
NATIONAL
INSTRUMENTS™

Sparking Innovation in the Classroom With Mechatronics and the IoT

Mission Statement

NI equips engineers and scientists with systems that accelerate productivity, innovation, and discovery.

Grand Engineering Challenges

- Advance Personalized Learning
- Make Solar Energy Economical
- Advance Health Informatics
- Enhance Virtual Reality
- Reverse-Engineer the Brain
- Engineer Better Medicines
- Provide Access to Clean Water
- Develop Carbon Sequestration Methods
- Restore and Improve Urban Infrastructure
- Secure Cyberspace
- Manage the Nitrogen Cycle
- Provide Energy From Fusion
- Prevent Nuclear Terror
- Engineer the Tools of Scientific Discovery

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CERN LARGE HADRON COLLIDER

World’s Largest Particle Accelerator

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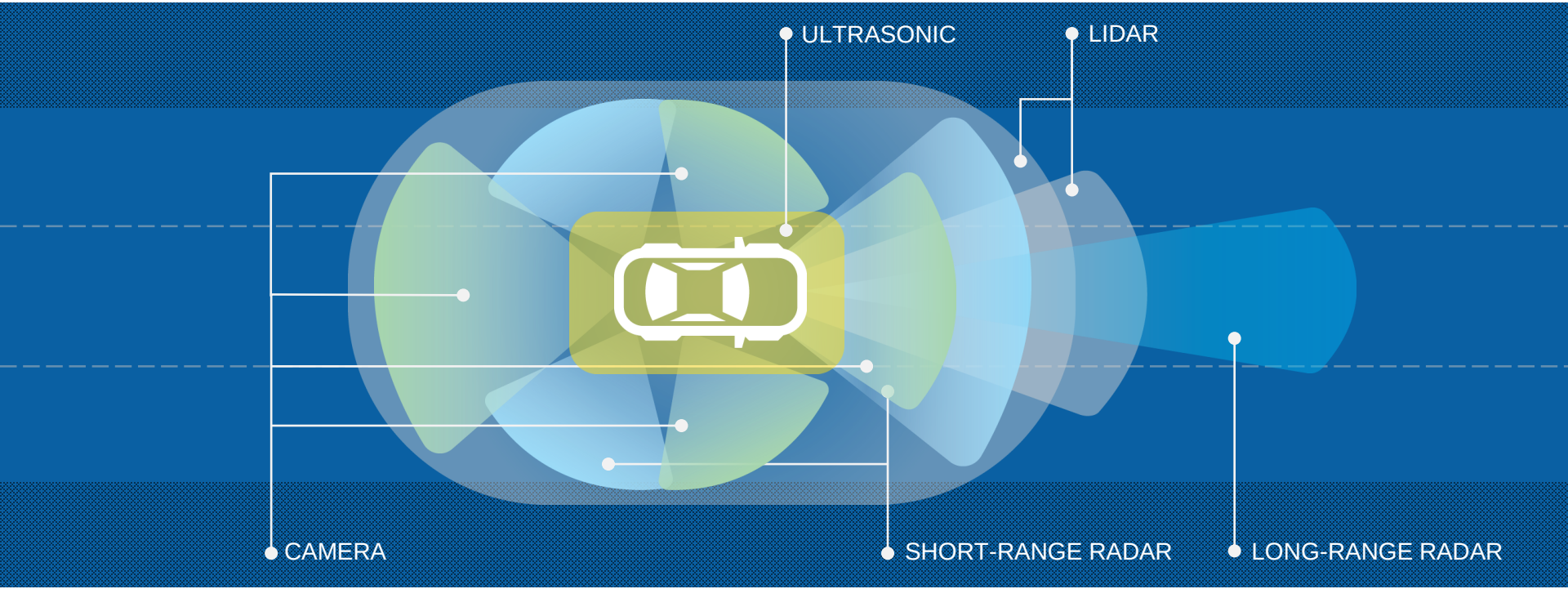
IEEE Spectrum

