



National Testing Service - Pakistan

Building Standards in Educational and Professional Testing

Graduate Assessment Test (GAT 2018-III) GAT Subject

Test Date: Sunday, 5th August 2018

(Result)

Search Result for the keyword " 17301-6637288-3 "

Roll No : 18863-230084

C.N.I.C : 17301-6637288-3

Name : NOOR MAST

Father Name : SHAH MAST

Subject : Computer Science

	English / 15	Analytical / 15	Subject / 70	Accumulative / 100
Test Score	10	11	44	65
Percentile Score	36.29	59.68	72.58	72.85

All test record (hard copies) is kept by NTS for 45 days only. (from test result date)

RegNo CS420201001
Student Name Noor Mast
Degree Program PhD-CS-IIT-KUST

	Course Code	Course Title	Credit Hours	Percentage	Grade Points	Grade
SEMESTER-1---SPRING-2020						
1	CS-771	Mobile Adhoc Networks	3.0	83.00	3.75	A-
2	CS-779	Advance Wireless Networks	3.0	79.00	3.42	B+
Semester Credit Hrs:			6	GPA: 3.59	SGPA: 3.59	
SEMESTER-2---FALL-2020						
1	CS-776	Wireless Sensor Networks	3.0	78.00	3.33	B+
2	CS-875	Mobile Communication Systems	3.0	84.00	3.83	A-
3	MATH-831	Evolutionary Computing-I	4.0	91.00	4	P
Cumulative Credit Hrs:			16	CGPA: 3.58	SGPA: 6.25	
SEMESTER-3---SPRING-2021						
1	CS-778	Advance Wireless Network Security	3.0	75.00	3.08	B
2	CS-877	Traffic Control and Quality of Services	3.0	80.00	3.5	B+
3	MATH-581	Research Methodology	3.0		0	P
Cumulative Credit Hrs:			25	CGPA: 3.49	SGPA: 3.29	
SEMESTER-4---FALL-2021						
1	CS-991	Research/Thesis	6.0		0	IP
Cumulative Credit Hrs:			31	CGPA: 3.49	SGPA:	
SEMESTER-5---SPRING-2022						
1	CS-991	Research/Thesis	6.0		0	IP
Total Credits Earned : 31		CGPA : 3.49				

Cumulative Credit Hrs:			31	CGPA: 3.49	SGPA:
SEMESTER-6---FALL-2022					
1	CS-991	Research/Thesis	6.0		0 IP
Cumulative Credit Hrs:			31	CGPA: 3.49	SGPA:
SEMESTER-7---SPRING-2023					
1	CS-991	Research/Thesis	6.0		0
Cumulative Credit Hrs:			31	CGPA:	SGPA:
Total Credits Earned : 31		CGPA : 3.49			

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KOHAT UNIVERSITY OF SCIENCE & TECHNOLOGY

Kohat 26000, Khyber Pakhtunkhwa, Pakistan Ph # 0922-554563-554565, Fax #. 554556

PERFORMA FOR COURSEWORK PhD PROGRAM

S.No	Name	18 Cr.Hrs Courses in the major subject (700 & above) must be approved from the statutory bodies of the University			
		CGPA	Names of specialized courses of 09 Cr.Hrs with minimum passing grade "B"	Names of elective courses of 09 Cr.Hrs with minimum passing grade "C"	Names of two non-credit courses (06 Cr.Hrs) shall be in related subjects (700 & below) and graded as satisfactory or non-satisfactory
1	Noor Mast	3.49	CS-771 Mobile Ad-hoc Networks	CS-776 Wireless Sensor Networks	MATH-831 Evolutionary Computing-1
2			CS-779 Advance Wireless Networks	CS-778 Advance Wireless Network Security	MATH-581 Research Methodology
3			CS-875 Mobile Communication System	CS-877 Traffic Control and Quality of Services	

Please attach the Transcript(s)

Name & Signature of Departmental Graduate Committee:

1. Prof. Dr. Shafiullah Khan, IoC
Convenor/Director

2. Prof. Dr. Wali Khan Mashwani, INS
Member

3. Prof. Dr. Muhammad Asif Jan, INS
Member

4. Dr. Amjad Mahmood, Associate Professor, IoC
Member

5. Dr. Saima Hassan, Assistant Professor, IoC
Member

6. Dr. M. Irfan Uddin, Assistant Professor, IoC
Co-Opted Member (Coordinator MS)

7. Dr. Muhammad Romay, Lecturer, IoC
Member

8. Dr. M. Altaf Khan, Assistant Professor, IoC
Secretary DGC

Date: 18/7/2023



Kohat University of Science & Technology, Kohat

Notification No: PhD-Computer Sc/Comprehensive-Exam/Sp-2021


Institute of Computing

The Comprehensive Examination Result in respect of the following PhD Scholars in the discipline of Computer Science, duly approved by the respective Dean of the faculty, is notified as under:

RegNo	Name	Specialization	Percentage of Marks Obtained	Result	Attempt No.	Semester During Which Current Attempt Made
CS420201001	Noor Mast		79.00	Pass	1st	Spring-2021

Errors and omissions, if any, are subject to subsequent rectification.

Result Declared On: October 15, 2021


Controller of Examinations
KUST

Semester U. of Section
(Dispatch)
No: 690
Date: 18-10-21

PROCEEDING OF THE MEETING OF THE ADVANCE STUDIES & RESEARCH BOARD (ASRB), DATED 12.08.2022

A meeting of the Advance Studies & Research Board was held on 12.08.2022 at 09:30 am in the Committee Room of the Vice Chancellor's Secretariat. The following members attended the meeting:

In Chair

Prof. Dr. Sardar Khan

Vice Chancellor, Kohat University of Science & Technology, Kohat

Members

1. **Prof. Dr. Syed Tasleem Hussain**
Dean, Faculty of Chemical & Pharmaceutical Sciences
2. **Prof. Dr. Shahid Niaz Khan**
Dean, Faculty of Biological Sciences
3. **Prof. Dr. Muhammad Naseer ud Din**
Dean, Faculty of Social Sciences
4. **Prof. Dr. Wali Khan**
Dean, Faculty of Physical & Numerical Sciences
5. **Prof. Dr. Muhammad Jamil**
Department of Biotechnology & GE
6. **Prof. Dr. Muhammad Iqbal Khan**
Department of Chemistry
7. **Dr. Saeed Ahmad Khan**
Associate Professor, Department of Pharmacy
8. **Dr. Sammar Abbas**
Associate Professor, Institute of Business Studies
9. **Dr. Saad Ullah Khan**
Associate Professor, Department of Biotechnology & GE

10. Dr. Muhammad Zeeshan Bangash

Director, Quality Enhancement Cell

11. Dr. Wasiullah Malik

Director, ORIC, KUST

12. Dr. Shamim Saleha

Director, Advance Studies and Research

A-Fresh PhD Cases

PhD Synopses in Biotechnology & GE

Agenda Item No.1

Maha Rehman, PhD Scholar of Biotechnology & GE (Reg. # BT420201002)

Research Title: Approved with changes

MOLECULAR IDENTIFICATION, GROWTH KINETICS, AND FOLIC ACID PRODUCTION OF *SPIRULINA SPP.* ISOLATED FROM OLIGOTROPHIC WATER RESERVOIRS OF KOHAT, PAKISTAN

Supervisor-I:

Dr. Rehan Naeem,
Department of Biotechnology & GE, KUST

Supervisor-II:

Dr. Muhammad Jamil,
Department of Biotechnology & GE, KUST

RESEARCH PROPOSAL: Approved with changes

Decision: Submit a revised synopsis to the Directorate of Advance Studies & Research after incorporating the suggestions/modifications pointed out by the Board as given below:

1. Corrected/suggested title by the board is "Folic Acid Production of *Spirulina spp.* Isolated from Water Reservoirs of Kohat, (Pakistan) and its Utilization as Food Supplement".

RESEARCH PROPOSAL: Approved with changes

Decision: Submit a revised synopsis to the Directorate of Advance Studies & Research after incorporating the suggestions/modifications pointed out by the Board as given below:

1. Corrected/suggested title by the board is “Molecular Status of Drug Resistance in Malarial Parasite and Therapeutic Potential of Pakistani Bee Propolis”
2. Revise synopsis for corrections as per University format (correct in-text citations, remove numbering with subheadings as well as with lines, change numbers with bullets by separating objectives and correct referencing errors).
3. Add in introduction a paragraph about the socioeconomic benefits of proposed study.
4. Write aim of study in end of introduction.
5. Write either “by” or “using” at multiple places in synopsis.
6. Do correction for grammatical mistakes in whole synopsis.
7. Specify number of samples.
8. Mention areas of Khyber Pakhtunkhwa and Punjab for samples collection.
9. Write standard conditions and programming for PCR amplifications in methodology.
10. The in vitro approach may be valuable for proposed research. In this regard, the supervisor written consent is required about possibility and inclusion of in vitro approach in proposed study.

PhD Synopses in Physics**Agenda Item No.4**

Rifat Sultana, PhD Scholar of Physics (Reg. # PH420202003)

Research Title: Approved

ELECTRONIC TRANSPORT
CHARACTERISTICS IN BLACK
PHOSPHORENE

Supervisor-I:

Dr. Abdullah Yar,
Department of Physics, KUST

RESEARCH PROPOSAL: Approved with changes

Decision: Submit a revised synopsis to the Directorate of Advance Studies & Research after incorporating the suggestions/modifications pointed out by the Board as given below:

1. Add in introduction a paragraph about the socioeconomic benefits of proposed study.
2. Highlight the novelty of proposed study through the introduction.
3. Change numbers with bullets by separating objectives.
4. Correct referencing errors.

PhD Synopses in Computer Science**Agenda Item No.5**

Noor Mast, PhD Scholar of Computer Science (Reg. # CS420201001)

Research Title: Approved

ENHANCING TRANSMISSION
CONTROL PROTOCOL PERFORMANCE
IN WIRELESS AD-HOC NETWORKS

Supervisor-I:

Dr. Shafiullah Khan,
Institute of Computing, KUST

Supervisor-II:

Dr. Muhammad Irfan ud Din,
Institute of Computing, KUST



RESEARCH PROPOSAL: Approved with changes

Decision: Submit a revised synopsis to the Directorate of Advance Studies & Research after incorporating the suggestions/modifications pointed out by the Board as given below:

1. Rephrase objectives for more clarity and make them precise, comprehensive and confined. In addition, objectives shall reflect the two novelties of the work proposed.
2. Do corrections for grammatical mistakes in whole synopsis.
3. Revise introduction by rephrasing the sentences like "Give Birth to".
4. Do corrections of personalized terms such as "we" in text of introduction and use generalized terms.
5. The parameters to be fixed for running the simulation along with simulator detail may be included in the synopsis.

Note: The revised synopsis will be checked by Dr. Muhammad Zeeshan Bangash, Director, Quality Enhancement Cell, KUST and then will issue a certificate of corrections.

B-Referred Back MS/M.Phil. Cases**M.Phil. Synopses in Biotechnology & GE****Agenda Item No.6**

Azmat Ullah Khan, M.Phil. Scholar in Biotechnology & GE (Reg. # BT320191007)

Research Title: Approved

MOLECULAR DETECTION OF
*ENTAMOEB*A *HISTOLYTICA* AND
GIARDIA LAMBLIA IN DIFFERENT
WATER SOURCES OF DISTRICT
KURRAM

Supervisor-I:

Dr. Nawab Ali,
Department of Biotechnology & GE, KUST

Supervisor-II:

Dr. Noor ul Akbar,
Department of Zoology, KUST

RESEARCH PROPOSAL: Approved

Decision: Synopsis is accepted in its present form

M.Phil. Synopses in Microbiology**Agenda Item No.7.1**

Rabia Hayat, M.Phil Scholar in Microbiology (Reg. # MB320202005)

Research Title: Approved

EVALUATION OF INDEGENOUS
BACTERIAL STRAINS FOR
DEGRADATION OF PESTICIDES USING
MICROCOSMIC ASSAYS.

Supervisor-I:

Dr. Muhammad Anees,
Department of Microbiology, KUST

Supervisor-II:

Dr. Nazish Manzoor,
Department of Microbiology, KUST

RESEARCH PROPOSAL: Approved

Decision: Synopsis is accepted in its present form.

Agenda Item No.7.2

Shakeela Naz, M.Phil. Scholar in Microbiology (Reg. # MB320202010)

Research Title: Approved



PROCEEDING OF THE MEETING OF THE ADVANCE STUDIES & RESEARCH BOARD (ASRB), DATED 07-07-2023

A meeting of the Advance Studies & Research Board was held on 07-07-2023 at 09:00 am in the **Ibn-al-Haytham Conference Hall**. The following members attended the meeting:

In Chair

Prof. Dr. Sardar Khan

Vice Chancellor, Kohat University of Science and Technology, Kohat

Members

1. **Prof. Dr. Muhammad Naseer ud Din**
Dean, Faculty of Social Sciences
2. **Prof. Dr. Wali Khan**
Dean, Faculty of Physical & Numerical Sciences
3. **Prof. Dr. Muhammad Jamil**
Department of Biotechnology & GE
4. **Prof. Dr. Muhammad Iqbal Khan**
Department of Chemistry
5. **Prof. Dr. Muhammad Asif Jan**
Institute of Numerical Sciences
6. **Dr. Saad Ullah Khan**
Associate Professor, Department of Biotechnology & GE
7. **Dr. Muhammad Sajjad,**
Associate Professor, Department of Physics
8. **Dr. Muhammad Zeeshan Bangash**
Director, Quality Enhancement Cell
9. **Prof. Dr. Rozina Gul,**
Department of Plant Breeding and Genetics, Agriculture University, Peshawar
10. **Dr. Shamim Saleha**
Director, Advance Studies and Research

A- PH.D. SUMMARY CASES

Institute of Computing

Agenda Item No. 1

Noor Mast, Ph.D. Scholar of Computer Science (Reg. # CS420201001)

Research Title: As approved in the 97th meeting of ASRB.

ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE IN WIRELESS AD-HOC NETWORK

RESEARCH PROPOSAL: As approved in the 97th meeting of ASRB.

Decision: The Board discussed and approved Mr. Noor Mast's dissertation summary and recommended that his Ph.D., dissertation may be sent to an international and a national (internal) reviewer/examiner for evaluation based on the QEC report on publication in HEC-approved "W" category journal and the certificate issued by supervisor for confirmation of publication from his PhD dissertation work subject, to fulfillment of other requirements.

B- PH.D. REFERRED BACK CASES

Ph. D. Synopses in Botany

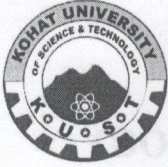
Agenda Item No. 2

Fakhar Mohsin, Ph.D. Scholar of Botany (Reg. # BO420202001)

Research Title: Approved

METAGENOMICS ANALYSIS OF SOIL BACTERIAL DIVERSITY ASSOCIATED WITH THE PHYSIO-CHEMICAL PARAMETERS OF *ACACIA NILOTICA* L. NATURALLY GROWN UNDER DIFFERENT ECOLOGICAL CONDITIONS





KOHAT UNIVERSITY OF SCIENCE & TECHNOLOGY

Kohat 26000, Khyber Pakhtunkhwa, Pakistan Ph # 0922-554563-554565/4786, 4785, Fax # 554556

Directorate of Quality Enhancement

No. 569 /KUST/QEC/PC/23
Date: 06/06/2023

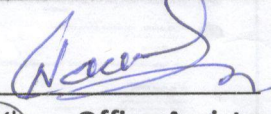
Anti-Plagiarism Test Certificate

(Similarity Index Certificate)

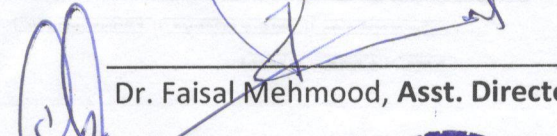
For M.Phil./MS/Ph.D Thesis/Synopsis


Name of Scholar: NOOR MAST
Discipline (M.Phil./MS/Ph.D.): Ph. D
Department/Institute: INSTITUTE OF COMPUTING
Title of Synopsis/Thesis: ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE IN WIRELESS AD-HOC NETWORKS
Document Type (Synopsis/Thesis) Thesis
Words Count 20013
Name and Designation of Supervisor PROF. DR SHAFI ULLAH KHAN, INSTITUTE OF COMPUTING , KUST
Plagiarism software (Similarity Index Checking) Turnitin.com
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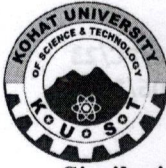

Dr. Faisal Mehmood, Asst. Director


Dr. Muhammad Zeeshan Bangash
Director Quality Enhancement Cell



Note: Technical Errors and Omissions are subject to be rectified.

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Directorate of Quality Enhancement

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 Submitted: 2

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 Similarity by Source: 100% (1), 0% (1)

ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE... By Noor Mast

1% match (Internet from 03-Sep-2017)
<https://www.researchgate.net/publication/3236001> Improving protocol capacity for UDP/TCP traffic with model-based frame scheduling in IEEE 802.11 operated WLANs

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<https://www.researchgate.net/publication/3602992> Dynamic Source Routing in Ad Hoc Wireless Networks

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<https://www.researchgate.net/publication/352001> Improving protocol capacity for UDP/TCP traffic with model-based frame scheduling in IEEE 802.11 operated WLANs

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<https://www.researchgate.net/publication/352001> Improving protocol capacity for UDP/TCP traffic with model-based frame scheduling in IEEE 802.11 operated WLANs

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 Similarity by Source: 100% (1), 0% (1)

ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE... By Noor Mast

20% match (Peer Mast, Shahulhan Khan, Muhammad Irfan Uddin, Yaseen Yasin Ghadi, Hani Khalid Alkhatib, Samir H. Mostafa, "A Cross-Layer Solution for Contention Control to Enhance TCP Performance in Wireless Ad Hoc Networks", IEEE Access, 2023)

1% match (Internet from 03-Sep-2017)
<https://www.researchgate.net/publication/3236001> Improving protocol capacity for UDP/TCP traffic with model-based frame scheduling in IEEE 802.11 operated WLANs

1% match (Internet from 21-Feb-2023)
<https://www.researchgate.net/publication/3602992> Dynamic Source Routing in Ad Hoc Wireless Networks

1% match (Internet from 27-Jan-2023)
<https://www.researchgate.net/publication/352001> Improving protocol capacity for UDP/TCP traffic with model-based frame scheduling in IEEE 802.11 operated WLANs

1% match (Amir Al-Jubari, "TCP performance in multi-hop wireless ad hoc networks: challenges and solution", EURASIP Journal on Wireless Communications and Networking, 2011)

1% match (Amir Al-Jubari, "TCP performance in multi-hop wireless ad hoc networks: challenges and solution", EURASIP Journal on Wireless Communications and Networking, 2011)

1% match (Internet from 08-Mar-2010)
<https://www.researchgate.net/publication/3236001> Improving protocol capacity for UDP/TCP traffic with model-based frame scheduling in IEEE 802.11 operated WLANs

1% match (publications)
 Mast H and Ghadi Y, "A Survey of performance enhancement of transmission control protocol (TCP) in wireless ad hoc networks", Springer Open, 2012.

1% match (Internet from 13-Jan-2023)
<https://www.researchgate.net/publication/352001> Improving protocol capacity for UDP/TCP traffic with model-based frame scheduling in IEEE 802.11 operated WLANs

1% match (Internet from 06-Feb-2022)
<https://www.researchgate.net/publication/352001> Improving protocol capacity for UDP/TCP traffic with model-based frame scheduling in IEEE 802.11 operated WLANs

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 Submitted to Higher Education Commission Pakistan on 2012-11-02

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 Submitted to Higher Education Commission Pakistan on 2013-12-26

Supervisors Email (dated 5 Jun 2023, 12:11 pm) screen-shot certifying that the Paper Published is from the Thesis

Request for Publication Verification and Relevancy Certificate in r/o Mr. Noor Mast

IT M. Waaseem Khan
 Ask Please for the attached documents for the subject matter. Regards Waaseem Khan ITC

Office Assistant QEC
 Dear Noor Mast, The email regarding excluding Research Papers of Ph.D. Scholar should be verified and routed through his concerned supervisor.

Irfan Uddin, irfanu@kust.edu.pk
 Dear Noor Mast,
 I am Supervisor of Mr. Noor Mast. His paper published in IEEE Access [https://doi.org/10.1109/ACCESS.2023.3236001] is from his PhD dissertation and should be excluded from plagiarism checking by QEC.

On Jun 4, 2023, at 1:10 PM, IT M. Waaseem Khan <waaseem@kust.edu.pk> wrote:

Thank you for the information. Thank you for the clarification. Thank you for your response.

Reply Reply all Forward

Director Quality Enhancement Cell
 KUST / / 20



Manzoor_Estf

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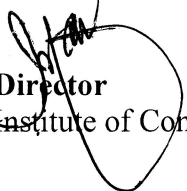
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INSTITUTE OF COMPUTING

Ref: 381 KUST/IoC/23
Date: May 25, 2023.

C I R C U L A R

It is hereby circulated for the information of all concerned that Mr. Noor Mast, course registration no. CS420201001, Ph.D. scholar in computer science will deliver departmental presentation on his research titled “**Enhancing Transmission Control Protocol Performance in Wireless Ad-hoc Networks**” on 1st June 2023 (Thursday) at 2:00 pm in the IoC conference room.

All respected faculty members and graduate students are invited to attend the mentioned event on given date, time and venue.


Director
Institute of Computing

Copy to: Copy to:

1. Dean, Faculty of Physical & Numerical Sciences
2. Director AS&R
3. Director QEC
4. Director Academics
5. Coordinator MS/Ph.D.

(with request to inform all IoC MS and PhD Scholars to attend the presentation)

6. IoC Faculty Members
7. IoC Notice Board
1. IoC Notice Board
2. Office file



KOHAT UNIVERSITY OF SCIENCE & TECHNOLOGY
INSTITUTE OF COMPUTING

Title of Dissertation: Enhancing Transmission Control Protocol Performance in Wireless Ad-hoc Networks”

Presenter: Mr. Noor Mast, course registration no. CS420201001, Ph.D. scholar in Computer Science

S.No	Name	Signature
1	Dr. M. Wajid Uddin	
2	SAOOD IQBAL	
3.	Dr. Altaf Khan.	
4	Supriya Pasha	
5.	Dr. M. Roman	
6.	Prof Dr. M. Arif Jan	
7.	Rizwan Talib	
8.	M Qasim	
9	Wajahat Ali	
10	Ishfaq Khan	
11	Hanzla Afridi	
12	Shameen	
1.3	Zia	

Ph.D. Coordinator
Institute of Computing

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Editors

Dr. Ethem İlhan ŞAHİN

Dr. Mustafa Latif EMEK



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IEEE 802.11 MAC PROTOCOL: A REVIEW OF BACKOFF ALGORITHMS

Noor Mast¹, Wali Khan Mashwani², Shafiullah Khan^{3,1}, Muhammad Irfan Uddin¹

¹Institute of Computing, Kohat University of Science and Technology, Kohat, 26000, Pakistan.

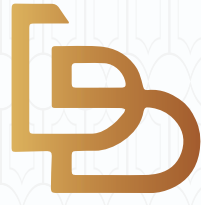
²Institute of Numerical Sciences, Kohat University of Science and Technology, Kohat, 26000, Pakistan.

³Faculty of Computer and Software Engineering, Huaiyin Institute of Technology, Huai'an, 233003, China.

ABSTRACT

In Wireless Local Area Networks (WLANs) and Wireless Ad-hoc Networks (WANETs), the IEEE 802.11 MAC (Medium Access Control) protocol is used as a de-facto standard, which provides channel contention-based access to the shared medium. Since channel contention causes collision among packets; therefore, the Binary Exponential Backoff (BEB) algorithm has been implemented for its handling. However, the efficiency of any network is significantly impacted by packet collision. As a result, the research community proposed several techniques to enhance the BEB algorithm's performance further. This paper provides an overview of those mechanisms and identifies other areas for development. Additionally, the wrong notification of route failure due to channel contention and its effect was analyzed using NS2.

