



Biometrics in Credit Cards: A New Way To Pay

A Case Study, CSE891

Lindsey Murray and Unsang Park

Course Adviser: Anil K. Jain



Contents

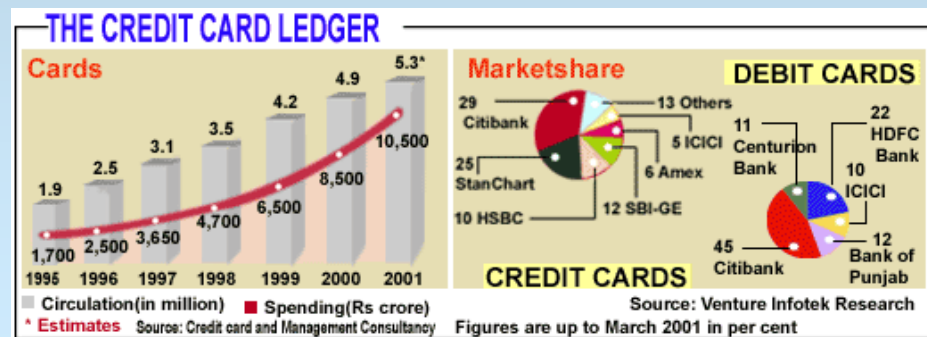
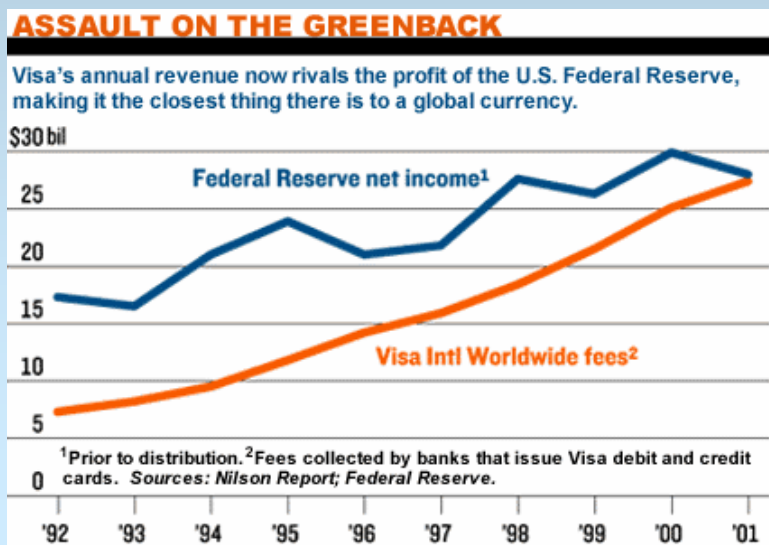
- Credit card markets
- Credit card fraud
- Biometrics in credit cards
- Cases
 - Discover card
 - MasterCard
 - American Express
 - Other credit cards
- Aspects of using biometrics in credit cards
- Conclusions



Credit Card Markets



- Customer trends (as of 2004).
 - 49% of consumers carry less than 20 dollars in their wallets.
 - 86% of consumers would like to use cash less often than they do now.
 - Credit card market has been growing fast.



Credit card markets in India



Credit Card Markets

- Charts of credit cards market

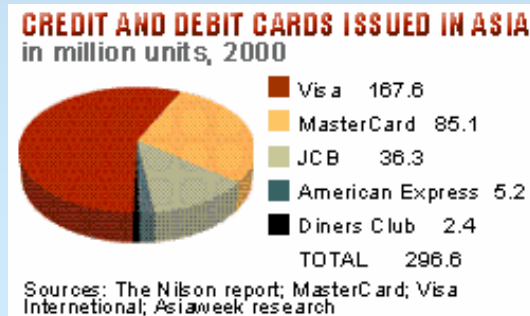
MOST PROFITABLE CREDIT CARD ISSUERS – U.S.
Year-End 2002 vs. 2001 (Billions)

RANK	ISSUER	VOLUME (BIL.)
1	Citigroup	\$2.46 up 18% from \$2.08
2	American Express	\$2.14 up 46% from \$1.46
3	MBNA	\$1.77 up 5% from \$1.69
4	U.S. Bancorp	\$1.58 up 21% from \$1.31
5	Sears, Roebuck	\$1.50 down 2% from \$1.53
6	Bank One	\$1.17 up 23% from \$0.95
7	CapitalOne	\$0.90 up 40% from \$0.64
8	Discover	\$0.77 up 9% from \$0.70
9	Bank of America	\$0.74 up 17% from \$0.63
10	JPMorganChase	\$0.72 up 44% from \$0.50
11	GE Card Services	\$0.63 down 4% from \$0.65
12	Target	\$0.53 up 20% from \$0.45
13	Household	\$0.34 up 17% from \$0.29
14	Fleet	\$0.23 up 22% from \$0.19
15	Providian	\$0.22 up 461% from \$0.04

