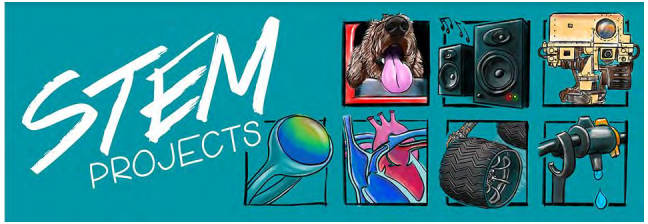


STEM and Coding Projects for After Exams

Stacy Thibodeaux

Chemistry I/II, Robotics teacher
Southside High School
Youngsville, LA
T^3 National Instructor
svthibodeaux@gmail.com
Twitter: @stacythib

Jessica Kohout

Biology teacher
Reservoir High School
Fulton, MD
T^3 National Instructor
jessica.c.kohout@gmail.com
Twitter: @MrsKohout

Why STEM and Coding in the Classroom?

1. **Collaboration in the Classroom**

   Teamwork and Communication

2. **Creativity**

   Introduce Innovation with Real-World Problems

3. **Critical Thinking**

   Connect Science and Math

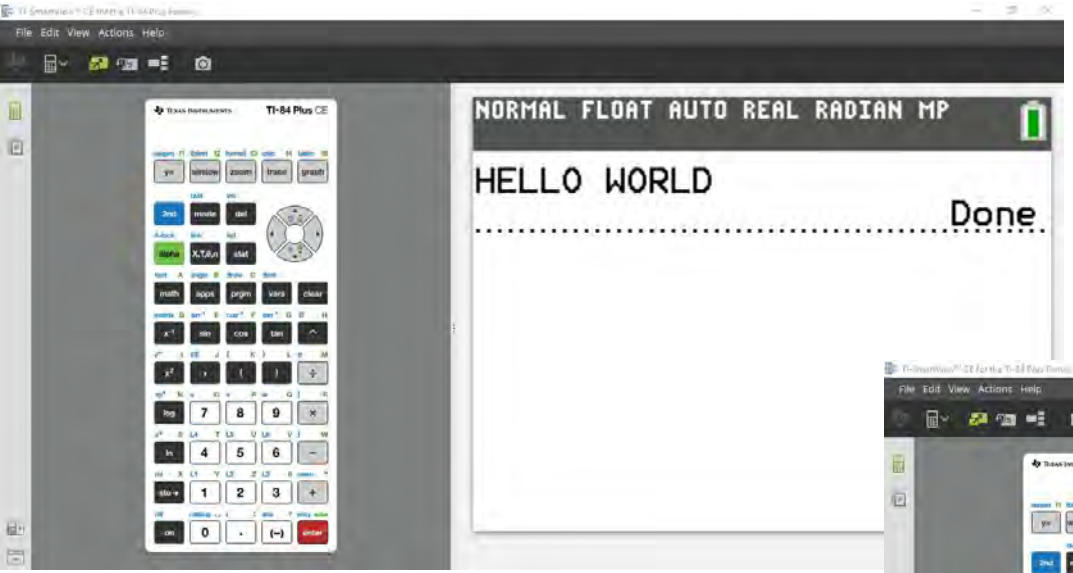
Ten Minutes of Code

Python Programming »

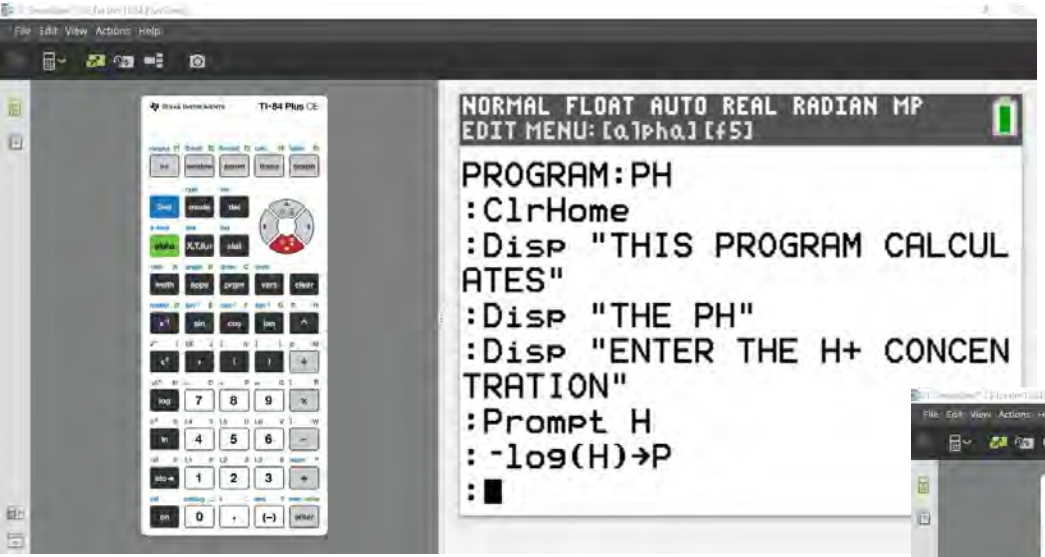
TI-Basic Programming »

