Telemetry Unit for a Formula Student Race Car

Formula Student is an international race car competition for student teams representing their respective university. As race cars in this competition grow increasingly complex, so do their control systems. The cars need to compete in several categories under different conditions. Often, the race car‘s control units are operating using changing parameters for each of the categories.

Using bidirectional telemetry solutions, the control system of a car can be supervised as well as it can be modified and tweaked. They provide insight into sensor data like the current SoC (state of charge of the car‘s HV battery) as well as system parameters like the current maximum torque permitted to the actors. Additional data collected in the car, such as video data, can also increase the understanding of the observed processes.

Wireless telemetry solutions enable these possibilities without physically accessing the car. Applications range from debugging, calibrating and testing to remotely modifying the car‘s behavior during races.

The objective of this thesis is to implement a wireless telemetry solution for the AMZ (Akademischer Motorsportverein Zürich) Formula Student race car. The range of the wireless connection should cover distances up to 600m, so to cover all common race tracks of the Formula Student series. The reliability of the connection should be tested with respect to range in conditions with little to no obstacles, thus simulating a setting similar to the actual race tracks.

As part of the thesis, a suitable network technology (Bluetooth, ZigBee, WLAN, etc.) and operating frequency should be chosen to fit the given requirements and constraints. The Implementation should be able to transmit sensor data as well as data from the internal state of the VCU (Vehicle Control Unit) to a laptop computer or similar device next to the race track.

Besides this, video data recorded using a GoPro camera should be transmitted over the same distance, in order to allow for further insight into the processes under consideration as well as to give a training assistance to drivers in the team currently not driving the car.

Key goals of the implementation must be flexibility and ease of use, as well as minimum weight and form factor of all physical parts in the race car.