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GROUP REF.: D2
PREF. SUBJECT: THE OPPORTUNITIES AND CHALLENGES BROUGHT BY EMERGING INFORMATION AND COMMUNICATION TECHNOLOGIES TO ELECTRIC POWER UTILITIES IN THEIR PATH TO DIGITAL TRANSFORMATION
QUESTION N°: 1.3 What are the perspectives and potential areas of using industrial robots to enhance the concept of the Internet of Things at electric power utilities? Is there any known industry experience of using industrial robots as an integral part of the electric power utility's business/technological processes on the regular basis?

Autonomous Substation

Starting point Elia

Elia has already implemented sensors, drones and wheeled robots within its infrastructures within different initiatives, depending on the environment. This will be our first time exploring the implementation of a legged robot in any context and especially for remote teleoperability.

Use Cases

1. AUTONOMOUS PREVENTIVE INSPECTION

<u>Current Situation</u>

If maintenance is not performed correctly, the asset generates additional costs and delays in the execution of further projects:

<u>Autonomous Preventive Inspection Implementation with legged robot (SPOT from Boston Dynamics):</u>

2. AUTONOMOUS POST INCIDENT INSPECTION

<u>Current Situation</u>

Currently – when a storm (or other severe damage) on an offshore station occurs – a helicopter must be used to get the team on site – to perform the inspection after the incident.

When the incident happens – connectivity issues may occur

Danger for employees in bad weather conditions (for transportation as well as just for "residents")

Missing information about human friendly environment in offshore substation (hot gas, missing earthing)

<u>Autonomous Post Incident Inspection Implementation with legged robot (SPOT from Boston Dynamics):</u>

Permanent resident – Spot Robot which activates itself automatically as the incident on the substation occurs.

Black Box principle – similar as in the airplane industry – with one significant difference: the robot can perform measurements AFTER the incident.

The robot should be de-coupled from the internet connectivity, and be able to work automously

Data Dump on the Docking Station. Local Backup – then send to an internal Storage in the intranet.

Analysis based on video, thermal vision, acoustic.

Flow: Incident trigger occurs -> robots wakes up -> makes an exploratory round -> records the content -> goes back to the docking station -> stores the data -> end.

3. ROBOTIC SWITCHING ASSISTANT

<u>Current Situation</u>

The hardware and processes required for the switching operations differ from substation to substation.

The GIS system is designed to handle HV in a compact way by using pipes. This restricts the view on the moving parts inside the system. The switching console is not close to the switching-mechanic that will execute the switch. To validate the switching the switching operator needed to go to the GIS-pipes after every step to verify the process.

<u>CHANGEABLE PAINS</u>

Delay in switching will cause a delay in executing projects

Switching needed between 30 -180 minutes Long and expensive travel time to assets

Lack of qualified and certificated staff

No possibility to observe assets directly after the switch, because switching officer is already on the move.

Two people are required by law for the validation process, currently those are: switching officer onsite + dispatcher remotely.

<u>Robotic Switching Assistant with legged robot (SPOT from Boston Dynamics):</u>

1. Autonomous walk by mission planning
2. Camera can be adjusted autonomously or by operator
3. Visual validation of thermal sensor on switching arms, earthing switch and circuit breakers
4. Gives feedback about condition of the circuit breaker and switches by analyzing sound while switching

4. AUTONOMOUS ASSET DOCUMENTATION

The autonomous asset documentation will be done based on a LiDAR Scanning that will be performed at each stage of the 3 first use cases, henceforth creating a collateral benefit of the latter without deploying further resources.