PERSONAL INFORMATION

Khalid Mahmood

National Yunlin University of Science and Technology,

No. 123, Section 3, Daxue Rd, Douliu City, Yunlin County, 64002, Taiwan

+886910712429 +886-5-534-2601

khalid@yuntech.edu.tw khalidm.research@gmail.com

WeChat ID Dr_kmm Skype ID khalid.mahmood40 Line ID kmm631

Gender Male | Date of birth 24th October 1983 | Nationality Pakistani

WORK EXPERIENCE

August 2022 – Present
Assistant Professor
National Yunlin University of Science and Technology, Douliu, Taiwan

October 2021 – September 2022
Post-Doc Research Fellow
Department of Mathematics, University of Padua, Padua, Italy

September 2016 – September 2021
Lecturer
Department of Computer Science, COMSATS University Islamabad, Pakistan

March 2007 – June 2012
Software Developer
GOL Technologies (Pvt) Ltd., Islamabad, Pakistan

EDUCATION

2012–2018
PhD in Computer Science
Thesis Title: 'Secure Authenticated Key Agreement Schemes for Smart Grid Communications in Power Sector'

International Islamic University, Islamabad, Pakistan

2008–2010
Master of Science in Computer Science
Thesis Title: 'Efficient Resource Preservation through Data Compression in Wireless Sensor Networks'

Riphah International University, Islamabad, Pakistan

AWARDS & ACHIEVEMENTS

2023
Ranked as World's Top 2% Scientists
Stanford University List 2023

2023
Newcomer Research and Development Excellence Award
National Yunlin University of Science and Technology, Douliu, Yunlin County, Taiwan

2022-23
IEEE Senior Member (Member Number: 96774352)
Institute of Electrical and Electronics Engineers

2022-23
Fengtai Outstanding Research Performance Award in Academic Field
National Yunlin University of Science and Technology, Douliu, Yunlin County, Taiwan

2022 **Approved Supervisor**
Higher Education Commission of Pakistan

2020 **Appreciation Letter for Productive Researcher**
Campus Director, COMSATS University Islamabad

2017 **Young Productive Scientists Award, Sci ID 30184**
Pakistan Council for Science and Technology (PCST)
http://pcst.org.pk/docs/PSP/listspsp2018/under40/math.pdf

RESEARCH PROJECTS

2022 **Secure Access Control Framework Using One-Time Physically Unclonable Function (OPUF) for Internet of Medical Things (IoMT) Based Telehealth Systems**
National Yunlin University of Science and Technology, Yunlin, Taiwan R.O.C
Worth 906,000 TWD per annum

2021 **Securing the Transition Toward the Future Internet**
Department of Mathematics, University of Padua, Italy
Worth 19,367.00 Euro per annum

2021 **Provable Privacy Preserving Authentication Solution for Internet of Things Environment**
DSR, King Abdulaziz University, Jeddah, under Grant D-26-611-1441
Worth 11,200.00 SAR

2020 **Lightweight Authentication Protocol for NFC Based Anti-Counterfeiting System in IoT Infrastructure**
DSR, King Abdulaziz University, Jeddah, under Grant D-156-611-1440
Worth 11,200.00 SAR

TRAINING

2022 **Certified Hacking Forensic Investigator (CHFI)**
EC-Council, Albuquerque, New Mexico, USA

2014 **Desktop Application Development with VB**
Pakistan Manpower Institute, Islamabad, Pakistan

2007–2008 **CCNA**
UCAT, The Mall Rawalpindi, Pakistan

2007–2008 **MCSE**
UCAT, The Mall Rawalpindi, Pakistan

PERSONAL SKILLS

Mother tongue: Punjabi

Other languages

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
Urdu	C1	C1	C1	C1	C1
English	C2	C2	B2	C2	C1

Levels: A1 and A2: Basic user – B1 and B2: Independent user – C1 and C2: Proficient user
Common European Framework of Reference for Languages

Professional skills

- team work: I have worked in various types of teams like research teams, training teams and counseling teams. I believe in teamwork practice because being able to work in a team is essential when you are a part of a large endeavor.
- mediating skills: I work on the borders between young people, youth trainers, youth policy and researchers

Professional Responsibilities

- Member IDS Course Allocation Committee, National Yunlin University, Douliu, Taiwan since Spring 2022
- Convener Incharge BS(CS) Program @ COMSATS University Fall 2020 to Fall 2021.
- Convener NCEAC Accreditation Committee @ COMSATS University Fall 2016 to Fall 2021.
- Convener Departmental Financial Assistance Committee @ COMSATS University Fall 2016 to Fall 2019.
- Member DARC/CARC Committee @ COMSATS University Fall 2016 to Fall 2021.
- Departmental Representatives on Newsletter Board @ COMSATS University Spring 2017 to Fall 2021.
- Member Proctorial Board @ COMSATS University Spring 2018 to Fall 2021.

Computer skills

- Security Protocol Verification Tools: ProVerif, Avispa, Scyther
- Programming languages: BASIC, C/C++, Java, JavaScript, HTML
- Latex (Document Preparation Tool)

Research Profile Links

- Google Scholar: https://scholar.google.com.pk/citations?hl=en&user=Hvjr9voAAAAJ
- Research Gate: https://www.researchgate.net/profile/Khalid_Mahmood26
- Scopus: https://www.scopus.com/authid/detail.uri?authorId=57342911900
- Mendeley https://www.mendeley.com/profiles/khalid-mahmood39/
- ORCID https://orcid.org/0000-0001-5046-7766
- ResearcherID: https://publons.com/researcher/AAE-9552-2020
- DBLP: https://dblp.org/pid/48/1165-2