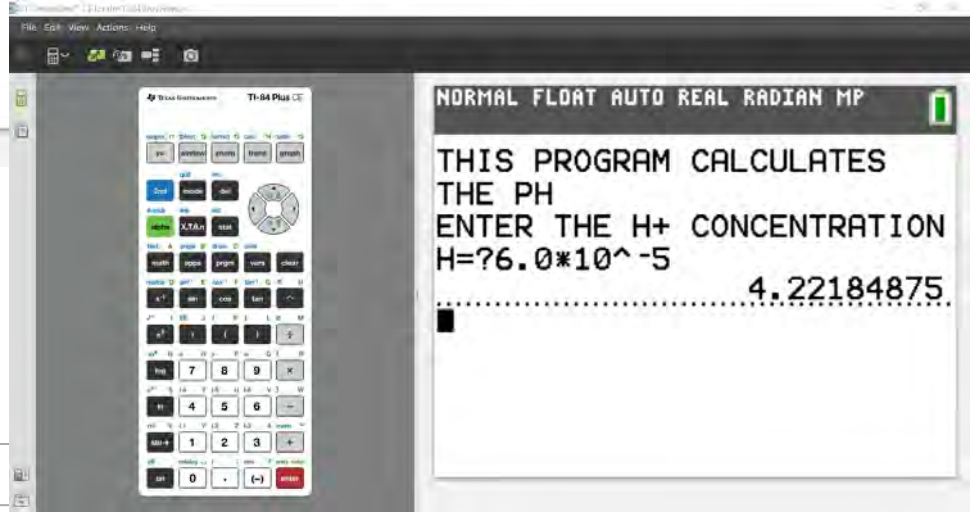
- » Entry-level
- » Menu-based
- » Python (TI- Nspire CX II) or TI-Basic (TI-84 CE/TI-Nspire CX)
- » STEM integration with TI-Innovator Hub
- » Spark interest in Robotics with TI-Rover

