COL 215 : Assignment 3: Digital Image Filter

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Design Overview

An external switch, a push button and a QQVGA display is available. Modules for storing/retrieving data (1 RAM and 1 ROM) along with a multiplier-accumulator are available for use.

All of these are used in the following way:

1. **External Switch:** This is used to toggle between the filtering modes. By default, when switch is off, filtering coefficients starting from address 0 are used. When the switch is on, the coefficients starting from address 16 are used.

2. **Push Button:** This is used to start the filtering. whenever the button is pressed, the system checks the filter type in the external switch and starts filtering.

3. **Display:** This is used to display the image. We are not concerned with how this works and limit ourselves to storing the image data in the RAM.

4. **RAM:** This is used for both reading the input image and writing the final filtered image. The address for the input image start from 0, while that of the filtered image starts at 32768. For every pixel in the input image, filtering is performed and then result stored in the filtered image. The address to be read changes with the position considered for filtering (9 different positions for each pixel), while it is fixed for writing in a single pixel.

5. **ROM:** This is used for reading the filter coefficients. The coefficients for the first filter are stored starting from 0, while that of the second are stored starting from 16. According to the value of externalSwitch, the address for the coefficients is decided.

6. **MAC:** This is used for the actual calculations. For every pixel, there are 9 multiplications and additions to be performed. These are done through the MAC.

From a user's perspective, the features of the design are:

1. Input image can be loaded in RAM and displayed on the display.

2. Which filter to use can be decided and the external switch be set accordingly.

3. The button can be pressed, whereby the image filtering starts, and soon, the results will be stored in RAM

4. The filtered image from RAM can be viewed on the display

The design of the system is kept modular. It is broken into multiple processes an substates that perform some specific tasks. The small components are brought together in the main entity and they work with each other to perform image filtering.