Keywords: Wireless Networks, WLAN, WANET, Channel Contention, Backoff algorithm, BEB



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CERTIFICATE OF PARTICIPATION

This certificate is proudly presented to

Noor Mast

in oral and technical presentation, recognition and appreciation of research contributions to

**3. International Anatolian Congress on Multidisciplinary Scientific Research
held on December 28, 2022 / Kayseri, Türkiye**

with the paper entitled

**IEEE 802.11 MAC PROTOCOL: A REVIEW OF BACKOFF
ALGORITHMS**

Dr. Mustafa Latif EMEK
Head of Congress



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RESEARCH ARTICLE

A Cross-Layer Solution for Contention Control to Enhance TCP Performance in Wireless Ad-Hoc Networks

NOOR MAST¹, SHAFIULLAH KHAN^{1,2}, M. IRFAN UDDIN¹, YAZEED YASIN GHADI³, HEND KHALID ALKAHTANI⁴, AND SAMIH M. MOSTAFA⁵

¹Institute of Computing, Kohat University of Science and Technology, Kohat 26000, Pakistan

²Faculty of Computer and Software Engineering, Huaiyin Institute of Technology, Huai'an 233003, China

³Department of Computer Science, Al Ain University, Al Ain, United Arab Emirates

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ABSTRACT With the development of wireless technology, users not only have wireless access to the Internet, but this has also sparked the emergence of Wireless Ad-hoc Networks (WANETs); this promising networking paradigm has the potential to adopt the shape of new emergent networks such as the Internet of Things (IoT), Vehicular Ad-hoc Networks (VANET) and Wireless Sensor Networks (WSN). However, channel contention (CC) is one of the key reasons why the TCP performs poorly in WANETs. This paper presents a mechanism called Cross-layer Solution for Contention Control (CSCC) to enhance TCP performance in WANETs. Each node starts marking packets in the proposed mechanism when its CC level reaches a certain threshold. As a result, the source node adjusts the congestion window (cwnd) size to a good state to control the insertion ratio of packets into the network. To provide a fair share to each flow, the flow having a large cwnd is penalized more. Numerous simulations have been conducted across several topologies to clarify the performance of the suggested mechanism. The simulation findings show that, in the presence of the Ad-hoc On-demand Distance Vector (AODV) routing and Dynamic Source Routing (DSR) protocols, the proposed CSCC mechanism outperformed TCP NewReno in terms of throughput and fairness. In comparison to TCP NewReno, the suggested mechanism has fewer retransmitted packets.

INDEX TERMS TCP, wireless ad-hoc networks (WANETs), channel contention (CC), congestion window (cwnd), CSCC, IEE802.11.

I. INTRODUCTION

Transmission Control Protocol(TCP) [1] is a reliable acknowledgment-based transport layer protocol initially designed for wired networks. When TCP was in its early days, it faced congestion problems, which led to the integration of congestion algorithms [2], [3] for further advancement. Due to its reliability, TCP is widely utilized in numerous Internet applications such as email, remote access, and file transfer. Moreover, according to reports, TCP is used to carry up to

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90% of all internet traffic [4], [5], making it a vital protocol that still needs work to be improved.

However, with the development of wireless technology, users not only have wireless access to the Internet, but this has also led to the emergence of Wireless Ad-hoc Networks (WANETs). These networks are beneficial when the infrastructure may not exist or may be too expensive. WANETs are built up of wireless nodes (as depicted in Fig. 1), where nodes are connected wirelessly to each other without using any access point, and every node performs the roles of both a host and a router. These networks can be quickly deployed anywhere at any time. This alluring networking paradigm has the

potential to adopt the shape of new emerging networks such as the Internet of Things (IoT), Wireless Sensor Networks (WSN), Vehicular Ad-hoc Networks (VANET) and Tactical Wireless Networks [5], [6]. The IEEE 802.11 standard [7] is a de-facto standard for accessing medium in WANET [8].

However, wireless networks have unique properties (such as dynamic topology, a shared medium, and a medium prone to errors) compared to wired networks. Due to this mismatch, TCP experiences difficulties on wireless networks and performs poorly, notably in WANETs [9]. TCP must overcome these difficulties to efficiently use wireless technologies by connecting to the Internet or creating a WANET.

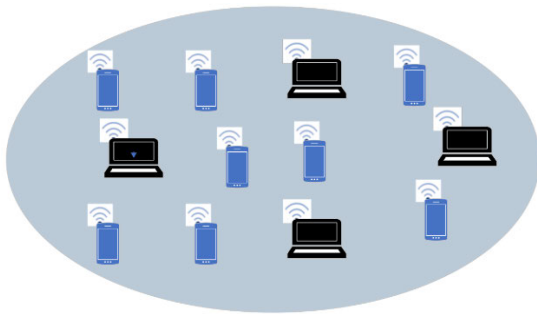


FIGURE 1. A scenario of a wireless Ad hoc network.

The research community works on various aspects to improve wireless networks' overall performance. For example, many routing protocols like [10], [11], [12], [13], [14], and [15] have been proposed to establish network paths effectively. But TCP's performance on wireless networks is still insufficient in the presence of such routing algorithms. Because there have been changes to the wireless technology's lower tiers of the communications stack without considering how those changes would affect the higher layers; therefore, wireless networks have a very different communication environment than cable ones. However, TCP fails to account for this shift and continues to operate as though a wireless network were wired. Furthermore, utilizing congestion algorithms in the event of losses not arising from network congestion is the primary problem for TCP in WANET. That is to say, TCP cannot tell the difference between losses due to congestion and losses due to the unique features of WANET [16], [17], [18].

For wired networks using TCP, buffer overflow is the most common cause of lost packets. But this assumption is false with WANETs because packet loss can be caused by channel contention (CC) or route failure [19]. Furthermore, if the WANET nodes can store more than ten packets in the buffer, then buffer overflow is rare. However, one of the most frequent causes of packet loss in WANETs is CC, resulting from the shared medium [20], [21]. Therefore, TCP must be aware of CC to respond accordingly and operate more effectively in WANETs.

To enhance TCP's functionality in WANETs, this paper presents a mechanism known as Cross-layer Solution for

Contention Control (CSCC). In the proposed mechanism, packets are marked at each node once the CC at the MAC layer reaches a certain threshold. As a result, the source node adjusts the congestion window (cwnd) size to a good state to control the insertion ratio of packets into the network. To provide a fair share to each flow, the flow having a large cwnd is penalized more.

Here is how the rest of the paper is structured. Section II describes the Distributed Coordination Function of the IEEE 802.11 MAC protocol. Section III summarises the relevant literature. The proposed mechanism is described in detail, beginning with section IV. Results from simulation experiments of the suggested mechanism's performance are reported in Section V, and section VI offers the conclusion.

II. THE DISTRIBUTED COORDINATION FUNCTION

In the IEEE 802.11 MAC protocol, the Distributed Coordination Function (DCF) provides two mechanisms for accessing the medium. One of these mechanisms is the CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) used to share the medium among compatible devices, also known as the basic access mechanism. Before commencing a transmission in CSMA/CA, A node will check by sensing the medium that any other node within the range is sending data. The node transmits a frame if the medium is free for longer than the distributed inter-frame space (DIFS). Otherwise, the node defers transmission using the binary exponential backoff process to reduce the chance of packet collisions with packets sent by other nodes. The receiver sends an acknowledgement (ACK) to the sender when the frame is received. Otherwise, the sender schedules a retransmission of the frame. Additionally, the CSMA/CA algorithm requires that adjacent frame sequences have a minimum specified space between them.

On the other hand, the virtual carrier sensing method is an alternative to the basic access mechanism that calls for exchanging special RTS and CTS (Request to Send and Clear to Send) frames before transmitting actual data frames. With virtual carrier sensing, a sender will first send an RTS frame, and then, after a brief delay called short inter-frame space (SIFS), the receiving node will send a CTS frame in response. If the CTS frame is received after the RTS frame, the sender is free to send the data frame; otherwise, the transmission of the RTS frame is rescheduled.

When the medium is busy, both medium access mechanisms initiate the Binary Exponential Backoff (BEB) algorithm, where CW_{min} (minimum contention window) is the initial size of the contention window (CW) in the BEB algorithm. After that, the size of the CW is incremented exponentially for each unsuccessful transmission. However, the size of the CW cannot exceed the size of the CW_{max} (maximum contention window).

The IEEE 802.11 MAC protocol specifies that if the number of tries for transmitting a frame hits its maximum limit, then drop the frame and set CW to its minimum value. Also, reduce the value of CW to a minimum in the case of

successful transmission. Since the RTS and CTS frames in the virtual carrier sensing mechanism provide information about the time needed to transmit a frame. Any listening node can read this information and utilize it to update its NAV (Network Allocation Vector). Each node uses its NAV to estimate how long the medium will be busy and defers transmission accordingly.

From the above explanation, DCF utilized in non-QoS WLAN defines four components—Physical Carrier Sense, Virtual Carrier Sense, Random Back-off timings, and Inter-frame Spaces (IFS)—to guarantee that devices share the medium fairly.

DCF gives all users the same priority, so it is not considered the best mechanism for transmitting highly sensitive packets such as voice or video. Therefore, a mechanism was required to assign different priorities to different types of packets and allow higher-priority packets more access to the shared medium. It resulted in the development of Enhanced Distribution Coordination Access (EDCA), also called The Enhanced DCF.

EDCA assigns the highest priority to voice, followed by video, while best effort and background are placed in the third and fourth categories. So, for queueing packets, there are four Access Categories (ACs) in EDCA, and each AC has its respective queue and contention requirements.

The packets to be transmitted through EDCA faces two types of contention: internal contention among the ACs and external contention among nodes. While the packets to be transmitted through DCF only faces external contention. However, the proposed mechanism is not only in DCF; it can be adopted with EDCA.

III. RELATED WORK

The researchers have proposed various mechanisms for addressing the CC problem to improve TCP performance. We want to present a brief overview of these techniques here. One of these mechanisms is the Prioritized Packet Scheduling with Adaptive Backoff window (PPSAB) [22]. This mechanism calculates the retransmission probability (RP) based on the packet expiry time and the number of tries made for frame transmission. The frame with the shortest lifespan and the most transmission attempts is given the highest priority. Then each node modifies the CW using the RP and number of neighbor nodes. The weight components $\alpha 1$ and $\alpha 2$ are used to calculate CW_{par} , and CW is then dynamically adjusted by equation (1).

$$\begin{aligned} CW_{par} &= (\alpha 1 \times \text{Average_Active_Neighbors}) + (\alpha 2 \times RP) \\ CW &= CW_{max} \times CW_{par} \end{aligned} \quad (1)$$

A mechanism named Priority Contention Window Approach (PCWM) [23] is proposed by Chou et al. to tackle the CC problem. The MAC layer receives data from the network layer about the total and remaining hops in the PCWM mechanism. Then, using equation (2) provided, the value of

CW is determined at each node along the path.

$$\begin{aligned} CW_{Max} &= 1024/2^y, \quad y = \text{Max}(0, (L - D - 5)) \\ CW_{Min} &= 1024/(2^x * 2^{(L-D)}), \quad x = \text{Max}(0, (5 - L)) \end{aligned}$$

L is the routing path's overall hop count, and D is the remaining hop counts in the Ad-hoc On-demand Distance Vector (AODV) routing table.

$$CW = CW_{Min} * 2^{n-1} \quad (2)$$

In equation (2) n is the number of attempts for data transmission, and $CW_{Min} \leq CW \leq CW_{Max}$

A mechanism named Cooperative MAC protocol with Multi-Node Collision Avoidance (MNCA-CMAC) [24] is proposed by Shan Wu et al. to avoid collision among frames. This mechanism consists of three phases, i.e., (i) channel reservation phase, (ii) cooperative node selection phase and (iii) data transmission phase. The Cooperative RTS and Cooperative CTS (CCTS) packets are used for channel reservation. After receiving the CCTS packets, the sender awaits to receive the HTS (help-to-send) packets from the cooperating nodes, which identify the residual energy of a cooperative node. The sender waits for a predetermined interval to elapse or to receive a specified number of HTS packets. When either of these two conditions occurs, the sender sends an SEI (Selection End Indicator) packet to terminate the selection phase of the cooperative node. After that, the data packet is transmitted to the most cooperative node.

Some techniques are focused on generating a delayed/proxy ACK to minimize CC. Proxy Acknowledgement (PACK) [25] is one such mechanism; in this mechanism, a proxy node is nominated if the number of hops on the path surpasses a predefined threshold. The proxy node identifies missing packets and informs the source node by sending an ACK packet. As a result, the source node will retransmit the lost packets without waiting for a retransmission timeout. One of the delay ACK mechanisms is the TCP ACK Delay Window (TCP-ADW) [26]; this mechanism looks at the channel situation to determine the number of ACKs for increasing/decreasing the delay window. The receiver must provide an ACK and set the count variable to zero when the sum of all received packets reaches the delay window. If an out-of-order packet arrives, then immediately provide an ACK or if a packet fills a gap in the receiver's buffer.

Altman et al. proposed a mechanism called the Dynamic Delayed ACK (DDA) [27] based on RFC1122 [28] also belongs to the category of delay ACK. After receiving d packets (where $d=2$), RFC 1122 specifies a standard for sending an ACK. However, send an ACK if d packets are not received within a specific time. The value of d in DDA can be between 1 and 4. Initially, DDA creates an ACK on the arrival of each packet and then increases this number to four ($d=4$) based on the sequence number of a segment. Under this strategy, once d achieves the value of four, there is no way to bring it back down. To improve this idea, even more, a mechanism called TCP-DAA (TCP Dynamic Adaptive ACK) [29] is suggested.

This mechanism considers the channel situation for sending an ACK; if the channel is good, send an ACK after four packets or two packets. However, immediately send an ACK if an out-of-order packet arrives or a packet fills the gap in the receiver's buffer. In standard TCP, three duplicate ACKs are required for fast retransmission, whereas in TCP-DAA, two are needed.

The author says in [17] that TCP-DCA (TCP with Delayed Cumulative ACK) is a technique that aims to determine the delay windows based on the hop count. The ACK might be suspended for an entire cwnd using TCP-DCA if the number of hops on the path is less or equal to three. On paths with a hop count of more than three but less or equal to nine, the receiver delivers an ACK after five packets. However, send an ACK after three packets in the case of more than nine hops. In contrast, TCP-ADA (TCP with Adaptive Delayed Acknowledgement) [30] is a technique; according to this approach, to avoid contention and collision, the best solution is to generate an ACK for a single cwnd. In the Contention-based Path Selection (COPAS) [31] mechanism, a different approach has been adopted than delay ACK techniques. The COPAS uses different routes for forwarding the data and ACK packets. After that, continuously monitors the paths for contention. A less-contended route is selected as soon as the traffic on a path exceeds a certain level.

The NRED (Neighbourhood Random Early Detection) [32] technique, which is based on [33], is proposed by Xu et al. to alleviate the effect of unfairness in WANETs. In the NRED algorithm, a distributed neighborhood queue strategy is adopted, in which all neighbor nodes' queues are aggregated so that every node holds a piece of the distributed queue. To determine the size of the distributed queue, each node monitors channel utilization; the packet dropping/marketing probability is determined based on channel utilisation.

Fu et al. have proposed a mechanism called Link layer RED+AP (LRED+AP) [20]; this mechanism selects two thresholds (i.e., maximum and minimum) to manage CC. The packets are dropped at the maximum threshold and added extra time to back-off time at the minimum threshold level. The additional time is equal to the transmission time of the preceding packet. Thus, the spare time depends on the size of the last transmitted packet.

Cross-layer congestion control (C^3 TCP) [34] has been proposed to deal with network congestion to improve TCP performance. This mechanism minimizes the data injected into the network for congestion avoidance. Therefore, the bandwidth and the delay experienced by each link are evaluated at each node. The collected data are inserted into the MAC header's option field. After collecting the bandwidth and link delay information at the first node, the next node compares its bandwidth with the bandwidth of the previous node and chooses the smallest one. However, the delay on the current link will be added to the previous delay. The process mentioned above is repeated on each intermediate node. As a

result, when the destination node receives a data packet, it contains the minimum available bandwidth on the path. It will also include the link delay information for the entire route. After that, the bandwidth and link delay information is communicated to the source node in the ACK packet for transmission rate adjustment.

The Wireless Contention Control Protocol (WCCP) [19] uses channel busyness to identify the network utilization and congestion status. Moreover, it allocates resources to a flow based on available bandwidth. WCCP replaces the TCP's window technique with a rate-based algorithm. As a result, WCCP introduces two modules: one at the transport layer and the second between the network and MAC layer, to check and, if required, alter the value of the feedback field in the TCP's packet. The source node adjusts its transmission rate based on the value of the feedback field.

Hamadani proposed a solution to address the problem of intra-flow instability called TCP ConTention Control (TCTC) [35]. The leading cause of intra-flow instability, according to [35], is transmitting more data to the network. In the proposed solution, the destination node monitors the amount of throughput achieved for a fixed interval of time and the level of contention in this interval. The receiver node decides the appropriate amount of data to be emitted by the sender node based on the information collected within the fixed interval to achieve high throughput and reduce the delay on each connection. After presenting a summary of the proposals suggested by the research community, the following section offers the proposed CSCC mechanism.

TABLE 1. presents a summary of the proposals discussed as related work. Several proposals are based on delayed ACKs, and all these proposals have a limitation in common: excessive ACK delays can upset TCP's round-trip time and packet clocking algorithms. In contrast, mechanisms such as PACK violate the end-to-end connection handling mechanism of TCP. Moreover, failure of the node responsible for proxy ACK may lead to more poor performance if the destination node demands retransmission.

In PPSAB, estimating active nodes is challenging, and the wrong estimation can affect the algorithm decision. While in MNCA-CMAC, after the CCTS packets, the exchange of the HTS packets is also required to determine the cooperative nodes. So, it is an extra burden on the shared medium. On the other hand, in WANET, the probability of route failure increases with high mobility, and the routing's overhead will also increase. Therefore, COPAS, which maintains two routes, is unsuitable in a high-mobility environment.

Moreover, the extra delay at the MAC layer in the case of LRED+AP is also a reason for low throughput and retransmission may occur. None of those mentioned above mechanisms enable TCP to distinguish that the network is congested or has high contention. However, the proposed mechanism sends a contention notification to the sender that the network has contended, and the sender can take appropriate action in the case of contention..

TABLE 1. A summary of the related work.

Mechanism	Layers Involved	Problem to Handle	Routing Protocol used	Brief Description	Simulation Environment
PPSAB	N & MAC	Channel contention	Not mentioned	Adjust the CW based on the number of active nodes and the retransmission probability (RP).	Mobile
PCWM	N & MAC	Channel contention	AODV	To adjust CW of a node based on the total hop count and remaining hop count in the routing.	Mobile
MNCA-CMAC	MAC	Channel contention	Not mentioned	Calculates the contention waiting time based on the network's probability of channel gains.	Static
PACK	T	Channel contention	AODV	A proxy node is nominated if the number of hops on the path surpasses a predefined threshold.	Mobile
DDA	T	Channel contention	AODV	Suggests the DACK for one to four packets based on the sequence number.	Static
TCP-ADW	T	Channel contention	AODV	To estimate the channel situation and set the delay window based on cwnd, packet loss and packets' inter-arrival times.	Mobile
TCP-DAA	T	To minimize retransmission due to contention	Not mentioned	Delay ACK for a maximum of 4 packets, based on the inter-arrival time of packets to estimate channel condition.	Static
TCP-DCA	T	Channel contention	AODV and DSR	To delay ACK based on hop count.	Mobile
TCP-ADA	T	Channel contention	DSR	Suggested one ACK for the whole cwnd.	Mobile
COPAS	N	Channel contention	DSR	Forward Data and ACK packets on different routes based on Backoff time.	Static
NRED	MAC	Unfairness	AODV	Extends the RED concept to the distributed neighborhood queue, and packet dropping probability is based on channel usage.	Static
LRED+AP	MAC	Channel contention	Manual routing	Specifies two thresholds; packets are dropped at the maximum threshold and add a delay at the minimum threshold.	Static
C ³ TCP)	T & MAC	Congestion	Not mentioned	Adjusting transmission rate based on bandwidth and delay	Static
WCCP	T & MAC	Unfairness due to contention	AODV	Adjust the sending rate based on Channel Usage. It replaces the window algorithm with a rate control algorithm.	Static
TCTC	T & MAC	Congestion	DSR	Adjust the data rate based on the achieved throughput and contention delay experienced by packets in a specific interval.	Static

IV. PROPOSED SOLUTION

In the proposed mechanism, each node counts the number of attempts to access the medium for transmission at the MAC layer. After that, each node calculates the Weighted Moving Average (WMA) of the number of tries (as explained in subsection A of Section IV) to estimate the CC and react accordingly. When the WMA reaches a specific threshold CC_{Thresh} (Channel Contention Threshold), the MAC layer will set the CC status ON. As a result, the node will start marking packets to inform the TCP's source node about

contention (Subsection B of Section IV describes how to notify the source node). On receipt of CC notification, the source node adjusts its transmission rate to control contention.

Marking packets is more effective than dropping packets. Because when the MAC layer fails to transmit a frame, it is dropped and wrongly notifies the network layer that the path is unavailable. The network layer then initiates an unnecessary route recovery process [36]. The proposed mechanism attempts to control packet drop due to CC to save the time

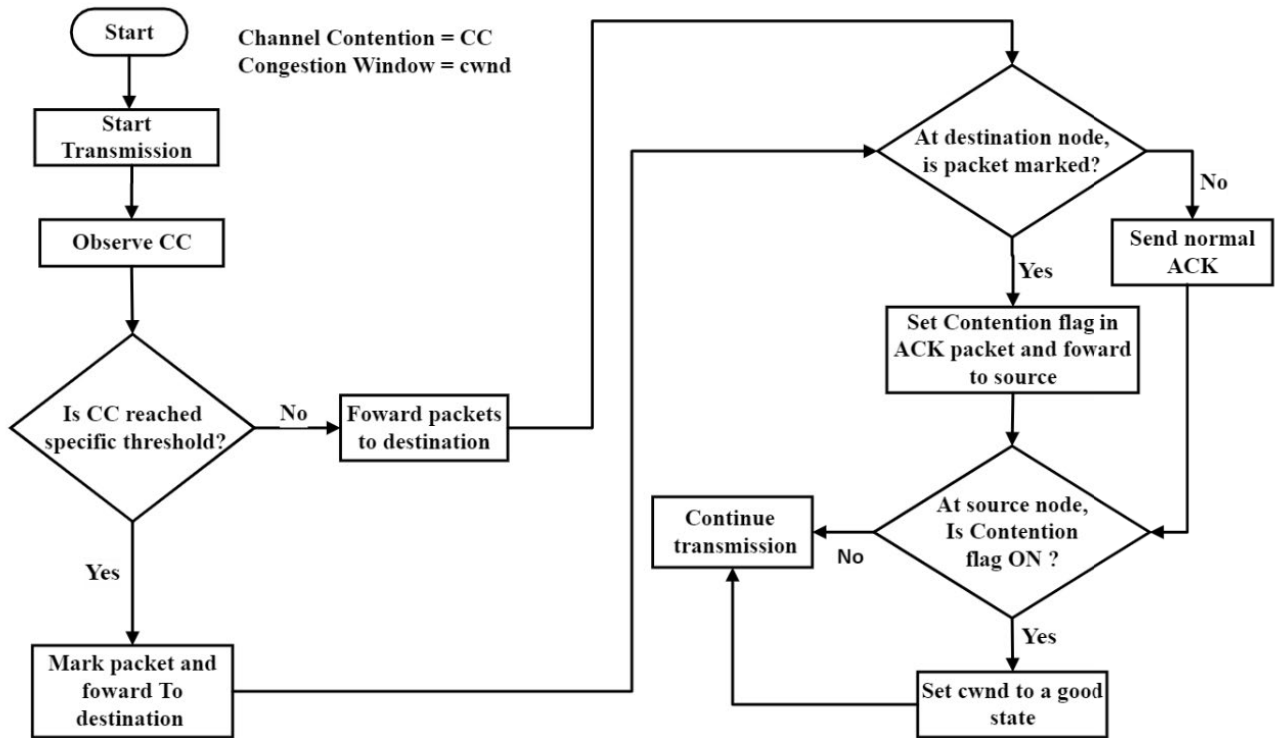


FIGURE 2. Flowchart of a cross-layer solution for contention control (CSCC) to Enhance TCP performance in WANET.

TABLE 2. Computing the weighted moving average (WMA).

Packets Transmission Sequence	Node A		Node B	
	WMA	Transmission Attempts	WMA	Transmission Attempts
	Initially $A_{WMA}=0$		Initially $B_{WMA}=0$	
1	$A_{WMA} = (0.55 \times 1) + (1-0.55) \times 0$ = 0.55 + 0 = 0.55	1	$B_{WMA} = (0.55 \times 2) + (1-0.55) \times 0$ = 1.1 + 0 = 1.1	2
2	$A_{WMA} = (0.55 \times 2) + (1-0.55) \times 0.55$ = 1.1 + 0.2475 = 1.3475	2	$B_{WMA} = (0.55 \times 3) + (1-0.55) \times 1.1$ = 1.65 + 0.495 = 2.145	3
3	$A_{WMA} = (0.55 \times 1) + (1-0.55) \times 1.3475$ = 0.55 + 0.606375 = 1.156375	1	$B_{WMA} = (0.55 \times 3) + (1-0.55) \times 2.145$ = 1.65 + 0.96525 = 2.61525	3
4	2.1704	3	2.2769	2
5	2.0767	2	2.1246	2
6	1.4845	1	1.5061	1

the network layer searches for a new path due to a wrong notification of route failure.

The problem of contention and congestion occurs because of the greedy behaviour of TCP. However, in WANETs, congestion control is often turned on due to MAC layer losses and not buffer overflow. The proposed mechanism enables the TCP to distinguish congestion and contention losses and react

accordingly. The CC leads to the problem of unfairness as well. So, in the case of CC, it makes sense to impose a higher penalty on flows with a larger cwnd. Therefore, the proposed mechanism adjusts the cwnd size to a good state (good state is explained in subsection C of section IV) to make fair and efficient use of channel resources. Fig. 2 shows the flowchart of the suggested mechanism.

