DCIM_PUE_Prediction Complete Documentation

What is PUE?

Power Usage Effectiveness (PUE) is a metric used to determine the energy efficiency of a data center.

$$\text{PUE} = \frac{\text{Total Facility Energy}}{\text{IT Equipment Energy}} = 1 + \frac{\text{Non IT Facility Energy}}{\text{IT Equipment Energy}}$$

Folder Structure:

```
DCIM_PUE/
│
└── Pue_prediction/
    │
    ├── main.py
    ├── prediction.py
    ├── prediction_db.py
    ├── db.py
    ├── config.py
    │
    └── templates/
        └── dashboard.html
```

Path:

10.10.8.22

/opt/nms

Execution Flow Inside the Structure:

```
main.py
   ↓
prediction.py
   ↓
db.py (fetch historical data)
   ↓
prediction_db.py (store prediction)
   ↓
dashboard.html (display results)
```

Config.py File:

Config file contain Baseline tolerance in percentage and absolute PUE alert threshold. Here the following has been set but can be reconfigured as per user requirement:

BASELINE_TOLERANCE_PERCENT = 2

PUE_ALERT_THRESHOLD = 1.70

Basic Information About Prediction:

Data taken for training: All data present in database

Model: Random Forest Regressor

Trend Followed: The plotted Prediction Data is following the past 24 hours data trend

Baseline: Baseline is the mean of last 24 hours value + next 24 hours value

Upper band: Tolerance of 2% from baseline (user config)

threshold: Threshold is set as 1.7 (user config)

Ticketing Logic:

if value>Upper band, show warning in anomaly table

if value>threshold, show warning in anomaly table

****Always set threshold>Upper band

Note: In database we are getting value in 1 min interval, when we are plotting them, it is 1 hour (mean of last 60 data points) interval to make the graph clean.

Logic behind the predicted data which is Saved in DB (prediction_db.py):

This script runs a background **PUE prediction service** that executes every 5 minutes or whenever the alert threshold/tolerance changes. It first ensures the prediction_pue table exists, then checks whether a new prediction cycle is required using a saved state file. If needed, it calls run_prediction(), processes the predicted PUE, baseline, and anomaly flags, and upserts the results into the database. Finally, it updates the last run time and configuration state, ensuring controlled and efficient periodic execution.

Service Name:

/etc/systemd/system/pue_prediction.service

Logs:

/opt/nms/logs/pue_prediction.log

Report:

Full Anomaly and prediction report is available by clicking **“full report”** button at anomaly table.

Conclusion:

The DCIM PUE Prediction module:

- Predicts future PUE based on historical trends
- Provides anomaly detection
- Supports configurable tolerance & thresholds
- Runs as automated Linux service
- Achieves \>95% accuracy
- Helps optimize data center energy efficiency

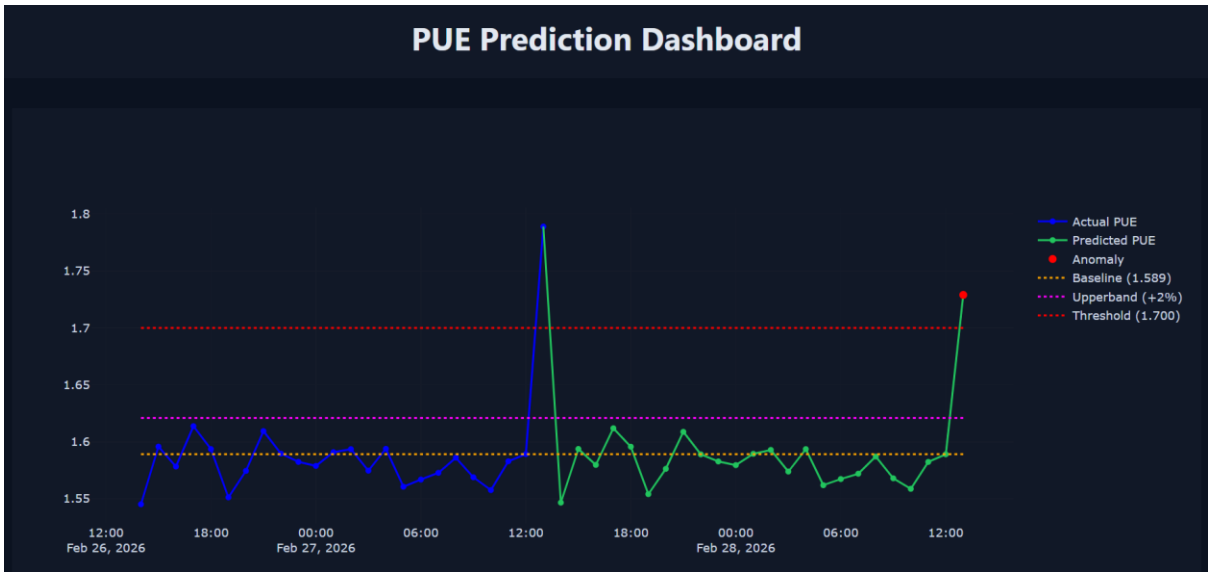
Model Accuracy: Overall, more than 95%

Date	Hour	Predicted PUE	Actual	
23-02-2026	16:00	1.583	1.5386	102.886%
23-02-2026	17:00	1.58	1.5563	101.523%
23-02-2026	18:00	1.609	1.5913	101.112%
23-02-2026	19:00	1.57	1.5777	99.512%
23-02-2026	20:00	1.564	1.5662	99.860%
23-02-2026	21:00	1.582	1.5795	100.158%
23-02-2026	22:00	1.559	1.5786	98.758%
23-02-2026	23:00	1.586	1.5781	100.501%
23-02-2026	00:00	1.578	1.5895	99.277%
23-02-2026	01:00	1.586	1.5842	100.114%

23-02-2026	02:00	1.572	1.6042	97.993%
23-02-2026	03:00	1.575	1.597	98.622%
23-02-2026	04:00	1.6	1.5953	100.295%
23-02-2026	05:00	1.575	1.5512	101.534%
24-02-2026	06:00	1.585	1.5882	99.799%
24-02-2026	07:00	1.585	1.5949	99.379%
24-02-2026	08:00	1.58	1.58068	99.957%
24-02-2026	09:00	1.586	1.58051	100.347%
24-02-2026	10:00	1.551	1.6015	96.847%
24-02-2026	11:00	1.581	1.5696	100.726%

Screenshots:

Prediction Graph



Prediction Table

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Date	Hour	Predicted PUE
2026-02-27	14:00	1.547
2026-02-27	15:00	1.594
2026-02-27	16:00	1.580
2026-02-27	17:00	1.612
2026-02-27	18:00	1.596
2026-02-27	19:00	1.554
2026-02-27	20:00	1.576

Anomaly Table

Download Report

Date	Hour	Predicted PUE	Expected Baseline	Upper band	Threshold	Status
2026-02-28	13:00	1.729	1.589	1.621	1.700	Critical