EEP701 Digital System Lab
Assignment8-Interface a Keyboard with an FPGA spartan 3 kit

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PROBLEM STATEMENT

Interfacing a keyboard with an FPGA Spartan 3 kit through a PS2 port and display the inputs in the 7-segment display. Your objective in this assignment to interface a keyboard with Spartan board and display the typed characters on a 7 segment LED display. The LED display supports 4 characters at once. You have to write an interpreter in VHDL to interpret the code received from keyboard into a character. The interpreter in this case should work like an FSM. There is a unique scan code generated for each character typed from keyboard. Interpretation should be done for following keys:

- Printable characters: alphabets and numerals
- Control keys: CAPS LOCK, SPACEBAR and BACKSPACE

Display of characters on LED display should be done in following way:

- Keystrokes : CAPSLOCK A CAPSLOCK B C D
  Display : dcbA
- Keystrokes: A CAPSLOCK H SPACE 3
  Display: 3 H a
- Keystrokes: 1 2 3 BACKSPACE 4 5
  Display: 5 4 2 1

ABSTRACT

This report is on interfacing a keyboard with a Spartan kit usnig VHDL. The Objective of this Assignment is to understand the woking of a keyboard and th interfacing to different devices with a kit.The interfaceing is done through a PS2 port that are available on board a Spartan 3 kit.Generally all keyboards have a PS2 interface.We have to show the character the characters that are input through the keyboard. We store the inputs done afer each keystore and display the latest of them in the 7 segment display that is available on the board.We also have to implemant the shift and caps lock entries and give the corresponding outputs to the display.Also “backspace” is also implemented.

INTRODUCTION

VHDL (VHSIC Hardware Description Language) is a hardware description language used in electronic design automation to describe digital and mixed-signal systems such as field-programmable gate arrays and integrated circuits. VHDL can also be used as a general purpose parallel programming language.

The idea of being able to simulate the ASICs from the information in this documentation was so obviously attractive that logic simulators were developed that could read the VHDL files. The next step was the development of logic synthesis tools that read the VHDL, and output a definition of the physical implementation of the circuit.

Xilinx ISE (Integrated Software Environment) is a software tool produced by Xilinx for synthesis and analysis of HDL designs, enabling the developer to synthesize ("compile") their designs, perform timing analysis, examine RTL diagrams, simulate a design's reaction to different stimuli, and configure the target device with the programmer.

This report is on interfacing a keyboard with a Spartan kit usnig VHDL. The Objective of this Assignment is to understand the woking of a keyboard and th interfacing to different devices with a kit.The interfaceing is done through a PS2 port that are available on board a Spartan 3 kit.Generally all keyboards have a PS2 interface.We have to show the character the characters that are input through the keyboard. We store the inputs done afer each keystore and display the latest of them in the 7 segment display that is available on the board.We also have to implemant the shift and caps lock entries and give the corresponding outputs to the display.Also "backspace" is also implemented.

SPECIFICATIONS AND ASSUMPTIONS

Specifications and Assumptions

- Total of 100 Characters can be stored on the chip which could be dispalyed on the display
- Left Shift an Right Shift work
- Caps lock is also assimilated
- Backspace deletes the last character from the input stream
- The keys which cannot be displayed would be bypassed and not be shown in the display

LOGIC USED/METHODOLOGY

Getting the key code

We use FSM for getting the inputs.A clock and code comes from the keyboard when a key is pressed.It s starts with a start bit . This is fallowed by an 8 bit code of the key that is pressed.This code is the keycode which supplies the information of what key is pressed. The next bit is parity bit and then a stop bit is generated.When a key is released, a similar code is sent which is of 2 bytes.

