International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 5, May - 2014

ORCSM: Online Remote Controlling And Status Monitoring of DWR

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***Abstract*— ORCSM is the process of developing the software which helps in remote controlling and monitoring of radar Operation and Subsystem. Radar Controller communicates with Subsystems and creates Volume and Status Header. An authenticated client can remotely login to the DWR web server and can set parameters and view status of individual subsystems. Earlier operator has to stand in each Subsystem and inform about the status of subsystem to Radar Controller to carry out Doppler Weather Radar operation. It takes more time and make more complex for operator to control Doppler Weather Radar operation. This problem can be solved by using ORCSM. This software reduces complexity and time to control entire Doppler Weather Radar operation.**

Keywords—DWR,RC,StatusHeader,Volume Header,Subsystems

I. INTRODUCTION

Radar is an active system which uses electromagnetic waves to determine the range, altitude, direction, or speed of objects. It can be used to detect aircraft, ships, spacecraft, guided missiles, motor vehicles, weather formations, and terrain.
Doppler weather radar (DWR) is a long–range surveillance system that measures the rain fall Intensity. The data from DWRs will be useful for the study of monsoon dynamics, avalanche prediction, and detection of clear air turbulence and tracking of cloud burst, hailstorm and other severe weather events .Thus the Doppler weather radar can detect the severe weather phenomena well before it reaching a dangerous devastating stage, giving more precise advance warning for saving valuable lives and property. India Meteorological Department (IMD) decided to update their existing cyclone detection network by replacing the conventional (reflectivity only) weather radars by sophisticated state of the art Doppler Weather Radars. The major advantage of the Doppler weather radar is its ability to transmit and receive both horizontal and vertical polarization for the accurate estimate of rain rate. The Real time subsystem of DWR provides online processing of the radar base data and display of the parameters namely Reflectivity, radial velocity and Spectrum width on to the screen as graphs[1] .
ORCSM helps the operator for Smooth Operation, Quick Calibration and Easy Maintenance of the Radar with user-friendly software. It helps the operator to select the desired operating mode. For the selected mode, ORCSM software guides the operator to select the System and Subsystem parameters. It generates a Volume Header, providing information about the chosen modes of the operation and parameters to the other related subsystems like Digital Signal Processor and Workstations. It interfaces major subsystems of Radar like Transmitter, Indoor Receiver and Outdoor Receiver unit, Angle Servo and Simulator. RC communicates to all these subsystems and sets the required parameters of these subsystems for the chosen mode. RC also helps the operator for the Calibration of the Radar system. Real-time calibration and easy maintenance is also provided in this system.

ORCSM provides online status monitoring of different subsystems. It displays subsystem status online for operator's appropriate reaction. It provides the facility for measuring critical subsystem parameters like Transmitter Power and Receiver Noise Figure.

II. EXISTING SYSTEM

All GUI functions like parameter selections and Status monitoring was developed under platform independent software (JAVA) and installed in Radar Controller, which may be a PC/ Workstation. Operator need to be at the site location to diagnose the status of each system and to operate Radar. This consumes a considerable amount of time and due to this DWR comes to halt which affects the radar operation.

III. PROPOSED SYSTEM

The proposed system is designed in an user friendly manner using technology, JavaServer Pages. The main objectives of the system are :

- Parameter selections and Radar Operation are done remotely.
- Provides the Calibration of the Radar system online.
- ORCSM has been developed such that it can be executed from any PC/Workstation at Remote site.
- ORCSM also provides Status Monitoring information to monitor the status, Interlocks and Analog parameters of different subsystem.

IV. MODULE DESIGN

Proposed system has mainly two modules shown in Fig-1:*Operations control and Status monitoring.*

A. **Mode Selection**: This module helps the user for the selection of different modes for radar operation. Operation mode helps to select the different types of scan and its parameters .Calibration mode carries out Calibration activities during real-time. Radar Controller sends the Header information (consisting of calibration details) to Subsystem to initiate calibration operation. Calibration mode carries out Calibration activities during real-time. Radar Controller sends Volume header (consisting of diagnostics mode selections) to Subsystem to initiate diagnostic operations in Diagnostic mode. Here, all the contents of Volume header except diagnostics mode settings are invalid. After receiving diagnostics mode selections from Radar Controller, the subsystem executes the diagnostic routines and sends the status information to RC. RC in turn sends the status information to Webserver in the subsequent Status Header.[2]

