

# Suman Bhunia

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## Education

- 2013–2017 **Ph.D. in Computer Science**, *University of Nevada, Reno, USA*, *Thesis: Survivability Against Intelligent Adversary in Next-Generation Wireless Networks.*  
GPA:4.0/4.0  
Advisor: Dr. Shamik Sengupta
- 2008–2010 **Masters of Technology in Distributed and Mobile Computing**, *Jadavpur University, Kolkata, India*, *Thesis: Performance Evaluation of WiMAX Network in Aspect of Modulation and Coding Schemes and Hand-off using OPNET.*  
GPA:8.39/10  
Advisor: Dr. Iti Saha Misra
- 2004–2008 **Bachelor of Technology in Electronics and Communication Engineering**, *West Bengal University of Technology, Kolkata, India.*  
GPA:8.36/10

## Professional Experience

### Research Experience

- 2017–current **Postdoctoral Scholar**, *Computer Networking Lab*, University of California, Davis.
- 2013–2017 **Research Assistant**, *Computer Networking Lab*, University of Nevada, Reno.
- 2012–2013 **Research Assistant**, *Security in Wireless & Ad hoc Networks (SWAN) Lab*, John Jay College of Criminal Justice, City University of New York.
- 2009–2011 **Research Fellow**, *Broadband Wireless Communication Lab*, Jadavpur University.

### Teaching Experience

- 2016-2017 **Instructor**, *Department of Computer Science and Engineering*, University of Nevada, Reno.  
*Courses Taught:* Computer Operating Systems (CS 446/646), Enrollment ~ 70 students
- Summer 2016 **Instructor**, *University of Nevada, Reno*, Project: Research Experience for Teachers.  
Cyber Security Initiative for Nevada Teachers
- 2014-2016 **Teaching Assistant**, *Department of Computer Science & Eng.*, University of Nevada, Reno.  
*Courses Taught:* Digital Design Laboratory (CPE 201)
- 2011-2012 **Adjunct Lecturer**, *Department of Computer Science*, City College of New York.  
*Courses Taught:* Introduction to Computing (CS 102) and Operating System Laboratory (CS 332)
- 2011-2011 **Adjunct Lecturer**, *Institute of Engineers, India*, Kolkata.  
*Courses Taught:* Computing and Informatics

## Research Interest

- Security Network security, malicious node sensing/detection, cyber-physical security, wireless honeypot, jamming attack, spectrum fingerprinting
- Wireless Cognitive radio, dynamic spectrum access (DSA), cross-layer optimization, ad hoc, unmanned autonomous systems (UAS), 3D wireless mesh, LTE-WiFi coexistence
- Networking QoS and resource management, end-to-end performance, testbed implementation

## Research Projects

- 2013-present **Survivability Against Intelligent Adversary in Next-Generation Wireless Networks**, *PhD Dissertation*.
- Explored honeynet-based defense mechanism for cognitive radio networks under jamming attack.
  - Designed stochastic learning mechanism to perceive attacker's strategy by wireless fingerprint.
  - Formulated queue model with fixed vacation to analyze traffic behavior of cognitive radios.
- The effectiveness of the proposed mechanism has been evaluated on a state-of-the-art high spectrum agile radio testbed comprising several USRP software defined radios which are controlled using open source GNURadio.
- 2015-present **Neighbor Discovery in Directional Communication**, *Lead Student*.
- Proposed line-of-sight (LOS) discovery methods for mobile nodes with full directional transceivers. Works both for directional RF and free-space-optics (FSO) networks.
  - Modified helix equations to optimize neighbor discovery scanning in 3D.
- This work has been evaluated with a prototype built with an off-the-shelf robot car, IR transceivers and Raspberry Pi as the controller. In addition, one patent application has been filed in collaboration with M Khan and Dr. M Yuksel.
- 2015-2016 **Jamming Avoidance Multihop 3D UAS Mesh Networks**, *Lead Student*.
- Examined the performance of adaptive beam nulling as a mitigation technique against jamming attacks in multihop ad hoc networks.
  - Proposed Kalman filter based tracking model to predict movement of the jammer with discrete DoA estimation; and optimized the beam null region based on stochastic model.
  - Built 3D mobility model for UAVs in ns3.
- 2010-2011 **Enhance Performance of Voice Service for Congested Networks**, *Research Fellow*.
- Proposed optimization mechanism for SIP based VoIP service over wireless networks.
  - Proposed effective adaptive jitter playout buffer algorithm for real-time application.
  - Built MAC layer for cognitive radio in OPNET using Proto-C.
  - Designed cross Layer optimization model of VoIP end-to-end QoS over cognitive radio.
- 2009-2010 **Real Time Traffic over WiMAX**, *Masters Dissertation*.
- Evaluated performance of WiMAX under mobility, pathloss models, traffic type and scheduling.
  - Investigated VoIP service in WiMAX, WiFi and integrated WiMAX-WiFi networks.
  - Reduced hand-off delay for WiMAX network by integrating MAC and mobile-IP.

