Systematic

January report

1. Model optimization

Without the AI kit for the Raspberry Pi, we had to optimize our existing models. Since the last report, we have trained additional models. We switched from YOLOv8s-seg to YOLOv11n-seg and reduced the input image size from 640 to 320 pixels.

Here are the performance metrics for the different configurations:

- YOLOv8s-seg (640x640): approx. 1200 ms/frame
- YOLOv11n-seg (640x640): approx. 550 ms/frame
- YOLOv11n-seg (320x320): approx. 150 ms/frame
- YOLOv11n-seg (640x640, ncnn format): approx. 150 ms/frame
- YOLOv11n-seg (320x320, ncnn format): approx. 40 ms/frame

We also experimented with adding a TPU (Coral USB Accelerator), but the inference was slower than with the ncnn model. This is likely due to the high power consumption of the TPU and the fact that the Raspberry Pi limits the power available to its peripherals. The performance of YOLOv11n-seg (320x320) with the Edge TPU was around 85 ms/frame.

Ultimately, we decided to use the YOLOv11n-seg 320x320 ncnn format until we find a more efficient way to run our segmentation model.

2. Implementing logic from simulation

The next step was to implement road center detection, which we developed for our simulation to work with the new model, as well as the PID controller to help determine the steering value for the servo.

Unfortunately, due to mechanical issues with the steering and transmission mechanisms, we have not yet been able to test the code on the physical car.

This code is located in the "Project Status/Project Status 2" folder and will be integrated into the main framework at a later stage.