Top U.S. General Purpose Credit Card Issuers
Ranked by Total Volume Midyear 2004*

RANK	ISSUER	VOLUME (BIL.)
1	American Express	\$145.80
2	JPMorgan	\$137.90
3	Citigroup	\$105.70
4	MBNA	\$75.86
5	Bank of America	\$53.43

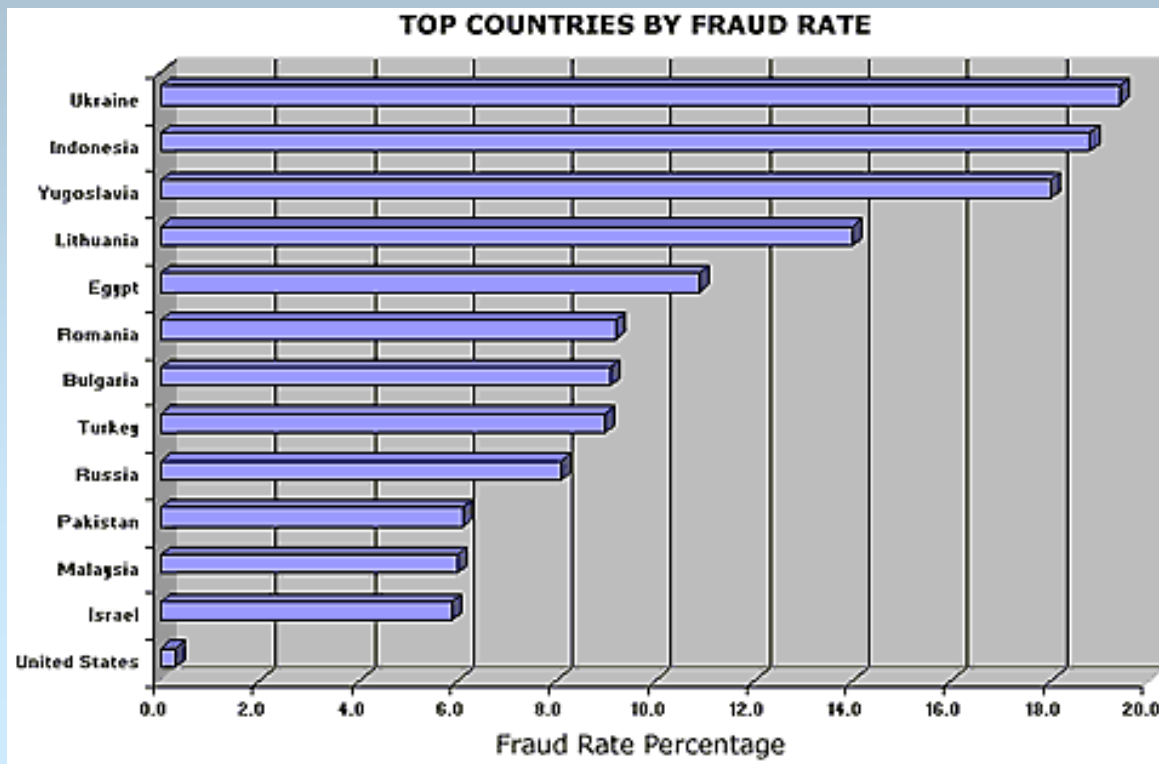
* Total Volume includes purchases at merchants and cash advances. © 2004 The Nilson Report





Credit Card Fraud

- Amount to \$48 billion in 2002
- Card thieves are getting smarter
- Increasing loss of private information



4 in 10 U.S. Consumers Know A Victim of Credit Card Fraud (2003)



Credit Card Fraud

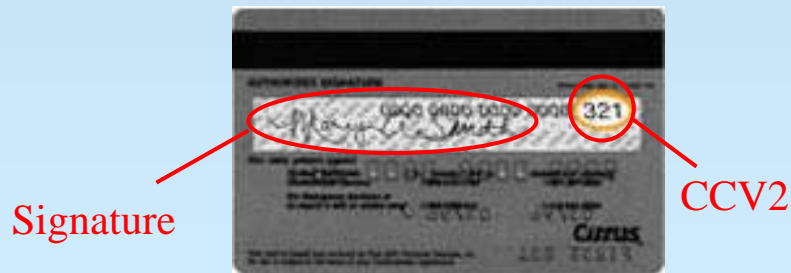
- Categories of credit card frauds
 - Counterfeiting
 - Lost or stolen cards
 - Deceptive trade with card information
 - Credit card from fake account





