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A Survey on Techniques of Critical Infrastructure Monitoring

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Abstract: ***In our day today life electricity may be broken due to afternoon storms, snow storms and natural troubles. When these events occur we may think that it is due to some technical fault & the power will come after some time. If it is not coming, then we are calling to operator. Then the available artifacts and analytic techniques are applied to find the fault, determine the faulted area, complete repairs of that area and restoring service to that area. This is done by the control room staff by coordinating with field person. That's why the idea of proposed work is to design a system which is very cost effective. This system can be used to monitor MV/LV application also.***

Keywords: SCADA, Arduino, Set Points, Supervisory control, .Net Interface

1. Introduction

We can use SCADA to manage and control any kind of equipment or system. SCADA systems are used in automation of complex industrial processes or critical infrastructures where human control is impossible or difficult.

Often, they are used in critical infrastructures (CIs) where security and safety are vital factors. Due to this, they have to meet with strict regulatory standards. Traditional SCADA systems are deployed in which there is a central data centre and with a large amount of wiring is required to connect different hardware elements with the central unit. But it has limited access to these wired elements, traditional security provision mainly focuses on physical protection measures [1].

Now a days for monitoring of critical infrastructure we are using SCADA (Supervisory Control And Data Acquisition), LabVIEW software package, Mango SCADA, Digital Protective Relays(DPR's),Digital Fault Recorders(DFR's),PQ Meters(PQM's),Intelligent Electronic Devices (IED's), Web based SCADA .

2. Related Work

i. SCADA

It acquires the real time data from field devices and performs supervisory control on it, where operators can monitor & control the behavior of system. But SCADA system is too costly. SCADA monitors, controls and alarms the plant and/or regional facilities' operating systems from a centralized location. It includes the communication of information between a SCADA central computer, many scattered units and/or Programmable Logic Controllers. For example, in a water filtration plant, the remote units measure the pressure in pipes and report the readings to the central computer located somewhere in the control tower. In case of any anomaly, the SCADA system would alert the main station of the problem appraising it of other details like the severity of the anomaly and measurement values in an organized fashion. The systems may vary from simple, like temperature reporting in a building to complex like monitoring the traffic on many traffic lights. SCADA systems were independent systems with no connectivity to other systems. Control system of SCADA has one MTU means Master Terminal Unit and one or more RTU that is Remote Terminal Unit. RTU gathers data locally and sends it to the MTU which then issues certain commands which are suitable and fires a supervisory action. The SCADA system offers open loop operations only thus it does not have continuous control over operations.

Disadvantage:

[1] Cost is too high
[2] Complex wiring
[3] No web interface available

ii. LabVIEW

It uses ARMA model. LabVIEW software package use with DSC module that is Data Logging and supervisory control In this system the application is set up for continuous acquisition and the data is read repeatedly until the user decides to stop the monitoring. A disadvantage of IED's (Intelligent Electronic Devices) is removed by using LabVIEW. The processing of the measured values as well as the statistical analysis is mainly done in other places where the data come from communication systems. Acquisition i.e. collection of the measured data is commonly done on-line while the processing and analysis is performed off-line. The sensors that detect air pollution are located at the lowest possible level. These sensors are connected by current loops to the collecting devices, which may be PLCs, industrial or PC computers, microprocessors or laptops. At the supervisory level, there are PCs and Android mobile devices that provide result of current measured values and also provide statistical analysis of pollutants in the air. The device predicts the values of pollutants in the air, so that users are timely get notification of dangerous concentrations of pollutants that we can expect in some areas.

Disadvantage:

[1] Off line processing
[2] Service restoration time more
[3] No web interface available

iii. Mango SCADA

Mango SCADA system is integration of WSAN(Wireless Sensor Actuator Network) and SCADA system. It uses concept of keep-alive packet monitoring. WSAN nodes are expected to periodically send a keep-alive packet to the gateway. If the gateway fails to receive keep-alive packets from any node during a predefined time interval, it reports the situation to the SCADA and a color warning is depicted on the GUI. This service helps to detect events such as node and network failures and also jamming attacks.

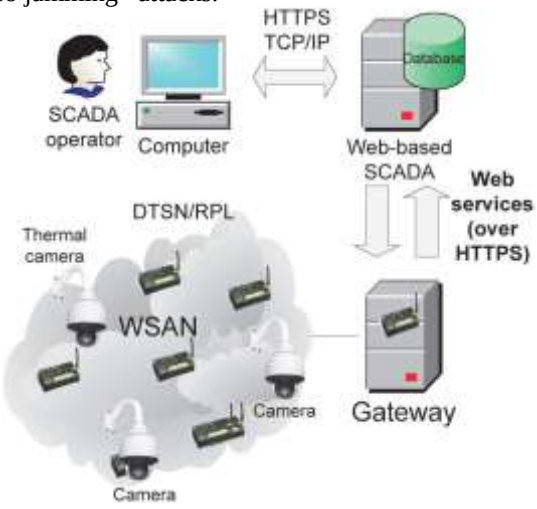

Fig. 1. Mango SCADA architecture

Disadvantage:

[1] Packet may get loss
[2] Node failure

iv. Web based SCADA

Web-Based SCADA is the area of research nowadays and it is a topic of research. There is lots of research is going on in this area. SCADA has wide range of applications. Here we are going to develop a small module with three substations which are sensing the real time parameters from environment and web based monitoring is provided to it with the help of interfacing to wireless computer/Laptop.

Advantages:

[1] Control & monitoring service able to operate over web.
[2] Notification service both on web and mobile network.
[3] Provides report generation and delivery service.
[4] Reduces volume of data that is bandwidth consumption.
[5] Improved performance with surveillance.
[6] Allows intelligent data pre-processing.
[7] Hierarchical storage & presentation of data to facilitate past calculation and retrieval.
[8] Provides scalability.

Disadvantage:

[1] Problem in frequency selection
[2] If number of concurrent user increases it produces load on database but it can be removed by using OPC server.

SCADA systems use to control following applications:

1) Electric power generation, transmission and distribution
2) Water treatment and monitoring
3) Manufacturing
4) Transportation system
5) Traffic signals
6) Food production
7) Electric and gas utilities
8) Telecom and Information Technology

3. Conclusion

The proposed system that is Web based SCADA system which is cost effective than available system, which can be used to monitor medium voltage and low voltage application also. This system is designed by using HTTP protocol instead of ModBus. It can be used for remote monitoring and also provides standard alarm and messaging system. It improves the visibility of the distribution system for the operator. It provides the techniques to improve the efficiency and reliability of the distribution system. All processing and controlling is performed in real time at the server station.

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