IMPROVEMENT OF COMMUNICATION BETWEEN TWO REMOTE PLCS BY ESTABLISHING WIRELESS COMMUNICATION.

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To provide, cost effective, reliable, Industrial communication networks, for managing wide area automation, for control and monitoring of industrial assets, is the most viewed challenge to the present day technology and automation system providers.

Underlying technologies

M2M

Machine-to-machine, machine-to-man, or man-to-machine (M2M) communication refers to the set of technologies that enable data communication between machines, devices, systems and people. A concept often talked about is the ”Internet of things”, where ”smart” devices are connected to the Internet. The idea of M2M is itself nothing new. In the beginning M2M communication took place over wired cables, with its obvious disadvantage and constraint that a cable must be installed to the device in question. Assets such as oil and gas wells have been monitored via wired cables for long, often with very simple protocols between the devices. Today, M2M communication based on packet data is well established. The availability of GPRS, EDGE and 3G in cellular networks has broadened the use of M2M communication and the connection to the Internet has made numerous applications possible.

TCP/IP

The TCP/IP protocol suite is the set of communication protocols used for the Internet and other similar networks. TCP/IP consists of dozens of different protocols of which the ”core” protocols are the transmission control protocol (TCP) and the Internet protocol (IP) . The protocol suite is constructed as a set of layers where each layer solves a set of problems involving the transmission of data, and provides a well-defined service to the upper layer protocols based on using services from lower layers.TCP/IP The Internet protocol (IP) is the network layer protocol and provides addressing and datagram routing allowing packets to be sent over rather complicated topology of interconnected networks. The transmission control protocol (TCP) is the primary transport layer protocol, responsible for connection establishment and management and ensures that data arrives without errors and in the correct sequence. The IP protocol transmit data without consideration for the sequencing of the packets or reliability of the connection in terms of data errors and lost packets. TCP divides the data into packets that the IP protocol in the network layer can transmit. TCP is also responsible for error checking and ensuring that the packets are not lost or received out of sequence. If necessary the TCP will request retransmission of any lost packets and will place out of sequence packets into the correct order before passing them up to the application.

Control systems

There are many different types of industrial control systems. A very simple control system can be a single PLC. A more advanced control system can consist of several PLCs connected to a master PLC or SCADA system. Instead of a PLC, there are dozens of manufacturers that build their own hardware that aren’t PLCs but perform the same task as a PLC. Therefore, in some sense, when describing a PLC, this could target other hardware as well.

PLC communication

Somehow the control system needs to communicate with the PLC, as shown in Figure 1. This can be done in a number of ways. In the industry there are many different opinions how this should be done, but there's no general solution. In an ideal world all PLCs and devices would talk the same communication language and it wouldn't matter which unit to connect to the other. Unfortunately, this is not the case. From the early development of PLCs all manufactures developed their own communication protocol to communicate with and between their PLCs. One important reason for this was to prevent the customers from changing and mix PLC brands. Selecting the correct communication language is a very important issue.

Presently the physical medium selected by almost all the vendors are communication data cables of various forms including fibre optic cable.

