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Internet Of Things On 230kv/400 Kv Switchyard Operation By Scada Method

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ABSTRACT--- ***Switchyard is the interconnection of generating station and grid. The generated power from the generating station is transmitted to the grid through switchyard. Switchyard is used to give a secured power to the grid. In our process SCADA is used to operate and control the switchyard operations. SCADA is a emerging trend in WSN technology. It is a transceiver used to transmit and receive data in full duplex mode. The switchyard is controlled and monitored from the UCB room through the underground cables. But in our process it is done by SCADA MODULE. These modules are fixed in switchyard and another in UCB room. In the switchyard side it is controlled by microcontroller and in UCB room side it is by operator. If any operation such as opening/closing the isolator , generator breaker can be done by operator by giving command to SCADA module in UCB side. The SCADA module receives the command signal and transfer it to microcontroller. It will do the operation through relay module. In this concept we are replacing cables by wireless sensor network SCADA by using Mesh topology.***

Keywords: ***Switchyard, transceiver, operator, microcontroller, grid, wireless sensor. Mesh topology.***

I INTRODUCTION

Now-a-days technology has developed more in this competitive world which reduces the work of the humans and make it easy for them .Technology is the application of the engineering mathematics ,physics and life benefits. IOT playsan vital role in the advanced technology. The functioning of power system equipments are controlled by means of an internet with the coding language called as the microcontroller. Switchyard is the nterconnection of the generating station and grid.The generating station provides generated power and it is getting transmitted to the grid through switchyard. It provides secured power to the grid. In this process SCADA is used to operate and control the switchyard operation. SCADA is the emerging trends in the WSN technology.It is the transceiver which is used to transmit and receive data in full duplex mode and it replaces cables by wireless sensor network SCADA. SCADA- [Supervisory Control And Data Acquisition]

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1.1 Switchyard Introduction :

Switch yard is the yard which is used to transmit the power to the load centres . The transmitted voltages are 230kV and 400kV. The thermal power station (TPS II) switchyard is the largest switchyard in the southern grid .The switchyard of 230kV is get connected to the TNEB grid and union territory grid.400kV switchyard is connected to the southern electricity grid through power grid corporation limited. The 230kV and 400kV switchystemi switchyard are Zinter connected through 400kV/230Kv interconnecting transformer. switchyard has bus arrangement which are 2 main bus and 1 transfer bus system.230kV and 400kV has the 3 system bus namely first bus ,second bus and transfer bus with the presence of bay .Bay means the equipment which is used to connect with any one bus .The bay consists of first bus isolator (89A),second bus isolator (89B),line isolator (89C), breakers, lighting arrester, current transformer, voltage transformer,etc. Each bay has relay panel and control panel in control room.

1.2 Components of the Switchyard: Bus bar & conductor. Circuit breakers.

Isolators.Current transformer. Capacitor voltage transformer. Earth switch.Surge arrester. Carrier equipment. Lightning protection. Insulator. Earthsystem.

1.3 Description:

Bus bar & conductor : Bus bar is the current carrying conductor in the switchyard. the conductor is to carry the normal current continuously with the rise of temperature with specified short circuit current for a specified time

Circuit breaker: Circuit breaker is the breaker which operates as switching and current interrupting device. It has the two principle. At normal condition purpose of operationand maintenance and at abnormal condition short circuit and interrupting fault current as the fault current damages the equipment.

Isolator: The isolators are used for disconnecting the flow of current under no load condition since it is operated under no load condition and it does not have any breaking capacity.It is used to transfer load from one bus to another and also isolate equipment for maintenance. It is interlocked with circuit breakers and earth switches. Current transformer: current transformer is the transformer used to measure current and are connected in series with the circuit .

The high value of current is stepped down to the low value current for measurement & protection.

Capacitor voltage transformer :voltage transformer is the transformer used to measure the voltage and are connected in parallel with the circuit .The high value of voltage is stepped down to the low value of voltage for measurement & protection.

