WIRELESS DATA TRANSMISSION SYSTEM
A SOLUTION FOR CCRD SYSTEM

By
C R NANDI DGM EMD
M MISBAHUL ISLAM Dy SUPDT EMD

NTPC, Singrauli
INTRODUCTION

- Paddle Feeder (PF), Stacker/Reclaimers (S/R) Movable Trippers (MT) are vital equipments of CHP used for the loading/unloading of coal at key positions.

- Their proper running and synchronization (interlocking) with the conveyor belts are maintained through signal processing received via CCRD System.

- CCRD (Control Cable Reeling Drum) system is a part of PF/SR/MT use to carry control signal from moving structure to a stationary remote panel via control cable.

NTPC, Singrauli
INTRODUCTION contd...

- CCRD (Control Cable Reeling Drum) system is an assembly of different components and each component are prone to its own particular problems.

- Seeing the problems in existing system and on comparison, Wireless Data Transmission System (WLDTS) was adopted.

- On 5\textsuperscript{th} Aug 2011 CCRD system of PF-2 in Track Hopper Stage-1 was replaced with a new WLDTS.

- After a Year on 10.10.2012 : a Bluetooth technology (BT) based WLDTS was installed at PF-8

- And on 06.12.2012 WLDTS (BT) was installed at S/R-1.
WORKING & PURPOSE OF CCRD SYSTEM

Following are the interlocks/permissive required for the safe running of PFs/S-Rs/MTs:-

- Conveyors running feedback
- EPB commands from particular equipments
- Equipments running feedback
- Fire sensing alarms
- Transformer relay healthiness (for S/R)

CCRDS AT S/R

NTPC, Singrauli
PROBLEM FACED IN CCRD SYSTEM
COMPONENT WISE

1. CONTROL CABLE
   - Cable snapping
   - Cable inter core short circuiting
   - Breaking of individual core
   - Earth Fault

2. SLIP-RING
   - Earth fault
   - Flash over
   - Ageing of carbon brushes

3. POWER & CONTROL CIRCUIT
   - Lug loosening
   - O/L Relay fault
   - Contactor failure
PROBLEM FACED IN CCRD SYSTEM COMPONENT WISE

4. MOTOR (Stall Torque Motor)
   Breaking of motor gear tooth
   Loosening of motor break
   Motor TB flash
   Over current & Earth fault

5. RESISTANCE BOX
   Short circuit/ open circuit problem of resistor wire

6. MECHANICAL STRUCTURE
   Misalignment of CRD & Pendulum Switch
   Malfunctioning of Pendulum Switch
   Breaking of Gear chain.
NEED FOR REPLACEMENT OF CCRD SYSTEM

- Problems like cable core breaking due to continuous reeling and unreeling of cable creates a situation of flying fault.

- Snapping of cable is not only being a monetary loss but also take a lot of time for cable replacement.

- Presently, CCRD system is just carrying 4 or 5 signals that too are digital signals i.e. ON or OFF conditions of the equipments. For this a huge system is not required in modern power industries.

- So frequent occurring problems, equipment outages and odd hour emergencies in PF/S/R/MT make a way for the introduction of Wireless Data Transmission System.
INTRODUCTION OF WIRELESS DATA TRANSMISSION SYSTEM AT SSTPS

- On 5th Aug 2011 CCRD system of PF-2 in T/H Stage- 1 was replaced with a new Wireless Data Transmission System.

- There are two modules, one installed at the Central JB (stationary point) and other at the PF-2 (moving point) works in Point to Point operating mode.

- Specification of WLDTS at PF-2
  
  Working Range : 200 meters (Tunnel)
  I/O capacity : 8 DO + 8DI + 2AI + 2AO.
  Frequency Range: 869.400 to 869.65MHz (license free)
  Communication Mode : Half Duplex.
WIRELESS SYSTEM COMPRISSES OF FOLLOWING COMPONENTS

1. RTU 1400D
2. Radio Modem
3. Antenna
4. SMPS : I/P-230 VAC & O/P-24 V DC
5. 220 V AC 8 Channel I/P relay module
6. 24 V DC 8 Channel O/P relay module
7. MCBs & Terminal Blocks.
WLDT SYSTEM PADDLE FEEDER -2

- Cable Reeling Drum
- Stall Torque Motor
- Sliprings Box
- Pendulum Structure
- RTU
- SMPS
- Radio Modem
- Relay module

CCRD SYSTEM OF PF-2, TH-I

WLDTS MODULE AT PF-2
WORKING OF WLDTs
WIRELESS DATA TRANSMISSION SYSTEM WITH BLUETOOTH TECHNOLOGY

- 10.10.2012: WLDTS (Bluetooth Based) was installed at Paddle Feeder-8 at Stage-II Track Hopper.

- 06.12.2012: WLDTS (Bluetooth Based) was installed at Stacker/Reclaimer-I of Stage-I

- Bluetooth operates in the unlicensed ISM (Industrial Scientific and Medical) band at 2.400–2.4835 GHz

- FREQUENCY HOPPING SPREAD SPECTRUM (FHSS): To reduce interference with other protocols that use the 2.4 GHz band, the Bluetooth protocol divides the band into 79 channels (each 1 MHz wide) and changes channels up to 1600 times per second

NTPC, Singrauli
WIRELESS DATA TRANSMISSION SYSTEM WITH BLUETOOTH TECHNOLOGY

- *Adaptive Frequency Hopping* which attempts to detect existing signals in the ISM band, such as Wi-Fi channels, and avoid them by negotiating a channel map between the communicating Bluetooth devices.
- Plug n Play Set - No software Programming Required.