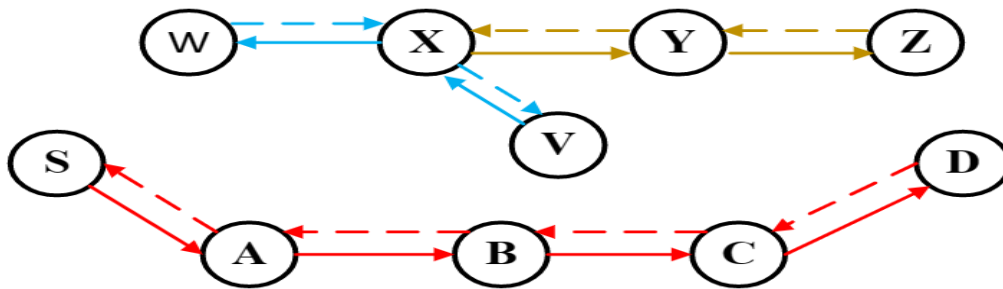


FIGURE 3. A ten nodes scenario of WANET.

Version 4 bits	Header Length 4 bits	differentiated services codepoint	ECN	Total Length 16 bits	
Identification 16 bits			Flags CCE D M		Fragmentation Offset 13 bits
Time to Live 8 bits	Protocol 8 bits		Header Checksum 16 bits		
Source IP Address 32 bits					
Destination IP Address 32 bits					

FIGURE 4. IP header with suggested modification.

Data Offset (4 bits)	Reserved (2 bits)	C R	C F	C R	E R	U E	A G	P K	R H	S T	S S	F Y	Window (16 bits)
Checksum (16 Bits)													Urgent Pointer (16 bits)

FIGURE 5. A portion of the TCP header with suggested modification.

A. COMPUTING THE WEIGHTED MOVING AVERAGE (WMA)

Whereas accessing the medium for transmission, the increase/decrease in the number of attempts means the node has potentially identified an increase/decrease in the CC. Therefore, to estimate the CC, each node obtains the WMA of the number of tries made to transmit a frame. Suppose the WMA is denoted by \hat{A} . Suppose again that R_{Att} is the number of attempts made by a node N transmitting a frame. Then at the end of every successful/unsuccessful transmission, a WMA is computed according to equation (3) [37] to reflect increases/decreases in the contention.

$$\left\{ \begin{array}{l} \hat{A}_{n+1} = \alpha R_{Att} + (1 - \alpha) \hat{A}_n, 0 < \alpha < 1 \\ \quad \text{if transmission is successful} \\ \hat{A} = CC_{Thresh} \text{ Otherwise} \end{array} \right\} \quad (3)$$

The value of α is constant and must be chosen very carefully; the value for α must be selected such that it does not reveal contention early. Otherwise, TCP will reduce the cwnd size unnecessarily. On the other hand, conflict reflection would not even need to be long enough to allow cwnd to grow to a larger size. Both cases lead to the poor performance of the network.

When $\hat{A} \geq CC_{Thresh}$, the MAC layer sets the contention status ON. After that, the concerned node starts to mark packets to inform the source node about the medium contention. On receiving the contention notification, the source node adjusts its cwnd size to a good state, as explained in Subsection C of Section IV. Whereas algorithm 1 shows how to observe and set the CC status.

To illustrate the WMA computing process with an example, see Fig. 3, where the solid line represents the direction

of data packets, such that source S is sending data packets to destination D. Similarly dotted line represents the direction of ACK packets between the endpoints. So, in Fig. 3, three data flows are employed to transfer data packets; one flow is from S to D, the second is from V to W, and the third is from X to Z.

On the path S-A-B-C-D, the A_{WMA} and B_{WMA} denote the WMAs at nodes A and B, respectively. The initial value of WMA at each node is zero, as shown in TABLE 2, and the weight factor (α) value is 0.55. Suppose, at first-time, Node A after one attempt and Node B after two attempts transmit a frame. Furthermore, how the WMA will be computed at nodes A and B, in this case, is shown in TABLE 2. The computed values for A_{WMA} and B_{WMA} are 0.55 and 1.1, respectively. It is also shown in TABLE 2 how WMA will be calculated at Nodes A and B after transmitting the second and third packets. The computed WMA in the case of the fourth, fifth and sixth packets is also listed. Looking at TABLE 2, after transmitting the third packet, the WMA value at Node B is 2.61525, suppose it is greater than the CC_{Thresh} . So, the MAC layer of Node B will notify that the channel has contended. As a result, the network layer of Node B will start packet marking to inform the source node.

Algorithm 1 Observing Channel Contention

```

Initialization
{
     $\hat{A} = 0$ 
     $R_{Att} = 0$ 
}
Counts Number of  $R_{Att}$ 
IF (Transmission successful == True)
     $\hat{A} = (1 - \alpha) \hat{A}_{Retry} + \alpha R_{Att}$ 
Else
     $\hat{A} = CC_{Thresh}$ 
Endif
IF ( $\hat{A} \geq CC_{Thresh}$ )
    Contention Status ON
Else
    Contention Status OFF
Endif

```

B. CHANNEL CONTENTION NOTIFICATION

Changes have been suggested in the IP (Internet Protocol) header for informing the source node about contention on the path. The IP header has a reserved field; the proposed mechanism uses this field to mark packets. Suppose the name of this field is CCE (Channel Contention Experienced), as shown in Fig. 4. When the MAC layer notifies that the contention has occurred, the network layer starts marking packets using the CCE field, as given in algorithm 2.

As clear from the literature, the ECN [38] mechanism has been proposed to inform the source node about the congestion or queue status. The ECN mechanism uses the ECN field in the IP header to mark packets in the case of congestion,

as shown in Fig. 4. So, the proposed mechanism and ECN mechanisms can be implemented together. As a result, the TCP's source will be able to differentiate between congestion and CC losses and react accordingly.

In the TCP header, there are eight control bits. The suggested mechanism introduces two new control bits called CCF (Channel Contention Flag) and CCR (Channel Contention Responded), as shown in Fig. 5. When a packet arrives at the destination node with the CCE field ON. The destination node sets the value of the CCF field to one in the ACK packet to inform the source node about contention. On receiving the ACK packet with the CCF field ON, the response of the source node is explained in subsection C of section IV.

Algorithm 2 Marking Packets to Inform Source Node

```

//At Intermediate Node
IF (Contention Status ON)
    Set CCE = 1
Endif
//At Destination Node
Sending ACK
IF (CCE == 1)
    IN ACK Header Set CCF=1
Endif

```

C. RESPONSE OF SOURCE NODE TO MARKED PACKETS

To control contention and provide fairness among data flows, the source node adjusts the size of the cwnd to a good state when receiving an ACK packet where the CCF field has one value. To explain a good state, suppose there is a TCP flow with an initial cwnd size of one. Its size hits 128 after some time without receiving a channel contention notification. Now all sizes of cwnd that falls below 128 are good states. Suppose again, when TCP's cwnd size is 128, the source node receives a channel contention notification. Then cwnd size will adopt a value below 128 (in this case, all values below 128 represent good states) according to algorithm 3. Furthermore, a flow with a cwnd size is less than the slow start threshold (ssthresh) is considered a flow with a small cwnd; otherwise, it is a flow with a large cwnd. Algorithm 3 shows how to adopt a good state and sets the value of the CCR field to one to inform the destination node that the cwnd has been reduced. Moreover, if the TCP source receives a CCF notification in a good state before the expiry of one round trip time, the TCP source should ignore the succeeding CCF.

D. SELECTION OF VALUE FOR ALPHA (α)

The WMA given by equation (3) is a recursive function, and one can write it in terms of older weights, as provided by equation (4). Expanding equation (4) to its older value will continue until it reaches the base term \hat{A}_0 . So, the recursive property of WMA implies that it calculates the value of the current state using the prior observation. The only choice a WMA user must make is the parameter alpha (α) selection,

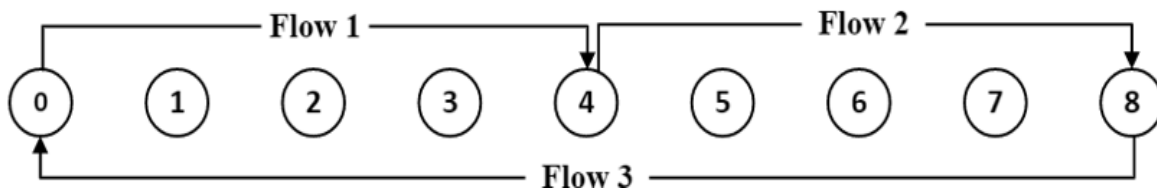


FIGURE 6. String topology of 9 nodes and three flows of TCP.

TABLE 3. Results achieved on a string topology of 9 nodes.

Values assigned to alpha (α).	Throughput (Flow 1)	Throughput (Flow 2)	Throughput (Flow 3)	Total Throughput (Kbps)	Fairness Index
0.40	130.51	159.43	25.17	315.11	0.768
0.45	121.11	168.73	43.15	332.99	0.821
0.50	140.67	176.56	37.31	354.54	0.800
0.55	123.63	169.66	63.70	356.99	0.883
0.60	119.41	160.65	34.27	314.33	0.799

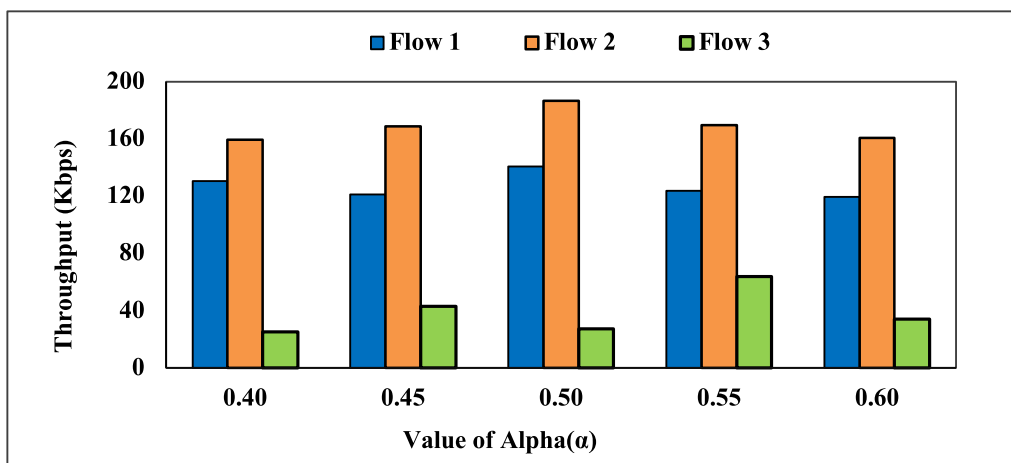


FIGURE 7. The throughput achieved on the nine nodes string.

which determines how significant the recent observation is in the WMA’s computation.

Some simulation experiments have been conducted to determine the value of alpha (α) for efficient utilization of the network resources. Therefore, the performance of the proposed mechanism was analyzed in the string topology of 9 nodes depicted in Fig. 6. The values assigned to alpha(α) are 0.40, 0.45, 0.50, 0.55 and 0.60. The number of TCP flows was 3, each with a payload of 1460 bytes.

$$\left\{ \begin{array}{l} \hat{A}_{n+1} = \alpha R_{att} + (1 - \alpha) \hat{A}_n, \\ 0 < \alpha < 1 \\ \text{if transmission is successful} \\ \hat{A}_{n+1} = \alpha R_{att} + (1 - \alpha) \\ * \left(\alpha R_{att-1} + (1 - \alpha) \hat{A}_{n-1} \right) \\ \hat{A}_{n+1} = \alpha R_{att} + (1 - \alpha) \\ * (\alpha R_{att-1} + (1 - \alpha) \\ * (\alpha R_{att-2} + (1 - \alpha) \hat{A}_{n-2}) \end{array} \right. \quad (4)$$

Conducting the simulation experiments, the throughput achieved by the proposed mechanism is shown in Fig. 7, and

Fig. 8 illustrates the fairness indexes achieved in each case. For further detail, look at TABLE 3.

Looking at the results illustrated in Fig. 7 and Fig. 8 and listed in TABLE 3, high throughput and more fairness have been obtained by assigning a value of 0.55 to alpha(α). The closest results were achieved when a value of 0.50 was assigned to alpha(α); however, the best results were achieved when a weight of 0.55 was used for alpha. Therefore, during further simulation experiments, the value of 0.55 was used.

V. PERFORMANCE EVALUATION

Using the network simulator NS2.35 [39], multi-hop wireless simulation experiments were conducted to verify the proposed mechanism’s performance against TCP NewReno. However, implementing the proposed algorithm, the most modified files are tcp.h, tcp.cc and tcp-newreno.cc at the transport layer. While at the MAC layer, the files called mac-802.h and mac-802.cc were modified to measure the channel usage and declare whether the channel has contended. During simulation experiments, in each scenario, each node’s transmission range and sensing ranges were 250 and 550 meters,

Algorithm 3 Adjusting the Size of Cwnd to a Good State

```
// on Receipt of ACK packet
ACK packet received
IF (CCF is ON)
  IF (cwnd ≤ ssThresh)
    IF (cwnd ≤ 1/2 ssThresh)
      cwnd = cwnd
    Else
      cwnd = 3/4 ssThresh
    Endif
  Else IF (cwnd > ssthresh)
    IF (cwnd/2 ≤ ssThresh)
      cwnd = cwnd/2
    Else
      cwnd = ssThresh
    Endif
  Endif
  Set CCR = 1
Endif
```

TABLE 4. Values of parameters used in the simulation.

Parameters	Value
Simulation Time	300 Second
Topologies and number of nodes	A string of 16 nodes
	13x13 Grid
	Random topology in a 1000 x 1000 meters area with 100 nodes
Routing protocols	AODV and DSR
Transmission Range	250m
Data rate	2Mbps
Queue size	20 packets
Packet size	1460 Bytes
Slot time	20 μs
SIFS	10 μs

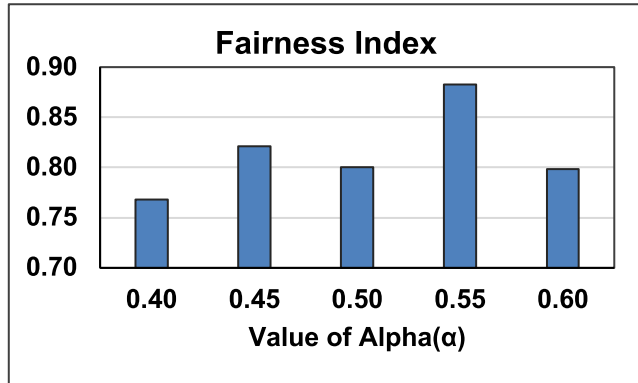


FIGURE 8. The fairness indexes achieved with different values of alpha.

respectively, and the data transfer rate was assumed to be 2Mbps. TCP packet in each case had a size of 1460 bytes. For each scenario, the simulation lasted 300 seconds. Each scenario’s results are based on an average of 15 runs.

String topology was considered during the simulation to determine the effect of the increasing number of hops. Then a grid topology and a more realistic random topology were evaluated with a growing number of flows. Throughput and flow fairness criteria were chosen for the performance study, and simulation tests were conducted with 95% confidence. The quantity of retransmitted packets is also used as a performance indicator. TCP retransmits packets for two reasons: (i) when any packet loss is detected or (ii) when a retransmission timeout occurs. As a result, if an algorithm has a low number of retransmissions, it also has a low number of retransmission timeouts and dropped packets.

The AODV [11] and Dynamic Source Routing (DSR) [10] routing protocols were employed to establish the routes. DSR and AODV are on-demand routing protocols, i.e., a path is kept around for as long as it is essential. The DSR uses

TABLE 5. Confidence intervals computed for throughput on a string topology with AODV.

Number of Hops	TCP NewReno			CSCC		
	Throughput	95% Confidence Interval		Throughput	95% Confidence Interval	
		Lower Bound	Upper Bound		Lower Bound	Upper Bound
3	327.59	325.92	329.26	363.58	361.81	365.35
4	247.01	245.71	248.31	283.60	282.73	284.46
5	205.45	203.93	206.98	241.66	240.87	242.46
6	180.01	178.51	181.51	220.25	219.02	221.47
7	155.45	146.29	164.60	201.60	196.87	206.34
8	139.88	132.22	147.54	188.20	178.29	198.11
9	131.53	126.22	136.84	177.77	164.67	190.87
10	122.33	117.08	127.58	168.01	162.17	173.85
11	116.07	109.23	122.91	160.52	150.65	170.39
12	106.99	99.87	114.11	153.79	148.03	159.56
13	99.53	91.96	107.10	147.80	138.51	157.09
14	93.80	88.20	99.40	142.46	134.55	150.36
15	89.11	82.13	96.09	139.40	133.84	144.96

source routing in which the sender of a packet determines the complete sequence of the nodes through which the packet must pass. But in AODV, each node has a routing table that it uses to decide where to forward packets. TABLE 5 provides a detailed description of the simulation parameters used for the experiments.



FIGURE 9. String topology of 16 nodes.

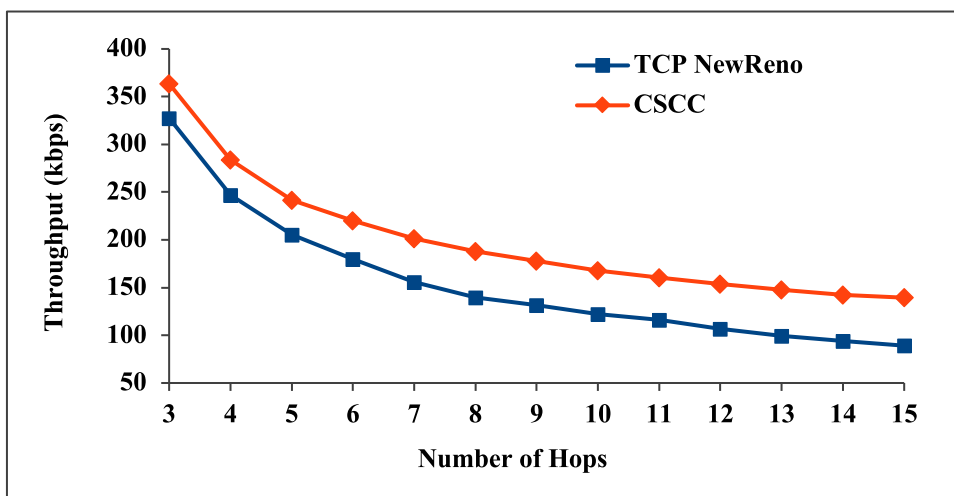


FIGURE 10. Throughput achieved in the string topology with AODV.

TABLE 6. Confidence intervals computed for throughput on a string topology with DSR.

Number of Hops	TCP NewReno			CSCC		
	Throughput	95% Confidence Interval		Throughput	95% Confidence Interval	
		Lower Bound	Upper Bound		Lower Bound	Upper Bound
3	230.79	227.00	234.58	259.83	256.41	263.25
4	195.33	191.95	198.71	227.97	221.70	234.23
5	166.82	164.54	169.10	201.54	196.51	206.58
6	142.13	138.93	145.32	176.72	172.75	180.68
7	128.48	123.17	133.78	164.84	159.67	170.01
8	119.47	115.85	123.10	161.61	158.07	165.16
9	114.47	111.35	117.59	159.51	153.72	165.31
10	112.26	108.67	115.86	158.86	155.91	161.81
11	107.98	104.91	111.05	155.74	152.29	159.19
12	105.08	100.75	109.40	150.70	147.59	153.80
13	102.61	99.30	105.92	151.84	147.66	156.03
14	98.46	96.35	100.58	145.90	143.19	148.61
15	92.38	89.61	95.15	142.92	138.82	147.03

A. STRING TOPOLOGY

To analyze how an increasing number of hops affects the performance of the proposed mechanism, the multi-hop simulations were performed in a string topology of 16 nodes.

The path length of a minimum of three and a maximum of 15 hops was considered. The distance between the adjacent nodes was set at 200 meters. The graphical representation of this topology is shown in Fig. 9. In the first case considered, a connection has been established between node 0 and node 3 to transfer the data, where node 0 and node 3 act as the source and destination nodes, respectively, which are not in the direct transmission range of each other.

In the second case, node 0 and node 4 are considered to act as the source and destination nodes, respectively, whereas nodes 1, 2 and 3 are intermediate nodes that forward packets between node 0 and node 4. This way, the transmission between node 0 and node 5, then node 6 and 7 up to node 15, was considered.

In each case considered for the string topology, the throughput achieved with TCP NewReno and the CSCC mechanism is depicted in Fig. 10 and Fig. 11; it is clear from these figures that the performance of the CSCC mechanism is more satisfactory than that of TCP NewReno in terms of throughput. The suggested mechanism achieved high throughput over TCP NewReno as the number of hops increased, ranging from 10.99% to 56.43% and a 12.58% to 54.71% in the presence of AODV and DSR, respectively. The 95% confidence intervals computed for the achieved throughput for the string topology cases considered with AODV and DSR are given in Tables 6 and 7, respectively.

It is clear from Fig. 12 and Fig. 13, illustrating the number of retransmitted packets, that the CSCC mechanism is transmitting fewer packets than TCP NewReno and achieving high throughput because there is lower contention on the channel. A reduced number of retransmissions

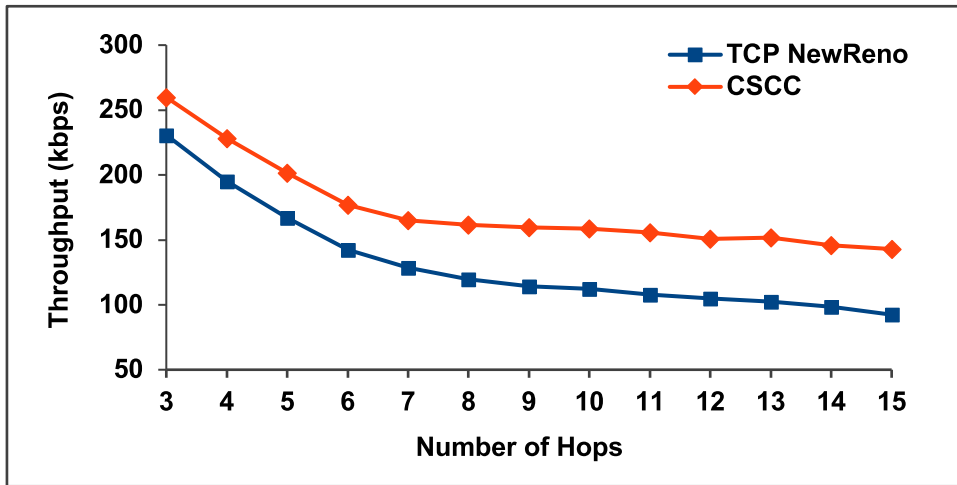


FIGURE 11. Throughput achieved in the string topology with DSR.

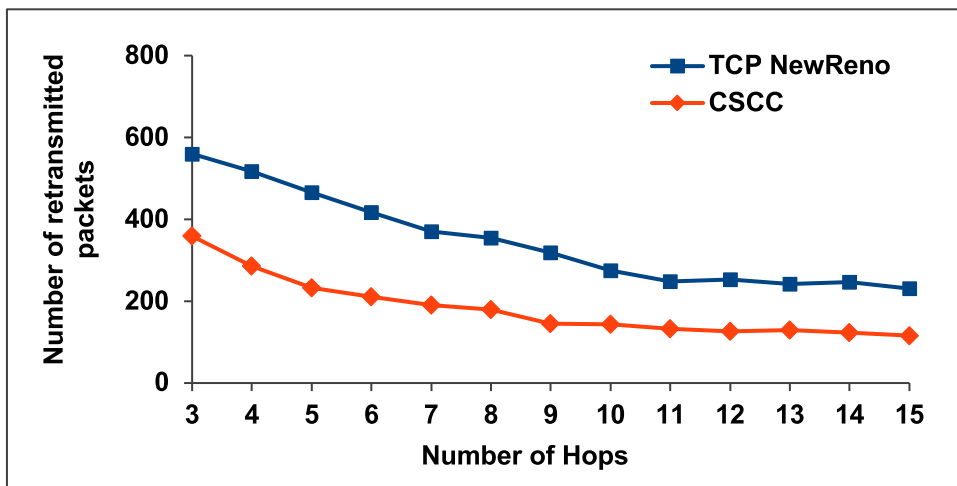


FIGURE 12. The number of retransmitted packets in the string topology with AODV.

