Online V2

An Upgraded Control-Monitor Software for GMRT

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Background:

A control and monitor system (CMS) consisting of hardware and software components is responsible for controlling the antennas and the electronics associated with it in addition to monitoring the parameters and the system performance. The CMS at GMRT consisting of monitor and control module (MCM), antenna base computer (ABC) and communication handler (COMH) as the hardware and ONLINE as the software was developed by NCRA. This indigenously developed system has been successfully supporting GMRT observations since late 1990s.

An expanded system using present day technology and other features of the GMRT upgrade is desirable and the hardware work for this was started a few years ago with the development of a new MCM. An upgraded version of ONLINE is currently under development at NCRA and is referred to as OnlineV2. OnlineV2 is Linux based and aims at reducing the RFI footprint at the antenna base by not requiring a separate computer. Instead OnlineV2 focuses on exploiting the power of the fast 1 Gbps Ethernet connection and in-built capabilities of the Rabbit processor on the MCM card. OnlineV2 uses and expands the control algorithms developed for ONLINE on a new framework.

The new features of OnlineV2 include :

(1) Enhanced functionality of control software

(2) Extensive web-based control data monitoring tools allowing for real time and statistical studies

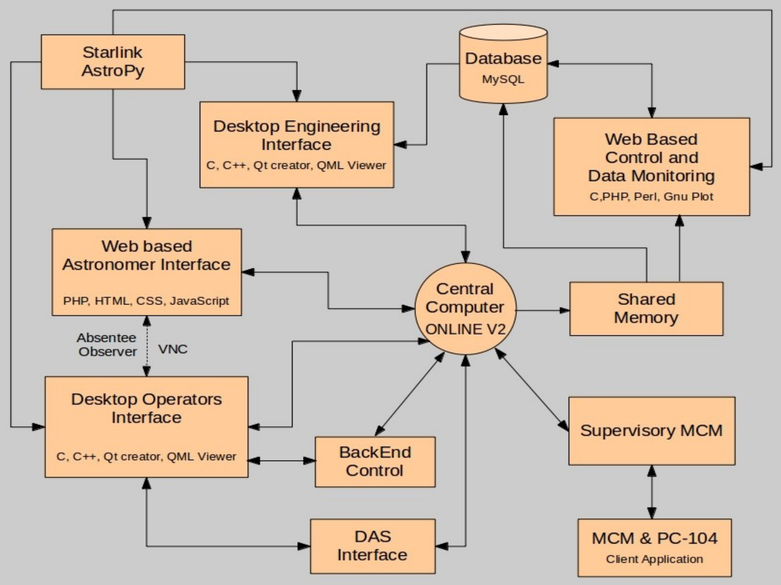
(3) Full support for observing in absentia

(4) Generalized framework to support future expansion

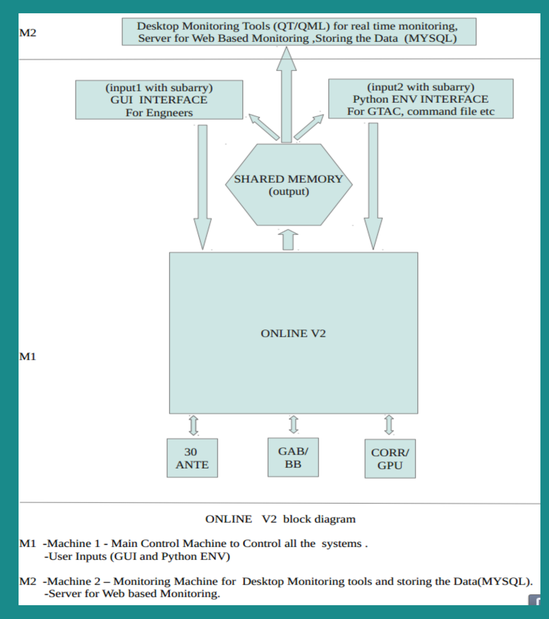
(5) Customized graphical interfaces for operators, engineers and astronomers

