BCD TO EXCESS 3 CONVERSION IN FPGA

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Contents

Abstract

This manual shows how to convert a BCD numbers to Excess3 using seven segment display decoder to learn boolean logic.

DECIMAL	BCD CODE	EXCESS3	
Digit	A B C D	W X Y Z	a b c d e f g
0	0 0 0 0	0 0 1 1	0 0 0 0 1 1 0
1	0 0 0 1	0 1 0 0	1 0 0 1 1 0 0
2	0 0 1 0	0 1 0 1	0 1 0 0 1 0 0
3	0 0 1 1	0 1 1 0	0 1 0 0 0 0 0
4	0 1 0 0	0 1 1 1	0 0 0 1 1 1 1
5	0 1 0 1	1 0 0 0	0 0 0 0 0 0 0
6	0 1 1 0	1 0 0 1	0 0 0 1 1 0 0
7	0 1 1 1	1 0 1 0	0 0 0 1 0 0 0
8	1 0 0 0	1 0 1 1	0 0 0 0 0 0 0
9	1 0 0 1	1 1 0 0	0 1 1 0 0 0 1

1 Components

Components	Values	Quantity
Vaman		1
JumperWires	M-F	5
Breadboard		1
USB-C cable		1

2 Setup

1. Connect the Vaman to the Laptop through USB.
2. There is a button and an LED to the left of the USB port on the Vaman.There is another button to the right of the LED.
3. Press the right button first and immediately press the left button.The LED will be blinking green.The Vaman is now in bootloader mode.

2.1 Steps for implementation

1. Login to termux-ubuntu on the android device and execute the following commands: Make sure that the required installation and tool builds of pygmy-sdk had done prior executing below commands

```
proot−distro login debian
cd /data/data/com.termux/files/home/
mkdir fpga
svn co https://github.com/9705701645/FWC/FPGA
    /CODES
cd codes
ql_symbiflow −compile −src /data/data/com.termux
    /files/home/fpga/codes −d ql−eos−s3 −P
    PU64 −v helloworldfpga.v −t helloworldfpga −p
     quickfeather.pcf −dump binary
```

This will generate **helloworldfpga.bin** file in codes directory transfer this bin file to laptop by executing the following command

```
scp /data/data/com.termux/files/home/fpga/codes/
    helloworldfpga.bin username_of_pc@IP_address:/
    home/username
```

Make sure that the appropriate username,IP address of the Laptop is given in the above command.

2. Now execute the following commands on the Laptop terminal
   Make sure that required installation of programmer application had done prior executing below command

```
python3 /home/username/TinyFPGA−Programmer−
    Application/tinyfpga−programmer−gui.py −−
    port /dev/ttyACM0 −−appfpga /home/
    username/helloworldfpga.bin −−mode fpga
```

3. After finishing the process of flashing with the programmer application press the button to the right of the USB port to reset. Vaman is now flashed with our source code

3 Implementation

KMAP FOR EQUATIONS

AB \ CD	00	01	11	10
00	0	0	0	1
01	0	1	0	1
11	0	1	0	0
10	0	1	0	0

W= AB'C'+A'BD+A'BC

AB \ CD	00	01	11	10
00	0	1	0	0
01	1	0	0	1
11	1	0	0	0
10	1	0	0	0

$$X = A'B'D + A'B'C + A'BC'D' + AB'C'D \quad (1)$$

AB \ CD	00	01	11	10
00	1	1	0	1
01	0	0	0	0
11	1	1	0	0
10	0	0	0	0

$$Y = A'C'D' + A'C'D + AB'C'D' \quad (2)$$

AB \ CD	00	01	11	10
00	1	1	0	1
01	0	0	0	0
11	0	0	0	0
10	1	1	0	0

$$Z = A'D' + AB'C'D' \quad (3)$$

K-map

Karnugh Map : The code below realizes the Boolean logic for G using 5V,GND of Vaman Board
2,4,6 GPIO Pins of J3 Bank in Vaman Board are configured as input pins and the required Logic for U,V,W are drawn from 5V (Digital '1'),GND (Digital '0'). Built in led will glow based on G satisfying the Table

Output variable	IO PIN	QFN
a	IO18	32
b	IO18	33
c	IO18	34
d	IO18	35
e	IO18	36
f	IO18	37
g	IO18	38

The code below realizes the Boolean logic for G using 5V,GND of Vaman Board using Verilog Language