2020 will be the year when 5G Goes from Theory to Reality

Autonomous Vehicle



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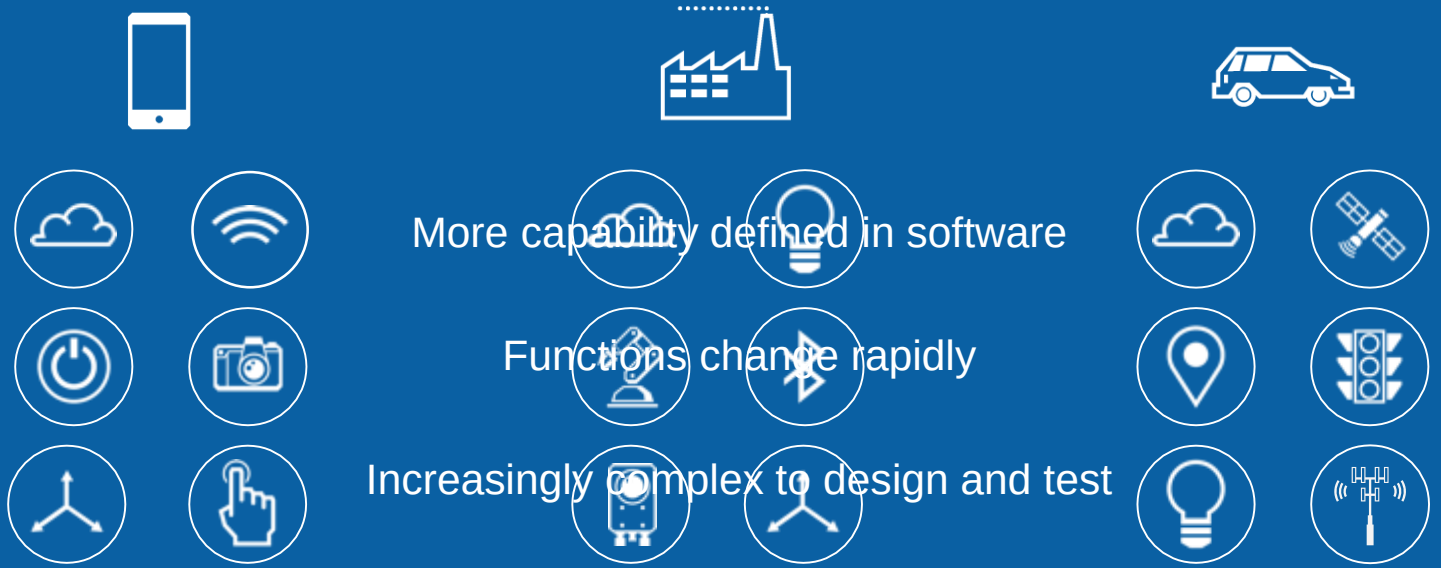
Student Focus Is on Engineering Systems



