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The Influence of Force on Fingerprint Recognition Using Automated Data Capture

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Introduction

Fingerprint image quality has a positive on recognition systems. By improving the quality of fingerprint images the performance of the system can be increased. Current automated fingerprint capture processes conduct quality analysis on fingerprints after capturing the fingerprint and prompt the user for additional fingerprints if the image does not conform to the quality criterion. The process of recapturing increases throughput time and increases the inconvenience faced by users.

Objective: The objective of this research was to redesign the image capture process by identifying optimal force levels for initiating the capture operation. 70 subjects interacted with an optical fingerprint sensor at several force levels to identify the force level that yielded the best fingerprint image quality and least number of matching errors.

1 Setup of the experiment



Fig. 1. Digital Personal U.are.U 4000

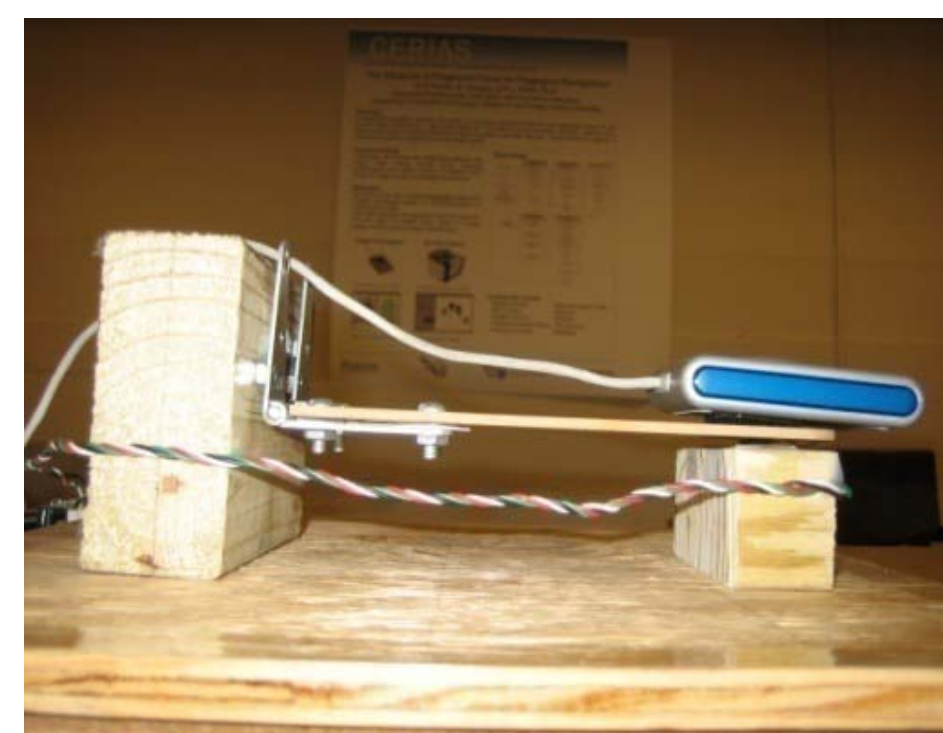


Fig. 2. Study Setup

2 Study design

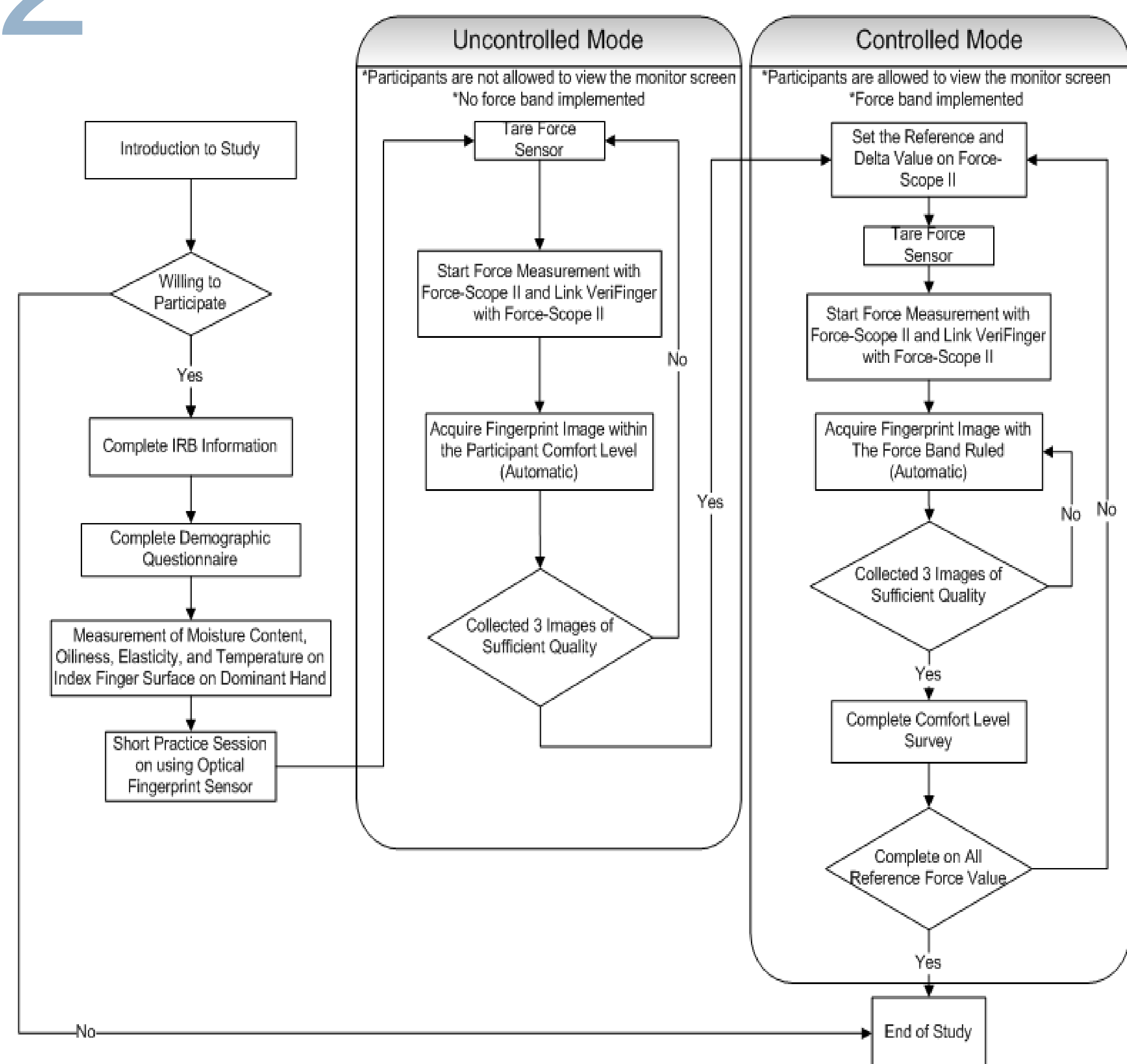


Fig. 3. Study Design

3 Samples

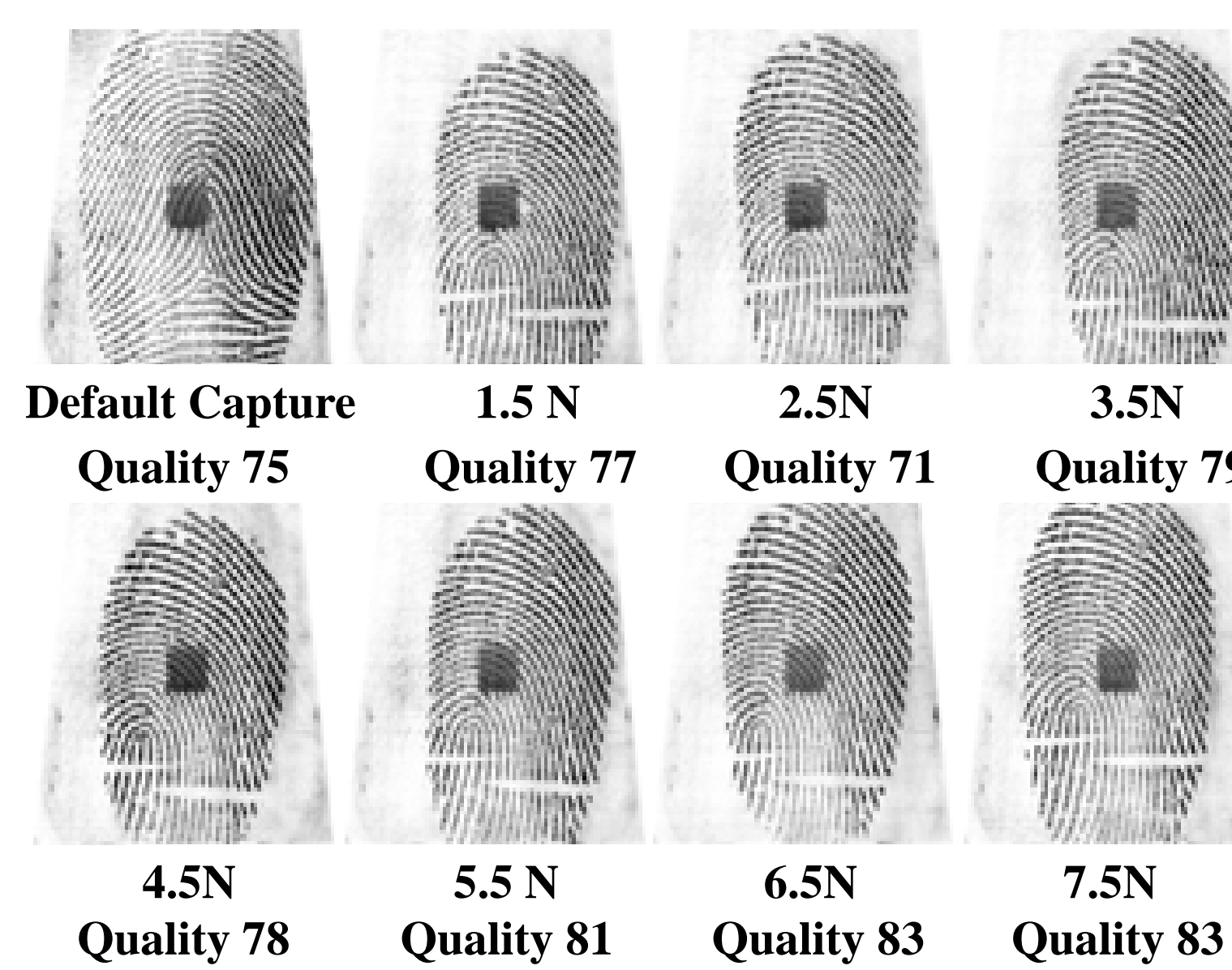


Fig. 4. Optical Fingerprint Samples