References

- Prof. Dr. Mauro Conti, IEEE Fellow | Young Academy of Europe Fellow, Head of SPRITZ Security and Privacy Research Group, Deapartment of Mathematics, University of Padua, Italy, Email: mauro.conti@unipd.it
- Prof. Dr. Mohammad S. Obaidat, IEEE Fellow and SCS Fellow, King Abdullah II School of Information Technology, The University of Jordan, Amman, Jordan, Email: m.s.obaidat@ieee.org
- Prof. Dr. Muhammad Khurram Khan, Professor, Center of Excellence in Information Assurance (CoEIA), King Saud University, Kingdom of Saudi Arabia, Email: mkhurram@ksu.edu.sa
- Dr. Shehzad Ashraf Chaudhry, Department of Computer Science and Information Technology, College of Engineering, Abu Dhabi University, Abu Dhabi, United Arab Emirates, Email: shehzad.ashraf@adu.ac.ae
- Dr. Javed Ferzund, Associate Professor, Department of Computer Science, COMSATS University Islamabad, Pakistan, Email: jferzund@cuisahiwal.edu.pk

OVERALL PUBLICATIONS

Published Journal Articles

Total Impact Factor 341.381

1. Maryam Zia, Mohammad S Obaidat, Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, and Shehzad Ashraf Chaudhry. A provably secure lightweight key agreement protocol for wireless body area networks in healthcare system. *IEEE Transactions on Industrial Informatics*, 19(2):1683–1690, 2023 (**IF 12.3, Q1**)
2. Farva Rafique, Mohammad S Obaidat, Khalid Mahmood, Muhammad Faizan Ayub, Javed Ferzund, and Shehzad Ashraf Chaudhry. An efficient and provably secure certificateless protocol for industrial internet of things. *IEEE Transactions on Industrial Informatics*, 18(11):8039–8046, 2022 (**IF 12.3, Q1**)
3. Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, Rupak Kharel, Ashok Kumar Das, Sachin Shetty, and Joel JPC Rodrigues. Blockchain and puf-based secure key establishment protocol for cross-domain digital twins in industrial internet of things architecture. *Journal of Advanced Research*, 2023 (**IF 10.7, Q1**)
4. Salman Shamshad, Khalid Mahmood, Usman Shamshad, Ibrar Hussain, Shafiq Hussain, and Ashok Kumar Das. A provably secure and lightweight access control protocol for ei-based vehicle to grid environment. *IEEE Internet of Things Journal*, 10(18):16650 – 16657, 2023 (**IF 10.6, Q1**)
5. Salman Shamshad, Khalid Mahmood, Shafiq Hussain, Sahil Garg, Ashok Kumar Das, Neeraj Kumar, and Joel JPC Rodrigues. An efficient privacy-preserving authenticated key establishment protocol for health monitoring in industrial cyber–physical systems. *IEEE Internet of Things Journal*, 9(7):5142–5149, 2022 (**IF 10.6, Q1**)
6. Shafiq Ahmed, Salman Shamshad, Zahid Ghaffar, Khalid Mahmood, Neeraj Kumar, Reza M Parizi, and Kim-Kwang Raymond Choo. Signcryption based authenticated and key exchange protocol for ei-based v2g environment. *IEEE Transactions on Smart Grid*, 12(6):5290–5298, 2021 (**IF 10.275, Q1**)
7. Hafiz Muhammad Sanaullah Badar, Salman Qadri, Salman Shamshad, Muhammad Faizan Ayub, Khalid Mahmood, and Neeraj Kumar. An identity based authentication protocol for smart grid environment using physical uncloneable function. *IEEE Transactions on Smart Grid*, 12(5):4426–4434, 2021 (**IF 10.275, Q1**)
8. Muhammad Asad Saleem, Zahid Ghffar, Khalid Mahmood, Joel Rodrigues, Ashook Kumar Das, and Muhammad Khurram Khan. Provably secure authentication protocol for mobile clients in iot environment using puncturable pseudorandom function. *IEEE internet of Things Journal*, 8(22):16613 – 16622, 2021 (**IF 10.238, Q1**)
9. Muhammad Asad Saleem, Khalid Mahmood, and Saru Kumari. Comments on “akm-iov: Authenticated key management protocol in fog computing-based internet of vehicles deployment". *IEEE Internet of Things Journal*, 7(5):4671–4675, 2020 (**IF 9.936, Q1**)
10. Muhammad Arslan Akram, Khalid Mahmood, Saru Kumari, and Hu Xiong. Comments on “toward secure and provable authentication for internet of things: Realizing industry 4.0". *IEEE Internet of Things Journal*, 7(5):4676–4681, 2020 (**IF 9.936, Q1**)
11. Khalid Mahmood, Javed Ferzund, Muhammad Asad Saleem, Salman Shamshad, Ashok Kumar Das, and Youngho Park. A provably secure mobile user authentication scheme for big data collection in iot-enabled maritime intelligent transportation system. *IEEE Transactions on Intelligent Transportation Systems*, 24(2):2411–2421, 2023 (**IF 8.5, Q1**)
12. Khalid Mahmood, Salman Shamshad, Muhammad Faizan Ayub, Zahid Ghaffar, Muhammad Khurram Khan, and Ashok Kumar Das. Design of provably secure authentication protocol for edge-centric maritime transportation system. *IEEE Transactions on Intelligent Transportation Systems*, 24(12):14536 – 14545, 2023 (**IF 8.5, Q1**)
13. Salman Shamshad, Muhammad Faizan Ayub, Khalid Mahmood, Saru Kumari, Shehzad Ashraf Chaudhry, and Chien-Ming Chen. An enhanced scheme for mutual authentication for healthcare services. *Digital Communications and Networks*, 8(2):150–161, 2022 (**IF 7.9, Q1**)
14. Syed Muhammad Awais, Wu Yucheng, Khalid Mahmood, Muhammad Wahid Akram, Shafiq Hussain, Ashok Kumar Das, and Youngho Park. Puf-based privacy-preserving simultaneous authentication among multiple vehicles in vanet. *IEEE Transactions on Vehicular Technology*, 2023 (**IF 6.8, Q1**)