Carrier equipment :the data transmission and communication from one switchyard to another switchyard is carried out by means of power line carrier communication.50kHZ to 500kHz high frequency signals are used.

Surge arrester :Under fault condition the system instability will take place. High voltage power system experiences over voltages. Under this condition the insulation of power system equipment are to be protected from such over voltages at the time of occurrence.It is called as lightning arrester for protecting the device.

Earthing switches: It is the mechanical switching device. It can withstand very high current under abnormal condition and it does not carry current at normal condition .It is the safety device .It is used in every power station switch yards

Layout Of Switchyard:

230KV SWITCHYARD

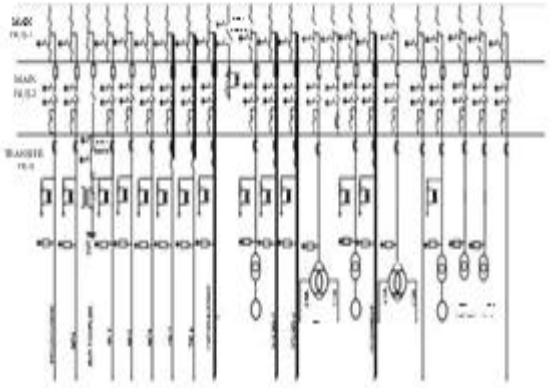


Fig 1.1 230kV switchyard layout

230kV Switchyard Specifications :

- 22 bays are present.
- 3 generator bays.
- 2 miningfeeders bays. 2 tie linefeederbays.
- 2 interconnecting transformer.
- 2 transformer station.

400KV SWITCHYARD LAYOUT

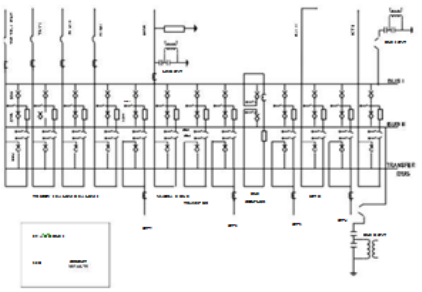


Fig 1.2 400kV switchyard layout

400kV Switchyard Specification:

- **4 A generator bay**
- **5 transmission bay**
- **2 interconnecting transformer 1 bus coupler bay**
- **1 bus transfer bay.**

SCADA:

SCADA means Supervisory Control And Data Acquisition

Structure of SCADA:

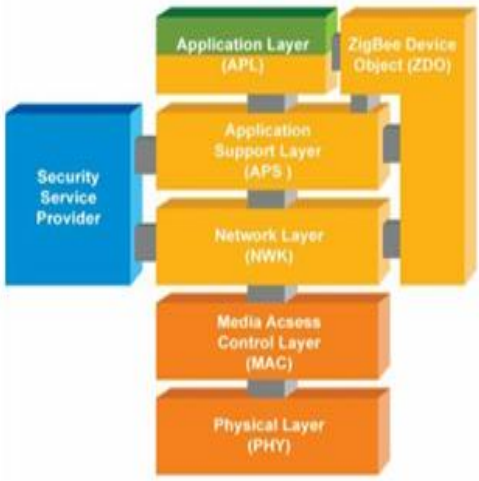


Fig 1.3 SCADA overview

In order to adopt the technology of WSN technology used in real life applications in an association of industry companies. It provides an high level communication with wireless sensor network.it provides an simple interface between network and user application

Main SCADA extension compared to IEEE 802.15.4

1. Entire network has an reliable communication .
2. Full support is given to a network topologies are mesh and tree.
3. Public application profiles for interconnecting better vendor and different devices.
4. Unified networking interface for end user applications.

3. Network topology:

Network topology is the topology which consist of different types of network arrangement are get coupled with connecting lines .It is the advanced technology going to be implemented in the switchyard operation.

The two types of network topologies are physicaland logical topologies. Physical topologies does not work on the logical process and the logical topologies work on the logical topologies. Logical topologies is good for the safety purpose .Example of physical topologies and logical topologies are tree topology and mesh topology.

