Remote Frequency Monitoring System

Ms. R. Kavitha, Mr. D. Kumar, Mr. Aju John, Mr. P. S. Balasubramaniam, Mr. DRJJ Nischal, Mr. R. Krishna Kumar

Abstract—The launch complex is unmanned during the final countdown and launch phases of PSLV/GSLV. It is essential to monitor the status of launch complex parameters such as electrical generators, UPS system. Hence, a remote monitoring system was realized to monitor the Electrical and A/C parameters of Launch Complex. The remote monitoring system monitors the Electrical parameters of Generators, UPS system of Launch Complex. This system acquires the data from Launch Complex system and the data is transmitted to Mission Control Center (through Mission Computers) for Display at MCC consoles.

Index Terms—PSLV, GSLV, MCC, FLP, UDP, LSB.

I. INTRODUCTION

The launch complex is unmanned during the final countdown and launch phases of PSLV/GSLV. It is essential to monitor the status of launch complex parameters such as electrical generators, UPS system. Hence, a remote monitoring system was realized to monitor the Electrical parameters of Launch Complex.

Remote Monitoring system at FLP launch complex consists of two chains. Each chain is equipped with one ADAM 5510/TCP embedded controller, three numbers of ADAM 5017UH analog input modules and one number of ADAM 5051S optically isolated digital input module for data acquisition. Local console and controller is located at LSB and Remote Console is located at MCC. Data from the Substation and CTR is extended via twisted pair cable to LSB.

Application software was developed in C-Programming controller language. This software will run in the embedded controller. This will acquire data from input modules, convert the data in to the Packed BCD format and transmit the data to local PC and remote console at MCC in UDP format through Ethernet packets.

II. BLOCK DIAGRAM

The overall block diagram of the RPMS with the key parameters, modules, and controllers and how the data is transmitted to the local PC or Remote Center is illustrated below.

The frequency parameter that is given to the satellite is fed to the frequency transducers respectively.

III. HARDWARE

ADAM 5510 / TCP controller with Analog input (ADAM 5017UH) and Digital input module (ADAM5051S) will act as a data acquisition system. ADAM 5510/TCP are a 4 slot module which can accommodate 3 Analog input modules and 1 digital input module. Analog input module can accommodate 8 differential ended channels and each digital input module can accommodate 16 digital input modules. The required power supplies are connected and all these are housed on the top of the rack. Power supply schematic at LSB is shown in figure 3. The transducers and sensors are interfaced to the system at LSB. These transducers are located at electrical substation for measuring the electrical parameters the transducers and sensors are common to both the system.

IV. SOFTWARE INTERFACE

The processed data from controller based system is transmitted through Ethernet cum FO link and is fed to Local PC at LSB and MCC servers at Mission computers. The data will be processed by MCC servers and will transmit the data to Merged Display system at MCC. The electrical and air – conditioning related parameters are displayed at Services Facility Console (SFC) at MCC. Data acquired by local PC will be processed and will display and log the data locally.

V. COMMUNICATION LINK

The data from the controller at LSB is transmitted to Local PC and MCC servers at MC through Ethernet cum FO link. MCC servers will process and will...
send the data to MCC. The data is then displayed at MCC Services Facility Console (SFC). A second Chain is also established to have redundancy from the PC to the MCC services.

Two modules are used here are
- Analog module (3 nos.)
- Digital module (1 no.)

A. Analog input module

This module is an extremely cost-effective solution for industrial measurement and monitoring applications. Its opto-isolated inputs provide 3000 VDC of isolation between the analog input and the module, protecting the module and peripherals from damage due to high input-line voltages. ADAM-4017 offers signal conditioning, A/D conversion, ranging and RS-485 digital communication functions. The module protects your equipment from ground loops and power surges by providing opto-isolation of A/D input and transformer based isolation up to 3000 VDC.

B. Digital input module

Digital Input Module, built with 2500 VDC optical isolation, suitable for critical applications. Different from other modules, the ADAM-4051 accepts 10~50V input voltage to fit various digital signals, such as 12 VDC, 24 VDC, 48 VDC. Moreover, users can read the current status from the LED indications on the front panel.

The frequency transducers is used in analog module and one digital module is used just to check the status of the power generator and ups that gives the power supply to the satellite.

C. Frequency Transducer

Frequency Transducer measures Power Frequency over a specified Frequency Range and converts it to an industry standard output signal which is directly proportional to the measured input. These Transducers provide an output which is load independent and isolated from the input. The output can be connected to Controllers, Data-Loggers, PLC's, Analog / Digital Indicators, Recorders for display, analysis or control. They are ideal for SCADA, Energy Management, and Telemetering for Remote, Local as well as Central Monitoring Systems.

IV. CHARACTERISTICS CURVES

A. Schematic Diagram of Data Acquisition System

B. Power Supply Scheme At Lsb

This figure illustrates how the redundancy of the system works by connecting the controllers, power supplies and the PC.

C. Scheme For Digital Inputs

The three indicators- Normal, Battery and Bypass for the respective Channels are connected in the circuit diagram. It also illustrates how the switching works.
Similarly, for the frequency transducer it converts the actual frequency which is 45-55Hz into 0-5V dc.