Credit Card Fraud

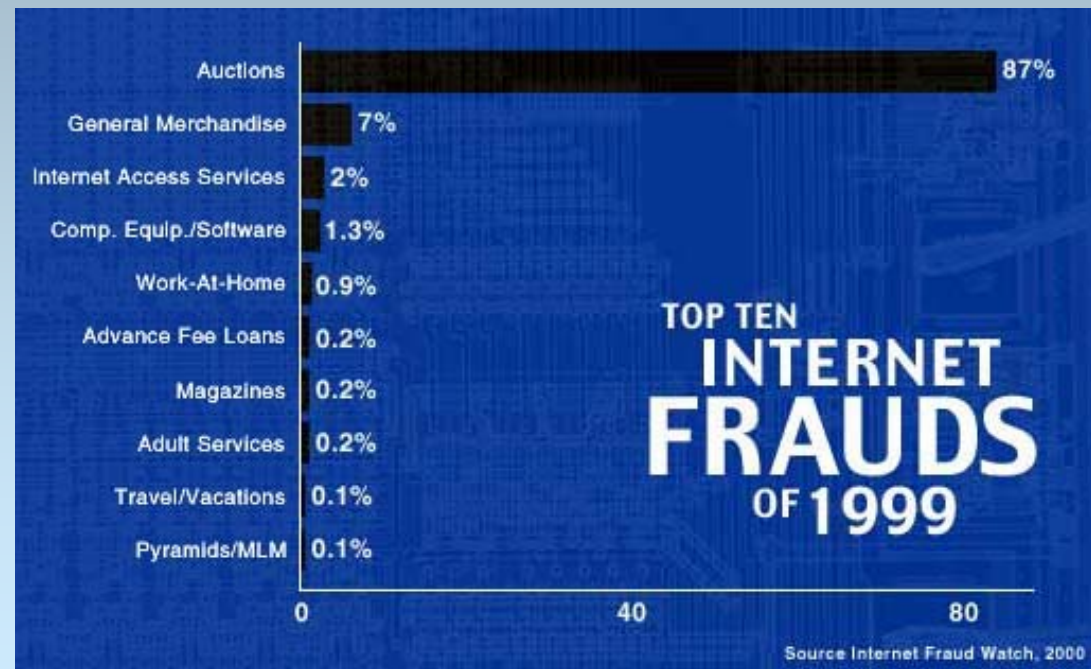
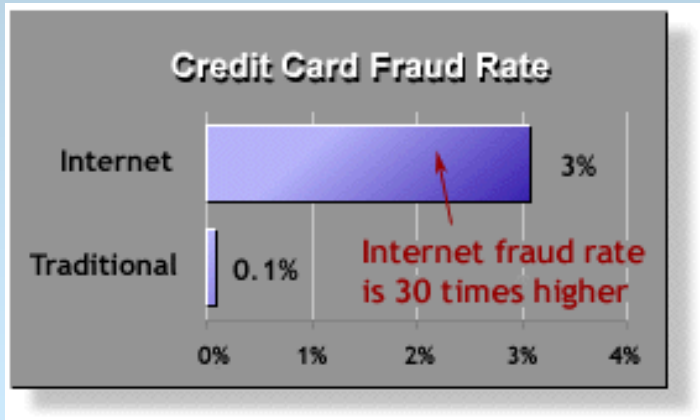
- Conventional method for preventing card fraud
 - Validity check of card numbers
 - Signature
 - Card Verification Values (CVVs, CVV2s, CVCs, and Indent CVCs)
 - Generated based on Primary Account Number (PAN), a 4-digit Expiration Date, a 3-digit Service Code, and a pair of DES keys (CVKs).
 - Holographic image





Credit Card Fraud

- Online transactions with credit cards
 - Online fraud overwhelms traditional fraud

