

PILOT NEXT GENERATION ROBOTICS programme for honours students

Introduction

Robotics is a multi- and interdisciplinary engineering domain. The creation of innovative robots needs high level research in all disciplines involved. It is a “mission” in which top level engineers of these disciplines work closely together. Currently the TU Delft does not offer bachelor programmes with this “mission” scope. It is expected that industry will need more and more these broadly educated and mission driven engineers (Kamp & Klaassen, 2016).

The honours programmes give sufficient room to experiment with an inter- en multidisciplinary programme. At TU Delft the quality of the incoming students is high and we know that especially students belonging to the top ten percent of the incoming VWO-students, perform really well in the regular programmes. Also we noticed that there are two both “mission driven” and “discipline driven” students, where the former select the TU-Delft because they want to build e.g. robots, aircraft, space craft etc. We expect to attract students from this mission driven group already in the first year of study by offering them a challenging robotics programme. The size of the programme is 30 EC on top of the regular programme.

Aim

To offer an interdisciplinary programme “**Next Generation Robotics**” (NGR) to talented, creative and motivated first year bachelor students who wish to become innovative professional team players with an interdisciplinary and multidisciplinary approach that are able to contribute to and complete a complex mission.

The programme starts in first year of the regular bachelor programme , has a duration of 2.5 years with a size of at least 30 EC and max 45 EC, in which students complete a full “design circle”. They do this by starting with the definition of a mission in the first year and ending with implementation, operation, evaluation of the results and suggestions for a next step in a dedicated minor and bachelor end (team) project.

The NGR programme aims for the same target group as the students that are aimed for at the Honours Programmes. Therefore, a successful first year in the NPR programme will meet the requirements for selection into the HPB (see below).

Target group

Excellent and talented first year bachelor students from:

- Aerospace engineering
- Electrical Engineering
- Information science
- Mechanical Engineering
- Industrial Design Engineering

Max. 15 participants: 3-4 from each faculty

Students have to apply before 1 December first year of study. The students will form a team.

Expected commitment from students

- Students are expected to finish the first year of their regular study in one year with a grade point average of 7 or higher with inclusion of the assignments. Participation in this programme will be stopped if the student does not meet the selection criteria for the honours programme.
- Students are expected to finish regular programme and the integrated honours programme in three years in order to receive an honours certificate (some extension is possible depending on the faculty policy with regards to the duration of the honours programme).

- Expected study load: First year: 8-10 EC; Second year: 10-12 EC; Third year: 8-12 EC.
- Students will be encouraged to take courses (max. 5 EC) offered by TU Delft and meant for all honours students.
- Taking the minor (advanced) Robotics is compulsory
- It is expected that selected and admitted students also choose a robotics research/development assignment in their final bachelor thesis (supervision and assessment according the guide lines and assessment criteria from major programme).

Returns on investment for students

- early orientation and preparation to become inter- and multidisciplinary innovative team players in Robotics
- experience to work with (research and industrial) experts and motivated peers
- extra challenge to broaden and deepen knowledge and experience
- possibility to experience state of the art developments in research and industry
- possibility to explore your own creativity, communication and innovative skills
- after the first year regular programme students become member of the TU Delft honours community (if they have met all the demands)
- this special programme will enable early network building in the Robotics field
- possibility to work on a mission from the start with enough time and skills to accomplish this possibility to write and present a scientific paper
- possibility to work in an interdisciplinary team and to experiment with the different engineering roles
- possibility to choose for master track Robotics from four faculties (LR, EE, CE/CS and Mechanical Eng.)
- TU Delft Honours certificate after completion regular BSc programme and Honours Programme in three years (some extension is possible and depending on the faculty policy with regards to the duration of the honours programme).
- this honours programme is embedded in the TU-Delft Robotics Institute and students become part of the (international) robotics community

Selection

Selection takes place on the basis of past performance (VWO-grades, grades courses first quarter university), motivation and proof/evidence of perseverance and mission orientation. The selection will be coordinated by the coordinator.

After a successful first year (P in 1, mean grade > 7.5 of BSc programme) the students, that take part in the NGR programme, are invited to join the Honours Programme, which forms an integral part of their NGR. They are admitted to the HPB when the coordinator of the HPB approves a motivation letter by the student.

