

Real-Time Camera Array Lecture Capture System



1. Introduction

Distance Education programs are rising in popularity, and classroom lectures are commonly recorded to host both in-person and online students. However, technical lectures that rely on several whiteboards are inhibited by current lecture recording techniques that reduce a teacher's workspace.

The Camera Array Lecture Capture (CALC) System enhances the learning of both in-class and online students by sending a real-time, video of multiple white boards stitched together. The system allows a teacher to utilize every whiteboard in the classroom and send a complete replica of the whiteboard notes to distance education students.

2. Hardware

Utilized hardware:

- 3 USB Logitech C920 Cameras
- 3 USB Extension Cables
- GEFORCE GTX 1080 (2560 NVIDIA CUDA Cores)

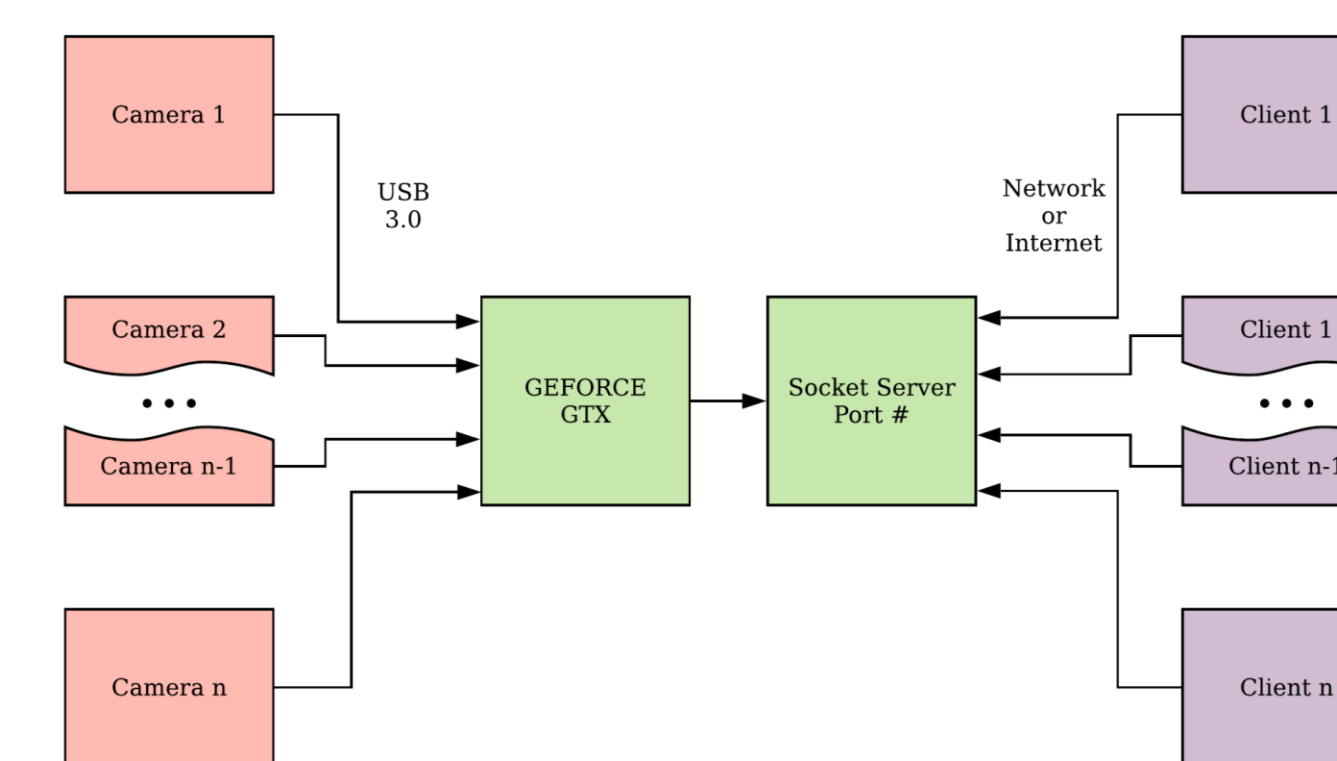


Figure 2.1: Hardware Block Diagram

3. Software

Figure 3.1 outlines the software flow of the CALC system.