- Working Range - 500 meters (Tunnel)

- I/O capacity - 16 DO + 16DI + 2AI + 2AO.

- Sets with 8 DB Panel antenna.

- PROTECTION : IP 65
WLDT SYSTEM (BT) AT PADDLE FEEDER - 8

ANTENNA

MASTER MODULE
PF-8 CENTRAL JB

SLAVE MODULE
AT PF-8
WLDT SYSTEM (BT) AT S/R-1

WLDTS MODULE AT S/R-1
CCRD SYSTEM VS WLDT SYSTEM

A COMPARATIVE ANALYSIS

NTPC, Singrauli
## CCRD SYSTEM VS WLDT SYSTEM

<table>
<thead>
<tr>
<th>SNO</th>
<th>DESCRIPTION</th>
<th>WLDTs</th>
<th>CCRDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TECHNOLOGY</td>
<td>Modern, fast &amp; Reliable</td>
<td>conventional</td>
</tr>
<tr>
<td>2</td>
<td>FAULT POSSIBILITY</td>
<td>Very Less</td>
<td>Very High</td>
</tr>
<tr>
<td>3</td>
<td>MAINTENANCE</td>
<td>Easy</td>
<td>Tedious</td>
</tr>
<tr>
<td>4</td>
<td>SIZE &amp; PROTECTION</td>
<td>Compact with IP 67</td>
<td>Huge, prone to dust ingress</td>
</tr>
</tbody>
</table>

*NTPC, Singrauli*
5. FIXED COST COMPARISON

FIXED COST OF WLDTS IS ABOUT 11% OF CCRD SYSTEM

Rs 18.23 Lacs

- CRD mechanical structure, Gear Cam switch, Pendulum switch (Rs=500000)
- Power Contactors, Control Contactors, circuit components (Rs=10000)
- Control Cable 150 mtrs (14 cores) (Rs=105000)
- Slipring Box (Rs=30000)
- Resistance Box (Rs=78000)

Rs 2 Lacs

- Control Cable Reeling Drum (CCRD) Motor Demag Make (Rs=1100000)

NTPC, Singrauli
6. RUNNING COST COMPARISON

<table>
<thead>
<tr>
<th></th>
<th>CCRD Annual cost in Rs</th>
<th>WLDTS Annual cost in Rs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical PM</td>
<td>20000</td>
<td>0</td>
</tr>
<tr>
<td>Mechanical BD (Gear, Chain replacement)</td>
<td>15000</td>
<td>0</td>
</tr>
<tr>
<td>Electrical PM</td>
<td>12000</td>
<td>2000</td>
</tr>
<tr>
<td>Electrical BD (Snapping of cable 1 No.)</td>
<td>120000</td>
<td>0</td>
</tr>
<tr>
<td>Energy consumption</td>
<td>17520</td>
<td>2920</td>
</tr>
<tr>
<td>Total Cost</td>
<td>184520</td>
<td>4920</td>
</tr>
</tbody>
</table>

- **ANNUAL RUNNING COST OF WLDTS IS ALMOST 2.5% OF CCRD SYSTEM.**
- **SOMETIMES ANNUAL RUNNING COST OF CCRD SYSTEM MAY BE MORE THAN THE FIXED COST OF THE WLDTS OR MAY BE EQUAL.**
- **ROLE OF MECHANICAL DEPTT IN WLDTS COUNTS TO ZERO.**
- **ANNUAL SAVINGS : RS 179600/-**

NTPC, Singrauli
7. ENERGY CONSUMPTION COST COMPARISON

- **CCRD System**: Power: 3 kW, Running Hrs/Day: 8, Annual Energy Consumption: Rs 17520

- **WLDT System**: Power: 0.5 kW, Running Hrs/Day: 8, Annual Energy Consumption: Rs 2920

- **Annual Saving**: Rs 14600 per equipment

- **SSTPS for 11 Equipments Annual Saving**: Rs 160600

- Unit Cost: Rs 2/-
PAYBACK PERIOD

- Annual Running Cost Savings: Rs 176900
- Annual Energy Cost Savings: Rs 14600
- Total Annual Savings: Rs 191500

- WLDTS Cost: Rs 200000

- PAYBACK PERIOD IN MONTHS

  $= \left(\frac{200000}{191500}\right) \times 12$

  $= 12.5 \approx 12$ MONTHS
PRIOR TO ADOPTION OF WLDTS

KEY POINTS TO BE TAKEN CARE OF BEFORE ADOPTION OF WIRELESS TECHNOLOGY:

1. WIRELESS TECHNOLOGY TYPE - WI-FI / Bluetooth / ZigBee etc

2. SYSTEM FREQUENCY BAND (in our case 869 MHz and 2.4 GHz) - Whether it is license free or not.

3. PRESENCE OF OTHER SYSTEMS – Choose Frequency of new system other than existing system frequencies.

4. ANTENNA – Type according to the ground needs.

5. LIGHTENING AND SURGE PROTECTION - Specially for open areas.

NTPC, Singrauli
CONCLUSION

The new system is

TECHNOLOGICALLY ADVANCED
LESS FAULT PRONE
RELIABLE
ALMOST MAINTENANCE FREE
ENERGY SAVER

Further this system could be adopted for the equipments having CCRD system like S/R, PF & MTs looking the feasibility and viability of the existing system in other NTPC Plants
THANK YOU

HAVE A NICE DAY