IoT Security

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Outline

- Biometric sensors
  - **Fingerprint scanner**
  - Face recognition
  - Other live signs

Face recognition

- Camera modules
- Face detection
- Face recognition

Camera modules

- Interfaces

- Resolution

- Environment / light conditions

Camera interfaces

- CSI2 – Raspberry Pi
- DVP – many other Pi, ESP32
- USB
- PAL/NTSC

CSI-2

- Camera Serial Interface 2
- https://www.mipi.org/specifications/csi-2
- Comes from MIPI – Mobile Industry Processor Interface
  - Physical Layer (C-PHY/D-PHY) + more
  - Lane Merger Layer – C-PHY = 2.5 Gbps/Lane
  - Low Level Protocol Layer
  - Pixel to Byte Conversion Layer
  - Camera Command Set

PAL/NTSC

- Analog signal
- Used for TV
- CCIR 625 lines
- 25 frames/s
- Interleaving
- Row and Frame synchronization as pulses

DVP

- 2x 8 bit data
- CLK
- SYNC

Face detection

- Known algorithms
- Open-source implementations
- Not that big performance needed
- Can be processed on RPI3

Face recognition

- Computation power intensive
- Changes in the human look – hair color, birds, …
- Photos
- Mirrors

Live signs

- Heart rate
- Pulse oxymeter
  - MAX30100
  - MAX30102
- EKG
  - AD8232
- Not ment as security device, but …

Fingerprint scanner

- Physical principle
    - Optical
    - Capacitive
    - Ultrasound
- Algorithms
   - Commonly implemented in chip

Fingerprint scanners - modules

- Many similar optical modules

- UART interface

- Similar chip sets

- The same software libraries

Fingerprint scanners - optical

- Oldest type of fingerprint scanners
- Light-sensitive microchip (CMOS image sensor)
- The skin surface is illuminated and fingerprint image captured
- Rather cheap solution
- Simple construction, easy to use
- Widely deployed
- Access control systems – buildings, facilities
- Immigrations

Fingerprint scanners - optical
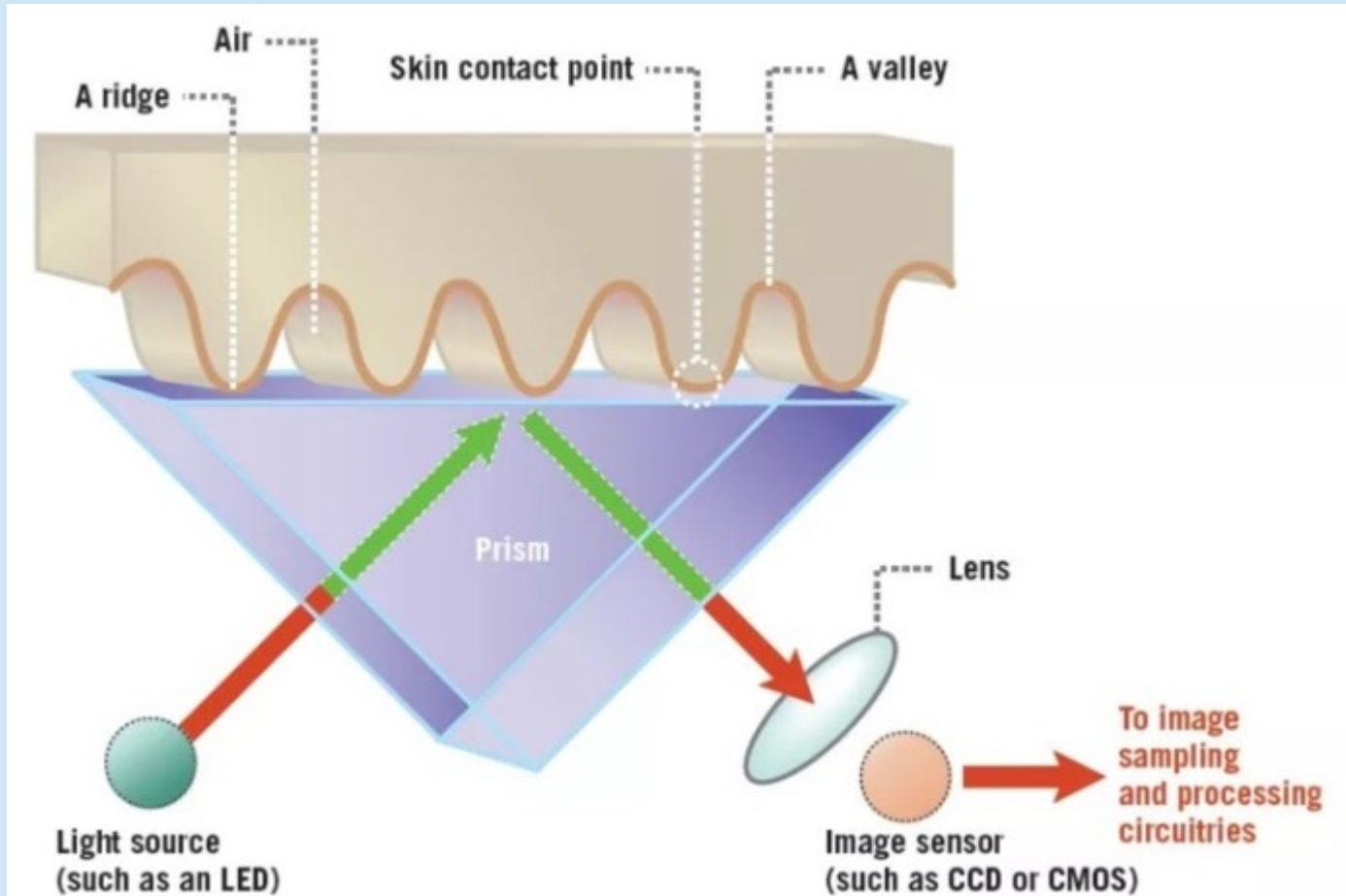
Fingerprint scanners - modules

