Teaching STEM Principles Through the Design, Construction and Deployment of Water Quality Sensors

Presented by: Liesl Hotaling

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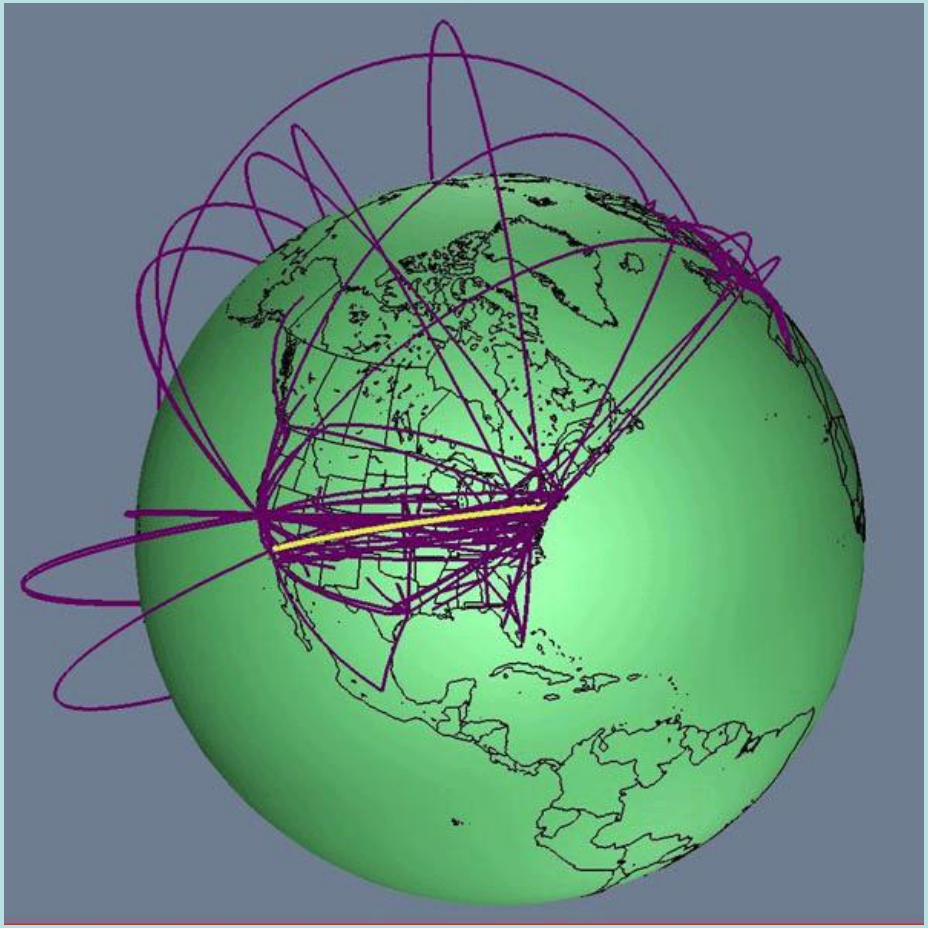
National Science Foundation
WHERE DISCOVERIES BEGIN

The Sensor Revolution

Sensors are ubiquitous in the modern world.

From motion-sensing light switches to environmental observatories; we are connected to our physical world in real time.

The “sensor revolution” is giving the world its first electronic nervous system.



"Telegeography Maps" at Telegeography at http://www.telegeography.com/resources

Feeding the Revolution

The education of the 21st century environmental technology workforce demands:

- an understanding of environmental sciences and other disciplines;
- an ability to resolve complex environmental issues; and
- the ability to communicate complex ideas to a broad audience.

Fostering these critical abilities will require a new set of learning opportunities.

Educational Context for SENSE IT

"Children learn best if they are immersed in complex experiences and are given the opportunity to actively process what they have learned" [3].

Our Other Youth [4], reports that the majority students learn best when instruction emphasizes application.

Yet only 16 percent of instruction in U.S. classrooms could be characterized as application [5].

To assist students in achieving content mastery, teachers must create learning environments that present students with challenging problems so that they can demonstrate their knowledge through application.

[3] Caine, R.N., & Caine, G. (1991). Making Connections: Teaching and the Human Brain. Alexandria, VA: Association for Supervision and Curriculum Development.
[4] Conrath, J. (1986).Our other youth: handbook of guidelines for teachers and other adults who work with at risk kids and discouraged or defeated learners. Gig Harbor, WA.
[5] Stevenson, H.W., & Stigler, J.W. (1992) The learning gap: why our schools are failing and what we can learn from Japanese and Chinese education. New York: Summit Books.

SENSE IT Project Goals

The objectives of SENSE IT are to*:*

1) Develop sensor technologies curricula for the high school classroom;

2) Use environmental sensors as an engaging context to teach technology, engineering, mathematics, science, and critical workforce skills;

3) Encourage learners to look at a local problem and data with a global perspective.

4) Promote awareness of sensor network related careers and opportunities among high school teachers, students, parents and guidance counselors;

5) Emphasize that mathematics is the language of all STEM disciplines and the key for entering any STEM career.

www.senseit.org

SENSE IT

Funded by NSF

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Introduction to SENSE IT

SENSE IT brings real world environmental sensor networks into the high school classroom. SENSE IT participating students are challenged to design, build, deploy and interpret data from their own environmental sensors.