Published Journal Articles

15. Haseeb Tahir, Khalid Mahmood, Muhammad Faizan Ayub, Muhammad Asad Saleem, Javed Ferzund, and Neeraj Kumar. Lightweight and secure multi-factor authentication scheme in vanets. *IEEE Transactions on Vehicular Technology*, 72(11):14978 – 14986, 2023 (**IF 6.8, Q1**)
16. Zahid Ghaffar, Salman Shamshad, Khalid Mahmood, Mohammad S Obaidat, Saru Kumari, and Muhammad Khurram Khan. A lightweight and efficient remote data authentication protocol over cloud storage environment. *IEEE Transactions on Network Science and Engineering*, 10(1):103–112, 2023 (**IF 6.6, Q1**)1
17. Khalid Mahmood, Mohammad Obaidat, Zahid Ghaffar, Bander A Alzahrani, Salman Shamshad, Muhammad Asad Saleem, and Shafiq Hussain. Cloud-assisted secure and cost-effective authenticated solution for remote wearable health monitoring system. *IEEE Transactions on Network Science and Engineering*, 10(5):2710 – 2718, 2023 (**IF 6.6, Q1**)
18. Muhammad Faizan Ayub, Khalid Mahmood, Saru Kumari, Arun Kumar Sangaiah, et al. Lightweight authentication protocol for e-health clouds in iot-based applications through 5g technology. *Digital Communications and Networks*, 7(2):235–244, 2021 (**IF 6.348, Q1**)
19. Muhammad Umar, SK Hafizul Islam, Khalid Mahmood, Shafiq Ahmed, Zahid Ghaffar, and Muhammad Asad Saleem. Provable secure identity-based anonymous and privacy-preserving inter-vehicular authentication protocol for vanets using puf. *IEEE Transactions on Vehicular Technology*, 70(11):12158–12167, 2021 (**IF 6.239, Q1**)
20. Khalid Mahmood, Muhammad Faizan Ayub, Syed Zohaib Hassan, Zahid Ghaffar, Zhihan Lv, and Shehzad Ashraf Chaudhry. A seamless anonymous authentication protocol for mobile edge computing infrastructure. *Computer Communications*, 186:12–21, 2022 (**IF 6.0, Q1**)
21. Amina Zahoor, Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, Muhammad Faizan Ayub, Mauro Conti, and Ashok Kumar Das. An access control scheme in iot-enabled smart-grid systems using blockchain and puf. *Internet of Things*, page 100708, 2023 (**IF 5.9, Q1**)
22. Muhammad Arslan Akram, Zahid Ghaffar, Khalid Mahmood, Saru Kumari, Kadambri Agarwal, and Chien-Ming Chen. An anonymous authenticated key-agreement scheme for multi-server infrastructure. *Human-centric Computing and Information Sciences*, 10(1):1–18, 2020 (**IF 5.9, Q1**)
23. Khalid Mahmood, Xiong Li, Shehzad Ashraf Chaudhry, Husnain Naqvi, Saru Kumari, Arun Kumar Sangaiah, and Joel JPC Rodrigues. Pairing based anonymous and secure key agreement protocol for smart grid edge computing infrastructure. *Future Generation Computer Systems*, 88:491–500, 2018 (**IF 5.768, Q1**)
24. Khalid Mahmood, Shehzad Ashraf Chaudhry, Husnain Naqvi, Saru Kumari, Xiong Li, and Arun Kumar Sangaiah. An elliptic curve cryptography based lightweight authentication scheme for smart grid communication. *Future Generation Computer Systems*, 81:557–565, 2018 (**IF 5.768, Q1**)
25. Waseem Akram, Khalid Mahmood, Xiong Li, Mazhar Sadiq, Zhihan Lv, and Shehzad Ashraf Chaudhry. An energy-efficient and secure identity based rfid authentication scheme for vehicular cloud computing. *Computer Networks*, 217:109335, 2022 (**IF 5.6, Q1**)
26. Zeeshan Ali, Shehzad Ashraf Chaudhry, Khalid Mahmood, Sahil Garg, Zhihan Lv, and Yousaf Bin Zikria. A clogging resistant secure authentication scheme for fog computing services. *Computer Networks*, 185:107731, 2021 (**IF 5.493, Q1**)
27. Minahil Rana, Akasha Shafiq, Izwa Altaf, Mamoun Alazab, Khalid Mahmood, Shehzad Ashraf Chaudhry, and Yousaf Bin Zikria. A secure and lightweight authentication scheme for next generation iot infrastructure. *Computer Communications*, 165:85–96, 2021 (**IF 5.047, Q2**)
28. Sajid Hussain, Khalid Mahmood, Muhammad Khurram Khan, Chien-Ming Chen, Bander A Alzahrani, and Shehzad Ashraf Chaudhry. Designing secure and lightweight user access to drone for smart city surveillance. *Computer Standards & Interfaces*, 80:103566, 2022 (**IF 5.0, Q1**)
29. Muhammad Asad Saleem, SK Hafizul Islam, Shafiq Ahmed, Khalid Mahmood, and Majid Hussain. Provably secure biometric-based client–server secure communication over unreliable networks. *Journal of Information Security and Applications*, 58:102769, 2021 (**IF 4.960, Q2**)

