(12) PATENT APPLICATION PUBLICATION
(19) INDIA
(22) Date of filing of Application :15/07/2023

(21) Application No.202321047823 A
(43) Publication Date : 01/09/2023

(54) Title of the invention : AUTHENTICATION SYSTEMS IN RESOURCE-CONSTRAINED IOT APPLICATIONS: A NOVEL LENGTH-FLEXIBLE, LIGHTWEIGHT, CANCELABLE FINGERPRINT TEMPLATE

(51) International classification :G06F0021320000, G06F0021620000, H04L0009320000, G06F0021600000, G06N0020000000
(86) International Application No :NA
Filing Date :NA
(87) International Publication No : NA
(61) Patent of Addition to Application Number :NA
Filing Date :NA
(62) Divisional to Application Number :NA
Filing Date :NA

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(57) Abstract :
Authentication Systems in Resource-Constrained IoT Applications: A Novel Length-Flexible, Lightweight, Cancelable Fingerprint Template ABSTRACT: Fingerprint authentication techniques have been employed in various Internet of Things (IoT) applications for access control to protect private data, but raw ?ngerprint template leakage in unprotected IoT applications may render the authentication system insecure. Cancelable ?ngerprint tem- plates can effectively prevent privacy breaches and provide strong protection to the original templates. However, to suit resource-constrained IoT devices, oversimpli?ed templates would compromise authentication performance signi?cantly. In addi- tion, the length of existing cancelable ?ngerprint templates is usually ?xed, making them dif?cult to be deployed in vari- ous memory-limited IoT devices. To address these issues, we propose a novel length-?exible lightweight cancelable ?nger- print template for privacy-preserving authentication systems in various resource-constrained IoT applications. The proposed cancelable template design primarily consists of two components: 1) length-?exible partial-cancelable feature generation based on the designed re-indexing scheme; and 2) lightweight cance- lable feature generation based on the designed encoding-nested-difference-XOR scheme. Comprehensive experimental results on public databases FVC2002 DB1-DB4 and FVC2004 DB1-DB4 demonstrate that the proposed cancelable ?ngerprint template achieves equivalent authentication performance to state-of-the- art methods in IoT environments, but our design substantially reduces template storage space and computational cost. More importantly, the proposed length-?exible lightweight cancelable template is suitable for a variety of commercial smart cards (e.g., C5-M.O.S.T. Card Contact Microprocessor Smart Cards CLXSU064KC5). To the best of our knowledge, the proposed method is the ?rst length-?exible lightweight, high-performing cancelable ?ngerprint template design for resource-constrained IoT applications. Many IoT applications use fingerprint authentication for access control, which helps keep sensitive data safe. However, the authentication method may be compromised if raw fingerprint templates were to leak out of unprotected IoT apps. Cancellable fingerprint templates provide strong protection for the original fingerprint templates and can successfully prevent privacy intrusions. However, oversimplified templates would significantly decrease authentication performance in order to suit resource-constrained IoT devices. Furthermore, existing cancelable fingerprint templates often have a set length, making deployment difficult in memory-constrained IoT devices. We propose a new length-adjustable, lightweight, cancelable fingerprint template to protect user privacy during authentication processes in low-power Internet of Things (IoT) applications. The proposed architecture for a revocable template is made up mostly of two parts: Second, using the encoding-nesteddifference-XOR approach, we can generate features that are both lightweight and cancellable. Extensive experiments on the public databases FVC2002 DB1-DB4 and FVC2004 DB1-DB4 show that the proposed cancelable fingerprint template achieves authentication performance comparable to state-of-the-art methods in IoT environments, while our design drastically reduces template storage space and computational cost. The proposed length-adaptive, lightweight, and cancelable template also works with a wide range of existing commercial smart card formats (including C5-M.O.S.T. Card Contact Microprocessor Smart Cards CLXSU064KC5). To the best of our knowledge, the suggested method is the first cancelable fingerprint template design that is length-flexible, lightweight, and high-performance for use in resource-constrained IoT systems.

No. of Pages : 11 No. of Claims : 6