(6) Fast background monitoring of system parameters

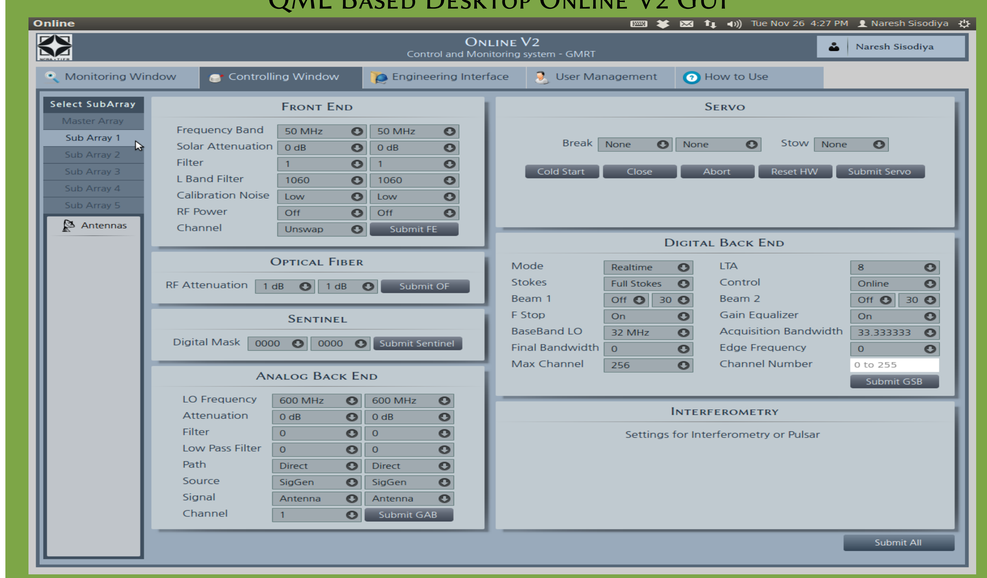
Architectural block diagram of ONLINE V2