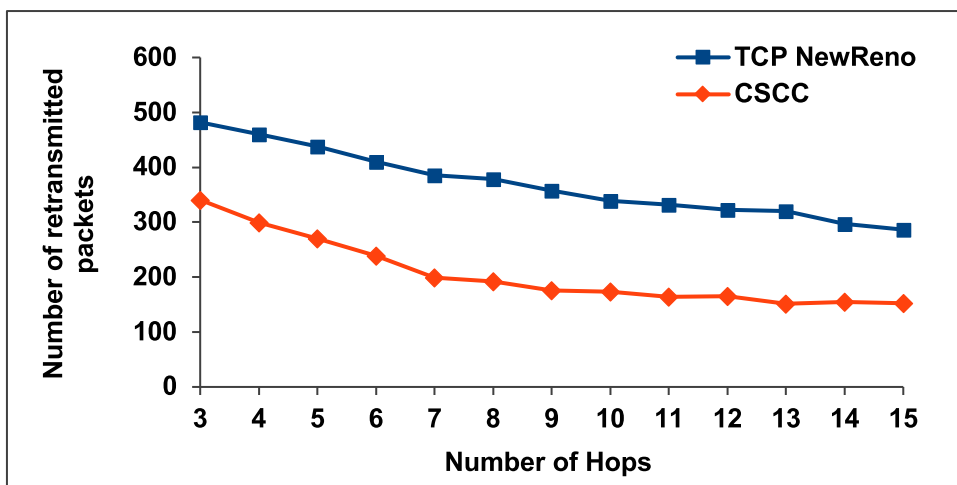


FIGURE 13. The number of retransmitted packets in the string topology with DSR.

means an improved utilization of network resources. Thus, the proposed mechanism handles contention more efficiently.

B. GRID TOPOLOGY

This subsection reports the results of the simulation analysis of the CSCC mechanism on a grid topology against TCP

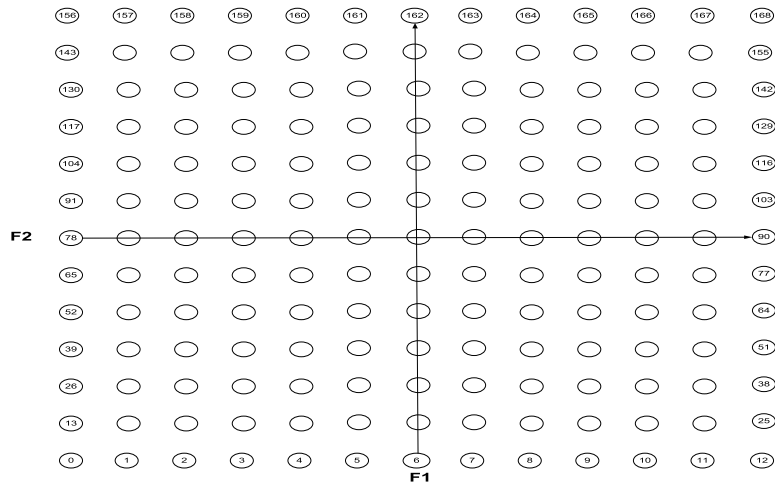


FIGURE 14. 13 × 13 grid with two flows.

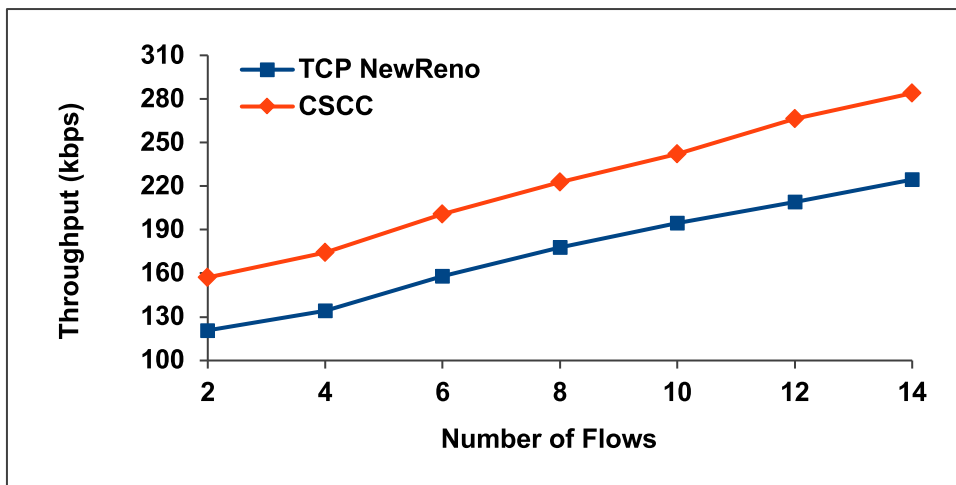


FIGURE 15. Throughput achieved on the 13 × 13 grid topology with AODV.

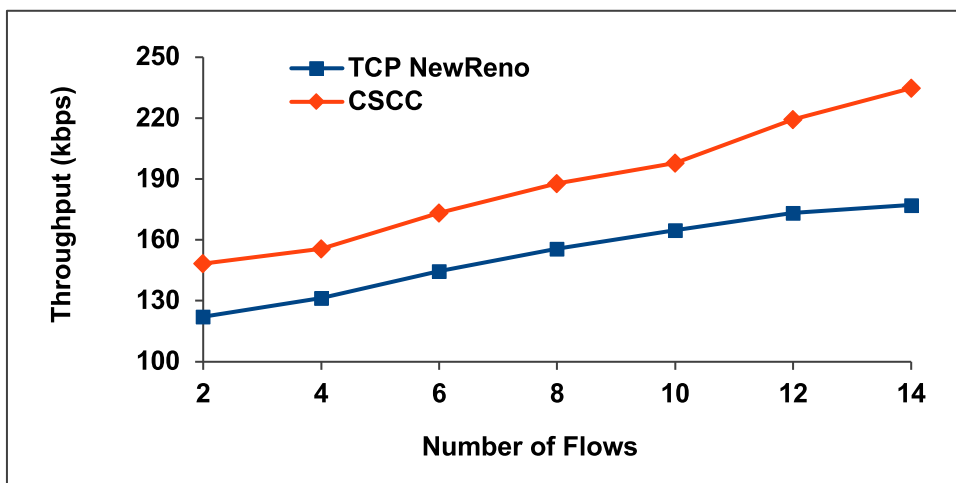


FIGURE 16. Throughput achieved on the 13 × 13 grid topology with DSR.

NewReno. A total of 169 nodes were simulated and placed in a 13 × 13 grid, depicted in Fig. 14. The distance between the

adjacent nodes, as was the case in the previously considered scenarios, was 200 meters. Compared to the string topology

TABLE 7. Confidence intervals and fairness indexes for the 13 × 13 grid topology, where the routing protocol is AODV.

Number of flows	TCP NewReno				CSCC			
	Throughput	95% Confidence Interval		Fairness Index	Throughput	95% Confidence Interval		Fairness Index
		Lower Bound	Upper Bound			Lower Bound	Upper Bound	
2	120.75	116.49	125.01	0.990	157.18	152.52	161.84	0.994
4	134.14	129.64	138.63	0.697	174.28	170.81	177.74	0.995
6	158.07	153.38	162.75	0.748	200.83	197.19	204.47	0.990
8	177.76	173.94	181.58	0.670	222.84	218.60	227.08	0.990
10	194.62	190.54	198.70	0.658	241.97	238.46	245.48	0.970
12	209.16	205.92	212.40	0.693	266.55	260.99	272.10	0.897
14	224.47	220.41	228.53	0.661	283.96	277.76	290.15	0.890

TABLE 8. Confidence intervals and fairness indexes for the 13 × 13 grid topology, where the routing protocol is DSR.

Number of flows	TCP NewReno				CSCC			
	Throughput	95% Confidence Interval		Fairness Index	Throughput	95% Confidence Interval		Fairness Index
		Lower Bound	Upper Bound			Lower Bound	Upper Bound	
2	122.19	119.51	124.87	0.830	148.34	145.38	151.31	0.996
4	131.43	129.27	133.59	0.797	155.53	152.65	158.40	0.998
6	144.50	141.73	147.28	0.819	173.29	170.52	176.07	0.991
8	155.52	150.15	160.89	0.835	187.93	182.46	193.40	0.916
10	164.67	159.13	170.20	0.910	197.99	190.99	204.99	0.970
12	173.29	168.36	178.22	0.884	219.50	214.86	224.14	0.929
14	177.27	167.59	186.94	0.935	234.74	226.93	242.55	0.971

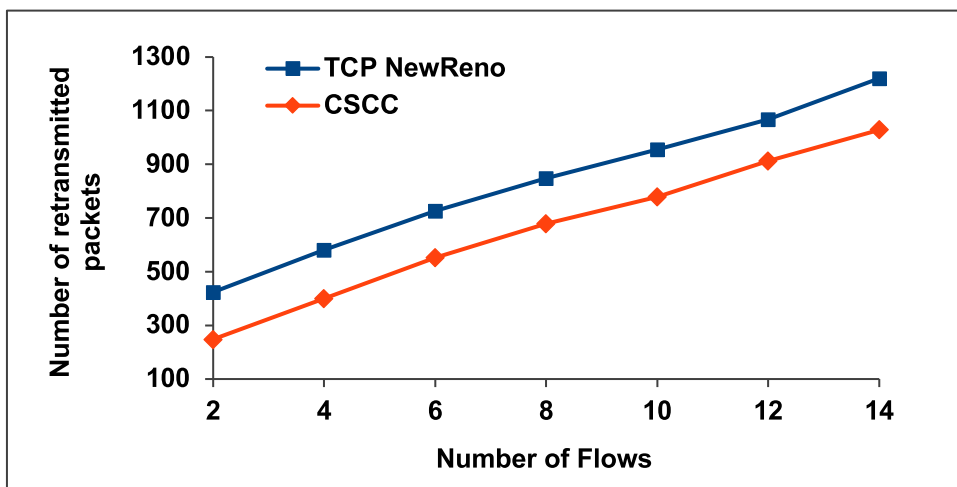


FIGURE 17. The number of retransmitted packets on the 13 × 13 grid topology with AODV.

considered in previous subsections, the grid topology has more nodes, and more data flows are considered to create

a highly contended environment. At the start, two flows (F1 and F2) were considered so that the flows cross each other

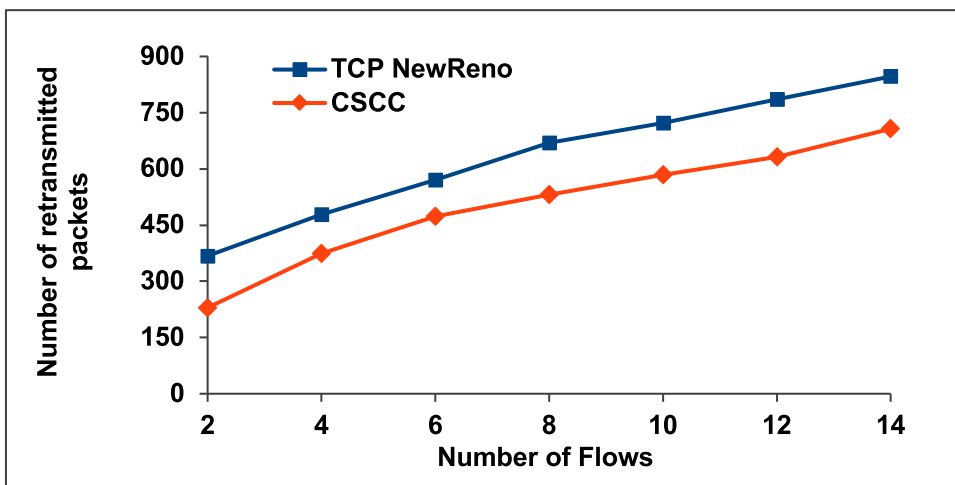


FIGURE 18. The number of retransmitted packets on the 13 × 13 grid topology with DSR.

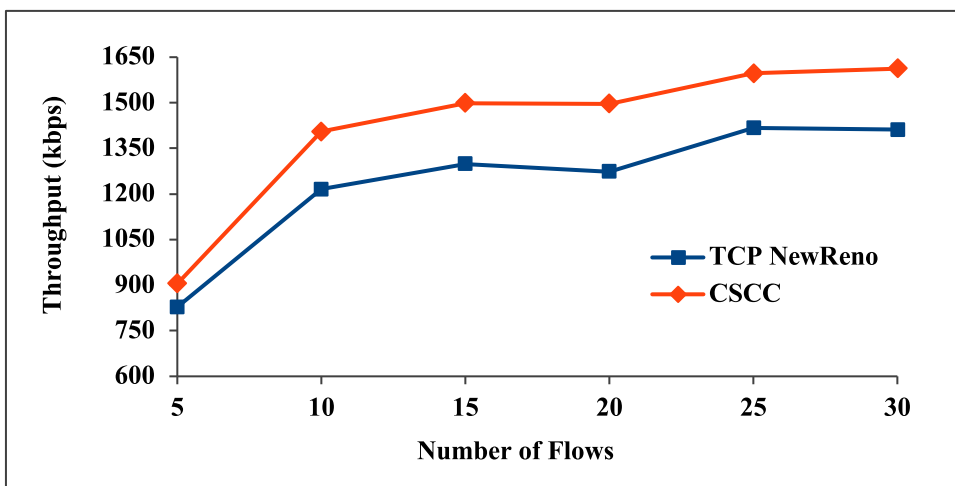


FIGURE 19. Throughput achieved on the random topology with AODV.

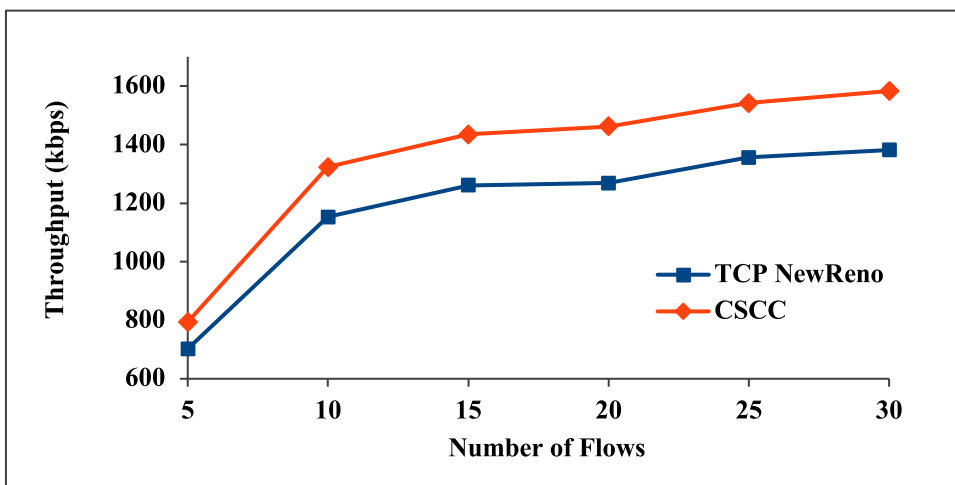


FIGURE 20. Throughput achieved on the random topology with DSR.

and move from one end to the other end of the grid, as shown in Fig. 14. Then two further flows (F3 and F4) were added,

one starting on each side and flowing opposite to the first one. The number of flows was increased to 14 by adding two

TABLE 9. Confidence intervals and fairness indexes for the random topology, where the routing protocol is AODV.

Number of flows	TCP NewReno				CSCC			
	Throughput	95% Confidence Interval		Fairness Index	Throughput	95% Confidence Interval		Fairness Index
		Lower Bound	Upper Bound			Lower Bound	Upper Bound	
5	828.08	809.67	846.50	0.370	838.15	810.80	865.50	0.450
10	1215.84	1169.04	1262.63	0.290	1405.30	1379.00	1431.60	0.391
15	1299.04	1252.20	1345.89	0.273	1498.57	1453.49	1543.65	0.389
20	1273.79	1219.14	1328.44	0.223	1497.07	1458.40	1535.73	0.360
25	1417.22	1358.29	1476.14	0.192	1596.25	1548.48	1644.02	0.344
30	1411.76	1344.62	1478.91	0.184	1612.11	1569.67	1654.55	0.341

TABLE 10. Confidence intervals and fairness indexes for the random topology, where the routing protocol is DSR.

Number of flows	TCP NewReno				CSCC			
	Throughput	95% Confidence Interval		Fairness Index	Throughput	95% Confidence Interval		Fairness Index
		Lower Bound	Upper Bound			Lower Bound	Upper Bound	
5	702.23	650.58	753.87	0.37	793.98	736.42	851.54	0.45
10	1152.24	1119.92	1184.56	0.29	1323.29	1288.20	1358.38	0.39
15	1261.29	1232.84	1289.73	0.27	1435.18	1409.65	1460.71	0.39
20	1268.77	1250.31	1287.23	0.22	1461.83	1442.30	1481.37	0.36
25	1356.24	1321.76	1390.72	0.19	1541.81	1515.60	1568.02	0.34
30	1381.37	1325.19	1437.56	0.18	1582.95	1561.30	1604.60	0.34

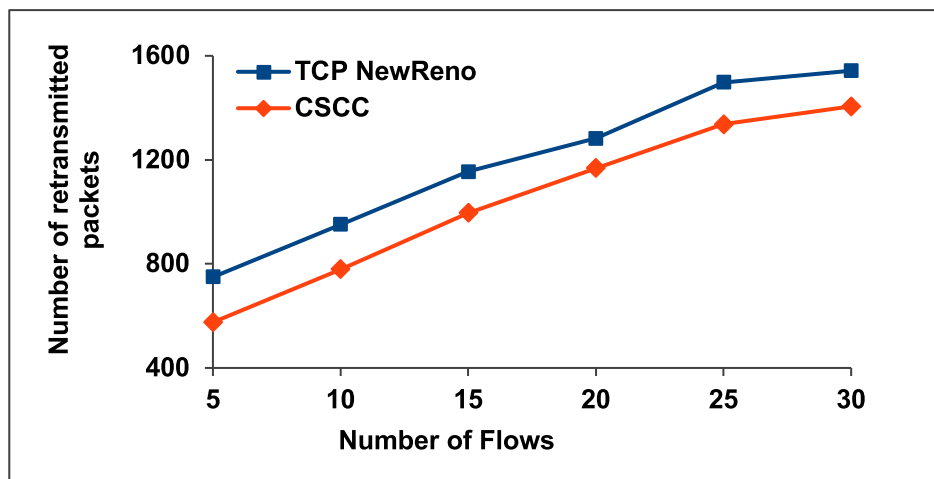


FIGURE 21. Number of retransmitted packets on the random topology with AODV.

successive flows at a time. The throughput recorded using the AODV and DSR routing protocols, respectively, is depicted in Fig. 15 and Fig. 16 for each scenario. The improvement achieved by the CSCC mechanism against TCP NewReno

ranges from 24.33 to 30.17% with AODV and from 18.33 to 32.42% with DSR. At the same time, the 95% confidence intervals and fairness indexes computed for the achieved throughput for each scenario are listed in Tables 7 and 8.

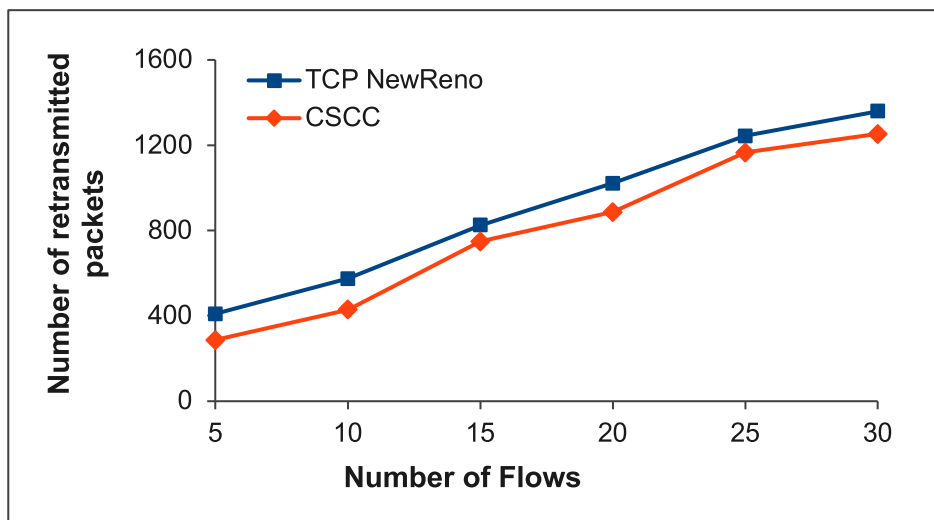


FIGURE 22. Number of retransmitted packets on the random topology with DSR.

Jain’s fairness index was calculated according to equation (5).

$$f(x) = \frac{[\sum_{i=1}^n x_i]^2}{n \times \sum_{i=1}^n x_i^2} \tag{5}$$

In equation (5), n counts for the total number of flows, and xi for the ith flow’s throughput. Equation (5) will provide a result between 0 and 1. The fairness increases as the calculated result approach one and decreases as it approaches zero (0).

Looking at Fig. 17 and Fig. 18, it is clear that the number of retransmitted packets in the case of the CSCC mechanism is less than in the case of TCP NewReno, in the presence of both the AODV and DSR routing protocols. Thus, the CSCC mechanism handles CC more efficiently in a dense network.

C. RANDOM TOPOLOGY

The suggested CSSS mechanism’s ability to handle growing traffic flows—from five to thirty connections—is evaluated using simulation experiments. A random network topology is employed in this simulation, with 100 nodes distributed at random throughout an area measuring 1000 by 1000 meters. Like all previous scenarios, the outcomes are averaged over 15 runs. For conducting traffic flow experiments, the throughput achieved by TCP NewReno and the proposed CSCC mechanism with AODV and DSR is illustrated in Fig. 19 and Fig. 20, respectively. Moreover, Fig. 21 and Fig. 22 show each case’s retransmitted packets. Analyzing these graphs, the CSCC mechanism has achieved high throughput than TCP NewReno, and less retransmission is observed in the case of the proposed CSCC mechanism. Furthermore, the 95% confidence interval and Jain’s fairness index computed in random topology, in the presence of AODV and DSR, are listed in Tables 9 and 10, respectively. The improvement in throughput achieved by the proposed CSCC mechanism against TCP NewReno ranges from 9.27 to 17.53% and from 13.07 to 15.22% in the presence of AODV and DSR, respectively.

VI. CONCLUSION

Improving the performance of TCP in WANETs is the main objective of the proposed CSCC mechanism. In the proposed mechanism, each node calculates the WMA of the number of tries attempted for a frame transmission at the MAC layer to reflect CC. When the WMA at any node hits a pre-defined threshold, the node begins marking packets to alert the sender about contention. Consequently, the sending node must adjust the injection of packets into the network based on the cwnd size of the data flow.

The performance of the proposed CSCC mechanism has been evaluated against TCP NewReno and observed that the proposed mechanism outperformed TCP NewReno in terms of throughput. The number of retransmitted packets is fewer with the proposed mechanism than TCP NewReno, which is a sign of contention control. Moreover, fewer retransmission means the packet drop rate is low.

For the string topology, the CSCC mechanism achieved 10.99% to 56.43% and 12.58% to 54.71% improvement in throughput against TCP NewReno with the AODV and DSR routing protocols, respectively. When the grid topology was considered, the CSCC mechanism achieved 24.33% to 30.17% and 18.33% to 32.42% improvement in throughput against TCP NewReno with the AODV and DSR routing protocols, respectively. A random topology was also considered to evaluate the ability of the CSCC mechanism to handle an increasing number of flows; the CSCC mechanism achieved 9.27% to 17.53% and 13.07% to 15.22% improvement in throughput against TCP NewReno with the AODV and DSR routing protocols, respectively.

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Date: June 08, 2023

TO WHOM IT MAY CONCERN

Reference: Request from *Director, Institute of Computing* to verify and certify the relevance of research paper (s) published by PhD Scholar **Mr. Noor Mast** (CS420201001)

Request received by the Directorate of QEC dated **6/6/2023** after completion of formalities

Request for

Verifying and Certifying the relevance of the following research article published in HEC recognized journals

Purpose of Request

(BPS appointment/ TTS appointment/ TTS promotion/ **Research Paper publishing requirement for PhD Thesis**)

Status of the research papers published:

S. No	Paper Title	QEC Findings	
		Journal Details	QEC Remarks
1.	<i>A Cross-Layer Solution for Contention Control to Enhance TCP Performance in Wireless Ad-Hoc Networks</i>	Journal Name: <u>IEEE ACCESS</u> Article Publishing Date : Feb 14, 2023 Volume: 11 ISSN (online): 2169-3536 DOI: 10.1109/ACCESS.2023 3244888 Verified from HJRS: Country: United States Scopus : Yes WoS : Yes	<ul style="list-style-type: none">• Author Status: Included• Author (s): Noor Mast; Shafiullah Khan; M. Irfan Uddin; Yazeed Yasin Ghadi; Hend Khalid Alkahtani• The paper was published on Feb 14, 2023 after the approval of Thesis title and supervisor in the 97th ASRB meeting that was held on 12/8/2022• The supervisor of the scholar has certified that the Published research paper requested for verification is published from the scholar's PhD thesis. <u>Category and requirement for PhD Degree Award</u> The journal is recognized by HEC (<i>HJRS-2022-2023</i>) as ' W ' category in the subject area of " Computer Sciences " with reference to the recommendations of the Departmental Graduate Committee (DGC) meeting held on 29/5/2023 for evaluating the published article and further to the


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Published Article Title	A Cross-Layer Solution for Contention Control to Enhance TCP Performance in Wireless Ad-Hoc Networks
Journal Name	IEEE ACCESS
HEC HJRS Journal Category	W

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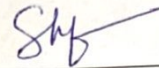
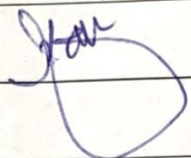
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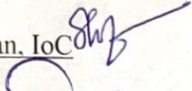
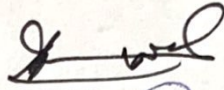
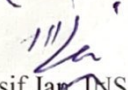
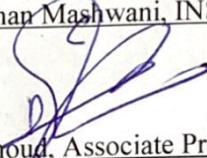
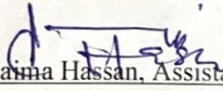
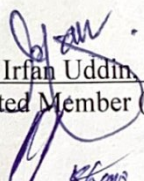
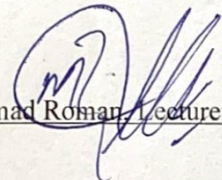
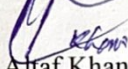
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Supervisor II	Dr. Muhammad Irfan Uddin		31/05/2023
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Supervisor II: Dr. M. Irfan Uddin

Dr. M. Irfan Uddin
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Thanks.