More capability defined in software

Functions change rapidly

Increasingly complex to design and test

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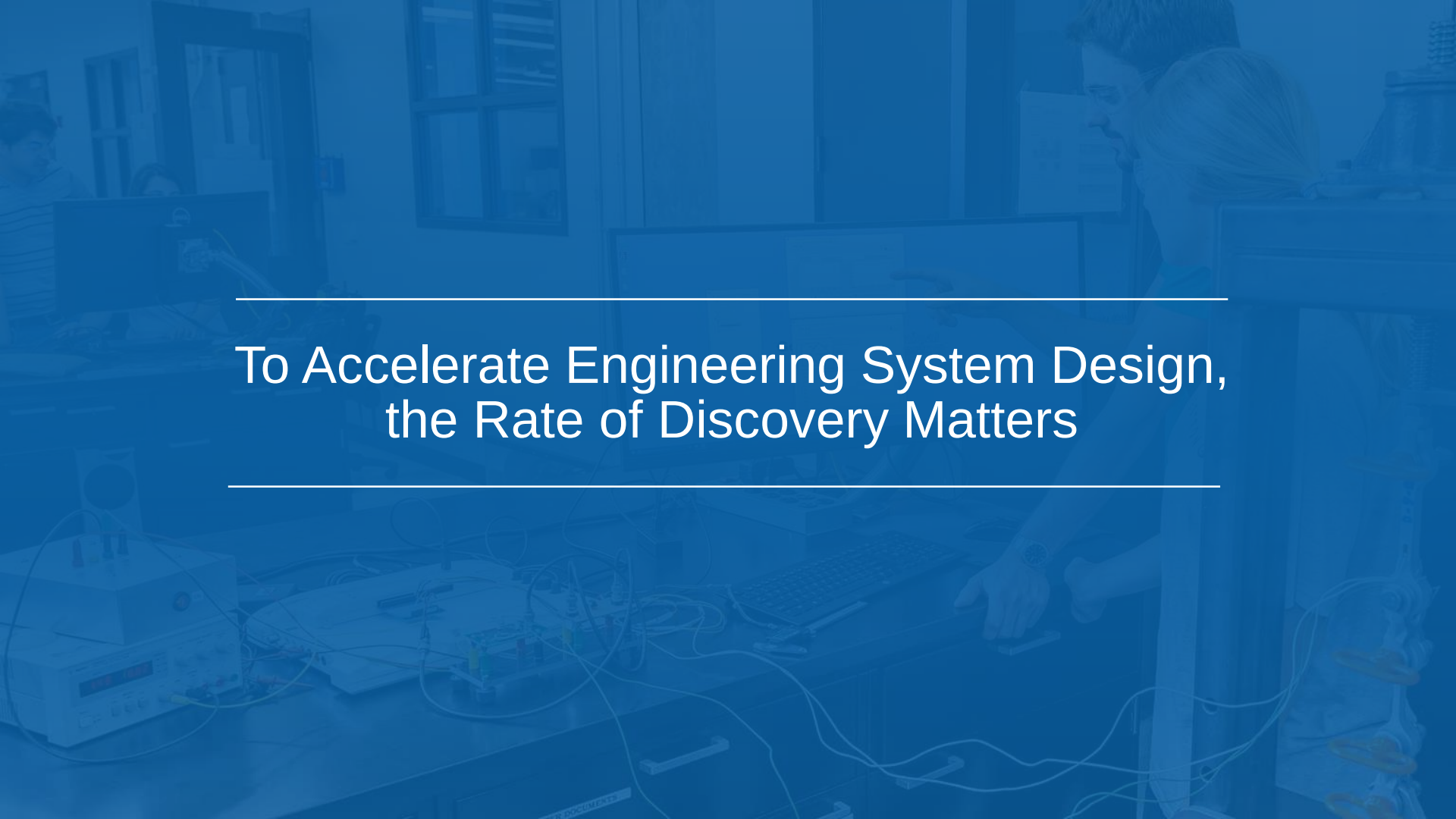
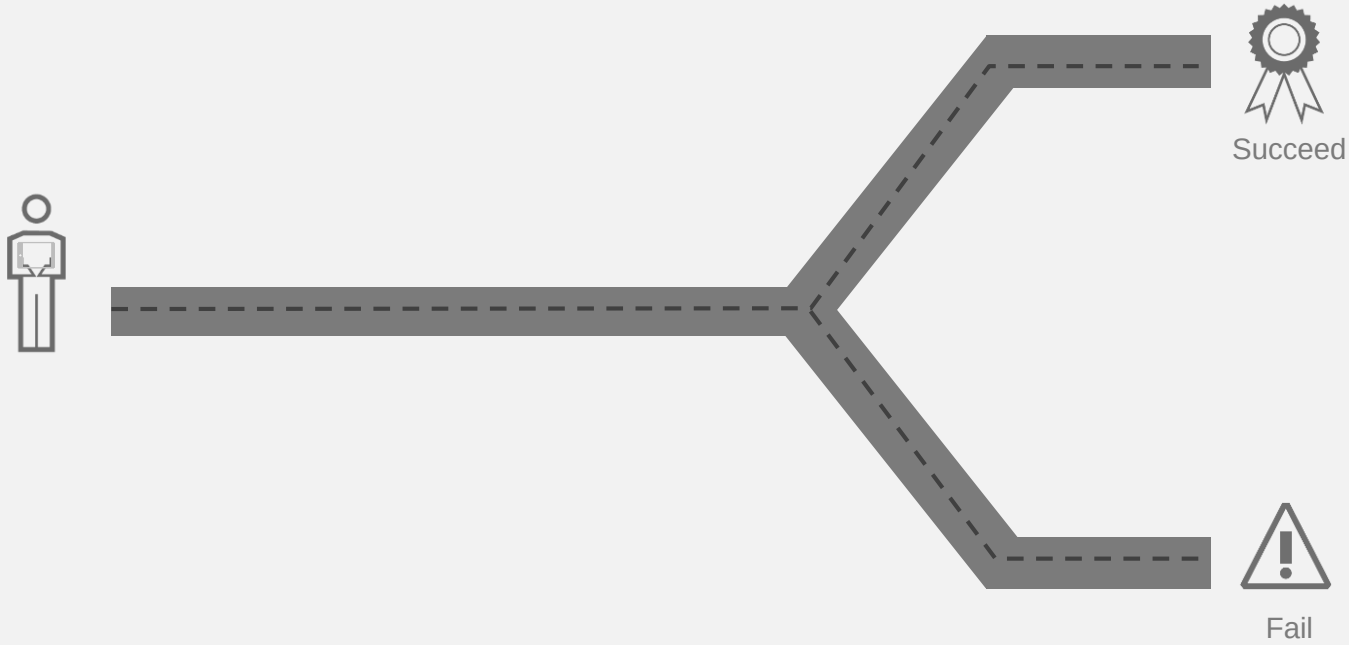
How Do We Prepare Students for Engineering System Design?



