Physically Unclonable Functions for Fully Fabricated Printed Circuit Boards used in Identification, Authentication, and Cryptographic Key Derivation
Technology #17648

Applications

- Electronic systems needing to incorporate unclonable identification devices for 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 create a unique key value from the sensor image. Invasive attempts damage the polymer coating, thus destroying the PUF value. However, there is a concern that advanced invasive methods can deduce the original PUF value from a damaged sensor image.

Technology

The invention provides a method for manufacturing a waveguide which increases the image distortion between the original and damaged image. This significantly increases the difficulty in deducing the initial PUF value from a damaged image. The technology employs a novel two-color phosphor-loaded waveguide technology. When an invasive attempt is made on the system, not only is the image distorted, but color sensitive phosphor is also activated causing a color change in the system. The device can be applied to systems after full fabrication, allowing the security systems of manufactured electronics to be upgraded.

Advantages

- Includes optical effects for improved security and hacker detection
- Increases image distortion for heightened protection of PUF value from hackers
- Applicable to fully fabricated systems needing security system upgrades

Categories For This Invention:

- Electronics & Circuits
- Electronic Components
- Lincoln Laboratory
- Networks & Systems
- Security
- Photonics
Other (Photonics)
Sensors (Photonics)
Detectors
Imagers

**Intellectual Property:**

Phosphor-loaded waveguide
PCT
2016-190937
Phosphor-loaded waveguide
US Patent Pending
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**Publications:**

**Helper-less Physically Unclonable Functions and Chip Authentication**
2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)
May 4, 2014

**Anti-Tamper in Open Architecture Systems**
HPEC
2011

**Full-Wave Analysis and Design of Dielectric-Loaded Waveguide Filters Using a State-Space Integral-Equation Method**
EE Transactions on Microwave Theory and Techniques
January 9, 2009

**Optical Physical Unclonable Function**
IEEE MWSCAS
August 2017

**Secure Embedded Systems**
MIT

**External Links:**

Lincoln Laboratory
http://www.ll.mit.edu/index.html

**Image Gallery:**