VR Based Smart Board

Team Details:

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Problem Statement

- To use human finger as a pen in virtual space which can be used to write things /draw images.

Initial Approach

- Using skin detection to recognize finger tip
- Recognizing hand out of the image
- Gesture Recognition and performing operation based on the two distinct gestures

Hand Segmentation

- Approaches tried

  – *Background Subtraction*

    - **KNN**
    - MOG

  – *Skin Detection*

    - YcbCR Space
    - **HSV Space**
    - Face Detection Using HAAR Cascade Classifier
    - Contour Detection and Thresholding

Gesture Recognition

- Key Elements
  - Contour Centroid--a
  - Farthest Finger Tip--b
  - Distance between a & b

- Gestures
  - Marker is on
  - Marker is off

Results

Results

Results

Issues

- The computation that performs max contour detection and convex hull creation was expensive and making system slow
- Finger tip detection was not accurate because of illumination issues and similar skin region in the frame
- Challenges to get more than two gestures

Issues

Another solution

- We didn’t need the hand, just the finger tips.
- So why bother for the hand, if we can just focus on the fingertips.
- So, we thought of colour coded markers for fingertip detection.

Marker Detection

- We used 3 different markers for different operations
- To detect colour range of marker, we've made a separate application
- We are working on HSV colour space