Published Journal Articles

30. Khalid Mahmood, Salman Shamshad, Minahil Rana, Akasha Shafiq, Shafiq Ahmad, Muhammad Arslan Akram, and Ruhul Amin. Puf enable lightweight key-exchange and mutual authentication protocol for multi-server based d2d communication. *Journal of Information Security and Applications*, 61:102900, 2021 (**IF 4.960, Q2**)
31. Muhammad Asad Saleem, Salman Shamshad, Shafiq Ahmed, Zahid Ghaffar, and Khalid Mahmood. Security analysis on "a secure three-factor user authentication protocol with forward secrecy for wireless medical sensor network systems". *IEEE Systems Journal*, 15(4):5557–5559, 2021 (**IF 4.802, Q2**)
32. Salman Shamshad, Khalid Mahmood, Saru Kumari, and Muhammad Khurram Khan. Comments on âĂIJinsider attack protection: Lightweight password-based authentication techniques using eccâĂİ. *IEEE Systems Journal*, 15(1):877–880, 2021 (**IF 4.802, Q2**)
33. Khalid Mahmood, Salman Shamshad, Saru Kumari, Muhammad Khurram Khan, and Mohammad S Obaidat. Comment on "lightweight secure message broadcasting protocol for vehicle-to-vehicle communication". *IEEE Systems Journal*, 15(1):1366–1368, 2021 (**IF 4.802, Q2**)
34. Salman Shamshad, Muhammad Faizan Ayub, Khalid Mahmood, Minahil Rana, Akasha Shafiq, and Joel JPC Rodrigues. An identity-based authentication protocol for the telecare medical information system (tmis) using a physically unclonable function. *IEEE Systems Journal*, 16(3):4831 – 4838, 2022 (**IF 4.4, Q2**)
35. Hafiz Muhammad Sanaullah Badar, Khalid Mahmood, Waseem Akram, Zahid Ghaffar, Muhammad Umar, and Ashok Kumar Das. Secure authentication protocol for home area network in smart grid-based smart cities. *Computers and Electrical Engineering*, 108:108721, 2023 (**IF 4.3, Q2**)
36. Khalid Mahmood, Tayyaba Tariq, Arun Kumar Sangaiah, Zahid Ghaffar, Muhammad Asad Saleem, and Salman Shamshad. A neural computing-based access control protocol for ai-driven intelligent flying vehicles in industry 5.0-assisted consumer electronics. *IEEE Transactions on Consumer Electronics*, 2023 (**IF 4.3, Q2**)
37. Muhammad Faizan Ayub, Xiong Li, Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, and Marwan Omar. Secure consumer-centric demand response management in resilient smart grid as industry 5.0 application with blockchain-based authentication. *IEEE Transactions on Consumer Electronics*, 2023 (**IF 4.3, Q2**)
38. Mah Noor Fatima, Mohammad S Obaidat, Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, and Muhammad Faizan Ayub. Privacy-preserving three-factor authentication protocol for wireless sensor networks deployed in agricultural field. *ACM Transactions on Sensor Networks*, 2023 (**IF 4.1, Q2**)
39. Safdar Hussain, Maaz Bin Ahmad, Muhammad Asif, Waseem Akram, Khalid Mahmood, Ashok Kumar Das, and Sachin Shetty. Apt adversarial defence mechanism for industrial iot enabled cyber-physical system. *IEEE Access*, 11:74000 – 74020, 2023 (**IF 3.9, Q2**)
40. Muhammad Faizan Ayub, Muhammad Asad Saleem, Izwa Altaf, Khalid Mahmood, and Saru Kumari. Fuzzy extraction and puf based three party authentication protocol using usb as mass storage device. *Journal of Information Security and Applications*, 55:102585, 2020 (**IF 3.872, Q2**)
41. Salman Shamshad, Khalid Mahmood, Saru Kumari, Chien-Ming Chen, et al. A secure blockchain-based e-health records storage and sharing scheme. *Journal of Information Security and Applications*, 55:102590, 2020 (**IF 3.872, Q2**)
42. Khalid Mahmood, Waseem Akram, Akasha Shafiq, Izwa Altaf, Muhammad Ali Lodhi, and SK Hafizul Islam. An enhanced and provably secure multi-factor authentication scheme for internet-of-multimedia-things environments. *Computers & Electrical Engineering*, 88:106888, 2020 (**IF 3.818, Q2**)
43. Shafiq Ahmed, Saru Kumari, Muhammad Asad Saleem, Kadambri Agarwal, Khalid Mahmood, and Ming-Hour Yang. Anonymous key-agreement protocol for v2g environment within social internet of vehicles. *IEEE Access*, 8:119829–119839, 2020 (**IF 3.745, Q1**)
44. Bander A Alzahrani, Khalid Mahmood, and Saru Kumari. Lightweight authentication protocol for nfc based anti-counterfeiting system in iot infrastructure. *IEEE Access*, 8:76357–76367, 2020 (**IF 3.745, Q1**)
45. Bander A Alzahrani and Khalid Mahmood. Provable privacy preserving authentication solution for internet of things environment. *IEEE Access*, 9:82857–82865, 2021 (**IF 3.476, Q2**)

