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A Privacy-Centered Protocol for Enhancing Security and Authentication of Academic Certificates
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Abstract

Academic certificate authentication is crucial in safeguarding the rights and opportunities of individuals who have earned academic credentials. This authentication helps prevent fraud and forgery, ensuring that only those who have genuinely earned certificates can use them for education and career opportunities. With the increased use of online education and digital credentials in the digital age, the importance of academic certificate authentication has significantly grown. However, traditional techniques for authentication, such as QR code, barcode, and watermarking, have limitations regarding security and privacy. Therefore, proposing a privacy-centred protocol to enhance the security and authentication of academic certificates is vital to improve the trust and credibility of digital academic certificates, ensuring that individuals' rights and opportunities are protected. In this context, we adopted the Challenge Handshake Authentication (CHA) protocol to propose the Certificate Verification Privacy Control Protocol (CVPC). We implemented it using Python and Flask with a Postgres database and an MVT structure for the application. The results of the implementation demonstrate that the proposed protocol effectively preserves privacy during the academic certificate issuance and verification process. Additionally, we developed a proof of concept to evaluate the proposed protocol, demonstrating its functionality and performance. The PoC provided insights into the strengths and weaknesses of the proposed protocol and highlighted its potential to prevent forgery and unauthorised access to academic certificates. Overall, the proposed protocol has the potential to significantly enhance the security and authenticity of academic certificates, improving the overall trust and credibility of the academic credentialing system. © 2023, International Journal of Advanced Computer Science and Applications. All Rights Reserved.

Author Keywords

Academic certificates; challenge handshake authentication protocol; privacy preservation; privacy-centered protocol

Index Keywords

E-learning; Academic certificate, Authentication protocols, Career opportunities, Challenge handshake authentication protocol, Digital age, Digital credentials, On-line education, Privacy preservation, Privacy-centered protocol, Traditional techniques; Authentication

References

- Rios, J. a., Ling, G., Pugh, R., Becker, D., Bacall, A.
Identifying critical 21st-century skills for workplace success: A content analysis of job advertisements
(2020) *Educational Researcher*, 49 (2), pp. 80-89.
[1]
- Protopsaltis, S., Baum, S.
Does online education live up to its promise? A look at the evidence and implications for federal policy
(2019) *Center for Educational Policy Evaluation*, pp. 1-50.
[2]
- Abelha, M., Fernandes, S., Mesquita, D., Seabra, F., Ferreira-Oliveira, A. T.
Graduate employability and competence development in higher education—A systematic literature review using PRISMA
(2020) *Sustainability*, 12 (15), p. 5900.
[3]
- Eaton, S. E., Carmichael, J. J.
Fake degrees and credential fraud, contract cheating, and paper mills: Overview

and historical perspectives

(2023) *Fake Degrees and Fraudulent Credentials in Higher Education*, pp. 1-22.

[4]

