GUI Design Considerations for Hyperspectral Microwave Atmospheric Sounder

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ABSTRACT

This article contains information on how the Hyperspectral Microwave Atmospheric Sounder is the next step in technology for weather and climate missions. This technology can help improve both the vertical and horizontal resolutions of the atmosphere. Hyperspectral microwave describes an all-weather sounding that acts just like hyperspectral infrared sounders. In hyperspectral infrared sounders clouds decrease the accuracy of the results, this is a big reason hyperspectral microwave are considered necessary. Hyperspectral measurements allow the user to determine the Earth’s temperature with vertical resolution exceeding 1 km (1093.61 yards). One of the objectives of Hyperspectral Microwave Atmospheric Sounder (HyMAS) is to develop a data system that will store and display the date received. PIC24 data stream will transfer 52 Data plus 16 H/K = 64 channels over Serial Peripheral Interface (SPI) at 100 Hz to scan head computer. Serial Peripheral is a synchronous protocol that allows the master device communication with a slave device. A Graphical User Interface (GUI) will be used to display the data received. A Graphical User Interface (GUI) is a type of user interface that allows users to interact with electronic devices using images rather than text commands. The author also develops documentation on how to operate the Explorer 16 development board. An Explorer 16 board can be used to interface with the emulator.

KEYWORDS
GUI, HyMAS, Hyperspectral Microwave Atmospheric Sounder, Visualization

INTRODUCTION

What follows is a research report detailing the steps taken to apply signal-processing algorithms to design of a graphical user interface (GUI) for satellite communications. One should be able to follow these steps with the specified set of hardware and software to get the same configuration on the proper RF communications and device design. These projects were implemented under the supervision of NASA scientists and faculty advisors in dedicated NASA labs. Following lessons learned here and authors’ previous experiences in data visualization and signal processing research and training relevant labs were designed to enhance the Computer Engineering program at the Virginia State University (VSU).

The idea of Hyperspectral Microwave Atmospheric Sounder (HyMAS) is to improve temperature and moisture accuracy compared to non-hyperspectral microwave sounding systems. Non-hyperspectral microwave sounding systems accuracy are challenged when high water vapor and clouds are present. Hyperspectral Microwave Atmospheric Sounder (HyMAS) uses a processor to gather frequencies,
which is analyzed and recorded. The recorded frequencies can be any precipitation or temperature in the atmosphere.

The frequencies can range within 118 GHz and 183 GHz. The Hyperspectral Microwave Atmospheric Sounder (HyMAS) Emulator is an intermediate frequency signal generated by a radio frequency. The emulator will amplify, filters, channelizes, and detect each channel using a detector. An Explorer 16 board can be used to interface with the emulator.

The Hyperspectral Microwave Atmospheric Sounder (HyMAS) Emulator will use Synchronous Serial Port (SPI) interface to program the computer’s instrument to format the data. Synchronous Serial Port (SPI) is a synchronous protocol that allows a master device to initiate communication with a slave device. Data is exchanged between these devices. SPI is implemented in the PICmicro MCU by a hardware module called the Synchronous Serial Port or the Master Synchronous Serial Port. This module is built into many different PICmicro devices. It allows serial communication between two or more devices at a high speed and is reasonably easy to implement.

The objective of my project is to design a Graphical User Interface (GUI) and begin implementation. My co-mentor informed me that the display takes up most of their time so I was to complete as much of the display as possible. The software will be used to display data on Graphical User Interface (GUI). Graphical User Interface (GUI) is a type of user interface that allows users to interact with electronic devices using images rather than text commands. Graphical User Interface (GUI) is restricted to a two-dimensional display screens with display resolutions able to describe generic information. I also was told to work on the Explorer 16 chip and see if I can get data in it. The Explorer 16 chip has rarely been used here and documentation is needed from me on how to run and program the chip. This work is important because the data from the Hyperspectral Microwave Atmospheric Sounder (HyMAS) needs to be able to display on a visual level. The importance of the Explorer 16 chip is to be used in the emulator.

METHODOLOGY

Equipment and data collection techniques:

- Programming language: Eclipse
- Explorer 16 development broad
- PIC kit 2 microchip
- PIC kit 2 v2.61
- MPLAB IDE v8.91

Eclipse

Eclipse is a multi-language integrated development environment (IDE) comprising a base workspace and an extensible plug-in system for customizing the environment. It is written mostly in Java. It can be used to develop applications in Java and, by means of various plug-ins, other programming languages including Ada, C, C++, COBOL, Fortran, Haskell, Perl, PHP, Python, Clojure, Groovy, and Scheme. Eclipse began as an IBM Canada project. Object Technology International (OTI), which had previously marketed the Smalltalk-based VisualAge family of integrated development environment (IDE) products, developed the new product as a Java-based replacement. The Eclipse Platform uses plug-ins to provide all functionality within and on top of the runtime system, in contrast to some other applications, in which functionality is hard coded. The Eclipse Platform’s runtime system is based on Equinox, an implementation of the core framework specification. This plug-in mechanism is a lightweight software component framework. In addition to allowing the Eclipse Platform to be extended using other programming languages such as C and Python, the plug-in framework allows the Eclipse Platform to work with typesetting languages networking applications such as telnet and
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