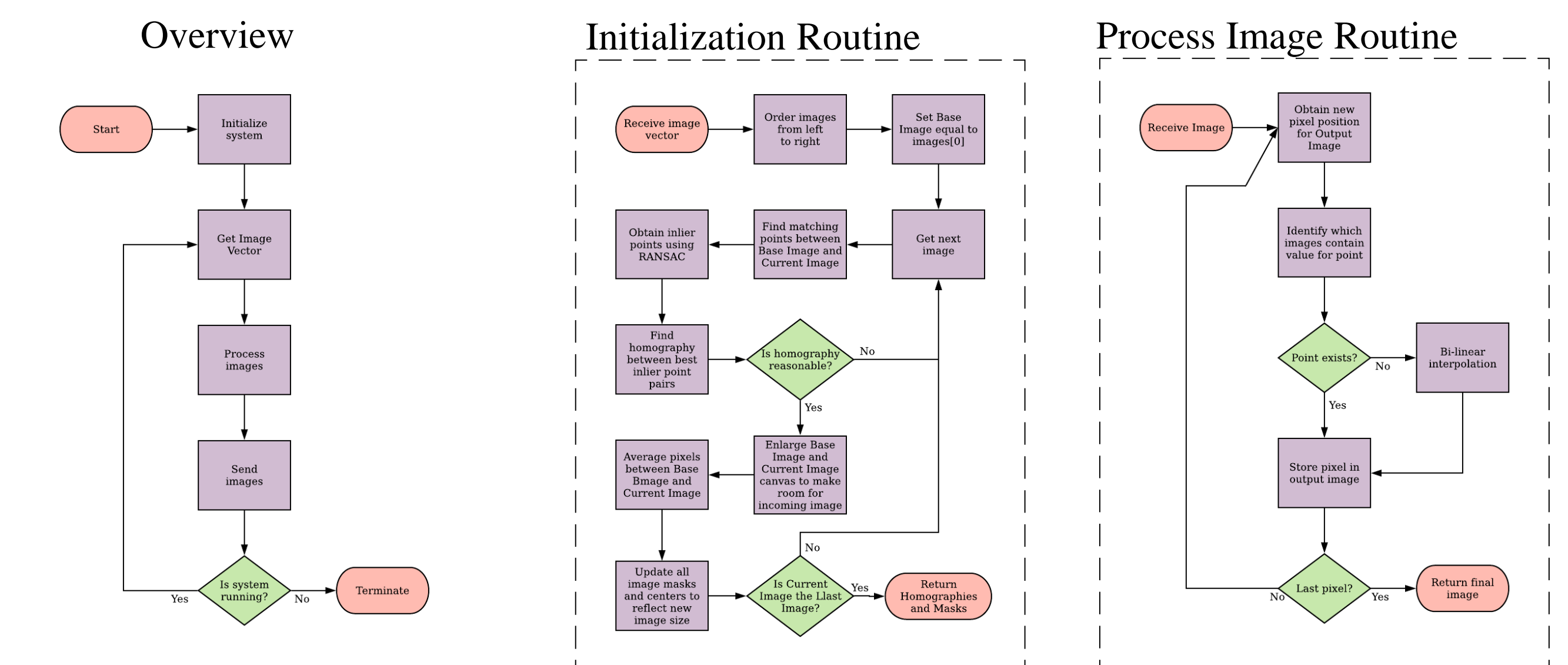