Published Journal Articles

46. Zahid Ghaffar, Shafiq Ahmed, Khalid Mahmood, Sk Hafizul Islam, Mohammad Mehedi Hassan, and Giancarlo Fortino. An improved authentication scheme for remote data access and sharing over cloud storage in cyber-physical-social-systems. *IEEE Access*, 8:47144–47160, 2020 (**IF 3.367, Q2**)
47. Izwa Altaf, Muhammad Asad Saleem, Khalid Mahmood, Saru Kumari, Pradeep Chaudhary, and Chien-Ming Chen. A lightweight key agreement and authentication scheme for satellite-communication systems. *IEEE Access*, 8:46278–46287, 2020 (**IF 3.367, Q2**)
48. Izwa Altaf, Muhammad Arslan Akram, Khalid Mahmood, Saru Kumari, Hu Xiong, and Muhammad Khurram Khan. A novel authentication and key-agreement scheme for satellite communication network. *Transactions on Emerging Telecommunications Technologies*, 32(7):e3894, 2021 (**IF 3.310, Q2**)
49. Muhammad Faizan Ayub, Salman Shamshad, Khalid Mahmood, SK Hafizul Islam, Reza M Parizi, and Kim-Kwang Raymond Choo. A provably secure two-factor authentication scheme for usb storage devices. *IEEE Transactions on Consumer Electronics*, 66(4):396–405, 2020 (**IF 2.947, Q2**)
50. Minahil Rana, Khalid Mahmood, Muhammad Asad Saleem, Fadi Al-Turjman, Manjur Sayyadbadasha Kolhar, and Chadi Altrjman. Towards a provably secure authentication protocol for fog-driven iot-based systems. *Applied Sciences*, 13(3):1424, 2023 (**IF 2.7, Q3**)
51. Mohammad Sabzinejad Farash, Omer Nawaz, Khalid Mahmood, Shehzad Ashraf Chaudhry, and Muhammad Khurram Khan. A provably secure rfid authentication protocol based on elliptic curve for healthcare environments. *Journal of medical systems*, 40(7):1–7, 2016 (**IF 2.456, Q2**)
52. Shehzad Ashraf Chaudhry, Khalid Mahmood, Husnain Naqvi, and Muhammad Khurram Khan. An improved and secure biometric authentication scheme for telecare medicine information systems based on elliptic curve cryptography. *Journal of Medical Systems*, 39(11):1–12, 2015 (**IF 2.213, Q2**)
53. Salman Shamshad, Minahil Rana, Khalid Mahmood, Muhammad Khurram Khan, and Mohammad S Obaidat. On the security of a secure anonymous identity-based scheme in new authentication architecture for mobile edge computing. *Wireless Personal Communications*, 124(1):283–292, 2022 (**IF 2.2, Q3**)
54. Akasha Shafiq, Muhammad Faizan Ayub, Khalid Mahmood, Mazhar Sadiq, Saru Kumari, and Chien-Ming Chen. An identity-based anonymous three-party authenticated protocol for iot infrastructure. *Journal of Sensors*, 2020, 2020 (**IF 2.137, Q3**)
55. Abdul Mannan, Mohammad S Obaidat, Khalid Mahmood, Aftab Ahmad, and Rodina Ahmad. Classical versus reinforcement learning algorithms for unmanned aerial vehicle network communication and coverage path planning: A systematic literature review. *International Journal of Communication Systems*, 36(5):e5423, 2023 (**IF 2.1, Q3**)
56. Hafiz Muhammad Sanaullah Badar, Mohammad S Obaidat, Khalid Mahmood, Najia Saher, Muhammad Faizan Ayub, and Dost Muhammad Khan. An access control protocol for iot-based critical infrastructure in smart grid environment. *International Journal of Communication Systems*, 35(8):e5115, 2022 (**IF 2.1, Q3**)
57. Muhammad Asad Saleem, Shafiq Ahmed, Khalid Mahmood, Saru Kumari, and Hu Xiong. An enhanced authentication protocol for client server environment. *Frontiers of Computer Science*, 14(6):1–3, 2020 (**IF 2.061, Q2**)
58. Muhammad Naeem, Shehzad Ashraf Chaudhry, Khalid Mahmood, Marimuthu Karuppiah, and Saru Kumari. A scalable and secure rfid mutual authentication protocol using ecc for internet of things. *International Journal of Communication Systems*, 33(13):e3906, 2020 (**IF 2.047, Q3**)
59. Khalid Mahmood, Aniqa Rehman, Pradeep Chaudhary, Xiong Li, Fan Wu, and Saru Kumari. Revised anonymous authentication protocol for adaptive client-server infrastructure. *International Journal of Communication Systems*, 33(4):e4253, 2020 (**IF 2.047, Q3**)
60. Azeem Irshad, Shehzad Ashraf Chaudhry, Saru Kumari, Muhammad Usman, Khalid Mahmood, and Muhammad Shahzad Faisal. An improved lightweight multiserver authentication scheme. *International Journal of Communication Systems*, 30(17):e3351, 2017 (**IF 1.717, Q3**)
61. Salman Shamshad, Khalid Mahmood, and Saru Kumari. Comments on âĂIJa multi-factor user authentication and key agreement protocol based on bilinear pairing for the internet of thingsâĂİ. *Wireless Personal Communications*, 112(1):463–466, 2020 (**IF 1.671, Q4**)

Published Journal Articles

62. Khalid Mahmood, Shehzad Ashraf Chaudhry, Husnain Naqvi, Taeshik Shon, and Hafiz Farooq Ahmad. A lightweight message authentication scheme for smart grid communications in power sector. *Computers & Electrical Engineering*, 52:114–124, 2016 (**IF 1.570, Q2**)
63. Mohammad Heydari, Seyed Mohammad Sajad Sadough, Shehzad Ashraf Chaudhry, Mohammad Sabzinejad Farash, and Khalid Mahmood. An improved one-to-many authentication scheme based on bilinear pairings with provable security for mobile pay-tv systems. *Multimedia Tools and Applications*, 76(12):14225–14245, 2017 (**IF 1.541, Q3**)
64. Khalid Mahmood, Jehangir Arshad, Shehzad Ashraf Chaudhry, and Saru Kumari. An enhanced anonymous identity-based key agreement protocol for smart grid advanced metering infrastructure. *International Journal of Communication Systems*, 32(16):e4137, 2019 (**IF 1.319, Q3**)
65. Khalid Mahmood, Husnain Naqvi, Bander A Alzahrani, Zahid Mehmood, Azeem Irshad, and Shehzad Ashraf Chaudhry. An ameliorated two-factor anonymous key exchange authentication protocol for mobile client-server environment. *International Journal of Communication Systems*, 31(18):e3814, 2018 (**IF 1.278, Q3**)
66. Shehzad Ashraf Chaudhry, Husnain Naqvi, Khalid Mahmood, Hafiz Farooq Ahmad, and Muhammad Khurram Khan. An improved remote user authentication scheme using elliptic curve cryptography. *Wireless Personal Communications*, 96(4):5355–5373, 2017 (**IF 1.200, Q4**)
67. Akasha Shafiq, Izwa Altaf, Khalid Mahmood, Saru Kumari, and Chien-Ming Chen. An ecc based remote user authentication protocol. *Journal of Internet Technology*, 21(1):285–294, 2020 (**IF 1.005, Q4**)
68. Mohammad Heydari, S Mohammad Sajad Sadough, Mohammad Sabzinejad Farash, Shehzad Ashraf Chaudhry, and Khalid Mahmood. An efficient password-based authenticated key exchange protocol with provable security for mobile client–client networks. *Wireless Personal Communications*, 88(2):337–356, 2016 (**IF 0.951, Q4**)
69. Khalid Mahmood, Muhammad Zubair, Zeeshan Shafi Khan, and Fazeel-Ud-Din Faraz. Efficient resource preservation through data compression in wireless sensor networks. *Journal ofBasic and Applied Scientific Research*, 3(9), 2013

