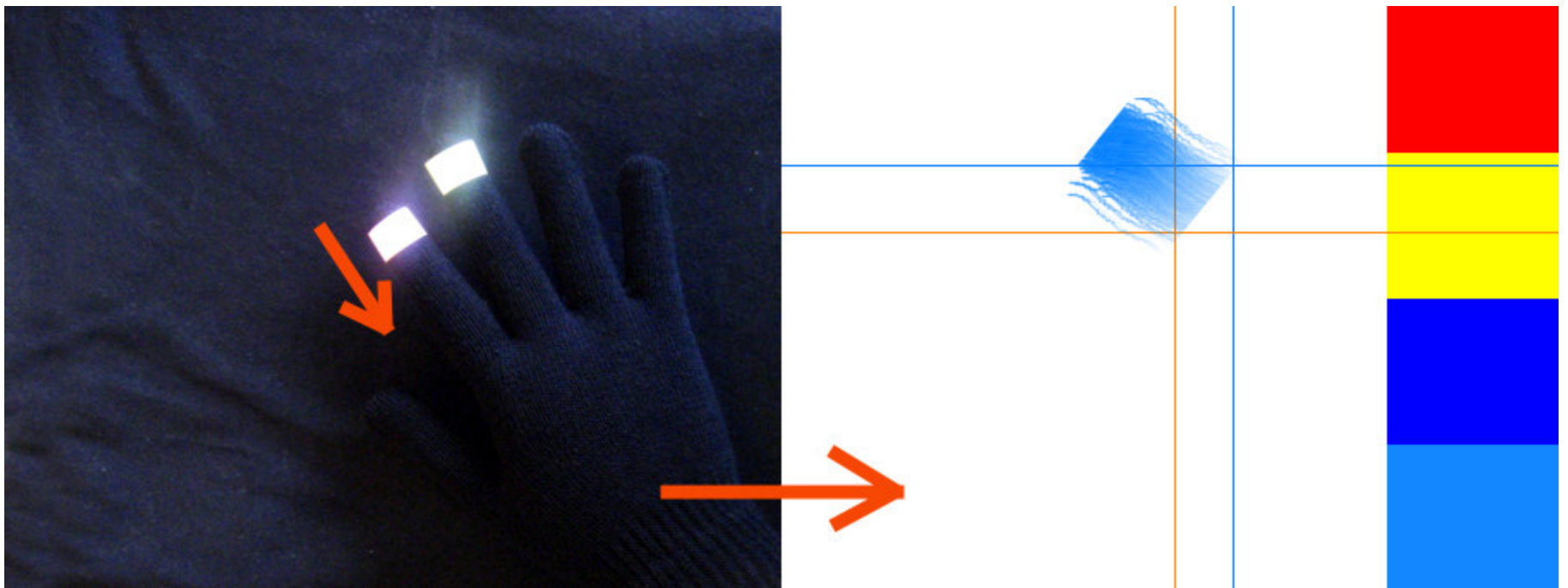


FingerArt

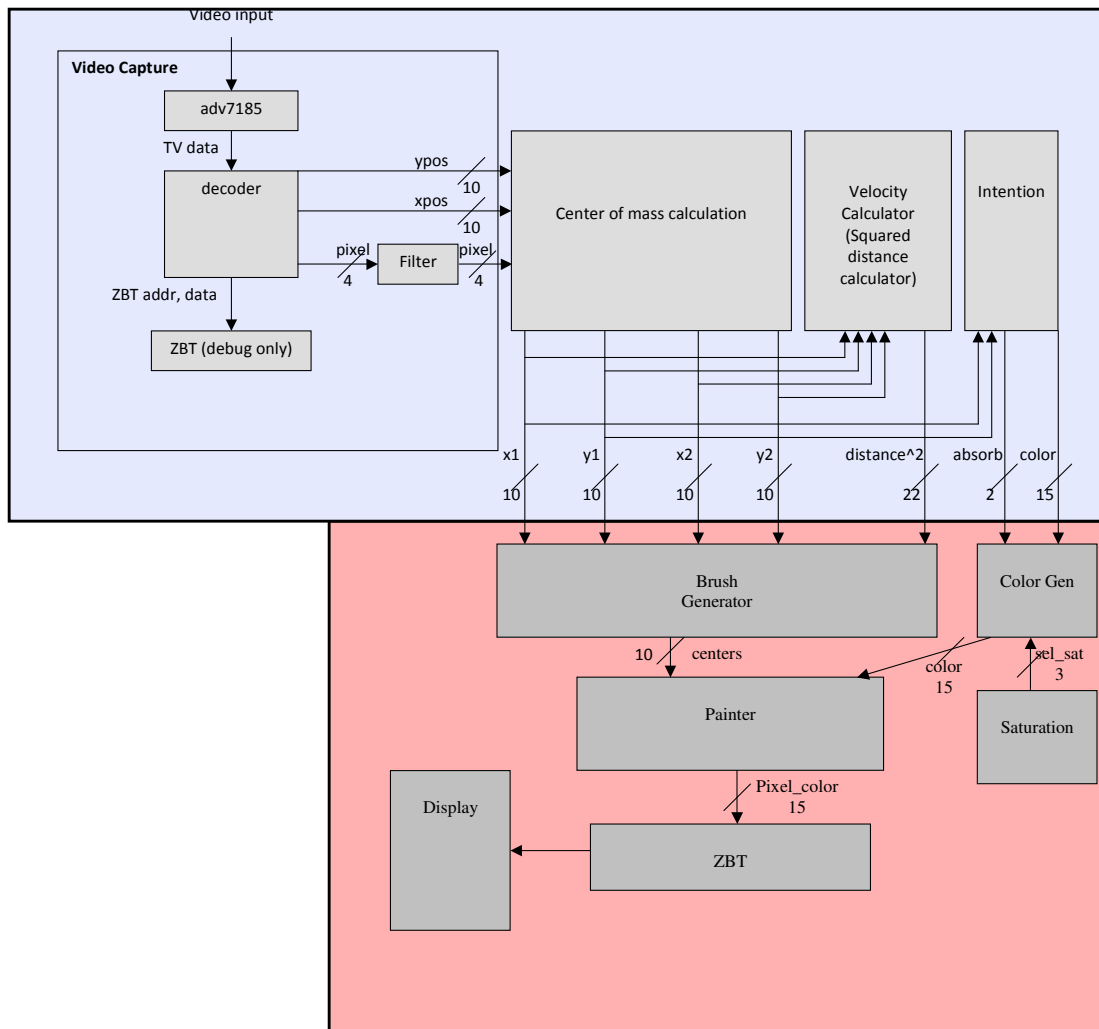
Grace Li & Sean Liu

Overview

- Artists draw on blank 800 by 600 screen
- Camera recognizes gestures
- System translates to virtual brush and paint