To Accelerate Engineering System Design, the Rate of Discovery Matters

A Common Misconception



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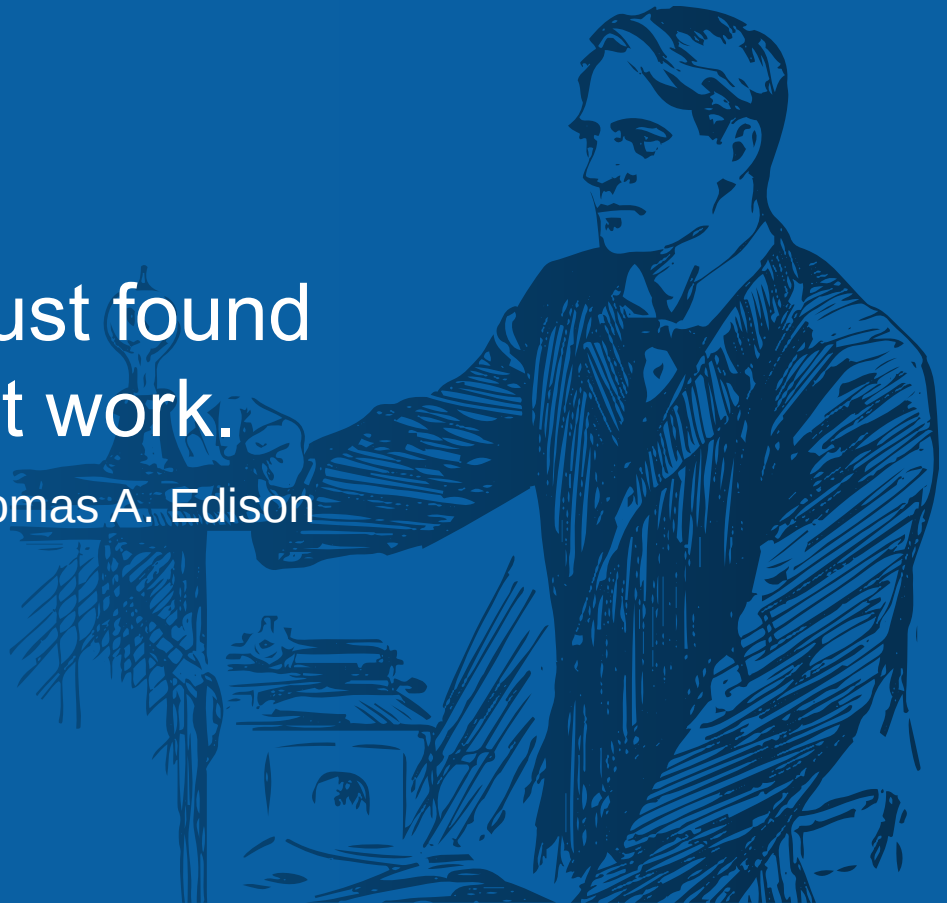
I have not failed. I've just found 10,000 ways that won't work.

—Thomas A. Edison



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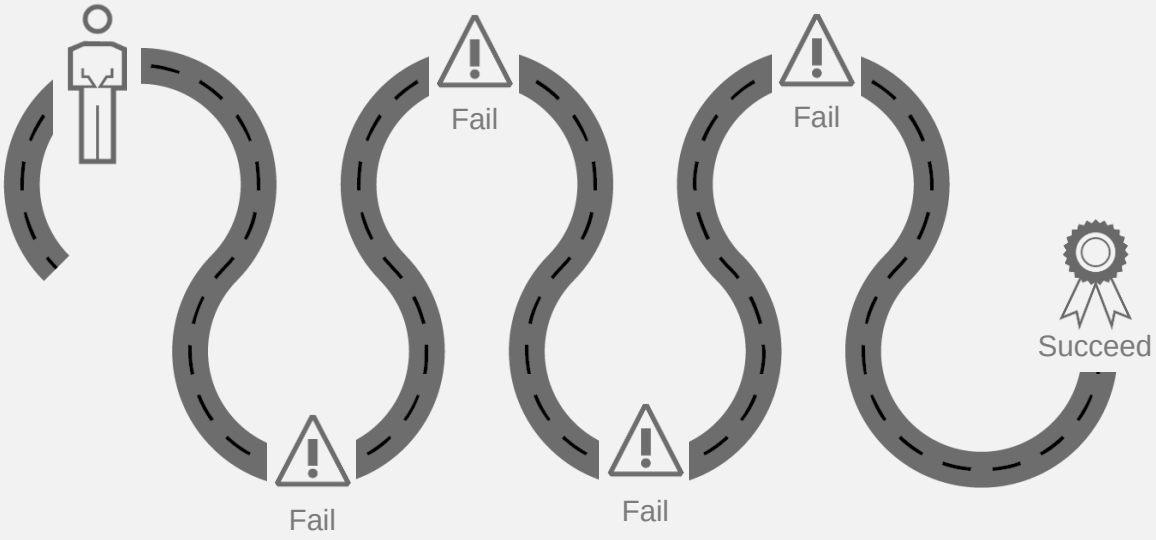
True Path to Success



