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 ízení

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**

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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

III. Assignment receipt

The student acknowledges that the bachelor's thesis is an individual work. The student must produce his thesis without the assistance of others, with the exception of provided consultations. Within the bachelor's thesis, the author must state the names of consultants and include a list of references.

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Date of assignment receipt   Student's signature