# Contactless Fingerprint Region Detection

IMAGE PROCESSING

PREPARED BY: TUSHANT(11015370)

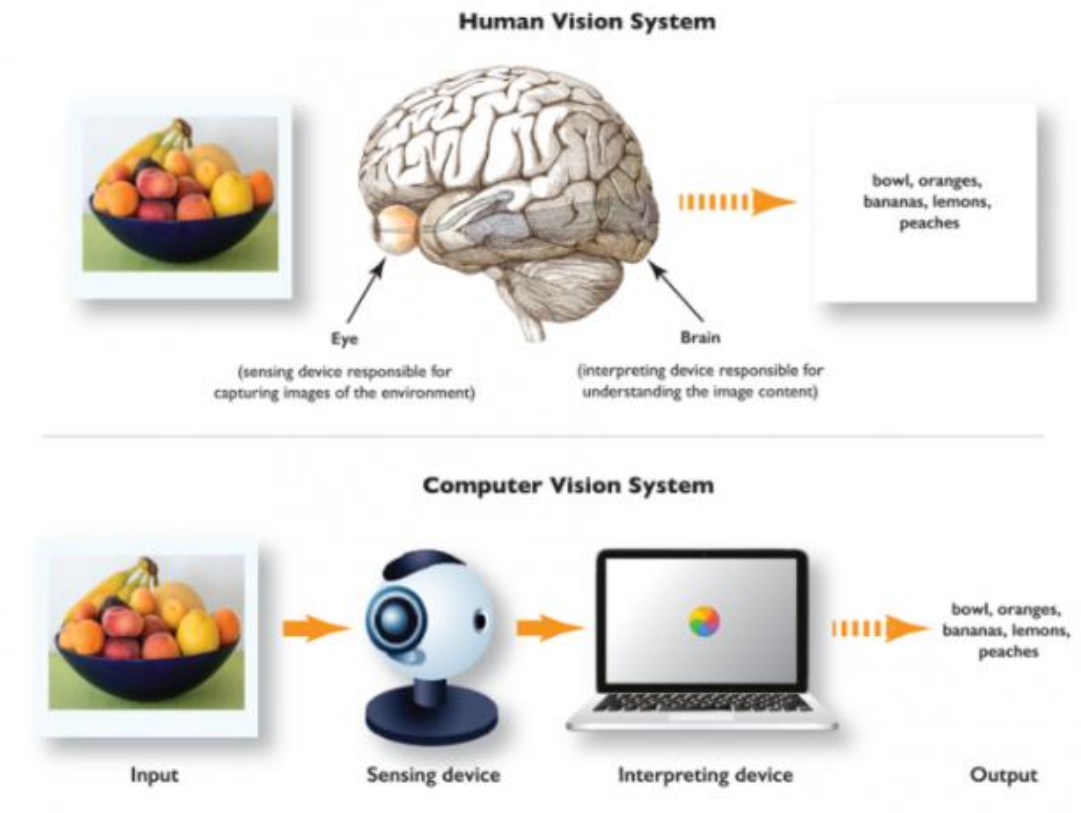
SUPERVISE BY: PROF. CHRISTOF JONIETZ

# Topics

- What is Computer Vision?
- Project Objectives
- Code Implementation using Flow Chart
- Skin tone Segmentation
- Image Enhancement
- Segregation of Fingers
- Region of Interest

# What is Computer Vision?

- Computer vision is a branch of computer science that focuses on developing digital systems that can process, interpret, and comprehend visual input (pictures or videos) in the same manner as people can. The notion of computer vision is centered on training computers to analyze and analyze images at the pixel level. Technically, machines use sophisticated software algorithms to retrieve visual input, process it, and interpret the findings.

