Strategic and Trajectory control of a self-driving bike

In a research project, self-driving bikes are developed with the purpose to be used in test-driving experiments where vehicles’ safety systems for bike safety are tested. Among others, Volvo Cars, Autoliv, Veoneer, and AstaZero are partners in the project. The goal is to have the bicycle driving pre-defined trajectories carrying a dummy to look as similar as possible as a real biker to the vehicle’s sensor system. Several bikes have been built, and the basic functionality has been validated. It remains to develop necessary functions so that the bike can be integrated with the test environment at the test track at AstaZero, and to develop the support functions to facilitate the use of the bike.

Problem description: A validation test is typically defined by that several objects, for example, a vehicle and a biker, follow well-defined trajectories so that it can be tested if the sensor system of the vehicle detects the bike. For a test to be valid and repeatable, the trajectories must be followed very accurately. The end goal of this master project is to propose and perform trajectory following tests to assess and quantify the performance. This master project will prepare and integrate the bikes into this overall control system. More specifically the following tasks should be covered:

- Define benchmarks trajectories, for example going straight and then wiggling. The rate of wiggling should be scalable so that one can scale from simple tests to more advanced ones.
- Evaluate present functionalities of the bike with the purpose to perform trajectory following experiments. Identify improvement possibilities, functionality which would make it easier to operate the bikes.
- Propose further development of any functionality needed for the tests. Start and stop functions could be examples of such.
- Validate and possibly improve the positioning system of the bike.
- Validate the radio communication with the bike.
- Implement the higher-order control on the bike and validate.
- Validate on track.

We are searching for one or two highly motivated students from the master program in Systems, Control and Mechatronics or a student with a similar background. Experience of real time control, programming and electronic design and building is of value. Having a driving-license is an advantage.

The master students will cooperate with experienced engineers to develop parts of the next generation of vehicle technology. You will work with basic theory from several engineering disciplines such as mechanics, signal processing, control, and software
engineering. You will implement algorithms in real-time hardware and perform driving tests at the test site AstaZero.

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