
hacking
fingerprint recognition systems
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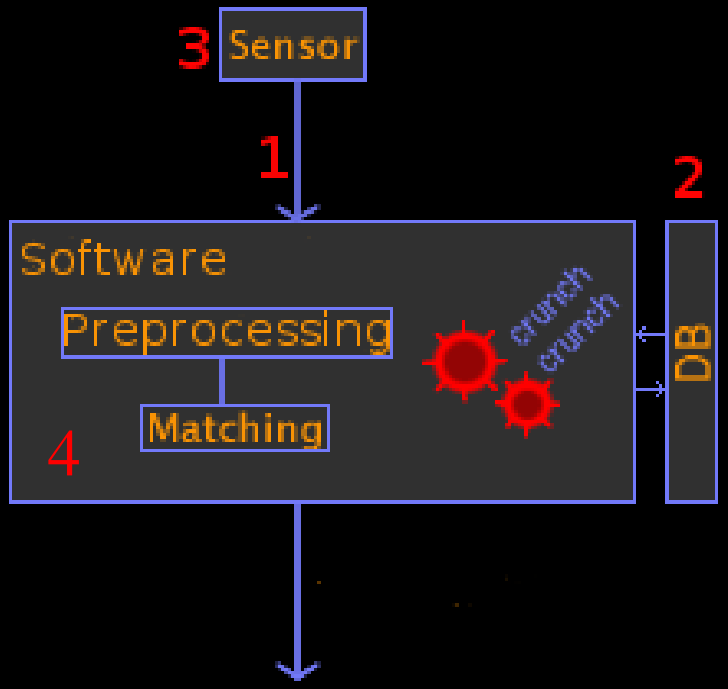
overview

- introduction
- collecting fingerprint data
- attacking the communication
- attacking the templates
- attacks using the sensor

biometric systems - types of attacks

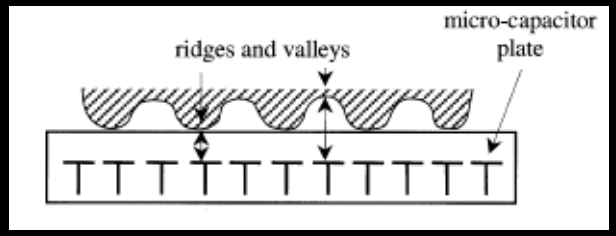


parts of biometric systems
by Lisa Thalheim

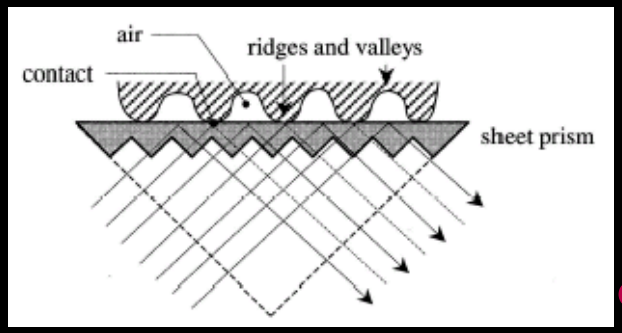
- attacking the data
  - communication data (1)
  - reference data (2)
- attacks using the sensor (3)
- attacking the software (4)
  - matcher
  - threshold
  - ...

sensor types

- capacitive
- optical
- electrical
- thermal



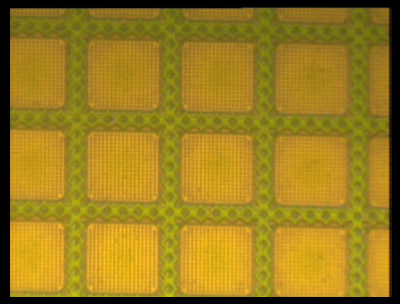
capacitive sensor



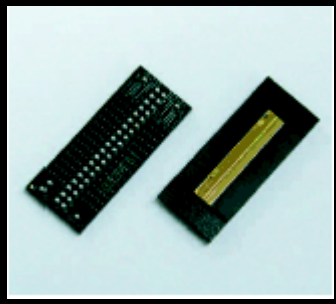
optical sensor

http://www.diva-portal.org/diva/getDocument?urn_nbn_se_liu_diva-2397-1__fulltext.pdf

