

Internet of Things Team: Long-range, Low-power, Low-cost Sensor Network

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Project Summary

The need for continuous monitoring of environmental conditions accelerates the development of wireless sensor networks (WSN). The advent of the Internet of Things (IoT), the availability of powerful and inexpensive hardware, and the development of open-standard stacks make the Internet-connected WSNs largely adopted for monitoring applications. The objective of this project was to design, develop, test, and demonstrate a long-range, low-power, and low-cost wireless IoT network for environmental monitoring. To demonstrate the system, we performed two use cases: (1) urban environment sensing; and (2) remote area environmental monitoring. Our solution uses open hardware as an environmental data collecting device, leverages the Long-Range Wide-Area Network (LoRaWAN) to transmit the data, and utilizes the OGC SensorThings API as a neutral format to avoid interoperability issues and to offer interoperable services to facilitate access to the collected data. From our experiments, our system can work in both urban and rural areas with different deployment specifications. In open urban areas, the system needs fewer gateways to cover the monitoring area and could collect data more frequently. The end device can send data back to the gateway from 6 km away. In remote areas, where multiple trees are on the way, the system should include more gateways. The gateway can receive data from the end device at an average of 1 km.



Management Implications and Lessons Learned

- The availability of open-source hardware and software makes it feasible to deploy large-scale WSNs to collect high temporal- and spatial-resolution environmental data
- LoRaWAN network can help us build a low-cost and secure bi-directional communication system in both urban and remote areas with increasing the monitoring coverage.
- The end-to-end geospatial cloud platform will streamline the process to collect, communicate, share, and analyze field data, and enable government, businesses, and citizens to share, collaborate, and access the information generated from the project via a unified web-service API.

Publication(s)

An example of data collected with such sensors and network can be seen online:

- <https://bera-3d-dashboard.s3-us-west-2.amazonaws.com/index.html>
- <https://bera-2d-dashboard.s3-us-west-2.amazonaws.com/index.html>