Abstract

Title: Analysis of LoRa/LoRaWAN Under Varied Environmental Conditions within the Southern Tier Region of New York State

Team: ACG

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LoRa (Long Range) is a wireless modulation technique which operates on sub-gigahertz bands designed for low bitrate and long distance wireless communication [1]. On the other hand, LoRAWAN is a Media Access Control protocol which defines how LoRa devices communicate [1]. Our project aims to evaluate LoRa/LoRaWAN transmission bitrate and error rates to assess the technology's reliability within the Binghamton, NY region. The region is known for its dense forests and mountainous terrain potentially interfering with LoRa/LoRaWAN transmissions and receptions. Given our limited timeframe and resources, we have focused our analysis on two primary scenarios and a motivational element involving environmental testing as followed:

1. **Impact of Device Placement:** We plan on assessing how the position of a LoRa device affects signal strength, bitrate, and error rates. For example, placing a LoRa device inside a vehicle versus on the vehicle's rooftop or how elevation affects LoRa transmission rates. This analysis will provide insights into optimal device placement for applications requiring stable LoRa communication from mobile assets.
2. **Mobility vs. Stationary Conditions:** We plan on comparing error rates when the LoRa device is stationary versus when in a moving vehicle. This will help us evaluate LoRa's performance and practically in dynamic environments, relevant to IoT applications where devices are frequently in motion, such as in logistics or remote monitoring.
3. **Environmental Conditions and Motivation:** To add a practical, motivational element to our project, we will conduct tests in varied natural environments, such as on a mountain or inside a cave, versus noisy RF environments such as downtown Binghamton, NY. By testing in these real-world conditions, we aim to observe how LoRa performs in varied environments with potential signal interference and physical barriers.

We plan on collecting data such as bitrate, signal strength, transmission distance, elevation and use the data to draw conclusions about LoRa/LoRaWAN technological capabilities within the Southern Tier region of New York State. Through these experiments, we also anticipate gaining valuable insights into factors that influence LoRa's transmission reliability, helping us provide practical recommendations for deploying LoRa/LoRaWAN technologies in diverse settings and use cases.

References:

[1] *What are Lora and Lorawan?*. The Things Network. (2024, March 19). https://www.thethingsnetwork.org/docs/lorawan/what-is-lorawan/