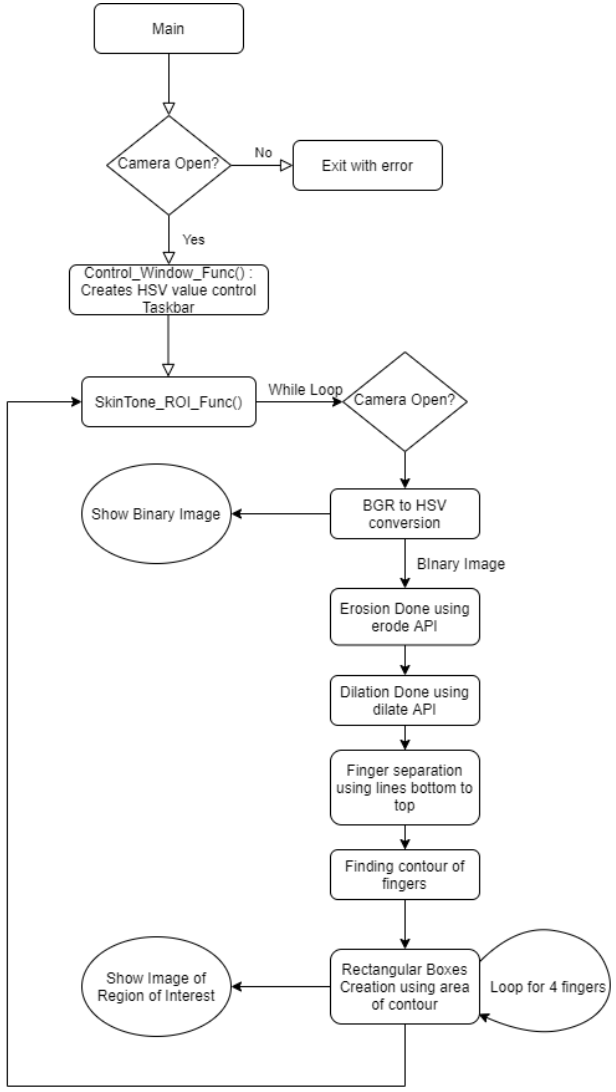



Source: https://xd.adobe.com/ideas/principles/emerging-technology/what-is-computer-vision-how-does-it-work/

# Project Objectives

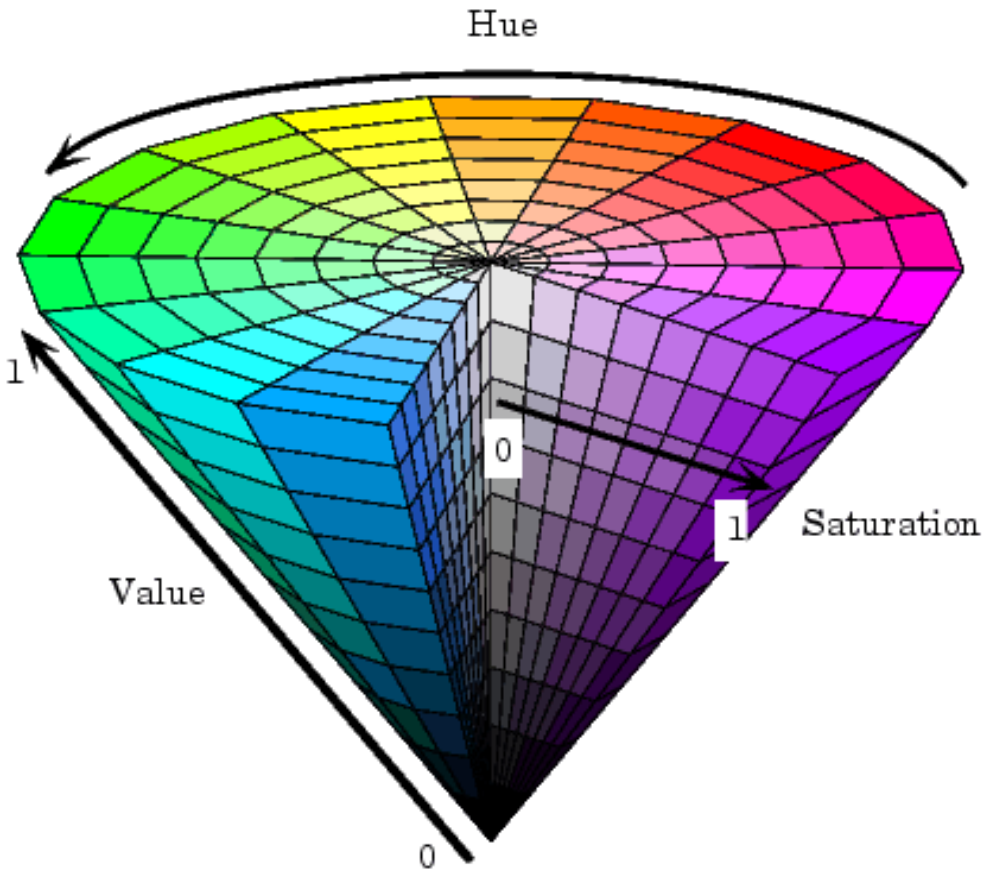
- In this project, I wrote code(In C++ using OpenCV library) to create a contactless fingerprint detection software for biometric applications that will use inbuilt video camera.
- Binary Image(HSV Image)  and Ultimately Region of Interest(i.e., Fingerprint area of all fingers) will be shown in real time.