Introduction to Coding on the 84 CE



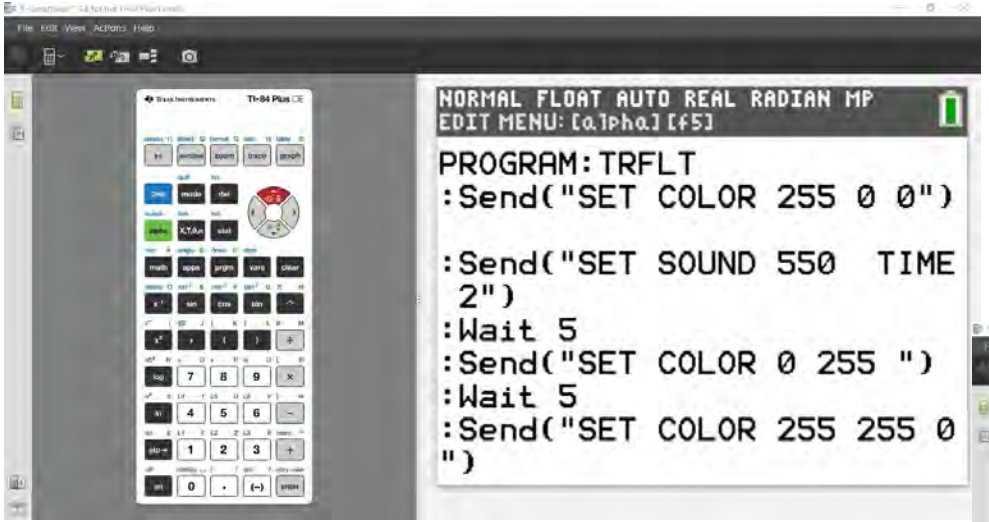
Introduction to Coding on the 84 CE



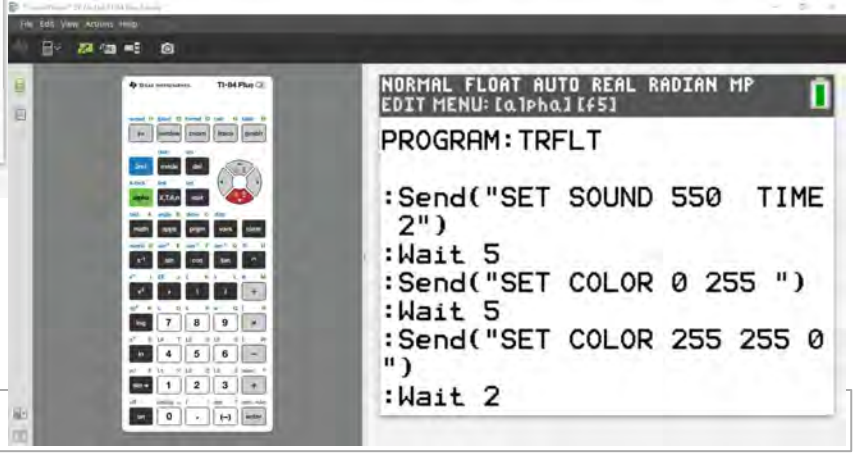


Introduction to Coding on the TI Nspire CX

Application Program with TI Innovator Hub Coding on the 84 CE



Traffic light with Sound for when it is safe to walk across the street



Application Program with TI Innovator Hub Coding on the TI Nspire CX II

1.1 1.2 *Traffic RAD

traffic 8/8

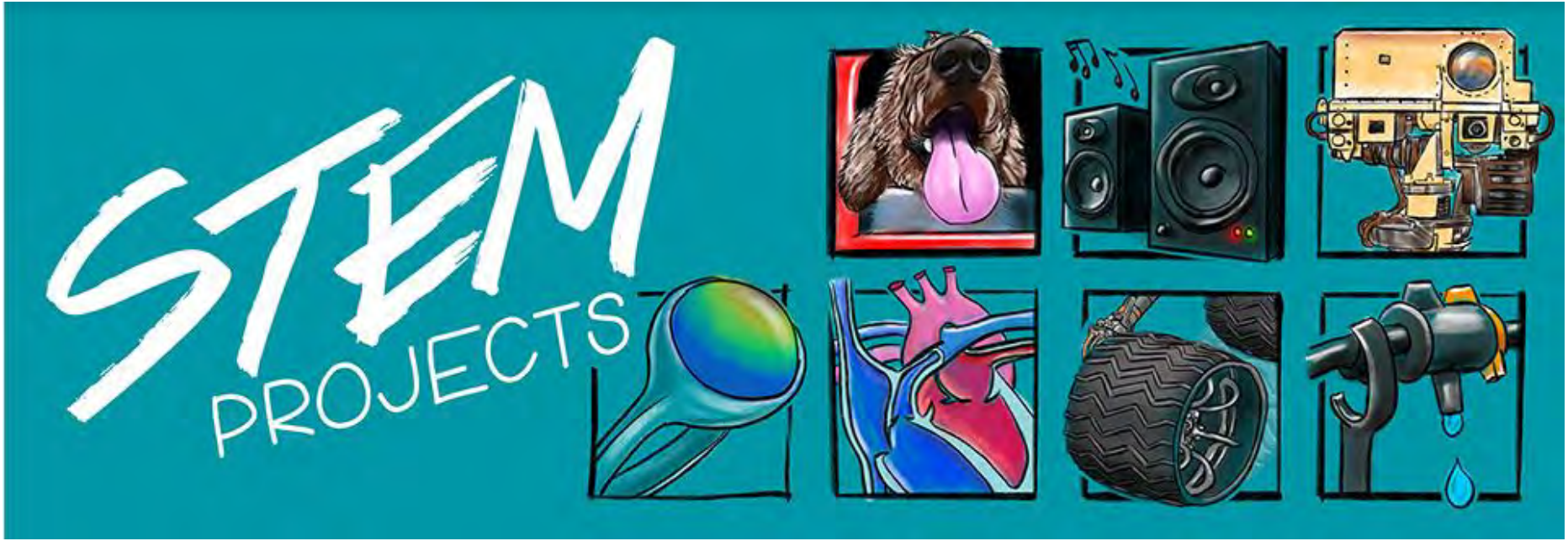
```
Prgm
For t,1,5
  Send "SET COLOR 255 0 0"
  Wait 5
  Send "SET COLOR 0 255 0"
  Wait 6
   Send "SET COLOR 255 255 0"
  Wait 2
EndFor
EndPrgm
```

1.1 *Doc RAD

*sound.py 17/17

```
from ti_system import get_key
#==================================
while get_key() != "esc":
  for t in range(1,5):
  color.rgb(255,0,0)
  sleep(.5)
  color.rgb(0,255,0)
  sleep(.5)
  color.rgb(255,255,0)
  sleep(.5)
color.off()
```

STEM Projects



TI-Innovator STEM project options

- **Pet Car Alarm** (middle school)

- **Smart Irrigation System** (high school)

- **Mood Ring Project** (introduction for all levels)

- **Mars Rover Challenge** (middle school and early high school)

Needs for each camp project
(32 students in groups of 4)

	Mood Ring	Car Alarm	Irrigation System	Mars Rover Challenge
TI graphing calculators (TI-84 Plus CE or TI-Nspire CX II)	32	32	32	32
TI-Innovators	8	8	8	8
Input Devices	8 Temperature sensors	8 each: Temperature, Hall Effect Magnetic Sensors	8 Each: Digital Humidity and Temperature, Soil Moisture, Light Level	
Output Devices or Rovers		8 each: Servo motor (with rechargeable battery)	8 Each: Pump-MOSFET-Battery Holder kit, 4AA Batteries	8 Rovers
Other materials	8 Chenille wires (pipe cleaners)	8 Cars, magnet, duct tape or other for decoration	Plant container, cistern, perlite or other growing medium, tubes, duct tape	Printouts of Mars surface, plastic obstacle cones, meter sticks, protractors, tape, markers

Estimated number of days for each STEM project camp

There activity time that it will typically take to build and code the projects. The camp days can be extended by in-depth exploration of related science, math and computer science topics. Also, there is typically time spent on snacks or meals and other activities not directly related to the projects.

