BACHELOR'S THESIS ASSIGNMENT

I. Personal and study details

Student's name: **Endler Martin** Personal ID number: **483764**

Faculty / Institute: **Faculty of Electrical Engineering**

Department / Institute: **Department of Cybernetics**

Study program: **Open Informatics**

Specialisation: **Artificial Intelligence and Computer Science**

II. Bachelor's thesis details

Bachelor's thesis title in English:

Using ROS2 for High-Speed Maneuvering in Autonomous Driving

Bachelor's thesis title in Czech:

Použití ROS2 pro manévrování ve vysoké rychlosti v autonomním řízení

Guidelines:

The goal of this work is to improve real-time properties of the autonomous driving stack used by the CTU team for the F1/10 autonomous racing competition. The current stack is based on the Robot Operating System, whose first version (ROS1) is known for its problematic real-time properties.
1. Make yourself familiar with the ROS2 framework and study its differences to ROS1.
2. Port the CTU F1/10 autonomous driving stack from ROS1 to ROS2.
3. Evaluate the properties of the ported stack on the F1/10 platform (NVIDIA TX2).
Focus on real-time properties, temporal determinism, communication overheads etc.
4. Extend the autonomous driving stack for the ability to perform some high-speed maneuvers such as overtaking. The focus is on "high-speed", because such maneuvers are problematic without proper real-time support.
5. Propose and evaluate a method for off-line (or on-board) verification of the selected maneuvers (e.g. overtaking).

Bibliography / sources:

[1] ROS 2 Documentation (https://docs.ros.org/en/foxy/index.html)
[2] D. Casini, T. B. s, I. Lütkebohle, and B. B. Brandenburg, "Response-Time Analysis of ROS 2 Processing Chains Under Reservation-Based Scheduling," in 31st Euromicro Conference on Real-Time Systems (ECRTS 2019), Dagstuhl, Germany, 2019, vol. 133, p. 6:1-6:23. doi: 10.4230/LIPIcs.ECRTS.2019.6.
[3] K. Osman, J. Ghommam, and M. Saad, "Guidance Based Lane-Changing Control in High-Speed Vehicle for the Overtaking Maneuver," J Intell Robot Syst, vol. 98, no. 3, pp. 643–665, Jun. 2020, doi: 10.1007/s10846-019-01070-6.

Name and workplace of bachelor's thesis supervisor:

Ing. Michal Sojka, Ph.D. Embedded Systems CIIRC

Name and workplace of second bachelor's thesis supervisor or consultant:

Date of bachelor's thesis assignment: **21.05.2021** Deadline for bachelor thesis submission: **15.08.2022**

Assignment valid until: **19.02.2023**

Ing. Michal Sojka, Ph.D.	prof. Ing. Tomáš Svoboda, Ph.D.	prof. Mgr. Petr Páta, Ph.D.
Supervisor's signature	Head of department's signature	Dean's signature