System Architecture

Introduction

In this section, an explanation of the system's function will be provided. In the system architecture plan, a detailed description of how the system operates will be itemized including the external and internal operation systems of the overall product. This list will include all electrical, software, and human interfaces. Each interface will be described in regards to what it consists of and how it will operate. In the system interfaces section, a system drawing and flow diagram will be presented. The initial diagram will show the general mechanical nature of the system as well as give a visual overview of the product. The second diagram will describe the high level system architecture and its interfaces. In the sub-system interfaces section, the first level flow diagram will be broken down into detailed interfaces. Multiple flow diagrams describing the electrical, software, and human interfaces shall be presented. Finally, the user interface section will explain the human interactions that are primarily for testing and demonstration purposes.

System Architecture Plan

The first level of interface of the system is the human interface. The human interfaces are the way that the user interacts with the system. The human interfaces for the system are fairly simplistic and is only used for demonstration purposes. A person can initiate a capture that will then be visible on a graphical user interface. The person can read all detected events on all eight channels over the 40 nanosecond acquisition period.

This project is almost entirely electrical in nature. There are two main electrical logic blocks. The two blocks are the event detector logic which is the primary focus of the design and the UART block which is necessary for transmitting the recorded event information to the computer to be displayed on the GUI. The UART block will also receive an initial “go” signal from the computer to initiate a 40 nanosecond event capture. The event capture logic will capture events of at least 5 nanoseconds in length over 8 sensor channels and store 40 nanoseconds worth of events. These events are then read by a state machine that will format the recorded values into 8 bit packets that will be sent to the UART and then transmitted by the UART to a PC running the GUI program. The 8 bit packets formed by the state machine include 3 bits for the channel that the event occurred on 2 bits for address in memory and then another 2 bits for the location within that pulse. Then there is one more bit for the actual value that was in that bit of memory. The event detector also receives a 100MHz clock signal from the FPGA.

The UART portion of the design will take in these 8 bit formatted pieces of memory and then transmit them using standard 8 bit, 38400 baud, UART interface over an RS232 cable to the PC running the GUI. The UART will also receive from the PC using the same interface. The only thing that the UART will receive is a “go” signal from the PC running the GUI over the same RS232 cable.

The graphical user interface is designed via matlab to accept an 8-bit piece of data coded for the channel, location, and strike. The GUI will send a signal to the UART interface to start the transmission of data. It will then constantly store the sent data in a large array. Given this accepted data, the GUI will display the strikes on all 8 channels graphically, as well as display the data in a chart. The chart will display the specifics of the radiation strike, i.e. time of strike and location of strike. The user of the GUI will also be able to select which channel for a more in depth view.

Electrical Interfaces

- 100MHz Clock signal
- 8 channel input to event detector
- 8 bit signal to UART
- RS-232 UART to PC
- PC to UART block

Software Interfaces

- Initiates event capture through RS-232 UART
- Recieves UART packets of captured events
- Displays 40 nanosecond captures of 8 channels

Human Interfaces

- Software button to initiate event captures
- DIsplay 40 nanoseconds of events over 8 channels

System Interfaces

The system interfaces describe how each sub-system of the overall product will interact. The diagrams below describes the event detector along with the UART block and software needed to demonstrate captures and then displayed captured data.