Regards,
Muhammad Adnan Khan, Ph.D.
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Pattern Recognition and Machine Learning Lab,
Department of Software,
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Thanks for inviting me to evaluate the PhD thesis of your student.
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Kind regards,
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Technical Editor, IEEE Network Magazine
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Institute of Innovation, Science and Sustainability,
Federation University Australia
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Email: m.imran@federation.edu.au||dr.m.imran@ieee.org
Google Scholar: <https://scholar.google.com/citations?user=4VfNLZoAAAAJ&hl=en>
URL: <https://federation.edu.au/institutes-and-schools/iiss/staff-profiles/staff-profiles/muhammad-imran>



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Federation University Australia acknowledges the Traditional Custodians of the lands and waters where its campuses are located, and we pay our respects to Elders past and present, and extend our respect to all Aboriginal and Torres Strait Islander and First Nations Peoples.

This message and its contents are confidential. If you received this message in error, do not use or rely upon it. Instead, please inform the sender and delete it.

From: Irfan Uddin <irfanuddin@kust.edu.pk>
Sent: Thursday, 24 August 2023 1:56 AM
To: Muhammad Imran <m.imran@federation.edu.au>
Subject: Consent for evaluation of PhD thesis

Dear Dr. Muhammad Imran,

Good Day.

As per our last communication, we are forwarding your name to evaluate the PhD thesis of my student. They need written consent from your side before the case is forwarded for evaluation. Please reply to this email from your official email that you agree to evaluate the PhD thesis. The details are given below:

Thesis Title: ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE IN WIRELESS AD-HOC NETWORKS
Student Name: Noor Mast
Supervisor I: Dr. Shafiullah Khan
Supervisor II: Dr. M. Irfan Uddin

Dr. M. Irfan Uddin

Assistant Professor/Coordinator MS
Institute of Computing
Kohat University of Science and Technology
Kohat, Pakistan.

From: Sadaqat Rehman S.Rehman15@salford.ac.uk
Subject: Re: Consent for evaluation of PhD thesis
Date: 24 August 2023 at 17:20
To: Irfan Uddin irfanuddin@kust.edu.pk

SR

Dear M. Irfan Uddin,

Thanks for your email. Yes, I am willing to evaluate the PhD thesis of the aforementioned student.

Kind regards,

Dr. Sadaqat ur Rehman

Assistant Professor in AI (Computer Science)
School of Science, Engineering and Environment
University of Salford, Salford M5 4WT, UK
s.rehman15@salford.ac.uk | <https://www.salford.ac.uk/our-staff/sadaqat-ur-rehman>

From: Irfan Uddin <irfanuddin@kust.edu.pk>
Sent: 24 August 2023 08:18
To: Sadaqat Rehman <S.Rehman15@salford.ac.uk>
Subject: Consent for evaluation of PhD thesis

Dear Dr. Sadaqat ur Rehman,

Good Day.

As per our last communication, we are forwarding your name to evaluate the PhD thesis of my student. They need written consent from your side before the case is forwarded for evaluation. Please reply to this email from your official email that you agree to evaluate the PhD thesis. The details are given below:

Thesis Title: ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE IN WIRELESS AD-HOC NETWORKS


Student Name: Noor Mast

Supervisor I: Dr. Shafiullah Khan

Supervisor II: Dr. M. Irfan Uddin

Dr. M. Irfan Uddin

Assistant Professor/Coordinator MS
Institute of Computing
Kohat University of Science and Technology
Kohat, Pakistan.

From: Atif Khan atifkhan@icp.edu.pk 
Subject: Re: Consent for evaluation of PhD thesis
Date: 23 August 2023 at 23:17
To: Irfan Uddin irfanuddin@kust.edu.pk

AK

I hope this email finds you well. Thank you for your email and for considering me to evaluate the PhD thesis titled "ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE IN WIRELESS AD-HOC NETWORKS."

I hereby provide my written consent to evaluate the mentioned thesis. Please consider this email as an official confirmation of my agreement to evaluate the thesis.

Best regards

On Wed, Aug 23, 2023 at 8:58 PM Irfan Uddin <irfanuddin@kust.edu.pk> wrote:
Dear Dr. Atif Khan,

Good Day.

As per our last communication, we are forwarding your name to evaluate the PhD thesis of my student. They need written consent from your side before the case is forwarded for evaluation. Please reply to this email from your official email that you agree to evaluate the PhD thesis. The details are given below:

Thesis Title: ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE IN WIRELESS AD-HOC NETWORKS
Student Name: Noor Mast
Supervisor I: Dr. Shafiullah Khan
Supervisor II: Dr. M. Irfan Uddin

Please also attach your updated CV in response to this email.


Dr. M. Irfan Uddin
Assistant Professor/Coordinator MS
Institute of Computing
Kohat University of Science and Technology
Kohat, Pakistan.

--
Dr. Atif Khan
Assistant Professor
Department of Computer Science,
Islamia College, Peshwar, KP, Pakistan.

Cell No: +923339257326
Whatsapp: +923339257326



Dr Atif
Khan_...23.pdf

From: Shah Nazir shahnazir@uoswabi.edu.pk 
Subject: Re: Consent for evaluation of PhD thesis
Date: 23 August 2023 at 22:11
To: Irfan Uddin irfanuddin@kust.edu.pk

SN

Dear Dr Irfan Uddin
I am willing to evaluate the PhD thesis of the following

Thesis Title: ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE IN WIRELESS AD-HOC NETWORKS
Student Name: Noor Mast
Supervisor I: Dr. Shafiullah Khan
Supervisor II: Dr. M. Irfan Uddin

My CV is attached herewith.

Regards,
Shah Nazir, Ph.D., Postdoc

On Wed, Aug 23, 2023 at 8:58 PM Irfan Uddin <irfanuddin@kust.edu.pk> wrote:
Dear Dr. Shah Nazir,

Good Day.

As per our last communication, we are forwarding your name to evaluate the PhD thesis of my student. They need written consent from your side before the case is forwarded for evaluation. Please reply to this email from your official email that you agree to evaluate the PhD thesis. The details are given below:

Thesis Title: ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE IN WIRELESS AD-HOC NETWORKS
Student Name: Noor Mast
Supervisor I: Dr. Shafiullah Khan
Supervisor II: Dr. M. Irfan Uddin


Please also attach your updated CV in response to this email.

Dr. M. Irfan Uddin
Assistant Professor/Coordinator MS
Institute of Computing
Kohat University of Science and Technology
Kohat, Pakistan.

--
Regards



Shah Nazir CV-
28.04.2020.pdf
[Downloading...](#)

From: Fakhre Alam fakhrealam@uom.edu.pk 
Subject: Re: Consent for evaluation of PhD thesis
Date: 24 August 2023 at 13:42
To: Irfan Uddin irfanuddin@kust.edu.pk

FA

Dear Dr. Irfan Ud Din,
I hope this email finds you well. I am writing to confirm my willingness to evaluate the PhD thesis of Mr. Noor Mast, titled "Enhancing Transmission Control Protocol Performance in Wireless Ad-Hoc Networks". Thank you for considering me for this important task. I am looking forward to contributing to the evaluation process and supporting the advancement of research in this field. In accordance with your request, I have attached my Curriculum Vitae (CV). Best regards,

Dr. Fakhre Alam
Assistant Professor
Department of CS & IT
University of Malakand

From: Irfan Uddin <irfanuddin@kust.edu.pk>
Sent: Wednesday, August 23, 2023 8:58 PM
To: Fakhre Alam <fakhrealam@uom.edu.pk>
Subject: Consent for evaluation of PhD thesis

Dear Dr. Fakhre Alam,

Good Day.

As per our last communication, we are forwarding your name to evaluate the PhD thesis of my student. They need written consent from your side before the case is forwarded for evaluation. Please reply to this email from your official email that you agree to evaluate the PhD thesis. The details are given below:

Thesis Title: ENHANCING TRANSMISSION CONTROL PROTOCOL PERFORMANCE IN WIRELESS AD-HOC NETWORKS
Student Name: Noor Mast
Supervisor I: Dr. Shafiullah Khan
Supervisor II: Dr. M. Irfan Uddin

Please also attach your updated CV in response to this email.

Dr. M. Irfan Uddin
Assistant Professor/Coordinator MS
Institute of Computing
Kohat University of Science and Technology
Kohat, Pakistan.



winmail.dat

Atif Khan

Department of Computer Science
Islamia College Peshawar (Public Sector University)
Email: atifkhan@icp.edu.pk
Cell No: +923339257326



Personal Particulars

Higher Commission Education(HEC) Scholar
HEC Approved Ph.D. Supervisor

Manuscripts:

Published: 42
Total citations: 1031
Cumulative Impact Factor: 142.284
h-index: 17
i10-index: 29

Supervision:

MS Supervised: 13
MS In Progress: 05
Ph.D. In Progress: 05

Research Interests

Text Mining, Information Retrieval, Machine Learning, Deep Learning and its Applications, Computer Vision, Internet of things (IoT)

Patents

Title: Semantic Approach for Multi-Document Abstractive Summarization
Application No: PI 2016700384
Grant No.: MY-189863-A
Applicant's/Agent's Ref.: PT /5400/UTM/15
Filing Date: 02 February 2016
Name of Inventor: **Atif Khan** and Naomie Binti Salim
Patent Owner: Universiti Teknologi Malaysia, 81310, UTM, Skudai, Johor Darul Takzim, Malaysia
Date of Grant: 14 March 2022
Publication Date: 14 March 2022
Duration Of Patent: 2 February 2016 Until 02 February 2036

Journal Papers

- [1] Muhammad Bilal, **Atif Khan**, Salman Jan, Shahrulniza Musa, Shaukat Ali. "Roman Urdu Hate Speech Detection Using Transformer Based Model for Cyber Security Applications". In: Sensors (2023): 1-28. **(WOS indexed, Impact Factor: 4.35)**
- [2] Bilal, Muhammad, **Atif Khan**, Salman Jan, and Shahrulniza Musa. "Context-Aware Deep Learning Model for Detection of Roman Urdu Hate Speech on Social Media

- Platform". In: IEEE Access (2022): 121133-121151. **(WOS indexed, Impact Factor: 3.47)**
- [3] Muhammad Umair, Iftikhar Alam, **Atif Khan**, Inayat Khan, Niamat Ullah, and Mohammad Yusuf Momand. "N-GPETS: Neural Attention Graph-Based Pretrained Statistical Model for Extractive Text Summarization". In: Computational Intelligence and Neuroscience (2022) : 1-14. **(WOS indexed, Impact Factor: 3.120)**
- [4] Muhammad Fayaz, **Atif Khan**, Muhammad Bilal, and Sana Ullah Khan. "Machine learning for fake news classification with optimal feature selection". In: Soft Computing (2022): 1-9. **(WOS indexed, Impact Factor: 1.34)**
- [5] Ahmed, Nisar, H. M. Shahzad Asif, Abdul Rauf Bhatti, and **Atif Khan**. "Deep ensembling for perceptual image quality assessment". In: Soft Computing (2022): 1-22. **(WOS indexed, Impact Factor: 1.34)**
- [6] Faizan Ullah, Abdu Salam, Muhammad Abrar, Masood Ahmad, Fasee Ullah, **Atif Khan**, Abdullah Alharbi, and Wael Alosaimi. "Machine health surveillance system by using deep learning sparse autoencoder". In: Soft Computing (2022): 1-14. **(WOS indexed, Impact Factor: 1.34)**
- [7] Shahzad Hameed, Qurratul-Ain Minhas, Sheeraz Ahmad, Fasee Ullah, Arshad Khan, **Atif Khan**, M. Irfan Uddin, and Qiaozhi Hua. "Connectivity of Drones in FANETs Using Biologically Inspired Dragonfly Algorithm (DA) through Machine Learning". In: Wireless Communications and Mobile Computing (2022): 1-11. **(WOS indexed, Impact Factor: 2.146)**
- [8] Muhammad Babar, Mohammad Dahman Alshehri, Muhammad Usman Tariq, Fasee Ullah, **Atif Khan**, M. Irfan Uddin, and Ahmed S. Almasoud. "IoT-Enabled Big Data Analytics Architecture for Multimedia Data Communications". In: Wireless Communications and Mobile Computing (2021): 1-9. **(WOS indexed, Impact Factor: 2.146)**
- [9] Sabir Awan, Sheeraz Ahmed, Fasee Ullah, Asif Nawaz, **Atif Khan**, M. Irfan Uddin, Abdullah Alharbi, Wael Alosaimi, and Hashem Alyami. "IoT with blockchain: A futuristic approach in agriculture and food supply chain". In: Wireless Communications and Mobile Computing (2021): 1-14. **(WOS indexed, Impact Factor: 2.146)**
- [10] Maneela Shaheen, Rafiullah Khan, Rajesh Roshan Biswal, Mohib Ullah, **Atif Khan**, M. Irfan Uddin, Mahdi Zareei, and Abdul Waheed. "Acute myeloid leukemia (AML) detection using AlexNet model". In: Complexity (2021): 1-8. **(WOS indexed, Impact Factor: 3.275)**
- [11] Mohib Ullah, Rafiullah Khan, Muhammad Inam Ul Haq, **Atif Khan**, Wael Alosaimi, Muhammad Irfan Uddin, and Abdullah Alharbi. "Multi-group ObScure logging (MG-OSLo) A privacy-preserving protocol for private web search". In: IEEE Access (2021): 79005-79020. **(WOS indexed, Impact Factor: 3.476)**
- [12] **Atif Khan**, Muhammad Adnan Gul, Abdullah Alharbi, M. Irfan Uddin, Shaukat Ali, and Bader Alouffi. "Impact of lexical features on answer detection model in discussion forums". In: Complexity (2021): 1-8. **(WOS indexed, Impact Factor: 3.275)**

- [13] Javed Iqbal Bangash, Abdul Waheed Khan, Asfandyar Khan, **Atif Khan**, M. Irfan Uddin, and Qiaozhi Hua. "Multiconstraint-aware routing mechanism for wireless body sensor networks". In: Journal of Healthcare Engineering (2021): 1-15. **(WOS indexed, Impact Factor: 3.822)**
- [14] Amjad Khan, Asfandyar Khan, Javed Iqbal Bangash, Fazli Subhan, Abdullah Khan, **Atif Khan**, M. Irfan Uddin, and Marwan Mahmoud. "Cuckoo Search-based SVM (CS-SVM) Model for Real-Time Indoor Position Estimation in IoT Networks". In: Security and Communication Networks (2021): 1-7. **(WOS indexed, Impact Factor: 1.968)**
- [15] Bilal Khan, Rashid Naseem, Muhammad Arif Shah, Karzan Wakil, **Atif Khan**, M. Irfan Uddin, and Marwan Mahmoud. "Software defect prediction for healthcare big data: an empirical evaluation of machine learning techniques". In: Journal of Healthcare Engineering (2021): 1-16. **(WOS indexed, Impact Factor: 3.822)**
- [16] Samina Amin, Muhammad Irfan Uddin, Duaa H. ALSaeed, **Atif Khan**, and Muhammad Adnan. "Early detection of seasonal outbreaks from twitter data using machine learning approaches". In: Complexity (2021): 1-12. **(WOS indexed, Impact Factor: 3.275)**
- [17] Ishtiaq Wahid, Fasee Ullah, Masood Ahmad, **Atif Khan**, M. Uddin, Abdullah Alharbi, and Wael Alosaimi. "Quality of service aware cluster routing in vehicular Ad Hoc Networks". In: Computers, Materials & Continua (2021): 3949-3965. **(WOS indexed, Impact Factor: 3.860)**
- [18] Ahmad Mustafa, Wan MN Wan-Kadir, Noraini Ibrahim, Muhammad Arif Shah, Muhammad Younas, **Atif Khan**, Mahdi Zareei, and Faisal Alanazi. "Automated Test Case Generation from Requirements: A Systematic Literature Review". In: Computers, Materials & Continua (2021): 1819-1833. **(WOS indexed, Impact Factor: 3.860)**
- [19] Masood Ahmad, Abdul Hameed, Fasee Ullah, Ishtiaq Wahid, **Atif Khan**, M. Irfan Uddin, Shafiq Ahmad, and M. Ahmed. "Adaptation of vehicular ad hoc network clustering protocol for smart transportation". In: Computers, Materials & Continua (2021): 1353-1368. **(WOS indexed, Impact Factor: 3.860)**
- [20] Muhammad Sohaib Aslam, Muhammad Younas, Muhammad Umar Sarwar, Muhammad Arif Shah, **Atif Khan**, M. Irfan Uddin, Shafiq Ahmad, Muhammad Firdausi, and Mazen Zaindin. "Liver-Tumor Detection Using CNN ResUNet". In: Computers, Materials & Continua (2021): 1899-1914. **(WOS indexed, Impact Factor: 3.860)**
- [21] Rafiullah Khan, Mohib Ullah, **Atif Khan**, Muhammad Irfan Uddin, and Maha Al-Yahya. "NN-QuPiD attack: neural network-based privacy quantification model for private information retrieval protocols". In: Complexity (2021). 1-8. **(WOS indexed, Impact Factor: 3.275)**
- [22] Noor Mast, Muhammad Altaf Khan, M. Irfan Uddin, Syed Atif Ali Shah, **Atif Khan**, Mahmoud Ahmad Al-Khasawneh, and Marwan Mahmoud. "Channel contention-based routing protocol for wireless ad hoc networks". In: Complexity (2021). 1-10. **(WOS indexed, Impact Factor: 3.275)**
- [23] Masood Ahmad, Fasee Ullah, Ishtiaq Wahid, **Atif Khan**, M. Irfan Uddin, Abdullah Alharbi, and Wael Alosaimi. "A Bio-Inspired Routing Optimization in UAV-enabled Internet of Everything". In: Computers, Materials & Continua (2021): 321-336. **(WOS indexed, Impact Factor: 3.860)**

- [24] Muhammad Saeed Yahya, Muhammad Awais, Muhammad Younas, Muhammad Arif Shah, **Atif Khan**, M. Irfan Uddin, and Marwan Mahmoud. "An Abstractive Summarization Technique with Variable Length Keywords as per Document Diversity". In: Computers, Materials & Continua (2021): 2409-2423. **(WOS indexed, Impact Factor: 3.860)**
- [25] Muhammad Fayaz, **Atif Khan**, Javid Ur Rahman, Abdullah Alharbi, M. Irfan Uddin, and Bader Alouffi. "Ensemble machine learning model for classification of spam product reviews". In: Complexity (2020): 1-10. **(WOS indexed, Impact Factor: 3.275)**
- [26] Rashid Naseem, Bilal Khan, Muhammad Arif Shah, Karzan Wakil, **Atif Khan**, Wael Alosaimi, M. Irfan Uddin, and Badar Alouffi. "Performance assessment of classification algorithms on early detection of liver syndrome". In: Journal of Healthcare Engineering (2020): 1-13. **(WOS indexed, Impact Factor: 3.822)**
- [27] Yasir Ahmad, Mohib Ullah, Rafiullah Khan, Bushra Shafi, **Atif Khan**, Mahdi Zareei, Abdallah Aldosary, and Ehab Mahmoud Mohamed. "SiFSO: Fish swarm optimization-based technique for efficient community detection in complex networks". In: Complexity (2020): 1-9. **(WOS indexed, Impact Factor: 3.275)**
- [28] Fasee Ullah, Izhar Ullah, **Atif Khan**, M. Irfan Uddin, Hashem Alyami, and Wael Alosaimi. "Enabling clustering for privacy-aware data dissemination based on medical healthcare-iots (mh-iots) for wireless body area network". In: Journal of Healthcare Engineering (2020): 1-10. **(WOS indexed, Impact Factor: 3.822)**
- [29] Masood Ahmad, Abdul Hameed, Fasee Ullah, **Atif Khan**, Hashem Alyami, M. Irfan Uddin, Abdullah ALharbi, and Furqan Aziz. "Cluster optimization in mobile ad hoc networks based on memetic algorithm: MemeHoc". In: Complexity (2020): 1-12. **(WOS indexed, Impact Factor: 3.275)**
- [30] Misba Sikandar, Rafia Sohail, Yousaf Saeed, Asim Zeb, Mahdi Zareei, Muhammad Adnan Khan, **Atif Khan**, Abdallah Aldosary, and Ehab Mahmoud Mohamed. "Analysis for disease gene association using machine learning". In: IEEE Access (2020): 160616-160626. **(WOS indexed, Impact Factor: 3.476)**
- [31] **Atif Khan**, Qaiser Shah, M. Irfan Uddin, Fasee Ullah, Abdullah Alharbi, Hashem Alyami, and Muhammad Adnan Gul. "Sentence embedding based semantic clustering approach for discussion thread summarization". In: Complexity (2020). 1-11. **(WOS indexed, Impact Factor: 3.275)**
- [32] **Atif Khan**, Muhammad Adnan Gul, M. Irfan Uddin, Syed Atif Ali Shah, Shafiq Ahmad, Al Firdausi, Muhammad Dzulqarnain, and Mazen Zaindin. "Summarizing online movie reviews: a machine learning approach to big data analytics". In: Scientific Programming (2020): 1-11. **(WOS indexed, Impact Factor: 1.672)**
- [33] Samina Amin, M. Irfan Uddin, Saima Hassan, **Atif Khan**, Nidal Nasser, Abdullah Alharbi, and Hashem Alyami. "Recurrent neural networks with TF-IDF embedding technique for detection and classification in tweets of dengue disease". In: IEEE Access (2020): 131522-131533. **(WOS indexed, Impact Factor: 3.476)**
- [34] Hamid Asmat, Fasee Ullah, Mahdi Zareei, **Atif Khan**, and Ehab Mahmoud Mohamed. "Energy-efficient centrally controlled caching contents for information-centric internet of things". IEEE Access (2020): 126358-126369. **(WOS indexed, Impact Factor: 3.476)**

- [35] **Atif Khan**, Muhammad Adnan Gul, Mahdi Zareei, R. R. Biswal, Asim Zeb, Muhammad Naeem, Yousaf Saeed, and Naomie Salim. "Movie review summarization using supervised learning and graph-based ranking algorithm". In: Computational intelligence and neuroscience (2020):1-14. **(WOS indexed, Impact Factor: 3.120)**
- [36] **Atif Khan**, Ibrahim Ibrahim, M. Irfan Uddin, Muhammad Zubair, Shafiq Ahmad, Al Firdausi, Muhammad Dzulqarnain, and Mazen Zaindin. "Machine learning approach for answer detection in discussion forums: an application of big data analytics". In: Scientific Programming (2020): 1-14. **(WOS indexed, Impact Factor: 1.672)**
- [37] Adil Khan, Muhammad Naeem, Muhammad Zubair Asghar, Aziz Ud Din, and **Atif Khan**. "Playing first-person shooter games with machine learning techniques and methods using the VizDoom Game-AI research platform". In: Entertainment Computing (2020): 1-15. **(WOS indexed, Impact Factor: 2.072)**
- [38] Sana Ullah Khan, Naveed Islam, Zahoor Jan, Ikram Ud Din, **Atif Khan**, and Yasir Faheem. "An e-Health care services framework for the detection and classification of breast cancer in breast cytology images as an IoMT application". In: Future Generation Computer Systems (2019): 286-296. **(WOS indexed, Impact Factor: 7.307)**
- [39] Fazli Amin Khalil, Shahzad Anwar, Muhammad Asif, Sana ul Haq, Naveed Ahmad, Majid Ashraf, Muhammad Kamran, **Atif Khan**, and Muhammad Arshad. "Energy management strategy for integrating photovoltaic energy in AC microgrid". In: Journal of Renewable and Sustainable Energy (2018): 1-13. **(WOS indexed, Impact Factor: 2.847)**
- [40] **Atif Khan**, Naomie Salim, Haleem Farman, Murad Khan, Bilal Jan, Awais Ahmad, Imran Ahmed, and Anand Paul. "Abstractive text summarization based on improved semantic graph approach". In: International Journal of Parallel Programming (2018): 992-1016. **(WOS indexed, Impact Factor: 1.447)**
- [41] Waleed Reafee, Naomie Salim, and **Atif Khan**. "The power of implicit social relation in rating prediction of social recommender systems". In: PloS one (2016): 1-20. **(WOS indexed, Impact Factor: 3.23)**
- [42] **Atif Khan**, Naomie Salim, and Yogan Jaya Kumar. "A framework for multi-document abstractive summarization based on semantic role labelling". In: Applied Soft Computing (2015): 737-747. **(WOS indexed, Impact Factor: 2.81)**