- **Digital Mood Ring** ~ ½ Day
  - includes in-depth treatment of coding concepts

- **Pet Car Alarm Project** ~2-3 days days to build and code the project
  - Includes in-depth Digital Mood Ring Project as an introduction
  - Example topics to extend beyond 2-3 days: greenhouse effect, physiology of heat stroke, sensing audio and visual alarms

- **Smart Irrigation Project** ~3-4 days to build and code the project
  - Includes in-depth Digital Mood Ring Project as an introduction
  - Example topics to extend beyond 3-4 days: water cycle, plant growth factors, drought data analysis, life and culture of students in Zimbabwe

- **Mars Rover Challenge** ~2-3 days to work through mini-challenges and to do the final challenge
  - Example topics to extend beyond 2-3 days: in-depth exploration and challenges of motor control concepts, distance-rate-time concepts, angle concepts and measurement.

TI Support for hosting a TI-Innovator STEM camp

- TI provides curriculum materials that can be used as the basis for detailed planning of the camp activities
- TI will provide training through webinars, emails and teleconferences to camp instructors.
  - TI can provide a loan of an individual set of equipment for instructors to prepare with.
- TI can provide recommendations for educators who have the necessary background with graphing calculators to be camp instructors.
- TI can provide information on sources for camp equipment.
- TI can provide support for publicizing your camp with media outlets.

STEM Projects with Python

TI Codes Python »

10 Minutes of Code: Python and TI-Innovator™ Technology

These short, easy-to-teach activities are designed to be completed in order, using TI-Nspire™ CX II and TI-Innovator™ Technology.

Note: These lessons require the use of TI-Nspire™ CX II technology with OS 5.2 and above.

- **Unit 1:** Getting Started With Python and the TI-Innovator™ Hub
- **Unit 2:** for loops With the TI-Innovator™ Hub
- **Unit 3:** Brightness, if and while With the TI-Innovator™ Hub
- **Unit 4:** Rover's Driving Features
- **Unit 5:** Rover's Sensors
- **Unit 6:** Coordinates With Rover
- **Unit 7:** The TI-RGB Array

