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## NIA Project Registration and PEA Document

### Date of Submission

Apr 2020

### Project Reference Number

NIA\_NGTO052

## Project Registration

### Project Title

Assessing wearable technology applications for transmission operation and design

### Project Reference Number

NIA\_NGTO052

### Project Licensee(s)

National Grid Electricity Transmission

### Project Start

May 2020

### Project Duration

1 year and 0 months

### Nominated Project Contact(s)

Mingyu Sun

### Project Budget

£286,487.00

## Summary

Wearable technology has been adopted widely for personal use and is now on the uptake for business. It is currently predominantly used to create handsfree operation, facilitate remote expert assistance and produce mixed reality overlay of information to task. These applications will be explored at National Grid through a proof of concept pilot study to gauge suitability for wider use across the business pending demonstrable improvements in productivity and decision making.

### Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

## Problem Being Solved

1. Currently field engineers carry out maintenance tasks using all reference documents on a laptop. Firstly the correct documents relevant to the asset can be difficult to locate. Once the correct script has been found online, the field engineer follows the script to complete the procedure. This means that work has to be interrupted regularly to reference back to the script. This continuous pausing of work means that the task takes longer than it needs to and therefore the output of completed tasks/day is not optimal. The field engineer may also need to call the technical support team when they have an issue they are unable to solve. This involves calling a remote team for expert guidance; describing the problem over the phone makes it very difficult to convey without a visual and often results in additional site visits to see the problem creating additional time wastage waiting for the visit.
2. Currently multiple site visits are required during the design period of capital projects to assess site suitability, spacial measurement tools are often inaccurate.
3. Engineers can be called out to site in emergency situations without necessarily having the relevant asset familiarization expertise. Being required to work isolated and under duress in an emergency increases the risk of error even for a skilled worker.

## Method(s)

This project will solve these problems by introducing wearable technology by way of a pilot study using the Microsoft HoloLens 2, Microsoft Dynamics 365 applications and a Microsoft Mixed Reality partner to utilize data from National Grid. Wearable technology has the capability to allow a user to be completely handsfree in tasks that would traditionally require the user to

alternate between the task and guidance material. Software applications will allow mixed reality overlay, guided visual assist and remote assist live video feedback to remote experts. The project will use wearbale technology in real world environment and collect evidences for demonstrable benefits, especially in terms of user acceptance.

## Scope

The project will cover the following use cases:

1. Hands free document assist. Using the application 'guides' to allow handsfree task completion leaving the user to concentrate on the task at hand whilst being guided through the process step by step. Appropriate task will be identified from actual work task.
2. Live video sharing 'see what I see'. Using the application 'Remote Assist' to share live field of view to remote users.
3. Investigation of mixed reality overlay of assets direct to site. Understand the technical requirements and data integration of 3D visualization of substation assets at real world scope.
4. Improving access to drawings on site using virtual document overlay and investigating capability to pull in the correct drawings and/or asset information based on GPS location rather than having to manually search.
5. Demonstrate capability to model a substation virtually to assist in silver command for emergency response.
6. Applying mixed reality applications into a real world environment to determine how appropriate the technology is for a substation scenario – Durability testing, climate condition testing, water ingress resistance, connectivity and data availability using wifi, 4G, 5G in the field.
7. Comparing utilisation of HoloLens apps across different hardware solutions. How do they perform on a tablet vs the HoloLens 2 and can this make mixed reality more broadly applicable across the business without hardware investment.

## Objective(s)

The objectives for this project are to:

1. Understand the benefits of wearable technology within National Grid in greater detail
2. Exploring the full width of the capabilities of HoloLens 2.
3. Test the concept live in the field and assess the benefits, e.g. reduction in maintenence time and site visits.
4. Understand additional requirements and costs to integrate NGET data with wearable technology through a mixed reality partner software pending successful implementation of Dynamics 365 standard apps.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

## Success Criteria

This project will be deemed successful if the suffiecient evidences are gathered to understand the value wearble technology can offer to Transmission utility activities based on the direct user feedback.

## Project Partners and External Funding

N/A

## Potential for New Learning

This project will demonstrate best practice early adoption of wearable technology within the utilities industry. It will demonstrate how feasible it is to wear a headset around a substation environment in an outdoor all weather environment, gauge if the comfort level to use whilst working is acceptable and how users are able to cope with holographic overlay. This project will explore how the two apps; Remote Assist, and Guides can be adopted within the utilities industry alongside VGIS GPS data based applications. All use cases could be applied to other network licences should they choose to invest in wearable technology too.

## Scale of Project

This scale of project was chosen to act as a proof of concept study live in the field to truly replicate potential uses.

