Hybrid Telecommunication Infrastructure Performance Modelling – By Extended Networks

Can you predict power consumption, downtime, and diesel consumption in hybrid telecommunications?

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Introduction

This contest is organised by the GDSC ML Community - UNILAG and is sponsored by Extended Networks.

Problem Description

With the growing number of hybrid technology deployments (2G, 3G, 4G and 5G) by mobile network operators in Nigeria, there is a growing concern over energy consumption by these deployments and upgrades actively taking place to make 5G and rural internet penetration a reality. For several years, service providers have relied on Diesel Generators, Battery power, Solar power, and a weak failing Grid to power their infrastructure.

Over 90% of Operational expenditure (OPEX) is on energy bills alone. Also, the revenue losses incurred from poor performance such as downtime, diesel leakages, abnormal increase in power consumption are of very deep concern to all stakeholders.

To maintain an average uptime of 99.8% on all sites as prescribed by the Nigerian Communication Commission and Mobile Network Operators, service providers believe that if they can predict power consumption, downtime, and diesel consumption on each site,

preventive measures can be put in place to ensure downtime and improve minimum time to repair (MTTR).

This ML challenge targets addressing the important questions mentioned above. In the challenge, you are to design machine learning-based solutions that can be trained on datasets of few scenarios and then generalise successfully to data from scenarios not seen before. In particular, the designed machine learning models must be able to achieve the following objectives:

Objective A

I. Develop a model capable of predicting downtime before it occurs. The participants are required to develop a model that can predict date, and time a downtime is likely to occur in different hub sites, taking into consideration the site configurations as shown in Appendix A, B and C.
II. Develop a model capable of estimating power consumption. The participants are required to develop a model that estimates the energy consumed by different hub sites, taking into consideration the power source (Grid, Generator, Battery, Solar) as per the configurations in Appendix A, B and C. The model should be able to flag unexpected increase in power consumption never seen before.
III. Develop a model capable of estimating diesel consumption. The participants are required to develop a model that estimates the rate of change or diesel consumed by different hub sites, taking into consideration the configurations in Appendix A, B and C. Any sudden sharp change (negative change) in diesel level consumption should be flagged by the model.

OBJECTIVE B
Achieve generalisation capabilities across different hub sites for (i), (ii), (iii). The model must estimate downtime, power consumption and diesel consumption of a new base station product based on measurements collected from existing ones from configuration A, B and C from the Appendix. For example, if training data is available for these three configurations, the model must be able to provide an estimate of the downtime, power consumed and diesel consumption.

Datasets

There are 4 different datasets for 4 different sites.The naming convention of the site was given by the company, please do not alter them to ensure seamless marking for our reviewers.
You are to work with only one dataset but note that the dataset you choose would determine the use case you would be hacking for. See Appendix for more details.

A site is basically a building so in each folder, you would see the specification for each site. A site contains logs split into 4 parts/files, these files are all in a .csv format. For example, the first site - EEN0005C has 4 files, the first file -

0_EEN0005C_log_20230430-1524_to_20230629-1524.csv simply contains all the daily logs of EEN0005C from 30th of April to 29th of June, 2023.

Find the link to the 4 sites here: https://drive.google.com/drive/folders/1PWcX0URicVj5BF0P_nuYkbmZnb3Bavd9?usp=drive_link

Ideally, a team should work with **ALL** the sites and all the use cases but winners would be selected based on how much they can complete within the timeline. See Selection Criteria for more details.

Timeline

The hackathon would run from **November 6th** to **December 3rd**, 2023. All applications should be made before **6th of November.** All deadlines are at 11:59 PM WAT on the corresponding day unless stated otherwise.

Eligibility Criteria

Note that you can either compete as a team or as an individual. To be eligible to participate in this hackathon, you must be a member/have team members from the GDSC ML Community.. For teams, your team should:

- consist of 2 to 4 members
- have at least one female in your team.

Appendix

Consider the 4 site configurations below:

A: EOS0001C (Grid, Solar, battery)

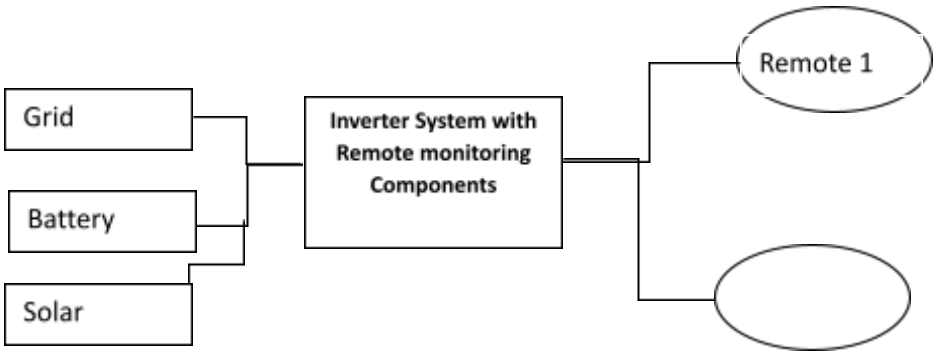

Figure 1:Hub Site Configuration with Generator, Battery and Solar

B: EAJ0001C (Generator, Grid, Battery)