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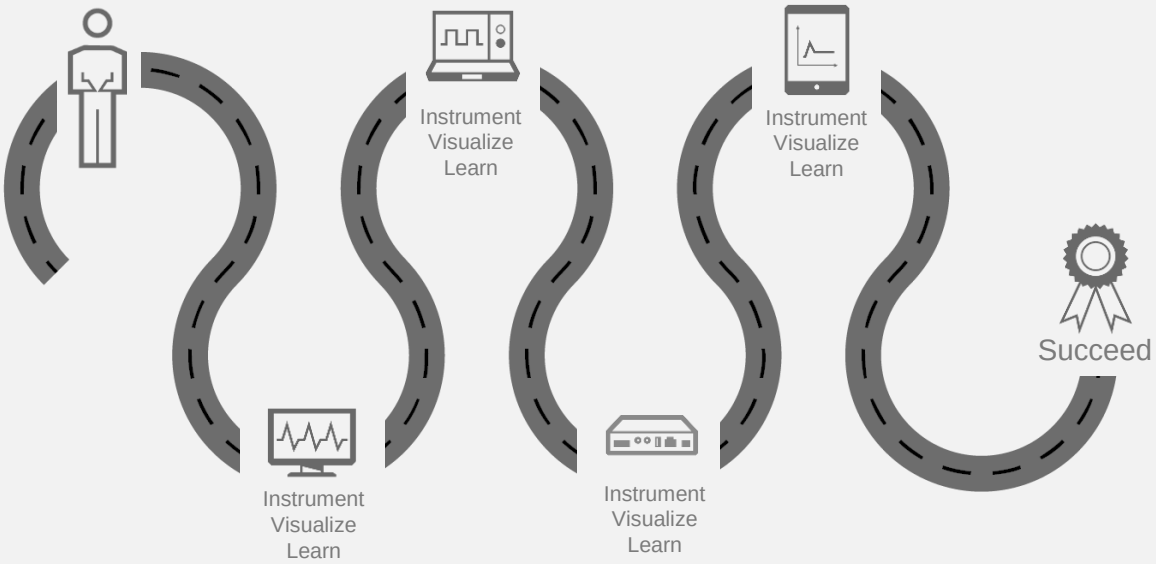
True Path to Discovery



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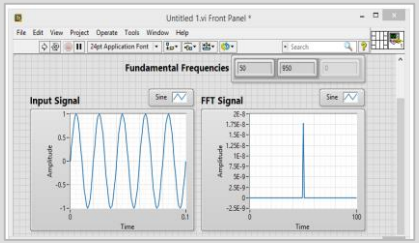
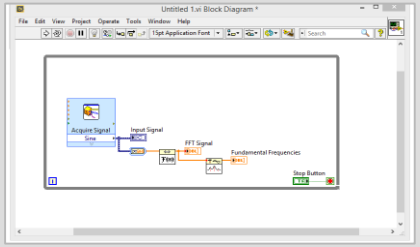
Accelerating Engineering System Design

Rapid assembly of system through modular I/O	Instant insight at every step through virtual instrumentation	Software at a schematic-level overview to integrate system
		

