SlamCar

Spatial localization of RC Cars Using SLAM

Student

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Introduction: In this project, the goal was to creating a remote-controlled car that can localize itself in an indoor area using only a low-cost onboard camera. The car is controlled remotely via WiFi, with a controller software, running on a Linux computer, sending instructions to the car. The car is equipped with a raspberry pi, sending images to the controller. These images are then processed by an VSLAM algorithm to determine the car's current position, relative to an map that is dynamically updated as the car is exploring the area.

This project builds upon the hardware created for the OST AI-Challenge.

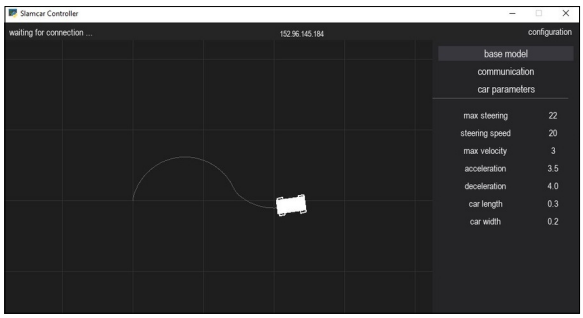
Approach / Technology: The project includes two key software parts: the controller component and the worker component. The worker component is running on the Raspberry Pi on the remote-controlled car. It captures pictures from the onboard camera using GPIO, compresses these images, and forwards them to the controller software. It also maintains a separate communication stream for reporting its current controls to the controller software. In response, it gets new controls based on user input, which it uses to control the motor and steering servos accordingly.

The controller software provides the user with car control and the ability to adjust worker configurations over the network. Upon startup, it also initiates the VSLAM software in the background. When an RC car connects to the controller software, a virtual webcam device is created, and the received images are attached to it. This setup then enables the VSLAM process to be started from the controller's user interface.

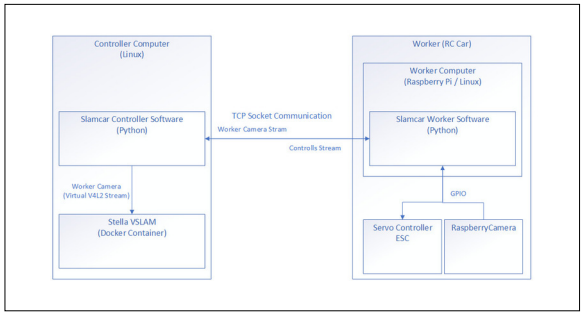
Conclusion: The project demonstrated the potential feasibility of using an affordable camera as an alternative to expensive LIDAR systems for indoor localization, opening up possibilities for cost-effective solutions in various applications. Although the camera-based approach have some limitations compared to LIDAR, it proved to be effective for less demanding mapping scenarios. The precision and effectiveness of the localization however relies heavily on the environment surrounding the vehicle. With the pipeline implemented in this project, VSLAM localization worked well in parts of the room where many distinct visual keymarks were present in the camera image. However, when driving through an area with only a few prominent visual keymarks, such as driving right in front of a blank wall, the algorithm tended to lose track of the car's relative position.

AI Challenge remote control car with a Rasperry Pi
Own presentment

Controller Software UI
Own presentment



Software Overview
Own presentment



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Subject Area
Data Science