control_direccion();  
            control_freno();  
            delay(100);  
        }else if (data.ch[7]>1000){  
            read_serial();  
            control_freno();  
        }  
    }  
}
```

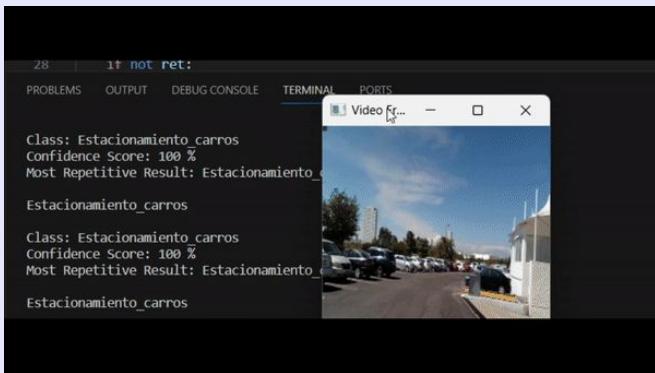
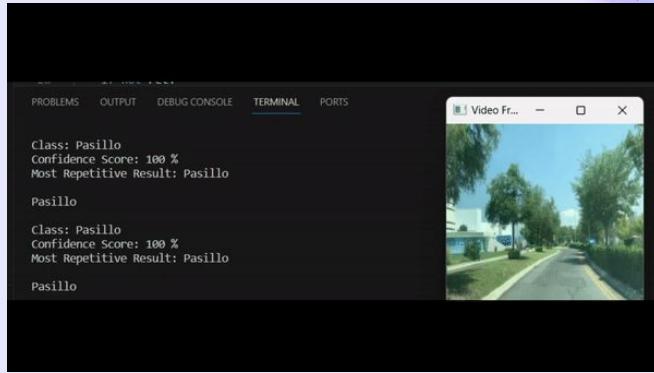
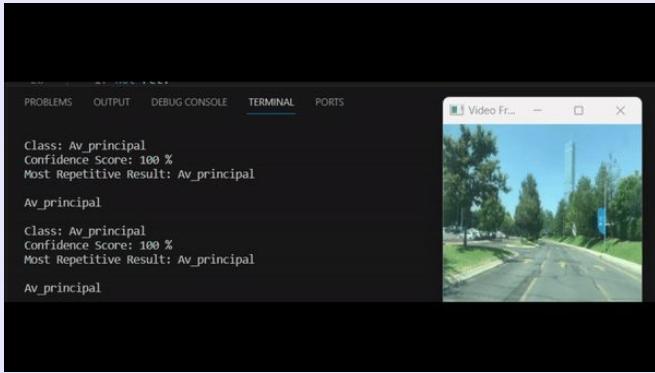
```
void read_serial(){  
    if(Serial.available()>0){  
        commandBuffer = Serial.readString(); //Leer puerto serie  
        int arrayLength = length_string(commandBuffer);  
        if (arrayLength == 2) {  
            commandBuffer.trim();  
            // Assuming elements are separated by spaces  
            String thirdElement = extractElement(commandBuffer, 2);  
            valorDirEx = thirdElement.toInt();  
