Hyperspectral Microwave Atmospheric Sounder Emulator

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Abstract

Major weather facilities around the world recognize microwave atmospheric sounding is the key to developing technology for weather and climate missions. The mission for Hyperspectral Microwave Atmospheric Sounding Emulator is to produce a model for demonstrating the hyperspectral techniques that retrieve data near 118 and 183 GHz through a 52 channel Intermediate Frequency processor. This project establishes a test bed that mimics the functionality of the instrument such as how data is retrieved and processed through computers in the instrument. The computers are programmed using a new framework application called Interoperable Remote Component. This software allows flexibility to program computers on how to communicate with each other, what devices to connect to and other factors.

Introduction/Background

The concept of Hyperspectual Microwave Atmospheric Sounding is to collect Intermediate Frequencies sampled from the same area and volume of the Earth's surface and atmosphere through a high-powered processor from multiple channels. The processor pulls several frequencies that are slightly different from each other to process into data that can be analyzed to accurately determine precipitation, temperature, and moisture. The frequencies range between 118 GHz and 183 GHz This efficient packaging technology will improve all-weather performance of atmospheric sounding and is low cost.
The HyMAS Emulator will provide a test bed for the instrument. The focal point is to imitate the processor by using SPI Interface on the test equipment and to program the computer components to format data traveling through the interface,

HyMAS Computers

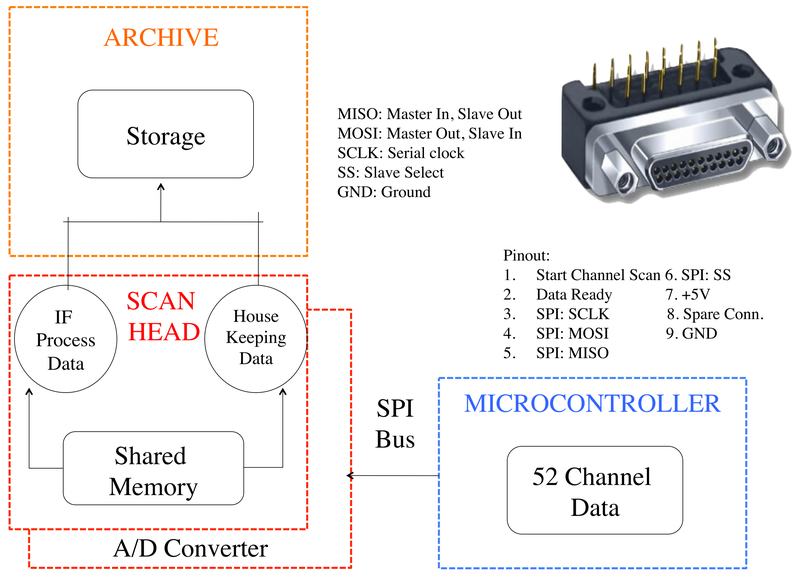
HyMAS instrument is divided into three components: The ScanHead, Calibration, and the Archive computers.

ScanHead Computer
↳Records IF processor data for temporary storage and later sent to the main computer.
↳Primarily stores IF processor and rack-housekeeping data.

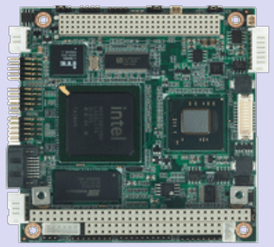
Calibration Computer
↳Records temperature data for temporary storage and later sent to the main computer.

Archive Computer
↳responsible for self-diagnosis and correction of problems, as well as supervisory control of the motion control, calibration, and Scanhead computers.

Test Bed Diagram



Hardware Test Bed



The test bed consists of three PCM-3362Z2-1GS6A1E boads. The PCM board is a PC/104-Plus that has an Intel Atom N450 Processor, 224 MB shared memory, two serial ports for communication, and 8-bit general purpose Input/Output. These boards are three components that HyMAS in divided into.

The Xtreme I/O ADC-DAC DAG003. Connect Tech Inc designed the Xtreme I/O analog and digital peripheral board. The Xtreme I/O board has 16 differential channels of analog input with 16-bit resolution. The ADC is created for the form factor of a PC/104-Plus bus and a sampling rate of 100,000 samples per second

Four HE104+DX power supplies are needed to give power to each board and also reduce some radio frequency noise that would interfere with receiving accurate data. The HE104+DX is a high performance DC-to-DC converter that supplies +3.3V, +5V, +12V and -12V outputs to the PC/104-Plus bus.

HyMAS IRC

Interoperable Remote Component is a new application framework that was created fro controlling and monitoring remote devices and sensors. This framework application is utilized to program functions of each component in the HyMAS instrument. IRC uses eXtensible Markup Language (XML) descriptions to configure the framework for a specific application. The Instrument Markup Language (IML) is used to describe the commands used by the instrument, the data streams produced, the rules of formatting commands and parsing data, and the method of communication.

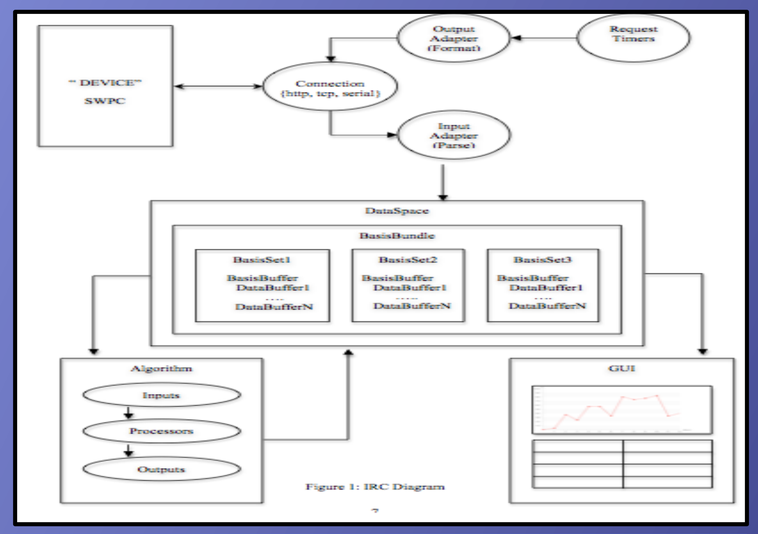


Figure 1: IRC Diagram

Future Work

Once the construction of the test bed is completed, the IRC system will be installed on each computer and tested for functionality using sample data produced through a microcontroller. Not all parts of this project are complete, MIT Lincoln Labs is responsible for building the Intermediate Frequency processor module. NASA GSFC is still developing the receivers and the computers that process the incoming data. Completion is expected in 2014.

Acknowledgments

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