BCD to GRAY Conversion

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Contents

Abstract

This manual explains BCD to GRAY code conversion by finding boolean equations.

1 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.

1.1 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/NavyaValmeekam/FWC/
    tree/main/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

2 Implementation

Connections :-

Arduino	2	3	4	5	6	7	8
Display	a	b	c	d	e	f	g

3 Karnaugh Map

Using Boolean logic or kmaps, G0, G1, G2, G3 in the truth table can be expressed in terms of the inputs A,B,C,D

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

Kmap for G0

$$G0 = A'C'D + A'CD' + AB'C'D \quad (1)$$

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

kmap for G1

$$G1 = A'BC' + A'B'C \quad (2)$$

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

kmap for G2

$$G2 = A'B + AB'C' \quad (3)$$

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

Kmap for G3

$$G3 = AB'C' \quad (4)$$

Using Boolean logic or kmaps, a,b,c,d,e,f,g in the truth table can be expressed in terms of G0,G1,G2,G3 as:

$$a = G0'G1'G2G3' + G0G1'G2'G3' \quad (5)$$

$$b = G0'G1'G2G3 + G0'G1G2G3' + G0G1'G2G3' \quad (6)$$

$$c = G0'G1G2'G3' + G0'G1'G2G3 \quad (7)$$

$$d = G0'G1'G2G3' + G0G1G2G3' + G0G1'G2'G3' \quad (8)$$

$G0G1$ \ $G2G3$	00	01	11	10
00	0	0	0	1
01	0	0	0	0
11	1	0	0	1
10	1	0	0	1

Kmap for e

$$e = G0G3' + G0G2G3' \quad (9)$$

$G0G1$ \ $G2G3$	00	01	11	10
00	0	0	0	0
01	1	0	0	0
11	1	0	0	1
10	1	0	0	0

Kmap for f

$$f = G0G2'G3' + G1G2'G3' + G0G1G3' \quad (10)$$

$G0G1$ \ $G2G3$	00	01	11	10
00	1	0	0	0
01	0	0	0	0
11	0	0	0	1
10	1	0	0	0

Kmap for g

$$g = G1'G2'G3' + G1'G2G3 + G0G1G2G3' \quad (11)$$

Verify the output using below truth table.

A	B	C	D	G3	G2	G1	G0	a	b	c	d	e	f	g
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	1	0	0	0	1	1	0	0	1	1	1	1
0	0	1	0	0	0	1	1	0	0	0	0	1	1	0
0	0	1	1	0	0	1	0	0	0	1	0	0	1	0
0	1	0	0	0	0	1	1	0	1	0	0	0	0	0
0	1	0	1	0	1	1	1	0	0	0	1	1	1	1
0	1	1	0	0	1	0	1	0	1	0	0	1	0	0
0	1	1	1	0	1	0	0	1	0	0	1	1	0	0
1	0	0	0	1	1	0	0	0	1	1	0	0	0	1
1	0	0	1	1	1	0	1	0	0	0	0	0	0	1

https://github.com/NavyaValmeekam/FWC/blob/main/fpga/codes/helloworldfpga.v