COSMOS Educational Toolkit

Abhi Adhikari

Department of Electrical and Computer Engineering, Columbia University

https://cosmos-lab.org/outreach

May 2023

*The **COSMOS testbed design and deployment** is joint work with the COSMOS team (www.cosmos-lab.org).

COSMOS Educational Toolkit

- Hardware components:
  - **Processing Units:** Intel NUC, Raspberry PI
  - **Software Defined Radio:** ADALM Pluto SDR, RTL-SDR
  - **IoT Nodes:** Arduino/Micro:bit, XBEE/BLE, sensors
- Software components:
  - **Web front-end interface:** HTML, CSS and Javascript
  - **Web back-end server:** Python
  - **SDR Software:** GNU Radio
  - **IoT management:** influxdB and Chronograf

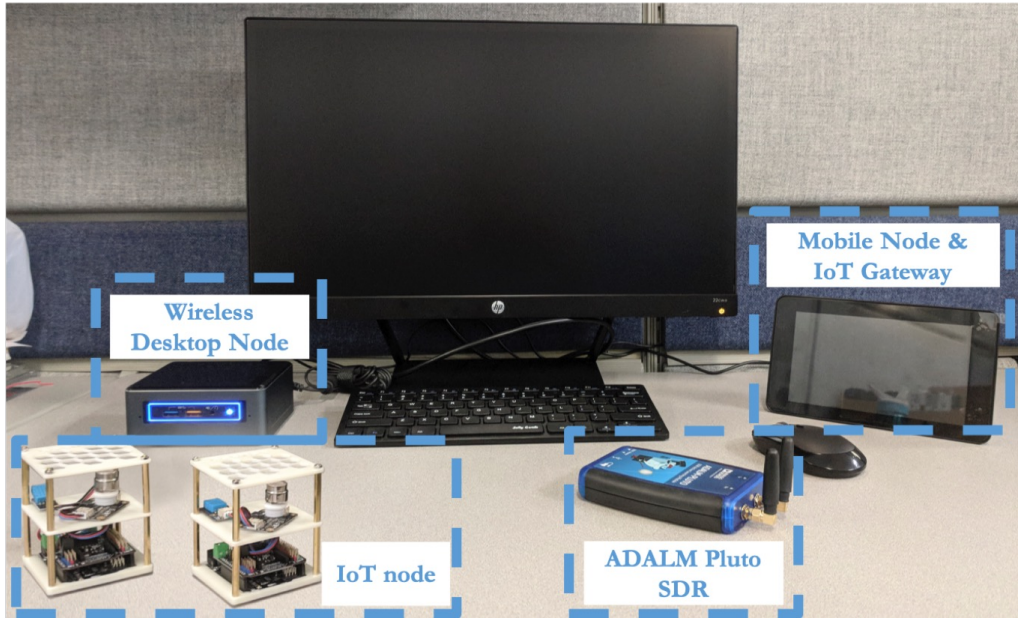


Fig: Hardware components of the 'COSMOS Educational Toolkit'

Program Overview (1/3)

a. **Lecture and lab phase:** The participants are introduced in fundamental and some advanced concepts in wireless communications and networking
   - $8K stipend for summer

b. **Design phase:** The participants conduct research on potential educational NGSS STEM lessons with a hands-on wireless labs using the ‘COSMOS Educational Toolkit’

Fig: Participants attend an instructor-led lesson using the ‘COSMOS Educational Toolkit’

Fig: Participants conduct research using sensors

COSMOS RUTGERS COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK NYU NYC <sh> The City College of New York THE UNIVERSITY OF ARIZONA IBM

Program Overview (2/3)

c. **Development phase:** teachers co-develop with the researchers their best ideas on how to use the wireless labs for NGSS-aligned STEM lessons

d. **Implementation phase:** teachers and students use the developed lessons in the class during the school year