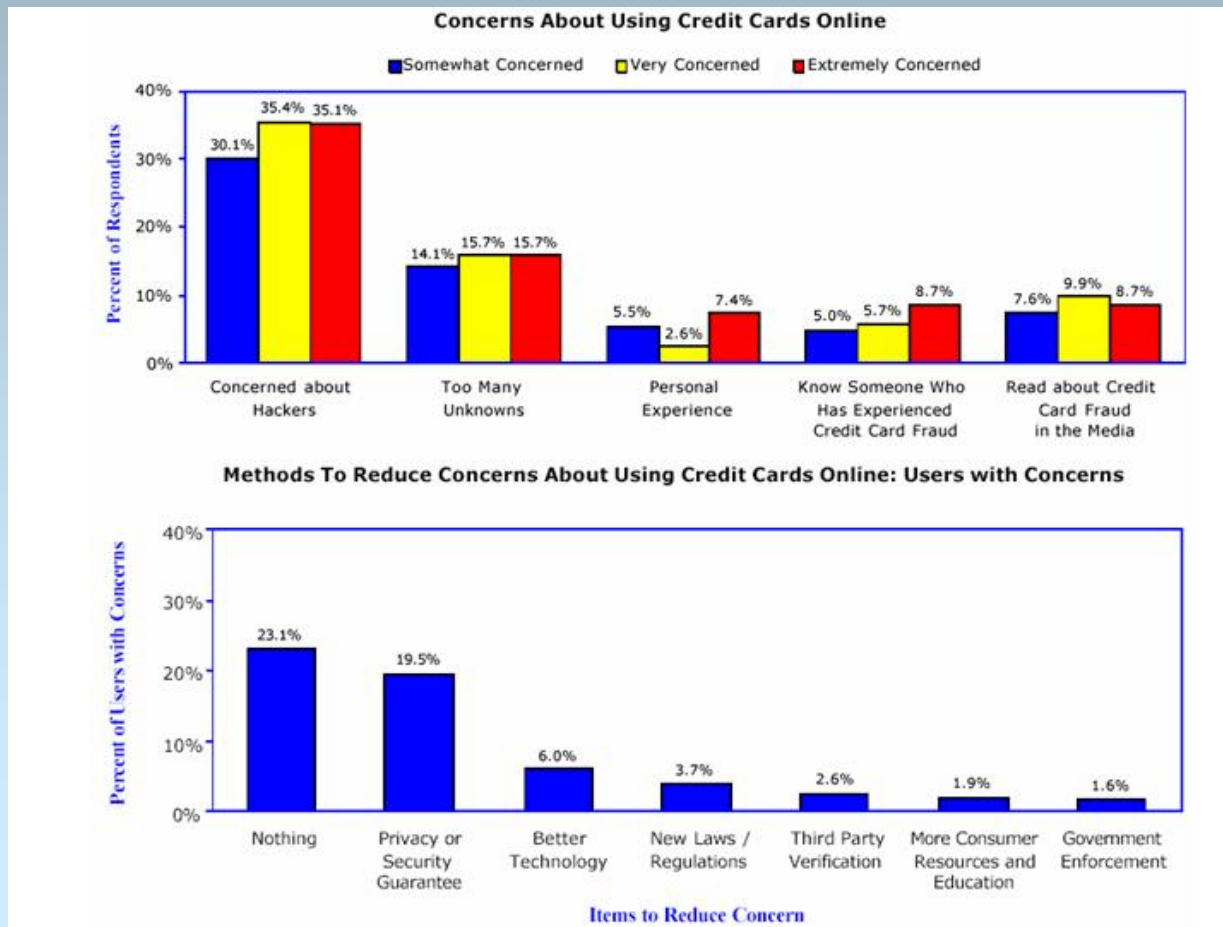


Year of 2000



Credit Card Fraud

- Online transactions with credit cards





Credit Card Fraud



- **An example of an on-going effort towards card fraud found on the web**

“Head of Dark Coding, Mon Mar 21 22:15:23 2005:

Finally I found a hack that really works to get free VALID CREDIT CARD NUMBERS! I bought the information off ebay for \$100.00.

You basically send a coded message to the hotmail account information computer database. All the account information still active is in this computer. I'm not going to explain exactly how it works (its around 7 pages long), I'll just tell you how to do it. Copy the information below in its exact format or it will not work. Make sure to put a zero under each character (number, letter, hyphen, etc) you type. Type in small caps. If you capitalize, it will not work. And if you do not send the exact information on the credit card, it will not work. The computer has to register the information to be valid before it will send you an account. I've tried to use a false account, it doesn't work.

```
credit card number
000000000000000000
name on credit card
000000000000000000
address
0000000
City
0000
state,country,zip
0000000000000000
type of card
000000000000
expiration date
0000000000000000
.....
```

”



Credit Card Fraud



- **Another example of an on-going effort towards card fraud found on the web**

Credit Card Fraud brought to you by The *** Roger**

- Money is hard to come by
- It is easy to use someone else's credit card
- The stakes are high, but the payoff is worth it.