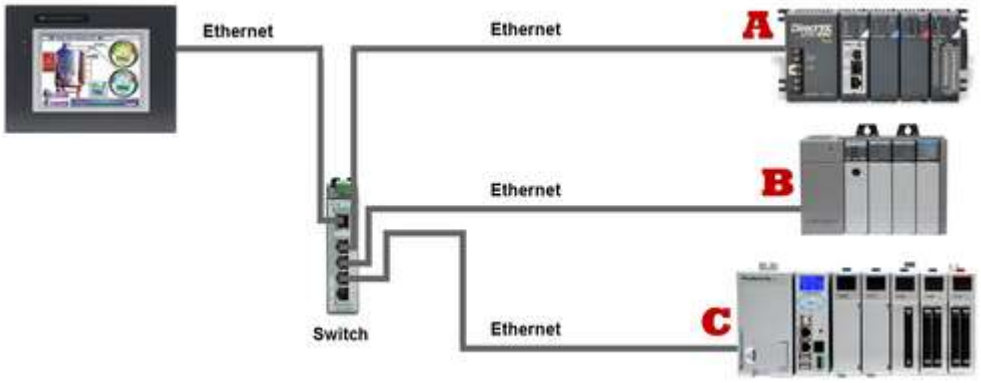


Figure 1

Wireless communication

Wireless communication is a field that has been around for over hundred years starting around 1897 with Marconi's successful demonstration of wireless telegraphy (Ebersp¨acher, J. V¨ogel, H-J. Bettstetter, C. Hartmann, C., 2008).Television transmission, in its early days, was broadcast by wireless radio transmitters. Later many wireless transmitters were replaced by cable transmission. Similarly, the point-to-point microwave radio links that form the backbone of many mobile telephone networks are being replaced by optical fibers that allow higher bandwidths. In the first example the wireless technology become outdated when a wired distribution network was installed. In the second example the wireless technology was replaced by new optical fiber technology. The opposite is happening today. Wireless cellular technology is more and more replacing wired telephone lines (particular in parts of the world where wired networks are not well developed). The interesting thing here is that there are many scenarios in which there is a choice between wireless and wired technology, and that the choice often changes when new technology becomes available. Wireless communication is gaining more and more popularity in the industrial sector. There are several different wireless networking technologies available.

• Radio modem

• GSM/3G

• ZigBee

Wireless HART Radio modem is a technology suitable for creating a private radio network. Radio modem can be used for short and long range communication and often implies use of licensed frequencies in the UHF or VHF band. Licensed frequencies have the advantage that they are reserved for a certain user in a certain area thus ensuring that there is a less likelihood to have radio interference from other RF transmitters. One issue that can arise is that there are areas and buildings sensitive to RF interference where it's directly impropriate and unfeasible to setup a wireless communication link. A typical architecture for Wireless communication between PLCs is shown in Figure- 2