Sub-System Interfaces

Electrical Interfaces

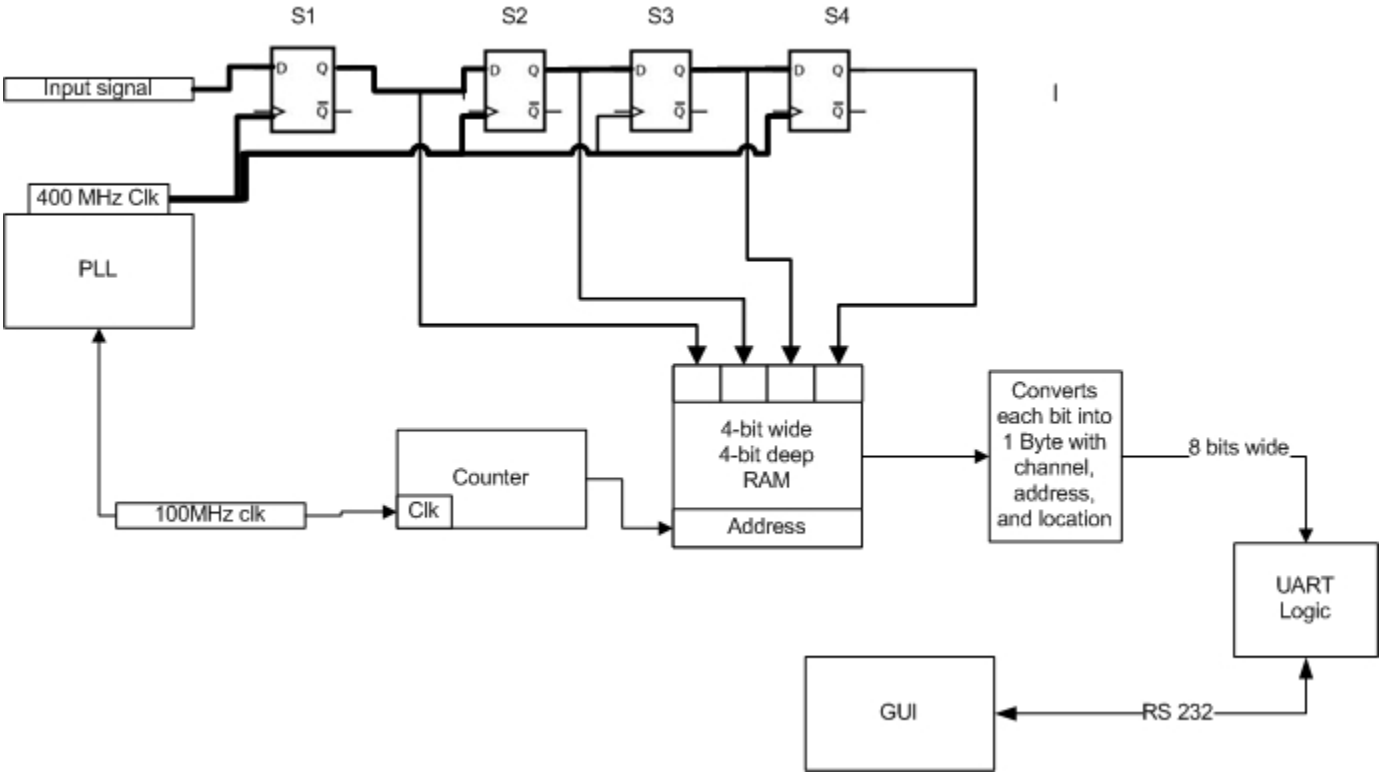

Figure 1: Drawing of electrical interfaces

Software Interfaces

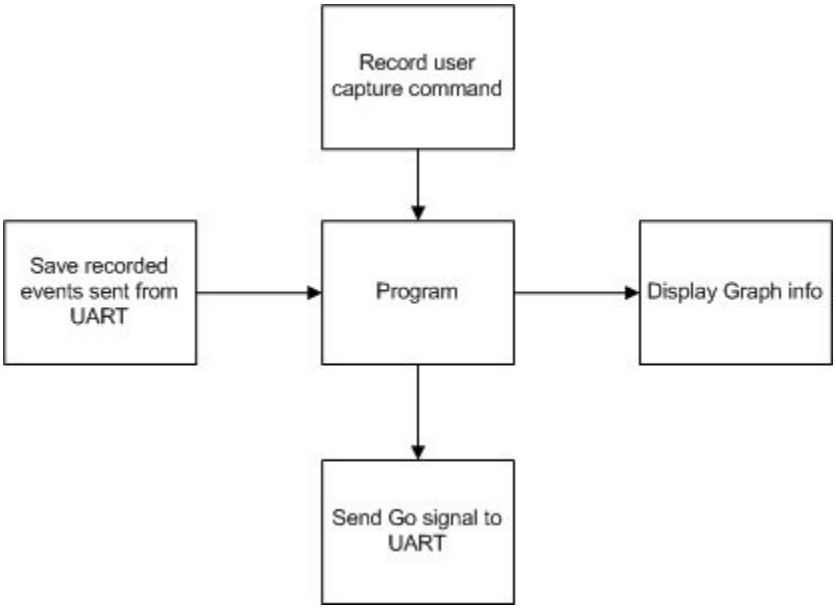

Figure 2: Software interface drawing

Human Interfaces

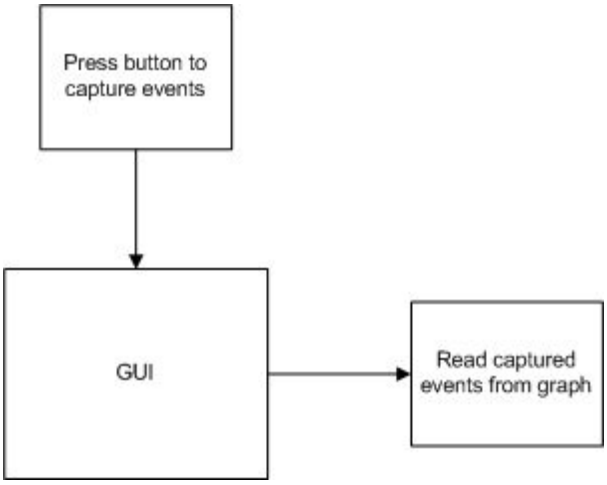

Figure 3: Human interface drawing

User Interfaces

The human interface is pretty limited for our project. The first think the user is going to interact with is pushing the start button on the software. This is done by using the mouse and pointing it at the capture button on the graphical user interface on the computer screen. The software will take care of grabbing the information and plotting it. The last user interface is reading the plot and being able to understand what it is displaying. The plot will display the hits, what time it happened and on which channel.