NIA ENWL023
Intelligent Network Meshing Switch

Progress Report

31 July 2020

VERSION HISTORY

Version	Date	Author	Status	Comments
V1.0	06.07.20	Kieran Bailey	Final	

REVIEW

Name	Role	Date
Lucy Eyquem	Innovation PMO Manager	23.07.20
Dan Randles	Head of Innovation	29.07.20

APPROVAL

Name	Role	Date
Steve Cox	Engineering & Technical Director	31.07.20

CONTENTS

GLOSSARY

Glossary Term	Description
GSM	Global System for Mobile Communications
INMS	Intelligent Network Meshing Switch
LV	Low Voltage
NMS	Network Management System
PLC	Power Line Carrier
UDB	Underground Distribution Box

1 PROJECT FUNDAMENTALS

Title	Project Avatar
Project reference	NIA_ENWL023
Funding licensee(s)	Electricity North West Limited
Project start date	April 2019
Project duration	1 year
Nominated project contact(s)	Kieran Bailey (Kieran.bailey@enwl.co.uk

2 PROJECT SCOPE

The project will further improve the link box meshing device to allow deployment in all locations and environments. The improved link box meshing device will be trialled at a number of link boxes on the LV network. These sites will be selected to cover the full range of location types covering all the environmental issues identified.

3 OBJECTIVES

A staged approach is proposed to produce a final device that is suitable for installation network wide. The three stages can be summarised
as follows:

Stage 1
Improve the existing devices to make the device smaller with an improved water ingress IP rating. Investigate and select communication protocols that will provide maximum connection time to the installed device. Multiple protocols may be required to cover all location types.

Stage 2
Simulate heat and humidity in a link box with the device fitted. Investigate solutions and trial in a test environment. Develop a power supply and electronic design that will reduce overall heating and trial in a test environment.

Stage 3
Complete type testing and install a number of devices for live field testing. Evaluate live trial results.

4 SUCCESS CRITERIA

The following criteria will be used to determine if the project has been successful:

- Link box meshing devices show no signs of condensation during the trial period
- Link box meshing devices show no signs of water ingress during the trial period
- Link box meshing devices show high level of communication availability during the trial period

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

Stage 1 - Work for stage 1 concentrated on review of the LYNX device that was used on the Smart Street project demonstration. The team pursued a major conceptual redesign away from existing UDB switching technology in order to address the issues around heat dissipation/build up, and an improved water ingress IP protection rating.

A number of communications protocols were investigated in depth, including a new concept for GSM antenna installation, use of roaming SIM cards to be able to connect to the highest power GSM provider rather than a fixed GSM service provider, as well as Power Line Carrier (PLC) technology.

If no or limited GSM coverage is available, PLC becomes a reduced functionality (lower bandwidth) alternative. This was tested on ENW's network, and the reduced bandwidth is evident, but is sufficient to enable basic switching control operation and voltage and current monitoring features.

GSM, as a higher bandwidth technology is preferred, and testing was carried out on antenna integration into the new ventilated UDB access cover. Results from the field show that this approach will work in a majority of installations.

Stage 2 – Prior experience in Smart Street showed that good thermal management could prove critical in this application. Getting heat out of the underground cavity was key to the design from the outset, and improved heat management techniques concentrated on ventilation and maximising the use of that ventilation. Advanced computer simulation was used to test candidate concepts, followed by prototype testing on the Kelvatek LV test network in Lisburn, Northern Ireland.

The design will use a newly installed ventilated pavement level cover, with associated frame that needs to be installed into the road level. This cover will support heat exchange with the outside environment, and prevents excessive temperature rise in the UDB cavity itself. The design will be optimised using the simulation data along with new heatsink designs to provide a decrease in the rise-over-ambient temperature in the region of 25%..

Stage 3 – Comprehensive testing will be carried out on the new design alongside appropriate trials – Physical design tests will check the fit to the UDB and how that design will assist n thermal management, testing of the ventilated access cover and the overall system architecture.

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

There were no modifications required in the project scope.

7 LESSONS LEARNED FOR FUTURE PROJECTS

The LV Underground Distribution Box is a harsh and challenging environment. As the technology for this area of the LV network automation is in a relative infancy compared to say the 20+ year experience with LV fuse way automation, there are still approaches to be investigated in the future. As the technology matures and the lifetime of devices and associated control electronics are better understood and very reliable, then consideration should be given to complete sealed and buried LV automation, monitoring and switching equipment. Without years of reliability data, currently this approach is considered risky as it would require excavation if repair or maintenance were ever needed.

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 has been no data gathered during the course of this project.

10 FOREGROUND IPR

There is no foreground IPR associated with this project.

11 PLANNED IMPLEMENTATION

Not applicable.

12 OTHER COMMENTS

Not applicable.