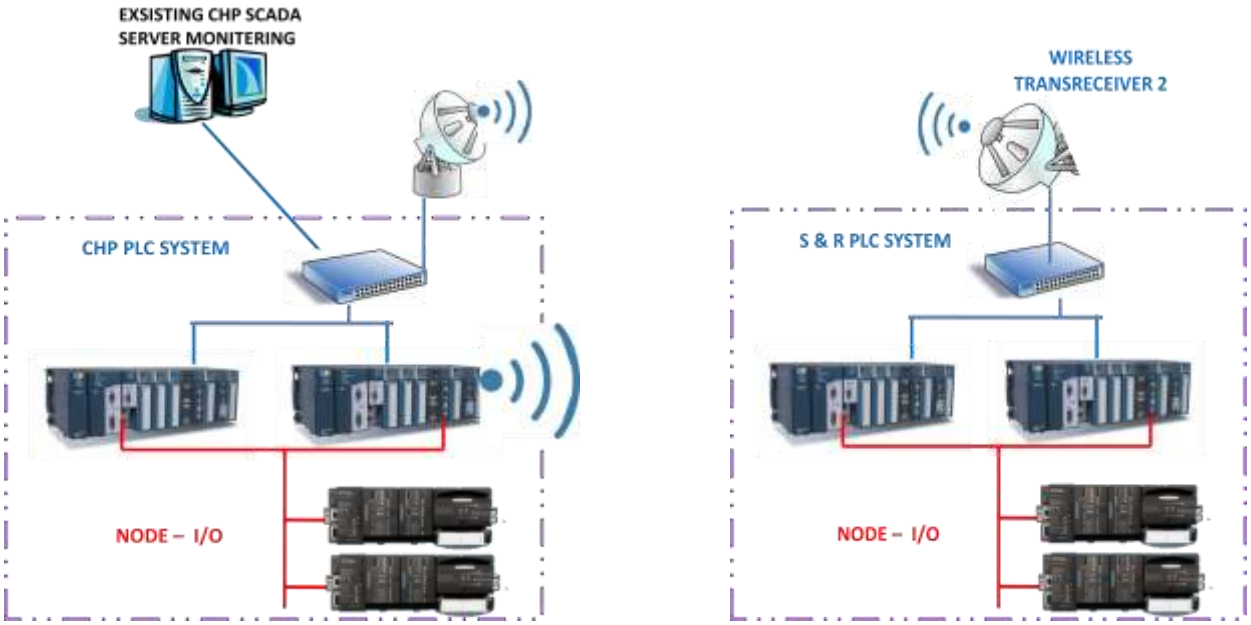


Figure- 2

Control system at TTPS CHP

Control system of CHP at TTPS is through two numbers of PLCs(GE Make, 90-30 series), one in the main CHP and other is at stacker- reclaimer. Total 10 nos of digital signals are exchanged between both the PLCs to have proper control of stacker reclaimer. These signals are being exchanged by hardwiring through CCRD cable and interfaced through I/O cards at both ends. This signals are used in logics(in both plc) for start/stop of drives During operation of the stacker reclaimer data loss between the PLCs takes place too often due to various problems in the CCRD cable and coal dust environment. This results in unreliable control and operation of stacker reclaimer.

Smart Technology solution:

The above mentioned problem initiates the requirement to connect Main CHP PLC & 'Stacker & reclaimer' by wireless communication so that tags/data which were previously exchanged between two PLCs via CCRD, can be exchanged by wireless communication.

The wireless communication has been established on OCT'16 with the following network components.

a) Wireless antenna - 4 nos

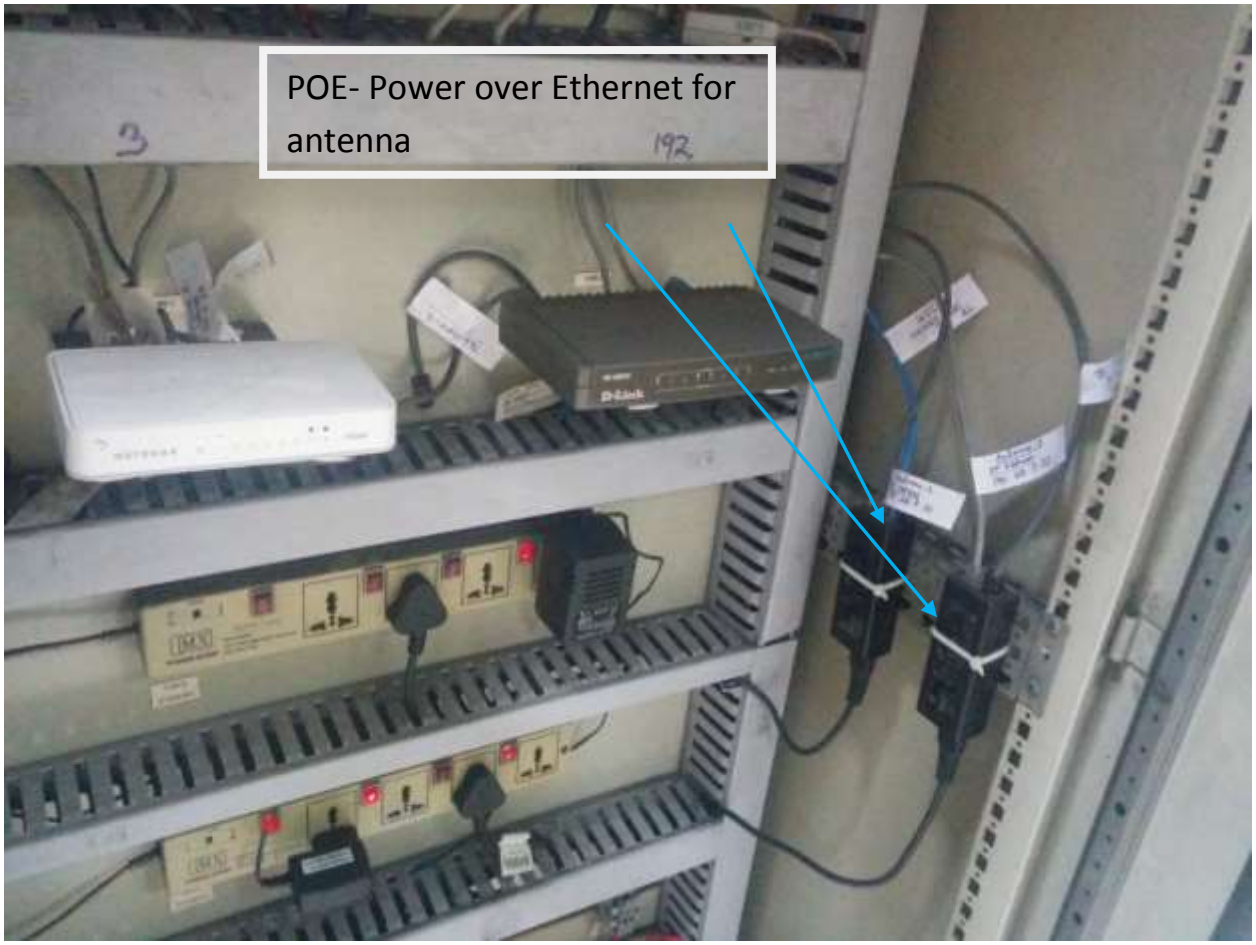
Frequency band : Licence free band suitable to requirement
Minimum Coverage : 2 km
Application: Outdoor
Power supply : Through POE
PROTOCOL :TCP IP