## Testbed Development and Demonstration

- 2015-present **Dynamic Spectrum Access Testbed with GNURadio**.
- Implemented frequency agile cognitive radio testbed using USRP, GNU Radio.
  - Inspected performance for channel aggregation, fragmentation, jamming attacks etc.
  - Implemented full duplex transmission using single radio device.
  - Implemented dynamic spectrum selection in multi hop mesh networks.
- 2013-2014 **Mobile Frequency agile Testbed**.
- Built on top of Atheros chips and ath5k as the WiFi driver.
  - Investigated pseudo random channel hopping to mitigate jamming.

## Student Advisement

### Graduate Students

- 2014-2017 **Paulo Regis**, *PhD student*, [pregis@nevada.unr.edu](mailto:pregis@nevada.unr.edu).  
Topic: Joint Routing and Position Control in 3D UAV Mesh Networks
- 2016-2017 **Manash Saha**, *MS student*, [msaha@nevada.unr.edu](mailto:msaha@nevada.unr.edu).  
Topic: LTE-WiFi Coexistence

## Undergrad Students

- 2016 **Dat Luu**, dat\_luu@nevada.unr.edu.  
Topic: Testbed Development for Spectrum Agility in Mesh Networks
- 2016 **Edward Miles**, elmiles93@live.com.  
Topic: Testbed development of Jamming Resistant Networks using GNURadio and USRPs

## International Professional Activities

### Session Chair at International Conferences

- 2015 International Symposium on Cyberspace Safety and Security (IEEE CSS) 2015, New York, USA. Track - Active Defense Techniques and Systems

### Technical Program Committee

- 2017 Military Communications Conference (MILCOM)  
2017 Conference on Decision and Game Theory for Security (GameSec)  
2015-2016 International Conference on Information Technology (ICIT), 2015, 2016

### Selected Journal/Conference Reviewer

- Journals IEEE Communications Magazine, Computer Communications (Elsevier), Physical Communication (Elsevier), Pervasive and Mobile Computing (Elsevier), Future Generation Computer Systems (Elsevier), International Journal of Communication Systems (Wiley), Wireless Communications and Mobile Computing (Wiley), International Journal of Distributed Sensor Networks (Hindawi)
- Conferences IEEE Globecom, IEEE ICC, IEEE MILCOM, GameSec, ISCIT, IEEE WoWMoM

## Patent Invention Disclosure

- [1] S. Bhunia, M. R. Khan, S. Sengupta, and M. Yuksel. *In-Band Line-of-Sight Discovery for Directional Full-Duplex Transceivers*, U.S. Provisional Patent Application 62/338,953

## Peer Reviewed Publications

### Journals

- [1] S. Mneimneh, **S. Bhunia**, S. Sengupta, and F. Vazquez-Abad. A game-theoretic and stochastic survivability mechanism against induced attacks in cognitive radio networks. *in press of Elsevier Pervasive and Mobile Computing*, 2017. (Impact Factor: 2.366).
- [2] **S. Bhunia**, V. Behzadan, P. A. Regis, and S. Sengupta. Adaptive Beam Nulling in Multihop Ad hoc Networks Against a Jammer in Motion. *Elsevier Computer Networks*, 109:50 – 66, 2016. Special issue on Recent Advances in Physical-Layer Security (Impact Factor: 1.903).
- [3] **S. Bhunia**, S. Sengupta, and F. Vázquez-Abad. Performance Analysis of CR-honeynet to Prevent Jamming Attack Through Stochastic Modeling. *Elsevier Pervasive and Mobile Computing*, 21:133–149, 2015. (Impact Factor: 2.366).
- [4] T. Chakraborty, A. Mukhopadhyay, **S. Bhunia**, I.S. Misra, and S.K. Sanyal. An Optimization Technique for Improved VoIP Performance over Wireless LAN. *Journal of Networks*, 7(3):480–493, 2012.
- [5] **S. Bhunia**, I.S. Misra, S.K. Sanyal, and A. Kundu. Performance study of mobile WiMAX network with changing scenarios under different modulation and coding. *Wiley International Journal of Communication Systems*, 24(8):1087–1104, 2011. (28 citations).

- [6] A. Kundu, I.S. Misra, S.K. Sanyal, and **S. Bhunia**. VoIP performance over broadband wireless networks under static and mobile environments. *International Journal of Wireless & Mobile Networks (IJWMN) Vol, 2(4)*, 2010. (19 citations).