Step One: Getting the credit card information

- Blue carbons used in a credit card transaction
- Pretending to be an employee of a credit card company over the phone

Step Two: Recognizing information from carbon copies

Step Three: Verifying the information

Step Four: The Drop

- Once the cards are cleared, you must find a place to have the package sent.

Step Five: Making the transaction

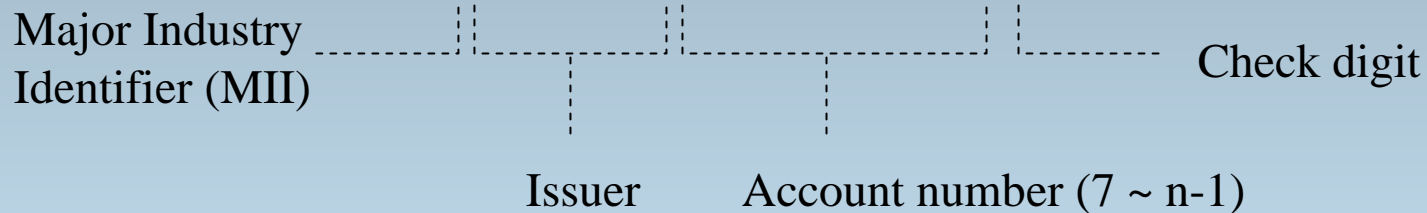
“If everything goes right, you should have the product, free of charge. Insurance picks up the tab, and no one is any wiser. Be careful, and try not to order anything over \$500. In some states, UPS requires a signature for anything over \$200, not to mention that anything over \$200 is defined as grand theft, as well as credit fraud. Get caught doing this, and you will bite it for a couple of years. Good luck!”



Credit Card Numbers

- Card Number standards
 - International Standards Organization (ISO/IEC 7812-1:1993)
 - American National Standards Institute (ANSI X4.13)

4408 0412 3456 7890



MII Digit Value	Issuer Category
0	ISO/TC 68 and other industry assignments
1	Airlines
2	Airlines and other industry assignments
3	Travel and entertainment
4	Banking and financial
5	Banking and financial
6	Merchandizing and banking
7	Petroleum
8	Telecommunications and other industry assignments
9	National assignment

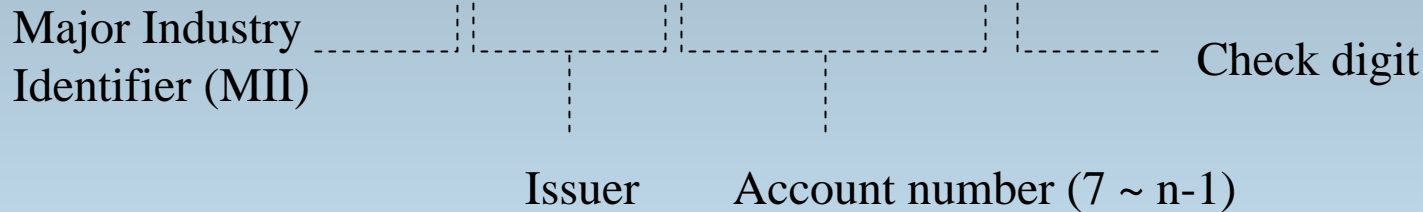
Issuer	Identifier	Card Number Length
Diner's Club/Carte Blanche	300xxx-305xxx, 36xxxx, 38xxxx	14
American Express	34xxxx, 37xxxx	15
VISA	4xxxxx	13, 16
MasterCard	51xxxx-55xxxx	16
Discover	6011xx	16



Credit Card Numbers

- “Luhn check” for the validity of card numbers

4408 0412 3456 7890



4	4	0	8	0	4	1	2	3	4	5	6	7	8	9	0
$4 \times 2 = 8$	4	$0 \times 2 = 0$	8	$0 \times 2 = 0$	4	$1 \times 2 = 2$	2	$3 \times 2 = 6$	4	$5 \times 2 = 10$	6	$7 \times 2 = 14$	8	$9 \times 2 = 18$	0
8	4	0	8	0	4	2	2	6	4	$10 - 9 = 1$	6	$14 - 9 = 5$	8	$18 - 9 = 9$	0
8	4	0	8	0	4	2	2	6	4	1	6	5	8	9	0

Sum = 67 \neq multiple of 10



Biometrics in Credit Cards



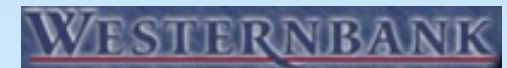
- Binds the credit card to the cardholder by storing a biometric signature within the card
- Started to reduce card fraud.
- Also regarded as a more convenient way of paying
- Some issues need to be solved
 - Additional cost
 - Customer's acceptance