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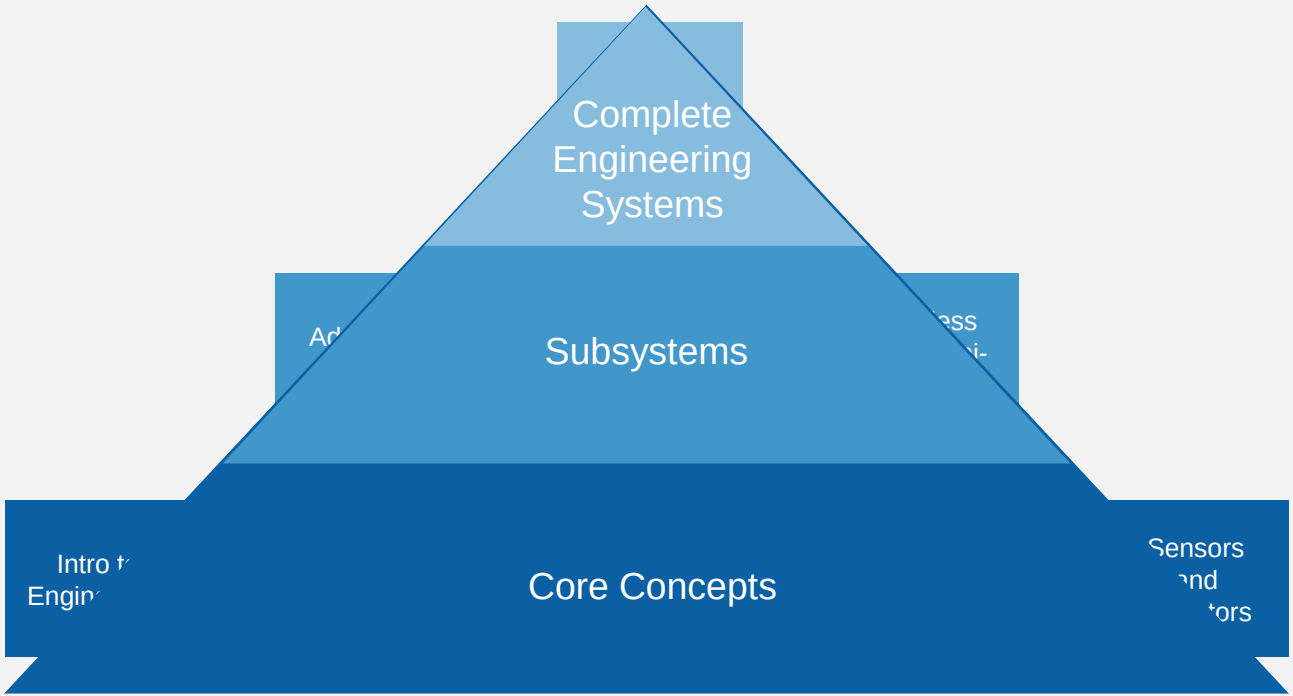
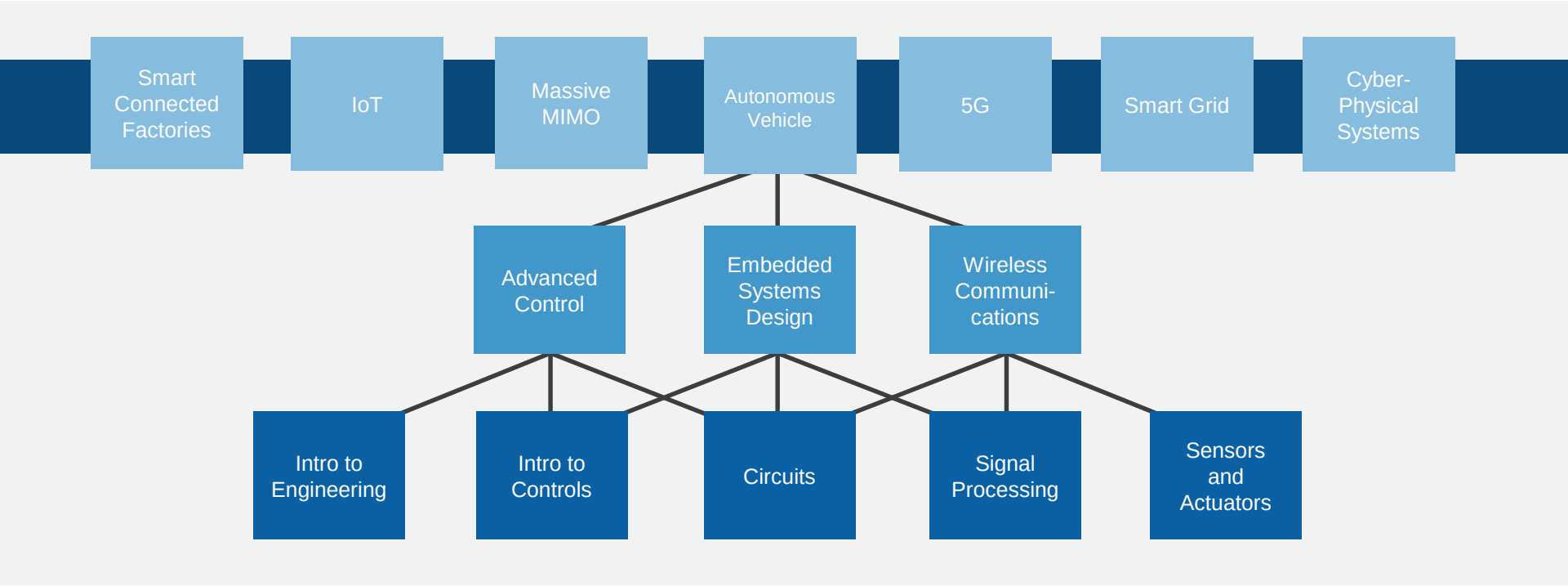
Path to Engineering System Design