#### In Progress

- [7] **S. Bhunia**, M. Khan, M. Yuksel, and S. Sengupta. LOS Directional Neighbor Discovery Using In-Band Full-Duplex Transceivers. *submitted to IEEE Transactions on Mobile Computing*.
- [8] **S. Bhunia**, E. Miles, S. Sengupta, and F. Vazquez-Abad. CR-Honeynet: A Cognitive Radio Learning and Decoy Based Sustenance Mechanism to Avoid Intelligent Jammer. *submitted to IEEE Transactions on Cognitive Communications and Networking*.
- [9] **S. Bhunia**, P. A. Regis, and S. Sengupta. Distributed Adaptive Beam Nulling to Mitigate Jamming in 3D UAV Mesh Networks. *submitted to IEEE Transactions on Wireless Communication*.

#### Conference Proceedings

- [10] **S. Bhunia** and S. Sengupta. Distributed Adaptive Beam Nulling to Mitigate Jamming in 3D UAV Mesh Networks. In *2017 International Conference on Computing, Networking and Communications (ICNC)*. IEEE, 2017. (acceptance rate 29%).
- [11] P. A. Regis, **S. Bhunia**, and S. Sengupta. Enhancing Performance and Longevity of Multi-radio Multi-channel HetNets through Dynamic Path-assignment. In *2017 International Conference on Computing, Networking and Communications (ICNC)*. IEEE, 2017. (acceptance rate 29%).
- [12] **S. Bhunia**, M. Khan, S. Sengupta, and M. Yuksel. LOS Discovery for Highly Directional Full Duplex RF/FSO Transceivers. In *Military Communications Conference (MILCOM)*, 2016.
- [13] M. Khan, **S. Bhunia**, M. Yuksel, and S. Sengupta. LOS Discovery in 3D for Highly Directional Transceivers. In *Military Communications Conference (MILCOM)*, 2016.
- [14] P. A. Regis, **S. Bhunia**, and S. Sengupta. Implementation of 3D Obstacle Compliant Mobility Models for UAV Networks in Ns-3. In *Proceedings of the Workshop on Ns-3, WNS3 '16*, pages 124–131, 2016.
- [15] **S. Bhunia**, V. Behzadan, and S. Sengupta. Enhancement of spectrum utilization in non-contiguous DSA with online defragmentation. In *Military Communications Conference, MILCOM*, pages 432–437. IEEE, 2015.
- [16] **S. Bhunia**, V. Behzadan, P.A. Regis, and S. Sengupta. Performance of Adaptive Beam Nulling in Multihop Ad-Hoc Networks under Jamming. In *High Performance Computing and Communications (HPCC), 2015 IEEE 7th International Symposium on Cyberspace Safety and Security (CSS), 2015 IEEE 12th International Conference on Embedded Software and Systems (ICESSE), 2015 IEEE 17th International Conference on*, pages 1236–1241. IEEE, 2015. (acceptance rate=30%).
- [17] **S. Bhunia**, S. Sengupta, and F. Vazquez-Abad. CR-Honeynet: A Learning & Decoy Based Sustenance Mechanism against Jamming Attack in CRN. In *Military Communications Conference (MILCOM), 2014 IEEE*, pages 1173–1180. IEEE, 2014. (7 citations).
- [18] **S. Bhunia**, X. Su, S. Sengupta, and F. Vázquez-Abad. Stochastic model for Cognitive Radio Networks under jamming attacks and honeypot-based prevention. In *15<sup>th</sup> International Conference on Distributed Computing and Networking (ICDCN)*. Springer, Jan 2014. (10 citations).