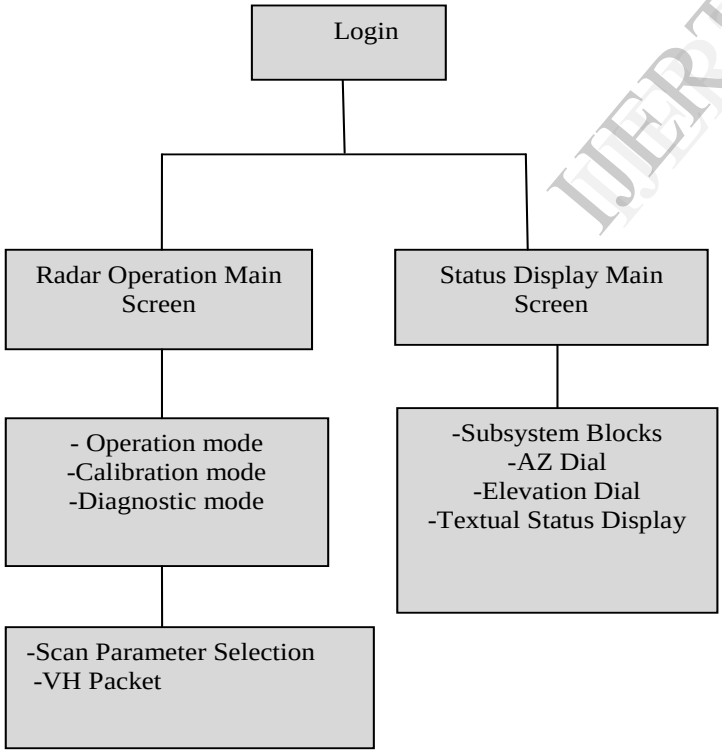

Fig-1: Module Diagram for Radar controller System.

B. **Scan Selection:** The scan selection is of three types: Volume scan, SectorAZ scan and SectorEL/ RHI scan. During the Volume scan, the user has to enter the no of elevations, elevation values (El) and scan rate. The SectorAZscan consists of same user inputs with additional StartAZ and EndAZ. During the Sector-EL/RHI scan consists of StartEL, EndEL, StartAZ, No of AZ, AZ step and EL scan rate. The product selection is of two types: single polarization and Dual polarization. During the single polarization, the user has to select the base products such as Reflectivity (Z), Velocity (V), Spectrum Width (σ). In Dual Polarization, the user can select other base products.

C. **Volume Header:** Radar Controller communicates to subsystems by creating Volume header. This header consists of operation type, base products and primary products. Volume Header is formed as byte array, and its Byte information is 1010 byte.[2]

D. Functions Of Subsystem:

The different subsystems of the DWR as in Fig-2 are:

a) **Transmitter:** The transmitter is a pulsed coherent system designed using a klystron amplifier. The transmitter power is connected to the feed through DDC, isolator, and the high power 4 port circulator. The transmitter input is generated in the coherent signal generator.

b) **Antenna Servo:** The Antenna Servo sub-system consists of an Angle Processor and the Drive Amplifiers, which moves the antenna in azimuth and elevation. It receives the angle data information from the encoders in the antenna.

c) **Workstations:** Workstations are used for real time Data display, Data Archival, and Offline Data analysis and Offline Product Generation. Radar Controller transmits Volume header data consists of the mode of operation, parameters selected for that mode, Pulse Repetition Frequency, Range Resolution, Number of Range bins to process, Unambiguous Range, Range covered, Workstation display range, Dwell time pulses etc. Operator has to select the products to be generated in Radar Controller menu and Radar Controller transmits this information through Volume Header to Workstation.