Antenna's beam solid angle sufficient to ensure uninterrupted signal transmission irrespective to position of Stacker & Recliamer.

b) POE - Power supply

4 nos for redundancy.
Suitable to the Antenna selected by the Party

POWER SUPPLY : 240 V AC



C) VOIP Telephone
Set- 1 nos
Protocol: TCP IP

IT INCLUDES ALL ACCESSARIES TO CONNECT BOTH END OF WIRELESS ANTENNA.

Following works were done to commission the system:

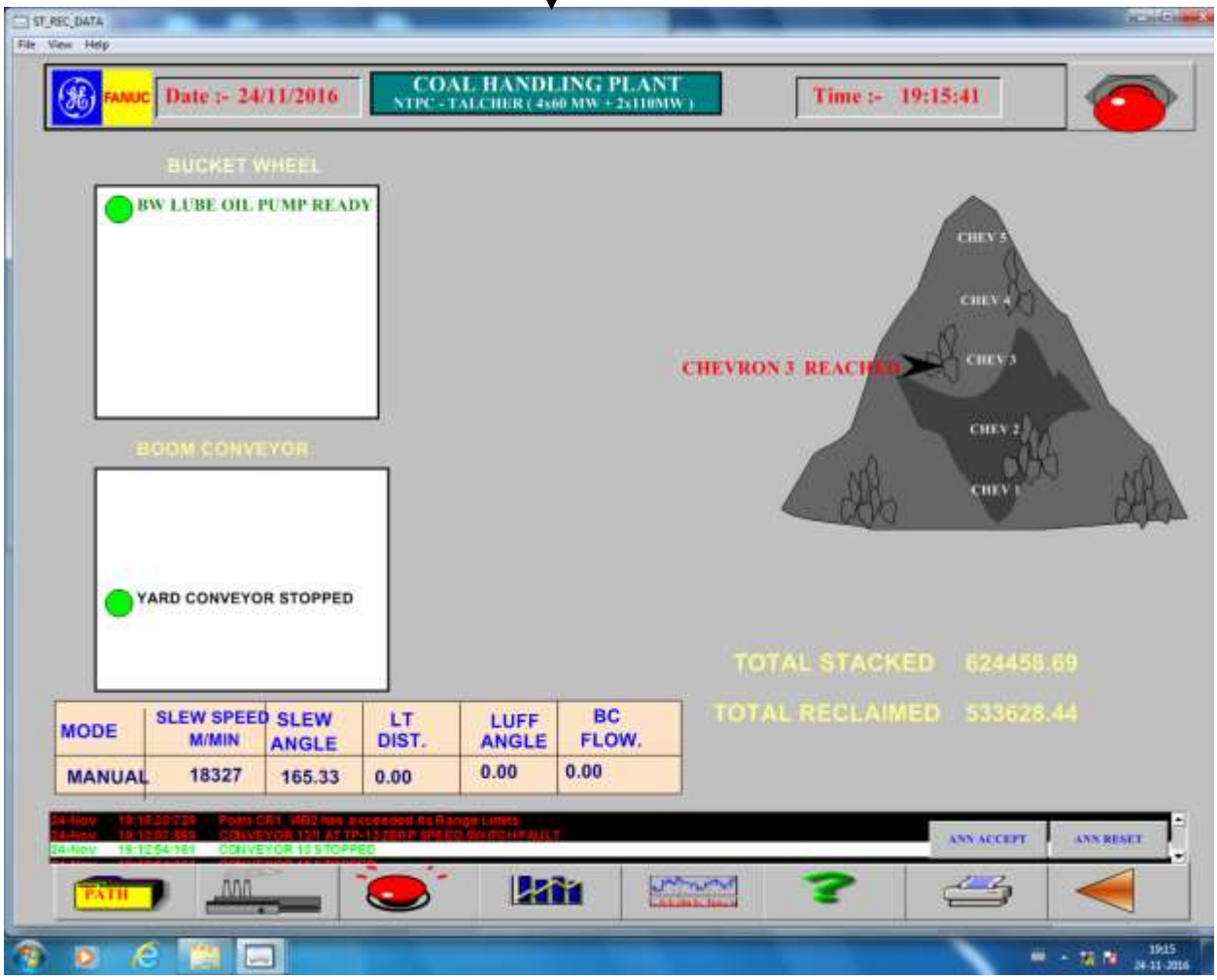
1. Required system setting modification were done at both the PLC end.