Modules

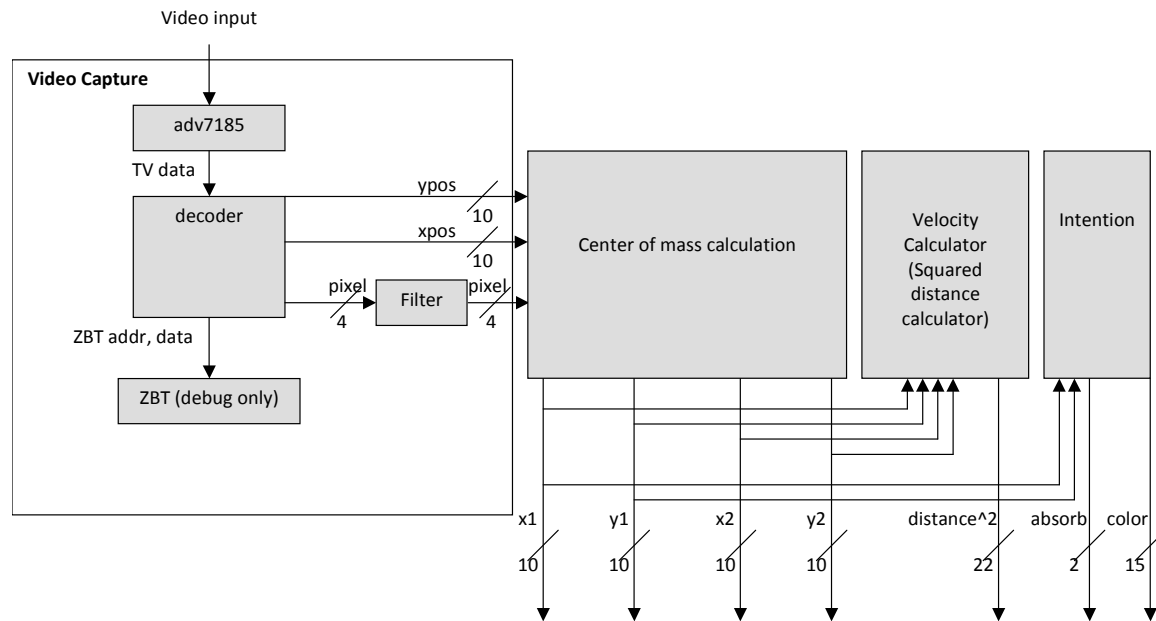


- **Gesture Detection**
Identifies the location of the user's hands, velocity, and intention.

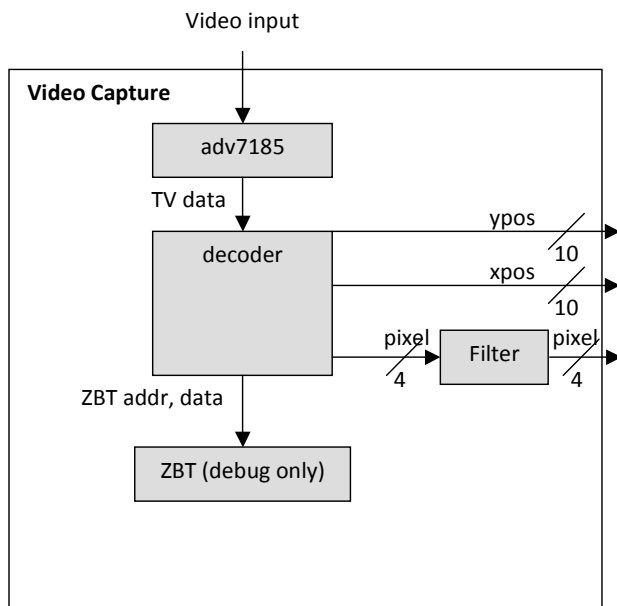
- **Paint Genesis**
Translates the position and speed of user's hands to paint.

Gesture Detection

- Video capture
- Center of mass calculation
- Velocity calculation
- Intention detection

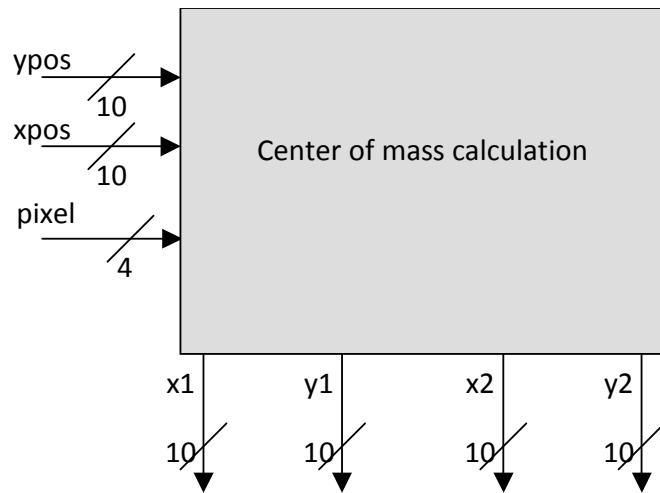


Gesture Detection Video Capture



- Obtain data from camera
- Filter to accept/reject pixels based on threshold
- Write to ZBT (debug only)