**Conference
Papers/
Book
Chapters**

- [1] Shah Faisal, **Atif Khan**, Sohail Yousaf and Muhammad Umair. "Contextual Word Embedding based Clustering for Extractive Summarization." In International Conference on Frontiers of Information Technology (FIT), 2022. 12-13 December. Islamabad, Pakistan: IEEE, 165-170. **(IEEE indexed)**
- [2] Javid Ur Rahman, Shaukat Ali, **Atif Khan**, and Muhammad Fayaz. "A Deep Ensemble Model for News Classification on Social Media." In International Conference on Cyber Warfare and Security (ICCWS), 2021. 23-25 November. Islamabad, Pakistan: IEEE, 57-62. **(IEEE indexed)**

- [3] Fasee Ullah, Ihtesham Ul Islam, Abdul Hanan Abdullah, and **Atif Khan**. "Future of big data and deep learning for wireless body area networks." In *Deep Learning: Convergence to Big Data Analytics*, pp. 53-77. Springer, Singapore, 2019.
- [4] Yogan Jaya Kumar, Fong Jia Kang, Ong Sing Goh, and **Atif Khan**. "Text summarization based on classification using ANFIS". In the *Asian Conference on Intelligent Information and Database Systems*, pp. 405-417. Springer, Cham, 2017.
- [5] **Atif Khan**, Naomie Salim, and Haleem Farman. "Clustered Genetic Semantic Graph Approach for Multi-document Abstractive Summarization". In *International Conference on Intelligent Systems Engineering (ICISE)*, 2016.15-17 January. Islamabad, Pakistan: IEEE, 63-70 (IEEE indexed)
- [6] **Atif Khan**, Naomie Salim, and Yogan Jaya Kumar. "Genetic Semantic Graph Approach for Multi-document Abstractive Summarization". In the *Fifth International Conference on Digital Information Processing and Communications (ICDIPC)*, 2015. 7-9 October. Sierre/Siders, Switzerland: IEEE, 173-181. **(IEEE indexed)**
- [7] Obasa Adekunle Isiaka, Naomie Salim, and **Atif Khan**. "Enhanced Lexicon Based Model for Web Forum Answer Detection". In the *Fifth International Conference on Digital Information Processing and Communications (ICDIPC)*, 2015. 7-9 October. Sierre/Siders, Switzerland: IEEE, 237-243. **(IEEE indexed)**

Education

Ph.D. in Computer Science, March 2016

Faculty of Computing, Universiti Teknologi Malaysia (UTM), Johor, Malaysia

Thesis Topic: *"Semantic Approach for Multi-document Abstractive Summarization using Genetic Algorithm and Semantic Graph"*

Advisor: Prof. Dr. Naomie Salim

Research Group: Soft Computing Research Group (SCRG)

M.S. in Computer Science, October 2011

Agricultural University Peshawar, KP, Pakistan

Major: *Computer Science, CGPA: 3.78*

M.Sc., in Computer Science, April 2005

Department of Computer Science, University of Peshawar, KP, Pakistan

Major: *Computer Science, Percentage: 78.25*

B.Sc. in Computer Science, September 2002

Islamia College Peshawar, Peshawar, Pakistan

Major: *Computer Science, Mathematics, Percentage: 80*

F.Sc. Pre Engineering, September 2000

Islamia College Peshawar, Peshawar, Pakistan, *Percentage: 72*

Matriculation with Science group, August 1998

Islamia Collegiate School, Peshawar, Pakistan, *Percentage: 80*

Teaching Experience

- *December 2016 – To date: **Assistant Professor***, Department of Computer Science, Islamia College Peshawar (Public Sector University), KP, PAKISTAN.
- *January 2008 – December 2016: **Lecturer***, Department of Computer Science, Islamia College Peshawar (Public Sector University), KP, PAKISTAN.
- *November 2005 – March 2006: **Lecturer***, Department of Computer Science, Preston University, Peshawar Campus, KP, Pakistan.
- *August 2006 – January 2007: **Lecturer***, Department of Computer Science, Peshawar College of Engineering, KP, Pakistan.
- *January 2007 – January 2008: **Lecturer***, Department of Computer Science, Agricultural University Public School & College Peshawar, KP, Pakistan.

Honors and Awards

- Awarded Scholarship for Ph.D. in Computer Science by Higher Education Commission, Pakistan.
- Excellence Award in Ph.D. thesis
- Pro-Chancellor Award in Ph.D
- Best Student Award in Ph.D
- Best Presenter Award in PARS 2014, Malaysia
- Overall 2nd Position in M.Sc
- Overall 1st position in B.Sc

Research Projects

Title of Project: Generic and Feature-based opinion Summarizer for Online Product Reviews using Machine Learning Algorithms

Project No: 21-1608/SRGP /R&D/HEC/2017

Project Grant: PKR 366362/-

Sponsor: Higher Education Commission (HEC), Pakistan

Title of Project: Easy Math for kids learning using Augmented Reality

Project Code: NGIRI-2023-22521

Project Grant: PKR 87,907

Sponsor: Ignite- National Technology Fund

Supervision of MS Scholars

- [1] **Muhammad Adnan**, “*Movie Review Summarization using Machine learning Technique integrated with Graph Ranking Algorithm*”, Islamia College Peshawar. Status: **Graduated** (September 2019)
- [2] **Jamal Nasar**, “*Feature-Based Opinion Summarizer for Product Reviews using Hash-Based Apriori Algorithm*”, Islamia College Peshawar. Status: **Graduated** (November 2019)

- [3] **Nafees Sarwar**, “Optimal Content Selection from Text Documents using Semantic Clustering Technique”, Islamia College Peshawar. Status: **Graduated** (January 2020)
- [4] **Ibrahim**, “Supervised Machine learning Based Answer Detection Model for Discussion Forums”, Islamia College Peshawar. Status: **Graduated** (May 2021)
- [5] **Qaiser Shah**, “Machine Learning Approach for Discussion Forums Summarization”, Islamia College Peshawar. Status: **Graduated** (August 2021)
- [6] **Muhammad Fayaz**, “Ensemble Machine Learning Model for Classification of Spam Product Reviews”, Islamia College Peshawar. Status: **Graduated** (September 2021)
- [7] **Rasheed Ahmad**, “Spam Review Detection Model using Machine Learning Algorithms”, Islamia College Peshawar. Status: **Graduated** (October 2021)
- [8] **Khairullah**, “Enhancing the Prediction Accuracy of Recommendation System using Machine Learning”, Islamia College Peshawar. Status: **Graduated** (December 2021)
- [9] **Javed ur Rahman**, “A Deep Ensemble Model for News Classification on Social Media”, Islamia College Peshawar. Status: **Graduated** (April 2022)
- [10] **Muhammad Umair**, “N-GPETS: Neural Attention Graph-based Pre-Trained Statistical Model for Extractive Text Summarization”, City University of Science and Information Technology. Status: **Graduated** (June 2022)
- [11] **Abbas Akbar**, “A Machine Learning Approach for Product Recommendation” Status: **Graduated** (July 2022)
- [12] **Tuaseef Jan**, “A Distributional Semantic Approach for Extractive Text Summarization”, Islamia College Peshawar. Status: **Graduated** (August 2022)
- [13] **Shah Arif**, “News Articles Summarization using Deep Learning Model”, Islamia College Peshawar. Status: **Graduated** (March 2023)
- [14] **Sohail Ahmad**, Status: MS Thesis submitted for evaluation
- [15] **Muhammad Nabeel**, Status: MS Thesis submitted for evaluation
- [16] **Abdullah**, Status: MS Thesis ready for submission
- [17] **Amir Hamaza Farman**, Status: MS Thesis ready for submission
- [18] **Sami ur Rahman**, Status: MS Thesis ready for submission

**Supervision
of Ph.D.
Scholars**

- [1] **Muhammad Bilal**, Ph.D. Thesis submitted for Evaluation
- [2] **Nouman Khan**, Ph.D. Research in Progress
- [3] **Muhammad Zubair**, Ph.D. Research in Progress
- [4] **Ali Shah**, Ph.D. Research in Progress

**Additional
Responsibilities**

- [1] Associate Editor in ACM Transactions on Asian and Low-Resource Language Information Processing (TALLIP)
- [2] Reviewer for many International Journals

- [3] Departmental Quality Enhancement (DQE) member
- [4] Convener of Final Year Projects (FYP) Committee
- [5] Convener of Departmental Accreditation Committee for BS Computer Science and BS Software Engineering Programs
- [6] Member of the Graduate Studies Committee (GSC)
- [7] Member of the Board of Studies (BOS)
- [8] Member of the Departmental Purchase Committee
- [9] Software Consultant/Researcher at Tech Mentors Company

Conferences Attended

- Attended 1st international Conference “KohaCon’21” as an organizer, 13-18th December, 2021, Islamabad, Pakistan.
- International Conference on Cyber Warfare and Security (ICCWS), 23-25 November, 2021, Islamabad, Pakistan.
- Technical Program Committee member in the 3rd International Virtual Conference on Intelligent and Interactive Computing 2021 (IIC 2021), 9th September, 2021 Melaka, Malaysia.
- International Conference on Soft Computing and Computational Mathematics (ICSCCM), 10-11 December, 2015, Langkawi, Malaysia.
- International Conference on Semantic Web Business and Innovation (SWBI), 7-9 October, 2015, Sierre, Switzerland.
- 9th Postgraduate Annual Research Seminar, 24-26 September, 2013, UTM, Malaysia.
- International Conference on Intelligent Systems Engineering (ICISE), 15-17 January, 2016, Islamabad, Pakistan.

Workshops/ Seminars

- Symposium on Plastic Developed Tools for Easy Resource Sharing Mechanism in Pakistan, 2-3 February, 2022, Islamia College Peshawar, Pakistan.
- Online National KUST Graduate Workshop, 11th June, 2020 Kohat, Pakistan
- One-day workshop on “Importance and Protection of Rights on Intellectual Property of Scientists”, 17th January, 2019, University of Peshawar, Pakistan.
- Attended Emerging Technologies Competition “ICUETC-18” as an organizer, 9-10th January, 2019, Islamia College Peshawar, Pakistan.
- Two-day workshop on “Blockchain”, 11-12th April, 2018, National University of Computer & Emerging Sciences (NUCES), Peshawar Campus, Pakistan.
- One-day workshop on “How to Hunt a Job”, 14th April, 2018, Peshawar, Pakistan.
- One-day Seminar on “Ethical Hacking – License to Hack”, 13th September, 2018, NUCES, Peshawar Campus, Pakistan.
- One-day Seminar on “WordPress and Freelancing”, 12th October, 2018, NUCES, Peshawar Campus, Pakistan.

- One-day seminar on “Now Selected What to do Next”, 12th November, 2018, Islamia College Peshawar, Pakistan
- Event on “Local Hack Day-Hackathon” sponsored by Microsoft, 1st December, 2018, NUCES, Peshawar Campus, Pakistan.
- One-day Seminar on “Social Entrepreneurship”, 18th December, 2018, NUCES, Peshawar Campus, Pakistan.
- One-day training workshop on “Pension Procedures”, 10th August, 2017, Islamia College Peshawar, Pakistan.
- One-day training workshop on “ESTACODE”, 30th October, 2017, Islamia College Peshawar, Pakistan.
- One-day Seminar on “Genetic Analysis of Pakistani Population”, 18th May, 2017, Islamia College Peshawar, Pakistan.
- Training workshop on “Self Assessment Report Writing”, 9-10th March, 2017, Islamia College Peshawar, Pakistan.
- Training on “English for Academic Purposes”, 9-10th November, 2017, Islamia College Peshawar, Pakistan.
- One-day training workshop on “Citation Management by utilizing HEC Digital Library Resources and Online Searching Techniques”, 19th October, 2017, Islamia College Peshawar, Pakistan.
- One-day training workshop on “Poster Designing / Photoshop”, 9th November, 2017, Islamia College Peshawar, Pakistan.
- Three Minutes Thesis (3MT) Competition, 25th February, 2015, UTM, Malaysia.
- Graduate on Time (GOT) Workshop, 7th January, 2015, UTM, Malaysia
- Writing for Journal Workshop, 8th January, 2015, UTM, Malaysia
- Design of Experiment (DOE) and Response Surface Methodology Workshop, 12th August, 2015, UTM, Malaysia.
- LATEX Workshop, 28 May 2015, UTM, Malaysia.
- 11th Postgraduate Annual Research Seminar, 11-12 October, 2015, UTM, Malaysia.
- Introduction to Twitter and R Programming Workshop, 10th December, 2014, UTM, Malaysia.
- 10th Postgraduate Annual Research Seminar, 29 September to 1 October, 2014, UTM, Malaysia.
- Introduction to NeuraBase Toolbox, 24 September, 2014, Neuramatix Training Center, Mid Valley City, Kuala Lumpur, Malaysia.

Copyrights

- Algorithm for Multi-Document Abstractive Summarization using Semantic Graph. *Reference No. UTM.J.14.01/27.13/1 JLD80(95)*
- Algorithm for Semantic Clustering of Predicate Argument Structures. *Reference No. UTM.J.14.01/27.13/1JLD80(96)*

- Algorithm for Semantic Similarity Computation of Predicate Argument Structures. *Reference No. UTM.J.14.01/27.13/1 JLD80(94)*
- Algorithm of Voting Scheme for Arrangement of Summary Sentences. *Reference No. UTM.J.14.01 /27.13/1JLD80 (93)*
- Modified Graph Based Ranking Algorithm. *Reference No. UTM.J.14.01/27.13/1 JLD80(91)*
- New or Modified Text Features for Abstractive Text Summarization. *Reference No. UTM.J. 14.01/27.13/1JLD80(92)*
- Java Code for Sentence Generation using Simple NLG Embedded with Simple Heuristic Rule. *Reference No. UTM.J.14.01/27.13/1 JLD80(90)*
- Flowchart for Multi-Document Abstractive Summarization using Semantic Graph. *Reference No. UTM.J.14.01/27.13/1 JLD80 (97)*
- Flowchart for Genetic Semantic Approach for Multi-Document Abstractive Summarization. *Reference No. UTM.J.14.01/27.13/1JLD80 (98)*
- Flowchart for Semantic Approach for Multi-Document Abstractive Summarization. *Reference No. UTM.J.14.01/27.13/1JLD80 (100)*

Personal Information

Citizenship: *Pakistan*
 Current Residence: *Peshawar, Pakistan*
 Marital Status: *Married*
 Date of Birth: *22-01-1982*

Professional Courses

- Served as an Oracle Developer and accomplished several database projects.
- Completed Oracle Database Administration course.
- Completed Machine learning, Deep learning, and Data Science courses

Computer Skills

- Mathematical Packages: Matlab.
- Languages: Python, C++, Java, Visual C++, C#.Net.
- Applications: \LaTeX , Microsoft Office.
- Operating System: Windows, Linux.

Courses Taught

- Database Systems (Undergraduate Level)
- Analysis of Algorithms (Undergraduate Level)
- Object Oriented Programming (OOP)-II (Undergraduate Level)
- Automata Theory (Undergraduate Level)
- Operating Systems (Undergraduate Level)
- Requirement Engineering (Undergraduate Level)
- Theory of Computation (Postgraduate level)
- Advanced Analysis of Algorithms (Postgraduate level)
- Information Retrieval (Postgraduate level)
- Python for Everybody (Postgraduate level)

- Text Mining (Postgraduate level)

References

Prof. Dr. Naomie Salim

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Shah Nazir, Ph.D., Postdoc

Professional Member ACM, IEEE, IEEE Industrial Electronics Society Membership, HEC approved supervisor

Assistant Professor

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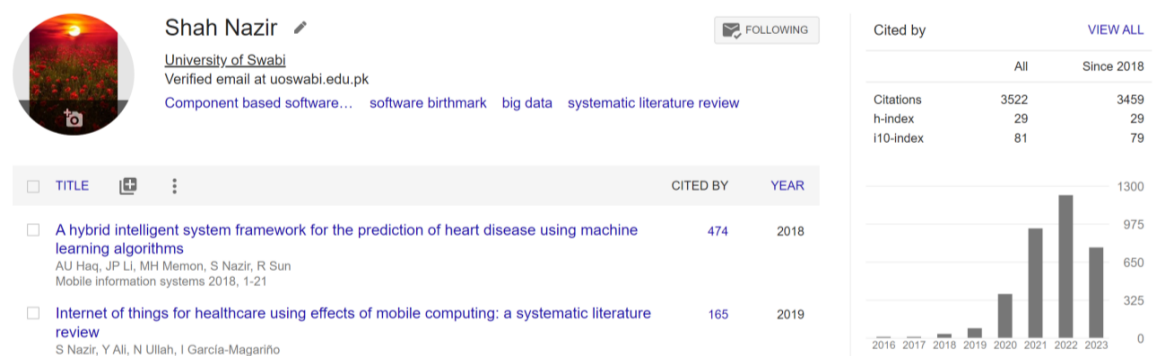
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Profile

Dr. Shah Nazir completed his PhD in Computer Science with specialization in Software Engineering at the University of Peshawar, Pakistan in December 2015. He did Postdoctorate under the World Academy of Science fellowship from University Putra, Malaysia in 2018. He has more than 185 research publications in well-reputed international journals and conference proceedings. He is an academic editor of four journals, lead and guest editor of several special issues, and is working as member of technical committee for more than 140 journals and conferences. He has organized one international conference and remains session chair for several conferences. He is currently working as assistant professor and head of department at the University of Swabi, Pakistan. Prior to this, he worked at the University of Peshawar, Pakistan since 2009 to 2016. He received several awards. His research interests include component-based software engineering, software birthmark, systematic literature review, big data and decision making.

Research profile

Googlescholar, Researchgate, ORCID, Scopus, Publons, Web of science



Academic Background

Postdoctoral Fellowship

Department of Multimedia, Faculty of Computer Science and Information Technology, University Putra, Malaysia- under The World Academy of Sciences fellowship, 2018

PhD Computer Science

Department of Computer Science, University of Peshawar, Session 2012-15
Research title- “Design and estimation of features based software birthmark”

MS Computer Science

Centre of Excellence in IT, Institute of Management Sciences, Peshawar, Session 2009-11
Research title- “Software Component Selection Modeling using Fuzzy Logic and Analytic Network Process”

MSc Computer Science

University of Peshawar, Session 2005-07

Bachelor of Education (B.Ed)

University of Peshawar, Session 2010

Experience (Total of 15 years)

1. Assistant Professor, Department of Computer Science, University of Swabi, Pakistan since 25th August 2016 till date
 2. Postdoctoral Fellowship, the University Putra Malaysia, 2018
 3. Assistant Supervisor, Directorate of Admissions, University of Peshawar from June 2009 to 24th August 2016
 4. Visiting lecturer, taught to MSc in Department of Environmental Science, University of Peshawar
 5. Visiting lecturer, taught to BS in Department of Economics, University of Peshawar, Pakistan
 6. Visiting lecturer, taught to BCS in Shekh Zaid Islamic Centre, Peshawar, Pakistan
 7. Visiting lecturer, taught to MS in Computer Science at IBMS, Agriculture University, Peshawar, Pakistan
 8. Lecturer at PAKTURK International College Peshawar, Khyber Pakhtunkhwa, Pakistan, from September 2007 to April 2009.
-

Awards

1. Wiley Top Cited Article 2021-2022, JOURNAL OF SOFTWARE: EVOLUTION AND PROCESS
2. HEC Best University Teacher Award 2022
3. Elsevier BV - August 2021 data-update for "Updated science-wide author databases of standardized citation indicators" (digitalcommonsdata.com)- 2% scientist, 2021, <https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3>
4. Research collaboration and mentorship, Qatar University, Doha, Qatar, August 1, to August 30, 2022
5. Scheme of Formation and Development of Special Interest Research Groups (SIRGs), Ref. Number : 1235/UN40.R4.1/PT.01.02/2021. Universitas Pendidikan Indonesia Grant Number: 1646/UN40/PT.01.05/2021 (23rd September 2021) Amount one hundred million rupia. Co-PI
6. Elsevier BV - August 2021 data-update for "Updated science-wide author databases of standardized citation indicators" (digitalcommonsdata.com)- 2% scientist, 2021, <https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3>
7. Amount **Rs. 319709/-** for Oral presentation of Research Paper at "Future of Information and Communication Conference (FICC) 2019, held on 14-15 March 2019, San Francisco, USA
8. The World Academy of Science (TWAS) Postdoctoral scholarship for pursuing Post-doctorate studies
9. Amount **Rs. 298065/-** for Oral presentation of Research Paper at "Computing Conference" held on July 10-12, 2018 London, UK.
10. "Active Reviewer" International Arab Journal of Information Technology (IF 0.6), for the year 2017
11. Best teacher award of the year 2017, University of Swabi, Pakistan
12. Amount **Rs. 184065/-** for Oral presentation of Research Paper at International Conference on Science in Information Technology" held on 25-26/10/2017 in Bandung, Indonesia.
13. HEC Scholarship for MS in Computer Science programme
14. Impact of software piracy on educational institutions, its issues and challenges and role of software birthmark for piracy detection in academia- under HEC research grant No.21-1249/SRGP/R&D/HEC/2016, total amount = **Rs. 423500/- (PI)**.
15. Local coordination in X-MAC/BEB protocol- under HEC research grant No.21-1539/SRGP/R&D/HEC/2017, total amount = **Rs. 453000/- (Co-PI)**.

Countries visited for academic purpose

1. Qatar
2. United States of America
3. United Kingdom
4. Malaysia
5. Indonesia

Research Publications (having Impact Factor of ISI JCR)

Total IF= 333.522

1. P. Panwar, M. Shabaz, S. Nazir, I. Keshta, A. Rizwan, and R. Sugumar, "Generic Edge Computing System for Optimization and Computation Offloading of Unmanned Aerial Vehicle," *Computers and Electrical Engineering*, vol. 109, 2023 (IF 4.152).
2. H. U. Khan, M. Sohail, F. Ali, S. Nazir, Y. Y. Ghadi, and I. ULLAH, "Prioritizing the Multi-criterial Features Based on Comparative Approaches for Enhancing Security of IoT Devices " *Physical Communication*, 2023 (IF 2.379, JCR 2021).
3. S. Khan, H. U. Khan, S. Nazir, and A. Hussain, "Analysis of Cursive Text Recognition Systems: A Systematic Literature Review," *ACM Transactions on Asian and Low-Resource Language Information Processing*, 2023 (IF 1.471, JCR 2021).
4. R. Ali, A. Hussain, S. Nazir, S. Khan, H. U. Khan, and Abdullah, "Intelligent Decision Support Systems – An Analysis of Machine Learning and Multicriteria Decision-Making Methods," *Applied Sciences*, 2023 (IF 2.838).
5. H. U. Khan, F. Ali, Y. Y. Ghadi, S. Nazir, I. Ullah, and H. G. Mohamed, "Human Computer Interaction and Participation in Software Crowdsourcing," *Electronics*, 2023 (IF 2.690, JCR 2021).
6. A. Gupta, H. U. Khan, S. Nazir, S. Muhammad, and M. Shabaz, "Metaverse Security: Issues, Challenges and a Viable ZTA Model," *Electronics*, 2023 (IF 2.690, JCR 2021).
7. Habib Ullah Khan and Shah Nazir, "Assessing the role of AI-based smart sensors in smart cities using AHP and MOORA," *Sensors*, 2023 (IF 3.847, JCR 2021), Art. no. sensors-2072640.
8. S. Khan, H. U. Khan, and S. Nazir, "Systematic Analysis of Healthcare Big Data Analytics for Efficient Care and Disease Diagnosing," *Scientific Reports*, 2022 (IF 4.996, JCR 2022).
9. H. U. Khan, S. Khan, and S. Nazir, "Features-based IoT Security Authentication Framework using Statistical Aggregation, Entropy, and MOORA Approaches," *IEEE Access*, 2022 (IF 3.476, JCR 2021).
10. S. Khan, H. U. Khan, and S. Nazir, "Utilizing the Collective Wisdom of FinTech in the GCC region: A Systematic Mapping Approach," *Measurement and Control*, 2022 (IF 1.648, JCR 2021).
11. S. Nazir, H. U. Khan, S. Shahzad, and I. García-Magariño, "Editorial on decision support system for development of intelligent applications," *Soft Computing*, 2022/07/29 2022 (IF 3.7, JCR 2021)
12. J. P. Li, B. L. Y. Agleby, Z. Ali, S. Nazir, C. B. Mawuli, and S. Uddin, "A survey of deep learning techniques based Parkinson's disease recognition methods employing clinical data," *Expert Systems With Applications*, 2022 (IF 8.665, JCR 2021).

