

(12) PATENT APPLICATION PUBLICATION

(21) Application No.202511073065 A

(19) INDIA

(22) Date of filing of Application :31/07/2025

(43) Publication Date : 05/09/2025

(54) Title of the invention : Dual-Factor Biometric and Proximity-Based Vehicle Access System Using Thumbprint and Bluetooth Authentication

(51) International classification

:H04W0004800000, H04L0009400000, G06F0021320000, G07C0009000000, H04L0009320000

(86) International Application No  
Filing Date

:NA  
:NA

(87) International Publication No

: NA

(61) Patent of Addition to Application Number  
Filing Date

:NA  
:NA

(62) Divisional to Application Number  
Filing Date

:NA  
:NA

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(57) Abstract :

The invention discloses a dual-factor authentication system for vehicle access that enhances security by integrating biometric fingerprint verification with Bluetooth-based proximity detection. The system comprises a fingerprint sensor, a Bluetooth Low Energy (BLE) module, a microcontroller, a locking mechanism, and a mobile application. The fingerprint sensor activates only when a registered mobile device is detected within proximity via BLE. Upon successful dual authentication, the microcontroller triggers the vehicle's door unlocking mechanism. The system further includes a mobile app for initial device pairing, fingerprint registration, and access management. It also supports fallback authentication methods, such as PIN entry or voice command, to ensure accessibility in exceptional situations. This solution addresses the vulnerabilities of traditional key or remote-based systems by ensuring that both possession of a trusted device and a valid biometric trait are required for entry.

No. of Pages : 5 No. of Claims : 6