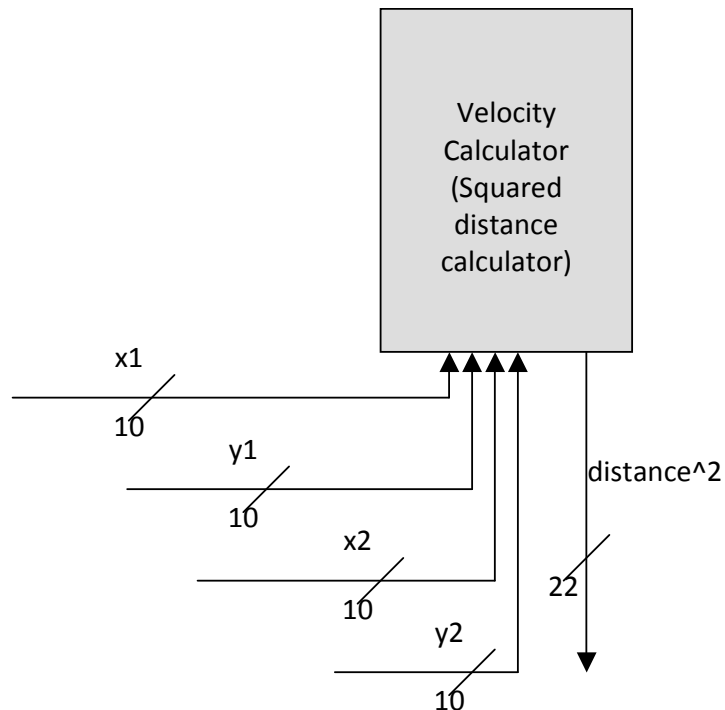
Gesture Detection Center of Mass



- Calculates the left and right centers of mass
- Saves two centers of mass clusters
- For each pixel input, if distance is $<$ threshold, updates center of mass. If distance is $>$ threshold, counts as second center of mass or discards
- Keeps track of the last 8 centers of mass and outputs the average