13. F. Aziz, Huangym, Qasim, Zakir, S. Nazir, and Shahid, "An Efficient Load Balancing Scheme for UAVs in 5G Infrastructure," *IEEE Systems Journal*, 2022 (IF 3.931, JCR 2020).
14. Habib Ullah Khan, Suliman Khan, Shah Nazir, "A Novel Deep learning and Ensemble Learning Mechanism for Delta-Type Covid-19 Detection and Diagnosing," *Frontiers in Public Health*, 2022 (IF 3.709, JCR 2020).
15. Y. Xu and S. Nazir, "Ranking the Art Design and Applications of Artificial Intelligence and Machine Learning," *Journal of Software: Evolution and Process*, 2022 (IF 1.972, JCR 2020).
16. H. U. Khan, F. Ali, and S. Nazir, "Systematic Analysis of Software Development in Cloud Computing Perceptions," *Journal of Software: Evolution and Process*, 2022 (IF 1.972, JCR 2020).
17. L. S. Riza, M. N. Fazanadi, J. A. Utama, K. A. F. A. Samah, T. Hidayat, and S. Nazir, "Algorithm SAX and Random Projection for Motif Discovery on Orbital Asteroid Resonance Using Big Data Platforms," *Sensors*, 2022 (IF 3.576, JCR 2020).
18. Habib Ullah Kha, Anwar Hussain, Shah Nazir, "A Decision-based Hybrid Proxy Mobile IPv6 Scheme for better Resources Utilization", *CMC-Computers, Materials & Continua*, 2022, (IF 3.772, JCR 2020)
19. Habib Ullah Khan, Sulaiman Khan, and Shah Nazir, "Efficient Power Grid Management Using Sliced-based Mechanism for Systematic Allocation of Energy Resources: A Conceptual Framework," *Frontiers in Energy Research*, 2022 (IF 4.008, JCR 2020).
20. Li Yan, Julian L. Webber, Abolfazl Mehbodniya, Balakrishna Moorthy, S.Sivamani, Shah Nazir, Mohammad Shabaz, "Distributed optimization of heterogeneous UAV cluster PID controller based on machine learning," *Computers and Electrical Engineering*, vol. 101, p. 108059, 2022/07/01/ 2022 (IF 3.818, JCR 2020).
21. Muhammad Shafiq, Zhaoquan Gu, Shah Nazir, Rahul Yadav "Analyzing IoT Attack Feature Association with Threat Actors," *Wireless Communications and Mobile Computing*, 2022 (IF 2.336, JCR 2020).
22. Habib Ullah Khan, Farhad Ali, Yasser Alshehri, and Shah Nazir, "Towards Enhancing the Capability of IoT Applications by Utilizing Cloud Computing Concept," *Wireless Communications and Mobile Computing*, 2022 (IF 2.336, JCR 2020).
23. Yin Hang, Sangeen Khan, Abdullah Alharbi, and Shah Nazir, "Assessing English Teaching Linguistic and Artificial Intelligence for Efficient Learning Using AHP and TOPSIS," *Journal of Software: Evolution and Process*, 2022 (IF 1.972, JCR 2020).
24. Qin Zhao and Shah Nazir, "English Multimode Production and Usage by Artificial Intelligence and Online Reading for Sustaining Effectiveness," *Mobile Information Systems*, 2022 (IF 1.802, JCR 2020).
25. Muhammad Shafiq, Shah Nazir, and Xiangzhan Yu, "Identification of Attack Traffic Using Machine Learning in Smart IoT Networks," *Security and Communication Networks*, 2022 (IF 1.791, JCR 2020).
26. Zhigang Li *et al.*, "Solution of Third Order Nonlinear Integro-Differential Equations with Parallel Computing for Intelligent IoT and Wireless networks Using Haar Wavelet Method," *Journal of Function Spaces*, 2022 (IF 1.807).
27. Kamran Habib Khan, Ikram Ud Din, Ahmad Almogren, Hasan Ali Khattak, Muhammad Ibrahim, and Shah Nazir, "Secure Delegation using Enhanced Capability Model," *Security and Communication Networks*, 2022 (IF 1.791).

28. Qingqing Chang, Shah Nazir, and Xia Li, "Decision making and computational modeling of big data for sustaining influential usage," *Scientific Programming*, 2022 (IF 1.025).
29. Yancheng Yang and Shah Nazir, "Decision support system for prioritizing self-assurance of academic writing based on applied linguistics," *Frontiers in Psychology*, 2022 (IF 2.990, JCR 2020).
30. Yunfei Han *et al.*, "Extraction of Landslide Information and Analysis Using Remote Sensing Technology," *Remote Sensing*, 2022 (4.848, JCR 2020).
31. Yan Cheng Yang, Shah Nazir, and Wajeeha Khalil, "A probabilistic approach toward evaluation of Internet rumor on Covid," *Soft Computing*, 2022 (3.643, JCR 2020).
32. Gaoyuan Liu, Huiqi Zhao, Fang Fan, Gang Liu, Qiang Xu, and Shah Nazir, "An Enhanced Intrusion Detection Model based on Improved kNN in WSNs," *Sensors*, 2022 (IF 3.576, JCR 2020).
33. Neelam Mukhtar, Mohammad Abid Khan, Nadia Chiragh, Shah Nazir, and Asim Ullah Jan, "An Intelligent unsupervised approach for handling context-dependent words in Urdu Sentiment Analysis," *ACM Transactions on Asian and Low-Resource Language Information Processing*, 2022 (IF 1.413, JCR 2020).
34. Tiancheng Yang and Shah Nazir "A comprehensive overview of AI-enabled music classification and its influence in games" *Soft Computing*, 2022, (IF. 3.643, JCR 2020).
35. Jaweria Kainat, Syed Sajid Ullah, Fahd S. Alharithi, Roobaea Alroobaea, Saddam Hussain, and Shah Nazir "Blended Features Classification of Leaf based Cucumber Disease using Image Processing Techniques," *Complexity*, 2021 (IF 2.833, JCR 2020).
36. Jiayi Guo and Shah Nazir, "Internet of things based intelligent techniques in workable computing- an overview," *Scientific Programming*, 2021(IF. 1.025, JCR 2020).
37. Ikram Ud Din, Zeeshan Saddique, Mudassar Khan, Ahmad Almogren, Irfan Mohiuddin, and Shah Nazir, "Machine Learning-based Detection of Spam Emails," *Scientific Programming*, 2021 (1.02, JCR 2020).
38. Ming Di, Shah Nazir, and Fucheng Deng, "Influencing User's Behavior Concerning Android Privacy Policy – An overview," *Mobile Information Systems*, 2021 (IF 1.802, JCR 2020).
39. H. Yu and Shah Nazir, "Role of 5G and Artificial Intelligence for Research and Transformation of English Situational Teaching in Higher studies," *Mobile Information Systems*, 2021 (IF 1.802).
40. Samia Bushnaq, Rohul Amin, Kamal Shah, Muhammad Awais, Ibrahim Mahariq, and Shah Nazir, "Solution of Third Order Nonlinear Integro-Differential Equations with Parallel Computing for Intelligent IoT and Wireless networks Using Haar Wavelet Method," *Journal of Function Spaces*, 2021 (IF 1.807).
41. R. Amin, Ş. YÜZBAŞI, and Shah Nazir, "Efficient numerical scheme for the solution of HIV infection CD4+ T-Cells using Haar wavelet technique," *Computer Modeling in Engineering & Sciences*, 2021 (IF 0.9, JCR 2020).
42. Sulaiman Khan, Anwar Hussain, Shah Nazir, Fazlullah Khan, AmmarOad, Mohammad DahmanAlshehri "Efficient and Reliable Hybrid Deep Learning-enabled Model for Congestion Control in 5G/6G Networks " *Computer Communications*, 2021 (IF 3.167).
43. Zeng Chen, Sangeen Khan, Muhammad Abbas, and Shah Nazir, "Enhancing healthcare through detection and prevention of COVID-19 using Internet of Thing and Mobile Application," *Mobile Information Systems*, 2021 (IF 1.802).

44. Guangping Zhuo, Shah Nazir, Habib Ullah Khan, and Neelam Mukhtar, "An efficient multi-feature model for improving the performance of critical energy infrastructure," *Journal of Advanced Transportation*, 2021 (IF 2.419, JCR 2020).
45. Swarn Avinash Kumar, Iván García-Magariño, Moustafa M. Nasralla, and Shah Nazir, "Agent-based simulators for empowering patients in self-care programs using mobile agents with machine learning," *Mobile Information Systems*, 2021 (IF 1.802).
46. Wang Ping, Jie Fu, Wenyu Qiao, Muhammad Yasir, Sheng Hui, Md Sakaouth Hossain, and Shah Nazir, "Decision support system for Hyperspectral Remote Sensing Data of Yellow River Estuary, China," *Scientific Programming*, 2021 (IF. 1.025, JCR 2020).
47. Chenglong Du and Shah Nazir, "Evaluating A's of big data for transformation of smart cities," *Scientific Programming*, 2021 (IF. 1.025, JCR 2020).
48. Altaf Hussain, Tariq Hussain, Farooq Faisal, Iqtidar Ali, Irshad Khalil, Shah Nazir, and Habib Ullah Khan, "DLSA: Delay and Link Stability Aware Routing Protocol for Flying Ad-hoc Networks (FANETs)," *Wireless Personal Communications*, 2021/08/24 2021 (IF 1.671, JCR 2020).
49. Muhammad Dawood Atta Ur Rahman, Shakeel Mahmood, Ghani Rahman, and Shah Nazir, "Assessing the impact of climate change on discharge in Swat river basin using fuzzy logic model," *Arabian Journal of Geosciences*, 2021 (IF 1.827, JCR 2020).
50. Yancheng Yang, Saad Ul Islam, Asra Noor, Sadia Khan, Waseem Afsar, and Shah Nazir*, "Influential usage of big data and artificial intelligence in healthcare," *Computational and Mathematical Methods in Medicine*, 2021 (IF 2.238, JCR 2020).
51. Shah Nazir, Iván García-Magariño, Rodziah Binti Atan, and Shaukat Ali, "Healthcare Big Data Management and Analytics in Scientific Programming," *Scientific Programming*, 2021 (IF 1.025, JCR 2020).
52. Dong Xue, Shah Nazir*, Zhiqiang Peng, and Hizbullah Khattak, "Selection and ranking of Fog Computing-Based IoT for monitoring of health using the Analytic Network Approach," *Complexity*, 2021 (IF 2.833, JCR 2020).
53. Yancheng Yang, Farhad Ali, and Shah Nazir*, "Selection of devices based on multi-criteria for mobile data in Internet of Things environment," *Scientific Programming*, 2021 (IF 1.025, JCR 2020).
54. Zhen Ying, Iftikhar Ahmad, Saima Mateen, Asad Zia, Ambreen, Shah Nazir*, and Neelam Mukhtar, "An overview of computational models for Industrial Internet of Things to enhance usability," *Complexity*, 2021 (IF 2.833, JCR 2020).
55. Sulaiman Khan, Habib Ullah Khan, and Shah Nazir, "Offline Pashto Characters Dataset for OCR Systems," *Security and Communication Networks*, 2021 (IF 1.791, JCR 2020).
56. Hui Xiao, Shah Nazir*, Hanmin Li, Habib Ullah Khan, and Chengwei Li, "Decision support system to risk stratification in the acute coronary syndrome using fuzzy logic," *Scientific Programming*, 2021 (IF. 1.025, JCR 2020).
57. Hualing Wu, Rohul Amin, Asmatullah Khan, Shah Nazir, and Sultan Ahmad, "Solution of the systems of delay integral equations in Heterogeneous data communication through Haar wavelet collocation approach," *Complexity* 2021 (IF 2.833, JCR 2020).
58. Ying Zhang, Farhad Ali, Kunhao Wang, Shah Nazir, and Zeqi Leng, "Utilizing Virtual Crowd for Global Software Development," *Scientific Programming (IF. 1.025, JCR 2020)*, 2021.

59. Xu Qiang, Zhao Huiqi, Farhad Ali, and Shah Nazir*, "Criteria based opinion leader's selection for decision making using Ant Colony Optimization," *Scientific Programming*, 2021 (IF 0.963, JCR 2019).
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176. Shah Nazir, Habib Ullah Khan "Role Of Information Management System In Laboratory And Petrochemical Quality Assurance" 51st Annual Conference of the Decision Sciences Institute, 2020
177. Shah Nazir, Sara Shahzad, Asif Ullah, and Anwar Hussain, "Identification and analysis of project attributes affecting the decision of requirement elicitation technique," in *National Graduate Conference* Islamabad, Pakistan, 2017.
178. Hanif-Ur-Rahman, Hemant Kumar Bamma, Shah Nazir, Sara Shahzad, and Thomas Hodosi, "A Sourcing Decision Model for Application Maintenance Services," in *3rd International Conference on Science in Information Technology (ICSITech)*, Indonesia, 2017.
179. Shah Nazir, Anwar Hussain, Sara Shahzad, Islam Zada, Zohaib Ahmad, and Abdullah, "Determination of Awareness of Piracy Level on Educational Institutions- A Questionnaire Based

- Study," in *The 2nd EAI International Conference on Future Intelligent Vehicular Technologies* Islamabad, Pakistan, 2017.
180. Ammara Hussain, Sara Shahzad, and Shah Nazir, "A Clone Management Framework to Improve Code Quality of FOSS Projects," in *International Conference on Communication, Computing and Digital Systems*, Pakistan, 2017, pp. 253-258.
 181. Anwar Hussain, Shah Nazir, Yasir Salim, and Sara Shahzad, "User modeling for Domain-wise Learning Style variations," in *1st National Graduate Conference*, Pakistan, 2017.
 182. Shah Nazir and Anwar Hussain, "Estimation of software birthmark- a step to measure software piracy," in *The 18th International Pure Mathematics Conference 2017*, Islamabad, Pakistan, 2017.
 183. Shah Nazir, Sara Shahzad, and Islam Zada, "Social Awareness to Prevent Software Piracy," in *International Conference on Distance Education & E-Learning*, Islamabad, Pakistan, 2016.
 184. Shah Nazir, Sara Shahzad, Islam Zada, and Humaira Khan, "Evaluation of software birthmarks using fuzzy analytic hierarchy process," in *Proceedings of the Fourth International Multi-topic Conference*, 2015, pp. 171-175.
 185. Islam Zada, Sara Shahzad, and Shah Nazir, "Analysis of Issues in Offshore Software Outsourcing," in *13th International Conference on Statistical Sciences*, Pakistan, 2015, pp. 113-120.
 186. Shah Nazir, Sara Shahzad, Neelam Mukhtar, and Muhammad Nazir, "Ontology for efficient text/criteria based search functionality in website," in *2nd Abasyn International Conference on the Technology and Business Management (AiCTM)*, Pakistan, 2014.
 187. Sara Shahzad, Islam Zada, and Shah Nazir, "Issues and challenges for scrum using in global software development," in *1st National Conference on Mathematics and Computer Science*, 2014.
 188. Shah Nazir, Sara Shahzad, Muhammad Nazir, and Hanif Ur Rehman, "Evaluating security of software components using analytic network process," in *11th International Conference on Frontiers of Information Technology (FIT), IEEE*, Islamabad, Pakistan, 2013, pp. 183 - 188.
 189. Neelam Mukhtar, Sara Shahzad, Muhammad Abid Khan, and Shah Nazir, "Ontology for Feature Based Selection of Web Development Tools," in *International conference on digital information modeling (ICDIM), IEEE* 2013, pp. 90 - 95.
 190. Shah Nazir, Sajid Anwar, Muhammad Amir Khan, Humaira Khan, and Muhammad Nazir, "A Novel Fuzzy Logic Based Software Component Selection Modeling," in *International Conference on Information Science and Application (ICISA), IEEE*, Korea, 2012, pp. 1-6.
 191. Shah Nazir and M. Nazir, "Comparisons of Membership Functions for Fuzzy Rules," 1st International Conference on Computational and Social Sciences (ICSS-13), pp. 10-14, January-February 2014.

Society Membership

- Professional member ACM, ID- 0429896
- Professional member IEEE
- IEEE Industrial Electronics Society Membership

Academic editor

1. Spatial Information Research
2. Research Reports on Computer Science (**RRCS**)
3. Computer Systems Science and Engineering (**IF 1.486, JCR 2020**)
4. Scientific programming (**IF 0.963, JCR, 2019**)
5. Security and Communication Networks (**IF 1.288, JCR 2019**)

6. Frontiers in Communications and Networks

Lead/Guest Editor

1. Translational Neuroscience, Advances In Multimedia-Based Emerging Technologies And Data Analytics For Neuroscience As A Service (NAAS), **(IF 1.2, JCR 2021)**
2. Nonlinear Engineering. Modeling and Application
3. Open Computer Science, Recent advances in biometrics based on biomedical information
4. IEEE Journal of Biomedical and Health Informatics “Enabling Healthcare AI and Informatics by Energy-Efficient Network Design and Protocols for 5G” **(IF 7.02, JCR 2021)**
5. Context-aware intelligent visual analytics for real-time environmental monitoring systems, Spatial Information Research

6. Big Data Analytics for Robust Decision Making in Complex Business Markets, International Journal of Engineering Business Management **(IF 1.2, JCR 2020)**
7. Robust Decision-Making in Complex Business Markets: Emerging Models and Applications
8. **IET Software**, Soft Computing and Decision-Support Systems for Health Informatics, **(IF 1.2, JCR 2020)**
9. **Soft Computing**, Soft computing-based intelligent decision support systems and its use in solving real-world issues, **(IF 3.732, JCR 2021)**

10. Trends in distributed wireless sensory networks for e-health services
11. Autonomic and Adaptive Cyber-Defense Algorithms for Healthcare Applications <https://www.sciencedirect.com/journal/healthcare-analytics/about/call-for-papers>
12. Intelligent Automation & Soft Computing **(IF 3.401, JCR 2021)**
13. Sensor **(IF 3.8, JCR 2021)**
14. IET Software **(IF 1.2, JCR 2020)**
15. Sensor, MDPI, **(IF 3.7, JCR 2020)**
16. Computer Systems Science and Engineering, Tech Science Press **(IF 1.486, JCR 2020)**
17. Decision support system for development of intelligent applications, Soft Computing **(IF 3.643, JCR 2020)**
18. Managing Big Data, Visualization and its Analytics in Healthcare Based on Scientific Programming 2021 | Hindawi, Scientific programming **(IF 0.963, Journal Citation Reports, 2019)**
19. Special Collection on Internet of Things and Mobile Computing for Big Data in Healthcare: International Journal of Distributed Sensor Networks: SAGE Journals (sagepub.com), International Journal of Distributed Sensor Network **(IF 1.151, JCR 2019)**
20. Special Collection on Internet of Things and Mobile Computing for Big Data in Healthcare: International Journal of Distributed Sensor Networks: SAGE Journals (sagepub.com)
21. Security and Communication Networks **(IF 1.288, JCR 2019)**- Identification of Attack Traffic Using Machine Learning in Smart IoT Networks <https://www.hindawi.com/journals/scn/si/686917/>
22. Journal of Healthcare Engineering **(IF 1.803, Journal Citation Reports, 2019)**, Healthcare of Things and Big Data for Healthcare Engineering, <https://www.hindawi.com/journals/jhe/si/879297/>
23. Scientific Programming **(IF 0.9, Journal Citation Reports, 2019)**, Big Data, Scientific Programming, and Industrial Internet of Things <https://www.hindawi.com/journals/sp/si/804379/>
24. Scientific Programming **(IF 1.26, Journal Citation Reports, 2018)**, Special issue- Healthcare Big Data Management and Analytics in Scientific Programming

25. Wireless Communications and Mobile Computing (**IF 1.396, Journal Citation Reports, 2018**),
Special issue- Internet of Things for Healthcare Using Wireless Communications or Mobile Computing

Courses studied at higher studies

Advanced topics in software engineering, software measurements and metrics, ontology engineering, requirement engineering, software architecture, software quality assurance, advance operating system, theory of computation, computer architecture, advanced analysis of algorithm, real time system, automatic translation, middleware, pattern recognition, network security and quality of services, research methodology, and statistics.

Courses taught to Undergraduate and higher studies

1. Software testing and quality assurance
2. Software project management
3. Software engineering
4. Introduction to Computer
5. Computer Application
6. Introduction to Information and Communication Technologies
7. Compiler construction
8. Information security
9. Formal methods of software engineering
10. Requirement engineering
11. Component based software engineering
12. Research methodology
13. Object oriented databases
14. Theory of computation

Supervision of Undergraduate projects/thesis

2022	2021	2020
1. Abdullah Khan	1. Mahnoor Maqsood	1. Muhammad Tauqeer
2. Shayan Ahmad	2. Bushra Fida	2. Muhammad Sulaiman
3. Muhammad Afnan	3. Nouman Khan	3. Syed Ameer Hamzad
4. Suliman Khan	4. Muhammad Shadab	4. Bilal Ahmad
5. Faisal Muhammad	5. Muhammad Tufail	5. Tufail Khan
6. Abdullah Javaid	6. Sangeen Khan	6. Wiqar Ahmad
7. Basit Ali Khan	7. Muhammad Abbas	7. Sangeen Khan
8. Rashid Ul Haq	8. Muhammad Atif	8. Mehmood Ul Hassan
9. Muhammad Aqib	9. Ali Hassan Kaleemi	9. Waseem Javed
10. Abdullah	10. Shahid Iqbal	10. Muhammad Qaddafi
11. Amir Khan	11. Zeeshan Khan	11. Kamran Bahadar
12. Wajahat Ullah	12. Hammad Ahmad	12. Amir Qayum
13. Osama Anwar	13. Ahmad Ali	13. Kamal Shah
14. Amir Zaman	14. Saqib Saeed	14. Aizaz Ul Haq
15. Toheed Rehman	15. Jehangir Khan	15. Sheraz Ahmad
16. Abdur Rab	16. Mustafa Zaib	16. Shakeel Ahmad
17. Shahan Khan	17. Muhammad Saqib	17. Izhar Ullah
18. Aqib Hassan Zeb	18. Mehad Saeed	18. Kawsar Ali
19. Khalil Ur Rahman	19. Muhammad Faraz	19. Adnan Bashir
20. Usama Akbar	Hamid Khan	20. Daniyal Qadeem
21. Talha Rashid	20. Muhammad Atif	21. Muhammad Waseem
		22. Rukhsar Ahmad
		23. Faisal Ali

22. Masood Khan 23. Abdaal 24. Abdur Rahim 25. Muhammad Haris 26. Abdul Aziz 27. Farah Qadir 28. Sareer Ahmad 29. Muhammad Alyan 30. Bilal Rehman 31. Saad 32. Awais Ali 33. Rizwan Ullah Khan 34. Aqib Ullah 35. Saad	21. Yamen Ahmad 22. Adil Amin 23. Haseeb Ali 24. Muhammad Haris 25. Mohsin Khan 26. Usama Ali 27. Muhammad Zeeshan 28. Kashif Mehmood 29. Muhammad Azam 30. Shahrukh Zaib 31. Said-ul-Amin	24. Habib Ullah 25. Zia Ullah 26. Osama Abdul Basit 27. Rizwan Khan 28. Jawad Shehbaz 29. Hamza Farooq
2019 1. Saif Ullah 2. Asad Ali 3. Muhammad Bilal 4. Muhammad Nasir 5. Dawood Bin Qayum Shebaz Ahmad	2018 1. Muhammad Junaid 2. Aamar yousaf 3. Mashal Khan	2017 1. Saira Gul 2. Javed Iqbal 3. Abid Ali 4. Yasir Iqbal 5. Faheem Qamar 6. Mateen Ur Rashid 7. Muhammad Ayub 8. Aamir Sohail 9. Asadullah 10. Junaid javed 11. Saif Ullah 12. Asad Ali 13. Bilal Khan 14. Zohaib Muhammd

Supervision of research scholars (PhD)

1. **Sulaiman Khan**- Pashto handwritten characters recognition system using adaptive hybrid approach
2. **Anwar Hussain**- LH-PMIPv6 - location-based hybrid proxy mobile ipv6 to enhance mobility management in pmipv6 domain
3. **Muhammad Asif**- in process
4. **Abdul Hamid**- in process

Supervision of research scholars (MS)

1. Saad Khan
2. Waseem Khan
3. Atteque Ahmad
4. Syed Sulaiman
5. **Muhammad Imran**- Using the concept of gamification for facilitating the patient of hypertensioin in healthcare
6. **Naeem Ullah**- Mobile computing: a roadmap towards the authentication and application of IoT devices in healthcare

Completed MS

1. **Muhammad Farooq**- Analyzing Public Sentiment Towards COVID-19 Vaccine in Pakistan on Twitter: An NLP based approach
2. **Asra Noor**- Evaluating The Significant Features Of Software For Enhancing Industry Best Practices In Continuous Software Development
3. **Qaiser Hayat**- Recognition Of Pashto Text In Soft Dialect-Form Using Densenet Approach
4. **Mohammad Sohail**- Prioritization Of Authenticating Features To Improve Internet Of Things Devices Security
5. **Iftikhar Adhmad**- The Healthcare Data Classification From Territory Hospitals Through Cloud Computing-Based Natural Language
6. **Abdullah**- Multi-criteria based Selection of task in crowdsourcing
7. **Farhad Ali**- Multi-criteria based crowd selection in crowdsourcing using ant colony optimization
8. **Yasir Ali**- Evaluating security of IoT in healthcare based on mobile computing
9. **Muhammad Imtiaz**- Number plate based vehicle detection and speed measurement
10. **Asif Ullah**- Attributes based selection of requirement elicitation techniques using the Analytic Network Process

