

## Survey on Minutiae Coordinates of X-Axis and Y- Axis in Fingerprint Captured Image using Optical Fingerprint Scanner

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### ABSTRACT

Fingerprint recognition is the most effective biometric to provide authentication. Fingerprint images are captured using an optical fingerprint scanner. The fingerprint images are then marked for unique points like bifurcation or ridge termination called minutiae. In this paper, we have surveyed fingerprints of 40 subjects and proposed a new factor in fingerprint image captured from the optical sensor. X-Axis and Y-Axis of the minutiae in the captured fingerprint images are analyzed using coordinate measurement system in order to find an improved and effective way of minutiae coordinates storage as a database for further recognition. This technique acts as an effective way for fingerprint database compression.

**Keywords** – Biometric, Compression Technique, Coordinate System, Fingerprint Image, Fingerprint Minutiae.

### I. INTRODUCTION

Fingerprint recognition is one of the most flexible and secured way of biometric identification. Fingerprint is the feature pattern of one finger [1]. All human being possess fingerprint and these fingerprints are result of unique ridge and valley structure formed by skin over the fingers[2]. They are also used for controlling access to highly secured places such as offices, equipment rooms, control centers and so on [3]. A number of biometric characteristics are being used in various applications as Universality, Uniqueness, Permanence, Measurability, Performance, Acceptability, and Circumvention [4]. The technique fetches minutiae points and these minutiae are stored in the database for further use in the form of coordinates (X-Axis and Y-Axis) and angle[5]. In the fingerprint, Bifurcation and Ridge End are the two commonly used Minutiae[6]. The processes of biometric recognition system have four steps[7]: Acquisition, Representation, Feature Extraction, and Matching. The storage of these unique values using less space is very important for the speedy authentication in case of bulk database. In previous researches, the coordinates are stored in database simply without any effective strategy. This paper will analyze fingerprints in order to

calculate new factor which will help in more efficient storage of the minutiae in the database.

### II. SURVEY AND ITS STATISTICS

The survey of fingerprint is done using Digital Persona U.are.U 4000 Optical Fingerprint Scanner [8]. Ridge and furrow image pattern is captured in grey scale as shown in the figures[9]. Each minutia is shown with a solid circle which marks its x and y coordinates along with an arrow which marks the angle direction of the minutiae. Inter-minutiae distance is also marked with the interconnecting lines. Survey takes the x-axis and y-axis coordinate points of minutiae on extreme edges of fingerprint image into consideration and measures the distance between them. A related table is shown along with each figure with the coordinates of extreme x-axis, y-axis points and the distance between them.

### III. FIGURES AND TABLES

Generally Index finger is used for identification purpose in fingerprint image scanners [10] so we have surveyed index finger of 40 subjects in total for this survey out of whom 10 sample images are shown in this paper as follows. Difference is calculated between the Y-Axis coordinates which mark topmost and bottommost minutiae in a fingerprint and of X-Axis coordinates which mark the leftmost and rightmost minutiae in a fingerprint.

The minutiae measurements and distance between the coordinated are calculated in pixels using Adobe Photoshop 7.0 software [11]. Each value is measured with an accuracy of 1 pixel. The Fingerprint Images captured are the exact original outputs from the fingerprint scanner and are used in survey.

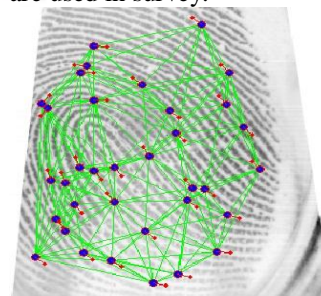


Figure 1. Subject 1 Index Fingerprint

Finger 1	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	202	22	325
Bottom	151	347	
Left	27	314	234
Right	261	204	

Table 1. Coordinate Values for Subject 1 Fingerprint

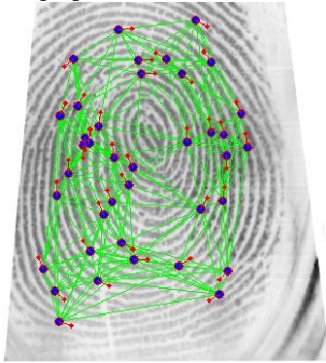


Figure 2. Subject 2 Index Fingerprint

Finger 2	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	199	20	310
Bottom	58	330	
Left	43	275	102
Right	252	150	

Table 2. Coordinate Values for Subject 2 Fingerprint

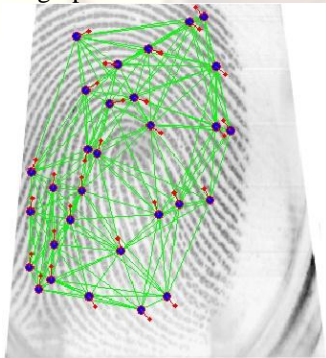


Figure 3. Subject 3 Index Fingerprint

Finger 3	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	211	15	304
Bottom	145	319	
Left	27	275	212
Right	239	134	