result

h: 67

s: 159

v: 39

6:33 PM
5/10/2016

result

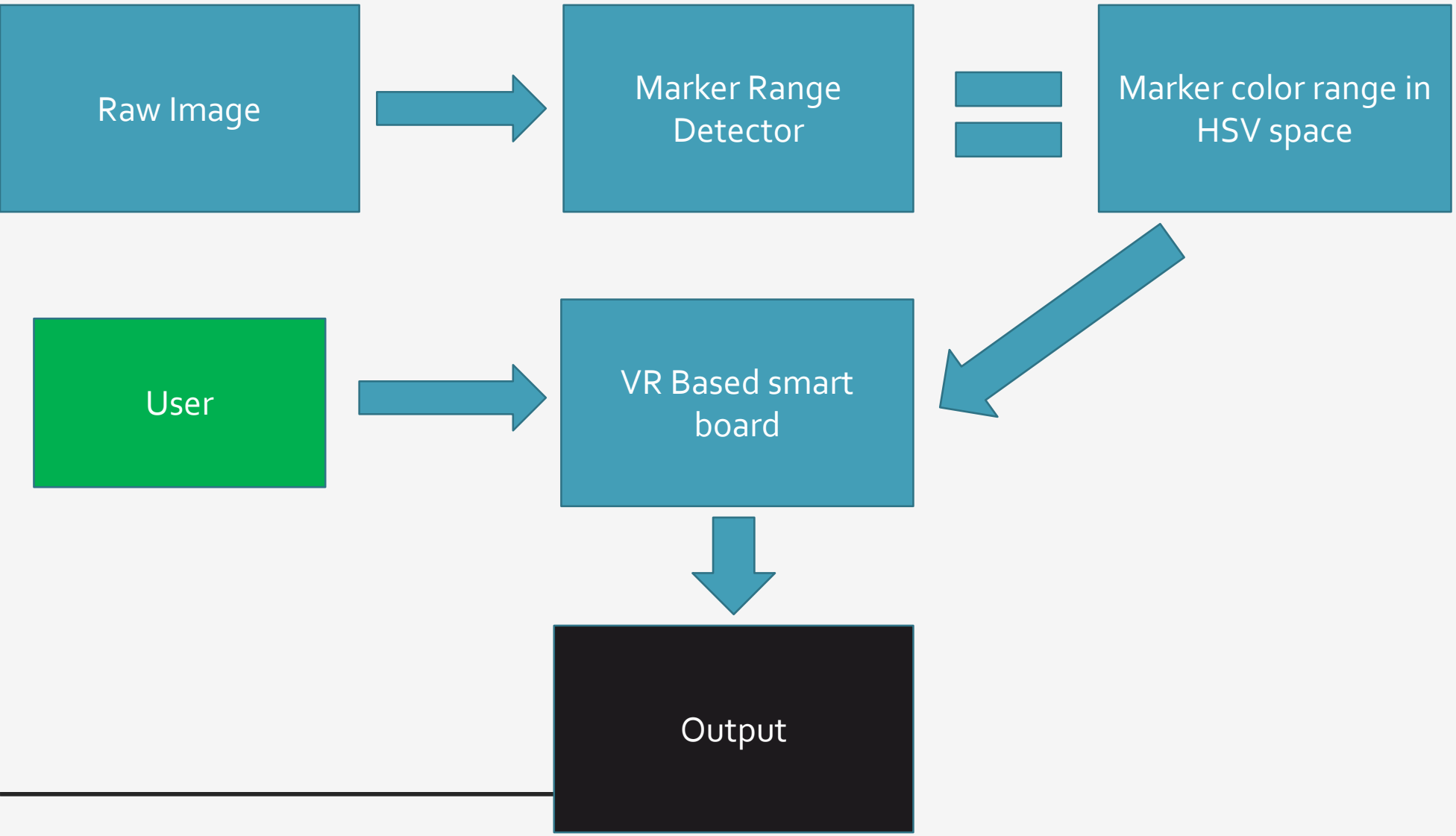
h: 0

s: 0

v: 0

6:34 PM
5/10/2016

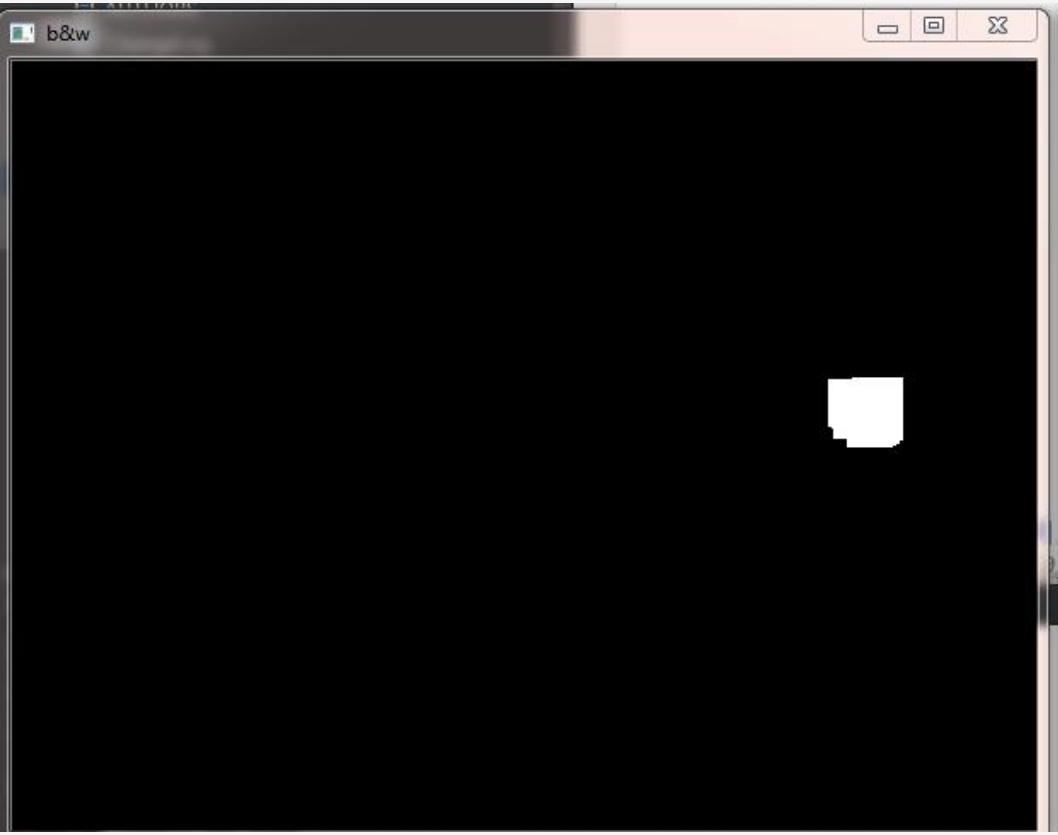