Biometrics in Credit Cards



- Signature (Conventional)
 - Endorsed on the back side of credit card
 - Easy to forge
 - Often disregarded by retailer
- Fingerprint
 - Most widely used in credit cards
 - Universal
 - Individualizing
 - Reliable
 - Inexpensive





Biometrics in Credit Cards



- Voice
 - Functions remotely
 - Voice is enrolled associated with the credit card account
 - Card can be equipped with voice sensor, so that send authentication signal when it verifies user's voice
 - Good for online shopping (In 2000, Expedia had \$4 to \$6 million charges to cover stolen credit cards that had been used to book air tickets)
- Face
 - Non-intrusive
 - Covert application

Biometrics in Credit Cards



Deployments - This deployments list is not intended to present a comprehensive view, but rather an indication of the scope and depth of biometrics applications within the financial services arena. Most, if not all, major financial sector players are testing biometrics. However, many are unwilling to report on pilot programs or deployments.

CUSTOMER FACING APPLICATIONS

Biometric	Companies	Customer	Application	Location
Face	GCA, Infonex, Vüisage	Harrah's Casinos, Las Vegas	ATM - ACM Cash Machines	USA
Finger	BioPay	Duthler Family Food	Check Cashing	USA
Finger	BioPay	BI-LO	Check Cashing	USA
Finger	BAC	Kroger	POS	USA
Finger	Identix	Grupo Financiero Banorte	ATM	Mexico
Finger	Identix	Banco Falabella	ATM, Teller Windows, Credit Cards	Chile
Finger	Indivos (now Soidus)	Thriftway	POS	USA
Finger	SAFLINK, Real-Time Data Mgmt	Huston Municipal	Kiosk - Credit union	USA
Finger	SAFLINK, Real-Time Data Mgmt	Riverside Health Systems	Kiosk - Credit Union	USA
Finger	SAFLINK, Real-Time Data Mgmt	Purdue Employees	Kiosk - Credit Union	USA
Finger	SAFLINK, Real-Time Data Mgmt.	First Financial	Kiosk - Credit Union	USA
Finger	SAFLINK, Unisys	Western Bank	Account Access - Teller, ATM, online	Puerto Rico
Finger, Hand	RSI, Diebold	Zion First National Bank	Access Vault (Safe Deposit)	USA
Finger, Hand	RSI, Diebold	Bank of Hawaii	Access Vault (Safe Deposit)	USA
Finger, Hand	RSI, Diebold	First Tennessee Bank	Access Vault (Safe Deposit)	USA
Signature	CIC	Charles Schwab	Account Application	USA
Signature	CIC	American General Life & Accident	Document processing	USA
Signature	CIC	First American Bank	Document processing	USA
Signature	CIC	National Health Insurance Co	Policy Application & Enrollment	USA
Signature	CIC, Interlink	Charles Schwab	Document processing	USA
Signature	CIC, Interlink	Prudential Financial	Document processing	USA
Signature	Cyber-Sign	Western Bank	Financial transactions	USA
Signature	Security Biometrics	Barton Insurance	work flow automation, web access	Canada
Signature	Wondernet	Bank Hapoalim	Financial transactions	Israel
Voice	Nuance, GMK Electronics Ltd.	Banco Bradesco	Account Access - PIN/PW reset	Brazil
Voice	Persay	First Direct Bank	Account Access - pin/PW reset	Israel
Voice	T-NETIX (Now Speechworks)	InTrust Bank	Transactions - Bank	USA
Voice	VoiceVault	Progressive Insurance	Call Center - PIN/Password Reset	USA
Voice	VoiceVault	Buywayz	Transactions	Ireland



Case 1 - Discover Card



- First credit card company to actively pursue biometric payments
- Partnered with Pay By Touch
- Pay using Fingerprint
 - Store 40 minutiae points
 - Prevents reverse engineering
- Stored in Secure IBM data centers



finger scanner used by Pay By Touch



Case 1 - Discover Card

- What Does the Consumer Have to Do?
 - Enroll
 - Touch finger to scanner
 - Choose desired Credit Card
 - Purchase is made!
- Grocers using this technology
 - Kroger
 - Thriftway
 - Piggly Wiggly





Case 1 - Discover Card



- Offers discounted fees to merchants for using biometric based payment system.
- No need to present photo ID
- Do not need a card for Pay By Touch transactions.
- Tie user's fingerprints to their rewards programs
 - Increases the incentive to use it



Case 2 - MasterCard



- In 1996, identity fraud at MasterCard quadrupled from the previous year.
 - Triggered interests in fingerprint based secure credit card.
- Store Fingerprint Minutiae
- MasterCard announced that they will switch their current credit cards to smart cards with biometrics by the end of 2004.
- Smart cards can be used as credit or debit cards and store such information as biometric traits, personal medical history and cryptographic keys for authentication.