- touching
- sweeping



array of capacitors



sweep sensor

collecting the data

visualisation of latent prints on glossy surfaces

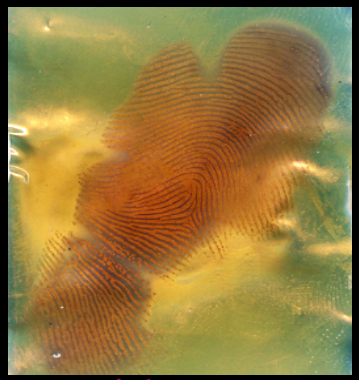
- coloured or magnetic powder


visualisation with coloured powder

- cyanoacrylate


visualisation with cyanoacrylate

- vacuum metal deposition



visualisation with sputtered gold

visualisation of latent prints on paper

- amino acid indicator
  - Ninhydrin
  - Iodide

visualisation with Ninhydrin

- thermal decomposition of grease

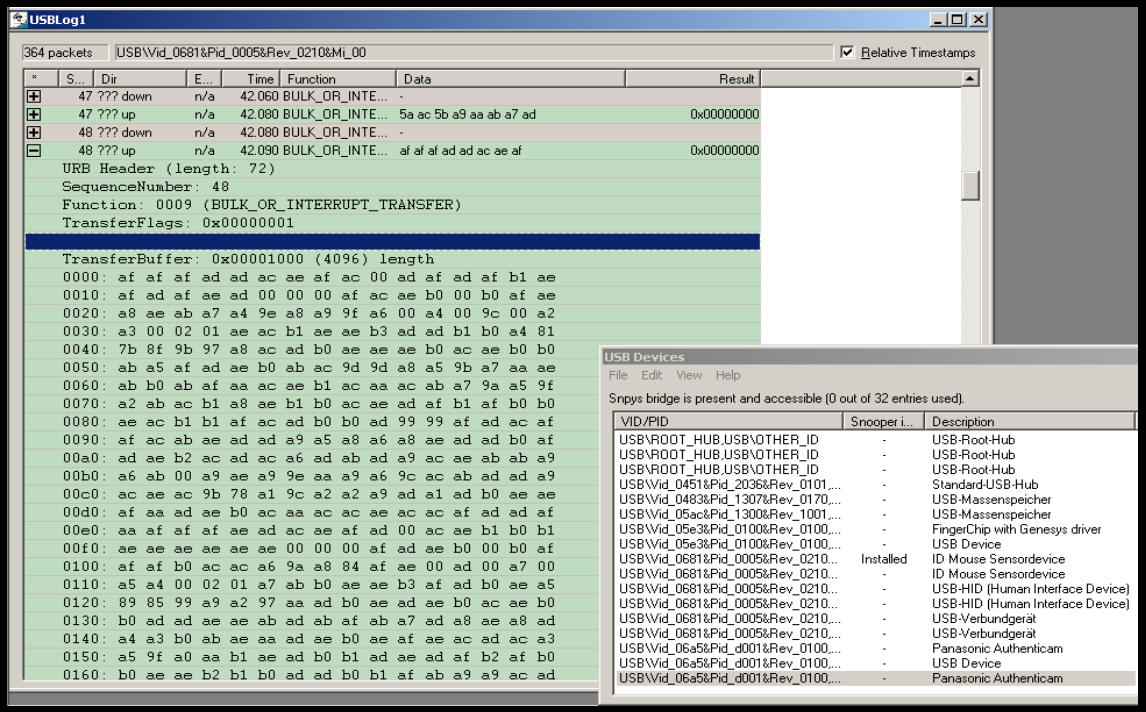
visualisation of grease

sniffing the communication

- Hardware
  - USB-Agent / USB Tracker
  - directly connected to the sensor
  - GNU-Radio