Publications as a Corresponding Author

1. Maryam Zia, Mohammad S Obaidat, Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, and Shehzad Ashraf Chaudhry. A provably secure lightweight key agreement protocol for wireless body area networks in healthcare system. *IEEE Transactions on Industrial Informatics*, 19(2):1683–1690, 2023 (**IF 12.3, Q1**)
2. Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, Rupak Kharel, Ashok Kumar Das, Sachin Shetty, and Joel JPC Rodrigues. Blockchain and puf-based secure key establishment protocol for cross-domain digital twins in industrial internet of things architecture. *Journal of Advanced Research*, 2023 (**IF 10.7, Q1**)
3. Salman Shamshad, Khalid Mahmood, Usman Shamshad, Ibrar Hussain, Shafiq Hussain, and Ashok Kumar Das. A provably secure and lightweight access control protocol for ei-based vehicle to grid environment. *IEEE Internet of Things Journal*, 10(18):16650 – 16657, 2023 (**IF 10.6, Q1**)
4. Salman Shamshad, Khalid Mahmood, Shafiq Hussain, Sahil Garg, Ashok Kumar Das, Neeraj Kumar, and Joel JPC Rodrigues. An efficient privacy-preserving authenticated key establishment protocol for health monitoring in industrial cyber–physical systems. *IEEE Internet of Things Journal*, 9(7):5142–5149, 2022 (**IF 10.6, Q1**)
5. Shafiq Ahmed, Salman Shamshad, Zahid Ghaffar, Khalid Mahmood, Neeraj Kumar, Reza M Parizi, and Kim-Kwang Raymond Choo. Signcryption based authenticated and key exchange protocol for ei-based v2g environment. *IEEE Transactions on Smart Grid*, 12(6):5290–5298, 2021 (**IF 10.275, Q1**)
6. Muhammad Asad Saleem, Zahid Ghffar, Khalid Mahmood, Joel Rodrigues, Ashook Kumar Das, and Muhammad Khurram Khan. Provably secure authentication protocol for mobile clients in iot environment using puncturable pseudorandom function. *IEEE internet of Things Journal*, 8(22):16613 – 16622, 2021 (**IF 10.238, Q1**)
7. Muhammad Asad Saleem, Khalid Mahmood, and Saru Kumari. Comments on “akm-iov: Authenticated key management protocol in fog computing-based internet of vehicles deployment". *IEEE Internet of Things Journal*, 7(5):4671–4675, 2020 (**IF 9.936, Q1**)
8. Khalid Mahmood, Salman Shamshad, Muhammad Faizan Ayub, Zahid Ghaffar, Muhammad Khurram Khan, and Ashok Kumar Das. Design of provably secure authentication protocol for edge-centric maritime transportation system. *IEEE Transactions on Intelligent Transportation Systems*, 24(12):14536 – 14545, 2023 (**IF 8.5, Q1**)
9. Syed Muhammad Awais, Wu Yucheng, Khalid Mahmood, Muhammad Wahid Akram, Shafiq Hussain, Ashok Kumar Das, and Youngho Park. Puf-based privacy-preserving simultaneous authentication among multiple vehicles in vanet. *IEEE Transactions on Vehicular Technology*, 2023 (**IF 6.8, Q1**)
10. Haseeb Tahir, Khalid Mahmood, Muhammad Faizan Ayub, Muhammad Asad Saleem, Javed Ferzund, and Neeraj Kumar. Lightweight and secure multi-factor authentication scheme in vanets. *IEEE Transactions on Vehicular Technology*, 72(11):14978 – 14986, 2023 (**IF 6.8, Q1**)
11. Zahid Ghaffar, Salman Shamshad, Khalid Mahmood, Mohammad S Obaidat, Saru Kumari, and Muhammad Khurram Khan. A lightweight and efficient remote data authentication protocol over cloud storage environment. *IEEE Transactions on Network Science and Engineering*, 10(1):103–112, 2023 (**IF 6.6, Q1**)
12. Khalid Mahmood, Mohammad Obaidat, Zahid Ghaffar, Bander A Alzahrani, Salman Shamshad, Muhammad Asad Saleem, and Shafiq Hussain. Cloud-assisted secure and cost-effective authenticated solution for remote wearable health monitoring system. *IEEE Transactions on Network Science and Engineering*, 10(5):2710 – 2718, 2023 (**IF 6.6, Q1**)
13. Muhammad Asad Saleem, Salman Shamshad, Shafiq Ahmed, Zahid Ghaffar, and Khalid Mahmood. Security analysis on "a secure three-factor user authentication protocol with forward secrecy for wireless medical sensor network systems". *IEEE Systems Journal*, 15(4):5557–5559, 2021 (**IF 4.802, Q2**)
14. Salman Shamshad, Muhammad Faizan Ayub, Khalid Mahmood, Minahil Rana, Akasha Shafiq, and Joel JPC Rodrigues. An identity-based authentication protocol for the telecare medical information system (tmis) using a physically unclonable function. *IEEE Systems Journal*, 16(3):4831 – 4838, 2022 (**IF 4.4, Q2**)
15. Hafiz Muhammad Sanaullah Badar, Khalid Mahmood, Waseem Akram, Zahid Ghaffar, Muhammad Umar, and Ashok Kumar Das. Secure authentication protocol for home area network in smart grid-based smart cities. *Computers and Electrical Engineering*, 108:108721, 2023 (**IF 4.3, Q2**)

