T-Identity - Let's Make Digital Lives Safer

Ma, Yuecheng (School: Kells Academy)

Phishing, credential theft, and password reuse still remains as a major causes of digital account compromise. This project investigated if a low-cost hardware-bound identity device could potentially reduce these risks by replacing transmitted credentials with a physical device containing a stored secret. A prototype was designed using an Blaustahl Storage Device, taking advantage of it's RP2040 microcontroller, FeRAM storage, with the integration of a segmented server architecture. During initialization, a unique device identifier and device secret were stored on the hardware. User data was encrypted and stored on a secondary server encrypted, while only the authentication logic and one-time token issuance server connects to the internet, this guarantees more time for security response in the event of a breach. Simulated login trials were performed under different risk conditions, familiar and unfamiliar device, network environments, GPS locations. Depending on the context, the system either authenticated the user directly or required additional verification through biometrics or a six-digit PIN. Token reuse rejections was also tested. The prototype authenticated users without requiring password transmission and successfully rejected reused one-time access tokens in simulation. Server segmentation showed the effectiveness on keeping encrypted data isolated. Estimated mass-production cost was 12 to 16 Canadian dollars per unit, suggesting practical scalability. These results showed that T-Identity's authentication without transmitting any credentials is feasible on potentially reducing phishing and credential-based attacks. Future work includes nonce-based challenge-response authentication, tamper detection, stronger privacy protections, and tracking features.

Awards Won:

Association for the Advancement of Artificial Intelligence: AAAI Membership for the School Libraries of All 8 Winners (in-kind award / part of 1st-3rd prize and honorable mentions' prize)

Society Alumni Special Award: Excellence in Science Communication