            if (valorDirEx > -1 && valorDirEx < 101) {  
                valorDir = valorDirEx;  
                delay(100);  
            }  
            else if (arrayLength == 0) {  
                valorDirEx = commandBuffer.toInt();  
                if (valorDirEx > -1 && valorDirEx < 101) {  
                    valorDir = valorDirEx;  
                    delay(100);  
                }  
            }  
        }  
    }  
    void control_freno(){  
        if(data.ch[0]<980){  
            valorFreno = map(data.ch[0],980,172,140,179);  
            valorVel = 0;  
        } else if(data.ch[0]<1000 && data.ch[0] > 980){  
            valorVel = 0;  
            valorFreno = 140;  
        } else if(data.ch[0]>1000){  
            valorVel = map(data.ch[0],980,1811,50,170);  
            valorFreno = 140;  
        }  
    }
```

```
void control_direccion(){  
    valorDir = map(data.ch[1],172,1811,100,0);  
}
```

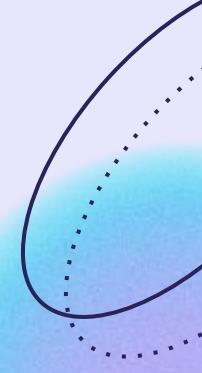
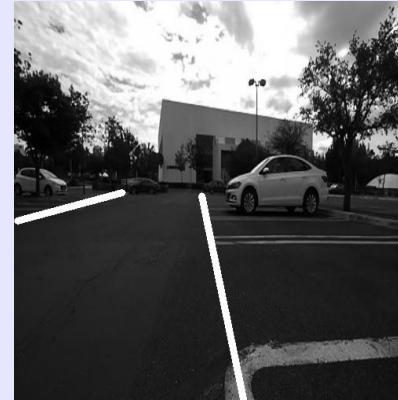
```
void control_reversa(){  
    if(data.ch[3]<980){  
        valorReversa = 1;  
    } else if(data.ch[3]>1000){valorReversa = 0;}  
}
```

```
void control_gear(){  
    if(data.ch[2]<980){  
        lowGear = 0;  
        highGear = 1;  
    } else if(data.ch[2]>1000){  
        lowGear = 1;  
        highGear = 0;  
    }  
}
```

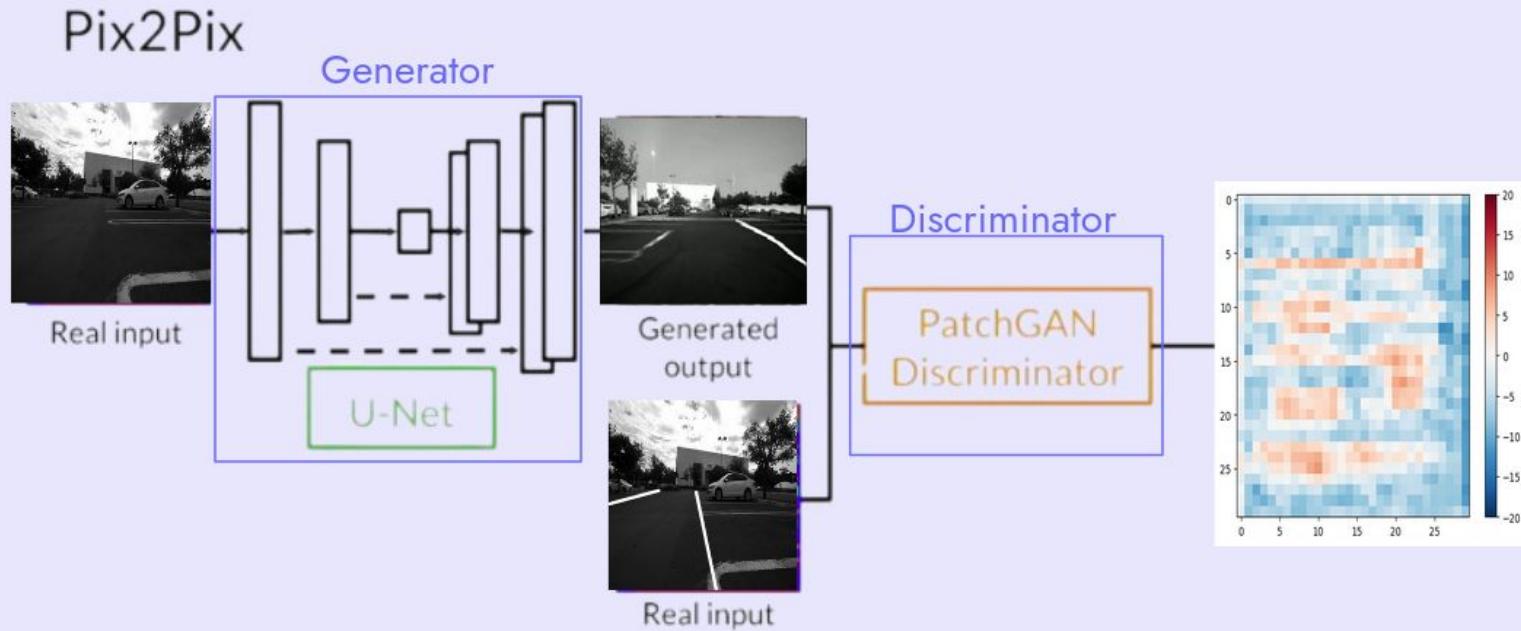
Scenario Case Detection



Implementation of Pix2Pix Architecture



