

COL215

Assignment 3

Image Filtering

Name – Abhishek kumar

Entry No. – 2019CS10458

Content

1. Design overview
2. ASM Chart

Design Overview

In this design we are given a Push_Button which is used to start filtering the image. We are also given a switch which tells whether to smooth the image or sharpen it.

We are given the pixels of the image(120 x 160) to be filtered in RAM memory which can be accessed using the address.

We are also given the filtering coefficient which is stored in ROM memory which is also accessible using the address.

Two variables are used to row(0 to 118) and col(0 to 158) which gives the start of the 3x3 matrix which is to be multiplied with filter 3x3.

For maintaining count for 3x3 matrix we are using i (row->0 to 2) and j (column->0 to 2). This i and j are used for obtaining the address of both ram and rom.

The formula for address can be given by

$$\text{Address_RAM} = 160 * (\text{row} + i) + (\text{col} + j)$$

$$\text{Address_ROM} = 3 * i + j + (16 \text{ if sharp_filtering else } 0)$$

As address is not available after the clock edge the MAC operation will be delayed by one clock. To avoid that we are using a variable c. For first operation we will not do MAC operation but instead return to same state(i.e. c=0). After first iteration only we will go to next where data_in1 and data_in2 of MAC will be updated using previous cycle outputs of RAM and ROM.

To perform the nine MAC operation we will use i,j. if both are 0 then we will set controller_mac to 0 (i.e. do only product) else controller_mac to 1 (do multiply and update the sum). The nine MAC will be done when both i,j goes to 2 otherwise we will increment i and j to get the row and column respectively of 3x3 matrix.

After the nine MAC are done as indicated by the values of i and j to be 2. Then we will update the filtered image at the address (158*row+col) in RAM and go back for another iteration.

The finishing of image filtration is indicated by row=118 and col=158.

The filtered image will be available in the RAM until next push_button is pressed.

The corresponding ASM Chart is on the following Page.

