How do we prepare engineering students for the era of intelligent engineering systems

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Edutech India
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QUANSER = Question + Answer
How do we prepare our students for the era of AI and complex intelligent engineering students?
SMART CITY
BUILDING TOMORROW’S CITIES

INDUSTRY
SECURITY
RETAIL
SOCIETY
HEALTHCARE
HOME
ENERGY
MOBILITY
Can undergraduates design high-fidelity complex, connected, intelligent systems?
Engineering design education innovation
The state of engineering education innovation

Can this adequately prepare students for the design of complex modern systems?
A Taxonomy of Design

- Intuitive systems
- Described systems
- Instrumented systems
- Connected systems

Engineering for the modern era

- Instinct-based design
- Model-supported design
- Validated design
- Complex system design
Demystifying complex intelligent engineering systems

Communication

Chat

Actuators

Sensors

See

Think

Physical System

Do

Computation
A case study: Drone system design
American University of Sharjah, UAE
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American University of Sharjah, UAE
Quanser Autonomous Vehicle Research Studio

Highly efficient platform for contemporary autonomous vehicle research
Complex skills development progression

- Exploration labs
- Skills sprint labs
- Guided design projects
- Open design projects

- Motivation
- Technical skills
- System integration & application
- Testing & validation
- Design for manufacture
- Design for commerce
E.g. Skills primitives for drone design

Foundation

- Dynamics
- Control Systems
- Instrumentation and Measurement
- Electromechanical Systems
- Power Systems
- Microcontroller Interfacing
- Analog Electronics
- Kinematics
- Machine Vision
- Autonomy
- Advanced Applications

Design skills

- Flight Control
- Integration
- Automation
- Design
- Fabrication
- Sensor Integration
- Control Implementation
- Verification and validation

Research & autonomous applications

- Review of drone systems
- Machine Learning
- Advanced Control
- Distributed Systems
- Autonomous systems
- Collaborative Robotics
- Advanced applications and special topics

Manufacturing & commercialization

- Design for manufacture
- Fabrication
- Verification and validation
- Logistics
- Regulatory
- Economies of Scale
- Intellectual property management

Technology platform

- QNET Trainers: Control, Sensors, Actuators, Interfacing, Power Systems, Robotic systems, Electronics
- NI ELVIS platform with RIO
- Quanser AERO Embedded
- Quanser QDrone platform
- qdex and QUARC-XR software
- Essential subsystem kits
- Embedded processors, controllers
- Sensors, electronics
- Motor selections
- Essential frame platform pieces
- Quanser Autonomous Robotics Research Studio. Components include:
  - Additional ground and manipulator robotics components
  - High performance communication and optical localization
  - Stationary gimbal test platform
  - Safety platform
- Rapid prototyping and fabrication platform
- Quanser Advanced Manufacturing Simulation platform with augmented reality support
A new course in autonomous drone design will be launched at AUS in 2019.

Extra curricular certificate course
80 hours of instruction
Flight performance based assessment
Scaffolding for guided design projects

- Dynamics and control
- Motivation
- Intel Aero + “Q-Brain” inside
- Guided decision-space, parts kit
- Simulink + QUARC + prebuilt models and resources
- Mobile device support

Prototype flight test
Prototype stationary test
Motor dynamics
Engineering for modern complex system design

- Design
- Theory
- Technology
- Systems thinking
Conclusions: A new approach to design education

1. Harmonizes foundational sciences and methods of engineering
2. Framed by priority applications of the modern era
3. Meaningful structured iteration
4. Efficiently develops modern-industry readiness skill set