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LORA NETWORK TESTBED PERFORMANCE EVALUATION IN UITM PERLIS

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ABSTRACT - Wireless networks are crucial in today's connected world, where IoT devices are being implemented in many environments such as smart homes, smart offices, and smart cities. LoRa (Long Range) are designed for IoT communication where devices enable connection between remote end nodes and LPWAN for analytic applications. LoRa Technology offers a promising alternative, providing low-power with long-range wireless data transmission. For a LoRa Network to be deployed, a performance LoRa analysis needs to be executed in the campus in order to measure received signal strength (RSS) and signal-to-noise ratio (SNR) for its usefulness. The research objectives are to set up the LoRa testbed in both indoor and outdoor environments and analyze the network performance. The LoRa testbed consists of a gateway and a few nodes that were deployed around the campus. The results for the indoor environment on three floors show higher RSS on the first floor, indicating acceptable signal coverage with the range of SF7 to SF12, whereas in outdoor only 15% coverage compared to the overall buildings except plantation area in UiTM Perlis.

Keywords: LoRa, LPWAN, RSS, SNR.

1. INTRODUCTION

LoRa is a wireless communication technology that operates on unlicensed frequency bands, allowing for cost-effective deployment and flexible network setup. It employs a spread spectrum modulation technique, enabling reliable communication in challenging environments with interference and obstacles. The main advantages of LoRa are its long-range capability and low power consumption. These features make it well-suited for applications requiring extended connectivity, such as smart cities and smart homes.A typical LoRa network consists of three components: end nodes, gateways, and network servers. End nodes are devices that collect data and transmit it to gateways. Gateways act as intermediaries between end nodes and network servers, which manage the network, process data, and facilitate communication with external systems.

2. METHODOLOGY

The method involves a LoRa Network testbed that consists of a gateway and a few nodes that were deployed around the campus. Various tests and measurements were conducted to evaluate the network performance in both indoor and outdoor environments. Performance evaluation involved collecting data on key metrics such as signal strength (RSS), signal-to-noise ratio (SNR).

3. RESULTS AND DISCUSSION

The research results indicated that the LoRa network demonstrated reliable connectivity and robust signal strength across the campus. The network was able to provide good coverage, allowing for effective communication and connectivity within the campus premises. Furthermore, the analysis of the data revealed that the performance of the LoRa network varied in different scenarios as shown in Figure 1 below.

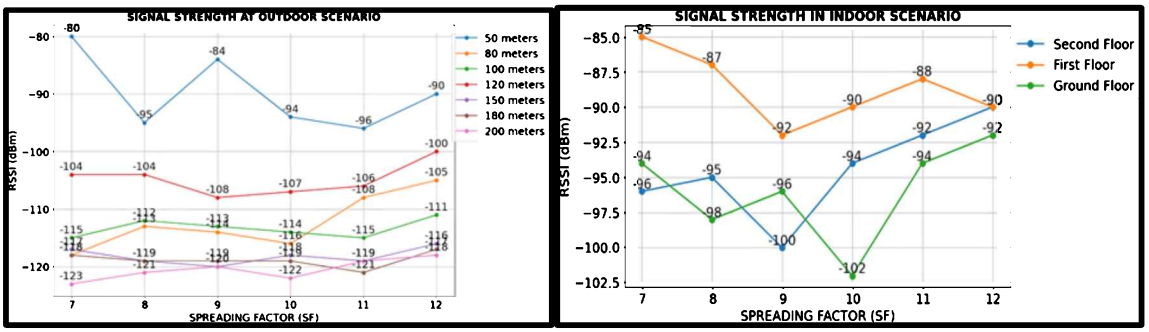

Figure 1 Signal Strength in Different Scenarios

4. NOVELTY OF RESEARCH / PRODUCT

This research is distinctive for its thorough evaluation of LoRa network performance in specific environments. Unlike previous studies that examined various applications, this research specifically focuses on how spreading factor selection affects coverage, packet loss, and signal strength. Santos et al. (2019) stressed the importance of choosing the right factor, while Muzammir et al. (2019) favored SF7 for better signal strength. Furthermore, Villiam et al. (2019) explored LoRa technology's robustness in dense urban areas and forests.

5. CONCLUSION

This research was to set up a LoRa Network testbed in UiTM Perlis that consists of a LoRa gateway and a few LoRa nodes. Next, the research has obtained new performance metrics such as RSS and SNR. The coverage areas that were covered by the LoRa Network is approximately 15% from the overall building areas. Nevertheless, the results for indoor coverage and outdoor with 200 meters radius are significant for any IoT devices implementation in UiTM Perlis Campus.

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