electricity north west

Bringing energy to your door

NIA ENWL020
Artificial Intelligence & Machine Learning

Progress Report

30 July 2021

VERSION HISTORY

Version	Date	Author	Status	Comments
V1.0	27.07.21	Ben Ingham		

REVIEW

Name	Role	Date
Lucy Eyquem	Innovation PMO Manager	27.07.21
Dan Randles	Head of Innovation	27.07.21

APPROVAL

Name	Role	Date
Steve Cox	Engineering & Technical Director	28.07.21

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GLOSSARY

Term	Description
ML	Machine learning
AI	Artificial intelligence
DSP	Digital Signal Processing
LV	Low voltage
LCT	Low carbon technologies

1 PROJECT FUNDAMENTALS

Title	Artificial Intelligence and Machine Learning
Project reference	NIA_ENWL020
Funding licensee(s)	Electricity North West Limited
Project start date	October 2018
Project duration	3 years
Nominated project contact(s)	Geraldine Paterson (innovation@enwl.co.uk)

2 PROJECT SCOPE

This project will be a research piece investigating the application of machine learning (ML) and artificial intelligence (AI) to data already being collected by low voltage monitoring equipment and transformer monitoring equipment already deployed on the network. The research will investigate whether machine learning can be used to identify hidden trends and make recommendations for network investment.

3 OBJECTIVES

- Collate data from the various systems.
- Build, train and evaluate a model to classify and work with the data.
- Produce recommendations for network operation and investment.

4 SUCCESS CRITERIA

- Report on the methodology for collating the data.
- Production of a model to interrogate the data sets.
- Report detailing outputs from the model and recommendations for network operation and investment.
- Report detailing how the model can be transferred to business as usual.

5 PERFORMANCE COMPARED TO THE ORIGINAL PROJECT AIMS, OBJECTIVES AND SUCCESS CRITERIA

Project Progress

The project partners progress for the delivery of the project has been outlined below. Good progress has been made in a number of areas, with further additional data collection and analysis/modelling work set to continue.

LV Data collection activities

Data continues to be collected using the deployed triggering algorithms, which have been furnished with new triggering techniques, and calibrations of the existing algorithms to increase sensitivity. This allows for very early stage predictive fault identification and has opened up new possibilities, including the ability to provide a time window until faulting, and the type of fault that is likely to occur.

LV Modelling

An advanced LV model for classification of load types attached to each feeder has been created and run on a large data set, producing a total of 16 individual classifications, with 12 uniquely identifiable and labelled with their type, and 4 highly mixed load types.

A second model uses device information to perform a basic health assessment and ranking of the health of cables, and a report including the ranking of networks is produced on a weekly basis for the Rising and Lateral Mains installations, helping to prioritise resources.

A third model has been developed by a team specialising in machine learning, targeted firstly at identifying existing issues created by low carbon technologies. Continuation of this work will be used to predict feeders and network areas that will likely develop problems in the future.

Data analysis has shown an ability to identify LCT growth within the networks, and a presentation showing the analysis has identified a number of heat pumps on the network just from data analysis has been given. The validity of the output still needs checked with information about the actual loads on the network, for this exciting new technique, but from the analysis, the algorithms show a lot of promise.

Fault Management

Improvements to fault management systems are ongoing, with fault classification and labelling work dependent on feedback and collation of data about actual fault locations. As stated previously the improvements to the algorithms including the possibility of providing a time window until faulting and details of the fault type.

Tap Changer Monitor Data Analytics

The separate tap changer monitoring project, which has deployed over 40 monitors on the network, has been extended, providing more opportunity to develop the anomaly detection system. Regular reporting from the monitoring units has between set up and now provides detailed information on switching events, including an estimated accumulated wear algorithm that takes into account the load level during the switching operation.

Transformer Analytics

Machine learning approaches for evaluation of transformer asset data to allow predictive analytics will be researched in the coming months.

6 REQUIRED MODIFICATIONS TO THE PLANNED APPROACH DURING THE COURSE OF THE PROJECT

There have been no changes to the planned approach.

7 LESSONS LEARNED FOR FUTURE PROJECTS

The main lesson Kelvatek has learned from this project is about the need of curated data and "truth about the real loading on the network" to create a data-driven applications with real-world validated performance.

Kelvatek devices have been collecting a significant amount of data over the last few years from the LV network and during these projects we have learned that it is critical to consolidate the data to improve its quality, allowing it to be used effectively in investigations and trials.

As a following step, Kelvatek has introduced new best practices in its data management workflow where all new data is processed to a consolidated format with higher quality.

Moreover, Kelvatek has learned that analysing just the sensor data is not enough to create and validate data driven products because it is fundamental to introduce "network truth" about the specific targeted application, like maintenance reports, presence of LCT technologies, presence, and cause of faults, and so on.

In particular, the tap changer projects have been very important in creating a monitoring system able to detect anomalies over a wide range of different assets. This has shown Kelvatek the importance of collecting data for longer time to allow the physical phenomena to be measured and then collaborating with ENW to understand what has happened to the asset.

8 THE OUTCOME OF THE PROJECT

Not applicable.

9 DATA ACCESS

Electricity North West's innovation data sharing policy can be found on our website.

There is currently no data available from the project.

10 FOREGROUND IPR

There is no foreground IPR associated with this project.

11 PLANNED IMPLEMENTATION

Not applicable.

12 OTHER COMMENTS

Not applicable.