Path to Engineering System Design



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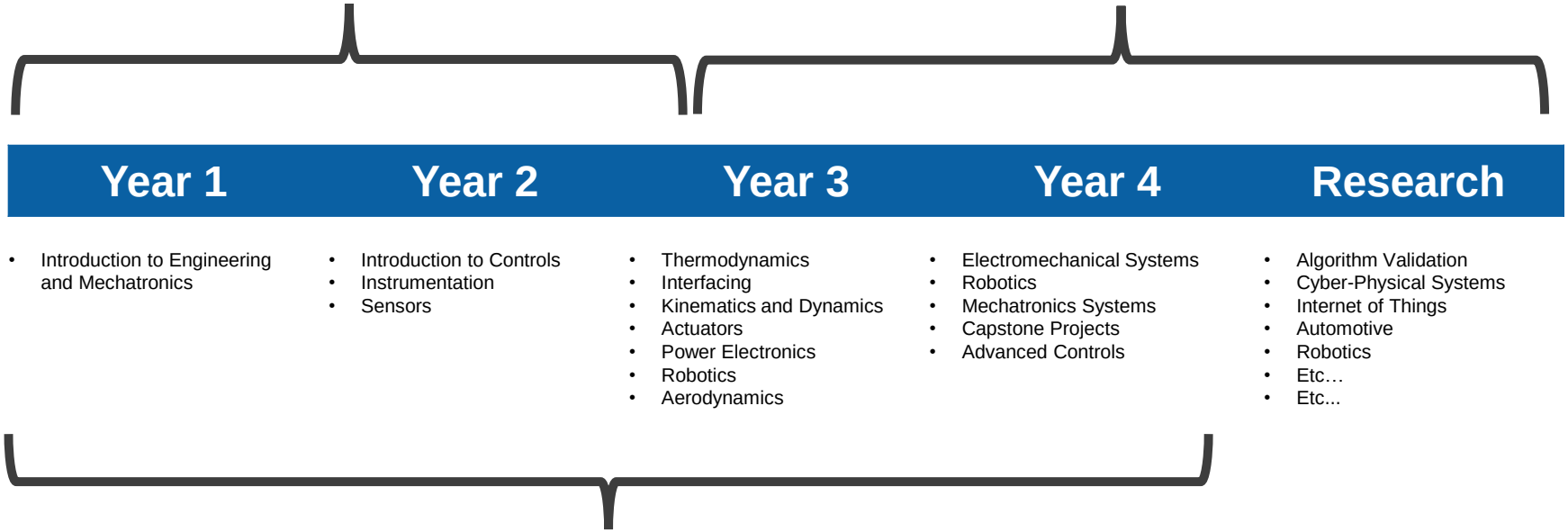
Focus on Key Courses for Controls and Mechatronics

Foundational concepts

Subsystems and multidisciplinary systems



Broad set of topics with a focus on instrumentation, controls, and mechatronics

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Challenges in Accelerating Controls and Mechatronics Education

- Students excited by ambitious projects; less excited by foundational topics
- Limited laboratory time to build true understanding
- Differences in theory from laboratory results drive student confusion
- Students do not retain understanding of foundational concepts, which leads to difficulties in later multidisciplinary classes

Tsinghua University

Success Story

- No. 1 ranked engineering program in the world (*US News*)
- Advanced controls and mechatronics topics taught in **Automation Program**
- Challenged to rapidly build student understanding of engineering topics toward outcome of complex design
- Students spent more time learning “new tools” each semester rather than focusing on engineering
- Built program on foundation of LabVIEW and Multisim software along with myRIO and NI ELVIS
- Program improved student engagement and employability and advanced robotics capstone projects

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Tsinghua University

First Year Foundation Projects	Second Year Platforms and Systems	Third Year Applications	Fourth Year Product Capstone Design	Research Research and Design
INTRODUCTION TO ENGINEERING	CIRCUITS SIGNAL PROCESSING	ADVANCED CONTROL CLASSIC CONTROL	PROJECT	ROBOTIC LEG SMART BIKE
 Robotics Starter Kit	 myDAQ  myRIO	 myRIO  NI ELVIS+QNET	 myRIO	 sbRIO  cRIO