Tree Topology :

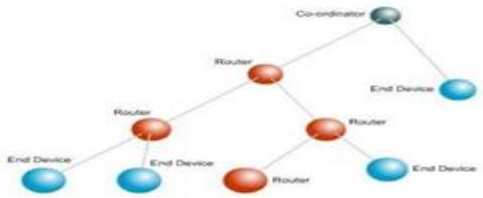


Fig 1.4 Tree Topology

Tree topology is the family of the physical topologies. Parent child relationship is used in the topology. It is the peer to peer data transfer model. Hence the properties of the tree topologies are:

- Direct communication is possible only if it is in parent child relationship.
- Router has the child node path operation . Hierarchical routing without alternative path.

If tree topology fails, data cannot be transmitted along the certain branch anymore.Hence there is no alternative link for direct communication

3.2 Mesh Topology :

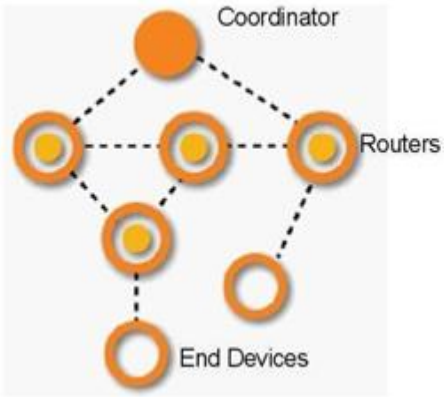


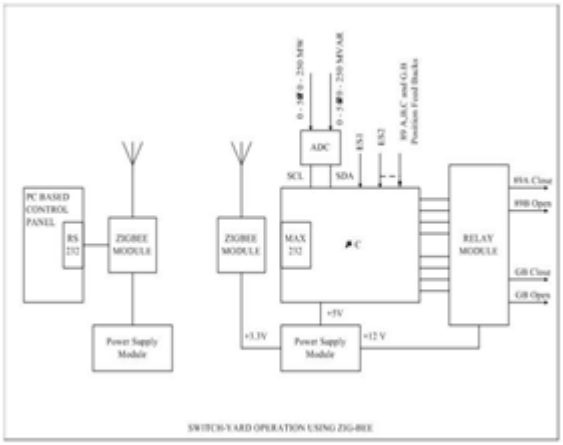
Fig 1.5 Mesh Topology

Mesh topology is the family of the logical topologies. Parent child relationship is not used in the topology. It is the peer to peer data transfer model.

Hence the properties of the mesh topologies are:

- Direct communication is possible between coordinator and routers.
- Router has the child node path operation .
- Alternative path with optimum and dynamic routing.
- An end device can exchange data with the parent nodes only
- If mesh topology fails, data can be transmitted along the certain branch anymore by an logical operations. Hence there is an alternative link for direct communication.

II. IMPLEMENTATION OF SCADA IN SWITCH YARD & RESULTS



Operation:

According to the above switchyard operation,power is distributed through various load centers.Two bus system ispresent in the switchyard. In our concept two SCADA is to be placed.One SCADA which is at the switch yard to monitor the components and another SCADA which is at the UCB room to receive the data . The switchyard SCADA which acts as the transmitter and another switchyard SCADA which acts as the receiver.

Opening and closing command of isolator and circuit breakers are given to the mimic panel. It is the VB based set up which is at the control room. By clicking the respective icon on the mimic panel the commands are given. LCD [Liquid Crystal Display] is the event manager which displays the status of the operations. SCADA will receive the information signal from the control room and it sent to the another SCADA which acts as the receiver.Status of the real power which givesan input to the microcontroller. On getting the signal which the processor receives and it checks for the interlocked condition. If satisfied the respective part pin will be activated. Thus this triggers the relay coil and one of the relay gets activated and specified command is given to the isolator and moves from its position towards the limiting switch.