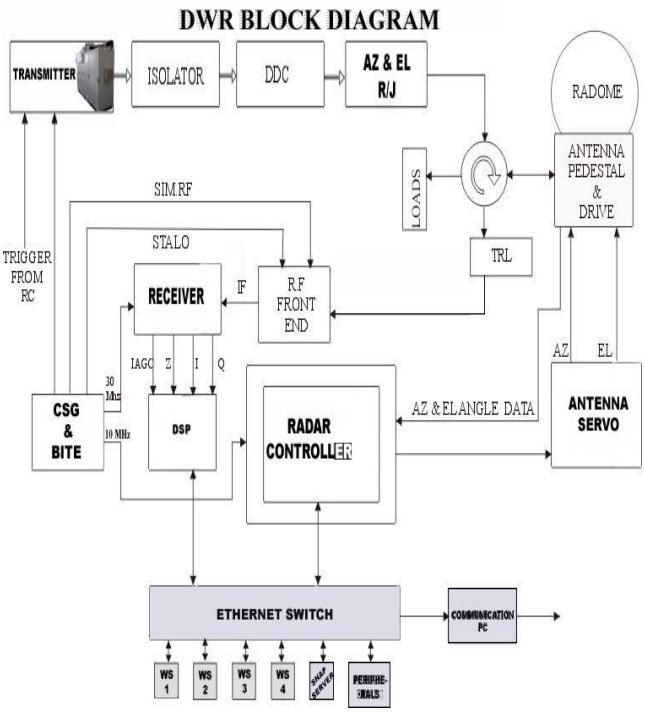

Fig-2: Interconnection of RC with Subsystem.

d) **Radome:** The DWR has to operate even in the most severe weather conditions and hence is to be protected by a Radome. The Radome is in the shape of a truncated sphere of 13 meters diameter. The Radome materials and structure are chosen to provide optimum electrical characteristics at the operating frequency band (2.7-2.9 GHz) [4]. The structure is designed to withstand winds encountered during severe cyclones viz., steady winds of 200 kmph and gusting up to 300 kmph. Radome is designed to work in tropical coastal climate.

E. S**tatus Header:** Subsystems transmits its status information to Radar Controller (RC) in the form of packet. RC appends header information to packet and forms Status Header for status display.

AZ dial and EL dial shows the graphical representation of Antenna's angle of rotation.

V. IMPLEMENTATION

ORCSM is designed and developed using Java and JSP with the tool NetBeans IDE 7.0.1 at RDA labs, ISTRAC, Bangalore.

A. System Overview :

ORCSM involves Client,Webserver, Radar Controller and Subsystems as shown in

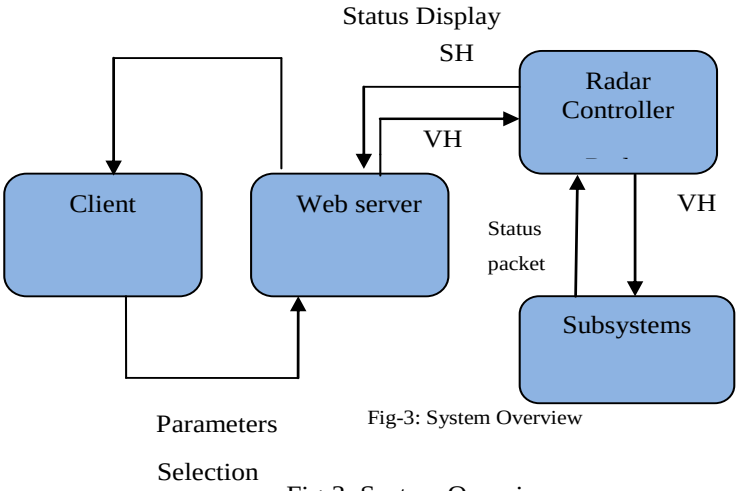

Fig-3: System Overview

Fig-3: System Overview.

An authenticated Client can log into the webserver to either view the status of each sub-systems or to select and control the operations of Radar[7].

Once user selects the desired operating mode for Radar, he can select the scan parameters, base/primary products etc…Once these selections are set, Volume Header (VH) is generated and is sent through the network to Radar Controller. Radar Controller transmits the selections to sub-systems.

When user wishes to view each subsystem status, Web Server receives Status Header (SH) from Radar Controller.[2] This SH is formed by Radar Controller by assembling each status packets received from individual sub systems. The status of individual and overall status of sub systems are displayed on web browser using JSP.

VI. CONCLUSION

The Doppler Weather Radar System provides precise advance warnings for saving lives and property in the event of natural disasters associated with severe weather.

This project helps to select operating parameters like antenna scan functions, basic radar waveform parameters like the pulse width, PRF and Signal processing and Product generation parameters through internet. It communicates in real-time with sub-systems, sends commands and receives status information from all subsystems. This project helps in controlling and monitoring the function of DWR, diagnosing the radar subsystems via remotely using Java Server Pages and thereby reducing the time.

ACKNOWLEDGMENT

A special thanks to our guides "Nirmala Hiremani,VTU-CPGS, Bangalore"and "J Shanmuga Sundari,RDA,ISTRAC,Bangalore" for their extensible support and guidance towards completion our work.

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