TI Online STEM Events

Digital Mood Ring

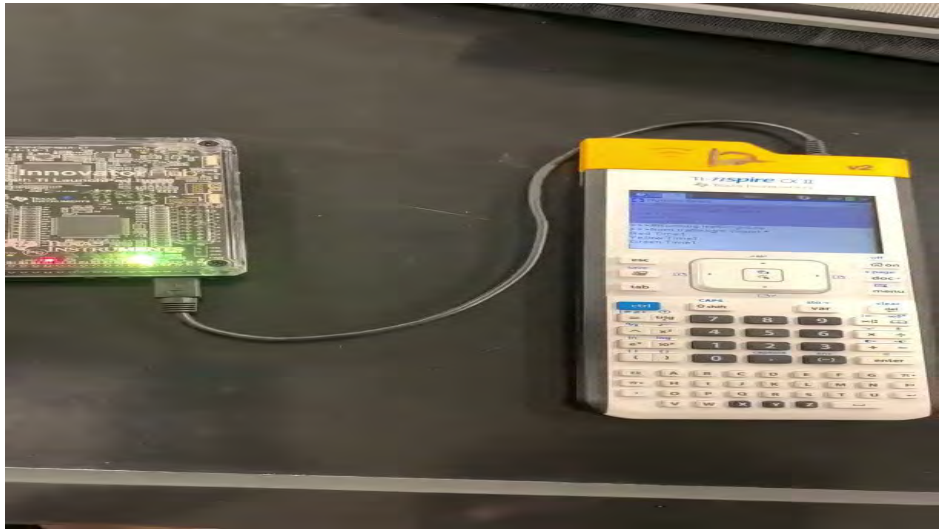
Getting Started with Nspire CXII

TI-Nspire CX II technology

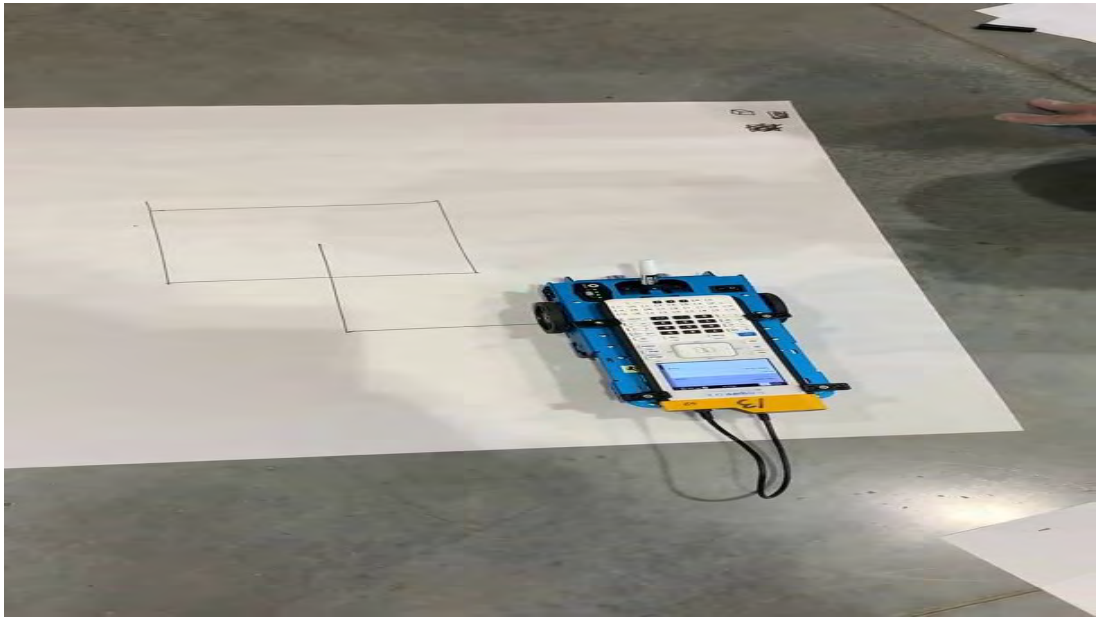
python™

Texas Instruments

TMOC - Application 1 - Traffic light

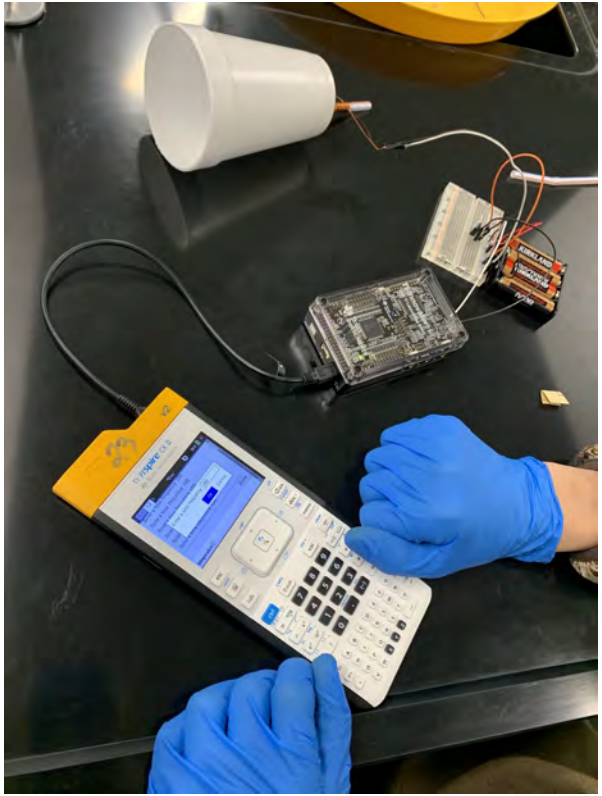


Stacy’s projects - Rover on the Move!



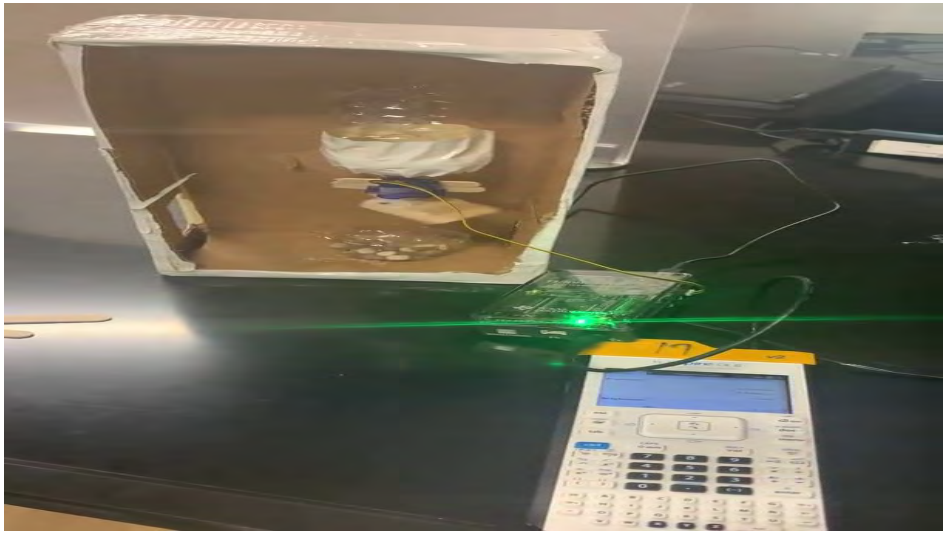
Using external breadboards - Path to STEM Projects

We made a speaker with magnetic wire, a nail, and the styrofoam cup!



Stacy’s projects - Automatic Dispenser

Use built in Brightness sensor to turn a Servo motor to dispense something - added sound and RGB LED.