V. FLOW CHART

1. Start
2. Initializations:
   - DataReady=0;
   - Timer1Ready=0;
   - Timer2Ready=0;
3. Definitions:
   - FALSE 0
   - TRUE 1
   - MAXBUFLEN 92
   - HOST_PORT
4. Start of main ()
5. Assign client address to the character pointer CAddr,
6. Initialization of iNoBytes [] array with the appropriate bytes count for the corresponding
7. Initialization of zeroth byte of cTransmitBuffer to Station ID
8. Call mulfactor
9. N

- Open file mulfact.txt in read mode for reading the multiplication factor
- Read the multiplication factor data and post it to MulFactor [] variable.
- Store the acquired Mulfactor values to the array Mulfactor
- Initialization of timer-1 and timer-2 with 1000 milli seconds for acquisition and transmission.
- If (timer1==1)
  - Print Timer Error
  - Exit
- If (timer2==1)
  - Print Timer Error
  - Exit
- Scaning for the Input modules and print slot number and module ID on the screen
- Initialization of Analog Input Modules (Module-1 for slot 0, Module 2 for slot 1, module 3 for slot
Acquiring the range of AI module and display the same on the screen.

Initialization of socket for UDP

if ((Host_Sock = INVALID SOCKET)
Print Socket
NO
Bind
Exit

if (bind() = SOCKET ERROR)
Bind Error
NO
IOCTLSocket
Exit

if (ioctlsocket (Host_Sock, FIONBIO, &pulArgp))
Yes
Print IOCTLSocket
Exit

Initialization of cTransmitBuffer array

While (TRUE)
Check for Timer 1 arrival

If (tmarrivecnt [timer_index1]>0)
Yes
Timer 1 error
Timer_Reset (timer_index2)

B

If timer-1 is ready

NO

Start acquiring of Analog Input data for channel 1 to 8 of slot 0, slot 1, and slot 2 and store the data in the local variable aiv1, aiv2, aiv3 respectively.

Start acquiring Digital Inputs from DI module of slot 3 and store it to a temporary integer variable StatusInp.

Access the stored data from local array aiv1, aiv2, aiv3 and convert the data to voltage data.

Conversion of Transducer output to Engineering units by applying the scale factor (accessed from MulFactor [ ] array) and save the data to a local buffer InputData [ ]

Accessing the digital status word from StatusInp variable and perform masking operation with 0x00FF to get the low byte of the word and store it to unsigned char variable DiStatus1

Accessing the digital status word from StatusInp variable and perform shifting operation by shifting the word by 8 bits and store it to the local variable StatusInp.

Access the Low Byte data from DiStatus1 variable. Manipulate bit-6 and bit-7 based on the analog input data for incorporating gen-1 and gen-2 status (ON/OFF status) and store the data in the same variable.

Initialization: iLocation=1;

Start of for loop

Ch=0
Ch<=23
D

Initialization: int p=0;

if(iNoBytes [ch]==3)
Yes
if(InputData[ch]<0.01)
  liTemp=0.0

if(InputData[ch]>999.99)
  liTemp=999999

if(InputData[ch]<0.01)
  liTemp=(long)(InputData[ch]*100.0);

if(iNoBytes[ch]==2)
  liTemp=0.0

liTemp=(long)(InputData[ch]*100.0);

Perform the modulus and division operations continuously on the local variable liTemp and store the data in the local buffer cTempBuff[].

Increment the local variable ‘P’ after each operation.

p<(iNoBytes[ch]*2)

If (p==1)
  Selection=iNoBytes[ch]

Switch (Selection)

Case 0
  Initialize BCDBuffer values to zero

Case 1
  Perform BCD packing and store the values in locations of

E

Case 2
  Perform BCD packing for 2 byte case and store the values in locations of

E

Case 3
  Perform BCD packing for 3 byte case and store the values in locations of

perform BCD packing for 3 byte case and store the values in locations of

End of Switch

Copy the packed BCD data from BCDBuffer to the transmit buffer. On every successful copying, increment the location by one byte.

cTransmitBuffer[iLocation]=cBCDBuffer[q]

DataReady=1
Timer1Ready=0

If (Timer2 ready =1)
  Call Host_WaitForMessag () function to get the status for data writing.

Initialize FdSet to have zero bits for all file descriptors

Set the bit for file descriptor serversocket in the file descriptor set FdSet

Initialize writefds with FdSet for parameter writing on UDP

Copy the Digital Input status to the byte locations 87 and 88 of transmit buffer.

cTransmitBuffer[87]=DiStatus1;
cTransmitBuffer[88]=DiStatus2;

Ch++

If (ch==23)
  Copy the Digital Input status to the byte locations 87 and 88 of transmit buffer.
  cTransmitBuffer[87]=DiStatus1;
cTransmitBuffer[88]=DiStatus2;

E
VII. RESULTS

Remote Frequency Monitoring System: Chain 1

A. UPS 1 And UPS 2 ON

Result of output parameters when UPS1 and UPS2 are in ON condition.

B. UPS 2 Bypass ON State

Result of output parameters when UPS1 and UPS2 Bypass are in ON condition.

C. UPS 1 And UPS 2 ON Battery

Result of output parameters when UPS1 and UPS2 Battery are in ON condition.

D. UPS 1 And UPS 2 ON Bypass

Result of output parameters when UPS1 and UPS2 Bypass are in ON condition.

VIII. CONCLUSION

Thus a Data Acquisition System was realized in the First Launch Pad to monitor the key parameters of the UPS Systems and Diesel Generators which provide the
Power Supply to the launch Vehicle. The Converted Frequencies are sent to the Mission Control Centre (MCC) are retrieved in its original form to ensure the proper functionality of the launch vehicle. Our project is fully focused on remote power monitoring so this project can be implemented in tsunami alert systems. This project can also be implemented in various industries where power parameters can be monitored from a remote place, even from home.

REFERENCES


Ms. R. Kavitha, M.E., MISTE, Assistant Professor, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.

Mr. D. Kumar, Scientist/Engineer-SF, EECF/ VAST, ISRO / SDSC-SHAR, Sriharikota, India

Mr. Aju John, UG Student, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.

Mr. P. S. Balasubramaniam, UG Student, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.

Mr. DRJJ Nischal, UG Student, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.

Mr. R. Krishna Kumar, UG Student, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.