Getting the seven segment display code

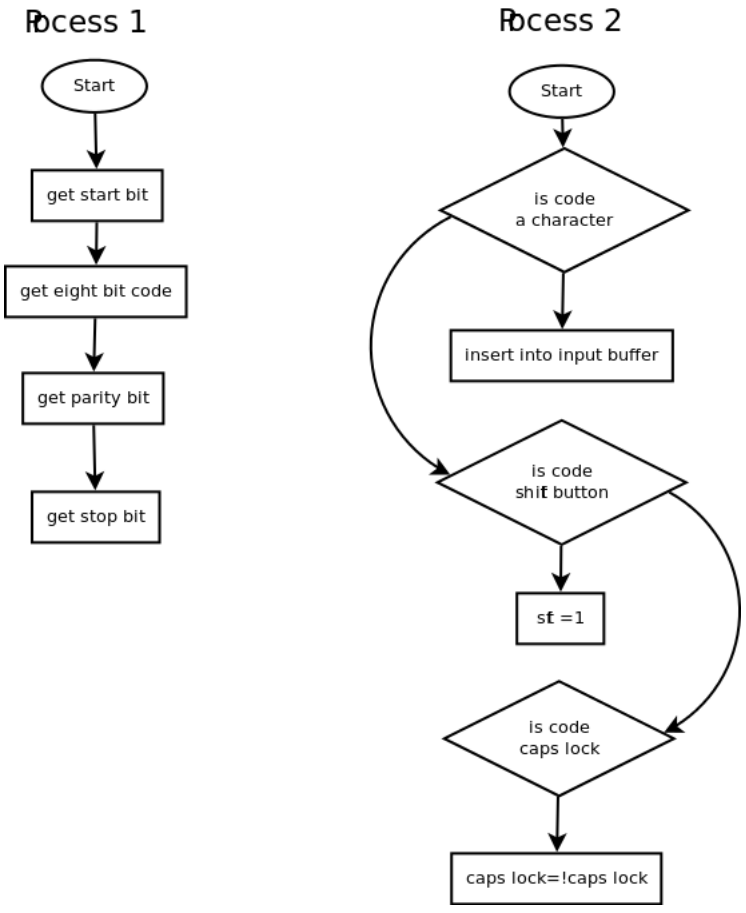
We have to assign the code for displaying the characters in the seven segment display by assigning the given codes to each symbol.We have created allokup table for that.If shift is pressed or caps lock is on then a seperate lookup table is reffered to.This is the code which is passed in to the display unit to display in the seven segment display.This code is pushed into a input buffer which stores all the input characters sent till that time.If backspace is pressed , then we delete the last code from the input stream.

Displaying

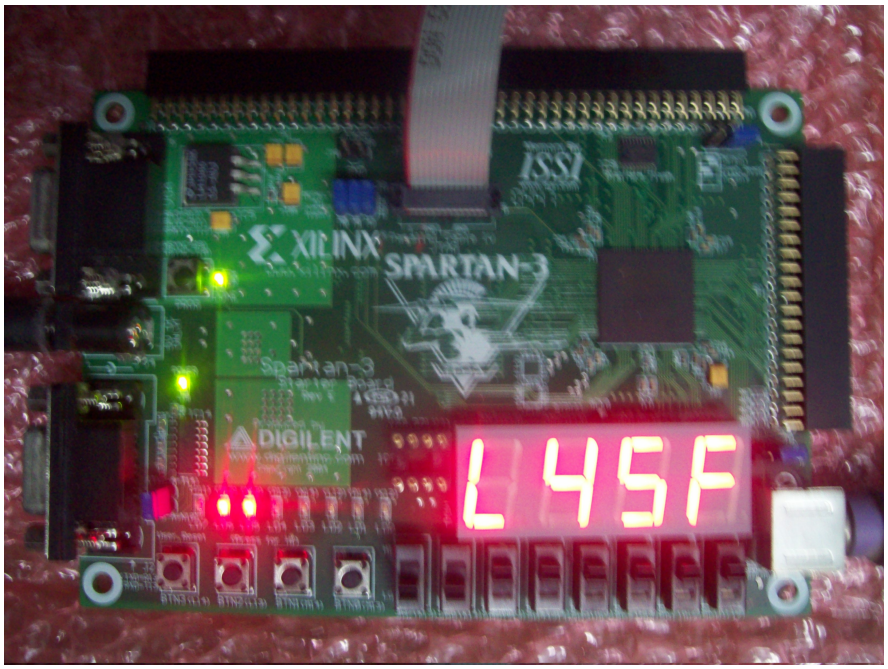
There are 4 display units in the Spartan kit.We can display 4 characters at the same time.The display on the 4 units are done in a time division basis.We have seperate enable signal for each of the 4 units.and the same control signal is sent to them.so we time multiplex the control signal and change the

control signal in synchronyzation with that.We are able to display 1 characters from the input stream at one time.But we change these control signals so frequently that to human eye it appears to be displaying simultaneously.This is how displaying is done

FLOWCHART


Process 1
Start
get start bit
get eight bit code
get parity bit
get stop bit
Process 2
Start
is code
a character
insert into input buffer
is code
shift button
shft =1
is code
caps lock
caps lock=!caps lock

OBSERVATIONS



RESULTS AND CONCLUSIONS

The keyboard interface with Spartan 3 kit was sucessfully designed and implemented on board.We got to learn how to interface devices and to take signals from various kinds of ports,how to handshake,etc.Also we got a chance to implement it on board and thus gave us exposure to designing ASIC chips.