2. Required logic modification , I/0 bit, memory bit modification were done at both PLC end.

3. MIMIC (cimplicity) modification was also done as per requirement.

4. All analog data, digital data, one end PLC was be made available other end.

STACKER RECLAIMER MODIFIED MIMIC THAT IN NOW AVAILABLE IN MAIN CHP CONTROL ROOM ON CONTINOUS BASIS



ADVANTAGES & BENEFITS :-

Operational Profit due to Less down time

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1). Availability of stacker reclaimer has enhanced which helped in maintaining healthy bunker level.

2) Rack unloading time has come down, due to which demurrage charges has come down.

3) Operation of Stacker & reclaimer can be done from Main CHP control room also, if required.

4) VOIP Telephone sets at both ends have made communication available between control room & stacker on 24*7 basis.

5) All data including all events & alarms of both PLC can be monitored at both ends which was not the case earlier. Hence healthiness of stacker & reclaimer can be monitored from Main CHP Control Room on continuous basis.

Maintenance Benefits:

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5) The availability of stacker recalimer is now independent of healthiness CCRD.

6) Reliable, as no hardwiring of IOs required to interchange data between stacker reclaimer & Main CHP PLC.

7) Utilization of full features of both CHP and S&R Data Tags whereas CCRD has limited number of tags that can be exchanged between stacker & reclaimer.

8)Only spare to be maintained is antenna the too is plug & play, no configuration required in antenna.

Signals exchanging between main CHP & S/R with wireless.

Yard conveyor (Conv-16) running permissive

Yard conveyor (Conv-16) trip permissive

S/R in stacking mode.

S/R in reclaiming mode.

Yard conveyor running.

Telephone – VOIP Technology

Advantages Achieved in TTPS

1) Availabity of stacker & reclaimer enhanced as CCRD becomes redundant.

2) Confidence level of the operator has increased regarding healthiness of stacker reclaimer on continuous basis.

3) Maintenance time reduced by 90%.

4) Down time of stacker reclaimer reduced to zero due to non availability of signal exchange between both PLCs.

CONCLUSION

TTPS is a very old power plant and is in process of adopting new technology to optimize the plant operation with reducing man power. This technology is helping us to optimize the operation of SR without deploying extra man power and maintain the healthiness of bunker level which is critical for unit operation. Two numbers of antennas are installed above Main Control Room of CHP & two above roof on SR on Oct'2016. Cost of implementation is around Rs.4.5 Lacs and the investment is well justified considering the advantages achieved as mentioned above. For plants like TTPS, seeking improved availability and low maintenance, wireless provides an ideal solution as it offers continuous monitoring of SR of all the parameters, reduced downtime & less maintenance.