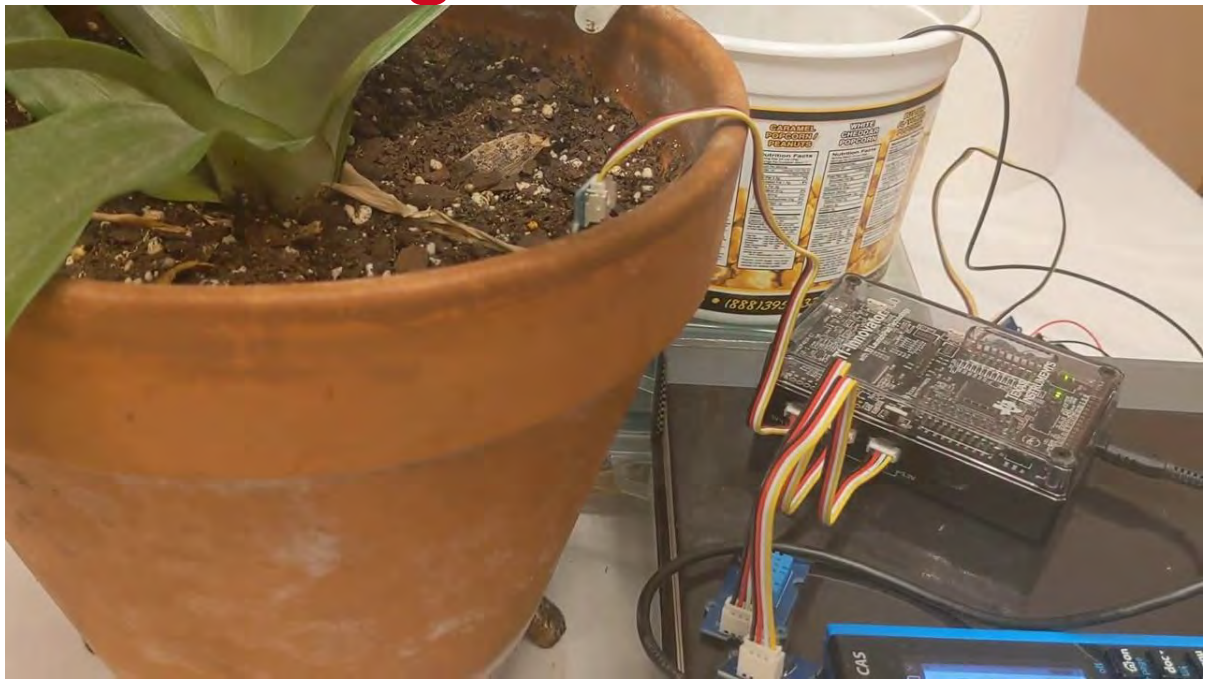
Sensor Link with Vernier Sensor

We used a TI Sensor Link connected to Vernier pH sensor. Code was written that when pH was too low, the motor turned on and dispensed material to raise pH.

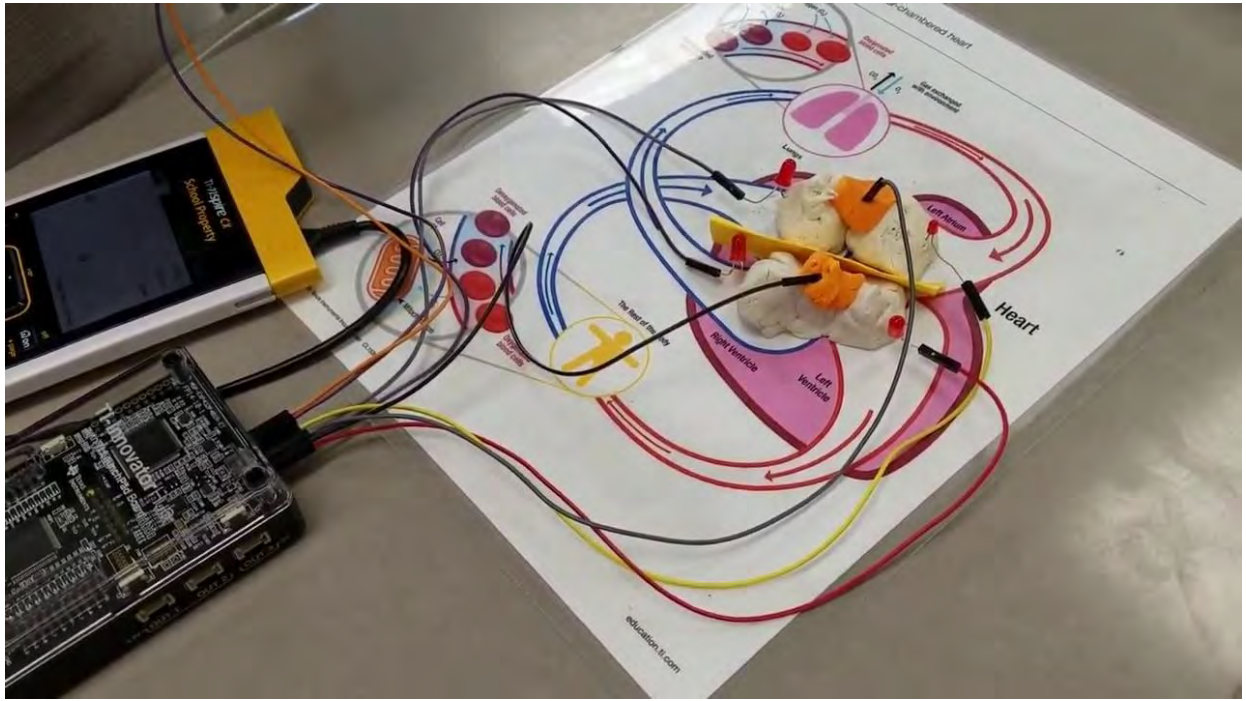
Created temperature sensor - Path to STEM Projects

Used thermistor to create temperature sensor with breadboard port on Hub. Use Vernier temperature sensor to collect actual data, create mathematical model of that data and then calibrated thermistor sensor.