- Gariup, M., Piskorski, J.
The challenge of detecting false documents at the border: Exploring the performance of humans, machines and their interaction
(2019) *International Journal of Critical Infrastructure Protection*, 24, pp. 100-110.
[5]
- Adjei, J. K.
Document Authentication System Preventing and Detecting Fraud of Paper Documents
(2014) *ProQuest Dissertations and Theses*, 5 (2), pp. 58-63.
[6]
- Massing, N., Schneider, S. L.
Degrees of competency: the relationship between educational qualifications and adult skills across countries
(2017) *Large Scale Assess Educ*, 5 (1).
[7] Dec
- Tijan, E., Aksentijevic, S., Ivanic, K., Jardas, M.
Blockchain technology implementation in logistics
(2019) *Sustainability (Switzerland)*, 11 (4).
[8] MDPI, Feb. 01
- Grolleau, G., Lakhal, T., Mzoughi, N.
An introduction to the Economics of Fake Degrees
(2008) *J Econ Issues*, 42 (3), pp. 673-693.
[9]
- Aini, Q., Rahardja, U., Tangkaw, M. R., Santoso, N. P. L., Khoirunisa, A.
Embedding a blockchain technology pattern into the QR code for an authentication certificate
(2020) *Jurnal Online Informatika*, 5 (2), pp. 239-244.
[10]
- Suteja, B. R., Imbar, R. V., Johan, M. C.
e-Certificate system based on Portable Document Format and QR Code for Academic Activities
(2020) *International Journal of Computer Science Issues (IJCSI)*, 17 (6), pp. 87-91.
[11]
- Mayowa, O. O., Adedayo, E. W., Olamide, O. O., Awokola, J. A. P., Sodipo, Q. B.
Design and Implementation of a Certificate Verification System using Quick Response (QR) Code
(2021) *LAUTECH JOURNAL OF COMPUTING AND INFORMATICS*, 2 (1), pp. 35-40.
[12]
- Mayowa, O. O., Adedayo, E. W., Olamide, O. O., Awokola, J. A. P., Sodipo, Q. B.
Design and Implementation of a Certificate Verification System using Quick Response (QR) Code
(2021) *LAUTECH JOURNAL OF COMPUTING AND INFORMATICS*, 2 (1), pp. 35-40.
[13]
- Chanda, D.
(2019) *Barcode Technology and its Application in Libraries*,
[14] Akanbi, LM, Bashorun, MT, Salihu, UA, Babafemi, GO, Sulaiman, K., & Kolajo, SO
(2019). Application of Barcode Technology in Landmark University Centre for Learning

Resources, Omu-Aran Experience. *Library Philosophy and Practice (e-Journal)*. Retrieved from

- Ray, A., Roy, S.
Recent trends in image watermarking techniques for copyright protection: a survey
(2020) *International Journal of Multimedia Information Retrieval*, 9 (4), pp. 249-270.
[15]
- VELICKOVIC, Z., VELICKOVIC, S., MILIVOJEVIC, Z.
Application of Watermark in the Form of QR Code in COVID Certificate Validation
(2021) *Journal of Mechatronics, Automation and Identification Technology*
JMAIT, 6 (2), pp. 1-5.
[16]
- Agrahari, A. K., Varma, S.
A provably secure RFID authentication protocol based on ECQV for the medical internet of things
(2021) *Peer-to-Peer Networking and Applications*, 14 (3), pp. 1277-1289.
[17]
- Calderoni, L., Maio, D.
Lightweight Security Settings in RFID Technology for Smart Agri-Food Certification
(2020) *2020 IEEE International Conference on Smart Computing (SMARTCOMP)*, pp. 226-231.
[18] (September) IEEE
- Khan, R. A., Lone, S. A.
A comprehensive study of document security system, open issues and challenges
(2021) *Multimedia Tools and Applications*, 80 (5), pp. 7039-7061.
[19] 13
- Sale, O. S., Ghazali, O., Al Maatouk, Q.
Graduation certificate verification model: a preliminary study
(2019) *International Journal of Advanced Computer Science and Applications*, 10 (7).
[20]
- Otuya, J. A.
(2019) *A Blockchain approach for detecting counterfeit academic certificates in Kenya*,
[21] (Doctoral dissertation, Strathmore University)
- González-Gaudio, E. J., Meira-Cartea, P. Á., Gutiérrez-Bastida, J. M.
Green Schools in Mexico and Spain: Trends and Critical Perspective
(2020) *Green Schools Globally*, pp. 269-287.
[22] Springer, Cham
- Hussein, K. Q.
Client Authentication By Selected Secure Password-Based On Image Using Challenge Handshake Authentication Protocol
(2019) *Iraqi Journal of Information Technology*. V, 9 (3), p. 2018.
[23]
- Ibrahim, A. S., Hussein, K. Q.
Client authentication by selected secure password-based on image using challenge handshake authentication protocol
(2019) *Iraqi Journal of Information Technology*,
[24]
- Ayub Khan, A., Laghari, A. A., Shaikh, A. A., Bourouis, S., Mamlouk, A. M., Alshazly, H.
Educational Blockchain: A Secure Degree Attestation and Verification Traceability Architecture for Higher Education Commission

