Waveguides with Dielectric-light Reflectors for Physically Unclonable Functions Applicable on Fully Fabricated Printed Circuit Boards for Identification, Authentication, and Cryptographic Key Derivation

Technology #17647

Applications

- Fully Fabricated Printed Circuit Boards (PCBs) for Identification, Authentication, and Cryptographic Key Derivation

Problem Addressed

Many electronic systems use digital identification for authentication and key derivation to achieve system security. One system security method uses an optical physical unclonable function (PUF), implemented on a printed circuit board. PUFs are constructed from light emitting diodes (LEDs) and an image sensor affixed to the PCB, which is then coated with a thin polymer planar waveguide. The system is designed to derive a unique key value from the sensor image. Invasive attempts damage the polymer coating, thus destroying the PUF value. Current methods of fabricating the waveguide reflectors rely on silver reflectors. These reflectors demonstrate large light loss at critical reflection angles and require special processing methods or manufacturing, dramatically increasing production costs.

Technology

The invention provides an alternative to the silver reflectors used in the polymer planar waveguide. Replacing the silver reflectors with dielectric reflectors resulted in the essentially total reflection of light in the critical reflection angles. Theoretical predictions indicate a more than doubled efficiency increase in light transportation. This would vastly increase the sharpness of the sensor image generated resulting in a stronger security system. The innovation also exhibits a large degree of flexibility as the dielectric material can be chosen for the particular application of interest. In addition, the dielectric reflectors do not require special processing methods for fabrication, vastly diminishing the cost of production.

Advantages

- Stronger security system
- Light transportation to sensor increased by factor of 2 over conventional waveguides
- Flexible design allows for application-specific choice of dielectric material
- Inexpensive fabrication due to no special processing requirements

Categories For This Invention:

Electronics & Circuits

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Electronic Components
Lincoln Laboratory
Materials
Thin Films
Networks & Systems
Security
Photonics
Other (Photonics)

Intellectual Property:

Waveguide with dielectric light reflectors
PCT
2016-190936
Waveguide with dielectric light reflectors
US Patent Pending
2018-0026801

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Publications:

Static Physically Unclonable Functions for Secure Chip Identification With 1.9–5.8% Native Bit Instability at 0.6–1 V and 15 fJ/
IEEE Journal of Solid-State Circuits
March 4, 2016
Dynamic Memory-based Physically Unclonable Function for the Generation of Unique Identifiers and True Random Numbers
2014 IEEE International Symposium on Circuits and Systems (ISCAS)
June 1, 2014
Anti-Tamper in Open Architecture Systems
HPEC
September 20, 2011

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Lincoln Laboratory
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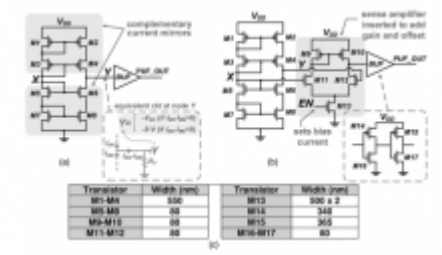

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