Table 3. Coordinate Values for Subject 3 Fingerprint

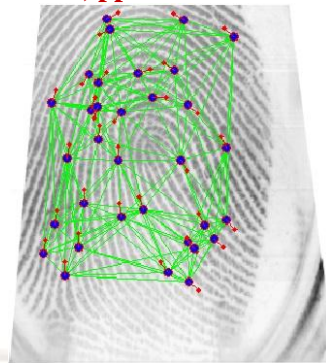


Figure 4. Subject 4 Index Fingerprint

Finger 4	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	102	16	270
Bottom	187	286	
Left	36	259	196
Right	232	36	

Table 4. Coordinate Values for Subject 4 Fingerprint

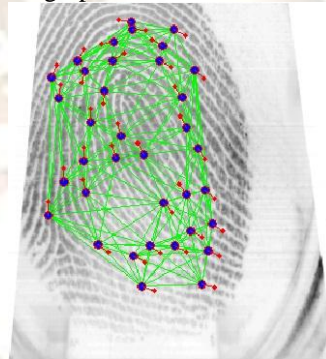


Figure 5. Subject 5 Index Fingerprint

Finger 5	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	127	20	273
Bottom	139	293	
Left	41	221	170
Right	211	229	

Table 5. Coordinate Values for Subject 5 Fingerprint

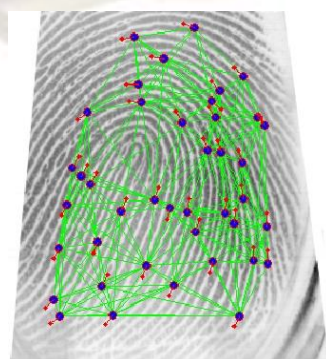


Figure 6. Subject 6 Index Fingerprint



Finger 6	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	196	18	301
Bottom	242	319	
Left	48	304	223
Right	271	121	

Table 6. Coordinate Values for Subject 6 Fingerprint

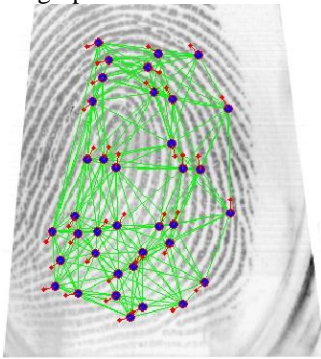


Figure 7. Subject 7 Index Finger

Finger 7	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	100	40	288
Bottom	134	328	
Left	51	238	185
Right	236	110	

Table 7. Coordinate Values for Subject 7 Fingerprint

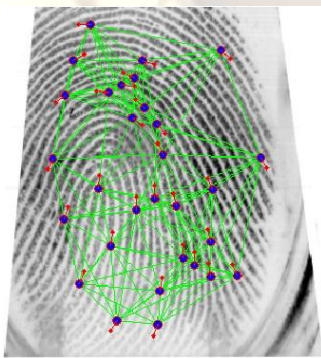


Figure 8. Subject 8 Index Finger

Finger 8	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	93	19	318
Bottom	163	337	
Left	53	162	218
Right	271	160	

Table 8. Coordinate Values for Subject 8 Fingerprint

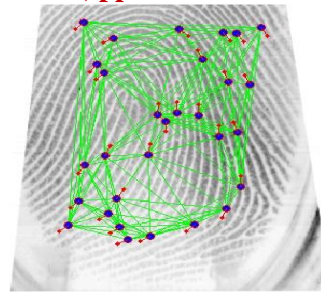


Figure 9. Subject 9 Index Finger

Finger 9	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	77	24	282
Bottom	124	306	
Left	62	286	202
Right	264	32	

Table 9. Coordinate Values for Subject 9 Fingerprint

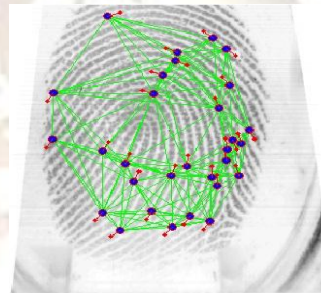


Figure 10. Subject 10 Index Finger

Finger 10	X-Axis Coordinate	Y-Axis Coordinate	Difference
Top	102	15	274
Bottom	114	289	
Left	45	114	85
Right	246	161	

Table 10. Coordinate Values for Subject 10 Fingerprint

	Difference in X-Axis Extreme Coordinates	Difference in Y-Axis Extreme Coordinates
Finger 1	234	325
Finger 2	102	310
Finger 3	212	304
Finger 4	196	270
Finger 5	170	273
Finger 6	223	301
Finger 7	185	288
Finger 8	218	318
Finger 9	202	282
Finger 10	85	274

Table 11. Comparison table for Extreme Coordinate Differences

Clearly, according to Table 11, we can state that in each fingerprint the difference between extreme X-Axis coordinates and Y-Axis coordinates we find that Y-Axis difference values are larger as compared to X-Axis difference values.

#### IV. CONCLUSION

With this paper, we conclude that Y-Axis coordinate values covers more distance between extreme minutiae as compared to X-Axis coordinate values. This will help in developing more efficient database storage technique for fingerprint minutiae. Still there would be some exceptions, but overall survey proves that more compression will be achieved using Y-Axis coordinates. Also this paper will help in designing of the high quality and easy to use fingerprint scanner which are image dimension oriented. Further studies on this survey can help in developing fingerprint minutiae database storage and extraction techniques for a faster, reliable and prompt identification and authentication. Moreover cheaper hardware can be effectively used to handle large fingerprint database.

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