Publications as a Corresponding Author

16. Muhammad Faizan Ayub, Xiong Li, Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, and Marwan Omar. Secure consumer-centric demand response management in resilient smart grid as industry 5.0 application with blockchain-based authentication. *IEEE Transactions on Consumer Electronics*, 2023 (**IF 4.3, Q2**)
17. Mah Noor Fatima, Mohammad S Obaidat, Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, and Muhammad Faizan Ayub. Privacy-preserving three-factor authentication protocol for wireless sensor networks deployed in agricultural field. *ACM Transactions on Sensor Networks*, 2023 (**IF 4.1, Q2**)
18. Safdar Hussain, Maaz Bin Ahmad, Muhammad Asif, Waseem Akram, Khalid Mahmood, Ashok Kumar Das, and Sachin Shetty. Apt adversarial defence mechanism for industrial iot enabled cyber-physical system. *IEEE Access*, 11:74000 – 74020, 2023 (**IF 3.9, Q2**)
19. Bander A Alzahrani and Khalid Mahmood. Provable privacy preserving authentication solution for internet of things environment. *IEEE Access*, 9:82857–82865, 2021 (**IF 3.476, Q2**)
20. Minahil Rana, Khalid Mahmood, Muhammad Asad Saleem, Fadi Al-Turjman, Manjur Sayyadbadasha Kolhar, and Chadi Altrjman. Towards a provably secure authentication protocol for fog-driven iot-based systems. *Applied Sciences*, 13(3):1424, 2023 (**IF 2.7, Q3**)
21. Salman Shamshad, Minahil Rana, Khalid Mahmood, Muhammad Khurram Khan, and Mohammad S Obaidat. On the security of a secure anonymous identity-based scheme in new authentication architecture for mobile edge computing. *Wireless Personal Communications*, 124(1):283–292, 2022 (**IF 2.2, Q3**)
22. Abdul Mannan, Mohammad S Obaidat, Khalid Mahmood, Aftab Ahmad, and Rodina Ahmad. Classical versus reinforcement learning algorithms for unmanned aerial vehicle network communication and coverage path planning: A systematic literature review. *International Journal of Communication Systems*, 36(5):e5423, 2023 (**IF 2.1, Q3**)
23. Hafiz Muhammad Sanaullah Badar, Mohammad S Obaidat, Khalid Mahmood, Najia Saher, Muhammad Faizan Ayub, and Dost Muhammad Khan. An access control protocol for iot-based critical infrastructure in smart grid environment. *International Journal of Communication Systems*, 35(8):e5115, 2022 (**IF 2.1, Q3**)
24. Khalid Mahmood, Muhammad Zubair, Zeeshan Shafi Khan, and Fazeel-Ud-Din Faraz. Efficient resource preservation through data compression in wireless sensor networks. *Journal ofBasic and Applied Scientific Research*, 3(9), 2013

Publications as a Primary Author

1. Khalid Mahmood, Salman Shamshad, Muhammad Asad Saleem, Rupak Kharel, Ashok Kumar Das, Sachin Shetty, and Joel JPC Rodrigues. Blockchain and puf-based secure key establishment protocol for cross-domain digital twins in industrial internet of things architecture. *Journal of Advanced Research*, 2023 (**IF 10.7, Q1**)
2. Khalid Mahmood, Javed Ferzund, Muhammad Asad Saleem, Salman Shamshad, Ashok Kumar Das, and Youngho Park. A provably secure mobile user authentication scheme for big data collection in iot-enabled maritime intelligent transportation system. *IEEE Transactions on Intelligent Transportation Systems*, 24(2):2411–2421, 2023 (**IF 8.5, Q1**)
3. Khalid Mahmood, Salman Shamshad, Muhammad Faizan Ayub, Zahid Ghaffar, Muhammad Khurram Khan, and Ashok Kumar Das. Design of provably secure authentication protocol for edge-centric maritime transportation system. *IEEE Transactions on Intelligent Transportation Systems*, 24(12):14536 – 14545, 2023 (**IF 8.5, Q1**)
4. Khalid Mahmood, Mohammad Obaidat, Zahid Ghaffar, Bander A Alzahrani, Salman Shamshad, Muhammad Asad Saleem, and Shafiq Hussain. Cloud-assisted secure and cost-effective authenticated solution for remote wearable health monitoring system. *IEEE Transactions on Network Science and Engineering*, 10(5):2710 – 2718, 2023 (**IF 6.6, Q1**)
5. Khalid Mahmood, Muhammad Faizan Ayub, Syed Zohaib Hassan, Zahid Ghaffar, Zhihan Lv, and Shehzad Ashraf Chaudhry. A seamless anonymous authentication protocol for mobile edge computing infrastructure. *Computer Communications*, 186:12–21, 2022 (**IF 6.0, Q1**)
6. Khalid Mahmood, Xiong Li, Shehzad Ashraf Chaudhry, Husnain Naqvi, Saru Kumari, Arun Kumar Sangaiah, and Joel JPC Rodrigues. Pairing based anonymous and secure key agreement protocol for smart grid edge computing infrastructure. *Future Generation Computer Systems*, 88:491–500, 2018 (**IF 5.768, Q1**)
7. Khalid Mahmood, Shehzad Ashraf Chaudhry, Husnain Naqvi, Saru Kumari, Xiong Li, and Arun Kumar Sangaiah. An elliptic curve cryptography based lightweight authentication scheme for smart grid communication. *Future Generation Computer Systems*, 81:557–565, 2018 (**IF 5.768, Q1**)
8. Khalid Mahmood, Salman Shamshad, Minahil Rana, Akasha Shafiq, Shafiq Ahmad, Muhammad Arslan Akram, and Ruhul Amin. Puf enable lightweight key-exchange and mutual authentication protocol for multi-server based d2d communication. *Journal of Information Security and Applications*, 61:102900, 2021 (**IF 4.960, Q2**)
9. Khalid Mahmood, Salman Shamshad, Saru Kumari, Muhammad Khurram Khan, and Mohammad S Obaidat. Comment on "lightweight secure message broadcasting protocol for vehicle-to-vehicle communication". *IEEE Systems Journal*, 15(1):1366–1368, 2021 (**IF 4.802, Q2**)
10. Khalid Mahmood, Tayyaba Tariq, Arun Kumar Sangaiah, Zahid Ghaffar, Muhammad Asad Saleem, and Salman Shamshad. A neural computing-based access control protocol for ai-driven intelligent flying vehicles in industry 5.0-assisted consumer electronics. *IEEE Transactions on Consumer Electronics*, 2023 (**IF 4.3, Q2**)
11. Khalid Mahmood, Waseem Akram, Akasha Shafiq, Izwa Altaf, Muhammad Ali Lodhi, and SK Hafizul Islam. An enhanced and provably secure multi-factor authentication scheme for internet-of-multimedia-things environments. *Computers & Electrical Engineering*, 88:106888, 2020 (**IF 3.818, Q2**)
12. Khalid Mahmood, Aniqa Rehman, Pradeep Chaudhary, Xiong Li, Fan Wu, and Saru Kumari. Revised anonymous authentication protocol for adaptive client-server infrastructure. *International Journal of Communication Systems*, 33(4):e4253, 2020 (**IF 2.047, Q3**)
13. Khalid Mahmood, Shehzad Ashraf Chaudhry, Husnain Naqvi, Taeshik Shon, and Hafiz Farooq Ahmad. A lightweight message authentication scheme for smart grid communications in power sector. *Computers & Electrical Engineering*, 52:114–124, 2016 (**IF 1.570, Q2**)
14. Khalid Mahmood, Jehangir Arshad, Shehzad Ashraf Chaudhry, and Saru Kumari. An enhanced anonymous identity-based key agreement protocol for smart grid advanced metering infrastructure. *International Journal of Communication Systems*, 32(16):e4137, 2019 (**IF 1.319, Q3**)

