



**Modernization of Mechatronics and Robotics for Bachelor degree in
Uzbekistan through Innovative Ideas and Digital Technology**

(MechaUz)

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Rethinking Mechatronics Design Education for the Modern Era

THE BACKGROUND

This project comes as a solution to the need of developing the higher education capacity & offerings in Uzbekistan in the field of Mechatronics. The main objective of the program is to develop a continuous education program to train a new generation of engineers well capable of performing constructive engineering works and meeting today's technological challenges by development of a new curriculum.

The main aim of the project is to develop bachelor's degree program in the field of Mechatronics; to improve the mechatronics' specialist's knowledge in Automation sphere, to support the capacity building of higher education institutions and to make contribution for the sustainability

This initiative is based on the theme of "Modernization of Mechatronics and Robotics for bachelor's degree in Uzbekistan through innovative ideas and Digital Technology"

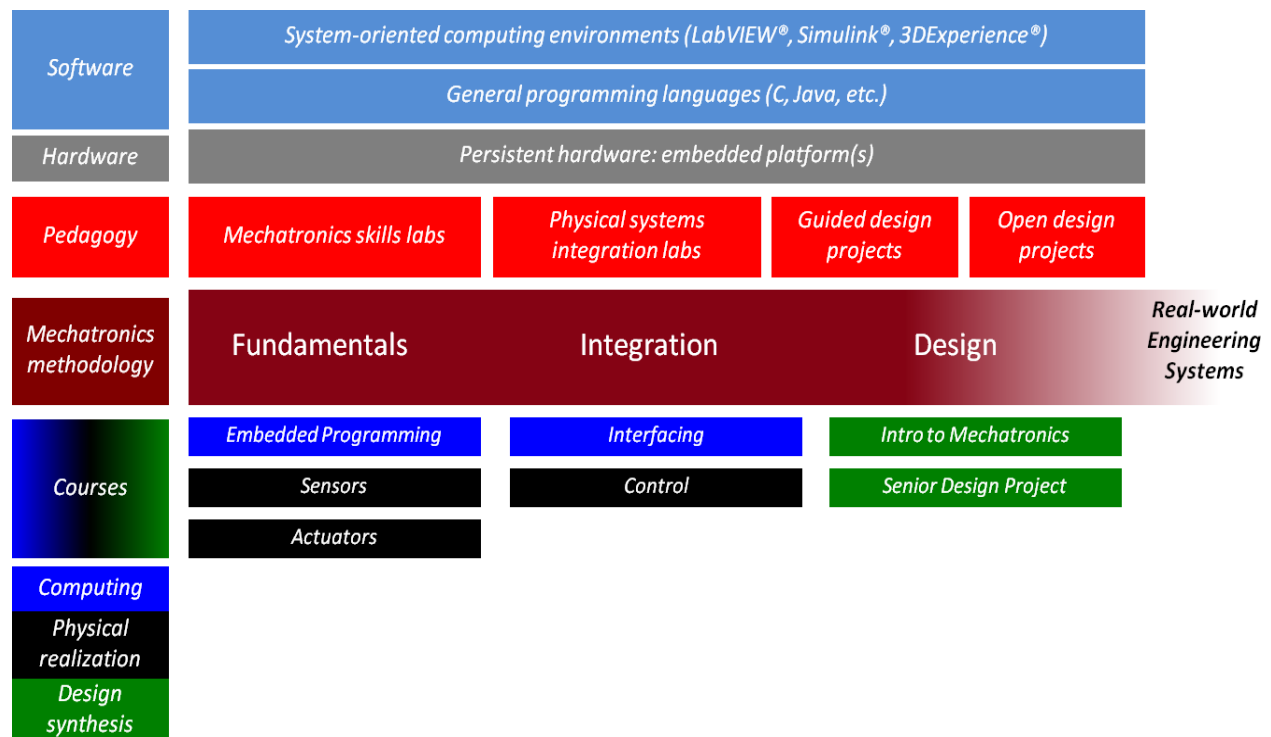
The project will focus on:

