Systemic Reform of STEM Education: The Vertically Integrated Projects (VIP) Consortium

VIP Consortium

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What is Innovation?

“The development of novel products, services, and processes for the benefit of society”
(Too Narrow)

“Inspiration plus Execution”
(Works in all Disciplines)
The Barriers: 3 Forms of Fragmentation

– **By Mission**
  - *Research*: Exploration, Idea Generation
  - *Education*: Knowledge, Skills
  - *Service*: Partnerships, Economic Development

– **By Time**
  - Semesters, Academic Years

– **By Discipline**
  - Budget Lines, Culture

**Must Overcome These**

– So Everyone can Participate
The VIP Approach: Foster Innovation by Involving Students in Challenging Projects Embedded in Faculty Research

Ensure Success by Providing:

TIME  CONTEXT  MENTORING
Vertically-Integrated Projects Program

Bringing People Together

Undergraduate Students

Faculty Research

Students need Real Projects in which they Experience the Innovation Process

Faculty can Benefit from Help at all Levels of The Innovation Process
VIP Program Architecture

- **Long-term, Large-scale Projects:**
  - Faculty Led Projects
  - Large teams: 10-20 undergraduates; 1-4 grad students
  - Sophomores through seniors on each team
  - Long-term participation – up to 3 years per student
  - Returning students train new students
  - Teams continue for years, decades
  - Academic credit each semester

- **Challenging, Real-World Projects**
Large Teams: The eStadium VIP Team (F’10)
Vertically-Integrated Projects Program

The eStadium *Internet of Things Testbed*:

at Georgia Tech’s Bobby Dodd Stadium
Vertically-Integrated Projects Program

People + Information: In-Stadium Web-Apps:

Video clips, stats, drive tracker on your phone: [http://estadium.gatech.edu](http://estadium.gatech.edu)
Vertically-Integrated Projects Program

Sensor Net Sub-Project:
- Few wired gateways
- Wireless sensor motes

Sensing Tasks:
- Vibration
- Audio
- RF - Spectrum
RF Sensor Node and Sensor Net Clusterhead
On top of Concession Stand in North Stands
Sensor Net Architecture

- 40~50 Sensor Motes
- 10~12 ClusterHeads
- Cognitive Radio Backhaul
- <125μsec Synchronization

500 MHz TV-White Space Backhaul Link

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Vertically-Integrated Projects Program

Structural Vibration Monitoring at Stadium
Structural Vibrations $\Leftrightarrow$ Events in a Football Game

- Touchdown by Miami
- Advertisement on the big screen
- Half-time break
- "Make some Noise"
- Introducing 1990 national champion team + half time show
- Touchdown by GT
- "Make some Noise"
- Introducing GT fans
- Touchdown by Miami
Model for How VIP Credits Count

Incentive to Participate Multiple Years

- Take 5 or fewer credits:
  - All are Approved-Elective (Free-Elective) Credits
- Take 6+ credits:
  - 3 to 6 Technical Elective Credits
  - Rest are Approved-Elective (Free-Elective) Credits
- VIP + VIP Senior Design: 8+ Credits
  - 3+ Credits as a Junior
  - 2 Credits (4812) 1st-Semester Senior Year
  - 3 Credits of VIP Senior Design (4813)
Vertically-Integrated Projects Program

VIP: Benefits to Universities

- Enhances Student Learning
- Enhances Faculty Research
- Enables New Partnerships
- Creates Multidisciplinary Opportunities
- **Everyone** Participates in Innovation
- Deepens/Broadens the University Community
The VIP Consortium .... So Far:

- Arizona State Univ.
- Boise State
- Colorado State
- Florida International
- Georgia Tech
- Howard Univ.
- Inha Univ.
- Morehouse College
- National Ilan Univ
- New York Univ.
- Purdue Univ.
- Rice Univ.
- Texas A&M Univ.
- Univ of California, Davis
- Univ of Delaware
- Univ of Hawaii
- Univ of Michigan
- Univ of Strathclyde
- Univ of Washington
- VA Commonwealth
What could you do if you had a VIP team?

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