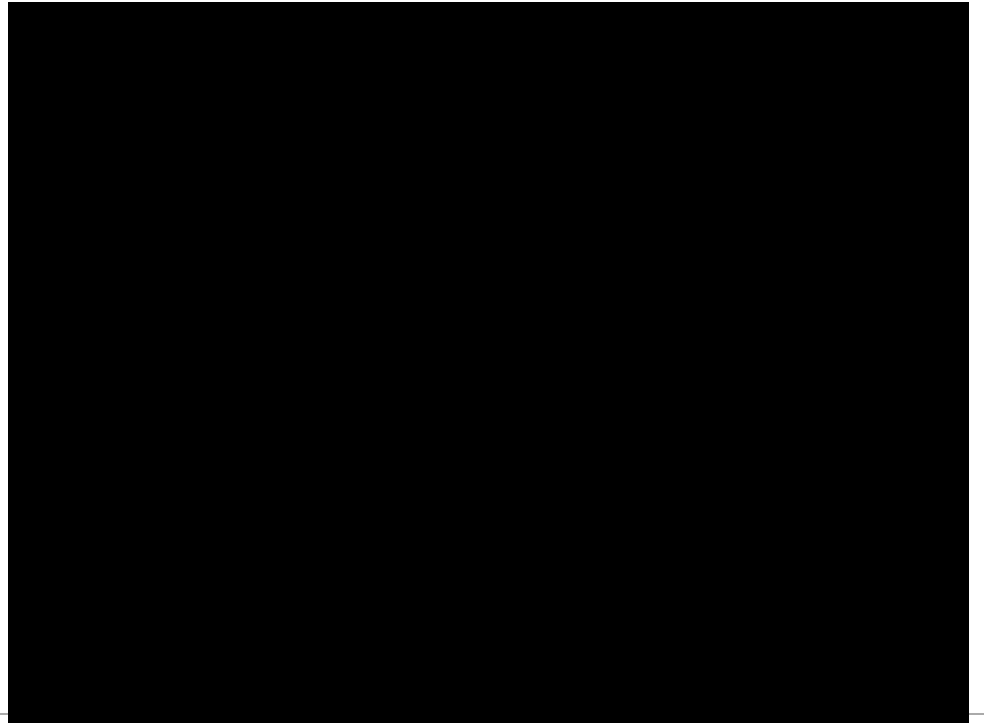
Smart Irrigation

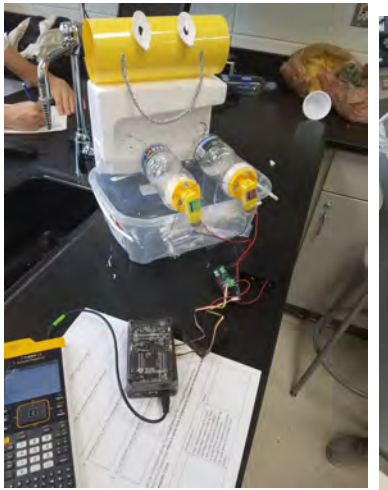


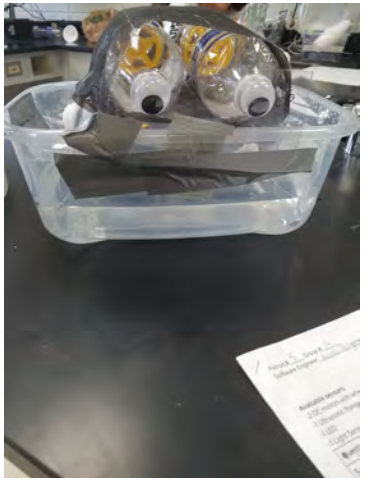
I ❤️STEM


Lungs
Left Atrium
Heart
Right Ventricle
Left Ventricle
education.ti.com

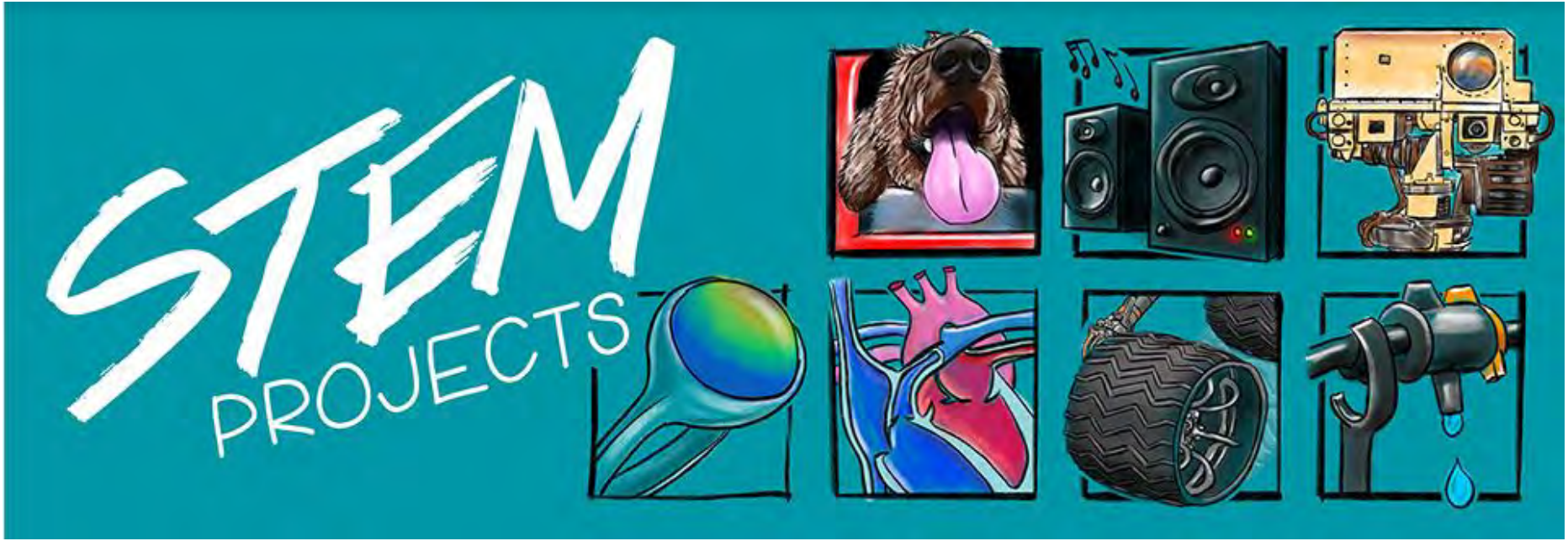
Innovative Problem Solving







STEM Projects- How to borrow supplies



Digital Mood Ring (introduction to feedback and control systems for all levels)

Bring science and coding together (no coding experience necessary) while developing a mood ring! Explore the science of color mixing while determining the right body temperature thresholds.

Project Overview: Mood rings enjoyed fad popularity in the 1970's and are still around today. The stone of the ring changes color, supposedly according to the mood of the wearer. The "stone" of a mood ring is really a hollow glass shell containing thermotropic liquid crystals. The crystals respond to temperatures by twisting in a regular way. The twisting changes their molecular geometry, which alters the wavelengths of light that are reflected from the crystals. Wavelengths of light are another way of saying color, so when the temperature of the liquid crystals change, so does the color reflected from the stone.

Your challenge: Investigate temperature measurement using a temperature sensor. Then build a digital mood ring that changes the color of the TI-Innovator Red-Green-Blue (RGB) Light Emitting Diode (LED) as the temperature on your finger changes.

TI Nspire CX II Link, TI-Nspire CX Link, TI-84 Plus CE Link

Pet Car Alarm (middle school)

Pets suffer when left unattended in a car on a sunny day. Understand the science behind the greenhouse effect. Use math, computer programming and engineering to design pet car alarm system.

Project Overview: Pets suffer when left unattended in a car with the windows rolled up on a hot sunny day. The temperatures inside a car may reach greater than 40◦C above the outside ambient temperature within an hour due to a greenhouse effect within the closed car. A car equipped with a pet-smart alarm could prevent harm to a pet left inside a hot car by taking action to cool the interior and notify the owner of impending pet harm.

Your challenge: Understand the science behind the greenhouse effect and use math, computer programming and engineering to design and build a pet-smart alarm system using a model car.