NGR Programme

Theory and masterclasses : 7-12 EC

Extra courses from other domains to acquire theory necessary for developing robots next generation. Extra theory is dependent of major regular programme.

Necessary knowledge: mechanics, programming skills, electronics, data-acquisition, systems and control, sensors, micro controllers, basics embedded systems, basics men-machine interaction, basics pattern recognition.

Projects 12-30 EC

- The students define a mission that can be used to create a consistent set of projects over the years.

- Students can choose a project to work on in small groups (2-3 students)
- Students can choose for small projects or one large project
- Students write a paper as result of at least one project

Other parts of programme

- Master classes newest developments robotics and human interaction with robots
- special cases /topics
- Participation (international) conferences in the Robotics field
- (international) collaboration (competitions/summer courses etc.)
- industry visits and projects
- Implementation of the full mission, demonstrate it and interpret the results
- Be part of the outreach programme of the university

The learning objectives for the interdisciplinary part (5 EC) of the HP will be met using the above listed framework and/or additional courses offered under the HPB programme.

Organisation, infrastructure and coaching

The Robotics Institute is responsible for the programme and will support the students from the different disciplines. The selected students will become member of the institute.

The following scientist from the Robotics Institute will contribute to an interesting and effective learning environment and the assessment of students:

Dr. ir. C.J.M.Verhoeven, programme leader

Dr. J.P.R.B.Daudt, programme coordinator

Dr.ir. J.C.Verlinden, Computer Aided Design Engineering (IO)

Dr. G.C.H.E. de Croon, Control and Simulation (LR)

Prof.dr.C.M.Jonker, Interactive Intelligence (EWI)

Prof.dr.ir.M.Wisse, Biorobotics (3mE)

Prof.dr.ir. I.R. van de Poel, Values Technology and Innovation (TBM)

Dr. R.G.Klaassen, Centre for Engineering Education 4TU federation.

For this special class a working place will be offered and created by the Robotics Institute to work together and exchange ideas etc. Students receive coaching (content and personal development) from scientists linked to the Robotics Institute. The Robotics Institute will also reserve a budget to enable practical implementation of the mission.

Quality assessment

The Robotics Institute is responsible for the quality assessment. On the process and product the coaches will have great impact. Other pieces of evidence are results of taking part in competitions and/or their contribution to solving problems from industrial partners of Robo valley. Students have to describe in a midterm- and end report how they have met the goals of the honours programme. The faculty honours coordinators will be consulted at the selection and during the programme, when students from their faculty are selected.

The individual NGR programme of the students may need adaptation because of planning or capacity issues along the way. The coach and the NGR coordinator at the faculty will give advice for changes to the individual programme of the students.

Since the NGR programme is an extra-curricular, non-accredited programme no rights can be claimed by the students, except for the Honours Programme, which is mentioned in the OER.

Selection and start

- Start first year 1 February 2017
- Start weekend: 11 and 12 February (compulsory attendance)
- Application open: from 1 December – 10 December (24:00)

- Application deadline: 10 December 2016 (24:00)
- Selection interviews: 20 December 2016
- Selection on basis of GPA VWO and grades after first quarter in combination with motivation letter.
- Selection will be done by the involved faculty honours programme coordinators.
- The selected students will be invited for an interview on 20 December 2016

Timeline for involved programmes and students:



Information meeting: 1 November, 12:30-13:30, EEMCS building, lecture room Pi

Overview extra programme

year	activities	EC's	Compulsory in regular programme	EC's in regular programme
1	Mission statement/ambitions, catching up missing knowledge with TU Delft courses or MOOC's; master classes, excursions, start project	8-10		
2	Catching up missing knowledge, project(s), master classes, excursions, interfaculty modules honours programme (max. 5 EC)	10-12		
3	Project(s), master classes, participation competitions, writing paper, participation honours symposium	8-10	Minor advanced Robotics and Robotics Bachelor Thesis Project (N.B.: thesis project according to regulations major programme).	45 EC
		min. 30 EC		

References

Kamp, A & Klaassen, R (2016). Impact of global forces and empowering situations on engineering education in 2030. In s.n. (Ed.), Proceedings of the 12th international CDIO conference (pp. 1-20). Turku: CDIO.