FPGA based Real-time Eye tracking system

Final Presentation

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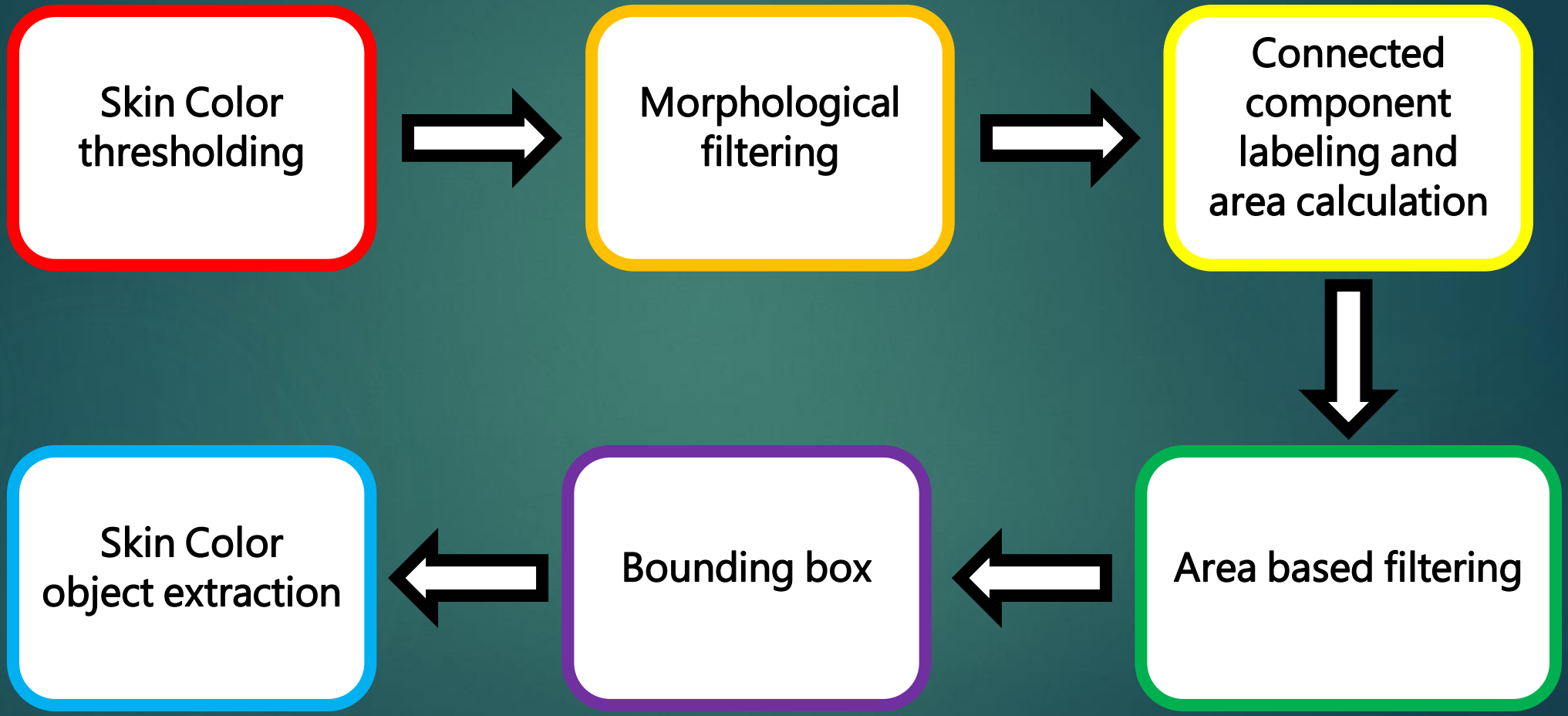
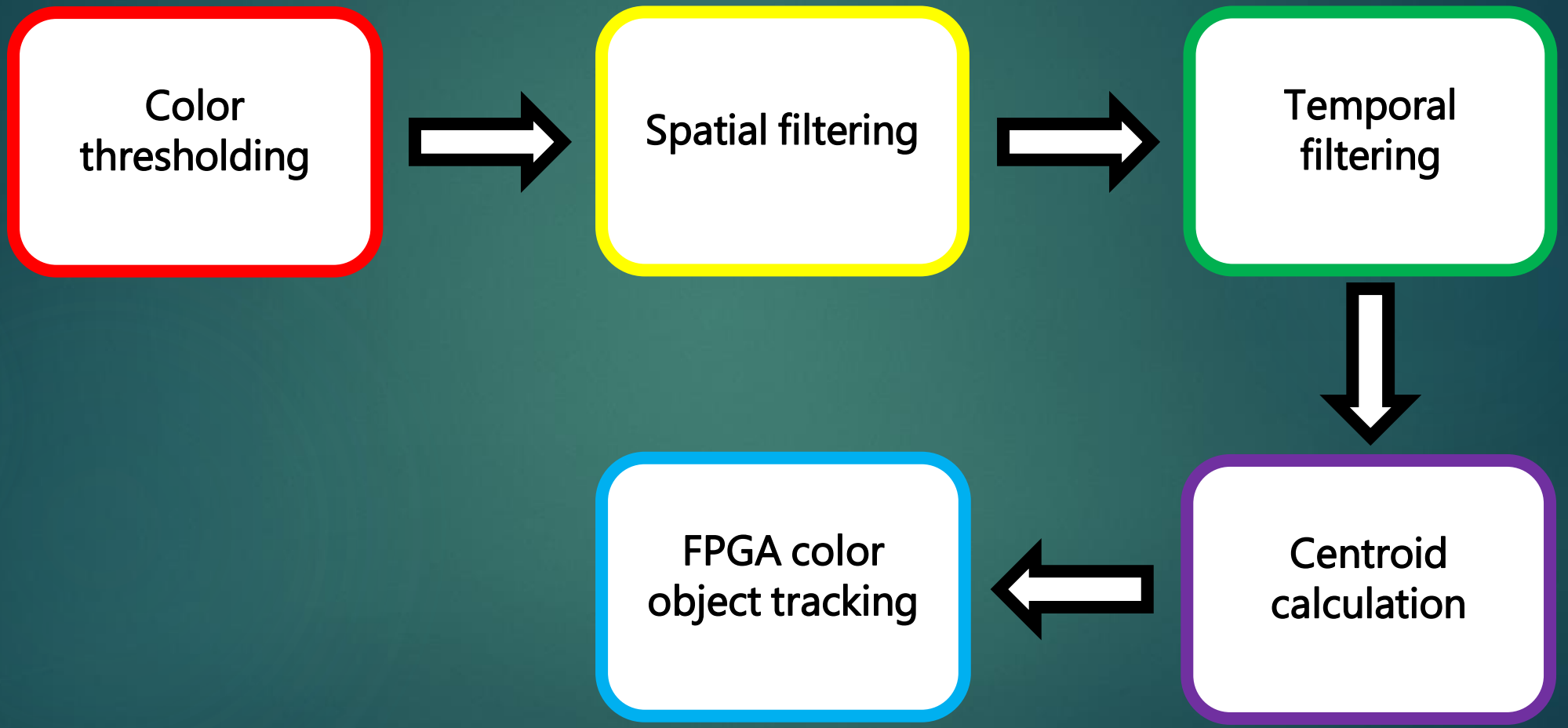
Introduction