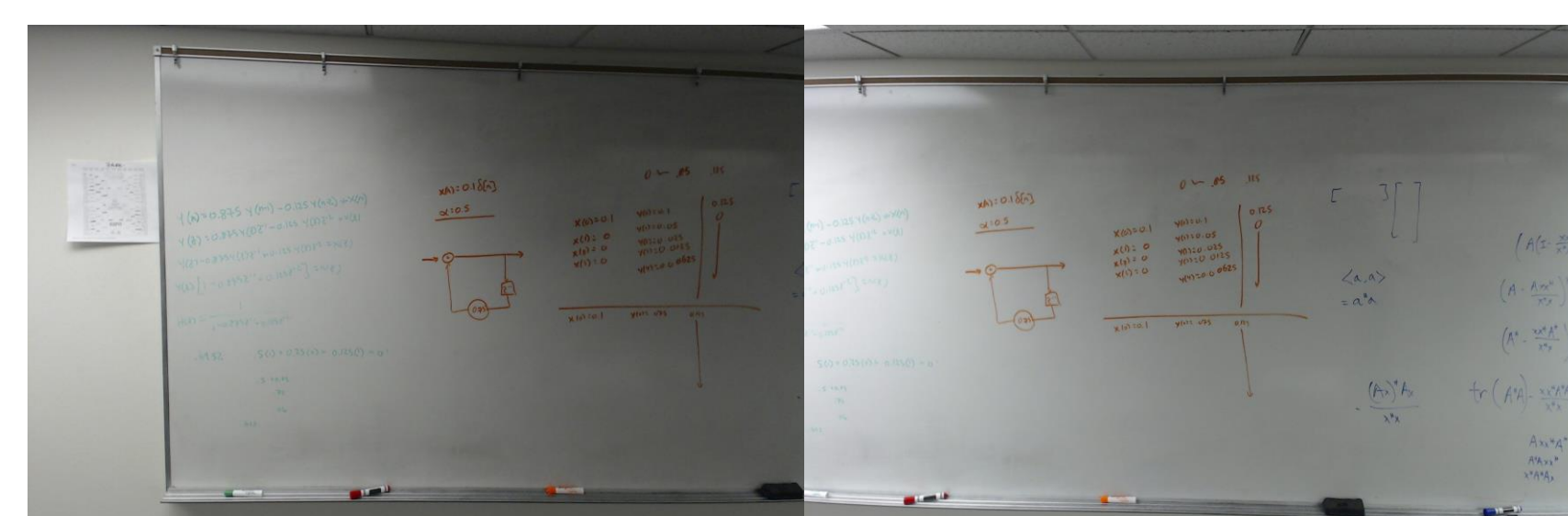


