A Data Descriptor for LoRaWAN Path Loss Measurements in an Indoor Office Setting: Impacts of Environmental Factors

BACKGROUND

Motivation:

- Expanding indoor IoT deployments
- Ensuring reliable LoRaWAN communication

Aims:

- Design and execute LoRaWAN path loss campaign (***Fig. 1***)
- Evaluate environmental impacts on signal strength variation (***Fig. 3 a & b***)

Contributions:

- Comprehensive data collection campaign (***Fig. 1***)
- Detailed measurement dataset (***Fig. 2***)
- Practical insights for optimizing indoor LoRaWAN networks

METHODOLOGY:

- **Gateway (GW):** The Kerlink Wirnet™ iFemtoCell.
- **End Devices (EDs):** 6 Arduino MKR WAN 1300 MCUs. Each equipped with:
  - ✓ *Sensirion SCD41 (CO_2, temperature, humidity),*
  - ✓ *Adafruit BME280 (pressure), and*
  - ✓ *Sensirion SPS30 ($PM_{2.5}$) sensors.*
- **Deployment:** Diverse environments, e.g. kitchen, server-room.
- **Campaign period:** *September 26th to November 4th, 2024.*

DATASET

- Total Entries: *324,919 rows*
- ED0: Highest RSSI, 10m, no obstructions.
- ED5: Lowest RSSI/SNR, 40m, multiple walls.
- Upper channels & SF7-SF10 favoured.

EXAMPLE USAGE: Path Loss Modelling

- The Log-Distance Path Loss Model with Multi-Wall (**LDPLM-MW**) accounts for distance and multiple wall types.
  - ✓ It is the most common.
- We **integrate** environmental parameters for enhancement; (**LDPLM-MW-EP**).

