Reconfigurable HOA-PUF Using Manufacturing Variations for Efficient Security in the Internet of Things

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Abstract

- Security is currently a major concern, especially in the area of Internet of Things environment.
- This work presents an energy efficient security solution, the **PUF,** for making the Internet of Things a safer environment.
- Low power consumption and low chip area makes it easier to be deployed anywhere.

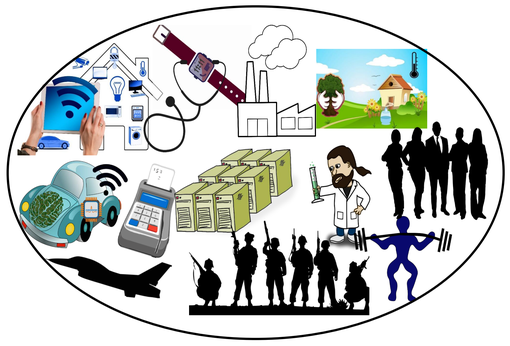


Fig. 1 The Internet of Things

Design of Proposed Physical Unclonable Function and Deployment in Device

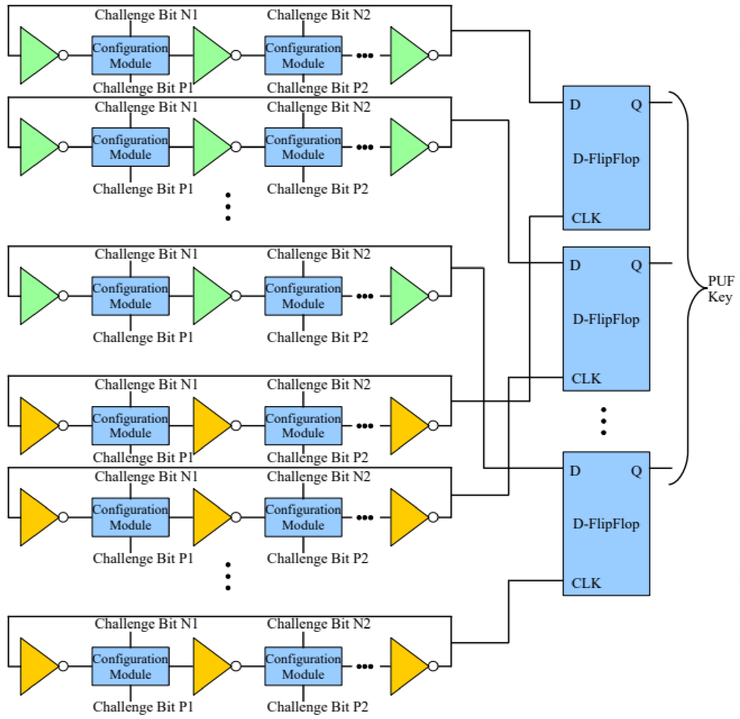


Fig. 2. Reconfigurable HOA PUF

- The Reconfigurable Hybrid Oscillator Arbiter Physical Unclonable Function consists of ring oscillators as the core component.
- A configuration module is introduced for reconfigurability and increased robustness.
- Challenge input selects the AND gates which select the transistors T1 or T2.
- With the change in the challenge input, a different transistor is selected which changes the delay introduced into the signal.
- Based on the signal at the D-input and clock signal of the flipflop, the output key will be '1' or '0'.

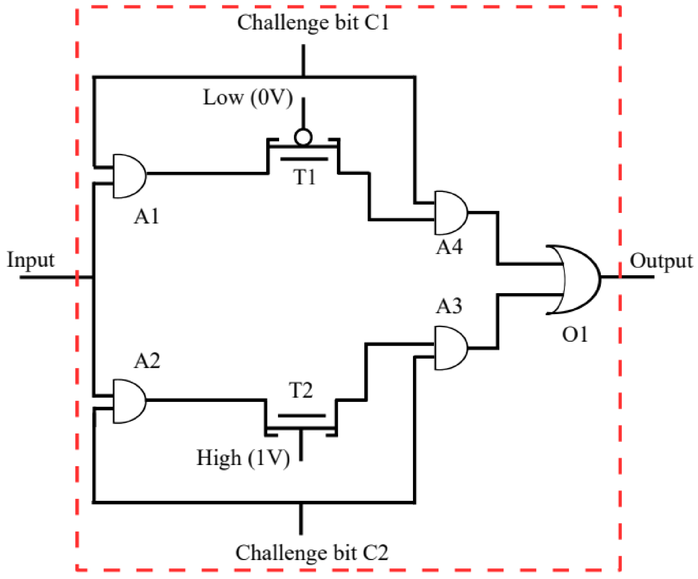


Fig. 3. Configuration Module

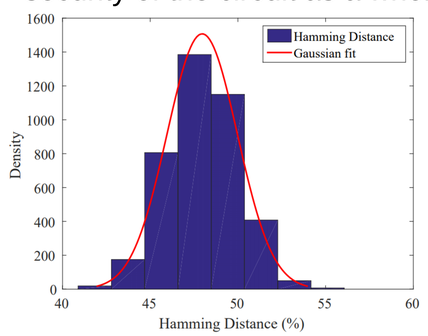
Simulation Results of The Design

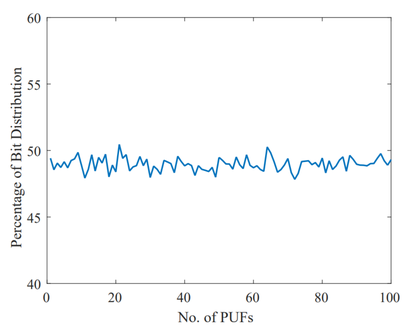
- Uniqueness: The same key should not be obtained using any other PUF design. Uniqueness is calculated using the Hamming Distance.
- Average Power: Average Power consumed by the entire circuit.
- Reliability: Environmental variability should not affect the working of a PUF module. Such effects include aging effects, temperature and power supply variations.
- Randomness: The number of 0's and 1's in the output keys should be equally distributed.
- Each of these results are presented below.

Parameter	Value
Conventional Ring Oscillator Physical Unclonable Function	
Average Power	310.8 µW
Hamming Distance	50%
Time to generate key	150 ns
Proposed Reconfigurable HOA PUF	
Average Power	167.5 µW
Hamming Distance	48%
Time to generate key	50 ns

Conclusion

- A reconfigurable HOA PUF design is presented.
- In future work, the design will be deployed in an IoT environment for real-time analysis.
- More robust designs can be implemented to increase the security of the circuit as a whole.





References

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