TABLE XIII Applied Technologies, Tools and Approaches in Various Studies

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Paillier Cryptosystem Gas Optimisation, Filtering Ding Y et al. [93] Ethereum, Hyperledger Fabric, Fisco BCOS, CITA, Xuperchain, Superchain, Auto Agents, Cross-Chain Smart Co AGRobot, Relay Chain Scheme, PKI, Digital Signatures Mukta R et al. [84] Blockchain, Smart Contracts, Ethereum, Sovrin, Hyperledger Fabric, DIDs, VCs, SSI, ZKP, Redactable Signature Flutter, Node.js, Web3.js, Merkle Tree, GGM Tree, Cryptographic Hash Functions, Ramic S et al. [64] Selective Disclosure, Merkle Trees, Boneh-Lynn-Shacham (BLS) Signatures, ZKP, Cryptographic Hash Functions, Aggregated Signatures, JSON		DID, Decentralized Key Management System (DKMS), VC, Microservice Architecture (MSA), Blockchain, Kubernetes, Chameleon Hash (CH), Attribute-Based Encryption (ABE), Shamir Secret Sharing Scheme (SSSS), JSON, JSON-LD, CBOR, ED25519, SHA-512, Curve25519ZKP, Sovrin, Uport, Jolocom, Hyperledger Aries, Hyperledger Indy, WQL, MongoDB, SQL		
AGRobot, Relay Chain Scheme, PKI, Digital Signatures Mukta R et al. [84] Blockchain, Smart Contracts, Ethereum, Sovrin, Hyperledger Fabric, DIDs, VCs, SSI, ZKP, Redactable Signature Flutter, Node.js, Web3.js, Merkle Tree, GGM Tree, Cryptographic Hash Functions, Ramic S et al. [64] Selective Disclosure, Merkle Trees, Boneh-Lynn-Shacham (BLS) Signatures, ZKP, Cryptographic Hash Functions, Aggregated Signatures, JSON		Ethereum Blockchain, Fully Homomorphic Encryption (FHE), Smart Contracts, ZKP, Secure Hash Algorithm (SHA), PKI, Paillier Cryptosystem Gas Optimisation, Filtering		
Flutter, Node.js, Web3.js, Merkle Tree, GGM Tree, Cryptographic Hash Functions, Ramic S et al. [64] Selective Disclosure, Merkle Trees, Boneh-Lynn-Shacham (BLS) Signatures, ZKP, Cryptographic Hash Functions, Verifiable Presentations, Aggregated Signatures, JSON		Ethereum, Hyperledger Fabric, Fisco BCOS, CITA, Xuperchain, Superchain, Auto Agents, Cross-Chain Smart Contracts, AGRobot, Relay Chain Scheme, PKI, Digital Signatures		
Verifiable Presentations, Aggregated Signatures, JSON		Blockchain, Smart Contracts, Ethereum, Sovrin, Hyperledger Fabric, DIDs, VCs, SSI, ZKP, Redactable Signatures, JWT, Flutter, Node.js, Web3.js, Merkle Tree, GGM Tree, Cryptographic Hash Functions,		
		Selective Disclosure, Merkle Trees, Boneh-Lynn-Shacham (BLS) Signatures, ZKP, Cryptographic Hash Functions, Verifiable Presentations, Aggregated Signatures, JSON		
Yamamoto D et al. [65] BBS+ Signature, VCs, Selective Disclosure, Linked Data, JSON-LD, RDF Graphs, Canonicalization Algorithms DIDs		BBS+ Signature, VCs, Selective Disclosure, Linked Data, JSON-LD, RDF Graphs, Canonicalization Algorithms, ZKPs, DIDs		
De Salve A et al. [85] Selective Disclosure, SSI, DIDs, VCs, Ethereum Blockchain, JWT, Hashing Functions (HMAC, SHA3-256, SHAD) Digital Signatures, Cryptographic Proofs, PKI, Linked Data, ZKP		Selective Disclosure, SSI, DIDs, VCs, Ethereum Blockchain, JWT, Hashing Functions (HMAC, SHA3-256, SHA3-512), Digital Signatures, Cryptographic Proofs, PKI, Linked Data, ZKP		