## Technology Readiness at Start

TRL5 Pilot Scale

## Technology Readiness at End

TRL7 Inactive Commissioning

## Geographical Area

Trial in working environment at substation sites and office locations.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

£286,487

## Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

### Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

#### How the Project has the potential to facilitate the energy system transition:

n/a

#### How the Project has potential to benefit consumer in vulnerable situations:

n/a

### Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

#### Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

1. Time and money can be saved through remote assist no longer requiring specialist engineers to have to visit site to troubleshoot issues. In engineering services for example this could turn a 2 day overnight site visit into a 2 hour office based footage review. This would save travel and time costs for both ES and the field engineer as well as reducing asset downtime waiting for diagnosis of the issue.
2. Maintenance task time would expect to decrease allowing each field engineer to be more productive and complete more tasks/day which would in turn reduce asset downtime.
3. The number of site visits per scheme is estimated at +10 (consisting of over 1000hrs of travel). This equates to £0.5m/year that could be mitigated using mixed reality overlay and visual assist to avoid site visits.
4. By providing guided instruction for work carried out under duress there will be a reduction in errors and an improvement in safety.

#### Please provide a calculation of the expected benefits the Solution

Assuming a 5 year life time for the wearable equipments, Base cost: Maintenance and site visit using traditional methods: £6.9m for 5 years period

Total development and subscription for 5 years period: £2m

Financial benefits: £4.9m for 5 years period.

#### Please provide an estimate of how replicable the Method is across GB

This method could be replicated across any network transmission site requiring maintenance tasks.

#### Please provide an outline of the costs of rolling out the Method across GB.

This could be rolled out per user at an additional £6000 (headset + 1 year dynamics 365 + VGIS licence) Assuming 4 HoloLens were made available per operations team (35 teams total) and connectivity is available at all sites: Year 1: £840,000

Yearly ongoing licencing cost: £280,000

### Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

- A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify

repeating it as part of a project) equipment (including control and communications system software).

- A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)
- A specific novel operational practice directly related to the operation of the Network Licensees system
- A specific novel commercial arrangement

#### RIIO-2 Projects

- A specific piece of new equipment (including monitoring, control and communications systems and software)
- A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven
- A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)
- A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology
- A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution
- A specific novel commercial arrangement

### Specific Requirements 4 / 2a

#### Please explain how the learning that will be generated could be used by the relevant Network Licensees

This project will demonstrate best practice early adoption of wearable technology within the utilities industry. It will demonstrate how feasible it is to wear a headset around a substation environment in an outdoor all weather environment, gauge if the comfort level to use whilst working is acceptable and how users are able to cope with holographic overlay. This project will explore how the two apps; Remote Assist, and Guides can be adopted within the utilities industry alongside VGIS GPS data based applications. All use cases could be applied to other network licences should they choose to invest in wearable technology too.

#### Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

Managing Assets - Managing assets throughout their lifecycle

- Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

#### Is the default IPR position being applied?

- Yes

### Project Eligibility Assessment Part 2

#### Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

#### Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

Existing projects within similar field:

NIA\_NGTO005 - EPRI Research Collaboration on Information and Communication Technology

High level assessment of augmented reality application, identifying areas for use, and available technology, no planned testing of the concepts. TRL 2 as opposed to this project at TRL 4.

NIA\_NGN\_190 - Health and Safety Monitor

Personal wearable technology device which focuses solely on improving health and safety by tracking and alerting the user on PPE requirements which is not the same scope of this project.

NIA\_SPEN\_0049 – iIdentify

This project will investigate asset identification using a camera in combination with an app to pull up asset information when identified. Whilst camera identification is also expected to be explored we will look to focus on monitoring and identifying of assets using the Microsoft HoloLens 2.

#### If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

n/a

## **Additional Governance And Document Upload**

### **Please identify why the project is innovative and has not been tried before**

This project is innovative because wearable technology is yet to be adopted within the UK utility industry to tackle improvements in productivity and health and safety.

### **Relevant Foreground IPR**

n/a

### **Data Access Details**

n/a

### **Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities**

This project will explore a number of use cases which have yet to be tested successfully in a substation environment. Due to the risks listed below, the NIA funding offers the most appropriate route for the National Grid Electricity Transmission (NGET) to fund this project.

### **Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project**

The project can only be funded through the NIA as there are significant risks which warrant further investigation and development of this innovation topic, prior to its use within the business. The main risks are: No proven business case – While a value case has been defined for this project, it is contingent on an as yet unknown level of technical development. This means that the benefits outlined in this document may not materialise, or may require significant further investment to adopt. Technical challenges – As this research is looking at a specific application of wearable technology, we may find that there are challenges in data integration which cannot be easily resolved. This unknown level of complexity to integrate with our systems may be challenging to achieve any effective software development therefore creating a risk. Without the NIA funding this risk would never be mitigated, and the business would justifiably not research this area; resulting in the potential benefits never being obtained or investigated.

### **This project has been approved by a senior member of staff**

Yes