

FORCES: Foundations Of Resilient CybEr-physical Systems

Education & Outreach

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Kick-Off Meeting

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Presentation Outline

- Overview
 - Scope of Education Work
 - Research behind our Plan Implementation
- FORCES Education Goals
 - Curriculum Development
 - Outreach to Community
 - Broadening Participation
- Wrap Up
 - Goals Year 1
 - Plan for Execution

FORCES Education - Scope of Work

- Curriculum Development

- Address the gaps in the EE, CS, and Systems curricula in the area of large-scale cyber physical systems.
- Incorporate new concepts and tools based on the theory of resilient network control, game theory, mechanism design, and network economics in teaching of CPS Applications.
- Real-world case studies from transportation, electricity, and information networks.

- Outreach to Community

- Provide training to the researchers and practitioners working in the area, and seeking degrees in the area of cyber-physical systems.

- Broadening Participation

- Infuse the EE and CS pipeline with (1) more diverse participation in the area and (2) increase the number of women and URMs involved in cyber-physical systems work.

Theory Behind the Scope

Kotter's 8-Step Model to Change Implementation

- Create Urgency ✓
- Form a Coalition ✓
- Create the Vision ✓
- Communicate the Vision 
- Remove Obstacles
 - Identify Expertise
 - Take Action
- Create Short Term Wins
 - Start Small & Grow into the Plan
- Build on the Change
 - Analysis & Evaluation
- Anchor Changes in Teaching & Learning
 - Modification to teaching Resilient CPS

*Kotter, John P. (1996). Leading Change. Harvard Business School Press. ISBN 978-0-87584-747-4.

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Curriculum Development

- Outcome 1: A Junior/Senior Level Undergraduate Course in the Integrated Design of CPS
 - Berkeley & Vanderbilt:
 - Leverage existing collaborations in embedded systems and model-based design and extend to resilient CPS design
 - MIT:
 - Leverage existing capabilities in Networks course and Engineering for Sustainable Infrastructures.
 - Michigan:
 - Game theory and Mechanism design
 - Electricity CPS networks
 - Year 1: Examine the current classes
- Outcome 2: A Master's/Ph.D. Level Design Course on Resilient Networks
 - Include concepts from theory of network control, game theory, and mechanism design
 - Year 1: Synergy Development across all four partner institutions

Outreach to the CPS Community

- Outcome 3: Professional Development Workshop/Seminar
 - In collaboration with the HiCons Conference
 - Years 1: Develop a workshop in response to an industry or professional need related to large-scale CPS
- Outcome 4: A MOOC on Resilient Networks
 - Berkeley: AI Class, Security (Song) through partnership with EdX
 - Year 2-3: Design a series of online modules
- Outcome 5: Develop capabilities to disseminate course material via CPS-VO.
 - Year 1: Use CPS-VO to share course materials and outcomes of student projects

Broadening Participation

- Outcome 5: Student Internship Experience
 - Select among our talented undergraduates for year long research projects
 - Growing the community focused on this topic area
- Outcome 6: Modified REU
 - Cross Campus exchange of year long research students. Provide students with exposure to other aspects of CPS on different campuses to develop well roundedness
 - Find a way to locate more/new talent
 - Year 1: 1-2 REU students per campus