TABLE XIII Applied Technologies, Tools and Approaches in Various Studies (Continued)

Study	Applied Technologies, Tools and Approaches		
Fotiou N et al. [66]	Selective Disclosure, VCs, ZKP, OAuth 2.0, BBS+ Digital Signatures, JSON-LD, Web of Things (WoT), Digital Signature Scheme, JSON Canonicalization (JCan), HTTP Proxy		
Kalos V et al. [86]	SSI, VC, JSON, JSON-LD, Selective Disclosure Cryptographic Protocols, ZKP, Canonicalization Algorithms, Anonymous Credentials		
Slamanig D et al. [63]	Proxy Re-Encryption, Redactable Signatures, Digital Signatures, Public Key Infrastructure(PKI)		
Tian R et al. [90]	Erasure Coding (EC), Merkle B-tree (MB-tree), Blockchain, Selective Disclosure, VCs, Smart Contracts, Cryptographic Proofs,		
Singh K et al. [61]	Hyperledger Fabric, Short Signature, Pairing, Elliptic Curve Cryptography (ECC), ECDSA, NIZKP, Schnorr PoK, Commitment Schemes, Bilinear Pairing, Java, Go, Hyperledger Fabric, Java SDK		
Yang Z et al. [59]	Merkle Tree, AES Encryption, SHA1 Hashing, ZKP, Fiat-Shamir Heuristic, Bulletproofs, ECC Signature Algorithm, Smart Contracts, Consortium Blockchain, DID, Credential Hashing, Attribute-Based Verification, Digital Certificates, Minimal Disclosure Authentication		
Mukta R et al. [76]	Hyperledger Fabric, Selective Disclosure, Redactable Signature, Smart Contracts, DIDs, VCs, SSI, GGM Tree, Merkle Hash Tree, Node.js, Web3.js, REST Server, Google Drive, Cryptographic Hash Functions, JSON-LD		
Li Z [89]	Ethereum, Solidity, Web3, Java SDK, JPBC Library, BLS Aggregate Signature, DID, VC, Selective Disclosure		
Yu Y et al. [77]	Ethereum blockchain, smart contracts, signature scheme, zero-knowledge proof of knowledge (ZKPoK), selective revocation, bilinear maps, pairing-based accumulators		
Deniz Sarier N [70]	Blockchain, Biometric-based credentials, Selective Disclosure, ZKP, Dynamic Accumulators, Fuzzy Extractors, Merkle Trees, Schnorr Signatures, Encryption, Bitcoin, Ethereum, GDPR compliance mechanisms, Tamper-proof devices, Industrial IoT (IIoT)		
Kaneriya J et al. [60]	Blockchain, Smart Contracts, Ethereum, Hyperledger, Sovrin, Selective Disclosure, DIDs, VCs, ZKP, Digital Signatures, IPFS, Attribute-Based Encryption (ABE), Consent Tokens, PKI, Merkle Trees, REST API, Web3.js, Solidity		

TABLE XIV Smart Contract Support for Identity Verification

Study	Impact of Smart Contracts		
Patil P et al. [3]	Automation and transparency, reduced manual intervention, enhanced auditability.		
Kumar M et al. [4]	Secure and efficient verification, tamper-proof records, reduced fraud.		
Moyano J et al. [91]	Dynamic updating, real-time dissemination, enhanced data accuracy.		
Ullah N et al. [75]	Streamlined KYC process, increased efficiency, reduced operational costs.		
Kapsoulis N et al. [69]	Privacy-oriented verification, robust access control, compliance with data protection.		
De Salve A et al. [82]	Trust frameworks for SSI, user autonomy, decentralized identity management.		
Gilani K et al. [29]	User-controlled management, selective disclosure, granular data sharing.		
Dong C et al. [5]	Scalable authentication, cross-chain interoperability, improved security.		
Moya C et al. [68]	Secure verification, privacy with ZKP, data confidentiality.		
Malik S et al. [43]	Privacy-preserving management, enhanced security and traceability in supply chains.		
Pralhad Rankhambe B et al. [92]	Optimized KYC process, automated verification, improved customer experience.		
Ding Y et al. [93]	Efficient cross-chain verification, transparency, compatibility.		
Dhiman B et al. [62]	Secure decentralized verification, homomorphic encryption, data confidentiality.		