# Code Implementation using Flow Chart



# Skin Tone Segmentation

- Camera by default give output in BGR format. To differentiate the skin tone, we need HSV(Hue, Saturation and value). cvtcolor API will be used to do so.
- It is complex to process the BGR image, so that is also a reason for converting to HSV format.




Source: http://www.ece.northwestern.edu/local-apps/matlabhelp/toolbox/images/color11.html

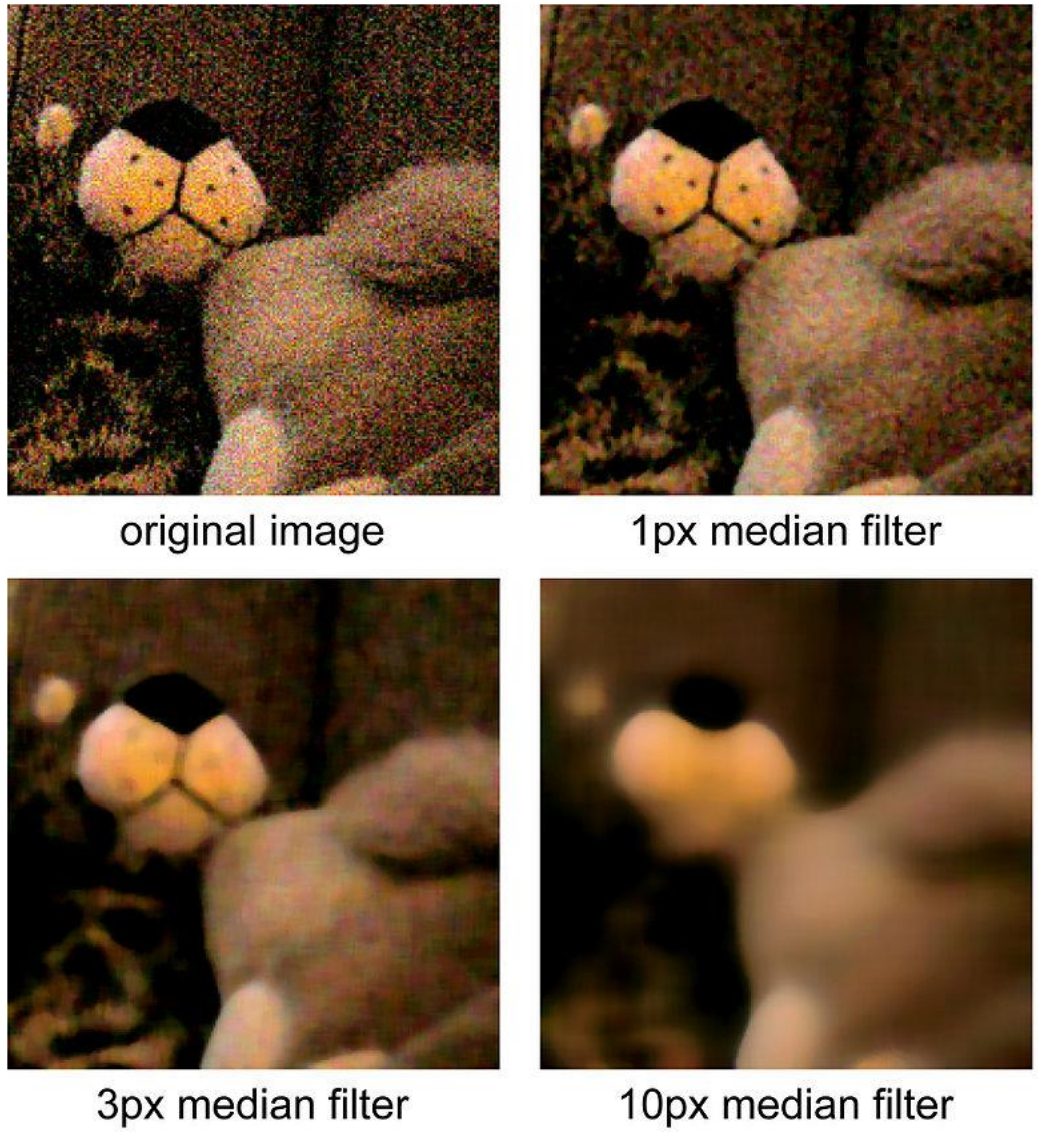