Pix2Pix Architecture



Implementation

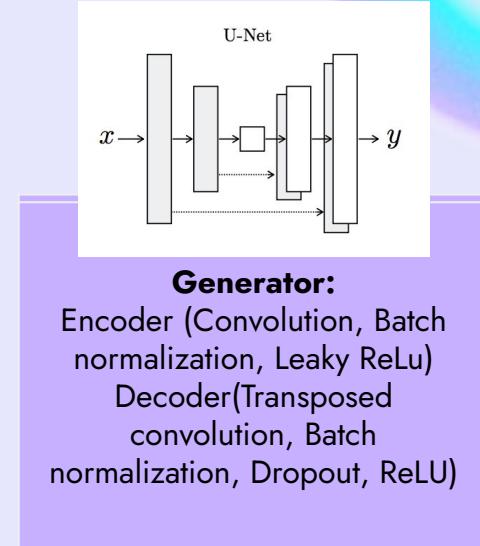
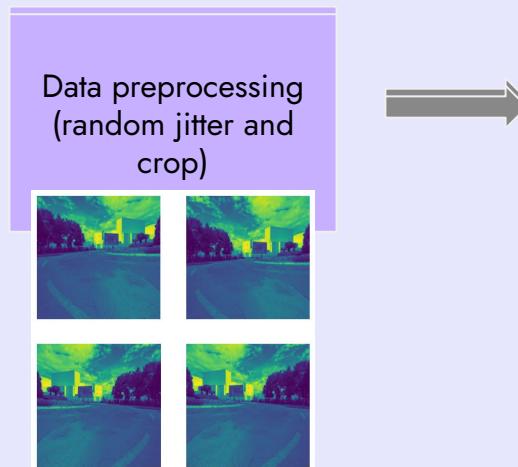


Image Processing



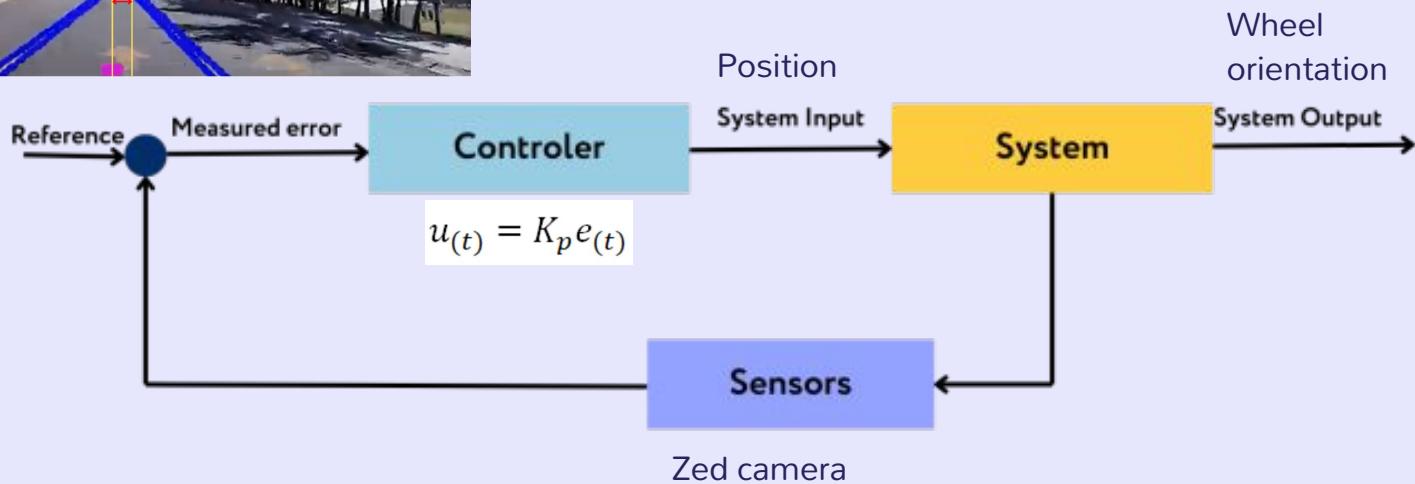
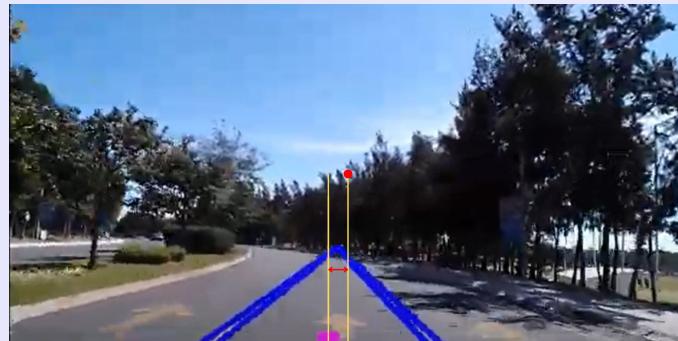
Canny Filtering



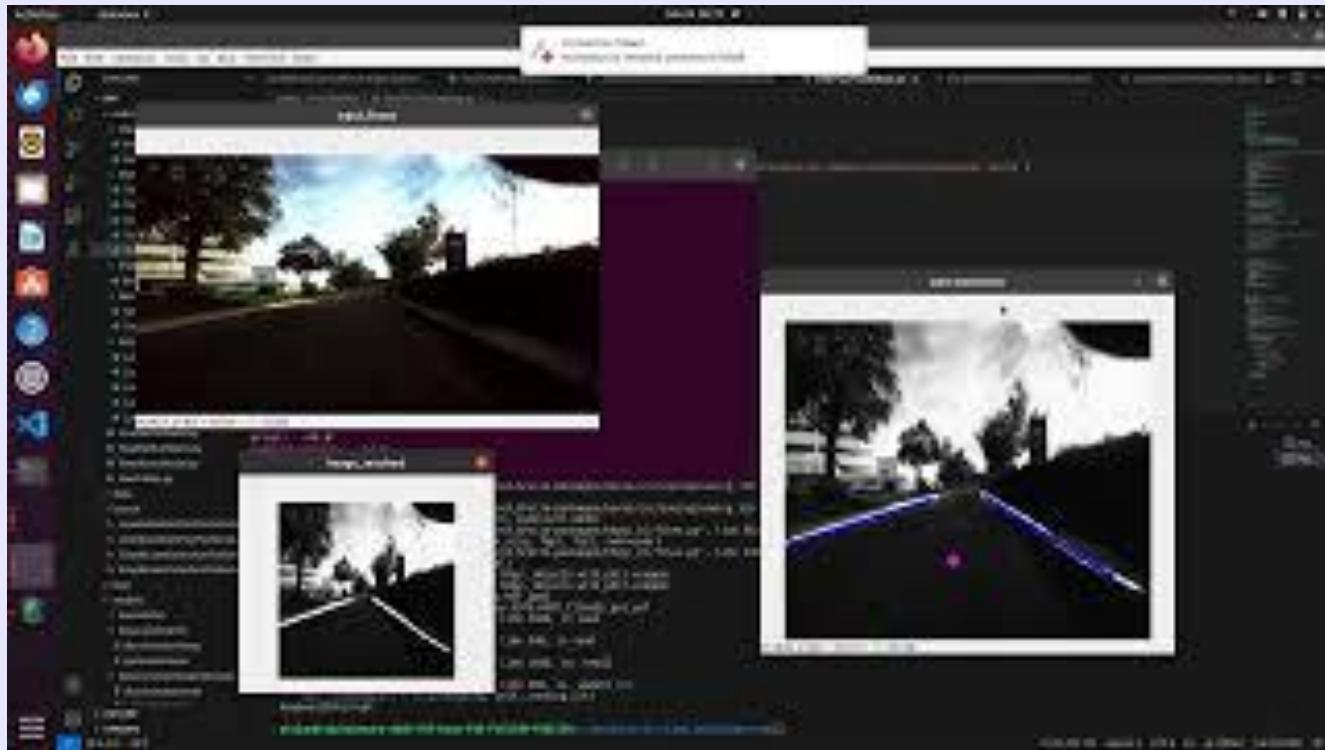
Lane Detection



Proportional Controller



Results



Results





Progress & Achievements Log Access

Regards!

- Luis Enrique Camaños Rebollo - A01732055
 - Miguel Alejandro Martínez Ayala - A01734990
 - Melanie Alarcón García - A01734924
 - Lilian Scarlett Díaz Romero - A01734788
 - Israel Lezama López - A01734758
 - Óscar Emiliano Ramírez Díaz - A01660338
 - Massimiliano Tuccella Ramírez - A01734774
-



Photo by H. González