TABLE XV Existing Research Focus for Identity Verification

Study	Research Focus	User Control	Analysis
Patil P et al. [3]	Preventing illegal activities in banks.	Voting mechanism for bank tampering prevention.	Improves efficiency and security. Requires inter-bank cooperation.
Mamun A et al. [18]	Document verification for banking.	Users control data sharing with multiple banks.	Saves time and money, but users must manage data sharing proactively.
Kumar M et al. [4]	Removing the need for third-party trust	Full control over KYC data.	Streamlines the KYC process, but involves complex coordination.
Moyano J et al. [91]	Dynamic information updates and dissemination among FIs.	Users manage data sharing.	Reduces costs and increases efficiency, but ensuring data consistency is challenging.
Ullah N et al. [75]	Speeding up KYC clearance and securing data sharing.	Users manage data updates.	Reduces redundancy and speeds up clearance, but requires significant initial setup.
Kapsoulis N et al. [69]	Effective and time-efficient KYC activities.	Users control data sharing.	Efficient KYC activities, but faces integration complexity.
De Salve A et al. [82]	Trust relationships in SSI.	Enhanced user control through SSI.	Enhances trust relationships, but complex multi-layer implementation.
Ferdous M et al. [6]	Developing the SSI4Web framework for SSI.	Users have full control over identity information.	Streamlines identity verification, but faces adoption barriers in existing systems.
Malik S et al. [43]	Privacy-preservation in trading activities.	Users control identity and trading activities.	Efficient trade verification, but requires extensive setup.
Schlatt V et al. [87]	Solving KYC challenges with blockchain-based SSI.	Users control KYC data.	Efficient KYC processes, but resource-intensive implementation.
Satybaldy A et al. [73]	Assessing and contrasting SSI systems.	Users manage their identities.	Enhances understanding of SSI systems, but complex implementation and interpretation.
Gilani K et al. [29]	One-time proof-verification mechanism.	Users manage proof verification.	Efficient identity verification, but depends on effective smart contract implementation.
Dong C et al. [5]	Access-level security and privacy protection.	Users manage access-level security.	Secure UAV delivery system, but involves technical challenges in edge computing.
Moya C et al. [68]	Study of ZKP protocols.	Users benefit from advanced cryptographic security.	Enhances security, but requires substantial computational resources.
Soni A et al. [97]	Know Your Customer process, challenges, and big data analysis.	Users manage large datasets.	Enhances data integrity and security, improves efficiency; implementation complexity and scalability issues.
Takaragi K et al. [72]	Customer privacy protection in CBDC systems.	Users benefit from strong privacy protections.	Ensures privacy, but complex implementation and performance overheads.
Naik N et al. [88]	Evaluating potential attacks and security risks.	Users benefit from systematic risk assessment.	Enhances security in SSI systems, but resource-intensive analysis and mitigation.
Satybaldy A et al. [88]	Addressing complexity and inter- operability in digital verification.	Users manage document verification.	Secure verification, but complex interoperability challenges.
Pralhad Rankhambe B et al. [92]	Document verification using blockchain.	Users control document verification.	Reduces costs, but requires robust blockchain infrastructure.
Parra Moyano J et al. [96]	Reducing cost and improving user experience.	Users benefit from reduced costs and improved experience.	Increases transparency, but faces implementation complexity.
Kim B et al. [9]	Identifying security threats in DID services.	Users benefit from detailed security analysis.	Enhances security understanding, but addressing threats can be complex and resource-intensive.
Ding Y et al. [93]	Scalable cross-chain access control and identity authentication.	Users manage cross-chain interactions.	Efficient cross-chain interactions, but managing interoperability is complex.