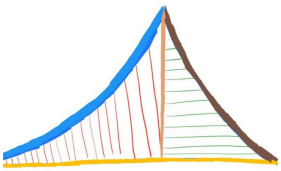
Embedd Systems Through Vaman



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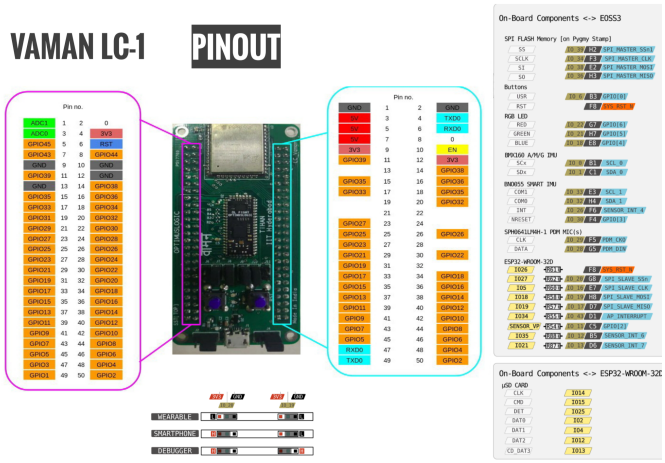

Fig. 1.1: Vaman pins. Right side reperesents ESP32 and left side M4-FPGA.

1 Blink

1.1 ESP

Here we show how to program the ESP32 on the Vaman using the Arduino framework.

1. Make sure that Vaman board does not power any devices.
2. Make connections as shown in Table 1.1.
3. The Vaman pin diagram is available in Figure 1.1.

VAMAN-ESP	UART PINS
5V	5V
GND	GND
TXD0	TXD
RXD0	RXD
0	GND

TABLE 1.1

4. Connect the Arduino-UART to raspberry pi through USB.
5. Connect the Vaman-ESP pins to the seven segment display according to Table 1.2

ESP	SEVEN SEGMENT DISPLAY
5V	COM
2	DOT

TABLE 1.2

6. On termux on your phone,

```
cd vaman/esp32/codes/ide/blink
pio run
```

7. Transfer the ini and bin files to the rpi

```
scp platformio.ini pi@192.168.50.252:./hi/platformio.ini

scp .pio/build/esp32doit-devkit-v1/firmware.bin
    pi@192.168.50.252:./hi/.pio/build/esp32doit-devkit
    -v1/firmware.bin
```

8. On rpi,

```
cd /home/pi/hi
pio run -t nobuild -t upload
```

9. On your phone, open

```
src/main.cpp
```

and change the delay to

```
delay(100);
```

and execute the code by following the steps above.

10. Flash the following code.

```
vaman/esp32/codes/ide/ota/setup
```

after entering your wifi username and password (in quotes below)

```
#define STASSID "..." // Add your network credentials
#define STAPSK "..."
```

in src/main.cpp file

11. You should be able to find the ip address of your vaman-esp using

```
ifconfig
nmap -sn 192.168.231.1/24
```

where your computer's ip address is the output of ifconfig and given by 192.168.231.x

12. Assuming that the username is gvv and password is abcd, flash the following code wirelessly

```
vaman/esp32/codes/ide/ota/blink
```

through

```
pio run
pio run -t nobuild -t upload --upload-port
    192.168.231.245
```

where you may replace the above ip address with the ip address of your vaman-esp.

13. Connect pin 2 to an LED to see it blinking.
14. Connect the pins between Vaman-ESP32 and Vaman-PYGMY as per Table 1.3

ESP32	Vaman
GPIO2	GPIO18
GPIO4	GPIO21
GPIO5	GPIO22

TABLE 1.3

15. Flash the following code OTA

```
vaman/esp32/codes/ide/ota/blinkt
```

You should see the onboard LEDs blinking.

16. Change the blink duration to 100 ms.

1.2 FPGA

We show how to program the Vaman FPGA/microcontroller board.

1. Follow the instructions available in the video at

```
https://github.com/whyakari/TermuxDisableProcces?tab=
    readme-ov-file
```

to ensure that termux is not killed during the following installation process.

2. On termux-debian,

```
wget https://raw.githubusercontent.com/gadepall/fwc-1/
    main/scripts/setup.sh
bash setup.sh
```

3. Login to termux-debian on the android device and execute the following commands

```
cd vaman/fpga/setup/codes/blink
source ~/.vamenv/bin/activate
ql_symbiflow -compile -src vaman/fpga/setup/codes/
    blink -d ql-eos-s3 -P PU64 -v helloworldfpga.v
     -t helloworldfpga -p quickfeather.pcf -dump
    binary
scp blink/helloworldfpga.bin pi@192.168.0.114:
```

Make sure that the appropriate IP address for the raspberry pi is given in the above command.

4. Now execute the following commands on the raspberry pi.

```
python3 -m venv ~/.vamenv
source ~/.vamenv/bin/activate
git clone --recursive https://github.com/QuickLogic-
    Corp/TinyFPGA-Programmer-Application.git
pip3 install tinyfpgab
deactivate
sudo reboot
source ~/.vamenv/bin/activate
python3 TinyFPGA-Programmer-Application/tinyfpga
    -programmer-gui.py --port /dev/ttyACM0 --
    appfpga /home/pi/helloworldfpga.bin --mode fpga
```

5. Make sure that the correct USB port address is given in the above command. Then press the button to the right of the USB port. After some time, the LED will start blinking red.
6. Replace the following line in the code in instruciton 8

```
assign redled = led; //If you want to change led colour
    to red,
```

with

```
assign blueled = led;
```

and execute the code.

7. Now modify the helloworldfpga.v file to get the green led blinking.
8. In the following verilog program,

```
codes/blink/helloworldfpga.v
```

pay attention to the following lines

```
delay = delay+1;
if(delay > 20000000)
begin
delay=25'b0;
led=!led;
end
```

It may be deduced from the above that the blink frequency is 20 MHz.

9. In instruction 8, replace

```
if(delay > 20000000)
```

with

```
if(delay==25'b1001100010010110100000000)
```

and execute the verilog code.

10. Since the delay is 20 MHz, the blink period is 1 second. Modify the verilog code so that the blink period becomes 0.5s.
11. Find the bit length of 20 MHz.
Solution:

$$\log_2(20000000) \approx 25 \tag{1.1}$$

12. Obtain the above answer using a Python code.
Solution: Exeucte the following code and compare with instruction 9.

```
codes/blink/freq_count.py
```

13. Ensure that the LED stays on in green colour.
Solution: Execute the following code

```
vaman/setup/codes/blink/onoff.v
```

14. Using Table 1.4 and Fig. **??**, control the onboard LED through an external input. Connect an external LED and control it using an output pin as well.

Type	Vaman Pin	Connection
Input	IO_28	GND
Output	IO_11	LED

TABLE 1.4: Vaman Input/Output.

Solution: Execute the following code and take out the input pin connect to GND. Plug it again. Do this repeatedly.

vaman/setup/codes/input/blink_ip.v
vaman/setup/codes/input/pygmy.pcf