Performance Analysis

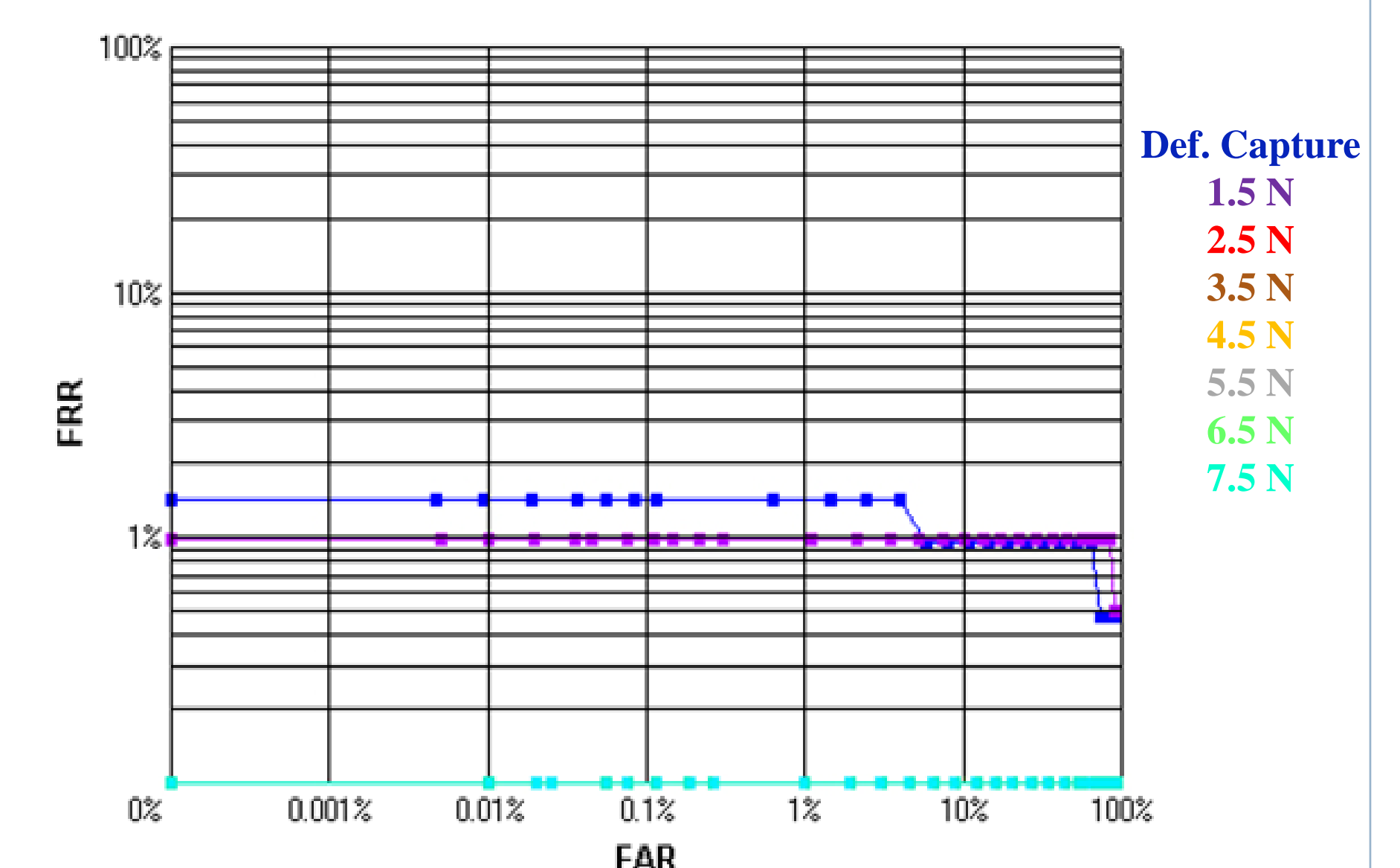


Fig. 5. DET Curves

Note: Force Range 3.5 - 7.5N overlapped each other

4 Results Image quality and time

Table 1. Image Quality Score and Timing Table

Force Level	Image Quality μ	Acquisition Time Image Quality μ (in second)
Default Capture	67.92	0.53
1.5 N	66.86	1.25
2.5 N	70.13	1.43
3.5 N	70.96	1.83
4.5 N	71.84	1.87
5.5 N	73.06	2.23
6.5 N	72.96	2.24
7.5 N	74.62	2.27