METRIC	LDPLM-MW	LDPLM-MW-EP
RMSE	10.524436	**8.404949**
R^2	0.730091	**0.827857**

Figure 1: Sensor Network Deployment

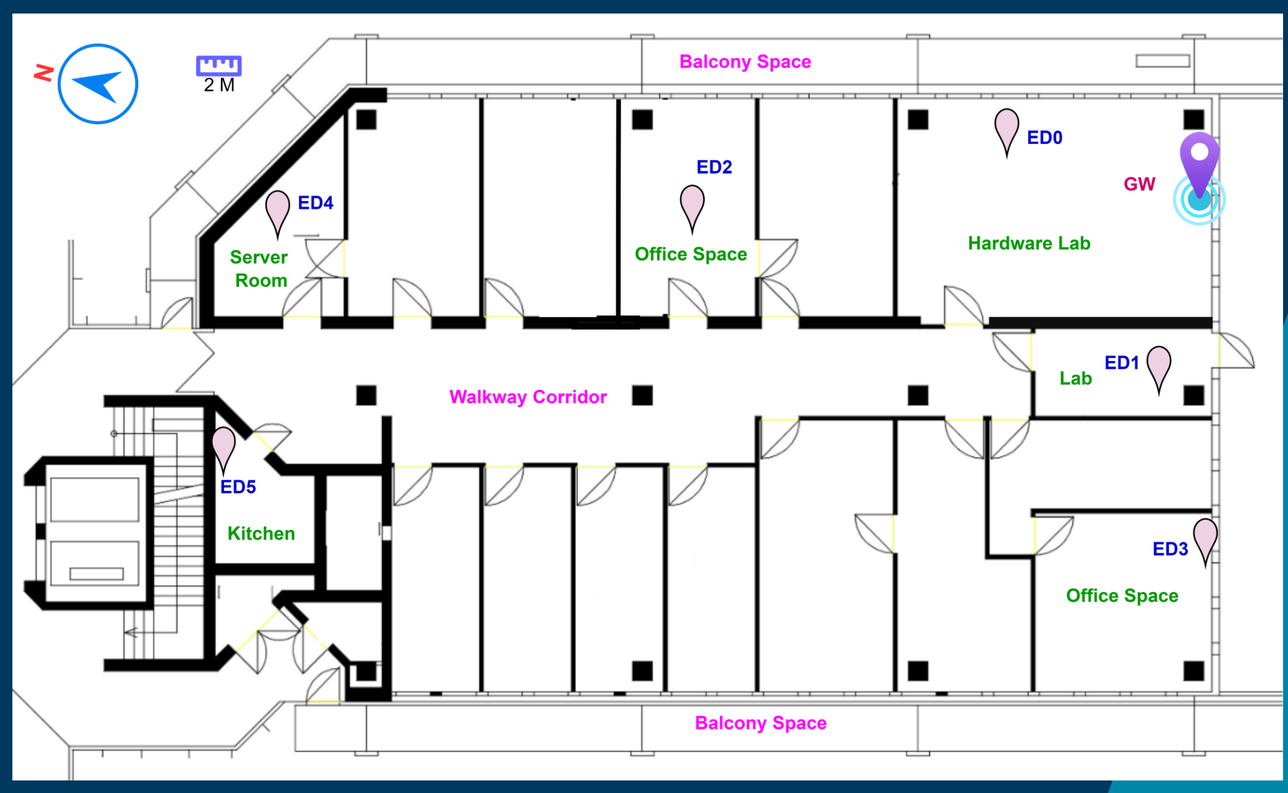


Figure 2: Empirical Distributions of a 39 days - Dataset

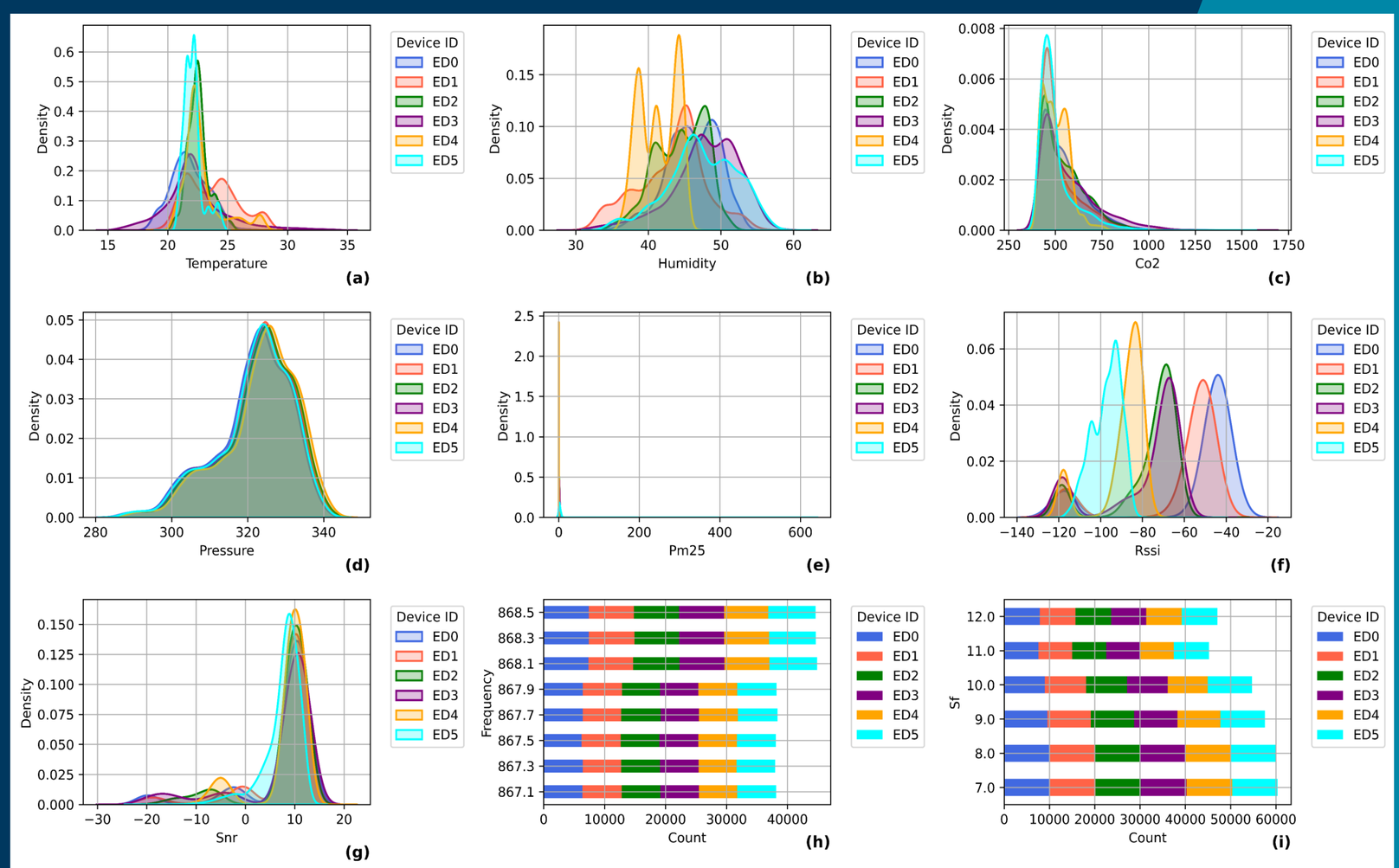
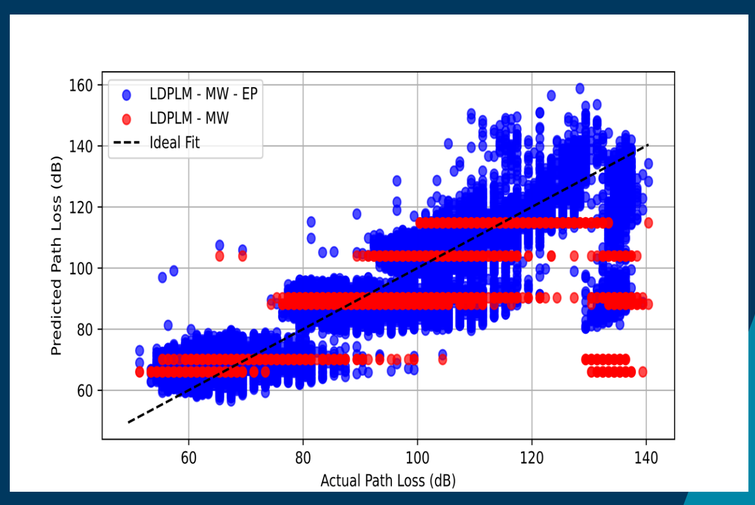