- The system that will be implemented as my project will be a FPGA based system that will track the users eyes in real-time by using a single camera module.
- The advantages are, it's going to be much faster (real-time) than the current consumer products, it's going to be accurate and the power consumption will be much lower.
- The main disadvantage is the system won't be much flexible as a software based system.

Project Process - Matlab



Project Process - FPGA



Results - Matlab

Figure 1. Original Image

Figure 2. Skin color filtered image

Figure 3. Morphological Filtered Image

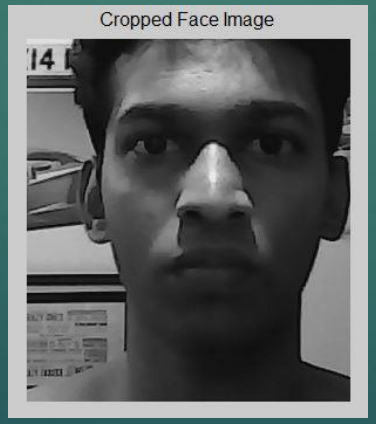


Figure 5. Automatically cropped skin color area

Figure 4. Centroid Calculated Image

Results - FPGA

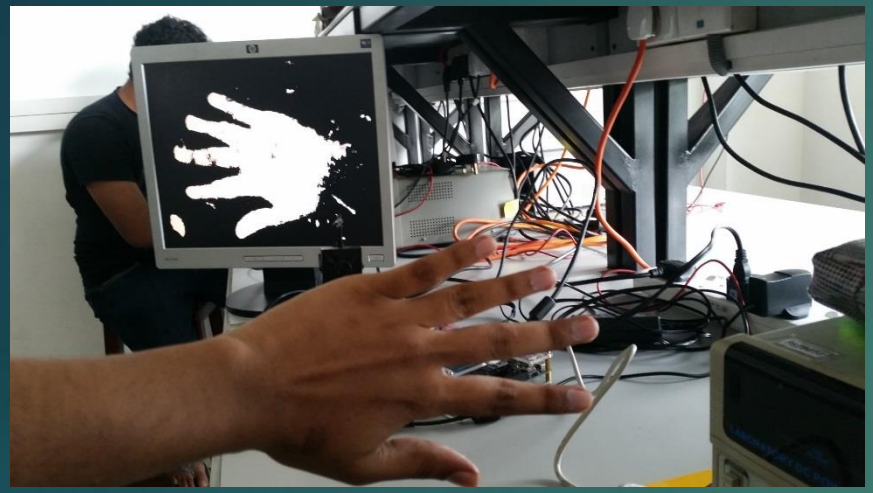


Figure 6. Color thresholding

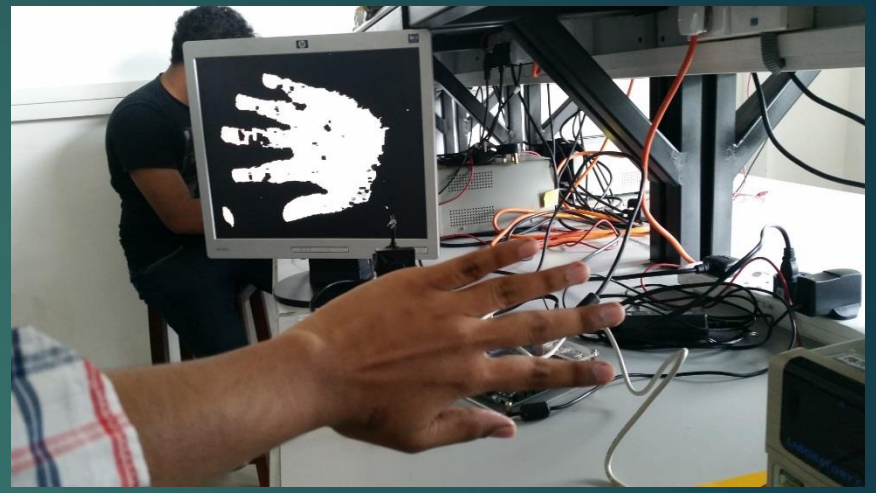


Figure 7. Spatial filtering

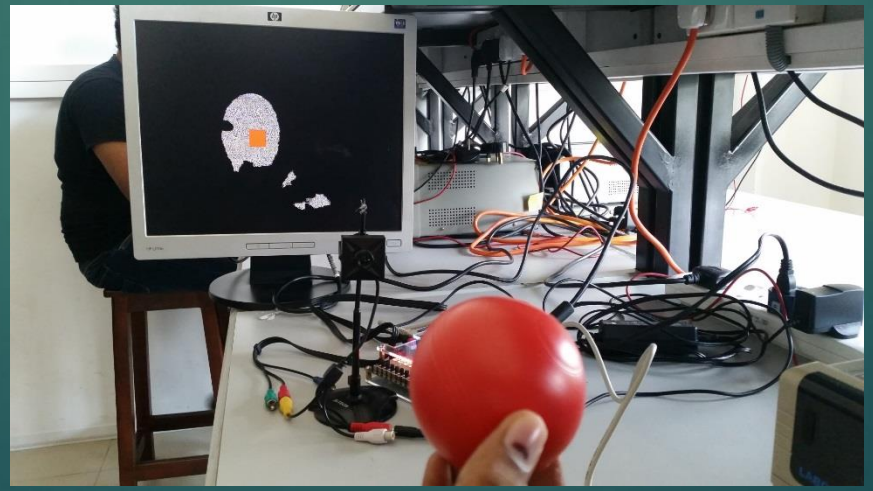


Figure 8. Temporal filtering & centroid calculation

Results - FPGA

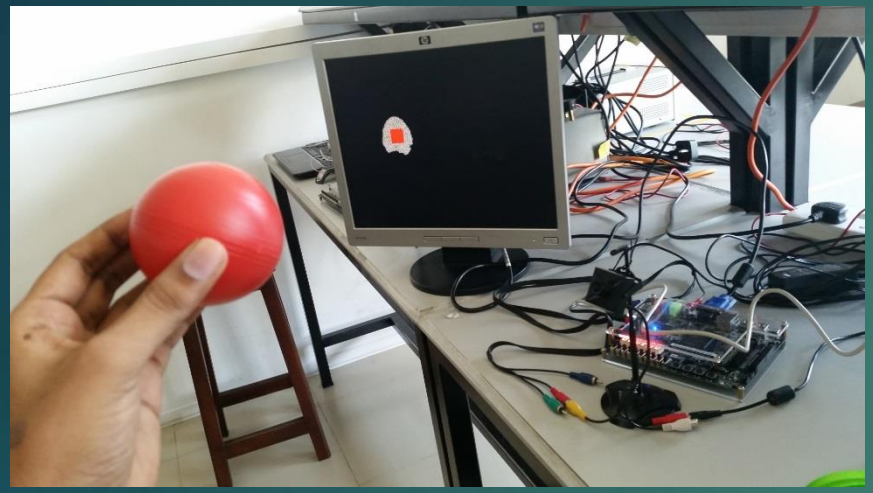


Figure 9. Red color object tracking

Figure 10. Green color object tracking

Figure 11. Skin color object tracking

Limitations

- FPGA system only tracks color objects such as Green, Red and skin color.
- Color filtering heavily depends on the lighting of the surrounding.
- Algorithm implementation in FPGA is very hard due to lack of available libraries.

Reference

[1]. Turk, M., Pentland, A., "Eigen faces for Recognition", *Journal of Cognitive Neuroscience*, 1991, vol. 3, no. 1, pp. 71-86.

[2]. Yang, M. H., Ahuja, N., Kriegman, D., "Face Detection Using a Mixture of Linear Subspaces", *In Proceedings of 4th IEEE International Conference on Automatic Face and Gesture Recognition FG00*, 2000, pp. 70-76.

[3]. Viola, P., Jones, M. J., "Robust Real-Time Object Detection", *Technical Report CRL 2001/01*, Cambridge Research Laboratory, Compaq, 2001.

[4]. Leung, T. K., Burl, M. C., Perona, P., "Finding Faces in Cluttered Scenes Using Random Labelled Graph Matching", *In Proceedings of 5th IEEE International Conference on Computer Vision ICCV95*, 1995, pp. 637- 644.

Thank You!