1 Algorithms developed & tested

- Median filtering
- N-stage maxima detection in spatial domain
- FFT with arithmetic, geometric and logarithmic means
  - N-stage maxima detection and N varying with image
- Heuristic extension of fft in cases where FFT with mean failed
  - Heuristic estimation with certain parameters introduced (nrows and inpercent)
- Radon transform to invert the inherent rotation in the figure followed by FFTs

All the above algorithms performed well with 12MP images from a digital camera vs 2MP pictures from different cell phone cameras

- 1-D and 2-D Correlation based evaluations
  - Ascertains that 2MP images lack something compared to 12MP images
  - Resolution is not a difference, as pictures were taken from various heights, changing the resolution per cm of the cloth
- Used imadjust, histeq and adapthisteq to enhance the contrast
  - Did not improve the performances for 2MP images
- Employed 2D-FFTs in similar fashion
  - Again, worked to provide accurate results with 12MP but not with 2MP
• Auto Regression
  
  – Based on the Paper 'Image Interpolation by Adaptive 2-D Autoregressive Modeling and Soft-Decision Estimation'
  
  – This paper published in 2008, shows that the algorithm described was better than bicubic spline & better-than-bicubic algorithms.
  
  – Again, images from 12MP worked flawlessly whereas the ones from 2MP cell did not.

• Bi-cubic spline interpolation
  
  – Similar results, again observed; Could not help the 2MP images to perform better

• Canny edge detection
  
  – Even this algorithm, different from the ft, works for camera images (12MP) but not cell images (2MP)

2 Modeling of thread pattern & computing inherent errors due to hardware

• Proposed a better method of measurement to reduce the inherent errors by more than 5 times
  
  – In this, we measure the distance for a given number of pores rather than the other way round. The least count of distance is better, hence this method will be more efficient

• Constructed theory and deduced explanations for the required CCD array specifications – a minimum required resolution (no. of pixels in the image) and a minimum required span area

  – Error requirements -> Number of threads in image (- > is for leads to)
  
  – Error requirements -> Number of threads in image -> Thread density range -> Ground span area
  
  – Error requirements -> Number of threads in image -> Algorithm constraint -> Total number of pixels
3 Interfacing Camera from Optical mouse

• Tried to interface the CCD (charge coupled device) chip ADNS-2610 from an existing mouse
• Conducted experiments on OM02 chip through testing mode pin
• Found that optical mouse have cameras with very low resolution (16 x 16 or at maximum 24 x 24) and would not match our specification requirements

4 Observations & Conclusions

• 12MP camera images are different from 2MP cell phone images and the difference is not resolution
• Quality of image also depends on cloth
• Algorithms based on FFT work flawlessly on 12MP digital camera images with actual resolution (pixels per cm) even lesser than those from 2MP cell phone images

5 Next Steps

1. Understand why digital camera images perform better than cell phone camera images, even for the same pixels per cm of cloth
2. Port the codes onto a microprocessor to complete the prototype design and test for realtime operations