Fig: Teachers present their developed NGSS lesson plans at Silicon Harlem

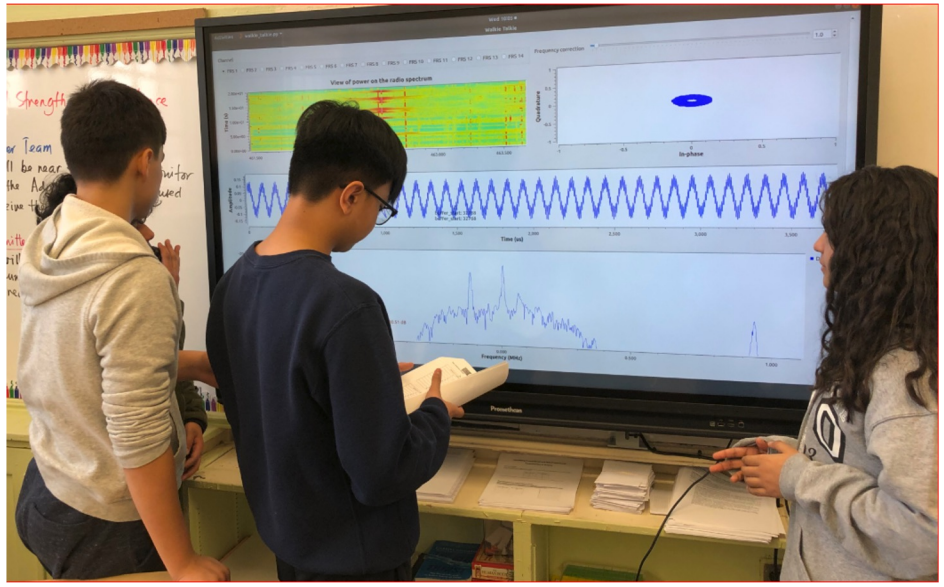


Fig: Middle school students using the 'COSMOS Educational Toolkit' in a Mathematics Class

COSMOS RUTGERS COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK NYU NYC <sh> The City College of New York THE UNIVERSITY OF ARIZONA IBM

Program Overview (3/3)

e. **Feedback phase:** teachers provide feedback in order to improve the NGSS STEM lessons and develop new ones

Fig: Teachers present the PD Program and the developed NGSS Lesson Plans at the NE-ASTE Conference 2018

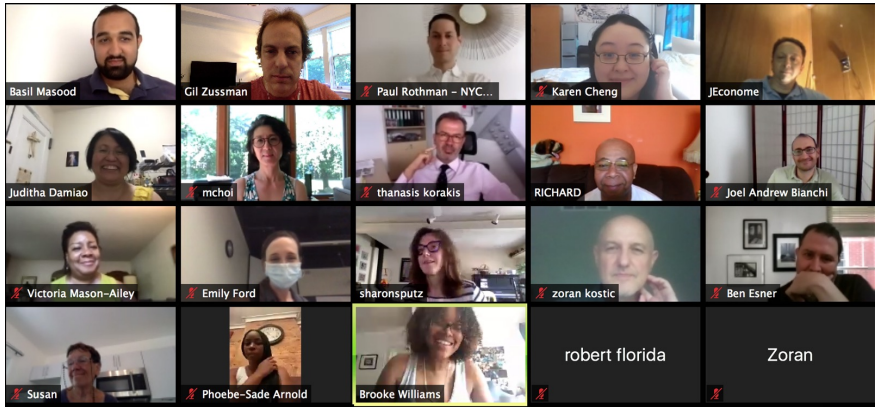
Conclusion

https://cosmos-lab.org/outreach

2022

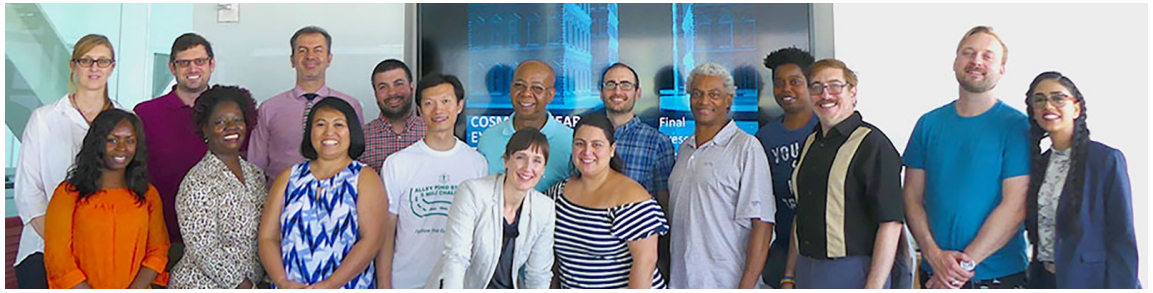
2021

2020



2019

2018



COSMOS RUTGERS COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK NYU NYC <sh> The City College of New York THE UNIVERSITY OF ARIZONA IBM