- Adafruit FPM10A-DY50
  - Hangzhou Zhian Technologies ZFM-20, ZFM-60
- RadiumBox R307
  - Synochip AS606
- SparkFun GT-521F52
  - Synochip AS608

Capacitive fingerprint scanners

- Measurement of time differences in electrical charge across the skin surface

- The ridges in the fingerprint touch the scanner's surface while the valleys don't

- The pattern of capacitance makes a digital image of the fingerprint
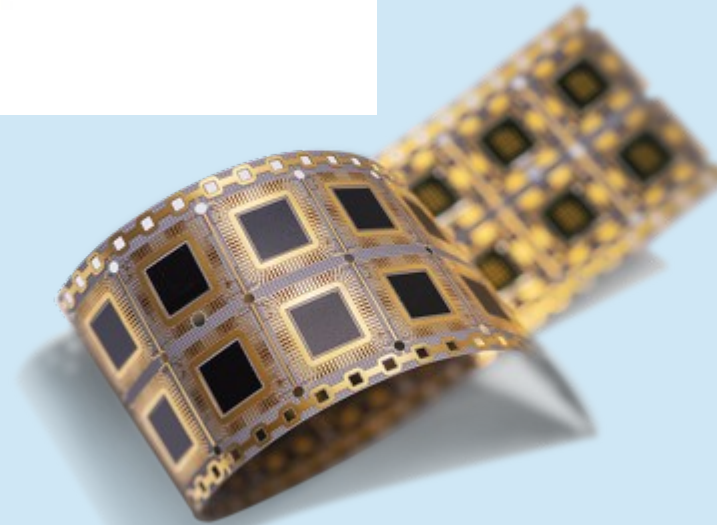
Capacitive fingerprint scanners

- Flat, compact size
- Power efficiency – battery powered devices
- Smartphones, tablets, laptops
- USB dongles
- Smart locks