Subject comfort survey

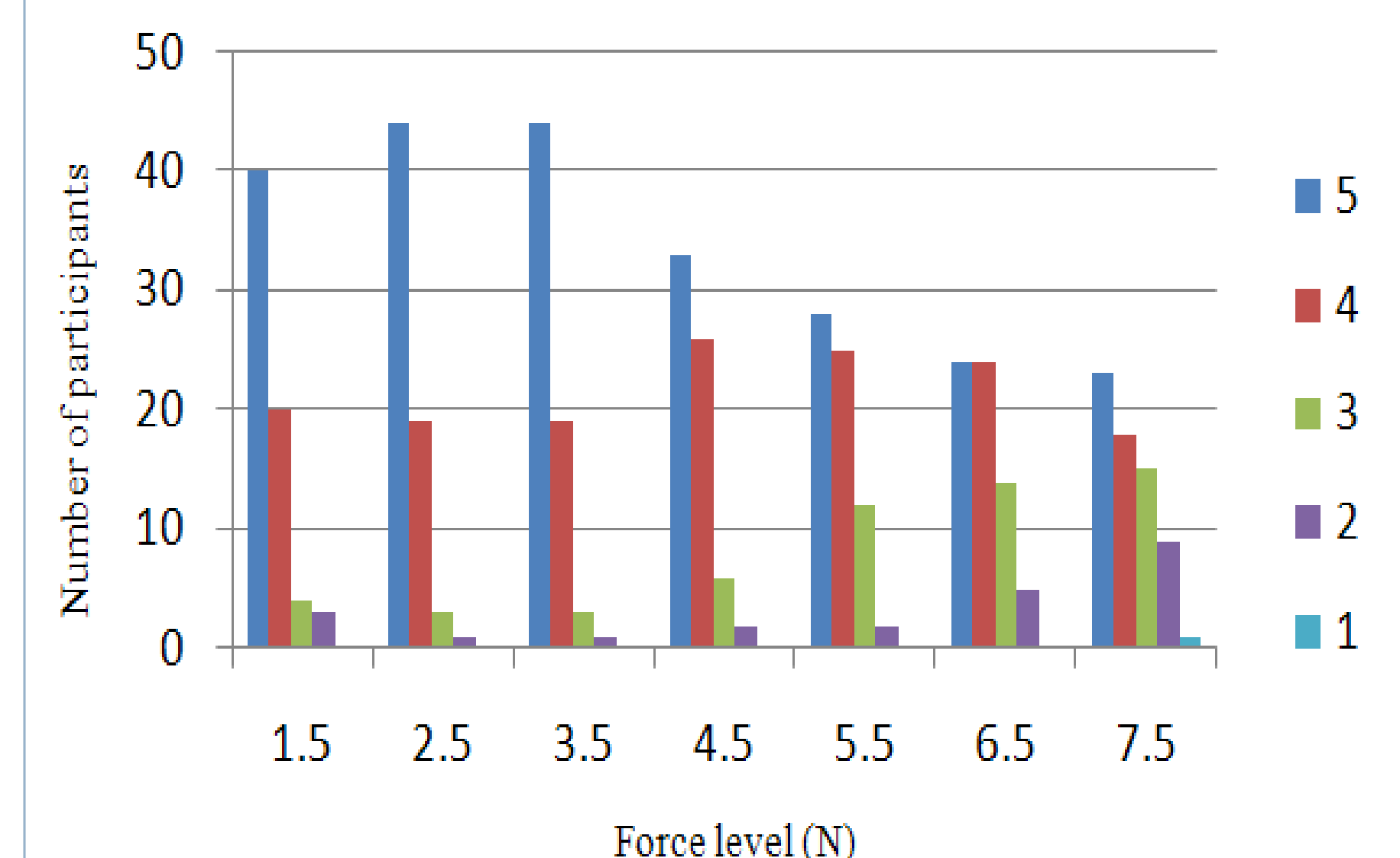


Fig. 6. Comfort Level Survey

Conclusion

This research displayed the feasibility of using an optimal force range for improving quality and reducing the number of errors. The research identified that the optimal force range was 5N to 6N. Although the capture time was longer using the force acquisition it would still lead to a higher throughput compared to the traditional acquisition due to the reduced number of errors and repeated fingerprint presentation.