LabVIEW AND MULTISIM SOFTWARE

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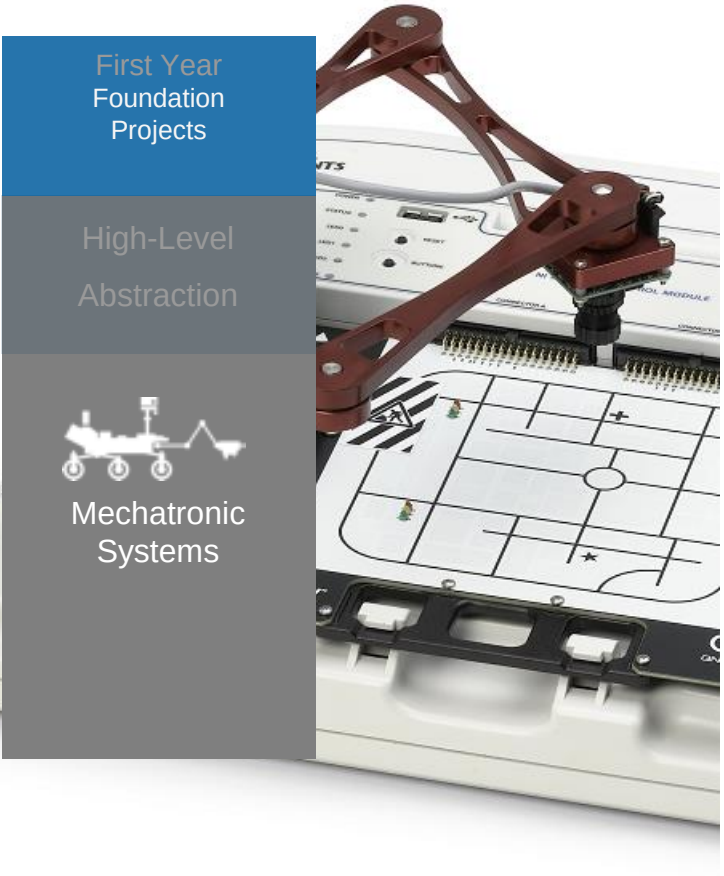
First Year
Foundation
Projects

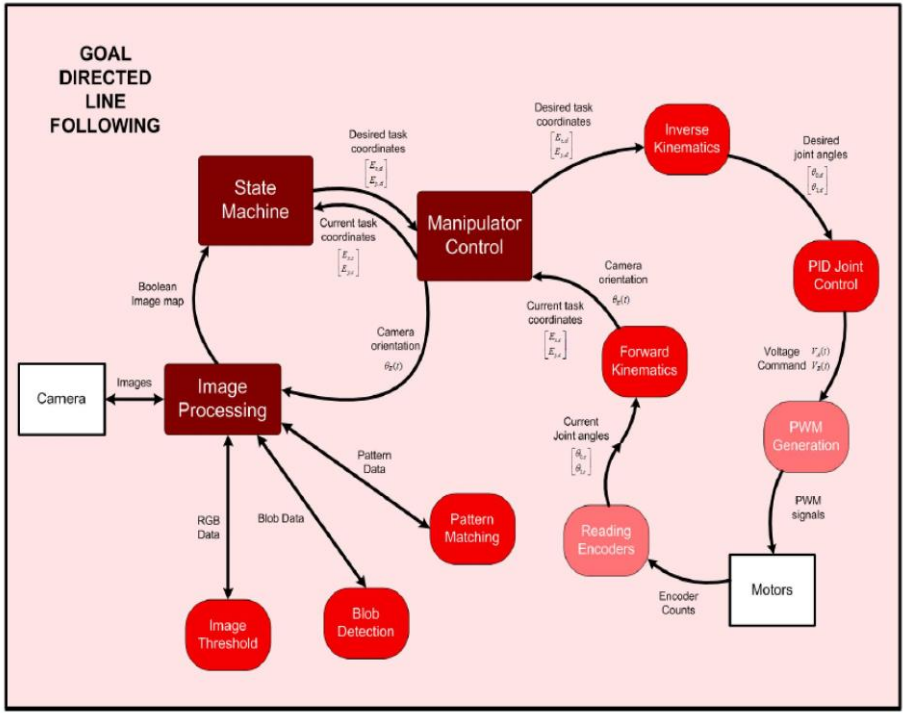
High-Level
Abstraction

Mechatronic
Systems



Challenge: Goal-Directed Line Follower

- Create a vision algorithm that centers on a line that will represent a road
- Create a control algorithm that uses the feedback from the vision application you created to make setpoints for a manipulator arm to achieve
- Create a user input mechanism that allows for new paths to be provided as the system is following already-created paths



First Year

Goal-Directed Line Following

Vision

Control

Component Integration

PID
Inverse/Forward Kinematics
Path Planning
Blog Detection

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