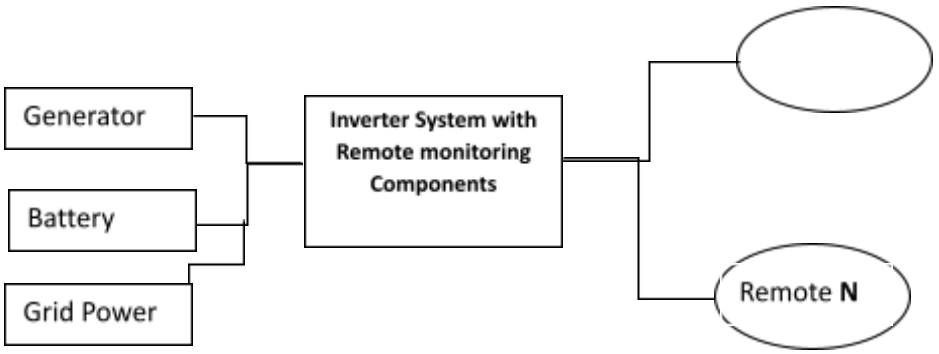

Figure 2: Hub Site Configuration with Generator, Battery and Grid Power

C: EKW0005C (Generator, Solar, Battery)

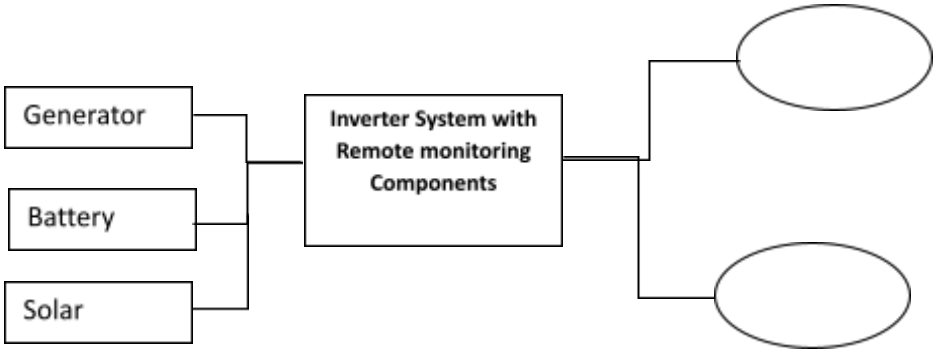

Figure 3:Hub Site Configuration with Generator, Battery and Solar

C: EEN0005C (Generator, Battery)

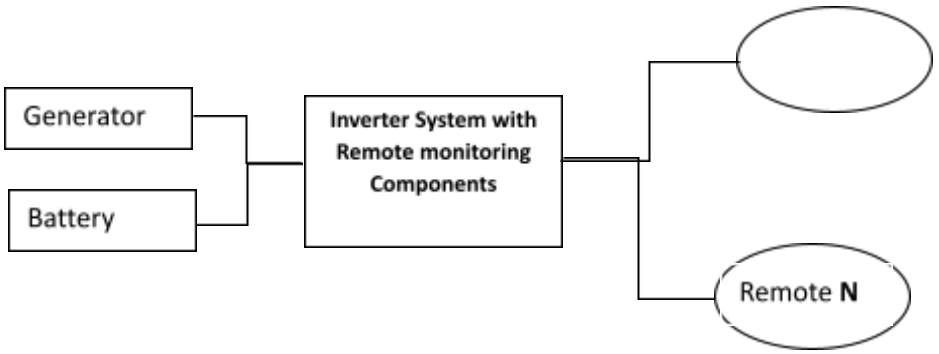

Figure 4:Hub Site Configuration with Generator, Battery

Submission Guidelines

You should make 3 submissions for the 3 use cases: **Downtime(DT)**, **Power Consumption(PC)**, and **Diesel Consumption(DC)**.

Submissions should be in a notebook format, i.e. a .ipynb extension, your notebook should be named with the following convention: teamname_modeltype_site_EN_GDSC.ipynb.

Note that there are 3 models so team Alpha's submission for power consumption should be like: **Alpha_PC_EEN0005C_EN_GDSC.ipynb**

Selection Criteria

You may split your data in any ratio that you deem optimal for you but bear in mind that we would keep a certain group of unseen data points to validate your model. Each use case would have different standards to measure success, they are:

- **DT** Criteria: Worst case scenario: 3 hours before downtime.
  Best case scenario: 24 hours before downtime.
- **PC** Criteria: total power consumption for the next day, power source allocation for a particular day, classify power usage between below max_thresh and above max_thresh
- **DC** Criteria: Time expended for a particular volume of diesel, flag sharp decrease in DC(anti theft) and by what quantity.

Overall, we would be considering X other criteria, they are:

- Accuracy
- Learning Algorithm implemented
- Conciseness of code

Prize details

1st Place - 250,000 Naira
2nd Place – 150,000 Naira
3rd Place - 100,000 Naira

The sponsoring company has offered to employ 2 students from our community, every participant is eligible for the interview process which would take place after the winners have been announced. Good luck and happy hacking!

Prost!