Figure 3.1: Software Flow Chart

4. Methods

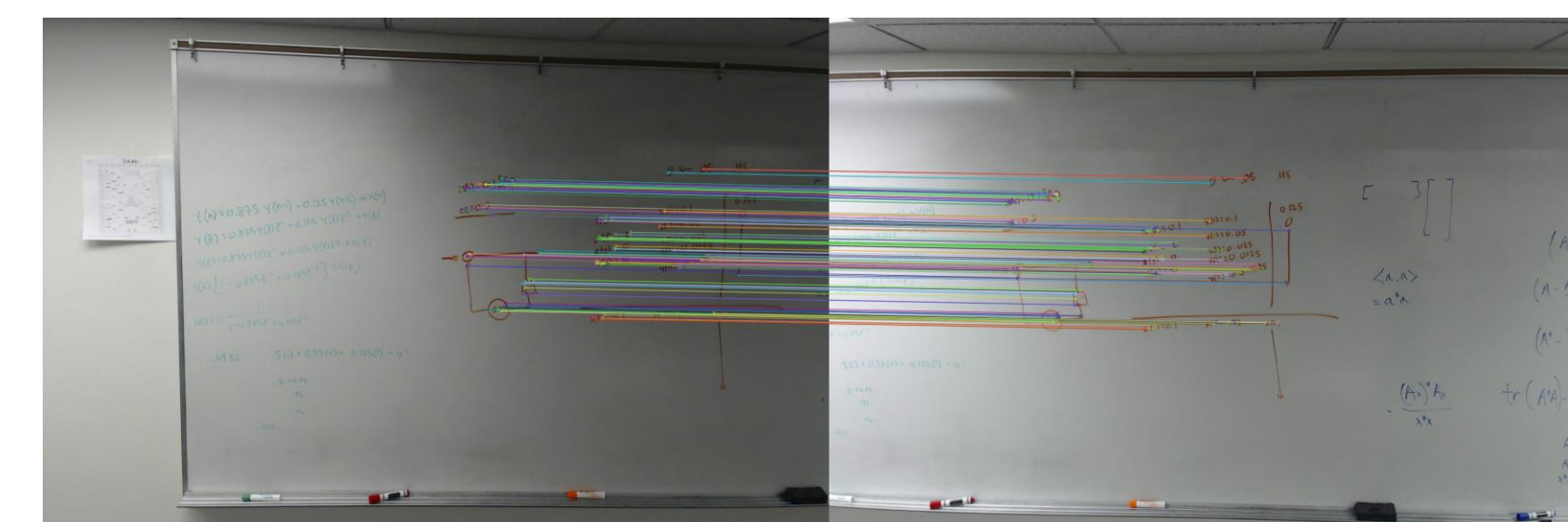
4.1 Capture Images



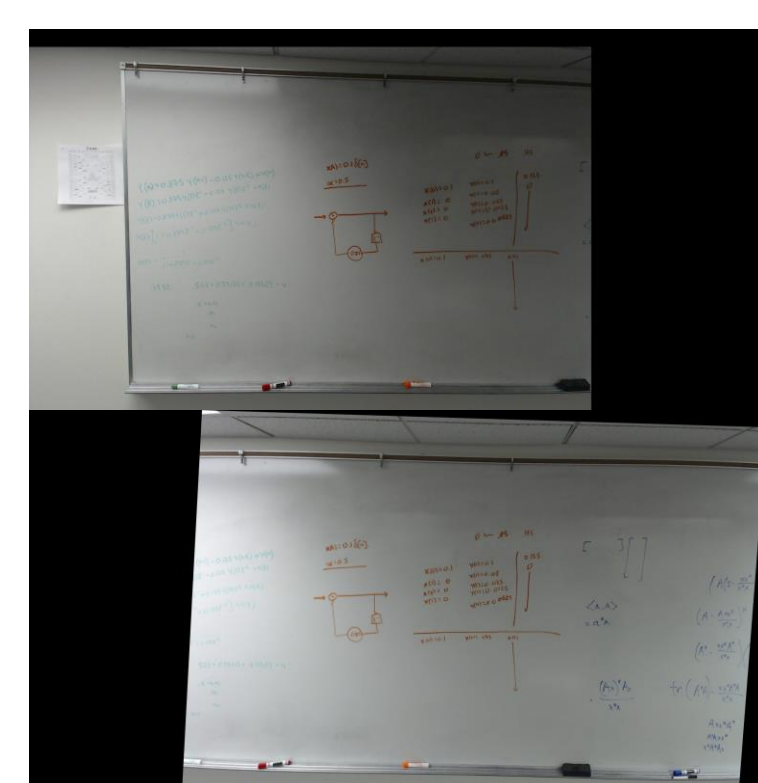
4.2 Apply SIFT



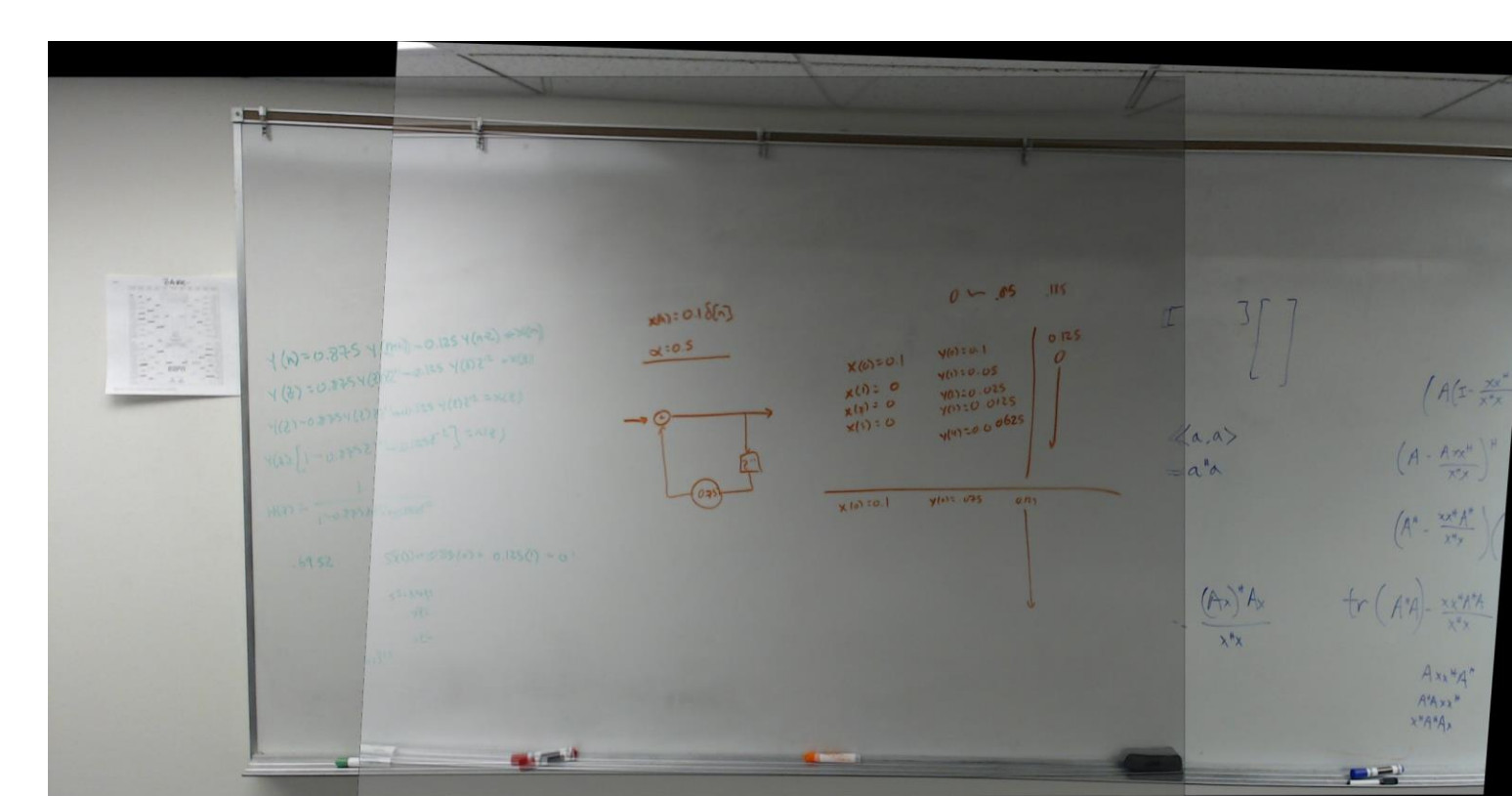
4.3 Classify using RANSAC



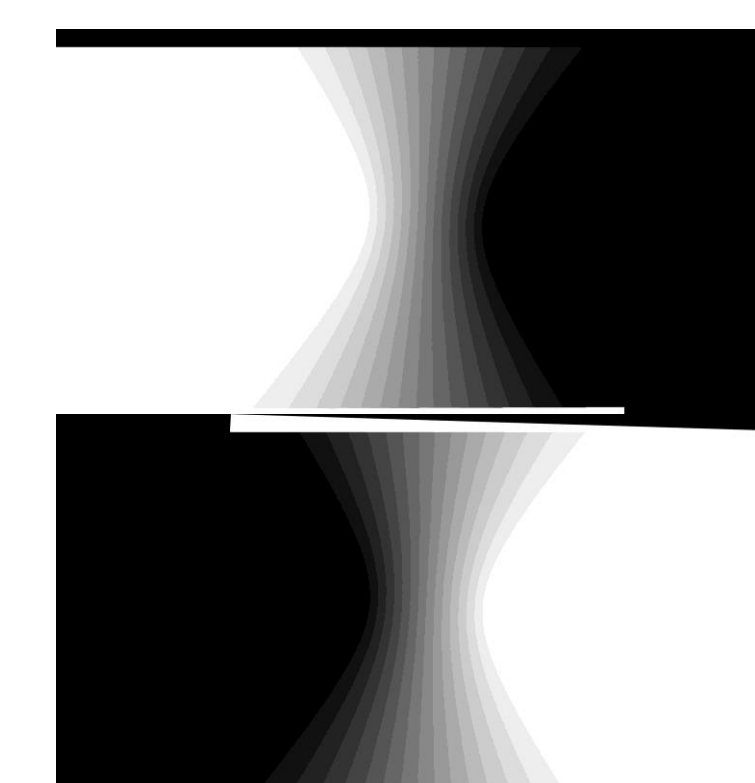
4.4 Transform Images