Invited/Key speaker

1. The 9th Mathematics, Science, and Computer Science Education International Seminar (MSCEIS), October 21st, 2023
2. Robotics & AI Research Conference RoboAICon2023, <https://2023.theresearchcatalyst-robo.com/#invited>
3. **Computer- based tools in research**, One day workshop/seminar on niceties of legal research organized by the Department of Law, University of Swabi, Pakistan, January 18, 2022
4. **Big data features, applications, and analytics in cardiology- a systematic literature review**, The International Conference on Computer Assisted System in Health, Education and Sustainable Development (CASH), <http://www.mycasd.upm.edu.my/cash2020/speakers.html>, Malaysia, October 2020
5. **“Software piracy- a global dilemma”** at the Ankara 3rd International conference on science, Ankara, Turkey, 31st July, 2018
6. **“How systematic literature can help you in research”** at the Faculty of Computer Science and Information Technology, University Putra Malaysia, 20 July, 2018
7. **“How to systematically search literature- a systematic literature review protocol”** In 2nd Workshop on Computer Based Software Applications in Research, Department of Computer Science, University of Swabi, January 12, 2018
8. **“References using endnote”** In 1st Workshop on Computer Based Software Applications in Research, Department of Computer Science, University of Swabi, May 22, 2017
9. **“Plagiarism detection, avoidance, and use of turnitin”** In 1st Workshop on Computer Based Software Applications in Research, Department of Computer Science, University of Swabi, May 22, 2017
10. **“Systematic literature review”** and **“Writing thesis/report in Latex”** at College of Home economics, University of Peshawar, on December 21, 2017
11. **“References using Endnote”** at College of Home economics, University of Peshawar, Peshawar, Pakistan
12. **“Plagiarism detection and prevention”** at College of Home economics, University of Peshawar, Peshawar, Pakistan
13. **“References using Endnote”** at the Department of English and applied linguistics, University of Peshawar, Peshawar, Pakistan

Conference organized

1. Chief organizer (Conference Chair/Focal person) of the 1st International Conference on Software

Engineering and Computing Disciplines, 2019 (ICSECD- 2019), 12-14, November 2019, Pakistan

2. Special session 6: Software Piracy- Types, Issues, and Remedies
3. Special session 8: Energy-efficient Techniques for WLAN, WSN, WPAN

Conference programme session chair

1. Organizer 17th International Conference on Information Technology and Applications (ICITA 2023)
2. 24th International Multi Topic Conference 2022 (INMIC 2022), Conference: October 21-22, 2022
3. Organizer 16th International Conference on Information Technology and Applications (ICITA 2022)
4. EAI BigIoT-EDU 2022 - 2nd EAI International Conference on Application of Big Data, Blockchain, and Internet of Things for Education Informatization, July 29-31, 2022, Beihai, People's Republic of China
5. 1st International Conference on Software Engineering and Computing Disciplines, 2019, 12-14, November 2019, Pakistan
6. 1st International Conference on Electrical, Communication and Computer Engineering (ICECCE) on 24th – 25th July, 2019 at Swat Serena Hotel, KP, Pakistan.
7. The 2nd EAI International Conference on Future Intelligent Vehicular Technologies (Special session 6: Software Piracy- Types, Issues, and Remedies)
8. The 2nd EAI International Conference on Future Intelligent Vehicular Technologies (Special session 8: Energy-efficient Techniques for WLAN, WSN, WPAN)
9. The 2nd EAI International Conference on Future Intelligent Vehicular Technologies, SESSION TB2: Wireless Sensor Networks II

Workshop/Seminar organized

1. Multi-criteria decision making to continuous software improvement based on quality management, assurance and metrics- Sponsored by IEEE, Event category- Technical, Events Map – 5th October, IEEE Day 2021
2. Chief organizer of “2nd Workshop on Computer Based Software Applications in Research” Department of Computer Science, University of Swabi, January 11, 2018
3. Chief organizer of “1st Workshop on Computer Based Software Applications in Research” Department of Computer Science, University of Swabi, May 22, 2017

Academic Editor

1. Journal of Computer Science and Artificial Intelligence
2. Madridge Journal of Bioinformatics and Systems Biology
3. Asian Journal of Research in Computer Science

Member of editorial board

1. Data and knowledge engineering
2. Information and Computer Security

Working as technical committee member for journals

1. IEEE Systems Journal (IF 4.802)
2. Journal of Field Robotics (IF 6.385)
3. Journal of Industrial Information Integration (IF 11.718)
4. International Journal of Retail & Distribution Management (IF 4.14)
5. Journal of Systems and Information Technology
6. Telematics and Informatics (IF 9.14)
7. Physical Communication (IF 2.378)
8. Applied Sciences (IF 2.838)

9. Computer Modeling in Engineering and Sciences (IF 2.027)
10. Expert Systems (IF 2.812)
11. Artificial Intelligence in Medicine (IF 7.011)
12. Bioengineering (IF 5.046)
13. IEEE Journal of Biomedical and Health Informatics (IF 7.021)
14. Internet of Things (IF 5.711)
15. Behaviour & Information Technology (IF 3.086)
16. Heliyon (IF 3.776)
17. Ain Shams Engineering Journal (IF 4.790)
18. Computers & Security (IF 5.105)
19. Automation in Construction (IF 7.700)
20. International Journal of Human-Computer Interaction (IF 3.353)
21. BMJ Open (IF 2.692)
22. Computer Speech and Language (IF 1.899)
23. Applied Artificial Intelligence (IF 1.580)
24. Frontiers in Psychology (IF 4.232)
25. Technology in Society (IF 4.192)
26. The Imaging Science Journal (IF 0.871)
27. Symmetry (IF 2.713)
28. Electronics (IF 2.397)
29. Applied Bionics and Biomechanics (IF 1.781, JCR 2020)
30. Peer J Computer Science (IF 1.39, JCR 2020)
31. Sensors (IF 3.576, JCR 2020)
32. International Journal of Information Technology & Decision Making (IF 2.22)
33. Automatika: Journal for Control, Measurement, Electronics, Computing and Communications (IF 1.156)
34. Mathematical Methods in the Applied Sciences (IF 2.321)
35. Transactions on Dependable and Secure Computing (IF 7.329)
36. IEEE Transactions on Vehicular Technology (IEEE Xplore: IEEE Transactions on Vehicular Technology) (IF 5.379)
37. IEEE Transactions on Industrial Informatics (IF 9.112)
38. IEEE Journal of Biomedical and Health Informatics (IF 5.223)
39. Automated Software Engineering (IF 1.857)
40. Technology in Society (IF 2.414)
41. Information Processing and Management (IF 6.222)
42. Wireless Communications and Mobile Computing (IF 1.819)
43. Mathematical problems in Engineering (IF 1.009)
44. Complexity (IF 2.462)
45. CMC-Computers, Materials & Continua (IF 4.89)
46. Journal of Information Security and Applications (IF 2.327)
47. Multimedia Tools and Applications (IF 2.313)
48. Journal of Software: Evolution and Process (IF 1.178)
49. Security and Communication Networks (IF 1.288)
50. Scientific programming (IF 1.21)
51. Egyptian Informatics Journal (IF 2.306)
52. Information and Software Technology (IF 2.921)
53. IEEE Transactions on Dependable and Secure Computing (IF 6.4)
54. Scientific Programming (IF 1.289)
55. IEEE Access (IF 4.1)
56. Mobile Information Systems (IF 0.958)
57. Artificial Intelligence Review (IF 3.814)

58. The Journal of Supercomputing (IF 1.532)
59. Computational and Mathematical Organization Theory (IF 0.9)
60. Software: practice and experience (IF 1.609)
61. Mathematical Methods in the Applied Sciences (IF 1.002)
62. Cluster Computing-The Journal of Networks Software Tools and Applications (IF 1.5)
63. Information Processing & Management (IF 1.39)
64. International Journal of Pattern Recognition and Artificial Intelligence (IF 0.9)
65. Arabian Journal for science and Engineering (IF 1.7)
66. The International Arab Journal of Information Technology (0.5)
67. Applied Mathematics & Information Sciences (1.2)
68. Sukkur IBA Journal of Computing and Mathematical Sciences
69. VFAST Transactions on Software Engineering
70. Sri Lankan Journal of Technology
71. Int. J. of Business Information Systems <https://www.inderscience.com/IJBIS>
72. Journal of Basic and Applied Research international
73. Asian Journal of Mathematics and Computer Research
74. Journal of Mathematical and Statistical Analysis
75. Journal of ICT Research and Applications

Working as technical committee member for conferences

76. **Fourth International Conference on Smart Electronics and Communication (ICOSEC 2023) on 20-22 September 2023**
77. 10th International Conference on Artificial Intelligence and Applications (AIAP 2023) <https://ccseit2023.org/aiap/index>
78. 8th International Conference on Data Mining & Knowledge Management (DaKM 2023), <https://ccsit2023.org/dakm/index>
79. 8th International Conference on Data Mining & Knowledge Management (DaKM 2023), <https://ccsit2023.org/dakm/index>
80. 29th Asia-Pacific Software Engineering Conference (APSEC 2022)Third International Workshop on Intelligent Software Engineering Automation
81. 16th International Conference on Information Technology and Applications (ICITA 2022)
82. 2nd International Conference on Computer Application and Information Security (ICCAIS2022)
83. 14th International Conference on Wireless & Mobile Network (WiMo 2022)
84. <https://www.itcse2022.org/wimo/index>
85. 14th International Conference on Wireless & Mobile Network (WiMo 2022), Toronto, Canada
86. 3rd International conference on Big Data, Machine learning and Applications (BIGML 2022), <https://ccsit2022.org/bigml/index>
87. 3rd International Conference on Signal Processing, VLSI Design & Communication Systems (SVC 2022), Zurich, Switzerland, <https://acsty2022.org/svc/index>
88. 14th International Conference on Wireless & Mobile Network (WiMo 2022), Toronto, Canada
89. 7th International Conference on Data Mining & Knowledge Management (DaKM 2022)” to be held in July 30~31,2022,London,United Kingdom
90. 3rd International Conference on Natural Language Computing Advances (NLCA 2022), Toronto, Canada, (itcse2022.org)
91. Third International Conference on Sustainable Engineering and Creative Computing (ICSECC 2021), <http://icsecc.president.ac.id/>
92. 4th International Conference on Inventive Computation and Information Technologies ICICIT 2022.
93. 7th International Conference on Communication and Electronics Systems on June 22-24, 2022 organized by PPG Institute of Technology

94. 2022 1st International Conference on Information System & Information Technology (ICISIT) (ICISIT-2022).
95. International Conference on Applied CyberSecurity 2021 (ACS21) Technical Committee (acsconf.org)
96. 15th International Conference on Information Technology and Applications (ICITA 2021) will be held in Dubai, UAE on 13 - 14 November 2021 (ICITA 2021 Conference: The 15th International Conference on Information Technology and Applications (ICITA))
97. 2nd International Conference on Soft Computing for Security Applications ICSCS 2022, 21-22, April 2022 (ICSCS 2022 (iciotc.com))
98. International Conference on NLP & Data Mining (NLDM 2021) <https://comit2021.org/nldm/index>
99. 3rd GS International Conference on Computer Science and Engineering (3rd GSICCSE'22) Gs Conferences – Conferences
100. IEEE COINS: IEEE International Conference on Omni-layer Intelligent systems (<https://coinsconf.com>)
101. 2021 5th International Conference on Informatics and Computational Sciences (ICICoS))
102. The 3rd International Conference on Machine Learning and Intelligent Systems (MLIS 2021) Home page - The 3rd International Conference on Machine Learning and Intelligent Systems (MLIS 2021) (machinelearningconf.org)
103. 2nd International Conference on NLP & Big Data (NLPD 2021) <https://cseit2021.org/nlpd/index>
104. 2nd International Conference on Big Data, IOT and Blockchain (BIBC 2021) October 23 ~ 24, 2021, Sydney, Australia (2nd International Conference on Big Data, IOT and Blockchain (BIBC 2021) (csen2021.org))
105. ICC 2021 Workshops
106. EAI International Conference on Application of Big Data, Blockchain, and Internet of Things for Education Informatization, EAI BigIoT-EDU 2021 – EAI International Conference on Application of Big Data, Blockchain, and Internet of Things for Education Informatization (eai-conferences.org)
107. 2nd GS International Conference on Computer Science and Engineering 2021 (2nd GSICCSE 2021), May 23,2021, Dubai, UAE
108. International Conference on Internet of Things (IoT) and Cybernetics (ICITCN 2021)
109. 2nd International conference on Big Data, Machine learning and Applications (BIGML 2021)" to be held in May 29~30, 2021, Vancouver, Canada, <https://ccsit2021.org/bigml/index.html>
110. Second International Conference on Creative Economics, Tourism & Information Management & Technology 2020.
111. 6th international conference on communication and electronics systems
112. International Conference on Smart Data Intelligence [ICSMDI 2021], <http://icsmdi.com/>
113. 2nd International Conference on Smart Electronics and Communication (ICOSEC 2021) Organized by Kongunadu College of Engineering and Technology, sponsored by IEEE (<http://www.icsec.in/2021/>).
114. First International Workshop on Intelligent Software Engineering Automation
115. 4th International Conference on Informatics and Computational Sciences (ICICoS)
116. International Seminar on Research of Information Technology and Intelligent Systems).
117. International Conference on Information and Communications Technology <http://icoiact.org/>
118. 4th International Conference on Intelligent Sustainable Systems (ICISS 2021) by St. Mother Theresa Engineering College Thoothukudi
119. 2nd International Conference on Machine Learning and Intelligent Systems (MLIS2020)

- <http://www.machinelearningconf.org/>
120. International conference on Big Data, Machine learning and Applications (BIGML 2020) (<https://ccsit2020.org/bigml/index.html>)
 121. 2019 International Conference on Information Systems and Technologies (CONRIST 2019)
 122. Global Society for research and development (<http://gsrd.co/committees.php>)
 123. 2nd 2019 International Conference on Electronics Representation and Algorithm
 124. 2019 International Conference on Science & Technology
 125. International Conference on Smart Electronics and Communication (ICOSEC 2020)-Advisory committee (<http://icsec.in/committee.html>)
 126. International Conference on Information Technology on Information Technology, Information Systems and Electrical Engineering
 127. 2nd International Seminar on Research of Information Technology and Intelligent Systems 2019 (<http://isriti.akakom.ac.id/>)
 128. The 3rd International Conference on Informatics and Computational Sciences (ICICoS 2019)
 129. 2019 International Conference on Machine Learning and Intelligent Systems (MLIS 2019)
 130. 1st INTERNATIONAL CONFERENCE ON ELECTRICAL, COMMUNICATION AND COMPUTER ENGINEERING (ICECCE-2019)
 131. 4th International Conference on Trends in Electronics and Informatics
 132. 2nd International Conference on Applied Science, Engineering, and Social Sciences 2019
 133. International Conference on Machine Learning and Intelligent Systems (MLIS 2019)
 134. International Conference on Sustainable Engineering and Creative Computing (ICSECC 2019) <http://icsecc.president.ac.id/>
 135. Fourth International conference on Trends in Electronics and Informatics (ICOEI 2020)
 136. The 2019 International Symposium on Electrical and Electronics Engineering (ISEE 2019) (<http://feee-conf.com/isee2019/>)
 137. The International Conference on Cloud Computing and Big Data (CCBD 2019) (<http://www.janconf.org/conference/CCBD/1078o3596.html>)
 138. International Conference on Electronics Representations and Algorithms (<http://icera.stmikelahma.ac.id/>)
 139. 2018 3rd International Conference on Information Technology, Information System and Electrical Engineering (ICITISEE)
 140. 2nd International Conference on Informatics and Computational Sciences (ICICoS)
 141. 2018 International Conference on Enhanced Computer Research, Engineering, and Advanced Multimedia
 142. 2018 International Conference on Information and Communications Technology (ICOIACT).
 143. 2018 International Conference on Sensor Networks and Signal Processing (SNSP 2018)
 144. International Conference on Innovations in Engineering, Technology, Computers and Applied Sciences
 145. 2018 International Seminar on Research of Information Technology and Intelligent Systems (ISRITI) (<http://isriti.akakom.ac.id/>)
 146. 2nd International conferences on Information Technology, Information Systems and Electrical Engineering (ICITISEE)
 147. The 2nd EAI International Conference on Future Intelligent Vehicular Technologies
 148. 5th International Conference on Advances in Science, Engineering, Technology and Natural Resources (ICASETNR-17) (<http://iaetr.org/conf-reviewr-committee.php?slug=ICASETNR-17&sid=1&catDid=156>)

149. 5th International Conference on Computer, Electronics and Manufacturing Engineering (ICCEME-16) (<http://iaetr.org/committee.php>)
150. International Conference on Fuzzy System and Data Mining (FSDM2015)
151. First International Conference on Computing and Communication (ICCC'16)
152. 2nd International Conference on Science in Information Technology (ICSITech) (<http://icsitech.org/2017/Committee>)
153. IEEE International Conference on Communication, Computing and Digital Systems (C-CODE) (<https://ccode.bahria.edu.pk/committees/technical-program-committee/>)
154. Reviewing thesis of Undergraduate and Higher studies level of different Universities
155. Evaluator of HEC projects

Projects evaluator

National Research Agenda (NWA), Netherlands

Conferences/ Symposium attend

1. One Day Multidisciplinary Online International Conference on Ecology, Economy, Emerging Technology And People For Sustainable Livelihood In SAARC Countries, 28th January, 2022
2. The International Conference on Computer Assisted System in Health, Education and Sustainable Development (CASH), 2020
3. 1st International Conference on Software Engineering and Computing Disciplines, 2019, 12-14, November 2019, Pakistan
4. 1st International Conference on Electrical, Communication and Computer Engineering (ICECCE) on 24th – 25th July, 2019 at Swat Serena Hotel, KP, Pakistan.
5. Future of Information and Communication Conference (FICC), San Francisco, USA, 14-14 March, 2019.
6. 1st International Conference on Cancer Drug Discovery and Other Diseases (CDDD), 2019, University of Swabi, Pakistan, 11-12, February, 2019
7. International Greentech & ECO Products Exhibition & Conference Malaysia (IGEM 2018), 17-20 October 2018
8. Aging, Learning & Technology: Enriching Lives, Connecting Communities'' conference, 2018, Kuala Lumpur, Malaysia, 6 October 2018
9. Ankara 3rd International conference on Science, Ankara, Turkey, 31st July, 2018
10. Computing Conference, 2018, London, United Kingdom, 10-12 July, 2018
11. International conference on Climate Change Impacts on Agriculture and Food Supply, 2018, University of Swabi, 24-26 April, 2018
12. National conference on "Mathematical Science in Engineering Application (NCMSEA- 2018)", University of Engineering and Technology, Peshawar, 18-19 April, 2018
13. First National Conference on Emerging Trends in Mathematics, Computing and Statistics NCETMCS 2017, 14, 15 November, 2017
14. 3rd International Conference on Science in Information Technology (ICSITech), Indonesia, 25-26 October, 2017.
15. 2nd EAI International Conference on Future Intelligent Vehicular Technologies Islamabad, Pakistan, 17-19 October, 2017.
16. 18th International pure mathematics conference, Islamabad, Pakistan, on 04-06 August, 2017
17. 1st National Graduate Conference Islamabad, Pakistan, on 15-16 March, 2017, Islamabad, Pakistan
18. International Conference on Communication, Computing and Digital Systems (C-CODE) on 8 – 9 March, 2017, Islamabad, Pakistan
19. 14th international conference on Frontier of Information Technology (FIT 2016), Sereena, Islamabad, Pakistan , December 19-21, 2016
20. International Conference on Distance Education & E-Learning, International Islamic University

Islamabad, Pakistan , 19-20 December, 2016

21. 2nd International Conference on Sustainable Utilization of Natural Resources, NCE Geology, University of Peshawar, 3rd October, 2016
22. Emerging Technology and Information Technology (ETIT 2015), at Baragali campus, University of Peshawar, Pakistan, 2015
23. 13th International Conference on Statistical Sciences, Islamia College Chartered University, Peshawar, Pakistan , March 16-18, 2015
24. Second Abasyn international conference on Business and technology management (2nd AICBTM 2014), Peshawar, Pakistan , March 26-27, 2014
25. Emerging Technology and Information Technology (ETIT 2013), at Baragali campus, University of Peshawar, 2013
26. 11th international conference on Frontier of Information Technology (FIT 2013), Sereena, Islamabad, Pakistan , December 16-18, 2013
27. International conference on Computational and Social and Sciences (ICCSS 2013), AWKU, Mardan, Pakistan, December 19-20, 2013

Seminar/workshops/webcast attend

1. Workshop for review of Mphil and PhD, University of Swabi, 30 December, 2018
2. Global optimization and infinity computing, Institute for Mathematical Research, University Putra, Malaysia, 30 July, 2018
3. 2nd One day workshop on impacts of hazardous pollutants (pesticides and heavy metals) on aquatic fauna and human beings, 2018, University of Swabi, 18 April, 2018
4. 2nd Workshop on Computer Based Software Applications in Research, Department of Computer Science, University of Swabi, January 12, 2018
5. 1st Workshop on Computer Based Software Applications in Research, Department of Computer Science, University of Swabi, May 22, 2017
6. One day workshop on “Statistical Techniques for Agricultural, Biological and Environmental Sciences” University of Swabi, May 16, 2017
7. One day Seminar on Awareness of TB control Program organized by Department of Microbiology, University of Swabi, 11-05-2017
8. Introduction to scholarly publishing: The journal publishing cycle- Elsevier publishing campus, 2016
9. Getting your paper noticed: Promoting your research for maximum impact- Elsevier publishing campus, 2016
10. Plagiarism- Elsevier publishing campus, 2016
11. Tell your research story with AudioSlides- Elsevier publishing campus, 2015
12. How do Editors look at your paper?- Elsevier publishing campus- Elsevier publishing campus, 2015
13. Ways for researchers to store, share, discover, and use data- Elsevier publishing campus, 2015
14. Survey Findings: Student Attitudes Toward Writing, Teacher Feedback and Turnitin
15. HP Product Boot Camp at Pearl Continental, Peshawar, Pakistan
16. Workshop on “Intellectual property rights”, arranged by ORIC, University of Peshawar and PASTIC, Islamabad, Pakistan
17. Certificate of completion “How reviewers look at your paper” presented by Jaap van Harten, Executive Publisher Elsevier.
18. Three day course on “scientific writing” Video conference by Higher Education Commission of Pakistan.
19. One day seminar on “changing paradigm of ICT and Library Information System” by Sarhad University, Peshawar, Pakistan.
20. Seminar on “writing a research paper” by Prof. Dr. Jeremy Richards at National Centre of Excellence in Geology, University of Peshawar, Peshawar, Pakistan.

Participation in events for students projects

1. **DigTech 2017**, held at CECOS, Peshawar on December 08-10, 2017
2. Annual event, **ExcITeCup 2016**, Capital University of Science & Technology, Islamabad , November 26, 2016 (got 2nd position in poster design competition throughout Pakistan)
3. “Poster designing” in **VisioSpark16**, Comsats Institute of Information Technology, Wah Campus, 12th November 2016

Additional responsibilities

1. Member, Graduate Studies Committee, Shaheed Benazir Bhatu Women University, Peshawar
2. Member, Board of Studies, University of Swat
3. Member of the Senate, University of Swabi (2019- 2022)
4. Member of the Board of Studies, Department of Mathematics, University of Swabi
5. Member of the Board of Faculty, Department of Computer Science, University of Swabi
6. Member of the Committee of the issues arises from B.Ed (Hons) programme, University of Swabi
7. Member of the Board of Studies, Department of Computer Science, University of Swabi
8. Convener of the committee of Network Router, University of Swabi
9. Convener of the inspection committee of ICT equipments, University of Swabi
10. Focal person National Computing Education Accreditation Council (NCEAC), Department of Computer Science, University of Swabi
11. Member of University Prospectus designing committee, Department of Computer Science, University of Swabi
12. Member at The Science and Information Organization (<http://thesai.org/MyProfile>)
13. Editorial board member Information Engineering and Applied Computing
14. Member of The Science and Information Organization
15. Editorial/Advisory Board Member <http://www.academicworld.org/editorial.php>, ID- IIE-AB-10047-102
16. Thesis evaluation, University of Peshawar, University of Malakand, University of Swat, AWKUM, Bacha Khan University, FAST Islamabad, City University, SBBWU Peshawar.



Fakhre Alam

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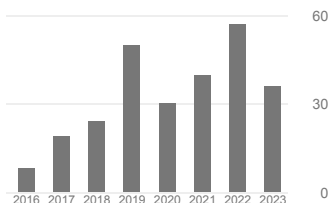
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