- [19] S. Das, S. Barman, and **S. Bhunia**. Performance Analysis of IEEE 802.11 Rate Adaptation Algorithms Categorized Under Rate Controlling Parameters. In *Proceedings of the 2014 International Conference on Information and Communication Technology for Competitive Strategies*, page 8. ACM, 2014.
- [20] **S. Bhunia** and S. Sengupta. Feasibility of channel hopping in jamming attack. *IEEE TCSIM Newsletter*, (19):2–5, 2013.
- [21] E. Troja, K. Ezirim, and **S. Bhunia**. Route aware dynamic channel scheduling and selection for multi-hop cognitive radio networks. In *IEEE 78<sup>th</sup> Vehicular Technology Conference, VTC 2013-Fall*. IEEE, 2-5 September 2013.
- [22] A. Mukhopadhyay, T. Chakraborty, **S. Bhunia**, I.S. Misra, and S.K. Sanyal. Study of enhanced voip performance under congested wireless network scenarios. In *International Conference on Communication Systems and Networks (COMSNETS)*. IEEE, 2011. (9 citations).
- [23] T. Chakraborty, A. Mukhopadhyay, **S. Bhunia**, I.S. Misra, and S.K. Sanyal. Analysis and enhancement of qos in cognitive radio network for efficient voip performance. In *World Congress on Information and Communication Technologies (WICT)*. IEEE, 2011.
- [24] A. Mukhopadhyay, T. Chakraborty, **S. Bhunia**, I.S. Misra, and S.K. Sanyal. An adaptive jitter buffer playout algorithm for enhanced voip performance. In *International Conference on Advances in Computing and Information Technology (ACITY)*. Springer, 2011.
- [25] T. Chakraborty, A. Mukhopadhyay, **S. Bhunia**, I.S. Misra, and S.K. Sanyal. Optimizing voip call in diverse network scenarios using state-space search technique. In *International Conference on Advances in Computing and Information Technology (ACITY)*, pages 231–242. Springer, 2011.
- [26] A. Kundu, **S. Bhunia**, I.S. Misra, and S.K. Sanyal. Comparison of voip performance over wimax, wlan and wimax-wlan integrated network using opnet. In *International Conference on Wireless and Mobile Networks*. Springer, 2010.
- [27] **S. Bhunia**, A. Kundu, I.S. Misra, and S.K. Sanyal. Reducing hand-off latency in wimax network using cross layer information. In *International Conference on Advances in Computer Engineering (ACE)*, pages 346–348. IEEE, 2010.

## Fellowships and Awards

- 2016 Outstanding Graduating Graduate Student, UNR (Awarded only two students)
- 2016 Outstanding graduate student of Department of Computer Science, UNR
- 2016 Outstanding Graduate Student by Graduate Student Association of UNR
- 2014-2016 Student travel grants to attend MILCOM 2014, 2015 and 2016
- 2015-2016 Student travel grants to attend IEEE CSS'15 and GRCon'16
- 2015 Outstanding International Graduate Student award, Graduate Student Association, UNR
- 2014-2016 International Graduate Student Award, Office of International Students, UNR - two times
- 2011-2013 Two year CUNY science fellowship
- 2010 Paper entitled "Study of OPNET and performance evaluation of WiMAX network under various terrain conditions in OPNET" won the *best student paper award* at the National Conference on Microwave and Communication NCMicroCom-2010

2008-2010 Two year full scholarship for M.Tech programme for qualifying Graduate Aptitude Test in Engineering, GATE (All-India basis)

## Leadership and Committee Experience

2014-2017 Elected thrice as a college of engineering representative at UNR Graduate Student Association  
 2015-2017 Elected twice as the chair of the clubs and organizations committee of UNR GSA  
 2014-2017 Serving budget committee of UNR GSA  
 2014-2017 Serving judicial committee of UNR GSA  
 2014-2015 Elected vice president of Computer Science Graduate Student Club, UNR  
 2013-2015 Elected twice as the vice president of Indian Student Organization, UNR

## References

- Advisor **Dr. Shamik Sengupta**, *Assistant Professor*, Department of Computer Science and Engineering, University of Nevada, Reno, Email: [ssengupta@unr.edu](mailto:ssengupta@unr.edu).  
<http://www.cse.unr.edu/~shamik/>
- Committee Member **Dr. Mehmet H. Gunes**, *Associate Professor*, Department of Computer Science and Engineering, University of Nevada, Reno , Email: [mgunes@unr.edu](mailto:mgunes@unr.edu).  
<http://www.cse.unr.edu/~mgunes>
- Committee Member **Dr. Sergiu Dascalu**, *Professor*, Department of Computer Science and Engineering, University of Nevada, Reno , Email: [dascalus@cse.unr.edu](mailto:dascalus@cse.unr.edu).  
<https://www.cse.unr.edu/~dascalus/>
- Department Chair **Dr. George Bebis**, *Professor and Chair*, Dept of Computer Science & Engineering, University of Nevada, Email: [bebis@cse.unr.edu](mailto:bebis@cse.unr.edu).  
<http://www.cse.unr.edu/~bebis/>
- Dean **Dr. David Zeh**, *Dean of the Graduate School*, University of Nevada, Reno, Email: [zehd@unr.edu](mailto:zehd@unr.edu).  
<http://www.unr.edu/biology/people/david-zeh>
- Collaborator **Dr. Murat Yuksel**, *Associate Professor*, Department of ECE, University of Central Florida (UCF), Email: [murat.yuksel@ucf.edu](mailto:murat.yuksel@ucf.edu).  
<http://www.ece.ucf.edu/~yukseml/>
- Collaborator **Dr. Felisa Vazquez-Abad**, *Professor*, Department of Computer Science, Hunter College, City University of New York (CUNY), Email: [felisav@hunter.cuny.edu](mailto:felisav@hunter.cuny.edu).