IARPA Nail-to-Nail Challenge Registration

All Stage 1 Registrations need to be submitted to Challenge.gov by March 17, 2017

Company Info		Technical POC	
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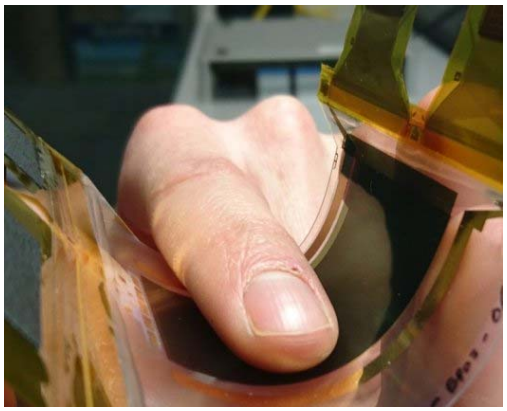
N2N System Description			
Title: Flexible Sensors – a rolled fingerprint solution		☐ Software Solution (uses conventional sensor) X Hardware/SW Solution (custom hardware and software)	

Abstract

Our nail-to-nail equivalent scanning demonstration will leverage the advantages of an array of organic thin-film transistor (OTFT) and organic photodiodes (OPD) on a flexible substrate. Instead of having a subject roll their finger across a flat scanning platen as is currently performed today, we will use a 500ppi array of optically sensitive pixels on a thin polymer backplane that wraps around a fingertip. The finger will be illuminated from above (nail side) with near-infrared (NIR) light. The NIR light will transmit through the finger and scatter out of the fingerprint at the bottom. Since the light scattering out of the skin will be roughly Lambertian in distribution, the sensor pixels that are in contact with the fingerprint ridges will pick up more light than those sensor pixels that are sitting beneath a valley of the fingerprint. In this manner an 8-bit grayscale image of the roll-equivalent fingerprint will be achieved. The capture of a nail-to-nail equivalent fingerprint will be performed one finger at a time. The team of companies working on this technology demonstration consists of Cross Match Technologies (Palm Beach Gardens, FL), ISORG (Grenoble, France) and FlexEnable (Cambridge, England).

Concept of Operation

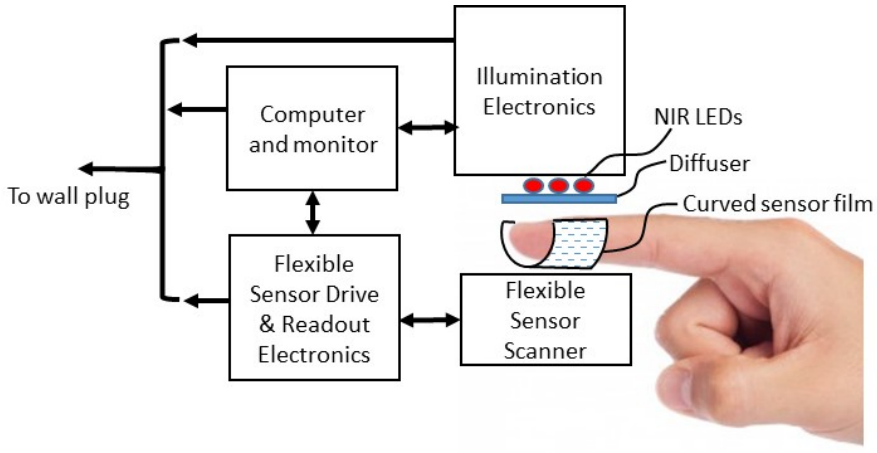


A subject will walk up to our technology demonstration and will be greeted by a computer screen and placards that have graphics illustrating the operation of our device. Our demonstration will instruct the subject to place his or her fingers one at a time on a concave platen. Starting with the right thumb, the subject will place his fingerprint into the opening of the device until the tip of the finger hits a mechanical stop. The prototype, sensing that a finger has been placed all the way forward, will have a mechanical or pneumatic mechanism to wrap the flexible optical sensor film around the sides of the subject's finger. During this process, the subject will keep his finger as motionless as possible on the platen. Once the subject's fingerprint is scanned, the flexible fingerprint sensor film will unwrap from the subject's finger and the subject will be instructed to place the next finger into the opening of the device. We envision that subject instruction and device status notification will be achieved through the use of a combination of LED indicators, beeps, and graphical images on an LCD screen, with verbal instructions from an operator as a last resort. If possible for a demonstration and definitely for a product, we would envision a camera monitoring the subject's hand to ensure proper placement of the correct finger each time.

System Diagram

- *Electric/Power source (supply voltage, current) and any battery specifications (if applicable)*
  - Laptop– 19.5V @ 3.3A, flexible fingerprint sensor: -Illumination: 7V @ <100mA
- *Materials of construction – particularly for any part(s) that would contact the subject*
  - The portions of the device in contact with the subject will be the mechanical house and support structure (made from Aluminum or printed plastic), illumination system (plastic diffuser placed over LEDs), and the flexible fingerprint sensor top layer (PET)

- *Optics/"light" information (type, wavelength, frequency, power)*
    - *Linear array of 850nm or 940nm LEDs with a diffuser in between LEDs and subject's finger. Optical power will be <700mW. No optics (imaging lenses) are required.*
- *Original specs from any COTS parts, plus info about any modifications:* No COTS parts will be used other than LEDs.
- *Description of any mechanical movements*
    - We anticipate movement of the flexible fingerprint sensor either mechanically or pneumatically in order to bend the film into a U-shape that allows a nail-to-nail fingerprint equivalent to be captured. Finger itself will be stationary



Anticipated Equipment

Hardware components will comprise a computer, LCD monitor, drive electronics, illumination LEDs and diffuser, mechanical packaging and mechanism for squeezing the flexible fingerprint sensor around the finger. Software developed will run the flexible fingerprint sensor, capture images, and post-processing them. For internal testing and proof to IARPA of a working prototype, we anticipate use of commercial fingerprint extract/match code (e.g., Innovatrics or Neurotechnology)

Devices

We will be creating a new device for this challenge.

Matchers

*A) Which Matcher will your team use for the **tenprint** to **tenprint** comparison? Please select one:*

____ Government ___ Custom __X__ Not Sure

We will most likely use the Government's matcher but since we are developing a prototype based upon a new technology, at this moment, we would like to reserve the right to supply our own matcher.

*B) Which Matcher will your team use for the **latent** to **tenprint** comparison? Please select one: __X_ Government*

Safety Assessment

Our technology demonstration will not have any safety issues. Electronic components will be appropriately shielded and optical illumination will be designed such that the NIR illumination only turns on during a scan and the light will be appropriately baffled such that little light will escape the device. We will make measurements before bringing the demonstration prototype to IARPA to ensure that the system is eye-safe. Mechanical movement of the flexible fingerprint sensor film about the finger will be at an appropriately low pressure to ensure no damage to the subject's finger.

Innovation

Our technology demo will be unique since it leverages optical sensors on a flexible backplane, thereby allowing the sensor film to wrap around a stationary finger in order to capture a nail-to-nail rolled equivalent image. We anticipate fingerprint matching accuracy and speed comparable to commercial scanners since our technology is also contact based and requires a single image to extract minutia features. Though our demo will be one finger at a time, it is conceivable that in the future a product could be constructed that has 5 separate locations for fingers to be placed, thereby allowing the simultaneous capture of the rolled print of all 5 fingers of a hand.