Publications as a Primary Author

15. Khalid Mahmood, Husnain Naqvi, Bander A Alzahrani, Zahid Mehmood, Azeem Irshad, and Shehzad Ashraf Chaudhry. An ameliorated two-factor anonymous key exchange authentication protocol for mobile client-server environment. *International Journal of Communication Systems*, 31(18):e3814, 2018 (**IF 1.278, Q3**)
16. Khalid Mahmood, Muhammad Zubair, Zeeshan Shafi Khan, and Fazeel-Ud-Din Faraz. Efficient resource preservation through data compression in wireless sensor networks. *Journal ofBasic and Applied Scientific Research*, 3(9), 2013

International Conference Papers

1. Husnain Naqvi, Shehzad Ashraf Chaudhry, and Khalid Mahmood. An improved authentication protocol for sip-based voip. In *IEEE International conference on recent advances in computer systems (RACS-2015) held in Hail, KSA*, 2016
2. Shehzad Ashraf Chaudhry, Khalid Mahmood, Husnain Naqvi, and Muhammad Sher. A secure authentication scheme for session initiation protocol based on elliptic curve cryptography. In *13th IEEE International Conference on Dependable, Autonomic and Secure Computing (DASC-2015) held in Liverpool, United Kingdom*, pages 1960–1965. IEEE, 2015
3. Salman Shamshad, Muhammad Asad Saleem, Mohammad S Obaidat, Usman Shamshad, Khalid Mahmood, and Muhammad Faizan Ayub. On the security of a lightweight privacy-preserving authentication protocol for vanets. In *2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS)*, pages 1766–1770. IEEE, 2021
4. Salman Shamshad, Mohammad S Obaidat, Muhammad Asad Saleem, Usman Shamshad, Khalid Mahmood, et al. Security analysis on an efficient and provably secure authenticated key agreement protocol for fog-based vehicular ad-hoc networks. In *2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS)*, pages 1754–1759. IEEE, 2021
5. Salman Shamshad, Mohammad S Obaidat, Usman Shamshad, Sahar Noor, Khalid Mahmood, et al. On the security of authenticated key agreement scheme for fog-driven iot healthcare system. In *2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS)*, pages 1760–1765. IEEE, 2021

SUPERVISION ACHIEVEMENTS

Note: *Two of my graduate students have achieved more than 100 accumulated impact factor*

HEC Approved Supervisor

Degree	No. of Students Supervised
PhD Computer Science	03
MS Computer Science	15
BS Computer Science	30

SELECTED LIST OF SUPERVISED STUDENTS

Name	Title	Year
Muhammad Asad Saleem	Lightweight and Secure Authentication Protocols for Client-Server Environment	2020
Muhammad Faizan Ayub	Design of Multi-Factor Authentication Protocols for USB Storage Device	2020
Salman Shamshad	Secure Authentication Key-Agreement Protocols for Telecare Medicine Information System (TMIS)	2020
Shafiq Ahmed	Anonymous Key-Agreement Protocol for V2G Environment within Social Internet of Vehicles	2020
Zahid Ghaffar	Lightweight and Key Agreement Authentication Schemes for Cloud Storage Environment	2020
Muhammad Arslan Akram	Energy EfĩňĄcient and Anonymous Authenticated Key-Agreement Schemes for Multi-Server Infrastructure (MSA)	2020
Izwa Altaf	A Novel Authentication and Key-Agreement Scheme for Satellite Communication System	2020
Minahil	Lightweight Authentication Protocols for E-Health Environment	2020
Akasha Shafiq	An Elliptic Curve Cryptography Based Remote User Authentication Protocol	2020
Muhammad Wahid Akram	Design and Analysis of Authenticated Key Agreement Schemes for IOD Environment	2021
Syed Zohaib Hassan	Secure and Lightweight Authenticated Key Agreement Schemes for Mobile Edge Computing	2021