# Image Enhancement

- Three types of Enhancement techniques are used:
  1. Image Smoothing (medianBlur openCV API is used)
  2. Erosion (erode openCV API is used)
  3. Dilation (dilate openCV API is used)

  Note: Keep Erosion only gives better result.

# Image Smoothing

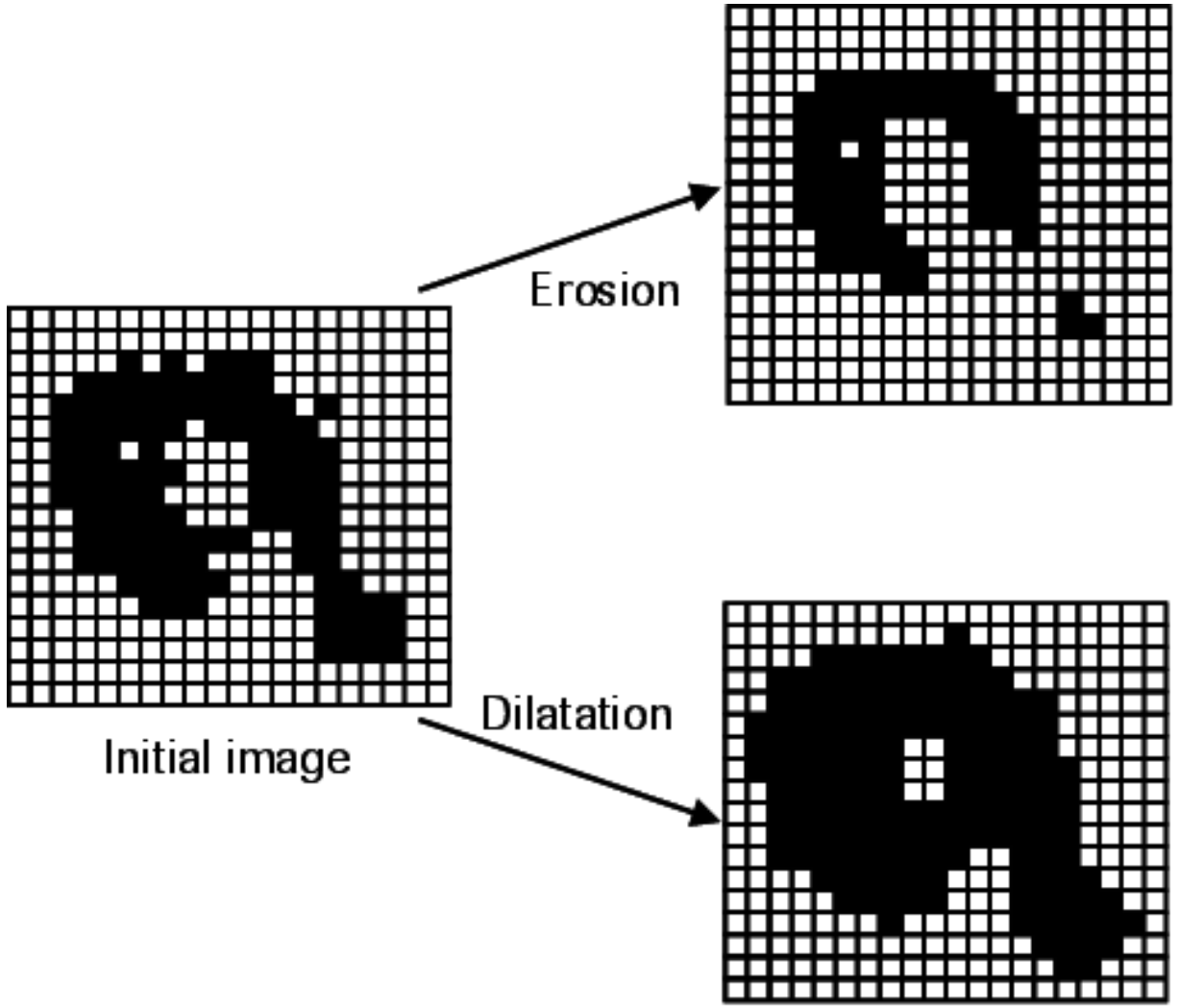
- The median filter(medianblur OpenCV API is used) is a non-linear digital filtering technique, often used to remove noise from an image or signal. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image).