Application workflow

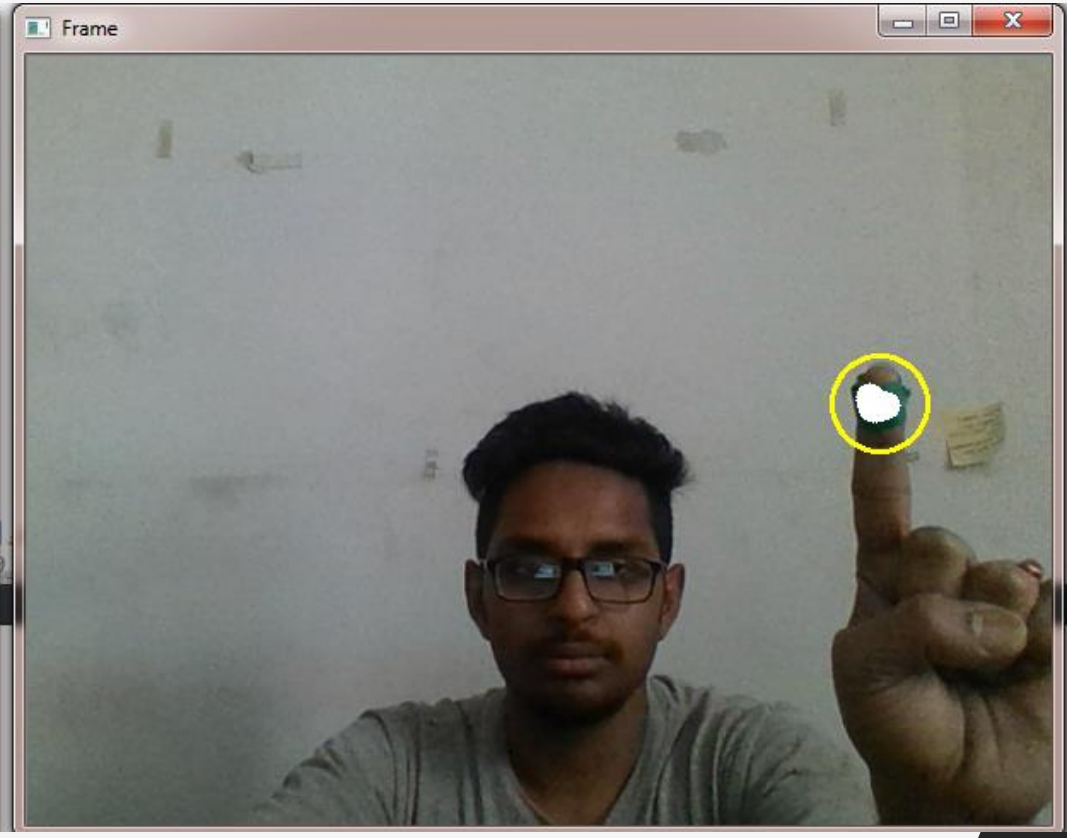


Operations

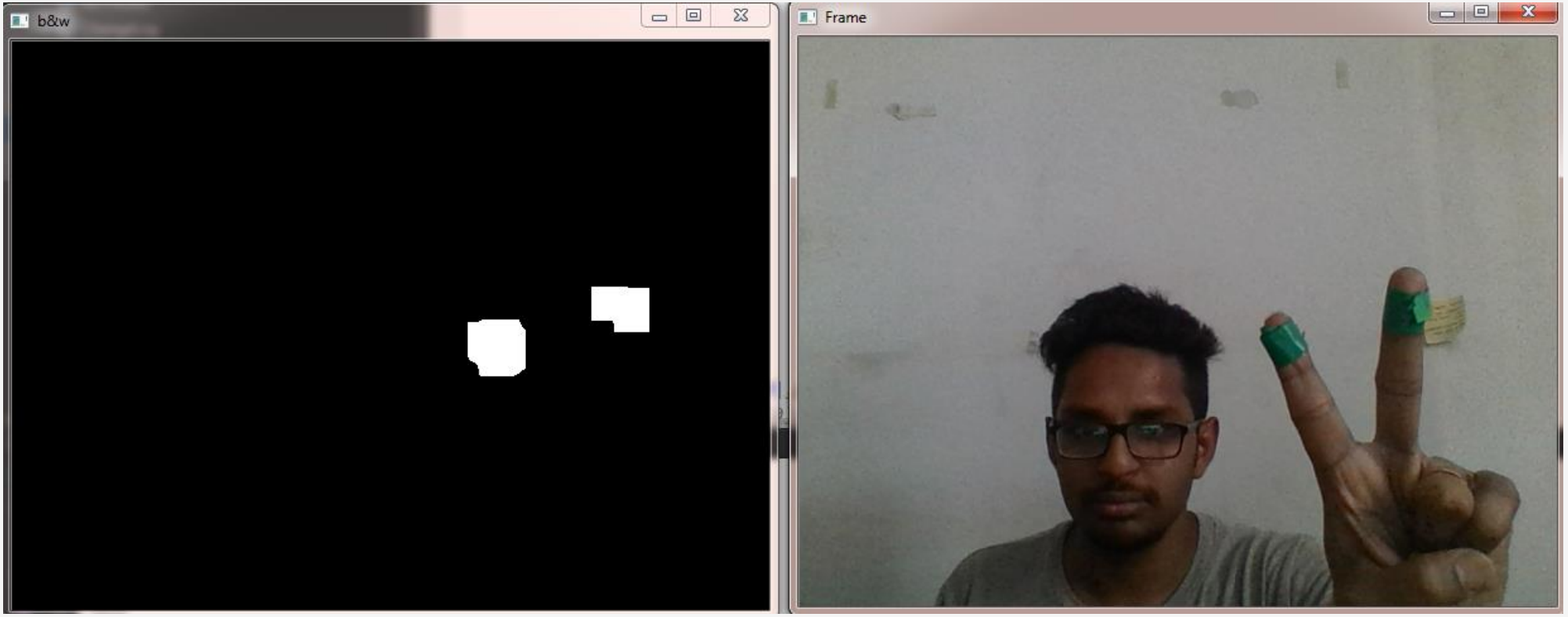
- **One marker:** virtual pen gets activated and now we can write into space.
- **Two markers:** we are saving the frame as an image in a separate folder.
- **Three markers:** acts as a reset marker, will erase everything from the board.

