June 30, 2021

TO: Members of the Board of Trustees

FROM: Carl W. Lejuez, PhD
Provost and Executive Vice President for Academic Affairs

RE: New Undergraduate Major in Robotics Engineering

RECOMMENDATION:

That the Board of Trustees approve a new undergraduate major in Robotics Engineering in the School of Engineering.

BACKGROUND:

Robotics is an interdisciplinary field focused on the design, construction, and operation of robots. The increased capability of embedded computation as well as advanced sensors has enabled significant growth in robotics. Application needs are apparent in a number of commercial areas including healthcare, logistics, manufacturing, maintenance, surveillance, amongst others as well as handling mundane household tasks such as mowing the lawn and vacuuming the floor. Robotics is anticipated to see significant growth in employment over the next decade. Data from Burning Glass Technologies showed over 5000 robotics job openings over the last year in New England (66000 nationally). Of those, 200 were explicitly listed as robotics engineer (1900 nationally). It is already one of the most popular STEM club activities at the middle school and high school level. While there is some local competition with Worcester Polytechnic Institute (WPI) and UHart, if UConn were to create this undergraduate robotics major, it would be the second Research 1 university, and only one outside of California with such a program.

The home department will be the Electrical and Computer Engineering (ECE) Department because of the department’s overlap with many of the core robotics topics and its existing faculty strength in the area. An estimate for enrollment, based on figures from the program at WPI would expect around 250 students in the program once it has been established. Because of the New England Regional Tuition Break program, we may expect an additional 50-100 students for a total of 300-350 students. We suspect that there may be a reduction of 50-100 students from the EE, CMPE, ME, and CSE programs as students opt for the robotics engineering program instead. An overall small increase in resources (faculty and robotics design labs) is detailed in the attached proposal.
PROPOSAL FOR A MAJOR IN ROBOTICS ENGINEERING
DEPT. OF ELECTRICAL AND COMPUTER ENGINEERING
SCHOOL OF ENGINEERING
UNIVERSITY OF CONNECTICUT

Introduction and Rationale
Robotics is an interdisciplinary field focused on the design, construction, and operation of robots. While robots are commonly thought of as machines capable of autonomously carrying out complex actions, a broader definition of a robot is a physical system which integrates sensing and actuation with computation and control. The increased capability of embedded computation as well as advanced sensors has enabled significant growth in robotics. Application needs are apparent in a number of commercial areas including healthcare, logistics, manufacturing, maintenance, surveillance, amongst others as well as handling mundane household tasks such as mowing the lawn and vacuuming the floor.

Robotics naturally builds on a number of disciplines including control systems, embedded systems, electronics, computer hardware and software design, machine learning, mechanical design, biomechanics, and others. These disciplines span a number of majors including Electrical Engineering, Computer Engineering, Mechanical Engineering, Computer Science, and Biomedical Engineering. However, one major alone cannot provide the needs of a practicing robotics engineer. It is in that light, we propose the creation of a new Robotics Engineering undergraduate degree. The home department will be the Electrical and Computer Engineering (ECE) Department because of the department’s overlap with many of the core robotics topics and its existing faculty strength in the area.

Robotics is anticipated to see significant growth in employment over the next decade\(^1\). Data from Burning Glass Technologies showed over 5000 robotics job openings over the last year in New England (66000 nationally). Of those, 200 were explicitly listed as robotics engineer (1900 nationally). It is already one of the most popular STEM club activities at the middle school and high school level. FIRST Robotics has over 3000 high-school-age teams nationwide, with 61 teams and over 300 participants in Connecticut. Likewise, VEX Robotics has over 100 high-school and middle-school teams with over 500 participants in Connecticut. UConn ECE has been a long-time sponsor of FIRST robotics at EO Smith High School. Oftentimes, students who participate in these robotics programs struggle to find a program at the college level that allows them to further their interests. In 2007, Worcester Polytechnic Institute was the first American university to launch an undergraduate robotics program. Since then, robotics programs have been created at a handful of other universities including Gannon University, Lawrence Technological University, Southern Illinois Edwardsville, University of Michigan Dearborn, UC Santa Cruz, and Widener University. The University of Hartford inaugurated their new robotics program this past

\(^1\) [https://www.zdnet.com/article/robots-will-take-50-million-jobs-in-the-next-decade-these-are-the-skills-youll-need-to-stay-employed/](https://www.zdnet.com/article/robots-will-take-50-million-jobs-in-the-next-decade-these-are-the-skills-youll-need-to-stay-employed/)


fall\(^2\). While there is some local competition with WPI and UHart, if UConn were to create this undergraduate robotics major, it would be the second Research 1 university, and only one outside of California with such a program. Mechatronics Engineering, which is similar in scope to robotics engineering, is offered at a few universities internationally, but is available in the US only at Kennesaw State, Middle Tennessee State, and UNC Asheville.

WPI’s program in robotics engineering was accredited by ABET in 2009. Gannon, Lawrence Tech and Michigan-Dearborn are the only other programs with ABET accreditation\(^3\). We will seek accreditation from ABET for the robotics engineering program as soon as the program graduates its first cohort of students. The School of Engineering’s next scheduled ABET visit is in 2025.

**Enrollment Projections**

We can only provide estimates of enrollment based on educated guesses. WPI, in Fall 2019, had enrollment of 565 in robotics engineering – roughly equivalent to their electrical engineering enrollment and half of their mechanical engineering enrollment\(^4\). If we have a similar distribution at UConn, we would expect around 250 students in the program once it has been established. Because of the New England Regional Tuition Break program, we may expect an additional 50-100 students for a total of 300-350 students. We suspect that there may be a reduction of 50-100 students from the EE, CMPE, ME, and CSE programs as students opt for the robotics engineering program instead.

**Required Resources**

In ECE, we have a core of 3 existing robotics faculty. With 75-80 robotics students each year, we will need to support 1-2 new robotics elective courses each semester which will require the effort of one new faculty member (at an average of 3 courses per year). In addition, the extra load on existing courses (e.g. ECE2001, ECE3101, etc.) will probably require extra faculty in ECE, ME, and CSE. Thus, we expect a need to hire at least 4-5 new faculty in ECE, ME, and CSE with additional funding for appropriate TA support. The new robotics design labs will require new specialized equipment and space. We anticipate the cost to equip the physical lab space will be around $150,000. ITE C27 may be able to serve as a location for this lab.

---


\(^3\) [https://amspub.abet.org/aps/name-search?searchType=program&keyword=robotics](https://amspub.abet.org/aps/name-search?searchType=program&keyword=robotics)

\(^4\) [https://public.tableau.com/profile/wpi.institutional.research#!/vizhome/Enrollment_15718046316670/Story1](https://public.tableau.com/profile/wpi.institutional.research#!/vizhome/Enrollment_15718046316670/Story1)