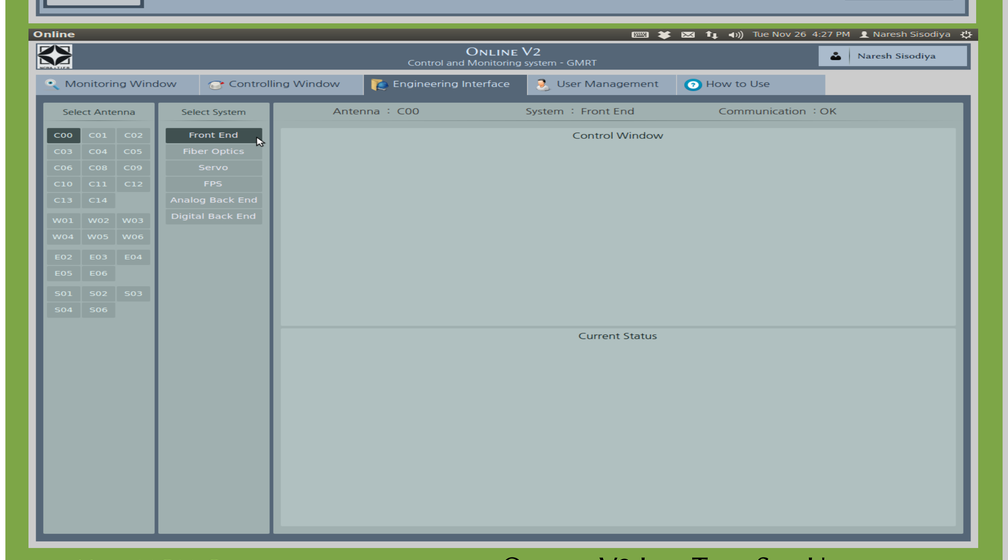


Online V2 and Desktop Utilities

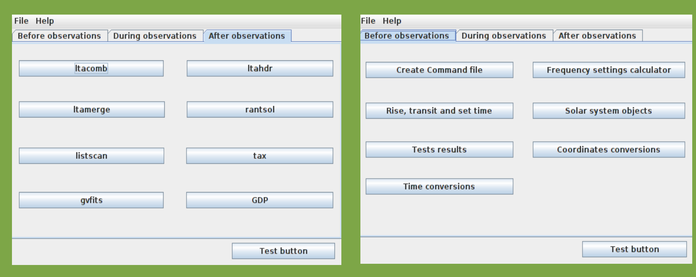


QML Based Desktop Online V2 GUI

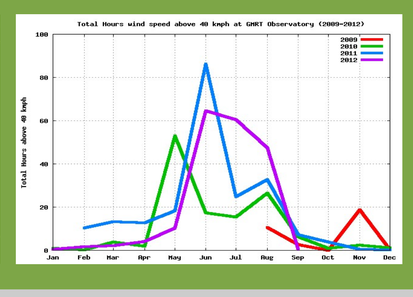


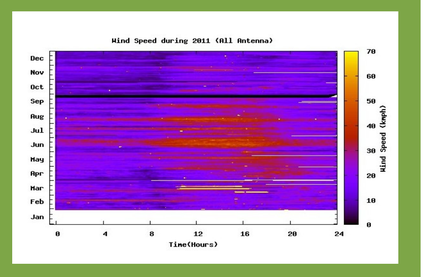


Web Based User Tools: Astronomer's GUI



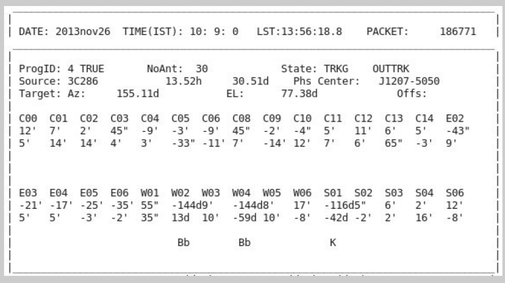
Web Based Monitoring : Wind Speed





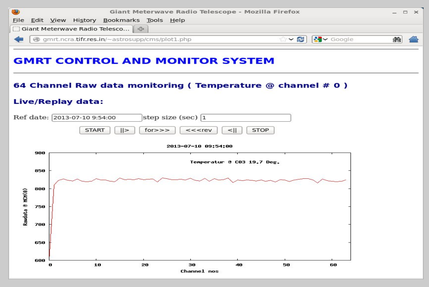
Web and Terminal Based Monitoring :

Real Time Monitoring

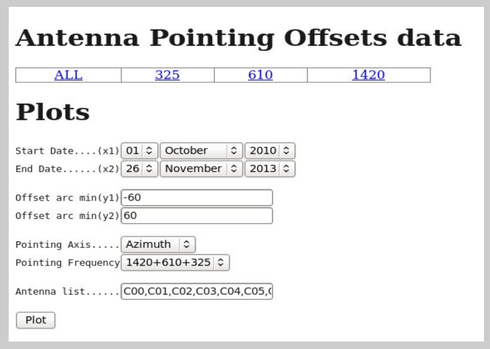


```
DATE: 2013nov26  TIME(IST): 10: 9: 0   LST:13:56:18.8     PACKET:     186771

ProgID: 4 TRUE        NoAnt:  30              State: TRKG     OUTTRK
Source: 3C286              13.52h      30.51d     Phs Center:   J1207-5050
Target: Az:     155.11d              El:      77.38d            Offs:

C00  C01  C02  C03  C04  C05  C06  C08  C09  C10  C11  C12  C13  C14  E02
12'   7'   2'  45"  -9'  -3'  -9'  45"  -2'  -4'   5'  11'   6'   5'  -43"
 5'  14'  14'   4'   3'  -33" -11' 7'   -14' 12'   7'   6'  65"  -3'   9'


E03  E04  E05  E06  W01  W02  W03  W04  W05  W06  S01  S02  S03  S04  S06
-21' -17' -25' -35' 55"  -144d9'   -144d8'   17'  -116d5"   6'   2'   12'
 5'   5'   -3'  -2'  35"  13d  10'  -59d 10'  -8'  -42d -2'   2'   16'  -8'

                      Bb        Bb             K
```