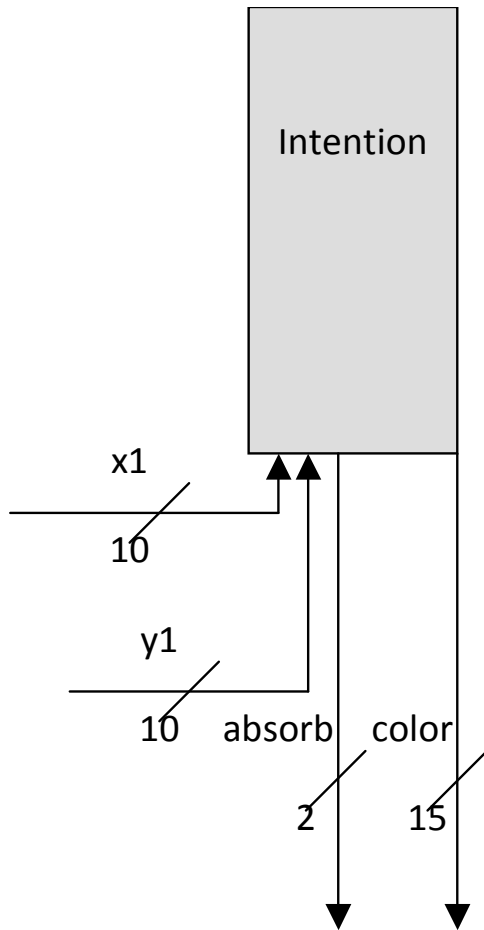


Gesture Detection Velocity Calculation



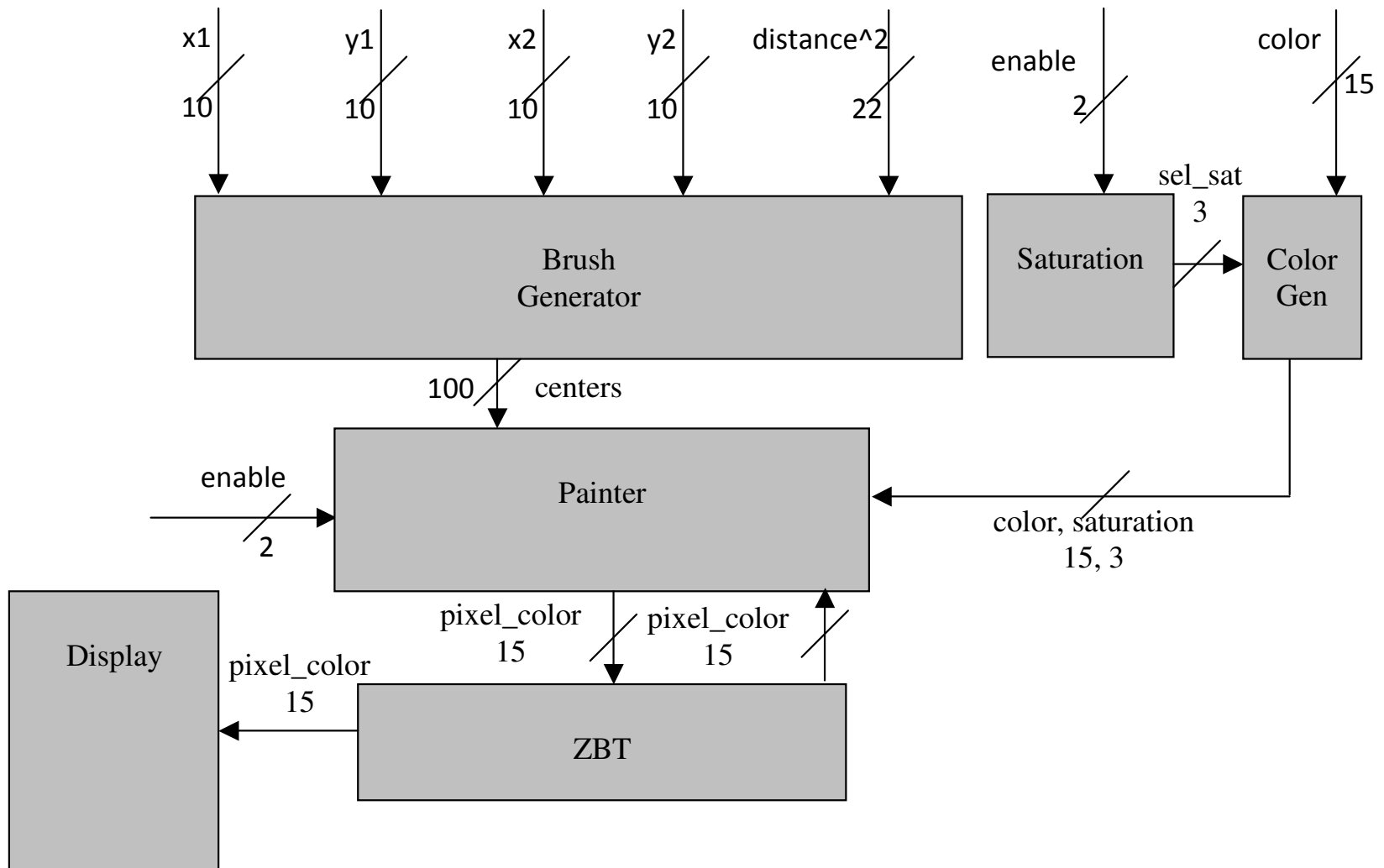
- Averages the two centers of mass
- Stores last 32 averages
- Keeps a total distance
- For each new average center of mass, subtracts off the squared distance from the oldest two points and adds distance from newest points

