Deployment of a wireless LoRaWAN sensor platform for fire & environmental science

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Abstract:

Land and resource managers need accurate data from scientists in order to make effective and sustainable decisions. Data for environmental science is traditionally collected through a combination of manual surveys, satellite remote sensing, and ground-based sensors. The collection of these data is most limited by balancing factors of cost, spatial coverage, and accuracy/reliability. Small and inexpensive Long Range Wide Area Network (LoRaWAN) sensors enable in situ environmental research to increase spatiotemporal coverage and relative accuracy while decreasing cost. Our work is experimenting with the deployment and capabilities of consumer grade off-the-shelf LoRaWAN sensors and gateways connected into a microwave enabled research wide area network. While the individual accuracy of these low-cost sensors does not match perfectly with that of widely accepted research-grade expensive sensors, their tailored deployment to a specific research question can illuminate spatiotemporal patterns with better resolution than satellite remote sensing and well below the price range of traditional high grade scientific instrumentation. These benefits are also bolstered by significant battery life, long distance transmission range, ease of deployment, and real-time communication reducing the need for in-person site visits to retrieve data. Sensor data are transmitted wirelessly via the research network to a database where retrieval is managed through a user portal and managed access limits users to authorized data. This workflow design allows many different projects to be running through the same data infrastructure simultaneously without interference between user groups, while access to data is limited only by an internet connection. Future work in these implementations includes experimenting with gateway local data buffering and timestamp alignment as well as reliable transmission distance limits in differing physical and radio traffic environments.