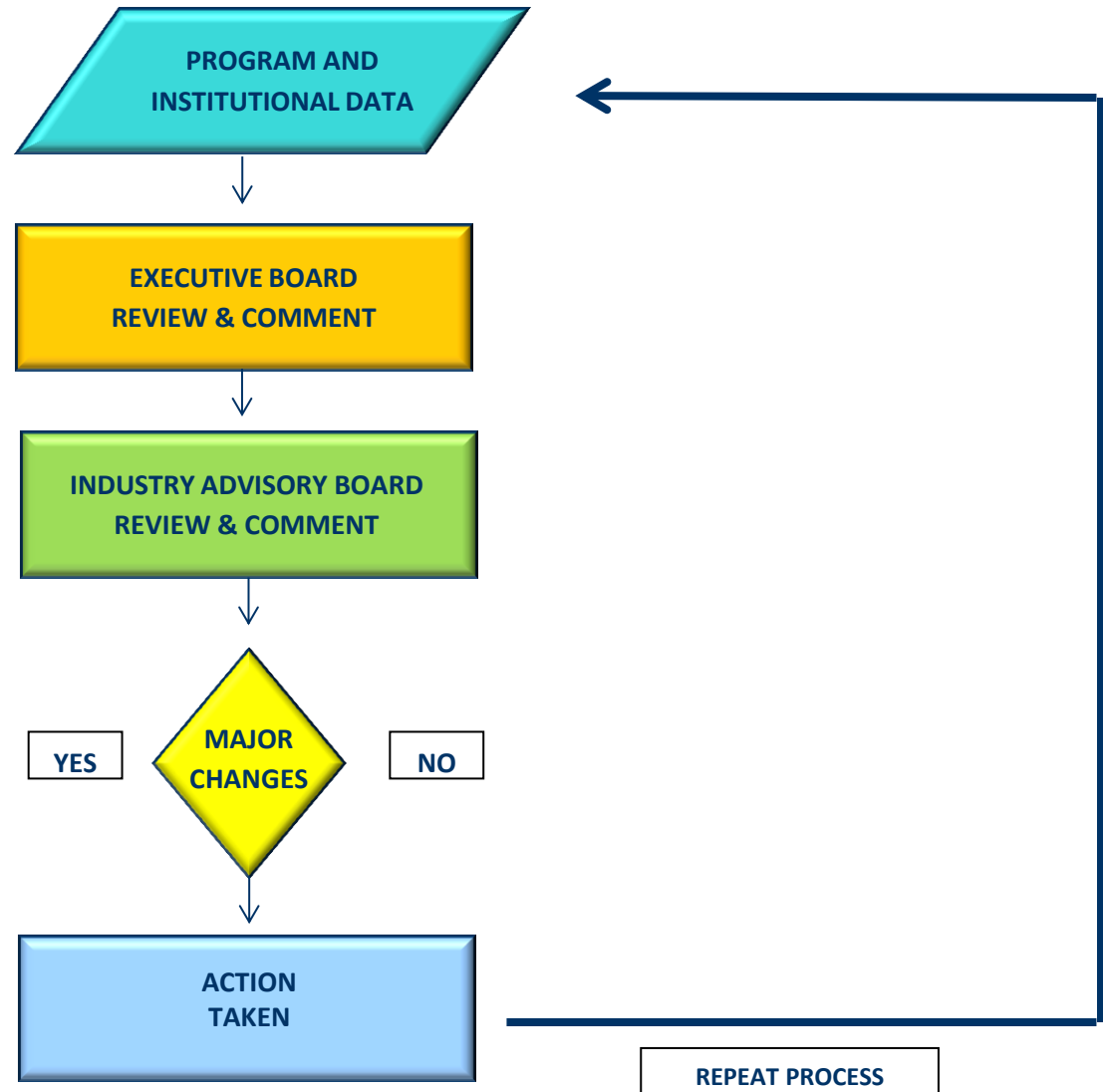
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 - Goals Years 1-5

Goals Year 1

- Examine current classes taught in the area of CPS across our institutions
- Identify the expertise of 4 partner institutions in the this area
- Plan for module development in these areas and how would these KSAs be employed through a Capstone Project, which employs real-world scenarios from various CPS domains
- Conduct outreach on topics of interest to professionals and graduate students who will attend conferences like HiCons 2014 and sister CPSWeek Conferences
- Identify a talented pool of students on each of our campuses who want to conduct research in CPS
- Plan for REU deployment in the summer of 2014

Evaluation Process Education



What Lies Ahead...

FORCES Education Matrix: Years 1-5

	Junior/Senior Level Course Integrated Design of CPS	Master's/Ph.D. Level Course Resilient Network Control	Professional Development Workshop	Online Modules on Resilient Cyber-Physical Systems	Student Internship Experience	Modified Research Experience for Undergraduates
YEAR 1	-Examine current classes offered -Create an integration plan -Explore synergies	-Examine current classes offered -Create an integration plan	-Develop and deliver a workshop on relevant hCPS topic	- Identify and develop collaboration with CPS-VO to disseminate education materials	-Select 1-2 undergraduate interns -Monitor students through research experience	-Plan for student transfers (summer REU) -Consult partners on other possible students
YEAR 2	-Module Development -Evaluation of Module Development	-Create a plan for a capstone project	-Develop and deliver a workshop on relevant hCPS topic	-Use CPS-VO to share modules and student projects	-Select 1-2 undergraduate interns -Monitor students through research experience	-Plan for student transfers (summer REU) -Consult partners on other possible students
YEAR 3	-Module Development -Evaluation of Module Development	-Deploy Capstone in graduate course or MEng -Conduct evaluation of capstone delivery	-Develop and deliver a workshop on relevant hCPS topic	-Think about scaling up the capabilities to share course modules	-Select 1-2 undergraduate interns -Monitor students through research experience	-Plan for student transfers (summer REU) -Consult partners on other possible students
YEAR 4	-Formalize Course syllabus for online deployment	-Retool Capstone if necessary. -Formalize Course syllabus for online deployment	-Develop and deliver a workshop on relevant hCPS topic	-Begin to formalize modules developed in years 2-3 into an online course.	-Select 1-2 undergraduate interns -Monitor students through research experience	-Plan for student transfers (summer REU) -Consult partners on other possible students
YEAR 5	-Course materials available on CPS-VO	-Course materials available on CPS-VO	-Develop and deliver a workshop on relevant hCPS topic	-Modules available on EdX/Coursera or other university platform for national use	-Select 1-2 undergraduate interns -Monitor students through research experience	-Plan for student transfers (summer REU) -Consult partners on other possible students