During the initial phase of SENSE IT, over 60 high school teachers in New York State will participate in the program, receive professional development on the interdisciplinary SENSE IT education modules, implement SENSE IT in their schools, and impact over 3,000 New York State high school students. Additionally, SENSE IT aims to foster science, technology, pre-engineering and mathematics (STEM) career awareness among students, teachers, guidance counselors, administrators and parents. For a list of participating teachers, click the following link. **(SENSEIT Teachers)**

Clarkson UNIVERSITY defy convention

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SENSE IT Description of Activities

SENSE IT is comprised of four modules:

1) **Sensor development**
2) **Sensor deployment and data gathering**
3) **Water Quality and Environmental Science**
4) **Sharing Data - Wireless sensor networks**

The modules are being implemented with high school students and Integrated into Environmental Science, Chemistry, General Science, Physics, Integrated Algebra, and/or Pre-engineering courses.

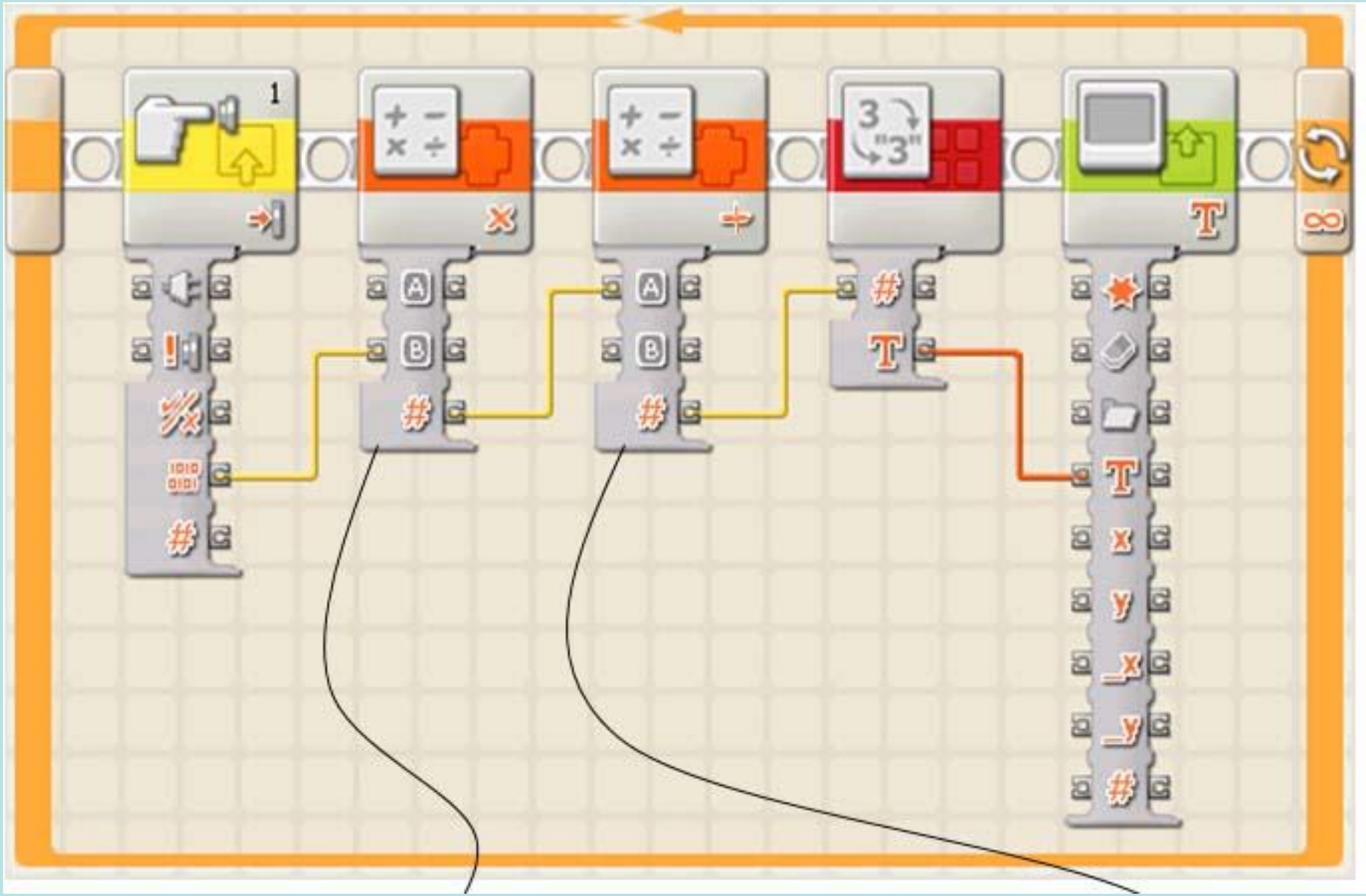
The students are challenged to design, assemble, test, deploy, program, troubleshoot and communicate with temperature, conductivity, turbidity, and hydrostatic pressure (depth) sensors.

SENSE IT Adaption of Activities

During the Spring of 2012, the temperature and turbidity lessons underwent modifications based on teacher feedback. The modified lessons are now currently being tested in classrooms.

Temperature Lesson

SENSE IT Adaption of Activities



Conclusion

SENSE IT promotes inquiry based learning strategies through a challenging hands-on project. It also promotes student awareness of the interdisciplinary nature of modern engineering and the interdependence of diverse areas of science and math.

The theme of environmental stewardship and sensor systems provides:

1) a motivating and meaningful scenario for learning a wide range of core math, science and technology topics;

2) an engaging link between biological, physical and social sciences and;

3) a cutting-edge example of science and engineering research, delivered directly into the classroom in a particular area of growing importance and workforce need.

Thank You!

Questions?

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