Isolator which is the another component consist of opening and closing of two limiting switch .Isolator (89A) has to be closed then the relay condition is moved. Then the isolator arm starts moving from limiting switch 1 to the limiting switch 2.The same process is followed for all other equipment. Thus if the interlocked condition is not satisfied then the command “ACCESS IS DENIED“ will be displayed in the LCD. This ensures that the safety operations of switchyard. The position of the earth switches are also monitored.

Architecture Of The Microcontroller : Series:89SXX family Technology: CMOSFeatures of the 89SXX Family:

- 4v to 6v operating range.
- Fully static operation 0hz to 24mhz. SPI serial interface.
- Dual data pointer .

- Interrupt recovery from power down. 2k bytes EEPROM
- Three level program memory lock.
- Six interrupt source Endurance :1000write/erase cycle.
- 8kbyte of in system reprogrammable lash memory.
- Two 16 bit timer/counters. 256*8-bit internal RAM

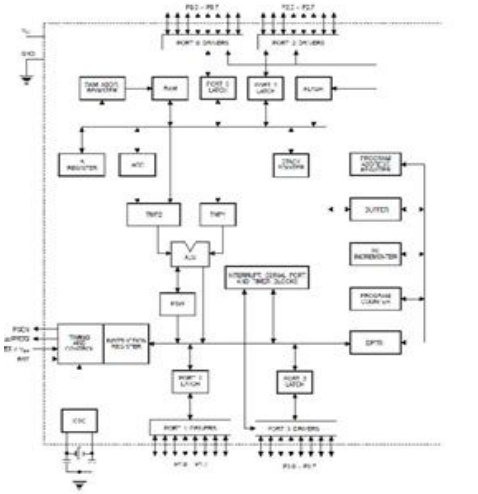


Fig 1.5 Architecture Of The Microcontroller

Pin Diagram:

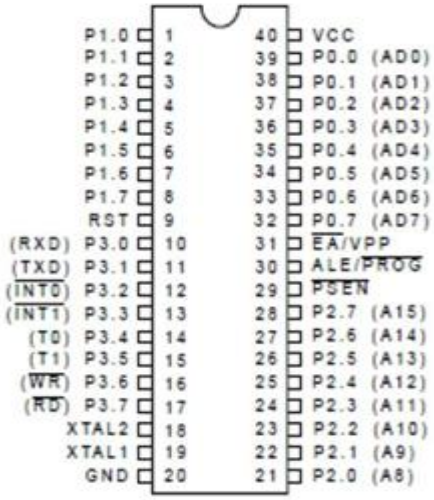


Fig 1.6 Pin Diagram Of The Microcontroller

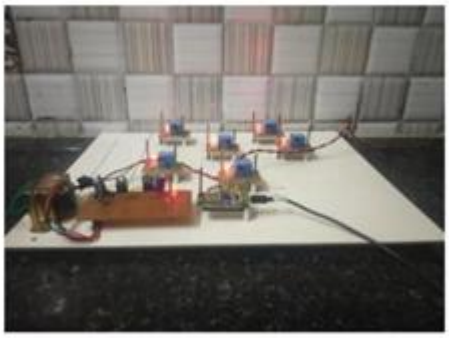
Port Description:

Port Pin	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	INT0 (extenal interrupt 0)
P3.3	INT1 (extenal interrupt 1)
P3.4	T0 (timer 0 extenal input)
P3.5	T1 (timer 1 external input)
P3.6	WR (extenal data memory write strobe)
P3.7	RD (external data memory read strobe)

Advantages:

230/400kV switchyard operation using SCADA method has following advantages:

- Easy fault detection
- Simple in design
- Low cost
- High reliability
- Easy to operate



III. APPLICATIONS

Replacement Of Wired Network:

Wireless sensor network is a less expensive more flexible and highly reliable alternative for existing collecting solutions and wired monitoring.

WSN technology system are rapidly replacing switches in weather stations, light switches ,HVAC system and many other area.

IV. NEW OPPORTUNITIES

These are the application become reliable only with the WSN's because using an wired between the devices were to expensive or impossible at all.

- Mobility
- Unattended areas
- Large scale network with many nodes
- Increased reliability.

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