- Developing and implementing a new scheme of cooperation for university-industry links based on EU skills in Mechatronics sphere.
- Developing standards and curricula, courses, teaching methods, materials, and tools (soft skills) in the field of Mechatronics.
- Developing and implementing new courses for teachers, staff, and engineers of the enterprises.
- Training teachers from HEIs in Uzbekistan with teaching methodologies based on Mechatronics at EU partner universities.
- Developing and publishing a new generation of handbooks/manuals for direction of Mechatronics.
- Establishing the Innovation laboratories (I-LAB), Training Centre and Mechatronics Society of Uzbekistan for disseminate the results of project.
- Testing, adapting and accrediting curriculum, materials, and methods.
- Transferring the recommendations of the new model of education system to other sectors of the Uzbek economy.

THE MOTIVATION

The global engineering academic community is witnessing an explosive growth in the number of programs and courses in mechatronics. They take the form of options or electives within conventional departments, or as fully realized programs and departments. This is not surprising as society is inundated with chatter about the “Internet of Things”, robotics, drones, etc. Additionally, within the engineering profession, the computer control of complex engineering systems is now firmly entrenched in a principal framework for increasing the precision, performance, efficiency, and decreasing the cost of modern systems. Understandably, the mechatronics programs are part of the academic response to these trends.

Quanser has looked through many university programs and recommended solutions that may benefit their education and research goals. Over the last few years, there has been a large increase in mechatronic programs that include control systems, robotics, instrumentation, software programming, mechanical design, and so on. Pedagogical courseware is also included with most of our products. These include full student/instructor workbooks and laboratory guides that cover many of the course topics taught in mechatronic programs.



THE CHALLENGES

By its nature, a mechatronics program relies heavily on hands-on experiences and labs. Microprocessor programming, sensor integration, or hobby robotics are all very typical kinds of labs that many institutions have introduced. A common lab sequence sees students programming hobby microprocessor boards and then connecting them to simple sensors to operate small motors, lights, or other components. Because of the use of hobby-grade components, often the essential learning challenge becomes the programming as opposed to the system, in addition to the programming.

In many cases, the lab sequence culminates in projects where students might build small hobby robots to perform a relatively complex task. The challenge is again, typically in the programming to refine the smarts of the control software. The physical system itself remains relatively simple in configuration.

While the core curriculum sequence of most undergraduate engineering programs is based on modeling and analysis of complex physical systems using mathematical and scientific methods, the mechatronics lab sequences remain problematically disconnected from this core. Quanser's contribution in this context is to offer a learning platform that reconciles the traditional applied sciences with modern mechatronic technique.

THE SOLUTION, A MODERN MECHATRONICS PROGRAM

Based on the mechatronic programs from different universities around the world that we have reviewed and our collaborations with various institutions, we have listed the following courses that would make up a well-rounded, modern Mechatronics program:

- Fundamentals
 - o Sensors
 - o Actuators
 - o Microprocessor Architecture
 - o Embedded Programming
- Integration
 - o Control Systems I – Classical Control
 - o Control Systems II – Modern Control
 - o Digital Control Systems
 - o Robotic Manipulators and Mobile Robotics
 - o Flight Dynamics and Control
 - o Mechanical Design (CAD)
- Design
 - o Senior Design Project

THE QUANSER METHOD FOR MECHATRONICS

The term Quanser Method refers to a core philosophy of harmonization of key concepts and techniques that are quite often treated independently in a curriculum sequence. For mechatronics programs, the Quanser Method focuses on the development of fundamental skills in a guided way that effectively prepares students to apply those skills in a more open-ended project and design context.

Additionally, the Quanser Method places significant emphasis on the inherent dynamics of engineering physical systems. In this way, the method differentiates itself from a programming-centric approach, and arguably is better at conceptually connecting to most of the courses in typical undergraduate programs that are founded on engineering science, modeling, and mathematics.