A
Dissertation
On

Fingerprint Based Fuzzy Vault

Submitted in partial Fulfilment of the requirement
For the award of the Degree of

Master of Technology

In Computer Technology and Applications

By

J. JAYAKUMAR

Roll No. 08/CTA/2010

Under the guidance of

Dr. Daya Gupta

HOD, Computer Engineering Department, DTU, Delhi

DELHI TECHNOLOGICAL UNIVERSITY, 2012

CERTIFICATE

This is to certify that the dissertation titled “Fingerprint Based Fuzzy Vault” is a bonafide record of work done at Delhi Technological University, Delhi, by J Jayakumar for partial fulfilment of the requirements for degree of Master of Technology in Computer Technology and Applications.

This project was carried out at DRDO under the guidance of Mr. A K Bhateja, with my supervision and has not been submitted elsewhere, either in part or full, for the award of any other degree or diploma to the best of my knowledge and belief.

Dr. Daya Gupta,
HOD, Computer
Engineering Dept,
DTU, Delhi

Acknowledgements

I would like to express our deepest gratitude to all the people who have supported and encouraged me during the course of this project without which, this work could not have been accomplished. First of all, I am very grateful to my project supervisors Mr. A K Bhateja and Dr. Daya Gupta for providing the opportunity of carrying out this project under their guidance. I am deeply indebted to them for their support, advice and encouragement without which the project could not have proceeded smoothly. I am highly thankful to all my friends and family for their continued support and encouragement throughout the research work.

I would like to make a special mention of Mr. A K Bhateja from DRDO under whose guidance I completed this work. I would like to thank him for his sparking ideas, inspiring discussions, his trust and belief, and his support throughout the process of the thesis. I gained a lot from his vast knowledge and skill in many areas (e.g., biometrics, image processing, cryptography, programming and optimizations, ethics, interaction with participants), and appreciate his assistance in writing this dissertation.

J. Jayakumar
Roll No. 08/CTA/2010
M.Tech (Computer Technology & Applications)
Department of Computer Engineering,
DTU, Delhi

Abstract

Through this project we intend to create a biometrics cryptosystem where one can send and receive secure information using just the biometric features like fingerprints, signatures etc. For this purpose we have used a fingerprint based fuzzy vault technique. Reliable information security mechanisms are required to combat the rising magnitude of identity theft in our society. While cryptography is a powerful tool to achieve information security, one of the main challenges in cryptosystems is to maintain the secrecy of the cryptographic keys. Though biometric authentication can be used to ensure that only the legitimate user has access to the secret keys, a biometric system itself is vulnerable to a number of threats. A critical issue in biometric systems is to protect the template of a user which is typically stored in a database or a smart card. The fuzzy vault construct is a biometric cryptosystem that secures both the secret key and the biometric template by binding them within a cryptographic framework. We present a fully automatic implementation of the fuzzy vault scheme based on fingerprint minutiae. The 128 bit secret key used in RSA and other cryptosystems are secured with the help of fingerprint minutiae. Since the fuzzy vault stores only a transformed version of the template, aligning the query fingerprint with the template is a challenging task. We extract high curvature points derived from the fingerprint orientation field and use them to obtain an intermediate coordinate system, with the fingerprint core point as the origin. Firstly, we have explored the possibility of using the high curvature points to create an axis for the Cartesian system and then we have used that as a reference axis for polar coordinate system. Finding the core point with accuracy is in itself a very challenging task. We have proposed a new algorithm which finds the core point for all the fingerprints with complete accuracy. Thus unlike the

existing fuzzy vault implementation, we don’t need to send the helper data for aligning the query and the template minutiae, which significantly reduces the overhead whilst hiding the details of the fingerprint completely. We demonstrate the performance of the vault implementation on two different fingerprint databases.

Contents

List of figures

List of Tables