Gesture Detection Intention Detection



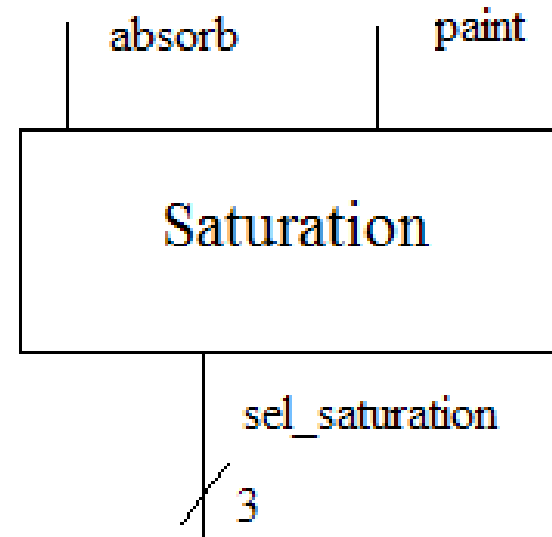
- Determines if the user is trying to pick up paint from the palette or trying to paint
- Looks at the left center of mass
- If the user is picking up paint, intention generator also outputs color

Paint Genesis



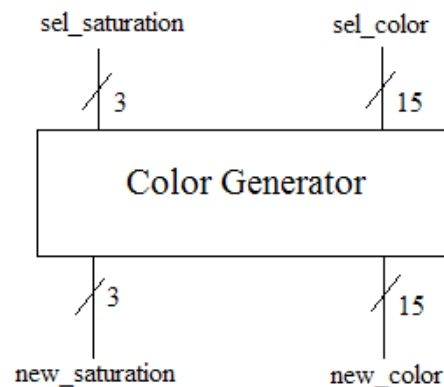
Paint Genesis Saturation Module

- Keeps track of whether the saturation is increasing or decreasing
- Interacts with Intention & ColorGen modules
- Counts the number of absorb or paint signals at 65mHz
- sel_saturation is either -1 or +1



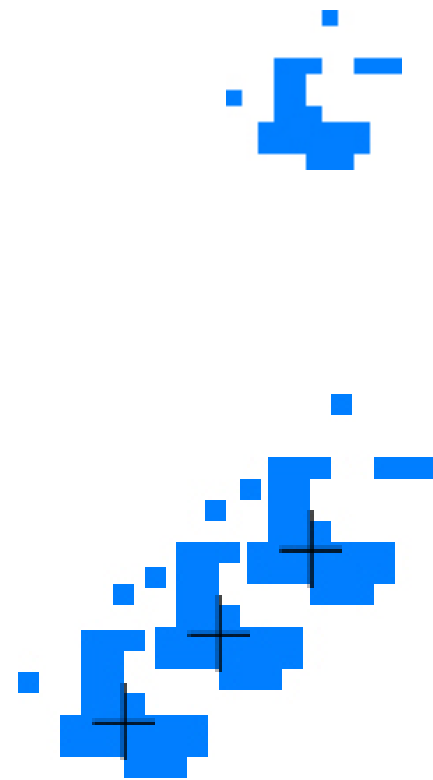
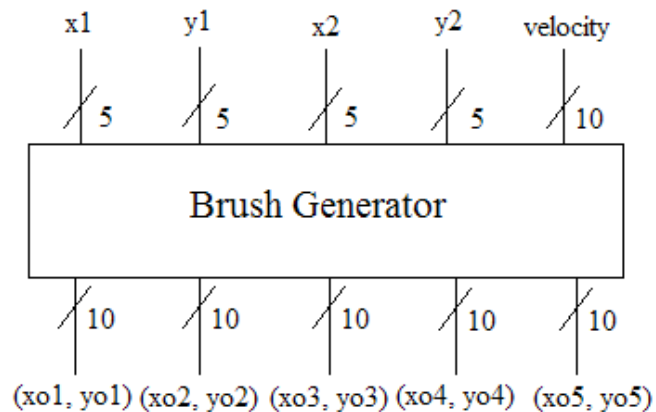
Paint Genesis Color Generator