USB-Agent www.hitex.com

- Software
  - usbsnoop
  - sniffusb
  - usbmon

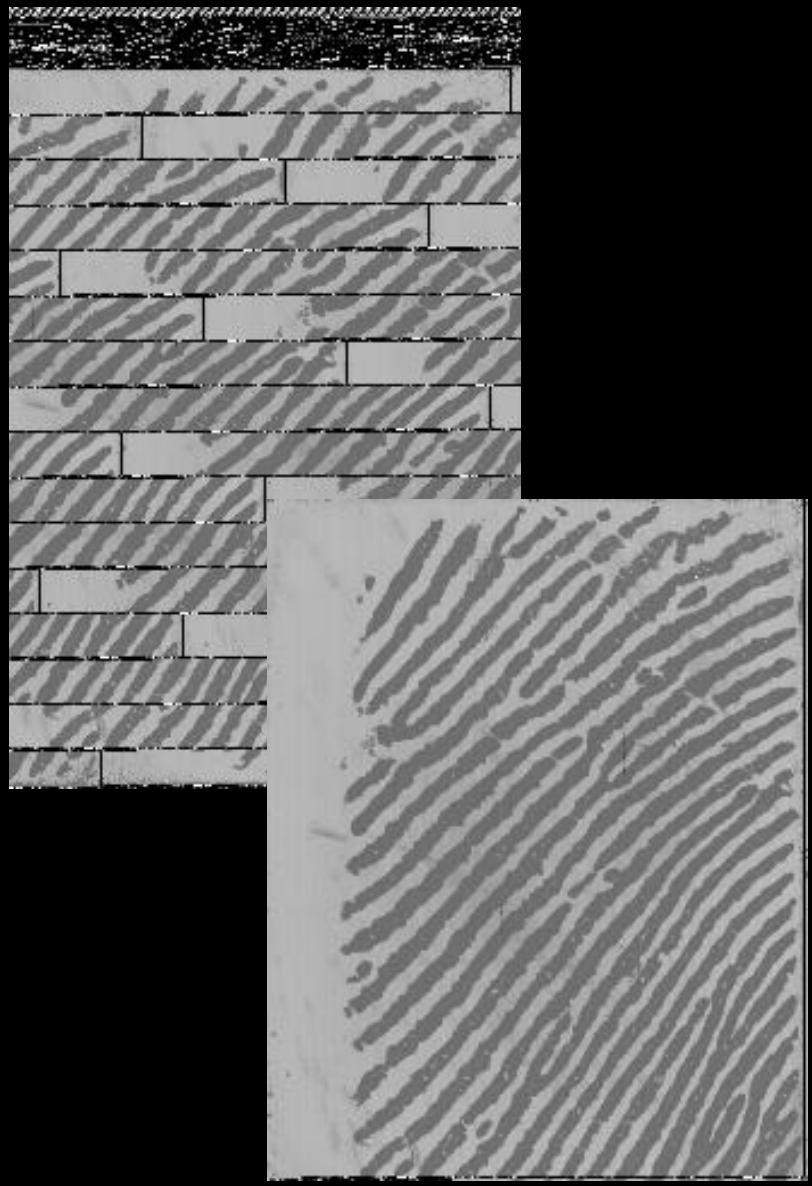


usbsnoop

data analysis

- collecting public information
- analysing the sensor

- type of data
  - raw vs. templates
- encryption
- header
  - timestamps
  - checksums

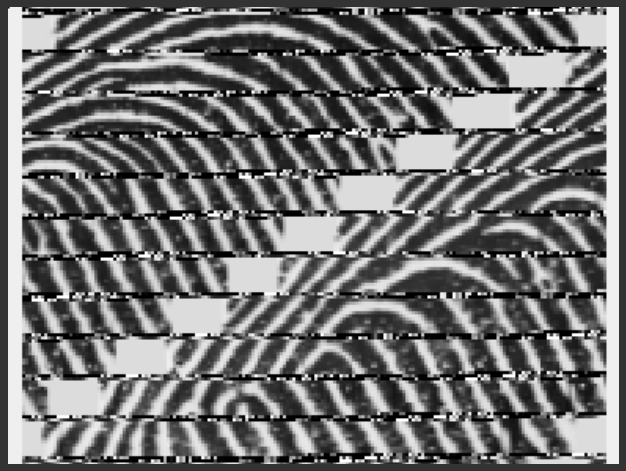


USB-sniff of the Siemens ID Mouse

sniffing the data @ thinkpad sensor

- direct sniffing not possible
  - hardware: built-in sensor
  - software: encrypted data (TPM?)
- external version of the sensor