Case 3-Chameleon Cards



- Pocket Vault-Combines account information from all credit cards into one card
- Powers up when it detects the owner's fingerprints.
- Uses same magnetic strip readers already in stores.
- Within 10 minutes, the card will be unreadable.

Hand Held
Pocket Vault





Cases 4- United Retail's Jet Stores (South Africa)

- Register a customer's face with a credit card.
- A camera next to a cash register would scan the face upon payment.
- Because face recognition is non-intrusive, 99.7% of customer acceptance has resulted.

Customer	Location	Supplier	Technology	Function
Cardenas Supermarkets	California	BioPay	Fingerprint	Cheque cashing
Fast & Easy	California	BioPay	Fingerprint	Cheque cashing at 30 stores
Food 4 Less	18 stores in USA	BAC	Fingerprint	Cheque cashing
HEB	San Antonio	BAC	Fingerprint	Time and attendance
Home Shopping Network	USA	Nuance	Voice	Caller identification
Hyvee	Five Midwest USA stores	BAC	Fingerprint	Cheque cashing
Kroger	Indiana	BioPay	Fingerprint	Cheque cashing
Kroger	Texas	BAC	Fingerprint	Cheque cashing
Lopez	Texas	BioPay	Fingerprint	Cheque cashing
Malone's Cost-Plus	Texas	BioPay	Fingerprint	Cheque cashing
McDonald's	California	Indivos	Fingerprint	Payment
Men's Warehouse	Houston	Key Source Int.	Fingerprint	T/A, cash register
PAL Market	California	BioPay	Fingerprint	Cheque cashing
Santoni's Surpermarket	Baltimore	BioPay	Fingerprint	Cheque cashing
Thriftway	West Seattle	Indivos	Fingerprint	Payment
United Retail's Jet Stores	South Africa	Biocom	Facial	Payment

Table 1. A selection of retail installations using biometric technology.



Other Credit Cards



- American Express
 - In testing stage for customer application
 - ExpressPay-contactless payment
- Currently used to check employee identification
 - Contactless card storing a biometric template to gain access to their office facilities at the Amex World Headquarters in New York
- Bioscrypt developed the fingerprint template software and access readers that is being tested.



Other Credit Cards

- Chase - Prefer voice
 - According to a review by them, 95% of consumers would accept voice verification, whereas only 80% of consumers would accept fingerprinting
- Visa
 - Plan to switch their current credit cards to smart cards
- Citibank
 - Testing eye-scanning technology on some 500 employees at its development test center
- BACOB Bank (Belgium)
 - Voice verification for customer account access.



Aspects of Using Biometrics in Credit Cards



- Advantages

- Increase the security
 - **Binds Credit Card to User!!**
- Faster and easier transactions for the customer and the retailer.
 - In restaurant drive-thru's 12-18 seconds have been cut off of the purchasing time.
- Higher throughput of individuals and thus more transactions per day
- Eliminates the need to carry a ID or membership cards
- Cut the average costs associated with transaction fees



Aspects of Using Biometrics in Credit Cards



- Disadvantages
 - Loss of privacy (Biometric traits)
 - Could be circumvented by fake biometrics (e.g., fingerprint spoofing, however cloning a card number is still much easier than spoofing a biometric system)
 - Attack on database
 - Authentication software updates
 - change would have to be applied to all authentication devices.
 - Until Biometrics are used mainstream-consumer may need to carry additional cards for the compatibility.



Conclusion

- Biometrics will reduce credit card fraud and identity theft
- Biometrics can be used as a means of payment and replace the actual credit cards.
- Fingerprint biometrics most widely used
- Voice is a promising biometrics for online transactions.
- Consumer Acceptance



Final Thought



- As prices of the technology continue go down and as consumers become accepting and accustomed to it, the use of biometrics will become the mainstream form of payment.