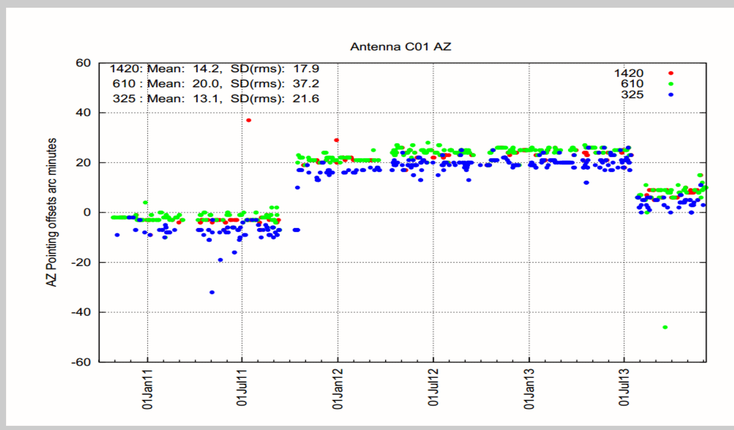
New MCM Monitoring



Web Based Monitoring : Pointing Offset

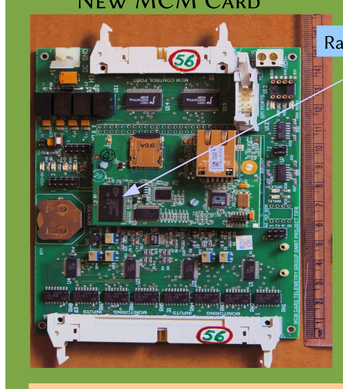


Real Time Monitoring

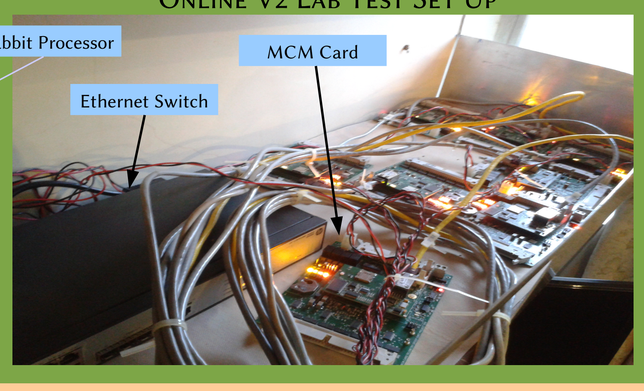



```
Fringe status

PDF  TXT  OND  DATE       TIME      SOURCE      RF1     RF2     Fringe   Fringe
pdf  txt  ond  24Nov2013  0804      1331+305    591     591     30       30
pdf  txt  ond  24Nov2013  0712      3C286       591     591     30       30
pdf  txt  ond  22Nov2013  1542      1459+716    1046    1046    6        6
pdf  txt  ond  21Nov2013  1637      1459+716    591     591     25       26
pdf  txt  ond  20Nov2013  0605      3C286       1371    1371    29       29
pdf  txt  ond  19Nov2013  1756      3C48        306     306     30       30
pdf  txt  ond  18Nov2013  1850      3C48        1261    1261    30       30
pdf  txt  ond  18Nov2013  0922      3C286       1409    1409    30       30
pdf  txt  ond  17Nov2013  2324      3C48        1409    1409    30       30
pdf  txt  ond  16Nov2013  1105      3C286       1280    1280    29       29
pdf  txt  ond  15Nov2013  2038      3C48        1410    1410    29       29
pdf  txt  ond  15Nov2013  1945      3C48        1410    1410    25       24
pdf  txt  ond  15Nov2013  1850      3C48        1371    1371    29       29
pdf  txt  ond  15Nov2013  0917      3C286       1411    1411    29       29
pdf  txt  ond  15Nov2013  0100      3C48        1411    1411    29       29
pdf  txt  ond  14Nov2013  2231      0433+053    1059    1059    29       28
pdf  txt  ond  14Nov2013  2207      3C147       1059    1059    28       28
pdf  txt  ond  14Nov2013  2111      3C147       1371    1371    29       29
pdf  txt  ond  14Nov2013  1806      3C48        591     591     29       29
pdf  txt  ond  13Nov2013  2128      3C147       591     591     30       30
```

