

TU Delft

Academic Master in Robotics

Assessment NVAO conditions

September 2022

Introduction

In June 2020, an NVAO panel assessed the new academic master's programme in Robotics of TU Delft. The advice on the programme was conditionally positive. The panel was positive about the programme's intended learning outcomes and the system of student assessment, but had some reservations about the teaching-learning environment. The panel concluded that the programme has a clear focus on cognitive robotics and offers students a robotic fundament (1st year), which has to be expanded in depth later on. The panel's main concerns were twofold, and related to: (1) the admission criteria, and (2) the specialisations and the full alignment of intended learning outcomes and curriculum.

The NVAO followed the panel's advice and, in July 2020, granted TU Delft conditional accreditation of its new academic master in Robotics. The conditions to be met within a period of two years were the following:

1. The programme must ensure that the admission criteria fully comply with the Dutch Higher Education and Research Act (WHW);
2. The programme needs to clearly define the role of the four specialisations, how they provide depth to the curriculum and how they contribute to the achievement of the intended learning outcomes.

Due to an internal administrative misunderstanding, the deadline of two years was not met. At the request of the university, NVAO granted an extension until 1 November 2022. In September 2022, TU Delft described in a document (MSc Robotics Additional Conditions September 2022) how it addressed the panel's conditions. The university invited the 2020 NVAO panel to assess whether the programme now meets the criteria for an unconditional accreditation.

All panel members accepted the invitation:

- Dr. Françoise Siepel (chair), Assistant professor, research group Robotics and Mechatronics, University of Twente, the Netherlands;
- Prof. dr. Ming Cao, Full professor with tenure of Networks and Robotics, director of the master program of industrial engineering and management, Institute of Engineering and Technology, University of Groningen, the Netherlands;
- Dr. Mårten Björkman, Associate professor and former director of undergraduate studies at the Centre for Autonomous Systems, KTH Royal Institute of Technology, Sweden;
- Vera Broek (student), Bachelor in Biomedical Sciences, Leiden University and Bachelor of Music at Codarts University of the Arts, the Netherlands.

The panel was supported by Dr. Marianne van der Weiden, independent secretary.

On 16 September 2022, the panel had an online meeting to assess whether the programme meets the conditions.

Assessment

Admission criteria

During the online visit by the NVAO accreditation committee on 23 June 2020 the panel found a discrepancy between the admission criteria as described in the dossier and on the website and the legal requirements. The TNO Robotics dossier stated on page 20: 'For the first year, no foreign and HBO students will be admitted.' The website mentioned: 'For 2020-2021, only students with a BSc degree Mechanical Engineering or Aerospace Engineering from the TU Delft can be admitted'. The panel pointed out that this admission criterion was incorrect and not compliant with applicable legislation (WHW article 7.30b).

After the online site visit and the publication of the panel report, this admission criterion was immediately adapted on the website and in the Teaching and Examination Regulations. The new documentation includes a table showing that the 2020 and 2021 intakes comprised a mix of internal TUD BSc students, students from other TUD programmes and external students. A significant number of external students came from abroad (China, India).

The panel agrees that the current admission criteria, as published on the website and in the formal regulations, fully comply with the Dutch Higher Education and Research Act (WHW).

The panel concludes that the admission criteria **meet the condition** set by NVAO.

The role of the specialisations and their contribution to the achievement of the intended learning outcomes

In the documentation and the discussions during the online site visit, reference was made to various terms, such as specialisations, tracks and pillars. This created confusion and left it unclear whether all students, regardless of their specialisation or study track, would meet the intended learning outcomes. In the new documentation, it is explained that the programme has no formal specialisations or tracks. The four subjects (Machine Perception; Planning and Control; Vehicle Dynamics and Control; Human-Robot Interaction) constitute the substantive pillars of the programme and are part of the study programme for all students.

In the MSc Robotics, all students follow the same 6 obligatory subjects on the above four subjects. In addition, all students follow the Multidisciplinary Project (5 EC) (which covers group work and project integration of the four subjects) and the Robot and Society subject (4 EC), which takes a closer look at the specialist field. Consequently, all students have the same substantial basis of 40 EC. Along with their thesis, portfolio and literature assignment students therefore fulfil the intended learning outcomes. Further, students have to obtain at least 5 EC of their electives by following 'Recommended elective courses on Robotics'. These are Robotics subjects taught within the Cognitive Robotics department. Students can fill in the remaining 20 EC of electives in the first year as follows:

- At least 5 EC by following 'Recommended elective courses on Robotics'. These are Robotics subjects taught within the Cognitive Robotics department (also referred to above);
- Between 3 and 6 EC via 'Courses on Transferable Skills' (transferable skills is an important theme within the MSc Robotics);

- Robotics-related subjects from the list of 'General elective courses'. For example, depending on the intended thesis subject students can choose a subject in the field of sensors (useful when exploring the perceptual side of robots), bio-inspired design (useful for bio-inspired robotics), or control technology (when the robots require complex controls).

Each student has to fill in the Individual Study Programme (ISP) form. This form is based on the study programme approved by the Board of Examiners and laid down in the Teaching and Education Regulations. If a student follows free electives rather than the electives on the form, the Director of Studies will check the (content of the) subjects for any overlap. In addition, the four eyes principle is used and the Board of Examiners will carry out an extra check to ensure that all intended learning outcomes are fulfilled in that instance as well. In the case of external subjects, the Board of Examiners also checks the host organisation and the level of the subjects. The panel agrees that, with the ISP form, there is a procedure in place to safeguard that students obtain the intended learning outcomes.

In the second year of the programme, students will graduate on the basis of a particular research project. In general this will be one or a combination of the above four facets. The research staff in the department are generally also specialised in one of the four subjects. The panel thinks that, in an informal sense, students may refer to their thesis subject as their specialisation, but it is evident that the programme does not offer specialisations in the formal sense. The programme has made this clear both on its website (in the section Frequently Asked Questions) and in the formal registration of TUD specialisations: both confirm that the MSc Robotics has no specialisations.

The panel appreciates the new documentation: it explains clearly how the previous confusion was caused and how the programme guarantees that all students achieve the intended learning outcomes.

The panel concludes that the programme's relation to the intended learning outcomes **meets the condition** set by NVAO.

Conclusion

The panel concludes that the admission criteria have been adapted and now fully comply with the Dutch Higher Education and Research Act (WHW). The panel also concludes that the programme does not offer specialisations and ensures that all students achieve the intended learning outcomes.

The panel concludes that the two conditions are met and advises NVAO to take a positive accreditation decision for the academic master in Robotics of TU Delft.

On behalf of the entire assessment panel,

Utrecht, 20 September 2022

Dr. Françoise Siepel, chair

Dr. Marianne van der Weiden, secretary