TI-Nspire CX Link, TI-84 Plus CE Link

Smart Irrigation System (high school)

A drought in South Africa has caused a famine in Zimbabwe and local students are quitting school to stay home and help grow food for the family. Design and build a smart watering system to manage a limited amount of water to irrigate a garden.

Project Overview: A drought in South Africa has caused a famine in Zimbabwe and local students are quitting school and soccer to stay home and help grow food for the family; read the full story in The Guardian. The project serves as a framework to teach concepts in algebra, ecology, computer programming, engineering and global awareness.

Your challenge: help solve the problem by designing and building a smart watering system to manage a limited amount of water collected in a cistern to irrigate a garden.

TI-Nspire CX Link, TI-84 Plus CE Link

Mars Rover Challenge – Path around Olympus Mons (middle and early high school)

Olympus Mons on the surface of Mars at 69,841 feet (more than twice the height of Mt Everest) is considered to be the tallest mountain on a planet in the solar system. Students will learn and use basic concepts for robotic vehicle control along with math concepts to write a program to drive their Rover around the base of the mountain.

Note: Also, includes concepts to give students an on-ramp to participating on robotics teams.

Project Overview: Prepare for the final challenge by working with basic concepts for moving a robotic vehicle: setting direction and power for the motor controlling each wheel, moving forward and backward, turning. You will apply math concepts of distance-rate-time and angles as part of writing programs to set the vehicle path.

Your challenge: Plot a course and write a program to drive your Rover around the base of the Olympus Mons. Who can have their Rover complete the course in the fastest time?

TI-Nspire CX Link, TI-84 Plus CE Link

Need assistance with technology and equipment? Educational Technology Consultants are the ones to contact!!!

Thank you

Stacy Thibodeaux

Chemistry I/II, Robotics teacher
Southside High School
Youngsville, LA
T^3 National Instructor
svthibodeaux@gmail.com
Twitter: @stacythib

Jessica Kohout

Biology teacher
Reservoir High School
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jessica.c.kohout@gmail.com
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