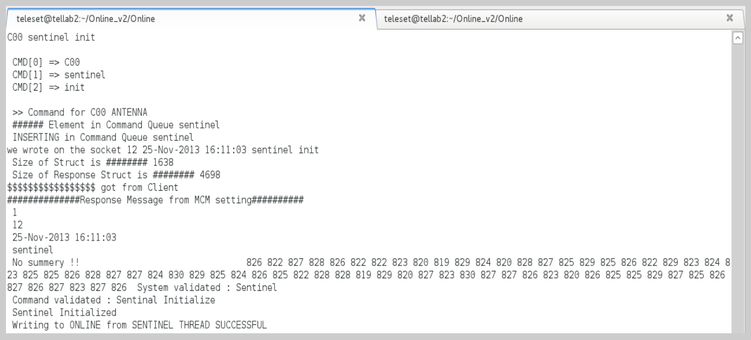
New MCM Card



Online V2 Lab Test Set Up

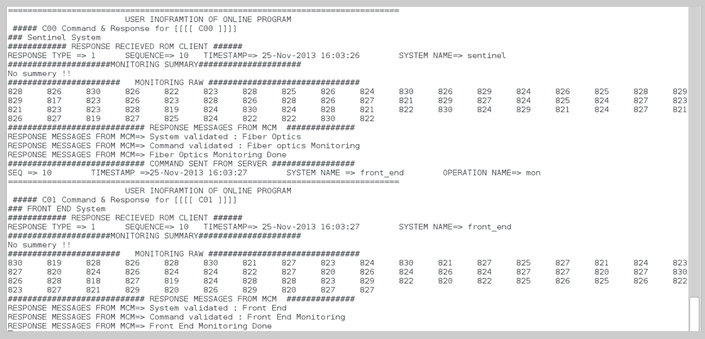


Online V2 Command Terminal



```
teleset@tellab2:~/Online_v2/Online        teleset@tellab2:~/Online_v2/Online

C00 sentinel init

 CMD[0] => C00
 CMD[1] => sentinel
 CMD[2] => init

 >> Command for C00 ANTENNA
 ###### Element in Command Queue sentinel
 INSERTING in Command Queue sentinel
we wrote on the socket 12 25-Nov-2013 16:11:03 sentinel init
 Size of Struct is ######## 1638
 Size of Response Struct is ######## 4698
$$$$$$$$$$$$$$$$ got from Client
#############Response Message from MCM setting##########
 1
 12
 25-Nov-2013 16:11:03
 sentinel
 No summery !!                                826 822 827 828 826 822 822 823 820 819 829 824 820 828 827 825 829 825 826 822 829 823 824 8
23 825 825 826 828 827 827 824 830 829 825 824 826 825 822 828 828 819 829 820 827 823 830 827 827 826 823 820 826 825 825 829 827 825 826
827 826 827 823 827 826  System validated : Sentinel
 Command validated : Sentinal Initialize
 Sentinel Initialized
 Writing to ONLINE from SENTINEL THREAD SUCCESSFUL
```