- (2021) *Applied Sciences*, 11 (22), p. 10917.
[25]
- Saleh, O. S., Ghazali, O., Rana, M. E.
Blockchain based framework for educational certificates verification
(2020) *Journal of critical reviews*, 7 (3), pp. 79-84.
[26]
 - Saleh, O. S., Ghazali, O., Idris, N. B.
A New Decentralized Certification Verification Privacy Control Protocol
(2021) *2021 3rd International Cyber Resilience Conference (CRC)*, pp. 1-6.
[27] (January) IEEE
 - Din, I. U., Hassan, S., Almogren, A., Ayub, F., Guizani, M.
PUC: Packet update caching for energy efficient IoT-based informationcentric networking
(2020) *Future Generation Computer Systems*, 111, pp. 634-643.
[28]
 - Hashim, N. L., Yusof, N., Hussain, A., Ibrahim, M.
User experience dimensions for e-procurement: A systematic review
(2022) *Journal of Information and Communication Technology*, 21 (4), p. 465494.
[29]
 - Din, I. U., Guizani, M., Kim, B. S., Hassan, S., Khan, M. K.
Trust management techniques for the Internet of Things: A survey
(2018) *IEEE Access*, 7, pp. 29763-29787.
[30]
 - Eaton, S. E., Carmichael, J. J.
Fake degrees and credential fraud, contract cheating, and paper mills: Overview and historical perspectives
(2023) *Fake Degrees and Fraudulent Credentials in Higher Education*, pp. 1-22.
[31]
 - Pathak, S., Gupta, V., Malsa, N., Ghosh, A., Shaw, R. N.
Blockchain-Based Academic Certificate Verification System—A Review
(2022) *Advanced Computing and Intelligent Technologies: Proceedings of ICACIT, 2022*, pp. 527-539.
[32]
 - Ahmed, H. A., Jang, J. W.
Higher educational certificate authentication system using QR code tag
(2017) *Int. J. Appl. Eng. Res*, 12 (20), pp. 9728-9734.
[33]
 - Emmanuel, A. A., Adedoyin, A. E., Mukaila, O., Roseline, O. O.
Application of smartphone qrcode scanner as a means of authenticating student identity card
(2020) *International Journal of Engineering Research and Technology*, 13 (1), pp. 48-53.
[34]
 - Abbas, A. A.
Cloud-based framework for issuing and verifying academic certificates
(2019) *Int. J. Adv. Trends Comput. Sci. Eng*, 8 (6), p. 27432749.
[35]
 - Singhal, A., Pavithr, R. S.
Degree certificate authentication using QR code and smartphone
(2015) *International Journal of Computer Applications*, 120 (16).
[36]

- Goyal, S., Yadav, S., Mathuria, M.
Exploring concept of QR code and its benefits in digital education system
(2016) *2016 International Conference on Advances in Computing, Communications and Informatics (ICACCI)*, pp. 1141-1147.
[37] (September) IEEE
- Aini, Q., Rahardja, U., Tangkaw, M. R., Santoso, N. P. L., Khoirunisa, A.
Embedding a blockchain technology pattern into the QR code for an authentication certificate
(2020) *Jurnal Online Informatika*, 5 (2), pp. 239-244.
[38]
- Wellem, T., Nataliani, Y., Iriani, A.
Academic Document Authentication using Elliptic Curve Digital Signature Algorithm and QR Code
(2022) *JOIV: International Journal on Informatics Visualization*, 6 (3), pp. 667-675.
[39]
- Khalil, G., Doss, R., Chowdhury, M.
A comparison survey study on RFID based anti-counterfeiting systems
(2019) *Journal of Sensor and Actuator Networks*, 8 (3), p. 37.
[40]
- Kewale, P., Gardalwar, A., Vegad, P., Agrawal, R., Jaju, S., Dabhekar, K.
Design and implementation of RFID based e-document verification system
(2021) *2021 Third International Conference on Inventive Research in Computing Applications (ICIRCA)*, pp. 165-170.
[41] (September) IEEE

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