

Study Committee B3

Substations and Electrical Installations

10457_2022

An Intelligent Approach for Remote Asset Monitoring of Substation using Visual Monitoring System

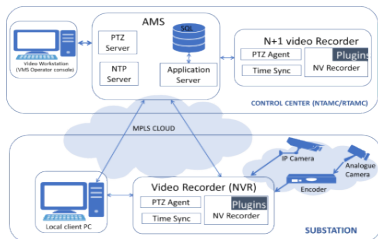
R.K.Arora, P.K. Srivastava, Anoop kumar SINGH*, M.A.Naveen
Power Grid Corporation of India Limited

Motivation

- Conventionally, while doing operation locally at a substations, there were difficulties in viewing oil gauge level/connector/bushings of switchyard equipment like Transformers, Reactors, STATCOM, SVC, Isolators ,Circuit Breakers, etc. in energized condition.
- The purpose of Visual Monitoring system (VMS) is to ease out the above mentioned problems by providing 360° live view of switchyard equipment during remote operation of substations.
- The VMS is observed as an elementary requirement for remote operation & supervising of substation elements.
- The paper also covers challenges faced during integration such as :
 - Visibility augmentation
 - Keeping recording configuration of cameras intact to recover failure of servers.
 - Keeping camera configuration intact while replacing faulty cameras.
 - Integration of various make and model of cameras & servers

Method/Approach

- VMS system comprises of IP & Analog cameras, NVR, Local clients & Application management servers. The architecture is as shown below :



- In VMS system cameras are installed at height at strategic locations in substations switchyard structures.
- Various features are available in VMS system like Video Motion Detection, Intrusion Detection, Detection zone, Object Blocking zone, Camera sabotage ,PTZ tracking, Home Presets, Camera tour, Audio Detector.

Advantages of VMS in remote operation of substations

- For supervising safety measures and alerting concerned in case of any violation observed during maintenance works in switchyard.



- To verify if Isolator contacts are properly closed/opened and aligned while carrying out switching operations.



- Identifying abnormal condition like oil seepage, sparking etc.



- Monitoring physical status of equipment during adverse weather conditions like snowfall, rainfall, etc. when access to switchyard is limited.



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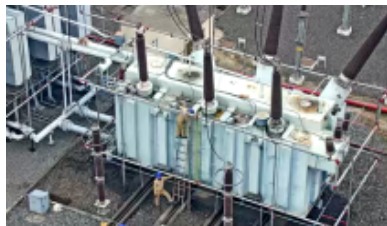
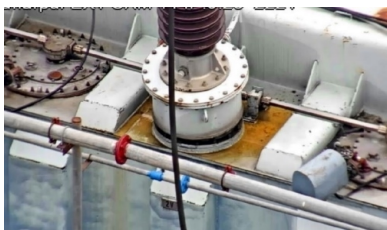
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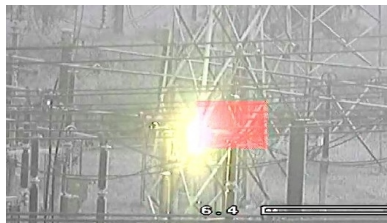
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Use Cases of VMS

- Transformer Oil Leakage detected and attended



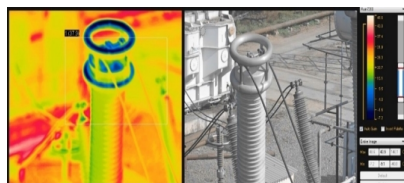
- Auto PTZ tracking of Sparks in Isolator contacts



- Correlation of SCADA events with VMS: VMS has a feature to record & store footage for a predefined period and these recorded video footages assist maintenance personnel on post event analysis & correlation of same with SCADA events.

Thermal Monitoring system

- The thermal monitoring system analyses thermal signatures and alerts operators in case of any abnormality observed in switchyard equipment like hot spots.
- Thermal imaging cameras convert thermal radiation to crisp images (as shown in figure below) from which temperatures can be read. This non-contact temperature data can be displayed on a monitor in real-time.



Advantages of Thermal Monitoring cameras

- The Thermal camera detect hot Spots in bushing contacts, jumper contacts, isolator contacts, etc. in a substation as shown in figures below and corresponding alerts were sent automatically by application to concerned maintenance team.



Conclusion

Based on the above-mentioned facts and experiences it is evident that VMS plays pivotal role in remote operation of unmanned substations. VMS and SCADA complement each other and facilitates operators to take swift decisions. It also assists in enforcing safety measures while carrying out O & M activities in the switchyard by providing a real-time view.

Further advancement in technologies like Artificial intelligence, video analytics, integrated command and control centre, etc., with more advanced features can be implemented in VMS system which will further provide additional information to control centre.