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Introducing the OPEnS HUB 2.0
-A Versatile, In situ, Remote, Sensor Hub

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ABSTRACT: NEW METHODS OF REMOTE DATA RETRIEVAL

Research in geoscience often requires transmission of significant amounts of data from remote locations. The emergence of microcontrollers and open-source sensors are allowing connectivity to affordable, distributed in-situ monitoring. This report describes the OPEnS HUB, a modular data hub board of magnitude cheaper than commercial data loggers when scaled to multiple nodes. The test HUB has achieved consistent transmission up to one fourth of a mile in a densely forested basin and pushed nearly half a million data points from a network of open-source weather stations and soil probes as a real-time stream to Google Sheets. The Hub can process 12 variables from each device, and telemetry options range from LoRa, nRF, GSM, and wired ethernet. The inherently modular nature of the HUB means the user can adapt the transmission protocol to suit the unique context of each deployment.

HUB COMPONENT BREAKDOWN

- Adafruit Feather 32u4 LoRa Radio (RFM9x) – Integrated Microcontroller.
- Adafruit Ethernet Featherwing – Ethernet Shield for LAN connectivity.
- Adafruit MicroSD card breakout board – Back-up data storage.
- 900MHz Antenna Kit – Increase radio transmission distance.
- Adafruit Fora GSM module – Cell tower connectivity from remote locations
- Custom 3D Printed enclosure - Weather-proof and modular for future development.

METHODS: FLOW OF DATA

The largest hurdle to overcome with any remote sensing project is the availability of the data being collected. This approach is unique because instead of having to physically go collect the data or retrieve memory banks at the site of collection the data is dynamically transmitted, compiled and uploaded to a google spreadsheet in 5 minute intervals. In the figure below, a diagram of the transmission protocol is outlined.

RESULTS: DATA RECEIVED

• Reliable Data Transmissions from up to 2km away in heavy wooded conditions for LoRa, and GSM transmitting from remote rural sites.
• Nearly 500,000 data points collected over the lifetime of the experiment
• 5 minute update interval gave near “real-time” updates

CONCLUSIONS: FUTURE DIRECTION

The need to develop wireless communication and networked data hubs is essential for expanding the viability and functionality of distributed sensor networks. Recent developments on the Norwegian microcontroller NORDAS have proven the ability to transmit LoRa signals to low-orbit satellites, implicating tremendous potential for this remote data logging strategy in the future. The OPEnS Lab also plans to develop a graphical user interface for the Hub to enable ease-of-use by researchers without any programming experience. This project is at the core of the lab’s Internet of Agriculture initiative, aiming to break down technical barriers and put environmental monitoring into the hands of farmers, hobbyists, and beginning researchers. This technology is currently being utilized by Kwame Nkrumah University of Science and Technology in Ghana.

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