# Capacitive fingerprint scanners
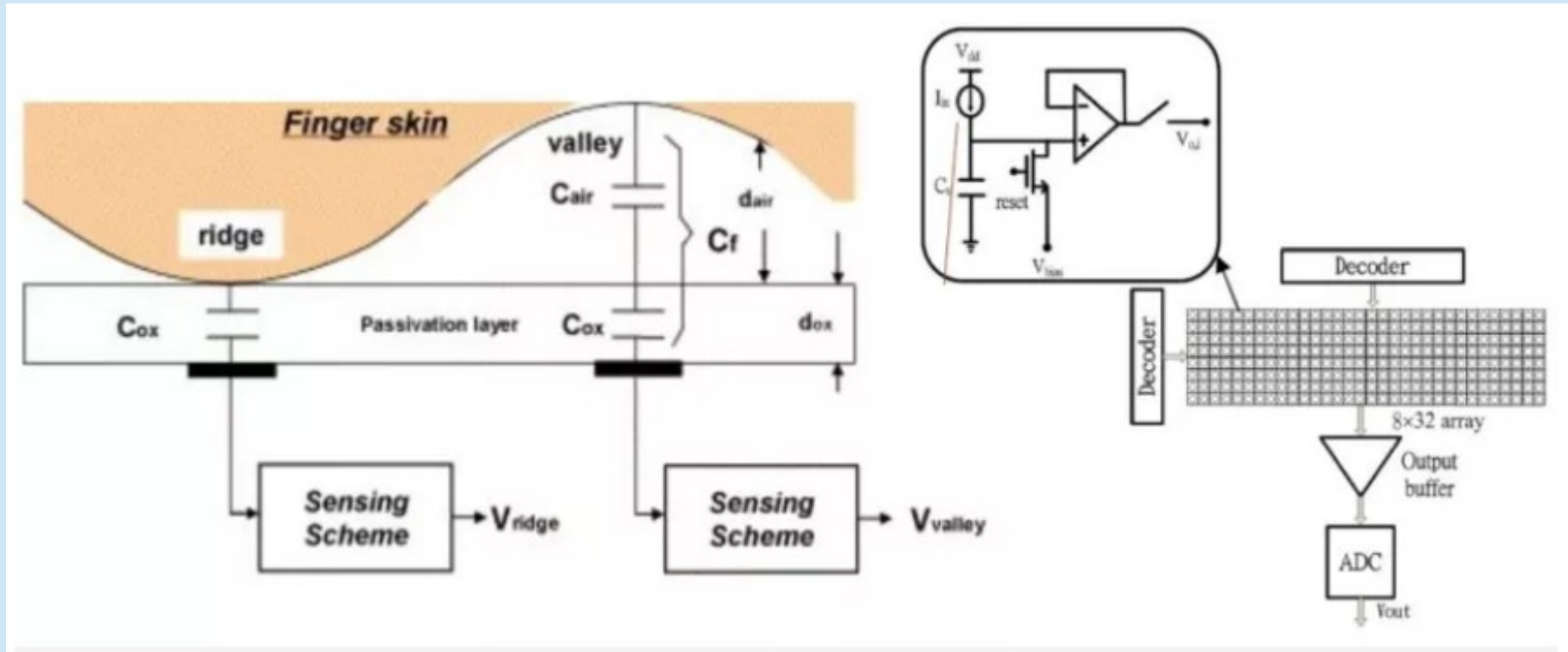
Capacitive modules

- FPC1020AM

- 192x192 pixels

- 8-bit grayscale resolution

- FingerPrint Cards AB (Sweden)

- New module FPC1323

Ultrasinc fingerprint scanners

- Most recent development
- Utilizes ultrasound waves to detect the details of fingerprints
- The scanner sends out an ultrasonic pulse which bounces back to the sensor after hitting the ridges and valleys of the fingerprint
- 3D representation of fingerprint
- Harder to spoof compared to 2D images
- Rather complex construction and higher price
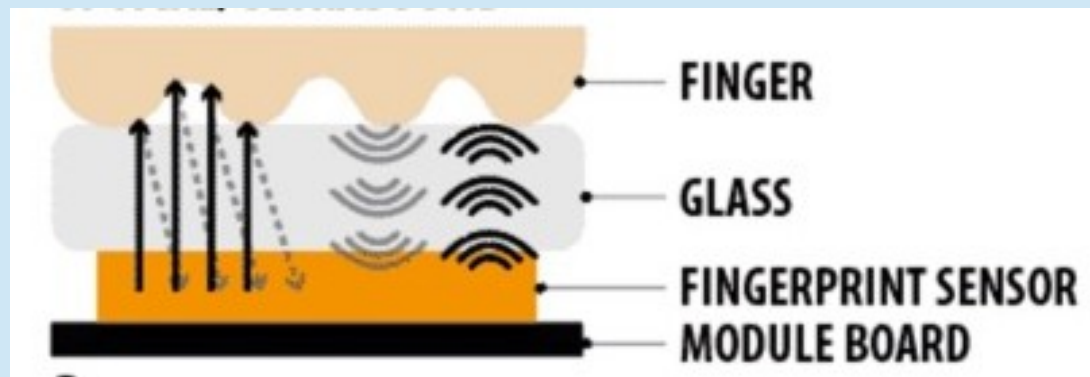
Thank for your attention!

Questions and comments?