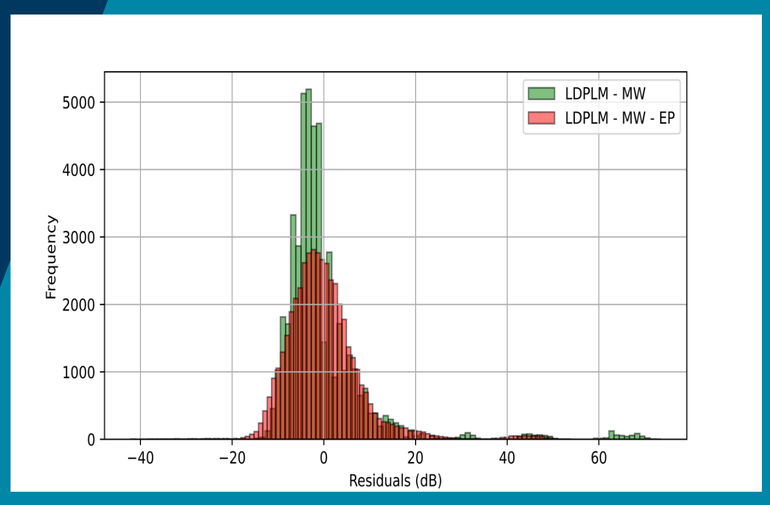


Figure 3: Evaluation of two models; example usage



(a)



(b)

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Ubiquitous Computing

https://ubi29.informatik.uni-siegen.de/usi/

GitHub Repository: *Dataset & Code*