Sasin Tiendee 2011: Method of Image Enhancement and Analysis of Fringe Projection Display for 3D Reconstruction. Master of Engineering (Computer Engineering), Major Field: Computer Engineering, Department of Computer Engineering. Thesis Advisor: Assistant Professor Charay Lerdsudwichai, Ph.D. 91 pages.

Digital fringe projection using a digital LCD (Liquid Crystal Display) projector is a technique used extensively for 3D surface reconstruction. Fringe pattern images which are projected by digital LCD projector and generated by spatial phase shifting are important procedures of the 3D surface reconstruction. Two major problems of LCD projector namely screen door effect and nonlinear gamma effect are addressed in this research.

First issue, this research proposed how to adjust the lens to the focal point. This could be easily achieved by moving out the focus until the screen door effect patterns are clearly observed. After this method was applied, fringe pattern image appeared to have high contrast. A preliminary experiment was conducted to isolate the net interference pattern by applying Fourier Transform to the image data which had disadvantages of difficulty and time consuming. Therefore, this work presented the technique which used wavelet transform to improve fringe pattern image. This proposed technique is faster and easier than the conversion Fourier Transform method. The result images are also better with the proposed method. Second issue, the problem of the nonlinear gamma effect that causes strips on 3D surface is studied. This research presented an algorithm to compensate phase based on background of the image plane along the y-axis, without image distortion. Firstly, the real phase was compared to the ideal phase which was calculated from the mathematical equations and created a look up table. Next, the width of the actual phase could be search from the table for matching the ideal phase value quickly. Then, the phase difference between the actual and the ideal phase was determined to create a search table for compensation. Finally, the results as 3D surface were shown. As the proposed method doesn't need to adjust the gamma, therefore the calculation is in real-time and does not depend on digital projectors or cameras.

In conclusion, two problems were solved in this study. The Screen Door Effect was removed from the image data as well as the image showed better results than the original image almost doubled. Also the problem of nonlinear gamma that caused the image stripe was disappeared and provided the realistic 3D images as well as the range that indicates the smoothing was reduced.

_____ _____ ___ / ___ / ___

Student's signature Thesis Advisor's signature