- Remembers and modifies the current color on the paintbrush
- Keeps internal state of color and saturation
- $\text{color} = a * \text{curr_color} + (1 - a) * \text{sel_color}$
- $\text{saturation} = \text{curr_saturation} + \text{sel_saturation}$

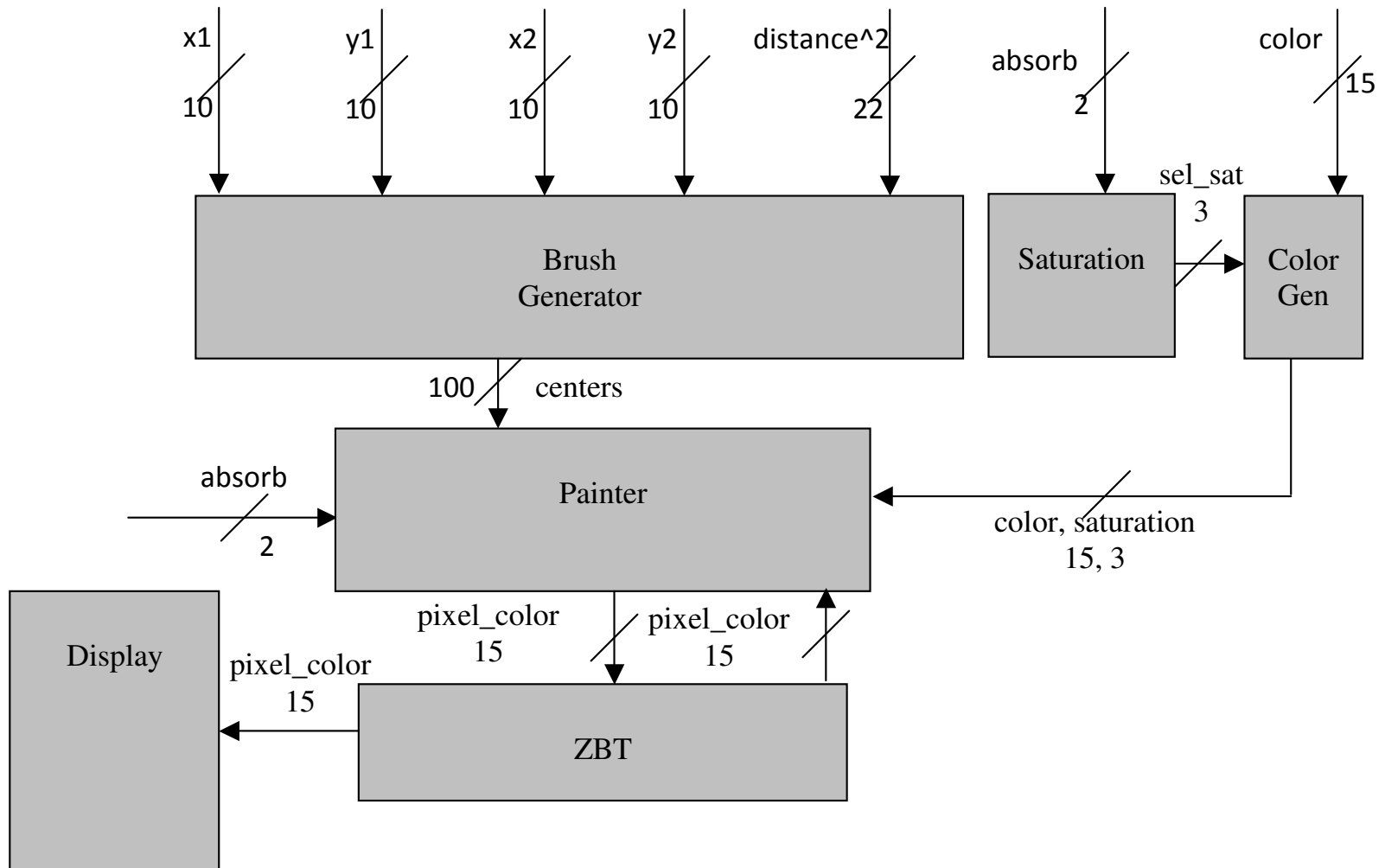


Paint Genesis Brush Generator

- Takes the (x, y) coordinates & velocity
- Makes three equidistant, intermediate points
- Total of 5 (x, y) points to use as centers of blobs

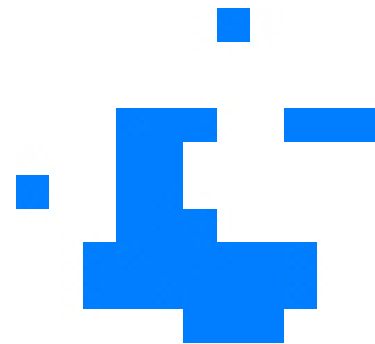


Paint Genesis Painting



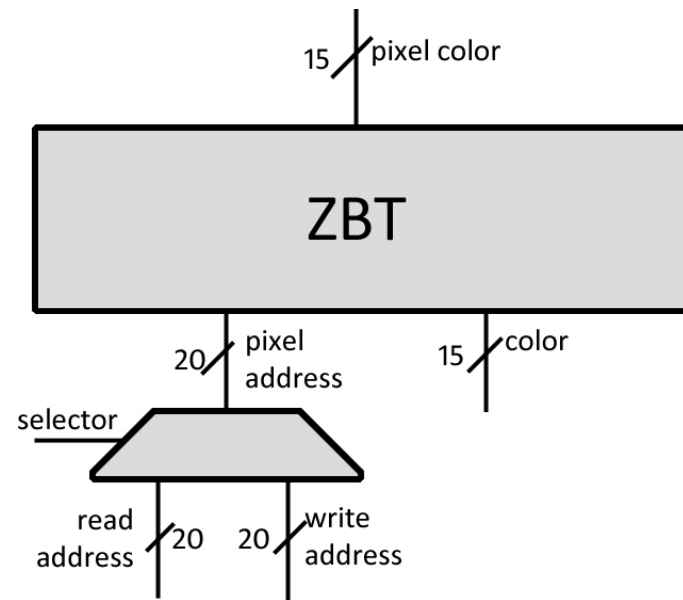
Paint Genesis Painter module

- Gets color information for pixel
- Determines whether the color changes
- Weights previous and paintbrush colors
- Creates new color
- Writes new color into ZBT
- 5 clock cycles



Paint Genesis Picture ZBT

- Stores pixels of the picture, RGB value = 18 bits
- Clocked at 80MHz
- Interact with Painter & Display modules
- Painter writes current, reads 5 pixels ahead
- Display reads current pixel to display



Paint Genesis Display

- Shows picture and positions of LEDs
- Displays a new frame at 60Hz
- Fetches color information for at 40MHz



Schedule

Monday	Tuesday	Wednesday	Thursday	Friday	Sat/Sun
November 10	11	12	13	14	15
		Saturation & Brush Generator & Color Generator & Display			
		Filter & Center of mass			
17	18	19	20	21	22
ZBT & Painter					23
Velocity & intention			Integration		
24	25	26	27	28	29
Integration					Expansion
					Expansion
December 1	2	3	4	5	6
Expansion					7
Expansion			Integration		
8	9	10	11	12	13
					14

Expansions

- Intention detection
 - Circular motions to absorb color
 - Blinking LED
- Paint genesis
 - Additional brush options
 - Fading of paint
- Game
 - User attempts to match system motions