Source: https://en.wikipedia.org/wiki/Median_filter

# Erosion and dilation

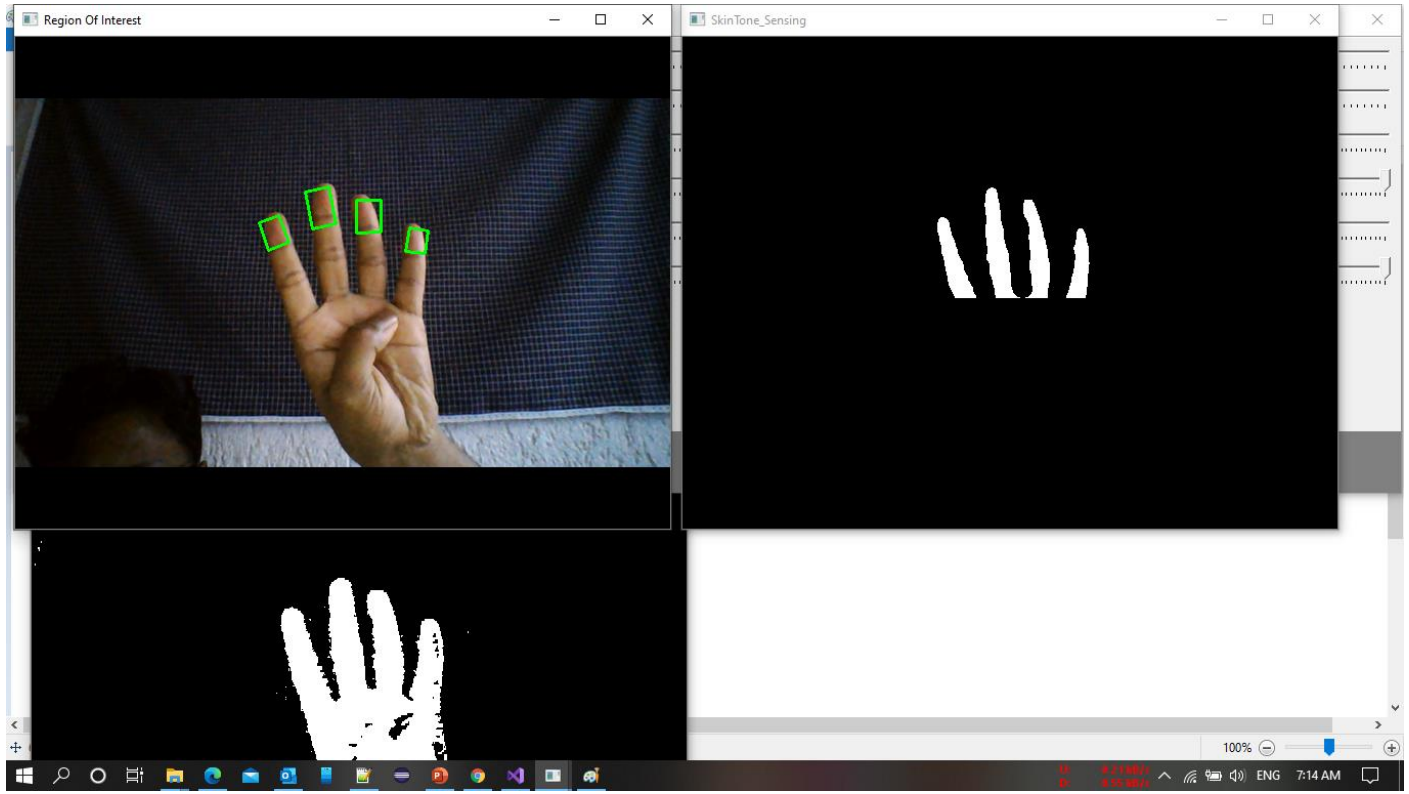
- Dilation and erosion are two fundamental morphological operations. Dilation adds pixels to the boundaries of objects in an image, while erosion removes pixels on object boundaries. The number of pixels added or removed from the objects in an image depends on the size and shape of the structuring element used to process the image.




