

Jared Herretes

Oak Ridge High School, Orlando, FL 32809

## Summary

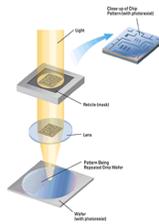
In today's world, devices of all sorts are being designed with the ability to connect with each other over open and closed networks. This idea is referred to as the Internet of Things (IoT) and is the next step in the way technology permeates modern life. Students can take advantage of this burgeoning field by setting their paths toward a career in STEM fields. The RET CoMET program at UCF provides the opportunity for teachers to learn about various uses for the interconnectivity of IoT devices and translate this knowledge into an engaging lesson plan for middle and high school students.

## Research Activities

Research experience is separated into 4 modules:

### ❖ Design Fabrication of Environmental Sensors

- Used photolithography and electroplating to create working heavy metal sensor
- Calibrated our sensors to detect varying concentrations of lead



### ❖ Hardware Platform Module

- Used MSP430 embedded circuit boards to write C programs to activate parts of the boards
- Learned about the serial communication between circuit boards and programming languages



### ❖ Software and Networking

- Obtained knowledge of networking and protocols used by devices to connect to servers
- Wrote sample code on Java along with Raspberry Pi computers to create webservers



### ❖ Mobile Programming

- Used Android Studio programming suite to write code for applications in Android smartphones

## Lesson Plan

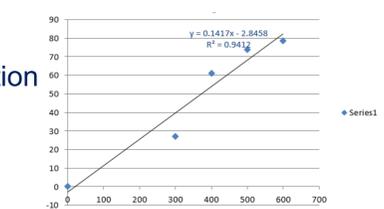
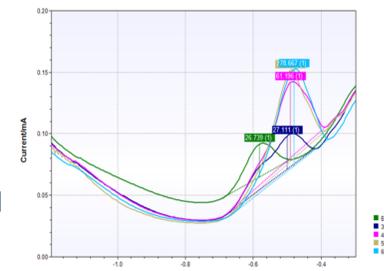
This lesson is used to augment the unit on exploring bivariate data and to provide an example of the applications of linear regression and correlation in the process of calibrating environmental sensors.

### Learning Objectives:

- ❖ Proper data collection procedures
- ❖ Creation of linear regression models
- ❖ Predict outcomes using self created models
- ❖ Hands on experience analogous to industry practice

### Lesson Activities:

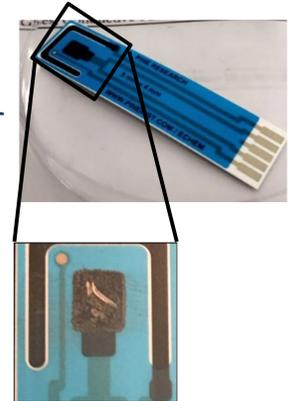
- 1) Directed Reading of Research Article
- 2) Pre-Test
- 3) Linear Regression and Correlation Introduction
- 4) Lab Safety and Procedures
- 5) Data Collection
  - i. Baseline measurement
  - ii. Concentrations increased and change in voltaic potential recorded
- 6) Calibration Models
  - i. Linear Regression Equation
  - ii. Correlation Coefficient
- 7) Prediction
  - i. Given samples students will be able to predict concentrations using self-generated models
  - ii. Can be done in classroom or in the field
- 8) Post-Test and Follow-up



## Lesson Learned and Assumptions

The RET program gave us hands on experience with all the steps necessary for the creation, testing, integration, and utilization of environmental sensors in an IOT environment.

We created a heavy metal lead sensor with bismuth reactant electrode. Due to the potential hazards of using these materials the same procedure can be replicated using simple pH sensors with acidic and basic solutions.



## Implementation Strategy

This lesson plan utilizes the following teaching techniques:

- ❖ Cooperative Learning
- ❖ Inquiry Based Learning
- ❖ Field Experience
- ❖ Hands-on Learning
- ❖ Project Based Learning
- ❖ Predictive Modeling

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### References

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MSP430 picture from: <http://www.ti.com/tool/msp-exp430fg4618>