external IBM sensor



USB-sniff of the Thinkpad sensor

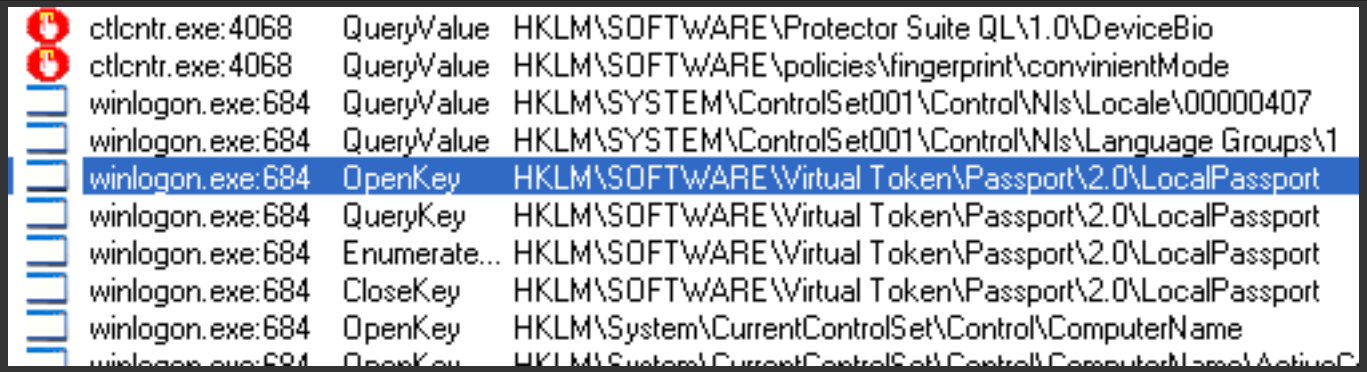
http://www-8.ibm.com/lenovoinfo/fingerprint/i/usb_fpr.gif

templates

- localisation
  - in the filesystem (filemon)
  - in the registry (regmon)

- analysing
  - template to user correlation
  - used algorithms
  - checksums
  - raw images

templates @ thinkpad sensor



ctlcntr.exe:4068	QueryValue	HKLM\SOFTWARE\Protector Suite QL\1.0\DeviceBio
ctlcntr.exe:4068	QueryValue	HKLM\SOFTWARE\policies\fingerprint\convinientMode
winlogon.exe:684	QueryValue	HKLM\SYSTEM\ControlSet001\Control\Nls\Locale\00000407
winlogon.exe:684	QueryValue	HKLM\SYSTEM\ControlSet001\Control\Nls\Language Groups\1
winlogon.exe:684	OpenKey	HKLM\SOFTWARE\Virtual Token\Passport\2.0\LocalPassport
winlogon.exe:684	QueryKey	HKLM\SOFTWARE\Virtual Token\Passport\2.0\LocalPassport
winlogon.exe:684	Enumerate...	HKLM\SOFTWARE\Virtual Token\Passport\2.0\LocalPassport
winlogon.exe:684	CloseKey	HKLM\SOFTWARE\Virtual Token\Passport\2.0\LocalPassport
winlogon.exe:684	OpenKey	HKLM\System\CurrentControlSet\Control\ComputerName

RegMon output of the enrolment

- HKEY_LOCAL_MACHINE\SOFTWARE\Virtual Token\Passport\2.0
  - \LocalPassport\User <Username>
  - \LocalPassportBio