Source: https://www.researchgate.net/figure/Principle-of-erosion-and-dilatation_fig9_281013570

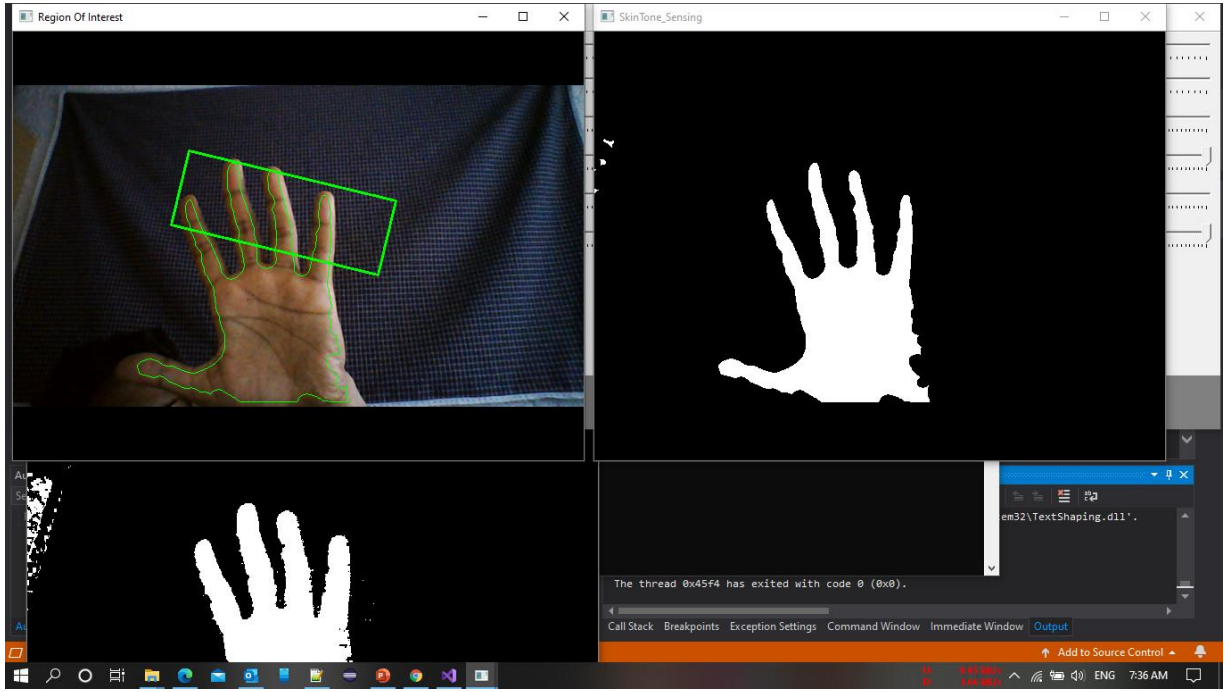
# Segregation of Fingers

- To obtain Segregation of fingers from palm, horizontal black lines must be drawn from bottom to top on the binary image.
- For this purpose, connectedComponents() OpenCV API is used. If connected components reaches more than 2 this means fingers are segregated.