Gesture to write: One marker

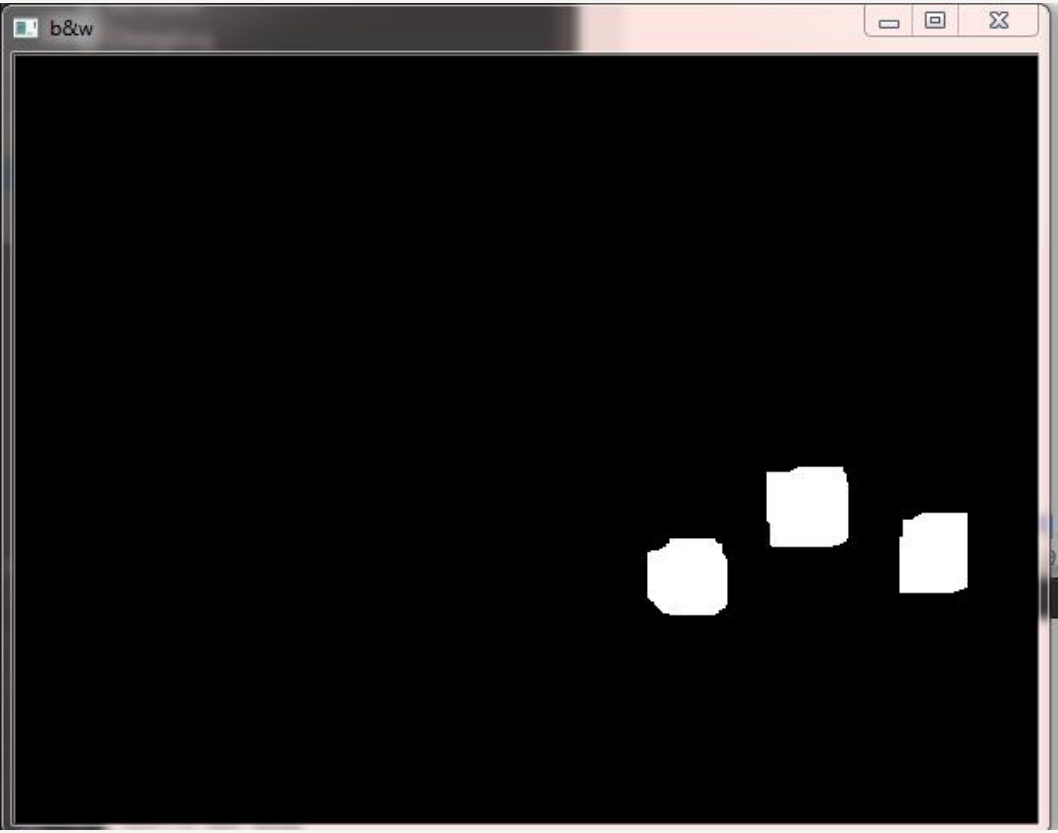


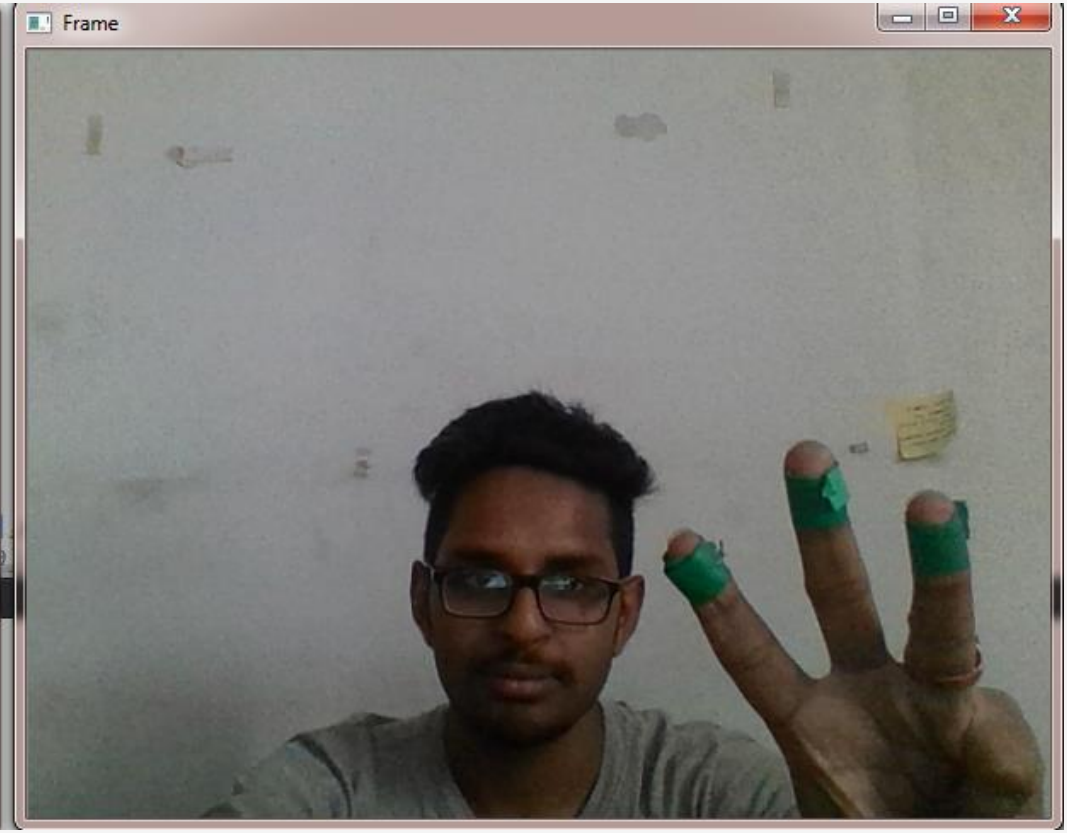


Gesture to save: Two markers

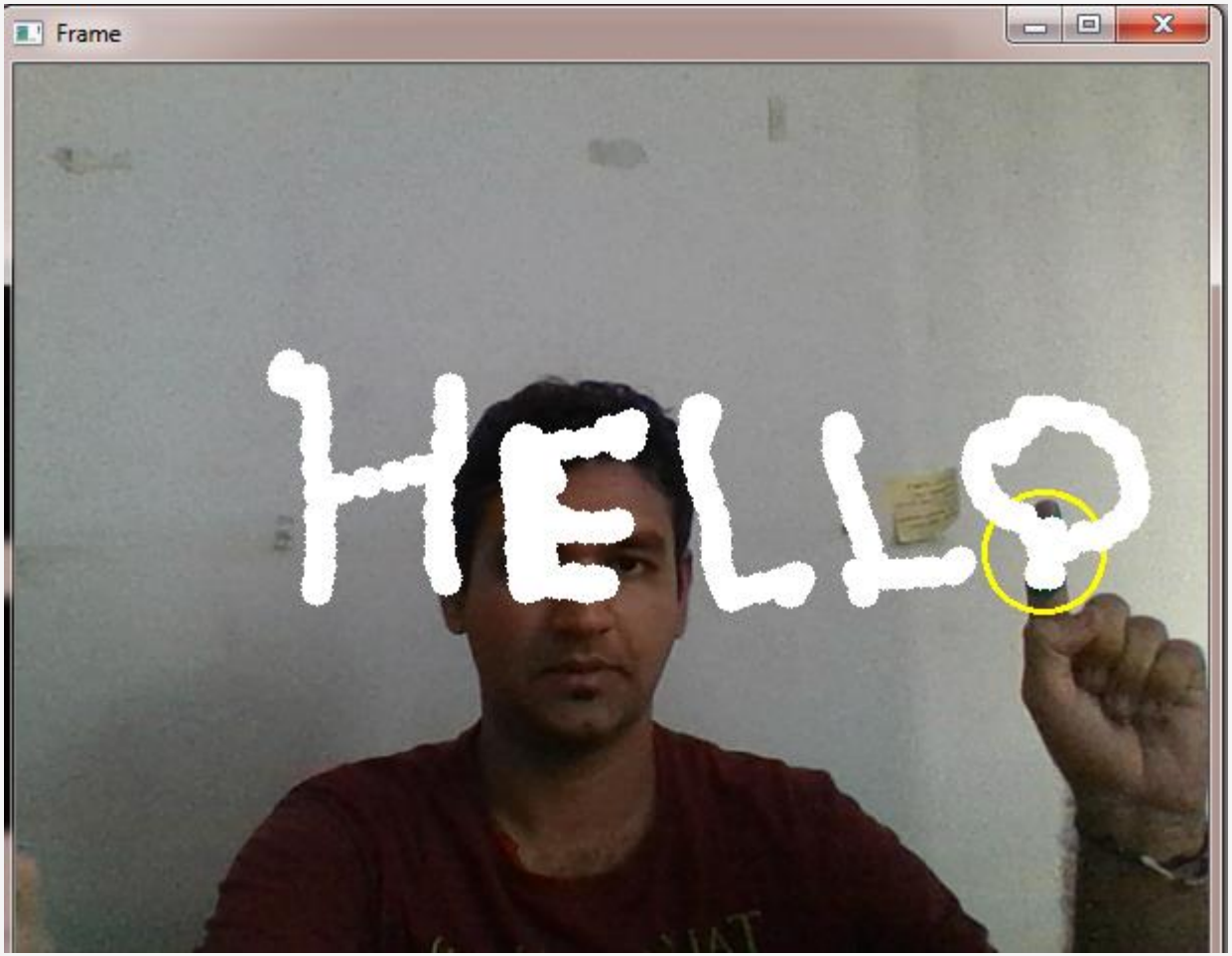


Gesture to reset: Three markers

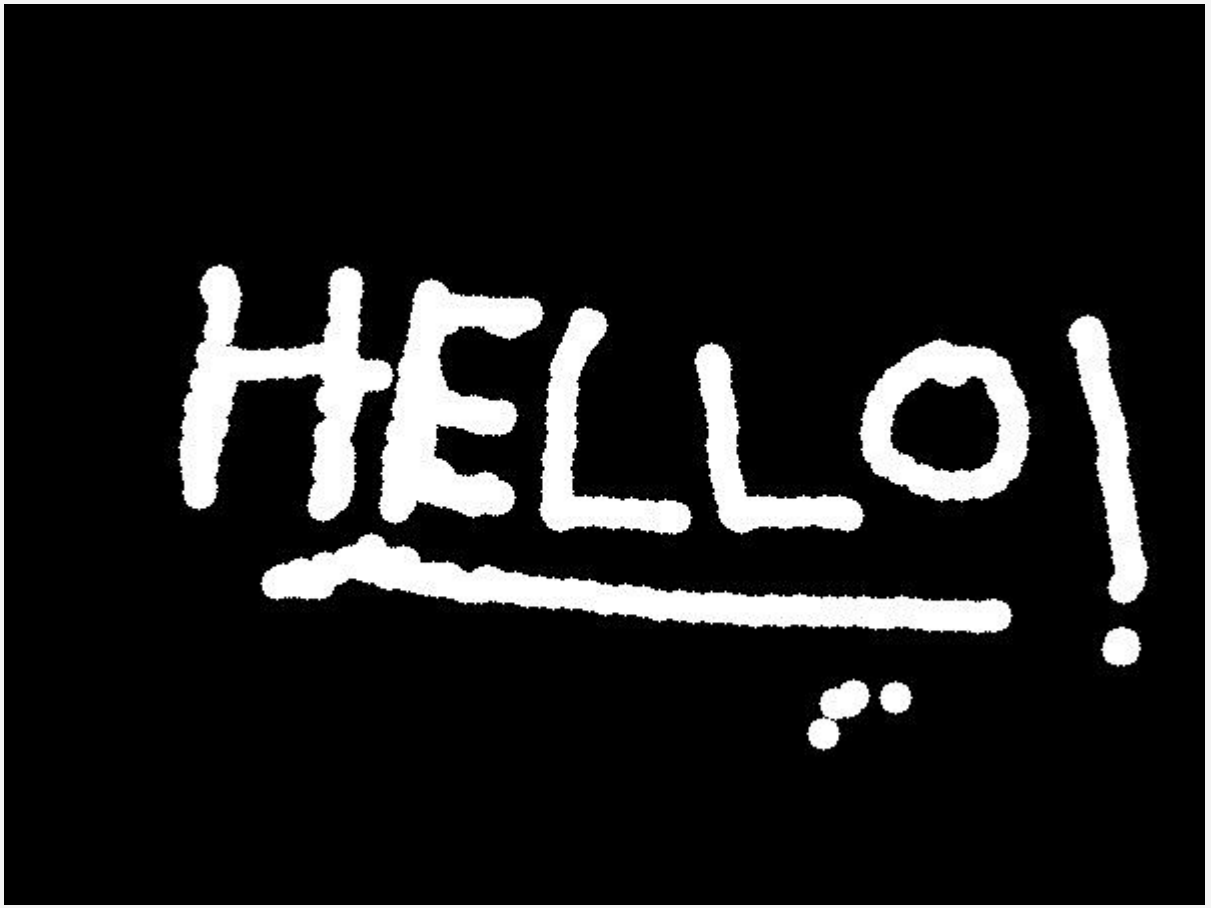




Writing into space



Saving the frame



Technical Details: Marker Detection

- Convert the frame into HSV space.
- Using trackbar, we are removing noise and other objects from background, therefore leaving just marker.
- Obtained colour range will be fed to the main application.

Technical Details: Using virtual pen

- Thus, a binary frame is generated from the **inRange** function which can be used to find area and number of contours.

- A single contour indicates the pen is ON, based on the area beyond the threshold. The writing point would be centroid of detected contour which is detected from the **moment function**, and gets fed into an array.

Technical Details: Save frame, reset

- If two contours are detected, current frame is saved in the form of image in black and white colour.
- The frame names has time-stamp associated with it. Frames will be saved only if there is a change in previous frame.
- If three contours are detected, we RESET.

Limitation and Challenges

- Illumination
- Same marker colour in background
- Feasible distance from camera
- Takes time to get along with the application
- Handwriting Recognition problem


Frame
Q&A