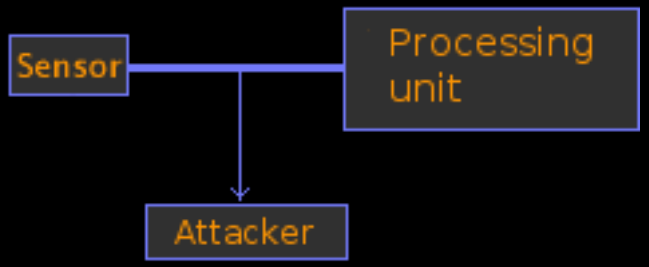
- C:\WINDOWS\system32\config\SOFTWARE
- template starts with: 00 13 48 5b [01 02]

attacking the communication

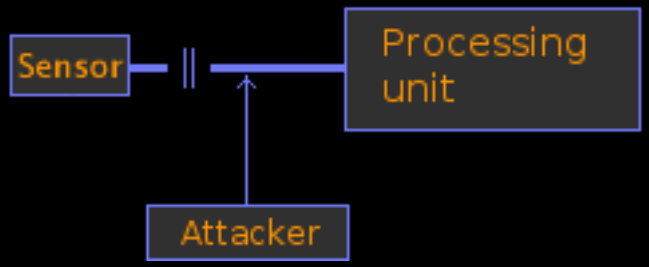
attacking the communication

- replaying sniffed packages

sniffing



replaying



replay attack

by Lisa Thalheim

- inserting self-generated data
  - analyse template data
  - attacking the software

attacking the templates

attacking the templates

- adding or deleting a template
- two people matching one template
- changing template to person correlation
- attacking the software using a manipulated template

attacking the templates @ thinkpad sensor

- read the template in the registry
- add your own fingerprint to an existing template
- write back to the registry (biometric worm)

attacks using the sensor

latent prints 1

- reactivating latent prints on touch sensors
  - capacitive: aspirate, graphite
  - optical: coloured powder

- countermeasures
  - checking minutia position of the last login

reactivating latent prints

http://www.heise.de/ct/02/11/114/

latent prints 2

- using latent prints (not on the sensor)
  - graphite or coloured powder on adhesive tape

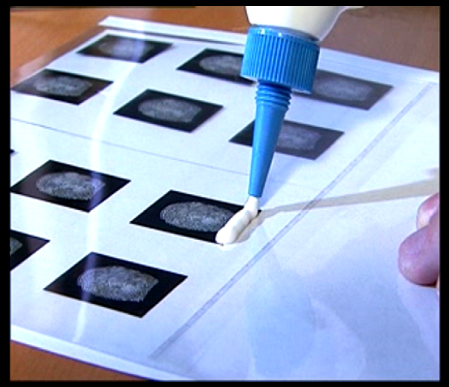
- not for sweeping sensors

graphite powder on adhesive tape

http://www.heise.de/ct/02/11/114/

making a dummy finger

- gelatine, silicone
- wood glue




making a dummy finger

- enhancing with graphite spray

making a dummy fingers @ thinkpad sensor

- etching an optical PCB
- aluminium foil on adhesive tape
- transfer the fingerprint onto the foil

etched PCB

dummy finger

life check

- pulse
  - IR illuminated bloodstream
  - deformation of the ridges
- property of the skin
  - electrical and thermal conductivity
  - colour
- absorption of the blood
- sweat

hacked sensors (systems)

- capacitive
  - Infineon (Siemens ID mouse)
  - UPEK (IBM Thinkpads)
- optical
  - Dermalog
  - U.are.U (Microsoft)
  - Identix
- thermical
  - Atmel (ekey, iPAQ)
- electrical
  - Authentec (Medion)

conclusion

- latent prints left on nearly every surface
- prints are easy to collect
- nearly all tested systems could be fooled with home-made dummy finger
- fall-back passwords still needed

- **Don't use fingerprint recognition systems for security relevant applications!**

Thank you.

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preventing the recognition

- superglue
- hard work :)
- etching
- scorching
- remove with emery paper
- transplantation