An Affordable Radiation Weather Station for High School Outreach

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Introduction and Motivation

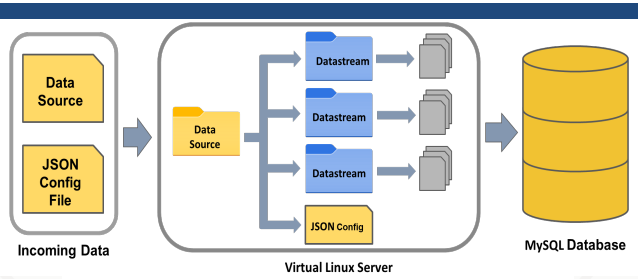
- No widespread collection of background radiation
- How to recognize minor incidents from unreported events
- Improve the lower-level detectability of radionuclides
- Graduating nuclear engineers do not meet demand
- Nuclear outreach is expensive and too specialized if only have nuclear focus
- Sensors, collection, collaboration, programming, and weather all important for garnering student interest

Mission Relevance

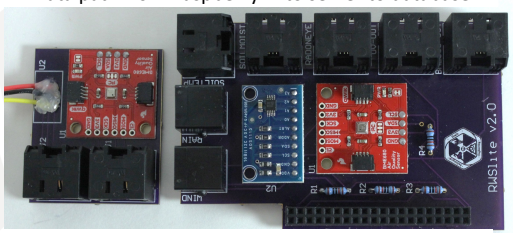
- Constant background monitoring to supply information for potential incidents
- Matches radiation data with weather to enable earlier and more sensitive detection and appropriate response
- Collects radon information to correlate with weather to possibly discriminate earthquakes from weapons testing
- Garnering more interest in STEM and Nuclear

Technical Approach

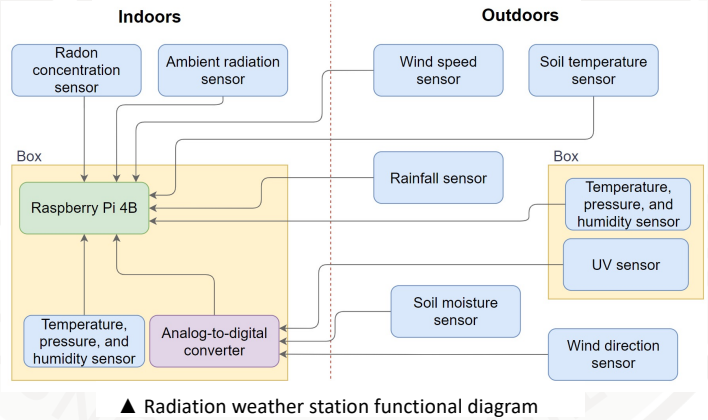
- Developed on Raspberry Pi 4b for low-cost
- Coding and data handling with Python on the Raspberry Pi
  - Reading values and pushing values to server
- Custom printed circuit board (PCB) for all hardware connections
- Server and Database Backbone
  - Public Facing database for free use
  - Server to handle all Raspberry Pi Devices



▲ Data path from Raspberry Pi to server to database



▲ Radiation weather station version 2.0 prototype



▲ Radiation weather station functional diagram

Results

- A third version of the printed circuit board in development
  (Combining Wire Ports, Reducing Size of Board)
- Upgraded air temperature, pressure, and humidity sensors at no increase of cost. (BME280 -> BME680)

Expected Impact

- Widespread, low-cost radiation background and weather data collection
- Public database of historic weather and radiation data
- High-school student outreach for nuclear engineering and STEM as a whole

MTV Impact

- Connecting to other researchers interested in this work
- Chances to go to workshops and present research
- Being supported as an MTV Fellow
- Taking nuclear engineering classes and considering a career in nuclear sciences

Conclusion

- Functional prototypes developed
  (collect data, push files to server)
- Upgraded capabilities of the system at no extra cost with more accurate sensors
- Constant background monitoring started with small number of devices for testing

Next Steps

- Circuit board testing on PCB v3
- Better PCB form factor for cases
  (smaller cases, thinner walls)
- Cleaner code
  (commenting, improved spacing)
- Manuals
- Sensor characterization and testing
- Link to data base and public website

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