References

- [1] Baard, M. “*Chameleon Card Changes Stripes*” Wired News. Mar 2004.
http://www.wired.com/news/business/0,1367,62545,00.html?tw=wn_story_related
- [2] Bardwell, B. “*BioProtect™ check cashing solution*”. Biometric Security Card Inc. June 2003.
www.biometricsecuritycard.com/checkcash_merchant.html
- [3] Berst, J. “*Web Sites Want Your Fingerprints (How it Could Save You Money)*” International Biometric Group. Mar 2000.
http://www.biometricgroup.com/in_the_news/anchor_desk.html
- [4] Best, J. “*How would you like to pay-credit card or fingerprint?*” Silicon.com. Feb 2005.
<http://management.silicon.com/itdirector/0,39024673,39127506,00.htm>
- [5] Biever, C. “*Credit card only works when spoken to*” NewScientist.com. April 2004.
<http://www.newscientist.com/article.ns?id=dn4900&print=true>
- [6] Callas, J. “*Biometrics and credit card security*” Expert Answer Center. Sept 2001.
<http://expertanswercenter.techtarget.com/eac/knowledgebase/0,295196,sid63,00.html>
- [7] Cameron, M. “*Biometric Voice Recognition Credit Cards*” OverClockersClub. April 2004.
<http://www.overclockersclub.com/?read=8324776>
- [8] Carlin, M. “*Ultimate ID*” Koisk Business. Jan-Feb 2002. <http://www.kioskbusiness.com/JanFeb02/articles/dept3.html>
- [9] Chan, S. “*An Overview of Smart Card Security*” Aug 1997. <http://home.hkstar.com/~alanchan/papers/smartCardSecurity/>
- [10] Discover Financial Services. “*Pay By Touch and Discover Financial Services to Jointly Market Use of Finger-Scanning Technology to Access Discover Card Accounts*” Aug 2004.
<http://pressroom.discovercard.com/data/articles/2004/08/16/200411041044130.shtml>
- [11] Farrell, C.B. “*FTC Releases Consumer Fraud Survey*” Federal Trade Commissions For the Consumer. Aug 2004.
<http://www.ftc.gov/opa/2004/08/fraudsurvey.htm>
- [12] Find Biometrics. “*Biometric Products: Guarantees 100% Elimination Credit Card Fraud and Identity Theft for Cardholders, Merchants and Card Issuers*” FindBiometrics.com. Sept. 2003.<http://www.findbiometrics.com/viewnews.php?id=455>
- [13] Goliath. “*Biometric technology backed by card brand*” Electronic Payments International. Sept. 2004.
http://goliath.ecnext.com/coms2/summary_0199-806056_ITM&referid=2090



References

- [14] Jae-hee, L. “*SecuIT introduces smart card reader with fingerprint authentication system*” International Biometrics Group: Korea Herald. March 2002. http://www.kisa.or.kr/english/trend/2002/trend_20020302_01.html
- [15] Jain, A. “*An Introduction to Biometric Recognition*” Circuits and Systems for Video Technology, Special Issue on Image- and Video-Based Biometrics, Vol. 14, NO. 1, Jan 2004.
- [16] Jones, P.D. “*Locking yourself up: How to keep your identity-and your money-where they belong*” Saint Louis Commerce Magazine-MasterCard. 2005. <http://www.stlcommerce.com/archives/march2004/technology.html>
- [17] O’Sullivan, O. “*Biometrics comes to life*” ABA. 1997. http://www.banking.com/aba/cover_0197.htm
- [18] Pastore, M. “*Discover Card Partners for Biometric Payments*” Inside ID. Aug 2004. <http://insideid.com/ecommerce/article.php/3396951>
- [19] Pay By Touch. “*Piggly Wiggly rolls out pay by touch payment service*” Pay By Touch Press Releases. Jan 2005. http://www.paybytouch.com/news/pr_01-17-05.html
- [20] RCMP. “*Counterfeiting and credit card fraud*” Reporting economic crime online. Jan 2005. http://www.rcmp.ca/scams/ccandpc_e.htm
- [21] Rineheart, G. “*Biometric Payment: The New Age of Currency*” Hotel Online. 2000. http://www.hotelonline.com/News/PressReleases2000_1st/Mar00_BiometricCurrency.html
- [22] RFID Journal. “*Partners to Offer Biometric Ids*” RFID Journal Inc. News. Oct 2002. <http://www.rfidjournal.com/article/articleview/99/1/38/>
- [23] Schuman, E. “*Discover to use biometrics to combat rivals*” Enterprise News and Reviews. Aug 2004. <http://www.eweek.com/article2/0,1759,1638238,00.asp>
- [24] SearchSecurity.com “*Chameleon Card*” Definitions. July 2004 http://searchsecurity.techtarget.com/sDefinition/0,,sid14_gci960262,00.html
- [25] Simon, L. “*Give your grocery the finger*” ASV (A Small Victory). Dec. 2002. <http://asmallvictory.net/archives/001839.html>
- [26] “*Solutions to the Problems*” No Date. <http://www.bhs.k12.nj.us/coltech/solution.htm>