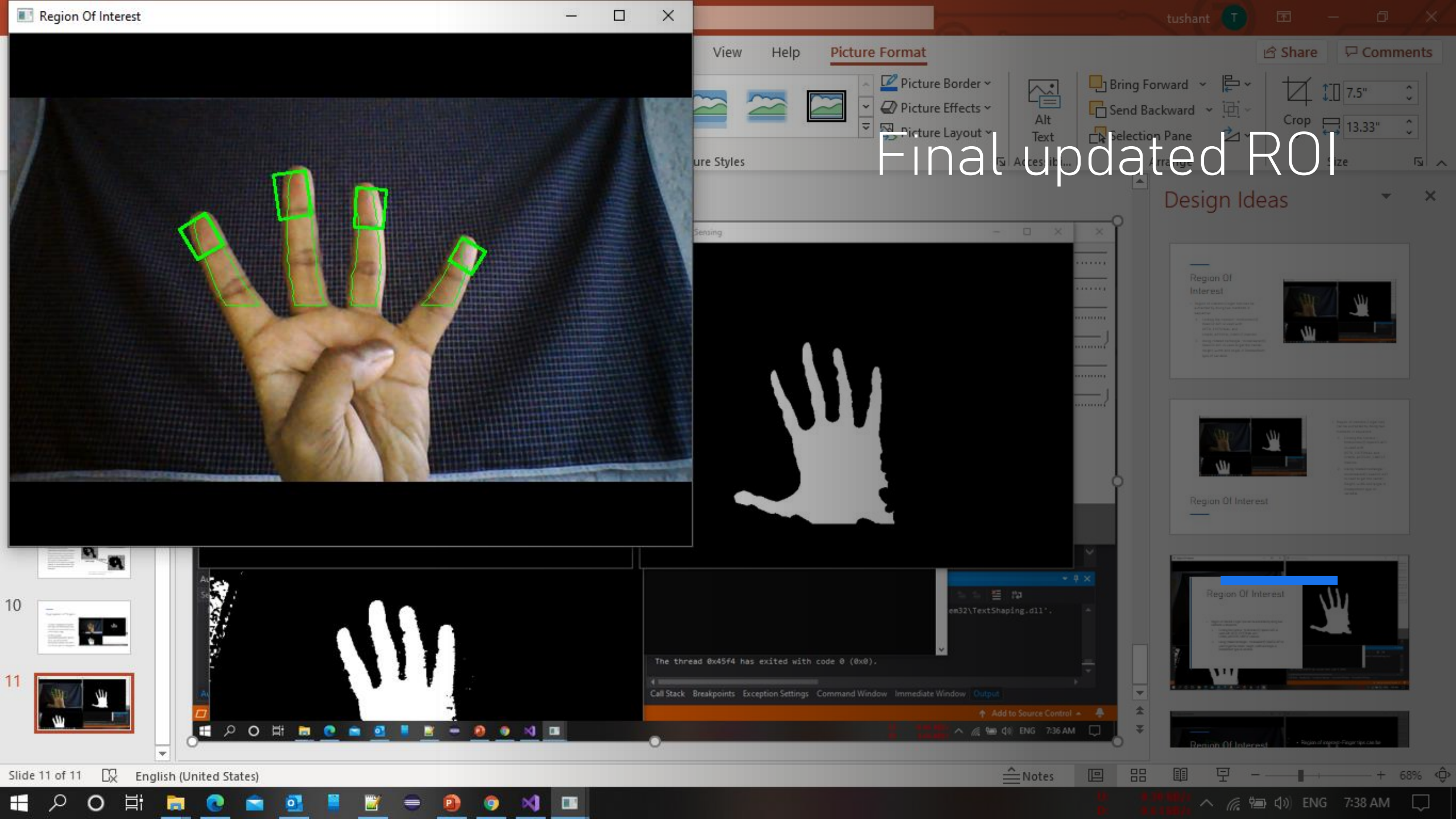


# Region Of Interest

- Region of interest-Finger tips can be extracted by doing two methods in sequence:
  1. Finding the Contour : findContour() OpenCV API is used with RETR_EXTERNAL and CHAIN_APPROX_SIMPLE macros.
  2. Using rotated rectangle : minArearect() OpenCV API is used to get the center, Height, width and angle in RotatedRect type of variable.




My head created issue in connected component algorithm


Region Of Interest
Final updated ROI
View
Help
Picture Format
Share
Comments
Picture Border
Picture Effects
Picture Layout
Alt Text
Bring Forward
Send Backward
Selection Pane
Crop
7.5"
13.33"
Design Ideas
Region Of Interest
The thread 0x45f4 has exited with code 0 (0x0).
Call Stack
Breakpoints
Exception Settings
Command Window
Immediate Window
Output
Add to Source Control
Slide 11 of 11
English (United States)
Notes
68%
ENG
7:38 AM

# Demo