Interest in self-driving cars and the AI research surrounding this topic have gained immense popularity and significance over the past years. Yet, it is often only possible to work on this topic inside simulators since real hardware, i.e., cars equipped with a multitude of sensing modules, are not affordable and too complex to get started.

Nevertheless, to get started within the domain of self-driving cars and still experiencing real hardware, RC cars can be a cheap and beginner friendly alternative. Yet, before being able to get started, one has to modify existing RC cars to enable them being controlled, programmed, and remotely monitored. This can be a tedious and complex task that prevents many beginners from even trying.

Thus, the goal of this thesis is to develop a platform based on a Raspberry Pi that, in its final form, provides a beginner-friendly and easy step-by-step solution on how to transform a normal RC car into a computer-controlled, programmable one. For this, the student has to tackle following tasks, document them in the thesis, and summarize them in an (later openly available) instruction list:

- Schematics on how to connect the Raspberry Pi to the existing actuators (servos, motors, etc.)
  - If there are well-known standards in the world of RC cars, the system should work with the most-widely used ones.
- Software that runs on the Raspberry Pi that is able to control each of these actuators.
  - The software should also be able to expose additionally added modules such as light sensors or distance sensors. At least, it must be documented how the software can be extended to support new types of modules. As a reference example, a camera has to installed on the car built during this thesis.
- A smartphone app in which the user is able to control the RC car manually. The app should also display the current state of each sensor and the video captured by the camera mounted on the car.
- To provide initial insights into AI capabilities, the system should also perform simple object detection on the camera image using OpenCV, TensorFlow, and/or PyTorch.

This work should provide a basis for future bachelor’s and master’s theses that want to experiment with RC cars, especially with AI capabilities, as it makes the initial preparation phase much more accessible. The results (schematics, instruction list, software) have to be published as open-source / open-access.

Modalities:
The progress of the project should be discussed at least every four weeks with the advisor. A time schedule and a milestone plan must be set up within the first 3 weeks and discussed with the advisor. It should be continuously refined and monitored to make sure that the thesis will be completed in time. The final version of the thesis must be submitted not later than 30.04.2023.