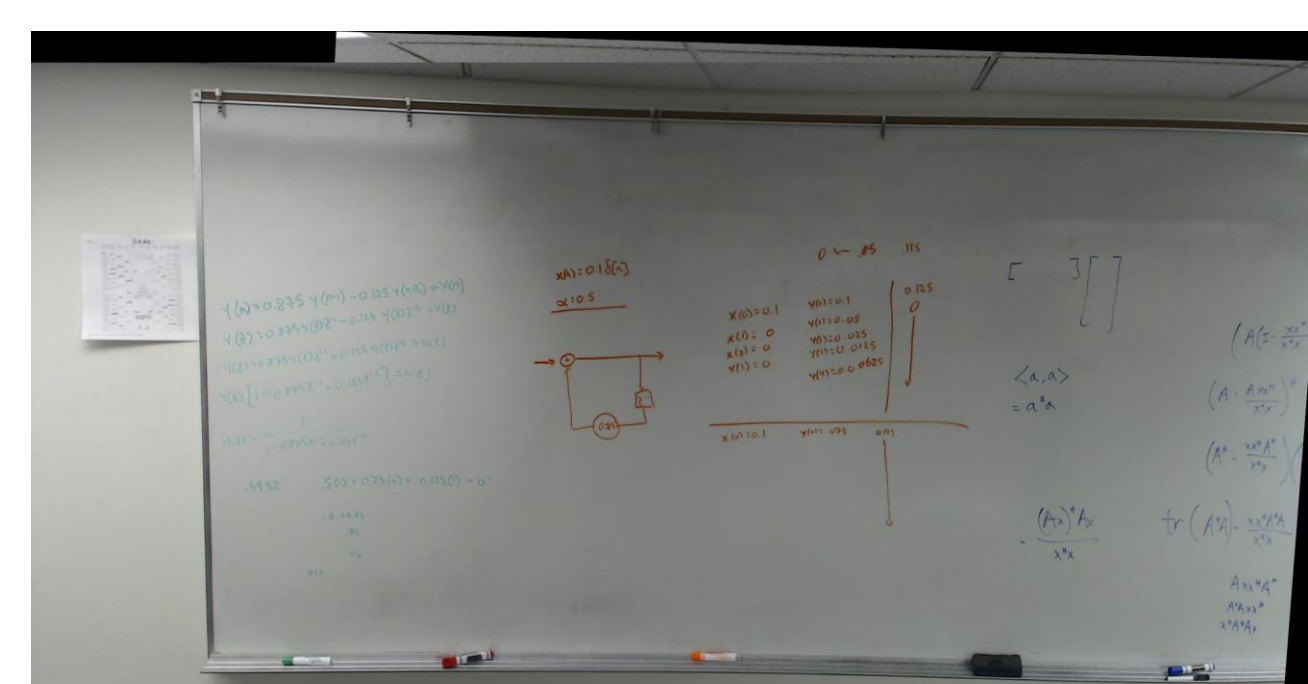
4.5 Overlap Image Space



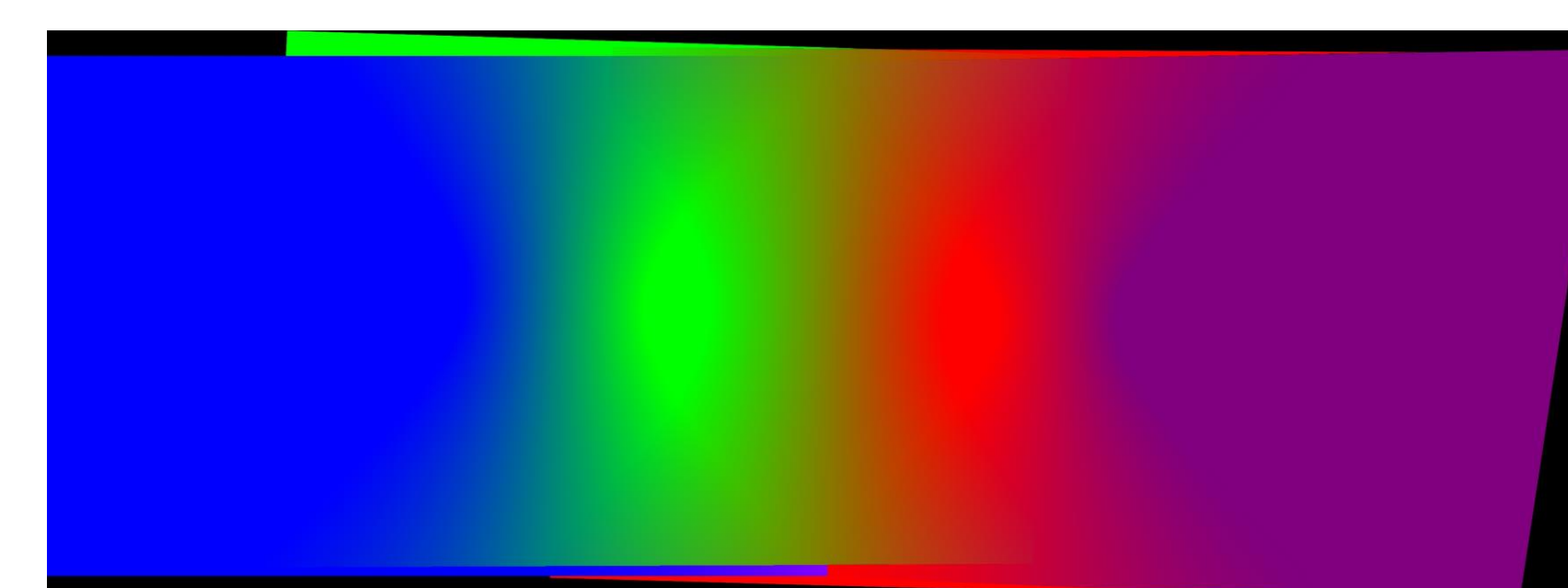
4.6 Create Blending Masks



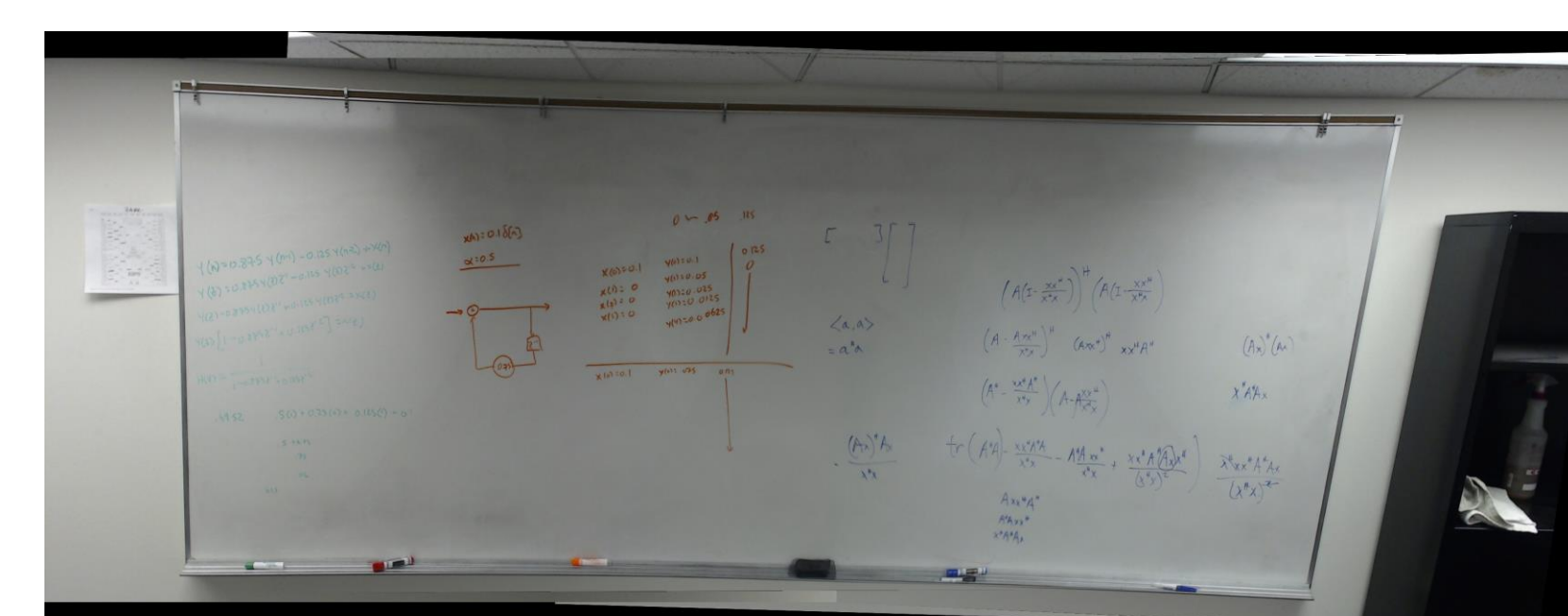
4.7 Blend Images



4.7 Blend Entire Mask



4.8 Display Stitched Video



5. Results

The Camera Array Lecture Capture System passed the tests in the specification document. The output video feed is produced at a real-time rate of 30 frames per second. The Graphics Processing Unit, GEFORCE GTX, performs the more than 18,662,400 computations in less than 0.003 seconds.

System Results:

- System tested up to 3 cameras,
- Current code structure supports 6+ cameras
- Output image is dynamically sized based on number of cameras and camera angle.

6. Conclusion

The CALC System will enhance technical lectures at Utah State University. The demonstration shows high detail captured with web-cameras, and with nicer cameras the results would be improved.

Future research includes:

- Remove teacher from scene
- Transport large image quickly across the network
- Enhance whiteboard colors and auto-crop the border

Clint Ferrin | clint.ferrin@gmail.com
Daniel Mortensen | daniel.t.mortensen@gmail.com
May 2018