Online V2 Shared Memory Display



```
                                                    USER INOFRAMTION OF ONLINE PROGRAM
 ##### C00 Command & Response for [[[[ C00 ]]]]
### Sentinel System
########## RESPONSE RECIEVED ROM CLIENT ######
RESPONSE TYPE => 1      SEQUENCE=> 10   TIMESTAMP=> 25-Nov-2013 16:03:26       SYSTEM NAME=> sentinel
####################MONITORING SUMMARY####################
No summery !!
####################   MONITORING RAW ##############################
828     826     830     826     822     823     828     825     826     824     830     826     829     824     826     825     828     829
829     817     823     826     823     828     826     828     826     827     821     829     827     824     825     824     827     823
821     823     823     828     819     824     830     824     828     821     822     830     824     829     821     824     827     821
826     827     819     827     825     824     822     822     830     822
########################## RESPONSE MESSAGES FROM MCM  #############
RESPONSE MESSAGES FROM MCM=> System validated : Fiber Optics
RESPONSE MESSAGES FROM MCM=> Command validated : Fiber optics Monitoring
RESPONSE MESSAGES FROM MCM=> Fiber Optics Monitoring Done
########################## COMMAND SENT FROM SERVER ###############
SEQ => 10       TIMESTAMP =>25-Nov-2013 16:03:27        SYSTEM NAME => front_end        OPERATION NAME=> mon
================================================================================
                                                    USER INOFRAMTION OF ONLINE PROGRAM
 ##### C01 Command & Response for [[[[ C01 ]]]]
### FRONT END System
########## RESPONSE RECIEVED ROM CLIENT ######
RESPONSE TYPE => 1      SEQUENCE=> 10   TIMESTAMP=> 25-Nov-2013 16:03:27       SYSTEM NAME=> front_end
####################MONITORING SUMMARY####################
No summery !!
####################   MONITORING RAW ##############################
830     819     828     826     828     830     821     827     823     824     830     821     827     825     827     821     824     823
827     820     824     826     824     824     822     827     820     826     824     826     824     827     827     820     827     830
826     828     818     827     819     824     828     828     823     829     822     820     822     825     826     825     826     822
823     827     821     829     820     826     829     820     827     827
########################## RESPONSE MESSAGES FROM MCM  #############
RESPONSE MESSAGES FROM MCM=> System validated : Front End
RESPONSE MESSAGES FROM MCM=> Command validated : Front End Monitoring
RESPONSE MESSAGES FROM MCM=> Front End Monitoring Done
```

Methods :

Insistence on using Open Software : LAMP

Tools used : C, C++, Dynamic C, Perl, Python, PHP, HTML, Javascript, Gnuplot
Qt Creator, QML Viewer

Database : MySQL

Libraries : XML, Readline, TCP/IP, HTTP, Qt Classes

ONLINE V2 :

Linux
Absentee observing support
C, C++
Desktop GUI for Operator, Engineers
Web based System data monitoring tools
Background Monitoring : At every 0.5 Sec
MCM : Rabbit processor
Control data monitoring :
Real time : Shared memory
Offline : Database
Ethernet communication @ 100Mbps
Environment : Python
No separate Antenna base computer :
Reduction in internal RFI

ONLINE :

Solaris
No absentee observing support
Fortran
No GUI
No web based components
Background Monitoring : At every 3 Sec
MCM : 8051 microcontroller
Control data monitoring :
Real time : shared memory
Offline : log file
Serial communication @ 9.6Kbps
Environment : AIPS
Antenna base computer 80186 microprocessor

Milestone :

- Communication between MCM ↔ ONLINE V2 ↔ GUI tested and working for 3 antenna setup.
- Offline control data monitoring.
- MySQL Database for monitoring data – Data displayed on web based interface.
- 500 mili seconds continuous background monitoring of control parameters enabled.
- Antenna shell temperature at C03 logged in database from shared memory using ONLINE V2.
- GUI for operators and engineers V1.
- Multi-threading implemented for many to one communication.
- Three-antenna system with 4 MCM each – Lab test setup.
- Subarray control implemented in Online V2.
- Internal discussion forum using Vanilla.

In Progress :

- Environment between operator interface and ONLINE V2
- Higher cadence of background monitoring
- GUIs
- Astronomical libraries : Starlink / Astropy
- Astronomer's interface and observing in absentia

Time Line :

- Project start : October 2012
- Prototype Demonstration : April 2014
- Final Version : October 2014

Acknowledgement :

We thank A. Pramesh Rao for valuable discussions and R. Balasubramanian for his help with the development of the new MCM card.